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Why ask for the moon
when we have the stars?
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CARPENTRY AND BUILDING.

VOL. I.—1879.

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DAVID WILLIAMS,
83 READE STREET.

INDEX.

A number of technical terms, and other items of interest, are included in this index in addition to the usual titles.

CARPENTRY AND BUILDING

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FRAMING AND CONSTRUCTION.

Examples of Roof Trusses.

Perhaps nowhere more than in the designing and framing of roofs, does the carpenter have opportunity to display whatever scientific skill he possesses. Roof framing is, ordinarily, the heaviest part of his work. The management of heavy timbers singly, in getting them into place in the trusses, although employing both tact and strength, proves light work in comparison to placing the completed truss in position. The carpenter not only requires a familiarity with the principles of his science in planning and laying out his roof, but he finds it necessary to employ the best mechanical appliances in hoisting and placing his work. A well designed and properly constructed roof is a monument to his name, while a poor roof is a perpetual shame.

In the framing of a roof there are several things to be taken into consideration, which influence a decision as to the general shape it is to have and the materials of which it is to be constructed. It must be strong enough to resist whatever pressure and strain it is to encounter. It must be as light as is compatible with a proper degree of strength, that it may not impose any unnecessary weight on the walls. In shape it must be in accordance with the general style of architecture in which the building is designed. With no other causes to determine it, the pitch is decided by the covering that is to be employed. All these items, and others equally important that we have not mentioned, the carpenter has in mind when deciding upon the style of framing he will adopt for his roof and the size of the timbers to be used in it.

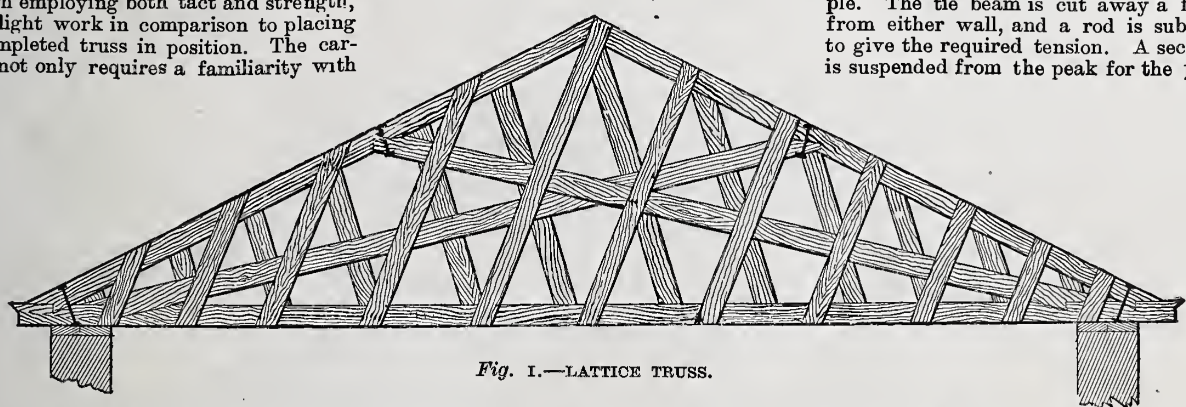

Fig. I.—LATTICE TRUSS.

In the annexed engravings we present three styles of roof trusses—not because either one of them possesses any new or peculiar features, but only as illustrating forms in quite general use among certain classes of builders, and as being patterns which are quite as likely to prove of service to our readers at large as any that could be given. There is a marked difference in the cost of the different trusses shown in our illustrations, as well as in the style of them. All have the elements of strength and stability, and while neither could exchange place with another, because each is adapted to a particular style of building and to a special shape of ceiling, each may be taken as a fair representative of its own class.

In Fig. 1 we show a lattice truss, or, as it is frequently called, a trellis truss. This is a very cheap and expeditious plan for framing a roof to span from 40 to 70 feet. According to the span, the tie should be from 4x10 to 5x12 inches. The rafters and braces should be from 4x6 to 5x8 inches. The battens should be of 1 to 1½ inch boards, thoroughly spiked or bolted to the timbers. This style of roof truss has all the advantages of a solid mass without its weight. It avoids the disadvantages of the shrinking of material, which is almost entirely obviated by the crossing of the pieces.

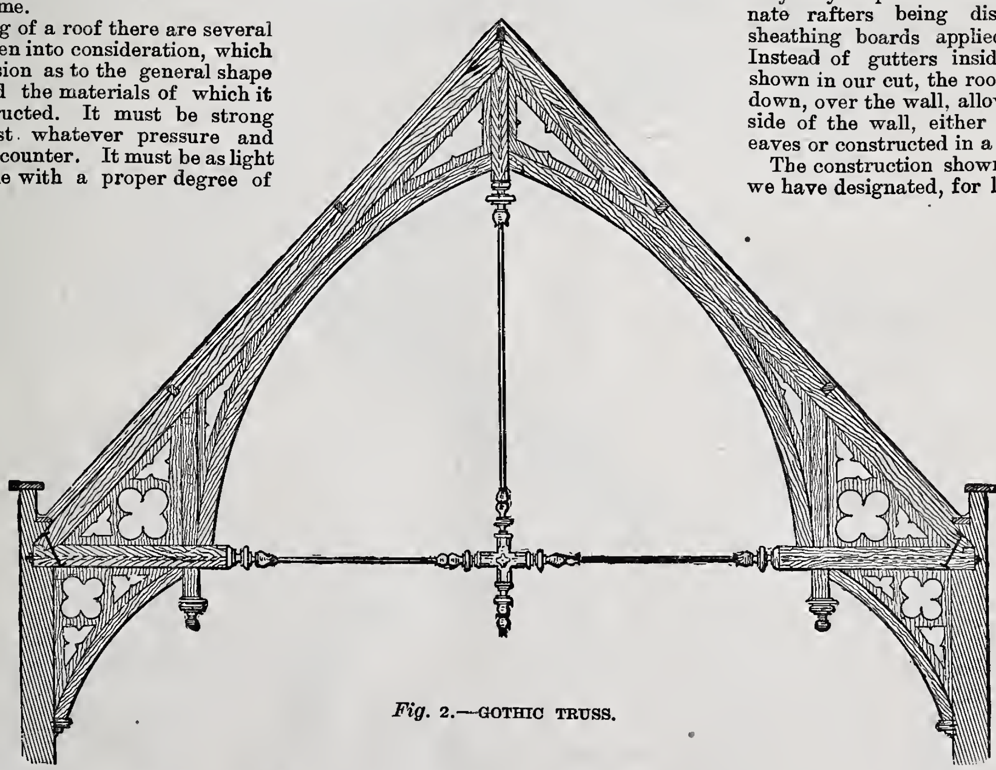

Fig. 2.—GOTHIC TRUSS.

In Fig. 2 is shown a form of truss which is of advantageous use in churches in which the inside finish is to conform to the general shape of the roof. In addition to the timbers constituting the truss, we show some mere suggestions as to the treatment of the interior for finish. The truss is quite simple. The tie beam is cut away a few feet from either wall, and a rod is substituted to give the required tension. A second rod is suspended from the peak for the purpose of preventing sag in the tie rod. For a space of 40 to 50 feet, the principal rafters should be of 8x8 inches timber. The purlins may be of large size, placed some distance apart, and form a feature of the interior finish, or they may be placed closer, and the subordinate rafters being dispensed with, the sheathing boards applied direct to them. Instead of gutters inside of the walls, as shown in our cut, the roof can be extended down, over the wall, allowing a gutter outside of the wall, either hanging from the eaves or constructed in a cornice finish.

The construction shown in Fig. 3, which we have designated, for lack of any better name, a braced truss, is suitable for spans of 40 to 50 feet. It may be built of 4x8 timber throughout. The necessity of a tie across the foot of the truss is obviated by the arrangement of the timbers below the rafters, which serve a double purpose. In the crossing of the braces and the central tie they are partly let into each other and partly sprung, each intersection being thoroughly secured by suitable bolts. Stirrup irons thoroughly clasp the rafter against the ends of the braces and tie beam. A bolt is passed through each of the struts, and bolts are also used at the base of the rafters. The ceiling finish may be segmental, elliptical, or of other shape, as required.

PRACTICAL CARPENTRY.

Stair Building.

I.

As preliminary to a practical exposition of one of the most important parts of joinery, viz., hand-railing, we introduce a brief notice of stair building. There are certain controversial points in both stair building and hand railing, of which for the present we shall avoid any discussion, leaving them with no more than passing attention until we have presented the general principles involved, and thereby paved the way for discussion upon the part of our readers who may see fit to favor us with practical views on each important point. To use the words of a celebrated writer on this subject:

"Of all the branches of the joiner's trade, staircases and their rails are the most important. They are seen by every one, their convenience or beauty readily appreciated, and their faults and defects instantly detected. More science is required in their plan, more ingenuity in setting out and adapting stuff, and more tradesmanlike skill in their execution, than in any other work about a building. The "staircase

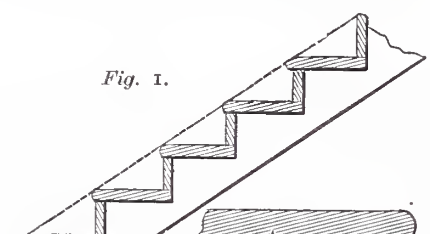

Fig. 1.

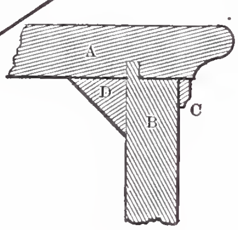

Fig. 2.

hand" is decidedly at the head of the joiner's trade; in fact, no man can call himself a complete joiner unless he understands this branch thoroughly. Still less, then, can any one undertake the situation of builder's foreman, or attempt to execute the responsible office of clerk of works, without he possesses in an eminent degree a thorough knowledge of this division of joinery." Certainly no other branch of the joiner's craft

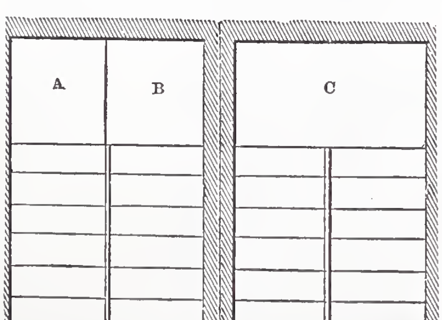

Fig. 3.

has been so earnestly debated, although, as each stair builder usually believes in his own method of hand-railing, and his own method only, no general agreement can be expected. Nevertheless, if any one will compare, say, Halfpenny's "Art of Sound Building," or Price's "British Carpenter," both published early in the eighteenth century, with the works of the present day upon hand-railing, he will realize at once the immense gain, both in correct principle and saving of material, which has been achieved since Nicholson first indicated the right track.

It is probable that the earliest wooden staircases were formed of planks placed at a more or less acute inclination, and having

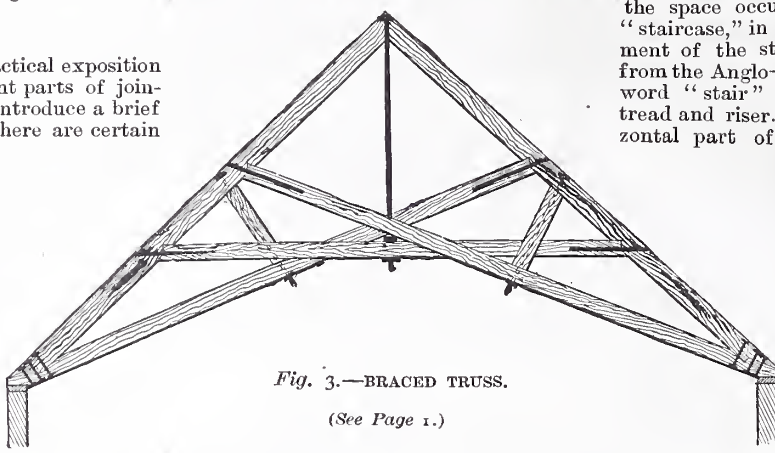

Fig. 3.—BRACED TRUSS.

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stout pieces of wood of a triangular section firmly nailed upon their surfaces at regular intervals. This means of ascent is still sometimes employed in scaffolding, &c.

The next step would be to reduce the thick

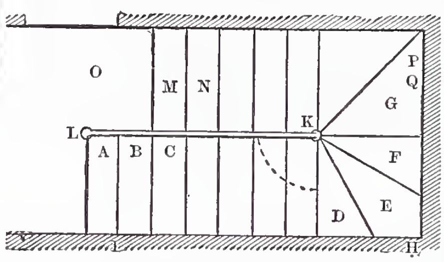


Fig. 4.

blocks until portions of board, connected at right angles or otherwise, were fixed to the inclined plane in place of the blocks.

It would soon then become obvious that

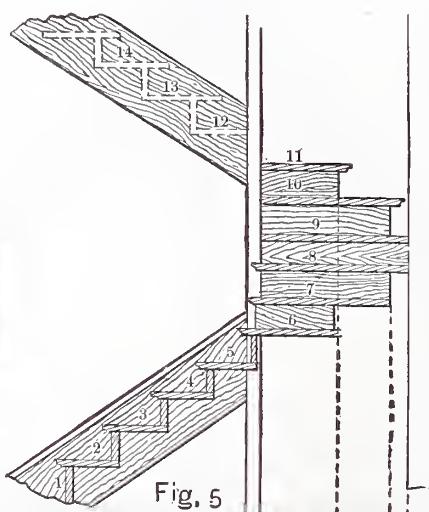


Fig. 5

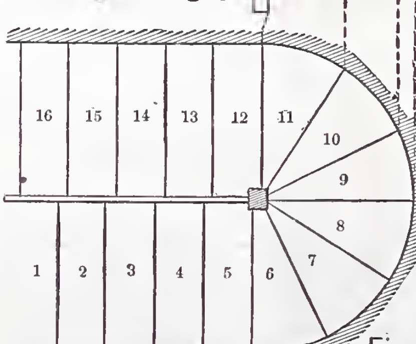


Fig. 6

these angular pieces only required to be supported at each extremity, and we should have the form shown at Fig. 1, still often employed in granaries and warehouses, and which exhibits in effect a "cut and mitred string" on each side.

Before proceeding further, it will be well to specify briefly the principal terms employed by the stair builder.

If the stairs are external to the building, as in the case alluded to above, they are known as outside stairs. When, however, they are inclosed within walls or partitions, the space occupied by them is called the "staircase," in each instance the arrangement of the steps being termed "stairs," from the Anglo-Saxon *stæger*, "to step," the word "stair" or "step" including both tread and riser. The "tread" is the horizontal part of the step upon which the foot is placed (A, Fig. 2), the "riser" being the upright portion, B, which supports the tread. The tread is usually 9 inches broad, and its outer edge is named a "nosing." This generally projects sufficiently over the riser to allow a small moulding, C, to be fixed beneath, and is then called a "moulded nosing." The riser is usually 7 inches in hight, and is tongued into the tread. A blocking, D, is put under the tread and against the riser. This is sometimes termed a "rough bracket," and is dovetailed or notched and nailed into the rough string. The space from riser to riser is sometimes termed the "going," and the entire distance from the first to the last riser in a flight of stairs, is called the "going" of the same. When the risers are parallel

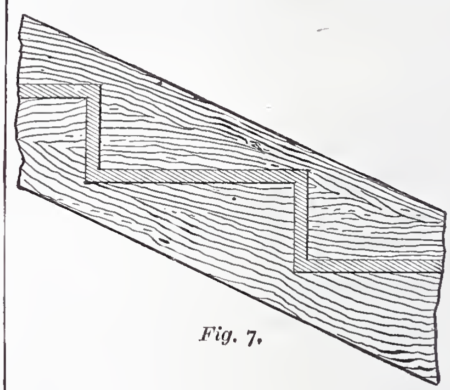


Fig. 7.

with each other on plan, the steps are, of course, straight, and called "flyers" (Fig. 4, A, B, C); but risers radiating on plan, and with triangular treads, are "winders" (Fig. 4, D, E). Sometimes the lower step of a flight of stairs has its outer end in the form of a spiral line or scroll, and is then known as a "curtail step;" at others it is simply formed into a half-circle, and is

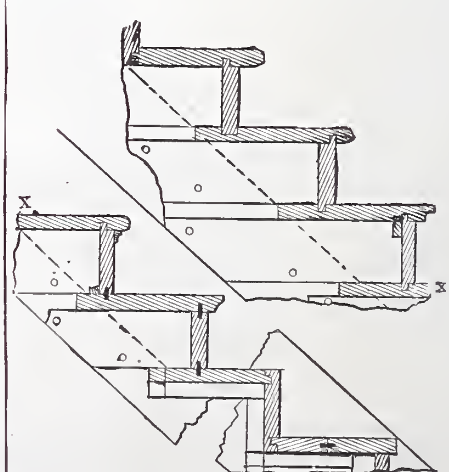


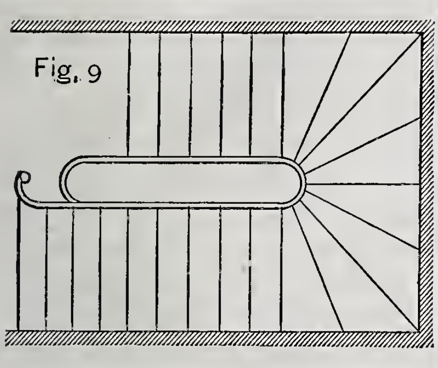
Fig. 8.

called a "rounded step," or a "round-ended step." Occasionally the treads of the lower steps are curved or swelled.

The succession of steps between one starting-place or landing and the one next above it is a "flight"—by some the term is restricted to the flyers only. The spaces wider than steps, which either form resting-places between the flights, or one of which is the termination of the staircase, are "landings." Sometimes this term is also restricted to the resting-places before room doors only. If the landing is square, and occupies half the width of the staircase, it is called a "quarter-space," as either A or B (Fig. 3), in which instance A is a step higher than B. Where, however, the landing stretches from wall to wall, or occupies the entire width of the staircase, it is a "half-space," (Fig. 3, C). Sometimes the portion answering to D E F, and G (Fig. 4) is made in a circular form, as shown in elevation at Fig. 5, and in plan at Fig. 6, the steps filling this space being winders.

A straight-edge laid on the nosings, as at Fig. 1, gives what is termed the "line of

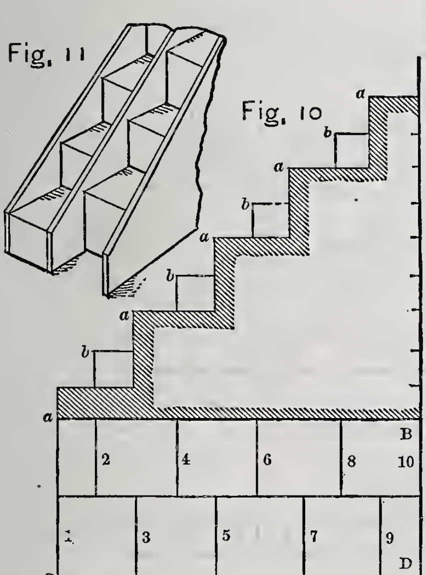
Fig. 9



nosings." The woodwork, or "carriage," which supports the end of the treads and risers, is principally composed of two raking pieces of timber, parallel to the adjoining side-wall, inclined in the direction of the line of nosings, and called "strings." The inner one next to the wall is called the "wall string" (H I, Fig. 4), and that on the outside (K L, Fig. 4) the "outer string." A "pitching piece," or "apron piece," is fixed securely to the side-wall, below the top of the bottom flight, and in a transverse direction to the strings, that it may carry the rough strings and the joisting of the landing; the rough strings, however, being sometimes continued to the bounding wall.

Fig. 11

Fig. 10



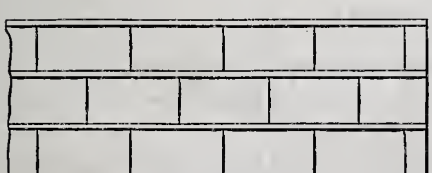


Fig. 12

In stairs composed of two flights, with quarter or half-spaces intervening, the timber which bears the rough strings is the pitching-piece, and that piece upon which the joists rest the apron. The joists are sometimes tenoned or bridged to the pitching-piece.

There are two methods of securing the steps to the strings. The latter may, as before mentioned, be cut away at intervals, so as to correspond with the angle of the tread and riser (Fig. 1), when it is termed a "cut and mitered" string. On the other hand, the string may be grooved for the reception of the ends of the treads and risers, as at Fig. 7. In this case the grooves are called "housings," and such string is known as a "housed" one. The steps, when long, are supported also by pieces of wood, framed and placed beneath the flyers, which are termed rough carriages. The longitudinal pieces, which run in the direction of the stairs, are called "rough strings," and the transverse ones, as stated, "pitching-pieces." "Rough brackets," or pieces of triangular shape, are fixed to the rough string, and scribed to the tread and riser. The winders are also supported by pieces of wood, called "rough bearers," which are wedged into the wall and fixed to the strings. Stairs, having cut strings where the steps come over the strings and the nosings and moldings are returned, are said to have "nosed and mitered moldings." Sometimes, beside the returns, pieces of wood cut to various designs are fixed upon the outer string, below the nosings, and are called "brackets." It then becomes a "bracketed staircase."

"Outside strings," says Tarbuck, "are from 1 inch to 1½ inches thick, and either plain, framed, rebated and beaded, with sunk face, cut and mitered to riser, molded, glued in thickness on a cylinder, ramped, kneed, &c., while wall strings are 1½ to 2 inches thick, plugged, ramped, wreathed, kneed, &c. Treads and risers, bracketed, blocked, glued, tongued, and screwed or nailed together, vary from 1 inch to 1½ inches in thickness, or there may be 2-inch treads and 1¾-inch risers, the latter being rebated, tongued, feather-tongued, &c., to the steps. Beaded apron lining, ¾ inch to 1 inch thick, is used to cover the apron piece. The under sides, or soffits, of stairs are usually lathed and plastered, but may be boarded, paneled, &c." At Fig. 8 a variety of details are given, exemplifying tonguing, blocking and other items of stair construction, as varied by choice or circumstances.

Stairs which are without a well-hole, and where the outer string of the upper flights stands in the same vertical plane as that of the lower flight, and is mortised into the same perpendicular piece of stuff, are called "dog-leg stairs." From this piece of timber, or "newel," forming the axis around which the spiral of the stairs winds, they are also sometimes termed "newel stairs." The newel is either chamfered, or more usually turned or in some manner ornamented, and when a piece of stuff turned to correspond with the molding of the hand rail surmounts the newel, it is called a "turned and mitered cap." The outer strings in stairs of this kind are tenoned into the newel or "newel post," which also carries the first and last risers of the flight. Carriages having bearers inserted in the wall, and fixed to the newel post and strings, are adapted to take the steps. A newel is also fixed at the foot of the stairs and starting point of the rail, and is sometimes turned to match the upper newel post, at others has a more ornamental form given to it. A newel or dog-leg staircase is shown in plan at Fig. 4, where A, B, C is the lowest flight of flyers; D, E, F, the winders; the dotted lines M, N, the flyers of the second flight, ending at the landing, O. L, is the newel post at the bottom of the stairs, and K is the upper newel. "Opened neweled" stairs are those having a well-hole and newel at the landings or winders, into which newels the strings are framed.

When the upper and lower flights do not have their outer strings in the same vertical plane, but separated by an interval of greater or less amount, as at G and H (Fig. 9), such space is termed a "well-hole." If there is no newel, but the string is continued in a curve perpendicular to the curve on the plan round the winders, the string is said to be "wreathed," and the staircase is termed a "geometrical" one. In stairs of this kind constructed by the joiner the principal support is afforded by the strings. The first geometrical staircases, from which those of wood were derived, were of stone, and the steps were pinned into the walls. Palladio, the celebrated architectural authority, attribuutes their invention to Luigi Cornaro, and those constructed by Sir Christopher Wren in the northwestern turret of St. Paul's, were the first erected in England. In wooden stairs the parts next the wall are housed in the wall string, the winders being also wedged into the wall at one end, and into the outer string at the other. When carriages are used, the winders are fixed to bearers and pitching-pieces. "Bracketed staircases" are upheld by carriages, newels and notched strings, the threads of the steps passing over the outer string. Brackets are mitered to the ends of the risers, not for support, but as ornaments, to conceal the ends of the steps. The treads and risers are glued and blocked at the inner angles, the step then screwed to the riser and roughly bracketed to the string. All staircases, whether dog-leg, open newel, or geometrical, if having cut strings, admit of being bracketed, and usually are so.

Before proceeding to the subject of the proportions of stairs, we may just glance at an ingenious contrivance for economizing room in places which are circumscribed, as by this plan, which is detailed in M. Godefroi's work, "Le Recueil des Machines," the ascent can be made in about half the quantity of space usually required. The width of the space allotted to the stairs is divided into two flights of steps. These steps are of equal length and width. The risers, however, of all, except those at one end of each set, are of double the general hight. Newland gives the following example of these stairs, which will be sufficient explanation: If the line a B (Fig. 10) is 72 inches and the width C D 33 inches, and it is necessary to rise 80 inches, divide the line a B into nine equal parts and make the step equal to two of these parts; also divide the width into two equal parts and the hight into ten equal parts, which gives 8 inches for the tread, 8 inches for the bottom riser and 16 inches for the intermediate risers a, a, &c., and 8 inches for the top riser b. Arrange the risers in such order that the face line of one riser shall be in the midway between the face of the one next below and the one next above, as will better be seen by reference to Fig. 11. The hight of the risers is so disposed that the bottom riser shall have the face of the first step 8 inches from the floor, while the first step on b shall be 16 inches from the floor, and the succeeding risers 16 inches each. In using this stair one foot is placed on a step of one flight, as at a (Fig. 10), and the other on a step of the other flight, as at b, and so on alternately. Such stairs will only admit the passage of one person at a time. When it is required to admit of two persons passing each other, three flights are necessary, the center flight being made wider than the exterior flight (Fig. 12). This contrivance may be used in places not sufficiently spacious to admit of stairs of the usual construction.

A very important matter in designing stairs is their proportionate dispositions, so as to admit the utmost facility of access to the various stories to which they communicate, without a wasteful sacrifice of either space or material. It may be well first to notice two or three general considerations applying to all cases alike.

These are: First, that every stair should have sufficient headway to allow a tall man wearing his hat to pass easily. If there is any difficulty about this the trimmer should be altered. The hight of the person passing must be taken when descending, as the body is sometimes bent forward in making the ascent. Nicholson advises to fix the foot of the compasses (in the section) at the under edge of the trimmer, with an opening of 6 feet; then describe part of a circle, and the line of nosing should touch this to give good heading. Secondly, as to the going, no stairs should be less than 2 feet 6 inches in width. Even kitchen stairs of common houses ought to have a width of 2 feet 10 inches. In public edifices, 4 feet is the least width permissible.

The third point, viz., the angle of ascent, we must defer until the next paper.

PLUMBING.

Some Bad Plumbing and How it was Corrected.

Not long since the writer was asked by letter from a friend in Europe to examine the plumbing work of his house, and if alterations or repairs were needed, to have it put in order before his return. During the two years he had owned and occupied this house, he had suffered more or less serious annoyance from bad smells, and from sicknesses in his family of a kind clearly indicating the existence of unwholesome conditions. The previous owner had lost some members of his family by typhoid fever, and had left the house in bad health.

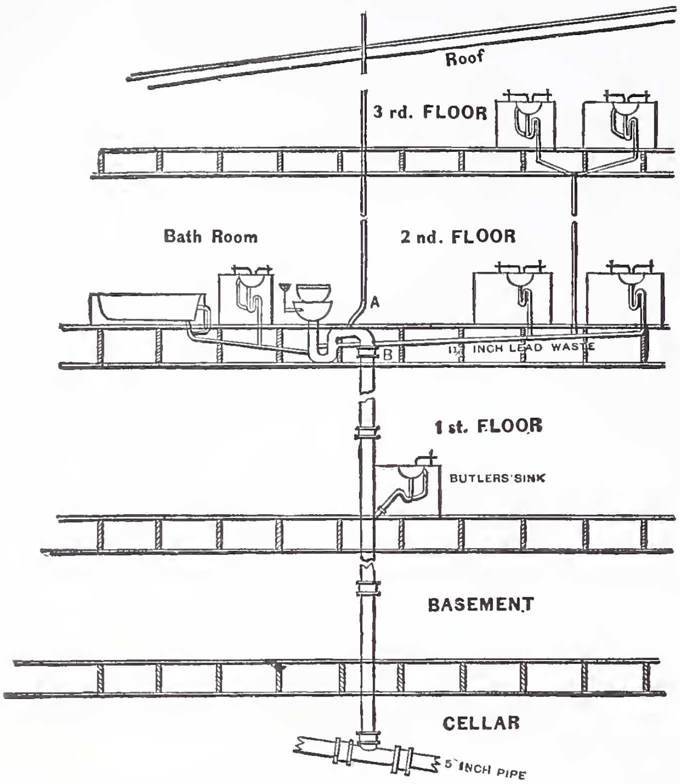


Fig. 1.—SOME BAD PLUMBING.

The house in question is a type of its class. It is a high-stoop, three-story brownstone house of good appearance, one of the kind to be found by the thousand in the upper wards of New York. It was built, like most houses of this class, on speculation, and had probably been sold at a satisfactory profit. Generally speaking, it is pretty well built, and is as good as almost any other of the houses in the fashionable neighborhood in which it stands. My friend had bought it for occupancy, and having sufficient means to live comfortably, he wanted to have so necessary a feature of the house as its plumbing work so arranged as to be convenient and safe. A *carte blanche* was given as to the nature, extent and cost of the repairs.

In compliance with his request I visited the premises, and found one of the most remarkable examples of the shoddy plumbing work of the time I have ever seen. The accompanying sketch (Fig. 1) gives an idea of how the waste and soil pipes were arranged with reference to the several fixtures. The details of the work were worse than the plan. Not a joint in the whole line of iron soil pipe was tight. Some were made with putty, some with cement and some with lead. Those made with lead were a very poor pretense of good work. The lead had been poured into the hub from the front, and chilling, as it flowed, had barely met behind. The calking tool had been in front only, and the insufficient character of the part of the joint not calked had been covered up by the friendly plasterer, who had carefully hidden whatever the plumber might not care to have seen. The connections between the lead and iron were fearfully and wonderfully made. The branch waste from the butler's sink on the parlor floor was made by boring a holei n the iron pipe, inserting the end of the lead pipe without an attempt to expand it, and actually wiping a solder joint against the iron. When examined, this joint was loose and could be easily pulled apart with the fingers, and from the first it had afforded an outlet for the foul air of the soil pipe. Under the closet on the second floor, the lead branch was slipped into the top of the 4-inch iron waste, and a joint made with the commonest painter's putty. The 2-inch air pipe from the top of the closet trap had been put in by the present owner, but as always happens when an attempt is made to ventilate a 4-inch pipe through a 2-inch extension, the venting was inadequate. In this case the 2-inch pipe, which was of iron, was slipped into the bend of the lead trap and connected with putty.

As shown in Fig. 1, all the wash basin waste ran through 1½-inch lead pipes, carried under the floors for a long distance, without fall enough to keep them free from obstruction. Their S traps rarely held any water, and when removed were badly corroded at the top of the bend. In a word, the entire plumbing system of the house was utterly bad in design, material and workmanship.

To correct it involved a much larger job than had been contemplated; but as the question of cost was a consideration of minor importance, it was deemed best to make it thorough. Work began by breaking through plastering from the basement to the third floor, and exposing the lines of pipe. The soil and waste pipes were then removed and new ones substituted, on the plan shown in Fig. 2.

In this arrangement the main line of 4-inch soil pipe has about three times the weight per foot of the old one, is put together with well-calked lead joints, and extends of one size from the cellar to and through the roof. A second vertical line of 2-inch iron waste, for the basin fixtures on the second and third floors, was put in, extending from the line of 5-inch pipe in the cellar to and through the roof. This, of course, obviates all the difficulties before experienced in wasting through long lines of lead pipe laid under the floor and connecting with the water-closet waste. It also obviates the danger of unsealing all the basin traps when any one basin was emptied, or the closet flushed sufficiently to displace the plug of soil held in the trap. Another important improvement was effected in giving the bath and wash basin adjoining it a connection with the soil pipe, independent of the water closet. It is always the meanest kind of bad practice to waste another fixture into a water-closet trap, when a direct connection with the soil pipe is possible.

This example is not given because it involves any interesting or novel problems in plumbing practice, but because it shows how work is commonly done in contract buildings, and how it should be done. The plan shown in Fig. 2 is simply a correct and common-sense arrangement of the waste pipes.

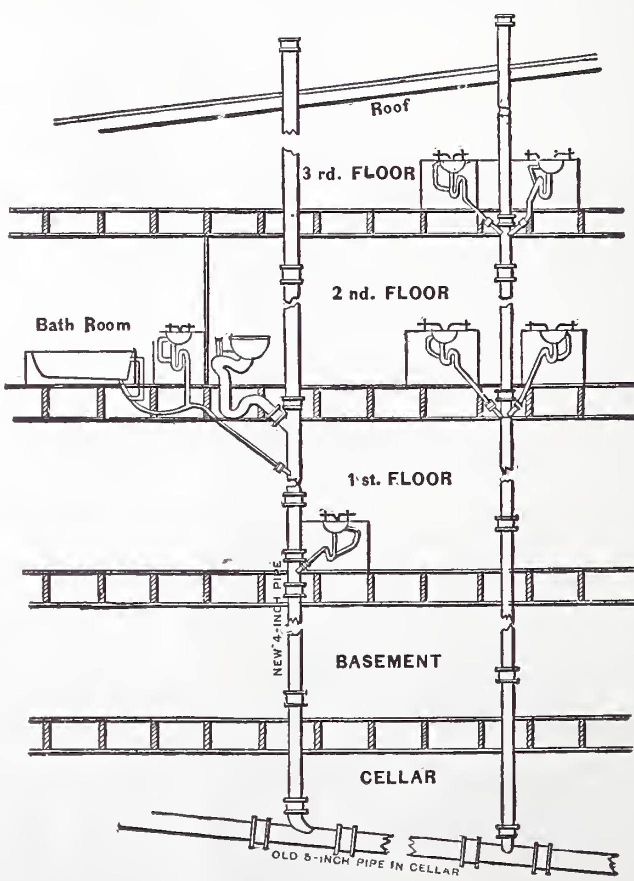


Fig. 2.—HOW IT WAS CORRECTED.

The plan shown in Fig. 1 combines all the errors which could well be combined, and, considering the materials and workmanship, was nearly as bad as it could be. To change the system and correct it cost nearly $500, including masons', carpenters' and painters' work. To have made it right in the first place would have increased the cost of the plumbing work less than a hundred dollars, which amount the owners paid many times over in funeral expenses and doctors' bills. We do not expect these considerations to have much weight with speculative builders or "bottom-figure" contractors, but they should have weight with owners who build for occupancy, and with honest men generally. J. C. B.

New Wall Hose Attachment.

Messrs. Bailey, Farrell & Co., Pittsburgh, have introduced a new combination wall hose attachment, which merits the favorable consideration of builders. We show the device complete in the accompanying illustration. By extending a rod from

WALL HOSE ATTACHMENT.

the outside wall plate to the stop valve on the inner side of the wall, the flow of water can at all times be controlled from without, avoiding the necessity of entering the building to turn the water off or on. They are constructed in a substantial manner, and make a very neat appearance on the outside wall. For marble or other fronts they can be silver plated or otherwise finely decorated.

Novelties in Rubber Valves.

We give herewith several illustrations of new forms of rubber valves for various purposes, which were exhibited at Paris:

The first, shown in two sections in Figs. 1 and 2, has been called the "diaphragm valve," the construction of which will be readily understood from the cuts, being a rubber disk. M. Trottier is the inventor of the second valve, Figs. 3 and 4. The valve body A is square, and it incloses a frame, D, which serves to compress a rubber tube, A, which is fastened in a very simple manner. The frame D has a movable cross-piece, B, which is acted upon by a screw, E. In order to compress the rubber tube uniformly, the lower portion of the frame D is lifted as much as the movable cross-piece B is depressed. When the valve is opened, the elasticity of the rubber and the pressure of the water flowing through the valve forces the cross-piece upward, a service which, it will be understood, the screw does not perform. A third form (Fig. 5 and 6) is that invented by Mr. Schrabetz, of Vienna, who uses rubber in the shape of a hollow ball. This ball is entirely surrounded by a casing, a part of which is pierced by many holes, at *c*, which, covered by the ball, cuts off the water. If, however, the button *y* is pressed, the rubber is lifted away from the holes and water flows through them and through the orifice *f*. When the valve opens, water escapes from the ball through the opening *b*; as soon as it is being closed it re-enters by the same way. As the size of this orifice regulates the flow of water into it, the closing, or rather filling, of the ball may be regulated at will, and thus any shocks be avoided. As the pressure upon the ball is equal on all sides, the magnitude of pressure has little influence upon the working of the valve, which may be used under varying circumstances without previous regulation. As the ball grows defective at the point *b* first of all, the valve will refuse to give water as soon as it is getting out of repair, and the danger of suffering a loss of water by a leaking valve without being aware of it, is obviated.

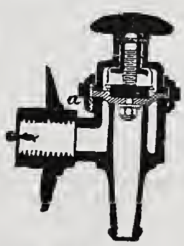


Fig. 1.

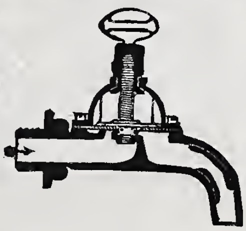


Fig. 2.

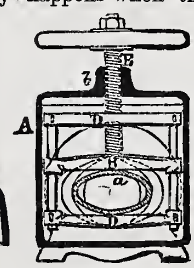


Fig. 3.

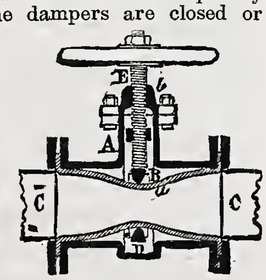


Fig. 4.

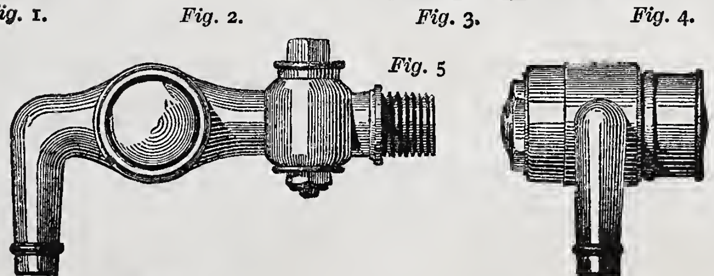


Fig. 5

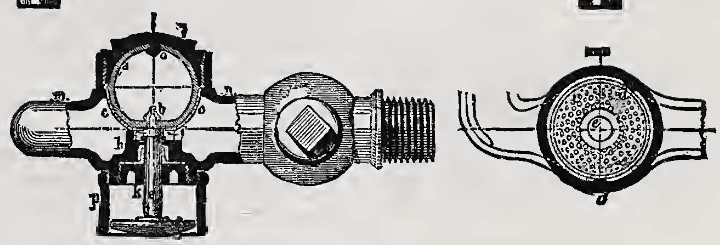


Fig. 6.

NEW FORMS OF RUBBER VALVES.

The Fire Risk of Defective Flues.

As the weather becomes colder and it is necessary to urge the furnace fires, there is each year what may be termed a fall and winter crop of fires, arising solely from defective flues and chimneys. The Philadelphia *Ledger* of a recent date chronicles the loss of an expensive school house in that city, owing to a defective flue, and a few days later another was considerably damaged from the same cause. Not long since, a fine depot was set on fire and narrowly escaped destruction because the builder did not know, or had forgotten the fact, that fire will burn wood, even when in the shape of a depot floor, and had allowed the beams to come within 10 or 12 inches of a coal fire. It seems rather late in the history of civilization to announce as a fact that fire will burn wood, and all that is necessary to set the wood on fire is to heat it sufficiently. Yet the statement almost loses its sarcasm when we see how closely flues and stoves are placed to floors, beams and wooden partitions, and one feels moved to make the statement in good earnest as an unknown truth. When a brick flue passes near woodwork, there is a double danger. First there is the constant corrosion of the mortar by the gases from the fire. Where wood is used as a fuel, the steam and pyroligneous acid, or creosote, have a very destructive influence upon the mortar, and if the flue is long, or special attention is given to economy by burning the fuel with the drafts nearly closed, the condensation of the acids and tarry matter will be very great, and the danger to the chimney great in proportion. It is quite difficult to find a modern chimney top where the mortar is not largely eaten away by this corrosive action, and it is not unusual, in making a careful inspection of a chimney, to find holes in many places inside a building. The second danger arises from the fact that when wood is exposed to a considerable degree of heat it undergoes certain chemical changes, parting with a portion of its water, and is then in a condition not unlike tinder. It takes fire at a much lower temperature than ordinary wood. According to the testimony of experts, it would seem that when in such a state a match will give a sufficient heat and blaze to set a heavy beam on fire. It is therefore the hight of folly to allow wood to come near enough to a flue to be heated by it. The heat chars the wood and prepares it to take fire at a spark, and the chimney is liable to be corroded into holes and thus furnish the necessary spark to kindle the fire. Wood in this condition, as might be supposed, burns with extreme rapidity, and is extinguished only with great difficulty.

Where metal flues are used for leading smoke to a chimney, the danger from heating the woodwork is greatly increased, on account of the greater radiation of heat from them. They are readily corroded, and where holes make their appearance there is no certainty that some day there may not be an escape of fire. Usually there is an inward draft into the chimney, so that the danger seems to be small. But it not unfrequently happens when the dampers are closed or fresh fuel has been put on and carbonic oxide is escaping, that the opening of a furnace door causes an explosion of the gas, which may extend some distance along the flue and be attended by a flash of flame from any of the larger openings. Several churches in Brooklyn have been destroyed by fire within the last ten years, under circumstances which make it not at all improbable that something of the sort may have taken place. A defective flue is as inexcusable as it would be to rest a stove pipe upon an unprotected wooden beam.

A great many fires result from hot-air flues. Because the heat in them is never greater than that of melting tin, and because they are not in actual contact with wood, it is taken for granted that there can be no danger. Wood which has undergone the slow charring process that we have described, not only burns easily, but can be made to take fire without a greater heat than that due to melting tin, and we have heard of cases, which we consider perfectly well authenticated, where a heat of 212 degrees continued through a series of years, has, without the presence of even a spark, set boards and beams on fire. The folly of those who put up hot air or steam pipes to run in contact with wood floors, beams or partitions, is little less than criminal.

When galvanized iron pipes are used, special care should be taken to see that corrosion does not take place very suddenly. If a stove or furnace pipe "sweats" or "drips" very much, frequent and careful inspection is needed to see that the pipe is not eaten into holes. When a faulty length is found, it should be removed at once. Next spring may be too late. In some parts of the country, notably in the eastern portion of Massachusetts, it is very difficult to prevent the rapid corrosion of stove pipe of all kinds; hence the greatest care should be taken in such localities to see that all pipes are in good condition, not only when they are put up in the fall, but during the winter also they should be inspected to see that no thin places have given out.

Few persons will credit the degree of heat to which the air in large hot-air furnaces sometimes rises. It is quite commonly believed that 190 degrees is about the limit, and that from 100 to 150 degrees is the rule. We are not prepared to say that this is not generally the case, but we do know that there are thousands of furnaces all over the northern part of the country where the hot-air flues frequently attain a temperature of from 440° to 500° F. It is not at all difficult with most furnaces, especially if they are a little too small for their work, to bring the flues in the immediate neighborhood of the furnace up to the melting point of tin, 440 degrees. The lessons to be learned are these: Wood will burn, and furnace flues are amply hot enough under some circumstances to ignite it; chimneys may work nicely, and yet have openings large enough to permit the escape of fire in case of gas explosions, and in any case it is best to be perfectly sure of the condition of chimneys and flues, not only in the fall, but all through the season during which they are to be used.

PRACTICAL PAINTING.

Certain Properties of Oil Paints.

Painting is done with two objects in view —either to change the natural color of the surfaces of various articles, or to protect those articles by rendering their surfaces less easily altered by air, rain, dust, &c. Three conditions must be fulfilled:

1. The paint must possess sufficient fluidity to spread with a brush, and also be viscous enough to adhere to the surface without running, and to leave coats of equal thickness when the surfaces are inclined or even vertical.
2. The applied paint must become hard.
3. After hardening it must adhere firmly to the surface on which it has been applied.

To secure these conditious under all the conditions which must be met in the practical work of house painting, requires some knowledge of the chemistry of the materials used and the reactions induced by their exposure to light and air. M. Chevreul, the eminent French chemist, has lately given this subject much intelligent attention, and we are able to give our readers the following interesting synopsis of his conclusions, which will be found full of practical information and replete with good suggestions:

I have proved that the hardening of white lead or zinc-white paints is due to the absorption of the oxygen of the atmospheric air. And since pure oil hardens, we see that the hardening is the effect of a primary cause which is independent of the drier, white lead or zinc white. Besides, my experiments demonstrate that white lead and oxide of zinc manifest a drying property in many cases, and that this property exists also in certain substances which are painted —lead, for instance. The painter, therefore, who is desirous of knowing, at least approximately, the length of time necessary for his work to become dry, will have to consider all the causes which produce that effect. Consequently, a *drier* will not be considered as the *only cause* of the drying phenomenon, since this phenomenon is assisted by several substances having also the property of drying under certain circumstances. Moreover, there is this remarkable fact, that the *resultante*, or sum of the activities (drying powers) of each of the substances entering into the composition of the paint, cannot be reckoned by the sum of the activities of each substance. Thus, pure linseed oil, the drying power of which is represented by 1.985, and oil treated by manganese, with an activity of 4.719, will, when mixed, possess an activity of 30.828. If there are substances which increase the drying properties of pure linseed oil, there are others which act in an opposite direction. For instance, if one coat of linseed oil is applied upon glass, it will dry after seventeen days; but if the same oil is mixed with oxide of antimony, it will take twenty-six days to dry. In this case the oxide of antimony acts as an anti-dryer. Linseed oil, mixed with oxide of antimony, and applied upon a cloth painted with white lead, will dry after 14 days; the same oil, mixed with the arseniate of protoxide of tin and applied upon the same cloth, will not harden for 60 days. Oak appears to possess an anti-drying property to a high degree, since, in an experiment made 22d December, 1849, three coats of oil took 159 days to dry. In an experiment made 10th May, 1850, a first coat of linseed oil was dry only on the surface after 32 days. Poplar seems to be less anti-drying than oak, and Norway fir less than poplar. In the experiment of 10th May, 1850, three coats of linseed oil took 27 days to dry for poplar, and 23 days for Norway fir. If there be a drying activity and a contrary one in certain substances, I have no doubt that there are also circumstances under which linseed oil is not influenced by the nature of the surface on which it has been spread. For instance, in the experiments of 10th May, 1850, one coat of linseed oil was given upon surfaces of copper, brass, zinc, iron, porcelain and glass, and in every case the oil was dry after 48 hours. I hasten to say that I do not pretend to classify all the substances, when in contact with linseed oil, or any other drying oil, into drying, anti-drying, and neutral, because the circumstances under which these substances are placed may cause variations in their properties. I believe that a substance may be drying or anti-drying under different circumstances—whether it be due to the temperature, or the presence or absence of another substance, &c. For instance, metallic lead is drying toward pure linseed oil, whereas white lead, which is well known to possess drying properties, is anti-drying toward linseed oil applied upon metallic leaf. If painters desire to understand their operations well, they must consider the drying of their painting in the same manner as I have just pointed out. By so doing, and in certain determined cases differing one from the other, they will be enabled to modify and improve their ordinary methods. Linseed oil is naturally drying, and this property increases almost always by its admixture with white lead, and in certain cases with oxide of zinc. If the mixture be not sufficiently drying, resource is to be had to an addition of oil boiled with litharge or manganese. At the same time it is necessary to consider the nature of the surfaces painted over—whether it be a first, second or third coat, the temperature of the air, the light, &c. From our present point of view, drying oil, boiled with litharge or manganese, loses part of its importance, because it may be dispensed with for the second and third coats, and even for the first one if the natural drying is aided by the temperature. Moreover, pigments themselves may act as substitutes, as in the case of light colors, which are altered by yellows or browns, if the painter has derived profit from some of the observations indicated in this article. Thus linseed oil, exposed to the air and to light, becomes drying and loses its color; it may therefore be employed with white lead or zinc white, without impairing the whiteness of either. Since by associating oxide of zinc with carbonate of zinc it is possible to dispense with a drier, we have a new way of avoiding the inconvenience of colored driers, at the same time it gives a hope that new combinations of colorless substance will be found, presenting greater advantages than those just noted. My experiments demonstrate that the processes generally followed by color manufacturers for rendering oils drying—that is, by heating them with metallic oxides—are open to objections of waste of fuel and coloration of the product. Indeed I have shown—(1) that oil kept at a temperature of 70° C. for eight hours had its drying powers considerably increased; (2) that if peroxide of manganese be added to the oil kept at this temperature it becomes sufficiently drying for use; (3) that a very drying oil will be obtained by heating linseed oil, for three hours only, with 15 per cent. of metallic oxide, and at the temperature generally adopted by the color merchants. My experiments explain perfectly well the effect of linseed oil, or more generally speaking, of drying oil in painting. Indeed, when oleic acid is mixed with metallic oxide, it passes instantaneously from the liquid to the solid state, and there is no uniformity in the *ensemble* of the molecules of the oleate. The effect is different when a drying oil, absorbing oxygen, passes progressively to the solid state. The slowness with which the change takes place allows of the symmetrical arrangement of the oily molecules, which would appear transparent if there were not opaque molecules between them. But if the latter do not predominate, the arrangement is such that the painting is glittering, and even brilliant, because the light is reflected by the dry oil as by a looking glass.

Turpentine Not a Dryer.

Oil, or Spirits, of Turpentine is generally supposed to be a dryer, and is used as such, while in fact it is only a thinner and has no drying properties in itself. This has been repeatedly proved in various ways, but the following simple experiment will suffice: In two vessels of equal size and shape put equal quantities of linseed oil, and with one mix a quantity of spirits of turpentine. Allow both to be exposed to the same atmospheric influences and watch them. Very soon you will find the quantity in each vessel to be alike, showing that the turpentine has entirely evaporated, after which, if you can perceive any difference in the rapidity of the drying between the two, it will be in favor of what was originally the pure oil. When a mixture of linseed oil and spirits of turpentine is spread out over a surface, the effect is produced which has led so many to call turpentine a dryer.

The turpentine rapidly flies off, the oil is left in a much thinner body than if it had been applied pure, and the air has so much the better chance to operate on it, but the turpentine has left nothing behind to aid the hardening or drying process. Painters like to use it because it makes the paint flow more readily, work easier and spread out better. For inside work it is desirable, because as the rule the object is to apply to the surface covered as little oil in proportion to the pigment used as possible, while for outside work the reverse is the case. Turpentine and benzine are almost identical in their mode of action, the benzine being the more volatile and escaping the more quickly. Neither should be used for the outside of a house, but for the inside they answer not only the purpose spoken of above, but, as they evaporate a "flat" surface, as it is technically called, is formed, and this is generally more highly esteemed.

Linseed Oil.

It is often asked, even by educated men, why linseed oil is so universally and almost exclusively used in painting, and why some other and cheaper oil cannot be substituted and still the same result, or an approximate one, be reached. The fact is that of all the ordinary oils of commerce, linseed has by far the greatest affinity for oxygen, and in absorbing it is hardened into a tough, elastic substance, which adheres closely to the surface covered and protects it from atmospheric changes. Within reasonable limits, the greater the thickness of this covering the better will be the protection afforded. Any one building a wooden house will be amply repaid for his trouble and expense if he will give the entire outside a good coat of raw linseed oil before painting. He will find that the wood will be preserved better, and the paint will adhere more firmly and keep its color longer. No other oil, with the single exception of poppy-seed oil, at all approaches it in its drying or hardening qualities, and even poppy oil is so far behind it that it would never be used had it not some peculiar and valuable properties of its own to make it often more desirable. Numberless experiments have been made, and they are constantly being made, to discover some oil to take the place of linseed, either in whole or in part, but so far to no purpose.

MASONRY.

Stone and Rubble Work.

I.

In the present and following papers on the subject of masonry, we propose to follow as methodical a method of treatment as is practicable. Speaking roughly, the field to be traversed may be divided into three parts: the geometrical processes involved in getting out the various curves, &c., to which stone is to be wrought; the preparation or dressing of the material to the desired forms; and, lastly, the setting. As, however, the latter operation is not unfrequently performed by workmen who are seldom concerned in the others, we will briefly advert to it first.

The art of masonry, especially in its higher developments, is largely dependent upon a certain knowledge of geometry, and the ability to make and read working drawings is essential to its proper prosecution. We intend, therefore, as we proceed, to devote considerable attention to this branch of the subject, using, so far as possible, examples from actual construction which have a permanent value, as illustrating various styles of architecture.

Masonry may be classified under two general heads, viz., that composed of stones used as they come from the quarry, or roughly brought to the desired condition by means of the scabling hammer or analogous tools, and that where the stones are squared, symmetrically proportioned and dressed. Under the first head come, as might be expected, the constructions and edifices which go back to remote antiquity—Druidical remains (comprising cairns, tol-

Fig. 1.

mens and logans), the Pelasgic, or Cyclopean fragments found in Southern Europe, &c., and the most ancient temples of Egypt and Hindustan. The second class comprises all the masterpieces of architecture, among them the glorious temples of Greece, the grand Roman Pantheon and triumphal arches, the India Taj Mahel, rising like a fairy dream of spray petrified to marble, and the marvelous cathedrals of Western Christendom.

As examples of primitive forms of the first kind of masonry, we may instance the wall Mycenæ (Fig. 1) built before the historic period, still standing, and having of late received fresh interest from the extraordinary discoveries of rare and precious Grecian (or Persian) relics, made in its vicinity by Dr. Schliemann.

Regarding masonry of the present day executed with unwrought stone, or that which has been little dealt with by tools, we borrow the following lucid and terse description from a paper read by Mr. Rawlinson, before the Liverpool Architectural Society:

"Masonry may be defined as the art of constructing with stone, upon a plan or system calculated to insure durability. The structure may be a single fence wall of dry random rubble, or it may be the most complicated and elaborately-carved cathedral. Betwixt these extremes there are many varieties of masonry.

"*Rough Rubble Masonry.*—This class of work, whether set dry or in mortar, consists of stones of small dimensions, upon which no labor has been bestowed other than that necessary to raise them from the earth or quarry. No stone should be larger than one man can lift, and a skillful worker always finds a place for each stone after he has taken it in hand. As defined by Johnson, 'A mason that makes a wall meets with a stone that needs no cutting and places it in his work.' Rough or random rubble masonry may be set dry, or it may be set in mortar; but dry it forms fence walls, retaining walls and backing, to prevent the earth coming in contact with masonry or brickwork—as behind retaining walls of

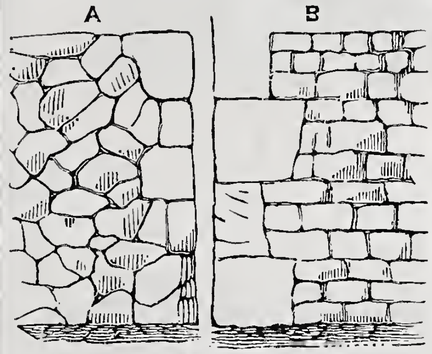


Fig. 2.

rubble set in mortar, of coursed wall stone or ashlar, or to protect foundation walls from clay, marl or wet earth.

"Rough rubble masonry consists of: 1. Random rubble set dry, as in moor and field fence walls. Examples may be seen in Cumberland and in most mountainous districts. 2. Random rubble set in mortar. Examples—fence walls, house walls and other structures. 3. Coursed rubble set in mortar. Examples—rubble stone, leveled up in courses, generally the depth of ashlar, or single quoins. 4. Snecked rubble set in mortar. Examples—rubble stone having the faces snecked; that is, the rough taken off so as to present a more even surface, the beds remaining undressed. * * Although random rubble forms work of the rudest class, it is not certain that untutored men would construct it, as considerable experience and skill are required to wall small unhewed stone in line on face and in form. At present there are districts in England, and in the British Isles generally, where men are educated as random rubble wallers, and follow the practice as a distinct branch of trade, and cannot execute masonry in any other form."

Among forms of this kind of masonry may be specified: "Random rubble, set dry; random rubble set in mortar; random rubble set with quoins, joints and architraves and leveled in courses; snecked rubble, generally set in courses; rubble with ashlar binders; rubble in alternate courses, with bricks or with tiles; flint rubble, whole or cut; boulder or pebble rubble, whole or cut. Flint and pebbles are generally used with brick, tile or stone quoins and courses. Slate rubble is set in horizontal beds, having an

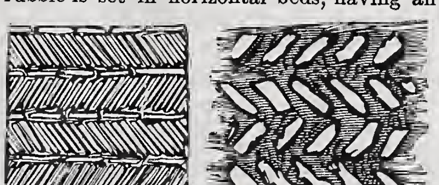


Fig. 3.

angle of 45 degrees, or at any intermediate angle, and examples may be found vertical. Herring-bone Rubble.—Where flat bedded stones are found this example of masonry may be seen. The Romans frequently used it, not only for face work, but to back squared wall stone, or to form the hearting to their military walls."

Fig. 2, A, is a sketch of part of a random rubble wall, while B, in the same figure, is a portion of one formed of coursed rubble. The random rubble is the same kind of work as the *opus incertum* of the ancient Roman builders, a term which had, indeed, much the same meaning as our own word "random." The remains of the earliest walls in England—Saxon, and perhaps early Norman—are frequently of coursed rubble, with sometimes a portion of herring-bone work (Fig. 3), the latter being occasionally laid with great regularity. Excellent examples of herring-bone work may be found at Guildford Castle. The rubble masonry commended itself to the builders of the Middle Ages, both from the little preparation it involved and the small size of the stones employed. It was not frequent at that time, in any work, to use stones which required more than two men to lift—indeed, they were often within the power of one man to manage. A characteristic of some ancient rubble in chalk districts, is the free employment of flints, placed either quite irregularly, or with their split edges outward, so as to form a moderately even face to the wall At the Bridewell (Norwich) and Sittingbourne Church (Kent), are good specimens. Some of the flint-work in Normandy is still better. Much of the early rubble masonry has quoins, door-jambs, &c., of hewn stone, in the style generally termed "longs and shorts," being formed of blocks alternately laid flat and set up on their ends.

In random rubble the stones are used just as they come from the quarry, any angle too sharp for the workman's purpose being struck off with the scabling hammer. What bond exists is secured simply by the inequalities of adjacent stones taking into each other. Good mortar, with occasionally large stones or "throughs," which pass entirely across the wall, will secure to random rubble walls a great portion of strength and stability, as is shown by the existing remains of very early work. Occasionally, rough rubble walls are grouted, besides being laid in mortar, thin "flushing" being poured between the stones. This renders the wall a well-nigh homogeneous mass, and correspondingly durable. Rubble masonry has been applied to the construction of bridges; but the long time which elapses

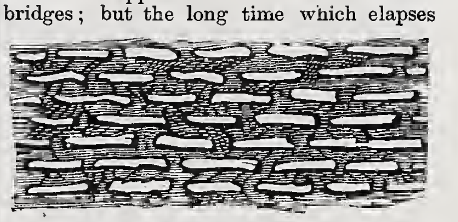


Fig. 4.

before the mortar becomes set and the centers can be struck, is a considerable drawback.

In coursed rubble masonry the stones are but little dressed, or not at all, as they are brought from the quarry and are sorted roughly into different heaps before beginning the wall. They require to be carefully laid in good mortar, using alternate headers and stretchers, so that they break joint. Chips or gallets of stone are used to fill up any cavity which would look unsightly if filled by the mortar alone.

Fig. 4 represents Kentish key-stone work, which consists of rag stones, about 4 or 5 inches thick, and varying lengths, carefully laid in good mortar.

"Intermediate," says the same paper to which we have before alluded, "betwixt true rubble and regular coursed wall stone, or ashlar, there are forms of masonry in which stones are set irregularly, labor being required to produce irregularity * * * Wall-stone, square and bedded; coursed wall-stone, set dry; coursed wall-stone, set in mortar; rough-faced wall-stone; pitch-faced wall stone; scabled wall-stone; punched wall-stone; scutched wall-stone; boasted wall-stone * * * *Block in course.*—This form of masonry may have all the varieties as named for coursed wall-stone, the difference consisting in dimensions alone. Block in course may commence from 9 inches (the depth of each course) upward until it verges into ashlar." It should be borne in mind, in connection with the foregoing, that the technical terms used in masonry vary more or less in different parts of our own country, as well as between this country and England, in which most of those we have used are current.

In the next paper the subject of ashlar work and the formation of surfaces therefor will be treated of.

Cements.

It is one of the popular errors of the day to suppose that the mortars used by the builders of former centuries were more enduring than those of the present age. Such is not the case, and no proof of it is furnished by any existing or historical evidence. The ancients used bitumen for cementing together bricks and stone in their masonry construction. Bitumen was used in building the Tower of Babel, and the walls of Babylon were composed of bricks united together with hot asphaltum. An analysis of some of the mortar taken from one of the Pyramids shows that the Egyptians used a mixture of lime and sand, proportioned about like the common lime mortar of the present day. The aqueducts of ancient Rome were built with a mortar of a similar character. A step in advance was the use of the Italian pozzuolanas, or volcanic ashes, a material which has been extensively employed throughout Italy and some parts of France, from the times of Pliny and Vitruvius down to the present century. In the Netherlands, what is known as Dutch trass, a material made from a soft rockstone, and in its properties closely resembling the Italian pozzuolanas, has long held an important place among building materials. Until about the beginning of the present century this class of materials, comprising, besides those above named, some of the ocherous earths, granites, schists and basalts, various sands, and sometimes furnace slags and burnt clay, were depended upon throughout the civilized world for conferring, in a feeble degree, the hydraulic property upon mortars.

The discovery of the natural cements was a second step in advance. That event was regarded at the time as only the rediscovery of a lost art, and hence to the article first produced was given the name of Roman cement, a name now generally applied to all natural, quick-setting cements. The Roman, or natural, cements gave such satisfaction that attempts to manufacture them, by burning an artificial mixture of chalk and clay, soon followed, finally culminating in the production of what was called Portland cement, which has been in general use from that time to the present, and which is now manufactured extensively in England, on the Continent and in the United States. With Portland, or hydraulic, cement we are able to produce a mortar of greater strength and hardness than any that the researches of antiquarians have ever brought to light. The examples we have of ancient masonry are restricted mainly to aqueducts, sewers and other subterranean works that have not been exposed to the disintegrating action of the elements. Nearly all the specimens extant have been found accompanied by conditions extremely favorable to their indefinite preservation. Mortar made with the hydraulic cement of the present day possesses, when but a few months old, more of the acknowledged characteristics of durability than anything that has ever been discovered.

Roman, or natural, cements usually take the name of the place of manufacture. They are produced by burning, at a heat just sufficient in intensity and duration to expel the carbonic acid, certain argillaceous or silicious limestones, containing less than 77 per cent. of carbonate of lime, or argillo-magnesian limestone, containing less than 77 per cent. of both carbonates, and afterward grinding the product to a fine powder between millstones. They can be produced artificially by burning a mixture of lime, or carbonate of lime, and clay. Prior to the discovery of the process for making Portland cement, Roman cements were made in both France and England, by slightly varying the proportions of the ingredients and burning the mixture at a high heat. The superior qualities of Portland cement, however, and its greater economy, gradually drove these quick-setting artificial cements from the market. Their manufacture soon ceased, and has never been resumed. But it is not to be expected that the use of these natural cements will be entirely superseded by that of the Portland. For certain purposes they are as necessary, not to say indispensable, at present as they were when their introduction revolutionized the former methods of executing submarine constructions in masonry. They possess sufficient strength for the purposes to which they are usually applied, viz., for massive concrete foundations, for the concrete hearting and backing of thick walls faced with brick or ashlar, and as the means of conferring the hydraulic energy upon mortar for ordinary stone and brick masonry. Nevertheless, it is true that for similar purposes good Portland cement, suitably diluted with common lime, in order to reduce it to the strength of the quick-setting natural cements, is in most localities the less costly of the two. Portland cement produces a mortar possessing about four times the strength, at less than twice the cost, of the quick-setting artificial cements.

For concrete foundations laid green in water, Roman cements are almost invariably to be preferred, in the hands of ordinary workmen, to those which set more slowly. Most of them not only hold the sand, by their unctuous and adhesive properties, more tenaciously than the Portland cement, but their prompt induration or hardening arrests the washing effects of the water, and prevents the progressive separation of the sand and cement before it has had time to proceed far enough to produce serious injury to the concrete.

Portland cement was named from its resemblance in color to the English Portland stone. In contradistinction to the Roman, or natural, quick-setting cements, it is described as a heavy, slow-setting cement, produced at a high heat. There are several processes in use for making this cement, dependent in some measure, so far as they differ from each other, upon the locality and the special characteristics of the materials employed. In general terms, Portland cement is produced by burning, with a heat of sufficient intensity and duration to induce incipient vitrification, certain argillaceous limestones or calcareous slags, or an artificial mixture of carbonate of lime and clay, or of lime and clay, and then reducing the burnt material to powder by grinding. This cement was discovered and first manufactured in England, soon after the beginning of the present century. Factories were shortly established in certain districts of France and in other parts of the Continent of Europe. The United States being plentifully supplied with the argillo-magnesian, and to some extent with the argillaceous limestones, suitable for making Roman cement of good quality, and having had a large capital invested in this industry since about 1830, were slow to adopt the Portland cement. It was not until after the close of the civil war that the importation of Portland cement received any encouragement. It was first used here upon government works, and afterward in the manufacture of artificial stone. Its consumption soon, however, assumed large proportions. In the years 1874 and 1875, the importations amounted to 100,000 barrels of 400 pounds each year. Since that period, Portland cement works have been started in different parts of this country, and have supplied the home demand to such an extent that the importation of foreign Portland cement has very much fallen off. It is probable that in a short time very little, if any, Portland cement will find a market in the United States except upon the Pacific coast, where it will be procured by direct importation.

The responsibilities of a builder, according to the law of the Province of Quebec, are very great. For ten years he is answerable for the giving way of any part of the structure he has erected, arising from causes that can be laid at his door. Not even if he can show that the architect was incompetent, and the strength of the materials called for by the specification was inadequate for the purpose required, will he be relieved from the responsibility; not even if he enters a legal protest and still goes on building, can he claim exemption from the law that makes a builder responsible for his work for ten years.

Chimney Building.

Why people will persist in building chimneys which will not draw, remains to us a mystery. No part of a house contributes in a greater degree to the comfort, and even the health, of the occupants than a chimney with a good draft, and yet, year after year, people go on putting up little 7 x 9 flues in the walls of their houses if they are in the city, or little 7 x 9 brick boxes in the country, and persist in calling them chimneys. To make an open fire-place draw without smoking where there is such a flue, is simply impossible. With such flues a "roaring fire" is never heard. At the Underwriter's Convention, held in Chicago, Mr. Daniel Morse, of the Home Insurance Company of New York, read the following paper on how a chimney should be built.

1. A broad, deep and substantial foundation is necessary—one that will not settle or be disturbed by frost. If the chimney is built in or rests upon the wall of the basement or cellar, the wall at that point should be sufficiently broad.

2. The chimney should be perpendicular, straight and smooth, without angles, corners, jogs or contraction, and at no point in contact with wood; with a space of an inch or more where it passes joists, rafters or timbers, or through floors, ceilings or roofs, and at least 4 inches between the back of the chimney and the end or side of the building. Joists should not be masoned in or rest upon or against the chimney wall, but a header well removed from the chimney should be used for their support. An additional reason why chimneys should be built very strong and entirely free from contact with any wood in the frame buildings of our Western country, is that they are so often what is known as "balloon frames," so lightly put up that they are always liable to be shaken by our heavy winds, so as to cause cracks in chimneys otherwise constructed.

3. The walls of the chimney, when built of brick, should be 6, 8 or more inches thick. A chimney with 6-inch walls, the inside course set on the edge and bound with brick laid transversely every four or five courses, is nearly as safe as an 8-inch. Where an 8-inch wall is laid, it is perhaps better to leave a space of about an inch between the two courses of brick, occasionally binding by laying a brick transversely. A wall of this kind will not heat so as to endanger wood, even in pretty close proximity. The chimney should be put up at a time when free access can be had by the masons to every part of its outside, before joists and other timbers have been placed in the way, and before the roof has been put on. Four-inch walls are unsafe at the best, and particularly so if there is any truth in the theory that brick, exposed to hot air or steam, will in time show a larger amount of heat than is at any time in the heated air or steam passing by or in contact with it; that is, if brick will accumulate heat, as we know some metals and minerals do. We know of some facts that seem to support this theory. If it is true, many queer fires from furnaces and chimneys will perhaps be more satisfactorily accounted for.

4. There should be openings at the bottom of the chimney, and of each separate flue, for the removal of soot. These openings should be closed with a heavy iron box or scoop-shaped stopper. If left open the draft will be affected, and, besides, there will be danger of fire falling upon the floor. These soot boxes, or scoops, unless made of heavy iron, are liable to rust out, owing to the damp soot and pyroligneous acid.

5. The chimney should be smoothly plastered with a mortar composed of one part fresh cow dung and three parts ordinary mortar. The mixture should be made from time to time, as needed, and applied before it has time to set and become hard. A chimney so plastered will present a hard surface, nearly as smooth as glass. Soot will not accumulate on the sides of the flue, and the draft will be quite perfect, other things being observed. The draft will be still fur-

ther improved if the area of the flue is increased 1 inch every 10 feet from the bottom to the top.

6. The flue for an ordinary dwelling fire-place or stove-pipe, should have an area of at least 128 square inches for a wood or soft coal fire, and not less than 96 square inches for a grate or stove burning hard coal. Where large wood or soft coal fires are required, the area should be 192 square inches. Each fire-place or stove-pipe should have a separate flue, otherwise you cannot rely upon the draft. If for any cause more than one stove-pipe is to enter the same flue, the size of the flue should be increased one-fourth for each additional pipe.

7. The hearth should rest upon a brick or stone arch. Timber and board foundations are always concealed incendiaries; iron, because of its power to conduct heat, is also unsafe.

8. The throat of the fire-place should be well contracted and pitched forward, so as to be directly over the fire. This will insure a draft, owing to the fact that the part of the atmosphere not passing through the fire, but entering the flue, will come in more direct contact with the heat, and thereby be more highly rarefied. The construction of the chimney being right, the draft is produced by the air being rarefied in passing through and over the fire. This heated and lighter air ascends the flue, while the denser air in the room rushes forward to supply the partial vacuum. Sometimes the draft is imperfect because a sufficient supply of air is not admitted to the room, and in other cases owing to an open pipe or soot-box hole. All openings should be closed with brick and mortar or closely fitted metal stoppers. The modern practice of pasting a piece of paper over an opening, should not be permitted.

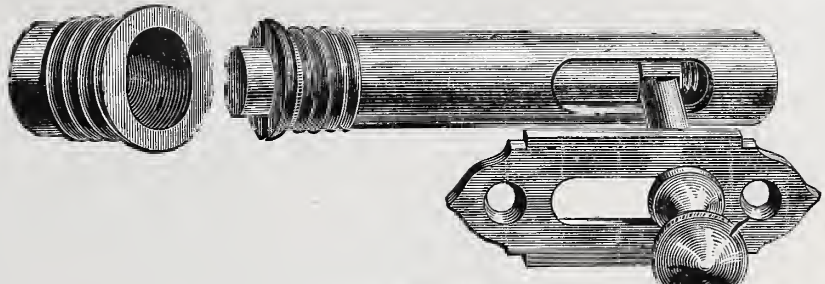
9. The walls of the chimney, particularly on the back side, where it is concealed from inspection, and at points where the chimney passes near wood, should be most carefully laid, pointed and plastered on the outside. Fires from defective flues where there is no crack, usually reveal the fact, if the chimney is left standing, that the wall on the back side, at points passing near timbers through floors on the roof, has not been well pointed and plastered on the outside. Good work has been done only at points or places exposed to the eye, and where there was no danger from fire.

10. The practice in many cases of building a water shed by projecting the brick just above the roof, should not obtain, nor should the chimney at this point be enlarged for any purpose. The projecting bricks, in a majority of cases, rest upon the rafters or roof boards; and if at any time the chimney below should settle there will be a crack, and by and by fire. Chimneys thus enlarged above the roof, presenting a massive and substantial appearance, fail to suggest the truth as to the small and cheaply constructed flue below. A word in regard to chimney sweeps and stated periods for cleaning flues. In places where ordinances have been passed and enforced on this subject, and sweeps licensed, fires caused by the burning out of chimneys or from defective flues, have been of rare occurrence. Perhaps if in our respective fields we were to aid in having ordinances touching this matter passed, we would prove ourselves public benefactors, and at the same time promote the interests of insurance companies.

Native Asphalt as a Material for Roofs.—It is known that native asphalt is one of the most permanent and unchangeable of substances. As a cementing material it was used in the earliest constructions upon record, as in the walls of Babylon. It is found to bear the greatest alternations of frost and thaw without disintegration or injury, and is not impaired by years of exposure to the intensest heat of the sun. Time seems to work no change in its constitution and quality. As stated by Ure, "It has been known to remain for ages without alteration." It is this permanence and unchangeableness of quality, together with its tenacity and adhesiveness, which have brought it into so extensive use as a cement for pavements in Paris and other cities of Europe. It is a matter of considerable public interest that a practicable method has been devised for applying this valuable material to the roofing of buildings, by substituting it for materials prepared from coal tar, in laying what is popularly known as the felt and gravel roof.

Mortise Door Bolt.

Sargent & Co., of New York, have just introduced a new mortise door bolt, of which the cut below is a full-size illustration. They claim for it simplicity and cheapness. Cheap in its first cost, and cheap because it can be put on at the expense of so little labor. The barrel of the bolt is only half-inch in diameter, so that it is applicable to very thin doors.



IMPROVED MORTISE BOLT.

It requires no mortising or cutting, but is applied by simply boring a half-inch hole to receive the bolt, and a five-eighths hole for the socket, and screwing them in. There are no screws needed to fasten either the bolt or socket. The knob and slide are finished in nickel-plate, giving a very neat appearance, quite in contrast to the clumsy bolt heretofore used for the same purpose. The nickel-plated screws for the slide are packed with the goods.

Improved Mortar and Artificial Stones.—M. Decourneau attributes the cracks in common mortars and cements to the uncombined quicklime that they contain. In order to neutralize the lime, he uses an *agrégat* composed of a very fine silicious powder, mixed with diluted nitric acid. He thus obtains mortars with much greater, more uniform and more lasting resistance than those hitherto used. The application of his method, especially in the new forts of Paris, has given excellent results, without a single failure. Stone made by his process may be sawed and chiseled like natural stone.

Improved Carpenters' Tools.

Among the class of carpenters who learned the trade a quarter of a century ago, and who have witnessed the improvements made during that period in the tools now employed in the various branches of carpentry, the remark is not uncommon, "If I had owned such tools as these, it would have saved me much trouble and many a hard day's work." With the standard in architectural style and in workmanship constantly advancing, some wholly new tools have been called into existence by the demands of the workmen, and many others have been greatly improved and changed from their primitive forms.

It is only a short time since a carpenter who wished to do a good piece of circular

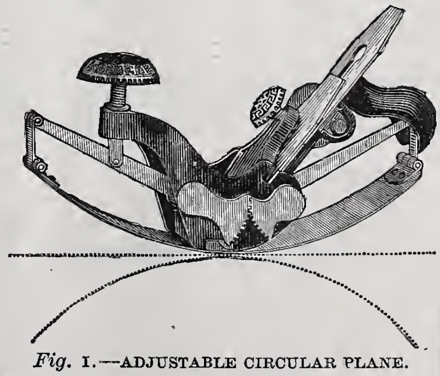


Fig. 1.—ADJUSTABLE CIRCULAR PLANE.

work about a window frame, a staircase, or the like, would be compelled to fasten a plane-iron to a block of wood, shaped out for the exact use to be made of it. With this carefully done, the work could be tolerably well finished; but if another piece of work requiring the planing of circular surfaces was needed, the whole process of fitting up for it had to be gone through again, with much painstaking and labor.

We illustrate in Figure 1, an adjustable circular plane, which the eye of a mechanic will readily observe is adapted to planing surfaces, either concave or convex, of any required arc. The stock of the plane is cast iron, and it has a flexible steel face, which may be quickly adjusted, at the owner's will, by turning the knob on the front of the plane stock. A double-acting screw moves the front lever, which is connected with the other lever by gears, thus giving accurate control of both ends of the face. The plane-iron is also adjusted by means of a thumb-screw on the back of the stock, and can be set forward or withdrawn at pleasure.

This plane, in its perfected form, has just been added to the extensive assortment of improved carpenters' tools manufactured by the Stanley Rule and Level Company, of New Britain, Conn. Price, $4.

Another very useful tool for all classes of wood workers (Fig. 2), has just been intro-

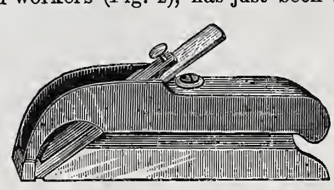


Fig. 2.—BULL-NOSED RABBET PLANE.

duced by the same house. It is called the "Bull-Nose" rabbet plane. The stock is of iron, 4 inches in length, and the cutter (1 inch in length) is set at the extreme front end of the stock, thus enabling the workman to plane closely up into corners or other places where it is impossible to use any ordinary plane. The throat to this plane can be made open or close, by means of the screw on the top, which passes through a slot in the upper section of the stock. Price, 50c.

Both the tools here referred to may be found at hardware stores generally.

Fixed Water Colors.

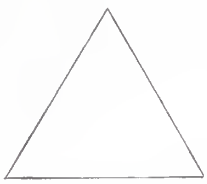
A new and important discovery is claimed to have been made by M. Mery, a Frenchman, which, if it prove to be true, will be valuable to the painting arts and trades. He has been experimenting a great many years, and he claims now to have hit upon the means of making and applying imperishable water colors. He does not explain what he uses as a vehicle for his pigments, but it is something which, while it will mix with water, is not soluble in it. Whatever it is, it renders the colors unalterable, and, as it becomes after a time as hard as cement or stone, they may be said to be indestructible. It can be applied to any surface suitable for ordinary oil or water painting, such as wood, paper, glass, stone, canvas, &c., and can be prepared so as to dry in a few minutes or remain moist for an indefinite length of time. It is suggested that possibly M. Mery has rediscovered the long-lost art of encaustic painting, which is supposed to have been applied and fixed by means of heat. It seems almost incredible that a paint can be applied by means of water, and yet not be affected by it afterward, but our authority is excellent for saying that such is really the case.

ROOFING.

A Familiar Talk about Roofs.

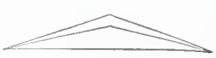
A roof may be described as consisting of the framework and the covering. It is of neither of these parts especially that we desire to speak at this time, but rather, in a general way, to talk of the styles and kinds of roofs in common use and of the terms used to designate them. Of these descriptive terms, some are in very common use and are generally understood, while others are of rare occurrence, except in architectural works and in the conversation of experts. Many of the terms in the latter class will be found useful when familiarized. Occasion for their employment will be found in the operation of designing roofs, in the labor of framing them and in the work of covering them. Precise language is of as great advantage among mechanics as with any other class.

One of the first terms met with in connection with a roof is *span*, by which is meant the distance between supports. By *rise*, is



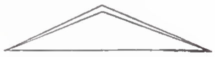
GOTHIC OR EQUILATERAL PITCH.

meant the hight in the center above the level of the supports. The *pitch* is the slope of the rafters, and is dependent upon both the *span* and *rise*. The *pitch* of a roof is expressed in several different ways. Sometimes it is given in the degrees of angle which the rafter makes with the horizontal. This method is not in common use outside of books. The most general plan of expressing pitch, is by the hight in parts of the span. It is quite common to hear a carpenter say



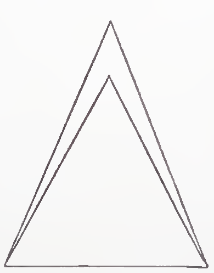
GRECIAN PITCH.

a roof is half-pitch or third-pitch. If, for example, the span is 30 feet and the hight is 10 feet, the pitch by this method is called third-pitch. Another plan, but not in such general use as the last, is by the length of the rafters in parts of the span. Thus, if the span is 30 feet and the length of the rafter 20 feet, by this method the pitch would be called two-third pitch. A fourth method of describing the pitch of roofs, and also one which is not of very general use, is by a name which indicates to the expert uniformity with some received model or standard. Of these terms may be mentioned *Grecian pitch*,



ROMAN PITCH.

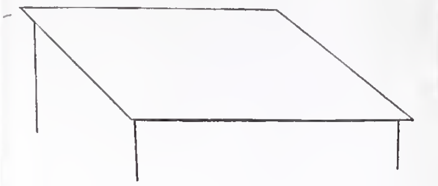
which is inclined from 12° to 16°, or which has a hight equal to 1-9 to 1-7 of the span ; *Roman pitch*, which is inclined from 23° to 24°, or whose hight is equal to 1-5 to 2-9 of the span ; *Gothic pitch*, in which the rafters are equal to the span ; and *Elizabethan pitch*,



ELIZABETHAN OR KNIFE-EDGE PITCH.

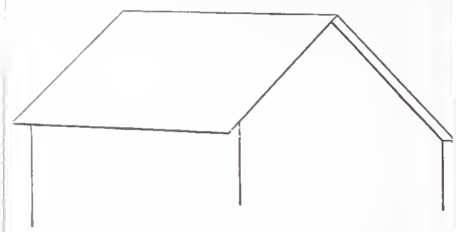
in which the rafters are larger than the span ; Gothic pitch is also called *equilateral pitch*, and Elizabethan pitch is also called *knife-edge pitch*.

From their general shape, the method of framing employed, the degree of pitch, &c., roofs receive designating names. Of these the simplest is the *lean-to* or *shed roof*, or a roof having but one inclination. This is also sometimes called a *pent roof*. Occasionally the



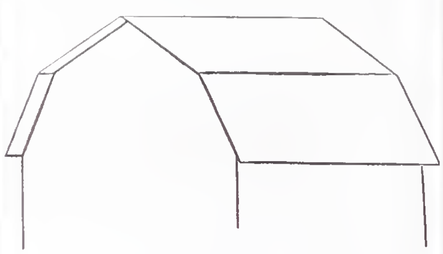
PENT OR SHED ROOF.

rafters of a roof are curved, which gives rise to the terms of *cone roof* or *ogee roof* and the like. When several inclined roofs meet, forming a pyramid or a frustrum of a pyramid, the whole is called a *hip roof*. When a roof consists of two inclined planes, meeting along a line extending over the middle of the building, it is called a *gabled roof*, and the line of junction is called



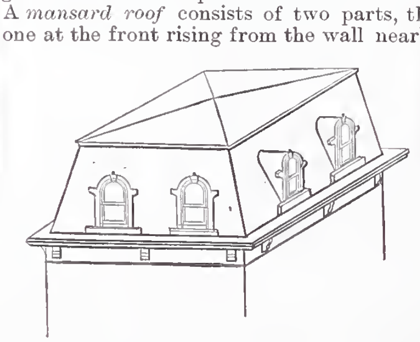
GABLED ROOF.

the *ridge*. When a roof rises somewhat steeply from each side-wall, meeting other portions extending with less inclination to the middle of the building, there forming a ridge, it is called a *curb roof* or *gambrel roof*.



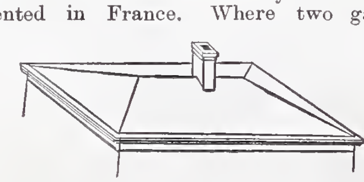
CURB OR GAMBREL ROOF.

A mansard roof differs from a curb roof or gambrel roof in the pitch of its outer section. A *mansard roof* consists of two parts, the one at the front rising from the wall nearly



MANSARD OR FRENCH ROOF, WITH A HIPPED DECK.

vertically, permitting the construction of windows, as in the walls of the building, and the other nearly flat, extending back from the junction with the first to the center of the building. A flat roof, like the upper section of a mansard roof, is very generally termed a *deck roof*. Mansard roofs are quite frequently called *French roofs*, from the fact that they were invented in France. Where two gabled



HIP ROOF.

roofs occur side by side, uniting at the eaves, the general shape produced gives rise to the term *M-roof*. Of terms describing roofs originating in the framing, *king-post roof* and *queen-post roof* are quite common. Names of roofs derived from the covering employed, are in very general use, as *shingle roof*, *tin roof*, *slate roof*, *tile roof*, &c. The names of roofs and their parts in most common use have direct reference to timbered roofs, although they are applied with entire propriety to iron roofs, which are essentially composed of the same parts. Timbered roofs in connection with Gothic architecture came into use about the year 1327, and began to be commonly employed in churches about 1400. The first iron roof was used in England in the year 1783.

Roofing Slates.

The slate quarrying industry is at present in a very depressed condition, and although the price of the commodity has been considerably reduced since last year, orders, nevertheless, continue to come in but slowly. Cable dispatches from London would seem to indicate that a similar condition of affairs exists at the other side of the Atlantic, and it is said that contracts to workmen at the great Welsh slate quarries have been let at a reduction of 25 per cent., "partly in consequence of the importation of American slates." Mr. John Galt, of this city, who is the principal shipper of roofing slates in the country, being agent here for four of the largest quarries, confirms, to a certain extent, the statement quoted; but he expresses the opinion that the reduction is due more largely to the great depression in trade now prevalent throughout Great Britain, the general depreciation in values and the consequent falling off in demand for all classes of goods.

"The slate business here," said Mr. Galt a few days ago, "is excessively dull at present ; prices are reduced to the minimum, and I suppose it is the same on the other side. We are exporting slates now for 30 per cent. less price than we were a year ago, and even at the reduced rates we cannot do much business. If trade were good in England, what we send over there in the way of slates would have no appreciable effect on the market, as the entire quantity raised here annually, would be but a drop in the bucket compared with the quantity produced each year in the Welsh quarrying districts. The exporting business was begun here not many years ago, in consequence of the home demand being so limited and there being a surplus of production. The quarry owners were also glad to find ready cash customers, as hitherto they had been selling on time and to irresponsible parties. In 1876 the export of roofing slates amounted in all to about 21,000 tons, valued at about $472,000, and in 1877 to about 25,000 tons, valued at about $562,000 ; while this year, so far, the quantity does not exceed 17,000 tons, valued at about $280,000, and it is not likely there will be much more sent abroad during the balance of the year."

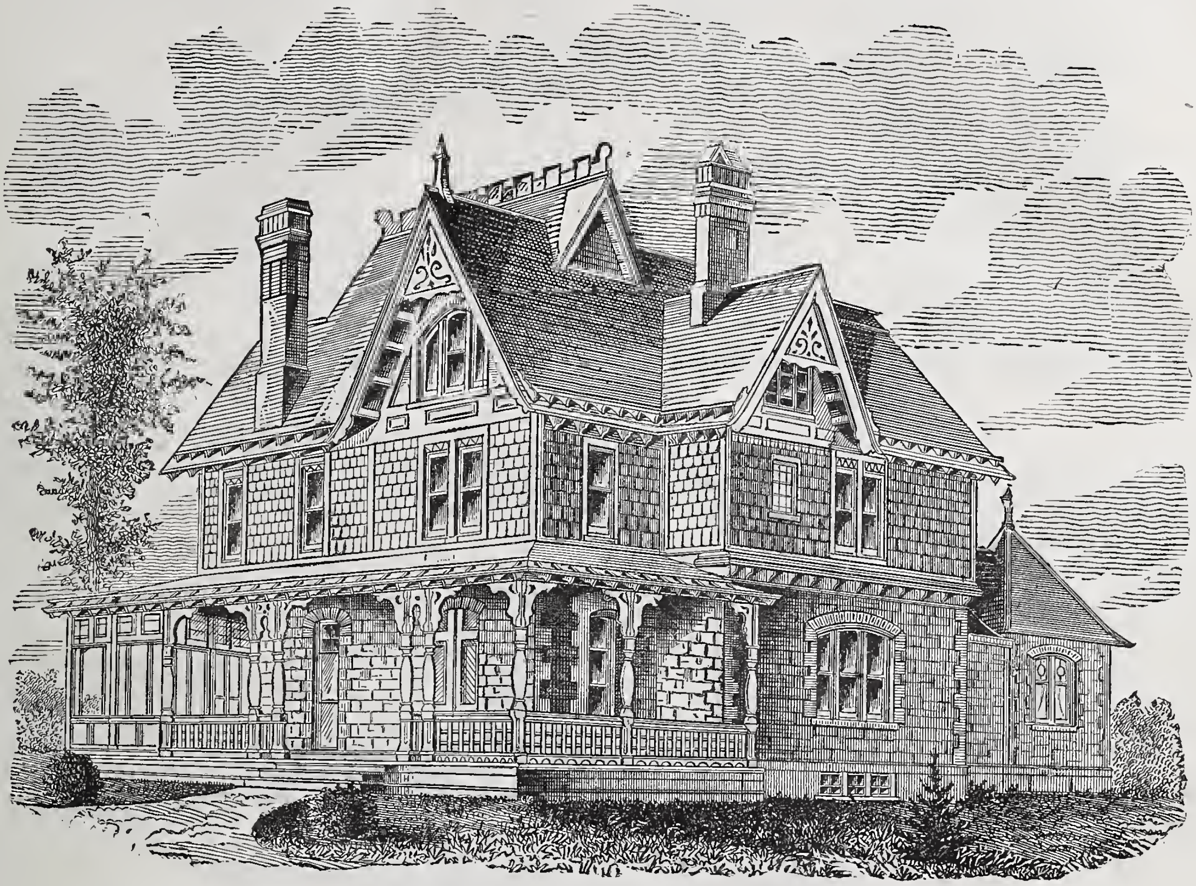
Mr. Galt added that the freight charges amounted to about 25/ per ton ; but notwithstanding this, the slates could be landed at the other side and sold a shade cheaper than the Welsh. He has all along sent the bulk of the shipments from here, and consigns the goods to one house alone in London. Most of the cargoes are sent from New York, but he has also sent in addition, this year, five ship loads from Philadelphia. The principal slate quarries are in Pennsylvania and Vermont, the former State having the two largest, namely, the Bangor and the Chapman. There are three great slate quarries in Wales, any one of which produces more slate in four months, or even less, than all the quarries in this country combined in one year. The largest of the Welsh quarries is that owned by Lord Penrhyn, who employs about 4000 men, a greater number than is engaged in the business in the entire United States. A curious fact in connection with the way Lord Penrhyn manages his business, is that he will not take orders from new customers. He has not, it is said, changed the names on his books for the last fifteen years. He will not advance the price of slates to his customers except when the wages of his work men are increased, and, on the other hand, he will not reduce rates unless the price of labor has first been decreased.

ARCHITECTURE.

Stone and Frame Country Villa.

[Designed and built by ARTHUR B. JENNINGS, Architect.]

The design and details illustrated on this and the two following pages are of a residence erected in Westchester county, N. Y., occupying a position which overlooks the Sound, on the road from Bartow to City Island. There are many features of the building which are unusual, and therefore interesting, especially as regards the treatment of the exterior. The cellar and basement are built of very solid masonry, a superior building stone of a light granite color being found on the grounds. To give variety to the stonework above the water table, the corners of the building and window and door openings are laid in face brick, the red color of which forms a fine contrast with the gray tint of wall. Above the first story the building is substantially frame, though for the sake of continuing the stone effect a light green slate is used for the siding, and the roof is covered with black slate (Chapman's). The woodwork in the gables is made heavy in effect with thick verge boards, and scroll-sawed panels at the apex of each, backed up behind to increase the strength and allow the figure made by sawing to be left in the solid. Each gable is cut to a different design. The chimneys above the roof are built with red and black bricks and encaustic tiles, representing monogram of owner, &c. The porches are laid with narrow yellow pine floors ; have turned columns, chamfered brackets, plates, rafters &c., all the structural parts of roof showing underneath finished. The westerly end of the porch on south side is glassed in for conservatory. The painting of the exterior is done in the main with dark brown color, to harmonize with the gray stone, brick and green slate. The columns, chamfers, brackets, &c., are picked out with other colors, chiefly Indian red, for relief.



STONE AND FRAME COUNTRY VILLA.

On the plan of interior, A represents the entrance hall, made in old-fashioned style like a room, with a cosy fire-place in it, stained glass windows, &c. The wainscoting of this hall is made high, with the top member forming a shelf all around it ; the cornice and center piece are also of wood. This room is fitted up in ash. B, is the library, which is also the parlor. At each side of the entrance door of this room, as shown by the dotted lines, a book-case is built in. The mantel and all the trimmings of this room are in walnut. The dinning-room is fitted up in chestnut and ash, with ash and walnut floor, paneled wainscot, fixed bouffé at one end, and Caen stone and tile mantel-piece opposite. This fire-place is arranged for an open wood fire, and immediately over it, above the mantel, is the window shown on the plan, which is filled with one sheet of plate glass. The faces of this chimney breast to the ceiling are covered with light buff and chocolate colored tiles, and there are introduced in it, as well as in the bouffé opposite, many hand-painted tiles by Messrs. Ward, of original design, of bud and flower patterns of unusual excellence. D, is a room designed to be used as a private office or library ; this is fitted up in oak. The triple window of this room has rolling venetian blinds. E, the staircase hall, is in ash, same as the entrance hall. The staircase has a square chamfered and carved newel with ball at top, close string, square chamfered balusters and double handrail. The floor of this and the entrance hall is covered with ash and walnut bordered floor. F, the pantry, is fitted up with butler's sink, cupboards, &c., complete. From the plan the room might appear a dark one, but is not so, the window shown by staircase throwing its light across into the pantry, and there being a skylight in addition immediately over the butler's sink. G, is the billiard room, fitted up in birch. H, the kitchen. K, conservatory. L, piazzas. On the second and third stories are nine bedrooms, with closets, &c., the bath-room and an attic. These are trimmed in pine, plain chamfered work. All the rooms of first story are fitted in separate and distinct designs, no two being alike. The mantel-pieces, with the exception of that in the dining-room, are of wood, made to order from designs, matching the other woodwork of the respective rooms. All rooms have inside blinds—hard wood on first story, pine on second. The floors of the house are made double, the

Front Elevation.

second layer in all rooms not described for walnut and ash, being in yellow pine throughout the first and second story.

Rear Elevation.

The cellar of the house (not shown as subdivided on plan) is fitted up with store rooms, refrigerator and wine-room, furnace apartment and laundry. All the masonry and carpentry of this building is done in the strongest and most substantial manner, and the plumbing and heating apparatus is fitted up with all modern improvements. Many things about the work are of a more costly character than is usual, the entire outlay for all, including heating, plumbing, fireplaces, &c., being about $14,000; but the main features which give the building its exterior effects, are comparatively inexpensive.

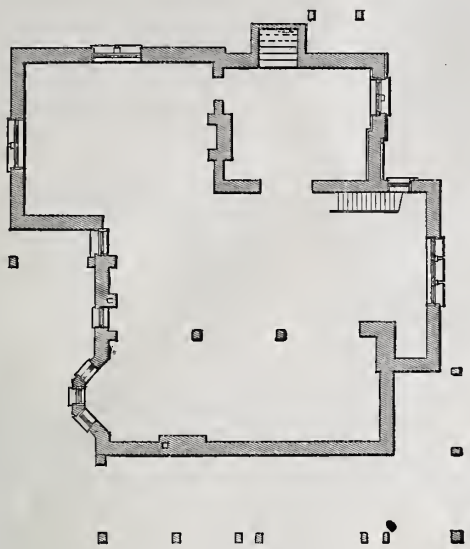
A California Tree.—The San Francisco *Post* describes as follows the section of a tree now on exhibition in that city, which exceeds the diameter of the famous Calaveras tree by five feet: This monster of the vegetable kingdom was discovered in 1874 on Tule River, Tulare county, about 75 miles from Visalia. At some remote period its top had been broken off by the elements or some unknown forces, yet when discovered it had an elevation of over 240 feet. The trunk of the tree was 111 feet in circumference, with a diameter of 35 feet 4 inches. The section on exhibition is hollowed out, leaving about a foot of bark and several inches of wood. The interior is 100 feet in circumference and 30 feet in diameter, and it has a seating capacity of about 200. It was cut off from the tree about twelve feet above the base, and required the labor of four men nine days to chop it down. In the center of the tree, and extending through its whole length, was a rotten core about 2 feet in diameter, partially filled with soggy, decayed vegetation that had fallen into it from the top. In the center of this cavity was found the trunk of a little tree of the same species, having perfect bark on it, and showing regular growth. It was of uniform diameter, an inch and a half all the way, and when the tree fell and split open, this curious stem was traced for nearly 100 feet, usually straight, but occasionally gnarled and twisted, as though it had met impediments in its growth. It is believed to have sprung from a seed in the bottom, grown the whole length of the trunk, and supported a green, living top at the summit. The rings in this monarch of the forest show its age to have been 4840 years.

Side Elevation, A.

Working of English Building Societies.—Building societies in England, although probably developed from the same idea or principle of co-operation as the Philadelphia societies, carry on a different kind of business. They have ordinary stock, preferred shares, and accept money on deposit from persons who have no interest in the societies as members. The money is lent chiefly to members, the loan being secured by bond and mortgage. Like other schemes of co-operation, such as stores and warehouses, they have been very popular in the manufacturing districts of Great Britain. An imperfect Board of Trade return shows the existence in England and Wales of 561 societies, having 224,427 members; 672 societies (not included in the Board of Trade returns) hold securities or cash valued at $115,000,000, of which $40,000,000 belong to depositors and other creditors and the balance to members, either as capital stock or profits. The returns show that 533 societies have a balance of unappropriated profit amounting to nearly $3,000,000, while 115 societies have lost or are deficient about $45,000. In Scotland there are 31 societies, with assets of about $5,500,000 and yearly receipts of $4,000,000. In Ireland there are 18 societies, with $3,500,000 assets and yearly receipts of nearly $3,000,000. There are no exact returns of Philadelphia societies, but they compare very favorably with those of England, since the number of societies is about the same, and the aggregate assets have been estimated at about one-half the assets of the societies in all England.

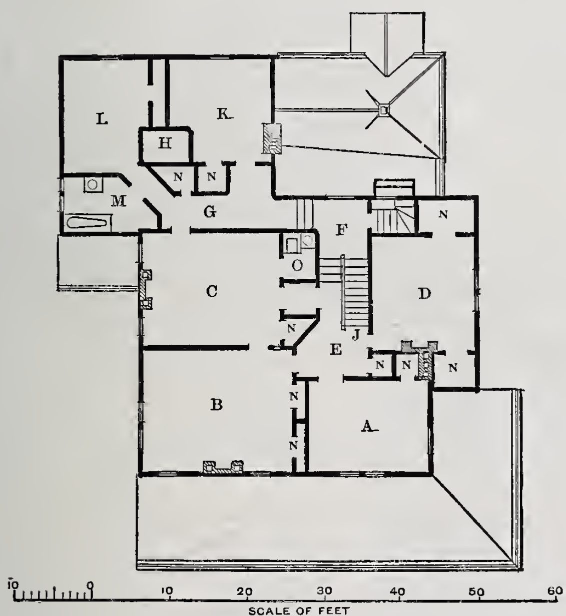
Side Elevation, B.

Palaces and Poisoned Air.—The death of the Princess Alice, who was so much more than a princess in her husband's little Court of Hesse Darmstadt, calls up the old certificate against palaces that was noted at the death of Mercedes, the young Queen of Spain. Very possibly it is the attempt to modernize these with all patent appliances for comfort, that makes them more unsafe than they used to be, when a surfeit or the small-pox were the sole expected dangers the inmates had to fear, after the little accidents of the poisoned dish, or glove, or dagger had gone out of fashion. At all events, diphtheria and typhoid fever are the two foes that no guard keeps out of the old palaces, although every day's lessons go to show that they are or may be preventable diseases, and there is no reason they should gain an entrance into the the humblest house. Both seem to come from underground coutamination of the water that is drank and the air that is breathed, in either palace or tenement house; but when a costly sacrifice calls attention to the fact that no amount of luxury, or wealth or medical skill can shut out these insidious destroyers, renewed search after their causes ought to make the people who live in alleys and small courts all the safer for it.

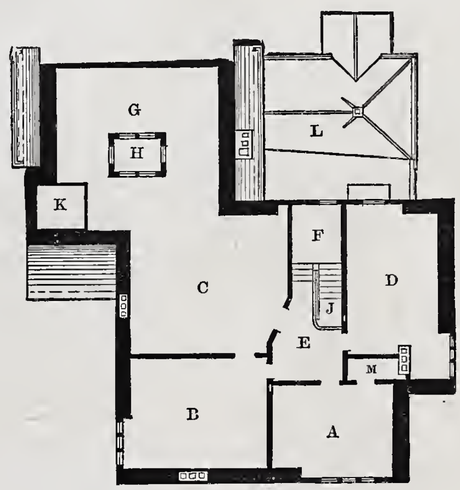


Plan of Cellar.

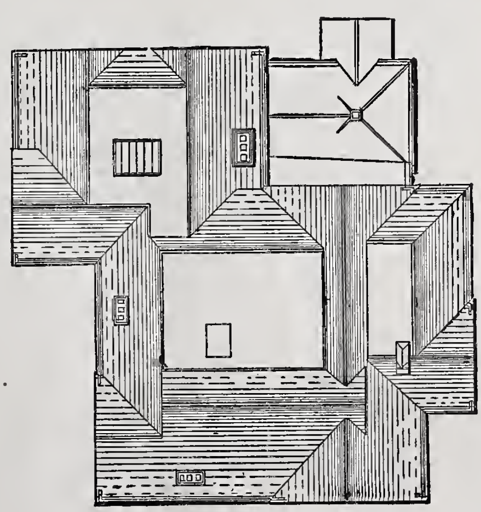
Plan of First Floor.



Plan of Second Floor.



Plan of Attic.



Plan of Roof.

A New Method of Inlaying Wood.—A new method of inlaying wood, by which we should think very good results with little labor may be obtained, has been contrived by a furniture manufacturing house in London. The process by which this is effected is as follows: A veneer of the same wood as that of which the design to be inlaid consists—say sycamore—is glued entirely over the whole surface of any hard wood, such as American walnut, and allowed to dry thoroughly. The design is then cut out of a zinc plate, about 1-20th of an inch in thickness, and placed upon the veneer. The whole is now subjected to the action of steam, and made to travel between four powerful cast-iron rollers, 8 inches in diameter by 2 feet long, two above and two below, which may be brought within any distance of each other by screws. The enormous pressure to which the zinc plate is subjected forces it completely into the veneer, and the veneer into the solid wood beneath it, while the zinc curls up out of the matrix it has thus formed, and comes away easily. All that now remains to be done is to plane down the veneer, untouched by the zinc, until a thin shaving is taken off the portion forced into the walnut, when, the surface being perfectly smooth, the operation will be complete. It might be supposed that the result of this forcible compression of the two woods would leave a jagged edge; but this is not the case, the joint being so singularly perfect as to be unappreciable to the touch—indeed the inlaid wood fits more accurately than by the process of fitting, matching and filling up with glue, as practiced in the ordinary mode of inlaying.

Building in New York.—Building operations in New York during the past year have manifested a fair degree of activity. By the records of the Building Department, in a period of twelve months, embracing the two seasons of most active building operations, spring and fall, it appears that the aggregate number of buildings for which permits were granted, was some 1600. While this showing, in comparison with some previous years, appears small, it nevertheless marks an unusually important step in the city's march of improvement. Of this number of buildings two-thirds, or about 1050, were dwelling houses. Of the remainder, 150 were for business purposes and 11 were public buildings. The assumed cost of the buildings ranged all the way from $200 to $350,000. The average cost was probably about $10,000 or $12,000. Dwellings of an unpretentious class largely predominate.

Loose Screws.—It is a common thing, when a screw or staple becomes loose, to draw it out, plug up with wood and reinsert. But screws and staples so secured soon come out again. It has been found that a much better way is to fill up the holes tightly with cork. Screws and irons so secured will remain perfectly tight, just as long as when put into new wood.

"Eastlake."—A gentleman having some business to transact with a dealer in foreign and hard woods, saw while there a good looking bedstead that had been taken in trade, and said to the dealer, "You've got a good looking bedstead there." "Oh, yes!" replied the dealer; "Eastlake made that; he makes a deuced sight of furniture nowadays; in fact, he seems to be getting all the business."

DRAFTING.

Methods of Projecting the Ellipse.

An old master builder of this city, a short time since, in a conversation about the degree of scientific and technical knowledge possessed by the mechanics of the various building trades, said in reference to the carpenters: "Why, I don't believe there is one in a hundred who can draw an ellipse by any other means than a trammel, and of those that use the trammel there are but a small number who can adjust it to fulfill specified conditions of size." Now, this builder's opinion of carpenters, as a class, may be entirely erroneous. Of our own knowledge we cannot say. But we do know that, of all geometrical figures of common application, the ellipse is perhaps the least understood. Accordingly, we have ventured to suppose a familiar talk about it at this time will not be entirely without interest to our readers. Other mechanics besides carpenters have occasion to understand the properties of the ellipse, and therefore we have made our remarks of a general, rather than of a specific character.

An ellipse is "an oval or oblong figure, bounded by a regular curve, which corresponds to an oblique projection of a circle, or an oblique section of a cone through its opposite sides." An oblique projection of a circle is most readily understood if explained by means of an oblique cut through a cylinder, as, for example, a shaft or column. It may be obtained as follows: In Fig. 1 let A

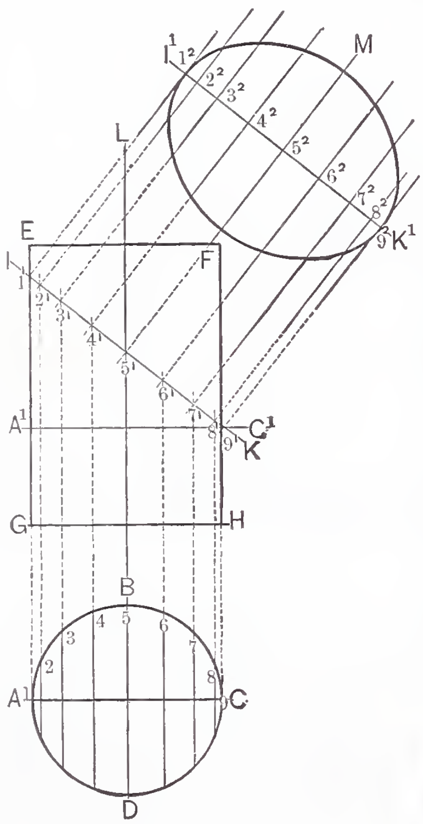


Fig. 1.

B C D represent the plan of the shaft, and E F H G the elevation. Draw the line I K to represent the oblique cut. Subdivide one-half of the plan, A B C, into any convenient number of equal parts, and through each of these points erect lines perpendicular to the diameter, A C, prolonging them until they cut the oblique line I K. In convenient proximity to the line, I K, but outside of the figure, draw the line I^1 K^1, corresponding in all respects to the former, the divisions 2^2, 3^2, 4^2, in it corresponding to 2^1, 3^1, 4^1, of the other. With the dividers, in the plan take the distance on each perpendicular line from A C to the circumference of the circle, and set it off on corresponding lines drawn through I^1 K^1, as shown. A line traced through the points thus obtained will be an oblique projection of the circle A B C D, and therefore an ellipse.

The second part of the definition, "an oblique section of a cone through its opposite sides," is illustrated in Fig. 2 of the accompanying engravings. Let A B C represent the elevation of a cone, and E D G F the plan of the same at the base. Draw H I to represent the oblique section. At convenient distance outside of the figure, and parallel to H I, draw H^1 I^1, upon which to construct the figure sought. Subdivide one-half of the plan, E D G, into any convenient number of equal parts, as shown by 1, 2, 3, &c. From the center, M, draw radial lines to each of these points. From these several points also erect perpendicular lines, cutting the

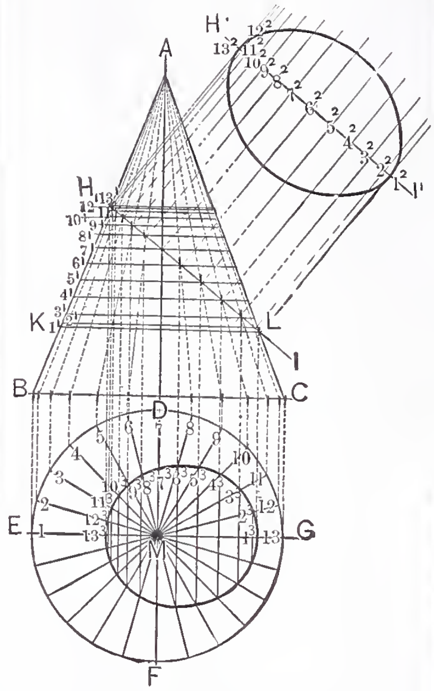


Fig. 2.

base B C, as shown, and from this base line draw lines to the apex A, cutting the oblique line H I. Through the points thus obtained in H I, draw the lines 1^1, 2^1, 3^1, &c., at right angles to the axis of the cone, and cutting the two sides, as shown. From the same points in H I drop lines vertically across the plan, as shown by 1^3, 2^3, 3^3, 4^3, &c., and also from the same points, at right angles to H I, draw lines through H^1 I^1, as shown by 1^2, 2^2, 3^2, 4^2, &c. With the dividers take the distance from the axial line, A D, to the side of the cone, either A B or A C, on each of the lines 1^1, 2^1, 3^1, &c., and set off like distance from the center, M, of the plan on each of the corresponding radial lines 1, 2, 3, &c. A line traced through the points thus obtained will give the plan view of the oblique cut. With the dividers again take the distance either side from E G in the plan, on the lines 1^3. 2^3, 3^3, 4^3, &c., to the line just traced, and set off corresponding distances on the lines 1^2, 2^2, 3^2, &c., from H^1 I^1. A line traced through these points will give an oblique projection of a cone through its opposite sides, or an ellipse.

A third, and not an unusual definition of an ellipse, is that it is "a figure bounded by a regular curve, generated from two foci."

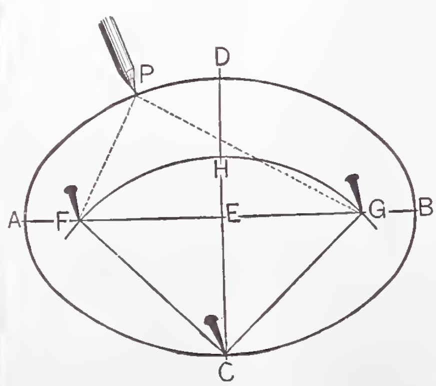


Fig. 3.

This definition is best explained by the use of string and pencil. In Fig. 3 draw the line A B, representing the length of the figure, and at right angles to it draw the line C D, representing its width. Take the distance A E, or one-half of the length, and with C as a center strike the arc F H G. The points at which this arc cuts the major axis, or in other words, F and G, will be the foci. Drive a pin in each, and also a third one in C Around these three pins tie a string. Remove the third pin and substitute a pencil. By moving the pencil around the two foci, keeping the string stretched all the time, a regular curve will

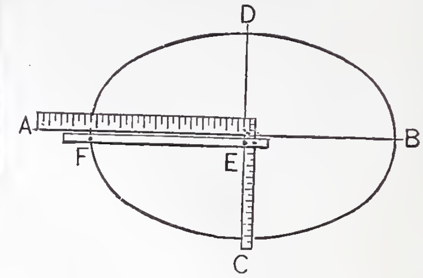


Fig. 4.

be produced, which is an ellipse. This method of drawing the ellipse also illustrates another form of this same definition, which may be mentioned in this connection. An ellipse is a figure bounded by a regular curve, each point in which is equally distant from two points within its surface, called foci. In other words, the sum of the distances from any point in the curve to the two foci is equal to the sum of the distances from any other point to the two foci. In drawing a circle, each point in the curve is determined by one center, and all points in the curve are equally distant from that center. In an ellipse, each point is controlled by two centers working in conjunction, and the distance from these centers to each of the several points in the curve must correspond accordingly.

The method of adjusting a trammel for drawing an ellipse to specified dimensions, may perhaps be better illustrated by showing an improvised trammel, in the shape of an ordinary square and a straight-edge, as ar-

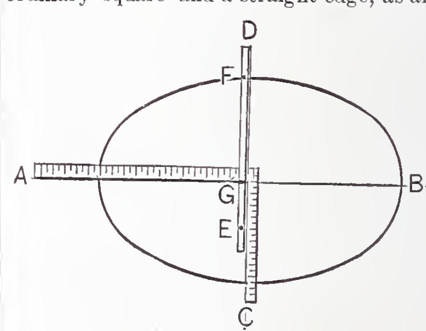


Fig. 5.

ranged in Figs. 4 and 5. Draw the line A B, and bisecting it at right angles, draw C D. Set off on these lines the required dimensions of the ellipse to be drawn. Place an ordinary square, as shown. Lay the straight-edge lengthways of the figure, as shown in Fig. 4, and putting a pin at E against the square, place a pencil at F, at a point corresponding with one end of the figure. Next place the straight-edge, as shown in Fig. 5, crossways of the figure, and bring the pencil F to a point corresponding to one

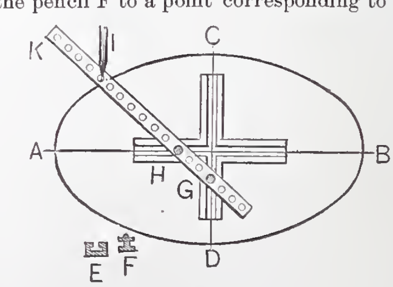


Fig. 6.

side of the figure, and set a pin at G. By keeping the two pins E and G against the square, and moving the straight-edge so as to carry the pencil from side to side, one quarter of the figure will be struck. By placing the square in the same relative position in each of the other three quarters, the other parts may be struck.

The advantage of a trammel (Fig. 6) over this method of using a square and straight-edge, consists in greater accuracy and convenience. The pins and pencil are set in the manner above described. Instead of the ho es in the carrier to receive the pencil and pins, the improved furniture for trammels sold by dealers in drafting instruments and the hardware trade generally, is much to be preferred. By means of it very accurate adjustments are made, which are impossible by other means.

An ellipse may be drawn by the intersection of lines, as shown in Fig. 7. Draw A B,

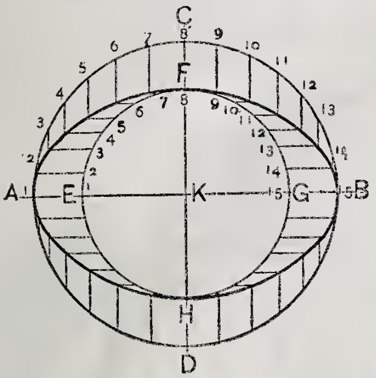


Fig. 7.

and bisect it at right angles with C D. With the point of intersection K as a center, and with one-half of the longer diameter of the required figure for a radius, strike the circle A C B D. From the same center, and with one-half of the shorter diameter for a radius, strike the circle E F G H. Divide each of these circles into the same number of equal parts, as shown by the small figures. From the several points in the outer circle drop lines vertically, and from the points in the inner circle draw lines horizontally, intersecting each other as shown. A line traced through these points of intersection will form an ellipse.

A method of producing an approximate ellipse, and one in quite common use among builders by reason of its convenience for large figures, is shown in Fig. 8. Lay off

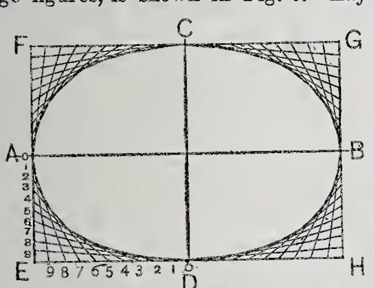


Fig. 8.

the length of the required figure, as shown by A B, and the width as shown by C D Construct a parallelogram that shall have its sides tangent to the figure at the points of its length and width, all as shown by E F G H. Subdivide one-half of the end of the parallelogram into any convenient number of equal parts, as shown by A E, and one-half of its side in the same manner, as shown by E D. Connect these two sets of points by intersecting lines in the manner shown in the engraving. Repeat the operation for each of the other corners of the parallelogram. A line traced through the inner set of intersections will be a very close approximation to an ellipse.

Various methods might be described for drawing approximate ellipses by means of several radii. The relative advantages of the different rules depend upon the nearness of approach to a true ellipse. At this time we will describe but one method, which is shown in Fig. 9, and which is one more generally used, perhaps, than all the others combined. Lay off the length C D, and at right angles to it, and bisecting it, lay off the width A B. On the larger diameter lay off a space equal to the shorter diameter or width, as shown by D E. Divide the remainder of the length or larger diameter E C, into three equal parts; with two of these parts as a radius, and R as a center, strike the circle G S F T. Then with F as a center and F G as radius, and G as center and G F as radius, strike the arcs as shown, intersecting each other and cutting the line

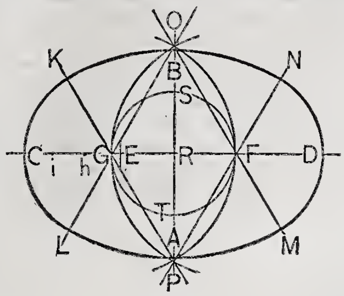


Fig. 9.

drawn through the shorter diameter, at O and P respectively, as shown. From O, through the points G and F, draw O L and O M, and likewise from P through the same points, draw P K and P N. With O as center and with O A for radius, strike the arc L M, and with P as center and with like radius, or P B, which is the same, strike the arc K N. With F and G as centers, and with F D and C G, which are the same, for radii, strike the arcs N M and K L respectively, thus completing the figure.

New Publications.

The Art Worker: A Journal of Design, devoted to Art Industry. Published monthly by J. O'Kane, 31 Park Row, New York.

This work, of which the 12 numbers for 1878 lie before us, consists of a series of designs, eight sheets in each number, suitable for the workman or designer. Upon looking carefully through the numbers we were first struck with the remarkable excellence of the work. Whether the design is a surface ornament, a wall decoration, a border to be made in metal, or a piece of stained glass work, there is a uniform excellence of design, high artistic feeling, and in general all those qualities which give a design its commercial and artistic value. Whether we considered them as designs for work to be manufactured, studies for the workman and designer, or as simple suggestive material, we found them equally good. Our second surprise was when we found that all the sketches were from American designers and artists. The scope of the work is very wide, and we cannot do better than give the announcement which the publisher makes:

"The scope and purpose of the *Art Worker* are fairly indicated by its title, viz., to supply good designs of the later styles, in response to the growing demand created by the increasing public interest in all branches of art industry. Illustrations of examples of decoration, ornament and formation will constitute its principal feature; though, owing to the wide field to be covered, many other subjects will necessarily receive treatment in its progress. The selections will be made with a constant view to *technical and practical utility*, and no effort will be spared to secure and maintain a uniform standard of excellence in the material. While the selections will not be entirely restricted to original matter, it is proposed to make the *Art Worker*, as far as possible, a vehicle for American art. Gentlemen of talent and ability in New York and elsewhere have volunteered to lend it their support with contributions; and throughout the country there is a great deal of good design now lying in the portfolios of designers, architects, decorators and other industrial designers, which merits wider circulation, and will always be welcomed to the pages of the *Art Worker*. Contributions especially prepared are invited. In short, the publisher solicits good and appropriate matter from every source, and would be glad to receive communications from all those who desire to be represented in the pages of the *Art Worker*." The year's work which is before us shows that the publisher has carried out the plan which he laid out in a very successful manner. The improvement which will result from a general circulation of these designs among manufacturers and others cannot but be felt in a very marked manner in the improvement of all kinds of manufactured articles. This improvement will even extend to things not usually ornamented. The familiarity with beautiful forms cannot but improve the form even of the commoner articles.

Bicknell & Comstock.—The firm of A. J. Bicknell & Co., architectural publishers, of this city, will hereafter be known as Bicknell & Comstock—Mr. J. C. Hutchings leaving, and Mr. W. T. Comstock entering the firm. Mr. Bicknell, who established this business in 1865, may be considered the pioneer, in this country, in the publication of practical architectural books. Several American works on this subject were made previous to the establishment of this house, but none giving so great a variety of designs and details to working scale, the illustrations in previous works being generally better adapted to the use of architects than to the practical wants of the carpenter and builder. The first book published by them contained over 1000 illustrations of the designs and details of the various parts of buildings, drawn to an intelligible working scale, and, although published at $10 per copy, had a large sale. Since then the firm have published an extensive line of works, and have done much to popularize the literature of architecture and the building trades.

Model Tenement House Plans.

Mr. Henry C. Meyer, D. Willis James, F. B. Thurber, Henry E. Pellew and Robert Gordon, have united in offering $500 as a premium for the best four designs for a house for workingmen, in which may be secured a proper distribution of light and pure air, with an arrangement of rooms that will yield a rental sufficient to pay a fair interest on the investment.

The *Plumber and Sanitary Engineer*, in which this offer is made public, says: It is hoped that architects will generally respond to this invitation, and that, as a result of the competition, the single lot owner as well as the capitalists may be shown how they can benefit those who are forced to live in tenements, and at the same time have a paying investment. To diminish crime, promote their moral welfare and prevent the spread of disease, the physical surroundings of the poor must be improved. This seems to us practical philanthropy, and while we would not turn aside one dollar now spent in sustaining missionary operations, still we are forced to the conclusion that the money will yield a much greater return when the poor have more habitable dwellings. To be permanently successful, the building of the houses for the poor must not be undertaken as an act of charity, but as a business operation, and to secure this end the gentlemen named have united with us in proposing the competition. The problem of building on a large block successfully, has been solved by Mr. White in Brooklyn; in this city we must see what can be done on the 25x100 foot lot, and it is hoped that the ingenuity of our architects will suggest a plan by which the single lot owner may profitably build a sanitary apartment house. If the latter can be shown how to do this, competition between owners of tenements will be an important element in solving this difficult New York problem. The unfortunate division here into lots 25x100 compels us to see what can be done on the ordinary-sized lot, though it is hoped, in laying out new sections or changing old ones, a different division may be adopted. The committee of award is to consist of Mr. R. G. Hatfield, architect; Prof. Chas. F. Chandler, president Board of Health; Rev. John Hall, D. D.; Rev. Henry C. Potter, D. D.; Mr. Robert Hoe. The designs will all be placed on public exhibition, at a place to be hereafter designated, from February 5th to 15th.

Chinese Bridges.—It is probable that the Chinese were the inventors of suspension, or, as they are called in China, flying bridges. The use of suspended bridges in China dates back to the Han dynasty, which flourished 1600 years ago. There still exists in Shen-se a bridge of 400 feet span, which is suspended over a chasm 500 feet deep. Most of these bridges are so wide that four horsemen can ride over them abreast.

The Holly System of Steam Heating.

Many persons, no doubt, have entertained a vague idea that districts might be supplied with steam for heating and other purposes very much as gas is now supplied, but no one has made a practical demonstration of it except Mr. Birdsill Holly. The successful operation of works constructed upon his system at Lockport, N. Y., which were in use through last winter, has paved the way for the introductiou of this method of heating into various other places. The resolution of the Board of Aldermen of New York city, empowering Gen. Spinola and his associates, representing the Holly Steam Heating Company, to lay steam pipes in certain streets of the city, and which was approved by Mayor Ely Dec. 11, gives the subject unusual interest at this time. The proposition at present, so far as this city is concerned, is to limit the enterprise to a few blocks in a suitable part of the city, in order that the experiment may be fully tried before general privileges are conceded. It is supposed that if it is thus proved entirely successful, the system may be made to produce a good revenue to the city.

The general scheme is to supply steam to the public by measure at a price, delivering it through mains and laterals of iron pipe laid in the public streets. The steam is generated in batteries of boilers of capacity proportioned to the district to be supplied. Mains are laid from the boilers through the streets, which in turn are tapped to carry the steam into the buildings. The mechanical difficulties which have been surmounted, and the invention and perfection of various apparatus and devices requisite to the successful issue of this scheme, constitute the preliminary work which has been accomplished by the inventor, and that which has been successfully tried at Lockport. We will refer, quite briefly, to some of the special features of this system, and to the appliances which have been invented in connection therewith.

It is estimated that steam can be satisfactorily and economically distributed from one central supply over an area of 16 square miles. In the arrangement of a battery of boilers for this purpose, or for a smaller area, connections are made in such a way that any boiler can be disconnected without interfering with the operations of the others. The mains throughout an entire district are divided into sections, each one of which is so controlled by an arrangement of valves that it can be closed or shut off, in case of necessity, without inconvenience to the other sections. Contraction and expansion of the pipes is provided for by an expansion junction service box, Fig. 1, which is placed at intervals of 100 to 200 feet in the line. From this box the service pipes are carried underground to the basement of buildings to be heated. Provision is also made in this connection for taking up the condensation as fast as it accumulates, by a plan which we will describe further on. The mains are laid 3 to 4 feet below the surface, so as to be above the gas and water pipes. The pipes are covered with non-conducting materials, and then inserted in logs of wood. These are laid over tile to secure drainage. The mains for an ordinary district are 8 inches in diameter, decreasing in size as they radiate and approach the limits of the district to 1½ inches in diameter, to correspond with the amount of steam to be passed. Accurate experiments with reference to condensation have demonstrated, contrary to popular belief, that steam can be conveyed through a continuous small pipe, properly protected, a mile and one-third, with so small a loss as to be no hindrance whatever. A 6-inch pipe will convey steam 9000 feet, and a 12-inch pipe will carry it 18,000 feet, without sufficent loss from condensation to render it uneconomical.

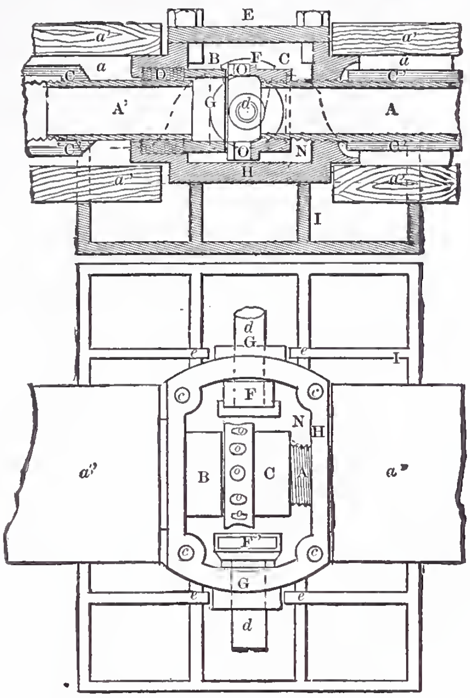


Fig. 1.—CONTRACTION AND EXPANSION JUNCTION IN THE MAINS.

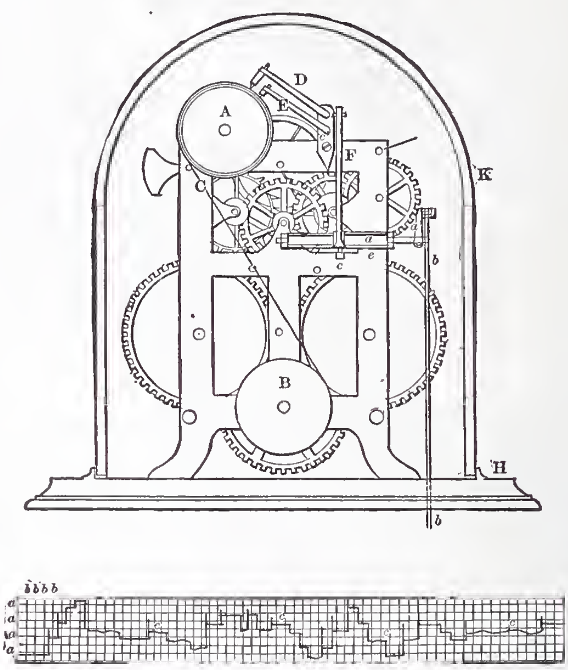


Fig. 3.—STEAM METER.

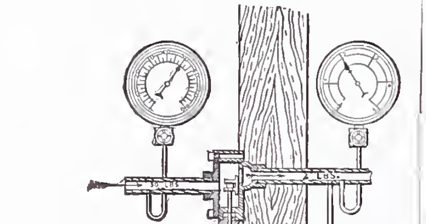


Fig. 2.—PRESSURE REGULATOR.

An essential part of the system is the method of regulation, by means of which from 50 to 60 pounds of steam may be carried in the boilers and mains, and only 2 to 4 pounds, as may be desired, in the houses. The water from condensation in the mains, at a degree of heat due to say 50 pounds of steam, is withdrawn through the regulator valve inside the cellar walls, and by the reduction of pressure thus effected is largely reconverted into steam and is carried on to the radiators. The general features of the regulator are shown in Fig. 2 of the accompanying engravings. The amount of steam used by each consumer is accurately recorded by a steam meter, a representation of which is shown in Fig. 3. The record is made by a pencil on a ribbon of paper which is moved by clockwork, and so comprehensive are the functions of this instrument, that it can be made to tell not only the entire quantity of steam consumed, but also at what hour each radiator in the house was put on or taken off. This system admits the use of radiators, both direct and indirect. While in many cases the radiators usually employed in steam heating are in use, the projector of the system has inveuted a new radiator, which, it is claimed, possesses new features of great advantage. It is called an atmospheric radiator. It is made of sheet copper, galvanized iron, or other suitable sheet metal. Upright tubes 3 or 4 inches in diameter are connected with a horizontal cap and base. In the base are openings to allow the air to pass in aud out freely. A little steam brought into the cap will occupy the upper portions of all the tubes, the inlet valve being set according to the amount of heat desired in the room. As steam is lighter than air, it can be made to occupy any portion of the radiator, and in no case can there be more than atmospheric pressure. The pressure of steam in the building being maintained at a given point by means of the regulator in the basement already referred to, the adjustment of the inlet valve to the radiator controls the temperature of the room absolutely. By this means the temperature of a room may be raised 1 degree or 80 degrees, as required, remaining stationary at the desired point until the valve is again changed. Of the advantages claimed for this new radiator may be mentioned, that it is estimated to cost in making and setting 50 per cent. less than the usual styles ; that the same surface will give off more heat than wrought or cast iron ; and that condensation in the pipes is reduced to about one-third of the amount incident to the old system, because smaller pipes can be used, and because the return pipe is always cold. The condensation water is gathered in a tank in the basement, an overflow pipe being connected with the sewer, and, being chemically pure, is very desirable for household purposes. With the appliances already perfected, almost every service for which a fire is used in a house may be performed by steam. The exceptions are the cooking of a few articles requiring a quick, glowing heat, as, for instance, a beefsteak. All ordinary operations of cooking can be done by steam, it being only a question of fixture and connections. For laundry purposes and for bath rooms, by an invention for the purpose, steam is discharged directly into the water without noise, raising the temperature in a very few moments to the boiling point. It will be seen that this invention does away with the system of hot-water circulation in houses. A drying room in connection with the laundry may also be cheaply arranged, with racks to slide over a coil placed on the floor, which will do the drying very expeditiously. Water may be carried to all the rooms in a dwelling by the use of steam, either by atmospheric pressure or by the direct application of the force of steam for the

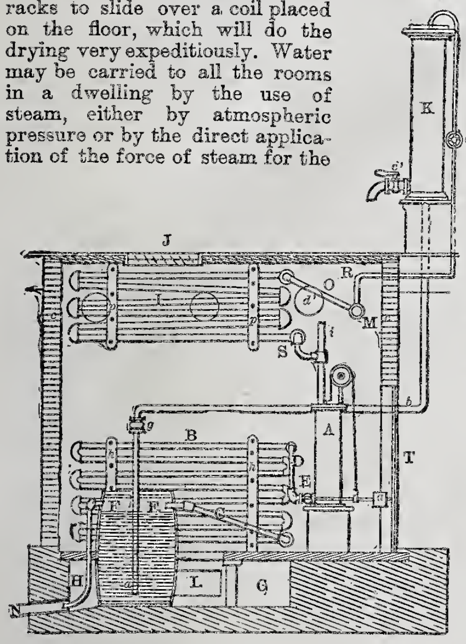


Fig. 4.—LOCATION OF STEAM TRAP, ARRANGEMENT OF COILS FOR VENTILATION AND MEANS OF RAISING CONDENSED WATER.

purpose. In Fig. 4 is shown the method of gathering the condensation water, of utilizing the heat that remains in the steam and water after leaving the radiators, when the usual styles are used, and a means of carrying the water to an upper story. The steam and condensation water, returning from the radiators,

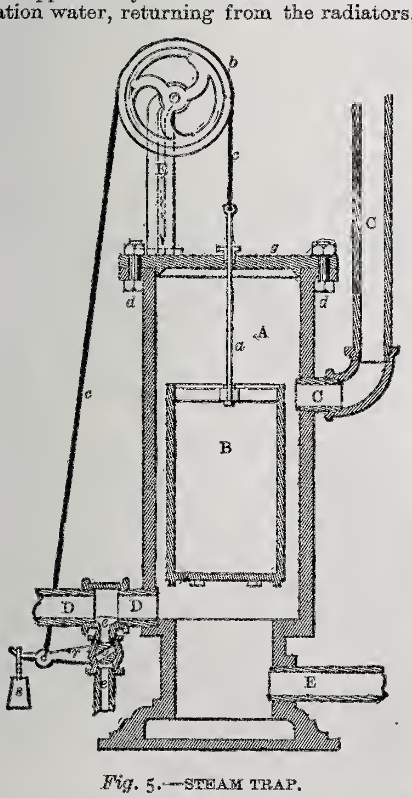


Fig. 5.—STEAM TRAP.

passes to the trap A, where it is separated and is circulated through the coils shown. Air from the outside of the building is passed around these coils, and thence through a register J in the floor of the hall above, producing ventilation and a summer-like atmosphere. The water from the coil is discharged into the tank F F. On some upper floor is located the accumulator K, which is connected at the top by a ⅜-inch steam pipe with the cellar. From the bottom of the accumulator to the tank of condensation water in the cellar, is a ½-inch pipe. On opening the valves *o* and *c*, the steam will enter at the top and drive the air out at *c*. Upon closing both valves the steam will condense and form a vacuum, when the space will be filled with water from the tank below. Water for use is then drawn through the valve *c*. The steam trap is shown in Fig. 5.

In addition to the advantages we have enumerated, the projectors of the scheme call attention to the heating of conservatories and green-houses; the removal of ice and snow from the streets and sidewalks, by placing a steam coil convenient to a sewer opening, which would melt the snow as fast as it could be delivered on to the same; the extinguishment of fires by filling buildings with steam; a reduction of expense in fire engines by dispensing with the boiler in use, the engine being connected to a steam plug for power the same as to a water plug for water. In reference to the economy of the system, it is claimed, from the experiments already performed, that the same amount of heat can be supplied at a good profit to the company for what the wood and coal would cost the consumer if his building were warmed in the ordinary way. In other words, the consumer will save the loss on stoves, furnaces and piping by deterioration, &c., and also the cost of stoking, removing of ashes, &c.

It will be readily seen that this scheme is a very important one, and, if successful, will bring a revolution in many branches of business. It will no doubt greatly reduce not only the cost of heating our dwellings, but in a great many instances it will cheapen the cost of power. Probably the users of small steam engines will feel the benefit as much as any other class, since they will then have all the advantages of using a large boiler without any of the attendant disadvantages. In steam heating also there will doubtless be a considerable saving, both in the cost of fuel and the attendance necessary with ordinary boilers.

The mechanical difficulties in the way of complete success are no doubt very great, and the engineering problems will need careful working out in order to avoid serious obstacles. Some persons apprehend a great deal of trouble from the rapid decay of the pipes, and the consequent dangers arising from bursts and leaks. Others make a great point of the danger from boiler explosions, where so many boilers are to be used. In regard to this there is little to be said, since the absolute number of boilers in the city will doubtless be greatly diminished, although their horse power may be very much increased. Steam power under such a system will be available anywhere, and the objection to boilers which prevents its use in many fine buildings will not be felt. Elevators can then be run without the necessity for a fireman, and in some buildings engineers will be able to run the elevator as well as attend the engine. With the exception of the proposition to distribute a non-illuminating gas for fuel, there has not been so important a scheme brought before the public for a long time. It is difficult now to see what the influences of the successful working of the scheme will be. It is quite possible that a complete change in the domestic economy of cities may ensue. The result of the experiment will be watched with the greatest interest by the public, and we shall keep our readers promptly informed of the progress of the undertaking.

Water and Creosote in Stove Pipes.

The question frequently arises as to the cause of the wet or creosote running down stove pipes, and what remedy may be employed. This difficulty is particularly annoying when it happens that the joints or lengths of pipe are so arranged as to throw all the gathered moisture outward, thus staining and disfiguring the pipe. An explanation of the trouble is readily understood, and in part it may be avoided. Almost all fuels commonly used in stoves contain a large amount of hydrogen in some form, usually in combination with carbon, and passing under the name of hydrocarbons. When a hydrocarbon is burned in air the results are water from the combustion of the hydrogen, and carbonic acid from the burning of the carbon. Usually the water makes its appearance, when the smoke is cooled a little, in the form of steam or vapor; a little further cooling and it takes the form of water. Those of our readers who have used kerosene stoves for heating small rooms, have doubtless noticed the quantity of moisture which soon collects in cold weather upon the windows. This is the result of the combustion of the hydrogen contained in the hydrocarbons of the kerosene, the steam being condensed upon the cold surfaces. Wood contains, besides a considerable amount of the hydrocarbons, a large percentage of water, even when very dry. When wood is slowly heated, besides the water, acetic or pyroligneous acid, tar, &c., are given off, the whole forming the black, disagreeable liquid usually called creosote. When a brisk fire is kept up in a stove where wood is burned, all the steam, tarry matter, &c., usually pass off into the air before they have time to cool and run down the pipe. If, however, the pipe is very long, the smoke is pretty likely to get cooled on its way out, and then the nasty dripping begins. This often takes places when the fire is first lighted, and lasts only for the little while necessary to heat the pipe. When a pipe drips after the fire is well started and the drafts closed, the remedy is quite easy. A little register is put into the pipe near the stove, and is opened whenever the drafts are closed. This allows a free circulation of air in the pipe, and the gases are carried out of the pipe at once, instead of moving along so slowly as to give ample time for condensation. The dripping when a new fire is kindled is a very serious matter, and we are not at all sure that there is any convenient remedy. Reversing the joints of pipe will not always do it. With dry anthracite coal there is much less trouble than with wood, because the coal has little or no water in its composition, and if the fire is started with charcoal there is scarcely any steam to condense, and none of the tarry acid products. Here we may very properly give a word of caution to our readers upon the subject of dry fuel, and more especially of dry anthracite. To allow either coal or wood to be wet with snow or rain is a very great waste, the heating power of the wood being greatly reduced by the action of the water upon it, even when it is afterward dried. In preparing wood for fuel it should be cut up and sawn while green, and at once stored out of the way of both snow and rain. In a word, it should "never see the sun" from the time the green cordwood is hauled to the shed. To attempt to dry wood in the stick we think very wasteful, both of power needed for its preparation and of its heating qualities. Cordwood newly cut, put under cover and at once sawed to stove length and piled up out of the sun and rain, where there is an abundant circulation of air, is, according to our experience, worth about one-fourth more than dry wood prepared in the ordinary manner, and for our own use we would rather have one cord of such wood than two cords of dry cordwood dried in piles out of doors and then prepared for the stove. The two cords in heating power might be a little ahead of the first, but the satisfaction in using would more than make up the difference. When wet fuel of any kind is put into the stove, a great quantity of heat is wasted in converting the water into steam, which escapes up the chimney without giving back any of this list. If there is a little sulphur in the coal the presence of the steam greatly increases its destructive action, and stoves and pipes are likely to show a rapid corrosion.

Asbestos Powder.—Asbestos powder, made into a thick paste with liquid silicate of soda, is used with great advantage for making joints, fitting taps, and connecting pipes, filling cracks, &c. It hardens very quickly, stands any heat, and is steam tight.

Artistic Wood Carving.

For several years Mr. Ben Pittman, of Cincinnati, has conducted at Cincinuati an important class for instruction iu wood carving, in the School of Design of that city. Mr. Pittman is a gentleman of fine artistic culture and large experieuce, and has been very successful in populariziug artistic work in wood carving. Those who saw the unique and remarkable exhibit of the work of the pupils of the class in the Normal Pavilion at the Centennial, will only need to be reminded of it to recall it with pleasure. We are indebted to Mr. Pittman for a copy of a letter, intended to give those iuterested some idea of the work undertaken by the students and how it is done, from which we extract the following concerning tools and methods of study. These facts have interest for all who, without opportunity for instruction, may desire to employ their leisure in artistic wood carving, either for pleasure or with a view to profit.

If we describe a pupil's first piece of carving, we shall readily find out what is necessary to be known to suitably decorate so simple a thing as a wall pocket—usually the first article on which a pupil commences. The front of a wall pocket is a rectangular piece of black walnut, seven-eighths of an inch thick, and eight by eleven inches square, with chamfered edges. To learn something of the nature and grain of the wood, and the use of the only tool that is first put into the pupil's hands, namely, a knife (called a hawk's bill, resembling a very small pruning knife), the panel is turned to its back, and on this a little experimental cutting is done. A few leaves are drawn with pencil by the teacher, and the pupil outlines them with the knife, first making a vertical cut over the pencil lines, and generally, at first, passing over the line twice, to make it sufficiently deep ; then on the outside of the leaf a slanting cut is made, deep enough to cut out an angular shaving, leaving a little groove about one-sixteenth of an inch deep all around the leaf. A few leaves outlined in this way will prepare the pupil to treat the face of the panel with assured success.

For the first effort several suitable designs are offered, from which the pupil selects one. All subsequent designs are made by the pupil, of course assisted and corrected by the teacher. Designs are made on paper with pencil, and when pronounced satisfactory are transferred to the wood by tracing over the design, having a piece of blackened carbon paper placed underneath. The front of the wall pocket is treated as a vertical panel —that is, the decoration must be suitable to a vertical position. A fitting design might consist of a border having a rosette at each corner, thus giving two horizontal and two vertical lines of ornament. Suitable lines of decoration for the top, bottom, sides and corners are shown, and the pupil selects the most inviting. The center of the panel would admit of a choice from a great variety of designs. A natural or symmetrical floral design, or a shield, with the owner's monogram, with some encircling sprays, would be both simple and appropriate.

When the design has been outlined with the knife in the way described, the background—that is, the space not covered by the design—is stamped or grained with a tool, the simplest form of which would be a tenpenny nail with its dull point grooved with a knife-edge file into rectangular cuts, two in the narrow and three in the other direction. This stamp, struck with a mallet, sinking the wood a bare sixteenth of an inch, gives the background a uniformly grained appearance, throwing the design into perceptible relief. If the pattern is then painted with dissolved shellac and the background oiled with clarified linseed oil, a simple but beautiful style of surface decoration is obtained, very suitable for all surfaces exposed to touch or wear, as the top or edges of tables, panels of doors, fronts of drawers, &c. The knife is the best tool for the pupil to commence with. It should be held firmly gripped with four fingers, the edge of the thumb resting on the wood. After a week or two of practice, the pupil will find that outlining may be more rapidly done with a parting or V-shaped tool, which cuts a groove at one stroke.

The pupil is not detained for theoretical teaching. He proceeds simultaneously with practical work. Students readily perceive that plant forms may be conveniently grouped for decorative uses, as (1) aspiring, (2) clustering, (3) climbing, creeping or drooping forms. The simplest natural elements of decoration are leaves, flowers, buds, sprays, fruits and geometrical forms. These elements may be decoratively employed by (1) repetition, (2) alteration, (3) inclosure (in geometrical forms), to produce lines of ornament, (4) by radiation, to form rosettes and panel decoration, (5) by inclosure to form diaper and all-over decoration. Good decoration is attained only when it is suitable for the position it occupies ; it must be modest or pronounced, according to the limitations of space, position, &c. The simplest form of a leaf, placed side by side (the principles of repetition), or leaf and bud (the principle of alternation), would form lines of horizontal decoration. A leaf repeated, one below the other, would form a line of decoration for a vertical position. A line of decoration for the top of a picture frame might consist of leaves or pendant flowers, or buds in a drooping position. A suitable line of decoration for the bottom of a frame might consist of geometrical forms, squares, diagonals, circles or arches, inclosing leaves or blossoms—a treatment suggestive of an architectural base—illustrating the principle of repetition by inclosure. If the upper portion of a frame, or the back of the wall pocket, already instanced, were made with a pediment-like finish, space would be afforded for decorative treatment of a more natural or realistic character. The question of conventional or natural treatment, about which authorities differ, readily settles itself in practical work. According as the space to be decorated is limited and the position constrained, will the treatment be more or less conventional. When the space is ample and the position one of importance and dignity (the panels of a cabinet for instance), the decoration may be as natural as the skill of the pupil can make it.

The carving tools with which the pupils begin to lower and model are small and convenient, and of a kind which would be called engravers' rather than carvers' tools. It is believed much of the success that has attended the Cincinnati experiment is due to the use of these easily managed tools, the handle of which is 2½ and the blade 2 inches long. The ordinary carving tool, with its long handle, is held in one hand and steadied and guided by the other. This action requires a special training of the arms, combined with considerable force, to produce accurate cutting. It is similar to the effort required to draw or write accurately without resting the hand upon the paper. The short tools, on the contrary, are easily held in one hand, while the other is free to hold and turn the work to the required direction. But the special recommendation of the short tools for the fine and delicate work which is first encouraged is, that the training which the fingers and hand have received in holding the pen and pencil for writing and drawing, suffices to give the necessary skill for carving, without spending time in acquiring a new technique of fingers, hand and arm. After six months' practice, when the pupil needs to cut from half to one and a half inch deep, the ordinary large tools, with a light mallet, are used.

Among the work produced in this department of the School of Design, have been stands aud tables of various designs, caskets, foot-rests, wall-pockets, book and dining room shelves, hall-racks, bench ends for churches, hanging and standing cabinets, bedsteads, bracket and standing mantels (a mantel 11 feet high is now in hand), picture frames, table and standing easels, bureaus, washstands, wood and coal boxes, gentlemen's dressing stands, music stands, music-book cabinets, fruit and alms plates, alms boxes, newel posts, pedestals, base boards and wainscoting, a parlor organ and piano, and, not to be omitted though one-half completed, the decoration of the great organ of the Music Hall.

The woods most preferred for carving are black walnut and cherry. The latter, when the fruit stain of the wood is developed with lime-water, produces a cameo-like result, throwing up the design with fine effect, especially suited for base boards, wainscoting, &c.

Statistics of Building in New York.

The first report of the newly appointed superintendent of buildings in New York, Mr. Henry J. Dudley, has been submitted to the Mayor. During the last quarter of 1878 153 plans for buildings were submitted, at an estimated cost of $3,121,630, and for the year, 753 sets of plans were submitted, at an estimated cost of $15,219,680. During the year, 1367 new buildings were begun and 1247 were completed. Of the 753 plans submitted during the year, 703 were accepted and 50 rejected. The total number of buildings included in the plan presented for the year, was 1672. On the 31st of December, 1878, there were 741 buildings going up, as against 726 last year. For alterations to buildings, 185 plans were presented during the quarter, affectiug 190 buildings, and $425,578 was the estimated outlay. During the year, 1121 plans for alterations were offered, affecting 1209 buildings, at a total outlay of $2,621,046. For the year, 1102 alterations were begun and and 1112 completed, and at the close of the year, 117 pieces of work were in progress.

Twelve unsafe buildings were taken down during the quarter, and 77 during the year, and in the 13 years, from 1866 to 1878 inclusive, 1024 buildings were made safe, and 696 buildings were entirely taken down. The assistant in charge of the Fire-Escape Bureau, reports a total of 1500 buildiugs provided with fire-escapes during the year.

Subjoined to the regular quarterly report, is an exhibit of the doings of the department and of building in the city for the past 16 years. This is given in detail for each quarter of each year, and for each class of buildings, but may be condensed as follows :

Year.	No. of Buildings.	Estimated valuation.
1868	2,014	$34,517,068
1869	2,342	40,352,058
1870	2,351	34,668,998
1871	2,782	42,585,391
1872	1,782	27,884,870
1873	1,311	24 936,535
1874	1,388	16,667,417
1875	1,406	18,226,870
1876	1,379	15,903,880
1877	1,432	13,365,114
1878	1,672	15,219,680
Totals	$19,811	$284,328,495

In the eleven years, $100,000,000 has been spent on 6270 first-class dwelling houses, $7,000,000 on 1921 dwelling houses of the second class, $9,000,000 on 485 flats, $10,000,000 on 26 hotels, $80,000,000 on 7041 tenements, $30,000,000 on 1166 stores, $8,000,000 on 68 office buildings, $11,000,000 on 1100 workshops, $2,500,000 on 60 schoolhouses, $5,750,000 on 107 churches, $12,750,000 on 100 public buildings, $1,000,000 on 1070 stables, and $500,000 on 3971 frame buildings.

The most noteworthy buildings of the past year were the residences of Richard Arnold, at Fifth avenue and Eighty-third street, costing $125,000 ; the French flat at 21 East Twenty-first street, $35,000 ; the Peters flat, on Fifty-ninth street, near Sixth avenue, $70,000 ; the store 472 Broadway, $60,000 ; Benjamin Brewster's residence, $40,000 ; the Clark flat, Seventh avenue and Fifty-fifth street, $300,000 ; the New York Hospital extension, One-hundred-and-seventeenth street and Boulevard, $100,000 ; the Loubat Building, 505 Broadway, $75,000 ; the Borell Building, Broadway, $270,000 ; and Columbia College extension, $200,000.

It is said that the fine and various carving into which old cathedrals blossom at every corner, where a piece of fantastic ornament could find a foothold, is partly due to the interest which the workmen took in their labor. They carried home stones, and in their leisure hours wrought out whatever design seemed best to them. It thus became a labor of love.

Queen Anne Sideboard and Mantel.

We show in the accompanying illustrations, two examples of cabinet work in the old English style, known as the Queen Anne. There is no good reason why it should be called Queen Anne, but since that term has come into general use, it probably serves its purpose as well as any other.

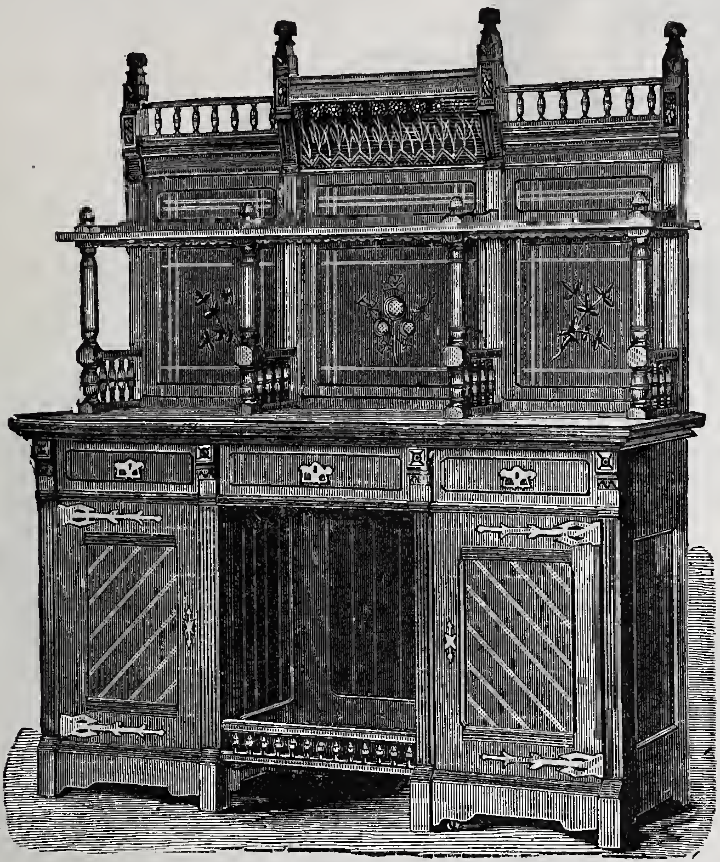


Fig. 1.—SIDE-BOARD IN QUEEN ANNE STYLE.

The transition from the French styles to the old English in furniture was a radical reform, but the great gulf between them is now pretty well bridged. One expressed a fancy in graceful curves and constructed ornament; the other expressed honesty of purpose, more or less intelligence in the use of materials, and an ornamented construction. The public taste was quick to recognize the improvement, and the French styles went out as soon as the old English styles were revived. Why the French styles failed to hold their ground, will be understood when it is considered that they did not conform to any of the natural laws of architecture, and that the necessity for making all sorts of curved members out of straight grained wood, made the construction essentially weak and flimsy. The old English styles, on the other hand, possessed substantial strength, and when it was found that beauty and strength were entirely compatible, and that one need not be sacrificed to secure the other, the style which combined them most completely came into popular favor. In what is known as the Queen Anne style, we have a substantial construction relieved with ornament. The side-board shown in Fig. 1 is a very good example of this style. The mantel shown in Fig. 2 expresses a somewhat different idea, and is not in all respects so satisfactory. It is, however, suggestive, and with modification in some of its minor details, might be made very beautiful. As it is, it is a vast improvement on the stiff, cold, ghastly white marble mantels hitherto accepted, or the things called mantels, which are made out of slate in all sorts of colors, to imitate stones which are found only in the fields of imagination. Messrs. Warren Ward & Co., 75 and 77 Spring street, N. Y., are the designers and manufacturers of the two pieces herewith shown.

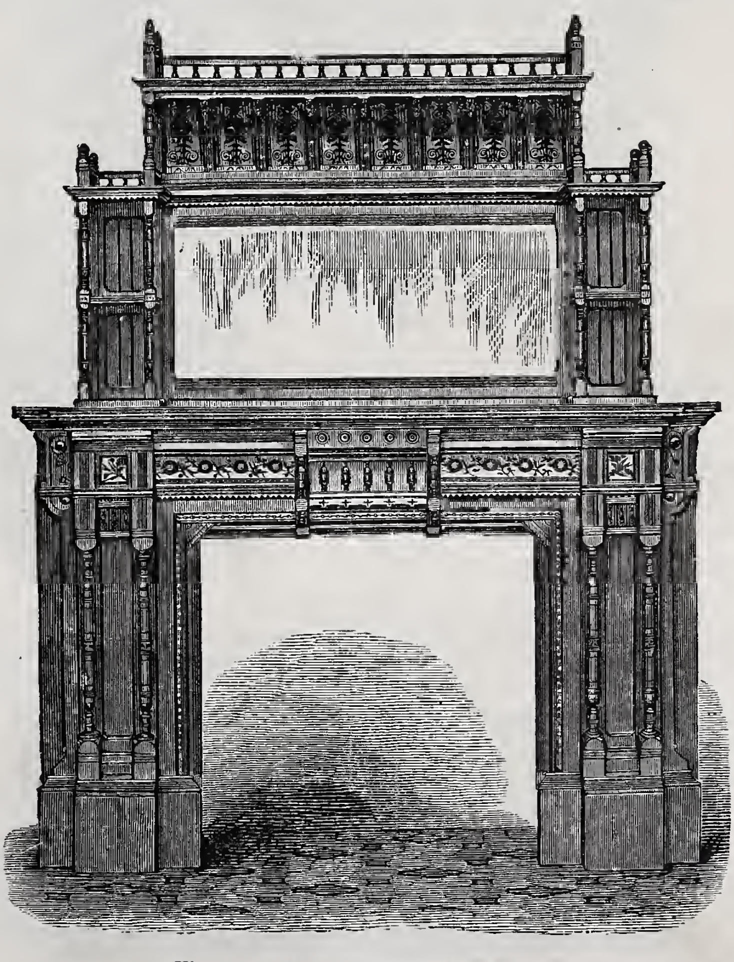


Fig. 2.—MANTEL IN QUEEN ANNE STYLE.

The Filtration of Drinking Water.—Dr. A. B. Prescott remarks, in the Michigan *Medical News:* It seems to me more attention might well be given to the purification of rain water, river water, &c., by that simple means, everywhere and at once cheap and available, the use of a portable filter with a good bed of pulverized charcoal in layers with gravel. I do not disparage filters set in cisterns or reservoirs. If made on right principles, they may do the work expected of them. They have an advantage of permanence and uniform supply without daily attention, but they are much more liable to failure from neglect of the true conditions of filtration, than the simple movable filters manufactured for sale. Some of the definitions and conditions of a good water filter may be given as follows: 1. It must be more than a strainer, and remove more than suspended matters. A brick partition (of bricks mortared edge to edge) in the cistern or reservoir makes a good strainer, removing undissolved matters, but not much else. 2. It must remove from the water the dissolved colloids—the organic matters. The power of a bed of powdered charcoal, especially bone charcoal, to withdraw coloring and other colloid matters, is familiar in manufacturing operations. 3. The good water filter, instead of becoming filled with the organic matters it removes, causes their prompt oxidation. To do this it must have air. A filter constantly submerged under water can act only with the attenuated oxygen dissolved by the water, and cannot effect half the oxidation it would if exposed to the air for the greater part of the time. Without oxidation of its gatherings, a filter can render only a brief service.

Improving the New York Fire Department.—Schools for the instruction of engineers and firemen in the New York Fire Department, have been opened at headquarters, under the instruction of Gilbert J. Orr, chief of the battalion in charge of the repair shop. There are two classes of 33 men each, who meet alternately twice a week and study, assisted by diagrams on a large board, to illustrate the construction of boilers, engines and the practical working of the various apparatus. A striking novelty has been introduced, in the application of steam to the steering gear on the self-propelling fire engines, precisely as used heretofore in guiding ocean steamers. Never before has the applicatien been made to land engines. The Fire Commissioners have also caused the construction of a "wrecking truck," provided with blocks and tackle and a powerful windlass, to sling walls or chimneys which are left by fire in a dangerous condition and which must be pulled down. This truck is a solid four-wheeled vehicle, an entire novelty in the line of fire apparatus.

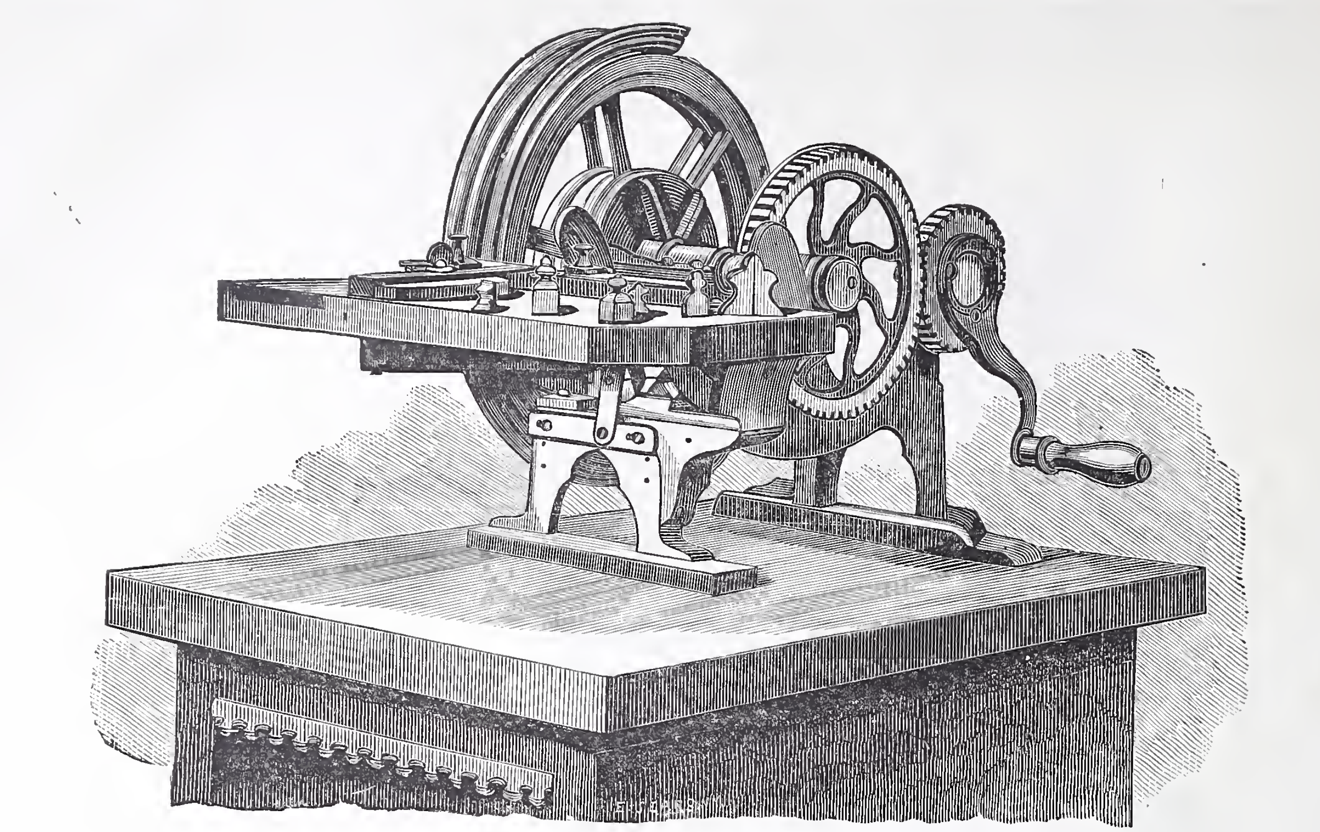


Fig. 1.—MACHINE FOR DECORATING MOLDINGS.

Machine for Decorating Moldings.

We show in the accompanying cuts a new machine for decorating moldings, in-

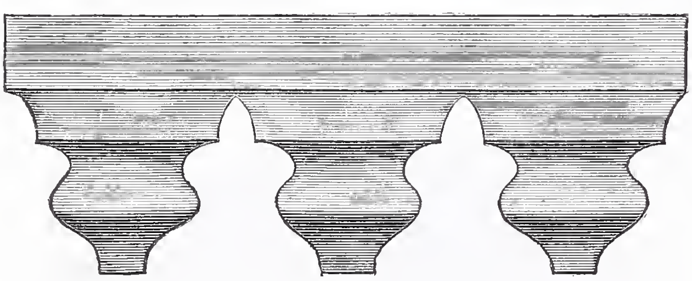


Fig. 2.

vented and manufactured by Wm. A. McDonald, Courtland avenue, near 150th street, N. Y., together with illustrations of the work it is designed to perform. It is likely to he found of value by cabinet makers and huilders. The machine, Fig. 1, is very simple and ingenious, and cuts with accuracy and rapidity any design in molding which it is desired to reproduce. It may he used to return the molding on its face, as shown in Fig. 2, or for ornamenting strips with plain surfaces, as show in Fig. 3. The stuff may also be cut to a hevel, producing the effect shown, and by exchanging hlanks cut from light and dark moldings of the same profile, we have a simple and heautiful inlaying, as shown in Fig. 4.

The means hy which the machine accomplishes these results may he understood if we imagine a thin saw blade, curved in the direction of its length, to conform to the face of the molding operated upon. This saw

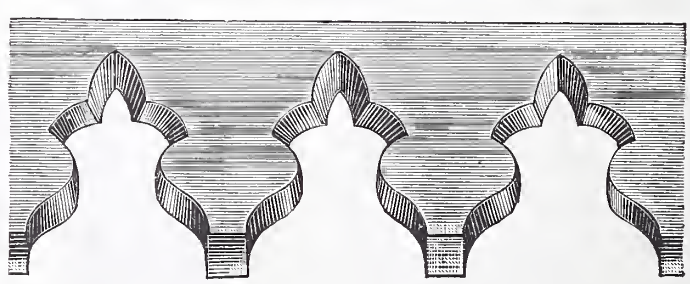


Fig. 3.

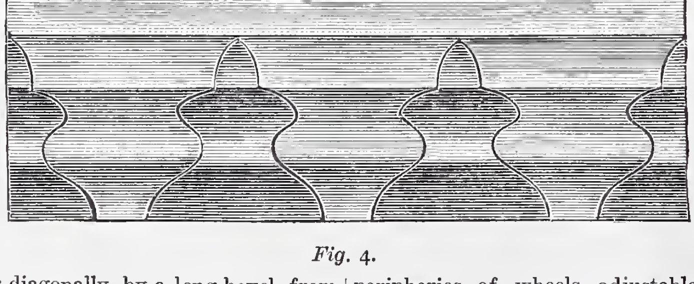


Fig. 4.

blade cuts diagonally, by a long bevel, from the point to the back edge, cutting across the different memhers of the molding in a straight line—the first member heing at the point and hack edge of the hlade, the last memher at the front edge, in the widest part of the hlade.

The hlade is secured to the frame in such a manner that it can descend vertically through the stuff operated upon, and, as it advances, it cuts the different memhers. Now, if we place two of these saws in the position shown in Fig. 1, secured to the peripheries of wheels adjustable on the shaft, so as to increase or diminish the distance between them, we have the essential principle of this machine As there are two saws, every revolution of the wheel produces a complete figure. The saws are stamped out of thin steel, but, owing to their form and curvature, are very stiff. They can be made in any shape desired.

This machine works rapidly and smoothly. The only waste is that represented by the sawdust. All the blanks are saved, and may he used as ornaments by placing them against a hacking. The machine shown in our illustration is made to work hy hand, but a pulley may he substituted for the crank when power is available.

Nails.—The origin of the terms "six-penny," "ten-penny," &c., as applied to nails, though not commonly known, is involved in no mystery whatever. Nails have heen made a certain number of pounds to the thousand for many years, and are still reckoned in that way in England; a ten-penny being a thousand nails to ten pounds, a six-penny being a thousand to six pounds, a twenty-penny weighing twenty pounds to the thousand, and having just one-half the number of nails to the ten pounds of the ten-penny; and, in ordering, the huyer calls for the three-pound, six-pound, or ten-pound variety, &c., until by the Englishmen's ahbreviation of "pun" for "pound" the abbreviation has been made to stand for penny instead of pound, as originally intended.

Sand Foundations.—It is said that the walls and iron columns of the Cooper Institute, New York, rest upon nothing hut sand for a foundation, although they have to support a fire-proof structure 100 feet high above the sidewalk. Notwithstanding that the huilding is some 20 years old, it has shown no signs of settling.

CARPENTRY AND BUILDING

A MONTHLY JOURNAL.

VOLUME I. NEW YORK—FEBRUARY, 1879. NUMBER 2.

Designs for Wood Ceilings.

In the accompaning cuts we show the plans and sections of two ceilings, which combine in a conspicuous degree artistic excellence with cheapness and simplicity. Both are made of pine, and either may be put up by an average carpenter. They are taken from a very charming house in Albany, N. Y., and were designed by the owner, who is an artist of reputation. Fig. 1 is a section and a plan of a drawing room ceiling. The fact that it was put up over a plastered ceiling accounts for its being furred off, as shown in the section. As will be seen from the plan, the effect is that of a ceiling made of tiles of creamy white color, and few persons will gain from seeing it any idea of its construction or how simple it really is. The boards are beveled along their edges and then crossed with V-shaped grooves, so that when laid together they form a series of squares resembling tiles. These are painted to imitate the color of old ivory, which may be obtained from an ivory-handled case-knife long in careful use. The only ornament is the little stencil design of the clover leaves with gilt stems, shown in the plan. The cornice and wooden frieze may be painted in any color that will harmonize pleasantly with the color of the wall. This ceiling is good and simple, and we take great pleasure in recommending it as altogether satisfactory.

The ceiling shown in Fig. 2 is especially adapted to a dining-room. It is made of pine, finished with shellac which has been toned with a little burnt sienna. The decoration around the edges is stenciled in indian red. The cornice is shellaced, but it is an advantage to color the moldings with burnt umber. The effect is excellent.

A new process by which ordinary wood has imparted to it the appearance of walnut, suitable for office, steamboat and other cabinet-work, has been recently described. Birch, beech, alder, or similar woods are first thoroughly dried and warmed, then coated once or twice with a liquid composed of one part by weight of extract of walnut-peel, dissolved in six parts of soft water by heating it to boiling and stirring. The wood thus treated is, when half dry, brushed with a solution of one part by weight of bichromate of potash in five parts of boiling water, and, after drying thoroughly, is rubbed and polished.

Builders' Liens in Canada.

The lien laws in the Canadian provinces are not uniform. While in some every effort has been made to protect mechanics and industrial men in their just claims, in others the loopholes opened by the law to fraud and injustice are very considerable. In Nova Scotia it is asserted that the owner of a lot of land may contract for the erection thereon of a building, and at the same time create a mortgage which covers the whole work and overrides all claims of the unfortunate contractor, whose means, credit and workmen's wages are swallowed up in the building. In the Province of Quebec the Roman law has provided, through the civil code, for vindicating the constructor's right, and establishes the procedure of law by which he can make good his claim. In Ontario the most careful provisions seem to have been made in the interest of mechanics and material men. The following are the principal provisions of the laws in Ontario upon this subject:

"Every mechanic, machinist, builder, miner, contractor and other person doing work upon, or furnishing materials to be used in the construction, alteration or repair of any building or erection, or erecting, furnishing or placing machinery of any kind in, upon, or in connection with any building, &c., at the request of the owner and on credit given him, shall have a lien unless there be agreement contrary for the price of such work and materials upon the building, &c., and the land occupied thereby, limited to the interest therein of the person at whose request the work has been done.

"No lien is valid unless registered within 30 days of completion.

"Registered liens appear as an encumbrance on the estate, and are discharged like any other mortgage, but they are only valid for 90 days after completion, unless in the meantime proceedings to realize have been taken, the rules for which are provided in the statute.

"The lien on previously mortgaged lands shall, in the event of sale by order of justice, apply against that part of the sum realized which shall be decided to represent the improvement in value resulting from the work done."

The practical working of the Ontario act is, that the mortgagee who provides money for construction makes his advances in the shape of payment of contractors' claims, and that the field of enterprise in the erection of buildings, mills and factories is open to the energy of any diligent tradesman, and is free from any pitfalls which may ruin him and leave him to suffer by fraud, injustice, and the delay and uncertainty of a chancery suit.

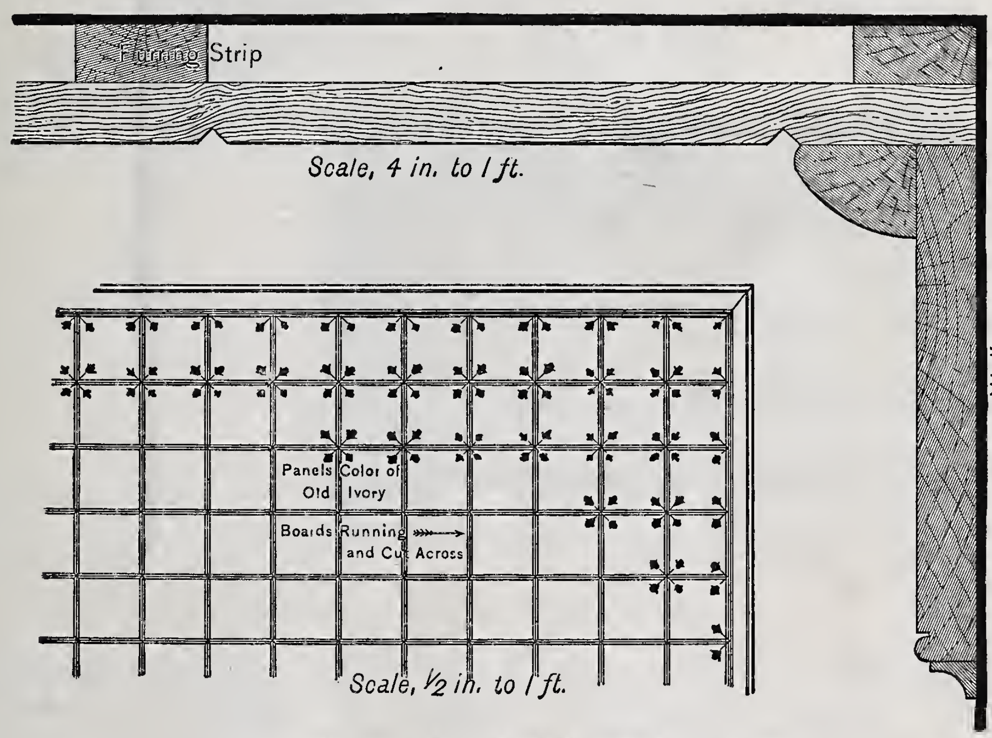


Fig. 1.—SECTION AND PLAN OF DRAWING ROOM CEILING.

Revival of Trade.—There are many encouraging signs of industrial revival throughout the country, and the prospect of more abundant employment for our working classes during the spring and summer, is good. Advices from all parts of New England are full of encouragement. The manufacturing interests there are decidedly more active than they have been at any time since 1873. In the Middle States many branches of industry are reviving in a very satisfactory way, and preparations to meet a considerably increased consumptive demand, though at low prices, are necessary. In the West a confident feeling prevails, and with the opening of spring trade we shall find the merchants of our Western and Northwestern cities full of enterprise and energy, tempered by a judicious conservatism. There is everywhere a considerable activity in building, and capitalists seem to have concluded that it is time to take advantage of the cheapness of land, money, material and labor, and build houses to profit by the advance in values, which cannot be long delayed. In a word, the outlook is really brighter than it has been for some years; and the encouragement is not all promise, since we are already in the enjoyment of many of the tangible evidences of revival.

Self-Instruction in Drawing for Mechanics.

The question of how to spend one's evenings, is one of no little importance to a large number of our readers. While of less interest to those who live in the great cities and large towns, it is even to them a question of interest. The importance of more skillful and better educated workmen—art workmen, as a correspondent puts it—is so generally acknowledged, and the demand for them is so pressing, that he who would better his condition feels the importance of adding to his skill and knowledge, and above all to his taste, in producing fine and beautiful work. Industrial art schools are not, however, within the reach of all, or even a majority of our readers. Many are debarred from the advantages of such schools even in the towns where they exist. It is a problem, therefore, to make up for this loss. The evenings furnish the time in which the work may be done. In most cases, even where men have families, three evenings per week can be safely counted on free from interruption. The first and most practical step toward the desired end is a course of industrial drawing. Although we should advise every one to have a teacher when it is possible, yet if one is not to be had there is no reason why the drawing should be abandoned. In many towns where industrial drawing is introduced into the public schools the children can be utilized as teachers, giving the lessons they have received during the day. If the student has had no previous knowledge of drawing, we should recommend him to procure a Teacher's Manual of Freehand Drawing for the primary department, and, taking it up at the beginning, go carefully through it, drawing all the examples on brown manila or other cheap paper. The manual costs but a dollar, and the paper a mere nothing. The individual drawings may be made some 6 inches high and of proportionate width. There are in the book 42 exercises, and if only three were drawn each week, the entire course could be got over in about three months. With even a little extra diligence the book could be completed and reviewed in about half that time, and another and more advanced book in the same course be taken up. Now, we do not expect that a single season's study by the fireside will turn out an accomplished workman, but it will help the eye and hand at the bench, it will give better ideas about what decoration should be, and will improve the judgment in regard to the form of work. To learn to draw well is a work of time, and one cannot expect that it will come at once or by a single course of lessons. Those who are dull must not be discouraged. Their progress may be slower, but if they keep on they will find that it is just as certain, and in some respects more satisfactory, than that of those who seem more favored in natural abilities. For those who have already some little idea of drawing, it may be advisable to take a more advanced text-book. Three evenings a week devoted to this work will be sufficient not only to go through the book, in about the same time drawing all the exercises, but also to review some of the more important parts. With the Intermediate Manual of which we speak there are small drawing books which contain the exercises, and in which the drawings are to be made.

Wherever there is more than one workman or apprentice in town, probably the best method of work is to form a little class, meeting from house to house if most convenient. One of the number can be appointed teacher to dictate the lessons, where dictation is needed, and generally repeat the instructions of the book. Sometimes more interest can be maintained by taking turns at teaching. A class in this way can soon grow into a sort of industrial art association, which may be made of the greatest value to the members. While employers can do little toward starting measures of this kind, they can, when once such an idea has taken root, be of immense assistance in keeping the interest alive and assisting men and boys over those points where the great difficulties are encountered. If journeymen, apprentices and men at the bench generally would take up this matter and give the evenings of the coming winter to improving themselves in drawing, they would, we are confident, feel the beneficial results, not only in their increased skill, but in their better appreciation of the beautiful around them. They would not only be better producers, but better consumers, because of more cultivated tastes.

The Building Association League.—The Building Association League of Pennsylvania, which failed last year to get its proposed law through the Legislature, mainly for want of time, is in the field early this year. The bill, as drafted last year, is to be presented without material change, having been again adopted by the League recently. The purpose of the proposed legislation is to protect the societies, and through them the individual stockholders, from some dangers which were not foreseen at the time of the passage of the existing laws, and also to permit the organization of societies on a new plan, substantially the same as, but simpler than, the old—which plan is not specifically authorized by the present law. The legislation asked for confers no additional powers on the societies, but is of great advantage to the stockholders and borrowers, whom it protects from excessive fines, while it secures for them an equitable settlement of their accounts when they desire or are compelled to withdraw. The league, which was organized a little more than one year ago, and is composed of delegates from building and loan associations throughout the State, has accomplished its first purpose of getting the societies released from a claim for a bonus on capital stock, and if it should succeed in having its bill enacted, may turn its attention to the correction of possible abuses in administration, of which complaints are occasionally made.

White Lead.—Many attempts have been made to hasten the process of making white lead, or carbonate of lead. A sample submitted to us lately was said to have been produced in 48 hours, while ordinarily it takes 90 days. It looked well, and we were in hopes that possibly the problem had been solved, but when we submitted it to a competitive test we found it decidedly deficient in body, or covering properties, and that is precisely the quality that is imperatively called for in white lead, and the point in which it surpasses other pigments.

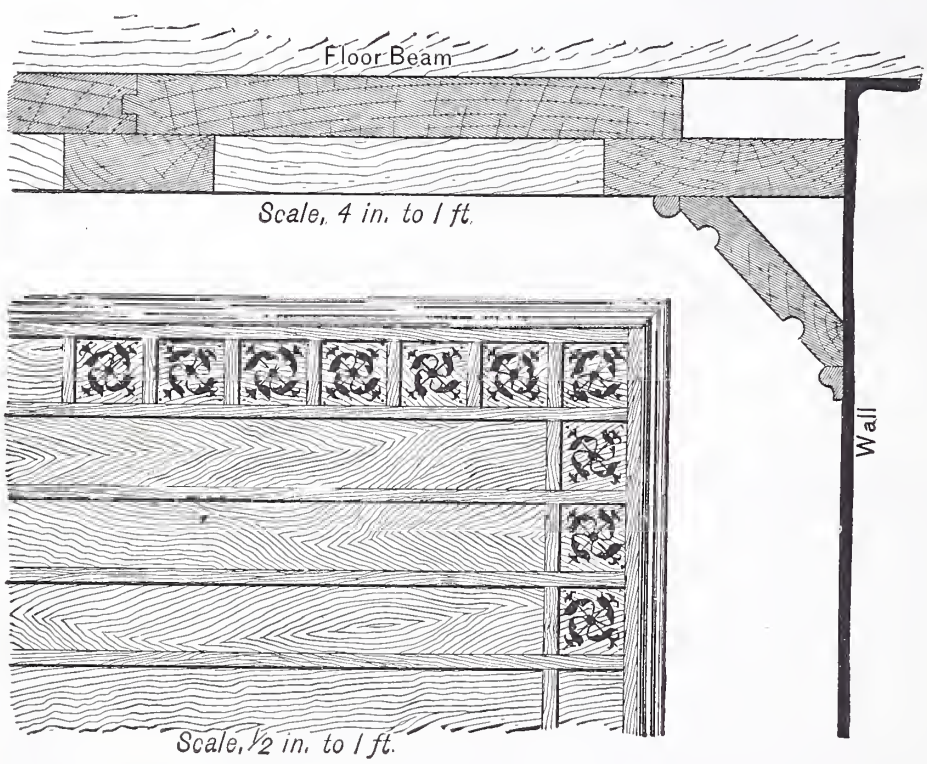


Fig. 2.—SECTION AND PLAN OF DINING ROOM CEILING.

PRACTICAL CARPENTRY.

Stair Building.

II.

The third element in the proper proportioning of staircases is the angle of ascent, which is necessarily dependent upon the dimensions of the risers and treads of the stairs. As this is a point of much importance in rendering a staircase easy of going,

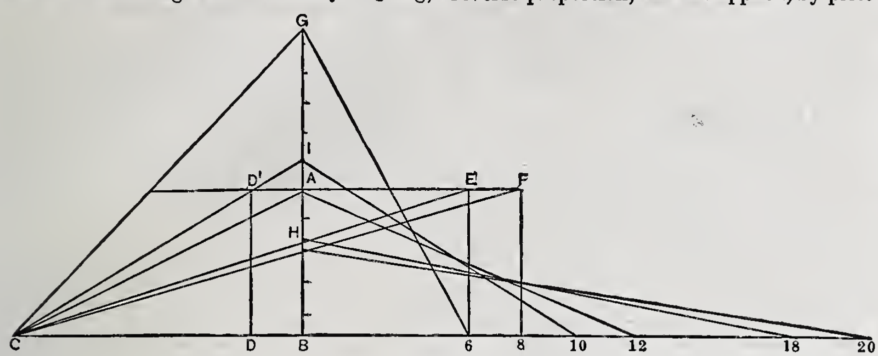


Fig. 1.

considerable attention has been given to it, not only by practical joiners, but by architectural authorities of mark, Vitruvius, Scamozzi, and others, having treated of the relations subsisting between the hight and width of steps. In this regard the same rules apply, with but slight modification, to all stairs, of whatever material they may be made—wood, stone, or iron.

It may be taken as a general maxim, that the greater the breadth allotted to the tread of the step the less should be the hight of its riser; and that this is a common-sense view is evident from the consideration that, in walking up inclines or hills, we find that the

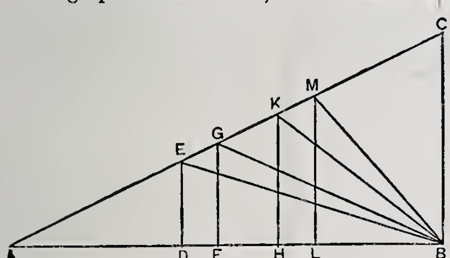


Fig. 2.

steeper the ascent the shorter are our steps, and *vice versa*. Experience has shown that a step of which the tread is 12 inches in width and the riser $5\frac{1}{2}$ inches high, is convenient and well-proportioned. This may, then, be taken as a standard from which the dimensions of others may be deduced. The subject has been algebraically treated by Blondel in his *Cours d' Architecture*, and it is claimed for him that he first formulated the method of proportioning stairs of easy going; but as there are many such existing, both of stone and wood, which had

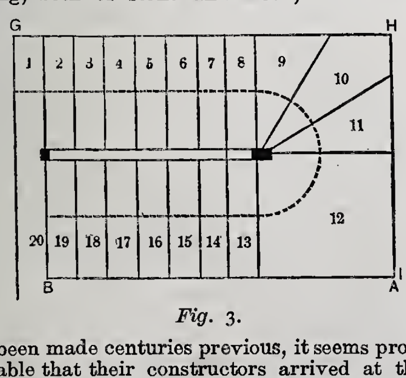


Fig. 3.

been made centuries previous, it seems probable that their constructors arrived at the result by a much more simple process.

A rule of proportion for stairs of other dimensions may be obtained from the relative sizes of the tread and riser above given, by substituting half-inches for the whole numbers—viz., tread 24, and riser 11. Then other widths, corresponding in inverse proportion to the example, will be as follows:

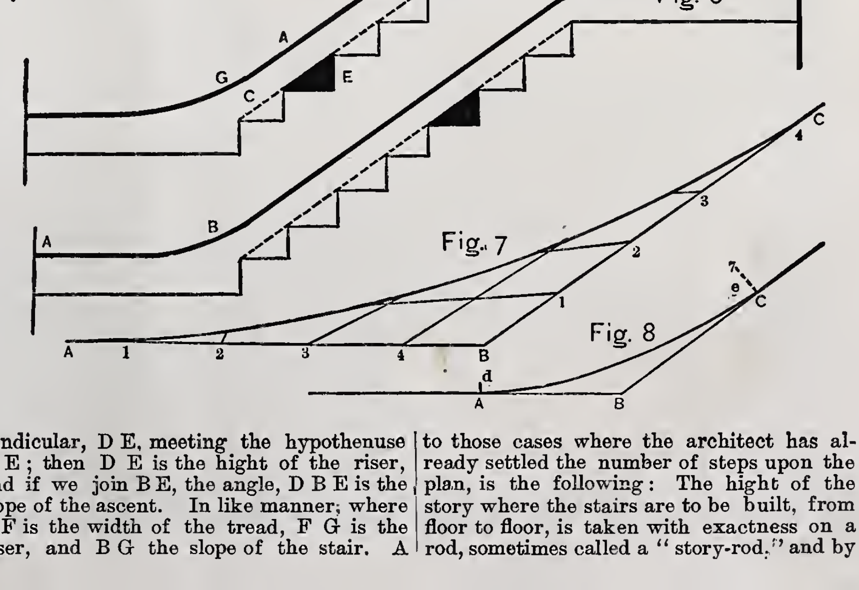
—As	24	:	11	::	12	:	22
	24	:	11	::	19	:	13.8
	24	:	11		20	:	13.2

A tread of 6 inches wide requiring, consequently, a riser of 11 inches in hight; a tread of $9\frac{1}{2}$ inches needing a riser of nearly 7 inches, and a tread of 10 inches being complemented by a $6\frac{5}{8}$-inch riser. In like manner also, as $12 \times 5\frac{1}{2} = 66$, the latter number will serve as constant numerator for the proportion. Thus, suppose a step 10 inches broad, then $66 \div 10 = 6$ 3-5 inches would be the hight.

Some authorities represent the process of inverse proportion, as thus applied, by pictorial means, the following two illustrations being from Newland's treatise:

Let the tread and riser of a step of approved proportion be represented by the sides C B, A, of the triangle A B C, Fig. 1. Through the point A draw a line, D¹ E F, parallel to the step line C B. Then, to find the riser for any other step, set off on the line C B, from the point C to D, the required width of a step, say 10 inches, and draw D D¹; draw also C D¹, and continue it to the line B A, and the point of intersection there will show the hight of the riser corresponding to the tread C D. In like manner, if the width given be 18 inches, set it off in the point 6; draw 6 E and C E, and the intersections at H will be obtained, giving $3\frac{2}{3}$ inches for the hight of the riser. A width of 20 inches will show a hight of 3.3 inches. On the right side of the figure is shown each step we have mentioned, connected with its proper riser, thus exhibiting the angle of pitch.

The same end, nearly, is arrived at thus: In the right-angled triangle A B C, Fig. 2, make A B equal to 24, and B C equal to 11, according to the standard proportion. Then, to find the riser corresponding to a given tread, from B set off on A B the length of the tread, as B D, and through D draw the per-



pendicular, D E, meeting the hypothenuse in E; then D E is the hight of the riser, and if we join B E, the angle, D B E is the slope of the ascent. In like manner, where B F is the width of the tread, F G is the riser, and B G the slope of the stair. A width of tread, B H, gives a riser of the hight of H K, and a width of tread equal to B L gives a riser equal to L M.

It is conceived, however, that a better proportion for steps and risers may be obtained by the annexed method:

Set down two sets of numbers, each in arithmetical progression; the first set showing the width of the steps, ascending by inches, the other showing the hight of the riser, descending by half inches. It will be readily seen that each of these steps and risers are such as may suitably pair together.

Treads. Inches.		Risers. Inches.
5	....	9
6	....	$8\frac{1}{2}$
7	....	8
8	....	$7\frac{1}{2}$
9	....	7
10	....	$6\frac{1}{2}$
11	....	6
12	....	$5\frac{1}{2}$
13	....	5
14	....	$4\frac{1}{2}$
15	....	4
16	....	$3\frac{1}{2}$
17	....	3
18	....	$2\frac{1}{2}$

Of course the angle of ascent varies in the above combinations. In perhaps most instances the proportions cannot

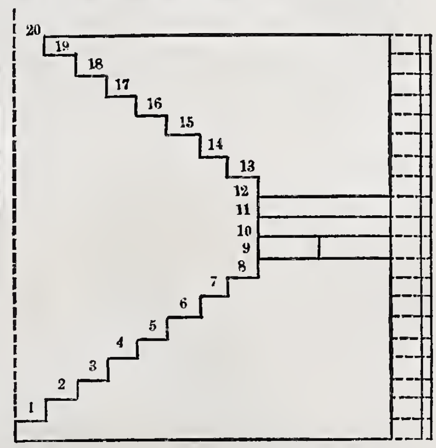


Fig. 3 A.

be arbitrarily settled, but will depend upon the space that can be given to the staircase, and other considerations; and in buildings of superior kind the architect frequently arranges the steps in the plan. As a rule, in buildings of the better class the breadth of tread is greater than in inferior dwellings. Not less than 12 inches, nor more than 18 inches, are the limits of the steps of high-class mansions or public buildings, while from 9 inches to 12 inches are about the limits for common dwelling houses.

The usual method of setting out stairs in edifices already erected, in contradistinction to those cases where the architect has already settled the number of steps upon the plan, is the following: The hight of the story where the stairs are to be built, from floor to floor, is taken with exactness on a rod, sometimes called a "story-rod," and by others a "hight-rod." The positions of the first and last risers are also determined upon. Then a probable hight of riser is taken, and the length of the rod divided thereby, and the quotient, or number of times that the supposed riser is contained in the story-rod, will (if there be no remainder) be the proper number of risers for the stairs. If there is a remainder, however, the operation may be reversed, the dividend being then the number of inches in the

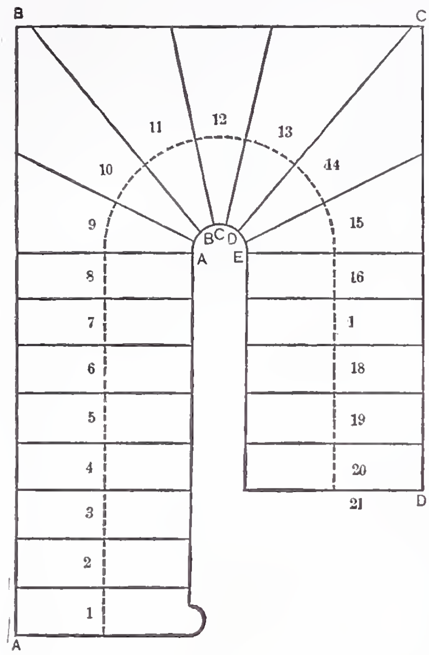


Fig. 9.

hight, and the divisor being the quotient, as found above. The operation of division by reduction may then be carried on until the proper hight of the riser is got at to a very small fraction. The operation may be thus illustrated:

Suppose the hight of the story to be 10 feet, and the thickness of the floor and its joists to be 10 inches, and also that we assume a step of 7 inches riser, then:

10 feet 10 inches.
12
—
7) 130
—
$18\frac{4}{7}$

From which result it appears that either 18 or 19 steps must be adopted. The former will give a rise of—

18) 130 (7
126
—
4

or 7 4-18 inches, or nearly 7¼ inches, while 19 steps will give nearly 6⅞, viz.:

19) 130 ($6\frac{16}{19}$
114
—
16.

The hights are set off with as much exactness as possible on the story-rod, which is then complete.

A rough sketch of the hall or other place where the staircase is to be erected should be made, with all passages, doorways, landings and windows adjacent. Upon this plan the position of the risers should be shown, and the pitch-boards should next be got out. The length of the stair must be taken from the front of the first riser to the front of the riser of the first winder or quarter-space, if there is one set down on the plan, and divided into as many spaces as there are steps—say in the example just given, 18 steps in two flights of 9 each. If, now, this length of the plan is 6 feet 9 inches, we have—

6 feet 9 inches.
12
—
9) 81
—
9

or 9 inches for the width of the step, exclusive of the part that passes under the riser of the upper step, and exclusive also of the nosing, which passes over the tread beneath it. A thin piece of stuff, cut to a right-angled triangle, with a hight of 7 4-18 inches, and a length of 9 inches, will form the "pitch-board" for this stair (X, Fig. 5), the hypothenuse of which gives the angle of ascent, which is parallel with the line of nosing. The base of the triangle which any pitch-board makes is always the exact going of the steps, and its perpendicular is the hight of a riser. The story-rod is shown on the side of the sketch of stairs at Fig. 3, A. The examples are adapted from Nicholson. Landings or resting places should occur at intervals of every 10 steps in superior staircases. Alberti says not more than nine steps shall intervene.

In order to still further elucidate this subject, we would call attention to Fig. 3, which is a plan of the simplest kind of staircase, namely, the dog-legged. It may be remarked that in this plan the fronts of the risers are indicated by black lines, and the line of the projection of the various nosings by dotted lines. Here let the hight from floor to floor (Fig. 3 A) be 12 feet; the number of risers, including that of the quarter space, 20, and the hight of each riser, therefore, 7 1-5 inches, and the threads 9½ inches. First set down on plan the width to be allotted to the landing; then mark the newel of its proper proportionate size, and in position, the center of the newel to be on the riser side of the landing, the latter being marked off on plan at a distance of half the width of the staircase from the back wall, and at right angles to the wall at the side. The last riser must now be bisected, and an arc described from the center of the newel. The breadth of the winders being set out on this arc, lines are drawn to the newel, indicating the face of each riser. Where there is not sufficient room to get in the whole of the space, the other quarter space may be occupied by winders also. The story-rod is placed at the right-hand side of the skeleton elevation.

The next illustrations show the strings for this staircase. Fig. 5 represents the wall string for the first flight of stairs, shown at Fig. 3 and 3 A, the letters corresponding with those of the plan. The pitch board is shown at X in the same figure, and the manner of employing it is pointed out in the sketch of the string at E and F. The line A B is the edge of the board of which the string is formed. At any distance which may be chosen the line C D is drawn, which marks the line of nosings. The pitch-board is then adjusted to this line, as shown by the shaded portions; and this outline of the steps may be readily marked therefrom. The position of the first winder

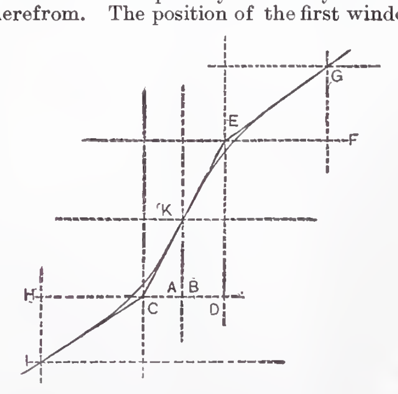


Fig. 10.

in the wall string is shown at the upper part of Fig. 5.

Fig. 4 shows that portion of the wall string marked H I on the plan, and Fig. 6 represents the wall string for the several flyers from A to C. The distance from the nosing to the edge of the wall string should be measured on lines perpendicular to the edge, as shown at N N, Fig. 4.

In order to give good effect to the various portions of strings, &c., which meet at different inclinations and are connected by curved lines, these curves are produced by what are termed "easings." A suitable curve for this purpose may be formed by the method shown at Fig. 7. Divide A B and A C into a similar number of equal parts, which number from A to B and from B to C, and join all the points which bear similar figures. These lines are tangents to the parabolic curve, which may now be drawn so as to successively touch each of them. Another plan of doing the same thing is shown at Fig. 8, where A and C are marked off at equal distances from B. At A erect the perpendicular, A *d*, and at B that of B *e*. Continue these lines until they intersect each other, which intersection will form the center from which to describe an arc of a circle joining A and C. Let us now apply the same principles to a geometrical staircase.

The plan of the walls wherein the stair is to be placed is first set down, as at Fig. 9. The opening of the well-hole and the line of balusters is next set out on the plan. The width of the stairs must then be divided into two equal parts, as shown by the dotted line, which is brought with a curve round

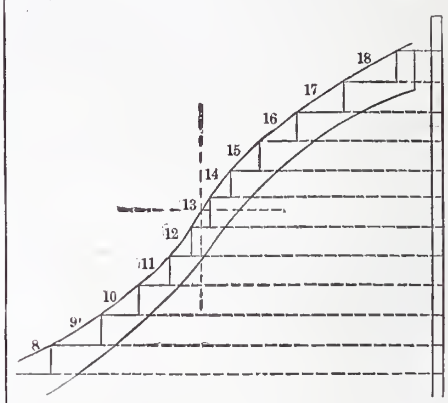


Fig. 11.

the circular part. If the hight of the story were 10 feet 6 inches and the hight of the riser 6 inches, there would be, of course, 21 risers. The number of steps in each flight is one less than the number of risers, so that in this case there will be 20 steps from the first to the last riser. The dotted lines of the plan can be divided, therefore, into 21 parts from the first to the last riser, and if this gives a proper breadth for each step (which, by the rule given, is 11 inches), the lines can be put down in the plan. When the proper dimensions cannot be thus obtained, various expedients may be resorted to—for instance, four of the winders may be replaced by a half space.

The string of these stairs is wreathed (or writhed), that is to say, it follows the semicircular form of the well as it ascends. It is plain that under these circumstances there is a tendency for the inclination of the string to change sharply where the winders commence. That part of the string at B C D (Fig. 9) must necessarily be much more steep than the parts above or beneath it, and it is of consequence that this change should be gradually accomplished, without any abrupt angle. To ensure this, the easing of the string is got at by arranging the widths of the winders at the ends nearest the well, so that their nosings follow an easy curve. It is important that an easy sweep should be found for this nosings line, as it determines both the string and the handrail.

The method of finding this line is exemplified in Fig. 10. On any line, A B, mark C D, equal to the development of the semicircle B C D on plan (Fig. 9). From D raise a perpendicular and on it mark the hight, D E, equal to the hight of five steps. Join C E, the diagonal of which shows the inclination of the string for the semicircle B C D of plan. Draw a horizontal line through E, and make the distance E F equal to the width of two flyers (on plan). From F raise a perpendicular, and on it mark the hight, F G, equal to the hight of the steps. Join E G, and the direction thereof marks the inclination of the spring for the upper flight. Proceed similarly for C H, as shown, and the line C I will be the angle of inclination for the lower flight. Make the easings C and E by one of the plans described, and the line I K G will be the nosing-line required.

At Fig. 11 is shown a method of getting the proper widths for the ends of the winders and diminished flyers by help of this nosing-line, which is here represented by the dark curved lines. The dotted horizontal lines from the story-rod show the hight of the steps. Perpendiculars let fall from the intersections of these lines with the line of nosing show the widths of the ends of the respective winders and reduce flyers, as shown in the figure.

Improved Skylight.

We illustrate herewith an improvement in the construction of skylights. It consists in the application of the dome-principle of ventilation. As shown in the accompanying cuts, a spherical ventilator is employed, surmounting the glass dome, but the essential features of the improvement are preserved with the use of any other good ventilator in the same position. The dome is made of a single piece of glass, set in a metallic base, and is applied to the top of an ordinary skylight, as shown in Fig. 1. Ample provision is made against leakage, and as the entire structure is simple, there is little difficulty in putting it in place. The draft for ventilation is controlled by a valve fitted to the ventilator surmounting the crown piece. In Fig. 2 is shown one of the improved domes attached to a metallic base, for use as a skylight alone, in which shape it is applicable to tops of show-cases, roofs of street cars and in similar positions.

While the main advantage claimed by the manufacturers of this article is based upon the thorough ventilation afforded by it, there are certain other advantages deserving attention. By their convexity a greater quantity of light is afforded than by the ordinary flat or hipped skylights. They are impervious to the weather; by their shape and by reason of the good ventilation obtained, there is no trouble from condensation; the ventilation is under perfect control, and may be entirely shut off when desired; the article by its thickness and shape is stronger than the ordinary skylight, and is, therefore, less liable to accident. These articles are manufactured of diameters from 10 to 26 inches, measured at the base of the glass dome.

In Fig. 2 is shown a device for a weathercock which may be seen from within, the operation of which is so simple as to require no explanation. The general appearance from below of one of these skylights is much finer than that of the common pattern. Where more ventilation is required than is afforded by one dome, or where a greater space is to be covered than can be done with one dome, several of them are used, presenting a good appearance when viewed either from the interior or from the exterior.

We are assured by the manufacturers (S. J. Pardessus & Co., Nos. 9 and 11 Park Place, New York) that the first cost is very reasonable, while the maintenance is but a trifle, placing them within the reach of all who require skylights.

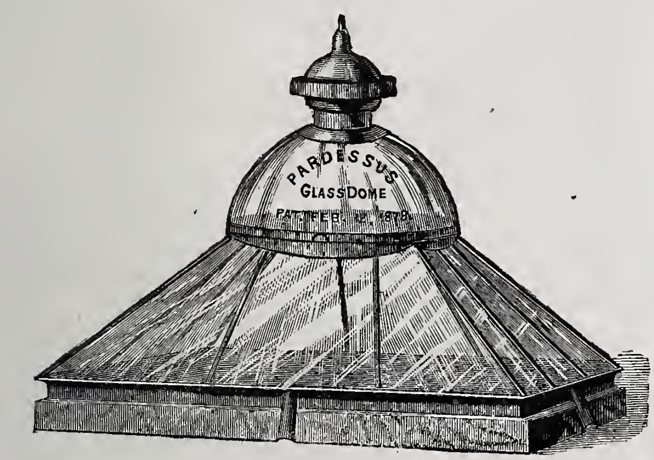


Fig. 1.

IMPROVED SKYLIGHT.

Fig. 2.

Some people carry their lanterns about to see their work, but architects make their roofs carry lanterns, and are often shabby enough to use borrowed lights.

Compacted Beams.

BY THOMAS MORRIS.

Works of magnitude in timber require larger beams than a single tree affords, and the means of combination becomes a necessary inquiry. The subject has given rise to many contrivances; but, so far from being exhausted, is, in fact, sufficiently open to excuse an *ab initio* glance.

In order to be at home in compacting beams, familiarity with the properties of materials and effect of mechanical appliances is requisite; but safety is so much more essential than exactitude, that it is customary to throw aside as great a proportion as five-sixths of the extreme power.

If we examine the natural construction of a tree, it is seen that the stem consists of the pith or central marrow, the wood and the bark. The pith, having no office to perform when the tree has become mature, dies. It is surrounded by the medullary sheath, from which rays of compact tissue communicate with the bark. They are especially noticeable in oak, of which they constitute the characteristic figuration called silver grain. The wood encompasses the medullary sheath in concentric layers, one of which is added every year, and never changes its original size. Each annual addition comprises two distinct plates. The innermost is soft, porous and vascular; the other consists of compact, fibrous, woody tissue. Secretions are gradually deposited in the vascular layers, and their liquid contents displaced. The deposits being more abundant in the older central portion, give to that part the perfected nature of heartwood; while the recent layers, with vegetable liquids in full activity, are known as sap wood, or alburnum, of inferior strength, durability and value. As the fluids consolidate and the vascular plates are condensed by seasoning, the breadth decreases, but the fibrous rings are less affected, and lengthwise there is no serious reduction.

Owing to this two-part formation, timber has a dual scale of strength, according as the fibrous and vascular plates are respectively brought into resistance. In any attempt either to elongate or to compress timber, the woody fiber is acted upon; but a dividing force, at right angles to the grain, tries the vascular plates, as does also such a strain as would draw a bolt near the end of a scantling out of the wood. Experiments show that good European fir, where all allowances for convenience and security have been made, is practically equal to a load of 1000 pounds on the square inch, whether in the way of extension or compression. The latter may be endwise or flatwise, but, in ultimate effects, tension stands highest; compression against the grain next; and, lastly, compression across it. But a transverse strain, tending to produce a sliding of the plates, must not exceed 100 pounds per inch.

The natural force, or cohesion, by which particles of matter are kept together, constitutes an important characteristic of all substances, and greatly influences their fitness for specific uses. Fir possesses this property in a very inferior degree to wrought iron. Taking the maximum of timber as one, the working ratio of iron may be reckoned at six, and it has the advantage of offering nearly the same resistance to strains in every direction. On this account rolled iron beams have their top and bottom flanges equal. But cast iron is so deficient in this homogeneity, and especially in tensile power, that the lowest flange of a beam has to be 6½ times as heavy as the upper; and while, as a strut, it would bear three times the load for fir, it is inferior to it for the duty of a tie. Looking, however, to iron generally, its complete subserviency to the carpenter's art has caused it to be recognized as a powerful and habitual *auxilium*. The weight being twelve times that of fir, and the strength six times, it follows that ironwork of the same ability will be twice the weight of woodwork. But, notwithstanding this drawback, the metal now assumes a character in which it was quite unknown to the mediæval builders. The sparing manner in which it was employed by Wren in the dome of St. Paul's, even, would form a remarkable contrast with the free use given to it by Gilbert Scott at the Albert Hall, South Kensington. At the beginning of the present age, bar iron was still a rarity, and the carpenter thought it a bold act to introduce a few slotted straps (excellent in their way), a king bolt, or other fortifying details, after the example of James Stuart (of Athenian memory) in the roof of the Hospital Chapel at Greenwich; a very able work, repeated at the Grecian edifice at St. Pancras, Euston road. It is not long since constructors thought it possible to strengthen beams by artificial internal arrangements of similar material. They opened the wood, cut pieces out, and filled the voids in ways mysterious; but their imaginings proved fruitless, and nature continued unsurpassed. Yet it may be fair to admit that the philosopher's stone, to which so many experiments had been sacrificed, and at which a modern student would smile, at length appeared. Not, indeed, as wood of any kind, or in any form of application, but as iron, represented by the rolled flitch, preceded by various kinds of trussing.

It is constantly impressed upon visitors, by the curators of ancient buildings, as though to excite surprise, that intricate examples of woodwork are without nails or screws. This is perfectly true, for the time at which those now universal articles became general, is comparatively recent. *Clout* nails were probably the earliest, and *clou* being the French for nail, it may be guessed whence they were derived. Wooden pins and treenails have, however, been quite superseded by iron substitues, which owe to American skill a share of their present perfection, and constitute the subject of a very considerable British industry. In this class, screws deserve especial notice, because (as the carpenter does not employ cements) of their mechanical utility in effecting that forcible contact of surfaces, which adds the element of friction to their own power. A screw one-eighth of an inch diameter within the worm, is equal in this way to 90 pounds, and as the power increases as the square of the diameter, a five-eighth solid core would represent a ton. The thread should be long and the head square where much force is necessary; but in other respects the less resemblance there is to the ordinary bolt the better. The latter is, perhaps, the least efficient of modern contrivances of the sort, having no hold upon the fibers, and the timber is released from its grip by the slightest shrinkage. The one solitary recommendation of the bolt and nut is facility of application.

Let me now proceed to connect the parts of a beam intended for exposure to a tensile strain. The beam is rectangular, and the dimension 10 by 6, giving a sectional area of 60 inches, and an assumed power of 60,000 pounds, or nearly 27 tons. The most obvious course would be to overlap the lengths, and fasten the broad faces together by means of 27 1-ton screws. Half the number are on one side, and half on the other. If the ends were now pulled in opposite directions the joint would be as strong as the single parts; but the stress would not be along the center of the pieces, and that want of directness would generally be fatal. The method called "fishing" is, therefore, resorted to. It consists in abutting the ends of the pieces to be joined, and adding at each side a fish of half the scantling, so that the continuous fibers are just equal to those that are interrupted. But, as the fishes have to receive the entire strength of one part and convey it to the other, there must be 27 screws on each side. A strong connection is thus made, but the appearance is clumsy, and where neatness is an object, other plans are followed.

By the process called "tabling" or "indenting," the fibers may be caused to interlock to the extent of one-third of the entire section, and thus to leave only two-thirds to be supplied by additions. This method is as follows: First, the indenting has to be proportioned to the 20,000 pounds assigned to it; and as each square inch is equal to 100 pounds, it is clear that the strained surfaces must each measure 200 inches. The depth being 10 the length must be 20. But each beam has been reduced to a third of its original section; and in this instance one-third is made up for on each face by a plate of iron. Had a plate or fish of wood been proposed, the section would have been 10 inches by 2 inches, but one of iron 7 inches by one-half inch has the same effect, and is secured by 18 1-ton screws. I venture to speak of screws in this allusive way to their powers, because if the principle here suggested became general, the manufacturers no doubt would be ready to adopt an indicative nomenclature. I am disposed to fear that two plates of one-half-inch iron, 8 feet or 10 feet long and 7 inches wide, attached by 36 large screws, may seem enormous, but I submit that they are consistent and proportionate to the cohesive force of fir; so that with a code of the sort before him the carpenter can work with facility and confidence. He will at the same time perceive whether expense can be saved by an abatement of the full strength in any part, for it is only on the assumption that very great abatements are practicable, that the oblique and fanciful jointings of a former day, such as exhibit the curious elaborations of Batty Langley, can be supposed to have done duty for a moment. In recent examples, beams of great power are connected by a few almost worthless bolts; and so, according to circumstances, the rules here indicated are fairly open to modification. But the neatest and most effectual mode of compacting long beams would probably be by layers or laminations screwed together, with intermediate headings. They might thus be of any extent, and without perceptible joints or additions of any kind.

The composition of beams for bearing purposes is easier and more satisfactory than in the class just considered. There the highest success was to make junctions of equal tenacity with the parts united. Here every part supplies an addition of power, and in an increasing ratio; since, as pointed out on a previous occasion, if one beam be laid upon a similar, the ability to sustain a load is not merely doubled, but quadrupled; and if a third beam be added, the power becomes nine-fold.

But, in order to insure the full effect, all the parts must be connected, so as to resemble, in the aggregate, a single tree. If numerous sheets of paper be fastened together at one edge, and then rolled into a cylindrical form, the leaves slide upon each other and offer little resistance to the force applied. Such sliding has to be counteracted in beams, and laborious measures have sometimes been adopted for that end. Serrated joints were frequently used with no small sacrifice of material and time. Keys at moderate intervals are efficacious, but, from what has been said on cohesion, it is apparent that their fibers should run at right angles to the grain of the beam. The surfaces of the layers should be kept in close longitudinal contact by screw-bolts cut with a thread for wood, in lieu of the common iron nut.

In a beam supported at the ends and loaded at the top, an action is set up throughout the fibers. Those near the top are compressed and those at the bottom extended, while a neutral plane or axis exists between them whose length is unchanged. M. Du Hamel experimented with willow bars half an inch square, and broke them with a central weight of 45 pounds; but by cutting one-third through from the top and inserting a wedge, he raised the weight to 51 pounds. A bar $1\frac{1}{2}$ by $1\frac{1}{2}$ inch broke with 525 pounds, but a similar one was cut three-fourths through, and, a wedge being inserted, the load was applied until the fibers were well compressed; it was then removed, a thicker wedge put in, and the load was raised to 577 pounds. More recent investigators have pursued the inquiry, but the practical result is that beams of rectangular section have the neutral axis at the middle of the depth, and the strain upon the fibers is in proportion to their distance from that axis. But although such experiments are valuable in demonstrating an important theory, they afford little warrant for executive repetition, for, in the search after an accession of strength amounting to some 10 per cent., as much ironwork and labor may soon be expended as would far exceed the saving in wood.

By the introduction of large screws as a structural element into carpentry, it would be possible to follow very closely in timber the principle on which material in iron beams is massed at the greatest distance above and below the neutral plane. Take, for example, a beam 12 by 12, whose neutral axis would be at the middle of the depth. The center of gravity of the upper half would be 3 inches above the neutral line, and that of the lower half 3 inches below it. The cross area of $72 \times 3 = 216$, which is the effective power of the half, or 432 for the whole. But if the beam were divided into three planks, 12×4, and built in the form of the letter I, there would be $24 \times 3 + 48 \times 8 = 456$ for each half, or a total of 912. The same quantity of timber, therefore, disposed in this way, would be fully twice as powerful as the solid timber, and the sectional figure would be convenient for application, as a support to other pieces in a combined work of carpentry.

Were a beam of this formation required of a greater length than the material at hand, pieces to form the top might be closely abutted, those for the web halves vertically, and those for the lower flanges flatwise.

Ventilation in Dwelling Houses.

The London *Lancet* passes the following comment on this subject:

If a man were deliberately to shut himself for some six or eight hours in a musty room with closed doors and windows (the doors not being opened even to change the air during the period of incarceration), and were then to complain of headache and debility, he would be justly told that his own want of intelligent foresight was the cause of his suffering. Nevertheless, this is what the great mass of people do every night of their lives, with no thought of their imprudence. There are few bedrooms in which it is perfectly safe to pass the night without something more than the ordinary precautions to secure an inflow of fresh air.

Every sleeping apartment should of course have a fire-place with an open chimney, and in cold weather it is well if the grate contains a small fire, at least enough to create an upcast current and carry the vitiated air out of the room. In all such cases, however, when a fire is used it is necessary to see that the air drawn into the room comes in from the outside of the house. By an easy mistake, it is possible to place the occupant of a bedroom with a fire, in a closed house, in a direct current of foul air drawn from all parts of the establishment.

Summer and winter, with or without the use of fires, it is well to have a free ingress for pure air. This should be the ventilator's first concern. Foul air will find an exit if pure air is admitted in sufficient quantity, but it is not certain pure air will be drawn in if the impure air is drawn away.

So far as sleeping rooms are concerned, it is wise to let in air from without. The aim must be to accomplish the object without causing a great fall of temperature or a draft. The windows may be drawn down an inch or two at the top with advantage, and a fold of muslin will form a ventilator to take off the feeling of draft. This, with an open fire-place, will generally suffice and produce no unpleasant consequences, even when the weather is cold. It is, however, essential that the air outside should be pure.

Some Drawbacks to the Use of Cedar Wood in Cabinet Making.

Cedar wood closets, and small articles of furniture made of cedar, are certainly in much favor, and the wood has doubtless many recommendations. It works up easily, shrinks only moderately, and stands exceedingly well when seasoned. It also enjoys the reputation of being very durable, and its odor is peculiarly obnoxious to moths and other insects. There are, however, some serious drawbacks connected with the use of the wood. There are six varieties in general use. Of these the more important are the pencil cedar and the Havannah or swamp cedar. The others are more rarely used, viz., the cedar of Lebanon, the Himalaya, the Toon wood and the Bermuda cedar. No injurious results have been noticed from cabinets made of the last four varieties, although the tendency to deposit an adhesive gum on objects contained in cabinets made of pencil or Havannah cedar, has long been known. In a recent communication from Mr. A. Bryson, that gentleman says that a paper portfolio in which two small sheets of note-paper were contained exhibited the following action of the wood: The portfolio was thoroughly permeated with the condensed volatile gum emitted from a cabinet of pencil cedar. The sheets of paper lying upon the lower portion of the portfolio were scarcely affected, while the one above showed evidence of the action of the gum. A bunch of keys, which had been in a drawer for three years, were at the expiration of that time coated with a thick deposit of the gummy matter, and thoroughly glued together. A steel clasp of a purse was also coated. In the same drawer lay for years a packet of papers. The outer sheets were not at all affected, while one of yellow-laid note-paper was thoroughly permeated with the gum. Another sheet seemed to have been very susceptible to the gummy atmosphere, as it was changed into a condition resembling tracing-paper. Gold coins and seals similarly exposed remained unaffected, while a copper-plate was affected, although the paper in which it was wrapped showed no traces of the gum. The conclusion drawn from the above instances is, that the only wood which ought to be used for drawers in which papers or valuable articles are to be preserved, is well-seasoned oak or wainscot.

Portland Cement.—The longer Portland cement is in setting the better it will be. At the end of a year, one part of cement to one part of sand is about three-quarters the strength of new cement. Strong cement is heavy, blue-gray in color, and sets slowly. The less water used in mixing cement the better.

ARCHITECTURE.

Brick and Frame Cottage.

[Design furnished by Messrs. Bicknell & Comstock, Architectural Designers and Publishers, New York.]

The illustrations accompanying this article show a perspective view, the front and side elevations, sections, floor plans and details of a brick and frame gothic cottage, in the modified English style. As will be seen by inspection of the elevations, the lower story is of brick, while the upper story is frame. The brick portion is tastefully ornamented by bands and figures of colored bricks, giving a relief to the general effect, and showing how much can be added to a building in this simple manner. It will be observed that there are several very pleasant features. in the arrangement of the house, which may be referred to as follows: The hall (see first-floor plan), instead of being narrow and inclosed, is of ample size. The stairs are built with a landing instead of being straight, which is a preferable arrangement for many reasons. The square passageway between the rooms affords a convenient means of communication to the different appartments. The chimneys, which are made a special and distinctive feature in the external appearance of the house, are so arranged as to admit of large fire-places in the several rooms, and also to accommodate ventilating flues.

Fig. 1.—BRICK AND FRAME COTTAGE.—*Perspective View.*

In the arrangement of the second floor (see Fig. 3) a large hall is provided, and communication to the side chambers is made by means of an alcove passageway opening out of it. The hall, which is entirely surrounded, may be lighted by glass in the doors, or by means of the transoms over the several doors leading to the rooms. A library is provided in the space over the front porch, in which is placed provision for an open fire. This room is shown in the plan with two windows, while in the part side elevation one of them is closed, showing the appearance of the house should more book space be required than can be afforded without the sacrifice of one window. Communication to the bath room is afforded from the hall. Ample closet room is provided throughout the upper story. From the front chamber there is communication to a balcony, which comes above the bay window shown in the first floor. While in the design as drawn the open balcony is made a prominent feature, the same general effect would be obtained if it were inclosed to form a conservatory. Enough of an attic story is provided to afford room for all necessary storage, sleeping room for servant, &c.

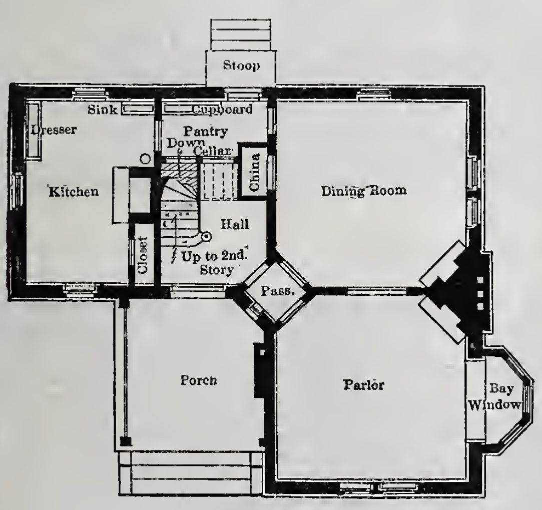


Fig. 2.—*First Floor Plan.*

Scale, 1-16 *inch* = 1 *foot.*

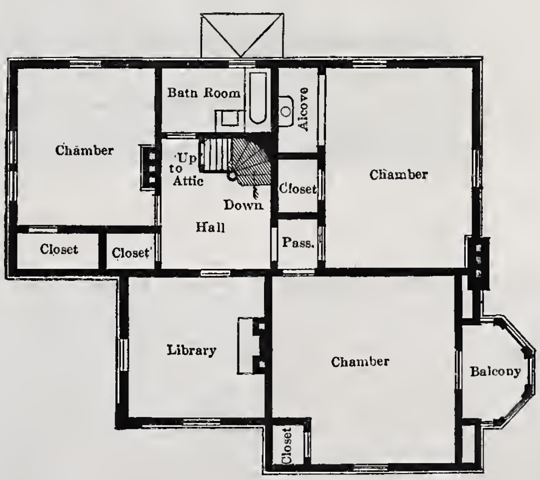


Fig. 3.—*Second Floor Plan.*

In the details of the inside finish two desirable designs for mantels are given. In the parlor mantel shown in Fig. 9, the space between the two shelves is occupied by a mirror. In the dining-room mantel (Fig. 7), midway in the space below the shelf and above the top of the fire-place, a course of tile is introduced, giving a very pleasing effect.

In Fig. 8 is shown a detail of the finish of the bay window opening out of the parlor. It is simple in its lines, neat and inexpensive. Fig. 10 shows the details of the kitchen dresser, being arranged with open shelves and drawers at one end, and with cupboards at the other.

The house, arranged as shown in the cuts, should be built facing the west, thus obtaining a southern exposure for the bay window and balcony or conservatory, as the case may be. The same features of design and arrangement can be maintained in a transposition of the rooms, &c., which shall adapt the house for fronting in any other direction.

This house was designed for and built in Western Virginia in 1876, at a cost of about $4000. Various features of decoration not included in these drawings and this description, but which, nevertheless, would harmonize with its various features, might be added in the finish of this house for one who desired to expend a larger sum of money. Stained glass windows, fancy tile-roof, frescoed ceilings, elaborate room cornices, marquetry floors, &c., are some of the features to which we refer, the cost of which is not included in the figure above named.

We call the special attention of carpenters and builders to the character of the accompanying illustrations. It will be noticed that they are all to a scale which can be easily and readily measured by a common pocket-rule. The elevations are to a scale of 1/8 inch to the foot—a scale sufficiently large to adapt them to use—while the several details are to the scale of 1/2 inch to the foot, which renders all features of ornamentation and decoration sufficiently clear to be used in the preparation of full-sized or working drawings. In the general features of all the drawings, the lines are so clear and distinct that there is no doubt as to their meaning. We shall endeavor to make all our illustrations of practical value to practical men.

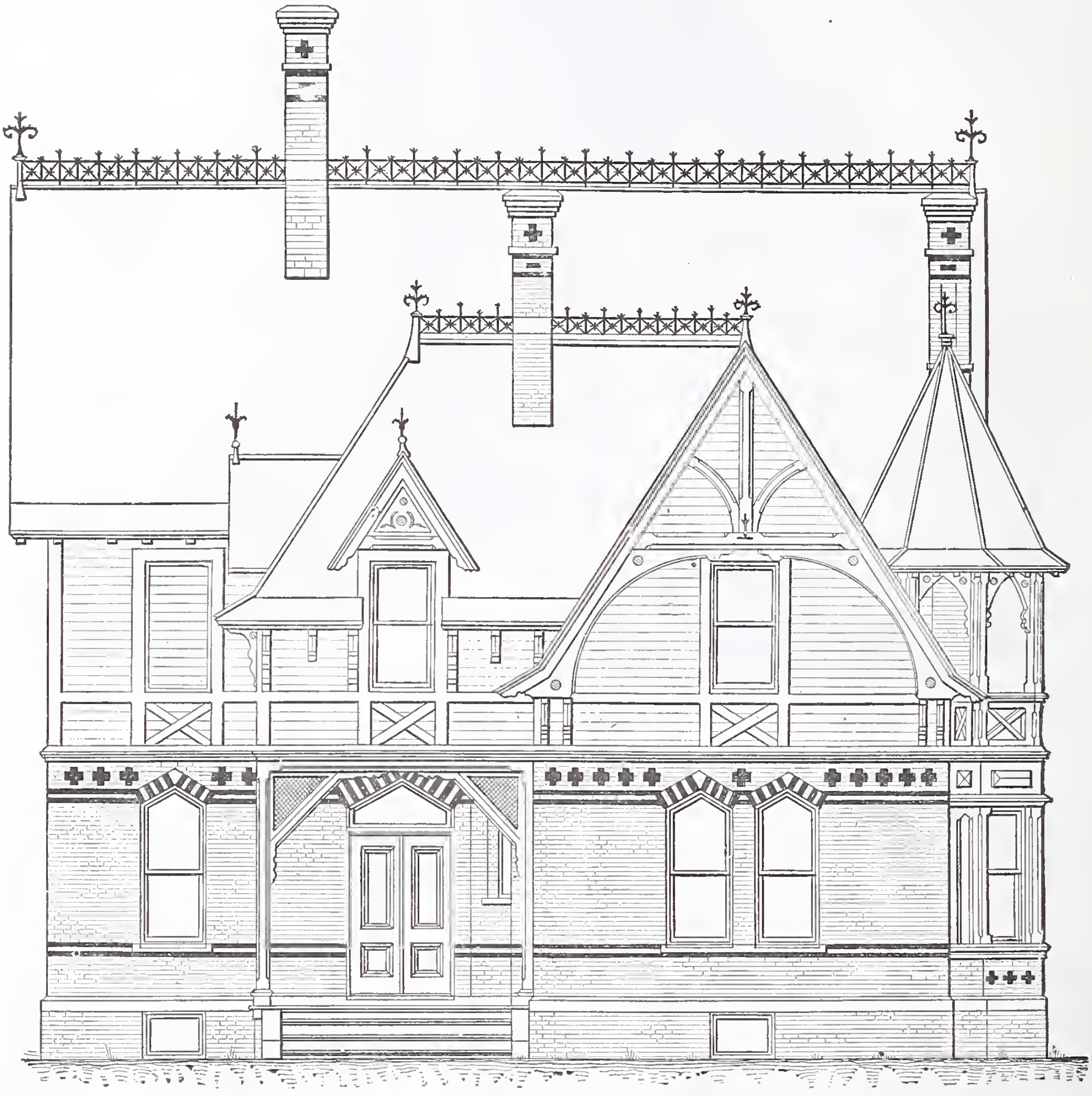


Fig. 4.—Front Elevation.—Scale, 1/8-inch = 1 foot.

Career of a Successful Architect.

The professional career of the late Griffith Thomas, architect, whose death occurred January 11, in point of success, has been rarely equaled. The best business section of New York city, as well as those parts occupied by genteel residences, is thickly studded with buildings erected from his designs. Gentlemanly in person, cultured in address, and possessing qualifications of a high order, he numbered among his patrons a very large proportion of the opulent and enterprising citizens of New York. More than a score of the most prominent buildings in the city, including hotels, libraries and other public institutions, besides stores and mansions without number, were erected in accordance with plans prepared in his office and built under his supervision. It would be safe to say that something like $15,000,000 or $20,000,000 were thus invested by prominent capitalists or corporations, by whom Mr. Thomas' judgment was held in high esteem. Mr. Griffith Thomas (son of Thomas Thomas, a pupil of the celebrated English architect, Peter Nicholson), was born in London in 1820, of Welsh ancestry, and after entering upon the study of his profession, removed to the United States at the age of 18 years. He resided in New Haven for a time, acquiring a good reputation, but finally decided that New York city offered a more inviting field. For a number of years he was located at the corner of Broadway and Canal streets, associated with his father, Thomas Thomas, occupying the identical floor more recently in possession of the unpopular "Popular Life Insurance Co.;" but since the completion of the New York Life Insurance Company's building, has had an elegant suite of offices there, almost palatial in their appointments. Some of the most notable of Mr. Thomas's works are the Grand Opera House, which acquired fame under the late Col. James Fiske; St. Nicholas Hotel and St. James's Hotel; Society Library, in University Place; Astor Library, in Astor Place; Dr. Spring's Brick Church, the Madison Avenue Baptist Church and the Twenty-third Street Baptist Church; Greenwich Savings Bank on Sixth avenue, the Park Bank and the Chemical Bank; the New York Life Insurance Company's building, Kemp's building on William street, Lord & Taylor's on Broadway and Grand street, the Mount Sinai Hospital and the Women's Hospital; the Continental Insurance Company's building, the Gunther building, the Domestic Sewing Machine building on Broadway and Fourteenth street, &c. His latest achievements were Arnold, Constable & Co.'s warehouse on Nineteenth street, the American News Company's building on Chambers street; also the elegant Kimball House in Atlanta, Ga., said to be the finest in the South. Among private mansions erected by Mr. Thomas are Wm. B. Lawrence's residence at Newport, R. I.; Benjamin Nathan's, Twenty-third street; John Steward's, Fifth avenue and Twentieth street. Marshal O. Roberts, Moses Taylor, the Astors, and others equally well known, were among his patrons. Such success as this might satisfy the most lofty ambition. While taking a just pride in his achievements, Mr. Thomas betrayed no vanity nor ostentation. His residence on Fifth avenue, just below Fourteenth street, was plain, but affording all needed comfort and convenience.

In passing upon the career of Mr. Thomas, it may be said that in one sense his success was up to the full measure of sanguine expectation, but that in another it was not everything that could be desired. With unprecedented opportunities for the carrying out of magnificent architectural ideas for making the metropolis of the New World a city of beautiful structures, the kindliest criticism which can be passed upon the hundreds of costly buildings that he originated, is that they were not shams. Mr. Thomas worked almost entirely in the classic styles, or rather in the Renaissance style of architecture, and his interpretations of this style were in the direction of coarseness and loudness, and it is not unfair to describe the general effect of his work as a vulgarization of the street architecture of New York. He was one of the first to recognize the value of iron as a building material for business structures, and he set to work duplicating forms of stone in that metal until Broadway and the dry goods district of the city are crowded with these metallic-stone constructions. Mr. Thomas owed his success in a great measure to the exactness with which he contrived to strike the architectural taste of New York. He did not affect or attempt at all to advance or direct it, and it cannot be said that he very much influenced it. He was simply the most successful of a large number of architects who had no other aim than to do what an uninstructed public liked, and whose success therefore proved, while it promoted, public ignorance. Though Mr. Thomas was known as an "expensive architect," the work done under his direction was uniformly honest and thorough, and his clients had in durability and honesty of workmanship, if they did not have in point of art, something to show for their money. His working drawings were models of accuracy, and it was his pride that he never exceeded his estimates.

The Carpenter.

Probably there is no one of the building trades in which the opportunities for advancement are so many and so certain as in carpentry. The prominence and importance of the wood-worker's art has made the carpenter the leading mechanic upon modern buildings. The carpenter is ordinarily the virtual, if not the nominal, superintendent of the building upon which he is engaged. Accordingly he is required to know all the peculiarities of the various trades which enter into the construction of a building. He must be familiar not only with his own trade, but he must likewise know very much about that of the mason, the bricklayer, the iron-worker, the cornice maker, the roofer, the plasterer, the plumber, the painter, &c. If a building is to be erected without the assistance of an architect, the carpenter is the first mechanic consulted, and to him is given the general direction of the undertaking. Therefore the carpenter in reality becomes the builder, and so well recognized is this that the two terms—carpenter and builder—are used almost synonymously. The carpenter's general and special knowledge is made use of at every stage in the progress of a building. He is very frequently called upon to lay off the ground upon which a building is to be erected. It is often the carpenter who pronounces the foundations satisfactory or otherwise before the superstructure is commenced. It is the carpenter who sees that the iron floor beams are placed exactly right. It is the carpenter who prepares the centers for the bricklayer and the mason and sees that their respective parts of the building are left in proper condition. It is the carpenter, in the wording of many specifications, who must supply whatever is necessary to the completion of the building and which has not been included in any of the other trades. If any new feature of work is introduced in a building for which there is not a special contractor, it ordinarily falls to the carpenter's lot. Whatever shortcomings there may be in the plans—whatever errors have been made by the architect—it becomes the duty of the carpenter to overcome and make compensation for. It is necessary for the carpenter to know everything about a building from beginning to end, and the more thorough and practical his knowledge, the more rapid his advancement and the wider his field of operations becomes.

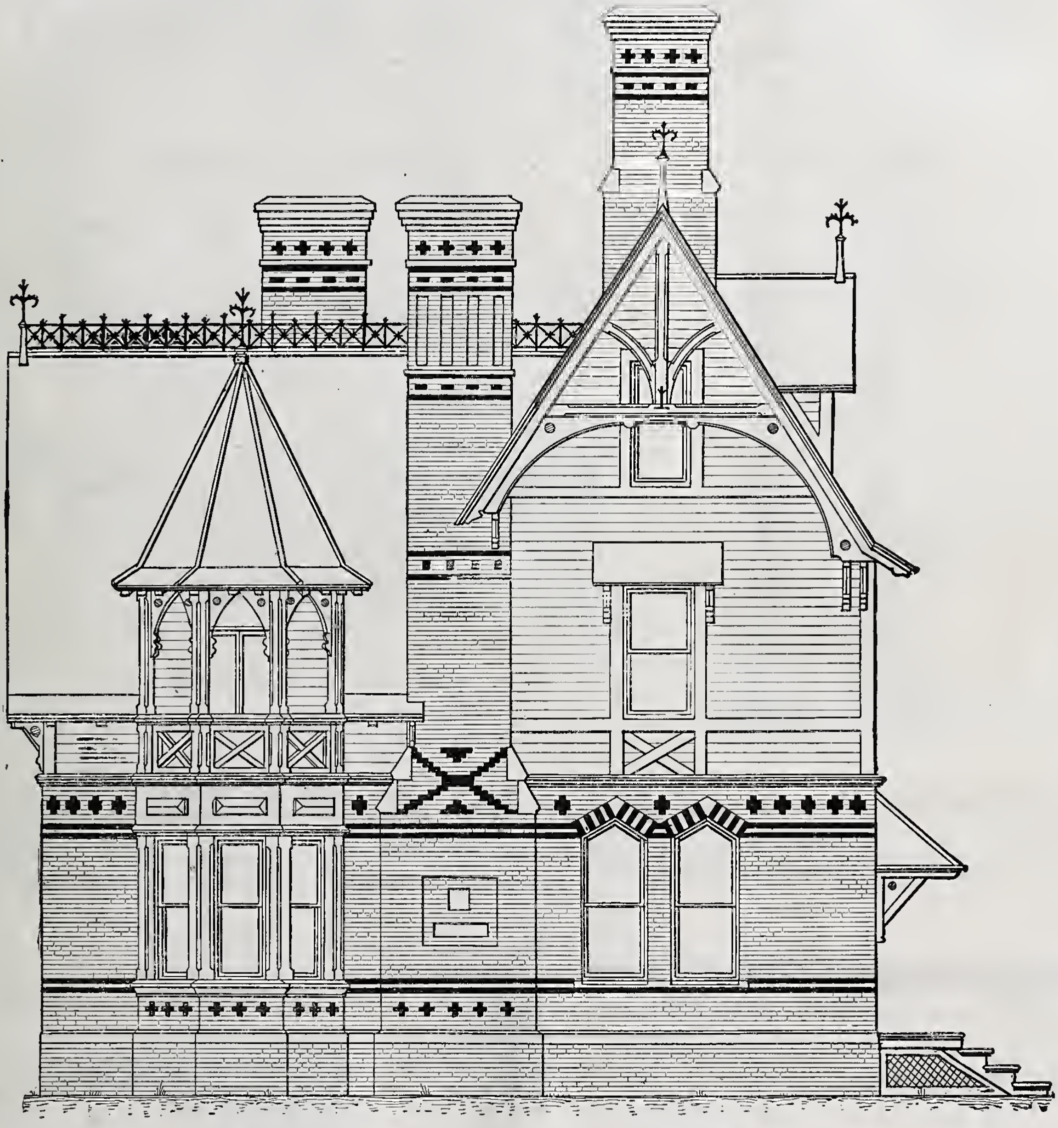


Fig. 5.—Side Elevation.—Scale, ⅛-inch = 1 foot.

There are several distinct stages in the carpenter's career. First, the apprentice and helper; then the common mechanic, working under a foreman; next he becomes foreman, directs workmen under him and has the superintendency of the building upon which he is engaged. From this he easily steps into business upon his own account and takes contracts for the erection of buildings. Not unfrequently he combines a theoretical knowledge of architecture with his practical experience as a builder, and enters upon a professional career with decided chances of success. The rate of his advancement from stage to stage depends largely upon the natural ability of the man—his care in studying the various parts of his trade and close attention to business. Of course something is attributable to opportunities, but, all things being equal, that man who is the most earnest in acquiring knowledge concerning his trade, who secures a fund of information from which he can answer almost any question that may come up in his daily work and who provides ready means for overcoming any unusual difficulties that may arise, is likely to make the most rapid advancement.

Carpentry pure and simple may be defined as the art of combining pieces of timber for the support of any considerable weight or pressure. The theory of carpentry depends upon two distinct branches of mechanical science. The carpenter gives his timbers their forms by the principles of geometry, and he adjusts the stress and strain, so as to preserve them in their original shape, by the laws of mechanics. In the wide range of application of these branches of science the carpenter finds ample field for the exercise of his best powers; his familiarity with them forms the foundation of his usefulness, and in a measure, aside from the relative importance attaching to his trade, gives him an advantage over other mechanics.

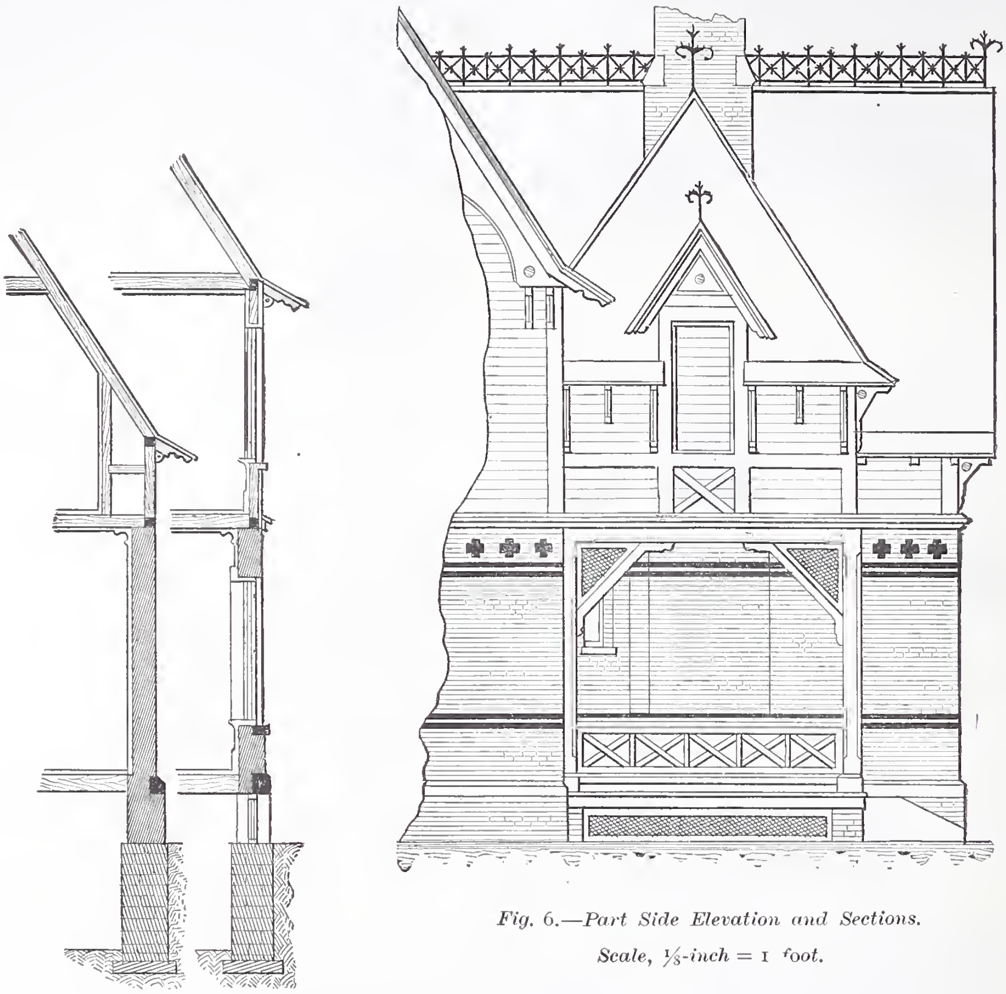


Fig. 6.—Part Side Elevation and Sections.

Scale, ⅛-inch = 1 foot.

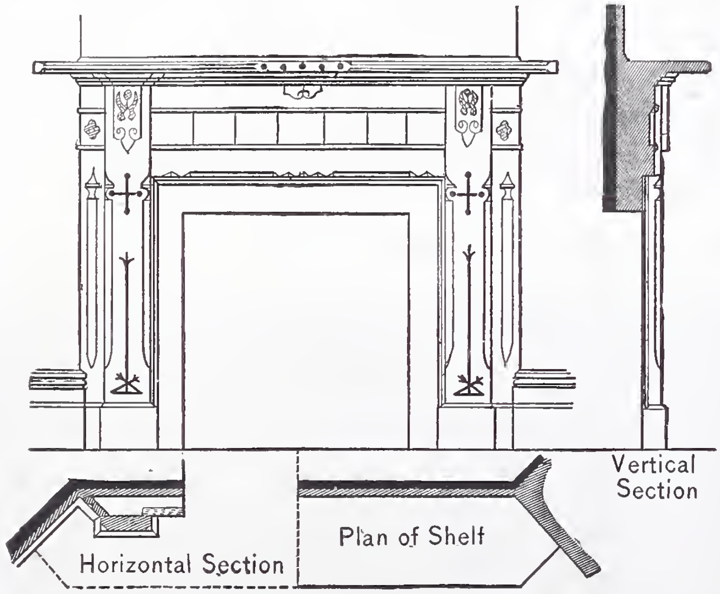


Fig. 7.—Dining-Room Mantel.—Scale, ½-inch = 1 foot.

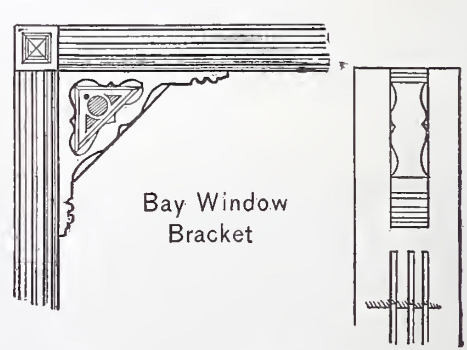


Fig. 8.—Detail of Bay Window.

Scale, ½-inch = 1 foot.

Shrinkage of Architects' Commissions.

These are hard times among the architects. We hear this complaint even among the favored half dozen who have taken nearly all the big jobs in New York for several years past. One of them says: "It is sad to see so many who have heretofore been independent now seeking employment as draftsmen." To be sure, the season is hopeful, as everything aside from heavy taxes favors investment in new buildings, either for business purposes or residences, and there are numerous inquiries on the part of capitalists. A leading architect on Broadway says that not before for several years has he had so many calls with reference to this subject, but thus far nothing definite has resulted. The trouble is the shrinkage in commissions, which are based the world over, in this line of craft, on 5 per cent. of the expenditure; and now that the cost of labor and materials has diminished something like 50 per cent., architects find that tneir income from jobs has diminished in like proportion. The case, as stated, is even worse than this, as the wages of draftsmen are almost as large as formerly. To illustrate the tendency of things, the case is cited where a fine building now in course of construction, to cost at present prices $80,000, will yield the architect in commissions only $4000; whereas a few years ago the same building would have cost $200,000 or more, and the commissions would have exceeded $10,000.

In the matter of commissions, there is

doubtless a strong temptation to employ builders or professional architects who will make low estimates and small expenses, but it is represented, on the other hand, by men who have gained for themselves an enviable reputation, that lamentable mistakes thus arise from a false economy. In other words, the architect who makes full drawings, leaving no guesswork by his assistants in the preparation of estimates, can secure more favorable contracts than men of the cheaper class. The saving in expense to the owner is far more than an offset to the smallest charge for commissions. The waste of material by cheap architects is obvious when it is considered that "the weakest point in a structure is the measure of strength."

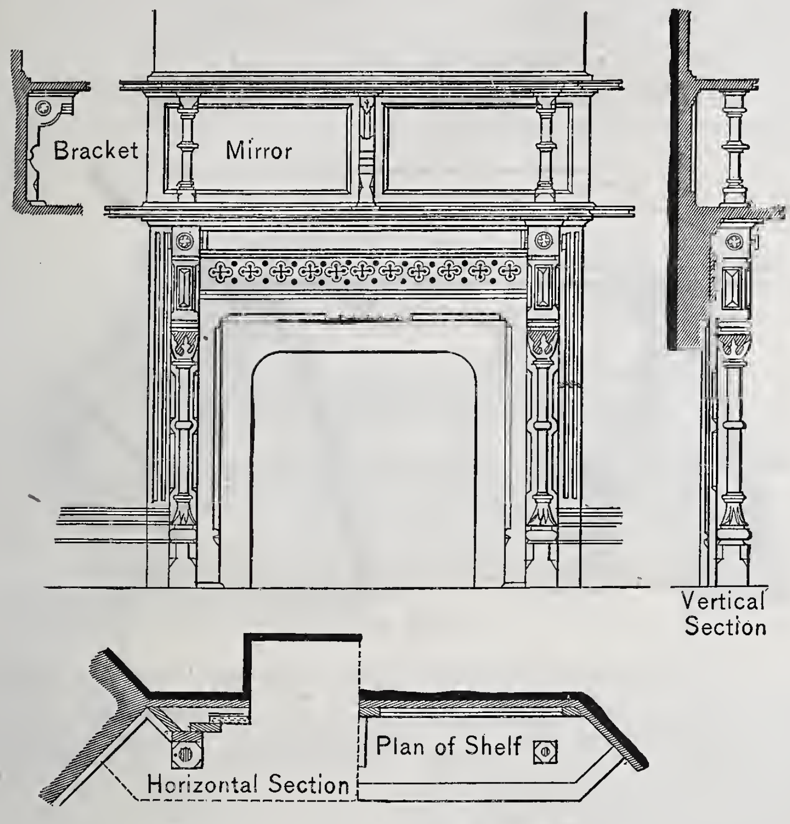


Fig. 9 —*Parlor Mantel*—*Scale, ½-inch = 1 foot.*

The Woodbury Patent Case.

By a decision rendered on the 28th ult. by Judge Lowell, in the United States Circuit Court sitting in Boston, the Woodbury patent case, which in one form or another has been in the courts for upward of 30 years, was brought to a close. The decision rendered refused to sustain the patent on the ground of lack of originality. Nothing that has come up in the way of patent claims has been so important to the interest of wood workers, and particularly to planing-mill men, as this case. Had the patent been sustained it would have covered nearly all the planing machines in use in the United States, and its value would have been nearly $40,000,000, of which some $10,000,000 is for royalty claimed to have accrued since its issue. With so much money involved, it is probable that exception will be taken to the present decision and the case be re-argued before the Supreme Court at Washington.

The history of this case is quite peculiar. The patent under which the suits are brought was issued April 29, 1873, 25 years after application was first made for it, and 27 years after the alleged invention was completed. It is for an improvement in planing machines, by which flat bars are placed before and behind the cutters to keep the stock firm during the operation, instead of the rollers which were used by Woodworth, the inventor of this class of machines. This change, though slight, has proved to be of very great value, and is now in general use. The original application for the patent was made in 1848, but by a blunder in the wording of the power of attorney, the attorney was left with insufficient authority to conduct the case after a rejection. In 1852 the application was withdrawn and tho fees were refunded by the Patent Office. In 1854 the case was put in the hands of another attorney to call up and prosecute the rejected application. The law of limitation, however, prevented any further action on the matter until the revision of the patent laws by Congress in 1870, under which a patent was finally obtained in 1873. The present decision of the court is based upon the fact of one Anson, of Norwich, Conn., having built a machine three years previous to the time of the alleged invention of Woodbury, in which the features covered by Woodbury's patent were used—although in Anson's application for a patent, made in 1844, no special claim was made for them.

Joseph P. Woodbury, the patentee, is dead, and the suits for infringement, which were instituted some three years ago, are brought by a corporation specially organized for the purpose, and to which Woodbury assigned the patent prior to his death. Realizing that against an association of speculators organized to prosecute claims covering so vast a sum of money, a defense should be set up stronger than individuals or private firms could make, the planing-mill men using these machines some time since organized themselves into an association for the defense of whatever suits might be brought, and the defense in the case just decided was conducted by representatives of this association.

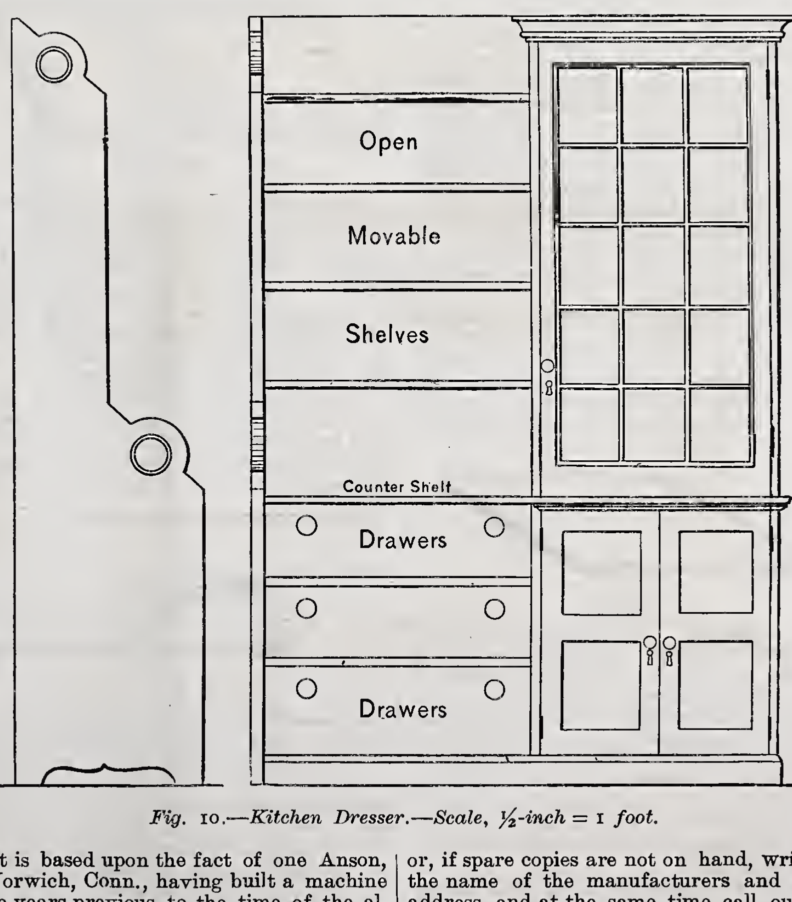


Fig. 10.—*Kitchen Dresser.*—*Scale, ½-inch = 1 foot.*

Catalogues.

Manufacturers and dealers will confer a favor, as well as in some cases advance their own interests, by mailing copies of their catalogues and price lists to *Carpentry and Building.* We shall, from time to time, notice in the columns of this paper new and meritorious articles, such as are likely to prove of general interest to our readers, and by having copies of current catalogues at our command, we shall be able to make far better selections than would otherwise be possible. Circulars describing any new features of trade will also be acceptable. A letter calling attention to any special features of interest should be sent in connection with catalogues. We trust that manufacturers of builders' hardware, building trimmings of all kinds, novelties, terra-cotta, artificial stone, architectural iron-work, builders' tools, cornice work, iron railings and crestings, decorations, stucco-work, center pieces, gas fixtures, sash doors and blinds, newel posts, hand railing, parquetry, window cornices, mantels, ventilators, &c., will favor us in this way. So far as we can we will be pleased to acknowledge receipt in our columns. In this connection we suggest to our readers generally, who feel enough interest in the publication to justify the small effort required, that if they will mail us spare copies of catalogues containing matters of general interest, or, if spare copies are not on hand, write us the name of the manufacturers and their address, and at the same time call our attention to the items of special interest contained, they will also be conferring a material favor and doing something to add to the general usefulness of the paper. Letters calling attention to any technical works and pamphlets which have proven of interest to the writer, will always be acceptable. We desire to enlist the co-operation of all in the effort to make a paper which shall not only possess general features of interest, but shall have departments of specific usefulness for all branches of the building trades. We throw out these suggestions merely as intimations of how our friends can very easily help us in some directions.

The Appliances for Drafting.

Every mechanic in the building trades ought, in his own interest, to be reasonably proficient as a draftsman. It is not enough that he gives his attention to drawing to whatever extent his particular trade demands, restricting his knowledge of this useful accomplishment to the current requirements of his art. He should do more. He should commence by making drafting a foundation stone, learning its principles and becoming familiar with the use of drawing tools while acquiring his trade. His success as a mechanic, in a very considerable degree, depends upon his ability in this direction. The mechanic, in whatever line engaged, who, in addition to his trade, is a draftsman, is certain to attain greater proficiency and to make more rapid advancement than his fellow who has equal talent, but who has not called to his aid the draftsman's art. Aside from these reasons for giving attention to drawing, it is a matter of great convenience, and very frequently of considerable saving, to be able to make any drawing whatsoever that is required in connection with a mechanical pursuit. The necessity for tracings for working drawings and scale drawings for various purposes, is continually arising. To be compelled to send for a draftsman on each occasion results not only in expense, which may be considered the smaller item, but also in tedious delay, and sometimes serious inconvenience. The mechanic who can make his own drawings, and by this we mean not only the drawings required in his own particular branch, but also any drawings illustrative of the work in a general way, is independent in this respect, and possesses a material advantage over those who cannot draw. To those who have ever given this matter a thought, it may seem altogether unnecessary to bring forward any arguments to prove the advantages to be derived from possessing a knowledge of drafting. But it is to be remembered that there are many who, never having had their minds especially directed to this subject, are working in the face of difficulties which a little attention to drafting would effectually remove. Besides, there are young mechanics and apprentices continually entering the building trades, who are likely to have their attention called to this subject for the first time by this article.

It is our purpose, in this paper, to call attention briefly to some of the more prominent tools used in mechanical drawing which it is desirable for a mechanic to possess. We shall consider the subject only in a general way, leaving remarks concerning drafting and tools belonging to special trades for

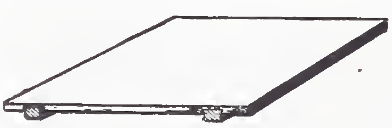


Fig. 1.

other occasions. Every mechanic should own proper facilities for drawing, as well as possess the ability to draw. Foremost among these is a drawing board (Fig. 1). The board should be of pine or other soft wood, thoroughly seasoned, and constructed with ledges of hard wood. The drawing board is suitable only for small drawings, and can be profitably used in connection with a drafting table, the latter being of a size sufficient to accommodate details and full size working drawings.

In Fig. 2 is shown a drafting table of simple construction, being a plain board laid upon two trestles. A drawer is attached to the under surface, and being in length equal to the full width of the board, may be drawn from either side. A second board is laid upon strips fastened to the trestle legs, forming a convenient shelf for the reception of books, drawings, &c. In the construction of a table of this description, it is well to use lumber of greater thickness than is actually required, in order that there may be enough material to bear repeated dressing, as required when the surface becomes old and worn. A good result is obtained by constructing of narrow plank, the whole being held together by rods passing through the table edgeways, and furnished with washers

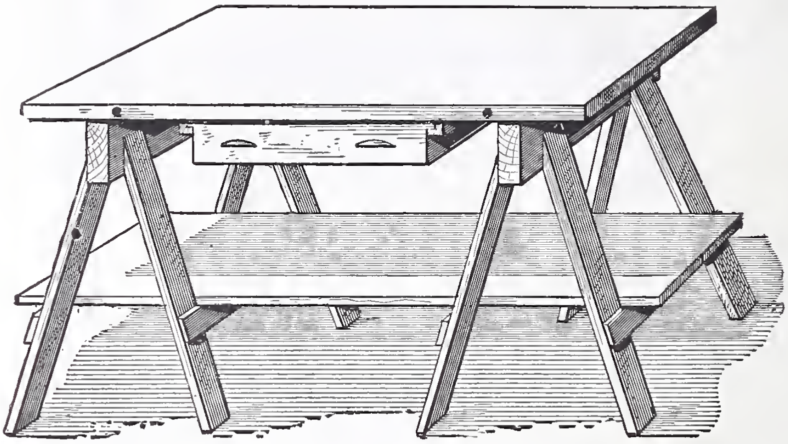


Fig 2.

and nuts. In order to remove any obstruction to the edge of the table, the nuts may be sunken into the wood, a common socket wrench being used to operate them.

Every drawing board and every drafting table should be an accurate rectangle. The opposite sides should be parallel, and each corner should be a right angle. While it is an easy matter to obtain a board approximately accurate, it is necessary to apply some special tests in order to obtain absolute accuracy. For the sake of illustration, we will assume that we have a T-square which is entirely correct. We place it against one side of the table or board (Fig. 3), and with

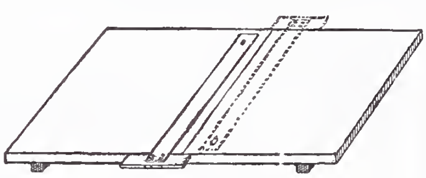


Fig. 3.

a hard pencil, or preferably with the blade of a penknife, we scribe a very fine line against one edge of it. We then carry the T-square around to the other side of the board, and bringing the edge of it against the line, draw another line in the same manner. If the two lines correspond throughout their length, it demonstates that the opposite sides of the boards are parallel.

The corners of the board may be tested with an ordinary steel square, or a carpenter's try square, but as such a tool does not reach to the middle parts of the sides, a test, as shown in Fig. 4, is desirable. With

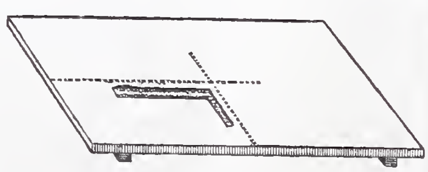


Fig. 4.

the T-square draw a line from one side of the board and another from one end of the board, as shown by the dotted lines in the engraving. If they intersect at right angles, which may be ascertained by the application of a square, as shown in the cut, it is safe to believe that the adjacent sides of the board are at right angles to each other. Still other tests, of a similar nature and of convenient application, will suggest themselves to the thoughtful mechanic. Boards and tables should be frequently and regularly tested. It is a saving of time to be able to work at will from either the end or side of a board, when the board is entirely correct; but when it is not accurate, it leads to confusion and loss of time. After a board has been in use for a considerable length of time and has become thoroughly seasoned, it will not change; but before it is fully seasoned, variations in the condition of the atmosphere will be found to vary it perceptibly.

In this connection, it may be well to call attention to certain tests which may be applied to some of the tools used in drafting. A steel square may be tested as shown in Figs. 5 and 6. If two squares are placed against each other, and against a straightedge as shown in Fig. 5, and are found to correspond throughout, and if they are also

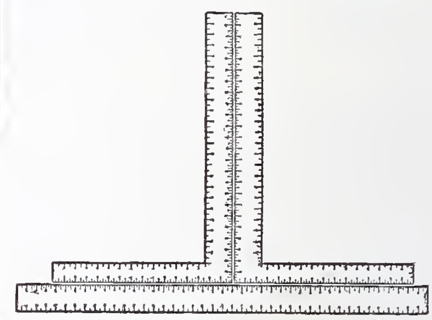


Fig. 5.

laid one on the other, and their outer edges correspond at every point, it is conclusively demonstrated that they are correct. With a square, the outer edge of which has been proved by the above method, the inner edge of another may be tested, as shown in Fig. 6. A T-square may be tested in several

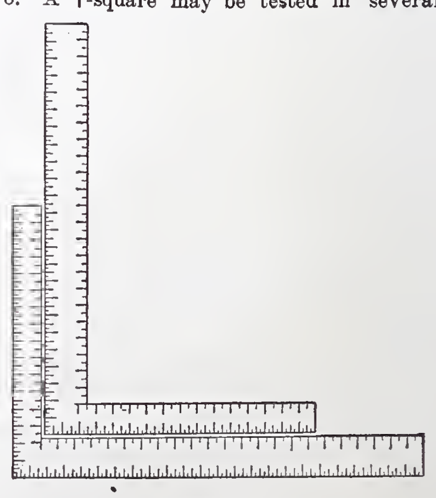


Fig. 6.

ways. If the blade is of one width throughout, place the square upon the drawing board and scribe a fine line by one side of it. Move the square along until the other edge comes against the line, and scribe again. If the two lines are identical at all points, the T-square is correct. If it is known that the opposite edges of the drawing board are parallel, the T-square may be tested by the same methods as described for testing the board. The readiest means of testing a T-square, however, is by the use of a steel square, or carpenter's square. For tests of all kinds it is best to commence with the common square, and having obtained absolute accuracy in it, proceed to each of the other articles in turn by its use.

In the selection of a T-square, the mechanic has the choice of either a fixed head

Fig. 7.

(Fig. 7) or a swivel head (Fig. 8). In addition, he has the choice of a variety of different woods, steel blade, hard rubber blade, &c. A walnut head, with a pear-wood or maple blade, answers a good purpose for common work. Many like the hard rubber blade, while a steel blade is probably more accurate and more durable than any other. No one can afford to have any other than a first-class tool of whatever grade he may select. The movable or swivel head is useful in drawing lines oblique to the side of

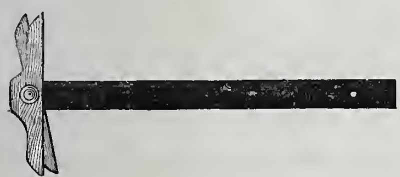


Fig. 8.

the drawing board. To be entirely satisfactory, the screw holding it should be very strong, and the nut or cap large enough to admit of being readily grasped, in order to fasten the movable arm positively at any required point. Two or more triangles are desirable in connection with a set of drawing tools, for whatever purpose intended. In material there is the choice between pear-wood, hard rubber and metal. The smaller sizes are generally made solid, while the larger sizes are open in the center. Fig. 9

Fig. 9.

shows a triangle of 45, 45 and 90 degrees, convenient for use in drawing lines at right angles to a straight-edge or T-square. Fig. 10 shows a triangle of 30, 60 and 45 degrees.

Most persons in buying drawing instruments buy a case, taking the set as made up by the manufacturer. It sometimes happens, however, that a few odd pieces are required for a special purpose, not justifying the purchase of an entire set. It also occurs sometimes that persons prefer to make

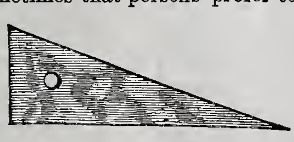


Fig. 10.

their own selection of tools, having a case made afterward to suit. Whatever may be the circumstances, too great care cannot be paid to the quality and finish of the tools selected. Drawing instruments are intended for fine and accurate work, and unless they are well made they fail to give satisfaction. German silver tools are preferable to those made of brass. Compasses having the improved lead holder, as shown in Fig. 11, are to be preferred over those of the old style, which clamp an ordinary lead pencil to the side of the leg. While a pair of plain dividers, as shown in Fig. 12, is useful for nearly every purpose, a pair arranged with a hair spring for accurate adjustment, as shown in Fig. 13, should also form a part of every complete set. A pair of spacers, as shown in Fig. 14, is useful for many purposes for which the plain dividers or hair-spring dividers answer only as tolerable substitutes. In Figs. 15 and 16 are shown scales, the former being triangular in shape and the latter flat. Each is divided to measure drawings 1-16, ⅛, ¼, ½, ¾, 1, 1½, 2 and 3 inches to the foot. One or the other of these should form a part of every set of drawing instruments intended to be used

Fig. 11.

in connection with architectural drawings. The triangular scale can be obtained of various lengths, either 6, 12 or 24 inches, and it should be selected accordingly with reference to the work to be done. Fig. 17 shows some trammel points, calculated to be used upon a rod. The screw at the top serves to fasten them in place upon the rod. The screw at the side of the one at the right is for holding a pencil when not in use, and the detached point during the time the pencil is substituted for it. For those who have a great deal of very accurate work to do, involving curves of longer radius than can be struck with the ordinary compasses, a set of beam

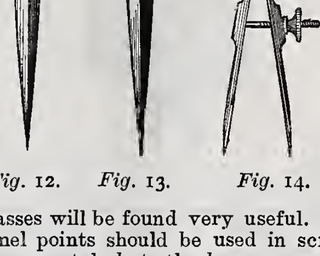


Fig. 12. *Fig. 13.* *Fig. 14.*

compasses will be found very useful. The trammel points should be used in scribing wood or metal, but the beam compasses, which admit of very fine and accurate adjustment, should be used upon paper.

French pear-wood or hard rubber scrolls and curves are very useful in certain kinds of ornamental drawing, and occasionally in the making of full-sized working drawings. Drawing pens are indispensable for all drawings to be made in ink. For ink drawings only the best quality of india ink should be used. The best grade at the present time costs from $1.50 to $2 per stick, while inferior qualities can be got for 15 to 50 cents per stick. The difference is discovered in the flowing qualities of the ink and in the appearance of the drawing when completed. A protractor, of the special uses of which we shall have more to say at another time, is useful in laying off various figures, in measuring angles, &c. Either a paper, horn or metal protractor may be obtained, according to the use to be made of it. Thumb tacks, for fastening the paper to the board, should be selected with broad flat heads, that they may

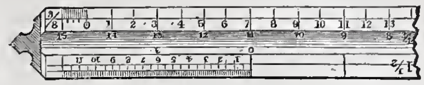


Fig. 15.

not injure the edges of the T-square. Those in which the point is screwed into the head are better than those with riveted points. The very best quality of pencils will be found the cheapest in the long run. Several pencils differing in the hardness of the lead should be constantly ready for use, different pencils being used for different parts of the same work. The quality of paper to be used depends so much upon the nature of the

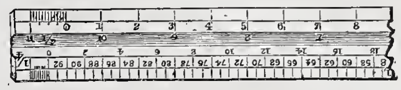


Fig. 16.

work and the kind of drawing to be made, that very little can be said upon this head in a general way. We will, therefore, pass it by for the time, proposing to give it the consideration to which its importance entitles it at another time. A good piece of rubber for erasing marks should be provided. In the selection of this, too, there is considerable choice, there being, on the one hand, a soft, porous article very useful for cleaning

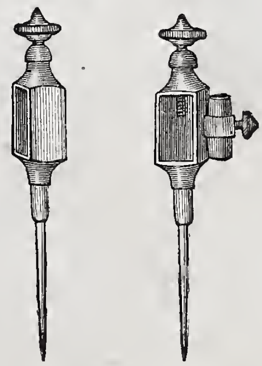


Fig. 17.

drawings after inking, and on the other, the artist's rubber, most suitable for general purposes.

Whatever selection of tools is made, and for whatever purpose they are used, they should be kept clean and in good order. For this purpose a chamois skin of suitable size and quality is indespensable. Proper drawers or boxes for protecting the tools from dust and dirt should be provided. Never leave the tools lying about in disorder. Have a place for each article and keep each tool in its place. At the outset get the best tools for the purpose, and then take scrupulous care of them. By this means the best will always be found to be the cheapest.

Mordants for Staining Woods.—Sulphuric acid, more or less diluted, according to the intensity of the color to be produced, is applied with a brush to the wood, previously cleaned and dried. A lighter or darker brown stain is obtained, according to the strength of the acid. When the acid has acted sufficiently, its further action is arrested by the application of ammonia. Tincture of iodine yields a fine brown coloration, which, however, is not permanent unless the air is excluded by a thick coating of polish. Nitric acid gives a fine permanent yellow, which is converted into a dark brown by the subsequent application of tincture of iodine.

"It's only the wealthy man who can afford to have wings on his house now," remarked a carpenter to a house owner the other day. "Yes," replied the other; "you remember the adage says, 'Riches have wings.'"

CORNICE WORK.

THE RELATIVE ADVANTAGES OF STAMPED ORNAMENTS FOR ARCHITECTURAL PURPOSES.

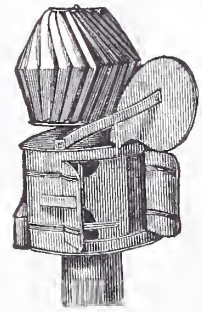
In the development of the manufacture of sheet-metal cornices for buildings, there has arisen a demand for a kind of ornamentation especially adapted to this class of work. Ornaments composed entirely of geometrical forms, and constructed by the joining together of small pieces of sheet metal, analogous to the general construction of sheet-metal cornice work, has been found too costly, while the character of the ornaments themselves, in style and finish, is unsatisfactory. Hand-raised ornaments, that is, ornaments produced by the use of hammers and other hand tools, manipulated by skillful workmen, are in cost entirely out of reason, and cast ornaments, although by various means made very light and thin, are not acceptable, being of a nature entirely different from that of the structures upon which they are placed, and possessing the unsatisfactory characteristics of all cast work for architectural purposes. Nor is it to be supposed that stamped ornaments are satisfactory in every particular. Stamped ornaments are doubtless the best of all the kinds of ornamentation yet attempted for galvanized iron cornices and that general class of work, yet there are some decided objections to them. Among the objectionable feature of stamped ornaments may be named that of the indefinite duplication of a design. The cost of the dies and of the preliminary processes are so great that it becomes impossible to produce any but a large quantity at a reasonable cost per piece. The absence of undercut, the feature so necessary in many styles of architecture to proper effect, is also frequently urged against their employment. The stretching of the metal in the process of drawing, by which some portions are rendered very thin, has also been frequently named as an objection. However, the absence of undercut and the thinness of the metal in some places are not valid objections against stamped ornaments as such. All the effect of undercut, and to a degree impossible to attain in stone, may be obtained in stamped work by proper construction of the dies. It may be necessary in order to accomplish this to strike-up the design in parts, and afterward join, but this adds very slightly to the cost. The extreme thinness of metal at some points is to be remedied by the use of a thicker gauge—by the use of blanks sufficiently thick—that whatever relative diminution of thickness takes place in some portions there will still be enough metal remaining in those parts to successfully withstand the process of oxidation incident to all zinc exposed to the atmosphere. It seems, therefore, that the most forcible objection that can be urged against the employment of stamped zinc architectural ornaments consists of the indefinite duplication of any pattern that may be designed. While other objections can be removed by proper mechanical expedients, probably no amount of argument is sufficient to dispel this objection of duplication—the making common of a design—from the mind of the architect, who prides himself upon the characteristic details of his architectural compositions. To the ordinary mind, however, this objection counts for little. It counts for so little, in fact, that in the use of stamped ornaments many incongruous combinations are made, thus offending in a still greater degree the fine sensibilities of the tasteful designer.

The strongest argument for the use of zinc ornaments, viewed from a purely commercial standpoint, is their small cost combined with their great availability. Manufactured in quantities by improved machinery, their cost admits of a selling price which defies competition, and, being made in quantities and carried in stock, they are available for use on call. The small manufacturer, in common with the large producer, finds the use of stamped ornaments advantageous, and the improvement in the style of sheet-metal cornices, as seen upon street fronts and upon public buildings since the general introduction of this character of ornamentation a few years since, testifies to the general appreciation of it. So available are stamped zinc ornaments that a few instances have occurred in this country, among which may be mentioned Memorial Hall of the Centennial buildings, Fairmount Park, Philadelphia, in which they have been used upon the face of stone. The saving in time and in cost, coupled with the fact that close scrutiny scarcely notes the deception, seems in some cases to justify such resorts. The employment of stamped zinc ornaments upon outside woodwork is quite common. In wood cornices upon the faces of brackets, as leaves and rosettes, in panels, as scrolls, &c., their use is far preferable to that of carved wood, from the combined advantages of lessened cost, greater durability and entire availability when required for use. For inside decorations upon woodwork, in the finish of public buildings, stamped ornaments have also been frequently used. In the construction of centerpieces for the ceilings of rooms, stamped zinc is now in competition with plaster, with many odds in favor of the former.

Decorative articles, as picture frames in imitation of rustic work, bas reliefs, enlarged *fac similes* of medals, busts and statuettes, are now produced in zinc by stamping process to a degree of perfection of finish which brings it as a material into competition with those materials so long associated with the forms in which they are so frequently seen. It is the boast of enthusiasts that this process is capable of producing in zinc such specimens of art workmanship as will ultimately give to its product a rank which, comparing it to more expensive goods or to the originals which it duplicates, may be likened to the position which the chromo holds relative to the costly painting of which it is a faithful reproduction. Whatever may be the future of this industry under the fostering attention of American genius, remains to be seen. As now conducted, while apparently answering the demands made upon it, it is quite crude in appliances, and up to the present time has been but little improved over the condition in which it was received from the French, from whom it was adapted.

Improved Fan and Ventilator.

We give herewith an illustration of a new form of fan and ventilator for chimneys, shafts, &c., invented by Mr. L J. Wing, and manufactured by Messrs. Reuter & Mallory, 22 Light st., Baltimore, Md. This apparatus consists of a hollow metallic casing, free to revolve, and having a lateral opening always turned from the wind by the directing action of the vane attachment. Within the



casing is a series of vertical paddles, turning upon a central shaft driven by the action of the wind upon the windmill above the casing. All the parts are made to work very freely and with but little friction. The paddles are arranged so as to swing round the inner periphery of the casing, leaving an undisturbed central core. Consequently the paddles, when revolving by their centrifugal action, force a strong current outward from the lateral opening, producing a vacuum which is supplied by the air flowing upward through the central core. The vertical position of the paddles offers no practical resistance to the upward current of air if the paddles should not be in motion, while the centrifugal action produces a vacuum, materially aiding the natural draft or producing one artificially when otherwise there would be little or none. Mr. Wing sends us the particulars of a very interesting test which he recently made in the Maryland Institute building during the fair. He put one of his ventilators in the building and directed a current of air from a Boston cupola blower upon the windmill. Mr. Butler, building inspector, and Mr. J. C. Neilson, architect, found by testing with an anemometer that, with the wind at 7 miles an hour, the exhaust through a 6-inch orifice was at the rate of 4000 cubic feet per hour, the ventilator being free from natural currents.

Rendering Woodwork Incombustible.

Every hint on this subject is well worth noting, more especially since ordinary woodwork is one of the most combustible materials. The following suggestion has the decided advantage of emanating from a practical man—a chemist. Mr. F. H. Gossage, of the Widnes Soapery, Lancashire, writes:

I find that painting woodwork of any kind with several coats of solution of silicate of soda, and finishing off with a mixture of this solution, and sufficient common whitening to make it about as thick as ordinary paint, a most excellent protection against fire. Wood treated in this way will not take fire from mere contact with flame; it requires to be heated till destructive distillation begins. Then, of course, gases are given out which ignite, and the wood is gradually converted into charcoal; but until destructive distillation (*i. e.*, the steaming of the moisture in the wood) takes place, the coated wood will not support combustion. A few years since, I had some screens made like ordinary doors, some prepared as I have described and some not. They were then placed over a fire of shavings, which was kept constantly renewed. In ten minues the unprepared screens were blazing away, and so nearly consumed that they had to be supported by an iron bar. The flames continued to lick the prepared screens for 30 minutes before the distillation commenced. After 45 minutes, the screens were still intact and able to support themselves; and in an hour, although pierced in many places with holes, they held together, and when the fire was removed, they did not continue to burn. This was a splendid success, and I still have the remains of the screens The experiments were made, at my suggestion, for the managers of the Liverpool Philharmonic Society, and the woodwork of the roof of their splendid hall at Liverpool was treated in this manner. I am sure a good deal might be done with this simple and inexpensive process to reduce the possibility of fires, especially in public buildings, theaters, &c., for, if the woodwork was thus treated, draperies and sceneries would burn away before the heavy timber-work of the structure could take fire.

Plumbing Hints.—Builders would do well to remember the great weight of set wash-trays of slate, especially when full of water and wet clothes, and provide adequate supports for them; that the sweating of a water-pipe can be prevented by covering it with a non-absorbent material; that a good way to prevent pipes leaking at the joints is to grease the gasket and surface of the pipes with tallow before screwing them home; that a crack in an iron pump may be calked with iron filings and sal ammoniac, so as to form a rust joint; that a water-back which is too large for the boiler attached, and consequently provides hot water in excess of the demand, will generate steam which will drive the cold water before it, so that when a faucet is opened steam will escape at that point, to the alarm of the unwary. With a little judgment nearly all the difficulties experienced in plumbing work can be avoided.

Steeple-jacks ought to make good floaters for bubble companies, as they can fly their kites well; but though they climb to a towering hight, they soon dip to their proper level.

Carpenters and joiners are always tonguing their work, and though it screeches under the operation, it never has the courage to speak out in return.

MASONRY.

Stone Cutting.

II.

In ashlar masonry, stones of larger size are employed than could be utilized in the endless forms of stonework of which we spoke in the last paper. The least depth of each block in ashlar masonry should be 12 inches. All the stones are carefully dressed, and special attention should be paid to the joints, in order that the courses should run parallel to each other and be horizontal. In the better class of ashlar masonry the faces of the stones are "rubbed." The upper part of a stone is termed the "top bed;" the lower portion the "lower bed." The front is called the "face," and the vertical joint opposite to the face is the "back." "Headers" and "stretchers" are used alternately in each course to obtain bond.

Fig. 1 shows part of a wall of ashlar work, where the stones are laid in regular courses, and bounded at the angles by quoin stones, having "chamfered" edges and "rusticated" faces.

The ancient Roman masonry, partaking of

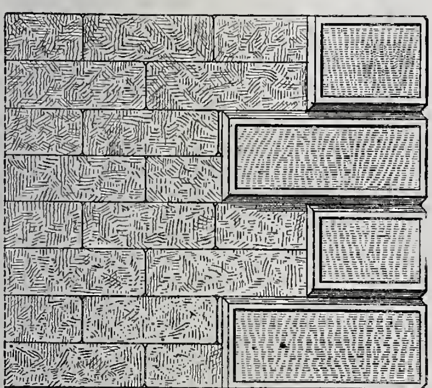


Fig. 1

the character of ashlar, had, like our own, many varieties. Sometimes rubble was used as a filling-in, as in the case of the tomb of Cecilia Metella, at Rome, where the rubble seems to have been laid at the same time as the courses, as there are tokens of where the levels have been discontinued and recommenced. The masonry known as "Isodomum" had all its courses of the same hight, and hence was extremely durable and solid, as, the beds being level and smooth, the mortar remained in its position, and, moreover, the wall was bounded throughout its entire thickness. The "Pseudomum" was characterized by the unequal hight of the courses. In other points it resembled the "Isodomum."

Almost every variety of masonry may be found among the extant remains of Roman

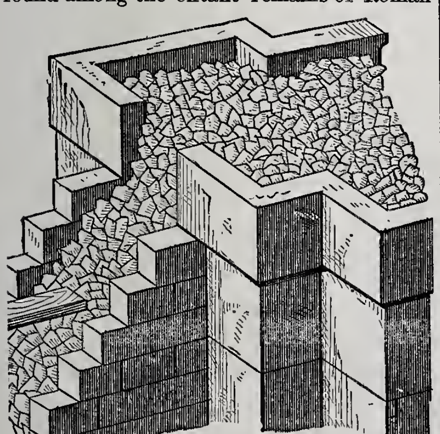


Fig. 2.

art, particularly in the gigantic amphitheater of Vespasian, at Rome. "The Colosseum," as has been well said by Cresy, "is not only a model for construction, but a school for the study of the mason's art; its general arrangement, and the proportion of its piers and walls were, no doubt, most useful guides to the builders of the Middle Ages. There is scarcely a peculiarity in masons' work of which an example may not be found admirably effected, amid the corridors and vaultings of this edifice; and the test to which its stability has been subjected during nearly 2000 years, is a convincing proof that every point in its construction was well consid-

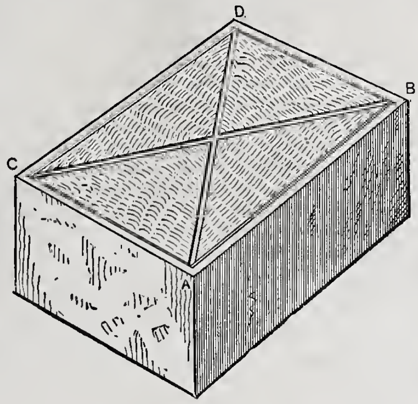


Fig. 3.

ered, and must impress upon us the rather humiliating conviction, that masonry has not progressed beyond the knowledge acquired by the ancients." Concerning this last assertion there may, however, be two opinions.

With the fall of the Roman empire masonry necessarily became deteriorated, and even extinct, in its higher branches. The first steps toward a better state of things in Western Europe were taken by the monastic builders. But they had neither the wealth nor the knowledge of the great classic builders, and had to content themselves with edifices in which make-shift expedients were freely resorted to. Fig. 2 gives an example of the kind of work with which the architects of that day had frequently to be satisfied. Stones of small size were employed in the least effective manner, and it required bond-timbers at frequent elevation to insure even moderate stability.

From the Roman examples of solidity and massive durability, and the tentative efforts of the early monkish builders, the art progressed to a fresh phase, and perhaps the

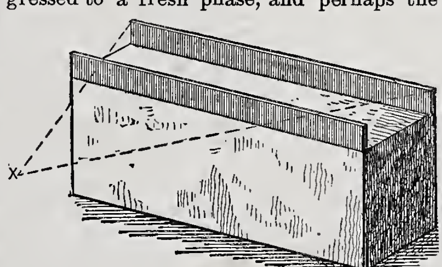


Fig. 4.

most glorious in its history, under those strange guilds of Freemasons whose handiwork is found in every realm of Western Europe, from the lofty minster to the little village church.

There were indeed "giants in those days," and gazing on some of their marvelous feats, alike of stone-cutting and constructive skill, we may well doubt whether the world will ever look on their likes again.

Before speaking further of the ashlar masonry, a preliminary word or two on the preparation of the stones may be advisable. Some interesting remarks on the manner of facing stone in mediæval times are given in Denison's "Lectures on Church Building." "The mode of working moldings," he says, "depends a good deal upon the kind of stone used. In that from Steetly, near Worksop, employed almost exclusively outside the new church at Doncaster, and in the Ancaster stone, used for pieces of window tracery and mullions too large for the blocks that can be got from Steetley, and in the Brodsworth stone, the moldings are all completed with a 'drag.' I do not use the word 'finished,' because that means going over the work to put a particular kind of surface upon it after it is really completed. On the other hand, the Crookhill stone, of which all the pillars and a few other parts are made, would utterly defy any such small-tooth-comb work as a drag; nothing under a chisel, with a heavy hammer, will touch it. Again, some stone from Huddlestone is too tough and cheese-like for dragging, and the moldings in it are completed by shaving them with a chisel, something like wood carving. The effect of that is very good, because a chisel run along in that way will always make a rather undulating surface, though smooth enough to the touch even to please a clerk of the works. In some real Norman arches, which had been covered with plasters for centuries, the molding showed that the drag or tool had never been allowed to make the marks directly across; generally they were oblique, and sometimes parallel to the direction of the molding, Worked in this way, the stones will be sure to show themselves distinctly, and the effect of the mortar staining the stones for a little distance from the joints produces anything but a bad effect. Tuck-pointing, to rather rough masonry, especially—*i. e.*, making prominent joints in mortar, with the edges cut straight and square—is another chance of spoiling work. After a few years this generally splits off."

Stone cutting may be practiced in various ways, the formation of as many plane surfaces as may be desired, with the least possible loss of material, being the end and aim of all. In dealing with a block of stone, its bed, which is usually one of the largest sides of the block, is generally first formed, and reworking should always be obviated as

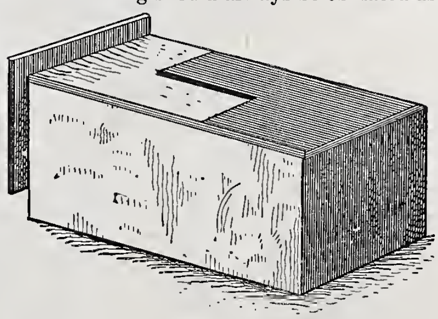


Fig. 5.

far as practicable. Care should be taken that the beds of stones are never worked hollow or concave. If they are so, the pressure will be shown on the elevated edges, and there will be a tendency in the stones to flush or break off in flakes at the joints, which has a very detrimental effect upon the appearance of the work, and gives the idea of want of stability in the wall. Convexity of bed, if slight, is to be preferred to concavity, but, of course, a perfectly plane surface is the desideratum.

To produce a perfectly plane surface on one side of a block of stone, the mason begins by making a narrow part of one edge straight by the aid of the chisel (Fig. 3), as at A B; this margin, worked to coincide with a straight line, is termed a "draft" or "draught."

Another draft, as at A C, is then made along an adjacent edge and at right angles to the first. A diagonal draft, B C, is then run

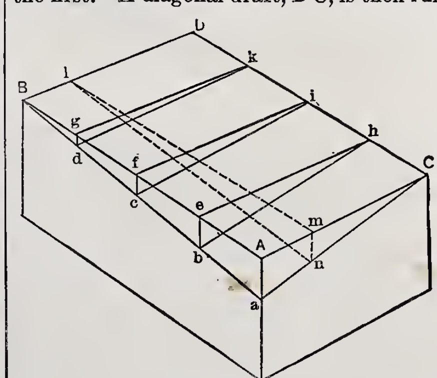


Fig. 6.

from the opposite extremities of the two first formed. These three drafts form a triangle, and are all in one plane. A second diagonal and two marginal drafts are then run, and finally the whole surface of the stone is reduced to the same plane as the drafts, so that the entire face coincides with an applied straight-edge. In cases of small stones the latter drafts are frequently dispensed with. Sometimes in small stones a draft is sunk along one edge of the stone, and a straight-edge of which the edges are parallel placed in it. A similar rule or straight-edge of precisely the same width is then sunk in a draft on the opposite side of the stone, until the top edges of the rules are out of winding (Fig. 4), when the stone is dressed to the level of the drafts, as before.

When the bed, or one plane surface has been produced, the required shape of the sides of the block are marked upon the surface with the aid of a square or templet. Drafts are then sunk by the chisel across the extremities of an adjacent face with the aid of a square, Fig. 5 (or bevel if the sides are not to be at right angles to the bed), and a second face is obtained between such

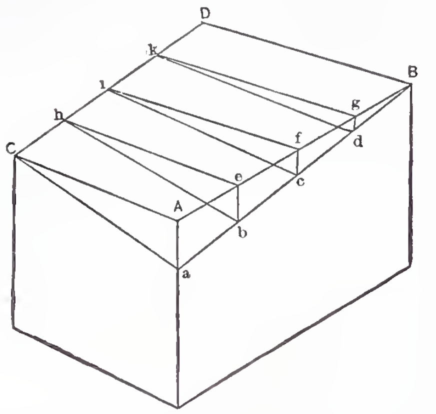


Fig. 7.

drafts. The process is repeated for the third face, and so on until the block has been brought to the desired form.

Regularly winding surfaces may be obtained in various ways The simplest plan is when the stone is worked to the proper planes and angles, as just described, to set off the amount of the winding, A a (Fig. 6), on the arris, and draw the drafts, lines a B, a C. A series of lines, as b e, c f, d g, are then drawn parallel with A a, and another series, e h, f i, g k, parallel to A C. The drafts being sunk at these, so that a straight-edge coincides from b to h, or c to i, or d to k, the surface is wrought so that when the rule is applied parallel to the plane. a B, it may coincide with the surface at every point. If one end of the stone is less in length than the other (Fig. 7), the line, a B, must be divided into equal parts, and the lines, b e, c f, d g, drawn parallel to A a. The line C D is then divided into the same number of equal parts in h, i, k; then e h, f i, g k, are joined instead of being drawn

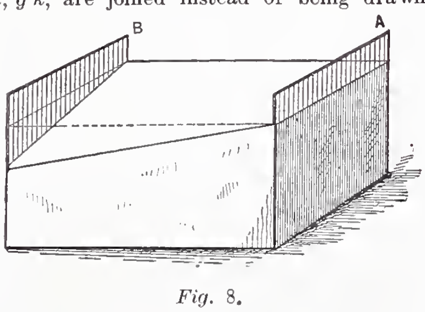


Fig. 8.

parallel to A C. The drafts are then sunk until a straight-edge agrees from b to h, and so on, and then the surface is dressed so that the straight-edge will coincide in a direction parallel to the plane a B.

Winding surfaces may likewise be formed by the use of two rules, one having parallel and the other divergent edges. These are sunk in drafts across the two ends of the stones, until their upper edges are out of winding. The ends of these drafts are then connected by means of two others formed along the sides of the block, and the entire surface worked down to them until it coincides with a straight-edge placed in a direction parallel to the drafts. The rules used in this process are known as "twisting rules," one of which, as at A (Fig. 8), is, of course, simply a straight-edge with opposite edges parallel. The other, B, is termed a "winding strip," and that portion of it which coincides with the twist of the stone, as shown by the dotted lines, is of necessity a triangle, and will be so considered in future sketches of this part of our subject.

Lathing and Plastering Ceilings.

Before beginning to lath a ceiling, the carpenter proves the under surface of the joists to which he has to work by applying a long straight-edge, and makes up for any slight inequalities in them, when the work is not to be of a very superior character, by nailing on laths or strips, so as to bring them as nearly even as he can. This operation, says the *Builders' Weekly Reporter*, is called "fizzing" or "fuzzing." If it be a framed floor with ceiling joists the plasterer has to work to, it is tolerably sure to be straight; but the carpenter must have fizzed down on the beams or binders to the level of the ceiling joists, unless the ceiling joists have been nailed to the beams or binders, when nothing of the kind is necessary. If a ceiling is to be divided into compartments or panels, the projecting or depending portions must be bracketed or cradled down to receive the laths. It is an important point to be attended to in plastering on laths, and in ceilings particularly, that the laths should be attached to as small a surface of timber as possible, because the plastering is not supported or upborne by its adhesion or attachment to the wood, but by the keying of the mortar itself, which passes through between the laths, and bends round over them. If, therefore, the laths are in constantly recurring contact with thick joists and beams, the keying is as constantly intercepted, and the plastering in all such places must depend on the portions between them that are properly keyed.

Under a single floor, it will be seen, in which the joists are necessarily thick, a narrow fillet should be nailed along the middle under the whole length of them, to receive the laths and keep them at a sufficient distance from the timber to allow the plastering to key under it; thus, too, the surface may be made more perfectly even, as it is in single floors that inequalities mostly occur. This being all arranged, the plasterer commences lathing. The laths should be of the stronger sort. Thin, weak laths, if used in a ceiling, are sure to produce inequalities, by sagging with or yielding to the weight attached to them. One or two weak ones in a ceiling of otherwise strong laths may be the ruin of the best piece of work. They should be previously sorted, the weak, crooked, and knotty, if there be such, being reserved for inferior work, and the best and strongest selected for the work of most importance, so that the workman shall find none to his hand that is not fit to be brought in. Taking a lath that will reach over three or four openings, he strikes a nail into it on one of the intermediate joists, at about three-eighths of an inch from the one before it, and then secures the ends of that and the one that it meets of the last row with one nail, leaving the other end of the lath he has just set to be secured in the same manner with that which shall meet it of the next bay in continuation. It is also of importance that in ceilings the workman should pay attention to the bonding of his work. In lathing or quartering partitions and battened walls, the bonding is not a matter of such material consequence as in a ceiling, because the toothing, which the thickness of the lath itself affords to the plastering, is enough to support it vertically; but, nevertheless, the more complete the keying, even in works of this kind, the better, as the toothing above will not always protect it from any exciting cause to fall forward or away from the laths. The thinner or weaker sort of lath is generally considered sufficiently strong for partitions.

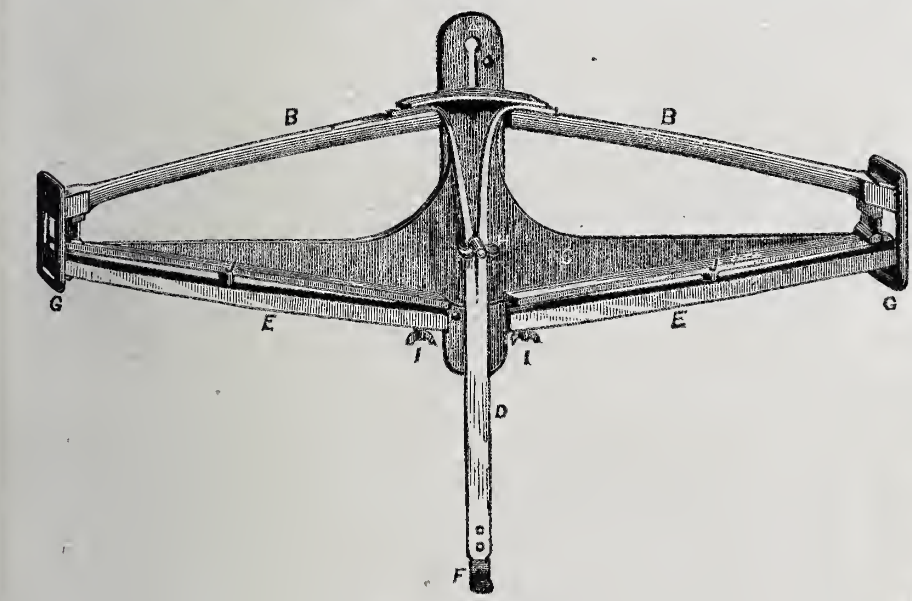
When the lathing is finished the work is either laid or pricked up, according as it is to be finished with one, two, or three coats. Laying is a tolerably thick coat of coarse stuff, or lime and hair, brought to a tolerably even surface with the trowel only; for this the mortar must be well tempered and of moderate consistence— thin or moist enough to pass readily through between the laths, and bend with its own weight over them, and at the same time stiff enough to leave no danger that it will fall apart, a contingency, however, that in practice frequently occurs, in consequence of badly-composed or badly-tempered mortar, unduly close lathing, or sufficient force not having been used with properly consistent mortar to force it through and form keys. If the work is to be of two coats—that is, laid and set—when the laying is sufficiently dry it is roughly swept with a birch broom to roughen its surface, and then the set, a thin coat of fine stuff, is put on. This is done with the common trowel alone, or only assisted by a wetted hog's bristle brush, which the workman uses with his left hand to strike over the surface of the set, while he presses and smooths it with the trowel in his right. If the laid work should have become very dry, it must be slightly moistened before the set is put on, or the latter, in shrinking, will crack and fall away. This is generally done by sprinkling or throwing the water over the surface from the brush. For floated, or three-coat work, the first, or pricking up, is roughly laid on the laths, the principal object being to make the keying complete, and form a layer of mortar on the laths to which the next coat may attach itself. It must, of course, be kept of tolerably equal thickness throughout, and should stand about one-quarter or three-eighths of an inch on the surface of the laths. When it is finished, and while the mortar is still quite moist, the plasterer scratches or scores it all over with the end of a lath, in parallel lines from 3 inches to 4 inches apart. These scorings should be made as deep as possible, without laying bare the laths, and the rougher their edges are the better, as the object is to produce a surface to which the next coat will readily attach itself.

When the pricked-up coat is so dry as not to yield to pressure in the slightest degree, preparations may be made for the floating. Ledges or margins of lime and hair about 6 inches in width, and extending across the whole breadth of a ceiling or hight of a wall or partition, must be made in the angles or at the borders, and at distances of about 4 feet apart throughout the whole extent; these must be made perfectly straight with one another, and be proved in every way by the application of straight-edges. Technically, these ledges are termed *screeds*. The screeds are gauges for the rest of the work; for, when they are ready, and the mortar in them is a little set, the interspaces are filled up flush with them, and a derby float, or long straight-edge being made to traverse the screeds, all the stuff that projects beyond the line is struck off, and thus the whole is brought to a straight and perfectly even surface. To perfect the work, the screeds on ceilings should be leveled, and on walls and partitions plumbed. When the floating is sufficiently set and nearly dry it is brushed with a birch broom, as before described, and the third coat or set is put on. This, for a fine ceiling that is to be whitened or colored, must be of putty; but, if it is to be papered, which is very unusual, ordinary fine stuff, with a little hair in it, will be better. Walls and partitions that are to be papered are also of this latter or of rough stucco; but for paint the set must be bastard stucco, troweled. But lathing and plastering on laths, as commonly practiced, is at best a very flimsy affair, and greatly requires improvement. Stronger laths than those commonly employed, put on further apart and with headed wrought nails, and the plastering laid on upon both sides in upright work, or above and below the ceilings, at the same time two men working against one another, will produce work in some degree worthy of the name. The practice of the French in this respect is well worthy the consideration, and, to a great extent, the imitation of plasterers of other countries.

Artificial Building Stones.—A correspondent, writing from the French Exhibition, calls attention to the great excellence of the French artificial stones. "They are made," says he, "simply of cement, sand and stone; their composition is the same as that of the hydraulic mortars which have been long in use, and their peculiarities are only in the excellence of their manufacture. Artificial cements of the kind commonly known as Portland cements, are used, but special care is given both to the manufacture of the cement and to the manipulation of the mixture which is to form the stone. The results are astonishing, producing plain stones, like the well-known béton-coignat, of which monolithic arches of over a hundred feet span have been built, or, by working into the mass, fragments of colored stones, products of which, when finished and polished, are equal in hardness and beauty to many kinds of variegated marble. The artificial stones which have been patented and made in the United States have commonly been newly-invented compositions, which, from their costliness or their worthlessness, have had little other effect than to prejudice people against all kinds of artificial stone."

Improved Jig Saw Strain.

We illustrate herewith what is known as Joslin's Improved Jig-Saw Strain, a device which is not only adapted to any make of jig saws, but may also be applied advantageously to foot morticing machines, miter machines, or any similar machine in which a quick-acting spring is required. It is adjustable to the various degrees of tension that may be needed, and is adapted to any size saw blades. It is claimed for it that with its use an inferior machine will work well. Many scroll saw machines in the market are really worthless, on account of employing inferior springs. By the use of this device, the manufacturers assert, such machines are rendered entirely efficient.



JOSLIN'S JIG SAW STRAIN.

Referring to the cut, the plate A is attached to the post above the table by means of wood screws, and is slotted to allow adjustment of the frame C to accommodate different lengths of saws. B B are arms to which the strap D is attached. The saw is connected with D by means of the hook F. B B are connected with wooden springs ; E E, by the bridles ; G G, at either end. The wooden springs rest on bridges or fulcrums, J J affording a leverage which gives an easy motion to the springs. The motion of the springs being very small, it is quite safe to run the machine at a very high speed. The strength, or stiffness, of the spring is regulated by thumb-nuts, I I, by which they can be readily adjusted as required.

This article is manufactured by the S. A. Woods Machine Company, 91 Liberty street, New York, to whom we are indebted for the illustration and description above given.

Damp Walls.—Moisture may be kept from penetrating a brick wall by dissolving three-quarters of a pound of mottled soap in one gallon of boiling water, and spreading the hot solution steadily, with a large flat brush, over the surface of the brickwork, taking care that it does not lather. This is to be allowed to dry for 24 hours, when a solution formed of a quarter of a pound of alum dissolved in two gallons of water, is to be applied in a similar manner over the coating of soap. The soap and alum mutually decompose each other, and form an insoluble varnish which the rain is unable to penetrate. The operation should be performed in dry, settled weather.

Wheeler's Wood Filler.

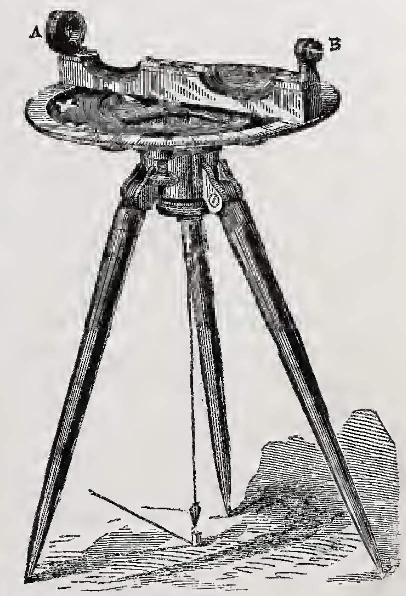
While it is beyond the art of man to improve upon the natural beauties of our common woods, to develop and preserve their grain is rendered a comparatively simple matter, by the use of the improved materials and processes which have been recently perfected and introduced. Knots and gnarls, so frequently a blemish in timber for carpentry, are in many woods the features of greatest beauty. The differences in density and color and the contortions of figure, give a charm that art cannot successfully imitate. The common method of treating unpainted wood is with an application of boiled linseed oil, which is absorbed by the wood about as fast as applied. Sand-papering ordinarily completes the work. The oil is apt to darken the wood and give it a greasy appearance, and the finish looks hard and dead. Sometimes a luster is given it by the application of shellac-coating, but this is likely to be marred by scratches, and is in time eaten away, destroying the surface. Of the various substances which in former years were used to fill the grain and to develop and fix the figure and color of wood, few, if any, were entirely satisfactory. Corn-starch, plaster of paris, Spanish white, clay and various gums have been employed, but their particles do not readily unite with the fibers of the wood, and the process of finishing requires considerable labor. The proper material for use as an artistic finish for wood, must develop and fix the natural beauties of color and figure, without being itself visible; it must be easily applied, and must render the finish durable.

We are led to these remarks by some specimens of walnut and oak, treated with Wheeler's wood-filler, which have been sent to us by the manufacturers, the Bridgeport Wood-Finishing Company, of 196 Mercer street, New York, which are certainly very fine, and which show in a marked degree the merits of the filler employed. The claims of the manufacturers, which are that it fills the pores of the wood perfectly ; that it is a non-absorbent, and is therefore not affected by water or damp atmosphere, and that it is perfectly transparent under shellac or varnish, and therefore does not spoil the beauty or life of the wood, are fully sustained. In composition this filler consists of particles which are angular and sharp, and which therefore readily adhere to and unite with the pores and fibers of the wood. This process of wood finishing is not only better than the common finish, but is far more economical, the saving in time, labor and material being estimated at 50 per cent. Strong arms rub in the filler, securing a hard, smooth surface, and there are no days of delay, as with the successive coats of paint and varnish, for one to dry before another can be applied. Its economy is a great recommendation.

Improved Leveling Instrument.

We illustrate herewith an instrument which, by reason of its simplicity, convenience and cheapness, is of special interest to contractors, builders, masons and all who have any need for running horizontal lines. It is also adapted for use in grading, in squaring foundations and in ditching. It is far less complicated than the ordinary surveyor's instrument used for the same purpose, and accordingly can be used by less skillful persons than are required to handle the latter.

As will be seen by inspection of the cut, the instrument consists of a circular plate or table, mounted at convenient hight upon three adjustable legs. This plate or table is made of iron, which prevents all trouble by reason of warping. The upper face of



SIBLEY'S IMPROVED LEVELING INSTRUMENT.

the outer edge of the plate is graduated, as is partially shown in the cut, the degrees corresponding to the various divisions or angles being plainly marked in figures. The level and the sights are arranged upon a revolving bar, pivoted in a hole in the center of the table. A plumb-bob is attached to the center of the bottom of the plate, all of which is clearly shown in the engraving. The sight marked A is of brass, with an adjustable ring, in which are set cross wires, the intersection of which is at an equal distance from the bottom of the level with the pin-hole brass sight B.

The method of operating is almost self-evident. Place the instrument, as shown in the engraving, with the plumb-bob directly over the starting point. By bringing the line marked on the plate into correspondence with the starting line, as shown in the cut, the instrument may be revolved so as to run a line at any required angle. For example, by turning it to the point marked 90 degrees, a line will be run at right angles to the face or starting line, and similar adjustments give other angles.

The glass in the level is adjustable by means of screws in the bottom operating against a pivoted cradle, thereby rendering it in the power of the operator to adjust it perfectly in case of accident.

This instrument, which is of special utility to masons, is manufactured for and sold by Messrs. Bicknell & Comstock, New York. The price is $10. We believe it answers a want long felt for a simple and inexpensive instrument for the purpose of leveling and running lines, and we cordially recommend it to the attention of practical men.

Joiners and cabinet makers are adepts at shooting; although they fail to kill hares, they succeed in running plenty of rabbets down.

CORRESPONDENCE.

The Editor of *Carpentry and Building* solicits communications and letters from all classes of its readers. The fullest liberty of discussion will be encouraged, and every effort will be made to answer inquiries fully and intelligently, and to obtain information on topics suggested for editorial discussion. Our own statements and opinions are always open to discussion and criticism, and we shall be glad to be set right whenever we make a mistake. Correspondents will, of course, be expected to avoid personalities and observe the recognized courtesies of debate.

We shall give especial attention to our department of Questions and Answers, which, when fairly organized, will be separately classified as a department. Questions which we cannot answer from our own experience or knowledge of principles, will be referred to our readers.

Designs from Our Readers.

From L. P. P., *Cincinnati, Ohio.*—I like your new paper very much. It is just what we want. It proposes to occupy a field hitherto vacant, and from the initial number, which I have examined very carefully, I believe it will be of great practical benefit to the building trades at large. I am glad to see you do not get your ideas from the stock books upon building and construction, but that fresh material is brought forward. In this connection I have a suggestion to make: Would it not be well to ask your readers to send you all kinds of drawings and designs which they meet with in the course of their business, from which to select for publication? If a system of exchange of this kind can be opened and maintained in *Carpentry and Building*, it seems to me it will greatly enhance the value of the paper as a paper, besides giving its readers in all parts of the land the opportunity of inspecting the best designs and best styles of construction that are shown in the current work of the architects and builders of the entire country. I merely throw this out as a suggestion for your consideration, firmly believing that some such plan will draw out the hearty co-operation of the best mechanics in the country, and result in great mutual benefit.

Remarks.—Our correspondent's suggestion anticipates our intention. We had intended to extend our readers the broadest kind of an invitation to aid our work by sending us drawings illustrating good designs in woodwork, or points in building practice which are new and interesting. It is our wish and intention to make *Carpentry and Building* a live, enterprising newspaper of practical value to all classes of our readers. We believe in pictures, and are ready to make as many as our columns will hold. It is necessary, however, that we should get the right kind of material. This we can do without help, if necessary, but we shall do it better and easier with the assistance of our readers, and such assistance we shall welcome. We cannot, of course, promise to engrave every drawing which may be sent us, nor to admire every design which is brought to our notice; but we will gladly engrave and publish anything which seems to possess interest and value for our readers, and give full credit to those who will permit the use of their names. Whatever pleases, interests or instructs one of our readers will probably have interest or value for many others.

Lest any person should be in doubt as to what we would be glad to receive, we will say that anything which has points of interest will be welcome, from the perspective elevations and plans of a house, church or business block, down to a simple molding, or a subordinate feature of decoration. With such help from even a small percentage of our regular readers, we can make *Carpentry and Building* an exchange for ideas and experiences which will be of the greatest practical value to the trades we address. To make a journal in the largest degree valuable, practical suggestions and the help of practical men are needed, and these we cordilly invite.

Slate Mantels.

From E. H. G., *Cincinnati, Ohio.*—The first number of *Carpentry and Building* has pleased me very much, and I take pleasure in recommending it to mechanics in the various building trades as a periodical of value to them. While I am free to commend the general scope and contents of the paper, I am also disposed to criticize some of its utterances; and at this time, with your permission, I will give you my views on the subject of slate mantels. I was greatly surprised at the following, which appears in the January number, in connection with a description of a wood mantel, and which, as it is likely to be generally understood, seems to be an unqualified approval of wood for the purpose, and wholesale condemnation of slate and marble. I quote: "It is a vast improvement on the stiff, cold, ghastly white marble mantels hitherto accepted, or the things called mantels, which are made out of slate, in all sorts of colors, to imitate stones which are found only in the fields of the imagination." Now, I have no interest in the slate or marble business. I give you this letter only in the spirit of fair play. I am not prepared to defend or recommend the "cold, ghastly white marble mantels" which some are partial to. That I leave to some one else. I like slate mantels better than marble mantels; I prefer a marbleized slate mantel to a genuine marble mantel. It is of slate as a material for mantels and the like that I propose to speak, and I shall attempt to give adequate reasons for my belief that slate is better for the purpose than marble. As to the imitation of "stones which are to be found only in the fields of the imagination," that is a secondary question. The most that can be said of it is that while the fact, which is undisputed, proves how well adapted for purposes and processes of decoration slate is, it also confesses a lack of genuine art taste upon the part of the people or such styles would not sell, and therefore would not be made.

Slate is one of the most valuable materials that we have, although its merits are not so thoroughly understood as they deserve. It is a material that does not warp; it is impervious to acids and oils; it can be worked to almost any form that is desirable. It is capable of decoration to an extent that very few understand, and its decoration is entirely legitimate. It is quite as proper as the painting of woodwork. It is possible, by marbleizing slate, to produce prettier marble than can be got out of a quarry. The imitation is so good that there is no one who can take two pieces—one of marbleized slate and the other of marble—and, placing them side by side, tell which is marble and which is slate. The only point of difference discernible to the eye might be that the slate will be the more beautiful of the two. This applies to any and every kind of marble. Most of our marbleizers have adhered very closely to the best examples of natural marbles. They have been very faithful in this respect. A marbleized surface is better than a marble surface for many reasons, but chiefly because it is acid and oil proof. Marble is more subject to injury than slate. In tasteful decoration marble harmonizes best with white walls. If wood is so much admired—I may remark by way of parenthesis—it is possible to produce in slate, treated in the general way to which I have referred, very excellent imitations of wood. Walnut and various light woods have been successfully imitated in a number of instances.

Slate can be worked in ways more like wood than any other material which we have. In fact, it seems to combine the qualities of wood, metal and stone within itself. The tools used in its preparation are many of them very like those used in woodworking. Its great toughness enables it to take forms which in any other kind of stone would be entirely inadmissible, and forms which, to some extent, legitimately belong to wood. These qualities or properties give it a value in construction which it is desirable should be more widely known. It should not be considered that the so-called marbleizing process is only useful in the imitations of marble. Slate that is intended to be marbleized can be decorated by painting in oil colors, and afterward be marbleized with good effect, rendering the painting more permanent than can be done by any other process whatever. If it were desirable to decorate a mantel or the pilasters and jambs of a fire-place with landscapes, birds, flowers or fruits, or in any other manner, it could be done upon slate with oil colors and then marbleized, producing a result that would stand for any length of time, and endure all ordinary usage which it would be likely to receive. For the purposes for which tiles are used, slate possesses material advantage in the fact that tiles are necessarily small, while slate is to be had in large pieces.

Builder vs. Architect.

From R. S., *New Jersey.*—The announcement of your new paper will, I am sure, be welcome news to thousands who have long needed a live, wide-awake, practical journal of information and discussion, devoted to the various departments of wood-working and building. I can probably do very little to aid you in giving it a send off; but what follows may furnish you a topic of interest, or, if you choose to print it as a letter, may give rise to interesting discussion. I don't ask you to adopt my views, but whether you do or not, they are correct.

In every large city, and indeed in almost every good-sized town in the country, there are to be found, at the present time, building firms of acknowledged responsibility, integrity and skill, at whose hands any owner may procure a set of plans and the execution of the same in any style he may wish, the full cost of which will be included in a given contract price. Builders who thus combine the profession of architect with their building trade, possess material advantage over their competitors who conduct business in the usual way. They not only have the essential advantage of entire familiarity with the plans that are to be followed, and the opportunity of avoiding in their composition all impractical or needlessly expensive ideas, and of adapting them to any special advantages they may possess in manufacturing and buying, but also the greater advantage of the study and application of the principles of design and good taste, through which they acquire a style of workmanship which is of itself a strong recommendation in their favor. This method of conducting the building business, beginning originally in the large cities, has extended over the whole country. A building firm upon whom both the responsibility of the design and erection of a building depend, will very naturally strive to please the owner by deferring to his expressed preferences, and by giving him the best building for the least money consistent with a reasonable profit to themselves. The relationship between the builder who is also the architect, and the owner, is likely to be of the pleasantest nature. There is no danger of the cost exceeding the estimate, for it is also the contract price. In all, this method of building has much to recommend it, and not least among its merits is the sense of authority and proprietorship of the owner over the premises, even while the work is progressing.

In contrast with this, my attention is called to the position assumed by the author of a work on architecture, recently issued by one of the most prominent publishing houses in the country, and which is intended for popular reading. This author takes the most ultra position with reference to the functions of the architectural profession, claiming that the architect shall not only control the entire details of planning and construction, but that his professional authority shall extend to the province of household appointments. In other words, he claims that the architect shall be permitted to assume the position of absolute dictator, before whose awful presence the owner shall shrink into proper insignificance. He proposes to complete the house, ready for occupancy in accordance with professional ideas of taste, convenience and furnishing, graciously permitting the owner to pay the bills during the progress of the work, and finally allowing him to occupy what may be, or may not be, an elegant example of some particular order or style, but with which the owner has no particular sympathy, other than that attendant upon paying for it. The average American citizen considers himself qualified to exercise the right of private judgment in matters of convenience and taste in his own home. Whether he possesses aesthetic culture or not, he is sure to be better satisfied with what he helped to plan and furnish, than with that which some architect, however expert, has put upon him because it is the popular style, and is accordingly the proper thing for him to have.

When it is remembered that upon ordinary private jobs the architect and builder are very ayt to pull in opposite directions, and further, that architects, having no adequate sense of responsibility, are very ready to lend themselves to the suggestions of costly improvements and expensive alterations of work, the advantage to the owner who builds under the first system described, becomes still more apparent. I would not for a moment be understood as underestimating the advantage of professional skill. On the contrary, I have the highest respect for and appreciation of it. I merely point out ways in which the profession and the trade, which are co-equal parts of one system, may be made to harmonize, and call attention, on the other hand, to other ways in which they are likely to antagonize. The average owner is likely to be best served under the former system, and it therefore becomes the one most desirable for the builder to follow. Architects, in assuming the role of dictator, call upon themselves contempt and derision, and pave the way for successful operations by those building firms who combine a high grade of architectural skill with excellent mechanical ability and unquestioned responsibility and integrity.

It should be remembered that in the foregoing remarks I have spoken in general terms, and that by the average owner I mean the average citizen who has little, if any, art culture, who wants a comfortable and convenient house which shall come within well-defined limits of cost, and who desires as much of beauty as can be secured without too wide a departure from the familiar types. In such average work I fail to see any room for the average architect. For the educated architect, with a true feeling for art and a talent for legitimate decoration, there is a wide and increasing field of usefulness. The only ones likely to be crowded out of the profession are those who have no business in it, and who have neither the talent nor the education to fit them for the rendering of services for which any one now finds it necessary to pay.

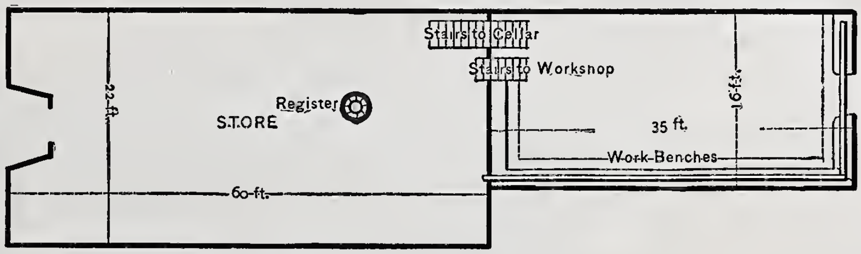
Danger of Fires from Tin Furnace Pipes in Partitions.

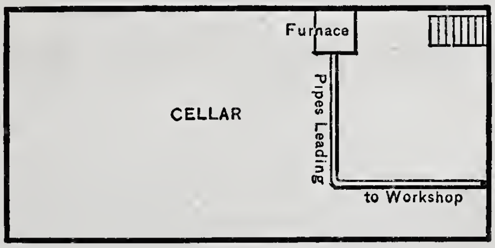
From W. G. W., *Atglen, Pa.*—I am putting in a cellar heater. The parties for whom it is put up wish to have the heat conveyed to rooms in the second story by means of square piping, made of bright tin. Will there be any danger from fire if the hot-air pipes are run up through the partitions between the lath and plaster?

Answer.—The danger from fires depends altogether upon the distance between the hot-air pipes and the wood. We should not feel safe with an unprotected hot-air pipe running up through a lath-and-plaster partition, unless there was a good distance between the woodwork and the pipe. If we were building for ourselves, we should want the pipe to have at least 8 inches in the clear all around. Even more than this would be advantageous, because, as the wood dries with long exposure to the heat, it takes fire more easily than at first, and the danger is constantly increasing with time. If there is any way of locating the heater pipes so that they do not come near the wood, it will be all the better. If there is room in the partition where the pipes are to run, they might be protected by brick or tiles. If the old-fashioned earthenware thimbles are obtainable, they can be used outside of the pipe. In that case, however, it would be necessary for the pipe to be made round. To run a line of heating or hot-air pipe from a furnace up through the open space of an ordinary lath-and-plaster partition, without any protection, we should consider dangerous, and we do not think any insurance inspector would consent to any such arrangement.

Heating a Store.

From O. & B., *Barrie, Ont.:* We are about to heat our store and workshop by inclosing a large stove (say 4 feet) with brick, in cellar under the store. Our intention is to heat the store with hot air and the workshop with hot water. The latter is to be done by placing a coil of pipes in the store, which will be fed by a tank. We shall then run a pipe from the store to the workshop along under the benches, say about 10 inches from the floor, and return to the tank. We intend putting 1-inch pipes into the store, and leading 1½-inch pipes through the workshop.





Ceiling of Workshop 10 feet high.

Cellar 10 feet high.

Floor of Workshop 3 feet lower than that of the Store.

The Store faces north, the Workshop being on the south end.

Would 1½-inch pipes be large enough, or would 2-inch be better? We are not much experienced in this matter and would like your opinions, as well as those of your readers, as to whether such an arrangement will give good results. We send you a sketch of store and workshop, in which size and location of rooms is given, and location of stoves and pipes. If the arrangement, as we have it, is not likely to work well, could you put us on the right track.

Note.—In looking over our correspondent's letter and plans, we do not see any reason why they should not work successfully, except in the shop. Here the pipe seems to be rather small, and we imagine that a much better result can be obtained by the use of what is called greenhouse pipe. This is a 3-inch cast-iron pipe, designed especially for greenhouses, and other places where a low-pressure hot water circulation is to be employed. If the shop is to be kept at a comfortable temperature, we think that the amount of surface which the 1½-inch pipe would give in going once along the side of the shop, is much too small. It might be necessary to run the pipe around to the further corner and back again, and locate the tank at the corner where the pipes enter, in order to have heating surface enough.

The 1½-inch pipe will, in round numbers, give 17 square feet of radiating surface, or 34 feet; if the line was made double there would be about 34 feet. The 2-inch pipe would give a trifle over 25 feet of radiating surface, while the 3-inch pipe would, in round numbers, give 51 feet in all. The plan is a very interesting one, and we wish that some of our readers who are accustomed to this kind of work, would express their opinions in regerd to it.

Drawing.

From C. B., *Illinois.*—Will you not give us during the year some of the first principles of drafting, with directions for coloring floor plans, &c. I think this would be a very desirable feature with the majority of your subscribers.

Answer.—In the present number we give an article upon the instruments, &c., used in drafting, and propose to follow it up with other articles which shall embrace the subjects our correspondent mentions, as well as those of a similar nature. If our readers will point out from time to time what they are most anxious to know, we shall be the better prepared to present them acceptable matter.

Estimates.

From J. W. B., *Traverse City, Mich.*—Will you not publish in *Carpentry and Building* the best methods of getting at the value of labor and materials in frame and brick houses? Such questions as the amount of mortar required to lay given quantity of brick, and the time required to lay up a given wall, are continually arising, and to young men like myself, just commencing business, are very important. It is also very desirable to know how to estimate carpenter work, both as to labor and materials.

Answer.—We fully appreciate the importance of the suggestion and request of J. W. C., and shall be glad to comply with it to the extent of our ability. Such questions, however, cannot be answered offhand nor without conditions. In the item of materials, a question of strength and quality often fixes the quantity; and in the item of labor, much depends upon the skill of the men employed. Local circumstances and customs have much to do with all such matters. We recognize, however, that there must be a right way and a wrong way with regard to all calculations connected with buildings. There are good methods and poor methods of arriving at required results, and it is for the practical men in the trade to point out the merits and demerits of various schemes. With the intention of obtaining the best information for our correspondent, we refer these questions to our readers. With the idea of an exchange of views, will not practical brick-masons write us concerning quantity of mortar to be calculated per 1000 brick; number of bricks a man ought to lay per day; cost of brick in the wall, with materials and labor at certain specified prices, comparing the different stories of a building; that is, showing the ratio of advance in cost as the building is carried upward? We also invite practical carpenters to write us with reference to figuring the timber and lumber in buildings, the calculation of labor to accomplish specified results, &c. If practical men will write us in this way, we shall be able to lay before our readers a digest of useful information upon the subject, and give results drawn from actual work done and doing, which will be infinitely more advantageous to them than anything we can give without such assistance.

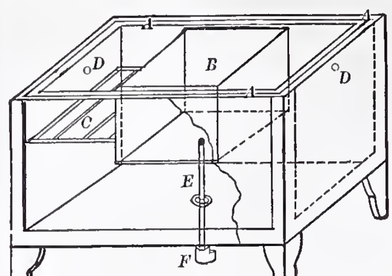
A Home-Made Refrigerator.

From C. S., *Philadelphia.*—If the following description of an ice-box or refrigerator which I made for myself several years since will be of any service to your readers, I shall be glad. I made a rough box

(1 inch board), say, 28 x 14 x 16 inches deep; then I covered the outside with about, say, 6 or 8 thicknesses of newspaper; then I nailed the outside casing tight over the paper, all around. (This way takes less room than to pack with sawdust or charcoal, which requires 3 or 4 inches on either side.) I put feet to it about 6 or 8 inches high, so as to give plenty space to get the drip-pan under it. This done, I lined it with zinc, which, if kept clean, will not oxidize to poison the food. I admit tin is cleaner, if it would not rust so quick. In the center of inner box I hung a zinc (ice) pan, with a waste-pipe in center, running through bottom, arranged with a trap, applied on the extreme end of tube. This pan I made 10 x 14 and 10 inches deep; on either side of the pan I put wire-gratings, upon which the food can be placed as the lower room can be used for those things which ought to be the coldest. I had two holes (1 inch in diameter) cut through from in to outside on the narrow ends; these are lined with zinc tubes, and covered on the outside with perforated tin, in order to keep any insects from going in box. The lid is done in the same way, like box, and can be hinged.

This box of mine, which is constructed in the above manner, has been in use about eight years, and is good for many years to come by the way it looks. With eight pounds of ice per day, through the hottest days of summer we never had anything spoiled yet, and there is always a lump in box in the morning when the ice-man comes.

Note.—We have had our friend's sketch engraved, and hope it may be a guide to any of our readers who wish to make a cheap



A A.—Paper lining.
B.—Ice-box or try.
C.—Grate, one on each side of ice-box.
D D.—Openings for ventilation.
E.—Drain-pipe.
F.—Trap on the bottom of drip-pipe.

ice-box. The plan is a very simple one, and in many respects cheaper than that of making a filling. The more thickness of paper put on, the better non-conductor of heat will the box be, and the longer will the ice keep.

NEW PUBLICATIONS.

Modern Surface Ornament.

We have received from Mr. J. O'Kane, 31 Park Row, N. Y., a portfolio of 24 plates, entitled "Modern Surface Ornament," which we consider one of the most useful contributions ever made to the pictorial literature of decorative art. As its name implies, it is a series of designs in great variety for the ornamentation of surfaces. An almost bewildering variety of detail ornament is given, such as panel and corner filling, borders, centers, diapers, &c., and the practical designer will find it of the greatest use in suggesting ideas and treatments. Very many of the designs seem to be especially adapted to wood, and the student of wood carving could not do better than to study its pages very carefully. We know of no better examples of conventionalized ornament than are given in this work, and none which will be more useful to any one whose daily work or natural taste leads him in the direction of decorative art in its industrial applications. Mr O'Kane is doing much for art progress in publishing this and other excellent works of design, and we hope his labors will meet hearty encouragement from the trades they are especially designed to benefit. This excellent publication, and *The Art Worker*, reviewed in our last issue, are works which every artist in wood or color should have.

Prices of Building Materials in New York, February 8, 1879.

Balusters.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned	7c	9c	10c	16c
Neck Turned	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

Blinds (outside).

Per lineal, up to 2 10 wide....$	....	@ 0.24
Per lineal, up to 3 1 wide	....	@ 0.27
Per lineal, up to 3 4 wide	....	@ 0.30
Per lineal, paint'd and trim'd	0.40	@ 0.50
INSIDE.		
Per lineal, 4 folds, Pine	....	@ .45
Per lineal, 4 folds, ash or chstnut	....	@ .72
Per lin'l, 4 folds, cherry or butternut	....	@ .86
Per lineal, 4 folds, bl'k wal't.	....	@ 1.00

Blue Stone.

Rubbed hearth, 10 ft. or under		20c
Rubbed hearth, 20 ft. or under		30c
Rubbed hearth, 30 ft. or under		45c
Rubbed hearth, 40 ft. or under		55c
Rubbed sills, imported		28c
Rubbed sills, domestic		33c
Sills and lintels	....	@ 17c
Sills and lintels, fine quarry cut sills	....	@ 35c
Coping, 11 to 18 in. wide	18c	@ 30c
Coping, 20 to 28 in. wide	35c	@ 55c
Coping, 30 to 36 in. wide	60c	@ 75c
Steps, 8 in	....	@ 55c
Steps, 7 in	....	@ 40c
Steps, 6 in	....	@ 25c
Steps, door. per in. wide	....	@ 2c
Platforms, promiscuous, 4 in...	....	@ 32c

Bricks Housed in First Hands.

Brick (nominal).

		Cargo afloat.	
Pale	℔ M.	$2 37	@ 2.75
Jersey	"	....	@ ....
Long Island	"	....	@ 5.50
Up-River	"	3.75	@ 4.00
Havers'aw Bay, 2ds.	"	4.25	@ 4.37½
Havers'aw Bay, 1sts.	"	4 50	@ 4 75
Favorite brands	"	5.00	@ 6.00
FRONTS.			
Croton—Brown	℔ M.	....	@ $7.00
Croton—Dark	"	....	@ 8.00
Croton—Red	"	....	@ 9.00
Philadelphia	"	20.00	@ 22.00
Trenton	"	19.00	@ 20.00

Yard prices 50c. ℔ M higher, or, with delivery added, $1.50 per M for Hard and $2.50 per M for front Brick. For delivery add $2.50 on Philadelphia and Trenton and $6 on Baltimore.

FIRE BRICK.

Red Welsh	$35.00	@ 36.00
Scotch	26.00	@ 30.00
American	25.00	@ 30.00

Cement.

Rosendale, ℔ bbl.		$	@ .90
Portland Saylor's American, ℔ bbl.		2.50	@ 2.90
Portland (imported) ℔ bbl..		2.65	@ 3 00
Roman	"	2.80	@ 3.25
Keene's coarse	"	6.50	@ 7.00
Keene's fine	"	10 00	@ 10 50
Martin's coarse	"	6.00	@ 6 50
Martin's fine	"	10.00	@ 10.50

Doors.

RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ in.	$0.67	....
2.6 x 6.6	1¼ in.	.95	....
2.6 x 6 8	1¼ in.	1.00	....
2.8 x 6.8	1¼ in.	1.15	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾. in
2.0 x 6 0	$1.23	....	....
2.6 x 6 6	1.52	1.93	....
2.6 x 6.8	1.57	1.95	....
2.6 x 6.10	1.59	2.01	....
2.6 x 7.0	1.62	2.09	....
2.8 x 6.8	1.68	2.32	2.57
2.8 x 7.0	1.69	2.17	2.69
2.10 x 6.10	1.79	2.26	2.84
3.0 x 7.0	1.87	2.45	2.80

Drain and Sewer Pipe.

Discount 50 to 60 per cent. according to quality and size of order.

Pipe, per foot.		Bends & Elbows, Each.	Branches Sing.	Branches D'bl. & V.		Traps, Each.
2 in..	$ .13	$ .40	$ .48	$ ...	Longer than 1 ft., charged as pipe.	$1.00
3 " ..	.16	.50	.61	...		1.25
4 " ..	.20	.65	.75	1.30		1.75
5 " ..	.25	.85	.90	1.55		2.50
6 " ..	.30	1.15	1.05	1.80		3.50
7 " ..	.35	1.50	1.20	2.05		5.00
8 " ..	.45	2.00	1.45	2.45		6.00
9 " ..	.55	2.50	1.70	2.85		7.00
10 " ..	.70	3.00	2.00	3.30		8.00
12 " ..	.80	3.75	2.52	4.24		10 00
15 " ..	1.25	5 00				
18 " ..	1.60	7.50				

House Branches pr. lin. ft.		Sewer Branches pr. lin. ft.,	
15x6	$1.75	15 in.	$2.25
18x6	2.50	18 "	3.00

Glazed Windows.

Dimensions of windows.	12 Lights. 1¼pl.	12 Lights. 1¼c.	12 Lights. 1½c.	8 L's. 1½c.	4 Lights. 1¼c.	4 Lights. 1½c.
2.1x3.6	$0.87	.92	....	....	....	....
2.4x3.10	.96	1.02	....	....	1.11	....
2.7x4.6	1.18	1.24	1.35	....	1.37	1.46
2.7x4.10	1.25	1.32	1.44	....	1.48	1.59
2.7x5.2	1.35	1.42	1.53	1.84	1.75	1.87
2.7x5.6	....	1.56	1.65	1.93	1.88	2.03
2.7x5.10	....	1.65	1.74	2.01	1.99	2.15
2.10x4.6	1.29	1.35	1.47	....	....	...
2.10x5.2	1.45	1.52	1.70	1.87	1.89	2.06
2.10x5.6	1.53	1.59	1.79	2.01	1.97	2.16
2.10x5.10	1.74	1.80	2.01	2.07	....	2.30

c. means counted checked—plowed and bored for weights.

Hot bed sash, glazed.......3.0x6.0....$1.90

Hair.

Cattle	℔ bushel..$	@ 0.10
Goat	"	@ 0.14

Lath.—Cargo rate....℔ M $ .... @ 1.40

Head Lights.

Two or three Lights, Glazed.

Sixe.	1¼	1½	Size.	1¼	1½
2.6x1.0	45	55	2.10x1.10.	45	59
2.6x1.6	55	63	2.10x1.6..	59	67
2.8x1.0	45	55	3.0x1.0	50	63
2.8x1.6	55	67	3.0x1.6	72	86

Lime.

Stone, common, cargo rate ℔ bbl	....	@ .75
Stone, finishing	....	@ .90
Rockland, common	....	@ .80
Rockland, finishing	....	@ .90
Ground	.80	@ .85

Add 25c. to above figures for yard rates.

Lumber.

Pine, very choice and ex.. dry, ℔ M. ft.	$45.00	@ $60.00
Pine, good	40.00	@ 45.00
Pine, good box	18.00	@ 22.00
Pine, common box	16.00	@ 17.00
Pine, common box, ⅝	13.00	@ 15.00
Pine, tally plank, 1¼, 10 in., matched, each	.40	@ .43
Pine, tally plank, 1¼, 2d quality, matched, each..	.35	@ .38
Pine, tally planks, 1¼, culls, matched, each	.25	@ .28
Pine, tally boards, match'd, each, good	.28	@ .30
Pine, tally boards, match'd, each, common	.22	@ .25
Pine, tally boards, culls, matched, each	.21	@ .23
Pine, strip boards, merchantable, matched, each	.14	@ .15
Pine, strip boards, clear, matched, each	.22	@ .25
Pine, strip plank, dressed clear	.33	@ .35
Spruce boards, dressed	.18	@ .20
Spruce plank, 1¼ inch, dressed	.22	@ .25
Spruce plank, 2 in	.28	@ .35
Spruce wall strips	.11	@ .13
Spruce timber, ℔ M ft.	16.00	@ 19.00
Hemlock boards, each	.14	@ .16
Hemlock joist, 2½x4	.13	@ .15
Hemlock joist, 3x4	.16	@ .18
Hemlock joist, 4x6	.40	@ .44
Ash, good, ℔ M ft.	38.00	@ 45.00
Oak	50.00	@ 60.00
Maple, cull	20.00	@ 25 00
Maple, good	42.00	@ 50 00
Chestnut	45 00	@ 60.00
Cypress, 1, 1½, 2 and 2½ in..	35.00	@ 40.00
Bl'k walnut, good to choice	85 00	@ 100.00
Black Walnut, 2d	55.00	@ 70.00
Black walnut, ⅝	70.00	@ 80.00
Black walnut, selected and seasoned	110 00	@ 150.00
Bl'k walnut counters, ℔ ft.	.12½	@ .20
Cherry, wide, ℔ M ft.	85.00	@ 100.00
Cherry, ordinary	60.00	@ 80 00
Whitewood, chair plank...	60 00	@ 70 00
Whitewood, inch	40 00	@ 50.00
Whitewood, ⅝ in	30 00	@ 35 00
Whitewood, ⅝ panels	35.00	@ 40.00
Shingles, extra sawed pine, 18 in.,	5.00	@ 7.00
Shingles, clear sawed pine, 18 in., 2 md	4.00	@ 5 00
Shingles, cypress, 24x7	20 00	@ 22.00
Shingles, cypress, 20x6	12.00	@ 15.00
Yellow pine dressed flooring ℔ M ft.	25 00	@ 35.00
Yellow pine girders	28 00	@ 45 00
Locust posts, 8 ft., ℔ in	.18	@ .20
Locust posts, 10 ft.,	.24	@ .25
Locust posts, 12 ft.	.29	@ .34
Chestnut posts, ℔ ft.	.3	@ .3½
Mahogany, ¼ in. ℔ ft.	.5	@ .10
Mahogany, ⅜ in. ℔ ft.	.8	@ .12
Mahogany, ½ in. ℔ ft.	.12	@ .15
Mahogany, ⅝ in. ℔ ft.	.13	@ .16
Mahogany, ¾ in. ℔ ft.	.15	@ .20
Rosewood, 1 in. ℔ ft.	.16	@ .22
Rosewood, ⅛ in. ℔ ft.	.11	@ .15
Rosewood, ¼ in. ℔ ft.	.16	@ .20
Rosewood, ⅜ in. ℔ ft.	.24	@ .28
Rosewood, ⅝ in. ℔ ft.	.40	@ .45
Rosewood, 1 in. ℔ ft.	.50	@ .65
Satin wood, ½ in. ℔ ft.	.15	@ .25
Satin wood, 1 in. ℔ ft.	.25	@ .35
Cedar (Cuban and Mexican) ℔ ft.	.10	@ .14
Cedar (Florida)	.8	@ .15

Octagon Paneled Newels.

Panels Veneered with French Walnut.

8-inch Newels, with Cap	$6.12
9 " " "	6.88
10 " " "	7.60

Plaster.

Calcined.................................$1.00

Slate.

By car load, delivered in New York.

Purple roofing slate, ℔ sq're.	$5.00	@ $5.50
Green slate	5.00	@ 5.50
Red slate	....	@ 9.50
Black slate, Pennsylvania...	....	@ 4.50
Tiles, 1¼ in. rubbed, ℔ sq. ft.	.20	@ .25

℔ sup. ft.

Steps and platforms, 1 in. thick sq.	28c
" " 1½ "	35c
" " 2 " round.	42c
Risers, 1 inch thick	27c
Coping, 1½ "	27c
" 2 "	31c

Lineal ft.

Window sills, 4x7	45c
" 3x7	36c
Window caps, 4x10, plain	65c
" 4x8, "	50c
" 3x10, "	47c
" 3x8, "	42c

Solid Newels, with Caps.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned	$1.60	$1.90	$2.50	$3.40
Octagon	2.10	2.40	3.00	3.90

Stair Rail.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	40c	45c	50c	53c
Toad Back	45c	50c	63c	68c

Stair Rail, Unfinished.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ℔ C ft.	$....	@ $0.85
Berlin freestone, in rough...	....	@ .85
Berca freestone, in rough....	....	@ .80
Brown stone, Portland, Ct...	1.25	@ 1.50
Brown stone, Belleville, N. J.	1.00	@ 1.50
Granite rough	.50	@ 1.00
Dorchester, N. B., stone, rough ℔ foot.	....	@ 1.00

Window Frames.

Up to 3 4 x 7.2, put together.. .... @ 2.15

Moldings 45c. to 55c. per inch per 100 feet, according to quality.

Window Glass.

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$7.50	$6.75	$6 25	$5.75
11x14—16x24	8.50	7.75	7.25	6.50
18x22—20x30	10.75	9.75	8.75	7.75
15x36—24x30	12.25	10.75	9.00	8.50
26x28—24x36	13.00	11.50	9 75	9.00
26x36—26x44	14.50	13 25	10.75	9.50
26x46—30x50	15.00	14.00	11.25	10.50
30x52—30x54	16.00	14.50	12.00	....
30x56—34x56	17.25	15 50	13.50	....
34x58—34x60	18.25	17 25	15 00	....
36x60—40x60	20 75	18.75	17.25	....

DOUBLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$12.00	$11.00	$10.00	$9.25
11x14—16x24	13 75	12.50	11.75	10.50
18x22—20x30	17.25	15.75	14 00	....
15x36—24x30	19.75	17.25	14.50	....
26x28—24x36	21.00	18.50	15.75	....
26x36—26x44	23.25	21 25	17.25	....
26x46—30x50	24.00	22 50	18.00	....
30x52—30x54	25 75	23 25	19.25	....
x56—34x56	27.75	25.00	21.75	....
34x58—34x60	29.25	27 75	24.00	....
36x60—40x60	33 25	30 00	27.75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length and not making more than 81 inches, will be charged in the 84 united inches' bracket.

Discounts, Single, 60&10; Double. 60&20

GREENHOUSE, SKYLIGHT AND FLOOR GLASS.

Per square foot, net cash.

⅛	Fluted plate	16 @ 18
3-16	Fluted plate	18 @ 20
¼	Fluted plate	22 @ 24
¼	Rough plate	22 @ 24
⅜	Rough plate	24 @ 26
½	Rough plate	23 @ 27
¾	Rough plate	50 @ 55
1	Rough plate	65 @ 75

VAULT LIGHTS.

Platform, sq ft	$3.50
Step and risers, sq. ft	3.75
Floor light, sq. ft	2.25
Roof light, sq. ft	2.00
Platform, 2d quality, sq. ft	2.60

COVERS.

Diameter.	Round.	Hexagon.
14 inch	$3.00	$0.00
16 "	3.75	4.00
18 "	5.50	6.00
20 "	8.00	8.50
24 "	14.00	15.00
26 "	16.00	17.00
30 "	23.50	25.00
36 "	31.00	33.00

CARPENTRY AND BUILDING

A MONTHLY JOURNAL.

VOLUME I. NEW YORK = MARCH, 1879. NUMBER 3.

Ebonized Wall Cabinet.

We show in the accompanying illustrations a perspective, the elevation and section (the latter to a scale of 1½ inch to the foot) and details of some of the parts of a very simple and pretty wall cabinet for *bric-a-brac* or *curios*. Wall cabinets are among the most po ular articles of cabinet work now made, and are in great demand. Ebonized and mounted with brass trimmings, they are very ornamental, and are also very convenient for holding and showing to good advantage old china, Japanese or Chinese ornaments, small statuettes and other pretty things which are not altogether suitable for mantel decoration, and which are liable to injury from frequent or careless handling. They find a place in any room, and decorate even bare walls devoid of other ornament.

The cabinet we illustrate was purchased for the use of our engravers from Tiffany & Co., New York, and was selected for the reason that it combines good proportion with simplicity of construction.

The ends are cut from a single board—the small column only being of a separate piece. The bottom and the two shelves are supported by the ends by rabbet joints. The back is composed of narrow matched stuff, beaded, as may be seen in the elevation, Fig. 8. Across the top, and against which end the pieces forming the back, is run a strip of molding, on the upper edge of which a row of small scollops is worked. The lower edge of the upper shelf is neatly carved in a simple manner, as is shown in the detail, Fig. 5. The edges of the lower shelf and of the bottom are ornamented by a simple bead run through the middle. Neat railings, as better shown in the details, Figs. 4 and 5, surmount the two shelves. Appropriate knobs and pendants finish the several angles of the front and ends. The capital and base of the small columns in the ends are shown in Figs. 6 and 7. The material used is cherry. This wood is probably the best for ebonizing of any of the American woods, and works without difficulty. The front of the little closet under the shelf is glazed with clear white glass. To secure a pleasing effect of color, the closet is finished on the inside in imitation of crimson velvet, by sizing the wood and sprinkling it with flock. A lining of red velvet or quilted cherry-colored satin, would of course be richer, but no more effective. Brass trimmings can be had from any dealer in cabinet makers' hardware.

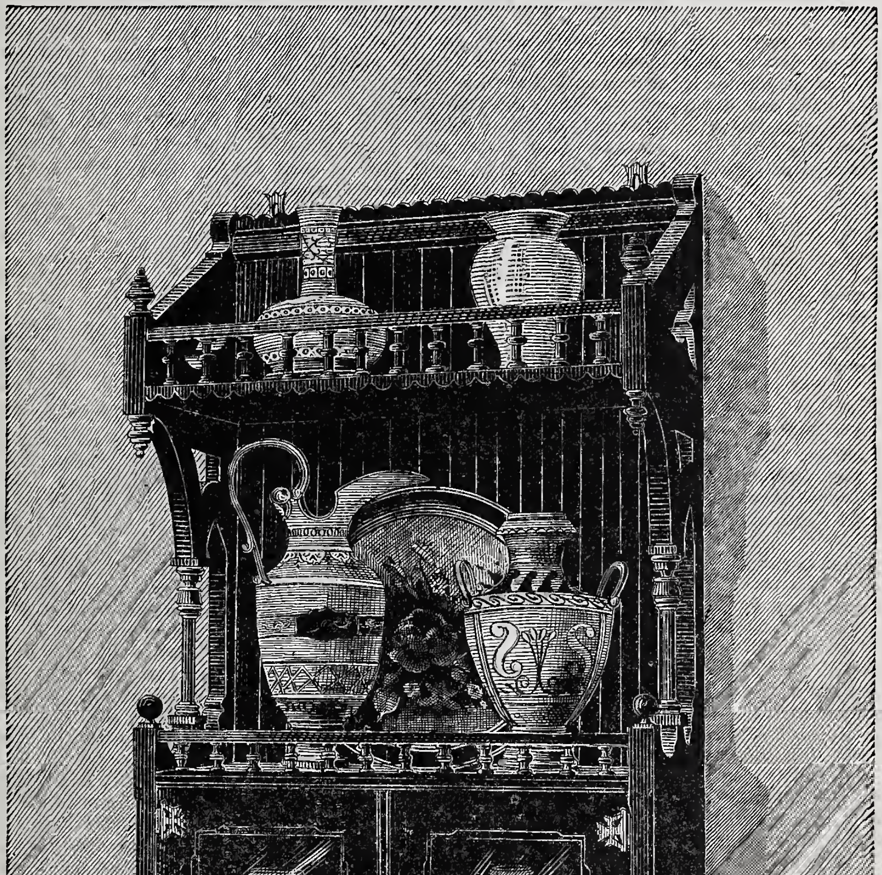


Fig. 1.—Wall Cabinet in Ebonized Wood.

As some of our readers may not know the process of ebonizing, a brief description of a simple and easy method will probably be of interest. The wood is first stained with a decoction of logwood. This may be purchased from any druggist or dealer in dye stuffs. An excellent logwood preparation comes in paper boxes, and looks something like bitumen. This is dissolved in warm water, until all has been taken up that the water will hold. Application to the wood may be made freely with a large soft-bristle brush, and the surface is rubbed with a cloth to prevent the formation of a gummy coat thereon. The article is then left to dry for a few hours. The second application is of vinegar, in which a quantity of nails or clean iron filings have been soaked for a few days. This also is applied freely with a brush. The moment the vinegar touches the wood it combines chemically with the logwood solution in the pores, making an ink which is a permanent jet-black stain. If any tendency to grayness is noticed, a second treatment with the logwood and vinegar may be necessary; but this seldom happens if the materials have been properly used in the first instance. The iron in the vinegar must not be forgotten, as it is this which really does the work. We know from personal experience that this method of ebonizing gives good results, and it is one which will probably be found more convenient than any other by the average cabinet-maker, who cannot easily procure the logwood and iron solutions especially prepared for this purpose by manufacturers of paint and varnishes.

When the ebonized wood is perfectly dry it is varnished and rubbed down, or finished with furniture oil well rubbed in. A dead black surface is greatly to be preferred to a polished one, hence we recommend oil instead of varnish. As we have said, cherry is considered by cabinet makers the best wood for ebonizing; others may be used, however, with good effect. Any close-grained, dense wood will answer, and we have had good success with white-wood, though maple and beech are better. Ash, chestnut and oak are not suitable. The value of the materials in this cabinet is not great, nor the amount of labor large. With our directions any intelligent mechanic can construct a duplicate. The original, from which our cuts were made, was bought for $17.

PAINTING.

Wall Decorations.—The Distemper Process.

There are four ways of decorating plastered surfaces of the interior of buildings that are, and have long been, in common use, as follows: Fresco, distemper, paper hangings, and painting in oil. Of the latter two we shall speak at another time. Fresco painting is rarely used at the present day, although it is the method by which some of the grandest effects of decoration have been produced in former times. It is a process of considerable technical difficulties, and one which when illy done is very bad indeed. When well done it is as durable as the plaster itself. Its greatest defect in this respect is its peculiar liability to injury from dampness. The color itself is imbedded in the plaster, and accordingly suffers from the moisture absorbed by the plaster. In the process of application a rough coat of plaster is first applied to the wall, and the painting is done upon the finishing coat while it is still fresh. The colors are ground in water and spread upon the fresh plaster, and are absorbed by it. Only so much plaster is put upon the wall as a workman can finish in one day. If any surplus remains it is removed and fresh is applied the next day. Fresco has the great advantage of present-

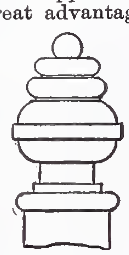


Fig. 2.—Wall Cabinet—Upper Knob.

ng a practically dead surface, not glossy ike an oil painting, nor dead and dull like distemper—a surface without reflections, or one that can be viewed in light from any angle.

It has become a very general practice to speak of any decoration of plastered surfaces in colors, perhaps excluding work in oil, as fresco-work. If we are not mistaken we have even heard of oil decorations of walls described as fresco. It seems to be a fact, in spite of the impropriety of the thing, that the word fresco has come to mean simply a painted decoration on wall surfaces. It is a misnomer, however, for the word fresco is derived from the Italian, and in truth is applicable only to a decoration as described, upon a fresh plastered surface. By this misuse of the term, what is correctly described as distemper is commonly known as fresco-work.

In distemper, the colors are ground in water in which size has been mixed or that contains a weak glue. Like water-colors, the color is held in place by the strength of the size or glue which is used in the water. The first wall-papers that were made were decorated with distemper colors. Distemper is the method of painting chiefly used upon the walls of modern buildings. It has many advantages over fresco-work in convenience

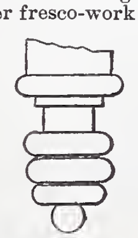


Fig. 3.—Wall Cabinet—Upper Pendant.

of being applicable to a variety of surfaces. In fact it can be applicable to almost everything that is not oily in nature. This method of painting has of late years assumed more importance than ever before. Its advantages are so marked as to give it a value in the arts which has not heretofore been recognized. The necessary skill for applying it is acquired with comparative ease by any one who has any experience or art in the processes of decoration, and who has an eye educated as to colors.

It has been truthfully observed by a writer on this subject, that the preparation of ceilings and walls for finishing in distemper is of vital importance to the ultimate result, inasmuch as, if they are not properly prepared, they will rarely turn out well at the finish. The first thing is to stop the "suction;" for except the finishing color lays on cool, and without any or very little "suction," the work is apt to be more or less rough, and will gather or accumulate more

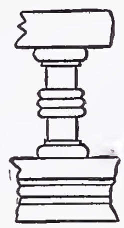


Fig. 4.—Wall Cabinet—Lower Railing.

color in one part than in another, and consequently will look shady. And here we may note a fact which shows the necessity for the use of a preparation. It will almost invariably be found that one part of a wall or ceiling will have a greater power of absorbing colors than another part. It will be observed, as with a first coat of paint, that some parts are glossy and others dry dead; that is, the paint has sunk into or been absorbed on the dead parts, while on the glossy part it remains on the surface, owing to the unequal finish of the plaster-work. Of course, in oil painting this is remedied by successive coats of paint. It therefore becomes necessary that some means should be adopted to stop this power of absorption, and for this purpose various preparations are used. The following has been recommended as a suitable preparatory coat, and will be found to answer the purpose very effectually: "Mix about a dozen pounds of the best whiting with water to the consistency of soft paste; add sufficient parchment or other size to bind the color fast; add about two ounces of alum and the same weight of soft soap dissolved in water; mix well together in a pail and strain through a coarse cloth or a metal strainer."

In order to produce good work, two things

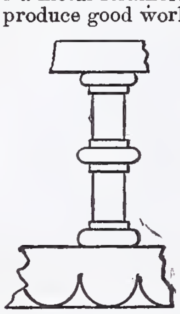


Fig. 5.—Wall Cabinet—Upper Railing.

are essentially necessary in the mixing of the distemper, namely, clean and well-washed whiting and pure jellied size. The whiting should be put to soak with sufficient soft water to cover it well and penetrate its bulk. When the whiting is sufficiently soaked the water should be poured off, which will remove any dust or foreign matter from the whiting. It should then be beaten up or stirred until all the lumps are broken and it becomes a stiff, smooth paste. A good workman will do this carefully with the hand, and will manipulate it until it is quite smooth; but it may be done most effectually with a broad stick or spatula, and then strained through a metal or other strainer. The size should now be added, and the two lightly, but effectually, mixed together. Care should be taken not to break the jelly of the size any more than can be avoided, and this may be done best by gently stirring the mixture with the hand. If the jellied state is retained intact, the color will work cool and lay on smooth and level. Then size, whether made of parchment clippings, glue or any other material, should be dissolved in a sufficient quantity of water to form a weak jelly when cold. In practice, we find that distemper mixed with jellied size will lay on better and make a better job than when the size is used hot. Color mixed on the former plan works cool and floats nicely, while the latter works dry and drags and gathers, thus making a rough ceiling or wall, and the difference in the labor required is very much in favor of the jellied size. A little alum added to the distemper has a good effect in hardening, and helps it to dry out solid and even.

It is customary in some cases to give the ceiling or wall a couple of coats of oil paint previous to the appplication of the distemper. This stops the suction, and gives a richness to the coloring; but if, as frequently happens, the wall gets low in temperature during a continuance of cold weather, when a change takes place the condensation is so great that the water runs down in streams to the top of the skirting, and the coloring matter thereby becomes stained.

The following hints for mixing various colors in distemper, &c., by which at least a theoretical knowledge of the subject can be acquired, will greatly facilitate progress in mastering the practical details.

The best size for distemper colors is made from parchment clippings. These are put into an iron kettle filled with water, and are allowed to stand 24 hours, until the pieces are thoroughly soaked. Then boil for five hours, occasionally taking off the scum. When the liquid is sufficiently boiled, take it from the fire and strain it through a coarse cloth. If the size is to

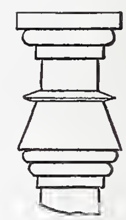


Fig. 6.—Wall Cabinet—Capital of Post.

be kept for any length of time, dissolve 3 or 4 ounces of alum in boiling water and add to every pailful. The size must be boiled again till it becomes very strong. It must then be strained a second time, put into a cool place, and it will keep for several weeks. Different kinds of size are sold at the color shops, some of which are exceedingly pure, and may be depended upon for general purposes.

Pink.—Dissolve in water separately whiting and rose pink. Mix them in the tint required, strain the color through a strainer and bind with size.

Lilac.—Take a small quantity of indigo finely ground in water, and mix it with whiting till it produces a dark gray; then add to the mixture some rose pink. Well mix and strain the color, and a beautiful lilac will be the result.

Light Gray.—A small quantity of lamp-black mixed with whiting composes a gray. A wide range of shades may be obtained from the darkest to the lightest gray.

French Gray.—Take the quantity of whiting required and soak it in water; then add Prussian blue and lake which have been finely ground in water. The quantity of each of these colors should, of course, be proportioned to the warmth of tint required. This is a handsome and delicate color for walls. Rose pink may be substituted for the lake, but it dees not make so brilliant a color, neither is it so permanent.

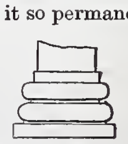


Fig. 7.—Wall Cabinet—Base of Post.

Orange.—This is a mixture of whiting, French yellow, or Dutch pink and orange lead. These ingredients may be proportioned according to taste. This color cannot be worked except in a size jelly, as the orange lead is a color which has great density, and will sink to the bottom, separating from the other colors.

Buff.—A good buff may be produced by dissolving, separately, whiting and yellow-ocher in water. A little Engligh Venetian red should be added to give a warm cast. Mix with size, and strain as before directed.

Drab.—1. Dissolve whiting in water, and grind some burnt umber very fine in water. Mix to the tint required. Raw umber will make a drab of a different shade. 2. Dissolve separately some whiting and yellow-ocher in water. Take a quantity of each and mix them together. Grind a little lamp-black very fine, and with it sufficiently stain the color to make the tint required. 3. Another shade may be obtained by adding a little Venetian red. By diversifying the proportions of these pigments a great variety of colors may be produced. These are all permanent colors and may be depended upon.

Salmon.—An excellent salmon color may be made by dissolving whiting in water, and tinging it with the best English Venetian red. A little Venetian red, mixed with lime whitewash and a quantity of alum, will answer very well for common purposes.

With regard to the method of laying on distemper colors, it may be accepted as a fact that the sooner they dry after they are laid on the better. The best plan is to close the windows and doors, and stop the free circulation of the air as much as possible, while the distemper color is being laid on. This prevents its drying too quickly, and enables the workman to lay the color on more evenly, and with less danger of showing any piecings; but the moment that the wall or ceiling is covered, the windows and doors should be thrown wide open, and as much fresh air admitted as possible. This free circulation of air absorbs and carries off the moisture from the walls. The evaporation is quick, and a good job results. If the distemper does not dry quickly it becomes slightly discolored and shaded. One great point to be aimed at is, of course, a level and uniform surface when dry, and this desirable result can only be obtained by the color being laid on of a proper consistency, and with every attention to equality.

It is proper to remark in this connection that colors for work in distemper are obtainable from dealers in painters' supplies, carefully ground to an impalpable powder, and which spread in water as smoothly as the finest grades of oil colors. The directions which we have given above will not come amiss even to those who handle the prepared colors just described. The preparation of colors in this way has greatly extended the scope of the art and the facilities for its application.

Size of Gas Pipes.—

Dr. Atkin, the inspector of gas and sealer of meters in Baltimore, Md., in his report for the past year, attributes the want of light, frequently complained of by consumers of gas, to arise from the smallness of the service pipes in many houses, by which the consumption is increased and the power of the light lessened. A simple remedy is to have larger pipes substituted, an outlay which the inspector thinks would soon be repaid in diminished bills for better gas. He also suggests that a simple mode of reducing the pressure and insuring better light, is to regulate the flow of gas by the stop-cock behind the meter, instead of by those at the burners. Much gas is frequently wasted by the use of old and defective burners. A large number of meters during the year have been removed by the gas companies and sent to the City Hall for inspection, at the request of consumers, the purpose being to secure an official test of a measure so little understood by the public. The inspector reports that the amount of the reduction in the gas bills paid by the city has been in proportion to the reduced price of gas, being two-fifths less per 1000 feet since March last. The inspector recommends the substitution of gas for gasoline lamps in all sections where the gas companies can be induced to lay their pipes. The gasoline lamps thus removed can be utilized in the outlying districts of the city. The report states that during the year there have been erected 146 gas and 54 gasoline lamps, making the total number of street lamps 4623 supplied by gas and 1006 by gasoline. In addition to this number, there are 173 lamps in the public parks and squares.

How to Successfully Veneer.

The following directions for veneering, if strictly followed, will insure success in this important branch of mechanical work:

The softest woods should be chosen for veneering upon. Perhaps the best for the purpose are those of perfectly straight grain and without a knot: of course, no one ever veneers over a knot. Hard wood can be veneered—boxwood with ivory, for instance; but wood that will warp and twist, such as cross-grained mahogany, must be avoided. The veneer, and the wood on which it is to be laid, says a writer in a contemporary, must both be carefully prepared, the former by taking out all marks of the saw on both sides with a fine toothing-plane, the latter with a coarser toothing-plane. If the veneer happens to be broken in doing this, it may be repaired at once with a bit of stiff paper, glued upon it on the upper side. The veneer should be cut rather larger than the surface to be covered; if much twisted, it may be damped and placed under a board and weight over night. This saves some trouble; but with veneers that are cheap it is not worth while taking much trouble about refractory pieces.

The wood to be veneered must now be sized with glue; the ordinary glue-pot will supply this by dipping the brush first into the glue, then into the boiling water in the outer vessel. This size must be allowed to dry before the veneer is laid. We will suppose now that the veneering process is about to commence; the glue in good condition and boiling hot, the bench cleared, a basin of hot water with the veneering hammer and a sponge in it, a cloth or two, and everything in such position that one will not interfere with or be in the way of another. First, damp with hot water that side of the veneer which is not to be glued, then glue the other side. Second, go over as quickly as possible the wood itself, previously toothed and sized. Third, bring the veneer rapidly to it, pressing it down with the outspread hands, and taking care that the edges of the veneer overlap a little all round. Fourth, grasp the veneering hammer close to the pene (shaking off the hot water from it), and the handle pointing away from you; wriggle it about, pressing it down stoutly, and squeezing the glue from the center out at the edges. If it is a large piece of stuff which is to be veneered, the assistance of a hot iron will be wanted to make the glue liquid again after it has set; but do not let it dry the wood underneath it, or it will burn the glue and scorch the veneer and ruin the work. Fifth, having got out all the glue possible, search the surface for blisters, which will at once be betrayed by the sound they give when tapped with the handle of the hammer; the hot iron (or the inner vessel of the glue-pot itself, which often answers the purpose) must be applied, and the process with the hammer repeated; when the hammer is not in the hand, it should be in the hot water. The whole may now be sponged over with hot water, and wiped as dry as can be. And observe, throughout the above process never have any slop and wet about the work that you can avoid. Whenever you use the sponge, squeeze it well first. Damp and heat are wanted, not wet and heat. It is a good thing to have the sponge in the left hand nearly all the time, ready to take up any moisture or squeezed-out glue from the front of the hammer.

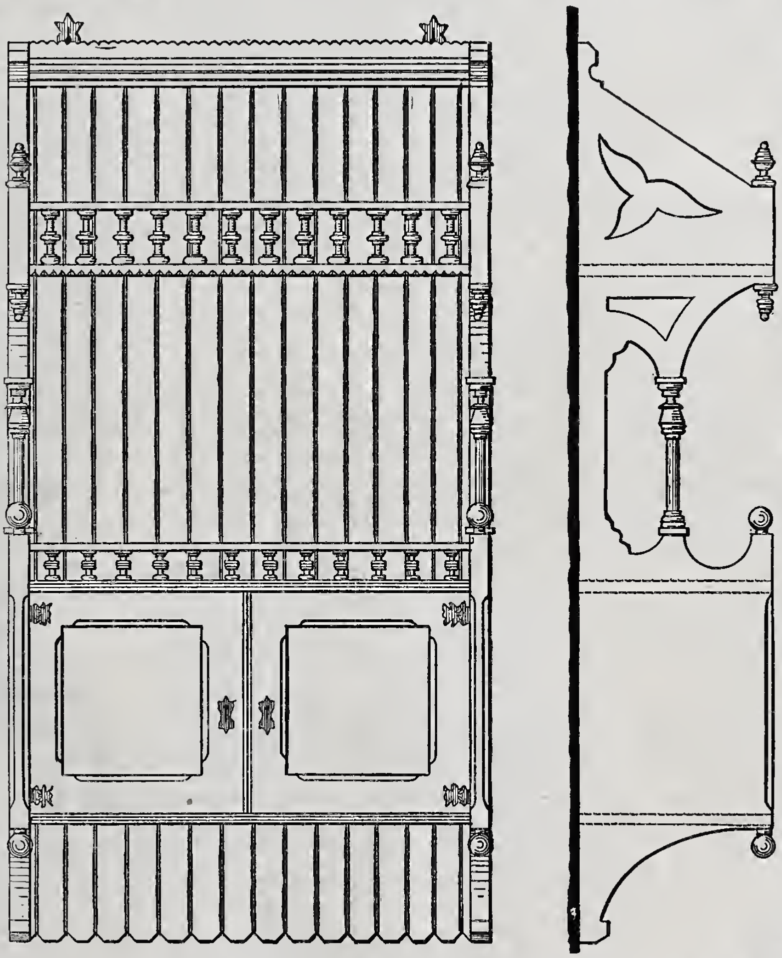


Fig. 8.—Elevation and Section of Wall Cabinet.—Scale, 1½ Inches Equal 1 Foot.—Details on Opposite Page are Half Full Size.

So much for laying veneers with the hammer, which, though a valuable tool, is not much used in the best cabinet-makers' shops—cauls are adopted instead. They are made of wood, the shape and size of the surface to be veneered, or, better still, of rolled zinc plate, and being made very hot before a good blaze of shavings, they are clamped down on the work when the veneer is got in its place; they must be previously soaped to prevent them sticking to the veneer. The whole is then left to dry together. The hammer is quite sufficient, however, in small cabinet shops. Veneers can be laid with it 5 feet long by 18 inches wide, without assistance and without leaving a blister. Cauls, however, are very necessary if a double-curved surface has to be veneered, or a concave surface; they need not be used for a simple convex surface. By wetting well one side of the veneer, it will curl up, and can easily be laid on such a surface; but it will be well to bind the whole round with some soft string to assist it in keeping down while drying.

Red Staining for Wood.—The wood is plunged first in a solution of 1 ounce of curd soap in 35 fluid ounces of water, or else is rubbed with the solution; then magenta is applied in a state of sufficient dilution to bring out the tone required. All the aniline colors behave very well on wood.

Iron as a Building Material.

The present position of iron as a building material is not one of such unquestioned confidence as to its fitness for every purpose, nor one of such general popularity, as it was a few years ago. A little while ago, an iron building was accepted as one of the very best buildings that could be erected for any purpose. It was believed to be fireproof. With characteristic impetuosity in running after a popular fashion, the American public took up with iron buildings from the first, and made free use of them. Iron was used with entire confidence for fronts, for floors, for walls, for partitions and for entire buildings, and as a building material it came into general and indiscriminate use before its merits had been thoroughly tested, and before any thought had been given as to whether iron buildings, as constructed, were in good taste or not. An immense industry was created by its demand. Architectural iron works were started in various places, and all found remunerative employment. Architects and engineers not only countenanced iron construction, but gave it the strongest possible indorsement, by using it throughout the buildings under their charge. Iron held its position as the most popular and most available building material until the tests of great fires, and the growth of the people in taste and culture, demonstrated that an iron building, as commonly designed and constructed, was deficient in many essential particulars.

A few years since, a paper read before the American Institute of Architects, which was accepted as embodying the best thought upon the subject at that time, presented the following nine reasons for the use of iron in buildings:

1. The great facility with which any architectural design may be carried out in iron.
2. The great economy of space that may, if necessary, be obtained, inasmuch as a much thinner wall of iron may be stronger than any stone wall now coustructed.
3. Economy in the construction of foundations, usually so expensive a part of the builder's work, and the safety of the building, notwithstanding the foundation may be imperfect.
4. If, at any time, the owner wish to move his building, he may do so, being only at the expense of the actual removal, and having his entire house in as good condition as when first made, losing nothing of the material.
5. Security against lightning—the electricity being diffused over a large surface, and thus losing its intensity.
6. Facility of ventilation.
7. The impervious nature of the material, preventing dampness and mildew and consequent decay.
8. Its durability, outlasting all the stone that ever was quarried
8. Its incombustibility. All public buildings, and such private buildings as are used for the storage of valuable goods, or works of art, should have the interior at least constructed with a view to the prevention of fires. Without the aid of iron this is impossible.

While the author of this paper would undoubtedly explain these reasons for the use of iron in a manner to render them quite consistent with what experience has proven true concerning iron architecture, and while many of the ablest members of the American Institute, in all probability, at that time disapproved of the wholesale use of iron, and therefore occupied a conservative position, the paper we have above referred to has formed the preface or introduction to several catalogues issued by iron works, and has been considered a platform broad enough upon which to rest the use of iron in almost every shape which the enterprise of manufacturers has been able to suggest. We call attention to it in this connection only as illustrating one feature of the general introduction and use of iron in this country for building purposes. That iron has intrinsic merits as a building material, some of which are of unusual importance, and that to be deprived of its use we should suffer a loss which the employment of no other known material could compensate, no one will deny. But iron architecture has been overdone, and iron construction, as practiced, has been proven to be of less reliability in case of fire than was claimed for it when it was first brought forward. Undoubtedly these difficulties, both in the matter of designs and in the plans of construction, are entirely the faults of the ideas embodied, rather than the fault of the material as a material. Iron as a building material is not to be condemned; but undoubtedly the ways in which iron has been generally used in the past are to be censured, if not condemned outright. In the introduction of iron, more stress has been laid upon its properties of strength, durability, incombustibility, &c., than upon its adataption, or upon the invention of styles and designs peculiarly adapted to its use. Many persons of refined taste see strong reasons against the use of iron in architecture upon this ground alone. They see in it a material debased by the imitation of forms which were invented for another, and they claim that its very general use in those shapes does much to corrupt good taste. The materials of which buildings are constructed seem to change much oftener than the styles of architecture. Wood and brick, from the stern necessities of the case, have developed for themselves a sort of architecture, if mere conventional shapes determined altogether by the requirements of construction and the nature of the material, can be entitled to the dignity of that name. Wooden buildings are built as wooden buildings, and brick buildings are built as brick buildings, without the attempt to convey the idea that they are stone buildings, or anything else than what they appear. But in the case of iron, however used, whether in sheets or in the form of castings, a material is found that is so readily fashioned, that the tendency is to use it exclusively in the shapes which have been especially invented for, and adapted to, the materials which have preceded it. A journal of undoubted standing upon matters of taste and criticism, in an article concerning the architecture of the buildings erected in Boston immediately after its great conflagration, used the following language, which not only embodies this idea, but is worthy of note as being one of the earliest criticisms concerning the employment of iron in the shapes becoming so common, which attracted general attention:

"Of iron architecture there is less than we had feared to see after the fire; but we should be glad to see less still. In spite of the fact that irou is the advancing, and, we might say, encroaching material of our time, there has been as yet no serious study of its proper employment in architecture—except in France, where, as iu the new markets of Paris, excellent use has sometimes been made of it—and no suitable forms for its use have been developed, it being almost universally employed thus far in debased imitations of forms which were invented for stone. It is refreshing, therefore, to see in some of the buildings erected a step in the right direction toward the invention of a system of design which shall be distinctively iron, and not bastard stone or bastard wood."

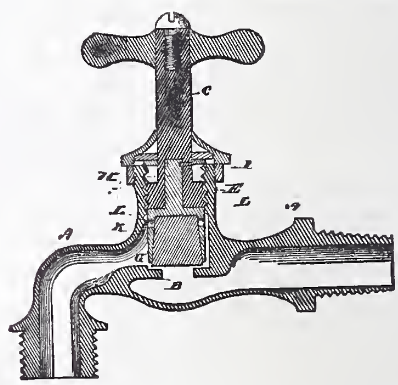
With all due regard for the æsthetics of the matter, it is perhaps to be said that it has been more because iron construction is not reliable in case of a fire, than because an iron building offends good taste, that iron has lost some of its popularity. An iron building is no longer considered fire-proof. In the case of a conflagration, firemen hesitate to enter the burning building if they know the floors are carried upon iron beams. While they will unhesitatingly work upon floors of wood construction until driven forth by the flames, they realize the risk of being upon a floor of iron construction, even with but slight heat. The expansion of iron beams in a floor soon destroys the brick arches between them, or thrusts the walls of the building apart, in either case proving themselves a dangerous element of construction, rather than one of safety.

For roof trusses for the framework of towers, and for many purposes about a building, there is no other material so useful as iron. The tendency in its use at present is to make judicious combinations of it with other materials, rather than trust to it alone. Brick has been proven to be the most enduring material in a conflagration; but a complete building cannot be built of brick alone. Iron has become a necessity, and the problem with which architects and engineers are at present contending, is how to use iron to secure all its advantageous qualities and avoid its difficulties. Improvements and changes in many of the minor parts of buildings, go to show the general tendency. Brick arches between iron floor beams having been proven unreliable, corrugated iron arches, covered with cement or concrete, are being substituted. The expansion of the beams, while enough to throw down a brick arch, does not destroy the corrugated iron arch, which is a shape of great strength with a small body of material, and which, in a measure, expands with the beams. Iron laths for plastering are fastened to wood studding with good results, so thoroughly protecting the wood as to render it, in this connection, practically fire-proof. Other changes of a similar nature have been introduced or suggested. Iron as a building material may not, in the future, occupy a place quite so conspicuous as it has in the past, but its real usefulness is likely to be greater rather than less.

Dowling's Improved Compression Cock.

The following is a description of an improved compression cock, invented and lately patented by Mr. John Dowling, and now under control of Messrs. Lee Bros., of Plymouth, Pa.

The invention of Mr. Dowling consists in a new valve, which is calculated as a substitute for leather, rubber or other composition washers. In the cut, A represents an ordinary compression cock, operated by a spindle, C, the lower end of which is constructed with a disk threaded to mesh with a corresponding thread in the chamber, E. G is the thimble or valve holder, and is provided with a stem, H. This stem enters a socket in the spindle, and is suspended therein



by the pin I, engaging in a groove at its upper end. K represents the valve, which consists simply of a close, fine-grained, wooden plug, placed in the thimble and projecting below the edge of same for a bearing surface; the plug being so arranged that the ends of the grain or fibers of the wood press against the seat B when the valve is closed. L L are meant for holes (not correctly shown in cut) in the side of thimble, for inserting a pointed instrument behind the valve for removal in case of repairs. These valves can be applied to all the different compression cocks used in plumbing work, and are especially adapted to hot water, where the best of other valves or washers give but poor results iu comparison.

As applied to gauge cocks for steam boilers, they are superior to metal, from the fact that they do not rust nor stick in their seats and are easily replaced. They readily imbed any grit or sediment, and still preserve a smooth, yielding surface that will not injure the seat. Probably there are few substances better adapted for valve seats of this sort than hickory boiled in oil, and used as shown, with the end of the grain against the valve seat. Such valves in heavy pumps almost invariably greatly outlast all others, especially where there is much sand or grit.

Every bricklayer has a Bob, which he hangs first and kills afterward.

PRACTICAL CARPENTRY.

Stair Building.

III.

Having in the two previous papers briefly touched on the principal points involved in stair building, we will now speak of some details of importance and interest. In a geometrical stair with winders, the risers of the latter are usually radii drawn from the semicircle of the well-hole, as at Fig. 9. But this plan is liable to one serious objection, for where the risers are radii of such a

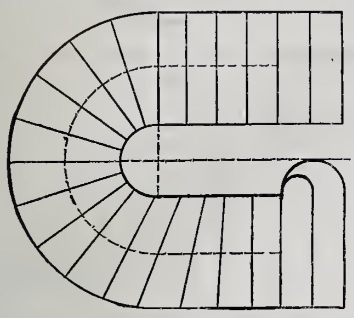


Fig. 1.

circle it is evident that the treads must be made inconveniently wedge-shaped, being much too wide at the end joining the wall-string, and far too narrow at the inner end next the well; this awkwardness of form making itself very papable when two people have to pass each other at that portion of such stair. Nor is this the only evil; for this peculiarity in the shape of the treads of the winders, while the risers remain of one hight, causes the ramp of the string-board to be so varying that its pronounced angles become unsightly. It is possible, however, to overcome both objections. If the steps be so proportioned as to distribute the inequality among some of the flyers, as well as all the winders, as is very frequently done by French staircase hands, a much better result may be arrived at. Generally speaking, the first and last three or four steps do not partake of the divergence given to the risers of the other flyers (see Fig. 1).

"Suppose, then," says Mr. Newlands, whose capital condensation of the subject we cannot do better than quote, "that the divergence is fixed to commence at the fourth step. It becomes necessary to distribute eight spaces along the center of the string, commencing at the center line of the stairs, which, from the center line to the fourth riser, shall follow some law of uniform progression, say that of arithmetical progression, as being the most simple. The progression then will consist of eight terms, the sum of which shall be equal to the

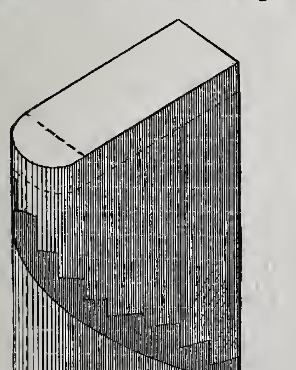


Fig. 3.

length from the center to the fourth step. Suppose that its development is 66 inches, a length composed of the breadth of three flyers, 4, 5, 6—namely, 36 inches—and the sum of the widths of the five winding steps, 7, 8, 9, 10, 11—namely, 30 inches:

	Inches.
Subtracting from	66
The width of eight steps of the same width as the winders	48
There is obtained the difference	18

From which is to be furnished the progressive increase to the steps, as they proceed from the center to riser No. 4. Suppose these increments to follow the law of the natural numbers, 1, 2, 3, 4, 5, 6, 7, 8, the sum of which is 36; divide the difference 18 by 36, and the quotient, 0.5 inches, is the first line of the progression, and the steps will increase as follows:

The end of step No. 11	= 6.5
" " " 10	= 7
" " " 9	= 7.5
" " " 8	= 8
" " " 7	= 8.5
" " " 6	= 9
" " " 5	= 9.5
" " " 4	= 10
The sum of which is	66

"These widths, taken from a scale, are to be set off on the line of balusters, and from the points so obtained lines are to be drawn through the divisions of the center line. It is easy to perceive that by this method, and by varying the progression, any form may be given to the curve of the string.

"The graphic method, however, now to be described, is preferable to the method of calculation, seeing that it is important to give a graceful curve to the development of the string. Let the dotted lines, S M P (Fig. 2), represent the kneed line, made by the first division of the stairs in the lower part, corresponding to the nosing of the

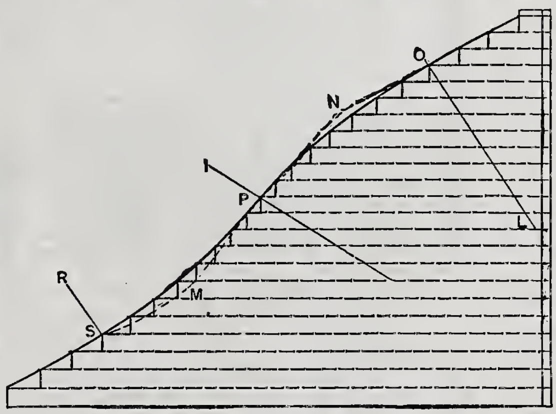


Fig. 2.

flyers, and the upper part, M N, to that of the winders. Bisect the line of the winders, M N, in P, and raise a perpendicular, P I. Then set off M S equal to M P, and make S R perpendicular to S M. The intersections of these two perpendiculars, S R and P I, gives the center of the arc of a circle, tangential in S and P to the sides of the angle, S M P. In like manner is found the arc, to which P N, N O, are tangents, and a species of cyma is formed by the two arcs, which is a graceful double curve line, without knees. This line is met by the horizontal lines, which indicate the surface of the treads; the point, P, being always the fixed point of the center step, the twelfth in this example. Therefore, the hights of the risers are drawn by the story rod to meet the curved line of development, S P O, and are thence transferred to the baluster line on the plan."

In the staircase shown in plan at Fig. 9, it will be observed that the inner string assumes a semicircular form as it winds round the well, as also in Fig. 1 of this article. There are several ways of forming this circular portion of the string. We will take first that adopted in veneered strings.

An important requisite in forming a veneered is what is known as the "working cylinder," or sometimes "cylinder" simply (Fig. 3), which is made to correspond with the shape of the well, and is, therefore, not a cylinder at all, but a half-cylinder with a couple of parallel sides attached, the distance between which is equal to the distance between the faces of the required string in the well.

When the strings were usually glued up from veneers, this cylinder was indispensable to the operation. The following is the mode of procedure: The stretchout of the

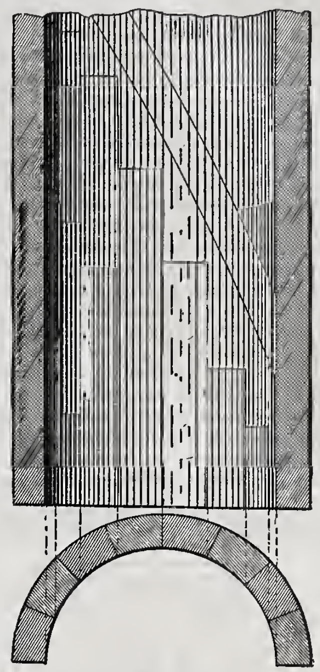


Fig. 4.

circular part of the cylinder, from springing to springing, is first carefully taken on a stout piece of paper, and laid out a straight line upon a drawing-board or other suitable surface. The exact situation of each riser adjacent to the circular portion of the well-hole is then measured from plan, as it cuts the line of the string's face, and its distance from the springing lines. These distances are also transferred to the drawing-board, and the development of the line of steps set out by pitch-board. When this is done, and due allowance made for the strength of carriage from the angles of the steps downward, it will be seen what the dimension and form of the required veneer ought to be. The lines are then transferred from the board to the veneer, being scratched in on both sides of it. It will now be easy to get the vertical center line, &c., marked upon the veneer to correspond with that upon the cylinder when the veneer is bent around the latter. The veneer having been thus adjusted and properly secured, blocks are glued over the whole surface, with their joints and grain parallel to the axis of the cylinder. When perfectly dry and firm, the back of the blocks is worked to a uniform surface, and strong canvas glued over it. The string is then removed from the cylinder and cut to the proper form for the re-

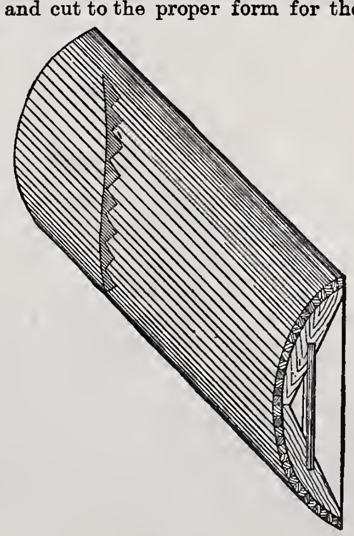


Fig. 5.

ception of the steps. Every beading joint ought to be glued and tongued.

The time and labor involved in this method of getting out a string have led to its being virtually superseded by other methods. One of these is to form the circular part of the string of staves, with curved faces, glued together at their edges, and dispensing with any veneer. This is shown in plan and elevation at Fig. 4. Each stave must have its edges carefully shot, and be glued up properly against its neighbor. Each rises also to the hight of a step above the previous stave, allowing sufficient length at bottom to cut the string the correct ramp of its under side, and at the top for cutting and mitering the risers and nosings. This plan is, perhaps, the most expeditious of all, but it is decidedly unsafe.

In another system the string is set out, as in the first instance, but in place of transferring the development of steps, &c., to a piece of veneer, it is set out upon an inch board. About the thickness of a veneer is then gauged on the edge of the board from the face, and it is secured to the bench. Grooves are then worked across its back in the direction of the riser, by means of a three-quarter-inch or 1-inch dado plane, which cut through to the gauge lines. The

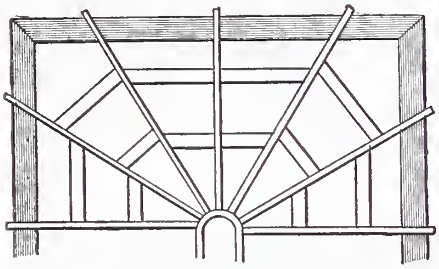


Fig. 6.

grooves may be about one half-inch asunder. One end of the string is then screwed to the cylinder or working curve, and the string having been drawn slowly and tightly over it, with the grooves uppermost, has its other end secured. Keys, or small pieces of wood, are then carefully fitted in the grooves and the whole well glued over, and sometimes further strengthened by coarse canvas glued over the whole, or a thin pine veneer, 2 inches or 3 inches wide, may be glued on each edge and secured by short nails in lieu of the canvas (Fig. 5.)

The carriages and timbering of stairs vary to some considerable degree, according to the idea of the stair-builder. A very usual arrangement of rough bearers, placed below the nosings to assist in supporting the winders, is shown at Fig. 6. The internal ends of these rough bearers is here fixed to the string and the other ends secured to the wall. Figs. 7, 8 and 9 give modifications of methods of arranging rough strings and bearers. The three latter are from Easterbrook and Monckton's excellent work, "The American Stair-Builder." Concerning them they say: "After the steps are wedged in the wall string, a rough board bracket, cut to fit the under side of step and riser and

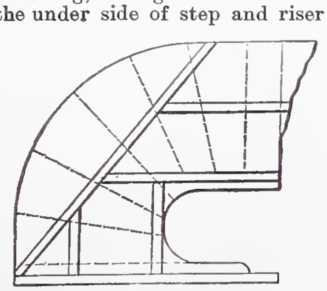


Fig. 7.

lower edge of middle timber, should be put under each step, and secured by nailing through the riser into the back edge of the next step below and at the lower edge of the timber. In furring winding stairs, a strip is first nailed along the wall as a guide for ranging and to fasten that end of the laths to. Sometimes it is thought best to fur across in the direction of the risers; then the laths are put on parallel to the strings."

New Decorative Material.—A new material for the decoration of walls has recently been brought out under the name of muralis, by Mr. F. Walton, of the Sunbury Works, the inventor of linoleum. The material is somewhat similar to linoleum, and is molded or stamped in dies, so as to have the appearance and effect of wood carving in slight relief. The material has much the character of india rubber, will stand almost any knocking about without disfigurement, may be scrubbed, cleaned with acids or flame for disinfection, is very durable, and is stamped with choice patterns.

Practical Hints for Joiners and Cabinet-Makers.

The mainstay of constructive woodwork is the mortise and tenon. A piece of woodwork which can be put together without glue, nails or screws, and serves its purpose, is an ideal work of construction; but this is not always possible. Another principle of construction is that every piece of wood should be so placed that it can swell or shrink without injuring itself or displacing

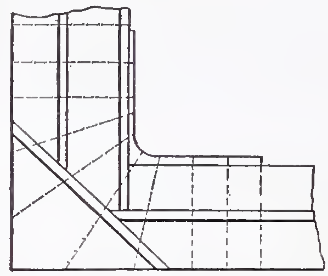


Fig. 8.

any other piece. This is maintained in an ordinary paneled door, providing no moldings are inserted. Another principle is that miter-joints should be avoided, whether for molded work or not, for the reason that shrinkage causes all miters to open. No piece of wood should be used unless the straight grain of the wood can be seen through its full length in one place. Inserted moldings should be avoided as far as possible; and all moldings for panel work should be worked on the stiles and rails. It is a general principle, observed in the best mediæval joinery, that all moldings on rails which are horizontal should butt against the stiles; and that stiles should be either plain or should have moldings stopped before reaching the joints with the rails. In practice, all rail moldings may be worked the whole length of the stuff used; and if muntins (which are the middle stiles) are used, the moldings may be cut away to the square wood before the mortise is cut which is to receive the tenon of the muntin. Thus the moldings will butt against the square sides of the muntin. All the parts for a door thus made can now be got out by machinery.

The dovetail is a constructive device, and the dowel is admissible in places as a substitute for the mortise tenon. Tonguing and grooving is a legitimate device both for ends and sides of boards. Beveling the edges of the pieces thus joined is better than beading. The best way to construct large panels is to

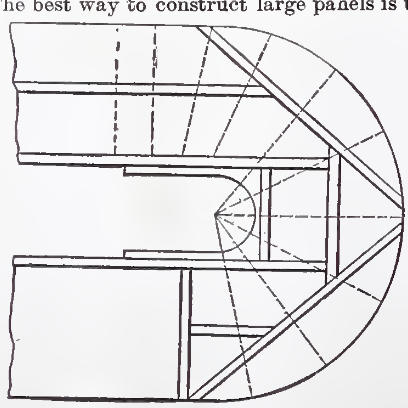
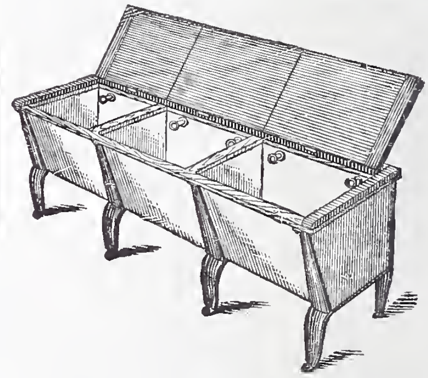


Fig. 9.

make them of narrow strips, tongued and grooved, and beveled at the joining edges. Such panels will never "draw." The shrinkage will be divided between all the joints. Solid table tops should never be fastened with glue or screws, but should be secured with buttons fastened to the under side of the top, which travel in grooves cut in the framework to allow for expansion and shrinkage. These are but a few of the principles to be observed in doing the best woodwork. All boards cut on a radius from the center to the periphery of a tree will remain true, while all others have a tendency to warp or crak. The first are called "quarter-sawn." It it a peculiarity of oak that the best grain is found in quarter sawn boards. It is only in these that the "silver-grain" is seen. This consists of a ribbon of very hard substance which grows out from the center of the tree. It is for this reason that oak is the most enduring wood; it has a grain two ways.—*Furniture Gazette.*

Stationary White Crockery Wash-Tubs.

We illustrate herewith a novelty, as well as an article of merit, being a stationary wash-tub, in one piece, of white crockery or ceramic ware. The advantages of such an article over all other stationary tubs can be readily perceived. Being of pure crockery throughout, there is no coating or lining to chip or wear off. They neither wear, leak, rot nor smell, and they furnish no lodgment for water-bugs. Ordinary tubs absorb dirty water from the clothes, which evaporates slowly, but surely, after the tubs are rinsed out, and the foul vapors and odors enter every room and closet in the house in their upward flight. With the crockery tub, however, there are no seams to open, and they will not leak through use or want of use. They cannot produce a disagreeable odor, since they are non-absorbent, and when once rinsed out, are as clean as any piece of crockery. They are durable, being made



Stationary White Crockery Wash Tub.

strong enough to withstand all ordinary rough usage, and are not likely to be broken, except by violence. They are mounted upon metallic feet or stands, properly japanned, galvanized or nickel plated, and the general appearance of the article is that of an ornament to the room in which it is placed. White wash-tubs, white wash-boards and white soap-suds make washing more cheerful than it has been heretofore. One tub in each set has a fluted surface molded upon the inner face, thereby furnishing an ever ready and quite convenient wash-board, which takes up no room whatever. Each tub in the set has a soap dish molded upon the inside front. The great advantages which these tubs possess over slate, enameled iron ware and wood, are in point of cleanliness, durability and entire freedom from odors. The American Institute, by the reports of its judges in 1871 and 1875, made these points quite prominent. From the latter report we quote the following: "These tubs are highly recommended; worthy of the attention of the general public, and should be in every house. The difference between these tubs and others made for like use, consists essentially in the fact that this article is made of non-absorbent material, is in one piece, and, therefore, has no joints or cracks to harbor insects, cause leakage or produce a disagreeable odor."

We are indebted to Messrs. Morahan & Co., the manufacturers, whose office and factory is at the foot of West Eighteenth street, New York city, for the accompanying engraving and the notes from which our description is made.

MASONRY.

Drawing Tools for Masons' Use.

III.

To form a plane, or regularly winding surface, on a block of stone, is, as we have shown, a sufficiently simple operation, necessitating only the aid of square, straight-edge, winding-strip and twisting rules. Where it is requisite that the arrises should be chamfered, or any analogous process should be performed, the rule, square, bevel, straight-edge, &c., will still render efficient aid.

When, however, it is necessary that one or more surfaces, or portions of surfaces, of the stone shall be brought to a given figure, from, say, a simple torus molding, upward, it becomes a different matter, and much has to

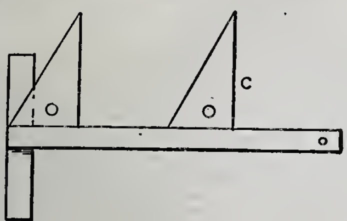


Fig. 1.

be done before stone-cutting proper can be commenced. In a large or ornate edifice, every individual block should have a full-sized working drawing made of its ultimate form before the operation of cutting begins. By many people outside the trade, but who yet ought to know better, and even by some few masons themselves, this is presumed to be a comparatively recent practice, say a couple or so of centuries old. It is even asserted that the great *franc maçons* of Western Europe, wrought the molding and tracery and gargoyles and bosses of minster church or baronial hall by some instinctive application of the "rule of thumb." The idea is altogether absurd. Take a comparatively simple example—for instance, the column, capital, and arch ribs, shown at Fig. 6 (from the "Dictionnaire de l'Architecture Française"). How is it possible that the blocks could have been brought to their proper forms without the previous preparations of accurate working-drawings and carefully-made templates? Both, unquestionably, the elder masons used, and there is every likelihood that the practice of today is substantially the same as theirs.

It follows, then, that every mason, if he aspires to be something more than a mere hewer of stone or rough-waller, should make it his study to become a good practical draftsman.

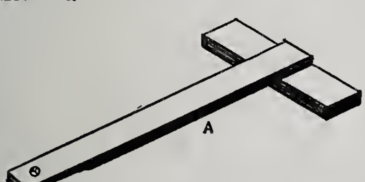


Fig. 2.

The most usual procedure in the erection of a large building, is first to prepare a set of drawings from the original designs, for transmission to the quarries. These, which should be on a large scale, indicate the number of courses, &c., distinguishing the stones to be worked to different sizes. A list of the numbers and sizes of the blocks should accompany these, so that when the blocks come from the quarry they are already of approximate size and shape and numbered consecutively, so far as possible, in the order in which they will be set in the building. Meanwhile plans and sections of the proposed edifice should be laid down on a large wooden platform or smooth even floor, with all courses, joints, voids, &c., exactly indicated, and from these sketches the proper templates, bevils, &c., are formed, each being plainly and durably marked with the proper number of the stone for which it is to be used, the lower numbers being appropriated to the first courses, as stated.

Let us, then, take a glance at the mason in the drawing office; and first, as to its requisites.

For the working drawings executed on paper, the principal instruments needed are the drawing-board, T-square, set-squares and curves of various kinds, rulers, a case of drawing instruments, black-lead pencils and Indian ink.

The best size for the drawing-table, which should stand near the window, but not be placed under a skylight, is about 2 feet 6 inches in breadth, with a hight of 3 feet 8 inches at the back and 3 feet 6 inches in the front. Where an ordinary level table is employed, the further edge of the drawing-board should be slightly raised. Drawing-

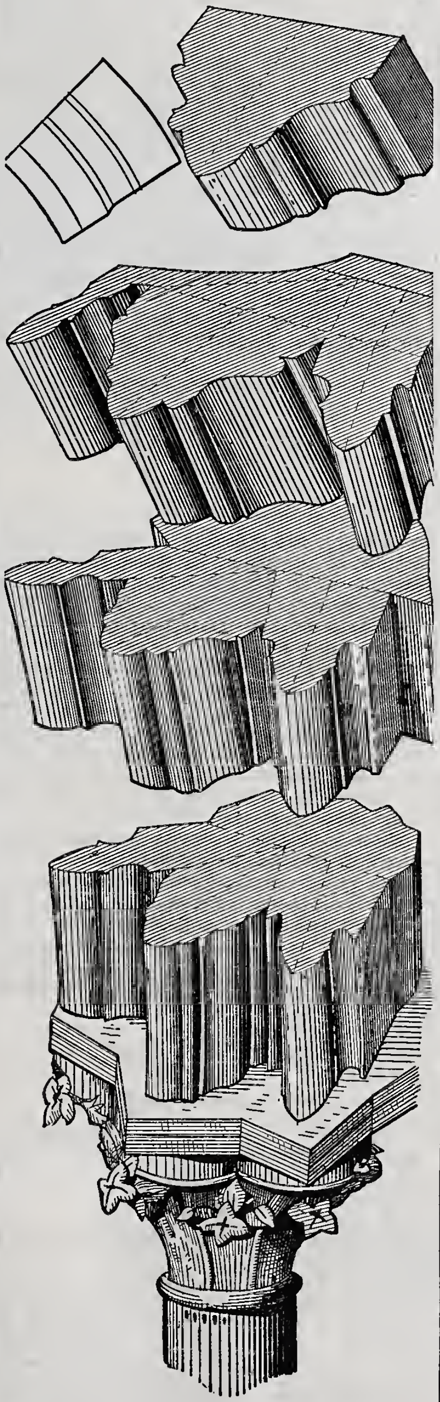


Fig. 6.

boards may be of any convenient size, it being advisable, where such work is done, to have several of various dimensions; 2 feet 6 inches by 2 feet is a useful size. Plane or sycamore is good wood for them, and they should be clamped at the ends, and they will be the better for tonguing in a couple of places across the back. Common boards are made of pine or deal. A *sine quâ non* for a board, of whatever stuff it is made, is that its surface is perfectly plane, and that it forms an accurate rectangle. The ordinary T-square needs no description; it may, however, be noted that T-squares differ in construction. In the commonest the "blade," or thin portion, is fixed flush with one side of the "butt," or "head." In other forms the blade is fastened in the middle of the butt (Fig. 3), and this is the preferable form for large squares; others, at Fig. 1, have the blade above the level of the head, to permit set-squares to go over it. Very large squares have a couple of little studs, as shown in the figure (Fig. 3), to steady them. Yet another T-square has the head formed of two thicknesses, kept together by a thumb-screw in the center. The blade of the square being secured to the upper of these pieces, the lower half of the head can be adjusted by the thumb-screw, so as to form any angle with the upper half. This kind of T-square is useful where lines diagonal to the side of the board, but parallel to each other, are to be drawn. When the movable head is secured in line with the fixed one, this T-square can of course be used for the same purpose as the ordinary one. The T-square is generally used for horizontal lines by placing its head firmly against the left-hand side of the drawing-

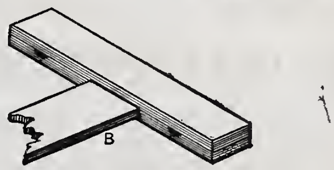


Fig. 3.

board. If the board is (as it of course should be) *perfectly* rectangular, the T-square may also be used for vertical lines by placing the head against the lower edge of the board, or that nearest the draftsman. The intersections of these vertical lines with the horizontal ones previously drawn, should then form right angles. But where there is the least inaccuracy of the board, the better way is to draw only the horizontal lines with the T-square, and then obtain the vertical lines by the aid of a "set square," which is a triangular piece of thin pear-tree or other close-grained wood, Figs. 4 and 5. The form of Fig. 4 is a "right-angled set-square." Others can be had; for example, one whose hypothenuse forms an angle of 60 degrees is much used in isometrical drawing (Fig. 5). The set-square should be tested, with the object of ascertaining whether the angle formed by the side is accurately 90 degrees. This is accomplished by drawing a straight line on the board with a very finely-pointed pencil, or preferably a knife. A perpendicular is then drawn from the line by aid of the square, and the latter then reversed. If its edge still coincides with the perpendicular line, the set-square is correct.

French curves (Fig. 7) are made in a great variety of combinations. They are extremely handy for drawing curves not easily struck by the compasses, and also for eccentric curves which the compasses are not able to describe, as mediæval moldings

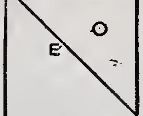


Fig. 4.

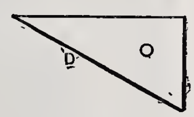


Fig. 5.

of some forms. In inking in a curve by the aid of one of these appliances, the edges must be turned about on the penciled drawing until some part is found which corresponds, when the edge of the curve will guide the drawing-pen. Perhaps it may be necessary to apply different parts in succession in order to complete the curve. The ordinary flat ruler is necessary for drawing lines from point to point. Straight-edges may be tested by holding a couple up to the light with their edges in juxtaposition, and observing whether the contact be continuous. If any light show through, the edges must be corrected until they coincide precisely. It is well to try several together in this way. The parallel ruler is needed for obtaining a series of parallel lines. There are two forms of this last instrument, viz., the old-fashioned one, consisting of two blades of ebony connected together by brass links, and the single ruler, carrying a small wheel at each extremity. The old-fashioned ruler is easier to use, and safer in the hands of an inexperienced draftsman, but the roller-ruler is more conducive to speed. Two set-squares, used as shown at Fig. 9, afford, however, a better way of obtaining a series of parallel lines than does the ordinary parallel ruler. If, for instance, it be required to draw a number of lines parallel to A B (Fig. 10), apply the hypothenuse (or longest side) of a set-square, C, to the line A B. A second set-square, D, is then put in juxtaposition with the first, as shown, and held tightly. If the set-square C be now drawn a little to the left, it is evident the line E F, parallel with A B, may be drawn. Another movement of C enables G H to be drawn, and so

Fig. 7.

on. Fig. 9 shows how lines perpendicular to the line I K may be got by the use of set-squares.

A case of the ordinary mathematical instruments is also needed, though for many of the masons' drawings means of obtaining larger curves, &c., have to be resorted to. The principal instruments included in the case are compasses of various kinds, drawing-pens and protractors. The larger pair have usually a shifting leg, in the socket of which can be inserted at pleasure a leg carrying a pencil, another with an inking pen, and sometimes one with a pen bearing a small dotted wheel to make dotted lines; but this latter is of little use. Whichever is used, it is of importance that its point is kept exactly level with that of the steel leg. "Spring" compasses have one leg capable of adjustment by means of a spring and a set-screw. These are useful in dividing a line into a certain number of equal parts, as the screw enables the distance between the points of the legs to be readily and exactly adjusted. There are also "spring dividers," or little compasses, suited for taking small measurements, but these are only of utility for finished drawings to small scales.

Besides the compasses in the case, some of larger dimensions will be required for

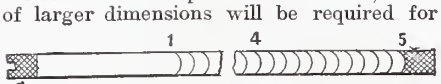


Fig. 8.

working drawings. If one of those in the case reaches a radius of 8 inches, there should be besides a pair with a 15-inch radius, and where expense is not taken into account, a beam compass may be added for curves up to 5 feet radius. This consists of a graduated horizontal beam, having a fixed point at one end, and being furnished with a movable one which can be set to any radius. A good serviceable substitute for this instrument can, however, be made from a smooth strip of pine about 1¼ inches in width, 1-16th-inch thick and 5 feet in length. A slip of drawing-paper is glued on each side to prevent splitting, the upper side being carefully graduated by the pen, so as to serve the purpose of a scale; the graduations being made of a curved form, having the pencil-nick for their center, so that the awl which serves as an axis may be set at any point in the breadth of the lath

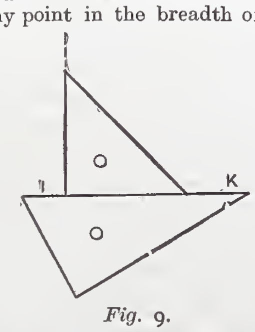


Fig. 9.

(Fig. 8). One end has a piece of notched mahogany fixed to it, in which the pencil is held firmly while a circle or curve is being struck. The axis is secured by a pointer or small brad-awl passed through the lath at the required distance, and into the drawing-board or table. In platform work a brad-awl can also be substituted for the lead pencil.

Arcs of large circle are sometimes described by means of an instrument called the "cyclograph," which is convenient but expensive, and not without disadvantages.

When arcs with a radius greater than 5 feet are required, they are very frequently struck without having recourse to a center by the agency of curved rulers, or "sweeps." In such cases the curves are drawn between points found by means of previous calculation, on sweeps of thin wood, a shown at Fig. 11. Three points in the curve are first found, the middle one being as nearly central as possible. A pointer or awl is driven in at each of the terminal points, and two straight-edges, A B, placed from them so that their other extremities cross at the middle point, C, these straight-edges being secured by a transverse piece, D. A fine-pointed pencil or sharp pointer is then placed at C and the curve struck, the trammel being kept meanwhile in close contact to the awls E and F. The wood outside the curve can then be removed carefully with a plane or spokeshave, and the sweep is ready for use. Care should be taken when drawing large curves by its means that the junctions are nicely made.

The "drawing-pen" is an instrument in frequent use. It is best to have two, or

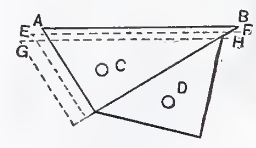


Fig. 10.

even more, reserved for lines of different degrees of thickness, as when the proper amount of opening is obtained it may be kept unaltered. The pen is supplied with ink either by first breathing between the nibs and then dipping the pen in the ink, or, preferably, by the agent of a camel's-hair brush. The pen should be held in a nearly upright position, with the screw side away from the rules or curve. It should be tried on a piece of spare paper before using, and invariably cleaned before being put away; which may be effected by passing a piece of paper between the nibs.

After having been in wear for some time, especially on some descriptions of cartridge paper, the drawing-pen will require setting, which is an operation of much nicety. Any mathematical instrument maker will do this, and it may be managed readily enough by one used to the hone. We cannot do better in this connection than give the excellent

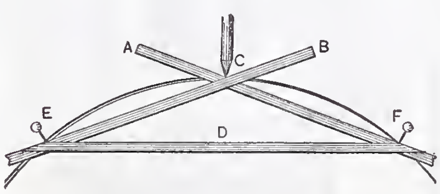


Fig. 11.

instructions of Mr. Binns, in his capital work on "Projection:"

"The nibs must be of precisely the same length, rounded in two directions, and as sharp as it is possible to make them without producing to the touch a sensation of cutting, and without scratching the paper when drawing a line, which is generally the case when one nib is longer than the other. This irregularity may be detected by placing alternately the sides of the pen at an acute angle with the forefinger and slipping the edge of the nail over the point, when the difference in length will be at once perceived; and it may be reduced by drawing a few lines, as it were, on a Turkey stone, with the pen applied to the edge of a set-square in the same manner as if drawing lines upon paper, but with this difference, that during the longitudinal motion of the pen the handle must be turned over in a circular manner, so as to give a rounded form to the point of the pen. If the pen be now held with the point directed toward the eye, and gently moved about so as to catch the angle of reflection, a bright speck on one or both nib will be observed, which must be reduced by rubbing the pen to and fro upon the stone, giving at the same time a slight rotary motion to the handle, which must be held at an angle of about 20 deg. with the face of the stone, the point of the pen being examined from time to time, and the process of reducing the fine specks continued until the point is as fine as can be used without cutting or scratching the paper. If at this stage the two nibs are of the same length, a perfectly solid and fine line can be drawn."

Improvements in Plastering.

Amid the rapid development and changes which have been wrought in most of the building trades the past few years, probably the plasterers' art has remained as nearly stationary as any. Yet there have been several important inventions perfected which have direct reference to this part of the construction of buildings.

Prominent among the new ideas in plastering, comparing the trade as it is at present with what it was but a very short time siuce, is the use of irou lath. In the perfection of this idea many different forms and constructions have been brought forward, and iron lath constitute no unimportant part of the patents upon building construction. Corrugated iron with perforations; sheets of iron formed into V-shaped grooves, set oblique to their surface; strips of iron somewhat like a flattened letter S, to be put on singly like wooden lath; sheets of iron formed into dove-tails, and strips of iron with edges turned and with perforations made in a way to give a clinch, and to be put on one at a time, like common lath, are among the inventions introduced. Some have been arranged to fasten to T-irons or angle irons forming the uprights of the partition or wall, and others have been adapted to nailing direct to wooden studding. Some are economical in principle and construction, and others are quite the reverse. Some give good results, while others are unsatisfactory, having a tendency to crack the plastering. The cost incident to the employment of any of these new ideas in lath precludes their use in any but first-class buildings. The fire-proof lath adapted to common buildings has not yet been brought forward.

Instead of animal hair for mixing mortar, which has been used from the earliest times, a vegetable fiber has been suggested, and to a certain extent introduced. It is well known that hair, by the action of lime, soon becomes rotten, whereas, on the other hand, it is an established fact that the very properties which destroy hair in mortar act as preservers of vegetable substances. Hence the principal advantage claimed for the vegetable fiber over hair. The secondary advantages of economy, cleanliness, convenience and strength, are not without weight.

In ornamental plastering or stucco work, sheet metal has been introduced in part as an auxiliary, and in part as a substitute. Parts of the cornices of rooms are made of zinc or galvanized iron, upon a plan which admits of ventilation. Perforated panels of sheet metal are often used in places formerly filled with a plastered surface Center pieces around chandeliers are now made of zinc instead of plaster of Paris, and constructed in a manner to adapt them for taking down to be cleaned. They are fastened in one piece to the ceiling by screws, and their use is an entire safeguard against the danger of pieces dropping from the old plaster constructions.

Other improvements have been made which we shall not attempt to euumerate in in detail at this time. There are improved appliances for screening sand, for burning lime, for mixing mortar, and for carrying the materials into the building. New forms of scaffolds are in use. Better tools are in the hands of workmen than formerly—all going to prove that in this age of progression and improvement, no industry can stand still. The incidental advantages to any trade from the developement of other parallel trades, are enough to carry it forward to a certain degree. In plastering we see substantial work done by inventers laboring for it alone, besides the advantages accruing to it from their efforts in other fields.

PLUMBING.

Syphon for Water Closet, with Effluvia Ejector.

We give two illustrations on this page of a new form of water-closet, with an effluvia ejector attachment. The closet is the invention of the manufacturer, Mr. William Smith, 21 Montgomery avenue, San Francisco, Cal. Its principle of action is peculiar. In emptying the basin, the contents are ejected from the basin without the use of valves or plungers, simply b~ the action head of water to operate the jets. This is necessary, because the jet and valves are all constructed to work with this pressure. The system is, however, susceptible of being operated with any pressure (provided it is constantly uniform), even as heavy as 200 feet head. In such a case the valve and jet would have to be very small and very strong, and the wear and tear upon it would be proportionally greater and its life would be shorter.

To attach a pressure of 50 feet to the valve as at present made, would make it difficult to operate the pull on account of the large area of valve face. It would also

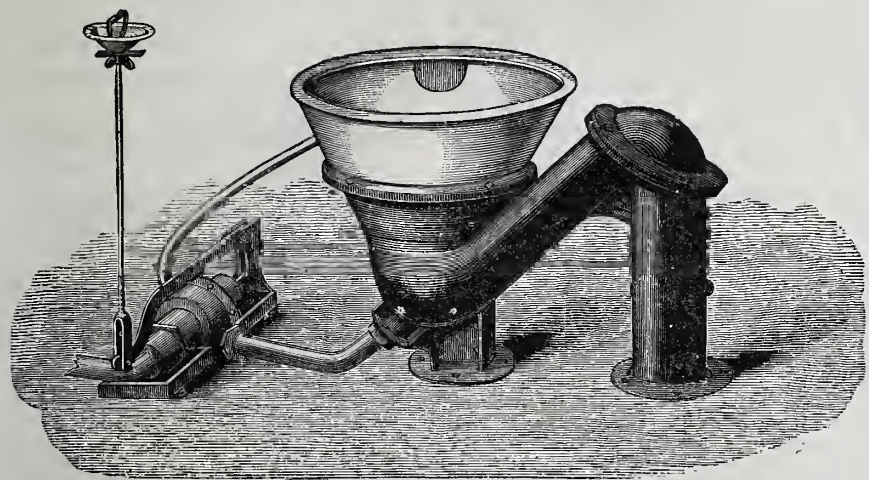


Fig. 1.—Syphon Jet Water-Closet—Earthenware Basin and Iron Bottom.

of a jet of water, upon the same principle that the ordinary injector acts. This closet is formed in the shape of an inverted syphon, in which the jet of water, with high velocity, is arranged at a proper angle, and forcibly ejects the contents of the basin into the soil pipe at each operation.

The valve is constructed in a peculiar manner, having one inlet and two outlets, by which the requisite flow is given to the ejecting jet, and afterward the requisite flush to fill the basin again. But a single movement of the handle is required. The closet has the advantage that it is not necessary to hold up the pull, or handle, for a definite period, as is commonly the case, a pull and instantaneous release being all that is necessary. In construction the valve is very simple. It is composed of a sliding plunger and retarding chamber. The plunger has ports on its sides, out of which, as it slowly advances into the retarding chamber, the water flows into the spaces partitioned off within the shell of the valve, to connect with the jet and basin alternately. The passage of sewer gas through the closet is prevented by reason of the unusual depth of water forming the seal, the "dip" of the syphon being 5 inches; and to force the seal it would be necessary to accumulate a pressure equal to 8 inches of water in the soil pipe, that being the hight of water in the basin when the level of the water is depressed sufficiently to allow the air to pass. In any event which might cause a vacuum in the pipe, and produce a tendency to syphon out, the syphon could not be emptied to the extent of having the closet unsealed, as the subsiding water retained in the ascending limb would always be sufficient to form a seal and exclude emanations from the sewer.

On account of the small area of surface exposed at the soil-pipe side of the syphon. and the distance and depth the gases would have to travel before passing the dip, it is not anticipated that there will be trouble from the fouling of the water in the syphon by sewer gases

The effluvia ejector shown in Fig. 2, consists of a container with a manifold spray of water, which, after the manner of a steam exhauster, produces a very strong current of air out of the bowl or basin, and sends off by a separate pipe and is conveyed to any suitable point of exit. The waste water from it drains into the soil pipe. The tank for supplying these closets is usually placed from 14 to 18 feet above the level of the closet, in order to obtain a perfectly uniform

overwash the basin and have a tendency to blow off the fan, and break the connection at the top of the closet at the bend where the jet strikes. It would also waste water without benefit, the surplus force being expended in destroying the closet.

The wash takes place first at the top of the basin, to wet down the paper and press it under water. The jet below then commences, and sweeps the entire contents of syphon and basin forward into the sewer. The upper wash then begins again and fills

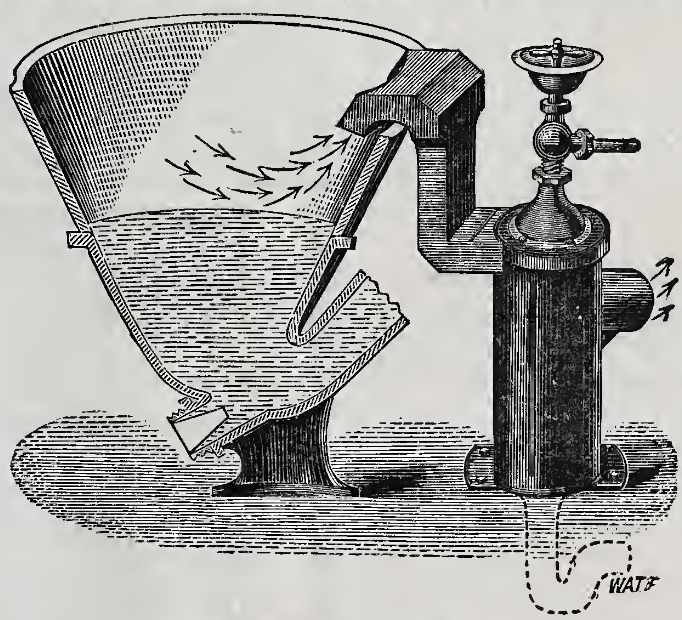


Fig. 2.—Effluvia Ejector Applied to a Closet.

the basin In order to prevent any chance of the escape of sewer gas when the flow is changing from the lower to the upper wash, the latter begins before the lower wash has entirely ceased, and while there is still a strong forward current into the sewer. If desirable, the handle can be held at half stroke, and the flow continued at the jet indefinitely, which action would give a continuous stream of air flowing into the soil pipe.

In regard to the condition of things when the tank is just becoming empty, and it is supposable that the closet might require extra attention, the inventor writes us as follows:

"The emptying of the tank invariably leaves the basin full of water, the closet being then minus the power to empty itself. Should the handle be arranged so as to designedly run off and empty the tank through the jet only, then the subsiding water from the tank and pipe is sufficient to fill and seal the syphon, after it has got low enough in the pipe to lack the requisite force to go over into the soil pipe. The scouring action of the jet is a very meritorious feature, in preventing the deposit of sedimentary matter that may be contained in the water."

He also says, in reply to a question: "The water and soil disappear much quicker than when descending by gravitation through a plug-valve or pan closet."

The water and soil discharged by the jet are not liable to produce syphoning in fixtures attached to the same line of pipes, because the contents of the bowl are not discharged in a solid body; the ascending leg of the trap or syphon, as it is called, is but 3 inches in diameter, while the bowl opening is 4 inches, as is also the soil pipe.

A draw-off cock can be placed between the jet and valve, which will (the handle being raised) draw off the entire contents of closet, valve and tank, leaving it in an absolutely non-freezing condition, if desired. This we should hardly think desirable, save in very exceptional cases, as that would practically leave the soil-pipe untrapped at a time when the tendency of the sewer gas to enter the house was the strongest. In the circulars which are sent out, the manufacturer gives very clear directions in regard to all points of setting, fitting and management of the closets. Fig. 1 shows an earthen bowl with an iron bottom; and Fig. 2, effluvia ejector applied to a closet. The closets are also made entirely of earthenware.

Drying Kiln.—In an English kiln for drying wood, the vapor arising from the evaporation of the sap is got rid of in the following ingenious way: A water-pipe of about two inches diameter, supplying cold water to the boilers, and always fully charged, enters the chamber at one end, and passes out at the other; but between its points of entrance and exit it is greatly amplified by being connected with what may be called three large gridirons of iron piping, of about the same diameter as that of the supply-pipe. Each gridiron consists of 15 vertical tubes, and through the whole system cold water passes continually. These pipes present a large area of cold surface; and on it the vapor arising from the drying wood condenses, falls to the bottom, and is drawn off and stored until a large quantity has been collected, when it is treated chemically to extract certain peculiar acids it contains.

A rampant hand-rail is eased by twisting its neck, and then horsing it to see if it rides well under the operation.

Artistic and Economical Decoration in Wood and Perforated Metal.

At the present time there is no branch of industry producing articles capable of decoration, in which there is not manifested a strong effort to give them pleasing form, or in some way to make them beautiful. In carpentry and cabinet work especially, there is a tendency in this direction. The day of common work, overloaded with machine-made moldings, is past, and there is a growing tendency toward better things.

During the past year a series of structures have been erected in New York city,

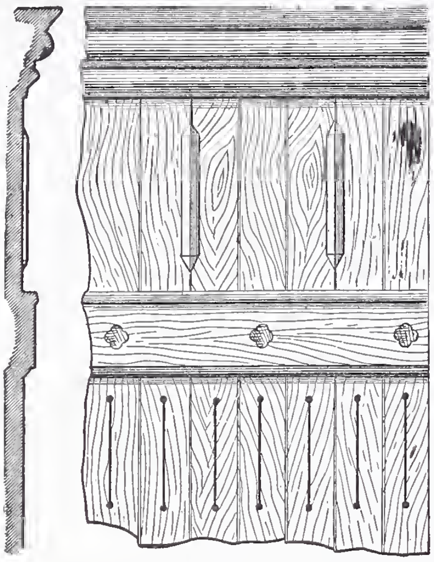


Fig. 1.

in connection with the lines of elevated railroad, which for beauty of outline, beauty of detail, and pleasingly simple and charming decoration, have not been surpassed. Nor has the treatment of the cars on the various lines been inferior to that of the depots. In most of the work of both depots and cars there has been close adherence to principles, which, until within a very short period, have been sadly neglected in all similar work. The designers of the depots and of most of the cars are among the first men of the country in their particular branches of business, and the work which they have done is exceptionally good. Economy of labor and of the means employed have been kept in mind throughout. In the accompanying engravings we give a few examples of the methods employed, showing how good effects in decoration have been secured by simple means, and with small expenditure of time and material.

In looking about the waiting rooms of the Metropolitan or Sixth avenue line, one of the first things that strikes the attention is the means employed for relieving the effect of blank walls. The general construction of the buildings is iron, and the interior finish is wood, the walls being cased with narrow matched stuff, and the ceiling formed of the same, fastened directly to the rafters carrying the roofs. Some eighteen inches or two feet below the ceiling line, a strip of board about eight inches in width is carried all the way around the room, being planted directly on to the face of the wall. This is beveled upon its edges and perforated with quarter-foil openings, as shown in Figs. 1 and 2. While this feature in the treatment of the walls is very nearly uniform in all the depots of this road, the detail of the other parts has been treated with a pleasing variation, as may be seen by comparing Fig. 1 and Fig. 2. In some of the depots, above the horizontal band formed by the board we have just described, short strips of moldings are tacked upon the joints of the wall, as shown in Fig. 1. Below the band each board is engraved with a half-round groove, terminating at top and bottom with a shallow, round depression, as shown. In other depots, as shown in Fig. 2, the joints above the band are ornamented by a chamfer-groove, which in the final finish is colored darker than the surrounding wood. The boards below are engraved similarly to those just described, but without the shallow, round depression at the bottom. It will be noticed, further, that the distribution of the quarter-foil perforations is not the same, and that the cornices are different.

In Fig. 6 is shown the elevation of the doors in one of the depots of the Third Avenue line. It illustrates a simple method by which a door may be enriched. A simple carved molding is run along the under side of the middle rail over the panel. A detail of it is shown in Fig. 5. Both style and mullion are chamfered upon their edges, so that no molding is needed save at the top and bottom. The carving of the molding, as will be seen by examination of the detail, is of the simplest description, consisting of nothing more than a V-shaped tooth, relieved by a small dot. It is evident that very little labor was expended in producing this shape, yet the effect of the door is much richer and more pleasing than the ordinary machine-made door, upon which moldings of all sorts and of the most complex forms are used. Another and still simpler form of this molding is shown in Fig. 8, in which the teeth, instead of being an inch or an inch and a-half from point to point, are spaced to fall upon the joints between the pieces of matched stuff, of which a partition is made.

In the framing which is to hold a panel, instead of a mitered molding being employed, it is noticeable, especially in the best samples of workmanship in the cars, that a molding with square joints is commonly put in at the top and bottom of the panels against the rails, while the edges of the styles are chamfered, and a treble or quadruple bead is run along near the edge. This beading usually stops where it reaches the rail. In some cases, however, as shown in Fig. 7, the vertical beading comes down nearly to the bottom, and is terminated by a similar form which intercepts it at right angles. Nothing can be simpler in appearance, and, although this feature is not quite so simple as it looks, it is by no means difficult of execution.

In some of the cars on the Metropolitan line there are examples of neat treatment for the tops of windows, one of which is illustrated in Fig. 3. The woodwork forms a cornice, beneath which a curtain (not shown in the engraving) is hung after the fashion of a lambrequin. A detail of this cornice to larger scale is shown in Fig. 4. The "scallops" are about three-quarters of an inch in breadth, and are sawn in the edge of the piece forming the top of the window cornice. Upon the face is worked a band, consisting of two beads similar to those already described. The section at the left shows

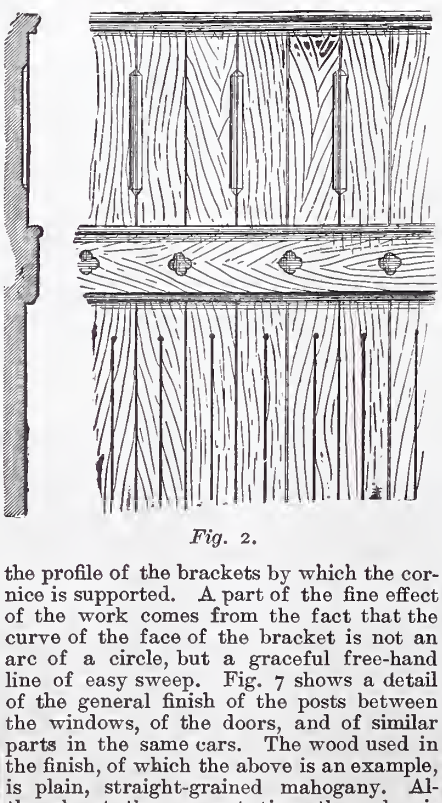


Fig. 2.

the profile of the brackets by which the cornice is supported. A part of the fine effect of the work comes from the fact that the curve of the face of the bracket is not an arc of a circle, but a graceful free-hand line of easy sweep. Fig. 7 shows a detail of the general finish of the posts between the windows, of the doors, and of similar parts in the same cars. The wood used in the finish, of which the above is an example, is plain, straight-grained mahogany. Although at the present time the color is rather light and raw, the effect of age will be to darken it and render it very rich.

(To be Continued.)

Roofing Materials.

Of the various meterials used as roof coverings, some few give good results in all respects, and are therefore satisfactory, while some are so nearly worthless as to cause perpetual annoyance wherever employed. A good roof, next to a good foundation, may be declared the most important consideration in building. What shall the building be roofed with? is a question that occurs in the construction of buildings of every kind, from the poorest to the best,

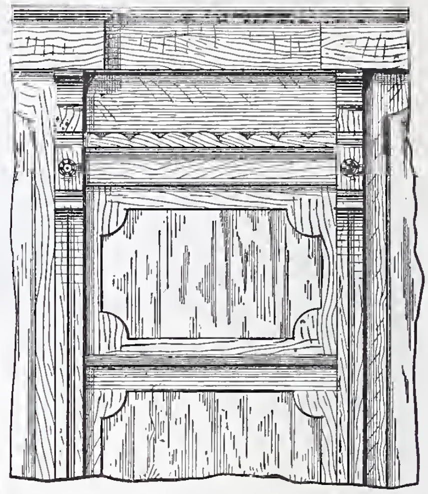


Fig. 3.

and the number of imperfect roofs, in the knowledge of every one, produces the impression that a good roof is quite rare. Good roofs need no attention, and are therefore seldom mentioned; while poor roofs, requiring constant repairs, are a fruitful source of complaint, and their existence is continually advertised.

It is not our purpose at this time to enter into an exhaustive argument concerning roofing materials. We prefer to present the subject in a general way, as introductory to more practical discussions upon specific items in succeeding issues. We shall content ourselves at present with mentioning some of the principal characteristics of the more prominent roof-coverings in common use, calling attention only, in the most general way, to the relative advantages and disadvantages of their employment. There are two leading considerations which are taken into account in deciding upon a roofing material. The first is its cost, and the second is its durability. In deciding upon the first, the cost of the mere covering is but a part of the consideration; the relative strength required in the roof framing, as between competing materials, is frequently a larger item than the cost of the covering, and accordingly the expense in this particular alone often decides the question.

The roof coverings upon modern buildings may be comprised in a very few general classes. There are wooden roofs, composition roofs, metal roofs, and slate and tile roofs in general use. Of the first class, embracing shingle roofs and all other forms of wooden roofs, there is very little to be said of special interest. While wooden roofs appear to be quite appropriate for wooden buildings, the fact that the better class of wooden buildings in very many cases employ either slate or metal coverings, goes to prove that the wooden roof lacks the elements which would render it entirely desirable. Good shingles well laid, and especially if protected by a coating of good mineral paint, form a roof covering which is comparatively durable, but as some forms of metal roofs and slate roofs far excel it in this important particular, the shingle roof is employed only on buildings of the cheapest character.

In the second class, which we have designated as composition roofs, we include two general kinds—the one being those roof coverings the essential features of which are a fabric or paper saturated with tar and covered with sand or gravel, and the other consisting of a fabric or paper treated with a material which is supposed to resist the action of sun, rain and frost. We believe it may be said with truth that the roofs of this class, except in very rare cases, have no intrinsic merits to warrant their use. They have held their place before the building public from time out of mind, only upon the basis of their cheap first cost and their great availability. Roofs of this class, not to condemn them with unreasonable severity,

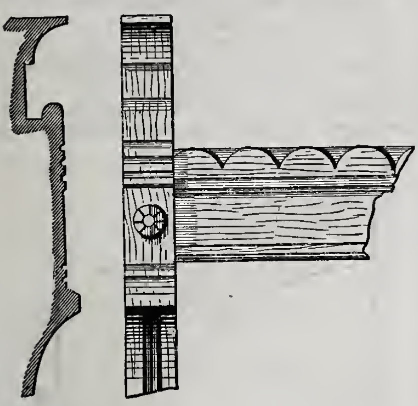


Fig. 4.

nor yet to admit altogether what enthusiastic manufacturers claim for them, have undoubtedly served a very good purpose for use upon buildings of a temporary character. But what can we say favorably of their employment upon buildings of the better class, apon handsome residences, and upon expensive store buildings? The policy which expends proportionately more money in the decoration and embellishment of a structure than upon its protection from the elements, is ever to be condemned. A list of the materials which form the ingredients of composition roofs, is a matter of more than passing curiosity. In the search for a good roof that shall be inexpensive, men have made use of many strange combinations and mixtures. Gutta-percha, pulverized clay, rice, red-lead, gypsum, salt, pulverized brick, resin, shellac, linseed oil, asphaltum, white-lead, pulverized slate, Japan varnish and mineral paint, with many others, go to make up the assortment of materials from which different compositions have been formed. Many of the mixtures devised have been made the subject of patents. Some have been quite extensively introduced, but none have secured an enduring popularity.

Of metal roofs, lead, zinc and copper, although extensively used in other countries, are practically out of the market here, on account of their greater cost in comparison with tin, slate, &c. Each of these materials possesses qualities for roofing purposes pecu liar to itself, and each has warm friends and decided opponents among the building classes. Zinc has been considered a failure

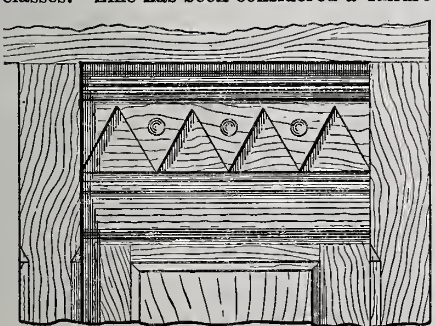


Fig. 5.

in this country, attributablo to the climate, &c. We are disposed to consider this a mistake, and to lay the responsibility for poor and unsatisfactory zinc roofs altogether to the thickness of the metal used and the character of the workmanship. Zinc roofs, so far as the attempt has been made to use them in this country, have been laid in competition with tin and iron roofs; whereas the cost of a zinc roof, using an amount of metal, and the character of workmanship to make it perfect, would put it so far above these materials that competition between it and them would be out of the question entirely. We believe we are correct therefore in saying that zinc, as well as lead and copper, is not in more general use solely on account of cost. Of the metal roofs commonly employed, tin is perhaps in most extensive demand, and is probably better known than any other. The merits of a tin roof depend upon its qualities in several particulars. There is the question of the iron in the body of the sheet; the kind and thickness of the coating on the sheet; the character of the seams and joints employed in laying the roof; and last, but not least, the character of workmanship in the operations of seaming, soldering and finishing. In general terms, good material and workmanship, and favorable conditions with regard to pitch, valleys, &c., render a roof covered with tin about as satisfactory as any material used. Like every other, it may be grossly abused, and in the mind of each reader of this article, no doubt instances of faulty tin roofs at once occur; but it is to be borne in mind that good roofs give so little cause for remark, that they exist on all sides of us without our attention being called to them.

Another class of metal roofs in common use, particularly for the past few years, are the iron roofs. A considerable portion of these roofs consist of sheets of common black iron, say 30 x 96 inches in size, of ordinary thickness, protected from the weather action only by a coating of paint. The essential difference between the various claimants to popular favor lies in the character of the

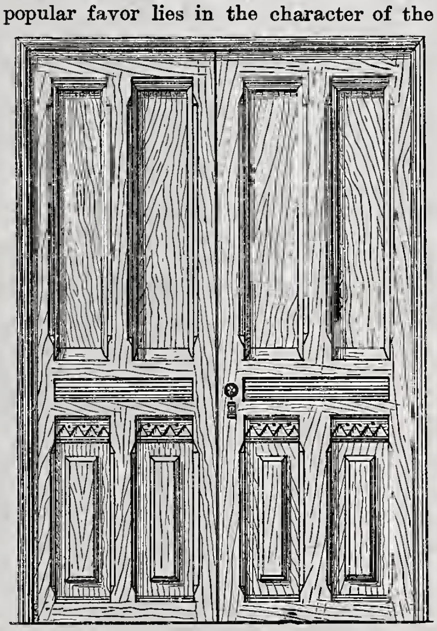


Fig. 6.

seams and joints used between the sheets. A few of them employ a single crimp or corrugation down the center of each sheet, but most of them are entirely plain. Their introduction was commenced at a time when tin was very much higher in price than at present, and it was with that material that iron roofs were placed in competition. The great saving in the labor of laying, as well as the cheaper cost of the material, gave a great impetus to the trade, and the fact was soon recognized that a good iron roof was quite as durable as a poor tin one, and somewhat cheaper. Black iron protected by paint cannot, by the nature of things, form a roof of permanent durability, and we fail to see any good reason for the employment of this kind of iron roofs, save the fact of economy of first cost.

Galvanized iron has never been extensively used as a roofing material, because of its high price in comparison with others. The various styles of iron roofs just referred to above are all adapted to the use of galvanized iron, and roofs are made to order of this material, as occasion requires, with fair results. Corrugated sheets, both of black iron painted and of galvanized iron, have been largely employed in the roofing of warehouses, railway depots, mills, &c. Roofs of this character, however, are not adapted to general use, and accordingly, corrugated iron is not a material to be considered for dwellings and other buildings of moderate cost, for ordinary purposes. Metal shingles or metal tile have been before the public in one shape and another for a long time without coming into general use. Their cost is above that of a roof composed of large sheets of the same quality and grade of material, while greater pitch is required for their successful use.

The last class to which we shall refer at this time, is that comprising roofs covered with slate and earthen tile. Of the latter, the introduction into general use in this

Fig 7.

country has been so recent, that data has not been obtained as yet to enable us to form a satisfactory opinion. We know of some very acceptable roofs of this character, and we know of some quite the reverse. We have in mind one which, while not being satisfactory in the usual essentials of a roof, cost probably three times as much as slate would have cost in the same place. Slate roofs, while requiring greater pitch and slightly heavier framing than some other materials, are commonly regarded as the best and most satisfactory roofs that can be laid in this country. Slate roofs, as well as others, may be spoiled in the laying, but the material itself being practically indestructible, the principal consideration in its use is the workmanship employed.

Finally, it may be said that, under certain circumstances and from certain standpoints, strong objections can be made to the employment of every roofing material that is in use; and, on the other hand, that under favorable conditions a good roof can be made from almost any material ever employed for the purpose. With these facts in mind, and remembering also the strong prejudices common to mankind for and against whatever they may have to do with, we hope to be able to conduct in these columns a discussion of the merits and demerits of special roofs, considering the questions of the qualities and dimensions of materials, degree of pitch, relative exposure, gutter connections, general durability, and

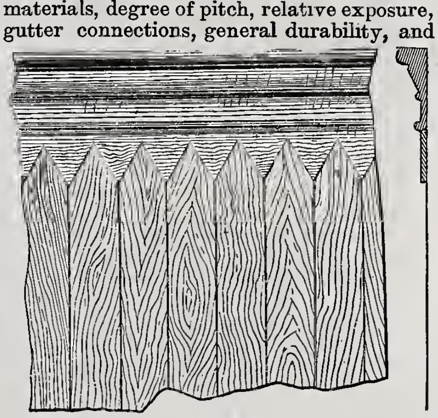


Fig. 8.

the workmanship of making and laying, in a manner which shall be fair toward all and with injustice toward none.

Black Walnut Stain. — Ashphaltum, thinned with turpentine, will stain a beautiful black walnut color. It must be varnished over.

It is strange that dishonest plumbers should be always taking the "lead" in buildings; and though often sent upon the roof to work, are generally found "laying" in the gutter.

DRAFTING.

Problems in Geometrical Drawing.

After the various tools and appliances for drafting have been obtained, and the mechanic has got ready to make use of them, no matter in what line he is working there will arise in his mind the question of how best to put upon paper the necessary lines to represent the subject of his study. The question may take the form of how to draw a certain geometrical figure, or it may be how to divide a given line into required parts. It may be how to subdivide an angle, or how to draw a curve, or how to find the center of a given circle. Some problems of this nature that will naturally arise in his mind are so simple as to warrant them being called self-evident. With a pair of compasses in hand, it requires no instruction to enable the student to draw a circle, and with an accurate drawing-board and a T-square, any one can lay out a rectangle to required dimensions. Other problems, however, come up very frequently, in the solution of which some instruction is desirable. In some cases there are several methods of arriving at the same result, one of which, for some

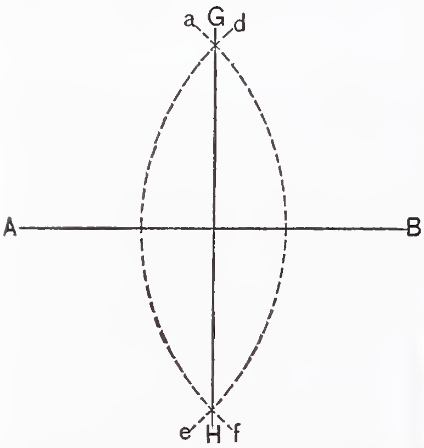


Fig. 1.—Bisecting a Straight Line.

reason, is better than the others. Again, in the solution of some problems, the application of a principle, to be learned only in the study of the higher branches of mathematics, renders the task quite plain and simple. It is hardly possible, in the space that can be devoted to this subject, to give an exhaustive treatise on geometrical drawing that would be satisfactory to all of the various classes for which this journal is intended. We can only point out a few of the leading problems that are certain to be of general usefulness to our readers; perhaps call attention, from time to time, to new applications of principles; and must refer the student for further information, and for a systematic presentation of the subject, to some good text book on geometrical drawings.

To bisect a given straight line—that is, to divide it into two equal parts—may be done by actual measurement of the line, either

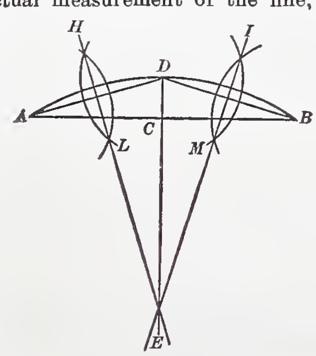


Fig. 2.—Finding the Center by means of Chords.

by the use of a rule or by spacing it off with the dividers. But in the operation of drawing, a better method, and the one commonly employed by draftsmen, is as shown in Fig. 1 of the accompanying illustrations. Let A B represent the given line, which it is required to bisect. With one foot of the dividers set on A, and with a radius greater than the half of A B, strike the arc *a e*, as shown by the dotted lines; and with one foot of the dividers set on B, and with the same radius, strike the arc *d f*, as shown. The line G H, drawn through the points of intersection of these two arcs, will bisect the line A B.

A practical application of the rule just

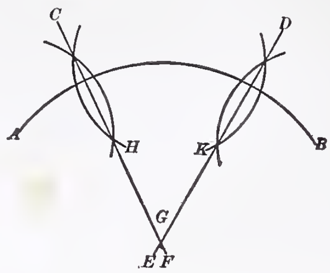


Fig. 3.—Finding the Center by which a Given Arc is Struck.

given is shown in Fig. 2. Suppose A D B to represent any segment of a circle—as the head of a window frame or the templet of an arch—and that it is desirable to find the center by which the arc bounding the curved side may be struck. Bisect the chord A B, drawing the perpendicular line D E through it at the central point C. Draw the chord D B, which bisect as shown, and draw the line I E. The point of intersection of this line with the line D E will be the center from which the arc A D B may be struck. Our engraving shows the operation of bisecting the short chord repeated on the opposite side. But, as is obvious, this is unnecessary. A line bisecting the chord of one side, and cutting the center line D E, is all that is required; or by using both short chords and the lines H E and I E, the center line may be dispensed with.

In Fig. 2 we have found the center of a circle by the principle of bisecting two chords of that circle. It is evident, however, upon inspection that the chords may be dispensed with. In Fig. 3 is shown the

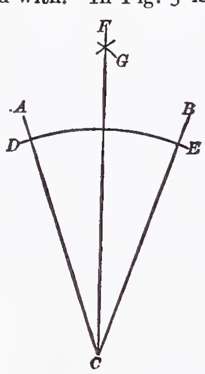


Fig. 4.—Bisecting an Angle.

method of finding the center of a circle without the use of chords. With the dividers set successively at A and B, and with any convenient radius, strike the arcs as shown. From points near the center of the curve, and with the same radius, strike corresponding arcs, intersecting the first. Through the points of intersection draw the lines C F and D E, meeting at the point G, which is the center of the circle of which the arc A B is a part.

In drawings for various purposes, it is

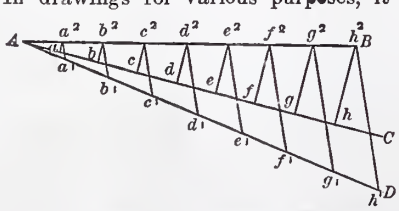


Fig. 5.—Dividing a Straight Line into any Number of Equal Parts.

frequently required to bisect an angle. A method of doing this is shown in Fig. 4. Let A C B represent any angle which it is desired to bisect. With C as a center, and with any convenient radius less than C A, strike the arc D E. With D and E as centers, and with a radius greater than one-half of D E, strike the intersecting arcs, as shown at G. A line drawn through the point of intersection to the vertex of the angle, as F C, will bisect the angle.

A method of dividing a given line into any required number of equal parts is shown in Fig. 5. Let A B be the given line, and suppose that eight equal divisions of it are necessary. From one extremity of the line, as at A, draw a second line, as A C or A D, oblique to it. Set the dividers to any convenient width, and step off on the oblique line, as A C, eight spaces, as shown by *a*, *b*, *c*, &c. From the last of the divisions thus made draw a line to the end of the given line, as shown by *h* B, and parallel to it draw other lines from each of the other points to the given line. The divisions thus obtained and

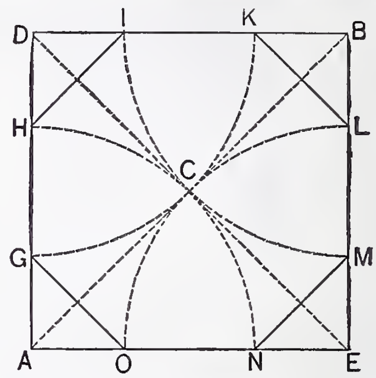


Fig. 6.—Drawing an Octagon in a Given Square.

indicated by a^2, b^2, c^2, &c., will be the desired spaces in the given line. It is immaterial whether the spaces stepped off on the oblique line are, in total, more or less than the given line. By inspection of the cut it will be seen that in A C the length is less than in the given line, while in A D it is greater. Each, however, produces the same result upon A B.

One of the commonest occurring plane figures, after the circle and the square, is the octagon. A ready means of projecting it is shown in Fig. 6. Draw the square A D B E of a size to correspond with the required octagon, as shown. Draw the diagonal lines D E and B A. With the several corners of the square as centers, and with a radius equal to one-half the length of a diagonal, strike the arcs H N, I M, K G and L O. Connect the extremities of these arcs by the lines H I, K L, M N and O G, thus completing the figure, as shown.

A convenient rule for describing within a circle any regular polygon is shown in Fig. 7. Through the given circle, and at right angles to each other, draw two diameters, as shown by E F and D G. Divide the diameter E F into the same number of equal parts as the required polygon is to have sides; in this case 11. Divide one-half the second diameter G D, or what is the same, the radius K D, into four equal parts.

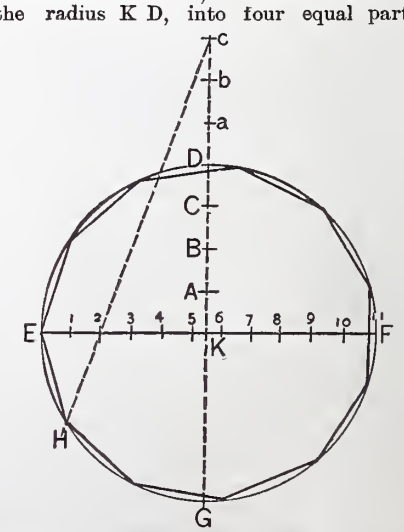


Fig. 7.—To Describe any Regular Polygon Within a Given Circle.

Prolong the line K D to the extent of three of these parts, as shown by *a b c* in the engraving. From the extremity of this radius prolonged, or from the point *c*, through the second of the divisions in the diameter E F, draw the line *c* H, extending it until it cuts the circle. Then the distance from H to E will be equal to one side of the required polygon. By the same rule any other regular polygon may be drawn within a circle, the diameter E F being spaced each time into the same number of equal parts as the figure is to have sides. Proceed in all other respects the same as in the example here given. The triangle will have the line H *c* drawn through the first division apparently, but it will be found that the side will be from H to F instead of H to E. If the student tries this rule upon the square, he will find that the line H *c* will coincide with *c* G, thus giving by the rule a side equal to G E, which by inspection is found to be correct.

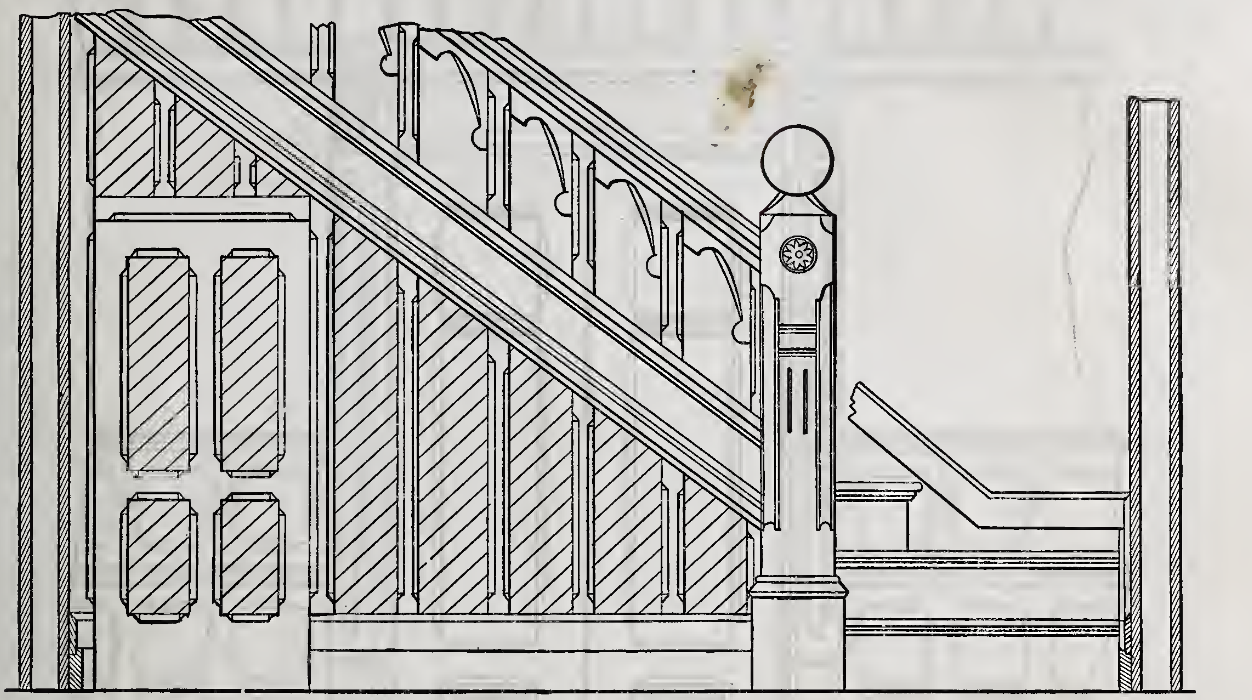


Fig. 1.—Staircase—Scale, ½-inch to 1 foot.

The Famous Woodworth and Woodbury Patent Suit.

People who are now middle-aged, remember to have heard of the Woodworth and Woodbury patent case when they were boys. Judges long since dead have given it the benefit of their legal learning. Lawyers now no more have appeared for plaintiff or defendant. Scores of witnesses who have testified in it have departed, to be sworn and examined and cross-examined no more. Thirty years have gone by since the litigation began; and now Judge Lowell, in the Circuit Court in Boston, has decided, as was stated in our February issue, that Woodbury's improvement in the Woodworth planing-machine was not patentable, the invention of flat bars to keep the stock firm having been anticipated. This late decision will bring relief to the minds of thousands of owners of planing-machines built upon Woodbury's plan, and put a stop at once to the collection of royalties upon it. Woodbury himself is dead, and his patent was held by a corporation.

It would satisfy a rational curiosity to know how much money has been expended in prosecuting and defending these planing-machine suits. The most distinguished and expensive lawyers have been engaged in them. The bills of cost must have been enormous, but these were nothing to the expenses not included in the category of legal costs. At the trials numerous witnesses were usually inattendance, and were supported by either party in handsome style. As a mere matter of money the stake played for was a large one; the machines were dispersed all over the country, and hundreds using them felt a personal interest in the suits. Several of the trials were before Mr. Justice Sprague, in Boston, and there are those who still remember his wonderful feats of memory. He took no notes of the evidence, which was often intricate and scientific, but when he came to charge the jury it was found that he remembered it all. Indeed, it was never safe for the lawyers to presume upon his forgetting the smallest detail. If they misrepresented the slightest particular, they heard from him at once.

Who would be an inventor? This is a question which any man who dislikes trouble, and keenly feels the hope deferred which maketh the heart sick, may well ask himself. There are quite as many suggestions of tragedy in the Patent Office as in any other department of the government. But there is nothing inexplicable in the litigations, prolonged and expensive, to which inventions give rise. The question of priority is not always easy to settle, especially in the matter of scientific discoveries. It is natural that there should be doubt, when many clever minds have been seeking to supply a single acknowledged want.

Fig. 2.—Chamber Mantel—Scale, ½-inch to 1 foot.

New Method of Dressing Stone.

The Edinburgh *Daily Review* calls attention to an invention of W. H. Thomson, of that city, for stone dressing, or the working of stone moldings. Various attempts have been made to supersede the primitive methods of working in stone. The inventors would seem to have worked upon wrong lines. Expensive steel cutters, made to the shape of the moldings, were fitted to powerful machinery, and under them the stone to be worked was passed to and fro. As soon as they commenced action the tools were found to lose their cutting edge and grind out of shape, with the result that the molding could not be formed. Observing the weakness of this complicated tool, Mr. Thomson set to work to devise a machine which would have a simple tool, and form the molding by some independent motion that could not be affected by coming in contact with a stone. It was intended to operate upon the stone by a circular saw set with black diamonds; but Mr. Thomson has recently patented, and is experimenting with, a new and cheap tool formed of a novel composition. A circular thin saw, composed of this new material, will be guided in its movements by a cast-iron enveloping form, working, in conjunction with suitable machinery, in such a manner that at the termination of each cut the saw is alternately moved or fed until the molding is completely formed. Thus moldings of all sizes and characters are worked by one and the same saw or tool; and as one developing form produces moldings of any size, only one simple cast-iron form is necessary for each distinct pattern or character of molding. Again, there being practically no wear on those cast-iron developing forms, no matter how great a quantity of moldings are worked, there will not be the slightest degree of variation. Another advantage obtained by forming all sizes from one development is, that the whole of the moldings are increased or diminished in size to a true scale, and these developing forms may be set out so as to produce the various members of a molding with care and precision. With such a machine—which may appear more complicated in its description than it is in its reality—there is the prospect of working stone on more economical and expeditious principles than have hitherto prevailed. There seems no reason why the example set by those engaged in the wood trade should not be followed out in masonry. The *Review* seems to think that, with a little enterprise and such a system of machinery as this set to work at the quarries, moldings, door porches, columns, &c, might be turned out and become staple articles of commerce, to be bought at the various local depots of the companies who manufacture them, and sent thence to the building site.

Polishing Brass.—For polishing brass, rub the surface with rotten-stone and sweet oil, then rub off with cotton flannel, and polish with soft leather. A solution of oxalic acid rubbed over tarnished brass soon renders the metal bright. Wash off the acid with water, and rub the brass with whiting and soft leather.

Household Taste.

A recent English paper, in an article upon this subject, presents it in a way entirely applicable to American houses.

The improvement which the last few years have witnessed in household taste—that is, in general decorative and upholstery work—is too palpable to be ignored by any but the willfully blind. Our carpets, our upholstery, our paper-hangings, aye, and our furniture of to-day, have very little in common with similar articles patronized, say, a dozen years ago. Under the influence of better standards and more general art teaching, the taste of our countrymen has much improved, so that, broadly speaking, the furniture patronized by the wealthy classes is more genuine, and the decoration of their houses more truthful, than in times past. The pomegranate wall-papers, the dainty crewel-work, the Lambeth pottery, the Persian tiles, the solid upholstery, the exquisite textile fabrics which so lately formed the peculiar property of an æsthetic clique, have now filtered through to all the well-to-do classes—a little thinned out and vulgarized, doubtless, in the filtering process, but still retaining much of their primitive beauty. Our views on this subject are echoed by a contemporary, who says that we are now in full sight of that first stage toward an artistic millennium which Mr. Ruskin and other vigorous preachers have long been dinning into heedless ears. What we want, they tell us in language sometimes unnecessarily vehement, is better jugs and basins, better pipkins, better table-covers and better floor-cloths. No nation will ever rise to the proper appreciation of Fra Angelico or Paul Veronese, unless it has first been educated upon good soup tureens and well-harmonized dessert plates. You can get no high æsthetic sentiments out of people whose taste has been systematically vitiated by staring rose-bunch wall papers and gaudy theatrical vases. But what Mr. Ruskin preached, Mr. Morris and his coadjutors have put into practice; and if it be true that he who proves discovers, then we may also say that he who practices revolutionizes.

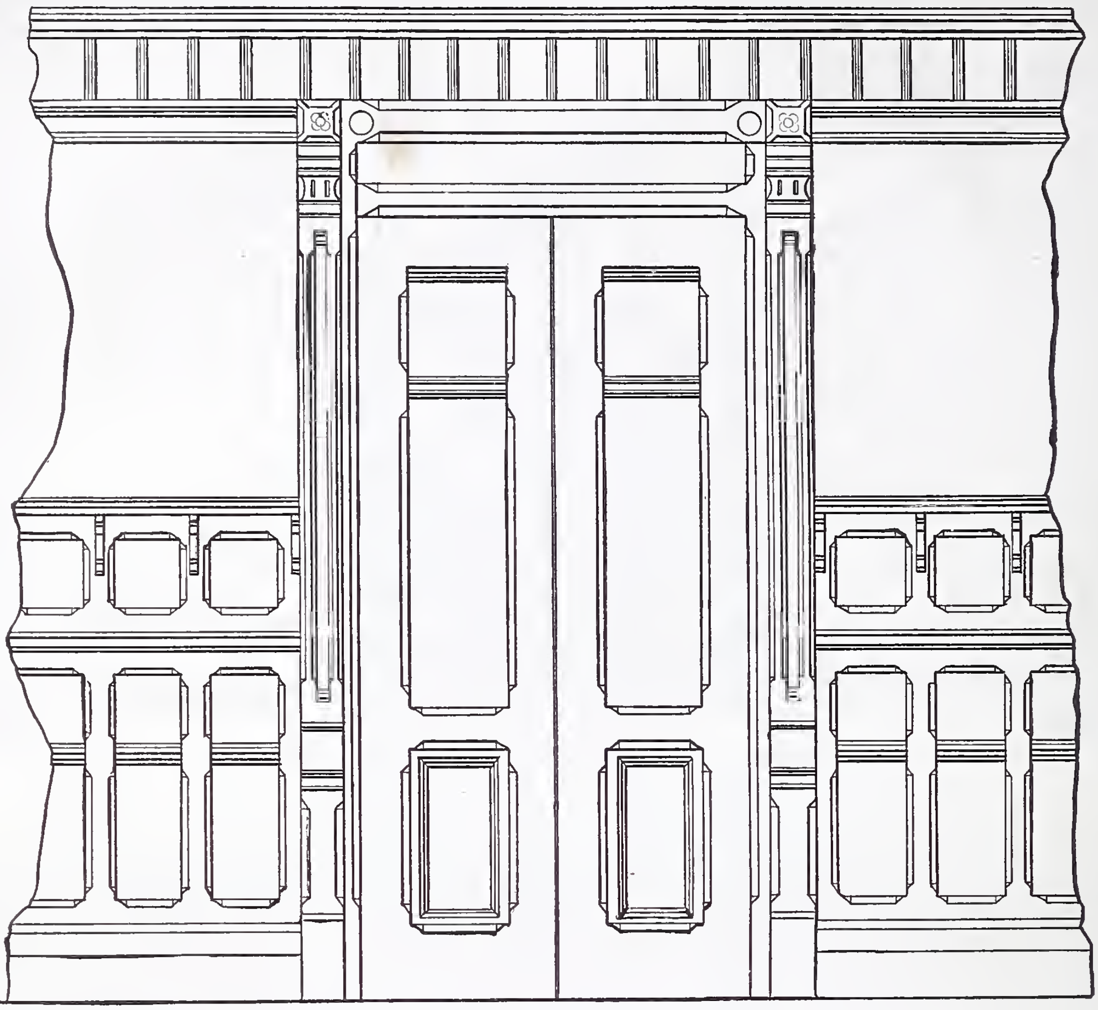


Fig. 3.—Door, Wainscoting and Cornice in Hall—Scale, ½-inch to 1 foot.

The chief danger of the æsthetic revival is that of mere vulgar fashion. A great many people, who have no eyes to see the really good points of the new school, are sure to adopt it to the best of their lights, because they see it patronized by those whose lead they are accustomed to follow. Already we meet with sad signs of this evil result in the appearance of spurious and shoddy imitations of the artistic fabrics and designs. No sooner had fashion stamped with its approval the new crewel-work of the South Kensington model—somewhat flat in its character, perhaps; a little wanting in verve and originality; bearing rather the stamp of a school than the stamp of an individual feeling; but still a blessed release from the old Berlin wool-work, with its patchy mosaic flowers and its monstrous cats and dogs—than the British manufacturer forthwith began to turn out machine-made imitations, with all the reality sacrificed to cheapness and ease of production. No sooner had artistic hand-made pottery begun to appear in the windows of a few tasteful decorators, than the common earthenware started on its course of debasing and vulgarizing their designs, by reproducing their most salient features in bad moldings and crudely-assorted hues. The central idea of the æsthetic revival is genuineness and personal artistic feeling. The imitators copy it in false materials and by mechanical processes. A house furnished by a man of individual taste will bear the impress of his individuality; it will not be a mere blind collection of the good things made by this and that famous decorator, but an harmonious whole, assorted into consonance with the ideal of its owner. Whereas a house furnished under the sole direction of fashion will be nothing more than an undigested museum, often made up of shoddy in the worst of all disguises, pretending to represent unvarnished truth.

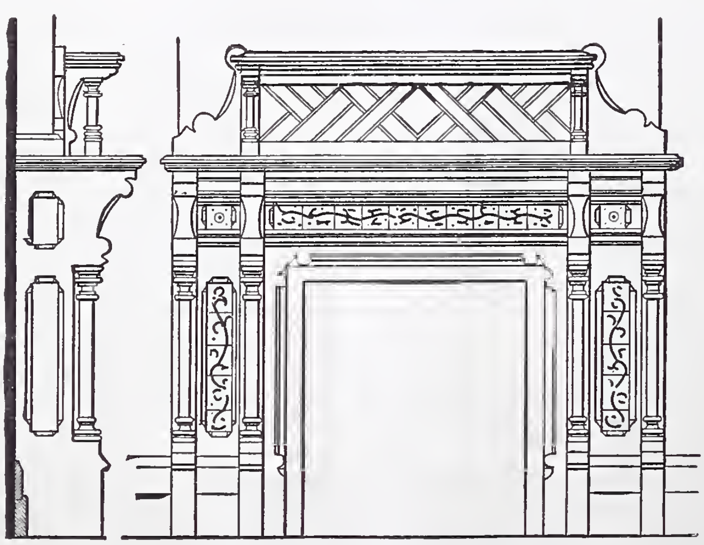


Fig. 4.—Parlor Mantel—Scale ½-inch to 1 foot.

Yet, in spite of the danger from ignorant imitation, and in spite of the ridicule brought upon it by extravagant excesses, the æsthetic regeneration is a fact, and a fact of great and far-reaching conse-

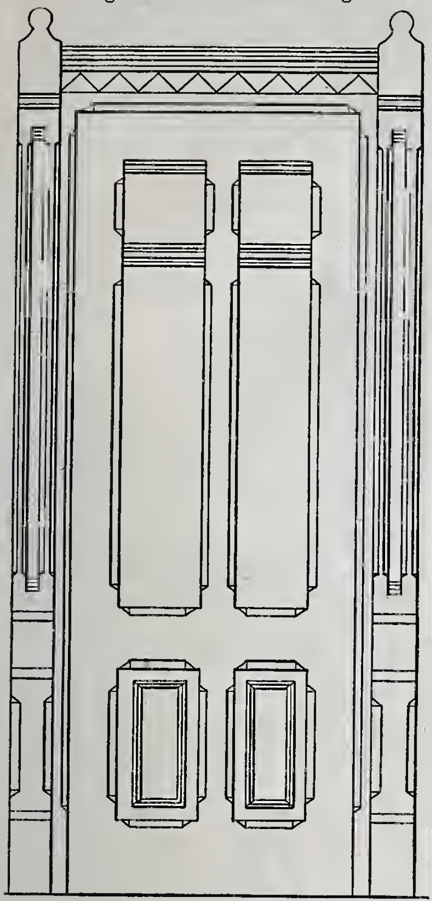


Fig. 5.—Principal Doors, First Story—Scale, ½-inch to 1 foot.

quences. We may be sure that it will live down the vulger copyists, and spread its refining influence slowly through all ranks of society. At first the utter Philistine will snugly compliment himself that his plaster and his compressed sawdust look just as well as real pottery and solid carved oak. But in the end he will gradually discover that people of taste take no notice of his pretentious rubbish, while they praise the simple reality of his neighbor's plain woodwork and pretty textile coverings. So he will dimly realize at last the futility of his attempt to buy æsthetic culture as he buys old wines, and will set himself to work in the right path by understanding the elementary principles of art before he tries to apply them.

ARCHITECTURE.

Details of Interior Woodwork.

In the January number of *Carpentry and Building* we gave elevations and plans of a stone and frame country villa, designed by, and recently erected under the supervision of, Arthur B. Jennings, architect, of New York. In the accompanying illustrations we show some of the interior woodwork which was used in the finish of this building. Our selections have been made with a view to presenting builders with something of good design adapted to their needs, rather than to illustrate the finish of this particular building. We have purposely omitted illustrations of some striking features in the house, selecting instead more common work, as being of greater service to our readers.

In Fig. 1 is shown an elevation of the staircase, the general features of which are clearly seen in our engraving. By reference to the first-floor plan in the January number, it will be seen that the hall in which this staircase was placed (E) is quite narrow. In order to give the appearance of greater space, the skirting below the line of stairs, instead of being placed flush with the front, is set back about half the depth of the stairs; the effect of this is quite satisfactory. The newel and balusters are of ash, and the hand-rail of walnut. All the parts and shapes are of the simplest kind, yet the whole presents a very neat and, withal, rich appearance.

In Fig. 3 is shown the finish of the hall, consisting of a view of the door, wainscot and cornice. The cornice is put up on a slant. The wainscot consists of simple parts. The detail of the door is very similar to that of the other doors and windows, and is better shown in the sections to larger scale, Figs. 12 and 14. The walls and ceilings of the hall are plastered. Wooden centerpieces of appropriate design, corresponding to the cornice and wainscot, are used in connection with the gas fixtures.

In Figs. 2 and 4 are shown two of the mantels which were employed in the finish of this house. In Fig. 15 is seen an enlarged section of the chamber mantel shown in Fig. 2, and which exhibits the parts so clearly that extended description seems unnecessary. The parlor mantel (Fig. 4) is finished with tile, of neat and appropriate figures, but which in our engraving are indicated by a simple scroll. The side elevation of the parlor mantel clearly presents its parts and construction.

Figs. 5 and 7 show the doors as used throughout the first and second stories, the general features of which are clearly presented in these engravings, but which are also in part shown in the enlarged sections, Figs. 12 and 14. The outside door (principal entrance) is shown in Fig. 6, one-half exhibiting the inside finish and the other the outside finish of the door. Enlarged sections of this door are shown in Fig. 13, which clearly exhibits the construction employed.

The general features of the windows are shown in Figs. 8, 9 and 10, and which are also further illustrated by the enlarged sections, Figs. 12 and 14. It will be noticed that a similarity of detail exists throughout these several designs, and yet a pleasing variety is maintained.

The sideboard which was built in the dining-room, and the dining-room wainscot, are given in Fig. 11. Tiles of appropriate design are employed in the panels of the sideboard. The patterns selected were representations of birds, and are hand-painted in bright colors. The general

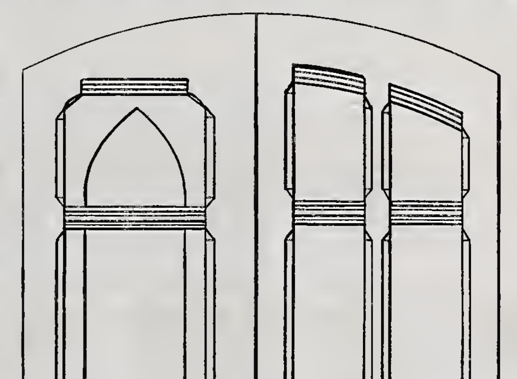


Fig. 6.—Front Door—Scale, ½-inch to 1 foot.

finish of the dining-room, including this sideboard and wainscot, is in chestnut. Each room in the house has its own particular and appropriate wood. The hall is in ash, the parlor in black walnut, and the dining-room in chestnut, and each room is fitted in a different manner.

The enlarged sections shown in Figs. 12, 13, 14 and 15 are so clearly defined in all

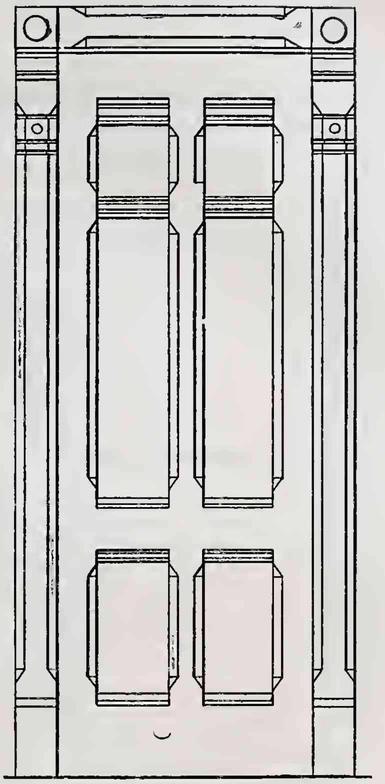


Fig. 7.—Second Story Door—Scale, ½-inch to 1 foot.

their parts as to require no further description. The entire series, as our readers will perceive, is constructed of the simplest forms, and yet the effect of the work in position is good. We feel certain that judicious use of the designs here presented will be found entirely satisfactory, in whatever connection they are employed.

CORRESPONDENCE.

To Our Readers.

We take this method of acknowledging a large number of letters from our readers in various sections of the country, who, in one way or another, have given expression to their appreciation of *Carpentry and Building*, and have at the same time raised the question, directly or indirectly, whether the standard of excellence established in the first numbers will be maintained.

One writes: "I am much pleased with the January and February issues, and if the numbers generally are to be equally good, you may count on me as a permanent subscriber." Another says: "The first numbers of *Carpentry and Building* are so much better than any other paper of its class, that I do not see how it can be maintained at such a high standard." A third writes: "Each of the first two numbers of *Carpentry and Building* contains several times as much as the average numbers of any building paper I have ever seen. Is it possible you propose to give us as much useful matter regularly in each issue, and at the low subscription price you have established?"

We might make extracts from many more letters, all expressing satisfaction with the paper so far as it has been published, and more or less of them querying whether the numbers regularly are to be as good as those already issued. The first and best answer we can make to all these correspondents, after thanking them for their encouraging words of appreciation, is to respectfully re-

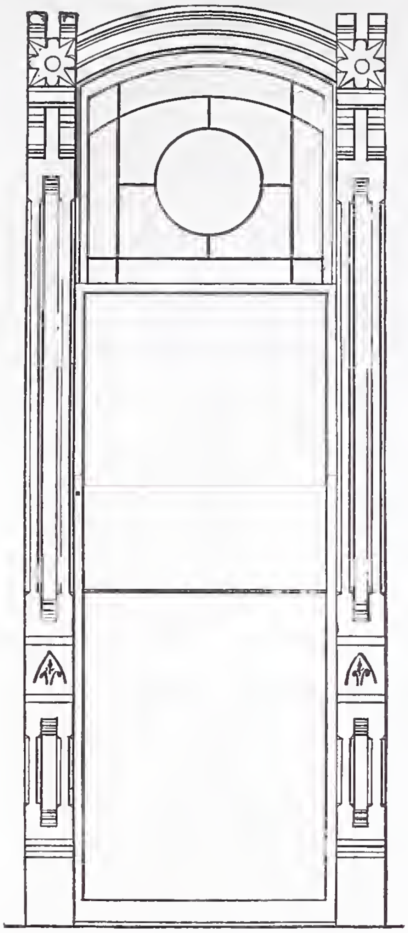


Fig. 8.

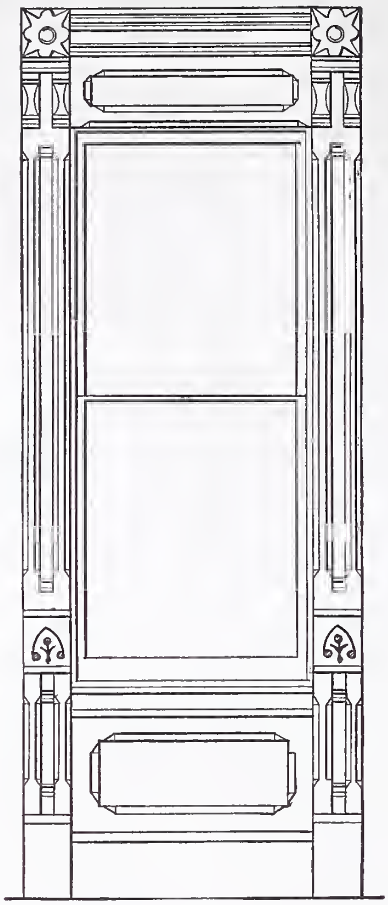


Fig. 9.

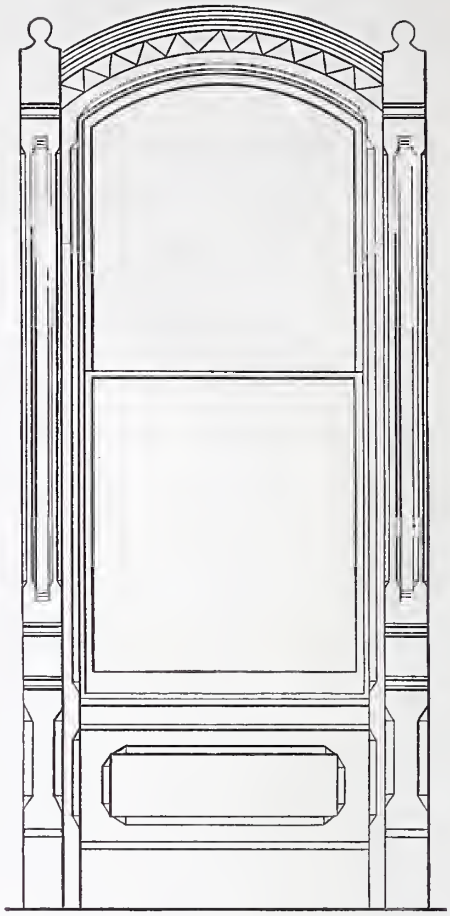


Fig. 10.

First Story Windows—Scale, ½-inch to 1 foot.

fer them to the present number, as further evidence of our intentions and ability with reference to the standard we propose to maintain. We confidently believe it will not be pronounced inferior to either of the numbers preceding it, if it is not considered superior to them.

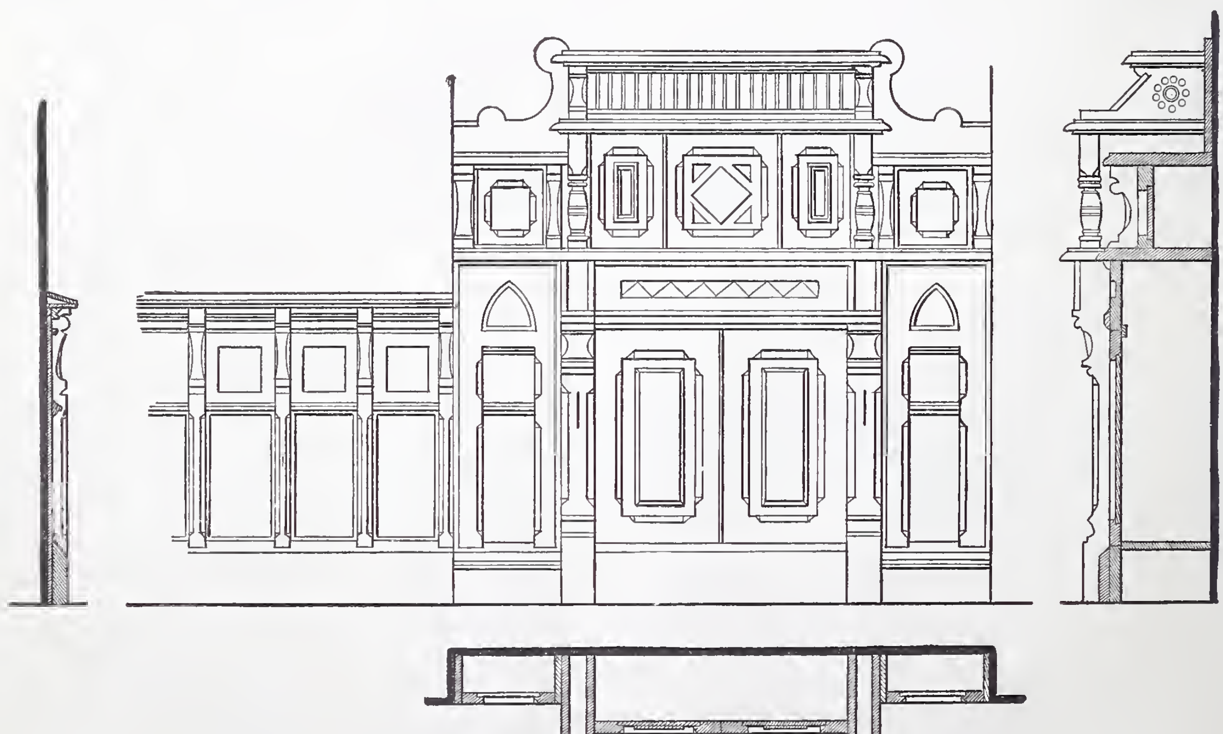
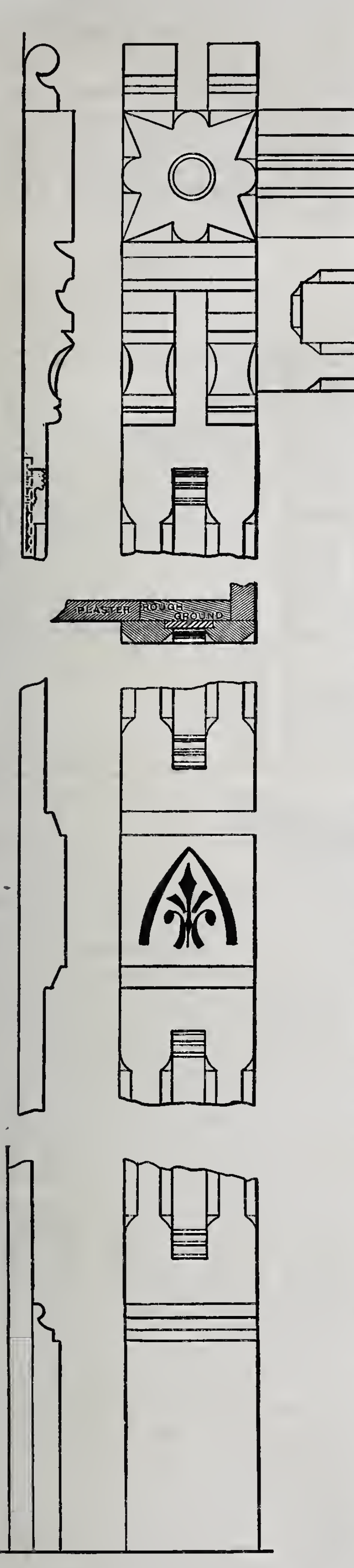


Fig 11.*—Dining-Room Sideboard and Wainscoting—Scale, ½-inch to 1 foot.*

We take pleasure in assuring our readers that we not only propose keeping this journal up to a very high degree of excellence and usefulness—making each number fully as good as those which have been published already, if not better—but that our arrangements are already fully perfected for doing so; and our readers may rely upon our assurance that we have not created expectations in their minds simply to disappoint them. *Carpentry and Building* has been established to serve the building trades in a plain, straightforward manner, to do a work which others have left undone, and no effort or reasonable expense will be spared to make it thoroughly useful and entirely practical in all its departments. Its subscription price has been placed so low as to bring it within the reach of all, and our policy is to conduct it in a manner that shall make it a necessity to all enterprising mechanics, builders and house owners, by the monthly service it renders them, and thus place upon its subscription list the names of these large classes.

A correspondent from the extreme West writes: "I notice that your journal talks to its patrons in a familiar, common-sense manner, explaining all the different terms and phrases as applied to our business." This correspondent credits us with success in a direction that has received most careful thought. While each month presenting



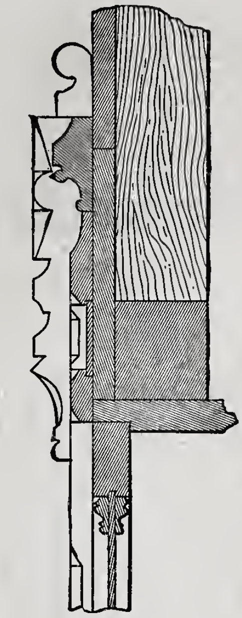


Fig. 12.—*General Detail of Doors and Windows—Scale,* 1½ *inches to* 1 *foot.*

matter which will be of special interest to master builders and to the most advanced men in each of the several building trades, we nevertheless hope to treat of each subject in such a way that the apprentice boys and mechanics of limited education and experience, will be interested and find profit. While using, so far as possible, the plainest language, and carefully explaining the use of terms where necessary, we still expect to present a paper which shall be acceptable to men of education and advanced position in the building trades.

Although we have made all necessary arrangements for maintaining this journal in each of its several departments without aid from our readers, and will be able undoubtedly to present to them month after month a paper entirely acceptable and fully up to the standard we have fixed, we yet recognize the value of co-operation. In the February number we solicited correspondence from our readers on subjects of general interest to the building trades, inviting questions for answers, and stating that the fullest liberty of discussion will be encouraged. We renew it at this time, both as a general invitation to our readers and as a special request, upon certain topics, to those who are able and willing to respond. We firmly believe we can render an article on any subject whatever, of more practical use to our readers if we have a free statement of their opinions concerning it, and some expression of their needs with regard to information about it. While we propose making the department of correspondence a medium of intercommunication between our readers, a builders' exchange, a platform for free discussion, we still solicit from another and larger class of readers than are likely to communicate for its columns, letters on practical subjects for our own guidance as to their wants, &c. Accordingly, we invite attention to the following:

Correspondence Requested.

We have in preparation a series of articles upon slate roofing, designed to be quite comprehensive, treating of the different kinds and qualities of slate; different methods of laying, including the various patented devices in connection with fire-proof roofs; the tools used by slate roofers; the art of making a perfect slate roof; felts and cements used in connection with slate roofs; figured roofs; the patterns to which slate may be cut; machines for trimming and punching slate, &c. Also a description of the measurements peculiar to slate roofs, and the extras charged by slate roofers. In short, we design that the series shall constitute a complete exposition and compendium of the slate-roofing business, valuable alike to those especially engaged in the roofing trades, and to carpenters and builders whose business interests demand a thorough knowledge of this subject. In order to render this series of articles of the greatest practical use, we solicit from our readers generally letters upon slate roofing. Any facts with regard to any of the topics above named will be welcome. We do not design the letters for publication, but for private use in the preparation of the articles. Questions concerning slate roofs will be especially acceptable, as pointing out what our readers desire to know. Lessons from practical experience will be welcomed, and testimony for or against the various styles of slate roofs in use, will be gladly received. We trust our readers will freely respond to this request. We hope none will be deterred from writing because they have only commonplace facts to record. We desire a general expression from our readers, that we may have the benefit of the advice and suggestions of their experience, in order that the series of articles may be altogether practical.

Correspondents also ask for information on subjects which (at least in part) we desire to refer to our readers, and concerning which we hope those who are able will write us.

Surface Ornament.

One correspondent asks for designs in surface ornament suitable for the general requirements of wood-workers and decorators. Cannot some of our readers send us designs to which they have worked, and which they know to be good from experience?

Wood Carving.

Another asks for information concerning wood carving, the tools employed and the manner of using them. We design giving a series of illustrated articles upon this subject after a time, and shall be pleased to receive contributions of material from any of our readers. We think many of them must have worked more or less at wood carving, and are, therefore, in a position to speak from practical experience.

Moderate-priced Houses.

Several correspondents request designs and plans of moderate-priced suburban houses. Many of our readers are now engaged in building just such houses of this class as would be acceptable for our pages. Write to us about them, sending copies of the drawings where practicable, or naming the architect and giving us enough particulars concerning the house to enable us to form an opinion of its merits. Actual items of cost in connection with such plans will always be acceptable.

Cheap and Tasteful Dwellings in Popular Styles of Architecture.

A correspondent asks for plans and details of a cheap and tasteful dwelling in the present popular style of architecture, as exhibited in high-priced residences. The cost must not exceed $1200 to $1500, and yet in general features, and in the style of finish, it is to be characteristic of the modernized Queen Anne, or Gothic, style of architecture.

We respectfully refer these various requests to our readers, and solicit contributions on each of the subjects named. To our friends of the architectural profession, we suggest that the last item above named is a nut the successful cracking of which seems to us quite desirable. The general features of decoration, as well as of construction, in the present popular styles of building, are understood to be very cheap—at least, not more expensive than the features in use in the immediate past, and which in houses of the better class the new ideas have supplanted. We think, therefore, that the architect who succeeds in arranging a comfortable and well-appointed small dwelling which shall embody these ideas, and which shall not exceed the cost of the cheap buildings of this class now commonly erected, will achieve a desirable reputation, as well as confer a real benefit upon those of limited means, yet possessing good taste, who are about to make a home. We respectfully refer it to the architects among our readers for consideration. Correspondence, as well as contributions upon any of these topics, will be quite acceptable.

Heating and Ventilating Churches.

From J. P., *Mayville, N. Y.*—The February number of *Carpentry and Building* came duly to hand, and has been carefully read. My attention was attracted by the communication on page 39, from O. & B. Barrie, Ont., and entitled "Heating a Store."

Having had considerable experience in heating buildings in the general manner described, I give the following for the benefit of O. & B., and others of your readers who may be interested: In the summer of 1877 I superintended the setting of a large wrought-iron stove in a brick case, similar to the one described in the communication referred to. It differed from it, however, in this particular: The hot-air register was directly over the stove or heater. On either side of the brick casement, near the bottom, were flues for the ingress of cold air. The cold air was taken from the audience room, the building being a church, down through registers placed in opposite corners of the room, and conducted back under the floors to the flues in the brick wall. By this arrangement a complete circulation was maintained in the audience room, warming all parts alike. For the purpose of changing the air when too warm or too foul, a conductor was arranged from the outer wall to the hot-air chamber of the furnace. This could be closed when necessary.

By an oversight, the hot-air register was placed directly under one of the chandeliers, and it was found that the draft of the hot air was so strong that it would extinguish the lights, and, consequently, it was found necessary to move the register.

A similar heater was placed in a church which I superintended last summer, except that it did not have the cold-air registers and conductors. Experience with this arrangement demonstrated that but little hot air could be got into the audience room, without first opening a window or an outside door. My attention being called to this fact, I directed the cold-air registers to be placed as described in connection with the first building, which change made the working entirely satisfactory.

Heated air rises to the ceiling, however high it may be, and if there is no place for the cold air to escape at the bottom, there can be no circulation. If a ventilator is placed in the ceiling, the hot air will escape through it and will not warm the room; but if registers are placed in the floor, and a tight box or conductor be constructed from the registers to the flues of the furnace, the cold air will be forced or drawn out through them, and in turn be heated and conveyed back to the room. In this way the temperature of the room may be kept nearly even in all parts.

The hot-water arrangement described by your correspondents I know nothing about, but it looks to me to be a failure, unless there is a rapid circulation of hot water through the pipes.

Remarks.—While undoubtedly our correspondent describes the correct principle for heating churches, we would remind him that the process of heating the same air over and over is attended with much risk to health, and it should only be practiced with the greatest discretion. The furnace or furnaces, as the case may be, should be provided with cold-air ducts leading to the outside of the building, fitted with dampers adapted for closing them readily. Cold-air registers should be placed in the floor of the church at opposite ends of the room, communicating with the flues of the furnace. Suitable ventilators, with registers or valves for closing, should be provided in the ceiling. In addition to the cold-air ventilating registers in the floor leading back to the furnace, registers should be placed near the floor, communicating with flues built in the walls for the purpose. By intelligent use of these several devices thorough ventilation can be maintained at all times, as well as thorough heating secured. When the fire is first started, the cold-air ducts leading outside of the building and all the ventilating registers in the room should be closed, but the cold-air registers in the floor leading back to the furnace should be left open. The registers should remain in this condition until the room is thoroughly warmed and the audience is seated. Then the cold-air floor registers should be closed and the outside ducts opened, and the registers near the floor communicatiug with the ventilating flues in the walls opened. In some instances the ventilators in the ceiling may be used to carry off surplus heat, or to take off foul air while the room is occupied. Immediately after the room is emptied of its people it should be thoroughly emptied of its air. It should not be closed up with the vitiated air in it, but should be thoroughly and completely purified. To do this the outside ducts communicating with the furnace should be left open, the ceiling ventilators opened, and windows opened as far as convenient, both top and bottom, to carry off the heated air. This should be continued until the room is thoroughly rinsed of all impurities, and until the foul vapors, adhering by force of friction to the walls, are all removed. After this the room may be closed up to wait another period of occupancy, with the assurance that it will be purer and sweeter, and far more healthful, than without this purification. Care of this kind would save much drowsiness on the part of the congregation, now commonly charged to dull sermons.

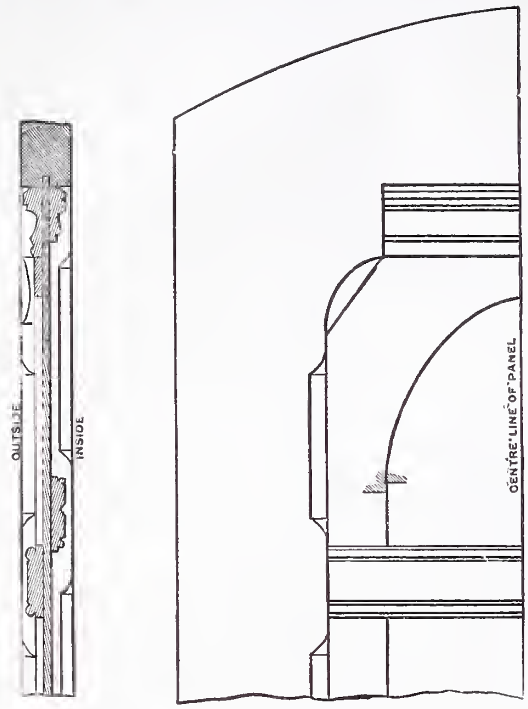


Fig. 13.—Detail of Front Door—Scale, 1½ inches to 1 foot.

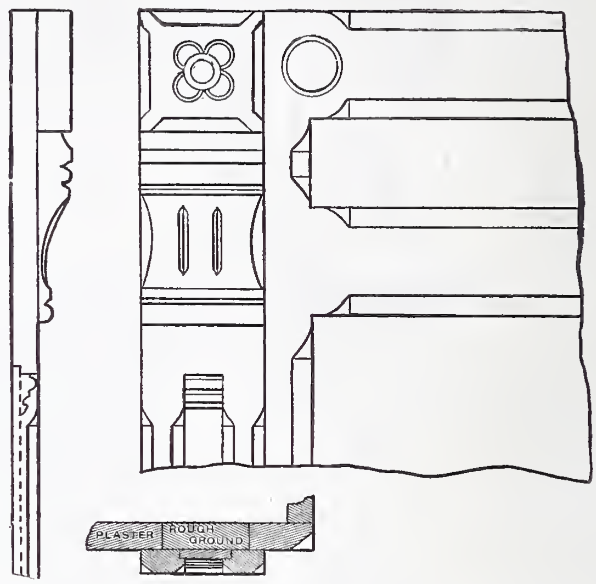


Fig. 14.—General Detail of Doors—Scale, 1½ inches to 1 foot.

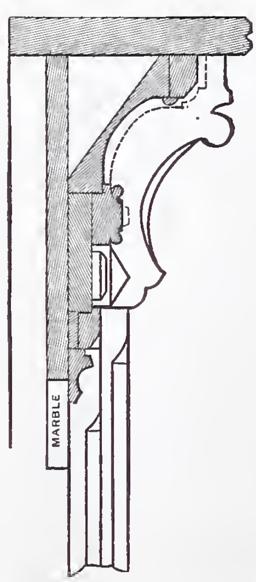


Fig. 15.—Detail of Bedroom Mantel—Scale, 1½ inches to foot.

Bricklaying.

From J. R. P., Farmington, Mo.—As I am a practical brickmaker and bricklayer, I will endeavor to answer the question of J. W. B. in the February number. I prefer laying brick by real count, which is the only fair way of putting up brickwork. I estimate my brick worth \$5 per M. at the kiln. I pay on an average \$1.25 per day for laborers. Hauling one mile costs me 70 cents per M. I pay \$1.25 per bbl. for lime, and \$1 per yard for sand. I pay bricklayers an average of \$2 per day.

I take contracts, based upon the above prices, at about \$9 per M. real count, or about \$7 per M. wall count. About one-half yard of sand and about one-half barrel of lime will lay one M. brick, without the walls being slushed. The latter is more expense than profit.

Bricklayers lay anywhere from 1500 to 3000 brick per day. A bricklayer who will lay 2000 brick per day, taking the average of front work, backing up and partition walls, is doing good work. The same man will be able to lay 3500 brick on a long, dead partition wall 13 inches thick.

It is worth more to put up a 9-inch wall than a 13-inch wall, for the reason that the quality of brick must be better, and it requires more pointing-up, in proportion to the number of brick in the wall.

As to ratio of advance in cost as the building is carried upward, it cannot be more than 25 cents per thousand additional on the third and fourth stories. The material costs the same, and the only extra cost is in the item of tenders. It requires about three more tenders to about five bricklayers.

Remarks.—We are obliged to J. R. P. for the above. Will not others also write us on the same subject? A general discussion upon this topic can be made iuteresting.

Sash Doors for Store Fronts.

From M. J., Santa Barbara, Cal.—Should the putty side of sash doors for store fronts be in or out?

Answer.—We believe it is customary to put the putty side iu, making the finish and best appearance upon the outside.

Question in Plumbing.—Single Trap for Several Basins.

From P. M. M., *Brooklyn, E. D.*—I would like to ask your opinion on the trapping of four wash-basins. They have been in use about six years and have never given any trouble, but I am not satisfied to leave them as they are, as the gentleman owning the house told me to examine everytbing and make it safe. They are situated on the second and third floors, between rooms, and waste into a 2-inch iron pipe, run straight down the partition to the sewer in the cellar, where there is a 2-inch trap which traps everything above. Now if I trap each basin separate, one will syphon tbe other and some one will be empty. This would stop if I could ventilate the traps and the 2-inch iron pipe, but the gentleman does not want tho wall broken. The soil pipe is ventilated and the leader free from traps, so that there is a direct outlet for sewer-gas. If the Board of Health sbould examine these basins they would order traps put in, and very likely make a great "time" about it, because they could see no traps, and "give it to the cheat of a plumber" who would do such a thing. Yet the specification called for the work done in that way. Just such orders are given, and work is done that is as bad, if not worse, than it was before. I cannot refrain just here to compliment Mr. Bayles' work on house drainage and water service. I procured one as soon as I could, and have had it out among my customers nearly ever since, and it has been the best paying investment I ever made.

Note.—There is no doubt that the basins are very badly arranged, and although they have a trap in tbe cellar they are by no means safe. The whole length of waste pipe from the basins to the trap is a sewer upon a small scale, and in it sewer gases are forming all the time, which are just as poisonous as those forming in the main sewer of the street. Whenever a basin is emptied a quantity of air, equal to the bulk of the water discharged, is sent up into the rooms through the other basins. We think tbat by taking out the trap below and putting in any of the modern traps that do not syphon out, the evil of sewer gas can be avoided. With a better arrangement of pipes at the points where they branch, it is just possible that even with the ordinary traps this evil might be avoided. Such construction as this is radically wrong, and we think it the duty of every plumber, builder or householder under whose observation they may come, to report them at once. They are a source of danger, are in violation of the regulations of the Board of Health, and should not be allowed if the only excuse which the owner has for not rectifying them is on account of the expense and inconvenience. A single case of sickness arising from basins arranged in this way, might easily cost more than it would to have the whole job taken out and done in a proper manner. We are heartily ashamed of house-owners who are too miserly or indifferent to have good plumbing in their houses. They are really no better than persons who buy tainted or injured provisions because they are cheap. In one case the boarder at the table has tainted meat or spoiled flour to eat, and in the other case the lodger has foul and tainted air to breathe. Let the plumber be bold in this matter and tell the truth in regard to the dangers arising from defective plumbing. They may run some risks in doing so, but they can remember this, that people are becoming better educated in these matters; tbe plumber is not looked upon in the same light as a few years ago, and an intelligent man will now be listened to with respect upon these topics.

Tin or Zinc for Gutters.

From J. M., *California.*—Will you please inform the readers of *Carpentry and Building* which is the best material for gutters in connection with shingle roofs, tin or zinc?

Answer.—Tin. The objection to zinc is its gradual consumption by the process of oxidation, which, in the case of light material being used, soon destroys the gutter, and which, in any case, contaminates the water to an extent to render it unsafe to use for culinary purposes. The only way to construct a durable and satisfactory gutter from zinc would be to use a very heavy gauge of material, which would render the cost of the gutter considerably more than the cost of a tin gutter of tbe same capacity. We presume the merits of tin for gutters and roofs are well enough known to our correspondent not to require special description in this connection.

Removing Oil Stains from Marble.

From G. A. P., *Great Barrington, Mass.*—Can you give me any information in regard to the method employed for removing oil from a marble slab?

Answer.—There are two metbods that may be employed, and both with tolerable success. The first of these is by the application of common clay saturated with benzine. The theory of this we suppose is that th~ benzine dissolves the oil and is then absorbed by the clay. If called upon to remove oil from marble, we should certainly try the plan of pntting on dry clay in powder, or French chalk, or some similar dry absorbent substance to take up the benzine, otherwise there would be danger from the spreading of the benzine in the marble and so making the stain larger, though not as strong. The remaining stain may be removed by the following application, which has been recommended for the purpose. An ox-gall is mixed with a quarter pound of soap boilers' lye and 2 ounces of oil of turpentine, then enough pipeclay is added to form a paste, which is placed upon the stain. Prepared ox-gall, such as may be obtained at artist material stores, will probably answer much better than the raw gall, and is much pleasanter to handle. If the oil is freshly spilled, whiting, put on warm and kept warm with an iron, will do something toward taking out the oil. We should be glad if our correspondents would give us their experience in this matter of removing grease from marble.

Material for Cellar Floors.

From W. D., *New York.*—Will you or some of your readers inform me what is the best material for cellar floors? If a cement floor is desirable, what is the best cement to use for the purpose? I want a dry floor, and desire to construct it in such a manner as will avoid the annoyance of ground air.

Note.—We respectfully refer the above to our readers, and hope to have responses from practical men.

Best Plate for Roofing.

From J. F. W., *Ohio.*—As you appear to be very willing to answer all questions, would you please tell me through your paper, *Carpentry and Building*, which will make the most durable roof, everything being equal—situation, climate, &c.—tin plate, lead, or terne plate, the quality of the plates being equal? Please give the reason why.

Answer.—With the conditions laid down by our correspondent, we think there can be but one answer to the question. He says the tin and terne plates are both to be of the same quality. This being granted, the tin plate is the more desirable, simply because tin is a less oxidizable metal than the alloy of lead and tin used upon terne plates. Tin is, however, the most expensive metal, and the coating is rarely made as heavy and perfect as is desirable for complete protection; hence the terne plate is generally most satisfactory. The cheapness of the lead coating enables a sufficient thickness to be put upon the plates, and, at the same time, they can be sold at a much lower figure than tin. In most of the wide range of climates found in this country, there is little sensible difference in the durability of pure tin and lead when exposed upon roofs. There is, however, a great difference between the durability of a terne plate roof in one town and that which a similar roof will have in another. In some situations roofs rust out with extreme rapidity, whether of tin or terne plate; in others they last very well. Now, in comparing one kind of plate with another, it will not answer to take one roof in one town and another in another, but both must be as nearly as possible in similar circumstances. For example, we know of places in New York where weil painted iron plates can hardly be made to stand more than two or three years, while in others, with about the same amount of exposure to the weather and no better care, they seem to be good for eight or ten years. The difference, so far as we can see, being simply due to the amount of salt water spray in the air.

Number of Registers for Heating Large Rooms.

From A. N., *New York.*—I would like an expression from practical men, witb reference to the number of registers to be used in heating halls and other large rooms, to obtain the best results. Supposing that the capacity of a given furnace is ample to heat the required space, is it best to use one or more registers in the room? If more tban one register is employed, how should they be placed in the room?

Note.—We shall be pleased to print letters from practical men in answer to the above questions, and shall not object if they touch on other points connected with the subject of heating and ventilation.

Heating a Shop.

From T. S., *Lawrence, Mass.*—In the February number of *Carpentry and Building* I notice a plan of heating a workshop. About ten years since I tried the same plan in my shop, and found it to be a very poor one, as well as quite expensive. In the first place, boiling water will not force its way around the shop, except it is above the level of the boiler. Boiling water will not boil down hill and force cold water into the boiler. In the second place, the water will not circulate until it is boiling in the boiler. From experience with a 2-inch pipe, I found it to take about two hours to get the shop warm, and when it got too warm there was no way that I could discover for regulating the temperature.

Wainscoting.

From M. J., *Santa Barbara, Cal.*—Is it customary to finish parlors with panel wainscot?

Answer.—The reply to this question depends in some measure upou the style of architecture employed. Wainscoting is more appropriate for halls and dining-rooms than for parlors, in all ordinary buildings. We believe, except in extreme instances of decoration in Gothic architecture, tbe general practice at present among the best architects is to finish the parlor without wainscoting.

Deferred Until Next Issue.

A number of communications, and several inquiries for answer, are, for lack of space, carried over until another issue.

Bleaching Wood.—In most cases the staining of wood may be effected so as to produce very bright colors without any previous preparation, as, generally speaking, the mordants employed have a bleaching action on the wood. But sometimes, in consequence of the quality of the wood under treatment, it must be freed from its natural colors by a preliminary bleaching process. To this end it is saturated as completely as possible with a clear solutiou of 17¼ ounces cbloride of lime and 2 ounces soda crystals in 10½ pints of water. In this liquid the wood is steeped for half an hour, if it does not appear to injure its texture. After this bleaching, it is immersed in a solution of sulphurous acid to remove all traces of chlorine, and then washed in pure water. The sulphurous acid which may cling to the wood in spite of the washing does not appear to injure it, or alter the colors which are applied.

White-smiths are often very black-smiths, and both are said to be evil doers, for they are not only constantly "on strike" themselves, but they invariably employ "strikers" to help them in their "forging" operations.

Black Walnut.—Important to the Cabinet Trade.

The Chicago *Northwestern* says: There has been much said of late about the rapid exhaustion of the supply of walnut timber in in this country. Sensational newspaper writers and hard-fisted individuals having a little walnut timber, for which they are anxious to get as good a price as possible, have industriously spread the report that about all of this kind of wood has been consumed; that the supply remaining will suffice only for the requirements of a dozen years. It is declared that black walnut trees are becoming almost as scarce in Ohio aud Indiana as date palms, and that the time is near at hand, indeed, when the most diligent searching will fail to disclose a single specimen. While it is no doubt tre that the supply of walnut, like that of every other commercial wood, is rapidly diminishing under the constant and ever-increasing industrial demands of the country, we are inclined to believe that the end of it is still a long way off. In conversation recently with a hard-wood lumberman of very wide experience, this subject was brought up, and he expressed the opinion that there is no necessity for the present generation, at least, to become alarmed about the stock of black walnut. There is no small amount still standing in Ohio and Indiana, in spite of all that is said about the impossibility of finding it. Farmers and landholders who came into possession of the timber when it was comparatively valueless, are holding it very much as they are their bank stocks or government bonds, if they have any, as a provision against a rainy day. Occasionally one of these men dies, and in settling up his estate the black walnut is thrown on the market in lots varying from 100,000 to 1,000,000 feet. Our informant states that such sales are very frequent, and prove pretty conclusively that Indiana walnut is not a thing of the past. And besides, there are extensive sources of supply that have not yet been touched. Walnut timber is found even in Alabama, and in Tennessee there are vast areas of timber land within whose limits the sound of an ax has never been heard. Black walnut may become scarce, but we veuture to predict that the supply will not be exhausted while anyone now living remains upon the earth.

At Pittsburgh the builder's trade promises to become reasonably active with the opening of spring weather. Prices are very low, and are sure to be higher next year. Idle capital can now be profitably and safely employed in house building. Architect Butz reports that he has $100,000 of work on hand, exclusive of the Riverside Penitentiary.

Building in Chicago.—The number of buildings put up in Chicago in 1878 was 1019, with a frontage of 31,118 feet; in 1877, 1398, with a frontage of 35,033; and in 1876, 1586, with a frontage of 43,222. The total cost was $7,419,000 in 1878; $7,552,649 in 1877, and $8,270,600 in 1876, the aggregate for the three years being $23,242,349. Of the buildings erected, 59 were stores, 167 stores and dwellings, 574 dwellings proper. The extensive additions to the houses, stores and public buildings of Chicago in the last three years are the best evidences that can be given of the vitality of our real estate interests and the best promise for the future. When an average of over seven miles a year is added to the improved streets of a city, it must be acknowledged to have seeds of growth in it.

Smoky chimneys, like swindlers, refuse to honor their "drafts," no matter in what way the wind is raised.

Prices of Building Materials in New York, February 27, 1879.

Balusters.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned	7c	9c	10c	16c
Neck Turned	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

Blinds (outside).

Per lineal, up to 2 10 wide	$.... @ 0.24
Per lineal, up to 3 1 wide	.... @ 0.27
Per lineal, up to 3.4 wide	.... @ 0.30
Per lineal, paint'd and trim'd	0.40 @ 0.50
INSIDE.	
Per lineal, 4 folds, Pine	.... @ .45
Per lineal, 4 folds, ash or chstnut	.... @ .72
Per lin'l, 4 folds, cherry or butternut	.... @ .86
Per lineal, 4 folds, bl'k wal't.	.... @ 1.00

Blue Stone.

Rubbed hearth, 10 ft. or under	20c
Rubbed hearth, 20 ft. or under	30c
Rubbed hearth, 3 ft. or under	45c
Rubbed hearth, 40 ft. or under	55c
Rubbed sills, imported	28c
Rubbed sills, domestic	33c
Sills and lintels	.... @ 17c
Sills and lintels, fine quarry cut sills	.... @ 35c
Coping, 11 to 18 in. wide	18c @ 30c
Coping, 20 to 28 in. wide	35c @ 55c
Coping, 30 to 36 in. wide	60c @ 75c
Steps, 8 in	.... @ 55c
Steps, 7 in	.... @ 40c
Steps, 6 in	.... @ 25c
Steps, door. per in. wide	.... @ 2c
Platforms, promiscuous, 4 in	.... @ 32c

Bricks Housed.

Pale	⅌ M.	$2.37	@ 2.75
Jersey	"	....	@ ....
Long Island	"	....	@ 5.50
Up-River	"	3.75	@ 4.00
Havers'aw Bay, 2ds.	"	....	@ ....
Havers'aw Bay, 1sts.	"	....	@ ....
Favorite brands	"	5.00	@ 6.00
FRONTS.			
Croton—Brown	⅌ M.	....	@ $7.00
Croton—Dark	"	....	@ 8.00
Croton—Red	"	....	@ 9.00
Philadelphia	"	20.00	@ 22.00
Trenton	"	19.00	@ 20.00
Baltimore	"	....	@ 38.00

Yard prices 50c. ⅌ M higher, or, with delivery added, $1.50 per M for Hard and $2.50 per M for front Brick. For delivery add $2.50 on Philadelphia and Trenton.

FIRE BRICK.

Red Welsh	$35.00 @ 36.00
Scotch	26.00 @ 30.00
American	25.00 @ 30.00

Cement.

Rosendale, ⅌ bbl.	$ .90 @ 1.15
Portland Saylor's American, ⅌ bbl.	2.50 @ 2.90
Portland (imported) ⅌ bbl.	2.65 @ 3.00
Roman "	2.80 @ 3.25
Keene's coarse "	6.50 @ 7.00
Keene's fine "	10.00 @ 10.50
Martin's coarse "	6.00 @ 6.50
Martin's fine "	10.00 @ 10.50

Doors.

RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ in.	$0.67	....
2.6 x 6 6	1¼ in.	.95	....
2.6 x 6 8	1¼ in.	1.00	....
2.8 x 6.8	1¼ in.	1.15	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾. in
2.0 x 6.0	$1.23	....	....
2.6 x 6 6	1.52	1.93	....
2.6 x 6 8	1.57	1.95	....
2.6 x 6.10	1.59	2.01	....
2.6 x 7.0	1.62	2.09	....
2.8 x 6.8	1.68	2.32	2.57
2.8 x 7.0	1.69	2.17	2.69
2.10 x 6.10	1.79	2.26	2.84
3.0 x 7.0	1.87	2.45	3.80

Glazed Windows.

Dimensions of windows.	12 Lights. 1¼ pl.	12 Lights. 1¼ c.	12 Lights. 1½ c.	8 L's. 1½ c.	4 Lights. 1¼ c.	4 Lights. 1½ c.
2.1x3.6	$0.87	.92	....	....	....	....
2.4x3.10	.96	1.02	....	....	1.11	....
2.7x4.6	1.18	1.24	1.35	.	1.37	1.46
2.7x4.10	1.25	1.32	1.44	....	1.48	1.59
2.7x5.2	1.35	1.42	1.53	1.84	1.75	1.87
2.7x5.6	....	1.56	1.65	1.93	1.88	2.03
2.7x5.10	....	1.65	1.74	2.01	1.99	2.15
2.10x4.6	1.29	1.35	1.47	....	....	....
2.10x5.2	1.45	1.52	1.70	1.87	1.89	2.06
2.10x5.6	1.53	1.59	1.79	2.01	1.97	2.16
2.10x5.10	1.74	1.80	2.01	2.07	....	2.30

c. means counted checked—plowed and bored for weights.

Hot bed sash, glazed.......3.0x6.0....$1.90

Drain and Sewer Pipe.

Discount 50 to 60 per cent. according to quality and size of order.

Pipe, per foot.		Bends & Elbows, Each.	Branches Sing.	Branches D'bl. & V.	Traps, Each.
2 in.	$ .13	$ .40	$ .48	$ ...	$1.00
3 "	.16	.50	.61	...	1.25
4 "	.20	.65	.75	1.30	1.75
5 "	.25	.85	.90	1.55	2.50
6 "	.30	1.15	1.05	1.80	3.50
7 "	.35	1.50	1.20	2.05	5.00
8 "	.45	2.00	1.45	2.45	6.00
9 "	.55	2.50	1.70	2.85	7.00
10 "	.70	3.00	2.00	3.30	8.00
12 "	.80	3.75	2.52	4.24	10.00
15 "	1.25	5.00			
18 "	1.60	7.50			

Longer than 1 ft., charged as pipe.

House Branches pr. lin. ft.		Sewer Branches pr. lin. ft.,	
15x6	$1.75	15 in.	$2.25
18x6	2.50	18 "	3.00

Hair.

Cattle ⅌ bushel	$.... @ 0.10
Goat "	.... @ 0.14

Lath.—Cargo rate....⅌ M $.... @ 1.60

Head Lights.

Two or three Lights, Glazed.

Size.	1¼	1½	Size.	1¼	1½
2.6x1.0	45	55	2.10x1.10.	45	59
2.6x1.6	55	63	2.10x1.6	59	67
2.8x1.0	45	55	3.0x1.0	50	63
2.8x1.6	55	67	3.0x1.6	72	86

Lime.

Glen's Falls, common, cargo rate ⅌ bbl.	.... @ .75
Glen's Falls, finishing	.... @ .90
Rockland, common	.... @ .90
Rockland, finishing	.... @ ...
Ground	.80 @ .85

Add 25c. to above figures for yard rates.

Lumber.

Pine, very choice and ex. dry. ⅌ M. ft.	$45.00 @ $60.00
Pine, good	40.00 @ 45.00
Pine, good box	18.00 @ 22.00
Pine, common box	16.00 @ 17.00
Pine, common box, ⅝	13.00 @ 15.00
Pine, tally plank, 1¼, 10 in., matched, each	.40 @ .43
Pine, tally plank, 1¼, 2d quality, matched, each	.35 @ .38
Pine, tally planks, 1¼, culls, matched, each	.25 @ .28
Pine, tally boards, match'd, each, good	.28 @ .30
Pine, tally boards, match'd, each, common	.22 @ .25
Pine, tally boards, culls, matched, each	.21 @ .23
Pine, strip boards, merchantable, matched, each	.14 @ .15
Pine, strip boards, clear, matched, each	.22 @ .25
Pine, strip plank, dressed clear	.33 @ .35
Spruce boards, dressed	.18 @ .20
Spruce plank, 1¼ inch, dressed	.22 @ .25
Spruce plank, 2 in	.28 @ .35
Spruce wall strips	.11 @ .13
Spruce timber, ⅌ M ft	16.00 @ 19.00
Hemlock boards, each	.14 @ .16
Hemlock joist, 2½x4	.13 @ .15
Hemlock joist, 3x4	.16 @ .18
Hemlock joist, 4x6	.40 @ .44
Ash, good, ⅌ M ft	38.00 @ 45.00
Oak	50.00 @ 60.00
Maple, cull	20.00 @ 25.00
Maple, good	42.00 @ 50.00
Chestnut	45.00 @ 60.00
Cypress, 1, 1½, 2 and 2½ in.	35.00 @ 40.00
Bl'k walnut, good to choice	85.00 @ 100.00
Black Walnut, 2d	55.00 @ 70.00
Black walnut, ⅝	70.00 @ 80.00
Black walnut, selected and seasoned	110.00 @ 150.00
Bl'k walnut counters, ⅌ ft.	.12½ @ .20
Cherry, wide, ⅌ M ft	85.00 @ 100.00
Cherry, ordinary	60.00 @ 80.00
Whitewood, chair plank	60.00 @ 70.00
Whitewood, inch	40.00 @ 50.00
Whitewood, ⅝ in	30.00 @ 35.00
Whitewood, ⅝ panels	35.00 @ 40.00
Shingles, extra sawed pine, 18 in.,	5.00 @ 7.00
Shingles, clear sawed pine, 18 in., 2 md	4.00 @ 5.00
Shingles, cypress, 24x7	20.00 @ 22.00
Shingles, cypress, 20x6	12.00 @ 15.00
Yellow pine dressed flooring, ⅌ M ft	25.00 @ 35.00
Yellow pine girders	28.00 @ 45.00
Locust posts, 8 ft., ⅌ in	.18 @ .20
Locust posts, 10 ft.	24 @ .25
Locust posts, 12 ft.	.29 @ .34
Chestnut posts, ⅌ ft.	.3 @ .3½
Mahogany, ¼ in. ⅌ ft	.5 @ .10
Mahogany, ⅜ in. ⅌ ft	.8 @ .12
Mahogany, ½ in. ⅌ ft	.12 @ .15
Mahogany, ⅝ in. ⅌ ft	.13 @ .16
Mahogany, ¾ in. ⅌ ft	.15 @ .20
Rosewood, 1 in. ⅌ ft	.16 @ .22
Rosewood, ⅛ in. ⅌ ft	.11 @ .15
Rosewood, ¼ in. ⅌ ft	.16 @ .20
Rosewood, ⅜ in. ⅌ ft	.24 @ .28
Rosewood, ⅝ in. ⅌ ft	.40 @ .45
Rosewood, 1 in. ⅌ ft	.50 @ .65
Satin wood, ½ in. ⅌ ft	.16 @ .30
Satin wood, 1 in. ⅌ ft	.30 @ .40
Cedar (Cuban and Mexican) ⅌ ft	.10 @ .14
Cedar (Florida)	.8 @ .15

Octagon Paneled Newels.

Panels Veneered with French Walnut.

8-inch Newels, with Cap	$6.12
9 " " "	6.88
10 " " "	7.60

Plaster.

Calcined.......$1.00

Slate.

By car load, delivered in New York.

Purple roofing slate, ⅌ sq're.	$5.00 @ $5.50
Green slate	5.00 @ 5.50
Red slate	.... @ 9.50
Black slate, Pennsylvania	.... @ 4.50
Tiles, 1¼ in. rubbed, ⅌ sq. ft.	.20 @ .25
	⅌ sup. ft.
Steps and platforms, 1 in. thick sq	28c
" " 1½ "	35c
" " 2 " round.	42c
Risers, 1 inch thick	27c
Coping, 1½ "	27c
" 2 "	31c
	Lineal ft.
Window sills, 4x7	45c
" 3x7	36c
Window caps, 4x10, plain	65c
" 4x8, "	50c
" 3x10, "	47c
" 3x8, "	42c

Solid Newels, with Caps.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned	$1.60	$1.90	$2.50	$3.40
Octagon	2.10	2.40	3.00	3.90

Stair Rail.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	40c	45c	50c	53c
Toad Back	45c	50c	63c	68c

Stair Rail, Unfinished.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ⅌ C ft	$.... @ $0.85
Berlin freestone, in rough	.... @ .85
Berca freestone, in rough	.... @ .80
Brown stone, Portland, Ct.	1.25 @ 1.50
Brown stone, Belleville, N. J.	1.00 @ 1.50
Granite rough	.50 @ 1.00
Dorchester, N. B., stone, rough ⅌ foot.	.... @ 1.00

Window Frames.

Up to 3.4 x 7.2, put together.. .... @ 2.15

Moldings 45c. to 55c. per inch per 100 feet, according to quality.

Window Glass.—(American.)

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$7.50	$6.75	$6.25	$5.75
11x14—16x24	8.50	7.75	7.25	6.50
18x22—20x30	10.75	9.75	8 75	7.75
15x36—24x30	12.25	10 75	9 00	8.50
26x28—24x36	13.00	11 50	9.75	9.00
26x36—26x44	14.50	13 25	10.75	9.50
26x46—30x50	15.00	14 00	11.25	10.50
30x52—30x54	16 00	14 50	12.00	....
30x56—34x56	17.25	15 50	13.50	....
34x58—34x60	18.25	17 25	15.00	....
36x60—40x60	20 75	18.75	17.25	....
DOUBLE.				
6x 8—10x15	$12.00	$11.00	$10.00	$9.25
11x14—16x24	13 75	12.50	11.75	10.50
18x22—20x30	17.25	15.75	14.00	....
15x36—24x30	19.75	17.25	14.50	....
26x28—24x36	21.00	18.50	15.75	....
26x36—26x44	23 25	21 25	17.25	....
26x46—30x50	24 00	22.50	18.00	....
30x52—30x54	25 75	23.25	19 25	....
x56—34x56	27.75	25.00	21.75	....
34x58—34x60	29.25	27 75	24 00	....
36x60—40x60	33.25	30.00	27.75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 inches, will be charged in the 84 united inches' bracket. Discounts, 70 & 10.

FRENCH WINDOW, PICTURE AND CAR GLASS.

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st. E F H	2d. I E H	3d. H H	4th. H B
6x 8—10x15	$8.00	$6.75	$6.25	$5 75
11x14—16x24	8.75	8.00	7 50	7 00
18x22—20x30	11.25	10.50	9 75	8.75
15x36—24x30	12.75	11.50	10.00	. .
26x28—24x36	13.50	12.25	11 25	. .
26x36—26x44	14.75	13.75	11 75	..
26x46—30x50	16.25	15 00	13 00	....
30x52—30x54	17.25	16.00	13 50	...
30x56—34x56	18 75	16 75	15 00	...
34x58—34x60	19.50	18.00	16 00	....
36x60—40x60	21 00	19 50	18.00	.. .
DOUBLE.	D	D	D	D
6x 8—10x15	$12.00	$11.00	$10 00	$9 25
11x14—16x24	14.75	13.75	12.75	11.75
18x22—20x30	19.00	17.75	16.00	....
15x36—24x30	21.50	19 25	16.50	....
26x28—24x36	23 00	20 75	18.25	....
26x36—26x44	25.00	23 00	19.25	....
26x46—30x50	27.00	25 00	21.25	....
30x52—30x54	28 50	26.00	22.25	....
30x56—34x56	30.00	27 75	24 75	. ..
34x58x34x60	31 75	30 00	27.00	....
36x60—40x60	35 50	32.50	30.25	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket.

Discounts, Single, 60&10; Double, 60&20.

GREENHOUSE, SKYLIGHT AND FLOOR GLASS.

Per square foot, net cash.

⅛ Fluted plate	16 @ 18
3-16 Fluted plate	18 @ 20
¼ Fluted plate	22 @ 24
¼ Rough plate	22 @ 24
⅜ Rough plate	24 @ 26
½ Rough plate	23 @ 27
¾ Rough plate	50 @ 55
1 Rough plate	65 @ 75

VAULT LIGHTS.

Platform, sq ft	$3.50
Step and risers, sq. ft	3.75
Floor light, sq. ft	2.25
Roof light, sq. ft	2.00
Platform, 2d quality, sq. ft	2.60

COVERS.

Diameter.	Round.	Hexagon.
14 inch	$3.00	$0.00
16 "	3.75	4.00
18 "	5.50	6.00
20 "	8.00	8.50
24 "	14.00	15.00
26 "	16.00	17.00
30 "	23.50	25.00
36 "	31.00	33.00

CARPENTRY AND BUILDING

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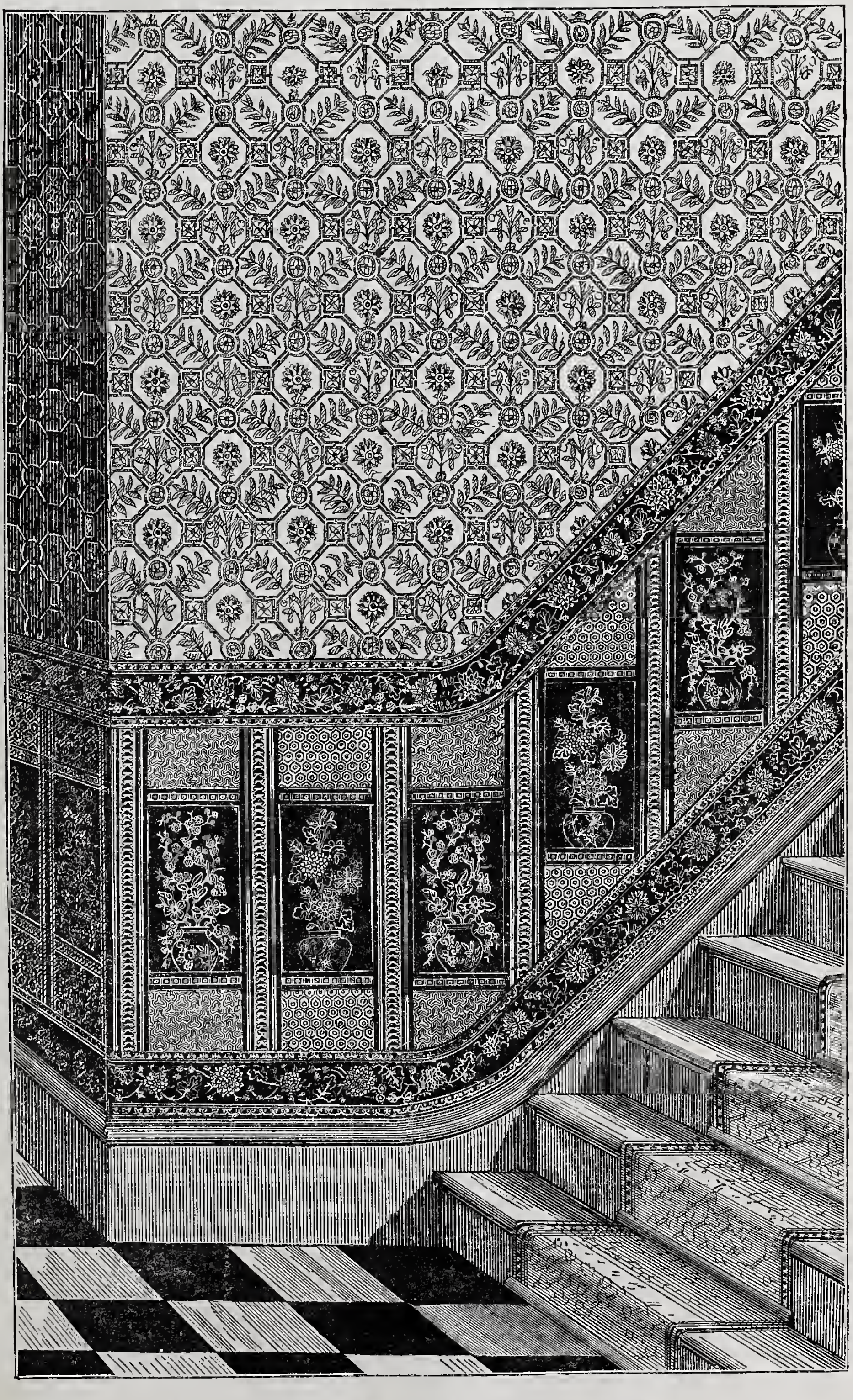
Wall Decorations.—Paper Hangings.

Until a recent time, the generally accepted idea with reference to wall paper has been that it is a cheap and convenient means of covering a wall which, either from age or from bad workmanship, has become unsightly. The lack of artistic excellence in the wall papers as manufactured rendered them fit for little else, and by long association, and from lack of better means, people came to use plain white walls in all rooms of which the finish cost a reasonable sum. Between frescoing or painting a wall, or decorating it in some way by the hands of an artist, and a white wall devoid of all decoration whatever, there has been no middle ground. Wall papers as produced failed to answer the want of a wall decoration reasonable in cost, and possessing artistic excellence.

Within a very few years, however, the status of wall paper has changed as completely as it is possible for any art to change. From being the last resort for covering a defaced wall, it has come to be recognized as a decorative material of the highest value. People are realizing that white, although a very clean color, so called, is not altogether pleasing when applied to a wall at which they must look day after day, and in no direction is the growing artistic taste of the people at large more manifest than in the stimulus which the demand for tasteful paper-hangings has given to the manufacture of wall papers. The trade has assumed large proportions, and the patterns which were in common use until a short time since—about the date of the Centennial Exhibition—have been altogether discarded, and in their place there are now sold styles which, in beauty and artistic merit, excel the effect which it is possible to obtain upon a wall painted by artists of ordinary skill. The art of making wall papers has been carried to a very high degree of perfection. Improvements in the manufacture of paper, in the processes of engraving and coloring and in the art of printing, have all contributed to the advancement of this industry. It is usual at the present time for manufacturers to purchase designs from the best artists in the world, and, in reproducing them in wall papers, they secure even better effects artistically than it is possible for artists to obtain with a brush upon a wall. This is entirely reasonable, from the fact that an artist may spend months, if necessary, in elaborating a design for a wall paper, while the cost, although a considerable sum, becomes insignificant when distributed over the large surface covered by the reproductions. By the process of printing it is possible to manufacture papers with designs of such character as are practically beyond the ability of an artist to produce satisfactorily at any cost; and designs are readily and cheaply executed in wall papers which, if attempted by handwork of any kind, would consume an almost endless amount of time. When the blocks for a design have been engraved, the production of any quantity of wall paper by means of them, is comparatively a matter of nominal expense only.

Paper, as a material for wall finish, combines a number of desirable features within itself. It is quite tough. Its surface may be adapted to almost any desired treatment. It can be made almost impervious to air, so that there is practically no absorption of bad odors. In the latter respect it is more healthful than plastered surfaces, which are always porous unless carefully painted. Taken all in all, there is no means of decorating walls which is at all comparable with paper in point of economy and durability, while for beauty



Example of Wall Paper Treatment for Hall and Stairway.

and artistic excellence it is capable of producing effects which are equal to anything that is purely decorative, and which does not approach the pictorial in character.

The manufacture of paper hangings was commenced in this country as early as 1837. In no industry, perhaps, has the steady progress of improvement been more marked than in this. At first, the only paper to be had was in small sheets, which were pasted together in order to form a continuous strip or roll. The printing was done altogether by hand, by means of what were known as hand blocks. From this stage of the industry, at its commencement in this country, the course of improvement has been steady, and in some periods of the time quite rapid. It was not long before paper was manufactured in continuous rolls, and this improvement, it is claimed, called forth by the needs of the paper-hanging industry, suggested the use of continuous rolls in newspaper printing. In printing and coloring wall papers from the use of hand blocks, the art has advanced until now perfected machinery is employed for applying the most delicate tints and shades ; and to such a degree of excellence has machine work attained, that few, save experts, can distinguish between somo printed patterns and the same design hand-painted by a skillful artist. All are familiar with chromos, and understand the relationship which a chromo bears to an oil painting, and how faithful the reproduction may be made. The production of wall papers is in many respects analogous to it, and equal skill, with even greater success, is displayed in producing the finest effects to be found in the artist's original.

At this time we cannot do more than merely mention a few of the interesting features of this branch of art manufacture, each of which might, with profit to our readers, be elaborated into an article. The principles of taste as applied to wall papers, harmony of colors, character of design and other topics are each important, but must be deferred until another time.

The engraving accompanying this article, which is furnished us by Messrs. Robert Graves & Co., of 833 Broadway, New York, is a characteristic representation of a wall-paper treatment as applied to a hall and stairway. In style, the hangings employed are known as Anglo-Japanese, possessing some of the features of Japanese art, but in composition and treatment conforming to the ideas of English and American artists. The pattern represented—like all others of a similar character—is manufactured of several different grades, and finished in various shades and colors, thus adapting it for use under a variety of circumstances, and making it cost different sums. It is impossible, by means of a description and an engraving which is printed in but one color, to convey an adequate conception of any design appropriate for wall paper. So much depends upon the colors and upon the harmonies and contrasts obtained, that nothing short of inspection of the article itself is at all satisfactory. In the selection of wall papers there is occasion for the best artistic perception. With designs and patterns carefully elaborated by the highest skill, there is need of cultivated taste in the matter of choosing the decorations for the walls of any room. The very best results are possible, and yet, by bad combinations and inappropriateness of design, or from unsuitable colors, the worst results, artistically speaking, may be produced.

In conclusion, therefore, it may be remarked that whereas a very few years since wall papers possessed no artistic merit by the advancement of the art, they have come to possess such excellence that it becomes an artist's work to select and combine them. In the tasteful decoration of a house, almost as much care and thought is to be put upon the selection of the wall papers to be employed as upon the choice of the paintings to be hung on the walls.

The Streets of Omaha.—It was intended that Omaha should be a beautiful city, and one means to that end was to give most of the streets a width of a hundred feet. It is found, however, that such streets are inordinately expensive to grade, pave, and keep in repair, besides being troublesome, and the Common Council is considering a proposition to make them narrower.

Explosions in Woodworking Shops.

It may not generally be known to workers in wood—but it is nevertheless true—that there is nearly as much reason to fear explosions in planing mills, sash and blind factories, turning shops and the like, as in flour mills. Such explosions in the latter case arise from flour, blown by some means or other into a cloud, coming in contact with a light, when it instantly ignites and explodes. Wherever there are accumulations of fine dust there is danger of an explosion, and it must be admitted that in woodworking factories, and particularly those converting dry material, it is rare indeed that dust is not to be found in abundance. Richards, in one of his works on woodworking establishments, says that the inflammable and explosive nature of wood dust is not generally known, but few being aware that it is a fulminate, like gunpowder. Any dust of combustible material, when floating or thickly distributed in the air, explodes or burns up with great force. To prove this, let any one hold a candle beneath a girder or beam in a wood-shop and sweep off the fine dust from its top, so as to fall on the light, and he will be convinced of its explosive nature. It is true there have been few, if any, fires in woodworking factories traced directly to this cause, but it will not do to argue from this that none have occurred. A large proportion of the fires in planing mills and similar places are of unknown or accidental origin, and it is far from unreasonable to suppose that many of them would be found, if it were possiblo to investigate the matter, to have been the result of explosions of this character. There are many ways in which the necessary combination of dust and air might be effected, and the fire to ignite it supplied, while the chances of discovering how it was done, after the mill is destroyed, are very small indeed.

These facts supply another very powerful argument in favor of maintaining perfect order and systen in all kinds of mills and factories where dust is made in any quantity, and these certainly include all those in which wood is the material converted. Where sawdust and shavings are removed, either by automatic devices or otherwise, as fast as they are made, and the mill and machinery kept perfectly clean, there is little danger that fine dust will accumulate in out of the way corners, or anywhere, to furnish the means of kindling at some unlucky moment a fire which can never be accounted for. And this is the only way in which dust explosions can be guarded against. It is almost impossible to prevent the use of exposed lights in mills in some shape or other, and if dust is lying about where it ought not to be—and it surely ought not to be in any well-conducted cabinet shop—it is almost certain to be some time or other stirred up under circumstances which are extremely favorable for its explosion. In a certain sense woodworking mills, flour mills, or in fact any manufacturing establishment where combustible substances in a fine state of subdivision are liable to be distributed through the air, are hardly less dangerous than powder mills. In both the explosive material is present, and the only difference is that in the former the precise conditions precedent to its ignition are nearly always wanting.

To many owners of saw-mills and woodworking shops, this idea of the danger they are constantly exposed to from the dust and rubbish which collects everywhere will be a new one ; but it is none the less worthy of their careful consideration on that account. The fact that the danger exists is sufficiently proven, and they will do well to take warning from the disasters that have already occurred, and provide such safeguards against similar ones in their own mills and shops as science and ingenuity may suggest. Prof. Macadam says : The chemistry of grain and flour may assist us in arriving at an understanding regarding these fire explosions. The starch and woody fiber are composed of carbon, hydrogen and oxygen ; so also are the gum, sugar and oil; and the gluten contains these elements, accompanied by nitrogen, sulphur and phosphorus. All these proximate constituents are combustible when burned in the ordinary way, and are consumed with greater rapidity when diffused through the air.

Automatic Fire Extinguisher.

It is the experience of all firemen that the chief difficulty in putting out fires consists in getting into such a position that water can be surely thrown upon the burning materials. When rightly applied, it needs but a small amount of water to extinguish a very considerable blaze, and hence inventive effort has been turned in the direction of devising some means by which, in case of a fire, water could be showered upon those portions of the building and its contents which were burning, and nowhere else. The first device of this kind was perforated sprinklers. This consisted of ordinary gas pipes through which small holes had been bored. These pipes were placed just under the ceiling of a room, 8 or 10 feet apart, and were all connected with the main supplying the building with water. When a fire broke out, all that was needed to extinguish it was that some one should open the valve and allow the water to enter the range of pipes just over the flames. For this purpose there was a separate valve for each story, and in some large buildings each floor was divided into two or more sprinkling sections, so that the man at the valves (which might be, and often were, outside of the building itself) could distribute the water as he saw fit. In theory all this was very admirable, and the experiments made for the purpose of inducing manufacturers to put the device into their establishments were eminently satisfactory; but when quite a number of sprinklers had been introduced, it was found that the plan was not so much of an improvement as had been supposed. In mills and factories the small apertures in the pipes soon became filled with dust and lint, so that when the time came for turning on the water the system proved inoperative. But where this defect was not observed, another equally serious one came to light when the critical moment for using the sprinklers arrived, and this was that too much coolness and good judgment were expected of those whose duty it was to open the valves. In numerous instances buildings have been drenched with water on every floor, in consequence of a slight fire in one story. Indeed, it has frequently happened that the contents of buildings have been damaged in this way on the mere suspicion of a fire. For this reason fire underwriters, who once urged the use of sprinklers in risks which they protected, have now little confidence in them. Efforts have been made to overcome the defects described, and perhaps the most successful of these attempts is an automatic sprinkler, which has been put into some of the New England cotton mills. In this, the holes in the gas-pipe are covered by metallic caps, fastened by a solder which melts at 155° F. When a fire occurs, the temperature quickly rises to this point, the caps directly above the flames then drop off, and as the pipes are kept constantly filled with water under pressure, this flows out just at the spot where it is needed. Theoretically this appliance is an exceedingly serviceable one, but practical usage may develop in it counterbalancing defects.

Old London Houses.—Writing of old London houses, an English contemporary remarks : There is no doubt many of these structures of timber were framed previous to their erection. We know, indeed—if we may depend on antiquarian accounts—that the celebrated None-such House, which stood on Old London Bridge, was imported from Holland piece by piece, and we may hazard the conjecture that many other houses of the Elizabethan era were of similar origin.

New friends, like green timber, must be seasoned by time, to determine their full value.

PRACTICAL CARPENTRY.

Stair Building.

IV.

There are many other forms of plan for stairs besides those of which we have briefly spoken. Thus, for instance, there may be a staircase with a level landing around a semicircular well, or one on a rectangular plan, with winders in the two angles, and the rectangle itself may differ in the proportions of its sides; then, again, there are elliptical stairs, and those winding round a large cylindrical newel, which latter is a very antique form. The examples already given, however, illustrate the general principles involved, and their application to special cases is easily worked out.

We may mention that in many instances

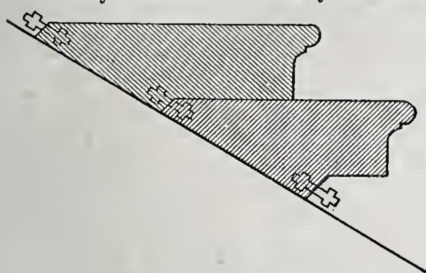


Fig. 1.

European stair builders, especially those of France, differ much in their practice from ourselves. For example, solid steps (Figs. 1 and 2) are frequently employed. They are, of course, much more expensive than the built-up steps, and need to be made of very well-seasoned wood. The method, however, insures good and solid stairs, and is especially adapted for winders. Some details of the manner in which these steps are connected are shown in the two figures specified. The strings are generally much thicker than our own. Another form of solid step is shown at C and

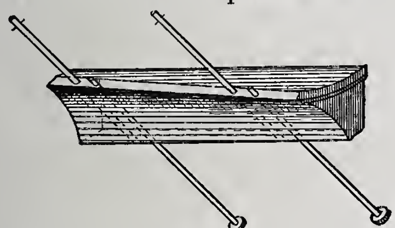


Fig. 2.

D (Fig. 3). The mediæval joiner employed this kind of step for his winding newel stairs, and some of them still remaining curiously illustrate his parsimony in the use of material. Thus, Fig. 4 shows the manner in which six solid steps were got out of round timber of 30 inches diameter, thereby effecting a saving of about 10 per cent. over cutting up square timber. Of course the longer side is the upper part of the tread. The solid steps were housed in the carriage. Where the going of the stairs is restricted, the French usually place the balusters outside the steps, which gives more room for persons ascending and descending. The manner in which these balusters are often connected with the stairs is given in Fig. 5. The same practice is now occasionally resorted to in this country.

As previsously stated, we do not intend at this time to enter upon the much controverted questions of hand-railing; but shall

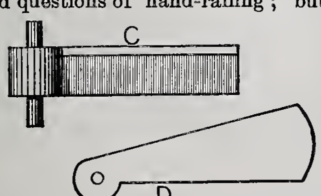


Fig. 3.

merely glance at some of the terms employed, and refer briefly to the principles upon which it is founded, purposing to continue the subject at another time. The upright pieces of stuff, whether plain or ornamented, which form the fencing of the staircase are termed "balusters," frequently corrupted into banisters. The piece of wood or metal which caps them is called the "hand-rail," being, as its name implies, a guide for the hand. The hand-rail and balusters should be of sufficient strength for safety and of proper hight, say from 2 feet 9 inches to 3 feet. The rail follows the line of nosings, with an extra rise when turning, and must

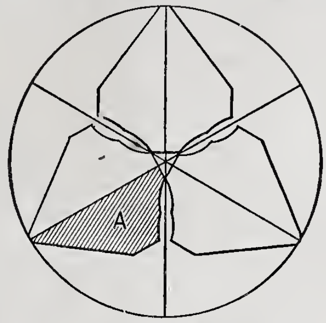


Fig. 4.

of course be quite smooth and free from inequalities, in order that the hand may glide easily over it. The varied curvatures which hand-rails necessarily make are differently named. Thus the conversion of an angle into a curve is called, as was said with regard to the string, an "easing" or "easing off." The curve made in a rail by the sudden rise, or ceasing to rise, at a landing, is called a "ramp." When the top curve is bent the contrary way to the ramp it is sometimes termed a "swan neck." The spiral termination of a hand-rail is called the "scroll." A "miter-cap" is the portion of the hand-rail over the newel, or vertical piece at the termination of each flight. Newels are chamfered, framed or turned, and the miter-caps are turned of such shape as to miter with the rail.

The chief point involved in hand-railing is that of the best methods of finding sections of cylinders, cylindroids, or prisms, relative to three given points, in or out of the surface—or, in other words, the section made by a plane through three given points in

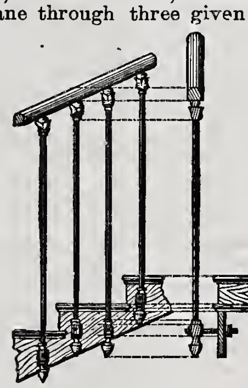


Fig. 5.

space. The definitions given by Gwilt in his "Encyclopædia of Architecture," are so terse and well expressed that we quote them in preference to any more diffuse descriptions of our own: "The cylinder, cylindroid or prism are hollow and of the same thickness as the breadth of the rail, or the horizontal dimension of its section, and their bases, their planes or projections on the floor. Thus is formed the hand-rail of a staircase of a portion of a cylinder or prism whose base is the plane of the stair, for over this the hand-rail must stand, and is therefore contained between the vertical surface of the cylinder, cylindroid or prism. As the hand-rail is prepared in portions, each whereof stands over a quadrant of the circle, ellipse or prism of the base which forms the plane, such portion may be supposed to be contained between the two parallel planes, so that the portion of the hand-rail may be supposed to be contained between the cylindrical, cylindroidal or prismatic surfaces and the two parallel planes. The parts to be joined together for forming the rail must be so prepared that in their place all the sections made by a vertical plane passing through the imaginary solid may be rectangular; this is termed "squaring the rail" and is all that can be done by the geometrical rules. But hand-rails, not being usually made of these portions of hollow cylinders or cylindroids, but of planks or thicknesses of wood, our attention is naturally drawn to the consideration of the mode in which portions of them may be formed from planks of sufficient thickness. The faces of the planks being planes, they may be supposed to be contained between two parallel planes, that is, the two faces of the plank. Such figures, therefore, are to be drawn on the sides of the plank as to leave the surfaces formed between the opposite figures portions of the cylindrical, cylindroidal, or other surfaces required when the superfluous parts are cut away. A mold made in the form of these figures, which is no more than a section of them, is called a 'face mold.'

"The vertical, cylindrical, or cylindroidal surfaces being adjusted, the upper and lower surfaces must be next formed; and this is accomplished by bending another mold round the cylindrical or cylindroidal surfaces, generally to the convex side, and drawing lines on the surface round the edge of such mold. The superfluous wood is then

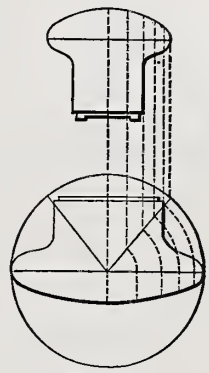


Fig. 6.

cut away from top to bottom, so that if the piece were set in its place and a straight-edge applied on the surfaces so formed, and parallel to the horizon, directed to the axis of the well-hole, it would coincide with the surface. The mold so applied on the convex side, for forming the top and bottom of the piece, is called a 'falling mold.'"

Figs. 6 and 7 exhibit two of the most usual forms of hand-rails. A of Fig. 6 represents the section of a rail of a dog-legged staircase, and B the miter-cap corresponding to it. The method of describing the miter-cap is as follows: The miter lines are drawn in B, as shown. Vertical lines are let fall from the section of the rail A to these miter lines, and thence are carried in arcs of circles to the straight line passing through the center of the cap at right angles to the former straight lines; then perpendiculars are set off and made equal in length to those in A. A curve being traced through the points gives the form of the cap.

The shape shown in Fig. 7 is called a toad's-back rail, and is used in connection with a

Fig. 7.

Fig. 8.

better class of stairs than the cap and rail shown in the previous figure.

To Imitate Ground Glass.—Put a piece of putty in muslin, twist the fabric tight, and tie it into the shape of a pad; well clean the glass first, and then apply the putty by dabbing it equally all over the glass. The putty will exude sufficiently through the muslin to render it opaque. Let it dry hard and then varnish. If a pattern is required, cut it out on paper as a stencil plate, and fix it on the glass before applying the putty, then proceed as above; remove the stencil when finished. If there should be any objection to the existence of clear spaces, cover with slightly opaque varnish.

DRAFTING.

THE DIVISION OF THE CIRCLE INTO DEGREES, AND THE USE OF CERTAIN TRIANGLES, OR SET-SQUARES, IN THE CONSTRUCTION OF POLYGONS.

As a matter of convenience in the measurement of angles, &c., the circumference of the circle is supposed to be divided into 360 equal parts, called degrees. This division is altogether arbitrary, and, so far as our present object is concerned, it would be quite as well served if the number of equal parts was some other than 360. Our purpose is to call attention to certain fractional parts of the circle, and the use of certain tools based upon those parts. In our illustrations we shall have occasion to refer to a quarter of a circle, a third of a circle, a twelfth of a circle, &c., and in doing this, in order to conform to the usual method of

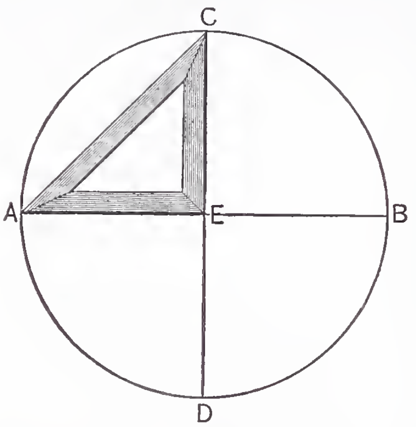


Fig. 2.—A Set-Square of 90 Degrees.

designating such parts, we shall describe them by the number of degrees contained. Or, in other words, the circle being divided into 360 equal parts, a quarter of a circle must contain one-fourth of 360, or 90 of those parts, and a sixth of a circle one sixth of 360, or 60 parts, and so on; and therefore we designate these parts as 90 degrees and 60 degrees respectively, and use corresponding terms for other fractions.

In order to make our meaning still clearer, we show in Fig. 1 a circle divided after the manner in common use. A drawing tool, called the protractor, based upon this division of the circle, comes in almost all boxes of instruments, and is ordinarily in the shape of a half circle, with divisions the same as here shown. In other words, it corresponds with the upper half of the present diagram, supposing it to be cut in two on the line A C. We have engraved the whole circle, in order to impress more clearly upon the minds of our younger readers particularly, the special uses of certain parts of it, described further on. We desire this matter of the divisions of the circle into de-

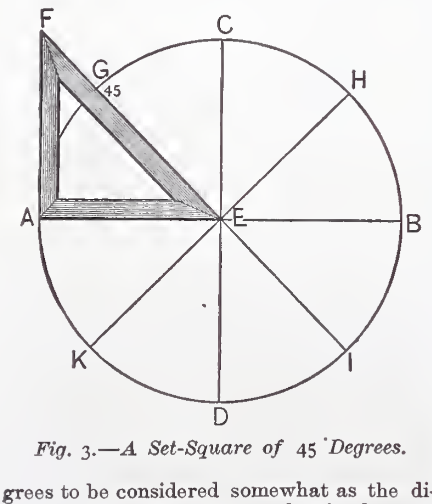


Fig. 3.—A Set-Square of 45 Degrees.

grees to be considered somewhat as the divisions upon any rule or scale, simply as a convenience for noting differences between given points, and as a means by which any given space may be subdivided into any required number of equal parts. For example, an ordinary pocket rule is divided into inches. By means of it we ascertain the distance between two fixed points to be 8 inches. Now, if we want to divide that space into four equal parts, we at once say mentally, eight divided by four equals two, and thus set off two inches in the space, with the full assurance that four times this distance will make the whole length. So it is with the circle. Whatever may be its size, the number of the divisions is always the same, or 360. Hence, by means of a protractor, either in the shape of a half circle or in full circle, like our engraving—whatever may be its size, measurements are always uniform. A quarter of any circle is 90 degrees, an eighth 45 degrees, a twelfth 30 degrees, and so on.

The use of the circle thus graduated is for measuring angles. Thus, in Fig. 1 the line A E meets the line B E in the point E at some angle. By inspection of the spaces between A and B on the circle, we find that we have set off 90 degrees, and therefore we call it an angle of 90 degrees. Likewise, A E H is an angle of 60 degrees, A E F an angle of 45 degrees and A E G an angle of 30 degrees.

By a well-known geometrical definition, a right angle is thus described: "When a straight line meets another straight line, so as to make the adjacent angles equal to each other, each angle is called a right angle." By inspection of Fig. 1 we see that the line B E, in meeting the line A C, makes the angle A E B equal to B E C. Therefore, each of these angles must be right angles, and, as they each measure 90 degrees of the division of the circle, a right angle may be further defined as an angle of 90 degrees.

Two tools in quite common use in drawing for various purposes, and which were named in our article on Drawing Tools in the February issue, are triangles, or set-squares, known respectively as 45 degrees and 30 x 60 degrees. Why they are so named will become apparent on inspection of Figs. 3 and 4 of the accompanying illustrations. The set-square designated as 45 degrees, it will be seen by Fig. 3, measures one-eighth of the circle, or, referring to Fig. 1, it corresponds with the angle A E F. By Fig 4 it will be seen that one angle of the second set-square measures one-twelfth of the circle, or, in other words, again referring to Fig. 1, it corresponds to the angle A E G, or 30 degrees. In the same manner, if the set-square were reversed, it would correspond in its second angle to the angle A E H, or 60 degrees. Referring to Fig. 2, it will be seen that the set-square designated as 45 degrees, corresponds in its largest angle to a quarter of a circle, or, in other words, to a right angle, or 90 degrees. The full description of this tool, then, is a triangle whose angles measure respectively 45, 90 and 45 degrees. The second tool, it will be noticed, also contains a right angle, and the full description of it, therefore, becomes a triangle whose angles measure respectively 30, 60 and 90 degrees.

Having glanced at the origin of these two tools, let us briefly consider some of the uses to which they may be put. By the use of the triangle commonly designated as 45 degrees, a circle may be divided into quarters, as shown in Fig. 2. The usual method would be to draw the line A B, by means of any straight edge, through the center E. Then placing the triangle as shown, erect the line E C, and reversing the tool, prolong it, as shown by E. D.

By means of the same tool, used in a little different manner, a circle may be divided into four equal parts, as shown in Fig. 5. With any straight edge draw A B tangent to the triangle given circle. Then with one side of the triangle against A B, as shown, bring the side C F against the center, and by it draw a line. Then reverse the triangle, as shown by the dotted lines, repeating the operation.

In Fig. 3 a circle is divided into eight equal parts, by using this tool simply as a measure of each section. In other words, each division is set off by means of the tool, the same as A E G, in connection with which the tool is shown.

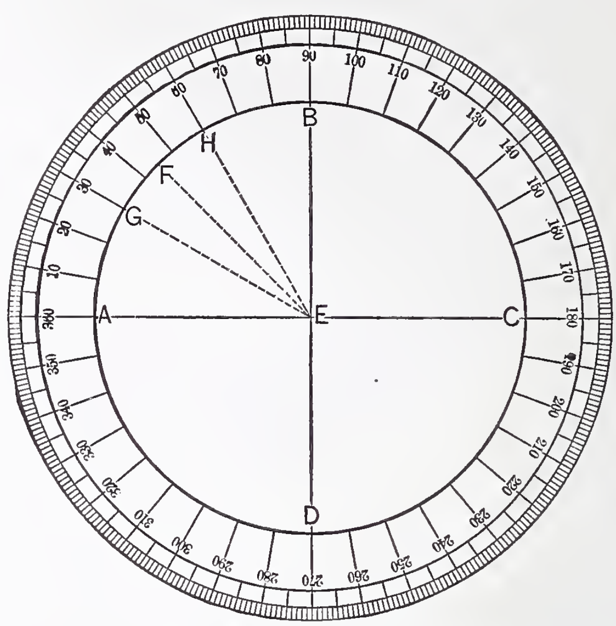


Fig. 1.—The Division of the Circle into Degrees.

The same end is accomplished in laying off an octagon in a circle, as shown in Fig. 7. In this figure we introduce the use of a T-square in connection with the triangle, which is a very convenient substitute for the tangent line that would otherwise have to be used, and which we described in Fig. 5. By means of the T-square the line B F is drawn. By means of the end of the triangle and the T-square, the line D H is drawn. Then with the triangle as placed in the engraving, the diagonal line A E is drawn, and by reversing it the line C G is drawn. By this means, the circle having been divided into eight equal parts, the figure is completed by drawing the several chords B C, C D, D E, &c.

By the use of the T-square and the same tool, an octagon may be laid off without the aid of a circle, as shown in Fig. 8. Suppose it be required to draw an octagon the

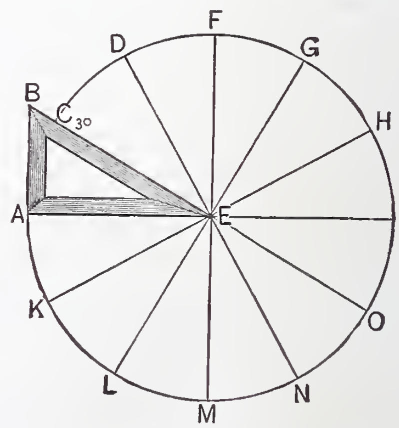


Fig. 4.—A Set-Square of 30 Degrees.

length of the side of which shall be equal to A. B. Draw A B by means of the T-square. Then place the triangle against the T-square, as shown, making the side touch the point B, and draw B C in length equal to A B. From C, by means of the end of the triangle, or by using the T-square from the other side of the board, draw C D of corresponding length. Then, by reversing the triangle from the position shown in the engraving, draw D C, and so continue until the figure is completed.

Similar use may be made of the other tool. A circle may be divided into twelve equal parts by measuring off the distances with it, as shown in Fig 4. In Fig 6 is shown a method of dividing the circle into six equal parts. Draw the line A B tangent to the circle. Place the long side of the square against this line, and, bringing the diagonal side against the center, as shown in the engraving, draw a line by it. Then reverse the square, as shown by the dotted lines. The figure is completed by drawing the line C I perpendicular to the tangent and through the center K, which may be done by using the right angle of the triangle.

Various other regular polygons may be drawn in a similar manner to those we have described. The student will find it profitable employment, after providing himself with a board, T-square and the two tools here described, to practice upon drawing various polygons. Each figure may be considered in several different ways. For example: To draw a hexagon within a given circle; to draw a hexagon about a given circle; to draw a hexagon whose sides shall be of a specified length. Each of these problems, and also similar ones relating to other figures, are conveniently solved by means of the tools

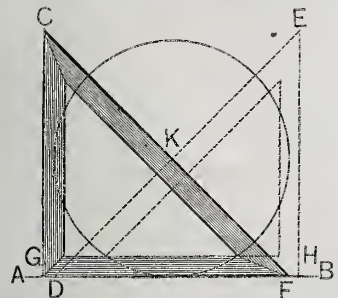


Fig. 5.—The Circle Divided Into Four Equal Parts by the Use of a Set-Square.

described, and we feel sure the learner can hardly spend his time to better advantage than upon some experimental study of the kind.

Brick-Making Machinery.

Brick machines may be classified, with respect to the humidity and condition of the clay affording the best practical results, into four classes, namely: 1. Dry-clay machines. 2. Crude or moist-clay machines. 3. Tempered-clay machines; and 4. Slush or mud machines. With the exception of the slush machines, which operate to advantage only upon very soft and highly-tempered clay, the machines of the several classes run almost imperceptibly into one another in their respective methods of producing bricks, although there is a marked difference between the extremes in the first three classes; that is, between those which require the clay to be dry enough to receive compression into form by means of a sudden blow or impact, and those which force the clay continuously through a die, in the form of a plastic bar, if for bricks, and of a plastic pipe or tube if for drain-tiles, to be immediately cut up into the required lengths.

Very great improvements have been made in brick machinery within the last 15 years, all successfully tending to the substitution, in a greater or less degree, of machine labor for hand labor, and the abridgment of the time consumed from the moment the clay is

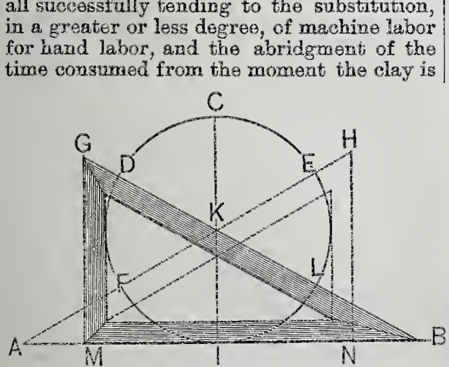


Fig. 6.—The Circle Divided into Six Equal Parts by the Use of a Set-Square.

dug from the bank until the finished brick is taken from the firing-kiln. These improvements, which at first were somewhat restricted in their scope, and had special reference to a more rapid and less costly production of common bricks, are now able to achieve the higher grade of workmanship. Indeed it seems altogether probable that in the near future the best quality of face bricks will be made by machinery, and hand-made as well as hand-pressed bricks will be driven from the market.

In the dry-clay machines the clay, if not in proper condition for the purpose, is first dried and then reduced to a coarse, granulated form by some suitable device. This is commonly done by passing it between two cylinders or two cone-shaped rollers, revolving toward each other on the upper surface with different velocities. They are placed nearly in contact with each other, so that the larger stones are thrown off, while the smaller ones pass through or are crushed. The granulated or disintegrated clay is filled into the brick molds by hand, or by some device of filler boxes or graduated measures, operated automatically, and is then compacted by tamping, or by one or more applications of steady pressure, according to the nature of the machine. In order to insure a close and compact brick of at least the required thickness, it is customary and necessary in practice to fill the molds to excess, and as they cannot be relieved of this excess by an orifice in the top or bottom mold plate, as in the case of a moist or plastic clay, which will flow more or less freely under heavy, continued pressure, the molded bricks are passed under a sizing knife, which shaves them down to a uniform thickness. A brick made with dry clay, whether compacted by tamping or by steady pressure, is not plastic when delivered by the machine, although it can be indented somewhat if pressed by the thumb or finger. When an attempt is made to bend it, only a very slight change of form will take place before breaking. The absence of the requisite degree of moisture causes imperfect cohesion during the process of molding, and imperfect or incomplete fusion in the kiln. It has been found that dry-clay bricks possess in an inferior degree the power to withstand the disintegrating effects of the machine, especially in high latitudes.

Crude or moist-clay machines generally work in clay in its natural condition, as taken from the bed. It is first disintegrated by some suitable apparatus, as in the dry-clay process, and then fed into the molds and compacted by one or more applications of steady pressure. The surplus clay may be removed and the bricks brought to a uniform thickness by passing them under a sizing-knife, followed, in some cases, by a smoothing-plate to remove the rough surface left by the knife. The bricks are more plastic than those produced by the dry-clay machine, and can generally be hand-pressed, if desired, immediately after they are delivered from the machine. A few hours' exposure in the open air, in favorable weather, renders them dry enough for burning.

Machines of the third class, or tempered-clay machines, are usually less costly, and therefore are in more common use throughout the world than those intended to work in dry or crude clay. There are exceptions to this rule, for some machines which work at their best in highly-tempered clay, and deliver a very plastic brick, consist essentially of a revolving mold-table, provided with molds with movable bottoms, to which pressure is applied by an arrangement of parts that are sometimes not at all simple. The usual device for tempering the clay is a pug mill, which consists of an iron cylinder, having a revolving shaft in its axis provided with radial knives set spirally, like the arms of a steamer's propeller, so that they not only cut up and mix and temper the moistened clay, so as to render it plastic, but they drive it forward toward the end of the cylinder, where it receives compression, either by being forced through a contracted opening or die, issuing therefrom in the form of a continuous bar, to be at once cut up into bricks, or by being fed into brick molds and compacted therein by suitable appliances for giving a steady pressure. As the expressed bar has a uniform cross section, a full set of dies of different forms will enable a single machine to produce, in turn, solid, perforated, or cornice bricks, floor-tiles, drain-tiles and other forms. Machines operated upon this principle are known as expressing machines. Their simplicity, comparatively low price and ready adaptation to the production of a variety of forms, confer a claim for popular favor not surpassed by that of any other class of brick-machines. The pug-mill may be set in a vertical or horizontal position, and the end in which the die is set in expressing machines may be tapering. Whatever may be the position of the pug-mill, the die is

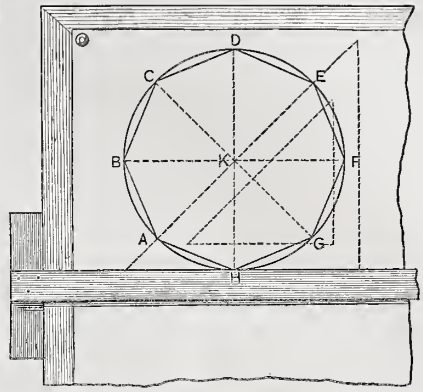


Fig. 7.—Drawing an Octagon within a Circle, by Means of a Set-Square and T-Square.

commonly so arranged that the bar of tempered clay issues forth horizontally. Bricks cut from an expressed bar by wires or steel blades, are apt to be rough and jagged on the edges where the cutting instrument leaves the bar, unless the clay is quite fine from ground and coarse sand; while, if a small pebble obstructs the cutter, the brick on either side is liable to be greatly injured in sightliness, if not altogether destroyed. The machines of this class, therefore, are by no means equally well adapted to all qualities of clay.

The producing capacity of brick machines differs very much between machines of the different classes and between machines of different sizes. Of nearly 20 brick machines exhibited at the Centennial Exhibition, the smallest producing capacity claimed for any one of them was 1000 bricks per hour, while the highest capacity claimed was 5000 bricks per hour. Brick machines vary in cost quite as much as in producing capacity. The lowest-priced machine exhibited at the Centennial was held at $300, while for the highest priced $4400 was asked.

For the highest grade of building bricks the operation of re-pressing is necessary after they have been suitably dried, whether they be hand-made or machine-made. Probably no city in the country has given the attention to this operation in the manufacture of bricks that Philadelphia has. Philadelphia pressed bricks are known all over the country. All the brick presses used in Philadelphia for pressing front bricks, with perhaps one exception, resemble each other in this, that they press one brick at a time flatwise by the upward movement of a plunger in the bottom of the mold, the top of the mold being closed for the time by a pressure-plate. The presses differ in style, there being what are termed single-lever, double-lever and treadle presses. All these presses re-press the bricks on the side or flatwise,

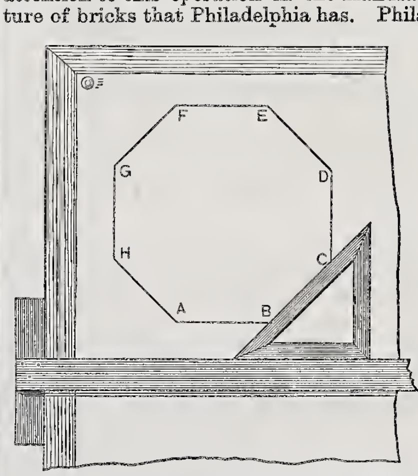


Fig. 8.—Drawing an Octagon with Sides of a Given Length, by Means of a Set-Square and T-Square.

givin; the bricks all equal length and breadth, but not all exactly the same thickness, there being a slight variation, due in part to the varying quantities of clay in the successive molds, and in part to the varying pressure applied by the hand-press. It is necessary, therefore, for the mason to gauge the bricks for the construction of the best quality of front brick masonry, in order to guard against the unsightly, or, at least, unworkmanlike appearance produced by bricks of random thickness in the same course. The exception noted above in the styles of machines for re-pressing iu use, is a machine which presses brick edgewise. They are, of course, all of one thickness, although they vary in width, which is not objectionable. While very much has already been accomplished by the inventors of brick-making machinery, the fact that re-pressing is still done exclusively by hand, shows that there is yet a field for their ingenuity. It seems to be entirely within the range of probability that in the near future all the higher grades of building bricks, not even excepting those for the construction of city fronts, will be not only molded, but re-pressed by steam machinery, thus doing away with the tempering wheels, which are already practically obsolete in the manufacture of the best quality of "Philadelphia fronts," as well as the hand-press. It is to be expected that the coming brick-making machine will be able to re-press the molded and partially-dried bricks as well as it can now be done with the hand-press.

MASONRY.

The Arch.

IV.

There are few subjects belonging to the mason's art which present such points of interest, and involve problems so difficult,

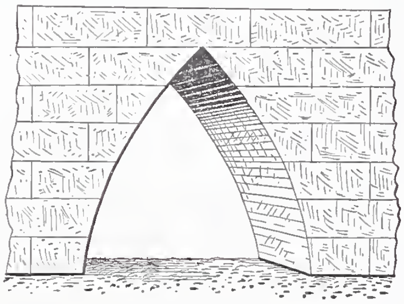


Fig. 1.

as those which concern the construction of arches and vaults, the latter especially.

An arch in building has been defined as a judicious arrangement of bricks or stones in a curved form over an opening, so planned, and with the weight and mutual pressure of the materials so adjusted in combination, as not only to support each other, but also to sustain a considerable superincumbent weight.

Much controversy has been carried on respecting the antiquity of both the arch aud the vault. In some of the earliest and rudest forms of masonry extant, such as the Cyclopean walls and Druidical circles, there are no traces of the arch, flat stones being simply placed upon upright ones in the fashion of a lintel. Sir Gardner Wilkinson is, however, of opinion that the ancient Egyptians were acquainted with the principles of the arch more than three thousand years ago, and instances some remaius at Thebes aud Sakkarah. Gwilt has, however, advanced strong reasons for doubting that these remains bear out Sir Gardner's hypothesis; and perhaps, until further discoveries be made, judgment must remain in suspense. It is, at any rate, certain that the lintel was in general use in the Nile Valley—indeed, its stern horizontal lines seem to harmonize better, both with the long, flat outlines of the landscape, and the rigid, unchanging formalism of the people, than the airy lightness of the skyward-springing arch. Sir A. H. Layard has claimed the use of the arch for the Assyrians; but here again the evidence is not very conclusive.

That openings having the superficial form of arches existed before the classic period, is certain; but they were not arches, any more than the rudely-wrought stone, vault-shaped chambers of ancient Greece were true vaults. As Mr. Fergusson aptly remarks, in his splendid "History of Architecture," "The so-called treasure-houses of Mycenæ and Orchomenos, as well as the chambers in Etruscan tombs, prove that as early as ten or twelve centuries before Christ, the Pelasgic races had learned the art of roofing circular and rectangular chambers with stone vaults; not constructed, it is true, as we construct them, with radiating voussoirs, but by successive layers of stones, and closed by one large stone at the apex, the joints of the stones running parallel." Fig. 1 shows a similar disposition of stones, which, although having the form of an arch, is not really an arch in our sense of the word. This sketch is taken from the ancient Etruscan gateway of Arpino. It is, of course, evident that the courses were arranged to leave a gradually diminishing opening, and their lower arrises subsequently removed.

Precisely the same process was followed in the construction of the vault-shaped "Treasury of Atreus," named in the foregoiug extract. The interior of this construction forms a pointed dome of 48 feet diameter, and about the same in hight, the section showiug a couple of interesting arcs of about 70 feet radius. In the masonry employed the radiating beds of vaulting proper are avoided, all the beds being horizontal, and the top formed of a level stone. The mason, therefore, had simply to cut away the soffits of the various courses, so as to produce the requisite curve, an operation sufficiently easy by the aid of the most primitive templet. Fig. 2 represents a portion of this interior.

One of the most singular early specimens of arched construction is, perhaps, the example found in a tomb near the pyramids of Gizeh by Col. Campbell (Fig. 3). This shows in front the primitive form of an arch composed of three stones only, while behiud this, and rising above it, is another arch of the orthodox form, constructed of four courses of voussoirs. With regard to this singular specimen, the evident tendency of the keystone B, to thrust the stones A and C from their position, is self-evident, and upon this point Mr. Fergusson remarks: "This disadvantage and difficulty have been felt by architects of all ages, aud in all countries; still, the advantage of covering large spaces with small stones or bricks is so great that many have been willing to run the risk, and all the iugeuuity of the Gothic architects of the middle ages was applied to overcoming the difficulty." In the example at Fig. 3 the three stones undoubtedly represent one of the most primitive arches extant; but all the work above the line D E, is probably that of a much later date.

It is usually said that even the Greeks, those wonderful originators of one of the loveliest species of architecture that the world has ever kuown, were ignorant of the arch. That their architects did not use it is

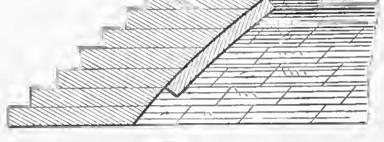


Fig. 2.

certain, but it would be rash to deduce from this that they were not aware of the principle or of the geometrical processes for describing the curves required. It is much more probable that, like the Egyptians, they rejected the arch on principle, considering, and justly, that it did not harmonize with the other details of their buildings, characterized as these are by the severity of horizontol and vertical lines alone. We mean horizontal in the general effect. It is abundantly evident from the researches of Mr. Penrose at the Parthenon on the curves of that building, that the Greek masons were able to set out and execute their work in so masterly a manner that it would be difficult to equal it in our own day. For the five months' investigations of Mr. Penrose revealed the astonishing fact that the lines of the pavements, architraves and cornices of the Parthenon are not strictly horizontal lines, but slightly curved; and, moreover, that the entasis, or curvature of the columns vertically, and the outlines of the moldings are formed of hyperbolic or parabolic curves, thus clearly inferring in the Greek architect a good knowledge of conic sections.

Whatever nation may have been the actual inventors of the radiating arch, it is

Fig. 3.

certain that its general introduction into architecture is due to the Romans. Once adopted, its influence grew gradually greater. Slowly, but surely, it sapped the leading principle of classical architecture—the predominance of the horizontal line. When first introduced it was independent of the columns and the entablature, which latter it did not spring sufficiently high to reach—the impost being merely a few plain moldings. Later the arch rises until it penetrates into the entablature, and the impost becomes enriched. Then come instances where the arch springs from the architrave of the entablature above the columns, and cuts the frieze and cornice. Thus the continuity of the horizontal lines is more and more impaired, until we find at last arches springing immediately from the capitals of the columns. When, after the fall of the Roman empire, architecture again began to raise her head, the ruins of these arches became the models for those of church and basilica. Later came the pointed arch, the glory of the Gothic style, entraining gradually the lines of the buildings still more from the old horizontal forms, and this remaiued the sole architecture of Western Europe until the Renaissance brought back the circular arches of the Romans.

To whomsoever the credit of the invention of the arch is due, it is certain that its varied phases of development have been produced by builders of widely different races and epochs. It will be of course impossible within our limits to give anything like a history, however succinct, of even this single feature of architecture; but a rapid sketch of the different main varieties of arch and their origin may be of service, reserving the consideration of the geometrical principles involved until that part of our subject is reached.

To the Roman builders no other forms, save the semicircular arch (Fig. 4), or more rarely, the segmental (Fig. 5), each struck from one center, seem to have commended themselves. The Romans thus not only lost much of the beauty obtainable by arches of varied outline, but also the power of constructing those of extensive span. Ancient Rome boasted of about eight bridges, but none of them were distinguished by great width of arch, and could not for a moment compare with similar works of modern construction, although doubtless they may claim the credit of being the early examples that pointed out the path in which perfection might be sought. The span or chord of the Roman bridges seldom exceeded 80 feet, and their versed sine, or hight, was nearly half the chord; their form, consequently, being almost semicircular.

Other early forms of arch sprang up when civilization began again to take halting and timid steps after the fall of the Roman Empire. Modifications of the segmental arch, as in Fig. 6, and those of an ellipsoidal character, or what the French called "basket-handle" arches, Fig. 7, became common, and these forms, with the semicircular, held their ground in Western Europe until the appearance of the pointed arch; nor even after that period were they entirely discarded. In the Romanesque and Norman arches, the center from which the curve is struck is sometimes to be found above the line of the impost, and any moldings intervening between these two levels are carried in a vertical direction, as at Fig. 8, when the arch is termed " stilted;" or slightly incurved, as at Fig. 9; or again with the curve

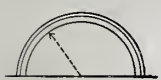


Fig. 4.

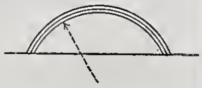


Fig. 5.

prolonged until it joins the impost, Fig. 10. These two latter forms are frequently called "horse-shoe" arches, and have probably a Saracenic origin. The Saracens had two favorite forms of arch—one that just spoken of, and the other where the curve has a flexure in the contrary direction, as in Figs. 11 and 12; and wherever the followers of Mahomet carried their cimeters, in Syria, Persia, Africa, Spain, or Sicily, they introduced their architecture. Among successful Moorish works may be mentioned the bridge over the Guadalquiver. Some have claimed for the Saracen masons that their work equaled the best arched constructions of Rome; but this is not correct. Neither the horse-shoe arch, nor that with the curve of contrary flexure described from several centers, are legitimate and stable arches. They are both vicious in respect of construction, from the difficulty of arranging the abutments so as satisfactorily to resist the thrust. Indeed, it would be almost impossible to construct stone arches of any considerable span in these forms. The Moors were, however, builders in brick, which lends itself more readily to such designs.

In another article we shall continue this subject, giving a description of the various gothic arches and foliated arches, and some account of their use in architecture.

Art in the House.

The fact is quite clear, says a writer in a daily contemporary, that art is not only making its mark upon the walls outside, but is getting into the house. This movement is very general, and when fine pictures and choice pottery are too costly, engravings, chromo-lithographs, and decalcomanie prove the growing taste for beauty of form and color. It is not so clear what the cause

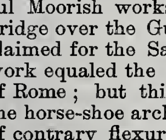


Fig. 6.

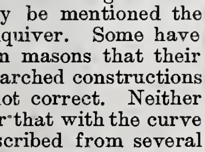


Fig. 7.

of the change is; and to say that it is a fashion only puts the question one step further back, and compels us to ask why fashion takes that turn and has taken it for so many years. Evidently, there has been a general strike in the ranks of plodding utilitarianism and a demand for more sweetness and light, for more loveliness and joy, among the workers in town and country. Sober thinking has rebelled against the dissecting-knife of science, and cried out for the artist's pencil and chisel to save nature and life from being murdered in the rage for cutting everything up. The eyes themselves have joined in the rebellion, and the printers, who have had their own way so long in the keeping of the conscience of the people, have been emphatically told that their day of domineering is over and that color must light up the blackness of ink, and queenly painting must divide the throne with kingly print.

It is certainly pleasant to see this change, and it is wholesome for business, as well as for culture, to have this rising demand for form and color in the house, and even household furniture has caught the enthusiasm, and it is sighing to be delivered by the living hand of art from the monotony of machinery and the routine of mechanism. It is well to have a chair that not only seats you well, but puts you on a footing of companionship with itself and your neighbor; well to have a table that holds your book or plate, and also in its poise, or its figure or carving, tells you what you like to hear, and gives you a sense of rest or a start to thought or fancy. Art apparently came into the homes of the people with the new modern liberty, in the democratic way, and some of the most significant relics of the Renaissance are in the form of chairs, chests and tables that show how it was that the new life, which sung itself in popular hymns and printed itself in popular woodcuts, made its unequivocal mark upon the household furniture, and was especially determined that every girl who was married should have some piece of furniture, to show that she was not thereby an article of use, but a bit of beauty, and that she should have something handsome, like herself, to go with her. When we are asked why it is that art is desirable in the house—whether in the simplest or the most elaborate forms—it is not difficult to reply. First of all, we desire to have expression wherever we live, and art is expression. It is the way to put the life of things into telling shape, so that it will keep on telling. A statue, even if it appears to you only in a cast of plaster or terra-cotta, has something to say to you. An engraving has a voice for you, and a picture with any approach to good color has a smile and a song. It is a human

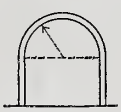


Fig. 8.

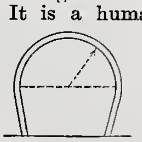


Fig. 9.

presence, it is man; his mask, and not only his mask, but his mind, his living mind; and the mind in the thing is there always, and does not change for the worse or for the commonplace, as the man himself might change were he there in person. Nor does that mind need to be entertained, and dined and wined and lodged, as the man himself might need to be were he your guest, together with the work of his hand.

There is also in a good piece of art something more than an ideal expression. There is a certain force that the true artist puts into his work and which stays in it always, and always radiates from it. A while ago there was a picture sale in this city, and a goodly collection of original works were sold at good prices, yet without any especial enthusiasm, until a canvas of moderate size with a hound upon it was put up for the highest bidder. The hound woke the spectators up at once, as if the horn sounded for the chase, as soon as it was seen that Rosa Bonheur had touched that canvas into life. The bidding went up by hundreds until near $3000 was bid, and the picture was knocked down to the plucky competitor. The creature was alive, not in the vulgar sense of the exact copying of reality—the life was not painted upon him, but it was made to live in him, and thus art in this creature was not only an idea, but a power. That picture carried with it a living force that came from living genius. All good art has something of this charm, and instead of covering our walls with dreary lots of soulless daubs, as if art were to prevail by much brushing, it is best to have a few examples of good art, however modest they may be, which prove the artist's true feeling for the life of things and his power to put that life into his work. A sunrise or sunset, a river side or sea view, an ivy-clad cottage or a village church, a single tree or a flower, may tell the secret of nature to you and give you its power.

Then, too, there is a true socializing influence in the household art that not only furnishes subjects for conversation, but which inspires a certain social feeling. It is a great matter to break the ice that keeps people apart from each other, and to allow the currents of sympathy to flow freely between them, to ripple with the breeze, and to color up or down with the light and shadows. Whatever partakes of beauty does the work, and a bit of cheering color or winning form brings people to each other before they know it, and sometimes breaks the ice between them, even when a stately dinner might leave them freezing. Something of this work is done by the present rage for *bric-a-brac*, and, absurd as its excess is, it is often very delightful to be stirred and cheered by the fine form and rich colors of a good piece of pottery, or the choice workmanship and marvelous tints of an Oriental rug of the best kind. High art carries us further in good fellowship; and a great picture or statue says more of us to each other than we can say with our own tongues for ourselves. What is coming from art in

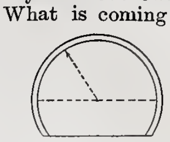


Fig. 10.

American houses it is not possible at present to say with certainty, but it is certain that a great many things may be expected if the next 25 years show the same progress as the last 25. Those of us who can remember what a fine thing it was once thought to be for a rich man to bring home from Europe a half dozen or more of tolerable copies of Italian masterpieces, cannot but observe with satisfaction the number of fine originals of modern masters in the houses of a score or more of our own friends. A few of our favored citizens have rich picture galleries in their own houses, and they are willing to give to friends, and sometimes to the public, the enjoyment of all that beauty, sure that, like heaven's own beauty, it is not lost, but enlarged, by being imparted. But these cases are and must be exceptions. The welfare of the great body of families of taste and refinement is the great matter, and it is important to have art so cultivated that they and their children may be the better for it. Would it not be well for every thoughtful family to have at home one or more really good pictures, such as give a blessing now and carry a treasure with them to the future? Might there not be an eye to this in the very structure of good houses; and where a stately gallery is out of the question, could there not be a room suited to hold some speaking gem of art, say a picture or statue that is too deep or exalted in meaning to go into a dining room or parlor, a card room or dancing hall? May not art in every house have its sanctuary, however modest, where memory shall be refreshed and faith and hope can be fed; and the world will not make any serious trouble for us, even if the place looks like a retreat for meditation or a closet of devotion—less

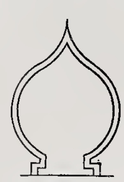


Fig. 11.

Fig. 12.

like a museum of entertainment than a little chapel of thought and prayer? Art as well as life would gain by this elevation of taste and demand for inspiration.

To Stain Wood Violet.—The wood is treated in a bath made up with 4¼ oz. olive oil, the same weight of soda ash, and 2½ pints of boiling water, and is then dyed with magenta, to which a corresponding quantity of tin crystals have been added.

Cement for Fastening Wood to Stone.—Melt together 4 parts of pitch, 1 of wax, and add 4 parts of pounded brickdust or chalk. It must be warmed before use, and applied thinly to the surfaces to be joined.

Yellow Staining for Wood.—Mordant with red liquor, and dye with bark liquor and with turmeric.

A hand saw is a bad graving tool, **but a first-rate instrument at " cuts."**

Artistic and Economical Decoration in Wood and Perforated Metal.

(Concluded from page 50.)

On the Third avenue line there are several cars in which a very neat use is made of colored lines, which are made to take the place of engraved wood with good effect. In Fig. 9 is shown an elevation of the panel occurring between windows in the car and the method of using the lines. A A are projecting strips of wood forming the posts between the windows, and, so far as their surface, are perfectly plain. These posts are surmounted by a cap. A detail of the post and caps is shown by A, B and C, in Fig. 10. The cap is made by sawing off proper lengths from a molding, and chamfering the edges of the upper bead. D and E, Figs. 11 and 12, show other forms of the same finish. The wood employed is cherry or light mahogany, and without any relief would be rather bare. To avoid this, a

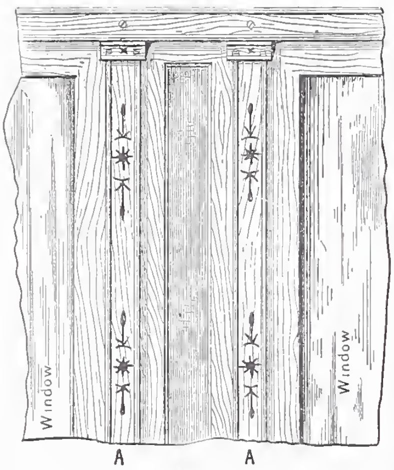


Fig. 9.

small pattern in dark brown is put on with a stencil. Throughout the woodwork on this road, simple lines of brown upon cherry and mahogany are made very effective in cheaply decorating surfaces which otherwise would have lacked ornamental effect.

In Fig. 13 is shown an inverted plan view of a pendant and its base, used in ornamenting and finishing the intersections of the belts separating the panels in the ceilings of the Third avenue line waiting rooms. The panels are composed of narrow matched stuff, the edges of which are chamfered instead of beaded, as is the usual manner of finishing in such material. The corners or angles formed between the panels and the belt pieces which separate them, are relieved by a simple three-quarter round bead. This bead at the corners, instead of forming a miter, as is commonly done in such cases, is finished by means of a square block, as shown. An enlarged view of this block, which as used is probably four or five inches square, is shown in Fig. 14. Upon the face of the block an L-

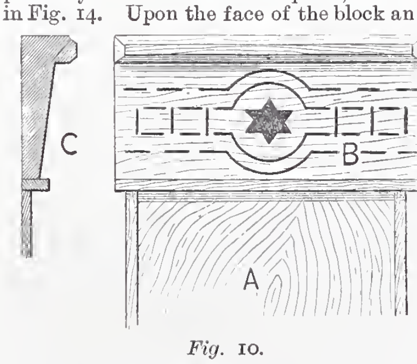


Fig. 10.

shaped channel is engraved. Beyond this there is no attempt at ornament, yet the whole effect is very pleasing, and it is attained at the smallest possible outlay of labor and material.

In Fig. 15 we give two views of an ornamental skirting used upon a window finish of a Broadway building, the effect of which is exceedingly good. The design is quite appropriate for the place in which it is used. The labor required to produce it is very small, and the material consumed quite insignificant. It may be produced in its simplest form by cutting the edge of a board into scollops and fastening it upon another one, the projection of the scollop in one board and the edge of the other board corresponding, and then putting a little arrow-shaped point into the angles. These points are finished with a gouge, and their upper surfaces are hol-

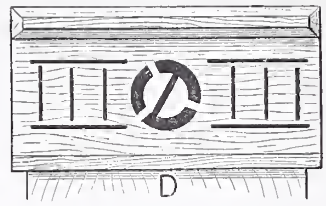


Fig. 11.

lowed both right and left. When in position this design gives an effect altogether out of proportion to the work required to produce it.

In Fig. 18 we represent a method of decorating an edge, which is very effective as well as very popular, and which, if we are not mistaken, has been used upon wood, stone and pottery work for numberless of years. It consists simply of V-shaped cuts along the edge which is to be decorated, with half round grooves running back a short distance and terminating in deep hollows, which are usually round bottomed. Its most appropriate place of use is in a skirting of any kind, the points having very largely the effect of a fringe or apron. When once the pattern has been laid out it can be produced easily and rapidly, and if not used for too large or too heavy work, is appropriate in a great variety of situations. As all these ornaments increase in size they grow bare, and, consequently, if used of large dimensions, must be placed at a greater distance from the eye. As they become smaller their value as a means of decoration increases, and they can be made to answer in many cases for very small work.

Almost any pattern of this general character, if made as small as the engraving which we have given of it, would be suitable for the decoration of work-boxes or other similar articles for use in the parlor. The design shown in Fig. 18 we have seen used

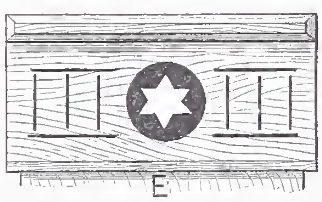


Fig. 12.

upon the fronts of buildings, spaced from 4 to 5 inches between points. Of the design shown in Fig. 15, the largest size we have ever seen was about 8 inches from point to point.

In the depot buildings of both of the elevated railroads, perforated metal-work has been used in connection with the natural colors of the woods employed, and with pleasing effect. The perforated metal is usually painted some bright color. In Fig. 16 we show a ventilator pattern used in the ceiling of the waiting rooms of the Third avenue line. In this the metal is painted a bright blue color, which contrasts very prettily with the shellaced wood in connection with which it is used. The pattern, which is also represented by black lines in our engraving, of course makes its appearance in black upon the blue.

In Fig. 17 is shown a pattern of perforated metal which is used in the construction of the roofs over the platforms of the Metropolitan line. In the final finish of this pattern, color has been sparingly used upon the rosette in the center, which is partly a perforation and partly a simple depression in the casting. In this respect the full effect of the design is not conveyed by our engraving. The entire appearance, however, may be stated as very good, and recommends the pattern as one which is quite desirable for the purpose.

It is to be remarked in this connection that the principles governing the design of perforated work are subject to modifications, dependent upon the position in which the pattern is to be used and from which it is to be viewed. In the case of Fig. 17, the pattern is frequently seen against the sky, and is consequently shown as light upon a darker color, and, therefore, in proportion, the openings or perforations are necessarily made smaller or finer than they would be made if the reverse were the case. In all cases where the pattern is to be seen so as to appear lighter than the ground, the openings must be very much smaller than when there is a covering and a dark space behind the pattern, so that it appears as black upon the color in which the metal is painted. The reason for this is quite simple. White, when spread in a pattern upon a surface, is so powerful in its effect upon the eye, that it not only destroys the distinctness of outline of the design, but it destroys the color around it and gives a general gray tone and effect to the whole surface. Therefore it is necessary to employ white very sparingly in designs for perforations, in order to produce pleasing effects.

In our references to the several elevated

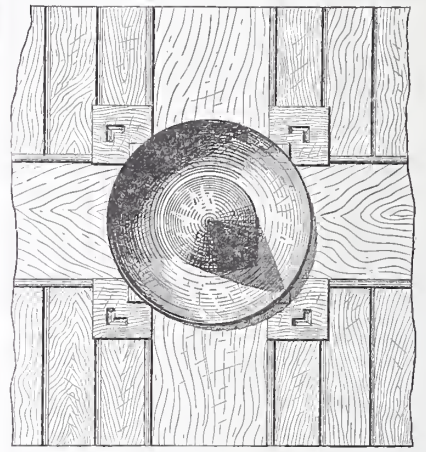


Fig. 13.

railroads, we have only named a few of the more prominent features in the construction and finish of the depots and cars. Throughout, with very few exceptions, the same principles are adhered to, rendering the entire work, as regards neatness, simplicity and good taste, of a higher grade than any other public work that it has been our fortune to inspect.

Pleasures of House Building.

To build or not to build ? That is the question which must have exercised many an anxious mind, for it is a question that is often difficult to answer. Of course there is great luxury in designing a house where you can carry out your own ideas and crotchets. It is to be presumed that you have had considerable previous experience of dwellings where you have felt or fancied that the discomforts decidedly predominated. For it is the nature of man to take all that is pleasant as a matter of course, while he is fretted intolerably by the thorns among his

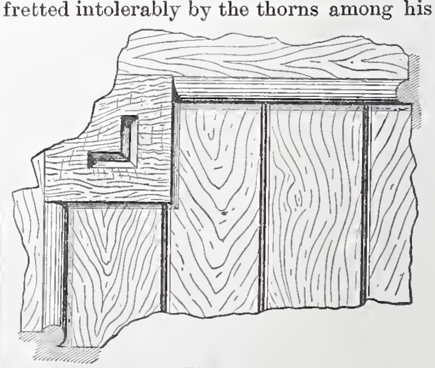


Fig. 14.

roses. So you have at least the advantage of knowing all that ought to be avoided, and you go to work upon models whose imperfections are beacons to buoy out your course. You take care that the kitchen regions shall be in convenient proximity to the dining-room, yet, at the same time, effectually screened off. You see that the back staircase is hermetically trapped and sealed—we are talking of course of a moderate-sized mansion—so that the more penetrating odors of the cookery shall not poison the bed-rooms on the upper floor. You look closely to the fitting of the casements, the opening of the French windows on the lawn, the scientific construction of the chimneys, and a variety of similar subordinate, yet most important, considerations. The modest dining-room is arranged artistically to accommodate comfortably the number of guests you best love to entertain, at a table that is round or long, as it suits your fancy. The conservatory is made to open out of the

Fig. 15.

drawing-room, at the angle where the eye will glance down its blooming vista as you lie reposing luxuriously in your favorite lounging chair, which commands at the same time the exhilarating prospect from the windows. You have selected a quiet corner for your library, where you may absorb yourself in the pursuits that make you a public benefactor, among surroundings which are at once snug and cheerful. The bed-rooms are made miracles of light and sweetness, without being the sport of the winds and drafts; the cellarage is cool, dry and well ventilated, so that it shall be a positive pleasure in the dog days to dive down among your wine bins. In short, we may assume that in theory, and almost in practice, your well-considered plans will leave little to desire. Moreover, you have the substantial satisfaction of believing that you are settled for life. No arbitrary landlord can give you short notice to quit at the first break in the lease that assigns him an option in that respect. Each trifling improvement you make is a permanent one. You fit up bookshelves in special recesses; you adjust works of art on their appropriate brackets, with the agreeable sense of an ownership that need only have its ending in the neighboring churchyard. You have to worry yourself over no harassing stipulations as to periodical painting and papering without and within; whereas the tenant who has solemnly set his hand and seal to a long list of stringent covenants, may have to submit to inconvenient expenditure at some most unseasonable time, and to remove his family to extravagant lodgings by the sea just when his credit with his bankers is least satisfactory.

All this is the sunny side of the picture; but, unfortunately, there are sure to be corresponding shadows which cast their ominous clouds over the pleasing prospect. The man who decides to build himself a house does so in the determination of bringing himself to an anchor for the remaining term of his natural existence. No doubt he may sell; but the odds are that he would have to sell at a serious loss, and then he is loth to cut loose from a cherished scheme and fatally compromise his character for foresight. He has been casting about for a site, and he has selected one to his satisfaction, as he fancies. But the more attractive he has made his residence, the more taste he has exhibited on the surrounding grounds, the more likely is he to provoke imitation.

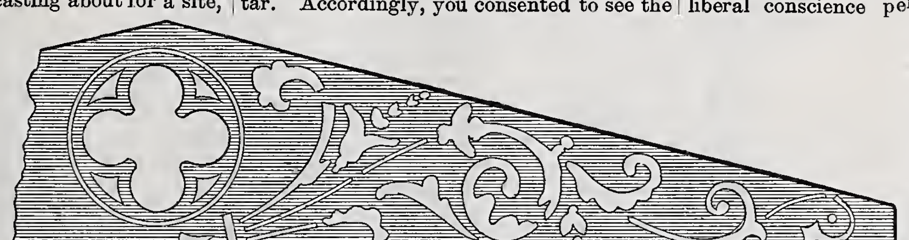


Fig. 17.

It is foolish to resent intrusion which he has no power to resist; but for the life of him he cannot help feeling morbidly fastidious about his neighbors. The stuccoed Italian villa that is run up to the right of him, with its Chinese cupola and its Mouresque verandas, is a standing outrage on his sense of the hideous. The self-satisfied proprietor of the commodious Queen Anne's mansion on his other side, is blessed with a numerous progeny with exuberant animal spirits. The girls are getting up perpetual garden parties, and what would be musical peals of silvery laughter in the chapters of a three-volume novel, come to him as shrill giggling in the seclusion of his desecrated study. The school-boys are hardened birds' nesters and little scrupulous about boundaries, while they can never resist the temptation of disturbing the philosophy of his wife's pet poodle or shying stones at her favorite cat. Trivial differences between the establishments fret and fester till they are aggravated into inveterate feuds. Then of a sudden the parish post-office, that stood within easy reach of the gate, is removed to a most inconvenient distance, owing to the lamented decease of the postmaster. The clergyman, in whom your wife and daughters are delighted, is translated to a better living, and the new comer irritates you with ritualistic practices, or vexes your soul with interminable discourses that are neither eloquent nor edifying. Possibly, worst of all, the trustees of a reformatory may find the situation salubrious and suitable for their purpose, and rear a grimly stupendous pile between your windows and the fair landscape that had attracted you.

But even if your little place should prove the paradise that you fondly anticipated, there is much that you must inevitably go through while it is in course of arrangement and construction. Make your calculations of its cost as liberally as you will, from the financial point of view it must be fruitful of provocations. Perhaps the idea of your building originated in the course of casual conversation with a friend. He had just

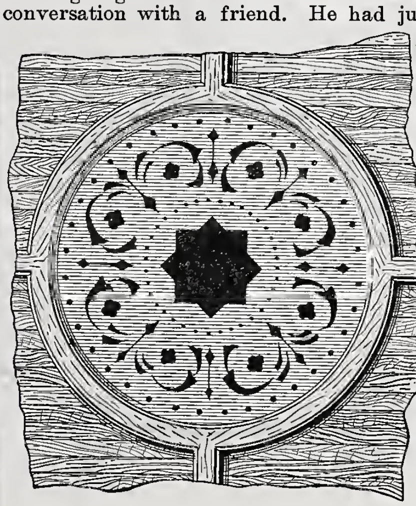


Fig. 16.

been running up a house himself; most of his sorrows were left behind him; and, as you are inclined to suspect on reflection, he was playing the part of the fox who had lost his tail. When he saw that you were seriously rising to his bait, he hinted at your having a talk on the subject with his architect—a capital fellow and quite a man of the world, and, moreover, a man who might be absolutely relied upon. It was this last confident assurance that decided you, for you remembered the proverb about fools building houses for wise men to live in, and, like most people of average intelligence, you had a wholsesome horror of brick and mortar. Accordingly, you consented to see the architect in question, and were greatly taken with him. An exceedingly intelligent man: a man of unimpeachable taste, of unquestionable powers of conversation, yet, to all appearance, thoroughly practical. You explained your ideas roughly to him, and he saw at once what you meant. The preliminary and most essential part was the estimates, and as to these he expressed himself with the decision of long experience. Only show him the house you proposed to take for your model, and he could make approximate calculations by which you might safely be guided. You did show him the house; you saw him step out the walls and count up the courses of brick and stone at the corner. He cubed up the contents, produced a pencil and memorandum book, and reached his results with the rapidity of genius. You were rather agreeably surprised by these, and begged him to

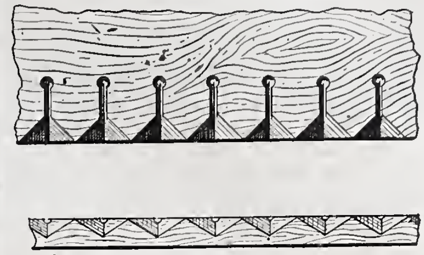


Fig. 18.

verify his opinions that he might make assurance doubly sure. He verified them accordingly, and shut up the note-book as if everything were disposed of, so far as he was concerned. Whereupon you entered into negotiations for the site, while you instructed your professional acquaintance to draw out regular designs. The drawings were all you could desire, and more, and you were only impatient to see the conceptions realized. You promptly closed your bargain for the site, having had to pay an extra percentage for your too evident eagerness; and you requested your architect to communicate with a builder. Then you had your first solid reason for apprehension. You learned to your surprise that, owing to local circumstances, the building of your house could not be put up to open competition; that builders residing at any distance would hardly care to compete, and that the one local man was virtually master of the situation. Your apprehensions were fully realized. The builder's estimates were exorbitant, somewhere between 50 and 60 per cent. in excess of the delusive calculations of your architect. The architect shrugged his shoulders and said something about unexpected local conditions, which defied and defeated the calculations of experience. Bricks were fetching fancy prices for the time, and must be carted from extraordinary distances over nearly impracticable by-roads. There had just been another strike of the bricklayers, and timber would seem to have gone up simultaneously, while slates and tiles are beyond all price. Far too late you learn, to your cost, that although the architect, from the æsthetic point of view, may be all that your fancy painted him, yet he is anything but a practical man of business. Now that the drawings are made out to his satisfaction, he is sublimcly contemptuous of those pecuniary considerations which the builder has very much at heart indeed. Virtually, the builder has you at his discretion, and you are reduced to an appeal to his honesty and sense of justice. But honesty, like charity, begins at home, and he has a chance which it would be culpable to neglect. He exacts as handsome a profit as his liberal conscience permits him. He will abate nothing of his actual charges, and any reduction that he does make in his terms is at the expense of the decorations and little refinements that you had set your heart upon. The building is begun, and may go briskly forward, or it may drag on in a heart-breaking manner, owing to a combination of unpropitious circumstances that are altogether beyond your control. But in any case, it is pretty certain that you will have to reconsider many points in the minor details, although each of these subsequent alterations is quite disproportionately costly. In short, by the time you invite your friends to your house-warming, your feelings may very probably be of a most mingled character; and if you speak your honest mind to any of your guests, you will hold yourself up rather as a warning than as an example. —*Saturday Review.*

Gothic Roofs.

The description of roof which was adopted, with various modifications, by the mediæval builders, and to which we are accustomed to apply the term "Gothic," possesses for us considerable interest, from the fact of the extensive revival and adoption of this style during the present century. Perhaps the general idea entertained of a Gothic roof is that it is one of very high pitch, and haviug hammer beams at the feet of the rafters. But in reality the roofs of the Middle Ages were of very varied degrees of elevation and material difference iu form. The pitch of some was immense, au angle of 90 degrees being frequently adopted in Norman roofs; others were almost as flat as the coverings

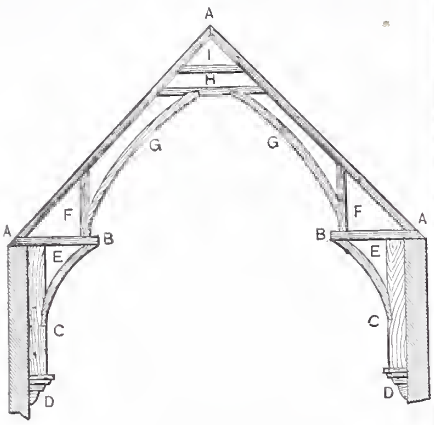


Fig. 1.

of classic times—thus the decorated roof of the south aisle of the Church of St. Martin, at Leicester, has a rise of 4 feet only, while the spau is 21 feet. The variety of forms was equally considerable, ranging from the simple truss of a pair of braced and tied principals, to the elaboration of a double hammer-beam roof. Nor is it possible to treat of mediæval roofs in a chronological series, developing from simplicity to complexity, because, with the exception of the hammer-beam roof, the various methods are frequently contemporaneous.

In our brief sketch of Gothic roofs, therefore, we shall, for the sake of convenience, divido them as follows:

1. Tie-beam roofs of various kinds.
2. Those with trussed rafters, or single-framed roofs.
3. Braced roofs, whether having collars or without.
4. Hammer-beam roofs.

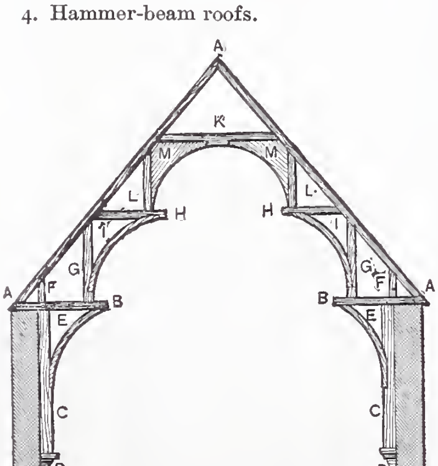


Fig. 2.

To make such references complete, we add the names of the parts of the hammer-beam roofs shown at Figs. 1 and 2. Fig. 1 is a single hammer-beam roof, where A A are rafters; B, the hammer beam; C, the pendant post; D, the corbel on which it rests; E, hammer brace; F, side post; G, collar brace; H, lower collar; and I, upper collar. Fig. 2 is a double hammer-beam roof. Here A A are the rafters; B, lower hammer beam; C, pendant post; D, corbel; E, lower hammer brace; F, ashlar piece; G, lower side post; H, upper hammer beam; I, upper hammer brace; K, collar; L, upper side post; and M, collar brace. "Post" is the general name for the upright pieces, with the addition of any necessary qualifying terms. Slanting pieces (otherwise than rafters) are "braces," or "struts," with qualifying term derived from the piece under which they stand. In many ancient roofs the ashlar pieces are adapted to each rafter. Where the wall plates are double, it is usual to term oue the "outer wall plate," while the other is the "inner wall plate."

Tie-beam roofs are found in all periods of mediæval architecture, and may usually, in England, at least, be resolved into modifications of Figs. 3 and 4, of which 3 represents the type of an early roof, and Fig. 4 that of a later one. Some of these roofs have about the outline of an equilateral triangle, others are more lofty, of which the roof shown at Fig. 5 may be taken as an instauce. This roof is supposed to date from about 1270. Some of the principals are connected by the tie beam, while other intermediate trusses consist of the rafters with collars and braces only. In the low-pitched roof the tie beam often bears the whole weight. "The roof over the south chapel of Kidlington Church, Oxfordshire," says Gwilt, "is of rather steeper pitch than that at Leicester" (noticed above). "The underside of the beam is well molded, and is connected with the wall pieces by molded curved braces, forming a very obtusely-pointed arch. The purlins rest directly on the beam, and the ridge is supported on it by a post, and by short curved braces, the whole of the space above the tie beam being filled up, so as to give it the appearauce of a solid triangular-shaped beam. The naves of Raunds and of Higham Ferrers churches, Northamptonshire, the latter of decorated date, and of Wimmington Church, Bedfordshire, present good and differing examples. The tie beam is rarely left horizontal; the

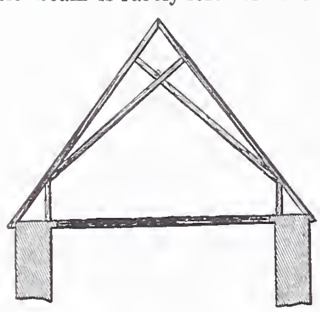


Fig. 3.

collar beams, and even the hammer beams, will be found to incline upward. Tie beams are sometimes employed quite independently of the other timbers, being simply laid across the building from wall to wall, notched down, and pinned to the wall plates. They were never entirely discarded, as they are to be met with in each of the four usually accepted divisions of the style. At Southfleet Church, Kent, the tie beam is beautifully molded; whereas at Northfleet it is left in almost its natural roughness, while the roof itself, which is of the trussed rafter kind, is paneled, and has molded ribs, with carved bosses at the intersections."

It is very usual in the earlier roofs to have the tie beam more or less cambered, an example of which is found at Swordestone Church, Norfolk. Other specimens occur in both Sussex and Kent. Fig. 6 is a tie-beam roof of the decorated period. This truss is a king-post, but here, unlike modern roofs, the tie beam assumes the office of a girder, and carries the timbers above it. The curved struts also play an important part in increasing the stability of the roof, as they distribute a portion of the pressure in a downward direction. This use of a pendant-post, resting on a stone corbel built into the wall, and having an arched strut springing from it, is characteristic of the middle-age roofs. In Fig. 7 we give a very antique example of the pendant post (sometimes called wall post), with its supporting corbel, superincumbent tie beam and arched strut. In the roof of the aisle of North Walsham Church, Norfolk (Fig. 8), the tie beam traverses the wall of the nave, and its end constitutes a corbel on which the wall pieces and struts of the tie beam of the nave roof abut. This roof also exemplifies a plan which was almost universal subsequently, uamely, the adoption of an intermediate truss between the tie beams, in consequence of the extreme width between the main trusses, to support the ridges and purlins, by the adoption of double rafters on each side, strongly united and framed together, springing from a small hammer beam over the apex of the arches. At Fig. 9 is an example from the church of Little Coxwell, Berkshire, of about the middle of the four-

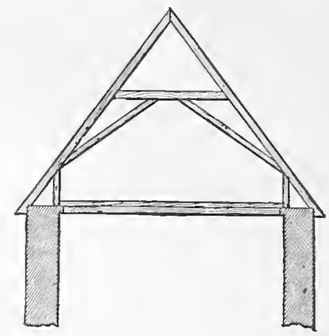


Fig. 4.

teenth century. It will be observed that there is a rude attempt at ornamentation in this roof, by the addition of a piece of timber under each rafter cut into concaves. This primitive plan was not uncommon in middle-age roofs, before the use of more elaborate ornament obtained. Sometimes this additional piece was merely chamfered on its edges, or even left plain. We have already mentioned that many of the tie beams have traces of ornament. Many examples are extant. A king post in the chancel of old Shoreham Church, Sussex, has an early English base, and the tie beam is carved with the well-known dog-tooth ornament. Fig. 10 shows the roof of the nave of Kidlington Church, already alluded to, and Fig. 11 gives a detail of the south-aisle roof of the same church. The tie beam and other roofs became more ornamental as the decorated style grew in favor, without, however, losing their constructive characteristics. A good specimen of this more florid style was seen in the chancel of the old church of Horsley, Gloucestershire, now destroyed. "This had a flower or other ornament carved at the top of each of the circular ribs. The king post and tie beam were both molded, and the latter had molded cir-

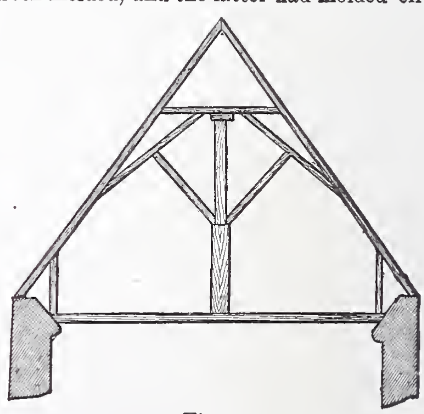


Fig. 5.

cular braces both above and below it, the lower ones supported on corbel heads. As the decorated style advanced, the leading timbers of the principals were often formed into an arch by the addition of circular braces under the tie beams, the beams themselves being also frequently curved. The spandrels formed by these braces were usually filled in with pierced tracery, and the timbers generally were more molded and enriched than in the earlier styles. Where the lines of moldings were interrupted, they very commonly terminated in carved leaves or other ornaments."

Character of Buildings in New York and Philadelphia Compared.—The building operations of New York and Philadelphia differ greatly in the character of the houses erected for the inhabitants of the two cities. During the last 11 years the average number of first-class dwellings built in New York has been 570 per annum, the average value of each being $16,000.

The average number of second-class dwellings (costing $3700 each) has been 174 per annum, but of tenements and French flats there have been 684 per annum built during the last 11 years. It appears very clearly from these returns that the larger number of dwelling houses were built for wealthy people, while the poorer mechanics and tradesmen were, for the greater part, condemned to live in tenement houses. In Philadelphia last year, although fewer dwelling houses than usual were erected,

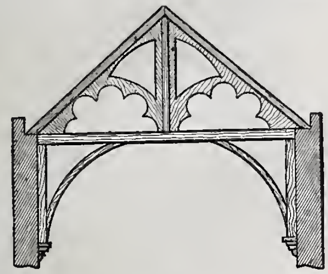


Fig. 6.

there were 2275 two and three story dwellings built, besides 138 stores and dwellings combined, but no tenements. New York in 11 years built about 1900 small dwellings, including frame "shanties," (which were not separately reported until 1875), but in 1878 alone Philadelphia built over 1200 two-story dwellings, and this was less than the average number for the last 10 years. Besides these there were probably as many more cheap three-story dwellings which could fairly be compared with the class of houses of which New York built only 1900 in 11 years. New York expends more money on a very much smaller number of buildings than Philadelphia. The whole number of new buildings erected in New York last year was 1672; the number in Philadelphia, 2902.

Waste Products.

Those inventions deserve special honor, and generally receive special and substantial recognition, which develop new industries or utilize waste products. It is saving that makes the individual rich and the community prosperous. The glycerine industry, which has attained colossal proportions, is a notable illustration of a great manufacture based entirely upon the saving of a product that until lately was a waste result with the soap-boiler. Even more important in mag-

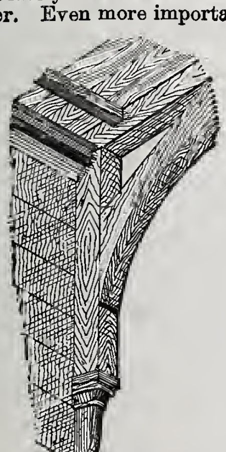


Fig. 7.

nitude we may estimate the industries connected with the manufacture of the aniline colors and artificial alizarine, from the refuse coal tar that was formerly the curse and nuisance of gas-works. The waste blood of the abattoirs is sought after by the sugar refiner and the manufacturer of albumen. Old boots and shoes and leather waste are turned to good account by the chemical manufacturer, in producing the cyanides, ferro and ferric cyanides, so indispensable in color printing and photography. Sawdust, mixed with blood or other agglutinative substance, and compressed by powerful pressure, is molded and turned into door-knobs, buttons, and a thousand decorative and useful articles; or, as is the case, too, with the spent tan of the tanneries and the spent bark of the dye-works, it is utilized for fuel. Oyster shells, of which our barbarous ancestors made the shell mounds that delight the soul of the archæologist, are burnt to lime. The waste of the linseed oil manufacture is eagerly sought for as food for cattle. The waste ashes of wood fires are bleached for potash. River mud is mingled with chalk, burnt and ground, to make the famous Portland cement, and the ruthless hand of utilitarianism has not even spared the brickbat, that from time immemorial has served only to crack the heads of opposing factions, but grinds it up with lime to make cement. The finest glue size is made of the waste of parchment skins. The waste gases of the blast-furnaces are now employed to heat the blast, to generate the steam that drives the engine that makes the blast, to hoist ores, drive machinery, &c.; and even the slag that had for years served to decorate the hill-sides, is cast into brick for buildings and into paving blocks, granulated for building-sand or ground for cement, mixed with appropriate chemicals and made into the common grades of glass, or blown by a steam jet into the finest filaments, to form the curious mineral wool used largely as a heat-insulating pro-

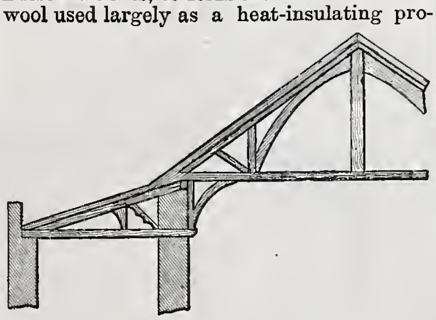


Fig. 8.

tector upon steam-pipes, boilers, roofs, &c. So, too, the enormous hills of anthracite coal dust, that have for years borne silent testimony to the crudity of our methods of coal mining, bid fair to disappear in time beneath the boilers supplied with ingenious dust-burning devices, or in lumps of artificial fuel. Even the anthracite itself, but a few years ago, was a black stone, unappreciated and useless. The waste heat of the lime-kiln is made to generate steam and made to warm immense public buildings, and the "exhaust" of the steam engine must do duty in heating the feed-water. Instances like the above could be multiplied almost indefinitely to demonstrate how invention has enabled us, with the most beneficial results, to reap advantages where none were supposed to exist, or where, if they were suspected, they were undervalued or unavailable, or simply neglected.

The Furniture of the Classical Ages.

The ancient Greeks knew how to furnish their great houses luxuriously. According to Barthelemy, through the real or pretended excellence of foreign goods, Thessaly supplied the required seats, Corinth the bed mattrass, and Cartagena the pillows. The men's department had a grass-plot in the middle, surrounded with four porticoes; the walls were coated with stucco and wainscoted with joiner's work. The porticoes led to other apartments profusely decorated. The furniture was inlaid with ivory and gold. Paintings ornamented the ceilings and walls, and Babylon supplied the screens and tapes-

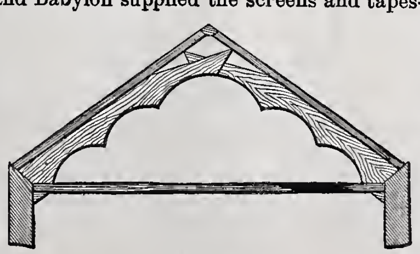


Fig. 9.

try. To these may be added what may be called carpets of purple, the manufacture of Cyprus, adorned with plates or nails of gold, or embroidered. In the "Odyssey" we read that Nestor's house was furnished with beds, tables, garments and carpets, and the house of Menelaus was resplendent with ivory, gold and amber. Bedsteads and couches were embossed with the precious metals, the beds themselves being filled with feathers. At Lacedæmon reeds were used

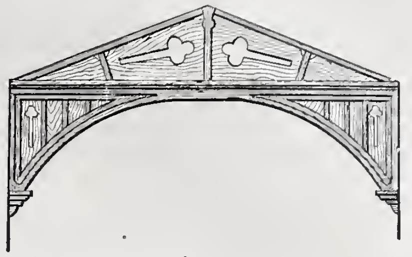


Fig. 10.

for this purpose, mixed in winter with a soft and downy thistle. Mats or beds filled with leaves or boughs sufficed for the poor. Homer mentions three kinds of chairs: 1. One containing two persons, and used by persons of the lowest rank. 2. A chair on which to sit upright, with a footstool under the feet. 3. A sort of easy-chair arranged for leaning backward. The tables or wooden boards were, in the heroic ages, made of polished wood; but at a later period they were adorned with plates of silver and made of costly woods. So luxurious were the ancients in this piece of furniture, that when the men at any time complained to their wives of their extravagance, the ladies were wont to retaliate by "turning the tables upon them." Hence the proverb. The Greeks did not use table-cloths, but the tables were carefully cleaned with wet sponges. The furniture of the ancient Greeks, as gathered from their authors, consisted of chairs (one an easy-chair), bedsteads, with beds of goose feathers, pillows of the same and lambskins for blankets, &c. There were also tables for dining, a particular kind for playing the cottabus and others for counting. Also candelabra, curtains, hangings, carpets, sofas, footstools, chafing dishes, lamps, chests of leather, wood or basket-work; fly-traps, bird-cages, tripods, vases in great numbers and of various fashions, &c.

Stain for Ebonizing Wood.—Since describing, in our last issue, the method of ebonizing wood which employs the logwood solu-

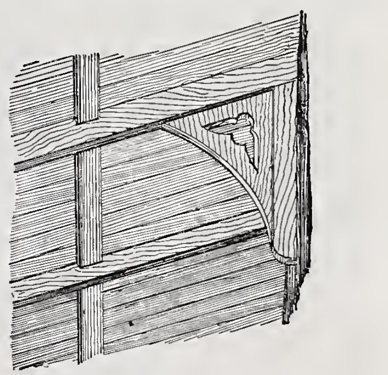


Fig. 11.

tion and the wash of vinegar containing iron, we have learned of a new method which seems to possess merit. Its object is to secure the required color without the use of any solution dissolved in water. A water stain swells the fibers of the surface of the wood, and necessitates a subsequent operation to smooth the surfaces so treated. It has been found that alcohol or methylic spirit, or both combined, will effect the solution of the solid extract of logwood, and that such solution, when used in conjunction with the tincture of muriate of iron, produces a very efficient ebony dye, free from the foregoing objections. The preferred formula is: Tincture of muriate of iron, 8 parts; extract of logwood (solid), 7 parts; alcohol or methylic spirit, or both combined, 37 parts. The composition, omitting the tincture of muriate of iron, may be applied, and the omitted ingredient then used upon the same surface, the jet-black hue being developed by the latter application.

ARCHITECTURE.

Frame House of Moderate Price.

[Design furnished by James W. Pirsson, Architect, 56 Wall Street, New York.]

The house represented in the accompanying elevations, plans and detail drawings, combines within itself taste in design, convenience in arrangement and economy in cost. The design is one which will go far toward answering the demand for low-priced, tasteful dwellings. It embodies features of the present popular styles of architecture, both in the exterior appearance of the building and in its interior trimming.

The general frame is intended to be of the character known as balloon framing, and is first covered with rough hemlock planking, over which is put the weather-boarding, as shown in the elevation. The front gable is finished by running the weather-boarding vertically, and placing a batten over each of the joints, as shown in the detail (Fig. 5). The lower ends of these vertical pieces are notched and pointed, giving a handsome effect in point of design, while but very little cost is expended in accomplishing it.

By examination of the first-floor plan, it will be seen that by means of the hall, which is formed by inclosing a portion of the piazza at the side of the house, convenient access is had to the front room, or parlor, to the dining-room and to the stairway. The stairs occurring between two partitions, and therefore requiring no balusters, rail, or other hard-wood finish, are of very economical construction.

The parlor is enlivened by a bay window in front, while it is further lighted by a window upon each side of the room. A mantel forms the finish at the end. The dining-room is lighted from windows upon opposite sides of the room. It is provided with two good-sized closets, as shown upon the plan. The passage to the cellar is through it, under the chamber stairs. The cellar is designed to extend under the parlor and dining-room. The house should be set sufficiently above the general grade of the lot to afford ample light and ventilation to the cellar by means of the windows shown in the elevations.

The kitchen is formed by a one-story addition to the house. It is provided with a large closet or pantry, is amply lighted from the end and side, and has an outside door communicating with the back piazza.

In the second story there are three comfortable bedrooms, and a hall by means of which communication is had with each independently of the others. By the plan as here given, the closet over the stairs is made to communicate with the front chamber only. By a change, if desirable, it could be divided into two, making a good-sized closet for each of the principal chambers, or it could be left as it is, another door being put into it from the other room—forming a connection between the two chambers which could be opened or closed at pleasure.

There are no rooms in the attic, but sufficient space is there provided to keep the second story rooms quite cool in the warmest weather.

The details of finish of the front gable, piazzas and bay window are so clearly shown in the details, Figs. 5 to 9 inclusive, as to render special description unnecessary.

The style of inside trimming introduced is of a simple pattern, designed in accordance with accepted principles of taste, and, as will be seen by reference to the detail (Fig. 11), is quite different from the ordinary patterns of machine-made moldings in common use. It has the special advantage of being in one piece, and therefore the shrinkage, which always takes place to a greater or less extent, reveals no joints between members. The blocks at the top of the door and window architraves, and also those at the floor against which the base finishes, should be of separate pieces. The architrave and base should be constructed to pass a short distance behind these blocks, so as not to disclose any joint when shrinkage occurs.

The roof of the house may be covered with slate or shingles, or with tin, as preferred. If slates are used upon the main roof, they should also be used to cover the roof of the bay window. The roofs of the piazzas and kitchen should be of tin. The cost of this house at the present time, built of good materials and finished in good style, in the neighborhood of New York, is estimated at about $1000. A number of them were built a short time since in Newark, N. J., upon speculation, costing even less than the figure named, while since that date there has been a considerable decline in prices of materials as well as labor.

Fig. 1.—Front Elevation.—Scale, 1/8 inch to the Foot.

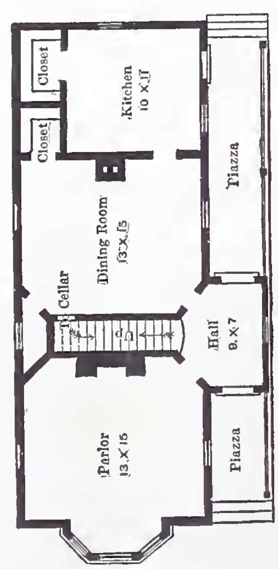


Fig. 2.—First Floor Plan.—Scale, 1-16 inch to the Foot.

Surveyors are men of quantities. They measure a builder's work by their own standard, and though they are always "taking out" they are never willing to be "taken in."

Destruction of Property by Fire.

"We build to burn—we erect buildings with the sole purpose, apparently, of having them destroyed by fire," says Mr. O'Donoghue, an insurance expert, in the extra number of the *Insurance Chronicle.* He then goes on to show that $275,314,600 worth of property all over the United States has been destroyed by fire in the four years which ended on last New Year's Day. This enormous sum represents, be it remembered, not property which has changed hands, but property which has absolutely perished. It represents the annihilation of the results of American enterpise and labor to a sum more than equal to one-tenth of the national debt. An insurance expert may be forgiven for almost "dropping into poetry"—like Silas Wegg—when he adds: "It would seem as though a stream of fire were continuously flowing; beginning with the fresh-hewn lumber in the forest and ending with the musty furniture shop in the big city."

It is significant as to the causes of this frightful state of things that only 101 furniture shops, with all their varnish and other inflammable material, and only 173 saw-mills were burned in 1878, against 407 hotels constantly inhabited and presumably patrolled. The greater the obvious risk, it would seem from this, the greater the probable safety. Last year's statistics also show that only one-half of the value of the property destroyed was covered by insurances. They show also, naturally enough, that blustering March and windy October are the most destructive months, each of them last year being so by more than a $1,000,000 over any other month. During 1878 the "fire-fiend" of the reporters spared ammunition sheds; packing-box, blank-book, oakum, coal-oil, linseed-oil, ether, cigar-lighter and envelop-factories; lime and creosote works, mills for cotton yarn, bark and gunpowder, and lard stores. Twenty-seven butcher shops, 22 slaughter houses, 18 cheese factories, 12 court-houses and 58 churches were burned in various parts of the Union—but only one theater. It is not surprising to hear of the burning of 56 newspaper offices, but it is surprising to be told of the burning of 63 ice houses!

It is not easy to draw any inferences or preach any discourses on these statistical texts, concerning the security of the insured or the insecurity of those who are not insured, because the amount of losses seems to be pretty equally divided between the two classes. Superficially, however, the statistics appear to indicate that hazardous and extra hazardous are not such arbitrary terms as the actuaries would have us believe. If any practical moral can be deduced from these facts and figures, it may be, perhaps, that when people are bent on insuring they will do well to beware of what is called cheap insurance.

A Model School Building.—The public school building known as Grammar School No. 64, at Fordham, New York City, is considered a model in point of arrangement, ventilation and general appointments. It is thus described: The building stands off the main road to Fordham from Harlem Bridge, and has an imposing and picturesque appearance. It is built on an irregular rectangular plot of ground, 100 x 300 feet, which is about three times as great space as is devoted to the school-houses in the other wards of the city. Every class-room is 26 x 24 feet, and the ceilings are 15 feet high. There are three large windows opening from each class-room directly on the outside into the air and light, and one smaller one opening into the hallway which runs through the center of the building. On the third floor there is a main assembly room 65 feet square, the ceiling being 22 feet in the clear. The janitor's apartments, in place of being on the first floor, are on the third, and thus the smells from cooking-stove and washtubs are avoided in the class-rooms. There is an ample open-air play-ground for fair, and an underground play-ground for foul weather. The water closets are entirely removed from the building, being more than 100 feet away. The ventilation is thorough, and is by means of registers set in the walls, as well as by the windows. The building is heated by steam radiators, which are believed to furnish the best system of heating. In each class-room of the upper grammar grade the principal allows only 48 pupils, though according to the rule of the Board as to the allowance per capita according to cubic air space, he might put in 62. There is no such thing as overcrowding. There are 17 available class-rooms, and the building, constructed with an eye to the exigencies of the future, has easy accommodation for 1200 children.

Fig. 3.—Side Elevation.—Scale, 1/8 inch to the Foot.

The Houses of the Ancients.—The house of Priam might, in the opinion of Dr. Schliemann, have had more than 100 rooms, and he thinks it was originally 5 or 7 stories high. One of the rooms now contains a jar so large that it is nearly filled by it. Four of such jars have been found by him, each measuring 5½ feet high and 4 feet 7 inches broad. The large number of jars found on the ground floor induces the belief that it was used for store-rooms. The four huge jars contain a number of beautiful terra-cotta vases, of which also many fine specimens were found in the brick-colored ashes with which the rooms are filled. Dr. Schliemann thinks the most remarkable thing in the ancient mansion is that here and there beneath it the walls of a still more ancient building are found; he ascribes them to the first city erected on the site of the famous city. All the fragments of pottery which he has seen in the rooms of the mansion immediately below the Trojan stratum have, he says, on both sides a beautiful lustrous red, black or brown color, which he has never found anywhere except in the strata of the first city. He is further of opinion that the great circuit wall was not built by the people who inhabited Troy at the time of the catastrophe, but by their predecessors.

Some Advice to Beginners in Wood Carving.

The *Art Interchange*, a journal published in this city in connection with a ladies' association for the encouragement and advancement of decorative art in its various applications, prints a long and interesting article on the subject of wood carving, which concludes as follows:

"The subject is beginning to receive much attention, and it is hoped women may find profitable and delightful employment in connection with it. A quick eye, ready taste, and a good set of tools are all that the beginner really needs. A good set of tools should comprise the following instruments: An ax and side-ax, and, when great accuracy is desired, an adze. For small work, a hand-adze is useful. There should be a good assortment of firmer, socket and mortise chisels. The other tools necessary are a carpenter's gouge, a mallet and a draw-knife. All these above mentioned are comparatively inexpensive, and, although we cannot promise great results, still, persistent application and steady work will often show progress astonishing to the beginners in wood carving themselves."

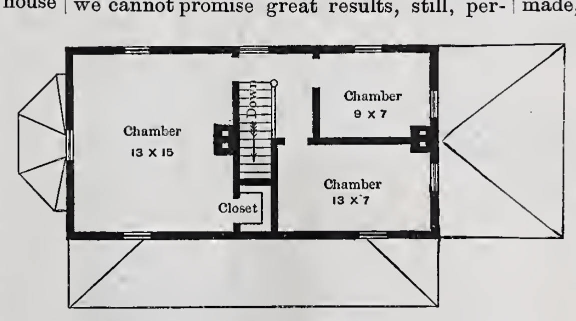


Fig. 4.—Second Floor Plan.—Scale, 1-16 inch to the Foot.

The spectacle of a young woman beginning the study of wood carving with the aid of an ax, a side-ax, an adze, an assortment of firmer, socket and mortise chisels, a carpenter's gouge and a draw-knife, would be an interesting one. We should, however, advise that the outfit include a quantity of lint and bandage, one or more cork legs, a bottle of Pond's Extract, three or four square yards of adhesive plaster, and a roll of crape for the use of the beginner's family. The last-mentioned item might not be needed, but it would be well to have it on hand. With such tools we should recommend the selection of rather ambitious subjects—say the carving of equestrian statues from sections of some of the big trees of California. We agree with our esteemed contemporary that it would not be safe to promise immediate satisfactory results so far as art creations are concerned, but we have no doubt that by persistent use of the axes, the adze, the chisels and the draw-knife, the beginners would soon make astonishing progress in carving themselves.

A New Hard-wood, "Quartered Oak."—A new sort of hard-wood lumber, says the *Northwestern Lumberman*, of Chicago, known to the trade as quartered oak, has lately been introduced into this market. The only difference between it and the ordinary oak lumber consists in the method of manufacturing it. As its name implies, it is made from logs which are first quartered, the process being practically the same as rift sawing, which has been heretofore described in the *Lumberman*. Lumber so made, as is generally well known, shrinks but little compared with stock sawed in the ordinary way across the grain, and for this reason is very desirable for all sorts of interior work, finishing, furniture, &c. The grain, in the case of oak, is also brought out by this manner of cutting in a peculiar way, which greatly increases the value of the wood. Considerable quartered oak has been used in this city already, and the demand is constantly increasing. It costs now 6½ cents per foot, but when arrangements are perfected for making it near by, it can probably be furnished at a somewhat less price. Messrs. Hatch, Holbrook & Co., of this city, are putting up a mill at a convenient point for procuring a supply of timber, and will soon begin manufacturing for this market. The first lot used here, we believe, was obtained from New York, and cost $75 per 1000 feet. It requires a peculiarly arranged mill to cut quartered lumber, and the process being slower than ordinary sawing, is rather expensive; but the increase in the beauty and durability of the wood is said to more than pay the difference. Another thing which increases the cost of quartered oak is the fact that it must be practically clear, and hence only the best butt logs can be used in making it.

A Day's Work at Tin Roofing.

The Metal Worker a short time since offered a number of prizes, ranging from a set of drawing tools or books of the value of $10, down to a leather medal, in a roofing championship contest. No specifications were made with regard to the style of roof or size of tin employed, all this being left to the discretion of the competitors. Each claimant for a prize was requested to submit such documentary evidence in support of his assertions as to him seemed conclusive. The end aimed at by *The Metal Worker* was, in the main, to draw out from tinners an expression as to what constituted a day's work. The replies recieved, although not so numerous as might have been expected, came from all sections of the country, and were of such a nature that it was practically impossible to make an award. We quote from the editorial article referring to this subject in *The Metal Worker* of March 1:

As we rather expected, the competition will be likely to furnish our readers more amusement than benefit. It calls attention, however, to one fact which should be remembered by the trade—namely, that the ideas of roofers as to what constitutes a good day's work are so widely at variance, that estimating on the cost of labor for a roof of given size and description must be very wild work. For example: Mr. John L. Viett, of Rockville, Ind., rode six miles to his work, laid six squares, ate his dinner, did some work on gutters, and drove back to his shop within 12 hours. Mr. C. K. Burnell, of Oxford, Iowa, considers two squares a good day's work, inasmuch as he is wiling to guarantee his roof for ten years if the owner will give it an annual coat of paint. Mr. W. E. Manrow, of Goshen, Indiana, with one helper, laid 8 squares in 10 hours under peculiarly distressing conditions, inasmuch as the roof was so hot that he blistered his knees through his pantaloons. We fear his knees have not been calloused by sufficient devotional exercise. Mr. H. C. Wood, of Rome, Ga., tells how much he and a helper did in two days, but don't know how much he could have done if the weather had been favorable. Mr. Peter Ehret, of Richmond, Ky., proves by affidavit that, with the help of a negro boy, he laid 95 squares in eleven days, which is not exactly to the point, although we are much pleased to receive the assurance of Mr. Anderson that Mr. Ehret is the fastest and best tinner he ever saw. Mr. Arthur L. Burtis, of Lockport, N. Y., considers 2 squares and 15 feet in 6¾ hours—equal to a little over 3 squares in 10 hours—a good record, and so it is. Mr. Charles F. Lippincott, of Salem, N. J., swears that with two men and a boy he laid 16.02 squares in 8¾ hours, and we congratulate him. A modest gentleman of Madison, N. J., who would like to have the belt sent to his post-office box, never put in a whole day at tin roofing, but affirms that he can lay 6 squares in 10 hours without help. Mr. George W. Chase claims 9 squares in 10 hours, and is not sure how much he could do if pushed, which we regret. Mr. Ehret, not satisfied with his record of January 2d, writes about a fortnight later to inclose an affidavit that he laid 10 squares and 62 feet in 10 hours. His chances are improving. Mr. Edgar I. Hulse, of Easton, Md., claims 5 squares and 3 feet as his best time. Mr. C. P. Williams, of Amsterdam, averages 4 squares a day ou a good roof in good weather, and gives 5 squares as his best day's work. Mr. J. H. Ferguson, of Millbury, Mass., claims 5 squares iu 10 hours; with a helper for two days he laid 22 squares in 2½ days. Mr. B. Field laid 5 squares and 60 feet in 9½ hours under adverse circumstances, with a boy to tend the fire and hand him the coppers. Mr. Paul Cabel, of Kingston, N. Y., finished 4 squares and 80 feet complete in 10 hours. Mr. Albert Bishop, of Southington, Conn., modestly hoping for the second prize, claims 7 squares and 67 feet in 7 hours, with the help of a green boy never on a roof before; but it was laid with paint seams. Mr. W. H. Drake laid and soldered 157 feet in 8½ hours, finishing the roof complete and without help.

From this comparison of records, it will be seen that a day's work at roofing ranges within pretty wide limits. Accrediting every correspondent with entire truthfulness of statement and worthy pride in establishing a good record as a mechanic, we confess that the difficulty of making a decision is greater than we had expected.

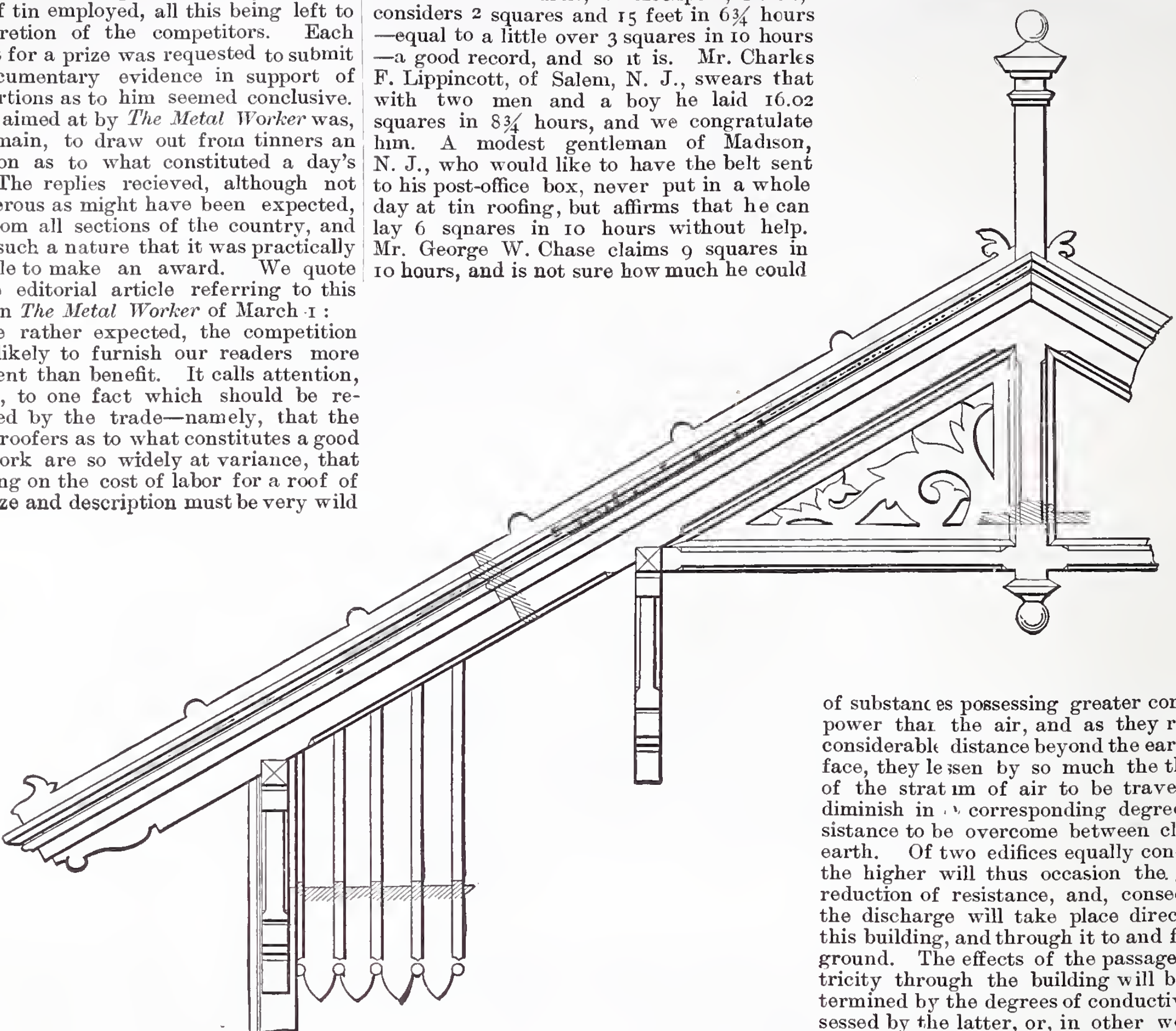


Fig. 5.—Detail of Gable Finish.—Scale, ½ inch to the Foot.

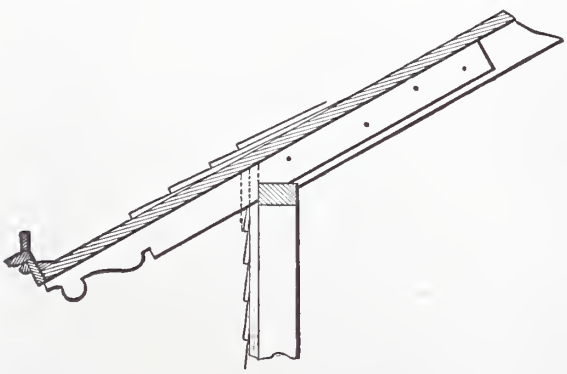


Fig. 6.—Section through Eaves.—Scale, ½ inch to the Foot.

Why Lightning Strikes Buildings.

It will be readily perceived why tall buildings, such as church spires, are more liable to be "struck," to use a common expression, than structures of a less hight. Buildings may be constructed, wholly or in part, of substances possessing greater conducting power than the air, and as they rise to a considerable distance beyond the earth's surface, they lessen by so much the thickness of the stratum of air to be traveled, and diminish in a corresponding degree the resistance to be overcome between cloud and earth. Of two edifices equally conductive, the higher will thus occasion the greatest reduction of resistance, and, consequently, the discharge will take place directly over this building, and through it to and from the ground. The effects of the passage of electricity through the building will be determined by the degrees of conductivity possessed by the latter, or, in other words, by the resistance it offers. If it be constructed of metal, or if it have a continuous piece of metal running through it from top to bottom, the electric charge will pass without causing in it any visible effect, because little or no resistance is opposed. For this reason buildings, as the reader doubtless knows, have often affixed to them, for their protection, a metal rod, called a lightning conductor. But if there be no metal employed in the construction of the building, or if the metal used be in separate and detached pieces, there will be great resistance to be overcome, and the force required to overcome it may be sufficient to cause the destruction of the building, or at least the displacement of those parts where the resistance is greatest. The heat generated by the passage of electricity through badly conducting substances, is often great enough to set combustible materials on fire.

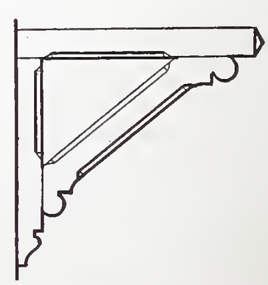


Fig. 7—Gable Bracket.—Scale, ½ inch to the Foot.

Plasterers have some peculiar tastes. They are fond of good hawks, swimming beds of mortar and floating walls, and though they cannot fly themselves, yet **even while at their work they can run well.**

"Hemacite."—A New Material for Hardware Trimmings.

Some of the greatest triumphs of this utilitarian age have been achieved in making serviceable "waste products." It is a marked tendency of modern industrial progress to aim at economical and profitable manufacture by taking advantage of the adaptability to specific ends of raw materials, which are cast off as valueless by other industries, to which sometimes they are even an incumbrance. One of the most interesting examples of this tendency which has recently come to our notice, is the successful establishment of a new industry which, since its conception, has excited much curiosity and incredulity. The idea of utilizing bullock's blood is one of striking originality, and yet it has been shown by Dr. W. H. Dibble, of Elizabeth, N. J., after a long series of experiments, consuming much time, that finely finished articles could be made from bullock's blood alone, or from this material deprived of its albumen.

The products of these earlier experiments, though exhibiting many qualities of merit, lacked the strength to insure for them the wide range of utility which in other respects seemed to be open to them. Dr. Dibble therefore continued his efforts, and found that when bullock's blood was mixed with certain finely comminuted mineral or vegetable substances, singly or in combination, and the substances so obtained were reduced to a dry powder, such powder could, by subjecting it to a powerful chemical and mechanical action simultaneously, be moulded into a great variety of useful and ornamental articles, and that the articles so made would possess qualities of beauty, strength, finish and sharpness of outline.

A number of useful and ornamental articles are also made by using sections of either paper, leather or cloth in place of comminuted substances. For many purposes these compounds offer advantages over the powdered mixtures, though when variety of color is desired, colored powder mixtures are used in combination with them, and very brilliant or neutral effects are produced at will.

As may be supposed, the variety of articles that may be made from "Hemacite," as the product has been called, is very large. Many articles now made of hard rubber and kindred compounds, are manufactured from the new material.

The Dibble Manufacturing Company, of Trenton, N. J., filed their certificate of incorporation on the 24th day of September, 1877, and became the possessors of the patents and registered trade mark, "Hemacite," that had been the property of Dr. W. H. Dibble. They established their experimental plant in temporary quarters at Trenton, and at once began to push their new manufactures. The usual need of proper appliances was encountered, but the company are now well established and have a constantly increasing demand for their goods in both the near and distant market.

We have examined a series of articles made by the Dibble Manufacturing Co., of various grades, chiefly in the shape of door knobs and ornamental articles. The better class of knobs resemble carved ebony, and are very beautiful, as well as agreeable to the touch. The cheaper goods seem to be made of material less minutely powdered, but as they are covered by a coat of varnish, they nevertheless present a pleasing appearance. The articles of higher grade possess a jet black color, a polished and uniform surface, and show a sharpness of outline in ornamentation which fully demonstrates how well the material is adapted to the reproduction of the most delicate designs. Adding to this its strength (it being a matter of great difficulty to break the knobs or detatch them from the spindles, even when roughly attacked with a hatchet or hammer), and its quality of adhering firmly to metal, it will be readily understood how valuable it is for many purposes. It seems to possess a range of adaptation which is remarkable, finding, as it does, its value as cheap material for many articles of domestic use, and as the basis for most elaborate and costly pieces.

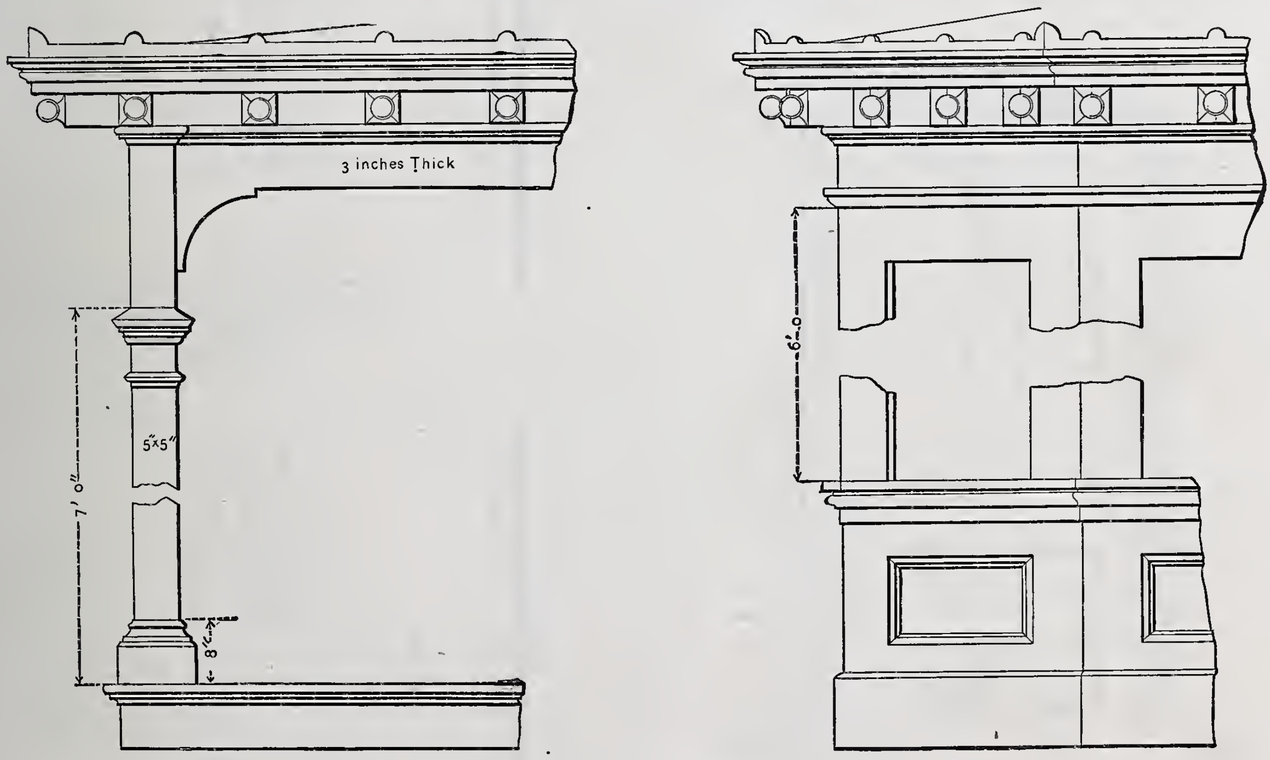


Fig. 8.—Detail of Piazza. *Scale, ½ inch to the Foot.* *Fig. 9.—Detail of Bay Window.*

Novel Dome for an Observatory.—Prof. Dascom Greene, of Troy, describes, in the *American Journal of Science*, a novel method of covering the revolving domes of observatories with paper. The dome just finished for the Rensselaer Polytechnic Institute, of Troy, is a hemisphere, with an outside diameter of 29 feet. The framework, which is of wood, consists primarily of a circular sill, forming the base, and two semicircular arch girders set parallel to each other, 4 feet apart in the clear, and spanning the entire dome. These are firmly attached to the sill, and kept in a vertical position by knee-braces. The sill and girders are of seasoned pine, 8½ inches wide by 3½ thick, and the latter each 4½ by 3 inches. The paper covering is made in sixteen equal sections. The framework of each section consists of three vertical ribs of pine, each 3¾ inches wide and three-quarters of an inch thick. The joints between sections were made weather-proof by inserting a double thickness of heavy cotton cloth, saturated with white-lead paint. A 4-foot opening between the arch girders is covered in a shutter, which is also of paper stretched over a wooden frame. The weight of the dome and its appurtenances is about 4000 pounds. It is supported on six 8-inch balls, which roll between grooved iron tracks, and can be easily revolved by a moderate pressure applied directly, without the aid of machinery.

The Lumber Supply Diminishing.

A Western paper publishes an estimate of the supply of manufactured lumber on hand at some 25 leading points in the Mississippi Valley, at the north of St. Louis to Minneapolis, placing the amount at 464,000,000 feet, as against 528,710,000 feet at a corresponding date a year ago. This shows a decrease of 64,710,000 feet. These figures are interesting, because there has been an impression among lumbermen that there would be a large shortage in the lumber supplies this year as compared with the season of 1877. Stocks were very low last January. The shortage was then estimated at 268,000,000 feet, as compared with the previous year. This shows a large decrease from the amount of stock ordinarily on hand at the beginning of winter. The same state of things is said to exist in the Michigan and Ohio lumber yards. The diminution this year may be in some measure attributable to the activity manifested by government agents in seizing and confiscating lumber alleged to have been stolen from the government lands. The particular attention that has recently been drawn to the evil of stealing timber will probably have the effect of still further diminishing the supply, and consequently raising the prices, more particularly in sections of the country wholly dependent upon remote sources for what they need for actual use. The lumber question is one of constantly increasing importance, and it is the duty of the government to use every posible effort to prevent lumber sharks from destroying the forests and making fortunes by a bold, bare-faced species of public theft. The talk about our inexhaustible lumber supply is arrant nonsense. At the rate which it is disappearing, the next generation of the American people may find themselves almost under the necessity of importing walking canes. Not only does the necessity of protecting the forests appear, but it is alike apparent that other material than lumber cannot too soon be brought largely into use for building and fencing purposes.

Measuring Standing Timber.

It is very puzzling to estimate with confidence the correct contents of standing trees. A beginner cannot trust the judgment of his eyes in estimating the dimensions either of hight or girth, and in consequence has recourse to such aids as measuring rods, tapes, strings, ladders, &c., at a great sacrifice of time, not always compensated for by extra accuracy of results.

By careful practice the eye can be trained to estimate distance and size with considerable accuracy, and many men, after proper study and training, are able to estimate the dimensions of standing timber with great facility and correctness; but young beginners require the aid of appliances of some kind to assist in tutoring the eye to the requisite degree of proficiency. The hight of a tree can be measured in a variety of ways, but simplicity in any instrument for that purpose, and ease in handling and carrying about, are great desiderata. A bundle of sticks carried under the arm and fitted together at almost every tree, is too tedious to be tolerated; shadows are not always available; besides, they entail loss of time in making calculations. The "Apomecometer" and the "Hypsometer" are handy appliances, but I think the "pocket sextant" is preferable to anything that I have either employed myself or seen used by others for estimating the hight of trees or similar objects.

In using an optical instrument of any kind for this purpose, the operator must place himself on a level with the base of the object to be measured. In using the apomecometer or hypsometer this is not always easily done, as the observer has to be at a distance from the object equal to the hight to be measured; but with the sextant the case is different, and the attainment of a proper position less difficult.

If the index of the sextant is set at 45 degrees, then it is used in the same way as the apomecometer and hypsometer at a distance from the object equal to his hight, but with the index set at 63 degrees 30 minutes the distance of the operator from the base would be just half the hight of the object, and a position on a level with the object more easily attained.

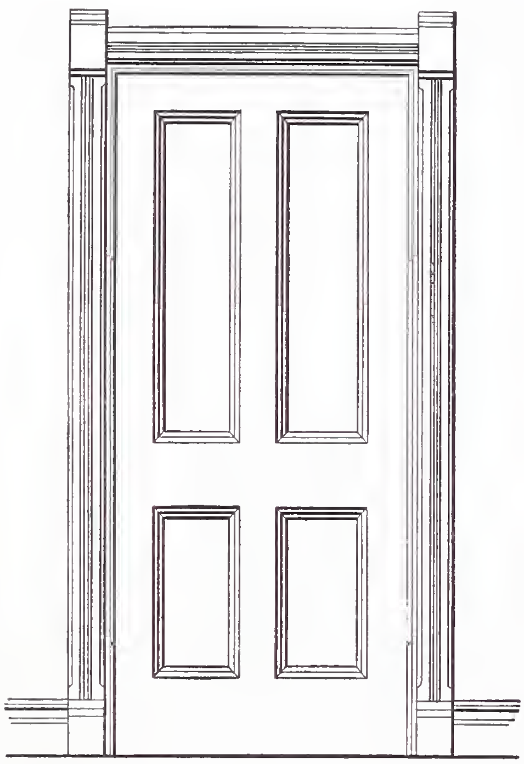


Fig. 10.—Elevation of Door.—Scale, ½ inch to the Foot.

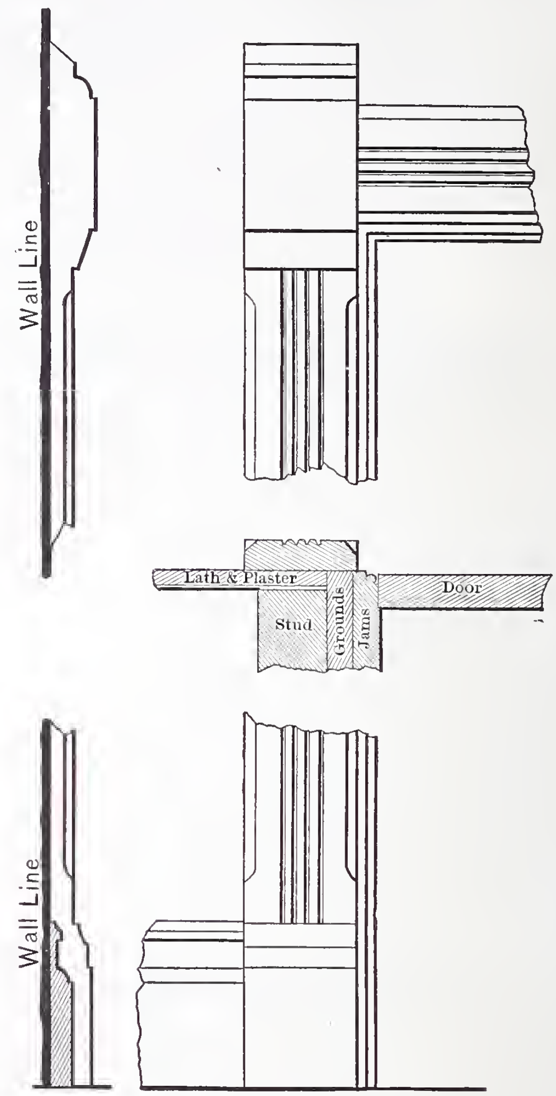


Fig. 11.—Detail of Trimming.—Scale, 1½ inches to the Foot.

To practice with this instrument in measuring standing timber, put a mark on the tree to be measured at the hight of your eye above ground—a knife, nail or bradawl stuck in the bark through a piece of white paper is a good mark; then if the ground is pretty level set the index of the sextant to 45 degrees, and walk backward in the plane of the tree until the part of the tree, the hight of which you wish to ascertain, is shown in the glasses of the instrument as level with the mark stuck on the tree; then measure your distance from the tree, add to that the hight of the mark on the tree, and the product is the hight required. Should the surface of the ground be very irregular, or brushwood or other obstacles obstruct a sight at 45 degrees, set the index to 63 degrees 30 minutes; perform the operation as already described, but double your distance from the tree, and add thereto the hight of the eye or mark for the required hight of the object.

To use the sextant for this purpose, set the index to the necessary angle; take the bottom of the instrument in the right hand; hold it in a vertical position, with the index facing to the left; look through the eyehole and unsilvered part of the object glass at the mark on the tree, and move backward or forward until the point, the hight of which you wish to ascertain, is reflected from the index glass to the silvered part of the object glass, and appears exactly on a level with the mark on the tree. Then, according to the angle at which the instrument has been set, calculate the hight of the instrument, as already described.

The pocket sextant is a very handy instrument, exceedingly useful in setting out buildings, in surveying and in measuring standing timber. Its portability is also a recommendation, as it can be carried in the pocket, or, preferably, in a sling case over the shoulder, and with ordinary care in using, is not liable to get out of order.

After a good deal of practice the eye can be trained to estimate the quarter-girth of a standing tree with considerable accuracy. A very good method of practice is to wait with a lot of men while they are timber-felling. Estimate by your eye the dimensions of a tree while standing, and measure for proof when the tree is on the ground, comparing actual dimensions with those of your previous estimate, and as your experience extends, your estimate will approach nearer the truth.

It is also advisable to practice comparisons of girth by actually girthing the tree as high as you can reach conveniently, say about 5 feet, and accustom the eye to estimate the difference between that girth and the size of the tree at any other part of its hight. This method of comparison is very useful for confirming a guess estimate of size at an unreachable point; but anything like facility in estimating accurately in this way is only acquired by extensive and careful practice, and that practice must not be allowed to lapse for any length of time, or the eye forgets its previous lessons, and has to undergo another course of training.

When estimating the contents of standing trees, the quantity of measureable timber in the tops should always be taken into account, and entered in a column of the book distinct from the contents of the trunks. Oak tops are sometimes of considerable value, and when the calculation includes their measureable contents, the probable yield of bark can be pretty accurately predicted.

Hedgerow trees having heads large in proportion to the size of bole, will not yield so much bark per cubic foot of timber as trees grown in woods or clumps. The difference may vary from 1½ lbs. to 2 lbs. per cubic foot, according to soil and position. I have found mature trees from hedgerows yield 14½ lbs. of bark per cubic foot of timber, while those grown in clumps in the same neighborhood yielded from 15½ lbs. to 16 lbs. per cubic foot. These figures are not acquired from calculating the produce of single trees, but from the contents and produce of lots of twelve, twenty or thirty trees in each, and may be of some use to young practitioners, but each should construct data for himself from the results of his own careful and accurate observation.—*Journal of Forestry.*

CORRESPONDENCE.

Painting Shingle Roofs.

From J. S., *New Knoxville, Ohio.*—Can you give me any information in regard to painting shingle roofs? I propose to paint the shingles on both sides before they are laid. Does paint add to their durability? Which paint is best for the purpose, iron paint or white lead? Would either paint affect the rain water injuriously (after filtering) for domestic purposes? An answer in the columns of *Carpentry and Building* will greatly oblige.

Answer.—To be of any advantage to a roof, the paint should be applied to the shingles before they are laid. This is a very generally received opinion, and we do not know of anything to contradict it. When shingles are well painted on both sides, the durability of the roof is undoubtedly greatly increased. The most convenient method of applying paint to shingles for the purpose, is probably by dipping. The paint must be kept well stirred and in proper condition. The shingles should be dipped considerably further than the part exposed to the weather. Dipping has the advantage over all other methods of filling up the ends of the shingle, thus preventing cracking and splitting, which are the great evils to be guarded against in shingle roofs. We have heard it recommended to dip the shingles at the time they are laid. In this case it would be well to give the roof a coat of paint after finishing

We consider iron paint the most satisfactory for the purpose. It is probably more durable than any other in such an exposure as a roof presents. Its only drawback is its color, which is against it.

There is nothing about iron paint after it is dry that will affect the rain water injuriously. It will be entirely safe to use it for domestic purposes without filtering.

Methods and Rules for Estimating.

From C. W. S., *New York.*—I would like to ask, through your columns, if contractors have any general rule by which they estimate their several works on buildings?

Why I seek for this information is because I have found such a difference in the estimates received for the same work, that I am almost led to believe the discrepancy the result of ignorance or carelessness.

I have thought over the matter considerably, and, in order to somewhat obviate the difficulty, I have adopted the plan of joining to my specifications a bill of quantities, which saves time to the contractor in estimating and enables all competing parties to form their estimates on one basis.

I hope my inquiry may induce some of the older contractors to give expression to their views, particularly in regard to estimating for labor, which seems to be the point on which young contractors make their greatest mistakes.

From J. E. F., *Syracuse, N. Y.*—I have no words but those of commendation for your valuable paper; but I would like to suggest that no design should be given in a mechanical paper for parties to execute, without giving a rule by which to estimate its cost. There appears to be a wide difference of opinion among house builders in respect to the worth of the buildings they are called upon to estimate. This difference, I apprehend, is the result of guess-work rather than actual knowledge. For instance, nine estimates were made recently upon a cottage to be built in our city, ranging from $1875 down to $1495, and the lowest estimate could have been raised over $100 and received the job. Now, here is an instance of a lamentable want of practical knowledge of the actual cost of construction. In my judgment the highest estimate in this case would have afforded the builder only a fair compensation for giving to the owner such a house as the specifications called for. It is a fact that owners shudder with fear when a builder proposes to them day work, for the reason that in most cases they know that they can get their building done at a much less cost by contract. It is humiliating to confess it, but a large proportion of the building done in our city for the past five years, has either had to be given up by the contractor before completion, or parties furnishing materials and labor have had to resort to liens and the courts to receive their pay. Hence I suggest that your paper will be valuable to inexperienced and experienced builders, just in proportion to the attention you pay to the cost of construction. Happy will that day be for builders and all business interests connected with building, when they shall be so thoroughly educated by their mechanical journals as to show capitalists very slight differences in their estimates, and I hope the name of *Carpentry and Building* will be honored in the memory of every reliable builder who, like myself, is hungry for practical knowledge because of the good work it shall do.

From J. E., *Hopewell, N. Y.*—Will you please tell me, through *Carpentry and Building*, how to estimate the cost of labor in framing a building?

Note.—The above are specimens of many similar inquiries received by us, and to which it is difficult for us to reply satisfactorily without some assistance from our readers. We know there are many who read this that are able to give young mechanics some useful ideas upon this subject, and our only object in publishing the above letter is to persuade practical men to write to us. Once more we make the request, that the experienced men in the trade among our readers will write us in answer to this question.

Tin Furnace Pipes in Partitions—Iron Laths.

From H. R. S., *Reading.*—Your correspondent W. G. W., Atglen, Pa., asks you a question, whether it is safe to run a tin heat flue up through a lath partition? It is safe, if caution is taken to protect the woodwork. I have in my time put in a great many tin hot-air flues through partitions, but always get in the space between two uprights, and then lath with sheet-iron lath that reach from one upright to the other. The lath are about 1½ to 2 inches wide, and are turned up on each side with a common pipe folder. The sketch shows the shape of a lath, seen end on. I then plaster right on top of these. Where the pipes get too near to the woodwork, I put a lining between the woodwork and pipe, using galvanized sheet iron, which is a non-conductor of heat, and fasten the galvanized iron to the woodwork, so that there is a space of from ½ to 1 inch between the sheet iron and woodwork. The nearer that the heater or furnace sets to such a partition the more careful it is necessary to be. If one is obliged to run a pipe 12 to 15 feet long from the heater, then there is not as much danger as if the heater only sets 2 or 3 feet from such partition.

Note.—The use of the iron laths entirely avoids the danger from fire, in taking a hot air pipe up through a partition where there is plenty of room between the studs, and where these are protected by sheet iron, there is little or no danger in any case.

Sweating Roof.

From J. C., *New York:* Could you suggest any remedy that would prevent an iron roof from sweating? I have been called upon by one of my patrons for an opinion in the matter, as the roof on one of his buildings down town sweats to such an extent as to make it very annoying to the tenant. I found on examination that the floor was quite wet, and he told me that it was a great deal worse at times than it was then. I suggested a lath and plaster ceiling be placed as near the roof as practicable, so as to prevent the warm air arising from striking directly on the iron, but thinking that you might know of something better and perhaps more simple, I concluded to ask your advice before acting. If you could suggest anything as a remedy you would confer a great favor.

Answer.—The interposition of a lath and plaster ceiling between the roof and the warm air which now comes in contact with it, will be the best means of curing the evil, but it will probably be necessary to ventilate the space between the roof and the ceiling to make sure. Any non-conducting sheathing, separated from the roof by a ventilated air space, will accomplish the same results.

Veneering.

From C. J. W., *Grand Rapids, Mich.*—In the article upon veneering in the March number of *Carpentry and Building*, there is one thing that seems to me to be liable to mislead the younger hands in the trade and those who have not had long experience. My experience has been that cauls should not be made too hot—not hotter than the hand can bear without discomfort. In fact, cauls should only be made warm, as otherwise the glue is rendered useless and non-effective. With British and European glues the case is different. With foreign glues the hotter the caul the better, but with American glues the cauls should only be well warmed. With a heavy coat of thinnish glue of American or Canadian make, and with cauls used warm, a job of veneering can be be done which will stand all reasonable wear and tear without blistering or cracking.

At another time I may write you more at length concerning glues, gluing and veneering, but at present cannot spare the time. I wish the new paper every success.

Note.—We are sure our correspondent's wishes for the success of *Carpentry and Building* are quite sincere, because he writes a letter which contributes to the interest and value of the paper. We trust he will favor our readers at no distant day with the letter about glues, gluing and veneering.

Design Clubs.

From G. S., *Chicago, Ill.*—I suggest to you the idea of getting up design clubs in connection with *Carpentry and Building*, something after the manner in which they are conducted by some of the English architectural and mechanical journals. I think it would prove an interesting feature in the paper, as well as be a stimulus to study upon the part of many young draftsmen and mechanics who would compete.

Note.—We like the suggestion of our correspondent, and if it meets with approval from our readers, we will be pleased to take the necessary steps to put the scheme on foot at once. We desire first, however, to assure ourselves of the wishes of our readers in the matter. We invite letters about this subject, with comments, and also further suggestions, if our readers feel disposed to make them. We shall also be pleased to hear from G. S. further about this same matter, with a detail of the scheme as he thinks it would be desirable to conduct it. If any others of our readers have ideas on the subject, we shall be pleased to hear from them likewise.

Pocket Rules.

From W. E. P., *New York.*—Will you, or some of your readers, inform me why all pocket rules, both 1-foot and 2-foot, are figured backwards? If you will examine any rule you will discover this absurdity. Every one, in using a rule, is likely to take it in his right hand. Using the rule in the right hand, the figures come either wrong end first or else upside down. I have asked this question repeatedly, even of rule makers, without even getting the semblance of an answer. In fact, it seems to me to be one of the things "no fellow can find out." I notice further that the rules put out by the Metric Bureau, containing both inches and the metric divisions, are figured in the same way. Is there any reason for this apparent absurdity?

Note.—We don't know, but will gladly publish any reasons our readers are able to furnish.

Pure Water.

From Jno. C. Rankin, *Mount Vernon, N. Y.*—A writer on architecture says: "What folly to be digging deep wells, and daily to labor at clumsy sweeps and wheezing pumps for a meager quantity of hard, unwholesome mineral water, when they might have the soft, pure, sparkling lymph * * * and yet how many allow the blessed element to run off and be lost, content to wash in water which turns soap back into grease, and to derange their bowels with muddy drafts from the river, or with solutions of salt and lime from the well. Many regard rain water as unfit to drink; and so it is when no care is taken to keep or make it pure. Properly filtered and

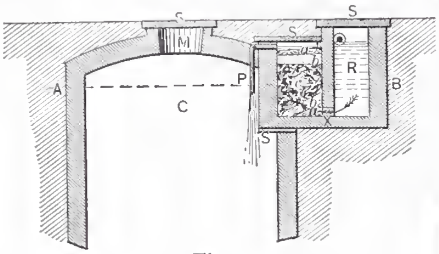


Fig. 1.

cooled, it is as palatable as it is wholesome. The cistern may be arranged for this purpose, or the water may be filtered as it is used."

Another characterizes well water as "a lixivium of nastiness."

In vital importance, the purity of water for drinking and culinary purposes is doubtless next to that of the air we breathe, and as any device or hint whereby deleterious properties in either may be prevented or eliminated, even partially, will afford humanity a corresponding degree of immunity from disease, I gladly accept your kind offer of space in your columns, to contribute my mite in a brief description of a cistern for the chemical and mechanical purification of rain-water, which I invented and had built for James M. Nelson, Esq., of this village, and which has been in use nearly four years with highly satisfactory results.

The accompanying diagrams will make the essential points clear. Figs. 1 and 2 show the arrangement of the cistern mentioned, and Figs. 3 and 4 a more compact form, involving the same principles, and which is, possibly, preferable.

Same letters indicate corresponding parts.

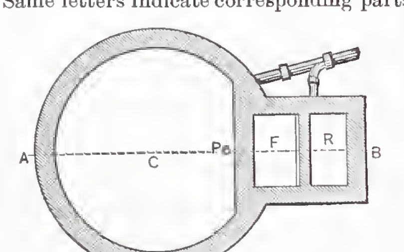


Fig. 2.

R, receiver; F, filter; C, cistern; T, iron girder; M, man-hole; S, slate or blue flag covers and supports of walls and floors of filter; X, roofing-slate strainer and support of partition wall of filter; P, discharge pipe; *a*, coarse gravel; *b*, fine, clean, sharp sand; *c*, wood charcoal broken to small nut size, and the arrow, indicating direction of flow of water. R receives the roof water, and is provided with overflow pipe connecting with earthen trapped overflow pipe from C. As the water rises in R it percolates upward through the filtering materials, and is discharged by P into C.

Build of hard brick laid in fresh hydraulic cement, thoroughly grout all joints, and plaster walls inside and outside with same cement, the roofing slate of strainer to be laid up sufficiently open to admit free flow of water; the filter to be filled with the materials as above described, and in about the proportions and in the manner indicated in section. Between the different layers place one thickness of white, clear-wool blanket, or two thicknesses of thick, close-woven flannel. These should be thoroughly shrunken before using. As will be seen, the renewal of the charcoal, when required, may be readily done. Bone or other animal charcoal is decidedly preferable to that of wood. As charcoal will retain its property of oxidizing and neutralizing impure matter for a longer period if exposed to the atmosphere than if constantly submerged, it is best, after rains, to use the water from the filter for such purposes as it may serve. It may be removed from the receiver by a pump or otherwise. It will be observed that the cleaning of the filter is accomplished by the reverse movement of the water while emptying the receiver. No special provision seems necessary for ventilation of cistern. In filling the filter, the general rule—the slower the filtration, the purer the water—should be borne in mind.

Kalsomine.

From L. Godfroi Cadier.—In your March number I saw with pleasure an article on painting, in which the process of distemper was described at some length. I should like to add a few words on that subject. The Americans are an inventive people. What they do not invent they can at least christen with a newly-invented name, and then the whole thing is American. So with tempera, it was too old-fashioned, it smelled musty—what could be done? The new name, kalsomine, was tacked on to it, and, *presto!* it is now young, fresh, sweet and—kalsomine. By that name, then, I shall designate it in this article.

A decorator may often be in a place where parchment size cannot be obtained or made. The best white glue can then be used as a substitute, and a very good one it makes too. The following method of mixing and applying I have used for a long time, and it has always given me such good results that it may be of benefit to others.

Into a 10-quart pail put 9 pounds of best washed whiting. Reduce it to a thick paste by pouring in hot water and breaking up the lumps with a "paddle," then finish the mixing with the hands. Add to this 12 ounces of dissolved glue, and color the mixture to make it of the desired tint. All colors should previously be ground in weak size. The mixture is now almost ready, and only needs to be "thinned down" to the right consistency for use. If it is not to be used until next day, "thin down" with cold water and set it away in a cool place. It will then appear like weak, trembling jelly. It should never be used except in this state. If for immediate use, instead of using water for a thinner, add ice finely ground up; this will jelly the mixture in about five minutes, when it can be applied.

First go over the walls to be kalsomined with a coat of strong size. Then quickly and evenly spread a coat of kalsomine, and when this is thoroughly dry apply a coat of alum size. Then spread the second and last coat of kalsomine. Never omit the alum size, as it binds on the first coat of color and prevents it from being "rubbed up," and in addition to this, the last coat floats better and spreads more evenly on it than it would if it were omitted. The color is also brighter and fresher than when one coat of kalsomine is applied directly on another. Two workmen should always be employed in spreading kalsomine. Let one take the upper "stretches" and the other the lower. Workman No. 1 will "bring a stretch" half way down the wall of about 5 feet in width; No. 2 will then take it, and when he has finished, No. 1 has another ready for him. In this way there is no danger of showing "laps" or piecings. All possibility of a "lap" should always be avoided, as it is the *bête noir* of all good decorators. This differs somewhat from your article on tempera, but that appeared to me somewhat English, and sounded as though Ellis A. Davidson might have written it. My method is American, and from experience I know it to give good results. Before closing I wish to say that *Carpentry and Building* is the best paper of its class that I have seen. If it continues as excellent as the first three numbers, there is no reason why it should not take precedence over all building journals in America.

Question in Plumbing.—Ventilating Waste Pipe into Chimney.

From J. M. I., *Baltimore, Md.*—Would it be advisable to run an air pipe from a stench trap into a chimney to ventilate the trap? There is a cap on the chimney, built of brick. Is there any danger of a bad smell coming down the chimney into the room?

Answer.—We do not approve the practice of ventilating traps or waste pipes into chimney flues under any circumstances. The only condition in which it is excusable is when the flue thus used is kept constantly warm. This cannot be counted upon even in the case of a kitchen flue, for kitchen fires will go out and the flues get cold at times. When the ventilation of waste pipes through a cold flue is attempted, mischief usually results. We are very apt to have down drafts in summer time through chimneys, especially when the temperature inside the house is a little lower than the temperature outside. It is much better to ventilate traps, &c., by pipes independent of the flues. We do not want an induced current in our pipes, either upward or downward, but simply need to let the air move whichever way it will to secure the best results in pipe ventilation.

Galvanized Iron vs. Tin for Roofing.

From W. & L., *Hamilton, Ontario.*—We do not know that the fact of our being subscribers to and readers of *Carpentry and Building* gives us a right to trouble you, but

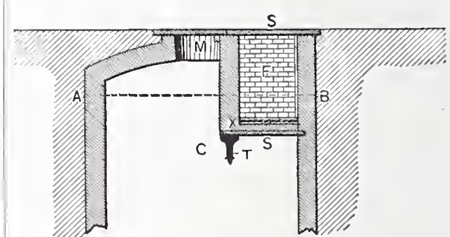


Fig. 3.

we shall feel greatly obliged if you will give us your opinion of the relative value of tin and galvanized iron for roofing, as regards being weather-proof and their durability. We have always been under the impression that galvanized iron was the best. Our query takes about the following form, referring to roofs in our climate, say about the same as Rochester or Albany:

1. Is galvanized iron in sheets 30 x 72, gauge No. 28, more liable to break from contraction and expansion incident to variation in temperature, than I. C. or I. X. tin, in sheets 14 x 20?

2. Are soldered joints in galvanized iron more likely to part and leak than soldered joints in tin?

3. Is a roof of I. X. charcoal tin more durable than a roof of charcoal galvanized iron of corresponding gauge?

4. Should a tin roof cost less than a galvanized iron roof?

Answer.—We believe the result of experience with galvanized iron for roofing to be that, when laid in the same manner as a tin

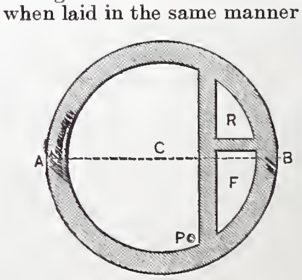


Fig. 4.

roof is laid, it is quite unsatisfactory. The reason for this may be one of several. It may be owing to different causes in different cases. Some roofers attribute the trouble to the size of the sheets; others to the quality of the coating, not being as perfect as tin; others to the nature of the coating, zinc being less ductile than tin; and others to the lack of adhesiveness of the coating, zinc being easily stripped off from a sheet of iron. Perhaps the difficulty may be safely stated as the result of all these inherent faults, and perhaps of still others we have not mentioned.

Referring, now, to our correspondent's specific questions :

1. A large sheet, say 30 x 72, even of tin, we believe, would be more liable to break in the process of contraction and expansion than a sheet 14 x 20. No. 28 galvanized iron is somewhat heavier than I. X. tin, the latter gauging 29 and under, while I. C. is still lighter, and this difference in the thickness of the metal, when considering the question of contraction and expansion, would be against the galvanized iron. But with all things equal, except the one particular of size of sheet, the chances are in favor of the smaller sheet, if for no other reason than the strength imparted to it by the cleats used in laying.

2. Restricting our remarks first to sheets of the same size and gauge in answering our correspondent's second question, a soldered joint between two pieces of galvanized iron is more likely to break than the same joint between two pieces of tin, on account of the lack of adhesiveness of the coating. This is very easily demonstrated. Solder a strip of galvanized iron on to the middle of a sheet of galvanized iron, and a strip of tin on to the middle of a sheet of tin, using, as near as possible, the same gauges in each case. Fasten the sheets, and pull upon the strips until a fracture occurs. In the case of the tin it will be found that the joint is about as strong as the strip, while in the case of the galvanized iron, in all probability, at the exertion of far less force than is required to rend the tin, the coating will peel from either the strip or the sheet, thus releasing the strip. When soldered joints are made between pieces of galvanized iron of heavier gauge, the natural effect of contraction and expansion, which always finds the weakest point, is generally enough to break the seams by thus stripping the coating from one piece or the other. Still another point may be mentioned in this connection. Every tinner knows how hard and brittle his solder becomes when even a very small portion of zinc gets into it. The same thing takes place, in a greater or less degree, in the process of soldering two pieces of galvanized iron together. The heat of the copper in floating the solder melts the zinc coating sufficiently to make an alloy of it and the solder. Upon examination of a soldered joint upon galvanized ironwork, the same mottled appearance will be seen upon it that is the sure evidence of zinc when seen upon the side of a bar of solder.

3. Our answers to the preceding questions have virtually anticipated the next inquiry of our correspondent. We consider a tin roof much more durable than a galvanized iron roof of the same gauge and quality of material.

4. As to the relative cost of galvanized iron and tin roofs, with prices of materials as they are at present in the United States, tin is the cheaper to use.

Tin Roof Spoiled by Putting up Cresting.

From W. F., *Fulton, Mo.*—I am a constant reader of *Carpentry and Building* and think it a most valuable paper. I have obtained much useful information from its columns, and would not be without it. I desire a little information. Some time since I put on a flat roof (tin), which was thoroughly tested after completion by several very hard rains and found perfect. But since the iron railing has been put up it leaks all around the edge. The railing was put up without lead under the feet of the uprights. What can I do to remedy the difficulty? I suppose there is some cement that will stand the weather that would be suitable in such a place.

Answer. — Since the trouble has been caused by bad workmanship in putting up the cresting, it occurs to us that the best way to remedy the defects will be to remove the cresting and put it up as it should be. We think the use of a rubber gasket under the foot of each upright will be found more satisfactory than a piece of lead. From long experience, we doubt if the use of any cement without removing the cresting will be satisfactory.

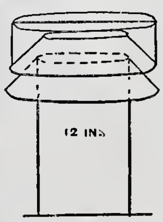
Polishing Brasswork.

From M. S., *Troy, N. Y.*—Will you please give me a recipe to clean brasswork and give it a polish. I mean such work as the brass ornaments on gas fixtures.

Answer.—If the work is old it must be washed or boiled in strong lye, in order to take off all the old varnish. When perfectly cleaned, it is taken out and washed to remove the lye. The next step is dipping, or pickling, as it is sometimes called ; this is dipping the brass into an acid solution, in order to perfectly clean its surface and give it a good color. A dipping acid may be made as follows : Sulphuric acid, 4 gallons ; nitric acid, 2 gallons ; saturated solution of copperas (sulphate of iron), 1 pint ; solution of sulphate of copper, 1 quart. After having been dipped it is taken out, washed, dried in sawdust, care being taken not to touch the work with the hand. It is then moderately heated and the lacquer applied in the usual way, with a brush. This method may answer another inquiry we have received on this subject.

Smoky Chimney.

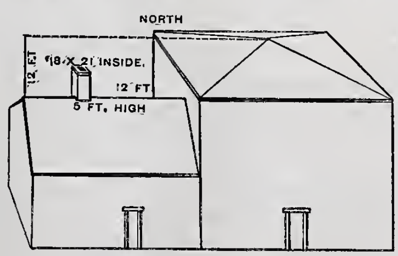
From W. H. G., *Colchester, Ct.*—In response to your kind offer of assistance when needed, I send you a little sketch showing the position of a chimney which does not have a good draft. So far, my efforts to improve it have not had any effect. The flue is 18 by 21 inches. I built a chimney-top of the same size at the bottom as the chimney, and tapered it to a 12-inch round pipe, which I carried up 6 feet, finishing with a top of the pattern shown in the sketch. With this on, the chimney smoked worse than without it. The chimney has been cleaned out, so that there is no obstruction from that cause. There are no trees near by that are higher than the chimney. I cannot think of anything that can be done to remedy the trouble.



If you can suggest anything to help me out it will be received with thanks. I may say that with the wind blowing from the west the chimney draws well, but with the wind blowing from any other direction there is trouble.

Note.—We shall not try to give a direct answer to our correspondent's question by recommending some particular cowl or chimney hood. We think, however, that we may be able to make some suggestions that will be useful in this and similar cases.

It will be noticed from the sketch that the roof is of a peculiar shape, and that the edge of the main building is only 12 feet away from the chimney, and also that the chimney is on the west side. Of course, when the wind blows from the west, striking the chimney before the roof, there is no down draft. It is plain, then, that an east wind could easily make the chimney smoke by blowing over the roof and causing an eddy. As we understand the arrangement of the building, the trouble with northerly and southerly winds is easily accounted for. The roof is quite low and slopes toward all the points of the compass, and when the wind strikes upon one of the sides, the tendency is to deflect or split the current and send streams off to either side. The downward draft is a consequence, whether the wind be from north or south. The usual remedy recommended in such cases is to carry the chimney up to or above the level of the roof which causes the trouble. Usually this is sufficient, and will remedy the evil; but, from our friend's experience with the cowl, we fear that this would not be all that is necessary, for we judge that the main trouble with the cowl was that a strong upward draft blew across or past the mouth, and thus produced, by the action of the cap, a downward draft in the chimney. He might try his cowl again, carrying it up 6 or 7 feet, and leaving the top of the pipe open. It is quite possible that this would work, although the size (12 inches) is much too small for a flue 18 by 21. The area of a 12-inch circle is 113 inches, while the area of the flue is 378.



We do not recommend any particular form of cowl, because there are so many very good claimants for favor that it would not be fair to speak of one above another, when all are doubtless good in their places.

Bad Roof—Wet Plastering.

From J. J. M., *Bath, N. Y.*—I am a constant reader of your valuable paper, and am very much interested in the questions and answers. As your readers are invited to go to you with their troubles, I would like to join in the crowd, although the information that I want in this case may seem to you a little queer. Nevertheless, I am sincere in my query and just as anxious to get out of my difficulty as the rest.

There is in this place a new house of eight or ten rooms. The roof is shingled, with tin valleys and gutters, the latter being built in the roof and lined. A tower on the front has tin flashings around the points where it joins the roof. The flashings are well turned up under the shingles and siding. After a heavy rain some of the lower rooms show wet on the plastering in several places, the most of it being under the tower. The second story rooms are dry. In the garret there is no sign of wet on the roof boards. Now, Mr. Editor, it is easy to say "repair the roof and the plastering will be dry," and all that. But you must remember that the leaking place must be found before it can be repaired. Several good mechanics have examined the house and given the question up. They say they have never seen anything like it before.

Now, is there not something that can be put on as a paint that will look well and make the roof tight? As they say, "it takes everybody to know everything," and then it's not all known. I really hope you can suggest something, for I am disgusted. The idea of a new house, not yet occupied, with the plastering wet on the first floor and everything dry above for all that any one can see, is not a very pleasant job for a man.

Note.—We are glad to hear from our friend and glad to have him send his question. It is just in the line of *Carpentry and Building*, since all roofing questions and the like come in our province. The very first question we should be inclined to ask would be, "How does any one know that the roof leaks at all? Is it perfectly certain that no windows were left open and that there was no opportunity for rain to get in at some point below the roof? Might not the trouble come from the dripping of the second floor—a dripping caused by the moisture arising from freshly plastered walls. Our correspondent does not describe the location of the trouble exactly, but from the account he does give we are not in the least inclined to think that the roof is accountable for the trouble. Indeed, we think we should look in a good many other directions before charging the blame upon the roof. There are a great variety of paints which are said to render roofs tight, and some of them, we suppose, are of pleasant colors, but we do not know enough about them to be able to recommend any of them intelligently.

Hardening Coal Tar.

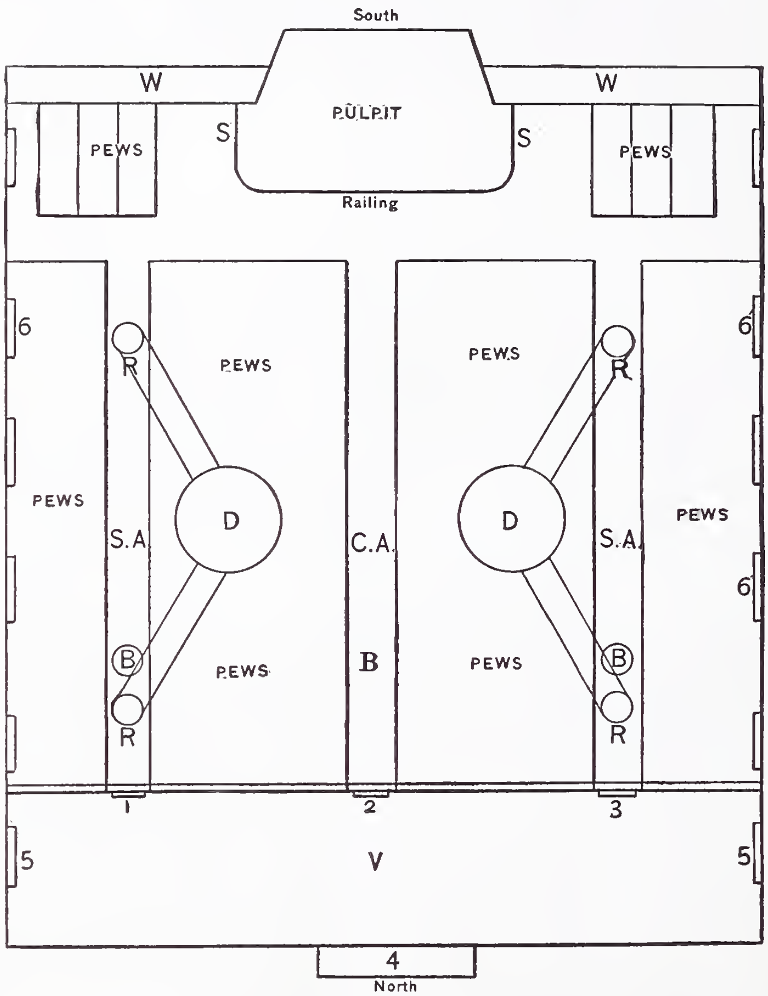
From T. M. A., *La Cygne, Kan.*—As you always seem ready and willing to be bored with questions, I come to you with one. Can you tell me what I can use with coal tar that will dry it quickly on iron? I am using it to paint fence wire, and heat it to a boiling point and dip the spool, leaving it in until the wire is hot, but it will drip and will not harden. Is there anything I can put in it that will be safe over the fire and will make it harden ?

Note.—We fear that we shall not be able to give our correspondent much light upon the subject. The problem of making coal tar harden so that it can be used for a paint, is one that has puzzled inventors for years. Probably the best thing to be done under the circumstances, would be to use a portion of Trinidad asphaltum or something of the sort. By writing to any of the large dealers in gravel, pitch or asphaltum roofing, our friend may be able to get some light upon the subject. There are a number of tolerably cheap asphalts in the market which would have a hardening influence upon the coal tar.

Number of Registers for Heating Large Rooms.

From G. E. H., *Philadelphia, Pa.*—To A. N., of New York, I give my experience in one case. It is a representative of several similar cases in which the results were about the same. In a church in which heaters were already in use I found three registers—one in each aisle—the same distance from the entrance doors. By this arrangement I found the largest proportion of heat to come out at the center register. I also found that with the center register closed, and the heat all coming out of side registers, the church was more comfortable at the front end, but not pleasantly warm at the pulpit end. In making some alterations in the church building afterward I abandoned the center register entirely, and moved the registers in the side aisles a little nearer to the entrance doors, which was necessitated by change in the room below, and put two more registers in the side aisles near the pulpit end. The change has been in every way satisfactory, making both the sides and center of the church much more comfortable than before. By the old plan the people in the center were excessively hot, while those on the sides were uncomfortably cold. Now they have an equitable heater all over the church. No change at all has been made in the heaters. Inclosed I send you a sketch of the audience room, showing both the old and new location of registers. It is a rough, uncouth drawing, but trust you will be able to understand it.

Note.—We are obliged for our correspondent's sketch, from which we have made the annexed engraving. It will assist in making his statements understood by our readers.



PLAN OF CHURCH.

W W.—Back wall.
S S.—Entrance to pulpit.
6 6.—Windows.
D D.—The heaters.
B B B.—Positions of the old registers.
R R R R.—The new registers, connected by the hot-air pipes with the furnace.
S A.—Side aisle.
C A.—Center aisles.
1 2 3.—Doors leading to vestibule.
V.—The vestibule.
5 5.—Side entrance.
4.—Front entrance.

From P. & C., *Troy, N. Y.*—Your correspondent, A. N., New York, inquires regarding the number of registers required to heat a public hall. It is our opinion that one register directly over the heater is the best, considering that one heater is sufficient to heat the building. If the hall is well ventilated at the base at both ends, the room will be evenly heated. If there is no provision for exit of air, the best plan is to locate the heater near one end of the hall, with the register directly over it; also a register in the floor at the other end of the room, same capacity, with an air duct leading from this register under the furnace. This will give perfect circulation, and is the only way that a large room can be properly heated.

From J. F., *Brunswick, Maine.*—I do not know that I wish what I am to write shall go into print, but am disposed to express my opinion in regard to a query in *Carpentry and Building* for March, regarding number of registers for heating a large room. What I say is upon the supposition that the room is capable of being sufficiently heated with one furnace. Economy of room, cleanliness in firing, and the advantage of heating any apartment at will, leads us to locate the apparatus in the basement. With this arrangement the quantity of heat is not diminished, but is confined, and because of small or ill-proportioned pipes, cannot circulate; hence cold rooms, excessive fuel bills, and dissatisfaction generally. In heating any room by means of a current of hot air passing into it, one principle stands before us which must be followed if quick and thorough warming is to be accomplished—namely, the apartment must be made as nearly as possible a portion of the hot-air chamber of the furnace, in order to facilitate the rapid radiation and absorption of the heat generated. To illustrate what I mean: If a large furnace was stripped of its covering, raised from the basement and located in the audience room of the building, the question of heating the same would be speedily solved, but there would not be that uniformity of temperature that is desirable. It is because of this that a furnace, as a means of warming, is superior to the direct radiation of a "salamander." The body of hot air is thrown into and mixed with the air of the room, which is set in motion, and a more comfortable atmosphere is the result—provided, of course, the conditions I have named are complied with. How, then, shall we best arrange the registers to heat large rooms? If possible to do so, locate one large register immediately over the furnace. Provide large return pipes from the room back into the air space of the furnace, or into cold-air flues, thereby effecting a rapid change of air and the absorption of the heat generated. While the details of the arrangement must be governed by the requirements and peculiarities of each case, these principles rule. I have endeavored to confine myself to the question asked, and have good grounds experimentally for the position taken.

To Remove Oil Spots From Marble.

From J. C. R., *Mt. Vernon, N. Y.*—Take clean rain water; dissolve in it all the crude potash it will take up; let it settle; pour off the clear liquid; with this mix whiting to consistency of cream if the marble to be cleaned lies horizontally, thicker, if vertically; apply a thick coating; let it dry thoroughly; then soak and soften with water and remove carefully with sponge or soft cloth, if on polished marble. Repeat the application twice or thrice, if necessary. Should the result not be quite satisfactory, and the marble portable, remove it into the sunshine and pour on it spirits of ammonia; let this evaporate, and wash off with rain water. If the marble is soft and the back of it can be reached, apply a thick coating of plaster of Paris mixed with water before using the potash, &c., or at the same time. The plaster seems to drive the grease to "the front," and the potash neutralizes it. I have frequently used the foregoing, with good results generally. Many of your readers, doubtless, would be glad to learn of some method to remove wine and iron stains. Old stains of any kind are very difficult blemishes to deal with.

To Stain Wood Scarlet.—Besides the aniline colors, which are, however, much affected by sunlight, cochineal gives a very good scarlet red upon wood. Boil 2 oz. of cochineal, previously reduced to a fine powder, in 35 oz. of water for three hours, and apply to the wood. When dry, give a coating of dilute chloride of tin, to which is added a little tartaric acid, 1 oz. of chloride of tin, and ½ oz. of tartaric acid, in 35 fluid oz. of water. If, instead of water, the cochineal is boiled in a decoction of bark (2 oz. of bark to 35 oz. of water), and the chloride of tin is used as above, an intense scarlet, and all shades of orange, may be produced, according to the proportions.

Staining Wood Brown.—Various tones may be produced by mordanting with chromate of potash, and applying a decoction of fustic, logwood, or peachwood.

German bricks measure 2.55 x 4.71 x 9.82 inches.

CARPENTRY AND BUILDING

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Cabinet Work.—An Ebonized Pedestal.

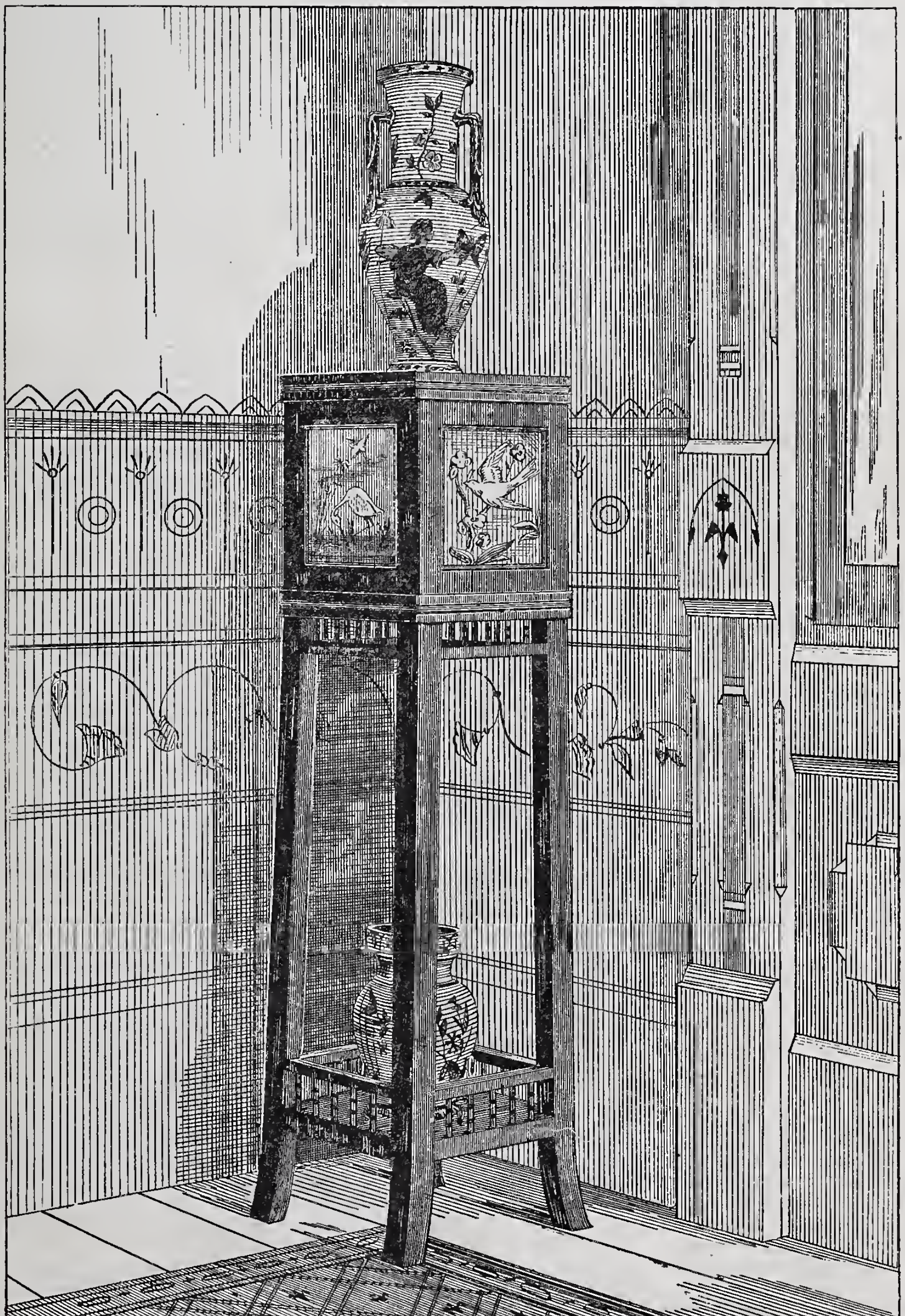
We show in the accompanying illustrations an example of a new and popular article of cabinet ware—an ebonized pedestal, illuminated with tiles, which is intended to show to advantage any object of art requiring an elevation of about 3 feet from the floor, such as a statuette, a brass candelabrum, a tall Chinese or Limoges vase, an antique bronze, or any similar article of decorative value. The construction is very simple, and may be readily understood from our drawings, so that description is unnecessary. In duplicating the article, the proportions given to the parts, as shown in the accompanying illustrations, should be closely followed, as a very slight variation of lines or proportions would probably change the effect and rob it of much of its beauty.

In use this article is equally well adapted to a corner or to a vacant space along the side of a wall, or it may be used as a central object in a bay window, where it may be employed to advantage in holding a porcelain *jardinière* with growing flowers. The lower shelf may be occupied by any article of suitable shape, preference being given to a tall and slender object, rather than to one which is short and thick, as our artist has shown in the perspective view.

The pedestal from which our engravings were taken was made for us from our own designs, by Mr. John Moller, of East Orange, N. J. The material employed is cherry. Of the four tiles used, two are Minton and two are Simpson, and all were hand-painted in appropriate designs and colors.

In selecting tiles for use in this pedestal or in similar positions in connection with a black border, care should be taken to choose such colors as will appear to advantage in the black frame which the construction gives them. Blue tiles, or white tiles with blue or black figures, should be avoided. Any hand-painted tiles in which the prevailing tints are ocher, pale red or pale green, will be found suitable, and will derive great brilliancy from contrast with polished ebony. Tiles suitable for this purpose range in price from 60 cents to $3 each. Very pretty Simpson or Minton tiles can be obtained for about $1 each, through any of the importers. Hand-painted wooden panels may be used in place of the tiles, but these will be found very costly unless produced by amateur talent. Designs in oil, on a ground of gold leaf, laid over an unprepared surface of oak or ash so as to show the grain, will be found very beautiful and very brilliant.

We suggest that all engraving or other attempt at ornamenting the wood surfaces should be omitted, with the exception of the channel shown on the edges of the shelves in our cut, and the turning upon the posts in the railings. Lines of gilding, brass nails, &c., would at once give the article a cheap look, which it does not have when left plain.



Ebonized Pedestal.—Fig. 1.

Directions for ebonizing wood were given in the March issue of *Carpentry and Building*, page 41, and also in the April number, page 71. The process is quite simple, and is readily applied by any one possessing mechanical tact. By it a very superior finish is given to plain and simple shapes, which renders articles that may be built by any carpenter very tasteful, and imparts to them a decorative value far in excess of their actual cost.

As is true of most articles of ebonized cabinet ware, this pedestal appears to best advantage when relieved against a background of warm color. The sharp contrast between a white wall and a black object of any kind is a little unpleasant, unless the furniture and decoration are so chosen as to give a general effect of warm color in the apartment.

What has been said concerning the selection of tiles to be inserted into ebonized cabinet ware, applies in the same degree to wall colors against which such articles will appear to best advantage. For example, it is well to avoid blue tints, both pale and decided, and any pattern of paper in which the groundwork and prevailing tone approaches white. If a dado is used in papering, the most suitable as a relief for ebonized furniture will be found to be that containing a great deal of gold, or a warm color of any dark, rich shade.

But black should be avoided as much as possible, as either the paper or the ebonized furniture will suffer from the inevitable contrast in texture and quality of the surface. If a wooden dado or high wainscoting is used, any of the light woods of yellow tints will be better than walnut. In a word, while we should seek to avoid sharp contrasts and to secure the general effect of color harmony, we should also be careful, in case our taste runs to rich tones, to avoid the almost inevitable tendency to reach somber effects, which are only beautiful in full daylight. It is almost impossible to illuminate brightly a room with dark walls and black furniture, however many lamps or gas jets may be lighted. For this reason, a considerable quantity of gold in dark-colored wall papers is useful as well as beautiful, as gold always reflects strongly, and with a very moderate amount of light gives one the impression of a brilliant illumination.

When the surroundings of such a pedestal as we show in our illustrations are of a character which do not afford enough relief, a very pleasant, and even desirable, effect will be secured by providing a brilliant red mat for the top and standing the vase or other article upon it. The best mat for the purpose is made of worsted, with thick fluffy borders, rising round the base of the article as it rests upon it.

Shafting for Wood Shops.

If any machine operator of long experience, or for that matter, of short experience, were asked what occasioned the greatest number of accidents about the wood shops and what caused most delays, he would be sure to reply, "The line shafting."

For a shaft to break by crystallization from bending—to be torn loose by winding belts—to have pulleys or couplings come loose, is a common cause of detention and expense. The couplings are mentioned last, although if ranked as to the amount of detention and trouble they cause, they should have been named first ; but whether it be coupling, pulleys, hangers, or shafting, the trouble is generally with the main line.

If we go to a machinist who manufactures shafting, and inquire whether there is any special difficulty in the way of making it safe from derangement or accident, he will answer, "Certainly not."

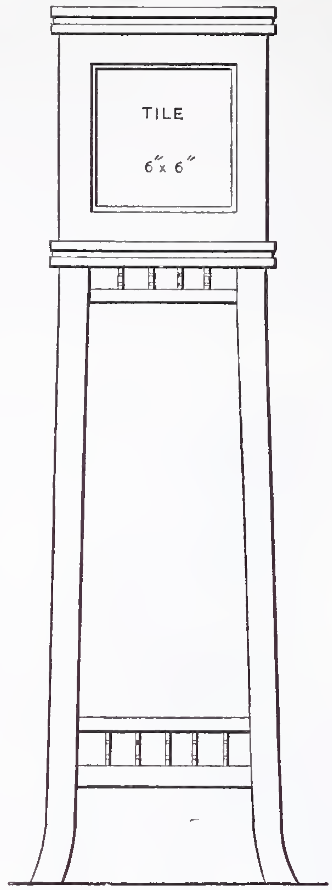
Granting this, we have either a paradox or very bad practice, and as a paradox is rare in mechanics, the latter is the safer conclusion.

Shafts for transmitting motion and power are the oldest of mechanical appliances, and should, as we would suppose, for this reason be among the most perfect, but this is a claim to which they can by no means pretend ; and the great diversity of the plans for couplings, hangers, and bearings by different makers attests the fact that the manufacture of shafting is by no means a perfected art.

There are but few places where line shafting is so severely used as in wood shops ; the usually small diameter, with the high speed, the wide belts, and the heavy duty that it generally has to perform, are all conditions that are more or less avoided in other manufacturing establishments.

Machines when suddenly started offer a resistance in proportion to the power employed in driving them, and measured by this rule there are but few machines in common use so heavy to start and causing so great a strain upon the shafting as planing machines and circular saws. There are many of course that require as much power, but to include all conditions, such as the speed of the belts and the usual means of shifting them, with the sudden stopping which often occurs, there is hardly a parallel among manufacturing machinery. A planing machine or saw that consumes eight or ten horse power to drive it, will have the belts shifted instantly from the loose to the tight pulley, and the only reason that the shafting does not give way is that such machines are generally but weakly belted, and the belts slip until the machine gets into motion. The same thing in effect occurs in over-feeding saws, so that the shafting is continually subjected to a succession of torsional strains that will soon search out the bad jobs in fitting couplings and pulleys.

In preparing plans for a woodworking mill, the shafting should go across the building whenever practicable. By belting from one line to the other at one side of the room



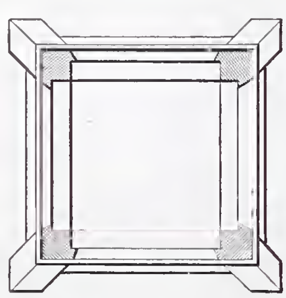
Ebonized Pedestal.—Fig. 2.—Elevation—Scale, 1½ Inches to the Foot.

the whole power is not transmitted through the couplings, as in the case of one continuous shaft to drive all the machinery. The work is also divided more evenly throughout the several lines, and this does away with the supposed necessity of having the line shafting in sections of various diameters, which prevents the interchange of pulleys from one shaft to another, and often leads to expense and trouble.

The first section of shafting carrying the main driving pulley should have a diameter equal to one-fifth the width of the main driving belt, and be supported at each side of the main pulley ; to make a rule, this section should not be more than 20 diameters long between bearings.

Having the first or driving sections 6 feet long, and four additional sections in each line 10 feet long, is a good arrangement for a mill about 50 feet by 150 feet.

The advantages gained by this plan over that of having a continuous line or a single



Ebonized Pedestal.—Fig. 3.—Section through Upper Part—Scale, 1½ Inches to the Foot.

line running the other way of the building are :

First.—Only a part of the power is transmitted through the couplings.

Second.—The speed of the different lines can be varied, and to some extent accommodate machines of different classes, which can be arranged with this view.

Third.—A part of the shafting can be stopped for repairs, or to put on belts or pulleys, without stopping the whole ; in other words, about two-thirds of the works may be kept going in such cases.

Fourth.—With this arrangement the shafting can be of a uniform diameter throughout, except the first or driving sections

Fifth.—The machines stand lengthwise in the building, and the course of the stuff is in this direction, as it should be, and as it must be, for it is no uncommon thing to find planing and other machines driven with quarter-turn belting to accomplish this, when the shafting is placed the other way.

For wood shops, 2½-inch and 3-inch shafting are the best sizes ; 2½-inch shafts are as small as any should be, and they should not, without some important reason, exceed 3 inches in diameter.

A line of 2½-inch shafting will run safely and well at 250 revolutions a minute, or a 3-inch line will run 200 revolutions a minute, if the bearings are properly made and it is kept in line.

Pulleys should be turned true and balanced —balanced perfectly, no matter what their speed.

The effect of an unbalanced pulley is as its speed ; but it is never known where pulleys may have to be used in changing, and the only safe rule is to have every pulley carefully balanced, no matter what the speed may be at which it runs.

Pulleys should be as light as possible, both as a matter of economy and convenience. Our best makers are, however, making them light enough, so that a specification as to weight need hardly be given with an order for pulleys.

As to couplings, they should be adjustable or compressive, not keyed on, or wedged on, for only such a key should be used as will not keep a solid coupling on. Adjustable couplings are now very generally used for line shafting, and certainly there is no place where they are more needed than in our wood shops, where there is such a continual changing and adding of machines and pulleys that the shaft has constantly to be disconnected for the purpose.

Hangers to support the line shafting in wood shops should always have their bearings pivoted, and adjustable vertically. The heavy loads of lumber that are piled on upper floors depress them between the posts, and a line shaft requires to be often leveled up. If the bearings have a vertical adjustment in the hanger frames, and are moved by screws, as they should be, it is a small matter to take a ladder, a level and a wrench and go along the line to level it. A hundred feet of shafting may be adjusted in this manner in an hour, if the larger belts are thrown off to relieve it from strain and the shafting is straight and true. The operation is so simple and so generally understood that it need not be explained here.

Shafting is not liable to get out of line horizontally, unless from the strain of belts ; it is, however, well to line up as often as twice a year, to be sure that all is right. It has been in times past a common thing to allow shafting to run as long as it would go without adjusting, and then stop the works for a day or two to line up, which is unnecessary and only a loss of time. A shaft may be leveled by almost anyone when the hangers are properly made, and can be done at noon, or after stopping in the evening, without interfering with the business at all.

To line a shaft horizontally is but little more trouble if the bearings or hangers can be moved in that direction.

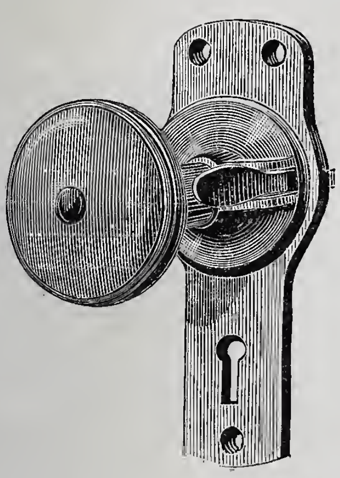
Suspended hangers should have the bolt-holes slotted for an inch or more of movement, and post hangers should have movable bearings that permit side adjustment.

Assuming that there is some means of moving the shaft horizontally, a good plan of adjusting it is by suspending a number of plumb-lines that will bear against one side of the shaft, and reach down low enough to be sighted from the floor ; or, for greater accuracy, a strong line may be stretched about 5 feet from the floor to gauge the plumb-lines from.

This lower line can at the beginning be set within about one-eighth of an inch of the two plumb-lines at the ends, and the rest can then be adjusted to the same position by moving the bearings, or the end bearings can be also adjusted, as the case may require.

A ball of strong packing thread, and half a dozen or more old screw nuts for the plumb-lines, make the outfit, and the job can be well executed, at but little expense and time, if the hangers are properly made and erected so as to be adjusted without trouble.

This kind of work must be to a great extent a matter of judgment; anyone who depends upon special knowledge, or what he may have seen done and been instructed in, will not be so successful in millwrighting as he would be if he proceeds boldly, using his



Gilbert Lock.—Fig. 1.—View of Knob.

own judgment as to plans, and reasoning thoroughly about the work before beginning it.

There are many ways of adjusting line shafting; some of them tedious and expensive, and some useless. The one suggested is the most simple that can be given, and is accurate enough for all practical purposes.

The Gilbert Lock.

The peculiar features of the Gilbert locks are their extreme simplicity, great strength and durability, as well as safety. The knobs do not rotate, but are stationary. They are held firmly by a bolt and cannot be pulled off, thus entirely avoiding a loose, shaky knob and spindle. The latch bolt is operated by a lever working horizontally, so that when grasping the knob the index finger presses the outer end of the lever, thus withdrawing the bolt from mortise. The furniture is self-adjusting to any thickness of door, and is made by the inner ends of levers overlapping each other, thus avoiding screws and washers. The best easy spring is used on all latch bolts made in this line of locks. The cheap locks are as smooth working as the higher priced, and have the same strength. The general features of the lock are seen in the accompanying illustrations, Fig. 1 of which shows the general appearance of the knob, with the lever which is operated by the finger in opening the door, and Fig. 2 of which shows the working parts. These locks and knobs have been extensively introduced, and are claimed to be the best for house-building in existence. They are manufactured by the Gilbert Lock Company, at 135 and 137 Halsey street, Newark, N. J.

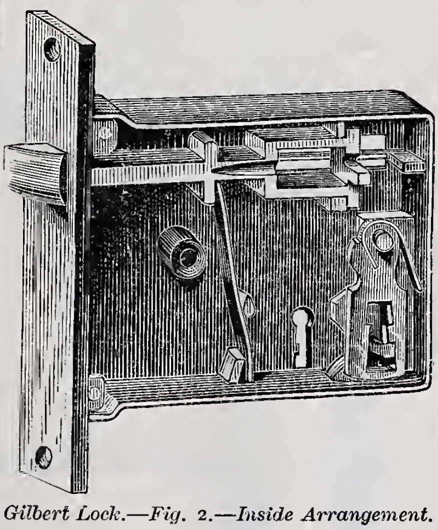
Sawdust in Mortar.—Some time since the use of sawdust in mortar was recommended as superior even to hair for the prevention of cracking, and subsequent peeling off, of rough casing under the action of storms and frost. Some one of the name of Siehr says that on his own house, exposed to prolonged storms on the sea coast, pieces of mortar had to be renewed each spring; and, after trying without effect a number of substances to prevent it, he found sawdust perfectly satisfactory. It was first thoroughly dried, and then sifted through an ordinary grain sieve to remove the larger particles. The mortar was made by mixing one part of cement, two of lime, two of sawdust and five of sharp sand, the sawdust being first well mixed dry with the cement and sand.

Encaustic and Other Tiles.

The first knowledge we have that tiles were used by the ancients, is mentioned by writers who have stored their minds with facts relative to the habits of these people, who were the first in Europe to develop the artistic resources of the human mind. It is said that an old woman of Athens placed a basket over the roof of an acanthus plant, and thereon laid a tile; the plant shooting up in the spring encompassed the basket until it reached the tile—it then turned back into a scroll. By accident the celebrated sculptor Callimachus saw it in passing, and so struck was he with the composition and beauty of nature, that he adopted it at once, and from that day the world has accepted the wisdom of his decision for giving to mankind the beautiful foliated Corinthian capital. The tile served as the abacus, the leaves of the acanthus plant for the volutes, and the basket for the vase or body. What pleasures of thought, what delight to the imagination of mankind, has this old woman given to generations that have passed away "into the dim vista of the past," by the accidental placing of a common tile. Tiles were also used by the Romans; some specimens have been unearthed from Herculaneum and Pompeii. The Venetians produced decorated tiles of great beauty, as did most of the nations of Southern Europe bordering on the Mediterranean, who, no doubt, drew their first inspiration

> "By viewing Nature, Nature's handmaid art,
> Makes mighty things from small beginnings grow."

Within the last few years, the introduction of decorated tiles in furniture has given a charm to these articles of household use unknown to us heretofore. Some accounts of these articles and their uses and manufacture may not be inappropriate, particularly as some persons appear to know but little of their origin or their application. Tiles are thin plates of clay, formed in a variety of sizes and shapes, allowed to dry in the sun, or subjected to heat for the said purpose, then burned to the required hard-



Gilbert Lock.—Fig. 2.—Inside Arrangement.

ness. There appears to be no actual date of their origin, yet we know that tiles in former days were used to cover the roofs of houses. The kind then in use was plain tiles and pan-tiles; the former were the most common, and were perfectly flat; the latter had curved edges, and when laid one over the other at the edges, protected the joints from the rain. The Romans used flat tiles, turned up at the edges, with a row of inverted semi-cylindrical ones over the joints to keep out the wet. In the Middle Ages tiles were extensively employed in Europe for the covering of buildings. It does not appear that any but flat tiles were used, except such as were required for covering the angles, which were sometimes made ornamental. It is not unusual in some of the old baronial halls of England and Normandy, to find the backs of fire-places formed of tiles, and strange as it may appear, the ovens were built at one side, and lined with the same material. These were the common uses of plain tiles.

Glazed decorated tiles were anciently used for paneling churches and sacred edifices. They are sometimes called Norman tiles, possibly from the supposition that they were originally made in that country; and considering the age and specimens in great variety that exist in the north of France, this idea may not be wholly erroneous. It is doubtful, however, whether any tiles have been discovered in England that present the feature of the Norman style of decoration—the most ancient being that of the thirteenth century. The name "encaustic" has also been given to these tiles, and it would not be inappropriate, were it not applied already to denote an antique process of art of a perfectly different nature; whereas, a method wholly distinct, and peculiar to the glazed tiles of the middle ages, was commonly practiced in Northern Europe.

The process most in use may be thus described: The thin squares of well-compacted clay, having been fashioned and dried to the proper degree, a stamp which bore a design in relief was imprinted upon them, so as to leave the ornamental pattern in cavetto; into the hollows thus left on the face of the tile, clay of another color was then inlaid; nothing now was required but to give it a richer effect, and at the same time give to the work durability, by covering the whole with a thin layer of metallic glaze, which, being of a yellow color, tinged the white clay beneath and imparted to the red a fuller and richer tone. It is not the intention to give here the method of manufacture, but to draw the attention of the uninitiated to a few practical facts thereof. It appears probable that the origin of the fabrication of decorated tiles by the process herein stated, is to be sought in the mediæval imitations of Roman mosaic work, by means of colored substances inlaid on stone or marble Many such examples may occasionally be seen used in cabinet furniture, both in ancient and modern times.

A profusion of the best examples still exist, which are only to be seen in sets forming a complete design, and presenting the characteristic style of ornament which was in use at each successive period; but examples of general arrangement are very rare. To this deficiency of authorities seems to be due that modern imitations of these ancient tiles have proved unsatisfactory.

The writer has examined some few of these ancient productions in Westleigh, in Devonshire, St. Omer's Cathedral and the Abbey Church of St. Dennis in England, and to-day may be seen reproductions of the same designs in our large cities, known as "imported tiles," but in no way do they come up to the original, which latter is probably more than five or six hundred years old.

It is interesting to cabinet makers, as well as to others, to know some little about tho origin of the articles they handle in the course of their every-day work, as well as adaptation to furniture when applied with good taste; and a proper appreciation of what is meritorious, lends a charm to the new by its association with the old. Heathen nations (so considered by our standard) have, from time immemorial, shown their exalted appreciation of the beauty of nature's productions for the purposes of ornamentation. The chief cause of their success consisted in their being content simply to adapt natural forms to their requirements, and in having a perfect knowledge of their peculiarities and growth.

> "Who lives to nature rarely can be poor;
> Who lives to fancy never can be rich."

To Keep Tools Clean and Bright.—When tools are clean and bright they may be kept so by wiping, before putting them away, with a cloth dipped in melted paraffine. If they are rusted, they may be cleaned by soaking in kerosene oil, and then rubbed with an oily rag dipped in fine emery powder.

MASONRY.

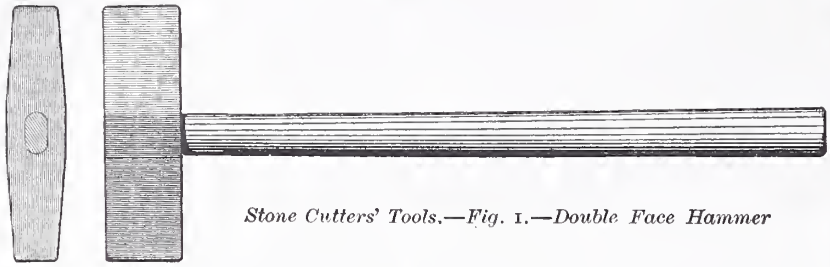
Tools Used in Stone Cutting.

V.

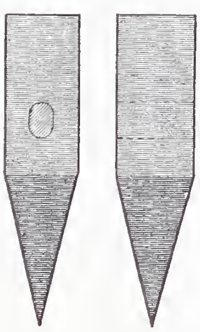
[*Scale of Cuts, 1½ Inches to the Foot.*]

The art of building in stone is of the greatest antiquity, dating possibly from the first human family. Among the earliest nations of the world, heaps of stones were regarded as memorials of some event, or as emblems of the permanency of the agreement entered into. Thus we find that Jacob took a stone and set it up for a pillar, and said to the people: "Gather stones," and they took stones and made a heap, and each party called it by a name, which, in his own language, signified "the heap of witnesses." After the desire to erect huge masses of stone, either to commemorate some event or for the exercise of some religious rite, the necessity for defense against predatory tribes seems to have given the next impulse to building in stone.

It is at this stage of the history of masonry that we have the first evidence of tools being employed for shaping and fitting stone. In some of the ancient walls built as defenses, as just mentioned, huge polygonal blocks of stone were employed, which were so carefully cut as to fit exactly to each other without mortar. In size some of these stones have been described as measuring 12 feet 8 inches long by 2 feet 10 inches high, and of proportionate width. Most of the stones used in one of these walls have been described as weighing from six to eight tons each. The skill required in dressing such blocks to fit accurately was very considerable, and tools of which no record has come down to us were undoubtedly employed.



Stone Cutters' Tools.—Fig. 1.—Double Face Hammer



Stone Cutters' Tools.—Fig. 3.—Cavil.

From history we learn that the masonry practiced in Assyria possessed the peculiarity that, excepting at the angles, it formed only a facing to thick walls, which were composed of brick. In this description of the work of ancient masons we are strongly reminded of the veneer work of the present day. To have fitted slabs of stone together in a manner to form the exterior facing of a wall must have required both skill and tools.

We might go on multiplying instances from history, all going to show that stone-cutting tools have been a necessity from the earliest antiquity, and proving in some measure that the tools used have been adapted to the purpose of the masons of the several periods. Thus we read that the Egyptians from the earliest times not only used gigantic masonry, with the parts fitted and adapted to each other with marvelous accuracy, but we also learn that they possessed the power of working, carving and polishing granite to a marvelous degree. We do not design this sketch, however, as a history of the art of masonry. We propose to glance briefly at some of the tools in common use at the present time.

The improvement that has been made in many of the mechanical arts and trades with the progress of time seems wonderful, and the apparent progress in masonry is perhaps more marvelous than that of others. When we see the ease with which huge blocks of stone are moved and hoisted at the present time, by means of steam derricks, &c., and when we inspect the wonderful steam-power stone-cutting machinery, the various saws and polishers, without which we hardly venture to attempt any work of magnitude at the present day, and the various contrivances for cutting stone, and remember that the ancients had none of these helps, we say it is indeed a mighty age in which we live. But when we reflect that with all our improved devices, and with all the disadvantages under which the ancients worked, the stonework of the early ages which has come down to us in ruins very generally excels that of our own time, we experience a feeling of mortification. The ancient Egyptains, with tools of copper, or, rather, of bronze—materials which we have entirely discarded for the purpose—executed work in granite, carving huge slabs and masses of this intractable material, which they had first cut to shape and polished, with the most delicate and sharp-cut hieroglyphical inscriptions—work which in all respects it is hard to equal at this day, with all our boasted skill and improved tools.

Stone-cutting tools at the present time are made wholly of steel. It was formerly the custom to make them of iron with steel edges, but with the increase in the supply and use of steel, tools made wholly of this material have superseded the others. In describing the tools in common use we shall, so far as possible, give the names by which they are ordinarily known, as well as the dimensions to which they are commonly made. The accompanying illustrations are to the uniform scale of 1½ inches to the foot:

The Double Face Hammer (Fig. 1) is a heavy tool, weighing from 20 to 30 lbs., used for roughly shaping stones as they come from the quarry and for knocking off projections. This is used only for the roughest work.

The Face Hammer (Fig. 2) has one blunt and one cutting end, and is used for the same purpose as the double face hammer, where less weight is required. The cutting end is used for roughly squaring stones preparatory to the use of finer tools.

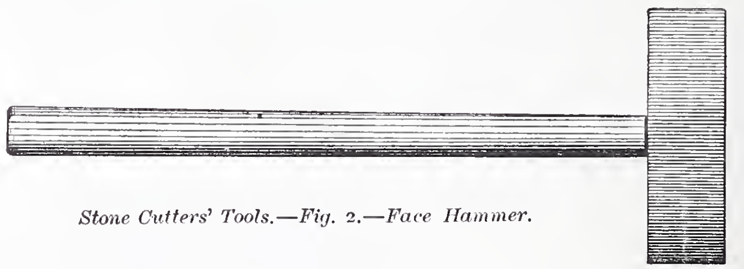
The Cavil (Fig. 3) has one blunt and one pyramidal or pointed end. It weighs from 15 to 20 lbs. Used in quarries for roughly shaping stone for transportation.

The Pick (Fig. 4) somewhat resembles the pick used in digging, and is used for rough dressing, mostly on limestone and sandstone. Its length varies from 15 to 24 inches, the thickness at the eye being about 2 inches.

The Ax or Pane Hammer (Fig. 5) has two opposite cutting edges. It is used for making drafts around the arris or edge of stones and in reducing faces, and sometimes joints, to a level. Its length is about 10 inches and the cutting edge about 4 inches. It is used after the point and before the patent hammer.

The Tooth Ax (Fig. 6) is like the ax, except that its cutting edges are divided into teeth, the number of which vary with the kind of work required. This tool is not used in granite and gneiss cutting.

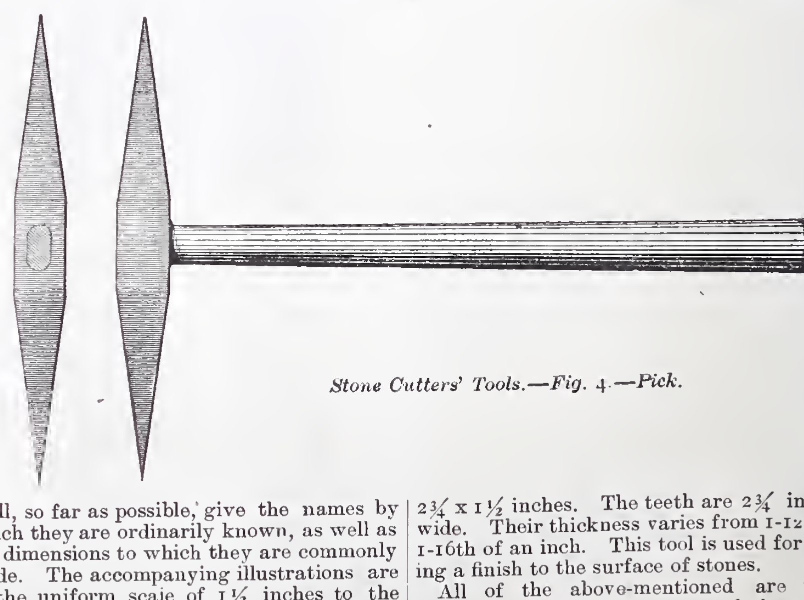
The Bush Hammer (Fig. 7) is a square prism of steel, whose ends are cut into a number of pyramidal points. The length of the hammer is from 4 to 8 inches, and the cutting face from 2 to 4 inches square. The points vary in number and in size with the work to be done. One end is sometimes made with a cutting edge, like that of the ax.



Stone Cutters' Tools.—Fig. 2.—Face Hammer.

The Crandall (Fig. 8) is a malleable-iron bar about 2 feet long, slightly flattened at one end. In this end is a slot 3 inches long and ⅜ inch wide. Through this slot are passed ten double-headed points of ¼-inch square steel, 9 inches long, which are held in place by a key.

The Patent Hammer (Fig. 9) is a double-headed tool, so formed as to hold at each end a set of wide thin chisels. The tool is in two parts, which are held together by the bolts which hold the chisels. Lateral motion is prevented by four guards on one of the pieces. The tool without the teeth is 5½ x 2¾ x 1½ inches. The teeth are 2¾ inches wide. Their thickness varies from 1-12th to 1-16th of an inch. This tool is used for giving a finish to the surface of stones.



Stone Cutters' Tools.—Fig. 4.—Pick.

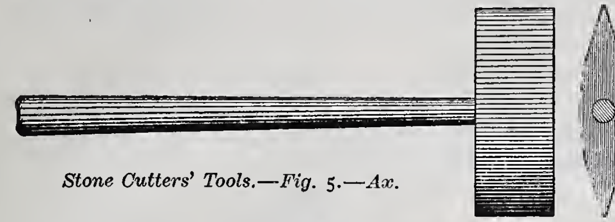
All of the above-mentioned are two-handed, or require both hands of the workman to use them. The remaining tools to be described require the use of only one hand for each.

The Hand Hammer (Fig. 10), weighing

from 2 to 5 pounds, is used in drilling holes, and in pointing and chiseling the harder rocks.

The Mallet (Fig. 11) is used where the softer limestones and sandstones are to be cut.

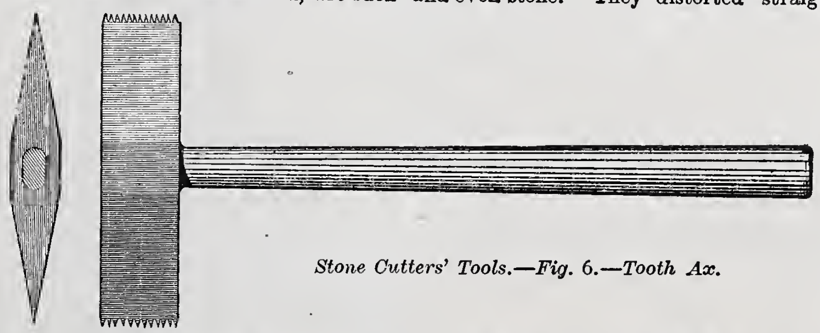
The Pitching Chisel (Fig. 12) is usually of 1⅛-inch octagonal steel, spread on the cutting end to a rectangle of ⅛ x 2½ inches. It is used to make a well-defined edge to the face of a stone, a line being marked on the joint surface to which the chisel is applied, and the portion of the stone outside of the line broken off by a blow with the hand hammer on the head of the chisel.



Stone Cutters' Tools.—Fig. 5.—Ax.

The Point (Fig. 13) is made of round or octagonal rods of steel, from 1¼ inch to 1 inch diameter. It is made about 12 inches long, with one end brought to a point. It is used until its length is reduced to about 5 inches. It is employed for dressing off the irregular surface of stones, either for a permanent finish or preparatory to the use of the ax. According to the hardness of the stone, either the hand hammer or mallet is used with it.

The Chisel (Fig. 14), of round steel of ¼ to ¾ inch in diameter and about 10 inches long, with one end brought to a cutting edge from ¼ inch to 2 inches wide, is used for cutting drafts or margins on the face of stones.

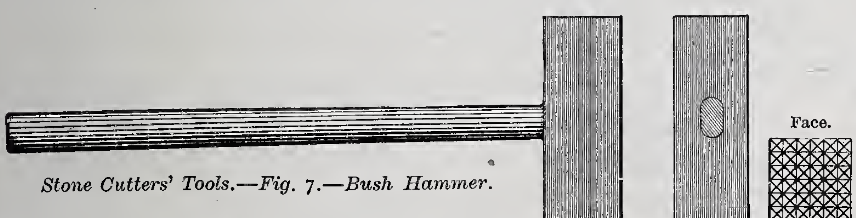


Stone Cutters' Tools.—Fig. 6.—Tooth Ax.

The Tooth Chisel (Fig. 15) is the same as the chisel, except that the cutting edge is divided into teeth. It is used only on marbles and sandstones.

The Splitting Chisel (Fig. 16) is used chiefly on the softer stratified stoues and sometimes on fine architectural carvings in granite.

The Plug, a truncated wedge of steel, and the Feathers, of half-round malleable iron (Fig. 17), are used for splitting unstratified stone. A row of holes is made with the drill (Fig. 18) on the line on which the fracture is to be made. In each of these holes two feathers are inserted, and the plugs lightly driven in between them. The plugs are then gradually driven home by light blows of the hand hammer on each in succession until the stone splits.



Stone Cutters' Tools.—Fig. 7.—Bush Hammer.

In architectural carving, a variety of chisels of different forms are used. For most of these no specific names exist, and their shapes are varied with the special work to be done.

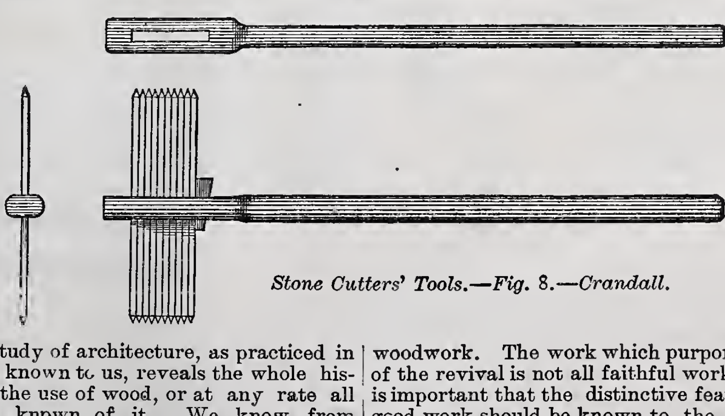
Blackboard Paint.—The following is a good recipe for blackboard paint: One quart of shellac dissolved in alcohol, three ounces pulverized pumice-stone, two ounces pulverized rotten-stone, four ounces lampblack; mix the last three ingredients together, moisten a portion at a time with a little of the shellac and alcohol, grind as thoroughly as possible with a knife or spatula; after which pour in the remainder of the alcohol, stirring often to prevent settling. One quart will furnish two coats for 80 square feet of blackboard not previously painted. The preparation dries immediately, and the board may be used within an hour if necessary. No oil should be used. Should it not be convenient to make this preparation, liquid slating may be purchased, ready prepared.

On the Constructive Use of Wood.

BY P. B. WIGHT.

The use of wood for constructive purposes dates back to prehistoric times. It was employed for the most primitive structures, when the only art of building known consisted of the tying together of branches of trees and covering them with brush. Then wood was actually used in its growing state, and the idea of "manufacturing" lumber was unknown. The remarkable properties of wood in its resistance to compression, together with its toughness and the ease with which it is worked, are such as to have adapted it to more varied uses than any other material known to man.

While treating of the constructive uses of wood, we refer to its use in best accordance with its own structural character, especially with reference to its employment in the finishing of churches and buildings generally, and its adaptation to the construction of furniture. We say the construction of furniture, rather than the manufacture of it, because we maintain that the construction is of more importance than any other process in its manufacture. Lightness, combined with strength, are the essential qualities of all movable furniture, while the constructive use of wood, with a view to developing the best properties of the material in the simplest manner, is no less essential in those articles which are more permanent in their nature.



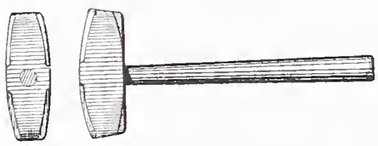
Stone Cutters' Tools.—Fig. 8.—Crandall.

The study of architecture, as practiced in all ages known to us, reveals the whole history of the use of wood, or at any rate all that is known of it. We know from paintings, that the Egyptians used straight wood in their furniture. The Greeks and Romans, as shown on their medals, used straight-grained, well-constructed furniture. The Chinese of ancient and modern times have been famous for their admirable woodwork, in which they have combined lightness and strength to a remarkable degree. The earliest actual remains of any extensive use of wood for interior work, are found in the buildings of the Middle Ages, from the 12th to the 15th century, and it is in this period that we find the highest development of the art of woodworking, and its most extensive use. For two centuries later, and in some localities down to the end of the 18th, wood continued to be used constructively, especially for furniture-making; and much of the work of this latter period which has been preserved, is now highly prized by connoisseurs and eagerly sought for by museums of art. To the preservation of these and the recent extensive study of mediæval art, may be ascribed the recent revival in furniture-making. The French artists of the Renaissance, however, did everything that was possible to debase the use of wood and make it subservient to whim and caprice, making it in many cases only the skeleton to be arrayed in ornament executed in a baser material, overloaded with paint, gilding and inappropriate adornments of metal, shells, and even stone. They distorted straight-grained wood, and gave it all sorts of twists and curves which made it resemble bent wood. In doing this they had to resort to tricks and ingenious devices to make it stand ordinary wear. Even when foreign materials were not employed for ornament, they overloaded the wood with carving, with total indifference to the use to which it was to be put. From the French Revolution down to the present time these styles have had their followers, and cheap imitations of French furniture have been the staple of most furniture factories and dealers. The revival which has set in during the past twenty years, especially in England and America, is one founded on common sense. It recognizes the distinctive properties of wood; that its grain runs one way, and in that direction is its line of strength; that it is liable to shrink greatly if used in wide pieces, notwithstanding the efforts that are made to prevent this natural occurrence; that it may check or warp, unless cut from the tree in a particular direction; and mainly, that it should only be joined together by the mechanical methods of securing wood to wood without other artificial adjuncts—or, in other words, that the mortise and tenon are the main reliance in joining two pieces, and that glue is at most but subsidiary. It is the observance of these principles which is the distinctive feature in constructive woodwork. The work which purports to be of the revival is not all faithful work, and it is important that the distinctive features of good work should be known to the general public, so that they can judge between the good and the bad. The revival has its true and its false prophets. The latter, unable to understand its meaning, and indifferent to the inculcation of true principles of art applied to mechanical work, consider it to be a fashionable style, and push it along as such. But it is only a fashion in so far as they can put such work on the market with imitation tenon and wedge work, panels which are not framed, glue joints for mortise and tenon joints, and the like. A revival such as that now in progress, urged on by the body of in-

Stone Cutters' Tools.—Fig. 9.—Patent Hammer.

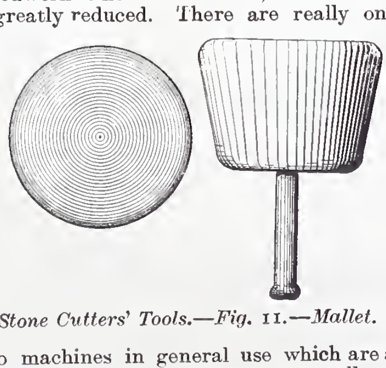
telligent architects and put in practical operation by a few conscientious manufacturers, is not for a day, but is permanent. It is a style always capable of higher development, and it is these improvements, in place of shifting fashions as of old, that will redound to the benefit of any faithful manufacturer no less than the advancement of art, because founded on the coustructive use of wood and its adornment in accordance with its capability to display genuine artistic work.

From the use of growing trees to the manufacture of modern woodwork there is a wide range between the degrees of excellence in workmanship growing out of the vast improvements in processes, and especially in the preparation of materials. The woodwork of the Middle Ages was without fault, but it was the result of an emount of actual labor from which we



Stone Cutters' Tools.—Fig. 10.—Hand Hammer.

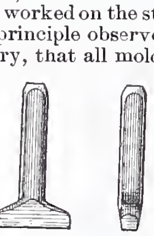
would now recoil. The lumber was well seasoned, but it was seasoned by time alone. Moreover, it was all hand-work. The ingenuity of man in modern times has devised methods for curing and preparing the material in much less time than was formerly employed; and, though the old methods should not be set at naught, the new methods have this advantage, that they economize the amount of capital required in carrying on work on an extensive scale to meet the enormous and rapid demands of our time. Now, also, in the sawing, dressing, molding, mortising aud sand-papering of lumber, machinery does all the work. The lathe was almost the only machine used by the ancients. Now, improved machinery enables us to do the most elaborate lathe-work at comparatively small cost. As long as machine-work does not invade the realm of the carver, the artistic value of machine-made woodwork is not deteriorated, and its cost is greatly reduced. There are really only



Stone Cutters' Tools.—Fig. 11.—Mallet.

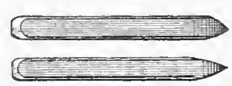
two machines in general use which are at war with art, and these are the scroll-saw and the shaper, both of which have led to great abuses in design; but they are but little used in the finer sorts of work.

The mainstay of constructive woodwork is the mortise and tenon. A piece of woodwork which can be put together without glue, nails or screws, and serves its purpose, is an ideal work of construction. But this is not always possible. Another principle of construction is that every piece of wood should be so placed that it can swell or shrink without injuring itself or displacing any other piece. This is maintained in any ordinary paneled door, provided no moldings are iuserted. Still another principle is that miter joints should be avoided, whether for molded work or not, for the reason that shrinkage causes all miters to open. No piece of wood should be used unless the straight grain of the wood can be seen through its full length in one place. Inserted moldings should be avoided as far as possible, and all moldings for panel work should be worked on the stiles and rails. It is a general principle observed in the best mediæval joinery, that all moldings on rails



Stone Cutters' Tools.—Fig. 12.—Pitching Chisel.

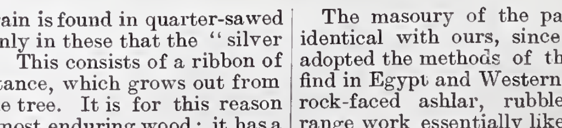
(which are horizontal) should butt against the stiles, and that stiles should be either plain or should have moldings stopped before reaching the joints with the rails. In practice all rail moldings may be worked the whole length of the stuff used, aud if mullions (which are the middle stiles) are used, the molding may be cut away to the square wood before the mortise is cut which is to receive the tenon of the mullions. Thus the moldings will butt against the square sides of the mullions. All the parts for a door thus made can now be got out by machinery, and the door will be fully constructive in every sense of the word. There is no obstacle to this in the way of cost. The dovetail is a constructive device, and the dowel is admissible in places as a substitute for the mortise and tenon. Tongue and grooving is a legitimate device, both for ends and sides of boards. Beveling the edges of the pieces thus joined is better than beading. The best



Stone Cutters' Tools.—Fig. 13.—Point.

way to construct large panels is to make them of narrow strips, tongued and grooved, and beveled at the joining edges. Such panels will never "draw." The shrinkage will be divided between all the joints. Solid table tops should never be fastened with glue or screws, but should be secured with buttons fastened to the under side of the top, which travel in grooves cut in the framework to allow for expansion and shrinkage. These are but a few of the principles to be observed in doing the best woodwork.

In all kinds of lumber the heart should be rejected. All boards cut on a radius from the center to the periphery of a tree will remain true, while all others have a tendency to warp or check. The first are called "quarter-sawed." It is a peculiarity of oak that the best grain is found in quarter-sawed boards. It is only in these that the "silver grain" is seen. This consists of a ribbon of very hard substance, which grows out from the center of the tree. It is for this reason that oak is the most enduring wood; it has a grain two ways. All woods check in the direction of a radius from the center. Quarter-sawed oak cannot check.



Stone Cutters' Tools.—Fig. 18.—Drill.

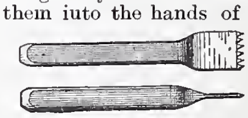
Some Features of Ancient Engineering.*

Modern research has developed the fact that nearly all the materials (in a very wide sense of the word) of modern civilization originated in antiquity, the peculiar province

Stone Cutters' Tools.—Fig. 14.—Point.

of our time being to ring the changes of variety upon these elements and give them an immense diffusion.

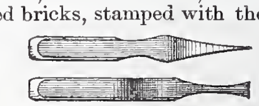
The textile fabrics of wool, cotton, flax and silk were known to the Egyptians of three or four thousand years ago, but the cotton-gin, the power-loom and the steam engine have greatly increased their variety and put them iuto the hands of everyone.



Stone Cutters' Tools.—Fig. 15.—Tooth Chisel.

The same thing is true of the engineering art, for, if we except iron framing, the ancients originated nearly all the typical forms we now employ. They were acquainted with the coustructive uses of wood, carried stone construction to a point that we have never since reached, and probably never shall; their brickwork dates from the very earliest times, and they constructed canals and aqueducts for irrigation, water supply and inland navigation, as well as elaborate drainage systems, long before their civilization culminated.

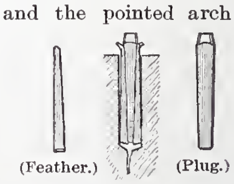
The Chaldean structures, dating from 2200 to 1500 B. C., were built of small sun-dried bricks, laid in bitumen, aud faced with kiln-dried bricks, stamped with the name of



Stone Cutters' Tools.—Fig. 16.—Splitting Chisel.

the king. These temples were built on elevated platforms of beaten clay, in some iustances cased with massive walls of stone, the object being to raise them above the level of the plain for architectural effect aud to avoid inundatiou. A brick burial vault at Mugheir exhibits a rudimentary arch. The vault is 7 feet long, 5 feet high and 3 feet 7 inches wide. The sides slope gently outward uutil the springing line is reached, when the successive courses are pushed toward each other until they meet at the top. Similar arches are found in early Greek work at Phigalia, Messene and other places.

The old notion that the round arch was of Roman, and the pointed arch of Gothic



Stone Cutters' Tools.—Fig. 17.—Plug and Feathers.

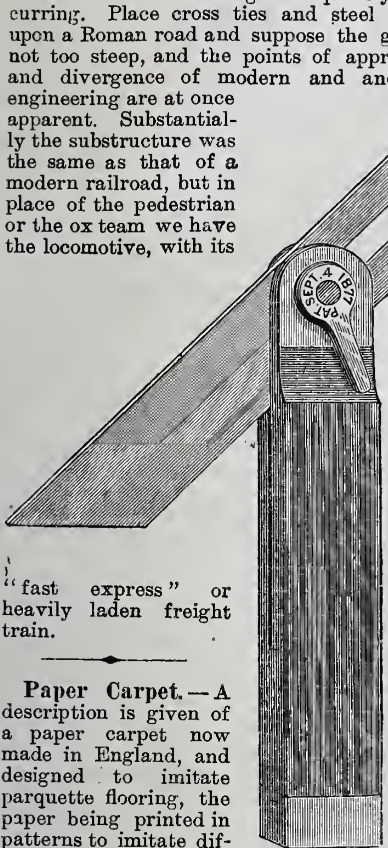
origin, has been dissipated by the spade of the archæologist. Both of these varieties are found in Assyrian work. They are usually of brick, and occur in underground construction, as drains and vaults. The brick arch existed in Egypt as early as 1540 B. C., and a stone arch has been found dating from 600 B. C.

The masoury of the past is, of course, identical with ours, since we have simply adopted the methods of the ancients. We find in Egypt and Western Asia smooth and rock-faced ashlar, rubble and irregular range work essentially like that of to-day.

* Abstract of a paper read by Mr. George Burnham, Jr., before the Engineers' Club of Philadelphia.

The Assyrian and Egyptian bas-reliefs indicate their method of moving heavy masses. Sledges were used, drawn by large bodies of men. Rollers were placed under the sledge, and the piece was carefully "guyed" by parties of men with appropriate ropes and props.

The Roman military roads crossed mountains and valleys without regard to the nature of the ground; tunnels, open cuts, embankments and bridges frequently occurring. Place cross ties and steel rails upon a Roman road and suppose the grade not too steep, and the points of approach and divergence of modern and ancient engineering are at once apparent. Substantially the substructure was the same as that of a modern railroad, but in place of the pedestrian or the ox team we have the locomotive, with its "fast express" or heavily laden freight train.



Improved Bevel.

Paper Carpet.—A description is given of a paper carpet now made in England, and designed to imitate parquette flooring, the paper being printed in patterns to imitate different woods from photographs, so that, as it is stated, the resemblance is absolutely perfect. The floor is first prepared, being made level, and the crevices filled up with plaster of Paris; over the surface, as thus prepared, hession is stretched, and on this, first, lining paper and then the patterned paper is pasted, the whole being finished with a coating of a peculiar kind of varnish, described as wonderfully hard and wear-resisting. This kind of carpeting can be kept perfectly clean with the greatest ease, and though the wear of paper carpeting may be thought problematical, the inventor states that he has had rooms covered with it for 16 months without showing any appreciable signs of wear. Its appearance, also, is very satisfactory to the eye.

Improved Flush Sliding T-Bevel.

Perhaps the best indication that a real improvement has been made in any tool which has long been in general use, is that when such improvement is introduced to the notice of mechanics the inquiry is made: "Why didn't some one think of that before?"

We call the attention of our readers to the illustration on this page, of improvements recently made in the ordinary sliding T-bevel. The value of the new features in this bevel will appear from a single glance at the illustration.

A brass lever for securing the blade at any desired angle has been substituted for the old style of thumb-nut, and the bevel can be held in one hand while the workman holds his scratch-awl or pencil in the other. The lever can be easily operated by the thumb of the hand in which the bevel is held, thus enabling the workman to take an angle in any difficult place, while one hand may be employed in maintaining his position on a ladder or staging. The blade can be clamped more firmly (with the same outlay of strength) than by the old method of fastening, owing to the greater purchase given by the lever. The sides of the handle are both depressed at the clamping end, and the lever is below the main surface of the handle. The tool will lie on a bench equally well with either side of the handle down, as both sides of the handle are flush.

The Stanley Rule and Level Co., of New Britain, Conn., manufacture these bevels, under letters patent, but they may be found in hardware stores generally.

Pure Air in the Cellar.—It will greatly aid in promoting a pure air in the cellar and health in the household if an opening be made from the cellar into the chimney, so that all impurities may find vent up this most convenient channel for ventilation. Most of the foul gases generated in cellars—carbonic acid gas being a notable exception—are light and tend to rise. In the chimney, the air being heated, there is a constant current of air sets from all directions toward this opening. We have been in houses in which, when the cellar door was open, we felt like holding our breath, so strong was the odor of decaying fruit and vegetables, mingled with other vile smells, which we knew were full of miasm and death. A hole in the chimney a foot square will prevent the rush of this pestilential air into the living rooms, but no such air should be generated or tolerated in the cellar—hole or no hole in the chimney.

How to Lay Floor Tiles.

If there is no cellar or other opening underneath the space intended for the tile pavement, the foundation may be brought up to within 3 inches of the proposed surface of the pavement with brick, gravel, broken stone, clean stone clippings, or other solid waste substances free from chips and shavings, so that complete solidity may be secured. Upon this substratum a mortar of gravel and cement should be spread, leaving a depth of 1 inch for ½-inch tiles, and 1½ inch for 1-inch tiles. A floating of cement and sand, in equal proportions, should then be spread ¼ inch thick over the cement and gravel layer. Upon this, when hard, the tiling may be fixed.

The above method is equally applicable, so far as requisite, to places above a cellar or other opening below, provided a firm foundation be given by an archway of brick or stone, or other equally solid substance. But when there is only an ordinary floor or floor joist, it is necessary that the surface of this floor should be 4 inches lower than the surface of the intended pavement. There being at that depth a strong flooring of plank or rough boards, the mixture of cement and gravel, as above, may be spread upon it, and finished in the same manner.

Where it is required to replace boarded flooring by tiles, and it is impracticable to lower the joists to the necessary depth, as just mentioned, the floor boards may be lowered by "cutting in" between the joists, securing them below by strips nailed to the sides of the joist, so as to leave a space of 3 inches deep above the boards and below the top of the joists. The space so obtained is then to be filled in between the joists with the cement and gravel mortar, raising it slightly above the joists, and finishing off with cement and sand, as described above. A flat, level surface of this last coating may be secured by striking off with a straight-edge, supported at each end upon parallel strips, either fixed to the walls or otherwise secured on a level.

It is not advisable to lay tiling upon a floor of boards, as it yields so much as to loosen the tiles. For affixing tiles to walls, it is best to remove the plastering and replace it by a coating of cement mortar, upon which, after setting, the tiles are imbedded with cement. A space ¼ inch in depth should be left for the purpose.

As regards the process of placing the tiles, it is best to work from the center of the space, and if the design is intricate, to lay out a portion of the pavement, according to the plan, upon a smooth floor near by, fitting the tiles together as they are to be laid. Lines being stretched over the foundation, at right angles, the fixing may proceed, both the tiles and the foundation being previously soaked in cold water, to prevent the too rapid drying of the cement and to secure better adhesion. The border should be left until the last. Its position, and that of the tiles are to be obtained from the drawing, or by measuring the tiles when laid loosely upon the floor. The cement for fixing should be mixed thin, in small quantities, and without sand. It is best to float the tiles to their places, so as to exclude air and fill all the space between them and the foundation.

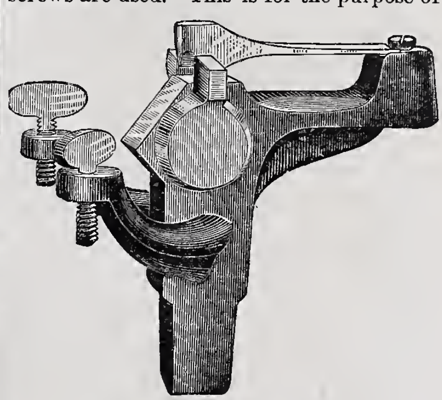
For fixing tiles in grate cheeks, sides and backs of fire-places, &c., equal parts of sand, plaster of Paris, and hair mortar may be used. These materials should be mixed with hot glue to the consistency of mortar. The tiles should be well soaked in warm water.

Tiles may be cut in the following manner: Draw a line with a pencil or sharp point where the break is desired; then, placing the tile upon a firm board, imbedding it in sand on a flagstone, tap it moderately with a sharp chisel and a hammer along the line, up and down, or scratch it with a file. The tile may then be broken in the hand by a gentle blow at the back. The edges, if required, may be smoothed by grinding, or by rubbing with sand and water on a flat stone.

Cement should not be allowed to harden upon the surface of the tile if it can be prevented, as it is difficult to remove it after it has set. Stains of cement, or the thin coating which is almost unavoidable upon the surface of the tiles after laying, may be removed by a dilute solution of hydrochloric acid, to be obtained of any druggist, and then washing with warm water.

Improved Saw Set.

In the accompanying illustration we show a new spring hammer saw set, manufactured by the Bemis & Call Hardware and Tool Co., of Springfield, Mass. A glance at the engraving shows that it has several features peculiar to itself, and in general differs decidedly from tools of a similar character. The arrangement of the anvil and gauges is of the well-known type, and allows not only quick, but accurate work, and is all that could be desired. The hammer is made with a spring projecting in the rear and secured to an arm by a screw. In front, instead of the single-gauge screw, two screws are used. This is for the purpose of keeping the blade steady lengthwise, and when the saw is prevented from canting in this direction there is no danger that the tooth will be twisted when it is struck, a thing very likely to happen when the saw blade has to be held by one hand only upon the top of a single-gauge screw. If properly adjusted the set may be given merely to the point, or the whole tooth may be bent. The workmanship is in every way first class, and the material used of the very best. The new tool is one of several styles of saw sets made by the firm, but is of the latest and most approved form.



Improved Saw Set.

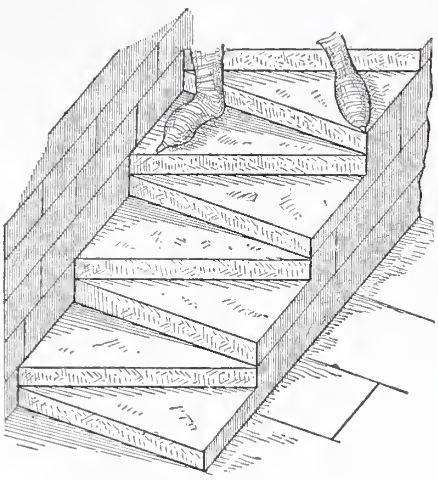
The hours of labor are life's coupons: when you cut off one, see that it is not lost.

PRACTICAL CARPENTRY.

Stair Building.

V.

Ancient staircase building followed in France much the same course as it did in England. Stone steps, usually external, were adopted as the earliest permanent stairs, and for internal and temporary purposes, fixed or movable ladders,

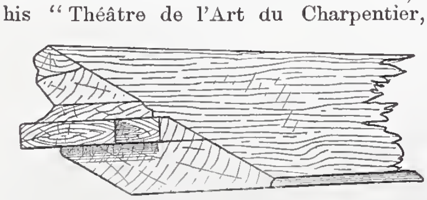


Stair Building.—Fig. 1.

leading to or from trap doors, sufficed. A very curious form of the stone steps in use among the French, we may note, was that of only sufficient breadth to allow of the passage of one person, the individual steps being made triangular in form like winders, the apexes alternating to the right or left. The broad portion of the step thus gave sufficient space for one foot, the other foot falling on the broad part of the next step, and so on (Fig. 1). Of course this plan ensured a great saving of space and material, and probably answered the limited requirements of the time.

Many of the early French interior stairs were of spiral or corkscrew arrangement, and when wood gradually superseded stone the same form was adhered to, and the solid stone steps were imitated in the other material. The stone pillar, or vise, as it was termed, around which the steps wound and to which their inner extremities were joggled or tenoned, was frequently richly ornamented. Many of the winding stone stairs were also surrounded by a circular cage of light stone pillars, which protected a person ascending or descending from the risk of falling, and served also in some degree the purposes of a hand-rail. Both these characteristics were subsequently reproduced in wooden staircases.

Of wooden staircases perhaps no perfect examples remain in France of greater antiquity than the sixteenth century. Some fragments, as those of the Sainte Chapelle at Paris, may mount to nearly a couple of centuries earlier. As the old castles, in which all comfort had to give way to the military requirements of strength and security, were replaced by handsome chateaux, half warlike it is true, but also a moiety domestic, staircases, like other internal fittings, began to receive more attention. Thus we find old Master Mathurin Jousse, in his "Théâtre de l'Art du Charpentier,"



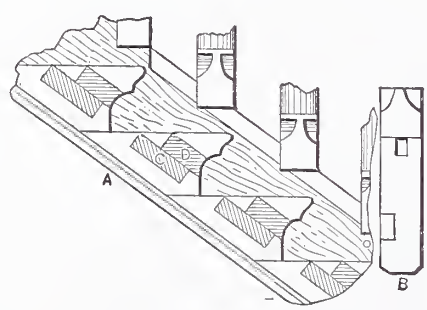
Stair Building.—Fig. 2.

waxing eloquent on the importance of well-proportioned and carefully placed staircases. "Of all the woodwork of a house," he says, quaintly, "the staircase yields to none."

In those examples of these ancient stairs, composed solely of flyers, we find the steps cut out of the solid, generally by the economical mode illustrated in the preceding article of this series, page 63. A strong shouldered tenon was formed at each, as shown at Fig. 2, this tenon running at an acute angle to the surface of the tread. Not only were the tenon and its shoulder inserted in corresponding mortises formed in the thick board which served for the string, but the entire ends of the solid steps were housed therein. The string is shown in elevation and section at Fig. 3, where the method adopted is clearly indicated. Great strength and solidity were, of course, insured by this system—perhaps not more than was necessary for stairs which had, on occasion, to bear the weight of mail-clad men. It will be evident that the manner in which the solid steps were cut from the stuff was such as to obviate, in a very considerable degree, the liability to warping or shakes in the wood. In fact, these staircases were constructed with the greatest care, as well in the selection of materials as in the accuracy and strength of workmanship. Oak was the material usually employed, although some stairs in the central department are made of walnut or chestnut wood.

Nothing could be more simple than the plan of the ancient staircases of this kind. A short flight of flyers led to a wide landing of a half space; from this a second flight sprung, lying beside the first on plan, with a narrow well intervening. The second flight terminated at a landing equally spacious with the first. If an altitude more considerable was to be gained, a third flight was used, which stood directly above the first in plan, and had for starting place the second landing.

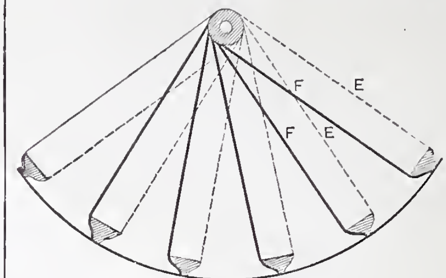
Many of the early winding stairs, both of stone and wood, were formed in the interior of small towers, which they completely occupied Others were entirely isolated, and



Stair Building.—Fig. 3.

completely independent of the building in which they stood. The latter were generally employed as a means of communication between two floors only, and were formed with great care, being frequently enriched with moldings and other ornamentation.

The plan of a quarter of a staircase of this kind is given at Fig. 4, where the plain lines, F F, show the front of the step, and the dotted lines, E E, the back—it being understood that each dotted line corresponds with the second plain line to the left of it. The steps are solid (Fig. 5), and firmly secured in their places by the following means: A series of vertical molded posts, B B (Fig. 6), are arranged in a circular form on the plan. Each of these has a strong bracket, C C, tenoned into it, the other extremity of the bracket being also provided with a tenon, which corresponds with a mortise in the opposite side of the adjacent post. The latter is cut away to allow the external end of the step to pass, and is also mortised for the reception of a small tenon on the step itself. The upper edge of the bracket, in its turn, is tongued in such a manner that it takes into the groove of the step end. This somewhat complicated, but very durable, arrangement may be better comprehended by an examination of the details at Fig. 5, where A is the step itself, with its projecting end and tenon; B is a portion of one of the posts, and C is a bracket, while D represents a section of the latter. Similar reference letters are used for the same parts in Fig. 6. The inner ends of the stairs were secured and kept in place by a central rod of stout iron, which passed through holes in the end of each (E, Fig. 6). The fronts of the steps were generally hollowed or chamfered (Fig. 5, A). The two staircases of the sacristy of the Sainte Chapelle of the Palace (13th century) are of this description, as also some belfry stairs, among others that of the tower of Saint Romain, at Rouen, which dates from the 15th century. It will be seen that the upright posts, besides acting as an outside string, form a cylindrical

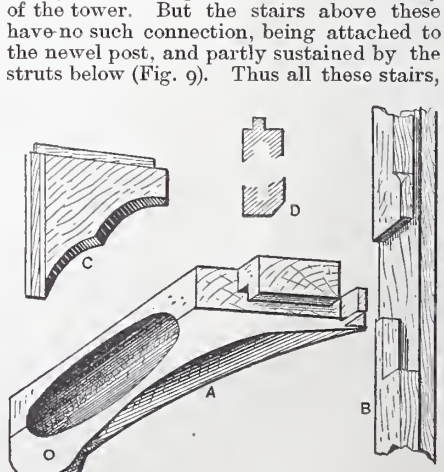


Stair Building.—Fig. 4.

or a prismatic cage around the stairs. No iron whatever is used in these staircases, except the axial bar, the ends of the steps themselves forming the newel post.

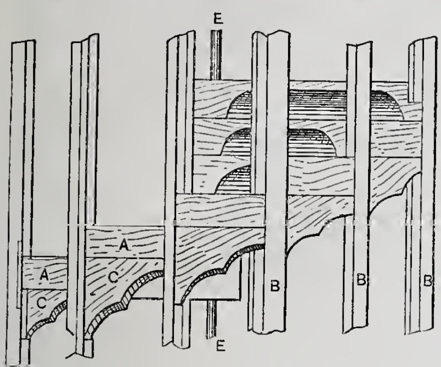
During the 15th century this method of framing spiral stairs fell into disuse, being superseded by the adoption of a central newel, into which the inner ends of the steps were framed, this plan being evidently copied from the staircases of masonry. An example of such an ancient newel post is given at Fig. 7, where A shows the mortises and the portion cut away for housing the stair ends, while B represents a winding shoulder-piece, adapted to aid in sustaining the steps. The molding, C, which is formed out of the solid, is what the French call a *main courante*, or running hand-rail, a form still occasionally in use. The post is given in section in Fig. 8, K being the winding shoulder bracket and G the hand-rail. Many of these posts were beautifully molded, grooved and otherwise enriched.

A very singular variety of staircase is mentioned in the old book of Mathurin Jousse, of which we have spoken. It recalls vividly the troublous times of yore, when a man's house had frequently to be his castle indeed. It was termed the pivot staircase, and was employed in keeps, or donjons, or where a night surprise might be feared. Fig. 9 is the plan, and Fig. 10 a section of this arrangement. The stairs were placed in a cylinder of masonry in the tower, the cylinder being provided with openings to the various floors or windows to which access was desired. The staircase itself was, however, entirely independent of the stonework surrounding it. In the plan (Fig. 9) we see at C a kind of landing formed in the masonry, and leading to the doorway or opening at D. If we suppose this doorway to be on the ground floor, we must imagine all the other doorways above it coinciding with it on plan. The first step is at E. The stairs from E to F, on plan, are the bottom ones. The lower stairs are independent of the central part, and are supported by strings and carriages fixed to the masonry of the tower. But the stairs above these have no such connection, being attached to the newel post, and partly sustained by the struts below (Fig. 9). Thus all these stairs,



Stair Building.—Fig. 5.

with their outer strings and inclosing cylindrical external wooden partitions, are solely supported by the powerful central newel post, whose lower extremity is shod with iron, and revolves as on a pivot. When it was required to close the doorways above, all that was necessary was to make the post perform a quarter revolution on its axis. The wooden partition then masked the apertures, while between the steps, F and H (Fig. 9), a vacancy would be found. Thus the stairs would lead but to the blank stonework, while the real doorways were entirely concealed. A lever placed at the upper



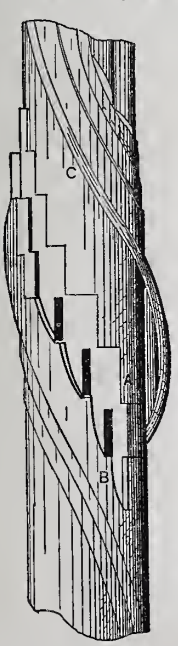
Stair Building—Fig. 6.

landing served to secure the staircase in this position, and prevent those below from turning it back.

Wood Carving, Past and Present.

BY N. R. HARRIS.

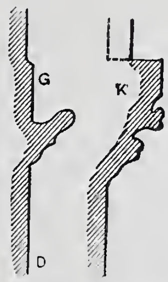
As far back as the days of King Solomon the Wise, we find the art of wood carving one of the specialties of his temple "dedicated to God." We read in the first book of Kings, seventh chapter and eighteenth verse: "And the cedar of the house was carved with knobs and open flowers." Again, in the twenty-ninth verse: "And he carved all the walls of the house round about with carved figures and cherubims, and palm trees, and open flowers, within and without;" and again in the thirty-second verse the wood-carver is still mentioned, which proves he was an important personage in those days; and this great and wise king of a by-gone epoch applied the cunning of the art-workman in the decoration of the



Stair Building.—Fig. 7.

house of God, the everlasting Jehovah. In King Solomon the wood-carver found a generous patron, for he has immortalized their profession, and their works will be spoken of as long as the world moves and man treads its soil, or while one being is left to worship at the everlasting shrine of the great architect of the universe.

When we take into account the extent of the building, the number of years it occupied in its construction, and the quantity of artwork required for its completion, there must have been a large force of wood-carvers engaged. No doubt all other buildings of that era partook in a lesser degree of the same style. Their furniture, and all things devoted to household use, would be on a par with the surroundings to make the whole complete. We must come to the conclusion that it must have been the paradise of carvers. In other days, and in other countries, both heathen and Christian, wood carving has been looked upon as the handmaid of sculpture. In fact, the ancient sculptors carved their figures in wood and draped them in plates of gold. It was at a later date that stone was used. Yet even then workers in wood carving were classed as artists. It used to be the pleasure of "the wealthy and cultivated few" to have a corps of wood-carvers to decorate their

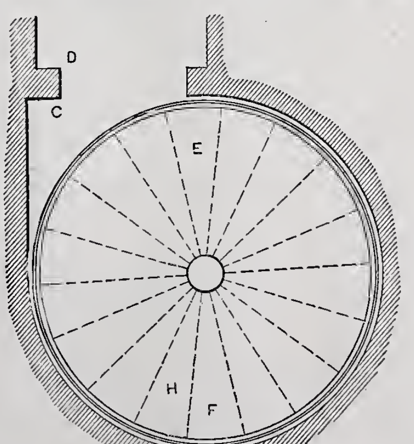


Stair Building.—Fig. 8.

halls and spacious rooms with specimens of their work, and by examples of munificence stimulate the proficient to higher aspirations, instead of permitting them to wither in obscurity and uselessness. But the generous patrons now are "few and far between."

Italy, France and England, to their honor be it said, have done much to bring before the world some of their most worthy specimens of this art. A few pieces were exhibited at the Centennial in 1876, but there seems to be a decadence throughout Europe and America, but more particularly here. Articles of real merit are not to be found in this country, the productions of the present day. The rage is for severe flatness, angular and straight lines. No bold relief or sculptured figure, except that which is erected in memory of man's unworthiness, or to perpetuate his name only, and leaving a perfect blank behind. But should wood carving revive, who is to perform the work? Our youths do not learn carving, and those artists who could have performed the task have fled to "pastures new;" others are preparing to go, and the few who are left are changing their occupation, so low has wood carving fallen. Such is the condition of an art that once could boast, in the early dawn of civilization, of having kings, emperors and princes for its patrons.

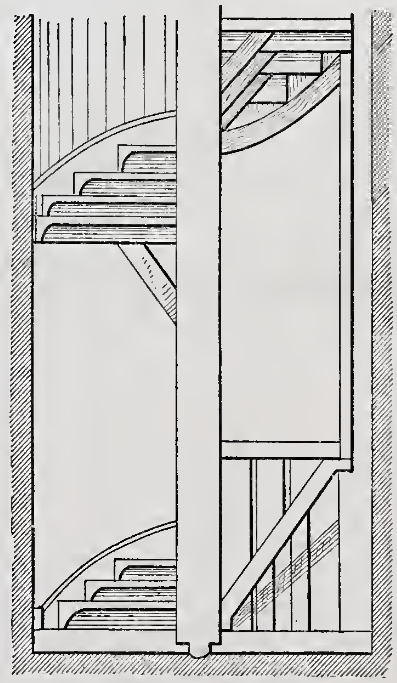
The public taste is tainted with cheap and gaudy tinseled work, made as it were to relieve the mind from studying the productions of thoughtful men and cultivated laborers. How sad is all this. There is no lasting cultivation of the mind. Yet on all



Stair Building.—Fig. 9.

sides we hear so much about "æsthetic taste," "cultivated taste," "household art lectures," art criticisms on drawing, painting and sculpture. All are rushing into the bewildering mazes of "high art." Everything to-day is artistic. We have art bricks, doors and windows; art furniture, "cheap and nasty;" art fire dogs, coal scuttles, fenders and tongues; art china, art candlesticks, &c. Why not have art boots and shoes, or even art breeches? One has as much claim as the other, and, to say the least, would be a joy while they lasted.

If we are to take a rank among the nations of the earth, we must cultivate the everlasting harvest of the mind. We must not sit down contented with the work and productions of others, but we should be able to appreciate or condemn with intelligence. If the productions of the ancient or modern masters are to be imitated, where in this void or space are the art students to find an opportunity for culture? Must the works of Gibbons and Bartelemy and others of equal fame have no students? Must they worship only at the shrine of Mammon? In consequence of the desire to obtain wealth and be able to live a life of indolence and ease, we are to-day making a retrograde movement in the cultivation of art. Let any one view the slavish profusion of cheap ornament on our public and private buildings, furniture, &c. No attention is paid to nature. Not the first thought is given to the flowers and foliage that deck our forests, our fields and gardens. Here nature has strewn with a bountiful hand these beautiful forms, and



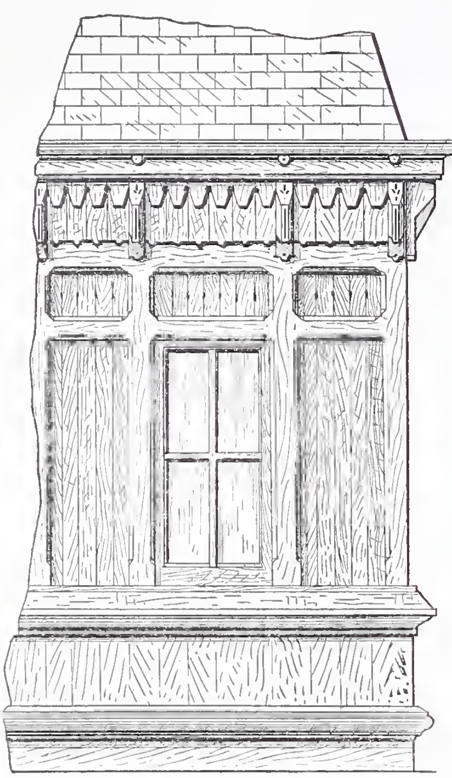
Stair Building.—Fig. 10.

invites us to copy, yet we prefer to pander to the ideas of others who are themselves but students. Art professors surround us on all sides, and give us something of their own, which means nothing more or less than a few borrowed lines used many hundred years ago in other climes, and workmen and students not being acquainted with the natural model, their chisel or pencil bears the evidence of weakness.

Designers, too, "celebrated" for knowing literally nothing, take the unwarrantable privilege of intermixing every known style in a jumbling manner, so that there may be found all the styles of the different periods in one single ornament, and the public are stupefied when they are told that Professor So-and-so designed the work, and the artist who worked out the pattern is a man of great taste, whose work is considered "toney." The undoubted cause of all this error may be traced to the want of proper facilities for our young men and women, in the shape of art schools under the auspices of the government, and of a corps of masters trained for this most popular branch of education. To the absence of these facilities, where the student may be able to take his lessons from nature, grasp the natural forms, and make them subservient to his will and genius, may be traced the decadence of wood carving at the present day.

External Framing.

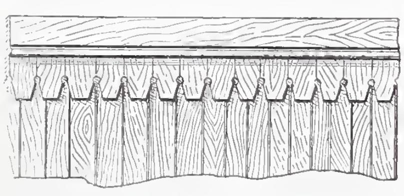
During the past few years there has been a great deal of interest manifested in old English architecturo, and in the numerous attempts which have been made to revive the best forms of early English domestic construction. It is only within a very recent period, however, that much interest has bcen manifested on the subject in this country. The few buildings which exhibit these features of architecture in the United



External Framing.—Fig. 1.—Exterior View of Building.—Scale, ¼ Inch to the Foot.

States have been erected within the past eight or ten years. Some of the examples are unusually good, while others do not do credit to the principles employed. There were several buildings erected in connection with the Centennial Exhibition, in which special forms of timber work and external framing were exhibited, and so far as we were able to judge by a comparatively hasty inspection of them, they were fair examples of this kind of work. The imitation or revival of old forms in this country has almost uniformly been good. The genius of American architects and builders—their innate perception of what is right and proper in woodwork—has enabled them to seize upon the foundation principles and to design in the spirit of the old masters.

Our attention has been directed anew to work of this general character within a



External Framing.—Fig. 2.—Detail of Skirting, Constructed of Different Pieces, as used in Cap of Partitions.

short time, both with respect to its artistic aspects and as a method of construction. From a purely artistic standpoint, there is no fault to be found with externally framed timber work. Shapes and forms are produced which recommend themselves to the eye, and which are quite useful in the decoration of the building in which they are employed. But as a method of construction, especially in this climate, it is not altogether desirable. Of this, however, we will speak further on.

The engravings which accompany this article, and which serve to illustrate some of the best forms it has been our fortune to meet, are from sketches of work found in the buildings on the Brooklyn side of Fulton Ferry, across the East River. These buildings probably constitute the best example of this kind of work to be found in the immediate vicinity of New York, and they serve to illustrate both sides of the question. The forms employed appeal strongly to the eye, while the unseemly cracks and rotten places in wood which are to be seen, serve to condemn the style in point of construction.

Fig. 1, which has been arranged to illustrate similar features of several buildings, rather than to exhibit those of any one of them exclusively, affords the reader a clear conception of the character and style of the work. The forms and principles of construction shown are used with pleasing variety of detail throughout all the buildings, and are embodied in the tower, which forms a leading feature of the front elevation. What may be termed the base, as may be seen in the engraving, consists of two courses of moldings, the upper one of which serves as a sill to the windows, or as a water table, and is separated from the lower member by a panel constructed of narrow matched stuff. Above the sill course the framing divides the lower part of the side of the building into narrow vertical panels, with smaller horizontal panels above. The boarding is in all cases vertical, and is composed of narrow matched stuff. There is no attempt at ornamentation below the tops of the windows, further than is afforded by chamfering the corners of the timbers and by the moldings in the base already mentioned. Above the windows, in the horizontal panels, of which in some cases there is one row and in others there are two rows, the latter occurring when the stories aro the highest, the boards are used with beveled edges, with a small diamond cut about midway of their length, similar to the shape shown in the frieze of the cornice in Fig. 4. This pattern is made to undergo pleasing variations in different portions of the building, and in most cases is very cheap, to make requiring only three or four cuts in the channels of the boarding with a broad chisel. A principle of construction which has been employed throughout the buildings, is to frame a sufficient number of panels to obviate the necessity of diagonal braces. The stiffness of the joints, together with the bracing afforded by the sheathing, gives the framework all the stability which it re-

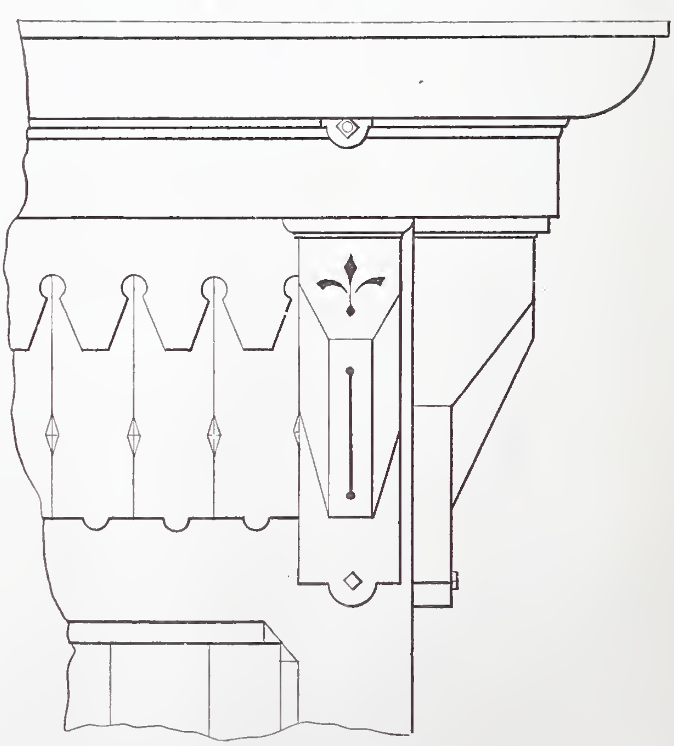
edges, the ends being cut so as to leave a half circle projecting downward. The diamond-shaped ornament cut near the middle, we have already described. In place of the usual bed molding, a toothed skirting is employed, which in the spacing of the members is made to correspond with the joints between the boards comprising the frieze, thus producing a neat and pleasing effect. The brackets throughout the cornices are cut from solid stuff, or are boxed up to imitate solid material, and are ornamented in a very simple manner. A few lines of pleasing form are engraved upon the face, and in the larger sizes a panel is cut in the sides. Above the bracket, against the corona, a half rosette is placed, as may be seen in the engraving.

The toothed skirting above referred to as taking the place of the bed molding in the cornice, like other features in different parts of the buildings, undergoes modifications to adapt it to various uses. We show other forms of it in Figs. 2 and 3. In one it is

External Framing.—Fig. 3.—Detail of Skirting, Constructed in one Piece.

cut from a single strip of board, across the grain, and in the other it is composed of separate pieces, being put together with chamfered edges. In this form it is used to trim the tops of the partitions in the waiting rooms. The same general form is also used at the bottom of the gates, as shown in Figs. 5 and 6, for which position it is as well adapted, perhaps, as any design could be.

The ferry-house gates, which also illustrate the features of design which we have been describing, but in which there is little or nothing to be objected to in point of construction, are as good examples of framing for the particular purpose as could well be devised. They have, under severe and constant use, for a long time held their shape perfectly, and so far as we can see upon inspection, have not sagged in the least, which is very high praise for gates. As will be seen from the cuts, each leaf consists of two panels, the lower one of which is filled with diagonal matched stuff, with chamfered



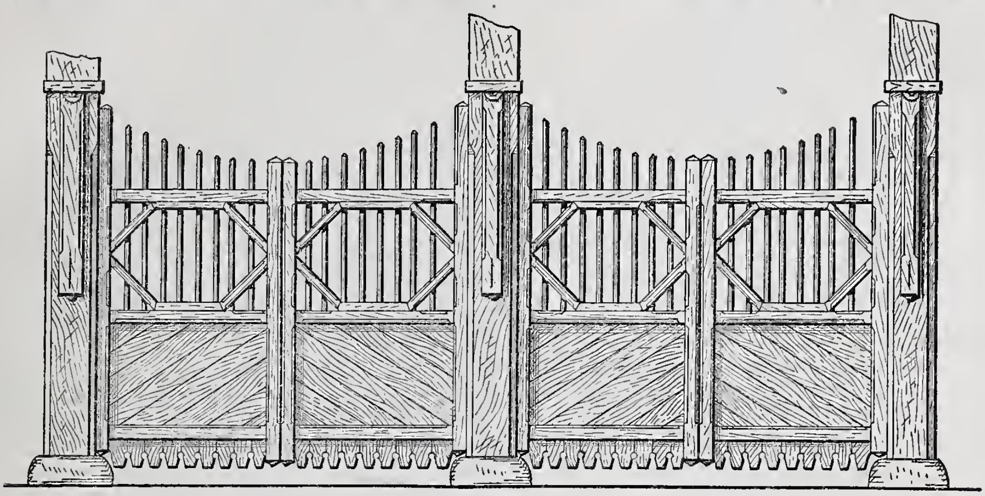
External Framing.—Fig. 4.—Detail of Cornice Shown in Fig. 1.—Scale, 1½ Inches to Foot.

quires. All the work is of the simplest kind. Most of it is straight-away machine work—the only exception, perhaps, being the chamfer upon the timbers.

In Fig. 4 is shown a detail which serves to illustrate the cornices employed throughout the buildings. The frieze is composed of vertical matched stuff, with beveled

edges arranged so as to brace the framing. The upper panel is filled with square pickets with chamfered corners. These are put in before the diagonal braces—the latter being formed in halves so as to clasp the pickets, and are secured together by bolts, not shown in the engraving. The bracing employed is complete within itself. Each brace takes a bearing against its neighbor at the side, which enables it to be driven into place after the gate is finished. The detail (Fig. 6) shows the arrangement of each leaf of the gates more completely than the elevation.

While there is very much to commend in the construction employed in these buildings from the artistic standpoint, as we have already remarked, they also afford an illustration of the objectionable features of external framing. Outside the dry regions of Africa or the great dry plains of the matic conditions as prevail in this country. The amount of work necessarily expended upon buildings of this character is not justified by the time they last. As a method of decorating large interior surfaces, the exposure of timbers seems to be not only a natural, but a very desirable means, especially in such places as waiting rooms of depots, halls, and similar apartments, when the ordinary plan of lath and plaster gives bare white surfaces, incapable of pleasant decoration. In such



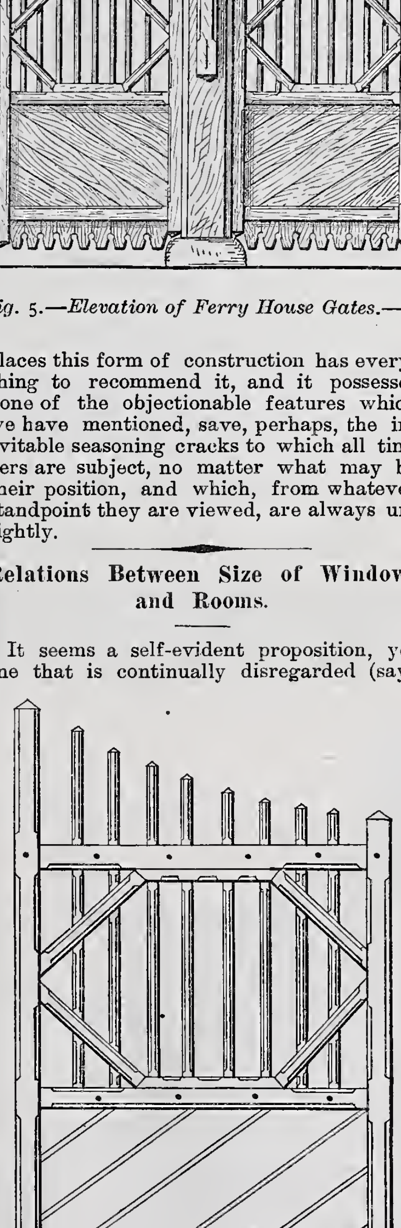
External Framing.—Fig. 5.—Elevation of Ferry House Gates.—Scale, ¼ Inch to the Foot.

West, there is scarcely any country where woodwork suffers more severely than in this country. So far as we know, there is no civilized country where there is anything like the dryness of atmosphere experienced here. This tells in a peculiar way upon all structures of wood. To be at all durable in our climate, wood must undergo a seasoning process but little known elsewhere. This is well illustrated by the fact that no cabinet work or joiner's work which is brought here from other countries will last for any considerable length of time, no matter how durable it may have been in the country in which it was made. Its failing is always shrinkage. Timber work, no matter how well protected by paint, when exposed in this climate, even for a very few years, begins to shrink, to check, and to open more or less at the joints. Woodwork exposed to constant moisture or to constant dryness, is one of the most enduring structures that man can devise, but with moisture, heat, cold and ice, and with snow and rain driven by various winds, conditions are formed that are most destructive to all things made of wood. Our summers are tropical in their character, while our winters are almost arctic. These conditions of climate prevail from Canada to Tennessee and throughout the width of the continent. Woodwork which in summer becomes dry, and which thereby develops shrinkage cracks, is filled in the fall with moisture by the frequent rains. In the winter the moisture freezes, frequently extending the cracks still further, and in the spring the work is again soaked by the rains, only to be dried as summer approaches. And this process of alternating wet and dry, heat and cold, goes on continually. The result can be but one thing—all exposed timber undergoes a rapid process of destruction, and herein lies the principal objection to outside framing in this country. The exposed beams are quickly destroyed by the elements. We have examined buildings within 10 years after their erection in which we failed to find a single joint which had not already suffered from this cause. In some of the rails which, to all appearances, by their sloping surface and good drip should have been well protected, we found lines of dry rot, and sometimes more common decay, from 2 to 3 feet in length, and in some places the openings were large enough to insert the hand.

The conclusion forced upon us by such facts, a few only of which we have narrated, is that for large permanent structures for all other than temporary purposes, outside framing is not appropriate under such climatic places this form of construction has everything to recommend it, and it possesses none of the objectionable features which we have mentioned, save, perhaps, the inevitable seasoning cracks to which all timbers are subject, no matter what may be their position, and which, from whatever standpoint they are viewed, are always unsightly.

Relations Between Size of Windows and Rooms.

It seems a self-evident proposition, yet one that is continually disregarded (says



External Framing.—Fig. 6.—Detail of Gate. —Scale, 1 Inch to the Foot.

the author, Aston Webb), that the size of the windows must be regulated by the size of the rooms that they are intended to light; yet nothing is more common than this example, where three windows all of the same size, "to preserve the uniformity of the elevation," as the speculative builder says, light three rooms of totally different sizes, the result being that one bedroom is fairly lighted, the other is very dark, while the dressing-room is so light that you hardly dare dress in it without the blind being drawn down, as you seem to be quite out in the open air. It is extremely difficult to lay down any law giving exact rules as to the proportion of lighting space necessary for a given room. Much depends, for instance, on the position of the light. In the well-known example of the Pantheon at Rome, the building is amply lighted by a small circular opening in the roof; the cubic contents of this building are given at 1,934,460 cubic feet, and the area of the circular opening only 572 feet, or about one-third the amount required had the lighting been from the side.

The rule said to have been adopted by Sir William Chambers is to add the depth and hight of the room together, and an eighth of the result will give the width of window. Gwilt gives as a general rule 1 foot superficial of light in a vertical wall to every 100 cubic feet in the room.

Robert Morris says that the superficial area of the window should equal the square root of the cubical contents of the room. This, however, though no doubt approximately true, must evidently be open to large variations, according to the width of the street, and especially according to the aspect and the climate; and the exact size of certain windows to suit certain shaped rooms can only be learned by observation and experience. The matter is one of the greatest importance, and cannot be too carefully considered. It should also be borne in mind that certain rooms will require more lighting than others—a drawing-room more than a dining-room, a dressing-room more than a bedroom, and so on. And if this is carefully attended to (and, of course, taste and discrimination used), the elevation will be at least an honest and truthful one, and you will not find the principal windows on the ground floor lighting, as is often the case, a cloak room.

To Remedy the Brittleness of Glue.—The very best pure glue becomes in drying very hard, and in some grades brittle. To remedy this, a small proportion of "bonnet" or "millinery" glue should be added. The latter is a glue made from calves' sinews, instead of hides, very white and flexible, that will bend without breaking, and this should be added in the proportion of 1 ounce of "bonnet" glue to 7 ounces of pure transparent glue.

First Quality Glue.—When glue has a dark, muddy appearance, it is owing to impurities and foreign substances other than pure gelatine, which latter is transparent even in thick flakes. Some manufacturers flake their glue very thin to give this transparent appearance. In this case, whether it be French or American, any glue that will not absorb ten or twelve times its own weight of water without "thinning out," is not first quality.

ARCHITECTURE.

A Study in Cheap Frame Houses.

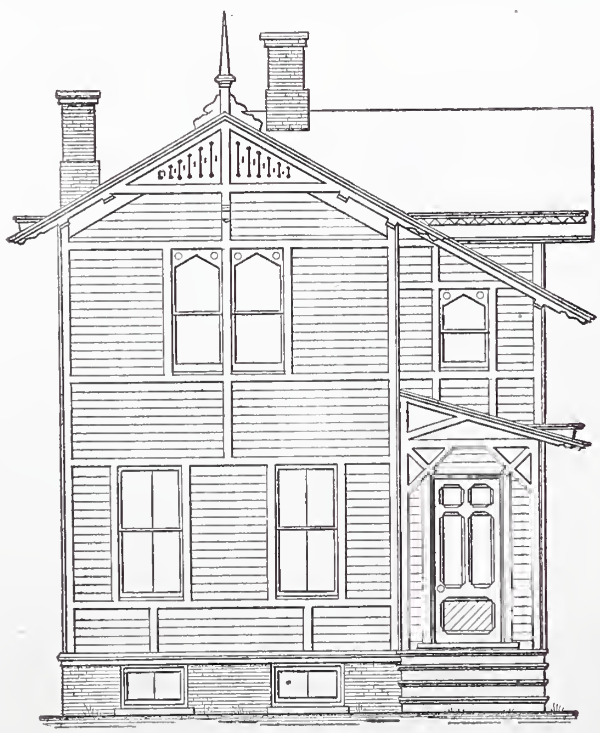
[Designs furnished by B. O'Rourke, Architect, Newark, N. J.]

In the neighborhood of large cities, especially where it is customary to build houses in rows, like the well-known brown-stone fronts of New York and the pressed-brick fronts of Philadelphia, it is quite common to build suburban cottages in the same general manner—that is, build a number of them upon adjacent lots, all to one design and plan. Real estate operations in the neighborhood of cities are seldom confined to a single house, and frequently embrace the buildings necessary to cover an entire block. Economical considerations, the advantages arising from duplicate parts throughout a lot of houses to be built at one time, together with the fact that upon narrow city lots the entire width of each of which is to be covered by its building, there is very little opportunity for variation either in design or plan, have given rise to the fashion of building rows of dwellings all alike. While there seems to be ample reason for this practice in cities, there is not sufficient excuse for it in their suburbs. In fact, a cottage situated in a row, being one of a dozen or more of the same design, does not prove to be as good an investment as one which is entirely unlike others, or, at least, has some distinguishing features. One of a row of houses all of the same pattern does not find as ready sale, nor will it rent for as much money, as a house of corresponding cost which possesses an individuality of its own. Aside from these reasons of a business character, others equally strong and important from an æsthetic standpoint may be advanced in the same direction. The picturesqueness of any locality, however striking, is greatly marred, if not altogether destroyed, by building in it a row of houses all of one design, while a pleasing variety in the buildings may be made to enhance the charms of the location.

The designs shown in the engravings accompanying this article, were gotten up with these several ideas in view. Mr. O'Rourke has very happily illustrated the variations which it is possible to make in the external appearance of houses, all of which are of one plan of arrangement. The designs which we give were selected from a series that were prepared for a lot of 16 houses to be erected in Newark, N. J. While these designs serve to illustrate what may be done with a single plan, each of them presents desirable features which recommends it for use anywhere, whether in a row or altogether isolated.

Study in Cheap Frame Houses.—Fig. 1.—Front Elevation, "English."—Scale, 1/8 Inch to the Foot.

The buildings throughout are intended to be finished in the same general style, with possibly as much variation in detail as is shown between the several designs of trimmings given in Figs. 12, 13 and 14. White pine, finished in varnish, is the material designed to be used. A marble mantel is to be placed in the parlor. Plumbing work to the extent of introducing water from the street, placing a sink in the kitchen and connecting with a cesspool in the rear, is covered by the estimates. The cellar extends under the entire house. Brick is used for the cellar walls and for the piers to the porch. The roofs of all of the designs are intended to be covered with shingles. In no way do the general features of construction differ from those in common use, and therefore a detailed description is unnecessary. The design shown in Figs. 3, 4 and 5 has the general effect of outside framing. This is obtained by spiking pieces 1 1/4 inch thick over the sheathing, and the weather boarding being cut to fit between.



Study in Cheap Frame Houses.—Fig. 3.—Front Elevation, "Swiss."—Scale, 1/8 Inch to the Foot.

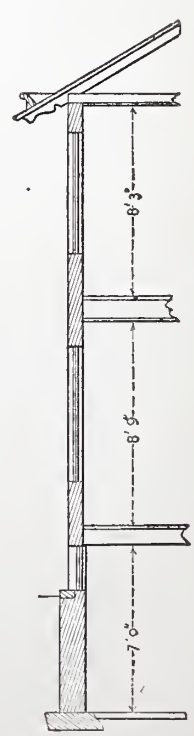


Fig. 4.—Section.

Referring to the plan, Figs. 17 and 18, it will be noticed that it avoids the necessity of a hand-rail on the stairs, which in itself is a saving in cost, while a box staircase is warmer than an open one. The entry is arranged in a manner to give the greatest space to the more valuable rooms, while of itself it is more desirable than a hall. The plan was designed especially for use upon

The estimated cost of these designs in Newark, at present prices of material and labor, is as follows:

House shown in Figs. 1 and 2	$1,100
" " 3, 4 and 5	1,200
" " 9, 10 and 11	1,400
" " 6, 7 and 8	1,500

count of his adventures in that unexplored region.

Among the many curious things which he carried from that country was a piece of a mahogany tree. This he presented to his sovereign. He related to her and the admiring court of that great woman

Study in Cheap Frame Houses.—Fig 2.—Side Elevation, "English."—Scale, ⅛ Inch to the Foot.

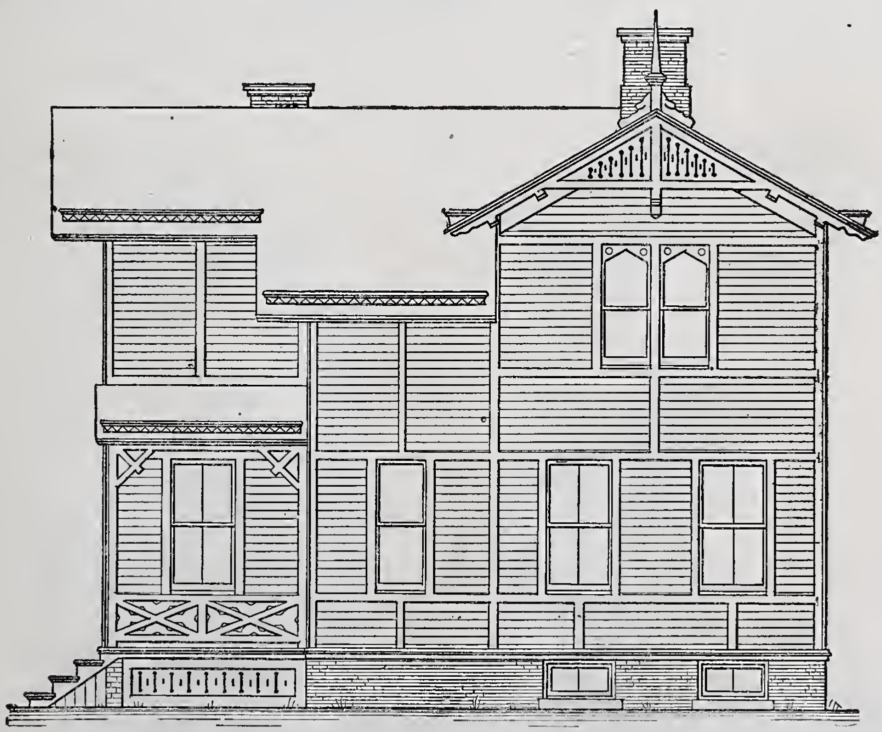
a city lot of 25 feet in width, but, as will be readily seen, additional room around it will render it still more desirable for use in any of the designs.

Figs. 1 and 2, and 6 and 7, show two variations of one design, which, for lack of a more specific designating term, we have

The Mahogany Tree and Furniture.

As far back as we have any knowledge of the mahogany tree, its uses have been very important, and its introduction among civilized man, for the comfort and decoration of his home, occurred thus: In the time of

the immense forests that stretch along the coast of this (then) distant clime, and informed them of the size and growth of this beautiful wood. Sir Walter was a man of science, a cultivated gentleman, and the favorite of his Queen. It may readily be supposed that the wonders



Study in Cheap Frame Houses.—Fig. 5.—Side Elevation, "Swiss."—Scale, ⅛ Inch to the Foot.

called English, the only essential difference between them being the tower. The design with the tower, Figs. 6 and 7, is probably the most pretentious of all the designs, yet in cost it will exceed the others only by about the value of the tower.

Queen Elizabeth of England, Sir Walter Raleigh commanded a fleet of British ships which sailed on an expedition to Brazil for purposes of commerce and exploration. After being absent some three years, he returned to his native land to give an ac-

told by him to his countrymen met with a ready response and confidence that is only bestowed by a people on a favorite child of fortune.

This product of that country was the cause of a great change in the character and style of furniture. At the time we speak of, the oak was the principal wood used in articles made by cabinet-makers, in church architecture and buildings generally. It being a wood of great endurance, it was well suited for such uses. This tree was largely cultivated, not only for the above purpose, but to supply timbers for building ships of war—"the wooden walls of Old England."

The interest felt in the mahogany tree presented by Sir Walter Raleigh to "Good Queen Bess," was such that it was made into articles for presents among the court favorites and lackeys of that day. A small work-box was made for Elizabeth, which she used, and it is stated by the chroniclers of the times that she considered it a rare article of household furniture, as well as being a choice product of the earth. This box may now be found in the Tower of London in a perfect state of preservation, yet it is nearly 300 years ago since the gallant Raleigh brought this durable and beautiful wood to England. Its adaptation to furniture was manifest, and it entered at once into the list of articles of commerce, was largely imported, and supplied the place, to a great extent, of the sturdy and famous oak.

Not only in Brazil does this tree fructify and flourish, but it is found in San Domingo, Cuba and the Bahamas. "San Domingo wood" grows to a very large size, is close in grain, cross mottled and wavy like the sundown of a summer's eve. It may be that the refraction of the clouds are photographed on its growth. It is heavy and durable, and better suited for cabinet work than any other known wood, from the fact that a variable climate affects it less than any other. "Cuba wood" is not quite so large, but resembles the former very closely, except in one feature. "Blood stains" frequently occur, and are considered objectionable; yet where these stains are not found it takes a very good judge to tell the difference. Yet it can be told by those who have handled and worked the various qualities. "Bahama wood" is equal to any of its competitors, but is rarely brought to market, there being few roads and fewer modes of conveying it to the coast for shipment. There is another called "Bay wood," shipped from the Bay of Honduras, from which it takes its name, but it is neither so valuable nor so durable as any of the above-mentioned. It is used with good effect for drawer sides, backs, &c., and answers for other work, but will never rank as first-class. It is but a grade better than what is known as "Havana cedar," both belonging to the mahogany family—to which there is no wood preferred by the cabinet-maker to show the quality of his workmanship.

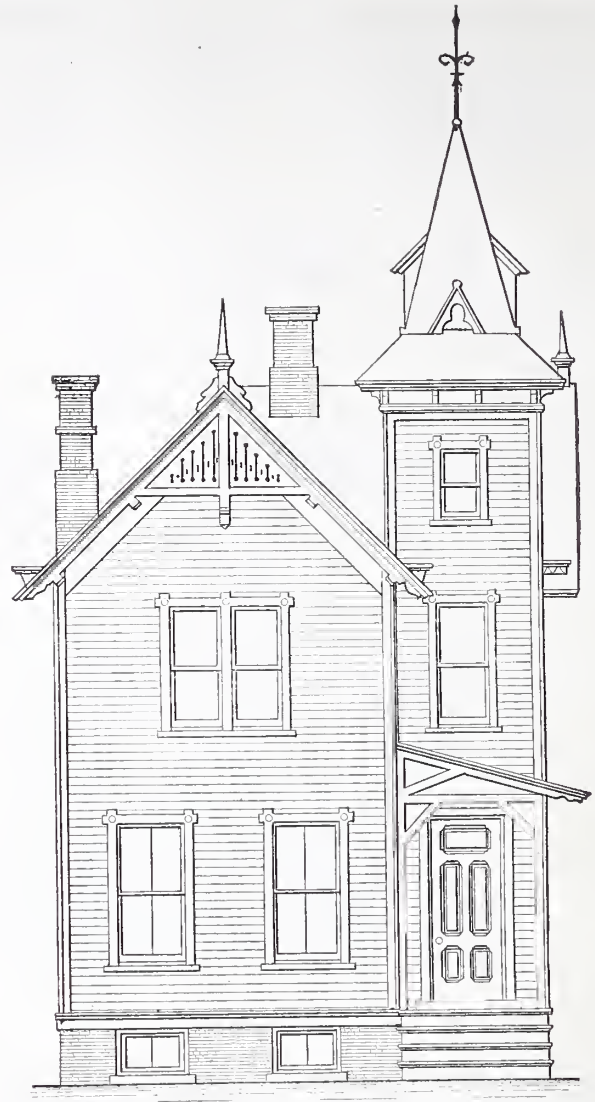
There are many specimens of the furniture of our ancestors to be found to-day. Who is there that has not read of or seen the old well-kept "chest of drawers of solid mahogany," the antique writing-desk with its "dark and somber hue," where the family record is kept—"the archives of the house?" the solid and heavy dining table, where "mine host and his guests spread their legs under the mahogany?" All articles made of this wood appear to be heirlooms, or household gods, and if we are returning to the "furniture of our daddies," may we not put in a plea for this precious wood, to inaugurate a new epoch in the cabinet-maker's art, and allow a chance for the slaughtered and butchered walnut to recuperate from the destructive hand of man? May we not say with the poet:

"Woodman, spare that tree!
Touch not a single bough,
In youth it sheltered me,
And I'll protect it now."

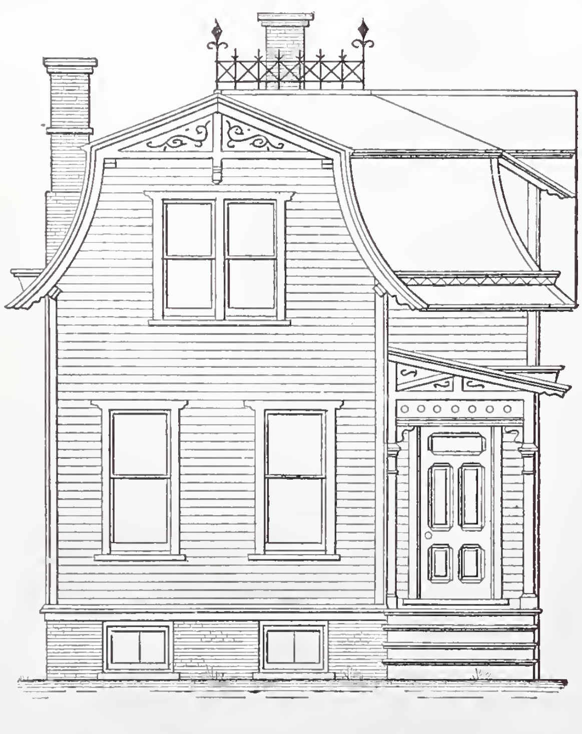
While we sing our peans in praises of mahogany, we shall not decry the usefulness of walnut in domestic household economy; but we incline to the solid taste that gives to mankind a source of happiness to the mind that is of more importance than all the gilded and glittering palaces of the Alhambra, or the gorgeous but mythical apartments of the Arabian Nights' tales.

"Sleep, balmy sleep! tired Nature's sweet restorer,"

gives a revivifying power to the human mind, and it is in the bed-chamber we seek a quiet solace from the cares of the day. It is in this apartment that mahogany finds its proper place. The rich and somber dignity of the wood leads us to the contemplation of the vast forests that wave like the golden harvest when breathed on by the winds of heaven, and shake their green, brown and golden foliage beneath the rays of a torrid clime, and bow in their own language to the God of nature, saying, "Thou hast made me



Study in Cheap Frame Houses.—Fig. 6.—Front Elevation, "English," with Tower.—Scale, ⅛ Inch to the Foot.



Study in Cheap Frame Houses.—Fig. 9.—Front Elevation, "French."—Scale, ⅛ Inch to the Foot.

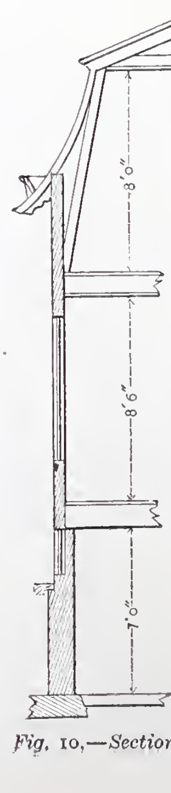


Fig. 10.—Section.

Study in Cheap Frame Houses.—Fig. 7.—Side Elevation, "English," with Tower.—Scale, ⅛ Inch to the Foot.

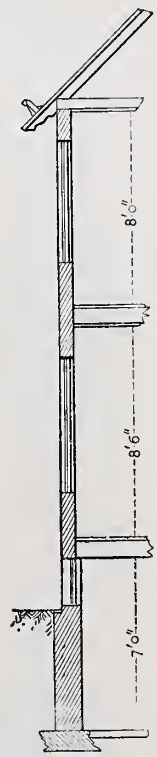


Fig. 8.—Section.

Study in Cheap Frame Houses.—Fig. 11.—Side Elevation, "French."—Scale, ⅛ Inch to the Foot.

for the uses of man, but he seeks me not." Then may we not say, its beauty challenges our admiration, its solidity gives a tone of ease and dignity in its appearance, and it only requires the hand of man to make it grace the abode of the "wealthy and cultivated few" or the more humble citizen of less pretentions. What say you, shall we have mahogany furniture in our home?

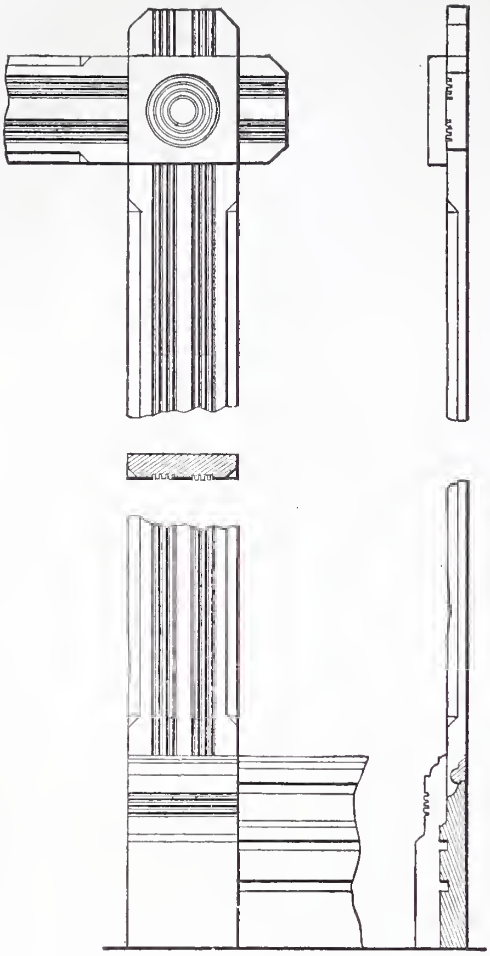


Fig. 12.

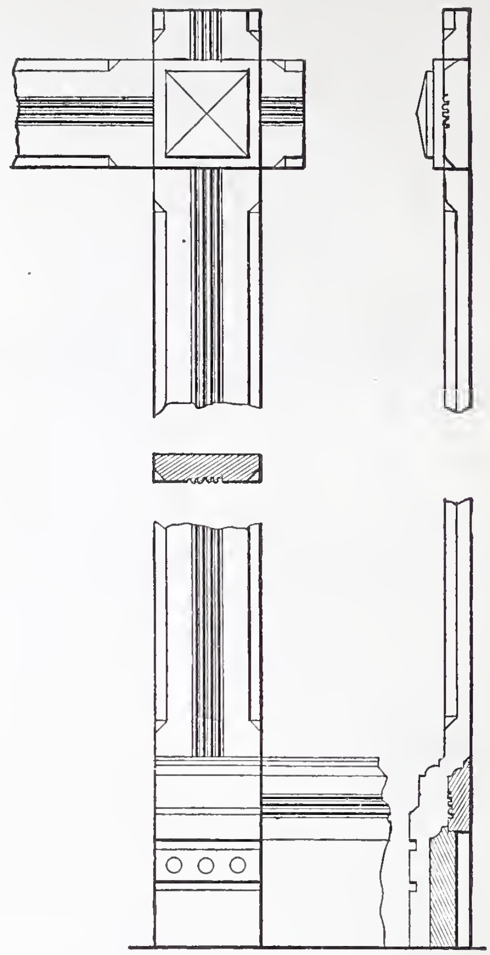
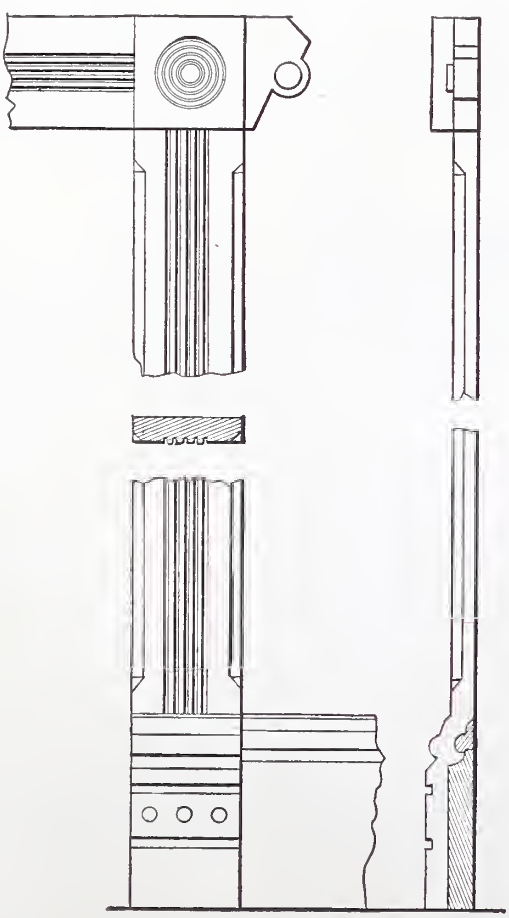
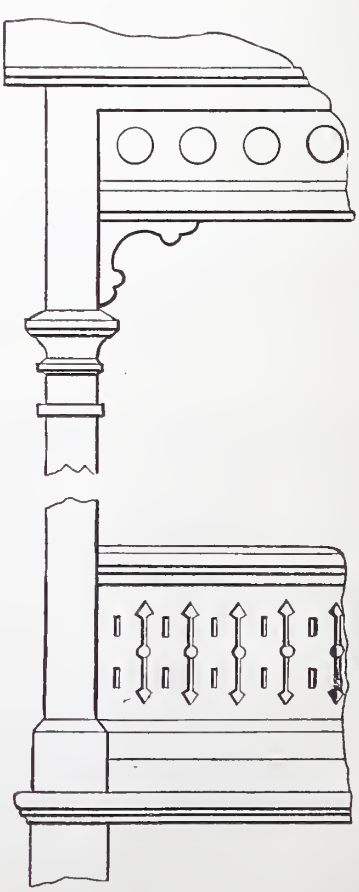


Fig. 13.

Study in Cheap Frame Houses.—Designs for Inside Finish.—Scale, 1½ Inch to the foot



Study in Cheap Frame Houses.—Fig. 14.—Design for Inside Finish.—Scale, 1½ Inch to the foot.



Study in Cheap Frame Houses.—Fig. 15.—Detail of Porches.—Scale, ½ Inch to the Foot.

CORRESPONDENCE.

A Practical Example of Estimating.

From X. Y. Z., *Springfield, Ill.*—I have read with interest all that has appeared in *Carpentry and Building* upon the subject of estimating, and I am disposed to contribute toward the general fund of information upon this subject, which is one that vitally concerns us all.

The question of estimating is largely a question of judgment, and it will be found that different persons have different ways. I know something of the difficulties that the young beginner has. If I can be of any assistance to learners, I shall be pleased to render all that is in my power. I think it well to advise all young beginners to settle upon some definite system of estimating at the commencement, and rigidly adhere to it in all cases. Constant practice upon a plan soon renders it almost a matter of habit, and this insures accuracy. When one is required to do much estimating, it is well to have in a book a list of the items that enter into a building, so that no omissions shall be made. By means of such a list one is reminded of just what items to figure on, and by going through the list in connection with a set of drawings, there will be nothing overlooked. Mistakes in estimates oftener occur from omissions than from any other cause—hence the suggestion above in the way of overcoming this difficulty.

I advise all mechanics to keep an accurate account of the time consumed upon any job upon which they may be engaged. It is not sufficient to keep the time in lump. It should be recorded in detail. For instance, so many hours upon the finish of the windows and doors of a given room, recording also the number of doors and windows, and so on for other items. In this way a man soon learns to know just what a certain piece of work is worth, and his estimates accordingly are reliable.

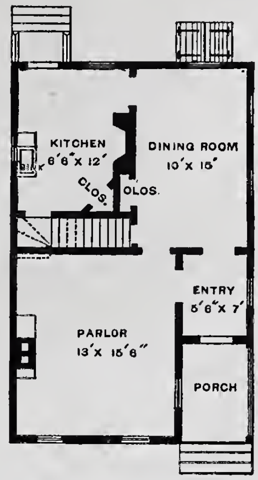


Fig. 17.—*First Floor.*

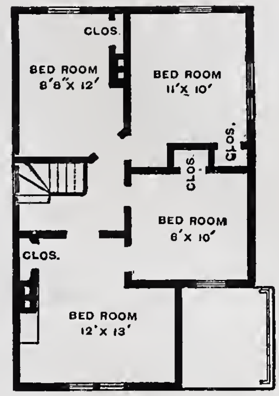


Fig. 18.—*Second Floor.*

Study in Cheap Frame Houses.—Floor Plans for all the Designs.—Scale, 1-16 *Inch to Foot.*

It is a good plan to make estimates in detail of all work to be performed, and then as the work progresses, record opposite each item the actual cost. Such plans as these, if rigidly adhered to, will in a short time make a mechanic's estimates very accurate.

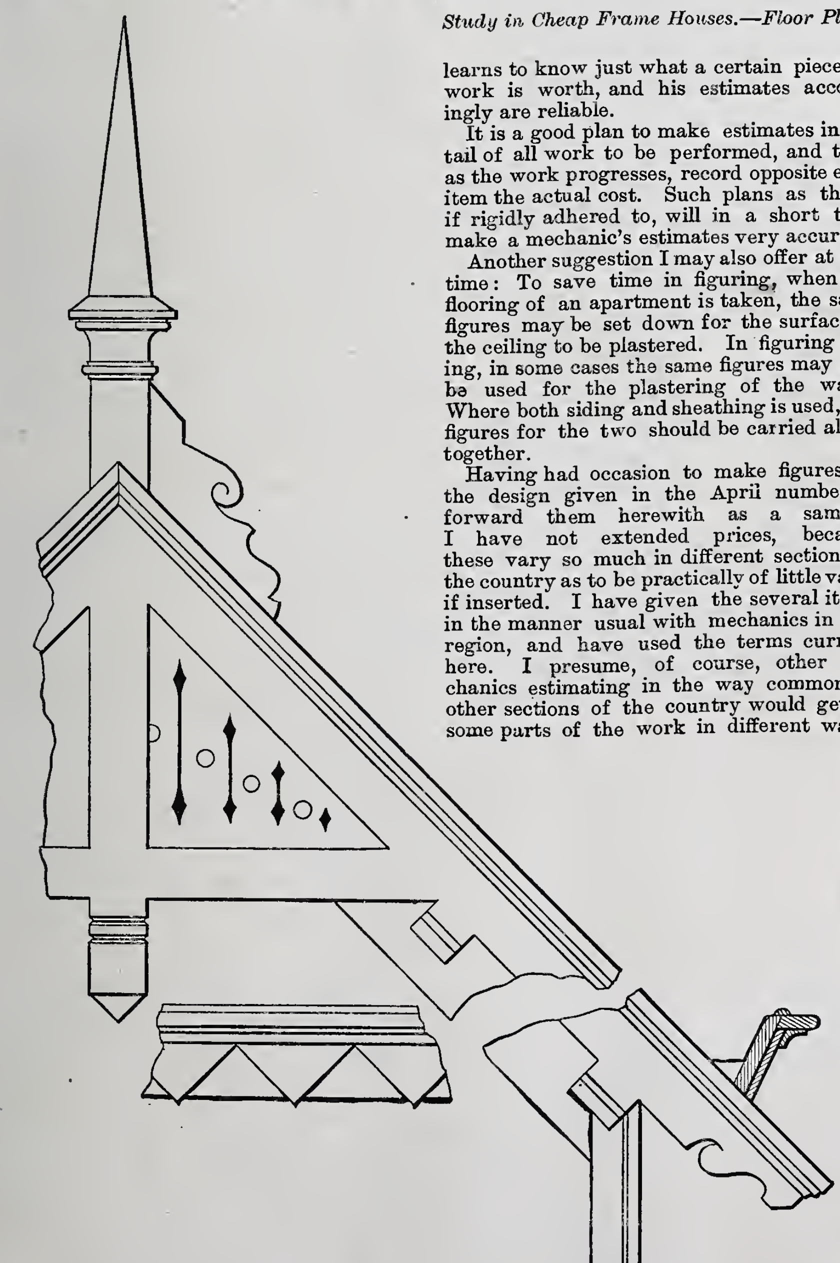
Another suggestion I may also offer at this time: To save time in figuring, when the flooring of an apartment is taken, the same figures may be set down for the surface of the ceiling to be plastered. In figuring siding, in some cases the same figures may also be used for the plastering of the walls. Where both siding and sheathing is used, the figures for the two should be carried along together.

Having had occasion to make figures on the design given in the April number, I forward them herewith as a sample. I have not extended prices, because these vary so much in different sections of the country as to be practically of little value if inserted. I have given the several items in the manner usual with mechanics in this region, and have used the terms current here. I presume, of course, other mechanics estimating in the way common to other sections of the country would get at some parts of the work in different ways. Some figure labor in framing by the thousand feet, but from experience I think better results are to be obtained by figuring it by the square. As a matter of comparison, I shall be pleased if others of your readers will give their estimate on the same building:

82 yards excavating, being for cellar under entire building, except kitchen, at........
Digging trenches for kitchen foundation (38 feet long, 2½ feet deep), at..............
10,500 brick in foundations, at..............
2,600 brick in chimneys, at............ .. ....
7 pieces for sills..............6x6, 16 ft.= 336 ft.
25 floor joists.... ....2x10, 16 ft.= 666 ft.
25 " .... .2x8, 16 ft.= 533 ft.
21 ceiling joists..............2x6, 16 ft.= 336 ft.
30 scantling..................4x4, 20 ft.= 800 ft.
34 " ....2x4, 20 ft.= 153 ft.
8 " ....4x4, 12 ft.= 138 ft.
22 " ....2x4, 12 ft.= 176 ft.
75 " for partitions....2x4, 12 ft.= 600 ft.
38 rafters, main building...2x6, 12 ft.= 456 ft.
2 joists for hip rafters......2x6, 14 ft.= 28 ft.
9 scantling for kitchen rafters............. ....2x4, 12 ft.= 72 ft.
9 scantling for porch rafters............. ....2x4, 12 ft.= 72 ft.
3 joists for floor of porch...2x6, 20 ft.= 60 ft.
2 scantling, roof of bay window..................2x4, 12 ft.= 16 ft.
Sheathing for roof and sides......... 2,850 ft.
Total, 7592 feet, at......................
28 pounds 4d. nails, at.......................
24 " 6d. " ....
150 " 8d. " ....
100 " 10d. " ....
50 " finishing nails, at........... ....
1625 feet flooring boards, at ....
7½ M. shingles at.... ....
4½ squares tin roofing on porch & kitchen, at
46 feet 4 inch down spouting, at... ....
12 " 2½ " " " ....
70 " 14 " gutter tin, with flashings for bay window, at.................................
122 feet cornice on main building, at ....
42 " " on porch, at..................
40 " " on kitchen, at.................
3 pieces, 3x3. 16 feet for gable, 36 feet, at....
2 turned balls for gable, at...................
22 feet cornice for bay window, at..........
2000 feet of weather boarding, at............
Allowance for corner boards, water table, porch columns, stairs, &c., 500 feet, at.....
28 feet balustrade for porch, at...............
8 windows, second story, at ....
11 " in first story, including bay, at....
3 cellar windows, at............ ....
3 outside doors, at...... ....
6 inside doors, first story, at..................
3 " second story, at................
5 feet balustrade at head of stairs, at........

CARPENTER WORK.

20 squares framing floors and ceilings, at.....
13 " " roofs, at.......................
23 " " outsides, at...................
10 " " partitions.....................
13½ " laying flooring, at ....
16 " " weather boarding, at.......
16 " " sheathing, on sides, at......
13 " " " roofs, at.........
7½ M. shingles, laying, at............... .....
Ornamental work for gable, at.................
Work about bay, not included in estimate for windows, at......... ....
Work on stairs, at putting down base, at.....
3 columns and frieze for porch, at............
2 sets steps for porch, at........................
1 mantel for parlor, at.........................
450 yds. painting, at............................



Study in Cheap Frame Houses.—Fig. 16.—*Detail of Finial Gable and Cornice.—Scale,* ½ *Inch to the Foot.*

From W. P. R., *Charleston, S. C.*—I notice remarks from C. W. S. and others concerning the discrepancy of estimates, which is quite as remarkable in this section of the country as elsewhere. I never expect the condition of things to be any better, because nine out of ten simply guess at the cost of workmanship, instead of calculating the time per man in detail.

I do not see how a practical mechanic who has had a reasonable experience in building can make mistakes if he estimates workmanship in detail; nor do I see any other safe method. Estimating is a nice job, and requires ability, experience in building, as well as great care and patience. It is not every "wood-butcher" and "theoretical builder" that can make a proper estimate. It is very generally guess-work.

I would like to suggest to your several correspondents and to all that are interested upon the subject, that the cost of labor is equal to the cost of material. In estimating, therefore, first carefully ascertain the cost of the materials required, and add a like sum for the labor. Try it on work of any kind, large or small, coarse or fine—no matter what the material may be. Add for labor, or, more respectfully speaking, for workmanship, a sum equal to the cost of the materials. Test the reliability of this rule by a close calculation of workmanship and attendant expenses in detail, and see if it does not turn out to be that workmanship equals materials in every case.

From W. H. M., *Leland, Ill.*—Several of your correspondents ask for estimates on buildings, or rules for estimating, particularly on labor. In estimating for labor, about three-fourths of our builders guess at it; but there are ways or rules which can be relied on. One party figures so much to the thousand feet of lumber, but this I do not think very accurate. Experience or personal knowledge is the safest way to figure. A man need not work at it very many years till he knows how much work of each and every kind he can do in a day. When he has ascertained this fact, he can estimate very closely on the labor of any kind of a building. This is my way of estimating. I have always been able to complete my contracts with a good compensation. To lay 2000 shingles is considered a day's work, but a good workman can lay 3000, and so in a great many other things; and when this is known you can take advantage of it in making an estimate.

Cost of Framing.

From J. D. J., *Newport, R. I.*—Your correspondent J. E. H. wishes to know how to estimate the cost of labor in framing a building. I have framed, raised and covered in a great many buildings, and I find that it costs to frame modern buildings, where you have a good framer, $4.50 per thousand feet and $2.50 to cover the frame with boards, making in all $7 per thousand feet to raise and board a modern building. At another time I may write you further upon the subject.

Note.—It seems to us that J. D. J. is in error in his statements, or else fails to say just what he means The inference from his last statement is that the number of thousands of feet of lumber in the entire building—that is, in the framing and covering together—multiplied by $7 will be the value of the labor required to frame, raise and board the building. By his first statement, the inference is that the framing is worth $4.50 per 1000 feet, figured on the amount of lumber used in the frame alone, and from the statement concerning the boarding, that it is worth $2.50 per 1000 feet of boarding. It is evident that these two statements are not in harmony with his summing up. To illustrate: Suppose, for example, that some building had 20,000 feet of lumber in the framing and 15,000 feet in the boarding. As we understand the first part of our correspondent's letter he would estimate it as follows:

20 M feet framing, at $4.50 per M..........	$90.00
15 M feet boarding, at $2.50 per M.........	37.50
Total cost labor..........................	$127.50

While by his last statement it would be as follows:

20 M feet framing, 15 M feet boarding, } 35 M at $7 per M....	$245.00

A very material difference in the result. We trust our correspondent will send another letter setting himself right on this point, and that others of our readers will write us concerning this matter.

Carpentry and Building Fills the Bill.

From J. H. P., *Paterson, N. J.*—I subscribed for *Carpentry and Building*, through our news agent here, at first sight, and I am very much pleased with it. So far it "fills the bill," much more acceptably than any previous publication that I have seen. The field is a large one, while the writers competent for its successful culture are very few. The disposition of most writers on carpentry as a science, seems to be an assiduous attention to the easy and simple problems, leaving those that are difficult and complex to the mother wit of the boss or journeyman, or to some occult "rule of thumb," which in no two problems gives the same result. I would simply ask those who in blissful ignorance imagine there is no science in carpentry, no geometry in cutting joints, &c., to try some for curiosity. I wish the new paper abundant success.

Note.—We have not room for the publication of hundreds of letters, of which the above is an example, all speaking in encouraging terms of *Carpentry and Building.* We trust our friends will write us none the less for not seeing their letters in print. Our space is limited and we must give preference to matters of practical importance, no matter how gratifying it may be to spread before our readers the words of appreciation and commendation which our correspondents send us. We take this opportunity of saying once more: Write often—write freely—carefully state what it is desirable to know in your branch of trade, and so far as is practicable, and as soon as is possible, your questions will be answered in this department of the paper. In this way we expect to be able to make *Carpentry and Building* "fill the bill" in the future still more completely than in the past.

Skylight Patents.

From J. B. C., *New York City.*—Having had experience in patent-case matters, and realizing by it how easily an unsuspecting person may be put to expense and loss of time in this land of inventive genius, by using or vending an article claimed to be protected by "letters patent," I would ask —for my own information, and for the benefit of the public as well—who of the several parties now manufacturing "patent bar skylights" is the "original Jacobs?" Apparently each one claims to be the true patentee under authority of United States patents.

Quite lately I noticed in one of the trade journals a warning notice, "To all whom it may concern," relating to the subject in question. Would it not, therefore, be a sensible thing for the several parties to state to the public wherein the merit of their respective inventions lies? By so doing, those using the articles would be better able to judge of the merits of the case, and be able to steer clear of all difficulties and complications. At least the real "medicine man" would thus be able to show himself bravely, and to strip the pretenders of any of their paint and feathers which happen to be borrowed.

I have been informed that a "patent bar" was known years before it was patented in this country; in fact, Sir Charles Barry, who is credited with having first used it in England, died in that country fully ten years before a patent was issued on the same article in the United States. Is it not possible, or even probable, that the so-called "patent bars" are the progeny of the old country article? I make the inquiry because, so far as my investigations go, all of them seem to bear a very striking resemblance to the parent stock (which, by the way, I believe was not patented), as well as to each other. Then what becomes of the originality of the invention?

Note.—This correspondent opens up a subject of very great interest to builders and house owners everywhere. There are, we believe, about twenty patent skylights now being manufactured in this country, all of which in some respects resemble each other, and the essential principle of which, many believe, was in general use in England long before the first patent was issued in this country. There is no doubt that a skylight more nearly perfect in all particulars is made under some of the patents than has ever been produced by the use of other forms, and on account of the merits of the article the public for a long time has paid very high prices for it without complaint. Within a comparatively recent period, however, new forms, slightly varying from the old ones, have been introduced and patents have been issued for them. Skylights have been made by the use of these new forms quite satisfactory in character, so that a sharp competition has arisen in the business, and prices have been considerably reduced. But in all instances, independent of the merit of the article, the loud talk upon the part of salesmen and manufacturers has been about the patents. Depending upon these for protection, in several instances an elaborate system of State and county agencies has been organized and established, and the royalty paid by the agents to the patentees has been at a rate per cent. that in these times of hard-pan prices looks very large, if not extravagantly high. That something is wrong with the patents somewhere, is evidenced by the fact that so many new devices have been patented quite lately, and that a general fight between the several patentees is in progress all along the line. While competition is undoubtedly the life of trade, the character of the competition that at present exists in the skylight business, bringing to the surface, as it does, so many conflicting claims, raises the question in the minds of many people whether there may not possibly be an element of humbug in the whole matter, and whether they may not be paying royalties on patents which, if the whole matter was carefully sifted, would be found to have no adequate foundation. If the original patents, as issued in this country, are in all respects valid, then unquestionably some of the devices more recently invented and now being manufactured, are infringements upon them. If this is the case, a clearing up of the several points involved is a matter of pecuniary interest to the owners of the original patents, as well as a matter of general interest to the building public at large. If, however, this supposition is not correct, then the question of whether the devices patented in this country ought not in equity to be common property, because of their forms being known and used in England before their introduction into this country, comes up with renewed importance. We commend the inquiry of our correspondent to skylight manufacturers and patentees as being of vital interest to them. We shall be pleased to give room for a statement of facts which any of them may communicate in reply.

Perspective Drawings.

From M. S., *Pokomoke City, Md.*—Will you be kind enough to give the practical rule employed by draftsmen for drawing perspectives of houses? I understand the principle, but not the rule—that is, determining the distance of the eye from the object.

Answer.—There is too much involved in the principles and applications of perspective drawing to admit of our taking up the subject at present. It would consume more space and time than we can devote to any subject not of general interest to our readers. We cannot answer M. S. satisfactorily without going into the subject at some length, and the best we can do, therefore, is to refer him to some of the numerous standard books upon drawing, almost any one of which will afford him an answer, not only to the question asked, but to all other similar queries.

Marking Pocket Rules Backwards.

From G. H. H., *Germantown, Pa.*—In the April number of *Carpentry and Building* W. E. P. asks: "Is there any reason for the apparent absurdity of pocket rules being marked backwards?" Let us vary the question, applying it to the 10-foot rod in use by all framers. To make the explanation as plain as possible, let us suppose a case. Let Bill be the framer and John a helper. The following dialogue takes place as they commence work:

"John, you go make a 10-foot rod; lay it off, and number the spaces."

Thereupon John makes the rod, and a very nice one it is, and numbers the spaces, commencing at the left hand end. He brings it to Bill.

"All right, John. I will lay off 18 feet on that piece of timber."

Bill commences the measurement, and says mentally, "10 and 8 are 18." He then looks at the rod and finds the 2-foot mark where he expected to find the 8-foot mark. Then he calls John.

"John, come here ! This is the most absurd rod I ever saw !"

"Why, what is the matter with it, Bill ?

"Why, matter enough ! I want to measure 18 feet. Here is my 10 feet. I am sure the rod is but 10 feet long, but when I want the 8-foot space it is at the other end of the rod, and if I turn it the figures are all upside down."

John at once sees his blunder and says to himself, "I'll number it from the right next time."

From experience I would advise W. E. P. to use the pocket rule in the left hand, leaving the right hand at liberty to do the marking. For example, suppose 12 spaces at 10 inches each. A certain point is fixed for starting. The left hand places the rule so that the ten mark comes opposite the point, and the right hand makes a point at the end of the rule, which in turn is used in fixing the second division, the same as the starting point was used in the first. The same process is repeated for the other spaces. This plan enables one to measure much more accurately than by setting the end of the rule to the point and marking opposite the figure on the rule.

From C. C. B., *Claywood, W. Va.*—In reply to W. E. P., of New York, I would say that I think he cannot be right-handed, or he would not hold his rule in his right hand. I usually hold a rule in the left hand and scribe awl in the right. I will venture to say you will seldom see a right-handed person with a scribe awl in the left hand.

The figure 1 is placed at opposite ends of the rule on different sides, so that you can always have the right end of the rule merely by turning it over. If the figure 1 was at the same end on both sides, one would have to reverse the rule—end for end. If W. E. P. is left-handed, he will have to get a left-handed rule made. The manufacturers make rules for the masses, knowing that the majority of purchasers are right-handed. I do not know whether they think the left-handed people are of too little importance to make it worth while to make rules for them. I think a rule made in any other way would be very awkward to handle.

From E. B. T., *Tenafly, N. J.*—I think the reason why a rule is figured backward is because, in most instances, mechanics have a tool in the right hand and use their left hand to hold a rule. If one looks at a gang of ship carpenters, he will find that they mostly have a rule-pocket (a very handy pocket it is) upon the seam of the left leg of the pantaloons or overalls. If obliged to carry a rule, I think it will be found that it is used more times in the left than in the right hand.

From W. H. C., *Erie, Pa.*—In reply to W. E. P., of New York, I would say that the pocket rule was invented by a man who intended it to be used in the left hand (or else he was an ancient Hebrew and read backward), thus leaving the right hand at liberty to use a pencil or scriber. The machinists use it in this way. The square is also used in the same way. Take the square in the left hand, as you would to lay out a pattern, and the figures are right; but take it in the right hand, the same side up, and the figures are upside down. Turn it over, and they are right again. So the square can be used in either hand.

From C. H. R., *Adrian, Mich.*—W. E. P.'s inquiries in regard to the figures upon pocket rules struck me in a new spot, and on investigating it I came to the conclusion that the pocket rule is intended to be used in the left hand, for, if numbered from the left to the right, it would be awkward in using with awl or pencil. The same is true of the square. I have extended my inquiries to six different foremen, and find that this method of using the rule is not peculiar to myself.

From F. M. C., *Litchfield, Conn.*—W. E. P. says every one using a pocket rule is "likely to take it in his right hand." I don't think so, but the reverse. When I am to line a box, I hold my rule in my left hand and my scratch awl or pencil in my right, and then the figures are not "upside down." A carpenter, in framing his building, generally commences at the left hand of the stick of timber, holding the square in his left hand with the tongue, or short end ; in his right, his scriber or pencil. Suppose he measures off 10 feet and wants 9 inches more. He moves his square along, placing the 9 on the square at the 10-foot mark, and then, with his pencil, marks the cut-off. I think the rule as now made is right. It must be that W. E. P. is left-handed.

Note.—Our several correspondents seem to take it for granted that all persons who use rules are to use them for a particular purpose. What are the thousands to do who employ them in a manner altogether different ? It is true that the large class of carpenters, machinists, &c., find it desirable to use the rule in one hand and the scribe-awl or pencil in the other, and it is quite evident that rules and squares are made to suit this way of working. But why should all folding, or pocket rules, be made in the same way ? There are a great many people who use the rule exclusively as a measuring instrument. We have known of many instances of errors in measuring to occur simply because the one using the rule, having both hands free, naturally used the rule with his right hand, which brought all the figures upside down. Why do not some of the rule makers furnish a pocket rule with the figures right side up, for people who do not always carry a scratch awl in the right hand when they desire to make measurements ? It would seem that rule makers have entirely ignored the fact that there are a great many times when it would be desirable to take dimensions instead of laying them off. So far as our own observations go, we do not know of a rule that is not figured for use with the left hand.

How Much Shingling Constitutes a Day's Work ?

From R. L., *Buffalo, N. Y.*—I am greatly pleased with *Carpentry and Building*—so much so that I am always impatient for the arrival of the new number.

I desire an expression from some of your readers as to how many shingles—placed, say, 5 inches to the weather—a man ought to lay in a day of 10 hours. I have laid 2½ squares in that time, and supposed I was doing a fair day's work. I have heard men claim to be able to lay 4 squares per day of 10 hours, but I have never seen it done.

Material for Cellar Floors.

From C. B., *New York City.*—Answering the inquiry of W. D., in the March number of *Carpentry and Building*, as to the best material for dry flooring for cellars, I recommend vitrified terra-cotta tile. Tiles of this material are entirely non-absorbent, and they prevent all dampness and ground air.

From I. R., *Madison, N. J.*—As a practical builder, I will attempt to answer the question of W. D., in the March *Carpentry and Building*, with regard to a satisfactory material for cellar floors. The plan proposed below is the result of years of experience in New York and Brooklyn. It produces a perfect, wholesome, durable and cheap cellar floor: Mix together, in the usual way for concrete, 4 parts of bluestone chips, 3 parts of coarse sand and 2 parts of Rosendale cement. Lay a course across the cellar as wide as the mason can reach handily to trowel. Then apply to it a top dressing, composed of 2 parts of coarse sand and 1 part of cement. Smooth carefully with the trowel, after which lay another section in the same manner, and so continue until the floor is covered. At the expiration of 24 hours, dampen the surface by means of a brush dipped in water, and trowel smooth, in the same general manner as for hard finish. This plan produces a floor as hard as stone. About four days are consumed in the hardening process, during which time it should have all the air possible.

From J. E. L., *New Haven, Conn.*—I notice, in a recent number of *Carpentry and Building*, that a correspondent desires to learn of a satisfactory material for cellar floors. From experience, I believe the very best floor that can be put down is composed of small broken stone, put down about one foot in depth and then filled with Roman cement. The cement should cover the stones about 4 inches deep.

Covering Wooden Wheels With Emery.

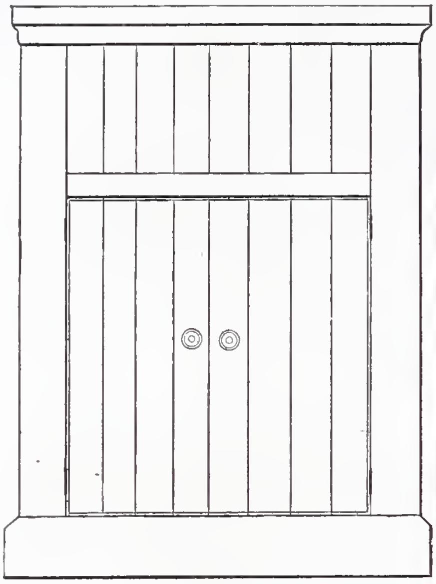
From B. & S., *Kalamazoo, Mich.*—We desire to ask, through *Carpentry and Building*, what is the best way to cover wooden wheels with emery to take the place of solid emery wheels ? We have had trouble in the use of solid emery wheels on account of bursting, and we desire to make a change if it is practicable.

Answer.—As to the substitution of a wooden wheel coated with emery for a solid emery wheel, it depends very much upon the nature of the work for which it is to be used as to the results obtained. A wooden wheel may be satisfactorily coated by the use of glue. The glue must be used very thick. If the wheel is new, first size it with glue about as thick as lard oil, and then allow it to dry thoroughly before applying the glue which holds the emery. Have the emery heated to 200 degrees F. and coat the wheel with glue about as thick as molasses, and roll it in the hot emery. If a wheel thus treated is allowed sufficient time to become thoroughly dry, it will be very serviceable.

Improved (?) Lightning Rods.

From M. A., *Mexia, Tex.*—I desire to ask your opinion concerning what is to me a new idea in lightning rods. It is generally conceded that the all-important point in a lightning rod is its ground connection—that however perfect a rod may be, if its connection with the earth is imperfect it is not reliable, and will surely fail when put to the test. These views have met with a contradiction quite recently in the shape of a pamphlet from the pen of Prof. John H. Tice, of St. Louis. The title of the pamphlet is "Electricity ; An Exposition of its Laws and Mode of Action Applicable to Means of Protection Against Lightning." A Mr. J. C. Chambers, of Cincinnati, is the inventor of a lightning rod having no earth connection, and this little book, which is published by the "Chambers National Lightning Protection Co.," is a defense and advocacy of the principles and theory thereof. "The apparatus consists of a rod bent so as to form three sides of a parallelogram, which is set upright upon the roof of the building, with the points vertical and the horizontal section insulated a foot or more from the roof," and, as I understand it, one of the points being positive and the other negative, the one is to receive the discharge of fluid from the cloud and the other to throw it off again. What knowledge we have on almost every subject is gained from others. When we find those who ought to be good authority differing so radically, we are necessarily greatly puzzled. The subject of protection from lightning is a matter of the very greatest importance, and my desire is to obtain correct ideas with regard to it, and this is my excuse in opening up the question in a letter addressed to *Carpentry and Building.*

Answer.—We have given the book our correspondent refers to some little examination, and while the arguments employed are very ingenious, and quite plausible in many respects, and while the claims of the "Chambers National Lightning Protection Co." are sustained by numerous testimonials signed by those who have been persuaded to have the improved (?) lightning rods applied to their buildings, there is nothing about the book, either in the facts asserted, or in the invention defended, or in the testimonials published—although one of them is over the name of one of our school teachers, the man who drilled us in much of the art we employ in the make up of *Carpentry and Building*—that would seem to entitle it to serious consideration. The principles upon which the improved (?) rod is constructed and put up are in opposition to the best science of the day. The rods as described by the Chambers National Lightning Protection Co., might protect buildings from "Chambers' National Lightning," but hardly from "Jersey Lightning," unless the occupants of the house were strict temperance people, and much less from the lightning of nature, against which they are particularly erected. Although, as our correspondent suggests, the doctors disagree, he need have no hesitation in this case concerning which to follow. On the present showing we prefer the old school. The new system might work well if the thunderbolts could be reduced to homœopathic doses, but no scheme for accomplishing this result, we believe, has been brought forward. A good conductor, properly pointed, completely insulated, and with a



Ice Box.—Fig. 1.—Front Elevation.

ground connection to moist earth, is the general recommendation of the ablest scientific investigators.

Home-Made Ice Box or Refrigerator.

From J. V. A., *Canandaigua, N. Y.*—In the February number of *Carpentry and Building* there appeared the plan and description of a home-made ice box, or refrigerator. Herewith I send you sketches of one in common use in this section of the country, and which I think is much better, while not any more expensive, than the one you have already published.

Fig. 1 is the front elevation of the box. Fig. 2 is a cross section lengthways of the box, showing the ice racks, marked C, the shelves or grates upon which articles are to be set, marked A, the waste pipe, marked S, and a broad flat pipe, marked B, by which circulation is maintained. Fig. 3 is a horizontal section taken at a point just above the ice racks, and Fig. 4 is a cross section through the narrow way of the box, showing the arrangement of the ice racks, drip pipe, &c.

The box may be made of any size, shape or finish that is desired. It is to be made double for packing, as indicated in the drawings, furnished with doors in front for general use, and with a lid at the top by which to put in ice. The ice racks are made of sufficient strength to withstand the weight of ice likely to be used upon them, and are covered with tin or zinc. They are inclined toward the center, as indicated in Fig. 4, and the edge of one is placed above the other. The lower rack is provided with a ledge, and is made wider at the middle than at the ends, so as to form a low point where the waste pipe S connects with it, as shown in Fig. 3.

The air-flue, B, may be made of tin or zinc, and is fastened to the back of the box. It reaches from a point near the top of the box to near the bottom, and serves to keep a current of air circulating through it. The waste pipe may be carried through the bottom of the box, or, where desired, it can be arranged to discharge into a pan set aside. Sawdust may be used as a material for filling the hollow space.

Proportioning Windows to Suit Stories, &c.

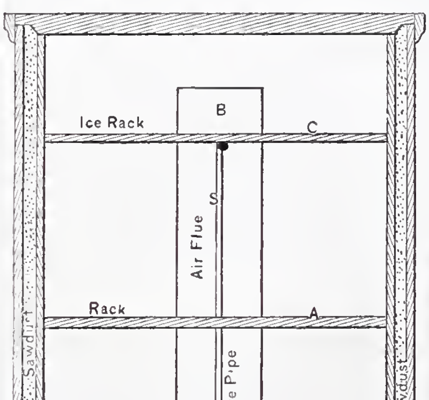
From D. W., *Greenville, Ohio.*—What rule, if any, is there for proportioning the hight and width of windows to suit the different stories of a building? What rule is there for proportioning the width of a front so as not to show too much blank wall? What rule is there for determining the hight of finish on store fronts proportionate to the two stories? By answering the above in the next issue of *Carpentry and Building* you will greatly oblige.

Answer.—Our correspondent's several queries are what might be called leading questions. We are not able to point out any arbitrary rules applicable to any of the points raised. A thorough knowledge of the principles of architecture, a considerable degree of familiarity with the style in which the building is designed, together with good taste, combine to form the only satisfactory guide in each of the cases. In the absence of such knowledge and experience, the general resort of mechanics and designers is to copy what some one else has done, and, upon general principles, to avoid any new departures. Good taste, even unaided by a thorough study of architecture, will very generally afford satisfactory answer to these questions, avoid glaring disproportions on the one extreme and too close copying of some other man's work on the other. Any rule that could be laid down applicable to these cases, would have but limited use. The exceptions, with the diversified forms and designs now in vogue, would by far outnumber the applications of the rule.

Tin Covering for Fire Protection.

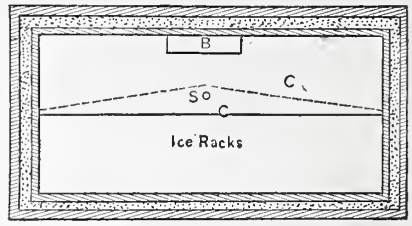
From I. J. M. G., *Fayetteville, Tenn.*—I am about to cover the doors, shutters and back part of a store with tin as a protection against fire, a wooden building being very near by. My theory is that if I cover the surface of the wood, doors, &c., with tin, laying the plate on close and air-tight, and thereby excluding the air and preventing it from having access to the wood, the wood cannot take fire within any reasonable time. Would you put the tin on as in flat-lock roofing seams, or lap the edges of the sheets one inch and nail close? Please give your advice, as it is a new idea to me, and I wish to know how to proceed to the best advantage.

Answer.—Our correspondent's plan is a good one, and will render a wooden building



Ice Box.—Fig. 2.—Longitudinal Section.

as safe from fire on the outside as one of brick built in the usual manner. In putting tin upon the side of a building for this purpose, several things must be observed. In the first place, no dependence can be placed upon solder for holding the sheets in place, whether upon the sides of the building or upon doors and shutters. In the next place, the tin ought not to be fastened by nails through the sheet themselves, because the expansion and contraction is liable to tear them loose. As the weight of the tin all comes upon the fastenings, these must be strong. If it were possible to put a standing seam upon such a surface, it would have a great many advantages. The cleats, however, would have to go into the cross seams, and, we think, should be the whole width of the sheet. If several were put in and were not as wide as the sheet, there would probably be trouble in closing the seam, unless a hand tool was used for the purpose. On small surfaces, like those of the doors and shutters, there would be no difficulty in putting on the standing seam and making it perfectly secure, without in any way ex-

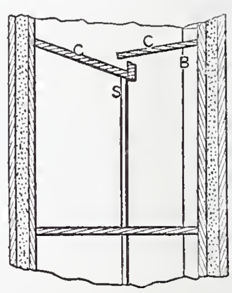


Ice Box.—Fig. 3.—Horizontal Section.

posing the nails. Of course, there would be no objection to the use of solder after the work was finished, but it must be understood that the solder only covers the edges of the tin and makes the joints a little tighter. Whatever plan is adopted, the exclusion of the air is the most important thing, and the sheets of tin must be securely fastened to the wood, so that the melting solder cannot in any way loosen it.

A Chimney Dripping Creosote.

From F. S., *Conway, N. H.*—I should like to ask you or your subscribers a question through *Carpentry and Building.* I wish to know how I can prevent a chimney from leaking creosote. There is a chimney in this town that has done considerable damage from the leakage of creosote between the bricks, spoiling carpets, &c. The upper part of the chimney has been taken down and rebuilt, carrying it up higher than before. The chimney has also been ventilated, yet the creosote still continues to come



Ice Box.—Fig. 4.—Transverse Section.

through between the crevices of bricks, besides running out at the stove-pipe holes, spoiling both carpets and paper. If you or your readers can tell me how to stop the trouble I shall be very greatly obliged.

Note.—From the description which our correspondent gives, it would seem quite probable that the chimney is too large, and, consequently, the smoke in its passage out is very much cooled. Whether this is the case can be easily decided by narrowing the mouth of the chimney temporarily. The vapors from burning wood are very corrosive, and attack the mortar with great rapidity. It is quite likely that the introduction of an earthenware pipe inside the chimney, using it for a flue, would remedy the difficulty. An old chimney that has decayed in the joints from the action of the smoke, &c., and which has become very dirty, is liable to leak creosote whenever there is a heavy rain, especially if the opening in the chimney top is large. We hardly know what to advise in this case, and think that there must be some peculiar circumstances in regard to the chimney. We wish our correspondent would tell us how many fires send their smoke into this chimney, and whether any of them are furnaces or large stoves. We do not understand whether the new part of the chimney leaks or only the old. If the glazed-tile flue is practicable, it will undoubtedly give satisfaction.

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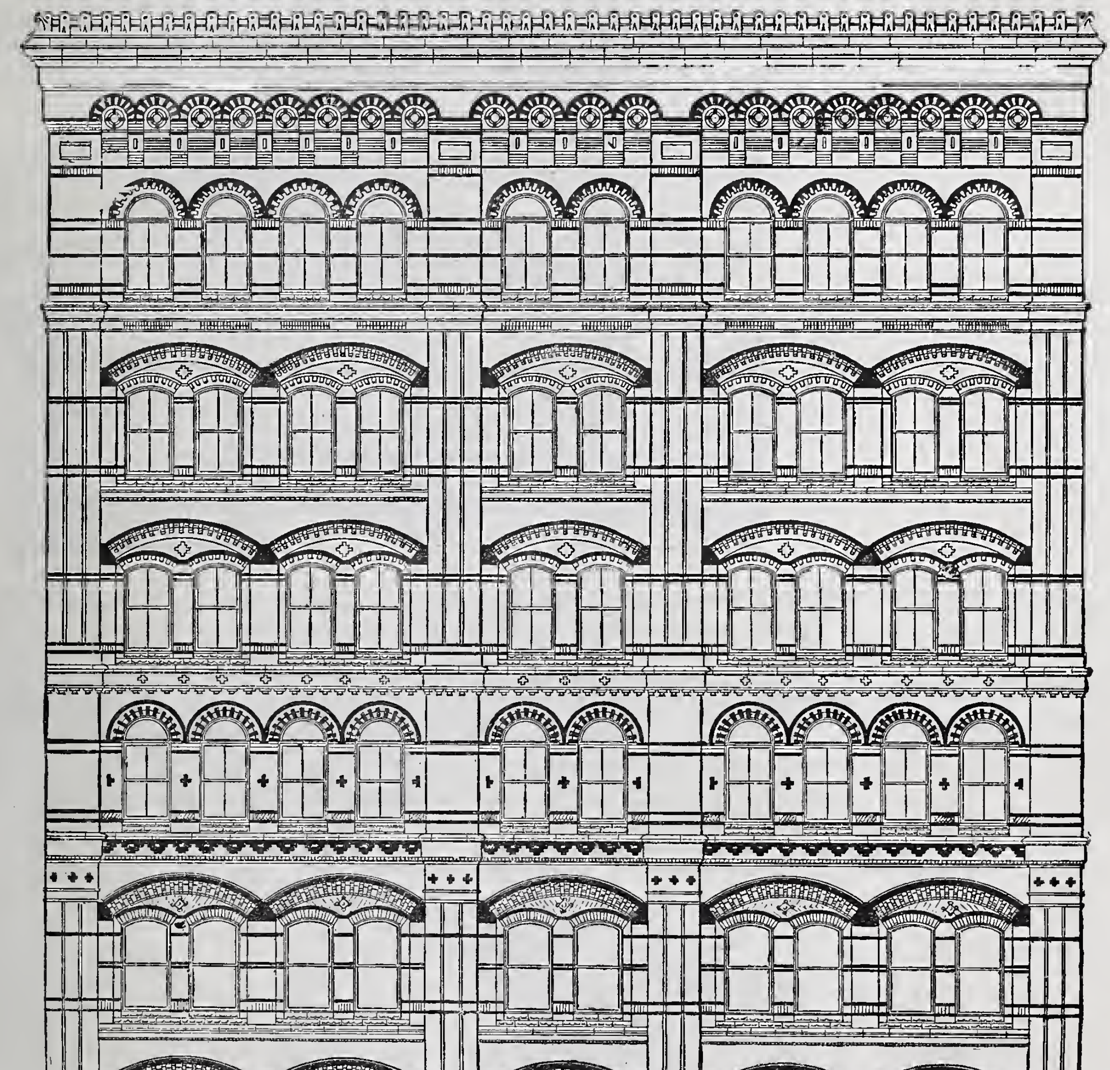


Artistic Brickwork.—Fig. 1.—The New Morse Building, Corner of Beekman and Nassau Streets, New York. Scale, 1-16 Inch to the Foot.

ARTISTIC BRICKWORK.

The Morse Building.

A building has been erected recently upon the corner of Nassau and Beekman streets, in this city, which in many respects attracts more than passing notice. It is known as the Morse Building, and stands upon the site of the old Park Hotel. Although there have been many tall buildings erected in New York of late years, this one outstrips them all. It is the highest sheer brick wall now standing in the city. But it is not its hight alone that attracts attention. There is a display of ornamental brickwork in its walls which, in its arrangement and effect, is very pleasing to the eye of the observer. The features of construction embodied in the building throughout are very striking, and the largest measure of convenience and taste in appointments has been obtained at the expenditure of a very moderate sum of money; besides, the building is fire-proof throughout.

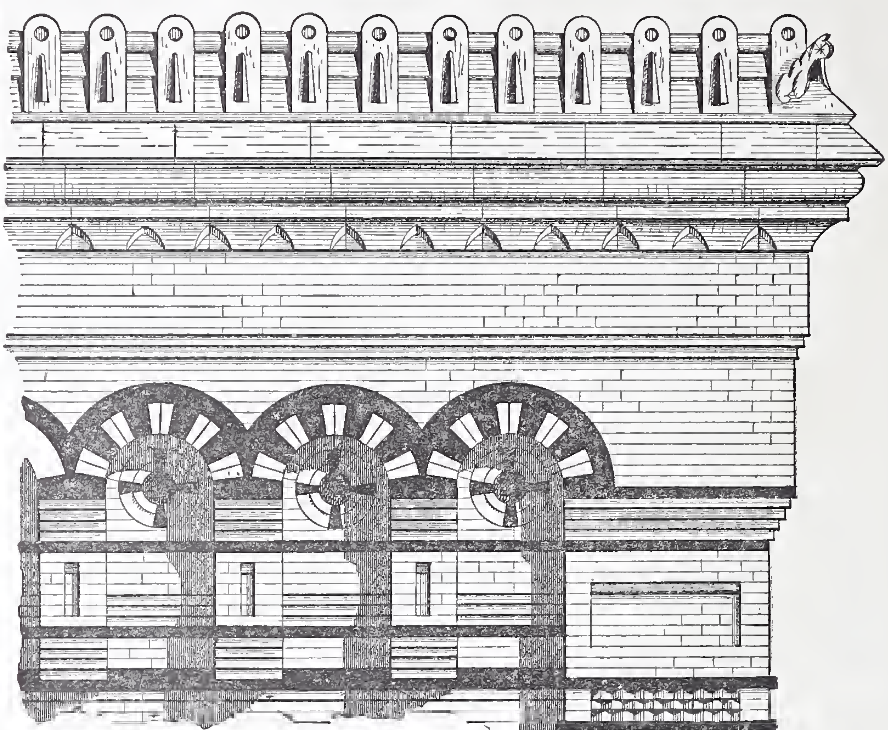
The features of this structure to which we particularly desire to call the attention of our readers, and a description of which we believe will be of practical use to them, lie in the peculiar use and treatment of brickwork. The accompanying engravings, which have been especially prepared for this article, serve to illustrate these points. Fig. 1 shows the principal, or Nassau street, elevation, while the other cuts represent details of the several stories and of the individual bricks employed.

Believing the building itself to be of interest to our readers, not excepting those who are situated at a distance from New York, we will attempt a general description of the structure, in connection with the special features of brick construction and decoration already referred to.

The architectural problem set by the owners was a very difficult one. With a frontage of some 85 feet on Nassau street and some 69 feet on Beekman street, they insisted upon a structure of eight stories, exclusive of the basement. It was to be fire-proof, and economy of construction was to be considered throughout.

The architects selected for the purpose of carrying out these ideas were Messrs. Silliman & Farnsworth, of New York, and that they have made a success is clearly indicated by the building they have produced. They set out to design a structure which should be as effective artistically as possible, which should be entirely appropriate and thoroughly adapted to the purpose for which it was intended, and which should involve the expenditure of the least amount of money. The result accomplished speaks for itself.

It was decided that the use of cast iron in a constructional fashion was to be avoided. No material which was simply decorative in character was to be employed, but whatever features of ornamentation were necessary should be obtained from the materials of which the structure was built. The lessons of the great Chicago and Boston fires, which clearly demonstrated that brick construction affords the greatest measure of safety against a conflagration, were remembered, and brick was selected as the leading material for the edifice.

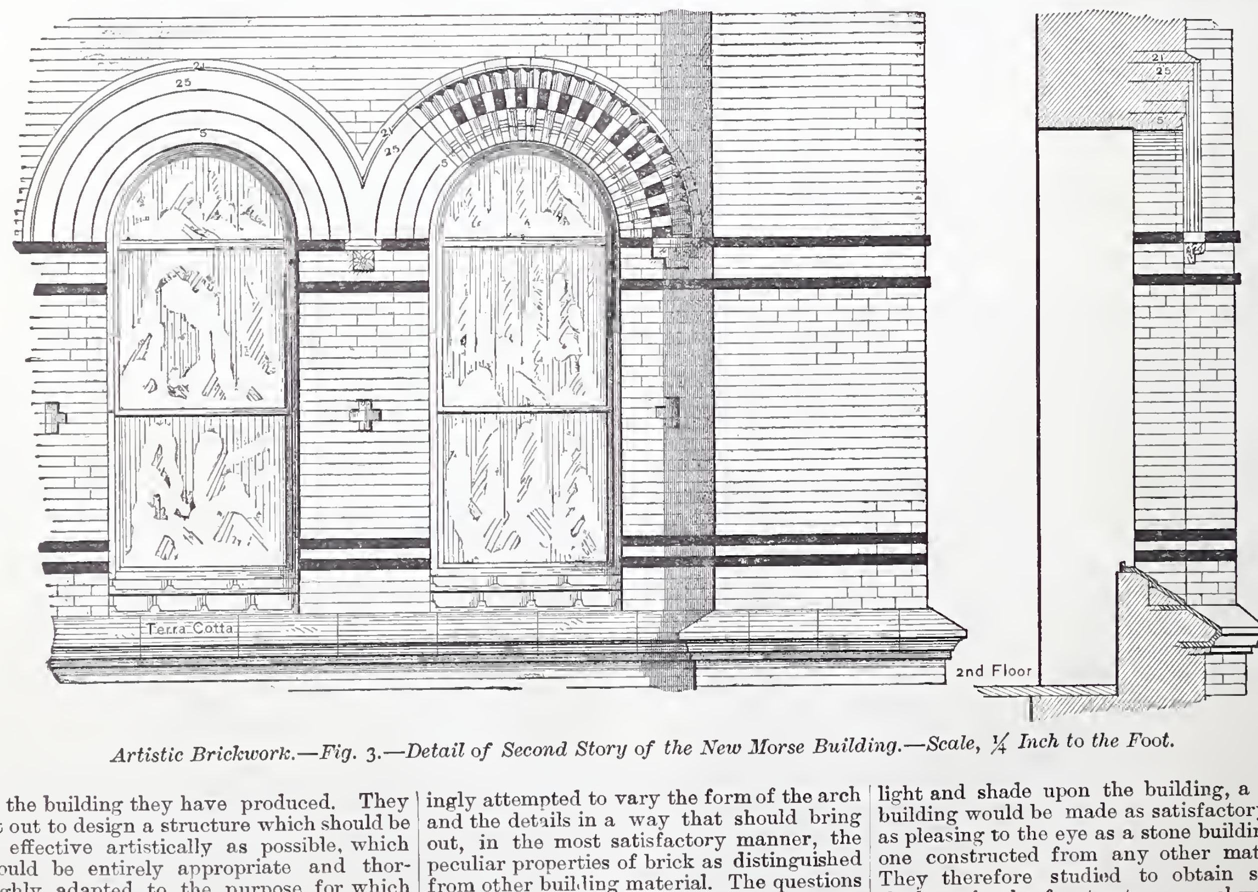


Artistic Brickwork.—Fig. 2.—Cornice of the New Morse Building.—Scale, ¼ Inch to the Foot.

The chief point of interest in brickwork is, of course, the arch, and the architects accordingly attempted to vary the form of the arch and the details in a way that should bring out, in the most satisfactory manner, the peculiar properties of brick as distinguished from other building material. The questions which arose in the consideration of the design were, first, the general mass; second, the forms of the openings of the windows and style of the cornice, and third, the details.

The general form of the building was necessarily determined by the purpose for which it is to be used—that of offices—and one story had to conform to another. To obtain variety, therefore, strong lines of piers were projected, throwing the building into bays, and these bays in turn were treated from story to story in such a way as to keep the horizontal lines as strongly marked as possible, in order to overcome as much as might be the excessive hight to which the building was obliged to be carried.

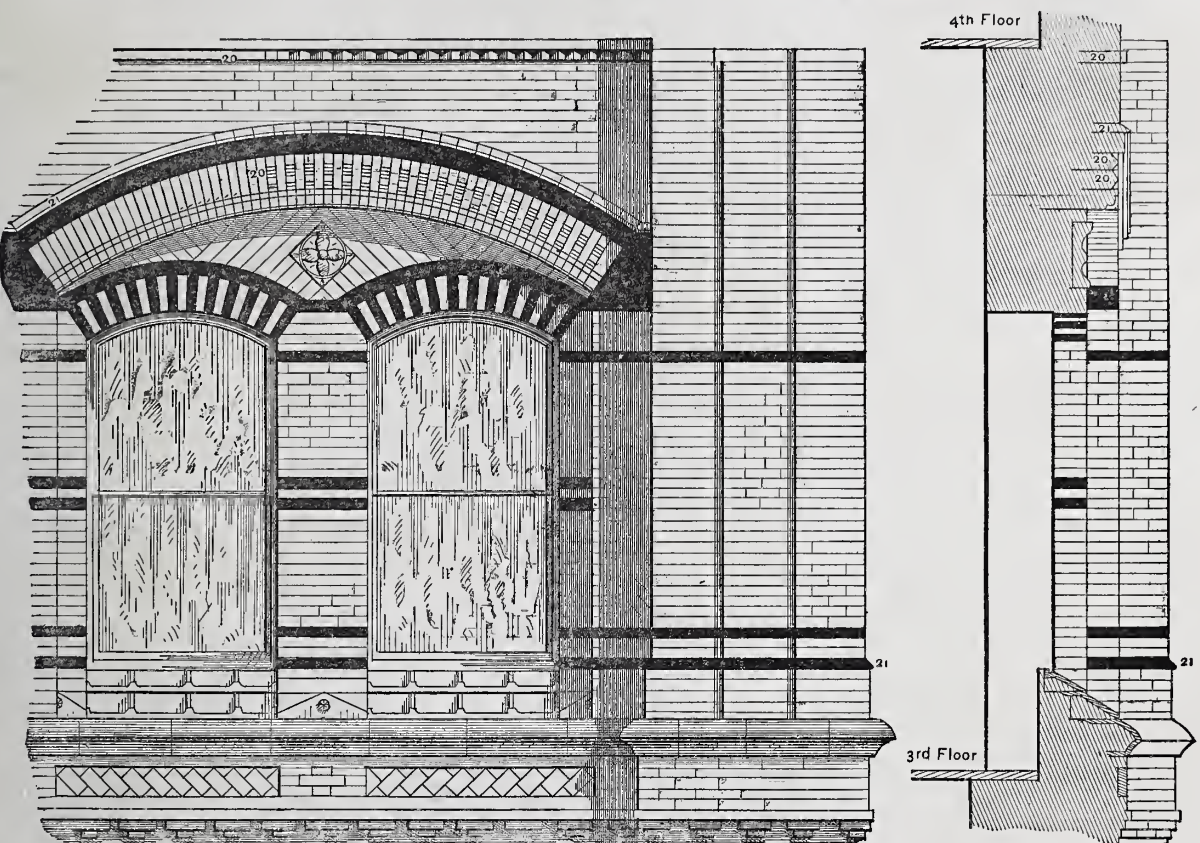
It was believed by the designers that, if they could succeed in obtaining enough light and shade upon the building, a brick building would be made as satisfactory and as pleasing to the eye as a stone building, or one constructed from any other material. They therefore studied to obtain strong shadows in the front entrance archway, in the window openings and along the sides of



Artistic Brickwork.—Fig. 3.—Detail of Second Story of the New Morse Building.—Scale, ¼ Inch to the Foot.

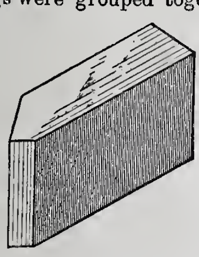
the main piers. These may be considered primary shadows. Secondary shadows were obtained by the projecting and receding of the bricks in the arch heads of the window openings and in the front entrance.

By examination of the elevation, the reader will see just how the front was divided by the piers, as above described, and how prominence was given to horizontal lines in the shape of belt courses, sills, &c. The details show the methods employed for what we have termed the secondary shadows, and in part those for the primary shadows. The requirements for these various purposes were happily blended in the general composition.



Artistic Brickwork.—Fig. 4.—Detail of Third Story of the New Morse Building.—Scale, ¼ Inch to the Foot.

In the basement heavy segmental arches were employed between the main piers, and the latter, in turn, were battered to assist in giving a strong and substantial appearance to the structure. In the first story large semicircular arches—of about 8-foot openings—were used, which were treated very boldly in all their arch lines. Above these, again, semicircular openings of about half the width were employed, and then for the next two stories the openings were grouped together in the



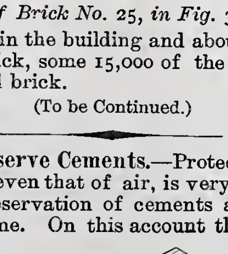
Artistic Brickwork.—Fig. 5.—Enlarged View of Brick No. 21, in Figs. 3 and 4.

form of segmental arches. The same order was then repeated, commencing with the semicircular arches in the fifth story and finishing with the same in the eighth, which in turn was surmounted by the cornice.

The cornice, a detail of which is shown in Fig. 2, was designed in terra-cotta, with bold projections standing upon corbels of brickwork. The capping member of the cornice presents a serrated sky-line.

As will be seen by examination of the details, molded brick was freely used throughout the building—in the arch heads, string-courses, corbels and other ornamental portions, and much of the pleasing variety of detail which the structure presents is due to the employment of molded brick. The only contrasts in color were obtained by the use of black brick. The latter were colored by dipping in coal tar while hot, and from day to day, during the progress of the building, as required for use.

The molded bricks employed were of the shapes shown in the diagrams accompanying our details, and the numbers of which correspond to the numbers inserted in the details. They were selected from the regular stock patterns of the Peerless Brick Company, of Philadelphia, concerning whose products we shall have more to say further on. Nearly 3,000,000 common brick were

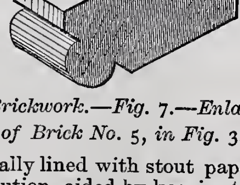


Artistic Brickwork.—Fig. 6.—Enlarged View of Brick No. 25, in Fig. 3.

consumed in the building and about 150,000 pressed brick, some 15,000 of the latter being molded brick.

(To be Continued.)

To Preserve Cements.—Protection from moisture, even that of air, is very essential for the preservation of cements as well as of quicklime. On this account the barrels

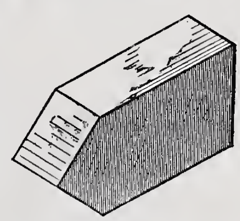


Artistic Brickwork.—Fig. 7.—Enlarged View of Brick No. 5, in Fig. 3.

are generally lined with stout paper. With this precaution, aided by keeping the barrels stored in a dry place, raised above the ground, the cement, although it may require more time to set, will not otherwise very appreciably deteriorate for six months. After 14 or 16 months Gilmore says it is unfit for use in important works; but in lumps kept dry, it will remain good for two or three years, and may be ground as required for use.—*Trautwine.*

Novel Method of Laying Floors.

A curious method of laying down floors has been adopted in France and has obtained a wide application. It consists in putting down flooring, not as hitherto, on sleepers, but in embedding the boarding in asphalt. The new floors are used mostly for ground stories of barracks and hospitals, as well as for churches and courts of law. Very little is known of the method outside of France, and as its usefulness is evident, it should have a wider application; therefore we append the following description: For the floors in question pieces of oak, usually 2½ to 4 inches broad, 12 to 30 inches long and 1 inch thick, are pressed down into a layer of hot asphalt, not quite half an inch thick, in the well-known herring-bone pattern. To insure a complete adhesion of the wood to the



Artistic Brickwork.—Fig. 8.—Enlarged View of Brick No. 20, in Fig. 4.

asphalt and obtain the smallest possible joints, the edges of the pieces of wood are planed down, beveling toward the bottom, so that their cross-section becomes wedge-like. Nails, of course, are not necessary, and a perfectly level surface may be given to the flooring by planing after the laying down. The advantages of this flooring, which only requires an even bed on which to rest, are said to be the following:

1. Damp from below and its consequence, rot, are prevented.
2. Floors may be cleaned quickly and with the least amount of water, insuring rapid drying.
3. Vermin cannot accumulate in the joints.

4. Unhealthy exhalations from the soil cannot penetrate into living rooms. Asphalt being impermeable to damp, rooms become perfectly healthy even if they are not vaulted underneath. In buildings with several stories, as in hospitals, the vitiated air of the lower rooms cannot ascend, an object which it has hitherto not been possible to attain by any other means.

5. The layer of asphalt will also prevent the spreading of fire from one floor to another in case of conflagration.

The flooring here described has been laid in the numerous casements of the newly constructed forts around Metz, to the satisfaction of the authorities. The cost is about 25 cents per square foot. This estimate, somewhat high, would be much lower in districts where oak and labor are cheaper, and the distance from places of construction less.

A Typical Modern Court-House.

Some three or four years ago the Court-House at Newark, Licking County, Ohio, being one of the oldest buildings in the State, and occupying the center of a large square handsomely laid out with walks, shade trees, &c., was burned to the ground. No time was lost in the preparations for rebuilding. The county had long since outgrown the capacity of the structure, and neighboring counties had already abandoned their old buildings for new ones of larger size and more modern appointments. The county officers and a certain class of taxpayers had favored the erection of a new building prior to the destruction of the old one, but a conservative element prevailed among a majority of the citizens of the county, which is an agricultural district, so that up to the time of the occurrence of the fire, the project of a new court-house had remained in abeyance.

When the necessity for building a court-house came upon the commissioners, the question was submitted to a vote of the citizens of the county, as provided by law, and an amount to be expended in the new building was agreed upon. In due course of time an order for plans was given to an architect, Mr. W. H. Meyers, of Cleveland, who is quite prominent as a court-house architect, being selected for the purpose from a number of competitors. The architect encountered several conflicting requirements at the outset. The destruction of the old building by fire created a demand for a fire-proof edifice. The site of the building, being the center of a large and handsome square, afforded unusual opportunities for architectural display, and really made four fronts a necessity. In opposition to these demands was the limit of expenditure fixed by the taxpayers, who, while desiring all the advantages of a fire-proof structure and the conveniences of a well-appointed and commodious building, together with a creditable architectural display, limited the cost to a sum which made it impossible to erect the building demanded without slighting it somewhere.

In the course of time the plans were perfected, the contract was let and the building was completed and paid for. During the course of erection an extra allowance was made to the contractors for facing the outside walls with blue limestone, instead of brick, as called for in the contract, a change made solely for the purpose of enhancing the beauty of the building. Besides this no changes of importance were made. Iron beams with arches were used for the principal floors, which really constituted the only fire-proof feature throughout the building. A mansard roof, framed and sheeted with wood, the steep parts slated and the flat parts tinned; an iron cornice put upon wood lookouts, and dormer windows of corresponding construction; a tower rising above the central part of the building, framed of wood and finished in galvanized iron, were characteristic features of the building and serve to illustrate the construction employed.

We are thus particular in itemizing the construction of this building, because in most respects it is a fair specimen of the public buildings erected of late years throughout the country, notable for their architectural display and for their insecurity from fire. We risk nothing, we believe, in saying that there are hundreds of court-houses in the country, mostly in the West, which are fairly typified by the one we have described. It is to be hoped no disaster awaits them similar to that which overtook the Newark building.

A feature of the tower was a clock with four illuminated dials. On the 29th March, which was a very short time after the completion of the building, the tower took fire from a gas jet employed to light the dials, and from it the fire spread until the building was destroyed, resulting in a loss to the county of nearly $200,000—another expensive lesson added to the long list of losses resulting from inadequate provision against fire.

We learn that the county commissioners have concluded a contract with Mr. T. R. Tinsley, of Columbus, Ohio, for plans for rebuilding, and that this time the structure is to be mostly fire-proof throughout. We shall watch the construction of the new building with considerable interest, and if any important features are developed, will lay them before our readers. In the meantime we commend this instance of characteristic construction in public buildings to the attention of county officers and taxpayers generally. It is never profitable to sacrifice the quality and character of a building for the sake of outside display. No county can afford to erect a court-house, whatever the amount to be expended, which is not thoroughly fire-proof. No taxpayers can afford to devote any sum whatever to the erection of a building for county purposes which is not entirely fire-proof. The moral of the account of the Licking County fire is altogether self-evident. Let us hope its influence may be salutary upon the citizens of other counties, as well as upon those who must make up the sum lost.

Sand: Its Origin and Varieties.

Sands are derived originally from the decomposition of the older rocks, either by the action of running waters or by the spontaneous decomposition of the rocks themselves. They are technically distinguished from dust by the fact that they sink at once to the bottom of water without leaving any sensible quantity in suspension. The decomposition of the rocks often gives rise to an agglutinating substance, which accompanies the sand and binds it together; but when acted upon by the waters it soon parts with such heterogeneous particles, and it arrives in a comparatively pure state in the beds of the principal rivers. This purity is lost as the rivers approach their *embouchures*; for the diminished velocity of the current allows the heavier particles to subside before arriving there. The water then only carries down the light earthy particles and the decaying vegetable matters which may fall into it, thus giving rise to the formation of clay deposits. The constituent parts of sands represent faithfully the rocks whence they are derived. Thus the granite rocks produce a sand the principal ingredients of which are quartz, feldspar and mica; the volcanic rocks are represented by sands in which lava, obsidian, &c., appear; the flat, soft-grained sand arises from the disintegration of the schistose rocks; the calcareous rocks, as might naturally be expected from their soft nature, are those which are least represented in the series, unless in the case of the silicious sands arising from the comminution of the flints, so plentiful in some of the secondary formations.

The partial and secondary revolutions of the globe have given rise to immense formations of sand in places where rivers have long since ceased to flow. The sand extracted therefrom is known under the name of "pit sand," to distinguish it from that borne down by the rivers, called "river sand," and from the "virgin sand," which remains in the places where formed, without in any way suffering the action of water. Pit sand is generally of a sharper and more angular grain than river sand, but in all other respects its composition is identical, excepting that it is occasionally stained by ochers. Practically speaking, clean, sharp, coarse sand is best and makes the hardest plastering as a general rule, and it is safe to rely on river sand, the coarser the better, within reasonable limits. Lake sand is the same as river sand, and pit sand also makes good work when the sand is clean and coarse.—*From Cameron's Plasterer's Manual.*

An Architect's Troubles.

What architect has not had clients who came to him with a painfully elaborated, impossible sketch, saying, "Now, this is about my idea of a house. I wish you would make me a design that would embody it in a practical form." The architect takes such a sketch and remodels it, endeavoring to satisfy all the requirements, and making of it, in the end, a creature entirely his own, which he presents to his client, who exclaims almost invariably, "Why, how simple! anyone could have done that!" and makes up his mind that architecture is a very easy business. Or, again, an architect inquires about some work that excites his interest or admiration as having architectural merit, and is answered, "Well, Mr. So-and-so was our architect, but we really did not need him; my wife was the real designer, and the good points of the house are all her ideas." Of course, it is not pleasant to have one's thunder stolen in such a manner, and the unfortunate architect who has twisted and turned his plans, and put one tracing over another, in trying to reconcile the ideas of his client's wife with themselves, with each other and with his design, is tempted to vow that in future he will reject, on principle, all ideas brought forward by his client's wife or any of his female relatives, or—a more dreadful vengeance still—that he will let madam design the house herself. It is the only redress he can hope for, as, when such a version of his services is given, it is more generally believed than would seem possible in view of its improbability, and he has few opportunities to justify himself.

But there are other instances where architects are subjected to more serious wrongs and annoyances, and which are seemingly as difficult of redress. An architect is invited, for instance, together with a number of other architects, to submit designs for some large building; the architect whose design proves the most acceptable to the owner or client is to be appointed architect of the building, and to carry out his design; the other competitors are to be paid a fixed sum, avowedly based, under the most liberal arrangements usually made, upon the amount of time and labor required to produce the drawings. In due time the designs are submitted to the owner, or his representatives, one of them is selected, and its author appointed architect, the other designs being returned to their authors, with the stipulated compensation. So far our architect, whom we will suppose to be one of the unsuccessful competitors, has nothing to complain of, unless, indeed, he has reason to believe that other considerations than the competence of the competitors and the merits of their design were allowed to influence the choice of the owner, a contingency which we will not consider here. The building goes on, and our architect returns to his own affairs, but discovers, during or after the erection of the building, that certain essential features, which at the time of the competition only appeared in his drawings, have been embodied in the new building. Now, what position can he take in the matter? Has he a right to feel that he has been defrauded, and if so, who has defrauded him, and what redress can he obtain?

Table of Weights of Materials.—The following shows the weight (avoirdupois) per cubic foot of various kinds of material: Average mortar, 106 pounds; water, 62½ pounds; loose earth, 95 pounds; common soil (compact), 124 pounds; clay (compact), about 135 pounds; clay with stones, 160 pounds; brick, 125 pounds; lime, 64 pounds; sand (loose), 96 pounds. And the following shows the bulk of one ton of different substances in cubic feet: Sand, 28 cubic feet; earth (compact), 18 cubic feet; earth (loose), 32 cubic feet.

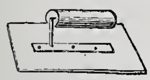
Tools Used in Plastering.

The following description of plasterers' tools, with illustrations, is taken from Cameron's Plasterer's Manual," just issued by Bicknell & Comstock, New York :

The Plasterer's Trowel (Fig. 1) is the tool which is most used by plasterers, and should be selected with care. It should be made of the best steel, light, springy and about 4 inches wide by 12 inches long, with a nicely rounded handle. " Disston's Improved " is about the style in general favor.

The Hawk (Fig 2) should be made of hard pine, and from 13 to 14 inches square, one-fourth of an inch thick at the edges and three-fourths of an inch thick at the middle, with a cleat nicely dovetailed into the baek to prevent warping. The handle should be from 5 to 5½ inches in length, and from 1¼ to 1½ inches in diameter.

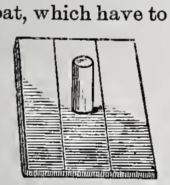
The Darby (Fig. 3) is also made of hard pine, 4 feet 4 inches long by 4 inches wide, with one handle similar to the hawk handle, fastened on about one-fourth of the length



Plastering Tools.—Fig. 1.—Trowel.

from one end, and the other handle, a narrow strip, fastened with one edge flat on the darby and running lengthwise of it. The length of this strip is generally about 8 inches, but some plasterers prefer to have it extend nearly the whole length, for the purpose of stiffening it; but the length may be varied to suit the workman using it or the nature of the work to be done.

The Float (Fig. 4) is composed of a good wooden handle, similar to a trowel handle (but all wood and attached at both ends), fastened on the back of a piece of hard pine board, 4 inches wide by 10 or 12 inches long, and about three-fourths of an inch thick. As the face of a float soon wears off and becomes thin, it is best to fasten the handle to a cleat and dovetail the cleat into the back of the face-piece, and keep several of these face-pieces on hand, and when one wears out throw it away and take another, thereby avoiding the inconvenience of nails in the face of the float, which have to be frequently



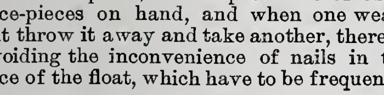
Plastering Tools.—Fig. 2.—Hawk.

driven in to prevent their scratching and marring the wall while floating it down.

The Scratcher (Fig. 5) is made of short slats, nailed to cross-pieces and sharpened at one end. The slats should be about 1 inch apart, and the width of the scratcher about 1 foot, and the middle slat should be long enough so that the opposite end from the point can be used for a handle.

The Straight-Edge is pine, 6 feet and upward in length, with a face-piece 2½ inches wide, nailed upon a back-piece 5 inches wide in the middle and tapering to 1 inch at each end, and is generally made of three-fourths inch lumber.

The Long Rod is a planed board, generally 6 inches wide and 1 inch thick, with a length nearly equal to the hight of the rooms in which it is to be used. These rods are often



Plastering Tools.—Fig. 3.—Darby.

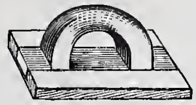
made with a spirit plumb, inserted like the plumb in a spirit level.

The Angle Block is used by many plasterers, and consists simply of a block from 10 to 14 inches in length and 3 inches in thickness, with its angles right angles, and with a handle on the opposite angle from the one which is to touch the angle of the wall. The handle and the block are generally made in one piece.

The Pointer (Fig. 6) is a small, pointed trowel, the same shape as a brick trowel, with a blade of good springy steel, and only about 4 inches long. It is used by plasterers principally to clean tools and to work where a larger tool could not be used.

The Plasterer's Brush (Fig. 7) is a kalsomine brush, 7 or 8 inches wide, made of good bristles, bound with zinc or other metal, and the wood between the two halves of the bristles should be shaved to an edge, so that water will not collect in it and run out as soon as the brush is inverted. The handle is short and permanently fixed in the head of the brush.

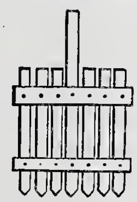
The Paddle is a small, flat wooden tool,



Plastering Tools.—Fig. 4.—Float.

used by some workmen to fill the angles when finishing. It is 4 or 5 inches long, and from 2 to 2½ inches wide, with one end shaved to an edge and the other used as a handle.

Molds are of a variety of kinds. Molds for full relief ornaments are generally made in sections and put together, leaving an orifice in which to pour the plaster. Molds for bass-reliefs are made in one piece. They are made of plaster and glue or beeswax. Molds for linear moldings are made of a metal plate, cut to fit the molding, and fastened to a wooden backing for the pur-



Plastering Tools.—Fig. 5.—Scratcher.

pose of stiffening the mold. Center molds of this kind are attached to an arm and swing on a pivot. Cornice molds (Fig. 8) of the same description are made with shoes, to slide upon strips and screeds, and the blade or cutting-plate is now set into the bed-pieces at an angle of 45 degrees, so that it will run into the angle and make the miter.

Mitering Tools are used to make miters by hand where they cannot be easily made with the mold, and also to finish out breaks or balks in the molding where the mold is taken off, &c. They consist of a number of steel and wooden tools, of a variety of shapes and sizes, among which is the mitering rod, a flat tool one-eighth of an inch thick, 3 inches wide and about 1 foot long, with one edge sharp and one end beveled to an angle of about 30 degrees, with the acute angle at the sharp edge.

Trammels are used to attach molds to, for

Plastering Tools.—Fig. 6.—Pointer.

the purpose of running moldings in the forms of ellipses (Fig. 9), arches and various other curves, and are made according to the particular use they are required for.

The Mortar Hod is made by nailing together the edges of two boards, about 1 foot wide by 2½ feet long, at right angles, forming a trough-shaped box; an end-piece is then nailed on one end, and the boards are beveled or rounded toward the angle at the other end; then a handle is attached, a little forward of the middle, and a flat block or pad is placed just behind the handle, to rest upon the shoulder of the carrier.

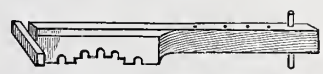
Scaffolds for plasterers' use are generally made with tresse's of hight and length to correspond with the rooms to be plastered, and covered with planks of a length to correspond with size of rooms. But for very high apartments, such as churches, &c., it is customary to make temporary scaffolds by placing scantlings on end for standards, and nailing cross-pieces to them, upon which the planks rest. The standards should be well braced, to prevent their falling over.

Mortar Boards are generally made about

Plastering Tools.—Fig. 7.—Brush.

3½ feet square, of boards 1 inch thick, with close joints. The boards are nailed on two solid cleats, and the cleats should be placed far enough apart to admit the head of a barrel between them, as the board is often placed upon a barrel when used. Boards used for finishing are frequently made larger than the ordinary mortar board.

The Slack Box should be a solid box made of 1-inch boards, and should be at least 8 feet long, 3 feet wide and 1 foot deep ; but



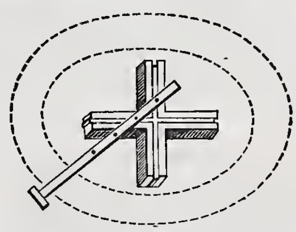
Plastering Tools.—Fig. 8.—Center Mold.

a larger one is often more serviceable. At one end of the box there should be a slide gate with slats nailed on, to prevent the lumps and sediment from passing through when the gate is raised to run off the lime.

Mortar Beds are generally made of boards, and of size and shape to suit circumstances, but not usually more than 1 or 2 feet deep. The sides and ends should be strongly fastened together, as they have to sustain a heavy pressure.

The Sand Screen is a long, narrow screen, usually about 2 feet wide by 6 feet long. It is leaned up at an angle of about 45 degrees, and the sand thrown against it sifts through as it slides down.

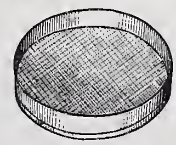
The Putty Sieve (Fig. 10).—The "putty"



Plastering Tools.—Fig. 9.—Trammel.

for finish coat is usually strained through an ordinary flour or meal sieve, which answers every purpose.

Oak Made to Resemble Ebony.—The *Revue Industrielle* states that oak may be dyed black and made to resemble ebony by the following means : Immerse the wood for 48 hours in a hot saturated solution of alum, and then brush it over with a logwood decoction, as follows : Boil one part of best logwood with ten parts of water, filter through linen, and evaporate at a gentle heat until the volume is reduced one-half. To every quart of this add from 10 to 15 drops of a saturated neutral solution of indigo. After applying this dye to the wood, rub the latter with a saturated and filtered solution of verdigris in hot concentrated acetic acid, and repeat the operation until a black of the



Plastering Tools.—Fig. 10.—Sieve.

desired intensity is obtained. Oak stained in this manner is said to be a close, as well as a splendid, imitation of ebony.

Watch the man who shows most energy when the bell rings to quit.

ARCHITECTURE.

A Frame House, Costing About $2500.

[Design furnished by Messrs. Bicknell & Comstock, New York.]

The design which we present to our readers this month, is that of a house suitable alike for country or suburban residence or for a farm house. More attention has been paid to obtaining large and commodious rooms than to the space of ground which the building covers. Cost has been carefully considered, and care has been exercised to obtain good architectural effects.

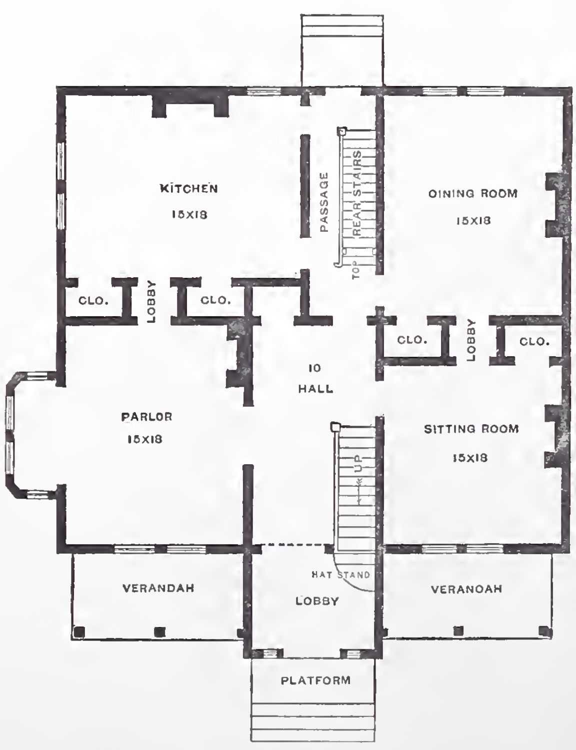
A Frame House.—Fig. 1.—Front Elevation.—Scale, 1/8 Inch to the Foot.

The style of the building—so far as an edifice of this character can be said to have a distinctive style—may be described as domestic Gothic, somewhat after the manner of the Pugins or Sir Charles Eastlake. It is a story-and-a-half building, with a very large gabled roof having heavy projections. The principal or first-floor plan is laid out in accordance with correct ideas of convenience. A veranda is placed on each side of the front entrance. The parlor is arranged with a large alcove bay window, and the entrance to it is provided with sliding doors. The sitting-room is convenient to the dining-room, with which it is connected by a passageway between closets.

The second floor is arranged in such a manner as to provide chambers with an abundance of closets. The connections between the chambers are conveniently arranged upon a plan in quite general use in both city and country houses.

The bath and water-closet are in the rear, which is not only a convenient location for use, but an enonomical one for the plumbing. Throughout the arrangement, the greatest care has been exercised to obtain a desirable number of apartments of convenient location and arrangement, with the least expenditure of money.

A noticeable peculiarity of this design will be observed in the plan of the front stairway and the halls which it connects. The usual arrangement is reversed. The stairs rise toward the front of the house, instead of away from it. A window is placed in the upper hall, so as to throw ample light upon the stairway and also into the lower hall.



A Frame House.—Fig. 2.—First-Floor Plan.—Scale, 1-16 Inch to the Foot.

This arrangement in the lower hall affords the opportunity for placing the doorways of the parlor and sitting-room nearly in the center of the space, and directly opposite each other. Other advantages from this arrangement are apparent in the upper hall, which will be readily noticed upon inspection of the second floor plan.

The general effect of the front is hightened by the use of colored glass in the upper portions of the windows.

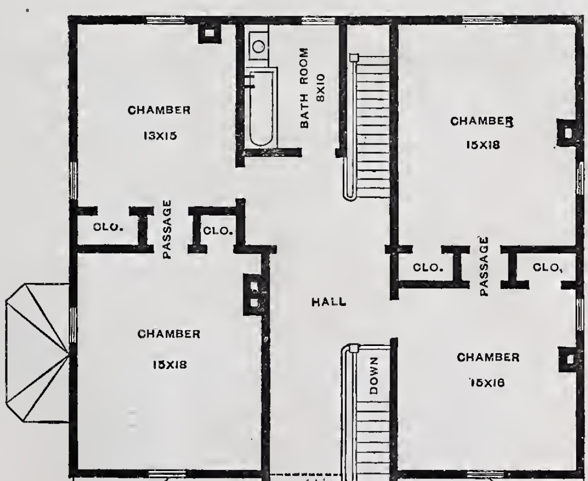
The building is estimated to cost at present prices of materials and labor, according to the section of country, from $2500 to $2800. This figure may be varied somewhat by the character of the inside finish, which, as above estimated, is intended to be of average quality and workmanship, but which could be either cheapened or increased in cost at pleasure.

The details of the building are neat in appearance and appropriate in their character, and of form and construction suitable for economical working. They are so fully illustrated in our engravings as to make particular mention of each altogether unnecessary.

Houses for Workingmen.—The Chicago *Tribune* mentions a building scheme, which the Union Mutual Life Insurance Company propose to carry out upon some of their vacant property in the southern part of Chicago. The plans are the work of Messrs. Wheelock & Clay. The problem of building houses in a continuous block, and yet having to a great degree the appearance of isolation, is accomplished by a double court in front between each pair of houses. This feature, besides giving ample light and ventilation to all interior rooms, affords the architects an opportunity of displaying considerable variety in the treatment of their designs, not only of the exterior, but of the interior. The courts in the rear are quite similar to those in front.

leaving only a short line of party-wall between the two houses. As the courts are thus in pairs, they give double the amount of light, and yet the windows are so arranged that it is impossible to see from one into any other. Also, by an ingenious arrangement of the staircase in each alternate house, the front entrances are entirely separate and come in regular succession. These houses are to be of two stories, with cellar and attic; in the cellar are the laundry, furnace-room, storerooms, &c. Each house has a parlor, hall, and staircase-hall, dining-room, kitchen, &c., upon the first floor; part of them have a library in addition, all well lighted and ventilated. The main stairs are at the rear of the parlor, and not exposed to view upon entering or leaving the entrance halls, which are to have tile floors, open and unobstructed.

Frame House.—Fig. 3.—Side Elevation.—Scale, ⅛ Inch to the Foot.



A Frame House.—Fig. 4.—Second-Floor Plan.—Scale, 1-16 Inch to the Foot.

Whitewashes.—Wash for fences: One-half bushel lime, slaked to putty; two pounds zinc white, dissolved in water; one pound common salt, dissolved in water. If color is wanted, color to suit, and set the color with one tablespoonful of powdered alum. Wash for wood, brick, stone or plastering: Slake about one peck of lime in hot water, keeping it covered during the slaking process; strain and add one-half peck salt dissolved in water, one and a half pounds ground rice put in boiling water and boiled to a thin paste, one-quarter pound powdered whiting and one-half pound clear glue, dissolved in warm water. Mix well together; let it stand for several days, and apply hot. Color to suit. Coloring should be put in before the glue and paste. Another: Fifteen pounds of whiting; one-half pound fresh slaked lime, dissolved in skim milk. Color to suit. This wash becomes as hard as paint.

Application of Varnishes.

In varnishing flat surfaces, the varnishes are all applied like paint, with brushes that should be soft and perfectly clean. For spirit-varnishes, camel-hair pencils and brushes are used, the sizes of which vary from one-quarter to three-quarters of an inch in diameter, according to the size of the work. When the surfaces are very large, flat camel-hair brushes are used; but, from their comparative thinness, they scarcely contain a sufficient quantity of varnish to preserve the brush uniformly charged in passing over a large surface. Turpentine and oil varnishes require less delicacy; and flat brushes, made of fine soft bristles, are generally used, or sometimes ordinary painting brushes are employed; but they are rather harsh, and, owing to the adhesion of the varnish, the hairs are apt to be loosened and come out.

The varnishes should all be uniformly applied, in very thin coats, very sparingly upon the edges and angles, where the varnish is liable to accumulate; and a sufficient interval of time should be allowed between every coat for the perfect evaporation of the solvent, whether alcohol, turpentine, or oil. The time required for this depends partly on the kind of varnish employed, and partly on the state of the atmosphere; but, under ordinary circumstances, spirit varnishes generally require from two to three hours between every coat. Turpentine varnishes mostly require six or eight hours, and oil varnishes still longer—sometimes as much as 24 hours. But whatever time may be required, the second layer should never be added until the first is permanently hard, as, when one layer is defended from the air by a second, its drying is almost entirely stopped, and it remains soft and adhesive. Every precaution should also be taken to prevent any dust or loose hairs from the brush becoming accidentally attached to the varnish. Should this occur, they should be immediately removed before the varnish dries; otherwise they will require to be carefully picked out with the point of a penknife, and the surface of the varnish leveled with fine glass paper, prior to the application of the next coat.

In using spirit varnishes, it is at all times of the first importance that particular attention should be bestowed upon carrying on the varnishing in a dry atmosphere, as all solutions of resins in alcohol are precipitated by the addition of water, not only as visible moisture, but even as vapor, which is at all times deposited by the atmosphere at a reduced temperature in the form of invisible dew, and in this state it precipitates the rosin in the thin coat of varnish, and gives the surface a milky, opaque or clouded appearance, when the varnish is said to be chilled. But this effect is frequently produced even on a warm and apparently fine summer day, when the atmosphere happens to be more than usually charged with moisture. This is a frequent stumbling block in varnishing, and is only to be obviated by carrying on the process in a room sufficiently warm to keep the moisture suspended in the air until the solvent has entirely evaporated, and left the rosin as a thin glassy coat, but little altered, in a chemical point of view, from its primary state of fragment, flake or grain, and entirely unacted upon by water, upon which circumstance the brilliancy and defensive value of the varnish depend.

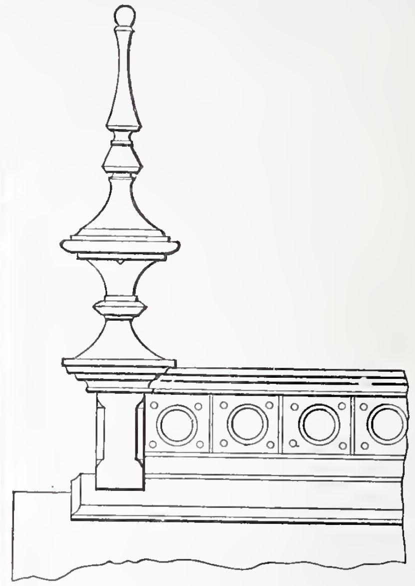
Not only should the room be sufficiently heated, but all currents of cold air must be avoided ; as cold drafts from the interstices of the door or window, if suffered to pass over the recently varnished surface, are quite sufficient to dull the varnish wherever they extend. When the varnish has been chilled, the brilliancy and clearness may frequently be restored by giving the chilled surface another thin coat of varnish, taking care to avoid the causes of the former failure, and immediately holding the varnished surface at a moderate distance from a fire, so as to warm it sufficiently to partially redissolve the chilled coat ; but care is necessary to avoid heating the varnish so much as to raise blisters, which would spoil the surface, and no remedy would remain but to rub off the entire coat of varnish with glass paper and recommence the process.

The temperature generally preferred for the varnishing room is about 72° F. ; but a few degrees more or less are not very important. The works to be varnished should be kept in the room for a few hours before varnishing, in order that they may acquire the same temperature as the atmosphere ; and the surfaces should be smoothed with fine glass paper to remove all traces of moisture or grease. If it should be necessary to stop any minute holes in the wood before varnishing, it should be done with some of the gums or with wax ; or at all events nothing containing oil or grease should be employed.

An ordinary preserve jar is frequently used for containing the varnish, and is sufficiently suitable ; but it is desirable to have a wire or string fixed across the top for reducing the quantity taken up by the brush, which is wiped against the wire every time that it is dipped into the varnish. The quantity of varnish poured into the jar should be sufficient to nearly cover the hairs of the brush, in order to keep it soft. Too small a quantity of varnish is liable to thicken rapidly by evaporation, which should at all times be prevented, as far as possible, by keeping the vessel closely covered when not actually in use. Should the varnish, however, become too thick, it may be readily thinned by the addition of spirit of wine ; and for good work, it is more desirable to apply an increased number of thin coats than to use the varnish when too thick, as the surface is then almost certain to appear irregular and full of lines.

In applying spirit varnish, some little tact and expedition are necessary, in order to spread the varnish uniformly over the surface before it becomes too much thickened by evaporation, or it will exhibit a very irregular surface when finished. If the surface does not exceed a few inches square, no material difficulty is experienced, as the whole may be brushed over two or three times before the varnish becomes too thick ; but surfaces containing 2 or 3 square feet present much greater difficulty, as it is necessary that the varnish should be sufficiently worked with the brush to exclude all minute air bubbles, which would spoil the appearance of the work, and can seldom be entirely removed until just before the varnish is becoming too thick to flow or spread uniformly after the brush has passed over it.

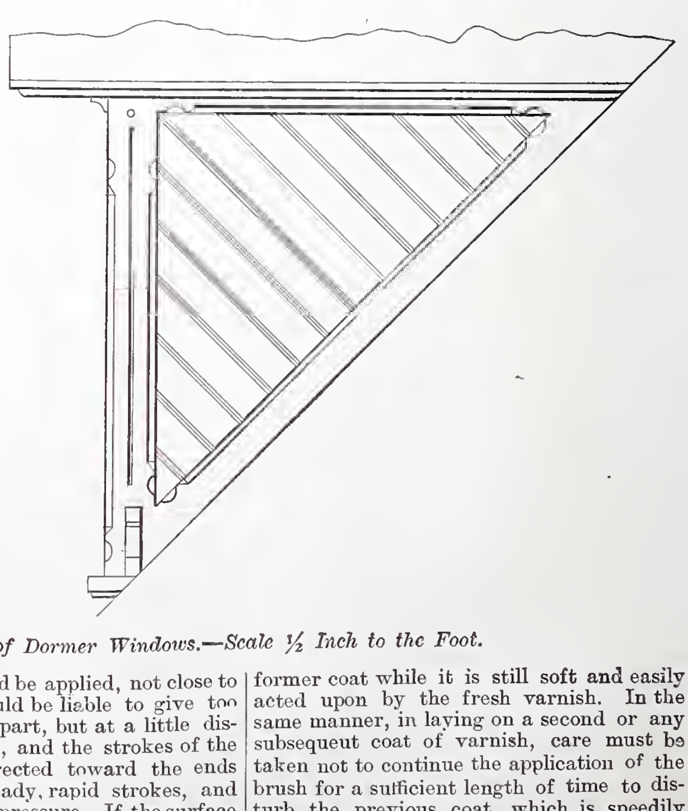
In first placing the brush on the surface, it should be applied, not close to the edge, which would be liable to give too thick a coat at that part, but at a little distance from the edge, and the strokes of the brush should be directed toward the ends alternately, with steady, rapid strokes, and only very moderate pressure. If the surface is small, the whole may be passed over at one operation, and then the brush may be returned to the edge at which it was first commenced, and it may be passed over the surface in the same manner a second or third time, to distribute the varnish uniformly and work out the air bubbles. Sometimes, in small surfaces, the second series of strokes is made at right angles with the first, in order to distribute the varnish more equally, and the third is laid on in the same direction as the



A Frame House.—Fig. 7.—Detail of Finial and Cresting.—Scale, ¼ Inch to the Foot.

first ; but, unless this is done expeditiously and equally, it leaves cross lines, which injure the appearance of the work.

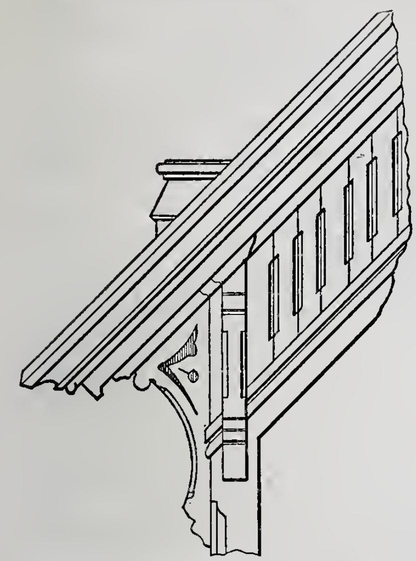
Large surfaces are more difficult, as the varnish thickens too rapidly to allow of the entire surface being covered at one operation ; they must, therefore, either be worked gradually from the one edge to the other, as in laying a tint of water-color, or the varnish must be applied upon separate portions successively ; but it is rather difficult to join the portions without leaving irregular marks. It may, however, be successfully executed by thinning off the edges of the first pieces, and allowing the adjoining portion to overlap also by thinning off the edge with light strokes of the brush, made in the same direction as those on the finished portion ; but some care is required to avoid disturbing the former coat while it is still soft and easily acted upon by the fresh varnish. In the same manner, in laying on a second or any subsequent coat of varnish, care must be taken not to continue the application of the brush for a sufficient length of time to disturb the previous coat, which is speedily softened by the fresh varnish ; and if the application of the brush were continued too



A Frame House.—Figs. 5 and 6.—Details of Dormer Windows.—Scale ½ Inch to the Foot.

long, it would be disturbed and give the work an irregular or chilled appearance.

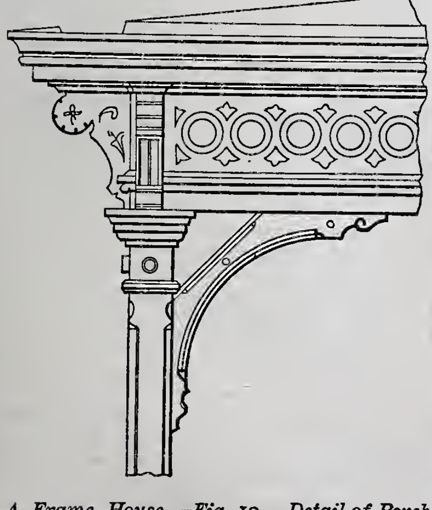
Wood and other porous surfaces absorb a considerable portion of the first coat of varnish, which sinks in deeper at the softer parts and raises the grain of the wood in a slight degree. A second coat is generally necessary to fill up the pores uniformly, and



A Frame House.—Fig. 8.—Detail of Main Cornice.—Scale, ½ Inch to the Foot.

sometimes even a third is required. The work is then rubbed smooth with fine glass paper, and, if the varnish is not to be polished, two or three coats more generally suffice to finish the work, as the thickness of varnish should not be too great, or it is liable to crack or chip.

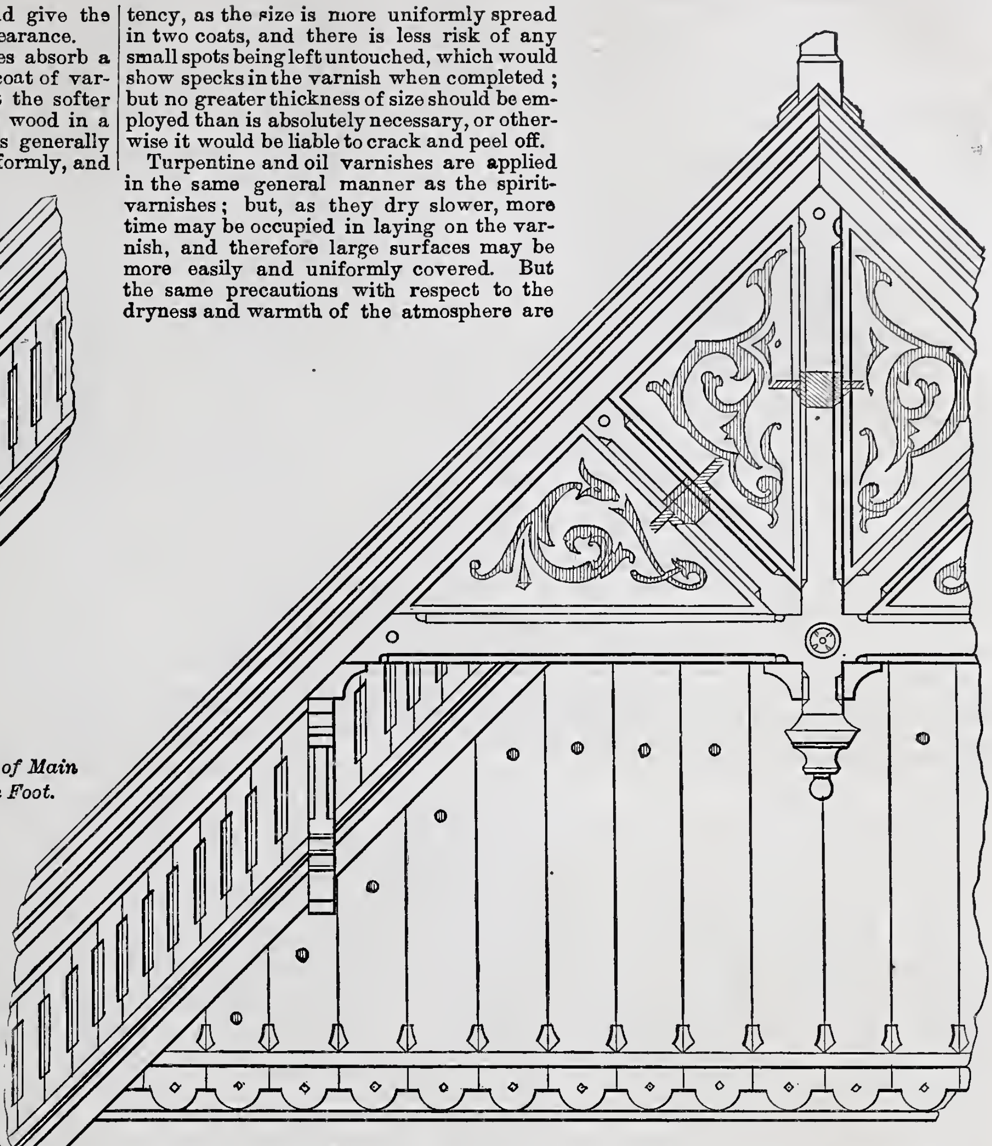
With the view of economizing the varnish, porous surfaces, such as wood and paper, are frequently sized over to prevent the varnish from sinking into the surface. For dark-colored works, thin size, made from ordinary glue of good quality, is generally used; but for light-colored surfaces, a lighter colored size is used, which is prepared by boiling white leather or parchment cuttings in water for a few hours, or until it forms a thin jelly-like substance, which is used in the tepid state; sometimes solutions of isinglass or tragacanth are employed in like manner. For wood, the choice, except as to color, is nearly immaterial, the object being only to prevent the absorption of the varnish by a very thin coat of some substance not solu-



A Frame House.—Fig. 10.—Detail of Porch Cornice.—Scale, ½ Inch to the Foot.

ble in the varnish; but for paper works, the parchment size is on the whole preferable, as it is almost colorless and tolerably flexible. It is better in all cases to use two coats of thin size than one of a thicker consistency, as the size is more uniformly spread in two coats, and there is less risk of any small spots being left untouched, which would show specks in the varnish when completed; but no greater thickness of size should be employed than is absolutely necessary, or otherwise it would be liable to crack and peel off.

Turpentine and oil varnishes are applied in the same general manner as the spirit-varnishes; but, as they dry slower, more time may be occupied in laying on the varnish, and therefore large surfaces may be more easily and uniformly covered. But the same precautions with respect to the dryness and warmth of the atmosphere are



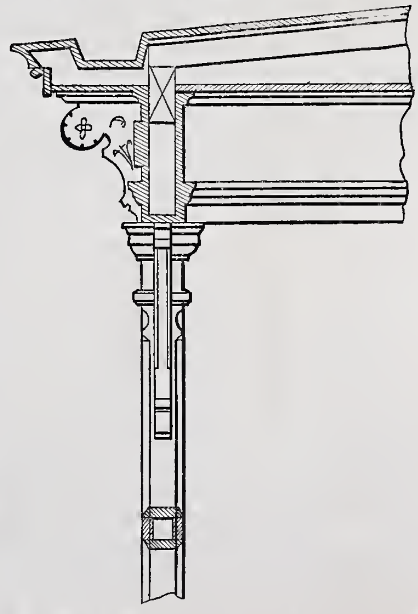
A Frame House.—Fig. 9.—Detail of Principal Gable.—Scale, ½ Inch to the Foot.

likewise desirable when it is wished to produce a brilliant surface.

Keys and Locks.

A writer in the *Magazine of Art* gossips as follows about keys and locks:

The history of keys abounds with interesting matter, and takes us back almost to the beginning of civilization. The exact place and date of their first use has not yet been determined, but their origin has been variously attributed to Egypt, Phœnicia and Greece. We find in Homer's "Odyssey" a simple appliance in the shape of a leathern thong inserted through a hole in the door, which, with the help of a ring or hook attached to it, would fasten or unfasten from the outside a bolt within. This was probably the precursor of the key. Those who have examined Dr. Schliemann's famous collection will not have failed to notice a very ancient fragment of bronze, somewhat in the form of a key, which is supposed to have secured nothing less than the Trojan treasure itself. But when we come down to Roman times, we arrive at a period in which locks and keys were established in constant use. It was a general custom for a Roman bride, on first entering her husband's house, to be presented with the keys of the household, except that of the cellar, which, prudently or imprudently, was always left in the custody of the husband. The museums of Europe possess manifold specimens of this epoch, which all bear a strong ancient character, though differing in many varieties of pattern. They are generally made of bronze, but sometimes occur also in iron—or rather, perhaps, the former metal has lasted the longest. Unfortunately, the locks to which they belonged, having been made chiefly of iron, have not withstood decay, and so do not enable us to judge of their mechanism. But the bronze keys are not unfrequently found in a very perfect condition, and the evidence of their construction is sufficient to show that the handiwork of the Roman locksmith was not unworthy of comparison with that of our



A Frame House.—Fig. 11.—Section of Porch Cornice.—Scale, ½ Inch to the Foot.

own time. Many have been discovered in London itself, some of which may be seen at the Guildhall Museum, and specimens have not been wanting among the *scavi* at Pompeii and Herculaneum.

The Sanitary Care of Premises.

The following paper was prepared by Mr. J. C. Bayles, at the request of the Citizens' Health Association of Orange, N. J. It will be found to contain suggestions of value to many of our readers:

We are now approaching the season of hot days and damp nights, when a due regard for health—to say nothing of comfort and convenience—demands that something like intelligent attention be given to the sanitary care of our houses, grounds and outbuildings. The ash piles and garbage heaps which accumulate unnoticed during the winter season, make themselves known during the first warm days of summer. Like the rattlesnake, these accumulations of refuse give warning before they strike with their envenomed fangs, and if we disregard this warning, which comes to us in the sickly odor of incipient decomposition, we have ourselves to blame if it brings evil upon us. For this reason I have prepared a few notes on the sanitary care of premises in rural neighborhoods, based chiefly upon the results of a somewhat varied experience in dealing with and correcting evils most often encountered in the houses and grounds of people in comfortable circumstances, who preserve at least the outward semblance of cleanliness and order. Even among our own membership there is reason to fear that many give too little attention to evils which would be noticed by the careful sanitary inspector, poking about the corners of back yards and in places not visible from parlor or dining-room windows.

Cleanliness.—Obviously, the first condition of healthfulness is cleanliness, and its best and most effective agents are the broom, the shovel and the scrubbing brush. How, when and where those implements should be used, the householder must determine for himself. I can only say in a general way, that anything which can be classed as "dirt" should be put where it will cease to be dirt. Bones, organic refuse and decaying animal or vegetable matter of all kinds should be burned, buried or composted—preferably the latter, as they will make excellent manure and prove a source of profit.

Garbage.—In the country there is no excuse for conserving garbage *as* garbage. In the city those twin censers in the temple of Cloacina, the "swill pail" and the "ash barrel," are a necessity; in the country we can dispense with them. If "swill" is saved as an act of charity to accomodate the swineheards who come to carry it away, see that a metallic vessel is used to hold it, that it is emptied and washed out daily, and that it is given the benefit of plenty of sunshine. A wooden pail or firkin is conspicuously unsuitable for this purpose, and should never be used. There are but few things in the waste of a house which enter the garbage receptacle in a state of decomposition, and when such a receptacle *stinks*—excuse the term—it shows neglect.

Privies.—The privy vault next invites attention, although it cannot be said to be an inviting subject for discussion. If offensive, as it is almost certain to be, order it cleaned out and disinfected. This done, see that enough clean, dry earth is thrown in from time to time—say three or four times a week—to prevent further cause of nuisance. If the privy cannot be abolished altogether, I would advise a tight vault, made so as to exclude surface water, and a plentiful use of earth. An earth closet is much more decent, and in every way better, than a privy vault can ever be made. In any case the dependence of a family should never be upon an outdoor privy of any kind. If you can do no better, put an earth-closet in one corner of the cellar for the use of women and children in wet or cold weather. It will prove an economy in doctor's bills. The habit of constipation induced by irregularity, even when the most abundant provision is made for the convenience of families, is one of the most fruitful causes of sickness in this country.

Cellars.—The sanitary care of a house should always extend to the cellar. Remember that this is under your house, and that between you and it there is seldom anything more than a floor laid rather loosely, as the rule. Keep your cellar as clean as your parlor. If wet, have it drained, and, if you can, provide it with floor and sides as tight as a bottle. The cost of doing this can be easily ascertained. Keep the cellar windows open most of the time and the walls well whitewashed. Lime is cheap and an excellent purifier.

Plumbing.—If your house is provided with what are called "modern conveniences"—that is, if it has water-closet, bath, wash basins, &c.—give some intelligent attention to the condition of the pipes and fixtures. This is no more necessary in summer than in winter—not so much, indeed, as open windows and doors give us better ventilation in summer than we get in winter; but plumbing should never be neglected at any time. See that every fixture is provided with a trap which will hold its seal, that the soil pipe is carried above the roof and left open at the top, and that your cesspool, if you have one, is kept clean and abundantly vented. Do not imagine that you can hold in suppression the gases which form within it. They will come out, and it is the safest policy to provide them an outlet where there is least danger of harm from them. A wooden chimney, 8 or 10 inches square and 4 to 5 feet high, will answer as a cesspool vent. It will discharge its offensive gases above the heads of children, and probably give no offense, as, with an outlet always open, and more or less constant agitation within from the inflow of waste water, there will be no accumulations of foul air to blow out.

Water-Closets.—If your indoor closet is of the kind known as the "pan closet"—the kind commonly used—see that the inside of the receiver, or containing vessel, is kept clean. People often suffer great discomfort from a foul-smelling closet, attributing the cause of the trouble to bad drainage, when the nuisance exists chiefly within the closet itself. If any odor is noticed which cannot be corrected by abundant flushing, or which is observed when the handle is raised, send for your plumber and direct him to burn out the receiver. Never tolerate any kind of a bad smell until all efforts to correct the cause of it have failed. Remember the simile of the snake, already used, and if you detect a bad odor, heed it as you would a rattle in the grass beside your path. It is a danger signal.

Disinfection.—When everything has been done in the way of cleansing and purification which is possible with broom, shovel, clean water, whitewash, fresh air and sunshine, it is sometimes necessary to have recourse to chemical disinfection as a means of correcting unwholesome conditions. As there exists a very general misapprehension, outside of professional circles, with regard to what are known as disinfectants and their uses, I shall discuss the subject briefly and in a very practical way.

As commonly employed, the use of so-called disinfectants savors strongly of superstition. We may compare it to the incantations of the savage, by which he hopes to drive away or appease the demon of disease. Many people believe that to correct one bad smell it is only necessary to make another of a different kind by chemical compounds. If they can pervade a place with the odor of phenol or chlorine, they fancy they have exorcised the demon of dirt and corrected the worst conditions. This is a mistake.

Disinfection should not be attempted until everything has been done to correct unhealthful conditions which is possible by mechanical means. For example, there is no use attempting to disinfect a privy vault half full of reeking filth. It cannot be done. First cleanse, then disinfect, if necessary.

When, for convenience or any other reason, it is desirable to disinfect before cleansing, we should remember that only partial success is possible, and that the best results we can attain are but temporary. We may compare the action of a disinfectant to the legal document known as a "stay of proceedings," which does not reverse the verdict of the court nor free the object of the law's penalties from the consequences of crime, but grants a brief time in which to make preparations for an appeal. A disinfectant is a stay of proceedings in this same sense. It arrests decomposition and grants a brief respite from the infliction of the penalties incurred through the infraction of nature's immutable laws. If we let this season of respite pass without availing ourselves of the chance it gives us to comply with nature's requirements, the penalties we seek to avert will be imposed upon us.

Carbolic Acid.—A good disinfecting solution is made of one part carbolic acid to from 50 to 100 parts soft water. This must be used freely, its efficacy depending largely upon the amount employed.

Carbolic Acid and Copperas.—For privies, cesspools, drains, sewers and vessels into which the discharges of the sick are evacuated, add copperas to the carbolic acid solution, in the proportion of 8 or 10 pounds copperas to five gallons of solution.

Quick Lime.—As an absorbent of moisture and putrid fluids, such as stable drainage, quicklime is good. Fresh stone lime should be broken into small pieces, the smaller the better, and sprinkled on the places to be made dry. In using limewash, it should be remembered that the benefits atteuding the free employment of what is known as whitewash, do not attend the use of kalsomine, as it is called. The addition of whiting, glue size or other foreign matter, neutralizes the disinfecting power of the lime.

Chloride of Lime.—Chloride of lime is of doubtful value, its disinfecting action being insufficient and very transient.

Charcoal.—Charcoal is invaluable as an absorbent of foul gases. It should be fresh and dry.

Patented Disinfectants.—Of the several patented disinfecting solutions in the market, it is difficult to speak positively. Some are good, others useless—generally speaking, they cost a great deal more than carbolic acid, copperas or lime, and are not worth the difference. The cheaper the material used the better, as it is likely to be used the more freely.

Aerial Disinfection.—As commonly practiced in sick rooms, and in houses where contagious diseases have appeared, aerial disinfection is probably worse than useless, since it gives rise to a false sense of security. This, however, is a question which it is not necessary to discuss at this time.

Too Much Shade.—In conclusion, permit me to offer a suggestion which is worthy of consideration, but which will be distasteful to many—avoid too much shade. I know the luxury of sheltering trees and interlacing vines, but these are often dangerous. The sunshine, which comes to us with God's blessing interwoven with its rays, is the best disinfectant of all. Let us give it a chance to work for us. The greatest favor which Alexander could do the wise old cynic, Diogenes, was to step aside and let the sunshine fall into the tub which gave him shelter. There was more than an ill-natured snarl in this answer. Let us, who boast a larger knowledge and a more comprehensive philosophy, be not less wise than the ancients in matters which concern us so deeply as this. More sunshine would lift many an unhealthy dwelling out of the Valley of the Shadow of Death, and do more to purify and sweeten its environments than all that science could suggest. Sunshine is rarely appreciated, or we would not so desire the growth of trees and vines to come between us and it. Knowing, as we do, what science has taught us of the wonders of sunshine—how all terrestrial phenomena are dependent upon its light, heat and actinic force—we should love it better than we do, and feel, with the poet,

> "That, had the world no joy but this—
> To sit in sunshine calm and sweet—
> It were a world too exquisite
> For man to leave it for the gloom,
> And dull, cold shadow of the tomb."

A Curious Relic.—The six-panel door now doing service in the depot front at Pennsville, Pa., shows the style of work of 100 years ago. The door spoken of is one that was taken from the front entrance of the Orthodox Friends' house of worship, built in 1797. It is 4x8 feet in size, and 1¼ inches thick, having a rim of oak bolted fast to it with four iron bolts. The molding to framework and panels is worked solid. The peculiar style and preservation of the work make it a decided curiosity.

Names of Dressed Stones.

All stones used in building come under one of three classes, viz.:

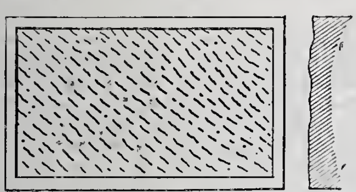
1. Rough stones that are used as they come from the quarry.
2. Stones roughly squared and dressed.
3. Stones accurately squared and finely dressed.

In practice, the line of separation between them is not very distinctly marked, but one class gradually merges into the next:

1. UNSQUARED STONES OR RUBBLE.—This class covers all stones which are used as they come from the quarry, without other preparation than the removal of very acute angles and excessive projections from the general figure. The term "backing," which is frequently applied to this class of stone, is inappropriate, as it properly designates material used in a certain relative position in a wall, whereas stones of this kind may be used in any position.

2. SQUARED STONES.—This class covers all stones that are roughly squared and roughly dressed on beds and joints. The dressing is usually done with the face hammer or the ax, or in soft stones with the tooth hammer. In gneiss it may be necessary to use the point sometimes. The distinction between this class and the third lies in the degree of closeness of the joints which is demanded. Where the dressing on the joints is such that the distance between the general planes of the surfaces of adjoining stones is one-half inch or more, the stones properly belong to this class.

Three subdivisions of this class may be



Dressed Stones.—Fig. 1.—Rough Pointed.

made, depending on the character of the face of the stone:

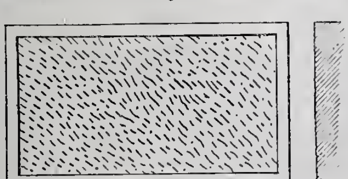
(*a*.) Quarry-Faced Stones are those whose faces are left untouched as they come from the quarry.

(*b*.) Pitched-Faced Stones are those on which the arris is clearly defined by a line beyond which the rock is cut away by the pitching chisel, so as to give edges that are approximately true.

(*c*.) Drafted Stones are those on which the face is surrounded by a chisel draft, the space inside the draft being left rough. Ordinarily, however, this is only done on stones in which the cutting of the joints is such as to exclude them from this class.

In ordering stones of this class the specifications should always state the width of the bed and end joints which are expected, and how far the surface of the face may project beyond the plane of the edge. In practice the projection varies between 1 inch and 6 inches. It should also be specified whether or not the faces are to be drafted.

3. CUT STONES.—This class covers all squared stones with smoothly-dressed beds and joints. As a rule, all the edges of cut stones are drafted, and between the drafts the stone is smoothly dressed. The face,



Dressed Stones.—Fig. 2.—Fine Pointed.

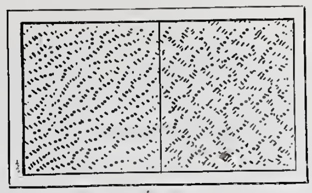
however, is often left rough when the constructions are massive.

In architecture there are a great many ways in which the faces of cut stone may be dressed, but the following are those that will usually be met in engineering work:

Rough Pointed.—When it is necessary to remove an inch or more from the face of a stone, it is done by the pick or heavy points, until the projections vary from ½ to 1 inch. The stone is then said to be rough pointed. (Fig. 1.) This operation precedes all others in dressing limestone and granite.

Fine Pointed.—If a smoother finish is desired, rough pointing is followed by fine pointing (Fig. 2), which is done with a fine point. It is only used where the finish made by it is to be final, and never as a preparation for final finish by another tool.

Crandalled.—This is only a speedy method of pointing, the effect being the same as fine pointing, except that the dots on the stone are more regular. The variations of level



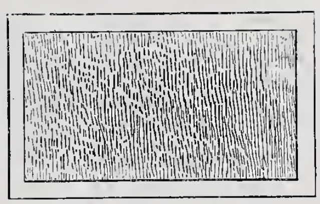
Dressed Stones.—Fig. 3.—Crandalled.

are about ⅛ inch, and the rows are made parallel. When other rows, at right angles to the first, are introduced, the stone is said to be cross-crandalled. (Fig. 3.)

Axed or Pane Hammered and Patent Hammered.—These two vary only in the degree of smoothness of the surface which is produced. (Fig. 4.) The number of blades in a patent hammer varies from 6 to 12 to the inch, and in precise specifications the number of cuts to the inch must be stated, such as 6-cut, 8-cut, 10-cut, 12-cut. The effect of axing is to cover the surface with chisel marks, which are made parallel as far as practicable. Axing is a final finish.

Tooth Axed.—The tooth ax is practically a number of points, and it leaves the surface of a stone in the same condition as fine pointing. It is usually, however, only a preparation for bush hammering, and the work is then done without regard to effect, so long as the surface of the stone is sufficiently leveled.

Bush Hammered.—The roughnesses of a stone are pounded off by the bush hammer, and the stone is then said to be "bushed." (Fig. 5.) This kind of finish is dangerous on sandstone, as experience has proved that sandstone thus treated is very apt to scale. In dressing limestone which is to have a bush-hammered finish, the usual sequence of



Dressed Stones.—Fig. 4.—Pane Hammered.

operations is: 1st, rough pointing; 2d, tooth axing; 3d, bush hammering.

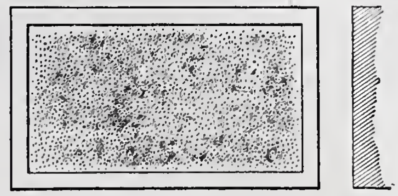
Rubbed.—In dressing sandstone and marble, it is very common to give the stone a plane surface at once by the use of the stone saw. Any roughnesses left by the saw are removed by rubbing with grit or sandstone. Such stones, therefore, have no margins. They are frequently used in architecture for string courses (Fig. 6), lintels, door-jambs, &c., and they are also well adapted for use in facing the walls of lock chambers, and in other localities where a stone surface is liable to be rubbed by vessels or other moving bodies.

Diamond Panels.—Sometimes the space between the margins is sunk immediately adjoining them, and then rises gradually until the four planes form an apex at the middle of the panel. (Fig. 7.) Such panels are called diamond panels, and in the case described, the panel is a sunk diamond panel. When the surface of the stone rises g adually from the inner lines of the margins to the middle of the panel, it is called a raised diamond panel. Both kinds of finish are common on bridge quoins and similar work.

To Stain Wood Black.—Boil 8¾ ounces of logwood in 70 ounces of water; add 1 ounce bluestone, and steep the wood for 24 hours. Take out, expose to the air for a long time, and then steep for 12 hours in a beck of nitrate of iron at 4° B. If the black is not fine, steep again in logwood liquor.

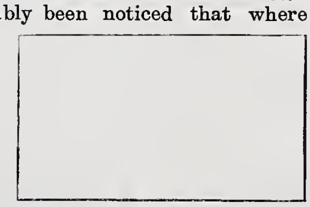
The Tarnishing and Rusting Metals.

Other metals besides iron are subjected to rust or corrosion; silver tarnishes on expos-



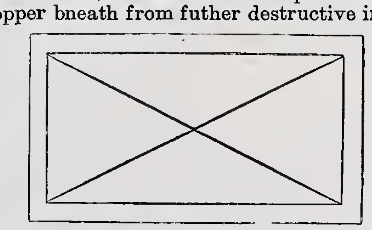
Dressed Stones.—Fig. 5.—Bush Hammered.

ure to air, but the agent which produces this is not oxygen, but sulphur. Silver does not oxydize when exposed to oxygen, but it very readily unites with sulphur if warmed with it. Sulphuretted hydrogen gas blackens silver at once, so that if a small piece of sulphide of iron be put on a shilling moistened with water, and a drop of hydrochloric acid be poured on the sulphide of iron, sulphuretted hydrogen gas will be set free, and the shilling will be spotted brown and black in a very short space of time. Now, sulphuretted hydrogen occurs in small quantities in the air, and its effect is to tarnish silver. It has probably been noticed that where silver



Dressed Stones.—Fig. 6.—Rubbed.

spoons are used in eating eggs the bowls become stained brown, and that it is very difficult to clean them. This brown tarnish is owing to the formation of sulphide, for eggs contain a large quantity of sulphur, which gives rise to their offensive smell when they "go bad," owing to the formation in them of sulphuretted hydrogen gas. A little diluted aquafortis will remove the tarnish from silver very rapidly. If this method be employed, the silver should be immediately washed thoroughly in water. Copper forms a rust which is usually green; this is not, however, an oxide, but a carbonate. Copper is readily tarnished in the presence of acids, especially the acid of vinegar; also in the presence of fats, so that copper cooking utensils should always be freed from grease, which promotes the rusting of the metal and so causes its introduction into food, where it never ought to be, as copper salts are very poisonous. The beautiful green tints of old bronze are due to the rusting of the copper, which is the principal constituent of bronze. But rusting in copper does not progress as it does in iron, so that a film of it protects the copper bneath from futher destructive influ-



Dressed Stones.—Fig. 7.—Diamond Panel.

ences. The same also is the case with lead; its rust is white, and, like that of copper, is a carbonate of the metal. When lead is once coated futher action is arrested, and it is well known that roofs have lasted for centuries. Gold and platinum do not rust at all, neither does aluminum bronze for watch-cases, pencil-cases, &c.

French Brick.—Experiments made upon French brick show that the resistance to breaking strain ranges from eight kilograms the square centimeter, for ordinary soft brick, to 20 kilograms for brown Burgundy bricks, which will also bear 110 to 150 kilograms before crushing.

JOINTINGS IN WOOD.

Scarfing, Fishing and Lapping.

It is not everywhere that timber can be found in sufficient length to stretch across the void which the carpenter has to cover. In such cases it is necessary for him to know how one piece of timber may be so joined to another for the purpose of lengthening it, that the two pieces, when joined, may be as nearly as possible equal in strength to one whole piece of timber of the same dimensions and length. This operation is of great service to the builder, and is technically called scarfing.

A scarf joint, therefore, may be defined as a joint formed by halving, notching or cutting away part of the ends of two pieces of timber, so that they will fit into each other and form a lengthened beam of the same size at the junction as elsewhere. The joint so formed is commonly called a scarf, and this term is also used to designate the part that is cut away from each piece of timber.

Besides the method of lengthening beams described above, there are two others in common use, namely, fishing and lapping. It also frequently happens in practice that joints are made which to some degree combine the principles of the three methods.

A fish-joint is one in which the ends are butted together, and an iron or wooden plate, or "fish-piece," is fastened on each

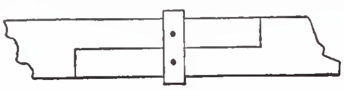


Fig. 1.

side of the joint by bolts passing through the beam. Fig. 9 of the accompanying cuts shows the simplest form of this kind of joint.

Lapping consists in laying one beam over the other for a certain length and binding them together with straps. If the joint is to stand a tensional strain, bolts are used. Lapping produces a very artless and clumsy tie-beam, but it is stronger than any that is more artificially made up. An example is shown in Fig. 8.

In forming joints, the object to be attained should always be kept in view, as that which is excellent for one purpose may be wholly unsuited to another.

Fig. 1 shows a form of scarfing suited to resist longitudinal compression. The band serves to hold the parts together.

Fig. 2 shows a very simple form of scarf, which is also well adapted to resist compres-

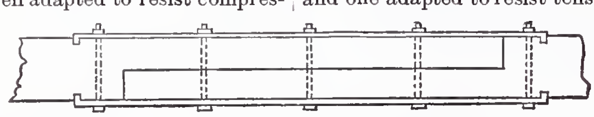


Fig. 2.

sion. The bearing surfaces are large. Its form does not help it to resist tension. Under a tensional strain it would depend entirely upon the bolts to hold it together. Nor is it adapted to a cross-strain, which would tear out the bolts. In this, and in like cases, it is best to put a continued plate of iron on each side of the joint for the heads of the bolts. The ends of the plates may be bent and let into the beams, as shown.

A modification of this scarf is sometimes formed, as seen in Fig. 15; but when intended to resist compression only, the keys are not required. The indentations at the

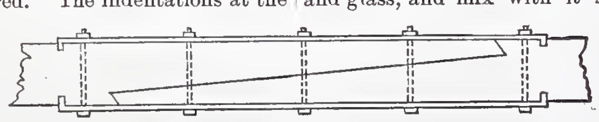


Fig. 3.

ends of the scarf serve to keep the pieces close side by side. The scarf shown in Fig. 4 is often used for beams to resist a tensional strain. It will hold without the aid of bolts or straps; but the triangle, which the shape of the cut presents, offers a weaker resistance to the pressure of the wedges than when the joint is left square, as shown in Fig. 14. In the joint shown in Fig. 4, a splayed angle, or "sally," is formed at each end to hold the pieces together side by side. The oblique surfaces of this scarf make it ill adapted to resist compression, and the angles which receive the splayed ends are liable to be split by their pressure.

Fig. 16 is a modification of Fig. 4, and is often used in preference to it.

The form of scarf shown in Fig. 14 is well

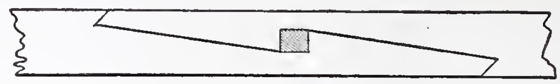


Fig. 4.

suited to resist both tension and compression, even independently of bolts and plates. It is, however, evidently weak in cross-section, on account of the timber being so much cut away, and therefore it is not fit to withstand a transverse strain. Wedges are required in the center only when bolts are to be added, in which case they are used to bring the parts of the joint up to their eventual position before the bolts are in-

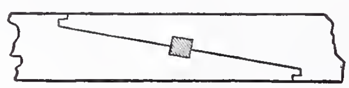


Fig. 5.

serted, so that there may be no violent strain upon the latter.

The joint shown in Fig. 15 is also adapted to resist both tension and compression. The tabling used in Fig. 14 is avoided, and the necessary resistance to tension is given by means of keys of hard wood, as shown, or pairs of wedges may be used to advantage.

Fig. 3 represents a very common combination, but one not so good as Fig. 2, because the bolts do not press the surfaces in a perpendicular direction. An oblique pressure, such as will have place in this example, will have more or less tendency to separate the joint, without any advantage in other respects.

In Fig. 5 is shown a modification of the form of joint seen in Fig. 16, which has already been described.

Figs. 6 and 7 show joints adapted to resist tension. They are designed for use in wall plates, &c., although much simpler forms are more satisfactory for general purposes.

Fig. 10 might be termed a combination joint. Fish plates are used, the upper one being tabled to the beam, while keys are placed between the beam and the lower one.

Fig. 11 shows a very simple form of joint and one adapted to resist tension.

Fig. 12 is a modification of the joint shown in Fig. 2. The iron plates are omitted and a key is used.

Fig. 13 shows the same joint as Fig. 11, the use of a key making the only distinction.

Fig. 16 shows a joint similar to that in Fig. 3, except that keys are used.

(To be continued.)

Very Hard Glass Cement.—For a glass cement, take $10\frac{1}{2}$ pounds of pulverized stone and glass, and mix with it $4\frac{3}{4}$ pounds of sulphur. Subject the mixture to such a moderate degree of heat that the sulphur melts; stir until the whole becomes homogeneous, and then run it into molds. When required for use it is to be heated to 248 degrees, at which temperature it melts, and and may be employed in the usual manner. It resists the action of acids, never changes in the air, and is not affected in boiling water. At 230 degrees it is as hard as stone.

Decorative Panels.

In the Early English style the panelings in stonework are varied; circles, trefoils, quatrefoils, cinquefoils, &c., and the pointed oval, are common forms; they are also frequently used in ranges like shallow arcades, divided by small shafts or mullions, the heads being either plain arches, trefoils or cinquefoils, and panels similar to these are often used singly. The backs are sometimes enriched with foliage, diaper work, or other carvings. Specimens of woodwork of the Early English style are not numerous. A common mode of giving the effect of ornamental paneling appears to have been by adding another thickness, molded and cut to the required shapes, upon the surface of plain boarding. In some churches pieces of plain and massive wainscoting are found with the panels of large size, and formed of upright boards with the edges overlapping each other, some of which may be of this date. In the Decorated style, wood paneling is frequently enriched with tracery, and sometimes with foliage also, or with shields

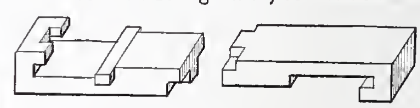


Fig. 6.

and heraldic devices. Some paneling varies considerably; it is very commonly arched, and filled with tracery like windows, or arranged in squares, circles, &c., and feathered or filled with tracery and other ornaments in different ways; shields are often introduced, and the backs of the panels are sometimes diapered. In the Perpendicular style the walls and vaulted ceilings are sometimes almost entirely covered with paneling, formed by mullions and tracery resembling the windows; and a variety of other panels of different forms, such as circles, squares, quatrefoils, &c., are profusely used in the subordinate parts, which are enriched with

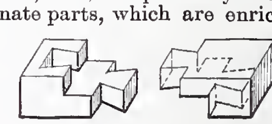


Fig. 7.

tracery, featherings, foliage, shields, &c., in different ways. In wood paneling the tracery and ornaments are more minute than was usual at an earlier period, and toward the end of the style these enrichments, instead of being fixed on to the panel, were usually carved upon it, and are sometimes very small and delicate. There is one kind of ornament which was introduced toward the end of the Perpendicular style, and prevailed for a considerable time, which de-

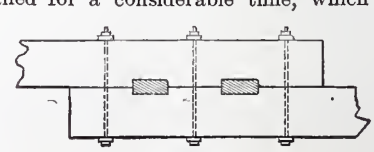


Fig. 8.

serves to be particularly mentioned. It consists of a series of straight moldings worked upon the panel, so arranged and with the ends so formed as to represent the folds of linen. It is usually called the "linen pattern." Many churches have wood ceilings of the Perpendicular style, and some perhaps of earlier date, which are divided into panels, either by the timbers of the roof or by ribs fixed on the boarding; some of these are highly ornamented, and have probably been enriched with painting. After the expiration of Gothic architecture, paneling in great measure ceased to be used in stonework, but was extensively employed in wainscoting and plaster work. It was sometimes formed in complicated geometrical patterns, and was often highly enriched with a variety of ornaments.

The revived taste for the later styles above mentioned, renders a practical knowledge of their various characteristics necessary to the designer, in order that the results of his labors may be in harmony with their intended surroundings. More than this; much of the paneling of the Early English, Decorated and Perpendicular styles is eminently suggestive, and the designer, as well as the carver, either in wood or stone, can find no better school than the interiors of some of our old ecclesiastical structures. The beautifully harmonized proportions, bold yet delicately-finished details, and generally tasteful effect, show

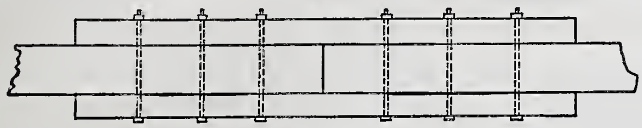


Fig. 9.

that in olden time the principles of decorative art were better understood, both by designers and workmen, than is often the case at the present time. The principles on which the ornamental panels were designed were identical with those characteristics of the panels introduced in early Greek and Roman architecture; the effect intended to be produced being the increased richness of appearance of the building, without allowing the details to become too conspicuous. Panels are of great service in relieving the otherwise monotonous aspect of a wall, but it should always be remembered that the panel is made for the wall, not the wall for the panel.

In designing a panel, care must be taken that the style of ornament is in har-

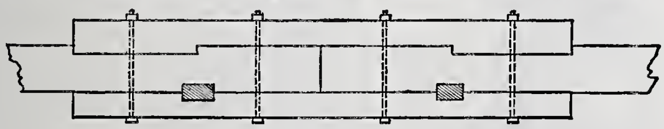


Fig. 10.

mony with the surroundings. To introduce Gothic ornament in a building where the architecture and furniture are of modern character, is absurd; yet such an anomaly is not infrequent. The size of the panel, if for wainscoting, depends upon so many circumstances that it is difficult to lay down a hard-and-fast rule. Practically, the eye, even of the uneducated in taste, seldom errs in determining the number of panels which should be introduced, and the relative size of each. It is singular that such should be the case, and can be explained only by the existence of an instinctive sense of harmonious proportion in the

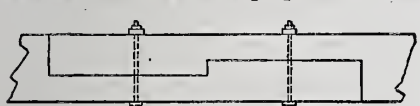


Fig. 11.

arrangement of simple square and circular outlines. The ornamentation of the panels is another and very different matter. The tendency of the untrained taste is to overload a given space with a multiplicity of detail, thereby producing an impression of heaviness, besides confusing and wearying the eye. This love of crowded detail is also an unerring indication of degenerate taste, as shown in the later style of ancient Roman art, when the designer found himself compelled to please the patrons, not by

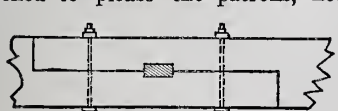


Fig. 12.

purity and elegance of form, but by introducing a mass of miscellaneous ornament. The result is also perceivable in the style known as Later Gothic, of which the Houses of Parliament are a notable example. No pile of buildings, either ancient or modern, in this country is richer than these in panel work; yet so crowded and diffuse is the general style, that the architect has wholly failed in attempting the majestic and imposing effect desired. Of course, we are speaking of carved panels, and in their production the leading object should be to employ

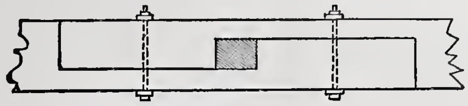


Fig. 13.

a combination of plain and carved surfaces, in such a manner as to produce effects analogous to those obtained by a judicious use of light and shade in a picture—the one being made to relieve the other by contrast. In the Early English, Decorated, and Perpendicular styles, this is particularly noticeable, the proportions of the plain and carved work being so admirably adjusted as almost to defy the possibility of improvement. In

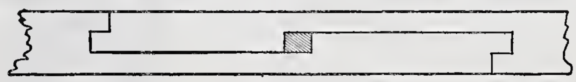


Fig. 14.

the modern styles such attention to the relative proportions of plain and carved surface has been invariably attended with harmonious results.

Where the whole of the panel is filled with carved work, the accessories must be of the richest character. In Elizabethan mansions, the use of stained glass windows and red velvet tended to lighten the otherwise cumbrous style of the carved panels in the state chambers and dining-rooms. In

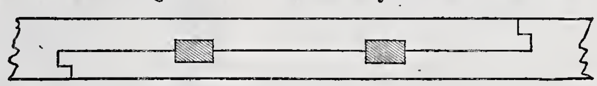


Fig. 15.

Oriental countries, where the love of elaborate ornament amounts almost to a passion, the multiplicity of detail is in some degree compensated by the lavish use of gold and brilliant color. The result, however, is seldom satisfactory. The principal object in designing an ornamental panel for a room is to introduce just sufficient decorative work to impart a tasteful appearance to the wall, without in any way decreasing its lightness. In fact, as a celebrated art teacher once expressed himself to us, his real task is, "not to get in all the ornament pos-

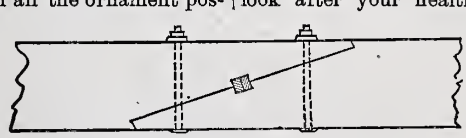


Fig. 16.

sible, but to leave out everything which can be spared." In gates, cabinet work and other articles, greater elaboration is not only allowable, but often necessary. That which would be a defect in a panel intended for the wall of a room, might prove otherwise in the panel of an entrance gate. Where, however, it is desired that the panel should be filled with carved work, the inevitable heaviness of appearance may become considerably mitigated by having the work done in low relief, and allowing the panel to be surrounded by a perfectly plain border or framework.—*Design and Work.*

The Biggest Tree.—A tree 325 feet high, in the neighborhood of Stockton, Cal., has hitherto enjoyed the reputation of being the tallest in the world; but an official of the Forests Department in Victoria, Australia, lately measured a fallen eucalyptus in Gippsland which was 435 feet long. Another tree of the same species in the Gandenong district of Victoria, still standing, is estimated at 450 feet.

House Building and Furnishing.

He who has never built a house, says a contemporary, has never known the whole of human grief, nor met the worst temptation to take the sacred name in vain. From the first design to the last stone or timber, he may encounter vexation and disappointment; and he is a lucky man if, for years after the work is done, or said to be done, he does not find buried mistakes rising up in vengeance before him, and bringing wounds and leaks to light. Yet there are good buildings and good builders; there are men who know how to plan and to make a house, and who are waiting the coming of prosperous times for a chance to show what they can do. It is no disparagement to them for us to say a few plain words of what a man may suffer who has paid for his knowledge in the school of dear experience.

There has been, and there still is to a certain extent, great trouble from architects, or from men who go by that name. Some of them are mere draftsmen, or hardly that, but mere designers on paper—sketchers of pretty pictures that are meant to catch the eyes of the unsophisticated. Tell one of these artists, so called, that you wish to spend $4000 or $5000 for a modest little house in the country or in a suburban village, and he will tell you that he knows just what you want, and that he will suit you to the very inch of dimensions or the nail of strength. The pretty design is brought to you—so charming, so picturesque; such lovely gables; such delightful perspective of piazzas and chimneys; and you are goose enough to like it, and to rejoice in the assurance of having all that you want within the desired margin. But you venture to suggest that it is best to ask your wife about it—perhaps a little skeptical as to the refinement of her taste in comparison with your own advanced art. She, good woman, who was given to you by kind Providence to look after your health and goods, and to save you from rheumatism and ruin, ventures to ask, as she looks askance at that romantic drawing, with its angles and gables, hoods and pinnacles, whether there is room for a bed in any chamber without placing the sleeper abreast of a window or a door, and whether there is any place left for closets, without which your house is as poorly off as a coat or pantaloons without pockets. You pity the good woman's want of high taste, but you cannot meet her objections, and you go back chapfallen to your expectant artist, who is waiting to reward your enthusiasm by word that the projected masterpiece of art will only cost about twice the amount stipulated by you at the outset.

Wondering at your own simplicity and at your folly in mistaking a drawing-master for an architect, you put down your foot and say that you will stop all this nonsense by trusting to a practical man who has risen from the work-bench, and who knows how things are done as well as planned, and who can tell you just what can be put into brick and mortar, wood and iron, stone and glass. You go to your carpenter–architect, and he gives you a plan of a convenient and good-looking house, with the help of books of practical designs at hand, mostly taken from actual buildings at known cost. He can tell very nearly what the plan will cost when carried out, although he may run beyond the estimate from 20 to 30 per cent. But he places you in difficulties of another kind. He may escape the artist's ambition for the picturesque, only to fall into the mechanic's fancy for the superfine and conventional. He may insist upon putting into your house everything that can be done by the saw and chisel and plane, whether it is needed by use or by proportion or not. Such windows and doors, such moldings and cornices, are crowded into your four little walls as might be enough for a grand mansion or monster hotel. The drawing-plans in detail may be faithful, and the work may be well done, but your house may have no true proportion, and some water arrangements that are adopted as conveniences may be discarded as nuisances, because impossible in a space so limited. You are fortunate if the first principles of stability and health are not utterly slighted, and unwholesome vapors and currents do not invade your walls and windows. He may not know that water in the wrong place is not drink, but poison or dropsy, and the moisture in your cellar is malaria in your parlors and bedrooms.

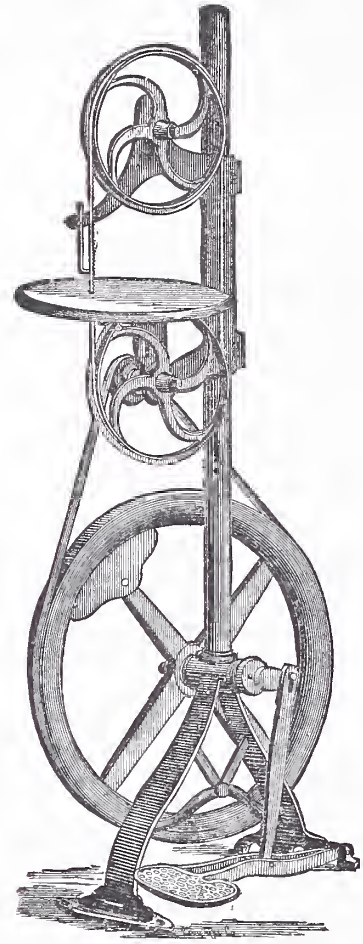
You encounter another class of difficulties in your builder or overseer who is employed to carry out the practical work of the design. If he is a mechanic, he tends to push forward his own trade at the expense of rival trades. If, as is most likely, especially in country houses, he is a carpenter, he will be severe upon the mason by launching out into needless woodwork and by cutting down the brick and mortar and stone, very likely pinching your chimneys into pigmy proportions, with utter wreck of your fine visions of large hearths and open fires. Or you may do still worse, as you can readily do, by contracting with a professed builder who is neither architect nor mechanic, but only a sharper on the lookout for a job, and who takes to building as the easiest way to conceal his ignorance by other men's brains, and whose aim is to buy materials and labor cheapest and sell them dearest. He will cheat you in every point, whether in measure, material or time. He may lie as fast as he can talk, and hardly seem to know that he is lying. This is a dark picture, but not darker than truth can paint, and the many execrable buildings that afflict both town and country are standing proof of the fact. Sometimes the wrong rises into tragic dimensions, and families lose their health, and fortunes are swamped by the roguery of builders and the carelessness of architects.

A man who thinks that he has taken every proper means to have his house well drained, sometimes finds that the walls absorb water on every side instead of discharging it, as they should. In fact, we have known the best practical mechanics in an old town assert that cellar walls laid neither in mortar nor in cement, but merely painted on the inner side with mortar, are the best, and thus they have put disease and decay under the very foundations of the edifice. Architects who know too much to run the risk of such porous filters of damp and inlets to malaria, are not always sure protection against leaks in the roof, or worse leak, as in the purse; and the estimates that are given by them are sometimes not more than half of the actual and necessary cost. That they mean to allure the unwary into unwise building, we are not prepared to say; but, if we grant them sincerity, we so far impeach their intelligence. We have known an error of $100,000 in an estimate to bring years of perplexity, and finally ruin, upon a before flourishing institution which ambition had lured into display under unwise or untrue guides.

These dark sketches of building expenses ought not to keep readers from building a house when they can afford to do it, but they should rather warn them of playing the fool, and encourage them to go forward with the best light and service. We have good architects, overseers and workmen; materials are cheap and plenty, and the new architecture offers excellent models for buildings of all kinds, from the most frugal to the most costly styles. The best is probably the cheapest in the long run, and the next 20 years of our returning prosperity ought to see our country covered with the good edifices of all classes that shall give our people place among the great cultured nations of the world. It is high time for us to stop playing the fool in lasting wood and stone.

Foot Power Band Sawing Machine.

The machine which we illustrate herewith is an attempt to do for the band-saw what has already been done successfully for the jig-saw—adapting it to use by foot power. A foot power band sawing machine has the



Foot Power Band Sawing Machine.

same advantages, in the class of work for which it is suited, in continuous motion and in speed of cutting, which the regular machines have, and is to be preferred over the foot power jig-saw accordingly.

The parts to this machine are very few, and the construction, as may be seen by the engraving, is very simple. The principal pieces of which it is composed are an upright standard, which, by means of suitable feet, is bolted to the floor; two brackets carried by it, which sustain the wheels; the wheels which carry the saw, a treadle, crank and fly-wheel.

The saw employed is of the well-known type ordinarily used upon band sawing machines, and runs upon wheels in the usual manner. The principal bracket carries an arm which holds the guide. A pulley on the shaft of the lower wheel is belted to the driving wheel, which in turn is driven by the crank connected with the foot treadle.

The saws used in connection with this machine are made thinner and finer than those used in the large machines, and are tempered by an entirely new process. The success attending their manufacture has been so great that the makers feel justified in warranting them from breaking.

The manufacturers claim for this machine that it is the most complete of its kind ever offered to the public. It is the only one that can be run with equal success by either foot or steam power. It is also claimed for it that it can do the finest, as well as coarse and heavy work, being adapted to use in the finest toy work and upon heavy lumber. This machine is manufactured by Messrs. Kimball & Kimball, 639 Arch street, Philadelphia, who will be pleased to furnish any further information desired.

NEW PUBLICATIONS.

THE NEW CARPENTER'S AND BUILDER'S ASSISTANT; AND WOOD-MARKER'S GUIDE. Revised and Enlarged. By Lucius D. Gould, Architect and Practical Builder. 8vo., cloth, pp. 70. Illustrated with 27 plates. New York: Bicknell & Comstock.

This is a new edition of a work which has already enjoyed a large sale, and which is deservedly popular among practical men. Several additional plates have been prepared, and much of the matter has been rewritten.

The following, which we extract from the preface, will give an idea of the book: "The object of the author in publishing this work, is to furnish workmen with rules for finding sections of pieces placed in any position; for cutting every description of joints; for finding the form of the raking mold at any point divergent from the straight line; for springing and bending moldings; for mitering circular moldings and planes oblique to the base at any angle."

Besides the rules above alluded to, the work contains tables of the weight and cohesive strength of the different materials used in the construction of buildings; a treatise on the adhesion of nails, screws, iron pins and glue; also an easy system of stair railing for straight and platform stairs.

AMES' ALPHABETS. Adapted to the use of Architects, Engravers, Engineers, Artists, Sign-Painters, Draftsmen, &c. By Daniel T. Ames. One vol., cloth, 33 plates. New York: Bicknell & Comstock.

This is a new book of alphabets, and in some respects is altogether original in its methods and contents. Several plates are especially adapted to the use of architects and draftsmen, for the purpose of lettering their drawings. The styles of letters presented for the purpose are easy of execution, and are arranged in words and phrases in most common use upon drawings, so that, if desired, many of them can be used by direct transfer.

The book opens with some valuable hints to draftsmen concerning the preparation of India ink for use, and upon tracing and transferring. There are several plates of shaded and fancy letters, especially designed for sign painters' use, and some plates of rustic letters, which exhibit fine taste and ability upon the part of the author, and which are designed for use as initials, &c.

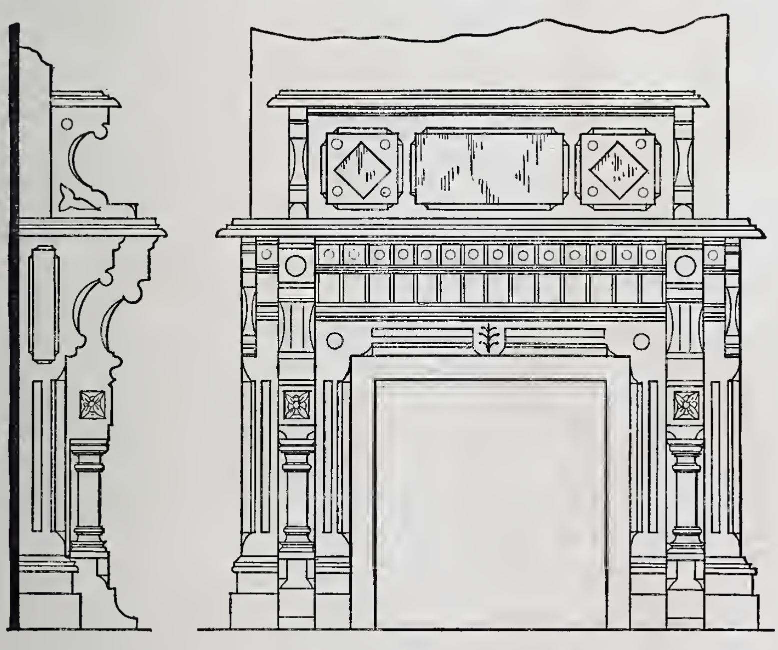
CAMERON'S PLASTERER'S MANUAL: Containing Accurate Descriptions of all Tools and Materials used in Plastering; Description of the Appearance and Action of Every Variety of Lime and Cement; Instructions for Making all Kinds of Mortar; Instructions for Doing all Kinds of Plain and Ornamental Plastering; Cistern Building; Form of Contract; Useful Tables; Many Important Recipes, &c. With Illustrations. By K. Cameron. New York: Bicknell & Comstock.

This little book is, so far as we know, the first treatise upon the plasterer's art which has been published in the English language. It is neatly gotten up, is conveniently arranged, and is precise in the information which it affords. The extracts which we have made from it, and which appear upon another page in this number of *Carpentry and Building*, serve to give a fair conception of its contents and their usefulness to the building trades. It is of convenient size for pocket use.

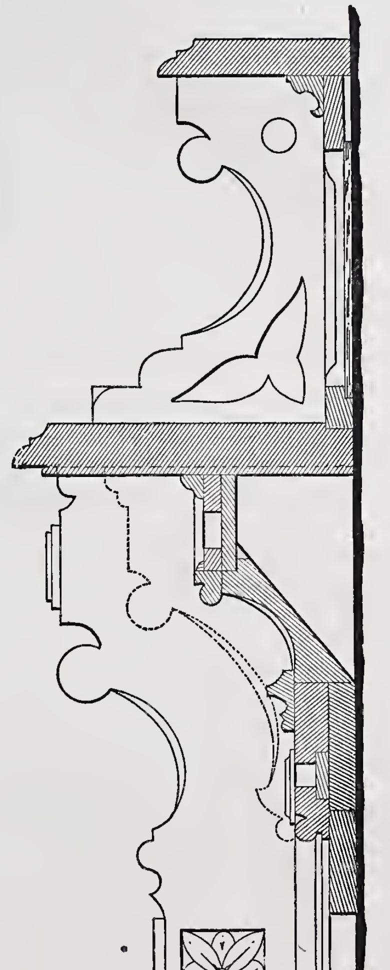
Dry Coating for Basement Walls.—Take 50 lbs. pitch, 30 lbs. rosin, 6 lbs. English red and 12 lbs. brick dust. Boil these ingredients and mix them thoroughly; then add about one-fourth the volume of oil of turpentine, or enough to make the whole flow easily, so that a thin coating may be laid on with a whitewash or large paint brush. Walls coated with this mixture are proof against dampness.—*Der Techniker.*

Design for a Wood Mantel.

The design presented upon this page recommends itself for neatness of outline, simplicity of detail and cheapness in cost. It is quite tasteful, and is entirely suitable for use in almost any room in houses of moderate cost. It is adapted to construction out of any suitable wood. The parts are so clearly shown in the detail, that extended description of construction is not necessary.



Design for Wood Mantel.—Fig. 1.—Elevation.—Scale, ½ Inch to the Foot.



Design for Wood Mantel.—Fig. 2.—Details.—Scale, 1½ Inches to the Foot.

The House of Leibnitz.

One of the most complete specimens of the dwelling houses of the seventeenth century, is the house of the celebrated philosopher, Leibnitz, in the Schmiede Gasse. After four large stories, begins the gable, which rises by five steps, each with a gradually decreasing number of windows, the whole carved most richly in string-course, cornice and mullion, and surmounted by the statue of a helmeted warrior. A broad gateway leads into the courtyard, and at the corner of the cross-street rises the *erker*, or oriel, as we should call it, still more richly decorated than the house itself. This is in three stories, and affords a convenient resting-place for the ladies of the family, from which they may observe the doings of their neighbors. Leibnitz was once a mighty name in Hanover and in the world. He made philosophy popular with the powers that be. Perhaps he would have more fame among posterity if he had less in his lifetime. Under his influence Hanover became a place of gathering for famous wits, and foreshadowed the splendor of Weimar in the succeeding age. Very different to the narrow lanes of the old town, are the broad spaces of the Neustadt, on the left bank of the river. Here the market is a broad space, with trees and a fountain in the center, and the church is much more modern. In still later times Hanover has not been able to resist the general movement by which all towns develop to the southwest. The railway station is the center of a new and more splendid quarter, full of the latest German, Gothic and Renaissance—the product of the pupils of the Polytechnic School. The town would, of course, be incomplete without its Residence-Castle, the scene of so many vicissitudes. Here is an orangery and a riding-school, an armory and a collection of antiquities, and under the hearth-stone of the chimney-place in the old guard-room, lie the remains of Köningsmark. This hall is now used for great receptions, and is gorgeous beyond expectation. On one side three consoles of massive silver occupy the spaces between the window, while above them rise three mirrors of enormous hight, framed also in silver, and in which the lights from the three chandeliers of silver hanging from the ceiling are reflected. Here is the reception on the first of the year, and the snowy silver gleams and glitters in the blaze of a thousand lights. The plate-room in Hanover was the finest in Europe. You went from chamber to chamber through absolute masses of silver and gold, wrought into a thousand curious shapes and forms. There was ancient plate and modern plate; there are candelabra reaching to the ceilings, and golden basins spreading over the floors; knights in armor tilting with burnished lances under frosted trees; and huge cisterns wherein you might drown a couple of Clarences. Only a walk from the town is Herrenhausen, the favorite residence of the later monarchs. The palace is surrounded with Dutch gardens and canals; a fountain in the middle of the garden springs 150 feet into the air, and, in very still weather, can be forced artificially to nearly double the hight.—*From "Picturesque Europe."*

Preserving Fence Posts.—A writer in the *Journal of Forestry* gives the following on preserving fence posts: What I would recommend with fence posts is that the materials, when felled, be directly sawn into posts and stored under sheds thoroughly ventilated, where they will remain at least a year exposed to sun and wind. The neck, or part between wind and water, of each post should be slowly charred over a strong fire—slowly, because our principle means heating the timber thoroughly to the heart, so as to extract any moisture which may still be lodged at the center and hardening a crust on the surface of the posts. Afterward, to prevent the posts absorbing water, they should be well coated with coal tar, having its acid destroyed with fresh quicklime. The tar should be thoroughly boiled, to evaporate all watery matter, and applied boiling hot. A large tank, holding the posts set on end, and filled with the scalding tar from a boiler, answers the purpose very well. Of course the upper half of the posts can be painted when placed "in place." I am fully convinced coal tar, properly applied to thoroughly seasoned timber, is far more effectual in preserving posts than creosoting, poisoning, kyanizing, or all the paraphernalia of iron prongs, sheet-iron wrappers (an American invention), &c. One great recommendation in favor of the above process is that it requires no skilled labor, and the cost is a mere trifle.

To Dye Wood Green and Blue.—Mordant the wood with red liquor at 1° B. This is prepared by dissolving separately in water 1 part of sugar of lead and 4 parts of alum, free from iron. Mix the solution, and then add one thirty-second of a part of soda crystals, and let it settle over night. The clear liquor is decanted off from the sediment of sulphate of lead, and is then diluted with water until it marks 1° B. The wood when mordanted is dyed green with berry liquor and extract of indigo, the relative proportions of which determine the tone of the green. The wood, mordanted as above directed, can also be dyed a fine blue with extract of indigo.

Bill of Material for 100 Yards of Plastering—Three Coats.—Eight bushels lime, one bushel hair, one load sand, one-quarter barrel plaster. This, of course, varies somewhat with the qualities of material. About two bushels of lime are required for the finishing—the other six for the coarse material.

CORRESPONDENCE.

Necessity of Uniform Prices in the Building Trades.

From MART, *Dayton, Ohio.*—I am highly pleased with your paper. All its matter thus far has, in my judgment, been of great value for its practical information to the building fraternity. I was particularly interested in the correspondence in the April and May numbers, touching upon a very important part of the business connected with building, to wit, making estimates. I would be glad if it led to a general discussion of the subject.

There is no other branch of business in which there is so much diversity of opinion as to the value of its product in the minds of those who are engaged in it. As it is a very large and important industry, it becomes interesting to know why there seems to be no definite or fixed rule upon which to base a common opinion as to the real value of a building. This disparity in estimates is not confined to those whose opportunities of an early education have been limited, and who might be supposed to make mistakes in their figures; but experienced builders and educated architects sometimes differ considerably with each other, and are sometimes inconsistent in their own views of the cost of different buildings. I have heard the remark a number of times, "You can't depend upon an architect's estimate, especially in reference to large buildings," and there seems to be some foundation for such remarks. This is quite as applicable to builders and manufacturers of building materials. I could mention a number of instances illustrative of this, and many of your readers doubtless could add to them. It is deplorable that this condition of affairs should exist; it has the effect of creating an impression that some one wants to be exorbitant, or that some one has made a great mistake, or that there is a lamentable degree of ignorance among the whole class of builders. When the lowest bidder secures the contract and sets about saving himself by using inferior materials, slighting his work, cutting off or leaving out something, and employing unskilled labor at low wages, and if remonstrated with, defending his conduct with the unmanly plea that he is losing money, it has a tendency to confirm the opinion that builders are an unreliable class in the business community. This want of confidence has been significantly displayed in the amount of legislation that has been deemed necessary in different States to protect the working class. The lien laws are designed not only to secure to the workingmen their wages, but also to intimidate those wishing to build from employing irresponsible builders.

It is not much wonder, however, that these evils do exist in the building business, and I think there are remedies for them. I believe that a consideration of the causes not only by builders themselves, but by every one intending to build, would speedily effect a considerable relief, if not an entire cure, of the evils. In this new country it is one of the principles of government that a man may pursue any occupation he chooses. In nearly all trades the only qualification required is for him to have a good opinion of himself. If this opinion happens to be a strong one and is persisted in, he is enabled to pursue the occupation chosen, despite of frequent blunders and mistakes, although others may be the sufferers. This grows, perhaps, out of the spirit that actuates all of us in the intense desire to get rich—to rise in the world. There are so many examples of success in those who seem to have blundred into it by sheer physical force, that it constantly excites others to follow. Especially is this true among the trades connected with house building. Many carpenters, bricklayers, plumbers, plasterers, tinners and stonemasons have started into business with scarcely an iota of knowledge of its principles save the handling of tools, and many of them are unskillful in that. They have blindly, and often carelessly, followed the instructions of the architect or owner. They often possess so little conception of the scientific principles that govern the appliances about a house to make it durable, comfortable and healthy, that they cannot see the necessity of carefully following the instructions to that end if there is any trouble or expense involved in them. These facts would indicate that there had been little attention paid to any sort of education, and if there was a lack in mathematical knowledge it would not be surprising. If, therefore, there is a want of knowledge of much that is needed about a building, and a deficiency in understanding the first four tables in arithmetic, it cannot be much to wonder at that the effort to make a correct estimate upon the cost of the building should be a failure. They can only arrive at conclusions by comparison—that is, by comparing the building in contemplation to one that has been constructed—a very unsafe method, as there may be many things in the details essentially different that will change the cost sometimes very materially.

The foregoing reflections do not apply to all who are in the building business; there are a large number who are careful and intelligent, and who thoroughly understand their business. They are competent to make estimates and to carry out the designs of the architect, and frequently to make designs and write specifications. When work is plentiful with them and their business prospers, their estimates are reasonably correct; but when work grows scarce, and they are compelled to enter into competition with new and inexperienced men, they find it necessary to lower their estimates or abandon their business. The hopes they may have entertained that their reputations would overbalance the difference in figures, become dissipated when they discover that the one who desires to build has a higher regard for $500 or $1000 than he has for any one's reputation as a builder. It is perhaps too often the case that proprietors do not understand that there can be any material difference in the skill and ability of the men who build their houses. It appears to be a simple matter to pile up the brick, stone and wood into a mass that gives the outlines of the architect's drawings, and they believe that the terms of the contract will compel a faithful and workmanlike execution of it. But they are not judges of the work. They are unacquainted with the technicalities of the specifications, and consequently have no idea whether they are being complied with or not. If they employ their architect to superintend, he is often too busy to give it the attention required, or becomes disheartened with wrangling and contending with the incompetency of the workmen, and allows the building to be imperfectly constructed.

Sometimes the experienced builder hopes that a few lessons of this kind will cause owners to learn what is best for their interest, and bring them back again to patronize legitimate work. But he is mistaken in this also. He finds that men do not profit much by such experience. The great difference in cost encourages the hope in the mind of the one who next intends to build that he may be more fortunate than the others. The only resource is to enter into the competition with the intention of becoming the lowest bidder. He may hope, again, to drive out competitors, but he becomes opposed by other experienced builders. Custom is drifting away from all of them; there is no concert of action; a general scramble ensues. Some of the incompetent may be driven from the field, but low wages and ambitious hopes continually drive others into it, so that the competition is continued. So great has been this competition, and so demoralized have the prices of buildings become since the financial reaction after the late war, that those who desire to employ the services of a builder, though it be in the smallest way, put up their work at competition, knowing very well that the chances are it will cost less than to have it done by the day. Sometimes, even at very low prices, the work is well done, as there are men whose pride and conscientiousness will not permit them to slight their work under any circumstances; but oftener the work is very poorly done and the materials are of a very inferior kind.

I am in favor of the contract system in the building business, especially in its application to constructing new houses. In remodeling and repairing old houses there may be contingencies that cannot be foreseen, and the builder may justly believe that he cannot enter into a contract without a margin sufficient to meet all possible contingencies; in such cases the fairest way to all parties is to have the work done by the day. It is very natural for a person intending to build to want to know just what his house will cost him before he begins building, for which no one can justly censure him. The builder, knowing what he is to receive, and being responsible for all that he has undertaken to do—in other words, the building being his until the contract is consummated—is induced to watch it carefully and see that economy and good management characterize the workmen. The owner will not be harassed by imagining that he is being imposed upon by waste in material and lazy workmen. If the work is being well done and the pay reasonably remunerative, good feeling will exist between builder and owner continually—a state of affairs that does not always obtain under the day system.

I am also in favor of competition in building—it is the power that gives life and energy to any business—and, as there is no law against it, I cannot say that I am opposed to any one entering into the competition, although I sometimes imagine that it would not be a bad plan if certain qualifications were required to enable a man to become a master builder, as is the case in Europe. In many of the States in this country a person cannot practice law or medicine without proving a knowledge of the elementary principles that govern the profession. This is done to prevent the unlearned from being imposed upon, and to protect or maintain the good standing of those professions. It is at least almost as important to the general community that a man should know how to construct a house properly, and quite as important to the maintenance of the good character of the occupation that he should be capable and intelligent in all that pertains to it.

There are rapid steps being made toward an advancement in knowledge of the principles and science involved, both in the architecture and construction of houses, by those who are workmen at the trades and those who carry on the building business. This is evinced by the patronage given to the night schools that have been established in different cities to teach architecture and drawing, and also in the fact that a periodical especially devoted to carpentry and building has been established. To maintain and make these improvements practical and permanent, I think it to be absolutely necessary that attention should be given to a systematization of the business of building. The mechanic who studies his trade needs some encouragement in feeling that his pecuniary wants will be well provided for in compensation for his efforts. This he cannot feel when he knows that he may lose part of his wages through the bad management of his employer, or that his skill is of no avail or is not considered when he comes into competition with cheap workmen. The first step in this systematization will be the adoption of a regular method of estimating material and work; and, second, of determining a uniform price of labor. In your correspondence for May several suggestions have been made, but they all seem unsystematic except the one from X. Y. Z., and that one is not satisfactory, because it is simply a codification of the items that it is necessary to put a price upon. It is very well for a man to exercise his judgment as to the value of certain items of materials—the quantity that will be required and the value of labor; but he has no definite judgment until he obtains it by experience, and in the meantime he must carry on his business in a haphazard way, guessing out his estimates, the very evil we are crying against. There are too many builders who start out with guessing and continue it always. If a few practical men with the judgment and experience of X. Y. Z., would put their heads together and determine a way to arrive at the cost of labor—that is, determine what an average workman can accomplish in ten hours—present a table of items, condensed and classified, of what constitutes the sum of a building, and also suggest what is a fair difference between skilled and unskilled labor, I am sure that it would be of incalculable benefit in all that pertains to the business. It may be said that if a bill of prices could be agreed upon, many builders would pay no regard to it; they would continue to bid as heretofore, and the confused character of the competition remain as it has been; but I think not. I feel quite sure that all builders would gladly avail themselves of some established rule to estimate upon. It would save them a great deal of time, relieve them of much uncertainty and cause them to feel more confident in submitting bids for work. The strife then would be to obtain reputations as faithful and skillful builders—an emulation much more pleasant to themselves and more gratifying to the general public. All other trades have established prices. The merchant knows what he can sell his goods for, and the lawyers, doctors and architects have established prices that are not affected by competition, although these professions are crowded. There may be some builders who would be unwilling to give way at present, but another generation would see the end of this unbusinesslike condition of affairs.

With an established, uniform system of arriving at the cost of a building, so that owners will know what will be a fair price for a substantial, well-built house, there will be fewer ill-constructed, unsubstantial houses built. The temptation for carelessness on the part of owners about them will be removed, or, if they have cheap houses built, the responsibility will rest entirely with themselves; they will not be able to plead ignorance, or that the contractor has swindled them. There will also be a higher appreciation of good work when it is known that in order to get it a definite price must be paid for it.

Estimating.—Prices of Labor.

From S. W. H., *Russell, Kansas.*—In the May number of *Carpentry and Building,* I notice several of your correspondents give their methods of estimating labor in erecting buildings.

W. P. R. says that the cost of labor is equal to the cost of material. That rule may answer in South Carolina, but it will hardly work elsewhere. In this locality common lumber is worth from $25 to $30.

What we as mechanics require is a list of prices based on a fixed price per day for labor. Having such a list it makes no difference whether one is in New York or California. The rule will hold good, it being only necessary to add to or take from the figures, according to the prices prevailing at the place and at the time the work is done.

Your correspondent X. Y. Z. comes nearer what is practical than any other whose letters you have published. I would add to his suggestions that every mechanic ought to have a pass-book, in which he should carefully note down the time required to perform different items of work, naming the style of the work. He should not only note in this manner what he does himself, but also keep a record of his fellow workmen. By continuing such a method a few years a handbook will be made that will be of great value in making estimates.

X. Y. Z. recommends estimating framing by the square. I do not consider it desirable to use this method exclusively. Some framing requires much more work than other, and the prices must be modified accordingly.

I annex a few of my prices used in estimating labor required for certain work, which I consider reliable. The prices are all based on $1 per day. If labor is worth $2, they are to be doubled, and if it is at some other figure, they are to be increased or diminished proportionately, as the case may be:

In frame buildings made of hard wood, for every lineal foot that has gains, mortices or tenons, $4 per 100 feet.

To frame common braces, 10 cents each.

Joists, studding and rafters required for the same, $1 per 100 lineal feet.

If the timber used is pine instead of hard wood, deduct one-fourth from the prices given. For balloon frames of pine for 1-story buildings, 50 cents per 100 lineal feet for all joists, studding, plates and rafters that have no mortices or tenons.

The same, for 1½-story buildings, 75 cents per 100 lineal feet.

The same, for 2-story buildings, $1 per 100 lineal feet. (The above prices include raising.)

If the sills are to be gained or morticed, $5 per 100 lineal feet.

Flooring 6 inches wide, including bridging, for 1-story buildings, 20 cents per square.

The same, for 2-story buildings, 25 cents per square.

(For 4-inch flooring add one-third to the above prices.)

Sheathing side walls of 1-story buildings, 75 cents per 1000 feet of lumber.

The same, for 1½-story buildings, $1 per 1000 feet of lumber.

The same, for 2-story buildings, $1.25 per 1000 feet of lumber. (The above prices include scaffolding).

Sheathing the roof (tight) and laying shingles upon a 1-story building, $1 per 1000 shingles.

The same, for 1½-story buildings, $1.25 per 1000 shingles.

The same, for 2-story buildings, $1.50 per 1000 shingles. (The above prices include staging).

Weather-boarding (including scaffolding) for 1-story building, $2 per 1000 feet.

The same, for 1½-story buildings, $2.50 per 1000 feet.

The same, for 2-story buildings, $3 per 1000 feet.

Cornice, including working it out (except moldings) for 1-story buildings, $2 per 100 lineal feet for each member.

The same, for 1½-story buildings, $2.25 per 100 lineal feet for each member.

The same for 2-story buildings, $2.50 per 100 lineal feet for each member.

Base boards and corner beads, $2 per 100 lineal feet.

Mop boards and plain casings, $1.50 per 100 lineal feet for each member.

Stairs by the tread according to the labor required.

Door and window frames vary according to style of work.

Fitting and hanging doors with rim latch or lock, including carpet strip (if the frames are rabbeted) 25 cents each.

The same, with stops, 30 cents each.

Fitting and hanging doors with mortice lock, including carpet strip (if the frames are rabbeted), 35 cents each.

The same, with stops, 40 cents each.

Fitting and hanging outside blinds for the first story after the frames are set, 20 cents per pair.

The same, for the second story, 25 cents per pair.

To fit and hang before the frames are set, 10 cents per pair.

The above embraces a few of the leading items taken from my book of the most difficult to estimate.

I am much pleased with *Carpentry and Building,* which serves to fill a vacancy long felt by the craft.

I hope others will communicate their ideas upon this important subject.

How Shall Mechanics Unaccustomed to Writing Contribute to the Paper?

From H. H. G., *Philadelphia.*—There are often discovered among workmen things that die there, just simply because we are not able to express ourselves properly with the pen. And now this valuable little paper of yours shines among us as a new light, but how are we to give expression to the new methods that necessity compels us to adopt almost daily? How are we going to contribute to it the matters of interest of which our minds are full, and for which you so earnestly ask in the desire to make the paper entirely useful to men of our trade? I am sure you do not wish to be bored with petty things. If every little matter was to be sent to you, you would soon be compelled to get out on the roof to get away from the rubbish. But there surely are dark spots in the minds of mechanics generally, into which the light of other men's experience ought to be made to penetrate, and the small things are very frequently the very ones they most need. *Carpentry and Building,* by its department of correspondence, offers the opportunity for an exchange of ideas so desirable to be had, and the necessity is upon us of sending along all we are able, in the best style we can command.

Note.—Our correspondent's conclusion is correct. Send along whatever seems desirable for practical men to know. Leave the matter of style and arrangement to us. If you succeed in making the Editor understand you he will be responsible for the presentation of your ideas to the readers of the paper. We are not alarmed at the prospect of an accumulation of rubbish. We have almost infinite resources for packing and storing away, and will not need to take to the roof for a long time, no matter how freely our readers write.

Methylic Spirits.

From Ebony, *Boston, Mass.*—Will you be good enough to give another name for methylic spirits, mentioned on page 71, April number of *Carpentry and Building,* in directions for ebonizing? No one seems to know what it means.

Answer.—Our correspondent will doubtless have no difficulty in procuring the article if he inquires for wood spirits or wood alcohol, the names by which it is commonly known.

Cleaning Floor Tiles.

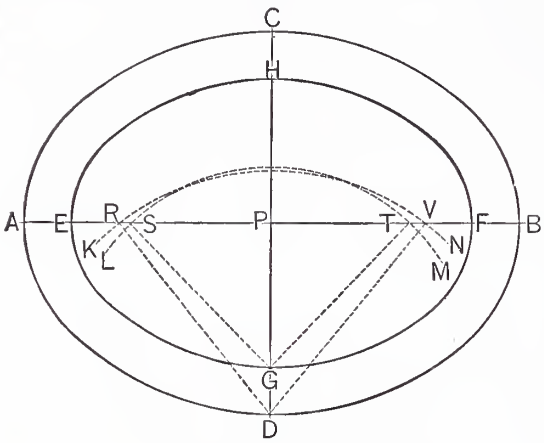
From Thos. Aspinwall & Son, *New York.*—We notice in *Carpentry and Building* for May, in an article upon "How to Lay Floor Tiles," some directions for cleaning off cement stains. We would say that in our experience of some ten years we have found that muriatic acid—one part of acid to two parts of water—applied with pumice stone or sponge to the tiles, and not allowed to remain on more than two or three minutes, washing the surface with clean water, is far better for the purpose than anything else with which we are acquainted. Tiles should be frequently washed with soft soap and water, which assists materially in keeping them brilliant and clean.

Note.—We are gratified to publish this corroboration of the directions for removing stains from tiles, published in the last number, coming, as it does, from a house so prominent in the trade. Hydrochloric acid and muriatic acid are the same—different names for the same thing.

Cement for Cellar Floors.

From P. M., *Farmer Village, N. Y.*—In reply to D. W. in regard to a cement bottom for a cellar, I would give the following recipe: Take one part water lime, three parts good sharp sand, mix well together, and spread it over the cellar bottom before it sets. It will make as good a cement as you can find in any place.

Note.—If a good coating of roofing pitch could be laid upon the cellar bottom before the application of the cement, the cellar would be less liable to be flooded with ground water. Indeed, it is strongly recommended by some architects of reputation to not only lay the cellar floor with pitch, but also several courses in the foundation with it, and thus provide an absolutely water-proof and gas-proof layer between the soil and the house. In new buildings they also recommend the pointing up of the foundations with pitch or asphalt. In France the material used is the famous Val de Travers asphalt. This costs too much in this country, but a very good substitute can be found in properly prepared Trinidad asphaltum, which can be used in the same manner as the foreign article and is much cheaper. Coal-tar pitch can be used for the purpose, and lasts tolerably well; but it has the disadvantage of a perceptible smell, and at the same time is likely to become soft in warm weather and brittle when cold. It is, however, vastly better than nothing, and may always be used when the prepared Trinidad pitch cannot be had. Almost any roofer who lays gravel roofs will know all about the different kinds of pitch and can apply them. Even the commonest kind of of coal tar, when hardened by a little rosin and protected by a coating of cement above it, would make a very good protection for a cellar floor. The fact that the cement protects it from wear, and the variation of temperatures are not great, gives it considerable durability. Col. George E. Waring lays the greatest stress upon the importance of preventing the ground air, that is, the gases and dampness which may arise from the ground, from entering the house. This can only be done by some method of making an impenetrable floor under the whole house. In regard to cement floors for cellars, we may say that while they are exceedingly good, and are valuable because they exclude rats and mice to a great degree, they are not air tight, nor are they altogether as waterproof as may be desirable. They also have the disadvantage of cracking easily in case of the ground or walls settling even a little. The elastic coating of pitch underneath, however, will yield and still form a complete shield, even though considerable settling takes place.



Parallel Ellipses.

Many people have a false sense of security when they find themselves with a good rock bottom to their cellars. In New York City there are few, if any, cellars with rock bottoms that are not exceedingly dangerous, and are even worse than those of sand. The reason for this is found in the openness of the rock, which is not only full of holes and of loose grain, but is traversed in all directions by seams, joints and fissures, with which connection is too frequently made with underground sources of filth, usually arising from leaky sewers, distant cesspools, blind drains and stagnant underground water. These breaks and cracks are likely to be found even in granite, and the only safe plan, therefore, is to secure the house by putting a water-proof and gas-proof floor under it, by which the possibility of upward soil leakage is prevented.

Parallel Ellipses.

From W. S., *Toronto, Canada.*—In recent numbers of *Carpentry and Building* there appeared several rules for constructing the ellipse, among which were the trammel, and string and pencil. Will you at your convenience, through your columns, give the application of the two methods just named to drawing parallel lines? By my sketch inclosed you will notice that the attempts I have made in this direction have failed, the space between the two figures being wider at some points than at others.

Answer.—We have illustrated the use of the string and pencil in drawing similar or parallel ellipses in the accompanying engraving, which will be understood by inspection. Suppose E F to be the length and G H the width of an ellipse, parallel to which another curve is to be drawn, as represented by the outer line A C B D. Draw the first curve by the rule, S and T being the foci. From the points E, H, F and G, set off the width of the space desired between the two figures, as E A, H C, F B and D G. Using the points A, C, B, D thus obtained as the dimensions of a second figure, proceed to draw it by the rule, R and V being the foci. Then the two ellipses will be similar, or their boundary lines will be parallel. The trammel is to be used in the same general way. Lay down the several necessary points for two figures. Set the trammel first by one set, and draw the resulting figure ; then set it by the other set, and draw the second figure.

Troublesome Gutters.

From C. J. F., *Belle Center, Ohio.*—There is a house in this town having a hip roof, the gutters of which have been laid some three years, and which have leaked almost from the first, although well soldered. I inclose you a sketch of the roof, showing the shape and construction of the gutter. In laying the gutters the tin was prepared as for an ordinary valley. It was then forced into the box shown as the gutter in the sketch. Miters were made at the corners. The joints draw apart and break the solder. It leaks all around, although in way of repairs it has been resoldered three or four times. The tinner who laid the gutters can give no explanation of the trouble. I was asked to look at it and fix it if I could. I told the owner I would ask *Carpentry and Building* about it, as it was in the habit of answering all manner of hard questions. I also inclose you a sample of the tin used in the gutter.

Note.—We are inclined to think some experienced tinner who can inspect the work in place and carefully observe all the surroundings, will be competent to give a much more satisfactory solution of the difficulty than we are able from the meager data furnished by our correspondent's letter. We publish his description in full, excepting the sketch of the roof, hoping that if any of our readers see anything in it more than we have observed they will favor us with letters. The sketch represents a section of a tolerably steep roof. The gutter, which is formed in the lookouts of the cornice, is of the form ordinarily known as "box." By the sketch the sides are very nearly or quite vertical. The bottom is horizontal throughout its width. The piece of tin inclosed is of fair to medium quality, as well as we are able to judge from the small sample. It is terue in coating and I C in thickness.

It occurs to us that the trouble may arise from any one of several reasons, or from a combination of all of them. But if so, it would surely seem that our correspondent and the man who laid the gutters would have discovered them. However, we will mention some of them quite briefly. The general shape of the gutter—flat bottom with vertical sides—is not desirable upon general principles. Putting the tin together as for a valley—by which we understand that the tin was put together in long strips by grooving and soldering—and then forcing it down into the box, was enough in itself to seriously strain every cross seam in the gutter, if not to break them outright. After being laid and in use, by the shape of the gutter the action of freezing and thawing would tend to break seams to a greater or less extent. The fact that the gutter breaks continually after being carefully resoldered, may count for something or nothing. If the difficulty arises from the shape of the gutter and the consequent strain upon it by the snow and ice in winter time, or from the quality of tin employed, or from poor solder being used, patched seams will naturally break as readily as the original ones. If the difficulty be of a somewhat different nature from that just supposed, the patched places might break from the fact of a perfect joint being practically impossible upon a tin surface which has been painted or has become more or less rusted ; or the new leaks may be new breaks, and the patched places may hold perfectly. We seriously doubt the possibility of remedying the existing gutters. We think it will be found advisable to commence over again with a V-shaped gutter, keeping it quite broad and shallow, and employing the best materials and workmanship, carefully guarding against every circumstance that can in any way interfere with the best results.

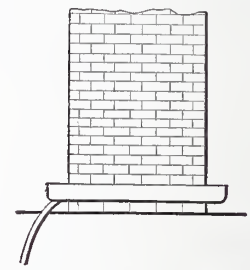
Conducting Power of Tin Plate and Galvanized Iron.

From M. S., *Poultney, Vt.*—Is galvanized sheet iron a non-conductor of heat, and to what extent compared with tin plate of the same thickness ?

Answer.—Galvanized iron can hardly be called a non-conductor of heat. In fact, it transmits heat very well. Tin plate is also a fair conductor. A moment's consideration will show that the difference between the two, due to the material, must be exceedingly small, because in each case the main body of the plate is of iron. The zinc conducts heat about twice as rapidly as the tin, but the coating of tin is usually somewhat thinner than that of the zinc, so that there will be little difference between the two. The only appreciable point of difference between them is probably due to the brightness or dullness of the surface. A bright surface reflects more heat than a dull one, and the latter transmits the most. Hence, the tin plate, when bright, does not transmit heat quite so readily as the galvanized iron. We presume, however, that this difference would practically disappear in the case of a piece of tin that has been in use for any length of time.

Dripping Chimney.

From W. C. C., *Portland, Me.*—In reply to F. S., of Conway, N. H., I would suggest that if the dripping chimney stands upon a floor, to make a shoe or truck of heavy sheet lead, and let it into the next to the lowest course of brick. This will act as a gutter on three or four sides of the chimney, and can be made to conduct the drip away to a pipe where it can run off, or to a pan in which it may be caught. A still better plan is to build the chimney in a lead pan when it is necessary to build upon the floor. The sketch shows what I mean.



Remedy for Dripping Chimneys.

Note.—The gutter can be treated in the same manner as a lead flashing. Where a chimney leaks through the mortar, it is, or is likely soon to be, in a dangerous condition, and any little gas explosion in the chimney is liable to set fire to woodwork by forcing the flame through the cracks. The number of houses in the country burned by reason of defective flues is surprisingly large, and we are astonished that so little care is taken to see that chimneys are tight and in good order. The rule seems to be that when a chimney is put up there is nothing more to be done to it until the house burns down or is torn down.

Paint for Tin Roofs.

From E. B., *Benton Harbor, Mich.*—What do you think the best paint for tin roofs ?

Answer.—The so-called iron paints, made from iron ore, are generally considered the best for tin roofs. Pure linseed oil should be used for mixing them. We do not know of anything better.

Arrangement of Pulpits and Choirs in Churches.

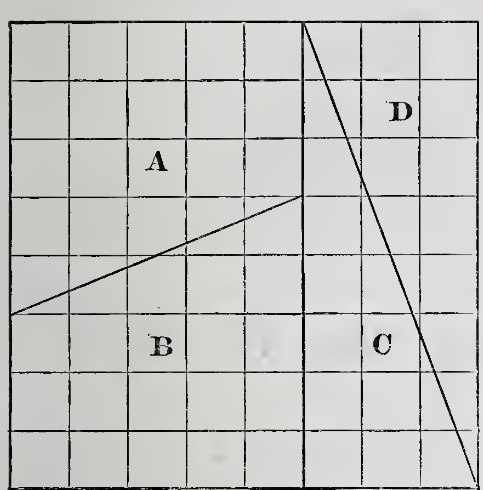
From A. P. L., *Mediapolis, Iowa.*—I would like to see something in *Carpentry and Building* concerning churches, the inside finish for pulpits, choirs, &c. Which is the better taste, to have the platform for the choir raised back of the preacher or at the sides ?

Answer.—Such questions are generally settled by the preferences of the congregation or the customs of the denomination. Conspicuous examples of various plans of arranging pulpit and choir might be cited, neither of which would necessarily prove the others to be in bad taste, and all of which have zealous advocates. Our correspondent's question is one which cannot be answered definitoly. The shape of the building has much to do with it, and it should be determined by those most interested before the building is planned.

Problem of Areas.—Does 64 Equal 65?

From J. R., *Jersey City*.—I have been a reader of your paper from the start, and think it just the thing for every mechanic. I have seen many questions answered through your columns, and I now venture to ask one if you will have the kindness to answer it.

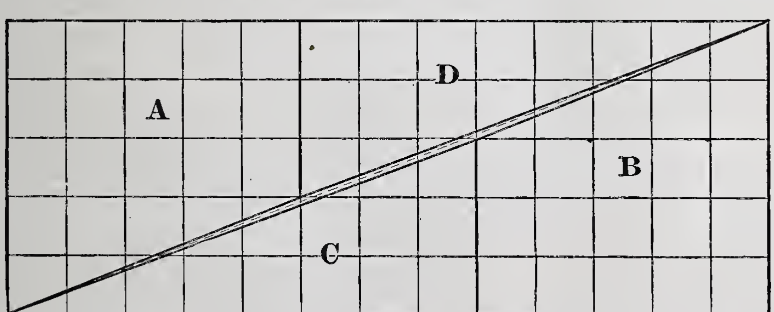
Inclosed I send two drawings, which show the nature of the question. Fig. 1 represents a surface which we will call 8 feet square, the area of which will of course be



Problem of Arears.— Fig. 1.—Showing the Lines upon which the Square is Cut.

64 square feet, as shown by the ruling. Now, if we cut this surface, as shown by the diagonal lines, into three parts, A, B and C, and place them so as to form a parallelogram, as shown in Fig. 2, we have a surface of 5 by 13, or containing 65 square feet. Now, I would like to know why there is 1 more square foot in one figure than in the other?

Answer.—We have had our correspondent's drawing engraved, but have added a few lines to show how the confusion arises which makes the four pieces seem 1-64th part larger in one form than in the other. As shown in J. R.'s drawing, Fig. 2 has a diagonal line running directly from corner to corner; this line we have shown in Fig. 2 by a dotted line. This, however, makes each of the pieces, A, B, C and D, a little larger than they really are. By looking at Fig. 1 it will be seen that A and B are just 3 feet wide at their narrow ends, and C and D measure exactly 3 feet at the wide ends. When we put them in the shape shown in Fig. 2, we find that the dotted diagonal line makes A and D just a trifle more than 3 feet wide at the line where they join, and it will be found that C and B are



Problem of Areas.—Fig. 2.—Showing the Pieces Arranged to Form an Oblong Figure.

also a little more than 3 feet wide at this point of union. Now, if the lines are drawn accurately, as shown by the heavy lines in Fig. 2, we find that there is a spindle-shaped space between the four pieces, which is just equal to the missing square. This is a very good illustration of the wild results which may often be obtained from slight inaccuracies in drawings from rules that "come near enough." In nineteen cases they may answer very well with a little clipping here and there, but in the twentieth case they will make mischief that cannot be remedied except by beginning anew and doing all the work over again. While approximate rules answer very well sometimes, it is exceedingly important that the workman should understand their nature, so that in cases where great accuracy is needed he may not rely upon them.

The question which our correspondent has sent us is one which has made a good deal of stir among the correspondents of some of the English and American papers during the last few years, and is a very common stumbling block, because the drawings are not usually made with sufficient accuracy, nor of a size large enough to show where the difference between the two figures lies.

Best Method of Laying Tin Roofs.

From C. & C., *Oswego, Kan.*—Will you be kind enough to inform us, through your valuable paper, which is the most approved method of putting on a tin roof, say 20 x 28 tin, with nails or cleats? Some put a nail through each corner of the sheet and then use cleats along the sides. Others put no nails at all directly through the tin, but use cleats entirely.

Answer.—The latter is by far the best method. Three to five cleats per sheet, according to the size of tin employed, and no nails through the tin give the best job. As far as possible, it is best to avoid putting holes in the roof. The expansion and contraction may cause trouble when there are nails in the corners, and, by tear ing the sheet, occasion leaks.

Bricklaying.

From R., *Nashville, Tenn.*—In your March number, J. R. P., of Farmington, Mo., gives some statistics in bricklaying, and you invite other communications, believing that a general discussion upon this topic can be made interesting.

I have waited until the present time, hoping that persons of practical experience would respond to your invitation, but, being unwilling that the discussion should be lost, I will, in a friendly spirit, criticise J. R. P., hoping to provoke further comment.

My business is the adjustment of losses for a prominent insurance company, and it has thrown me into company with numbers of the best architects and builders in many Western States, and compelled me to make a close study of detail, both in building, construction and estimates.

Much of the information furnished by J. R. P. is valuable, but there is a lack of precision and explicitness about it, which probably is the result of haste. He speaks of "real count" and "wall count," but does not give his definitions of those terms. Does his "real count" mean "kiln count" or "finger count?" The rules for measurement of brickwork (wall count) vary largely in different parts of the country, and the local custom must be known to judge intelligently whether the estimate is correct in amount or moderate in price. I find that wall measure is taken at an average of 17, 18, 19, 20, 21, 22, 22½, 23 or 24 bricks to the cubic foot, as the local custom prevails. Now, this is remarkable, but it is true; and, moreover, many of the "long" measurements are made without deductions for openings, while in others full deductions, or half deductions, or an allowance of 9 inches on each side of openings for jambs, are made.

Generally, in Kentucky and Tennessee, 21 bricks are allowed to the cubic foot. and in New York this number is fixed by statute. In Michigan, Northern Indiana and Ohio, and I believe upon all government work, 22½ bricks are counted to the cubic foot, and I judge that this is the rule in J. R. P.'s neighborhood. But such measurements overrun by about 30 per cent. the actual number of bricks required in buildings with ordinary openings, and $7 per M, wall count, would be about $9.10 per M, actual count. In a 13-inch wall there are about 18 bricks to the foot superficial. The face of the wall will measure 13 inches long and 11 inches high—143 square inches, or nearly a foot superficial. (Four courses of brick, each 1½ brick long, *plus* 2 mortar joints ⅜-inch each, equals 13 inches long; 4 bricks high, each 2⅜ inches, and 4 mortar joints, each ⅜ inch, equals 11 inches high.) Then 18 brick to the cubic foot, with no deductions for openings, would seem to be an ample allowance in measuring brick in the wall. The size of bricks differs in different localities, but there should be uniformity and a size fix d by law. Probably the best size would be, when burnt, 2⅝ to 2¾ inches thick, 4 inches wide and about 8⅜ inches long. The length should be twice the width, *plus* the mortar joint. If bricks were laid by measure, as is the English rule, instead of by count, and the long perch of 25 cubic feet were adopted as the standard, 1000 bricks would lay about 2 perches.

When J. R. P. states the average quantity of sand and lime required to lay 1000 bricks (13½ cubic feet of sand and one-half barrel, or 2 cubic feet, of lime), and the number that a mason will lay in a day, I understand him to mean "actual count" and not "wall count," although he is not explicit. Below I state the actual cost of a piece of brickwork in a moderate-sized building. The materials consumed and the prices paid for them were as follows:

132,000 bricks "kiln count," delivered, at....	$5.00
66 perches sand (25 ft. to perch), at..........	.90
264 bush. lime, at..............................	.27

Labor was contracted for at $1.75 per M, wall measure, of 21 bricks to the superficial foot. By this measurement there were in the wall 150,110 bricks, and the cost per M, wall count, was:

880 bricks, at $5 per M.........................	$4.40
9 bush. sand, at 4½c...........................	.40
1⅔ bush. lime, at 27c..........................	.45
Labor, contract price.........................	1.75
Total...	$7.00

It will be seen that in J. R. P.'s mortar the proportion of lime to sand is as 1 to 7, nearly; while in the example quoted the proportion is as 1 to 5, nearly. These proportions must necessarily vary according to the quality of sand and lime used, but the tendency of builders seems to be to reduce the proportion of lime to sand in the composition of mortar. I know that there is good authority for this, but the sand must be cleaner and sharper than is generally used to warrant it. The proportions called for in many specifications are of lime 1 part and sand 4 parts; and many architects require mortar to be made at least three weeks before it is used. It is a well-known fact that rich limes gain by exposure to the air, and the best and strongest mortars, therefore, are made in large quantities, and worked over and over again before using. When well beaten, mortar gains in strength and weight. Ordinarily there is not sufficient intelligence and care used in the composition of mortar. Mortar should never be made upon the open ground or in the sand pile, but there should always be provided a box in which to make it.

In many of our great conflagrations the fall of buildings is due largely to the quality of the mortar used, which had not cohesion sufficient to stand the strain and expansion to a wall from great heat. When such walls fall the bricks, when not broken, are self-cleaned. Bricks should be wet down before laying on wall if good and strong work is desired, otherwise the porous brick absorbs too rapidly the moisture from the mortar, which should dry out by evaporation and not by absorption.

As to an average day's work, taking all things into consideration, when there is the usual amount of front work, backing up and partition walls, the following, made from observation and experience, may prove valuable :

Average day's work of bricklayer and tender ; number of superficial feet of wall laid : In 9-inch wall, 100 to 120 feet ; in 13-inch wall, 90 to 105 feet ; in 18-inch wall, 80 to 90 feet.

The first figures in each estimate will approximate the amount done on dwelling houses, where angles are more frequent, and the last will prove more reliable for stores and large buildings, with long stretches of dead walls. Doubtless many builders realize larger averages, but others do not accomplish even these figures.

This letter has grown beyond the length intended, and calls for an apology for trespassing on your time and space. You have a large constituency of readers not actively engaged in building, but greatly interested in all that concerns that great industry, and who earnestly hope to see some attention paid to the details of cost, of materials, labor, time, &c., in the various operations of building. There are several excellent English works upon these matters of detail, but I have yet to learn of any thoroughly good American publication which meets the popular want, and it is to be hoped that *Carpentry and Building* will do something to call the attention of experts to these matters, and finally lay before its readers some practical, accurate, explicit, thoroughly digested information.

The Origin of Tiles.—The manufacture of tiles in Great Britain dates from mediæval times, and is supposed to have originated in the Roman mosaics—the transition from *tesseræ* to the tiles, with impressed designs, being gradual—the difference in the first place being in the size of the pieces only. Evidences of the gradual modification of the size have been found, and in Spain small tiles, intermediate between British tiles and *tesseræ*, are now in use.

To Stain Wood Gray.—Grays may be produced by boiling 17 ounces orchil paste for half an hour in 7 pints of water. The wood is first treated with this solution, and then, before it is dry, steeped in a beck of nitrate of iron at 1° B. An excess of iron gives a yellowish tone ; otherwise, a blue-gray is produced, which may be completely converted into blue by means of a little potash.

Wood Dyeing.—G. A. Schoen wished to give an old appearance to some articles of wood by rubbing them with oil of aniline, which, as is well known, browns rapidly, but he could only produce a mahogany tint. He then first painted the wood with a solution of aniline salt, which penetrates the wood very rapidly and colors it yellow. He next gave a coating of a solution of caustic soda to set the aniline at liberty, when there immediately appeared a deep brown hue like that of old oak. The same effect was observed in walnut, plum and other wood. He was equally successful in giving a black tint to various kinds of wood by impregnating them successively with aniline salt, bichromate of potash and soda, allowing them to dry after each application. The coloring was very uniform, penetrating the knots as well as the softer portions of the wood.

Prices of Building Materials in New York, May 28, 1879.

Blinds.—OUTSIDE.

Per lineal, up to 2 10 wide....$ .... @ 0.24	
Per lineal up to 3 1 wide..... .... @ 0 27	
Per lineal, up to 3 4 wide...... .... @ 0 30	
Per lineal, paint'd and trim'd 0.40 @ 0.50	

INSIDE.

Per lineal, 4 folds, Pine.......	.... @ .45
Per lineal, 4 folds, ash or chstnut	.... @ .72
Per lin'l, 4 folds, cherry or butternut	.... @ .86
Per lineal, 4 folds, bl'k wal't.	.... @ 1.00

Bricks (afloat).

Pale	₩ M.	$2.75 @ 3.25
Jersey	"	4.25 @ 4.50
Long Island	"	5.25 @ 5.50
Up-River	"	4.50 @ 5.00
Havers'aw Bay, 2ds.	"	5.00 @ 5.25
Havers'aw Bay, 1sts.	"	5.00 @ 5.50
Favorite brands	"	6.00 @ 6.50

FRONTS.

Croton—Brown	₩ M.	.... @ $8.00
Croton—Dark	"	.... @ 9.00
Croton—Red	"	.... @ 10.00
Philadelphia	"	20.00 @ 22.00
Trenton	"	19.00 @ 20.00
Baltimore	"	.... @ 38.00

Yard prices 50c. ₩ M higher, or, with delivery added, $1.50 per M for Hard and $2 50 per M for front Brick. For delivery add $2.50 on Philadelphia and Trenton.

FIRE BRICK.

Red Welsh	$35 00 @ 36.00
Scotch	26 00 @ 30.00
American	30.00 @ 35.00

Cement.

Rosendale, ₩ bbl.	$ 1.00 @ 1.15
Portland Saylor's American, ₩ bbl.	2.50 @ 2.90
Portland (imported) ₩ bbl..	2.65 @ 3 00
Roman "	2.80 @ 3.25
Keene's coarse "	6.50 @ 7.00
Keene's fine "	10.00 @ 10 50
Martin's coarse "	6 00 @ 6.50
Martin's fine "	10.00 @ 10.50

Doors.

RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ in.	$0.67	....
2.6 x 6 6	1¼ in.	.95	....
2.6 x 6 8	1¼ in.	1.00	....
2.8 x 6.8	1¼ in.	1.15	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾ in
2.0 x 6 0	$1 23	....	....
2 6 x 6 6	1.52	1.93	....
2.6 x 6.8	1.57	1.95	....
2.6 x 6.10	1.59	2.01	....
2.6 x 7.0	1 62	2.09	....
2.8 x 6.8	1 68	2.32	2.57
2.8 x 7 0	1.69	2.17	2.69
2.10 x 6.10	1.79	2.26	2.84
3.0 x 7.0	1.87	2.45	3.80

2nd quality 15 cts. less.

Drain and Sewer Pipe.

Discount 50 to 60 per cent. according to quality and size of order.

Pipe, per foot.	Bends & Elbows, Each.	Branches Sing.	Branches D'bl.		Traps, & V. Each.
2 in..$ .13	$ .40	$ .48	$ ...	Longer than 1 ft., charged as pipe.	$1.00
3 " .. .16	.50	.61	...		1.25
4 " .. .20	.65	.75	1.30		1.75
5 " .. .25	.85	.90	1.55		2.50
6 " .. .30	1.15	1.05	1.80		3.50
7 " .. .35	1.50	1.20	2.05		5.00
8 " .. .45	2.00	1.45	2.45		6.00
9 " .. .55	2.50	1.70	2.85		7.00
10 " .. .70	3.00	2.00	3.30		8.00
12 " .. .80	3.75	2.52	4.24		10.00
15 " .. 1.25	5.00				
18 " .. 1.60	7.50				

House Branches pr. lin. ft.	Sewer Branches pr. lin. ft..
15x6 $1.75	15 in. $2.25
18x6 2.50	18 " 3.00

Glass.—(American)

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$7.50	$6 75	$6 25	$5.75
11x14—16x24	8 50	7.75	7.25	6.50
18x22—20x30	10 75	9.75	8.75	7.75
15x36—24x30	12.25	10.75	9.00	8.50
26x28—24x36	13.00	11 50	9 75	9.00
26x36—26x44	14.50	13 25	10.75	9.50
26x46—30x50	15.00	14.00	11.25	10.50
30x52—30x54	16.00	14.50	12.00	...
30x56—34x56	17.25	15.50	13.50	....
34x58—34x60	18.25	17 25	15.00	....
36x60—40x60	20 75	18.75	17.25	....

DOUBLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$12.00	$11.00	$10.00	$9.25
11x14—16x24	13 75	12.50	11.75	10.50
18x22—20x30	17.25	15.75	14 00	....
15x36—24x30	19 75	17.25	14.50	....
26x28—24x36	21.00	18.50	15 75	....
26x36—26x44	23 25	21.25	17.25	....
26x46—30x50	24 00	22.50	18.00	....
30x52—30x54	25 75	23.25	19.25	....
x56—34x56	27.75	25.00	21.75	....
34x58—34x60	29.25	27.75	24 00	....
36x60—40x60	33.25	30 00	27.75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 inches, will be charged in the 84 united inches' bracket. Discounts, 70 & 10.

FRENCH WINDOW, PICTURE AND CAR GLASS.

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$8.00	$6.75	$6.25	$5 75
11x14—16x24	8 75	8 00	7.50	7 00
18x22—20x30	11.25	10 50	9 75	8.75
15x36—24x30	12 75	11 50	10 00	.
26x28—24x36	13 50	12 25	11 25	. .
26x36—26x44	14 75	13 75	11 75	..
26x46—30x50	16 25	15 00	13 00	....
30x52—30x54	17 25	16 00	13 50	...
30x56—34x56	18 75	16 75	15 00	...
34x58—34x60	19 50	18.00	16 00	....
36x60—40x60	21.00	19.50	18.00	..

DOUBLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$12 00	$11 00	$10.00	$9 25
11x14—16x24	14 75	13 75	12 75	11.75
18x22—20x30	19 00	17 75	16 00	....
15x36—24x30	21 50	19 25	16 50	....
26x28—24x36	23 00	20 75	18 25	....
26x36—26x44	25 00	23 00	19 25	....
26x46—30x50	27 00	25 00	21 25	....
30x52—30x54	28 50	26 00	22 25	....
30x56—34x56	30 00	27 75	24 75	....
34x58x34x60	31 75	30 00	27 00	....
36x60—40x60	35.50	32.50	30 25	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket.

Discounts, Single, 60&15 ; Double, 70.

GREENHOUSE, SKYLIGHT AND FLOOR GLASS.

Per square foot, net cash.

⅛ Fluted plate	15 @ 17
3-16 Fluted plate	16 @ 18
¼ Fluted plate	20 @ 22
¼ Rough plate	20 @ 22
⅜ Rough plate	22 @ 24
½ Rough plate	22 @ 25
¾ Rough plate	45 @ 50
1 Rough plate	50 @ 60

Hair.

Cattle ₩ bushel..$	.... @ 0.10
Goat "	.... @ 0.14

Lath.—Cargo rate....₩ M $ 1.60 @ 1.70

Lime.

Glen's Falls, common, cargo rate ₩ bbl	.... @ .75
Glen's Falls, finishing	.... @ .90
Rockland, common	.... @ .80
Rockland, finishing	.90 @ .95
Ground	.80 @ .85

Add 25c. to above figures for yard rates.

Lumber.

Pine, very choice and ex. dry, ₩ M. ft. thick	$45.00 @ $60.00
Pine, good	40.00 @ 45.00
Pine, second	25.00 @ 35.00
Pine, good box	14 00 @ 26.00
Pine, common box	14.00 @ 10.00
Pine, common box, ⅝	12.00 @ 14.00
Pine, tally plank, 1¼, 10 in., matched, each	.40 @ .43
Pine, tally plank, 1¼, 2d quality, matched, each..	.35 @ .38
Pine, tally planks, 1¼, culls, matched, each	.25 @ .28
Pine, tally boards, match'd, each, good	.28 @ .30
Pine, tally boards, match'd, each, common	.22 @ .25
Pine, tally boards, culls, matched, each	.21 @ .23
Pine, strip boards, merchantable, matched, each	.14 @ .15
Pine, strip boards, clear, matched, each	.22 @ .25
Pine, strip plank, dressed clear	.33 @ .35
Spruce boards, dressed	.18 @ .20
Spruce plank, 1¼ inch, dressed	.22 @ .25
Spruce plank, 2 in	.25 @ .35
Spruce plank (common)	.20 @ .22
Spruce wall strips	.11 @ .13
Spruce timber, ₩ M ft	15.00 @ 17.00
Hemlock boards, each	.14 @ .16
Hemlock joist, 2½x4	.13 @ .15
Hemlock joist, 3x4	.16 @ .18
Hemlock joist, 4x6	.40 @ .44
Ash, good, ₩ M ft	38 00 @ 45.00
Oak	45 00 @ 60.00
Maple, cull	20.00 @ 25.00
Maple, good	30.00 @ 45 00
Chestnut	45 00 @ 60 00
Cypress, 1, 1½, 2 and 2½ in	35 00 @ 40.00
Bl'k walnut, good to choice	85 00 @ 100.00
Black Walnut, 2d	55.00 @ 65.00
Black walnut, ⅝	70.00 @ 80.00
Black walnut, selected and seasoned	110 00 @ 150.00
Bl'k walnut counters, ₩ ft.	.12½ @ .20
Cherry, wide, ₩ M ft	85 00 @ 100.00
Cherry, ordinary	60 00 @ 80.00
Whitewood, 1 to 1½ inch	35 00 @ 45 00
Whitewood, ⅝ in	30 00 @ 35.00
Whitewood, ⅝ panels	35 00 @ 45.00
Shingles, extra sawed pine, 18 in.	5.00 @ 7.00
Shingles, clear sawed pine, 18 in., 2 md	4 00 @ 5.00
Shingles, cypress, 24x7	20 00 @ 22.00
Shingles, cypress, 20x6	12.00 @ 15.00
Yellow pine dressed flooring, ₩ M ft	25 00 @ 35.00
Yellow pine girders	28 00 @ 45.00
Locust posts, 8 ft., ₩ in	.18 @ .20
Locust posts, 10 ft.	.24 @ .25
Locust posts, 12 ft	.25 @ .30
Chestnut posts, ₩ ft	.3 @ .3½
Mahogany, ¼ in. ₩ ft	.5 @ .7
Mahogany, ⅜ in. ₩ ft	.8 @ .10
Mahogany, ½ in. ₩ ft	.10 @ .12
Mahogany, ⅝ in. ₩ ft	.12 @ .14
Mahogany, ¾ in. ₩ ft	.14 @ .16
Mahogany 1 in. ₩ ft	.16 @ .18
Rosewood, 1 in. ₩ ft	16 @ .22
Rosewood, ⅛ in. ₩ ft	.11 @ .15
Rosewood, ¼ in. ₩ ft	.16 @ .20
Rosewood, ⅜ in. ₩ ft	.24 @ .28
Rosewood, ⅝ in. ₩ ft	.40 @ .45
Rosewood, 1 in. ₩ ft	.50 @ .65
Satin wood, ½ in. ₩ ft	.10 @ .30
Satin wood, 1 in. ₩ ft	.30 @ .40
Cedar (Cuban and Mexican) ₩ ft	.10 @ .14
Cedar (Florida)	.8 @ .15
Less than 1 inch	.8 @ .24
1 inch and over	.25 @ .35

Plaster.

Calcined City	$1.00
" State	.90

Sash.

GLAZED.

Dimensions of windows.	12 Lights. 1¼pl.	1¼c.	1½c.	8 L's. 4 Lights. 1½c.	1¼c.	1½c.
2.1x3.6	$0.87	.92	....	....	....	....
2.4x3.10	.96	1.02	....	....	1.11	....
2.7x4.6	1.18	1.24	1.35	....	1.27	1.46
2.7x4.10	1.25	1.32	1.44	....	1.48	1.59
2.7x5.2	1.35	1.42	1.53	1.84	1.75	1.87
2.7x5.6	....	1.56	1.65	1.93	1.88	2.03
2.7x5.10	....	1.65	1.74	2.01	1.99	2.15
2.10x4.6	1.29	1.35	1.47	....	....	....
2.10x5.2	1.45	1.52	1.70	1.87	1.89	2.06
2.10x5.6	1.53	1.59	1.79	2.01	1.97	2.16
2.10x5.10	1.74	1.80	2.01	2.07	....	2.30

c. means counted checked—plowed and bored for weights.

Hot bed sash, glazed.......3.0x6.0....$1.90

HEAD LIGHT.

Two or three Lights, Glazed.

Size.	1¼	1½	Size.	1¼	1½
2.6x1.0	45	55	2.10x1.10	45	59
2.6x1.6	55	63	2.10x1.6	59	67
2.8x1.0	45	55	3.0x1.0	50	63
2.8x1.6	55	67	3.0x1.6	72	86

Slate.

By car load, delivered in New York.

Purple roofing slate, ₩ sq're.	$5.00 @ $5 50
Green slate	5.00 @ 5.50
Red slate	.... @ 9 50
Black slate, Pennsylvania	.... @ 4.00
Tiles, 1¼ in. rubbed, ₩ sq. ft.	.20 @ .25

₩ sup. ft.

Steps and platforms, 1 in. thick	28c
" " 1½ "	35c
" " 2 "	42c
Risers, 1 inch thick	27c
Coping, 1½ "	27c
" 2 "	31c

Lineal ft.

Window sills, 4x7	45c
" 3x7	36c
Window caps, 4x10, plain	65c
" 4x8, "	50c
" 3x10, "	47c
" 3x8, "	42c

Stair Material.

BALUSTERS.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned	7c	9c	10c	16c
Neck Turned	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

OCTAGON PANELED NEWELS.

Panels Veneered with French Walnut.

8-inch Newels, with Cap	$6.12
9 " " "	6 88
10 " " "	7.60

SOLID NEWELS, WITH CAPS.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned	$1.60	$1 90	$2 50	$3.40
Octagon	2.10	2.40	3.00	3.90

STAIR RAIL.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	40c	45c	50c	53c
Toad Back	45c	50c	63c	68c

STAIR RAIL, UNFINISHED.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ₩ C ft.	$.... @ $0.85
Berlin freestone, in rough	.... @ .85
Berea freestone, in rough	.... @ .70
Brown stone, Portland, Ct.	1.25 @ 1.50
Brown stone, Belleville, N. J.	1.00 @ 1.50
Granite rough	.50 @ 1.00
Dorchester, N. B., stone, rough ₩ foot.	.... @ 1.00

BLUE STONE

Rubbed hearth, 10 ft. or under	20c
Rubbed hearth, 20 ft. or under	30c
Rubbed hearth, 3 ft. or under	45c
Rubbed hearth, 40 ft. or under	55c
Rubbed sills, imported	28c
Rubbed sills, domestic	33c
Sills and lintels	.... @ 17c
Sills and lintels, fine quarry cut sills	.... @ 35c
Coping, 11 to 18 in. wide	18c @ 30c
Coping, 20 to 28 in. wide	35c @ 55c
Coping, 30 to 36 in. wide	60c @ 75c
Steps, 8 in	.... @ 55c
Steps, 7 in	.... @ 40c
Steps, 6 in	.... @ 25c
Steps, door, per in. wide	.... @ 2c
Platforms, promiscuous, 4 in...	.... @ 32c

Vault Lights.

Platform, sq ft	$3.00
Step and risers, sq. ft.	3.25
Floor light, sq. ft	2.25
Roof light, sq. ft	2.00
Platform, 2d quality, sq. ft.	2.60

COVERS.

Diameter.	Round.	Hexagon.
14 inch	$3.00	$0.00
16 "	3.75	4.00
18 "	5.50	6.00
20 "	8.00	8.50
24 "	14.00	15.00
26 "	16.00	17.00
30 "	23.50	25.00
36 "	31.00	33.00

Window Frames.

Up to 3.4 x 7.2, put together.. .... @ 2.15

Moldings 45c. to 55c. per inch per 100 feet, according to quality.

CARPENTRY AND BUILDING

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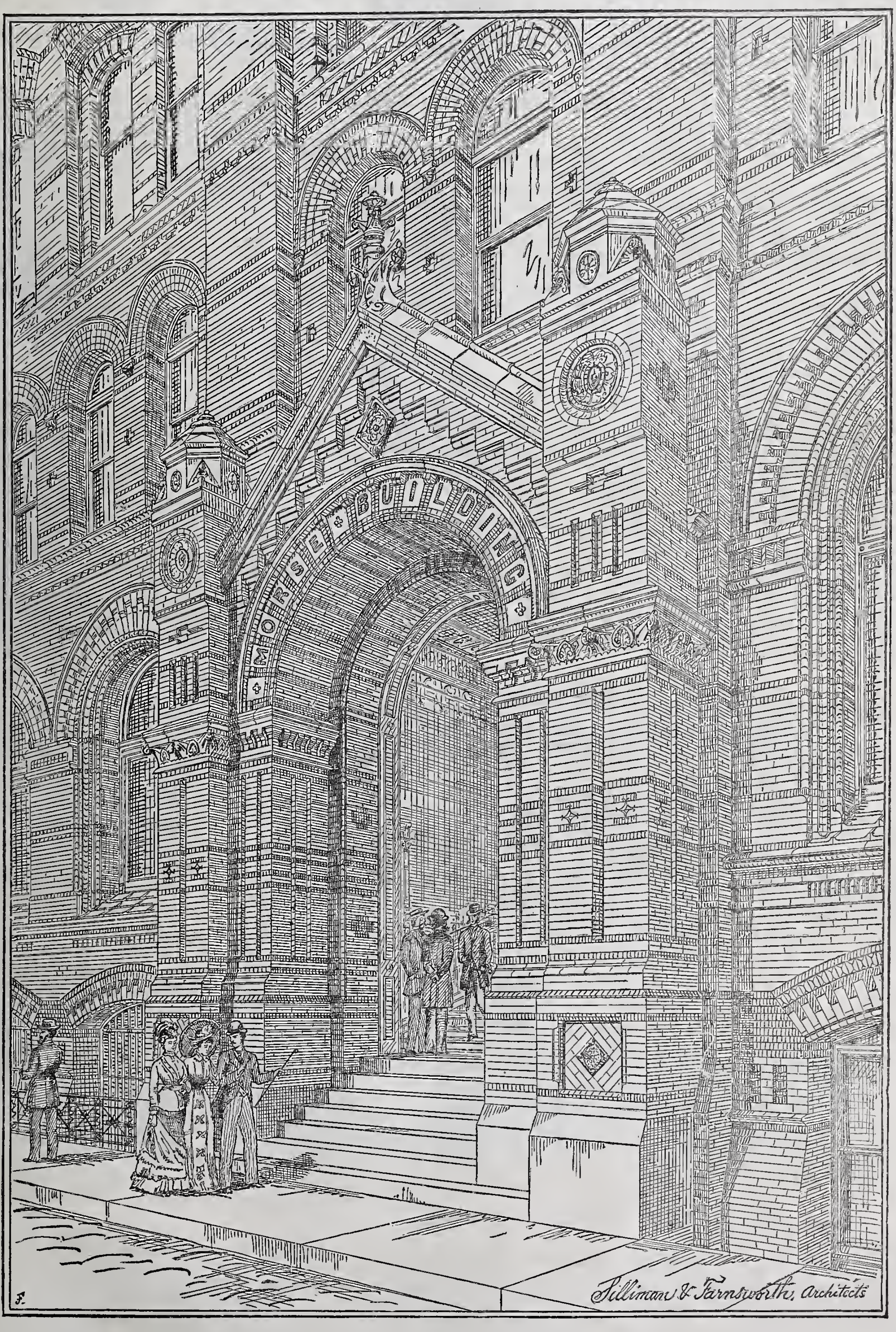


Artistic Brickwork.—Fig. 9.—Entrance to the Morse Building.

ARTISTIC BRICKWORK.

The Morse Building.

(Concluded.)

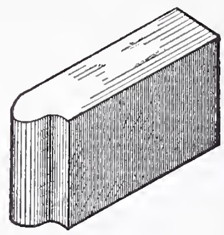
In Fig. 9 is shown in perspective the front entrance, which occurs on Nassau street, and which may be declared to be one of the most important features, artistically considered, in the whole building. In general appearance it is very imposing, and is altogether in keeping with the structure of which it is so conspicuous a part. Terra-cotta forms have been used sparingly in its details, as may be seen by inspection of the engraving; the finial above the pediment, the capitals to the pilasters, and the rosettes being of this material.

In Fig. 10 is shown a detail of the arches in the basement, of which mention has already been made. Figs. 12, 17 and 18 show enlarged views of the molded brick of which the basement arches are constructed.

Fig. 15 shows the first-story arches, also before mentioned. The sill in this story is formed by means of a terra-cotta tiling, the lower member of which is molded to form a drip. The details of the molded brick used in the first-story arches are shown in Figs. 11, 14, 16 and 19.

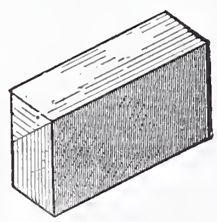
We have mentioned that the building is fire-proof. The general construction being of brick, goes far toward rendering this a fact, rather than a mere name. In the construction of the floors, iron beams, spanned by corrugated iron arches, have been employed. There is little in the building to be burned in case a fire should originate in any part of it, while its solid brick walls, separating it from adjacent buildings, will resist any fire which is likely to be kindled against it. Iron beams are used in the roof. The corrugated iron arches are covered by a heavy layer of cement, upon which are bedded flat, vitrified tile. A bonfire might be lighted upon this roof without endangering the building in the least.

Concerning the use of molded bricks in connection with this building, one of our daily contemporaries says: "There are few cases, for instance, in New York, in which molded bricks have been used at all, in which they have not been so intemperately used as to mar the effect of the building they were meant to beautify. The use of them in this building in the modeling of the openings of the basement and the first story, in which they are chiefly employed, is positively delightful. It is clear that they have been used, not because the designer was anxious to introduce molded bricks, as commonly appears to be the case, but because he found them necessary to carry out his design." The same writer continues: "The same is true of the use of black bricks, generally employed merely for variety, and so either ineffective or distracting, but here intelligibly to express or define an arch, to emphasize a needful line, or to add vigor to a springer, and consequently effective."



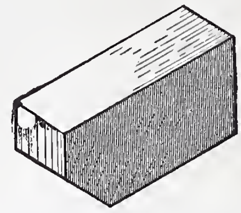
Artistic Brickwork.—Fig. 11.—*Enlarged View of Brick No.* 22, *in Fig.* 15.

We have already mentioned that the molded brick used in the construction of this building were furnished by the Peerless Brick Co., of Philadelphia. This company has given especial attention to the problem of obtaining rich and durable colors in brick, as well as good quality in ornamental brick. We clip the following from a recent Philadelphia paper:

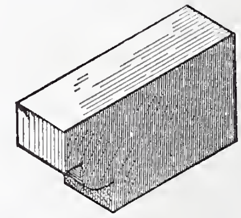


Artistic Brickwork.—Fig. 12.—*Enlarged View of Brick No.* 12, *in Fig.* 10.

"The Peerless Company has revolutionized the manufacture of bricks, and has gone far toward effecting a welcome revolution in brick architecture, not alone by the infinite variety of shapes and excellence of finish which the company imparts to the bricks it turns out, but also by reason of the beauty of their color. It is, doubtless, owing to the impossibility which architects have heretofore found of getting rich and lasting shades in vari-colored bricks, that a brick building up to this time has meant invariably a dull red pile, unrelieved by any other tint except in occasional instances, and then by the introduction of a white that would turn green, or a black that was not black when viewed from certain angles. George E. Street, one of the ablest writers of the age on art and architecture, says: 'At the present day there is, I think, absolutely no one point in which we fail so much, and about which the world in general has so little feeling, as that of color. Our buildings are, in nine cases out of ten, cold, colorless, insipid academical studies, and our people have no conception of the necessity of obtaining rich color.' And again: 'Our buildings should, both outside and inside, have had some of that warmth which color only can give; they should have enabled the educated eye to revel in bright tints of nature's own formation, while to the uneducated eye they would have afforded the best of all possible lessons, and by familiarizing it with the proper combination of color and form, would have enabled it to appreciate it.'"

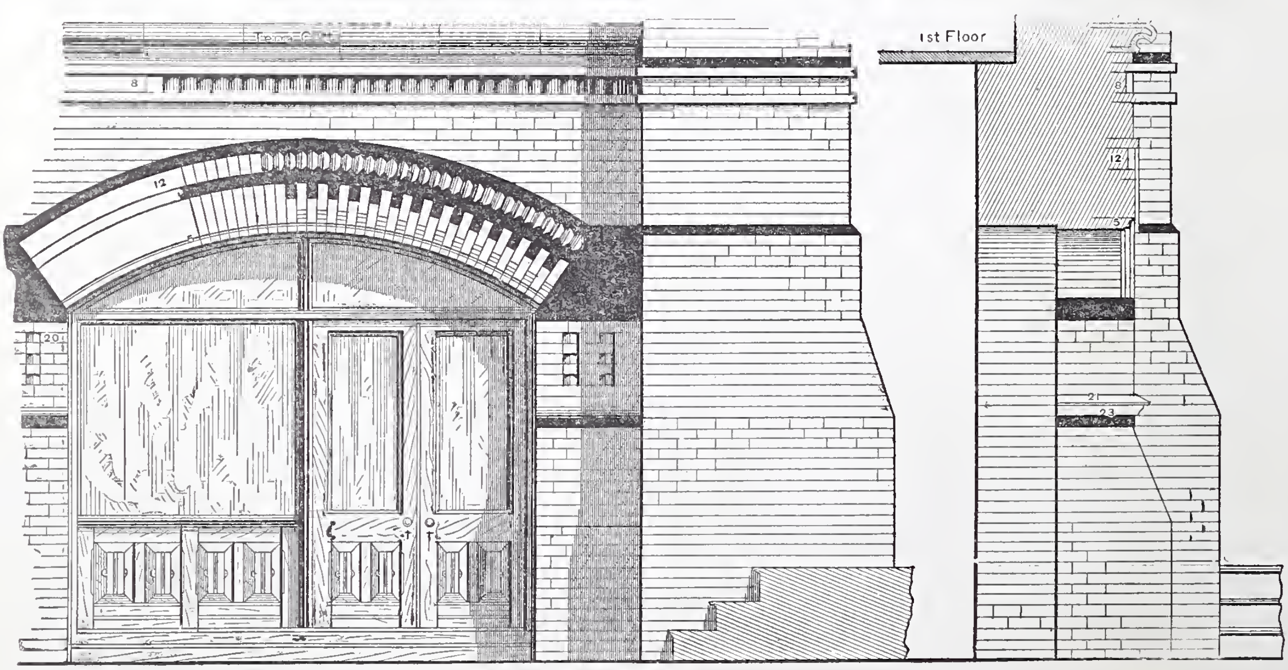


Artistic Brickwork.—Fig. 13.—*Enlarged View of Brick No.* 7.



Artistic Brickwork.—Fig. 14.—*Enlarged View of Brick No.* 50, *in Fig.* 15.

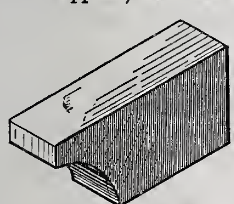
The Morse Building as it stands, independent of the ground, has cost about $175,000, rendering it one of the cheapest buildings, all things considered, which has been erected in this city since 1861. It will, no doubt, prove a profitable investment to its owners, while being a characteristic example of new ideas in the construction of office buildings.



Artistic Brickwork.—Fig. 10.—*Detail of the Basement Story of the New Morse Building.—Scale, ¼ Inch to the Foot.*

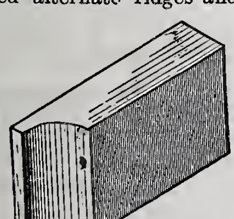
How to Grind Edge Tools.

Edge tools are fitted up by grinding. The sharp grit of the grindstone, being harder than the iron or steel, cuts very small channels in the surface of the metal, and the revolving disk carries away all the minute particles that are detached by the grit. If we were to examine the surface of the tool that has just been removed from the grindstone under the lens of a powerful microscope, it would appear, as it were, like the



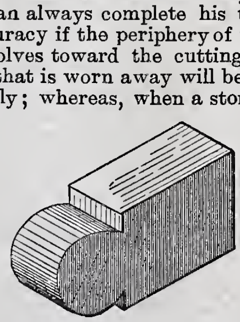
Artistic Brickwork.—Fig. 16.—*Enlarged View of Brick No.* 1 *in Fig.* 15.

rough surface of a field which has recently been scarified with some implement that had formed alternate ridges and furrows.



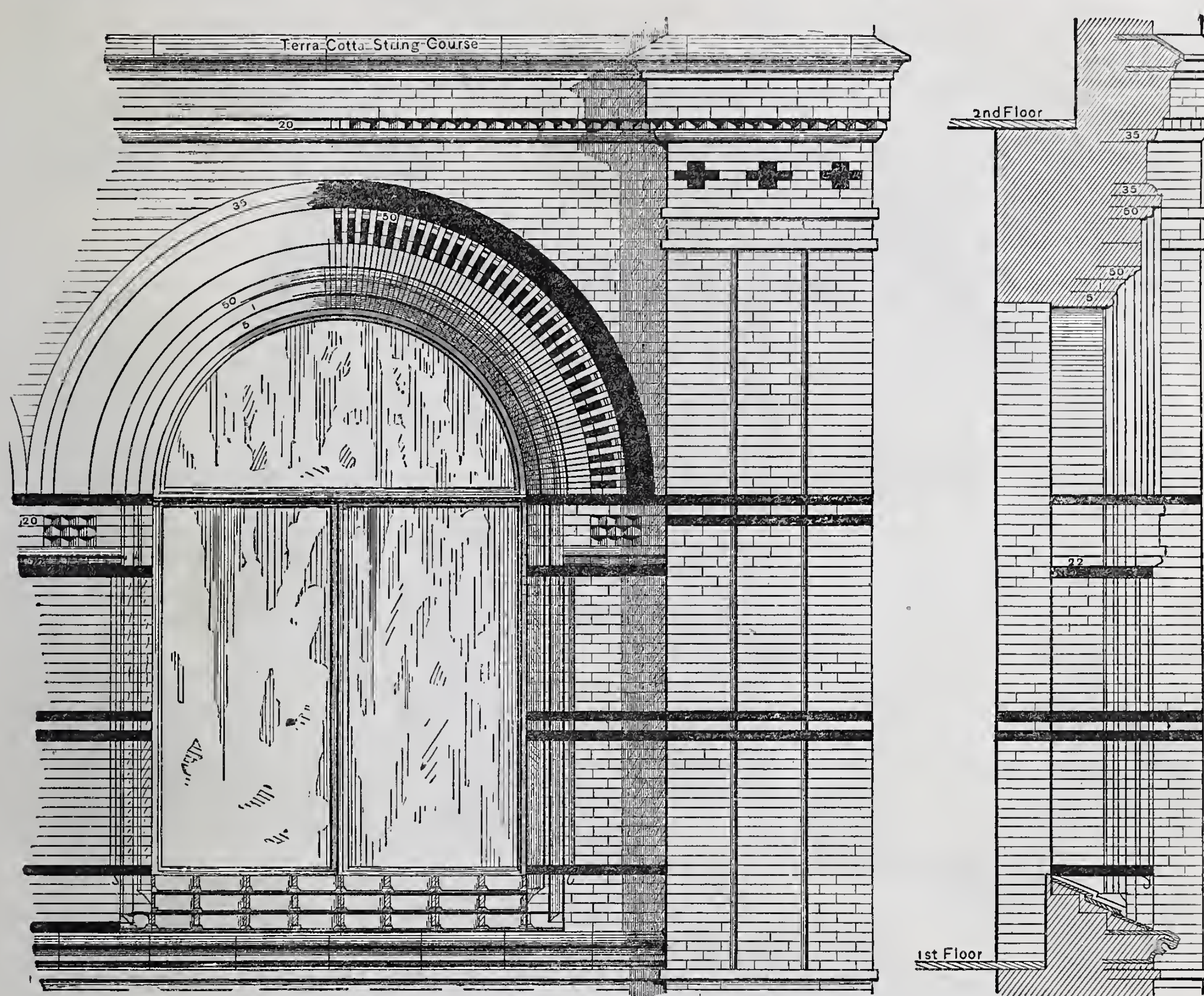
Artistic Brickwork.—Fig. 17.—*Enlarged View of Brick No.* 23, *in Fig.* 10.

Hence, as these ridges and furrows run together from both sides at the cutting edge, the newly ground edge seems to be formed of a system of minute teeth, rather than to consist of a smooth edge. For this reason a tool is first ground on a coarse stone, so as to wear the surface of the steel away rapidly; then it is polished on a wheel of much finer grit; and, finally, in order to reduce the serrature as much as possible, a whetstone of the finest grit must be employed. This gives a cutting edge having the smallest possible serration. A razor, for example, does not have a perfect cutting edge, as one may perceive by viewing it through a microscope. Beginners are sometimes instructed, when grinding edge tools, to have the stone revolve toward the cutting edge, and sometimes from it. When the first grinding is being done it is a matter of indifference whether this is done or not; but when the finishing touches are applied near and at the very edge, a grinder can always complete his task with more accuracy if the periphery of the grindstone revolves toward the cutting edge, as the steel that is worn away will be removed more easily; whereas, when a stone runs in



Artistic Brickwork.—Fig. 18.—*Enlarged View of Brick No.* 8, *in Fig.* 10.

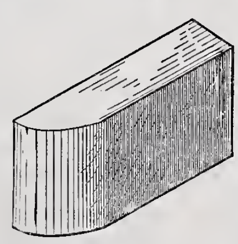
the opposite direction, the grinder cannot always tell exactly when the side of the tool is fully ground up to the edge. This is more especially true when the steel has a rather low or soft temper. The stone, when running from the edge, will not sweep away every particle of the metal that hangs as a "feather;" but when the stone revolves toward the edge, there will be no "feather edge" to deceive the eye of the grinder.



Artistic Brickwork.—Fig. 15.—*Detail of First Story Windows of the New Morse Building.—Scale,* ¼ *Inch to the Foot.*

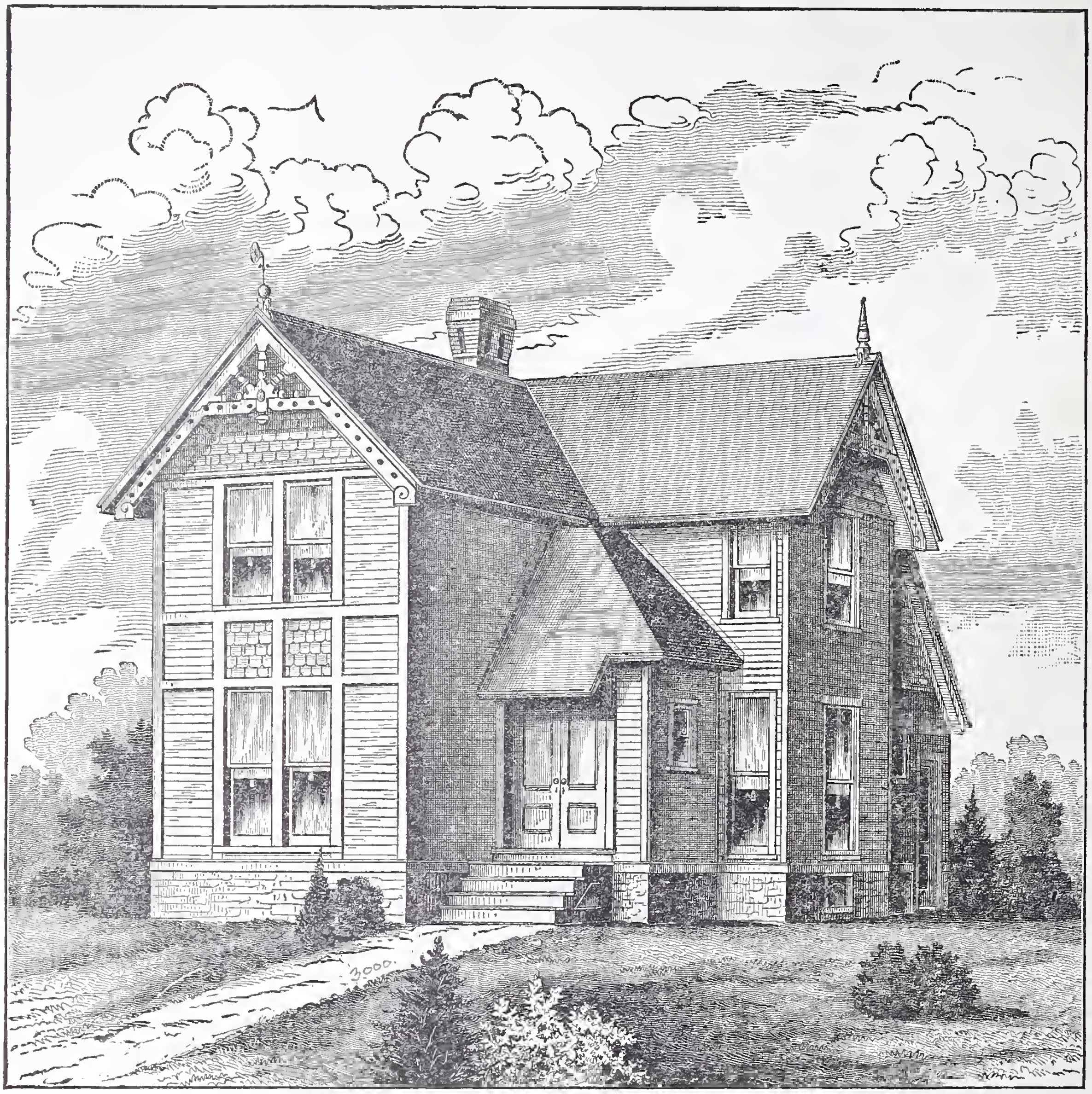
Comparison of Measures.—One bushel equals 2150.42 cubic inches; one gallon, 231 cubic inches; six and five-tenths barrels, one cubic yard; one load of earth, 21.7 bushels.

Tracing and Transferring.—There are numerous methods used for transferring letters, drawings, &c. The most common is by means of thin transparent tracing paper or cloth, which is placed over the design to be copied and traced over with a pencil, after which the opposite side of the tracing is penciled over with a soft black pencil; then the tracing is placed upon the paper to which the transfer is to be made, when the lines upon the tracing are retraced with a pencil or any smooth-pointed instrument which will give a distinct outline upon the paper underneath. Transfer or blackened paper is often placed under the tracing before retracing it, instead of penciling its reverse side, which is objectionable from the liability of blackening or soiling the paper upon which the drawing is to be made. Of course this method can be used only where the desired reproduction is the same size as the original. If it is to be enlarged or diminished, other methods must be sought. This may be accomplished by marking the



Artistic Brickwork.—Fig. 19.—*Enlarged View of Brick No.* 35, *in Fig.* 15.

copy to be transferred into certain sized squares, and the paper upon which the reproduction is to be made into corresponding squares, enlarged or diminished according to the change desired in the original copy. The same change is accomplished very readily by the use of proportional dividers, with which every draftsman should be provided.—*From Ames' Alphabets.*



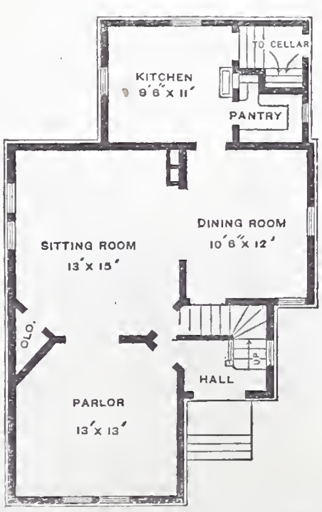
First Prize Design for Cheap Houses.—Fig. 4.—Perspective View.—F. A. Hale and W. L. Morrison, Architects, Rochester, N. Y.

ARCHITECTURE.

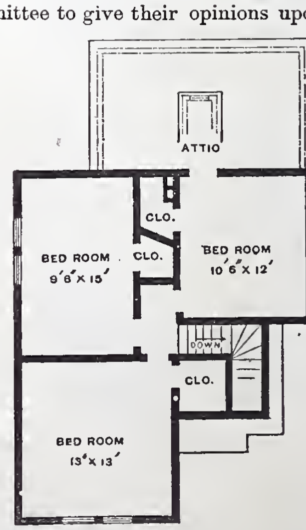
Competition in Designs for Cheap Dwelling Houses.

In response to the advertisement announcing a competition in designs for cheap houses, published in the May number of *Carpentry and Building*, we received upward of thirty sets of plans and specifications. As soon as possible after the expiration of the time set for the receipt of the plans, the committee of experts to whom was entrusted the examination and criticism of the designs submitted, and who were to award the prizes, got at their work. They found no small task before them. In the main the sets of plans submitted complied with all the requirements of the advertisement, although a few, by the estimates sent with them, considerably exceeded the limit of price fixed, $1000, while some of them, although accompanied by estimates which footed only $1000, were found to be worth much more than that sum. Of the latter, the estimates sent in were either short in quantities of the various items entering into the building, or else were short some entire parts of the work.

Inasmuch as the plans submitted came from various sections of the country, it was agreed by the committee that the prices of labor and materials prevailing at the several places from which the plans were sent, were the only ones which could be used in determining the value of the structures represented. It was manifestly unfair to individual competitors to estimate the cost of their designs in a market with which they were unacquainted, and which differed in the kinds of materials used for certain purposes from that of their own. Accordingly, careful scrutiny was given to the items entering into each estimate as defined by the specifications, and to the quantities of each kind of material required by the drawings. Corrections in these particulars were made if any were found necessary, and figures were extended by the prices current in the locality from which the drawings were sent. In cases where the estimate of cost accompanying the design was certified to by a responsible builder, it was considered satisfactory evidence that the plans could be executed in the locality from which they were sent at the figures named. Competent and responsible builders were called in by the committee to give their opinions upon various points with respect to materials and construction, and a number of the designs were figured throughout independent of the estimate sent in by the authors. Neither care



First Prize Design.—Fig. 5.—First-Floor Plan.—Scale, 1-16 Inch to the Foot.



First Prize Design.—Fig. 6.—Second-Floor Plan.—Scale, 1-16 Inch to the Foot.

nor expense was spared, in any particular, to arrivo at a just decision.

The decision of the committee awards the the prizes as follows :

First Prize to Messrs. F. A. Hale and W. L. Morrison, of Rochester.

Second Prize to Mr. David S. Hopkins, of Grand Rapids, Mich.

Third Prize to Mr. Thos. J. Gould, Providence, R. I., and the

Fourth Prize to Messrs. Clarence W. Smith and Augustus Howe, Jr., New York City.

We present herewith, for the consideration of our readers, the elevations, perspective, floor plans and details of the design receiving the first prize, together with the specification and schedule of the estimate.

Specification

of materials to be furnished, and labor to be performed, in the erection and completion of a new cottage dwelling for *Carpentry and Building*, in accordance with the plans, elevations and detail drawings made or to be made, and this specification prepared by F. A. Hale and W. L. Morrison, Architects.

June, 1879.

MASON WORK.

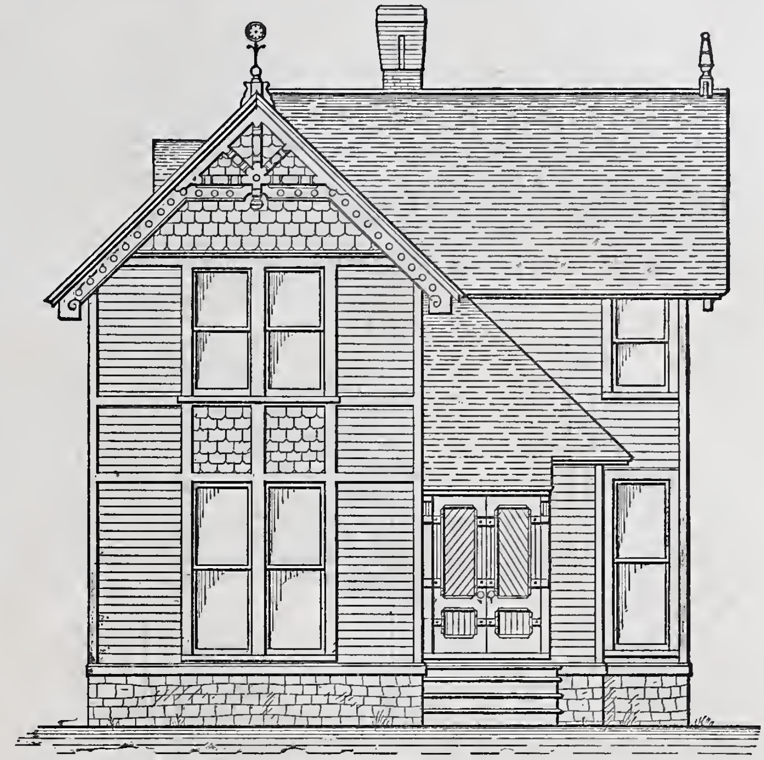
Dimensions and style of building will be obtained from the drawings, the figures upon them being preferred to the scale measurement, in all cases, and in case of disagreement betwen drawings, the full-size drawing, or if no full size is given of the part in doubt, then the drawing to the largest scale will be followed as correct. Carpenter will establish all hights, and set rod for mason to work to.

Hights.—Cellar to finish, 6 feet 8 inches in clear ; first story to finish, 8 feet 4 inches in clear ; second story to finish on rafters, 8 feet in clear. Other hights as per drawings.

Excavation.—Excavate for a cellar under entire house, as per drawings, for trenches, footings, etc., doing any and all excavating necessary to carry out the design in all its parts.

Foundation Walls—18 inches thick ; will start 6 inches below finished cellar bottom, on large flat stones, extending the full thickness of the wall and bedded solid in mortar. Footings under chimney and brick pier in cellar to project four inches on all sides and to be 20 inches deep. Step foundation 16 inches thick, to extend 3 feet 6 inches below grade.

All foundation walls laid with large-size first-quality quarry building-stone, to line both sides in good, fresh, burned quicklime and sharp, coarse sand mortar.



First Prize Design for Cheap Houses.—Fig. 1.—Front Elevation.—Scale, ⅛ Inch to the Foot

Walls to be carried up plumb and true, and beveled off for sills. The exterior face exposed above grade to be of large selected stone with rough face, neatly tucked with a dark red joint.

Brickwork.—All brickwork of good, merchantable brick, well soaked in water before used.

Chimney and flue will start at cellar bottom in hard brick ; flues to be smoothly plastered the full hight and left clear.

Chimney topped out as drawn, in hard seleted brick, stained dark red, anu neatly tucked with a black joint.

Chimney to have 6-inch thimble and tin cover at bottom of each flue and in each adjacent room.

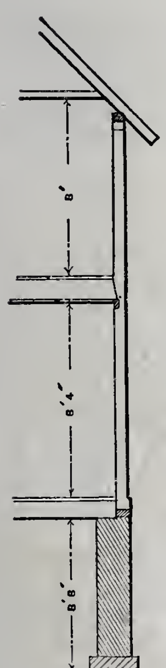


Fig. 2. —Section.

First Prize Design for Cheap Houses.—Fig. 3.—Side Elevation.—Scale ⅛ Inch to the Foot.

Lath and Plaster.—All walls, ceilings and soffit of stairs above cellar (except attic and cellarway) will be well lathed with sound sawed ⅜-inch dry pine lath, ⅜ inch apart and firmly nailed to each bearing, joints broken once in seven courses. All to be plastered in two-coat work, last coat of lime, plaster paris and Rockaway sand, well floated and troweled down to a true and even surface. All angles and arrises plumb and true, and the entire work left clean and uninjured.

Cellar bottom to be neatly evened off and rammed hard.

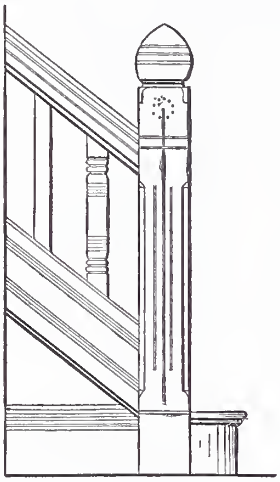
CARPENTER WORK.

Timber.—All timber necessary to carry out the entire design in all its parts will be sound hemlock, free from shakes or bad defects, and as dry as the market affords. Sills to be 6 x 6 inches. Posts and plates to be 4 x 4 inches. Studs to be 2 x 4 inches; 16-inch centers footed to plates and sills.

Sill posts and plates securely framed together and spiked. Second-floor joists to rest on a 1⅛ x 4 inches dry pine girt, gained into studs and spiked on.

Joists in first story to be 2 x 10 inches, 16-inch centers; joists in second story to be 2 x 8 inches, 16-inch centers; ceiling joists to be 2 x 6 inches, 20-inch centers, firmly spiked to rafters.

Floor joists cross bridged in rows not over



Prize Design.—Fig. 7.—Detail of Newel, &c. —Scale, ½ Inch to the Foot.

5 feet apart, or 5 feet from bearings, with 2 x 3-inch dry stuff, well nailed at each end of every piece with two 10d nails.

Rafters 2 x 6 inches, 20-inch centers, footed to plates and well spiked.

Framing to be close, workmanlike, and well spiked.

Trimmers and headers for chimney and stairways formed of three dry joists, well spiked together, the center joist to be one inch narrower than the others, to give space for keying of plaster; 10-inch joists to be framed with double tenons, and 8-inch joists with tusk tenons.

Girder in cellar to be formed of four 10-inch joists, firmly spiked together.

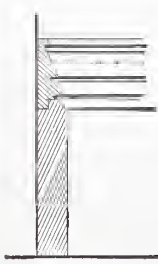
Roofs to be covered with 1-inch hemlock, roof boards firmly nailed to each bearing.

Flashings, gutters on all horizontal eaves, and valleys of ample widths to be of roofing tin. Joints to be locked and soldered, and all absolutely weather-tight.

Two lines of 3-inch cross tin conductors to lead to cistern, to be securely fastened.

Gutters to be formed, as per detail, by turning tin over a rounded dry pine strip, properly inclined toward conductors.

All roofs to be covered with dry, sawed, ⅜ inch pine shingles, laid 5 inches to the weather, and well nailed.



Prize Design.—Fig. 8.—Detail of Base.—Scale 1½ Inch to the Foot.

Gables and panels on elevations to be filled with cut shingles, as shown, of even widths, and neatly put on and smoothed for painting.

Shingling on sides of rear part will be plain, as per elevation.

Sunflower on front gable to be of stamped, galvanized iron, as per detail.

The entire exterior surface will be covered on the studs with 1-inch planed and matched pine sheathing, firmly nailed to each bearing.

The sheathing on rear part to be vertical, of even widths, and battened. Main part to be covered with first quality clear dry pine clapboards 5½ inches wide, laid 4½ inches to the weather, and all true and well nailed.

Corner boards and casings to be 1⅛ inches thick and 4 inches wide. Water table to be 1⅜ inches, beveled. Door and window-sills to be 2 inches thick. Cornice to be built as drawn, with trusswork and finials for gables. A plain gable on chimney, dormer window for attic, with glass 12 inches diameter, and a gable on roof, all to be finished as per detail to be furnished hereafter.

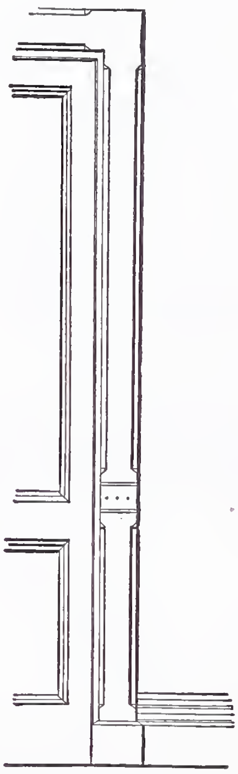
Outside steps to be made of 1⅜-inch pine. The platform to be jointed in red lead, with nosings, covers and returns. Side string to be filled with narrow vertical pine battens, as shown.

All exterior woodwork to be of clear pine, prepared for painting.

Inside Finish.—All floors to be of seasoned, sound, ⅞-inch dry pine, free from injurious defects, and not over 6 inches wide.

All to be driven up to close joints firmly, blind-nailed to each bearing and planed smooth.

Partitions to be well set to true lines, with 2 x 4-inch studs, 16-inch centers, firmly nailed and blocked between with 2 x 4-inch pieces once in each story.



Prize Design.—Fig. 9.—Detail of Inside Trimming.—Scale ½ Inch to the Foot.

Door studs to be doubled and blocked between.

Partition studs standing directly over partitions below, or over girder, will extend down to them, and not rest on joists or floors.

Grounds will be put on for casings and base.

Doors—To be one pair of double entrance doors, 4 feet 8 inches x 7 feet 4 inches, 2¼ inches thick, to be glued and screwed together; styles cut and panels filled with narrow diagonal beaded stuff, all as per detail to be furnished. Front doors to be hung on 2-inch rebated, clear, dry pine frame, with two loose-joint, black-japanned, acorn-tipped butts to each leaf; lava knobs, and trimmings of common bronze; flush bolts, mortise lock and night latch with duplicate keys.

To be two pairs of double doors, rebated, 5 feet 10 inches x 7 feet 8 inches; to be seven single doors, 2 feet 8 inches x 7 feet 4 inches; to be seven single doors, 2 feet 10 inches x 7 feet 4 inches; to be seven single doors, 2 feet 6 inches x 7 feet.

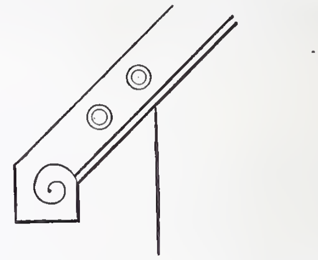
All to be 1⅜ inches thick, clear, dry pine, four panels to each leaf, and neatly flush molded, each hung in 1⅛-inch clear, dry pine, rebated frame, with two suitably loose joint butts.

Doors in the three main rooms of first floor to have white porcelain knobs, with plated furniture.

All other doors to have brown mineral knobs and jupanned trimmings. Inside double doors to have flush bolts and suitable catches.

Doors into bedrooms to have mortise locks. Outside cellar door to have mortise lock and heavy bolt.

Windows.—Cellar windows will be hung



Prize Design.—Fig. 10.—Detail of Verge Board.—Scale ½ Inch to the Foot.

with two butts, to swing up; with fastenings, open and shut; in 1⅜-inch frames, with 2-inch oak sills. All to be fitted with ½-inch round wrought-iron rods, set vertically 3 inches between centers in head and sill.

Sash to be 1⅜ inches. Dormer window to have glass 12 inches diameter, and pantry windows to have glass 12 x 16 inches in sash, hung to swing open; both to have spring catches.

All other windows will be double hung, in box frames, with best axle pulleys, round cast-iron weights and cotton sash cord.

Windows in first story to have sash locks.

The first story requires five windows, two lights each, 24 x 40 inches; one window, two lights, 28 x 40 inches; two windows, two lights each, 24 x 24 inches.

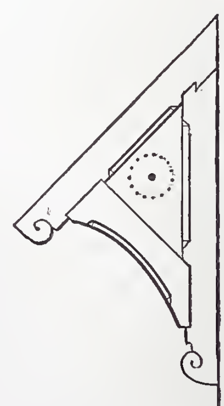
The second story requires five windows, two lights each, 24 x 30 inches; five windows, two lights each, 28 x 30 inches.

All sash to be molded, 1⅜ inches thick; painted one coat before glass is set.

All windows above cellar to be glazed with double thick French sheet glass. Glass to be single thick in cellar.

Casings—In kitchen part and second story to have ⅞-inch plain beveled band casings, 4½ inches wide; base, 8 inches high.

Casings in first story, main part, to be 1⅛ x 4½ inches, chamfered and grooved as per detail. Molded base to be 9 inches high, as shown in drawing.



Prize Design.—Fig. 11.—Detail of Bracket.—Scale ½ Inch to the Foot.

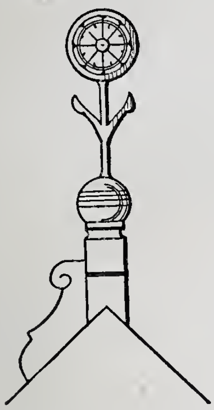
Windows not extending to floor will finish with neatly molded stools and aprons.

Stairs.—Front stairs, with winders, to have short rail, with two turned balusters and newel of Georgia pine, as shown in detail. Stairs to be partly inclosed. Treads to be 1⅛ inches; risers to be ⅞ inch, finished with nosings, coves and returns on lower steps. Lowest step to be rounded. All to be tongued, glued and blocked together, and housed into strings.

Cellar stairs above platform to have risers and nosings. All securely made. Head room is to be secured by properly boxing up under shelving in pantry.

Pantry to be fitted up with pine shelving on cleats, as shown. Slide, 14 x 18 inches, over sink to be neatly paneled, cased and trimmed, with spring catch.

Sink to be $1\frac{3}{8}$-inch clear, dry pine, filled in underneath with $\frac{7}{8}$-inch planed, matched and beaded pine, with battened door having a spring catch. Joints to be set in red lead. Size of sink to be 5 x 20 inches by 3 feet 6 inches, inside measure.

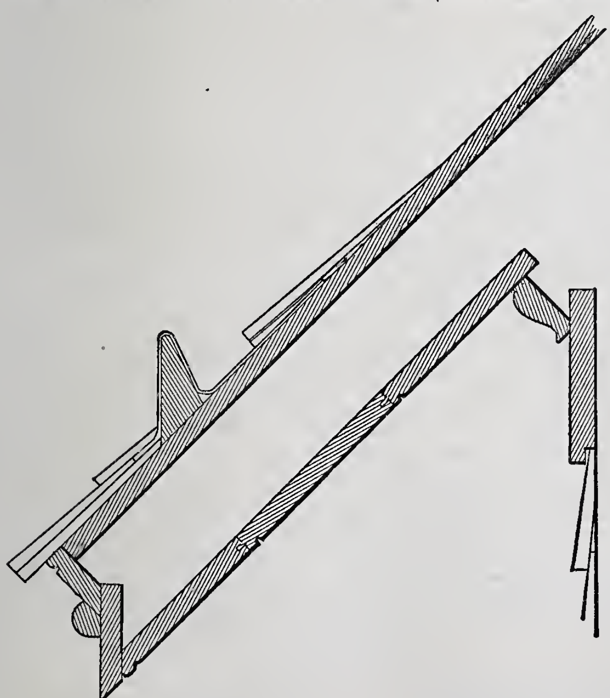


Prize Design.—Fig. 12.—*Detail of Front Finial.—Scale ½ Inch to the Foot.*

Cistern.—A wooden cistern, to be 5 feet in diameter by 5 feet deep, is to be set on 4 x 4-inch scantling in cellar. Staves to be 2-inch; all firmly bound with three heavy wrought-iron hoops, well riveted, and to have a rough brass stop-cock near bottom.

Painting.—All exterior wood and metal work, except shingling on roofs, will receive two coats best linseed oil and lead paint, to finish as follows:

Body of house, a medium olive. The trimmings to be three shades darker, sash (both sides), chamfers and grooves in turned work, shingling on sheathing, chamfers, &c., in front doors to be Indian red. Ceiling of hood over front doors to be medium blue.



Prize Design.—Fig. 13.—*Detail of Cornice and Gutter.—Scale, 1½ Inch to the Foot.*

Galvanized iron finial to be iron blue, tipped with a very little bright red.

All interior casings, doors, base, newel, rail, balusters, &c., to be finished in two good coats of oil and shellac.

Finally.—To make a complete finish of the entire work, to the true intent and meaning of the drawings and this specification, and to the entire satisfaction of *Carpentry and Building.*

Schedule of Estimate.

Schedule of estimate of actual cost, submitted by F. A. Hale and W. L. Morrison in connection with their design:

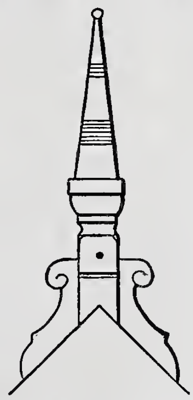
Excavating	$34.00	Cornices	46.00
Stone wall	110.50	Windows	98.00
Chimney	18.46	Cellar windows	6.00
Plastering	73.42	Doors	120.00
Frame	64.00	Flooring	45.00
Boarding	34.00	Stairs	20.00
Siding	25.00	Base	34.00
Roof boards	20.00	Sink, &c	10.00
Shingling	62.50	Cistern, &c	25.00
Gutters and hardware	42.00	Painting and Oiling	80.00
Truss work	13.00		
Water table, &c.	15.00	Total	$995.88

Revised and corrected by James Arnold, builder, 32 Rowley street, Rochester, N. Y.

Treatment of Foliage.

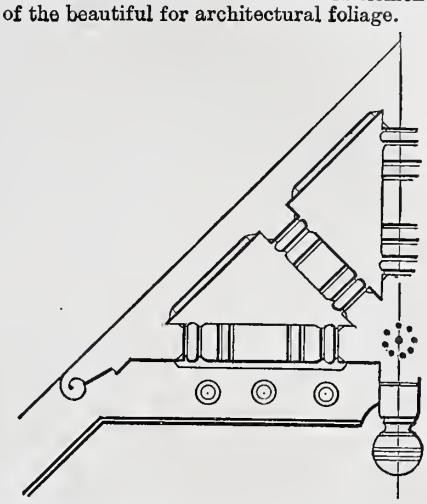
BY JAS. K. COLLING.

There are numerous instances in Roman work where nature has been studiously



Prize Design.—Fig. 14.—*Detail of Side Finial.—Scale ½ Inch to the Foot.*

followed, more practicularly in carvings from the vine, oak and ivy. Now, what I want to elucidate by this is that as there have been artists, even in ancient times, who have made a close and successful application of nature to art by entirely throwing over the conventional treatment of their time, so we, in the present day, should throw aside all architectural precedents for foliage, except the principles upon which they worked, and boldly make our applications directly from nature. But instead of doing so, we, like many of the Renaissance workers, who also strove to reintroduce nature, are so bound by conventional rule, that we are not likely, from this timid mode of proceeding, to succeed but in a partial degree, and by adopting two different manners we must fail in harmonizing them. But artist and carvers are told by architects, and one hears it continually held up as law, that foliage for architectural purposes must be highly conventionalized, that it must not be too natural, and so on. I was in a church the other day which had been lately restored, and I remarked to the clergyman, "Why, what commonplace designs all your new poppy-heads are." "Oh, yes," he replied, "our architect prefers them; the carver wanted to make some of them different, but the architect would not allow him to do so, but would insist upon his copying the old ones." In this manner, which is only too common a case, we are constantly trying to resuscitate the ornament of former ages. This plan will never lead to any good result, and will bring with it nothing but disappointment. For whether we essay to design in the style of the Greek or the Roman, or in Gothic (for instance, as in the manner of the very beautiful foliage of the early English period), however much we may admire these works, they are all things of the past, and we never can, by any mode of copying or adaptation, make them applicable to the nineteenth century. There is, therefore, a paramount necessity for again having constant recourse to nature as the main element of the beautiful for architectural foliage.



Prize Design.—Fig. 15.—*Detail of Gable Finish.—Scale ½ Inch to the Foot.*

The best positions for foliage upon a building are in friezes, moldings, string-courses, panels and diapers. Indeed, it is in panels that we find the greatest development for foliage; and by panels I include spandrels and all ornamental forms of panels. In all cases where I could, I would keep the most important sculptured decoration as low down as possible in a building, and not throw away work by placing it too high to be properly seen. Not that I would leave the upper parts plain, but I would have the ornament of a much more simple character and arranged to suit the respective hights. There are many instances where beautiful

Prize Design.—Fig. 16.—*Detail of Molding Across Gables.—Scale 1½ Inch to the Foot.*

work has been thrown away in this manner. A notable example of this is the position of the Panathenaic frieze in the Parthenon. In the first place, it must have been in a very bad light, and then the angle at which it had to be viewed was so steep and acute as to have made it an impossibility ever to see it properly. Similar errors were made in mediæval buildings. At Lincoln, it is impossible to see the sculpture of the Angel Choir as it should be seen from the ground, although one is enabled to get a better view of it by ascending into the triforium. But even when there, you still look up and find that the elaboration of tho work continues as it ascends, so that when the eye reaches the bosses in the groining you discover that they are just as delicately wrought and as highly finished as those parts below which are close upon the level of the eye.

In designing foliage wo have chiefly two things to study—form, and light aud shade. In form the first thing we have to decide upon is the leading or setting-out lines of the composition. And whether these consist of the scroll form, the branched, tho radiating, or any other lines, they must intersect and divide the space to be filled in the same manner that the ribs aud veins do the surface of a reticulated leaf. No portion must be left unprovided for, and they must harmonize with tho bounding or other architectual lines of the work itself. These should be laid out upon a geometrical and somewhat regular and symmetrical plan, and we can but partially obtain any assistance for this purpose from nature. But there are some general ideas that we can gather, such as the scroll lines we see in tendrils and climbing plants, the various modes of branching, the reticulation of leaves, and the radiation of flowers. Architectural foliage should represent natural growth, and uot be formed with flowers, fruit and leaves picked up and separated from life. In the Greek ante-fixal ornaments the growth of the plaut is plainly set forth; first in the plaut-leaves issuiug from the grouud, and then in the flower stems growing out of them, conventionalized by spirals and crowned with the flower. In the early Gothic, as in the example from Stone Church, the scroll form grows out of the ground at the back, and the different branches throw out leaves in a natural manner until the whole surface is covered. Crooked forms, such as we find in nature, must be altered to the tangential or angular, or a combination of both. We should remember also that upright lines represent life, hanging or drooping lines, decay and death

Having decided upon the leading lines of our stems, the next process is to clothe them with leaves, flowers and fruit. Here it is that we may briug to our aid that variety and beauty of form with which nature supplies us so bountifully. As a general rule, all well-marked and deeply-cut lobed leaves are most applicable to carving. such as the irregular-lobed leaves of the acanthus, thistle, hawthorn, oak, and the chrysauthemum; radiating leaves, as the horse-chestnut, cinque-foil, vine and maple; or those which have separate leaflets, as the trefoil, rose, ash and acacia. Perfectly plain leaves, such as the lilac, box, laurel and olive, are also very valuable where simplicity and breadth of form are required; or the more complicated can be reduced to their first simple form. Nature proceeds iu this manner herself, as will be seen by the geueral outlines of the rose leaf, the leaflets of which retain the form of the heart-shaped leaf. Other fillings in upon the more simple form, show how other leaves follow the same rule. In one leaf, the *Maranta*, nature has herself painted the forms of moro complicated leaves upon the plain leaf.

Leaves mostly assume, more or less, the forms of the geometrical figures—the *Laurestinus* that of the vesica. The *Cineraria Maritima* is of the same gonoral form, but is cut into deeply-rounded lobes, of the same type as the oak. All compound leaves still retain the general forms of the more simple ones. The dock has a leaf of an oval form, which is found again in the deeply crenate-lobed leaf of the greater celandine. The heart-form is seen in the black bryony and violet, and again in the leaflets of the clover. The main ribs of the leaf of the black bryony assume very beautiful flowing forms, having a strong resemblance to the lines of the Greek honeysuckle. In the violet, the ribs are quite different, and branch from the mid-rib, while in the bryony they flow gracefully from the base of the leaf where it joins the foot-stalk. The ground ivy approaches very nearly to the circle, and mallow leaves are of the same general contour. The water avens, or *Herba benedicta*, from which the early English foliage is said to be taken, give a very simple trefoil. The clover gives a very perfect trefoil, formed by three heart-shapod leaflets. The terminal point of the leaf of the sow-thistle gives the triangle, which is seen again iu tho young leaves of the ivy. The ivy assumes three typical forms during its growth—the triangle, the squaro or lozengo, aud at length, in its full development, the pentagon. The terminal leaflet of tho cow parsnip approches closely to the diagonal square. The five-pointed form is still retained by separate leaflets, as in the passion-flower leaf and the cinquefoil.

There are two modes of treating leaf-form. One, that of retaining the natural contour as we usually fiud it, more ospecially in older leaves, as in the maple and vine, which starts off with an abrupt angle or curve from the leaf-stalk. The other mode is that as seen sometimes in young leaves, as the hawthorn, where the leaf flows tangcutially and smoothly out of the foot-stalk.

It is not necessary to follow natural leaves literally—they may be simplified; modified to make them more symmetrical; or altered, to fill any particular form; their outlines may be changed by adopting various cuttings, or differently formed lobe. If we take, for instance, the most common of all leaf edgings, the serrated, we are not bouud to the number we uso in a leaf; we can reduce them to three, five, seven, and so on for the entire leaf, just as it may suit our purpose; or we can subdivide them, as in the hawthoru; separate them by lobes, which may again be as few or as numerous as we choose, as in the *Grevillea Acanthifolia*; subdivided as in the creeping crow-foot; or lastly, separated into distinct leaflets, as in the dielyta.

As I have already shown, nature works upon certain broad principles, and sets out all her forms upon a plain and simple geometrical foundation. What is done with leaves may also be done with flowers, or leaves may be substituted for petals. Variety of form may be also obtained by the introduction of insects, birds, animals and the human figure, which frequently give additional interest to the composition with the happiest result.

NEW PUBLICATIONS.

Foundations and Foundation Walls, for all Classes of Buildings; Pile Driving; Building Stones and Bricks; Pier and Wall Construction; Mortars, Limes, Cements, Concretes, Stuccos, &c. 60 Illustrations. By George T. Powell, Architect and Civil Engineer. To which is added a Treatise on Foundations, with practical illustrations of the method of isolated piers as followed by Chicago. By Frederick Bauman, Architect, and revised by G. T. Powell. New York: Bicknell and Comstock. Price, $1.50.

This is a carefully writteu work, prepared by a man acquainted with his subject, and is issued in good style by the publishiug house whose imprint it bears. In addition to practical explanations of the several methods of building foundation walls for various kinds of buildings and in different characters of soil, it gives descriptions of the kinds of materials used, the loads sustained, with tables of the weights of materials and explanations of the terms employed.

A very interesting chapter is the one upon the prevention of dampness in cellars, which we publish in this issue of *Carpentry and Building*. Other chapters are not less interesting or practical, and the whole work is one which can be advantageously read and studied by architects, contractors and builders generally.

Notes on Building Construction, Part III. Materials arranged to meet the requirements of the Syllabus of the Science and Art Department of the Committee of Council on Education, South Kensington. London, Oxford and Cambridge: Rivingtons.

This is one of the most carefully prepared and best arranged books of its kind that has been published. It is the third of a series—the proceding volumes treating of various features of construction and methods of performing work in connection with buildings, designed to afford to the student that kind of information not usually found in books or taught in schools, but which is ordinarily obtained only by intercourse with the mechanics of various trades, and by studying circulars, &c. By these books the student is saved much of the tedious labor of collecting information by visiting officcs and questioning workmen, and is presented with the results of careful research and investigation in a digested form. Tho work has been well done. The arrangement is clear, and facts are presented with careful regard to the selection of the most important. The book is quite modern in the information afforded, being brought down to date. Although designed especially for English students, thero is nothing which is not worthy the careful attention of American readers, while only those things which are distinctively and peculiarly American are omitted. For example, under the head of roof coverings, slate receives very careful attention, and full explauation of the methods of laying is given, together with a description of peculiarities of various grades, &c., while tin is not mentioned as a roof covering at all. The use of tin for roofing purposes is altogether an American idea.

Something New in American Tiles.

A tile manufactory of the most interesting kind was established at Chelsea, Mass., by Messrs. J. & J. T. Low, about a year ago, and is now in successful operation. Tile making is a new industry for this country, aud one which would give but small promise of success if an attempt was made to reproduce the styles which are turned out so cheaply and abundantly by British manufacturers, and so largely exported to this country. But Mr. John Low had no idea of following the beaten paths of foreign manufacturers—least of all, of manufacturing printed tiles in black or color, which are so common and so generally unsatisfactory to lovers of art. It was determined to make an entirely new product which should be artistically good, and by a novel and very ingenious process which permits the manufacture of tiles at a cheap price and in infinite variety. This process, which we have had the pleasure of witnessing, is a valuable trade secret, but is so simple and so obviously correct, that one can but wonder that it was not thought of and practiced when tile manufacture was first undertaken. The design is produced either in intaglio or relief, as may be desired, and the fidelity with which a device or composition of grasses or floral forms may be reproduced or varied, without increasing the cost over that of repeating a single design, is a suprise and delight to those who appreciate the beautiful in art or nature. Mr. Low's improvements have given tiles a new value which cannot but be appreciated by architects, since they can now furnish their own designs, or use tiles as freely as may be desired without having any two alike in a house.

Mr. Low is an artist of talent, and while he has undertaken tile manufacture as a business with the iutentiou of making it a success, he is thoroughly in love with his work and an enthusiast in developing its highest possibilities. He is assisted by Mr. Osborue, a South Kensington graduate, who is unquestionably a genius in plastic art, and is doing work of rare excellence in clay, terra cotta, and *pate-sur-pate*. The undertaking of these gentlemen is one in which we feel an especial interest, as it has placed within the reach of architects and builders a decorative material which is perfectly legitimate in all appropriate uses, and which possesses an art excellence far superior to anything which could hitherto be had at a price admitting of liberal use in houses of moderate cost.

A Brickmaking Center.

Along the banks of the Hudson from Tarrytown to Albany are upward of 150 brickyards, varying in productive capacity from 20,000 to 140,000 bricks a day in the working season. The greater number aro on the west bank of the river, which furnishes an inexhaustible supply of proper material. Tho sand is usually found at the surface, and the clay a few feet below, although the latter is frequently obtained at the surface and the sand at another point near at hand. The tempering machines and brick presses are now nearly all run by steam power; but the material is still carted by horses, and all other parts of the labor are performed by hand. The wages paid last year ranged from 60 cents to $3 a day, according to skill and ability, "boss" burners getting the highest wages and boys the lower rate; the average being about $1.25 a day. The leading establishments—70 or more in number—have together a daily capacity of more than 4,000,000 bricks. Various other small brick firms exist on the river, of which trustworthy data could not be obtained, and doubtless not far short of 400,000,000 bricks are made here in a single season, by about 4,000 men and boys; an average of 100,000 each. The great brick center is Haverstraw Bay, where about 40 separate manufacturers are established, including the largest on the river. Haverstraw and vicinity are especially adapted for the work, and their bricks usually lead the market, although various other makers claim to produce an article equally good. In burning this immense quantity of brick it is estimated that 40,000 cords of wood have been consumed, and the labor of cutting and hauling this is not easily realized. Cordts & Hutton, of this city, claimed to have burned last season the largest kiln ever burned above the Highlands; it contained 2,250,000 bricks.

The Way to Make Mortar.

Making morter includes the slaking of the lime and the mixture of the other ingredients with it. Both the former process and the proportions and nature of the latter differ according to the nature of the lime to be dealt with. It is, however, a universal rule, in contradiction to the slovenly practice of some builders, that lime, of whatever nature (excepting hydraulic limes in most cases), should be reduced to a paste before being mixed with the other ingredients. If the sand and other ingredients were mixed with the lime before, thus reducing it to a paste, it would be almost impossible to reduce it to a perfect hydrate, and it would be apt to blister and slake out after being applied to the wall. The degree of consistency of this paste should vary with the nature of the extraneous materials and the purpose for which it is to be used. In order to secure a proper state of the hydrate, it is of great importance that neither too much nor too little water be used in slaking the lime. When too little water is used the lime "burns," as the plasterers express it—that is, the lime becomes partially dry, and small particles of it fail to slake for want of water; then, when more water is added and the mass chilled, those particles do not slake until after the lime is run off, but afterward slake in the mortar bed, or sometimes even after the mortar has been applied to the wall. To say the least, these dry particles will make the mortar lumpy and cause "blisters" on the wall. On the other hand, if too much water is used, the lime is chilled, or "drowned," as the plasterers say, and thereby loses two-fifths of its strength, according to some of Vicat's experiments; and too much water also retards the process of slaking. Therefore just enough water should be put on at first to start the process of slaking and to keep the lime moist, and, as the slaking proceeds, more water should be poured on and the lime kept wet. It should also be stirred during the slaking after it has begun to warm up, so that when completely slaked it will be in the form of a thin paste. It should then be run off from the slake-box into the mortar-bed, letting it pass through the slats in the end of the box, or through a screen, to strain it and keep back any lumps or flinty sediment that may be in the lime.

For putty coat the paste should be made thinner, like cream or milk, and should be run through a sieve about as fine as an ordinary flour or meal sieve.

It is also important that no more mortar should be mixed up at one time than is immediately needed, or at most, no more than is needed for a few days or a week or so; for although the hydrates, which had begun to solidify, give off the water they had rendered latent, as it were, yet a portion of their force must evidently be lost by their so doing upon their being reworked, in proportion to the degree of advancement of the process of setting. And furthermore, although the pure lime gains strength by standing in the state of a thin paste or putty, without sand or other material being mixed with it, provided it be kept moist all the time, yet, according to careful scientific experiments, it is proven that the increase of strength is hardly perceptible under three or four weeks, that it increases in strength for five or six months, and that the greatest increase in strength is during the fourth month, the gain then being only about one-fifth the original strength of the lime. It is plain to any practical man that mortar mixed so long with the sand in it would be considerably set, thereby losing by the reworking and wetting more than it would gain by standing so long. If it were hair mortar for plastering, there would be a still further loss, inasmuch as the hair would be rotted or eaten up by exposure to the action of the moist lime for so long a time; and the hair cannot well be mixed evenly through the mortar except while it is in the form of a thin paste, as it is when first run off. As Vicat's experiments shew, the mortar could not be wet up the second time and made thin enough to receive the hair properly, after standing so long, without losing two-fifths of its strength. Therefore the old notion that plastering mortar should stand for from ten days to three weeks is an erroneous one and should be discarded, and the mortar should be allowed to lie only long enough for all the particles to become thoroughly slaked.

The proportions of sand to be used vary, as might be expected, according to the nature and quality of the limes, and also of the sand itself; but within certain limits, if the limes do not gain by the mixture, their effect is not sensibly diminished, to say the least. Thus we find that for the rich limes the resistance is rather increased if the sand be in the proportions varying from 50 to 200 per cent. of the lime after it is slaked and measured in bulk, in the form of a firm paste, or from 150 to 450 per cent. of the lime itself. Beyond this point the resistance decreases. The resistance of hydraulic limes increases if the sand be mixed in the proportions of from 50 to 180 per cent., and from thence it decreases. It is claimed for a few varieties that they will stand considerably more sand, but the average hydraulic lime will not. As no specific rule for proportions of ingredients of mortar can be given to suit all kinds and qualities of lime and sand, we will simply give the principles by which we must be guided.

For the first coat on lath it is necessary to have just a large enough proportion of lime to make the plastering adhere firmly to the laths, and enough hair to make the clinches strong—two pounds to the bushel, for instance.

For first coat on stone, brick or grout, and for second coat on lath, the mortar will bear more sand, and hair is not generally considered essential. When too little sand is used, the plastering is liable to crack in setting and drying, and it is also liable to crumble easily after it is dry; and, on the other hand, when too much sand is used, the plastering is liable to fall off, and also to crumble. The correct, but varying medium between the two extremes can only be attained by practice and good judgment.

For the last coat—that is, the putty coat or hard-finish—very little sand is used, and sometimes none; but when sand, stucco, marble dust, &c., are used, they are generally mixed just before using. The stucco is never mixed with the putty until it is to be applied to the wall or ceiling, as it would otherwise set and render the whole mass useless.

Care should be taken not to use too much water, either in the mixing of mortar at first or in the subsequent tempering of it, for too much water deprives the lime of about two-fifths of its strength, and also retards the crystallization of the setting process.

It will be noticed that mortar does not occupy as much space as its ingredients, taken separately; its greater weight alone proves that fact. Let a equal the bulk of the lime in paste, b equal the sand, and c equal the bulk of the water. Then $(a+b+c) \times 0.75 =$ the bulk of the mortar they will produce. According to the best experiments, the strength or resistance of good mortar, when set hard, is 14 pounds avoirdupois per square inch to a force acting in a direction to tear asunder by an effort of longitudinal traction; of 42 pounds per square inch to a crushing force, and of $5\frac{1}{4}$ pounds per square inch to a force tending to make the particles slide upon one another. Old work, which has been hardened by time and become more perfectly carbonized, will stand a better test.

Hydraulic lime should not be mixed with water until just before it is to be used. Hydraulic or water lime is generaly called cement, and is usually mixed with the sand dry before the mortar is made wet. The proportions of sand and lime given are for coarse sand; the richer the lime and the finer the sand the more sand is required, but fine sand does not make as hard mortar. —*From Cameron's Plasterer's Manual.*

A Cheap Substitute for Stained Glass.

Painted glass fire screens have been much used during the past winter, their opaque surface being usually adorned by a central medallion and pretty corner designs. The ruddy glare of the flames behind, lighting up all the colors with a brilliant glow, produces a beautiful effect. An ingenious and very cheap substitute for painted glass, not only for fire screens, but for window blinds, which at this season of the year is more to the purpose, has been devised by Charles H. Chapin, the artist. It is in use at his studio at the corner of Broadway and Twenty-first street, and we do not doubt that he would be pleased to receive a visit from any one who wanted to copy the idea. He takes a yard or two of bleached muslin, of good quality, and stretches it on such a frame as is used for mosquito netting. First, a preparation of light-colored varnish and turpentine, mixed in about equal parts, is applied with a varnish brush. This makes the material transparent. It is placed so that a current of air will pass through it, and then it will dry in about two hours. When it is dry, the design is traced with a lead pencil, it being transferred from a rough drawing on paper, by holding the copy against the window so that the light passes through both paper and cloth, on the same principle as a child's drawing slate. The outline being filled in, he takes some ordinary tube color, thins it with drying-oil, and applies it, not with a brush, but with a cloth. But as the texture of the muslin would otherwise show through now, he takes a dry rag, without color, and rubs the other side of the cloth. After the broad tints are put in, the details are finished in oil color with a brush in the ordinary way. The colors, of course, cannot be made as brilliant as those generally used for stained glass. But for the purpose to which they are applied, they are the better for that; for the effect of their somberness is to give a pleasant, subdued light to the apartment. Mr. Chapin has had to put two or three thicknesses of heavy paper behind the blinds he has made for his studio, so as to reduce the volume of light.

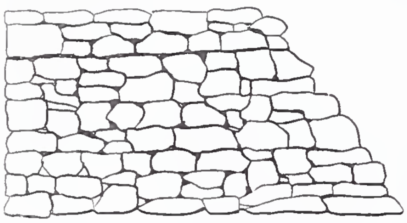
How to Design.—In studying for design, begin with one flower, or rather one species. Draw it in all the different positions—full face, fore-shortened, profile and the reverse, and the leaves as well. Make studies of all these different positions. Then select the articles which are to be designed. If, for instance, one is to be a tidy, do not draw a bunch of flowers merely, but decide that the design shall come from one side or the other. Take a paper the size that is needed, and try a spot the size of a flower, in one place and another, until an agreeable group is arranged. Five or three group better than four or six. After placing your flowers, place stems, and try to get easy and natural lines; then break those lines with leaves, trying to leave spaces between the flowers and leaves, stems and all, that shall be about equal; no one bare, blank space, and no crowded one. If one space looks bare, introduce a bud, or the point of a leaf coming from behind the stem. If the outside line, or general line of design, is too straight or too uniform, break it up with a branch thrust boldly out, or a butterfly, or something; and try to have each leaf and flower and stem characteristic of the plant and of itself. In this way, with care and practice, good designs may be made.

Names of Stone Masonry.

As the term "stone masonry" includes properly all classes of construction in stone which require the employment of skilled mechanics or masons, any class of masonry may be laid dry, in lime mortar or in cement mortar, at will. On this point specifications should always be precise.

RUBBLE MASONRY.—This is composed of unsquared stones. It may be *Uncoursed Rubble* (Fig. 1), laid without any attempt at regular courses, or *Coursed Rubble* (Fig. 2), leveled off at specified hights to a horizontal surface. The stone may be required to be roughly shaped with the hammer, so as to fit approximately.

SQUARED STONE MASONRY.—According to the character of the face, this is classified as *Quarry-faced* (Fig. 3), or as *Pitch-faced*

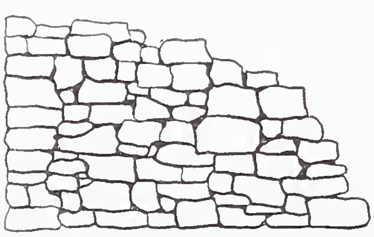


Stone Masonry.—Fig. 1.—Coursed Rubble.

(Fig. 4). If laid in regular courses of about the same rise throughout, it is *Range* work (Fig. 5). If laid in courses that are not continuous throughout the length of the wall, it is *Broken Range* work (Fig. 6). If not laid in courses at all, it is *Random* work (Fig. 7), and this is generally to be expected of this kind of masonry, unless the specifications call for range work.

In quarry-faced and pitch-faced masonry, quoins and the sides of openings are usually hammer dressed. This consists in removing projections so as to secure a rough-smooth surface, and is done with the face hammer, the plain ax or the tooth ax. This work is a necessity where door or window frames are inserted, and it greatly improves the general effect of the wall if used wherever a corner is turned.

ASHLAR MASONRY.—This is equivalent to "cut-stone masonry," or masonry composed of any of the various kinds of cut stone



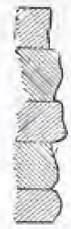
Stone Masonry.—Fig. 2.—Uncoursed Rubble.

described in *Carpentry and Building* for June. As a rule the courses are continuous (Fig. 8), but sometimes they are broken by the introduction of smaller stones of the same kind, and then it is called *Broken Ashlar* (Fig. 9). If the stones are less than one foot in hight, the term *Small Ashlar* is proper. The term *Rough Ashlar* is sometimes given to squared stone masonry, either "quarry-faced" or "pitched-faced," when laid as range work; but it is believed that it is more logical and more expressive to call such masonry "squared range work." From its derivation, "ashlar" apparently means large, square blocks, but practice seems to have made it synonymous with "cut stone," and this secondary meaning has been retained for convenience.

Dimension-stones are cut stones all of whose dimensions have been fixed in advance. If the specifications for ashlar masonry are so written as to prescribe the dimensions to be used, it will not be necessary to make a new class of such stones.

Range work, whether of squared stones or of ashlar, is usually backed up with rubble masonry, which in such cases is specified as coursed rubble.

Whatever terms are applied in common use to various classes of masonry, it is not safe to trust to them alone in preparing



Stone Masonry.

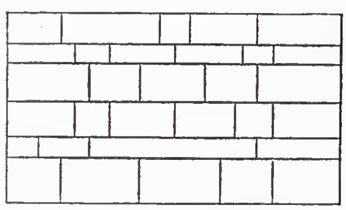
Fig. 3.—Quarry-Faced. *Fig. 4.—Pitch-Faced.*

specifications for construction, but every specification should contain an accurate description of the character and quality of the work desired. Whenever practicable, samples of such kind of cutting and masonry should be prepared beforehand, and exhibited to the persons who propose to undertake the work.

Self-Instruction in Wood Carving.

BY N. R. HARRIS.

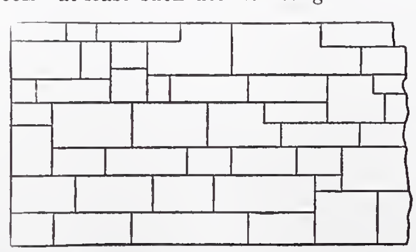
If the reader will bear with me and be patient, I will endeavor to tell him or her all I know about the art of wood carving, the use of tools, the mode of working at the bench, and the wood best adapted to the production of work in this branch of industrial art. I shall endeavor to give such instruction in a clear, matter-of-fact way, so that it may be plainly comprehended and thoroughly understood. Of course, it will be readily seen that such an undertaking as the above would not be practicable in one



Stone Masonry.—Fig. 5.—Range.

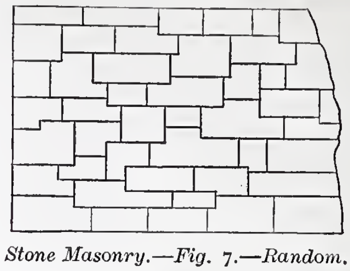
issue; therefore, it will be necessary to continue these papers until the object in contemplation is consummated, so that "those who run may read," and be able to arrive at the proper data to attain some practical knowledge of an art that dates back for some thousands of years.

To such persons as wish to apply themselves to the study of wood carving, it is necessary that they should have some knowledge of the elementary principles of drawing, so that by the use of the pencil they may be able to copy some object for practice, no matter how simple. A knowledge of how to turn a scroll, to draw a leaf or flower, or any other form that may suggest itself to their minds, is a paramount necessity before they can begin the use of tools—at least such use as will give entire



Stone Masonry.—Fig. 6.—Broken Range.

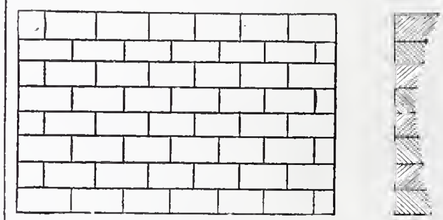
satisfaction in their productions, which, when the effort is once made, will gratify and astonish them beyond their most sanguine expectations. Close application and study of natural forms are best for the student, for it is from nature that the laws governing the lines of beauty are to be desired. The reproduction of a simple blade of grass, a common weed that we every day trample under foot, in an artistic point of view, may be the means of elevating



Stone Masonry.—Fig. 7.—Random.

some slumbering genius to the exalted character of a Canova.

Wood carving is one of the most agreeable occupations to follow, as it gives a wide scope for the culture of the mind in the art of formation; it refines the thoughts of the worker by opening up to him a silent, but graceful language, the character of which allures him on in the "Pleasures of Taste." And let me here add, that there are few men or women who may not be able to adorn their houses by their own productions in their leisure hours, or by the more practical method of making

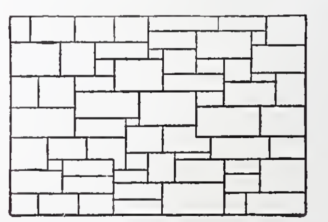


Stone Masonry.—Fig. 8.—Ashlar.

money, turn their art labor to a pecuniary account. By such occupation the Swiss peasant and his family, assembled together in the evening after their labors in the field, produce all the fancy articles that we see exposed for sale in the show windows, and by their industry and perseverance have made their art works a commodity of commercial exchange, and given to them a world-wide renown.

To excel in any branch of art, whether theoretical or practical, all the rules and maxims must be founded on knowledge and taste, and it will be necessary for all who desire to take advantage of this opportunity of self-instruction, to first begin modeling in clay, or some plastic substance, the object desired to be reproduced in wood.

Modeling cultivates the art of forms, embraces the design, and is the principal labor



Stone Masonry.—Fig. 9.—Broken Ashlar.

of the thought that guides the hand in execution; it gives an easy and simple method of producing a pattern; in a strict sense it is actually carving in a soft and pliable substance, and this makes it necessarily the precursor of wood carving, and more successfully interprets the forms of the design required; and with the least modicum of capacity, from an artistic standpoint, it will enable the artist to more easily produce what is most needed, and will bear the evidence of handiwork beyond that of the untutored workman. A workman who does not model, or who has never done so, is working blindfold, and cannot be expected to give that expression to his work that it is entitled to, for "God has diffused beauty and art has combined it." Then, to approach to any degree of truth or excellence in wood-carving, the subject must be first correctly modeled; thus different materials require different treatment to adapt them to the design and combination which forms their interesting peculiarities for practical purposes.

Pages might be written to exemplify the

importance of the above subject, without advancing tho direct practice of this pursuit or the attainment of the necessary information; but, to make it still more plain, and to encourage the anxious in their study, that which will assist them in the knowledge necessary for individual operations is here embodied.

Clay, wax or plaster are the substances most in use by professionals, but clay being the most readily obtained and the easiest worked, I shall suggest to the art student to commence with that first. The clay used and prepared by potters is the article most in use, and may be prepared by breaking it up fine and wetting it with water, so as to permeate every particle, then working it to the proper consistency, until it forms a firm substance like putty. It must be free from all sand, grit or stones, and made sufficiently plastic for working—a few trials will initiate the most ignorant into the required method of preparation, which, once known, may never be forgotten. When the clay is fit for use, procure a piece of hardwood board of the required size, smooth on the upper surface, with clamps screwed on the under side to keep it from warping, or a piece of glass or slate will answer equally as well; draw the form of your intended work thereon, and proceed by taking small pieces of clay in your fingers and forming the object in a rough manner, taking care to blend each piece to the other so as to form a homogeneous whole. The most experienced modelers use their fingers much more than they do tools, and although the latter are necessary, very few are required, and may be made by the art student himself out of any hard-grained wood, such as boxwood, mahogany, cherry, or even bone; others are made with a handle and bent wire for heavy work, and are very simple in construction. (Of these tools I shall give a diagram and explanation in my next.) The clay being formed to the required shape, keep your design before you and work it until you get the depth of shade and relief, but don't be in too great a hurry; take time and study your subject well. Should you desire to leave your work for any time untouched, procure a piece of fine muslin cloth, soft and pliable, wet it well with water, then squeeze out the redundant water so as to leave it moderately moistened before placing it over the work. Eject a spray of water gently over the clay, then place the cloth over it so as to prevent the air from coming in contact with the work, and if not left too long the clay will be found to be of the proper consistency when the student desires to resume his work. Now, when you are near the finish, of course your clay will become dry; then you may take a fine brush and gently pass it over, which will give the finishing touches to the art labor.

All work must be begun in the same way that a painter begins a sketch; but if you desire to model from nature, procure your subject and keep it constantly before you, and when you have finished it, and you desire to reproduce it in wood, and you have got a proper knowledge of handling the wood-carver's tools, astonishment and self-congratulation will give a greater zest to the pursuit of this most admirable art, which I am sorry to add does not receive the attention that it deserves—whether from a lack of taste in the production or in the quality of that produced, I shall leave others to determine; but if my humble effort can raise up in the public mind an admiration for the forerunner of the sculptor's chisel or the painter's pencil, I think then I shall have done my share by imparting to others what little knowledge I possess.

(To be continued.)

Chimneys.—The object of a chimney flue is a safe and efficient means of carrying off smoke, hot air, &c.; therefore, security is the main point inside of the building. In order to attain that end, the flue must be plastered smoothly inside, and must be as straight as practicable, thereby securing a good draft, thus preventing soot from collecting and frequently burning out. And the flue should also be built strongly, filling the joints carefully with good mortar to guard against cracking. Outside symmetrical form and clean work are essential features. Five courses of brick will lay up one foot in hight, mortar joints included.

How to Find the Bearing Strength of Timber.

Prof. Carpenter, of the Michigan Agricultural College, furnishes the following rules for finding the weights that timber of a given size, supported at both ends, will sustain:

First.—If a weight be uniformly distributed from end to end of a horizontal beam, it produces the same effect on a beam as though one-half the weight were gathered at the center of the beam.

Example.—A horizontal beam, 16 feet in length, sustains a floor 2 feet each side of it. If the weight of floor and load that may be expected to get on it be taken as 75 pounds per square foot, we should find the total load sustained by the beam to be its length, multiplied by the number of square feet sustained, multiplied by the load on each square foot, or $16 \times 4 \times 75 = 4800$ pounds. This would be equivalent to a center load of 2400 pounds.

Second.—(Converse of first.) If a beam sustain a certain load at the center, it will sustain twice as much load provided it be uniformly distributed.

Third.—The safe load should not exceed one-fourth or one-fifth the breaking load in bridges, or in floors subject to much vibration from moving bodies. In roofs the safe load should not exceed one-fourth or one-third the breaking load. (These precautions are necessary for two roasons—timber is injured by a load much below the breaking load, and imperfections in workmanship and material are constantly occurring).

Fourth.—(The safe load is assumed to be one-fifth the breaking).

To find the safe load that a horizontal pine beam, supported at both ends, will sustain:

Rule.—Multiply the breadth of a beam by the square of its depth, and that product by the number 90; divide this result by the length of the beam between the supports, and the quotient will be the number of pounds in the load that the beam will safely carry at the center. If the load is uniformly distributed it will be twice the safe center load, and the foregoing result may be doubled to obtained the total distributed load. (See rule first and second.) If any material besides pine is used, instead of the number 90 the numbers in the following table must be used:

White oak	120
Red or black oak	110
White ash	130
Swamp ash	80
Black ash	60
White beech	90
White cedar or Arbor Vitæ	50
Walnut	90
Tamarack	80
Spruce	90
Maple	110
Hickory	140
Rock elm	70
Locust	120
White pine	00

Example.—What will be the center safe load of a pine beam, 4 x 6 inches, supported in two places, and 12 feet long between the supports?

1. If the depth be 6 inches and the breadth 4 inches, the center load $= 4 \times 36 \times 90$ divided by $12 = 1080$ pounds.

2. If the depth be 4 inches and the breadth be 6 inches, the center load is $6 \times 16 \times 90$ divided by $12 = 720$ pounds. From these examples it is seen to be always most economical to set a horizontal beam on its edge, or place it so that the greatest dimension shall correspond to its depth.

Fifth.—To find the weight that an inclined beam (as a rafter) will safely bear at the center distance between supports:

Rule.—Find the center weight that a beam of length equal to the horizontal span or spread of the inclined beam will safely sustain, by the fourth rule; divide this result by the horizontal span of the inclined beam and multiply it by the length of the inclined beam.

Example.—What will a pine rafter 20 feet long, with 12 feet rise and horizontal span of 16 feet, if 2 x 4 inches, sustain safely at center when there is supposed to be no support at its center? If horizontal and 16 feet long, the safe center weight $= 2 \times 16 \times 90$ divided by 16, or 180 pounds, dividing this result by 16 and multiplying by 20, the safe center weight is 220 pounds. This would correspond to a uniformly distributed load of 440 pounds. If this rafter be supposed to carry two square feet for each foot in length, the load would be 104 pounds to each square foot.

Note.—A rafter of these dimensions would need a support at the center; in that case its horizontal span would be 8 feet instead of 16. The result would be a safe center load of 440 pounds or a safe distributed load of 880 pounds—but this is distributed over a rafter 10 feet long instead of 20, so that on the same supposition as before the safe load becomes 41.6 pounds per square foot—a safe load for any roof.

Remarks.—This rule, although sufficiently exact for ordinary purposes, and safe for ordinary roofs when the factor of safety, five, is used, must be replaced by more exact and complicated rules when very exact results are required. This is safe for all farm buildings.

Sixth.—When the dimensions of a horizontal beam that will safely carry a given load is wanted, the following rule must be used:

The product of the breadth into the square of the depth equals the load at the center divided by 90 for pine, or by the numbers given under the fourth rule for any other material. By assuming the depth the breadth can be found.

Example.—What sized pine beam, 16 feet long, will safely support 1000 pounds at its center? One thousand divided by 90 equals 11.1, equals the breadth multiplied by the square of the depth. If we assume the depth to be 3 inches, its square is 9 and the breadth 11.1, divided by $9 = 1.3$.

Hence the answer is a piece 1.3 x 3.

When the load is distributed over a number of square feet, the center load must first be found by multiplying by the number of feet and dividing by 2.

Seventh.—If the beam is inclined, divide the center load by the length of the beam. Multiply this quotient by the horizontal space, and proceed as in the sixth.

Eighth.—The amount an upright beam will safely carry when subjected to a pulling strain, can be found by multiplying the number of square inches of its cross section by the strength of 1 square inch.

The following table gives the safe strength of different woods in pounds per square inch:

Ash	3200
Elm	1200
Hickory	2200
Maple	2000
White oak	2000
Pine	2000
Walnut	1000
Poplar	1400

Ninth.—The amount an upright post loaded at upper end will sustain can be found approximately in the same way as the tensile load; the amount per square inch should be taken about four-fifths that given in rule eight. This is an approximate rule that cannot be relied on in cases where very accurate results are required.

These rules give accurate results, with the exception of rules fifth and ninth. The results given by rule fifth are safe and do not differ much from the true results. Those given by rule ninth, for the size of posts, are very nearly correct when the posts are of moderate length.

Whitewashing.—In order to do good whitewashing it is necessary to have a good brush and good wash. These two being supplied and a suitable scaffold being ready, dip the brush into the wash about half the length of the bristles, and then brush as much of the wall or ceiling as that amount of wash will cover, wetting it thoroughly, then finish by passing the brush once over the strip just put on, and immediately dip and repeat the process upon an adjoining portion of the wall or ceiling. Avoid dry joinings, and be careful not to spatter. One coat is not generally sufficient to whiten an old wall.

Some Problems in Framing.

From a correspondent in California we have the request for directions for framing a square structure, in which all the sides incline. He states his wants as follows:

"I wish to erect a frame support for a tank, 24 feet square at the bottom, 12 feet square at the top and 24 feet high. I desire to frame in cross girts all around, midway of the hight on which to lay floor joists. I wish to inclose the whole."

In Fig. 1 we show an elevation of the proposed structure, it being understood that in plan it is square at both top and bottom. The several sides incline toward the center, attempt by our illustrations and by our description to make all the principles entering into the framing so plain that all our readers, including the apprentice boys, will readily comprehend them.

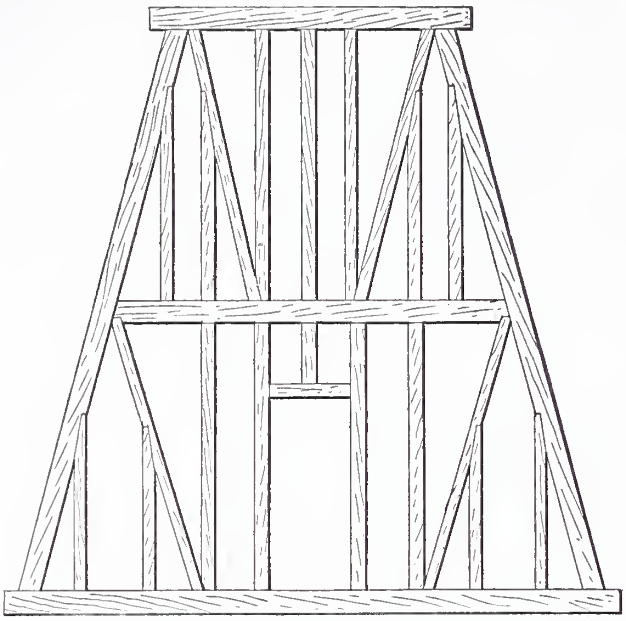
The sills are halved together at their intersection at the corners. The corner posts are mortised into the sills, the cheeks of the mortise being cut in such a manner as to form a joggle or abatement the entire width of the beam. The construction of the corners, as above described, is clearly shown in Fig. 3.

The intersection formed between the struts and corner post is shown in Fig. 4.

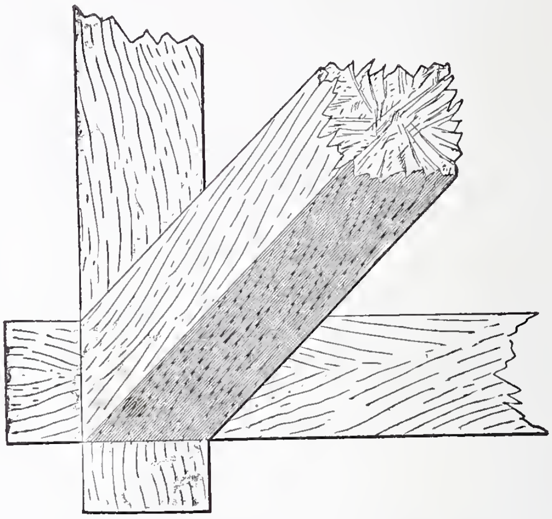
The girts are set square with and framed

There are several distinct operations to be performed in the framing of this structure, which, as their application is not by any means confined to the erection of supports for tanks, we will describe in detail. Some of them can be performed in more than one way, and as we believe the subject is one of general interest to our readers, we shall in such cases give the several methods, even though thereby we extend the article beyond the limits of the space we can devote to it in one issue, and make it much longer than a simple answer to our correspondent's request would seem to demand.

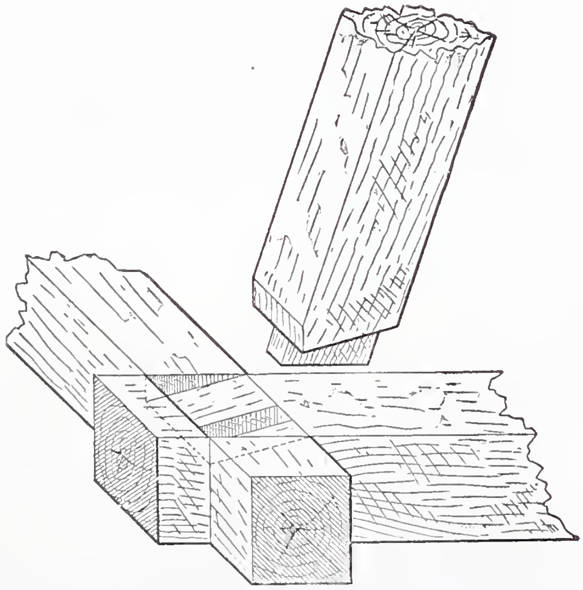
One of the first steps which suggests it-



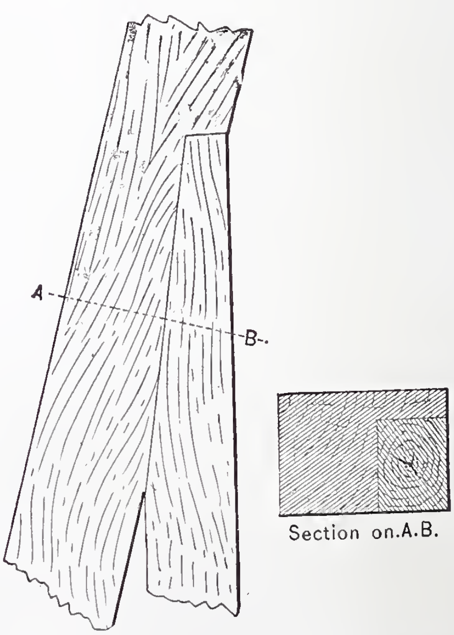
Problems in Framing.—Fig. 1.—Elevation of Frame.



Problems in Framing.—Fig. 2. Enlarged View of Foot of Corner Post.



Problems in Framing.—Fig. 3.—Joint to be Made at Foot of Corner Post.



Problems in Framing.—Fig. 4.—Joint Between Corner Post and Strut.

as shown by the profile of the elevation. The corner posts, therefore, have a double pitch, inclining with each side, or in a diagonal line, toward the center. Fig. 2 shows in perspective a somewhat exaggerated view, as far as pitch is concerned, of a section of the corner post and its connection with the sill.

The construction which we have employed, as shown by the elevation, has been chosen more with reference to its fitness for illustrating the principles of framing involved, than for its appropriateness for the purpose for which our correspondent desires to erect the structure. Nevertheless it is a frame work of considerable strength. We shall

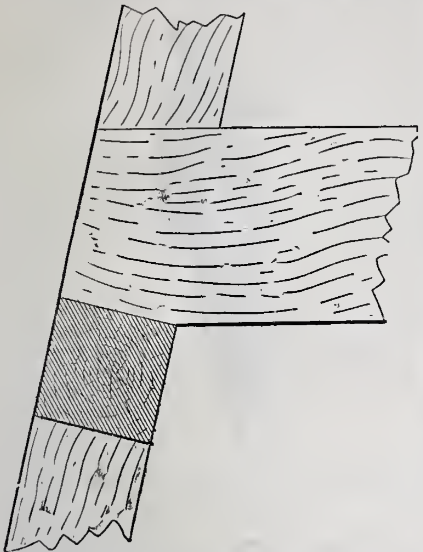
into the corner posts, as shown in Figs 5 and 6. The joists are to be laid directly upon the girts, as shown in Fig. 5, being spiked to the studding wherever the spaces suit. A double mortise and tenon joint is made between the ends of the girts and the corner posts, as shown in Fig. 6. The ends of the braces terminating against the girt and the corner post are gained, as also shown in Fig. 6.

The construction at the top is similar to that of corresponding parts already described. The plates are halved together, the ends of the corner posts are mortised into the plates, and the ends of the braces are also either gained or mortised into the plates.

self is the cut for the bottom of the corner posts. We will consider it independent of the tenon and of the shape to fit the abutment, as shown in Fig. 3, because after the line of cut is obtained which will fit it to the surface of the sill, these other forms are readily determined by using it as a basis of measurement.

If the corner post inclined in but one direction, it would be a very simple matter to transfer it to the bevel, as shown upon the drawing. But the post inclines in two directions; it pitches in common with the two adjacent sides, hence to transfer to the timber to be cut the bevel shown by the drawing, would not do. Instead of this we must double the bevel, putting it once for each face of the post. To do this we proceed as follows:

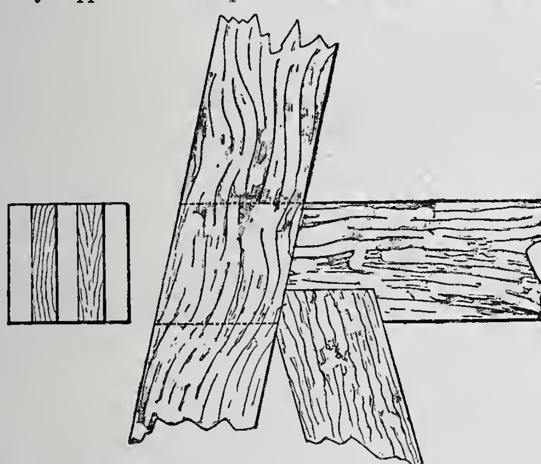
Set the T-bevel by the drawing, an enlarged section of which is shown in Fig. 7, as indicated. Mark one face of the timber



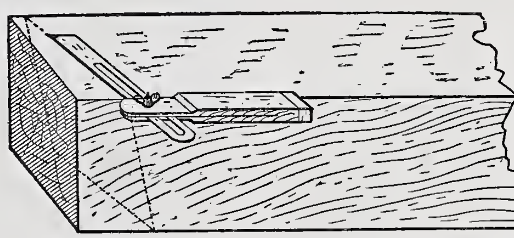
Problems in Framing.—Fig. 5.—Section of Girt, Showing Position of Floor Joists.

to be cut by it, as shown in Fig. 8, and then an adjacent face commencing where the first terminated, thus carrying the line around the timber, as indicated in the engraving by the dotted lines.

It may happen that this operation is to be



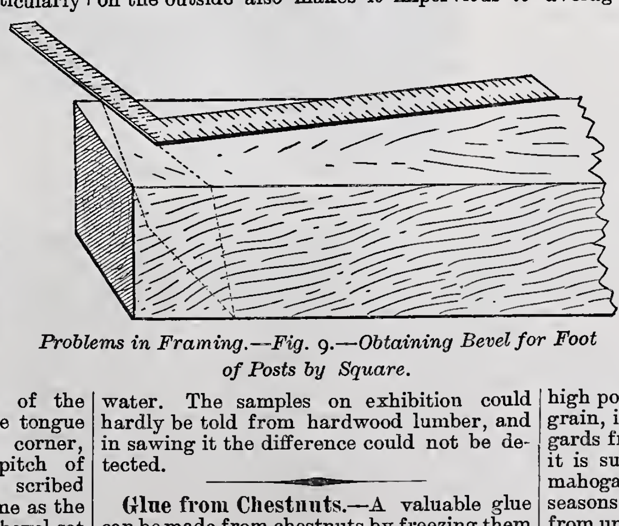
Problems in Framing.—Fig. 6.—Joint to be Made Between Corner Post and Girts.



Problems in Framing.—Fig. 8.—Manner of Scribing Posts by Bevel.

performed in cases in which no drawing is available by which to set the bevel. The same result may be obtained by a simple calculation, involving the rule of proportion and the use of the common square. The plan we shall now describe is particularly useful to those who make a practice of framing without drawings, while it is so simple that many will prefer to use it even where drawings are to be had.

The structure described is 24 feet square at the bottom and 12 feet square at the top. The difference, 12 feet, represents the aggregate pitch of two sides, or, in other words, each side pitches 6 feet. The hight is 24 feet. Then the pitch may be described as 6 feet in 24 feet. The same angle is represented by 6 inches in 24 inches. If, therefore, the square is placed as shown in Fig. 9, the end of the blade, or the 24-inch mark, being placed against one corner of the timber and the 6-inch mark on the tongue being brought against the same corner, as shown, it will represent the pitch of one of the sides, and the line scribed against the tongue will be the same as the line scribed on the timber by the T-bevel by the drawing. After making the first mark as above described, turn the timber over; again place 6 inches of the tongue to the end of the line already drawn, repeat the operation, and so on for the other sides, as described in connection with the T-bevel.



Problems in Framing.—Fig. 9.—Obtaining Bevel for Foot of Posts by Square.

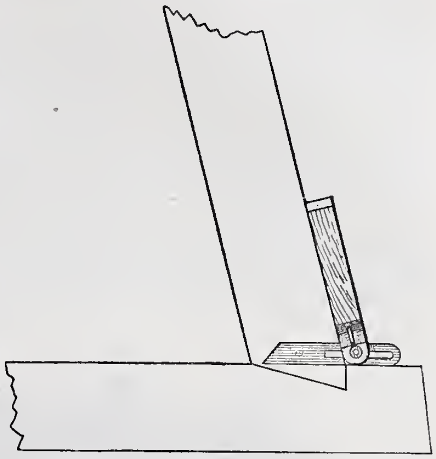
(To be continued.)

Making Lumber from Straw.

With the gradual disappearance of our forests and the lessening of our lumber supply, many are casting about them for some reliable substitute for wood. The following, which first appeared in a Western paper, is of interest, as bearing upon this subject:

A gentleman of Busnell, Ill., recently exhibited some samples of lumber that have attracted much attention among the lumbermen, and which, if it possesses all the virtues that are claimed for it, is certainly one of the most important inventions of its kind ever brought to notice. If it is a success, it will form a new era in the art of building. To make hardwood lumber out of common wheat straw, with all the effects of polish and finish which are obtainable on the hardest of black walnut and mahogany, at as little cost as clear pine lumber can be made up for, is the claim of the inventor, and the samples which he produces would go far toward verifying his claims. The process is as follows: He takes an ordinary straw board, such as is usually manufactured at any paper mill, for the purpose. As many sheets are taken as are required to make the thickness of lumber desired. These sheets are passed through a chemical solution which thoroughly softens up the fiber and completely saturates it. The whole is then passed through a succession of rollers, dried and hardened during the passage, as well as polished, and then comes out of the other end of the machine hard, dry lumber, ready for use. The inventor claims that the chemical properties, hardening in the fiber, entirely prevent water-soaking, and render the lumber combustible only in a very hot fire. The hardened finish on the outside also makes it impervious to water. The samples on exhibition could hardly be told from hardwood lumber, and in sawing it the difference could not be detected.

Glue from Chestnuts.—A valuable glue can be made from chestnuts by freezing them from the shells, grinding the kernel into a flour, mixing it well and washing in water, and passing through a sieve. The fine floury mass so obtained is washed in water several times and allowed to settle. The sediment or starch thus deposited is dried in the air, and again treated with chloric water, washed again and made into a glue similar to that made from starch. The advantage of this glue is that it will retain its liquid state even at a cold temperature, while common glue must have a constant fire to keep it ready for use.

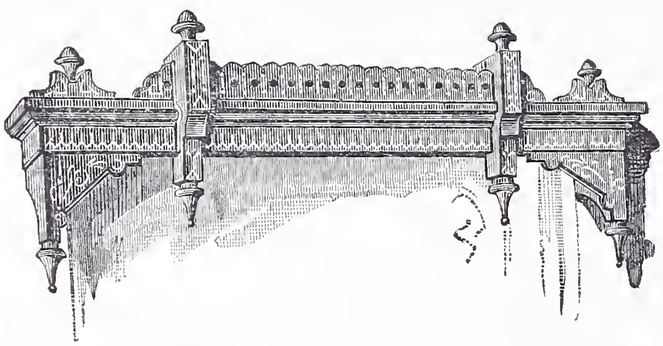


Problems in Framing.—Fig. 7.—Taking Bevel of Foot of Posts from Drawing.

A Valuable Cabinet-making Wood.—The following information in regard to the great value of the ailantus as timber, is taken from a paper on the subject by Prof. C. S. Sargent: In experiments made in the French dockyard at Toulon, where the wood of this tree was tested as to its tenacity or ability to resist a strain, in comparison with the timber of European elm and oak, an average of seven trials showed that the ailantus broke with a weight of 72,186 pounds, while the elm, in a similar number of trials, yielded to 54,707 pounds, and the oak, in the average of ten specimens, broke under a weight of 43,434 pounds Evidence as to the value of ailantus timber in exposed situations, and as to its durability when set in the ground, is yet meager, but the little that we have is favorable. Of its value for interior work and for cabinet-making there can be no doubt, the wood possessing properties remarkable in so rapid growing a tree. The wood is at first of a pale straw color, but grows somewhat darker with age, and takes a high polish. When cut to show the silver grain, it presents a satiny luster, and as regards freedom from warping and shrinking it is superior to walnut and fully equal to mahogany. It is said to cut up economically, seasons readily, is easily worked, is free from unpleasant odor, and has no ill effects on the tools. For the treads of stairs, the floors of offices, mills and other buildings, where constant use requires a hard, strong wood, it is probably superior to any of the woods commonly employed in such situations. There is one use to which its freedom from tendency to shrink will especially commend it—*i. e.*, interior finishing. Its warm color will make it very effective when used with both lighter and darker woods.

Improvement in Window Cornices.

We show in the accompanying engravings an improvement in window cornices, by which they may be varied to suit different widths of windows. The device may be termed an extension cornice. It consists of two thin moldings, fitted one over the other, and arranged to slide and thereby lengthen or shorten the cornice to adapt it to any window. The vertical pieces, or trusses, are attached one to the inner end of each sliding piece, and they are spilt at their upper ends and providea with a clamping screw, by means of which the parts may be fixed after they are properly adjusted. The trusses are



Improvement in Window Cornices.—Fig. 1.—The Cornice Closed.

lined with felt or flannel, as shown in Fig. 3, to prevent marring the face of the moldings. Fig. 1 shows the cornice closed together. In Fig. 2 it is represented as extended.

Any one who has had occasion to change his residence, knows too well that what will do for one house will not answer for another. The furniture, carpets and fixtures need remodeling to adapt them to their new situation. Not the least among annoyances is the variation in the width of windows, necessitating a change of shades aud curtains, and also of cornices, the latter being usually fully as expensive as either of the other items, and incapable of being adapted to a window narrower or wider than it was originally designed for. By the improvement here illustrated these difficulties are overcome, while makers and dealers in window cornices by it are enabled to fit any kind of a window without making a cornice especially for it.

These cornices are not restricted to any particular style of molding or finish, and their form is always symmetrical.

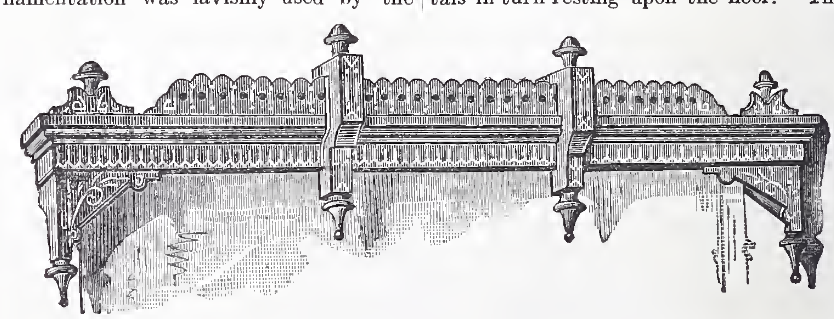
Further particulars may be obtained by applying to the inventor, Mr. James W. Campbell, No. 9 Baxter street, New York City.

Interior Decorations of Ancient Times.

The ancient inhabitants of Egypt, while the remaiuder of the nations of the earth were still in ignorance or rudeness, were comparatively advanced in the arts, and, as they claim, 6000 years before the Greeks became acquainted with the artist's skill, they used color and form for beautifying their houses. The development of their sense of proportion and form was checked by the conventional standard imposed by their religion, and their artistic feelings were in consequence obliged to find expression through the harmony of color, which they well understood. Thus, while we find upon the walls of Egyptian buildings endless processions of figures representing all the varied phases of ancient life, from the lack of proportion and conventionality of form they possess but little value as works of art, although the outlines show freedom and power. Nor is auy attempt made at painting of an imitative nature, simply the harmonious combination of certain hues being aimed at and invariably attained; indeed, to this day, the harmony of positive colors is thoroughly felt in the East, while lacking in more civilized countries. Excelling in this particular, the efforts of the Egyptian artists naturally received an impulse in this direction, and consequently color was applied to all the productions of the sculptor and architect, which were first prepared by the application of a thick coat of stucco, even stone monuments and statues being thus treated.

Among the Assysians, on the contrary, color was used but sparingly, the productions of the sculptor taking the place of those of the artist, and serving to delineate upon the walls of palaces the great deeds of monarchs and the daily life of the people. The passageways leading to the great halls in these Assyrian palaces were flanked by colossal lions 30 feet in hight, and winged and human-headed bulls, cut in bold relief from single massive slabs of stone, and sometimes covered with inscriptions in the cuneiform characters commemorative of some royal triumph. Passing into the hall, upon each side of the entrance were great bas-reliefs, 12 or 15 feet in hight, representing a good genius or spirit, human formed, with the wings and head of a hawk, bearing the sacred basket. The sides of the apartment were occupied to a like hight by a double band of bas-reliefs, separated by a band containing historical inscriptious, of which the sculptured scenes above and below were illustrative. These scenes were exceedingly various, presenting views of battles, sieges, armies, trains of captives, executions, warriors, hunting parties, chariot races, and all the thousand occupations of artisans and domestic life. Above these bas-reliefs were one or more bands, composed of bright colored enameled tiles, ornamented with elaborate and delicate patterns of geometrical designs.

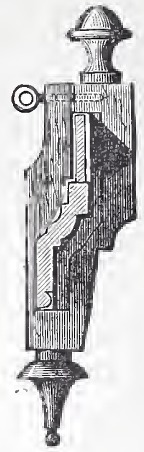
In the s uthern portion of the empire, where stone was scarce, these colored bricks or tiles were used for beautifying interiors, to the exclusion of the sculptures so common in the palaces of Nineveh. Sculptured ornamentation was lavishly used by the



Improvement in Window Cornices.—Fig. 2.—The Cornice Extended.

Persians, but its application was confined to exteriors, the interiors being decorated with painting and tapestry, and iu some cases with plates of beaten gold applied to walls, ceiling and columns.

The art of the Assyrians and Egyptians, transplanted to Greece, speedily lost its conventionality and reached a beautiful and perfect development, and, passing to the Romans, was employed by them to beautify palaces and villas, already the most beautiful and magnificent in the world. Some of the decorations of these splendid palaces have remained intact in the midst of ruins; and in Pompeii may be seen specimens of the decorator's work executed 1800 years ago. Upon a flat wall is painted in perspective an imitation of a sort of vaulted alcove, the ceiling apparently resting upon golden columns representing palm trees, the sides of the alcove supporting balconies occupied by figures of ladies. The background is divided into three bands, the lower being somber in tone, the others increasing in brilliance with



Improvement in Window Cornices.—Fig. 3.—The Trusses.

their hight. The base is jet black, the dado green, with a black panel surrounded and relieved by bands of red and white lines, upon which are delineated, in dark red and green, dolphins and hippocampi disporting themselves in the waves. Above, the picture panel is of a beautiful Venetian red, forming a background for a lovely female floating through the air, showering flowers on the earth beneath, surrounded by a border of a classic pattern of a delicate canary hue. The upper band, or frieze, contains a painting remarkable for its artistic qualities and harmonious coloring, representing a scene from the "Odyssey"—the encounter of Ulysses with the enchantress Circe. The hero has just drunk the charmed cup; the enchantress has uttered her incantation, which, by virtue of the charm furnished Ulysses by Hermes, has failed of its effect—

> "She spake; but drawing forth the trusty sword
> Upon my thigh, I rushed at her as if
> To take her life. She shrieked, and stooping low
> Ran underneath my arm and clasped my knees,
> And uttered piteously these winged words."

There is, properly, no cornice, its place being occupied by the representation of the vaulted roof of the alcove. From the columns and balconies depend golden chains and graceful garlands of flowers.

Roman walls were frequently decorated in an architectural manner, the cornice resting upon *telemones* supported by pedestals in turn resting upon the floor. These *telemones*, or pilasters, were elaborately ornamented with garlands, masks, &c., while the panels between were beautifully colored and decorated with grotesques and arabesques, the frieze beiug usually of figures in relief. Upon the downfall of the Roman Empire the arts of stucco-working and wall painting were lost to Western Europe, but were preserved by the Byzantine Christians, chiefly as decorations of religious edifices, the subjects being largely drawn from the traditions aud symbolism of the Church. Again introduced into Italy in the fourteenth century by Brunelleschi, fresco and stucco painting soon reached a magnificent development, rivaling the finest productions of the Roman artists, and in the grand masterpieces of Michael Angelo, surpassing anything ever put on canvas.

From Italy this ancient art was introduced into France, and, in accordance with the period, soon became florid and overdone, culminating, in the time of Louis XV, in an excessive profusion of brilliant colors, fantastic arabesques and allegorical representations, betraying the debasement of art, and its subservience to the tastes of that class with whom brilliancy aud gaudiness are synonymous for beauty. The use of tapestry is even more ancient than the arts of sculpture and painting, and there are many historical notices of its early use; but it was not introduced into Europe for the purposes of wall decoration until the twelfth century, when the returning crusaders brought with them specimens from the East.

Work in tapestry had been practiced in France from the earliest times of the monarchy, but the manufacture had been restricted to curtains, palls, altar-cloths, &c., for churches and monasteries; but now a great extension in its use took place, and it was applied generally to private houses. In the great baronial halls of the nobility, the lofty walls of stone no longer remained bare and naked, but were covered, often by the industry of noble ladies, with rich and costly hangings, on which were portrayed the heroic deeds of ancestors, fierce passages of feudal life, stately processions, and brilliant and exciting hunting scenes.

To the ninth century these beautiful embroideries were worked by hand; at that time the loom was introduced, and shared the manufacture, which, however, was still largely carried on by the needle, and formed the principal occupation of the ladies of that day. In the following century other parts of Europe produced fine tapestries, and those of England generally became highly prized on the Continent.

In the fourteenth and fifteenth centuries the Flemings, who had been long celebrated for their tapestries, carried the art to the greatest perfection, and produced very fine specimens, among which those of Arras became highly celebrated. The Flemish tapestries were chiefly of wool mixed with a little hemp or cotton; richer and more costly ones, with silk, gold and silver threads, being fabricated at Venice and Floreuce, to which cities various Eastern fabrics were brought. In the sixteenth century Francis I established the manufactory of Fontainbleau, which was encouraged by Henri II, who introduced a number of Italian workmen. At the Hotel Royal des Gobelins, founded by Louis XIV, beautiful work was executed from designs by Raphael, Giulio Romano, and other celebrated Italian painters.

In England, in Anglo-Saxon times, when interior doors were an unknown luxury, and chill drafts ranged freely through the long passages and corridors, tapestry was a necessity, and silken curtains embroidered with gold were made for some of the wealthier nobility, although among a people so plain and comparatively poor as were the Anglo-Saxons, such luxury could not have been common.

The magnificent example known as the "Bayeux tapestry," was worked by Queen Matilda and her maidens in commemoration of the conquest of England, and by her bestowed upon the Cathedral of Bayeux, in Normandy, of which Odo, the brother of William the Conqueror, was bishop. It was 20 inches wide and 214 feet long, and divided into 72 compartments, each bearing a separate picture and an inscription in Latin beautifully embroidered. At one time it was annually displayed, with great pomp, for eight days in the cathedral, being carefully laid away during the balance of the year.

Tapestry hangings were introduced into England more generally in the time of Eleanor of Castile; and there are many notices of the beauty and richness of the tapestry of Elizabeth's time. With the decay of feudal government, private houses gradually lost the character of fortresses, and more attention being paid to domestic architecture and the comforts of life, the poor construction which had rendered tapestry in some sense necessary, disappeared. The expense of tapestry was great; it was a sure refuge for moths, dust and dirt, and upon the introduction of fresco and stucco painting the use of tapestry gradually declined, and was replaced by the cheaper and more convenient process.

With the further progress of domestic comforts and luxuries, this process was found beyond the reach of all but the wealthier class, and upon the invention of the modern wall paper, frescoing, as a mode of decoration, was again reduced to comparatively small limits, and the inexpensive, cleanly, and in many cases artistic, paper-hangings came into universal use.

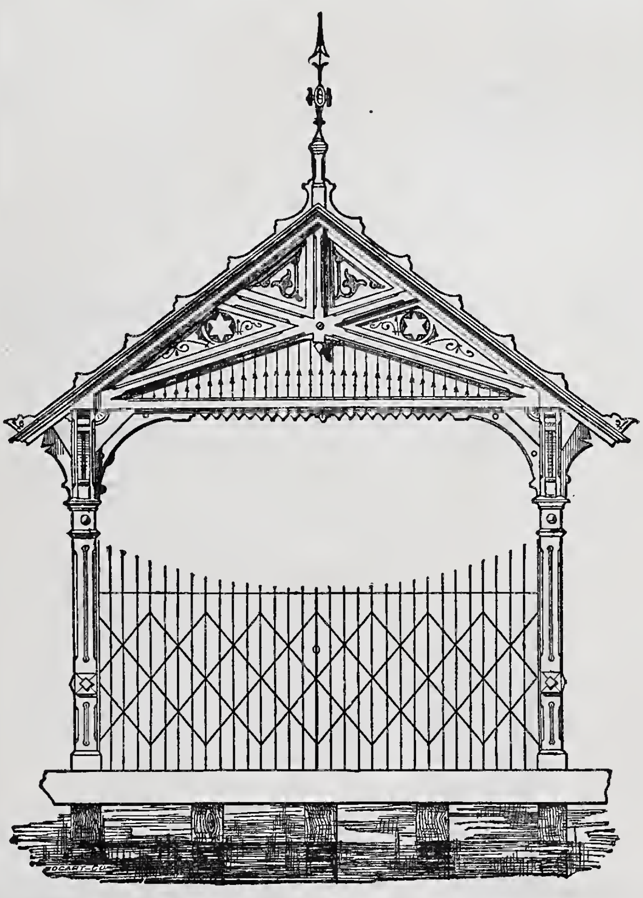
And such has been the march of improvement during the past century, that a modern home, the abode of culture and refinement, with its appointments by conscientious and capable artists, exhibits more of comfort than did the stately abodes of the nobility in time gone by. In the modern home we find happiness, refinement, intellect; in the barbaric glitter of olden times, the mingled squalor and magnificence of the Middle Ages, the gorgeousness and luxury of the court of Louis XV, only the passion the least worthy of the human mind—the passion for show.

Kalsomine.—To 15 pounds best whiting or French kalsomine, dissolved in cold water, add 1 pound fine white glue dissolved in water. Apply cold. For very fine white work, zinc-white is preferred to whiting, but as the expense is so much greater it is seldom used. One-half ounce of ultramarine blue added to the above gives a clearer white. Color to suit, but be sure to put in all the coloring before putting in the glue.

Folding and Extension Gates and Gratings.

The want of an outside guard to doors and windows, vestibules, elevator entrances, &c., which would be a safeguard while in use, and which could be removed with ease without the trouble of unhinging and stowing away, has long been felt, and much thought and study have been given to it. The device of which an illustration is given in the accompanying cut, is the invention of Mr. G. P. Humphries, who is well known as a practical architect, and is manufactured by Bostwick, Humphries & Co., of Cincinnati.

The manufacturers claim for these gates that they are unequaled in convenience, durability, and beauty of pattern, and that they are quite as cheap as other devices used for the purposes to which they are adapted. They are asserted to be perfect safe-guards against accidents, and when applied to the openings of a store or dwelling, offer entire security against burglars' operations. They fold back, when not in use, into very small space, thereby presenting no unsightly appearance.



Folding and Extension Gates Applied to a Ferry House.

The uses to which these gates are applicable are quite numerous and somewhat diversified. They are used as gates in front of vestibules; as gratings to windows and doors, both of dwellings and business buildings; as gratings to close the doors of express and baggage cars; as railings to shut off the platforms of sleeping coaches, &c. Our engraving shows them in use as ferry-house gates—a purpose for which they are well adapted.

During warm and sultry nights in summer, how tempting it is to have the windows open for ventilation! How enjoyable is the fresh, cool night breeze! Yet how inviting are open windows to the professional burglar, sneak-thief or midnight marauder. By the use of such a device as here described, windows and doors may be left open at pleasure, and rest may be enjoyed without apprehension.

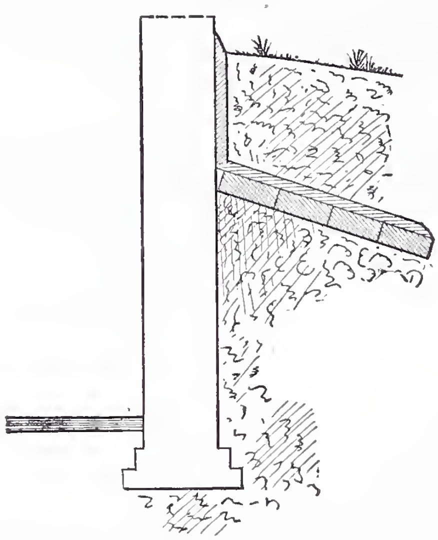
The construction employed in these gates, which may be clearly understood from the engraving, is quite simple. They are made of either iron or steel, as required. The claims of the manufacturers for their superiority over all other gates and gratings in use lies in the fact of the security afforded, the ease with which they are handled, and the facility with which they are put out of the way when not in use.

Machinery and Hand Labor.—There was a time when, as a rule, workmen looked upon machinery as being injurious to their interests; and a feeling of antagonism was naturally raised in them against any invention that aimed at rapid productiou of manufactured goods. This feeling of hostility was quite natural in the uneducated artisan, who fancied he saw in every new invention an implement of oppression. It must be admitted, however, that iu some instances, at any rate, the introduction of labor-saving machinery has been of great benefit to many of the working classes. But while it cannot be denied that the hours of labor have been shortened, wages advanced, and to some extent necessaries cheapened, it will be found that employees have increased out of all proportions, and that a larger amount of skilled labor remains idle than ever before; and that although some necessaries are cheaper in name than they were fifty years ago, it must be remembered that the purchasing power of a dollar is but little more than half what it was at that period. The great cry, also, of high wages being given to mechanics, has but little force, when the fact is taken into consideration that the amount paid to-day has but little more purchasing power than one-half the same amount had half a century ago. We are not prepared to say that the introduction and use of labor-saving machinery have not been a benefit to the world at large; but we think we are safe in saying that whatever may be the benefits derived from this source, they are evidently not evenly divided.—*Exchange.*

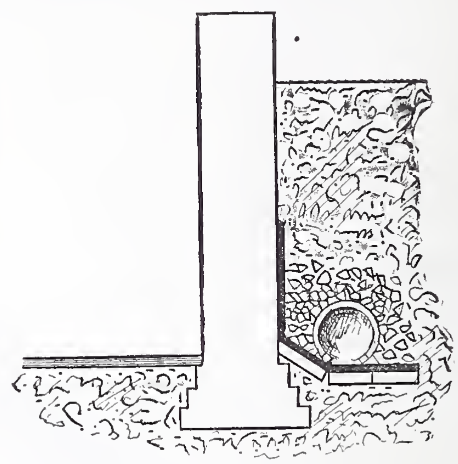
Dampness in Foundation and Cellar Walls.

From "Foundations and Foundation Walls," by George T. Powell, just published by Bicknell & Comstock, New York, we make the following extract on this important subject:

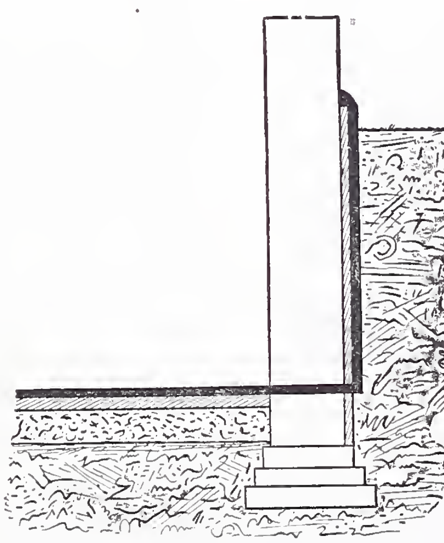
In dwellings that are isolated, to avoid dampness from penetrating the basement or cellar walls that are below the line of earth, architects sometimes specify that the outside of the walls be cemented from the footings to the base-board of framework, or base line of stone molding, and in some instances stop the cement 4 to 6 inches below line of earth. Then excavate the earth around the structure to the distance of 2 feet from wall, and to a depth of 16 to 20 inches, and at an angle of 10 degrees lay one course of brick flat up to wall line, and cover with a coat of cement, as shown in Fig. 1.



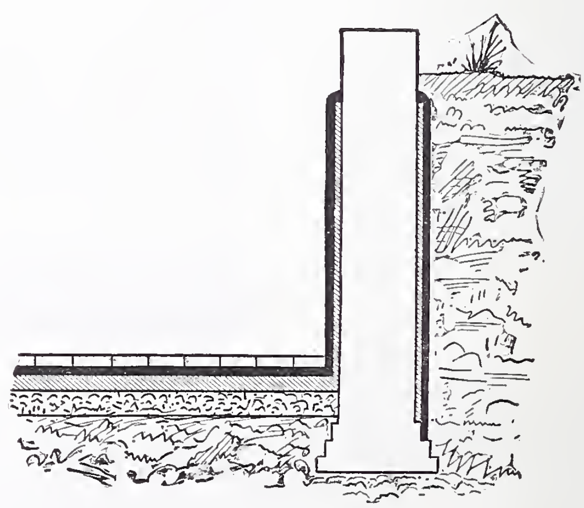
Preventing Dampness in Cellars.—Fig. 1.



Preventing Dampness in Cellars.—Fig. 2.



Preventing Dampness in Cellars.—Fig. 3.



Preventing Dampness in Cellars.—Fig. 4.

Before this is done, it is necessary to fill in earth and settle it around the walls. After this is done, allow it to set perfect before covering with earth. As the foregoing method interferes with flowers and grasses up to line of wall, here is another method (see Fig. 2).

After the wall has been built and cemented on the outside (Rosendale cement is good enough), excavate the earth on the outside to line of footings, fill with firm earth to top of footings, and grade the excavation to a proper descent to carry the water to sewer in a drain pipe, laid on top of a course of bricks cemented, and on top of this put loosely broken stone, and cover the whole over with earth when it is dry. Where there is a clay bottom and much moisture, even this will not prevent dampness from arising in the cellar. To overcome this, use the method shown in Fig. 2 on the outside, and that of Fig. 3 on the inside.

Prepare the cellar bottom, and lay, say, 3 to 4 inches of sand, rolled down firm and even. On top of this put a coat of cement, 1½ inches thick, over the whole surface of the cellar, and lay off around the cellar walls in the cement flat gutters of slight descent to the sewer or waste pipe.

There are clay soils sufficiently solid for walls of dwelling houses. But the clay in wet seasons retains so much moisture that it does not seem to be carried away into the earth, but rises and penetrates through the cellar bottom, and keeps the cellar damp nearly all the time. This is a serious difficulty to overcome, but I have known the following method to be carried out with success:

Excavate the foundations to the depth required to put in the footings, and in the cellar bottom 4 to 5 inches of sand rolled hard, on top of which lay a coat of cement, not less than 1 inch thick; and when this is as dry as possible, put a coat of asphaltum over the whole surface up to the lines of the inside walls, and through one course of brickwork around the whole structure, care being taken to cement the outside wall, and coat it with asphaltum, same as the cellar floor. This is the best course to pursue where there is no chance for a drain.

Another method to secure a dry cellar is as follows: Perform such leveling to the cellar bottom as may be required; spread over this sand to the depth of three to five inches, and roll or pack firm on top of this; cover the whole surface with 1-inch thickness of cement mortar, Rosendale or American brands; carry it well against the inside of the outer walls. Coat the outside walls with cement one-half to three-quarters of an inch thick in the same manner up to dry line. Then on top of this lay a coating of asphaltum, tar and sand, applied hot; carry the asphaltum through the wall (this should be provided for when foundation walls are being built), and coat the outside wall to dry line with hot asphalt. When the asphalt is sufficiently dry to walk on, dip heated brick into asphalt and tar, and lay closely the whole surface with brickwork. When it is not possible to carry the asphalt through the wall to the outside, carry it up on the cement on inside.

The best mixture of asphalt is to mix with the asphalt 10 per cent of coal tar and 25 per cent. of sand and use while hot, to form a cement for bedding brick for damp cellar bottoms.

Turning Grindstones.—The best thing to turn up a grindstone with is a piece of gas pipe used as a turning tool, using a piece of iron clamped to the face of the grindstone trough, so as to form a rest or support for the gas pipe. The stone should be turned when dry, and the face beveled off after it is true with a piece of thin sheet iron.

CORRESPONDENCE.

Discrepancies in Bids; a Standard of Valuation Needed.

From E. G. A., *Ossian.*—I have carefully gone over the pages of the numbers of *Carpentry and Building* already issued, with both pleasure and profit. In addition I have formed the hope that through its columns a want long felt by carpenters and builders, viz., increased unity of interests financially and a more systematic valuation of labor, may be discussed to some purpose. I am led to this train of reflection by reading the correspondence in the April and May numbers. These correspondents have written of the disparity of estimates in their own locality and within their own experience, but they have opened up a subject that probably has its parallel in every town and hamlet in the country, and might be said to be universal.

Perhaps no other trade can be charged with such a want of system in fixed prices. As noticed by your correspondents, most of it is due to ignorance and inefficiency, while a few cases may result from a reckless ambition to outdo a competitor or from local jealousy.

A prominent architect of Chicago says that the bids from a dozen builders for almost any building, costing say $50,000, will there vary, from the highest to the lowest, as much as $20,000, and in similar proportion, sometimes being even greater, whatever the magnitude of the work.

One correspondent, W. P. R., Charleston, S. C., says that the cost of labor is equal to the cost of material, "on work of any kind, large or small, coarse or fine—no matter what the material may be." As a general rule, this is without doubt safe, but in the experience of many builders there are cases when the labor is several times the cost of material employed.

W. P. R., however, strikes the key to a proper method of estimating when he says that no one need make mistakes if he estimates workmanship in detail. This is the indispensable condition to success, however laborious. One other condition is equally important, namely, carefully prepared drawings and specifications. With these and a builder's price book containing memoranda of every detail, together with close attention and careful computation, estimating builder's work can be made reliable and accurate.

But this is not the extreme difficulty. What is the intelligent builder to do when he is surrounded by competitors who are either too ignorant, too egotistical or too willful to practice by some accepted system that will prove safe and profitable? Cannot builders unite upon some method as basis for estimating construction?

Among the different price books published, I have found "Vogdes' Architect's and Builder's Companion and Prices Book" the most comprehensive of any, the calculations being made for labor generally by lineal and superficial measure. Any local variation from the schedule price can be added to, or deducted from, the estimates found by the book.

This subject of valuation of construction and the cost of labor involved, is the all-important one to builders. Some recognized standard, constantly put in practice by all carpenters and builders, is a necessity if we desire a just compensation for our labor, and expect to command the respect for our trade to which carpentry, the mother of arts, is entitled.

Practical Views upon Estimating.

From I. H. P., *Paterson, N. J.*—There is a great deal of amusement, instruction, and I am not sure but a little that is disgusting, in the remarks and opinions of some of your correspondents on the subject of estimating.

One says that materials are worth exactly the same amount as the labor on any work. I completed a job a short time since on which the labor amounted to $600, while the materials cost but $150. Under his system some one would have been very short on that contract. His ideas are certainly not correct.

Men for years have indulged in all kinds of wild and impracticable schemes and systems for working estimates of buildings which would require neither labor nor thorough knowledge of the business. We have heard all sorts of nonsense, as, for example, a building being worth so much a square foot, or so much a cubic foot, or so much a foot of girt both ways—systems of calculation all of which have come to grief.

There is no royal road to an estimate. There is no method of reliable guessing—no generalizing an estimate. It is, it must be a matter of detail, accurate, certain and convincing.

No system will do that will take a plain double-pitch roof and figure the framing at $6 per 1000 feet of timber, and then take another roof with hips, valleys, pediments, dormers, &c., scattered all over it as though from a pepper-box, at the same price.

Framing pitch pine or yellow pine, is not framing white pine. Framing with every stud, brace, &c., framed with mortises tenons, pins, &c., is not barefoot framing, in which the parts are nailed only. Double tenons are not single tenons. Shingling a roof of the kind first mentioned above is not shingling the second. Siding up a plain building is not siding up one in which every sill, window cap, belt course, column and pedestal requires the siding accurately fitted around and against it. Laying 3-inch flooring requires more time and more nails than 9-inch flooring can be figured to take.

Because a certain 15 x 32 window may cost complete $9, it does not necessarily follow that another 15 x 32 window, differently trimmed, glazed and completed, may not cost $30.

A base to a room may cost put down 10 cents per foot. Another of the same width may easily cost 30 cents per foot. The same principle holds good for all the items in a building. Each costs a different sum dependent upon its location, size, style and quality, and woe be to him who does not understand thoroughly that all things do not cost the same.

If a contractor has been accustomed to plain buildings, and drops upon some seemingly simple design of one of our modern architects, figuring it as he figures ordinary structures, he will wake up to a realizing sense of the situation when he finds that the plain cornice, slightly ornamented by a single stroke of the pen, shown by the elevation, which he estimated, as he thought with an ample margin, at 50 cents per foot, means a very different affair—that simple stroke of the pen standing for an elaborate chisel-cut molding, and other simple marks interpreted meaning lumber three inches thick instead of one inch, as he estimated, the whole cornice costing him $1.50 per foot net.

No, No. The rules will not do it. Practical judgment based upon long experience, combined with a thorough mathematical and mechanical education, is the only thing that will answer.

The Relative Price of Labor and Materials.

From W. P. R., *Charleston, S. C.*—Will you please ask S. W. H., of Russell, Kan., what the rate of wages is at his place, where he pays $25 to $30 per 1000 for common framing lumber? I am curious to know.

Will your same correspondent go further and make an estimate for a small frame building, to cost from $1500 to $2000, and say what is the difference between material and labor at his place, where lumber commands the price above mentioned.

I did not offer the statement that labor equaled material as a rule by which to estimate. I warned inexperienced mechanics against it, and simply called attention to the fact that I had found labor to equal material.

In this connection I would inquire of S. W. H. what the difference is in cost of labor and material in the production of gold leaf? What is the difference between the cost of labor and material in the manufacture of brick, or in black silk hats, also in bar iron? It seems to me that your correspondent has not attempted to test the statement that in the production of many things—buildings and bridges being of them—labor equals material. If your correspondent will look up this matter, and send the results of his investigations to *Carpentry and Building*, he will probably afford amusement for your readers, if nothing more substantial.

How to Make Brick Black.

From W. P. R., *Charleston, S. C.*—Will some one of your hyperborean subscribers who flourish among black-brick ornamentation of buildings, be so kind as to inform us of the sunny South, where this style of ornamentation is not known, the *modus operandi* of making black brick and black mortar? We would like very much to see more taste displayed in our buildings in this section. We think that black brick may be used at trifling cost, if we only knew how.

Answer.—The black brick employed in the ornamentation of the Morse building, which we have so fully illustrated and described, were prepared by dipping in hot coal tar. The same quality of bricks were used for this purpose as those which were not treated at all. We believe the colored bricks employed in the base course of the main building on the Centennial grounds were prepared in a similar manner. Common mortar is made black, for fancy joints and the like, by mixing lampblack with it. If any of our correspondents can suggest better methods than the above, of which we have seen practical illustrations, we shall be glad to receive descriptions, which we will publish for the benefit of those who may be interested.

Remarks upon Glue and Gluing.

From Charles James Woodsend, *Grand Rapids, Mich.*—There are few persons who cannot tell a piece of glue when they see it, but how much depends upon it in the practice of the cabinet maker's and joiner's trades, is only known to those who are fully initiated into the mysteries of modern construction, and how much (?) its use is understood every housewife can abundantly testify.

There is no department in a cabinet factory or a joiner's workshop that is so little understood or more slighted than the gluing department—not slighted with the deliberate intention of doing bad work, but from a habitual carelessness in the proper preparation and application of this abused, and at times useful, cement.

The following are some of the requisites and tests of good glue: Glue is adhesive, and to a certain extent elastic. It should present a clear appearance when held between the eye and the light; color is of minor importance, so that it is neither spotted nor streaked. When broken it should present a whitish edge where it is compressed in the breaking; it should not be too brittle, neither should it be too tough, but should break clean. Another test is to allow it to absorb all the water it will, then dry in a cool place. If the piece returns to the size it was in the first instance, it is good.

In the preparation, or as the trade term is, "making the glue" (I am not alluding to the manufacture of the glue, but the making as understood by cabinet makers), what is required is to preserve its elasticity and adhesiveness in the fullest extent, to destroy either of which is to render the glue worthless, and its worthlessness will be in exact proportion to the destruction of either of these properties.

If a cabinetmaker be asked why he puts water into his glue, in nine cases out of ten his answer will be, "It is too thick, and will not spread as it should do unless you thin it with water." All glue as received from the factory requires the addition of water before it will melt properly, and every addition of water (while the glue is fresh made) will, up to a certain point, increase the adhesiveness and elasticity; and it is the duty of every man who uses glue to find out just where that point lies, as it is possible to melt glue and have it so thick that after it is dry or set it will be so brittle as not to adhere to the wood. Some glues will bear more water than others, but all will bear more water than usually falls to their share, and that, too, with a great increase in the quality of the work.

For glue to be properly effective, it requires to penetrate the pores of the wood, and the more a body of glue penetrates the wood the more substantial the joint will remain. I have always found that glues that take the longest to dry are to be preferred to those that dry quick, the slow-drying glues being always the strongest, other things being equal.

I have made glue in many different ways, but as yet have not found a way that gives so good results for general use as the way I was taught when I first went to be apprentice. The method was as follows: Break the glue up small, put into an iron kettle, cover the glue with water and allow it to soak twelve hours; after soaking, boil until done, which will be when some is raised upon a stick and allowed to fall back into the kettle it falls without rattling. After the glue is boiled sufficiently, pour into an air-tight box; leave the cover off until cold, then cover up tight. As glue is required, cut out a portion and melt in the usual way. Expose no more of the made glue to the atmosphere for any length of time than is necessary, as the atmosphere is very destructive to made glue. We used to make up a quantity sufficient to last about a week.

Never heat made glue in a pot that is subjected to the direct heat of the fire or a lamp. All such methods of heating glue cannot be condemned in terms too severe.

Do not use thick glue for joints or veneering. In all cases, work it well into the wood in a similar manner to what painters do with paint. Glue both surfaces of your work, excepting in the case of veneering. Never glue upon hot wood or use hot cauls to veneer with, as the hot wood will absorb all the water in the glue too suddenly, and leave only a very little residue, with no nature in it whatever. The following extract is made from Mr. L. D. Gould's "Carpenters' and Builders' Assistant and Wood-Workers' Guide," published in 1874. Under the article "Adhesion of Glue," he says: "Mr. Bevan glued together by the ends two cylinders of dry ash wood, one-fifth of an inch in diameter and about 8 inches long. After they had been glued together 24 hours they required a force of 1260 pounds to separate them, and, as the area of the cylinders was 1.75 inches, it follows that the force of 715 pounds would be required to separate 1 square inch. In remarking further, Mr. Bevan tried the lateral cohesion of some dry Scotch fir wood. The force required to separate the wood was 562 pounds to the square inch; consequently, if two pieces of this wood had been well glued together, the wood would have yielded in its substance before the glue. For a subsequent experiment, made on solid glue, the cohesive force was found to be 4000 pounds per square inch, from which it may be inferred that the application of this substance as a cement is susceptible of improvement."

I quite agree with Mr. Bevan about it being susceptible of improvement.

Pattern makers in foundries usually understand and use their glue to better advantage than cabinet makers. Pattern makers require their glue joints to stand the effects of the damp sand, and not to draw out at the joints and leave a mark in the sand, or fall to pieces. They use the same kind of glue as cabinetmakers, but the general run of the cabinetmaker's joints will hardly bear a damp atmosphere, much less being placed in damp sand.

Oil or other like ingredients are not required in the glue to effect the end, but simply water. What a mine of wealth for the dairyman if milk was affected by water the same as glue is! There would be no danger of our receiving our milk too thick if water made it stronger. Why, then, should cabinetmakers be so blind to their best interests and persist in using their glue thick. The only way I can account for it is that they have become habitually careless.

A short time since I required a board five-sixteenths thick for an experiment I was trying with some cement. At the time I required it I was unable to obtain a piece wide enough, so I glued two pieces together. At the time of doing it I had grave apprehensions about it standing the severe ordeal I wished to subject it to. That piece of board (white wood) was covered on one side with stucco and the other side was covered with a composition; the stucco and composition were alternately saturated with water, frozen, thawed out, and then dried before a hot stove. The board was subjected to this process for two weeks, during which time it required to be frequently handled. There were no battens or any cross pieces whatever used, merely the board itself, with the joint square and glued with very thin glue. It went through all that was required, and to-day the joint is as solid as when it was first glued.

In conclusion, let me earnestly request every man who uses glue and who has read my remarks, to give water a fair trial and of the results I have no fear whatever.

Measurement of Standing Timber.

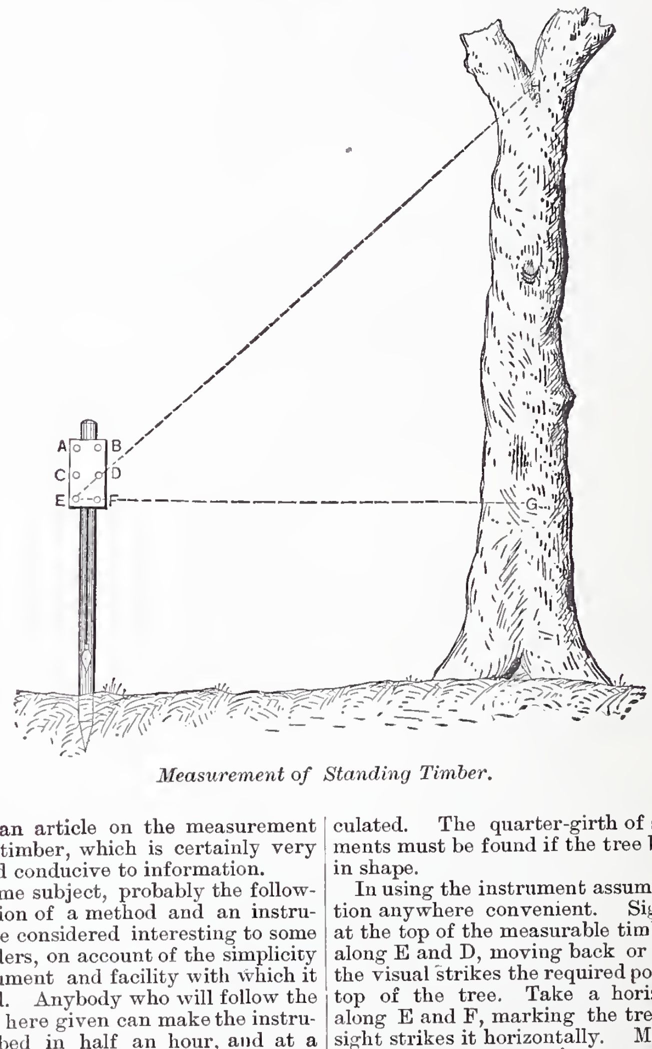
From P. D., *Wallingford, Conn.*—In the April number of *Carpentry and Building* there was an article on the measurement of standing timber, which is certainly very valuable and conducive to information.

On the same subject, probably the following description of a method and an instrument may be considered interesting to some of your readers, on account of the simplicity of the instrument and facility with which it may be used. Anybody who will follow the instructions here given can make the instrument described in half an hour, and at a trifling expense, while the pocket sextant recommended in the article referred to would cost about $40, besides the trouble in learning its practical application. The method and instrument I allude to are based on scientific principles, being deduced from the fourth proposition of the sixth book of Euclid.

The mode of estimating the tops, bark, &c., given in the April number, I consider very useful to any person measuring or valuing standing timber.

The construction of the instrument may be described as follows: Procure a rod about 7 feet long and 3 inches by 1 inch in section. The lower end should be pointed or shod with iron, like a surveyor's cross, so as to stick in the ground while taking observations or sights. To this rod is attached a plummet, to insure its perpendicularity. Attached to the rod also is a rectangular board about double as long as wide—say, 12½ x 6½ or 10½ x 5½—as shown in the sketch. Place on the face of the board straight pieces of wire, perpendicular to its face and projecting about one-half inch, to serve for sights, as indicated in the diagram. From pin A to B is 6 inches; from A to E is 12 inches; C and D are to be exactly in the middle of the board, so that C and D bisect the space between the A E and B F sights. The board slides up and down the rod, and is provided with a clamping screw at the back to keep it in its place when the sight is being taken.

From the properties of similar triangles, as may be seen from the diagram, the required hight may be ascertained by simple proportion. In fact, for using this instrument there is no further knowledge of mathematics required than simple multiplication. I have used it practically myself, and found satisfactory results. The quarter girth, of course, I found in the same manner as shown in the article before mentioned. In addition, I would say that the girth of any tree which tapers uniformly can be found very exactly by first ascertaining how much the tree tapers in the lower section of five or six feet, from which the mean girth, or the girth at any given hight, may be calculated. The quarter-girth of several segments must be found if the tree be irregular in shape.



Measurement of Standing Timber.

In using the instrument assume your position anywhere convenient. Sight the tree at the top of the measurable timber, looking along E and D, moving back or forward till the visual strikes the required point near the top of the tree. Take a horizontal sight along E and F, marking the tree where the sight strikes it horizontally. Measure from this point to the base of the tree, to which add the distance from the point E (or the eye) to the tree. The sum will be the hight of the tree. Or it may be stated thus: E F : F D :: E G : G H, (4th prop. 6th book of Euclid). But E F is equal to F D; therefore E G must be equal to G H, and hence G H added to the hight from the ground to G, must equal the hight of the object required.

In case there are obstructions to preclude any possibility of sighting by E and D, then take the sight by E and B. In this instance double the distance from eye to tree, and add it to the hight from the ground to the mark obtained by the intersection of the horizontal sight with the object. The result will be the hight required.

Heart vs. Sap Wood.

From D. T. A., *New York.*—In the article of Mr. Wight on the constructive uses of wood I observed the following statement:

"In all kinds of lumber the heart should be rejected." I believe the author to be too well informed to accept the above as his dictum without an explanation, and incline to the view that the printer or proof reader has mistaken the word "selected" for rejected.

The sentence should properly read, "In all kinds of lumber the heart should be selected."

It is well known that the structural character of trees consists mainly of heart, sap wood and bark.

The two latter are the mediums through which the ascending and descending currents of common and proper sap flow to perform the annual functions of nourishment and growth.

Each year's growth of a tree adds to the woody fiber, or heart wood, by the evaporation, so to speak, of the vegetable fluids, or sap, and by external pressure; after this process nothing remains but firm, durable wood, which is the only perfect wood for constructive uses.

During the life of the tree, sap wood is impregnated with vegetable matter, and is soft and spongy. After it has been felled, the best care will prevent the decay of the sap wood, and worms from finding lodgment and food therein.

Day's Work at Shingling.

From E. D. S., *Springfield, Vt.*—I am greatly pleased with the specimen copy of the *Carpentry and Building.* It is by far the best paper for carpenters that I have yet seen.

In reply to R. L., of Buffalo, I would say that I can lay from 3 to 4 squares of shingles in a day of 10 hours, and there are several here in Springfield that can do as well. A good deal depends on the quality of the shingles used.

From S. F. F., *Billerica, Mass.*—I notice in the May number of your paper a question from R. L., Buffalo, N. Y., asking how many shingles constitute a day's work, and as I have had some experience in that line I will try and enlighten him. It has always been considered that 2 squares or 2 M. was a day's work for an average man, but my experience has shown me that a good man ought to lay more. It makes a difference whether it is an old roof and you have the old shingles to take off, or a new roof without any old shingles. If an old roof I should consider 2 M. a good day's work, although I have laid more. If a new roof a man ought to lay from 2½ to 3 M. I have laid 3¾ and averaged it for a number of days, but 2½ to 3 is a good day's work, and if my help do that I won't complain.

Smoky Chimneys.

From A. M. D., *Mattapuisett, Mass.*—In the April number of your valuable paper we find W. H. G. in trouble with a smoky chimney. This is nothing new, and from my experience I can assure you that the whole trouble may be owing to the large size of flue; 378 inches is ample for two tons of coal per diem, whereas Mr. G. may consume only about 20 to 30 pounds. If Mr. G. will connect his stove pipe with another pipe put down from the top of chimney, say 6 inches diameter, ending at top of brick chimney, = 28 inches area, he will have no trouble. In an able article in a recent number of *Carpentry and Building* the writer says that for ordinary fire in a dwelling-house the flue should be at least 128 inches. I should think he meant only 28, but further on he says 96 for hard coal.

Will any one examine the flue of a common cook stove through its many windings, thence into the chimney, and tell us why the straight, smooth flue in the chimney should be 4 to 8 times the size of exit from the stove?

Mr. G. says there is no trouble when the wind is west; but I think the west wind has nothing to do with it, only so far as a west wind may favor any chimney owing to the condition of the air. If Mr. G. should put a window in his chimney, he would see, on lighting a fire, first a little puff of smoke come rolling along the pipe, and when it got into the chimney it would likely fall, having lost its heat. Next would come a little larger puff; being a little warmer, it would advance up the chimney a little, soon cool and fall back. Thus the conflict between a little hot air and gases would go on, simply because the hot air and gases have so large a quantity of cold air to drive out; and unless one can maintain a volume of air much hotter than the surrounding air, he cannot have a good draft.

The writer is running a 25-horse-power engine: Area of chimney, 236 inches, which is in good proportion; yet with a tight damper the flue or opening into the chimney is not often over 2¼ x 16 inches, usually about 1 x 16 inches, and the draft is sufficient to burn from 200 to 300 pounds of coal in 10 hours.

Nearly all smoky chimneys can be cured by reducing the flue so that the small fire will keep *hot* the air and smoke till it reaches the top of the chimney; even then it should have considerable heat to spare.

If any one will take a common kerosene lamp, light it so it burns bright; then make a tube of paper rolled so that one end shall go over the top of the chimney and the other end be much smaller, say one-fourth in diameter he will see that the lamp will burn just as well, the chimney being one-eighth its former size.

Dripping and Leaky Chimneys.

From G. W. G., ——. My method of remedying leaky chimneys is to put a funnel into them. A chimney that goes through a cold attic is very apt to leak creosote. By running the funnel from the top of the chimney to the attic floor I have, in almost every instance, been able to stop the leak. I would write particulars, but do not want to take too much space in *Carpentry and Building.*

Note.—Our friends need never fear that they will send us too many particulars in regard to their work. We are always glad to hear from them and learn what they are doing, even though we may not be able to publish it all. It is by exchanging ideas with practical men that we are able to get at the useful information that is necessary to make this department interesting. We should be glad if our friend had told us what material he uses for the funnel, and, if sheet iron is employed, how he prevents it from rusting. The plan is an exceedingly good one, and if all chimneys were furnished in this way there would be fewer complaints of smoky chimneys.

Design for Wall Towel-Rack.

From A. H. F., *Reading, Pa.*—I am in want of a design for a carved walnut towel-rack to hang against a wall. Will some of your readers kindly furnish me with something in that line?

Note.—We shall be pleased to receive from our readers designs of odd articles of this character, either original or selected (in the latter case always accompanied by memoranda of the sonrce from which they are obtained), the best of which we shall be glad to engrave. Designs for towel-racks, hanging shelves, whatnots, fancy tables, &c., will be acceptable.

Paint for Tin Roofs.

From B., *Mt. Vernon, Ohio.*—I have read your answer to E. B., Benton Harbor, Mich., in the June number of *Carpentry and Building.*

If he will add about a pint of melted rubber (any old rubber will do) to the iron paint, he will have a much better paint for tin roofs than just the iron paint alone. A roof in this place that had leaked and had been a source of trouble for a long time, was treated to a coat of that kind of paint, since which it has not leaked at all. The roof is a flat-seam roof.

A Michigan Saw Mill.

SAGINAW VALLEY, MICH., May 24, 1879.

To the Editor of Carpentry and Building: Our first impression of Bay City was a curious one. As we walked toward the town from the depot, our attention was attracted by the singular appearance of the sidewalks. Like everything else in this lumber country, these are of wood. The surfaces of the planks seemed to have been subjected to unusual influences. They looked as if they had had a severe attack of small pox. Every inch of exposed surface was covered with deep, well-defined indentations. Naturally, we fell to speculating as to the cause of this phenomenon. It might be atmospheric influence; it might be the work of some insect or worm; more likely it was hail. Presently we encountered an intelligent looking native, standing with hands in pockets before the door of a beer saloon, of which the door step furnished a striking illustration of the action of the mysterious influence which had so puzzled us. "Beg pardon, neighbor," said your correspondent, "but I'll be much obliged if you will tell me what causes the plank sidewalks of this interesting town to assume such a curious appearance?" The intelligent native looked at us, then at the sidewalk. "Waal, I don't know as I know what you mean." "Observe," said we, "the singular pock-marked appearance of the exposed surfaces, which is not seen on the fences or house fronts. My friend and I have been wondering whether it was hail, or an insect, or some other influence peculiar to this neighborhood, and not being able to arrive at any satisfactory decision, we concluded to tronble you for exact information on the subject."

A lambent smile overspread the countenance of the intelligent native. "Waal, stranger," said he, "it aint neither hail nor worms. It's log drivers." Not fully comprehending his meaning, we asked further information, and were told that the men who handle logs in the river wear boots with sharp steel spikes in the soles, so that they can walk or stand on the logs which, from long immersion, have grown slippery. We thanked the smiling citizen for his information, and were about turning away when he blandly remarked: "I say, stranger, if you'll just step inside you'll find them pock marks all over the floor, and more particularly in front of the bar." The hint was so delicately conveyed that we could not bnt act upon it; and then we went our way with the pleasing consciousness that we had furnished the lumbermen of the Saginaw Valley a standing joke, which would amuse them for years to come.

Bay City is a surprise to the stranger from the East. It is much larger and more important than one expects to find it. The streets are wide, with many blocks of fine stores well filled with merchandise of the best quality. There are many stores which would do credit to the best business streets of the most prosperous cities of the East. Many of the buildings are substantial brick structures. Stone is something very difficult to find in this neighborhood, but very good native bricks are made and are coming into use. Notwithstanding its abundance, lumber is but little, if any, cheaper here than in New York. Slabs and sawdust are plenty and cheap, but lumber of good quality is never in excess of the demands of the export trade.

THE LUMBER SUPPLY.

Of course, the exhaustion of the pine forests of the lower peninsula of Michigan is only a question of time, but as that term is used here, it is in distinction from eternity. About 11 years ago a careful estimate by experienced men, led to the conclusion that the standing pine in the valley of the Saginaw River and its tributaries would furnish 600,000,000 feet of sound lumber for 17 years, and then the supply would be exhausted. The time allotted for the life of this industry is drawing to a close, but the supply is as abundant as ever, and will last far into the future. Unfortunately, however, it is not inexhaustible. The destruction of the forests is proceeding with alarming rapidity, and if it were not that Canada still has vast and untouched forests, we might well regard with apprehension the exhaustion of the pine supply which, for this country, will mark the end of the age of wood and the beginning of the age of paper. Nature furnishes us no substitute for pine; when we need one we must make it.

During the 16 years from 1863-8, the mills of the Saginaw Valley cut over seven thousand millions of feet of lumber. Since lumbering operations began here the estimated product of the mills has been something over nine thousand millions of feet. To this must be added an immense shingle and lath product and the enormous aggregate waste of the mills. Some of the districts formerly largely productive are already exhausted. The Cass River no longer furnishes a supply of any consequeuce, and several of the rivers must soon be abandoned by the lumbermen. But while the pine lasts it will be a source of great wealth to this district, and will give employment to a large and generally prosperous population. The shipments of lumber and shingles from the Saginaw Valley from 1869 to 1878 inclusive, are given in the following table, for which we are indebted to the courtesy of Mr. Bennett, proprietor of the *Lumberman's Gazette* •

	Lumber.	Shingles.
1869	474,912,425	88,878,500
1870	487,489,268	130,448,490
1871	516,629,474	142,661,500
1872	492,834,990	87,204,500
1873	452,763,562	38,521,500
1874	448,707,652	82,154,500
1875	445,149,155	117,832,500
1876	455,227,252	105,743,050
1877	539,863,047	162,594,250
1878	525,282,098	187,699,380

Of the minor products of the mills—those which use up all the lumber that would otherwise go to waste—your correspondent had not time to gather information. These are principally hoops and staves.

A SAGINAW VALLEY MILL.

The largest and most interesting lumber mill in this district, and probably the largest in the world, is at the extreme southern end of Bay City. It is the famous mill of Thos. Mc.Graw & Co., and as it is the best representative of its class, a brief description cannot fail to interest the reader. The offices at the main entrance are large and convenient, and there is an extensive store for the accommodation of the workmen and their families.

The saw mill proper is a building 85 x 162 feet, with a wing 32 x 52 feet. Power is furnished by three engines for the gangs, each with 16 x 20 inch cylinders; an engine of 28 x 34 inch cylinder for the small machinery and circular saws; and one with 8 x 12 inch cylinder for the saw dust conveyers. There is one "live gang" of 30 saws; one "stock gang" of 36 saws; one "slabbing gang" with 16 saws on each side. There are two circular saws of 72-inch diameter; two trimming tables capable of trimming the entire product of the mill; four edgers, four slab saws and tables, one splitter for making flooring or siding from stock boards, and one resawyer for thin lumber. Among the wood working machinery there is a heading machine with a capacity of 5000 pieces per day; a stave machine with a capacity of 50,000 pieces; and a hoop machiue with a capacity of 10,000 pieces. The product of these machines is all ready for making into barrels when taken from the mill. In addition there is a lath mill with a capacity of 40,000 per day; a shingle mill with a capacity of 25,000, and a picket mill with a capacity of 3000.

"THE SLAUGHTER HOUSE."

The saw mill, or, as my companion called it, the slaughter house, is one of the most interesting industrial establishments your correspondent ever visited. It is more like a well-arranged abattoir than anything else to which it can be compared, and oue has but to see both to note the striking similarity. The logs are floated to the foot of the inclined planes leading up to the mill, and when the carriage which, a moment before, has made a plunge into the brown water, comes up again, it brings one, two or three great pine logs to be slaughtered. These are rolled into the unyielding embrace of the clamps attached to the carriages which serve the great circular slabbing saws. The carriage is set in motion, and the terrible saws tear their way through the wet log with railroad speed, sending a cloud of spray in every direction. The log is then turned and another side is taken off. The turning is effected by a curious instrument of torture which rises through the floor, lays hold of the log with its formidable spikes, shoulders it over and subsides. When the removal of four slabs has squared the timber, it is passed to the gang saws, which divide it into boards. These pass forward to the trimming tables, where they are edged. The slabs and edges all move forward in the same direction, over tables with rollers kept constantly in motion by endless chains revolving over drums. At the proper point they are gathered, sawed into conveuient lengths and passed down into hoppers, when they disappear from sight. The dust from the saws is caught and carried forward by belts with buckets, and conveyed where it is needed to feed the fires under the boilers.

The system in this mill is perfect, and everything is done by machinery, which only needs intelligent control to make it do all the work. Everything moves steadily forward. Nothing stops, nothing accumulates, nothing is in the way. The onward movement is like the flow of a river with a uniform current. The men employed merely guide the driftwood.

SAWDUST AS A STEAM FUEL.

Adjoining the sawmill is a boiler house of brick, with iron roof—fire-proof throughout. It contains six flue boilers, 4 x 24 feet; two tubular boilers, 4 x 14 feet; two large steam pumps for feeding the boilers and supplying water for fire protection. The fuel used is sawdust from the gang and circular saws. It is fed automatically, and the intensity of the fire attests the value of the fuel for this purpose. In another part of the works your correspondent saw the operation of firing by hand. The sawdust is handled with great wooden snow shovels, and feeding the fires under six boilers keeps two men constantly at work. The grate is a perforated plate, with a large ash-pit underneath. On this the firemen pile all the sawdust the furnace will hold, pushing it back with implements made for the purpose, and throwing in more until the mouth is closed. Your correspondent saw at least 4 feet of dust piled on a grate, and would have supposed that such a mass of cold fuel between the grate and the boiler would have choked the fire and lowered the steam pressure; but the heat somewhere in the furnace was intense, the boilers were singing like comfortable tea kettles, and the gauge recorded 85 pounds, with a tendency to rise.

The system of automatic feeding in the main boiler house is attended with great economy. One man can now take care of the fires which, if fed by hand, would keep six men hard at work. The surplus sawdust is carried on to a building designed for the purpose, from which it is returned at night to generate steam for the dry kilns. A great advantage of the automatic firing is found in the fact that it is never necessary to open the furnace doors; whereas, with hand firing, they are open nearly a third of the time. With automatic feeding the temperature is more uniform, and the steam pressure is maintained at a constant figure.

The mill and the platform up which the logs are drawn from the river are lighted with gas, so that, when necessary, work can proceed day and night without interruption.

THE SAWED LUMBER PRODUCT.

The average product of this one mill is about 205,000 feet of boards per day of 11 hours. At a trial of speed made in 1874, there were cut in this mill, in 10 hours and 43 minutes, 179,718 feet of lumber; since that time the machinery has been greatly improved, and on the 10th of August last there were sawed, in 11 hours, 335,240 feet. Of course, a net product of sawed lumber represents an immense amount of refuse in the shape of slabs, sidings, sawdust, &c., but of this little or nothing is wasted. The useful wood is all manufactured into pickets, staves, hoops, &c., and the chips and sawdust are all converted into power.

THE DRYING KILNS.

Most of the logs sawed have been more or less completely water-seasoned, but before shipment it is necessary to dry them very thoroughly. In McGraw's mill the kilns are of what is known as the Chicago Pattern. They are of brick with tall chimneys, and each will hold 700,000 feet of lumber. With lumber fresh from the mill, the amount which can be properly dried in one of these kilns averages 75,000 feet per day.

THE PLANING MILL

is a substantial brick building 40 x 60 feet and two stories high. It has three molding machines, 8, 10 and 12 inch respectively, and provided with knives for over 2000 patterns. In this mill and an adjoining building there is much fine and valuable machinery, including three planing machines with an aggregate capacity for dressing 100,000 feet of lumber per day; an edger, cut-off saw, scroll saw and picket pointer. The boiler room of this mill is 48 x 60 feet, and contains 8 tubular boilers 4 x 16 feet. The only fuel used is sawdust.

Among the other buildings of this vast establishment, of which only an imperfect idea can be conveyed by a description, is an extensive and well appointed blacksmith shop, a carpenter shop, a cooper shop with storage capacity for 8000 barrels, a barn, a mill for grinding feed, an extensive storehouse on the river for grain and coal, a large brick store, a boarding house with accommodation for 55 boarders, and 27 tenements leased to men employed. Of

TRAMWAYS

there are 8358 feet ou a level with the second stories of the mills. So perfect is the system that all the hauling necessary is done by two horses. These tramways are sufficient to afford piling room for 40,000,000 feet of lumber. On the ground there is a tramway connecting the drying kilns with the mills and with 20,000 feet of dockage on the Saginaw River. J. C. B.

How Picture Frames are Made.

The frame in which a fine picture is hung, bears the same relation to the work of art mounted therein that the setting of a gem does to the precious ornament it helps to display. Each requires an artistic taste to set it off to the best advantage, and the walls of the homes of those who can afford to indulge their taste in works of art and ornament, often proclaim the taste of the owner as much in the moldings and ornaments as in the more valuable treasures they display. For this reason the productions of frames to encase portraits, paintings, engravings and mirrors has become an industry of no mean importance, and one which has been brought to a degree of perfection worthy of regard and consideration. The elaborate ornaments, the delicate and artistic chasing and carvings, and the beautiful designs of picture and mirror frames have, no doubt, created a wonder in the minds of many of our readers as to how they are produced.

The first process is to cut the lumber into moldings, which constitute the foundation or groundwork of the frames. These strips, usually 12 feet in length, are distributed among the workmen, according to the purposes for which they are designed. They are first primed, and then the surface is covered with a composition, laid in with a tool somewhat simlar to that used by a plasterer laying on cornices. This gives the face of the molding a smooth, even and hard surface, which admits of a high degree of polish. They are then ready, when thoroughly dried and hardened, for the more elaborate ornamentation. When to be gilt, the gold or silver leaf is deftly laid upon a coat of varnish by men who become surprisingly expert in handling the delicate leaves. When the gilding is set it is burnished or frosted, as desired. As gilt frames comprise but a small portion of those manufactured, the other processes are worthy of attention. The greater part of the moldings, after being surfaced as above described, are stained or grained in imitation of valuable woods, or partly grained and partly gilded, and some of them traced with designs or elaborately carved before being cut into frames. A large portion of the work in this shape is sold to the trade by the foot, and the frames cut and put together by picture dealers. Those, however, intended for special designs and most elaborately ornamented are cut into frames, and much of the ornamental work is done after they have been put together. All round, oval and other than square cornered frames, are of course sent out entirely complete.

CARPENTRY AND BUILDING

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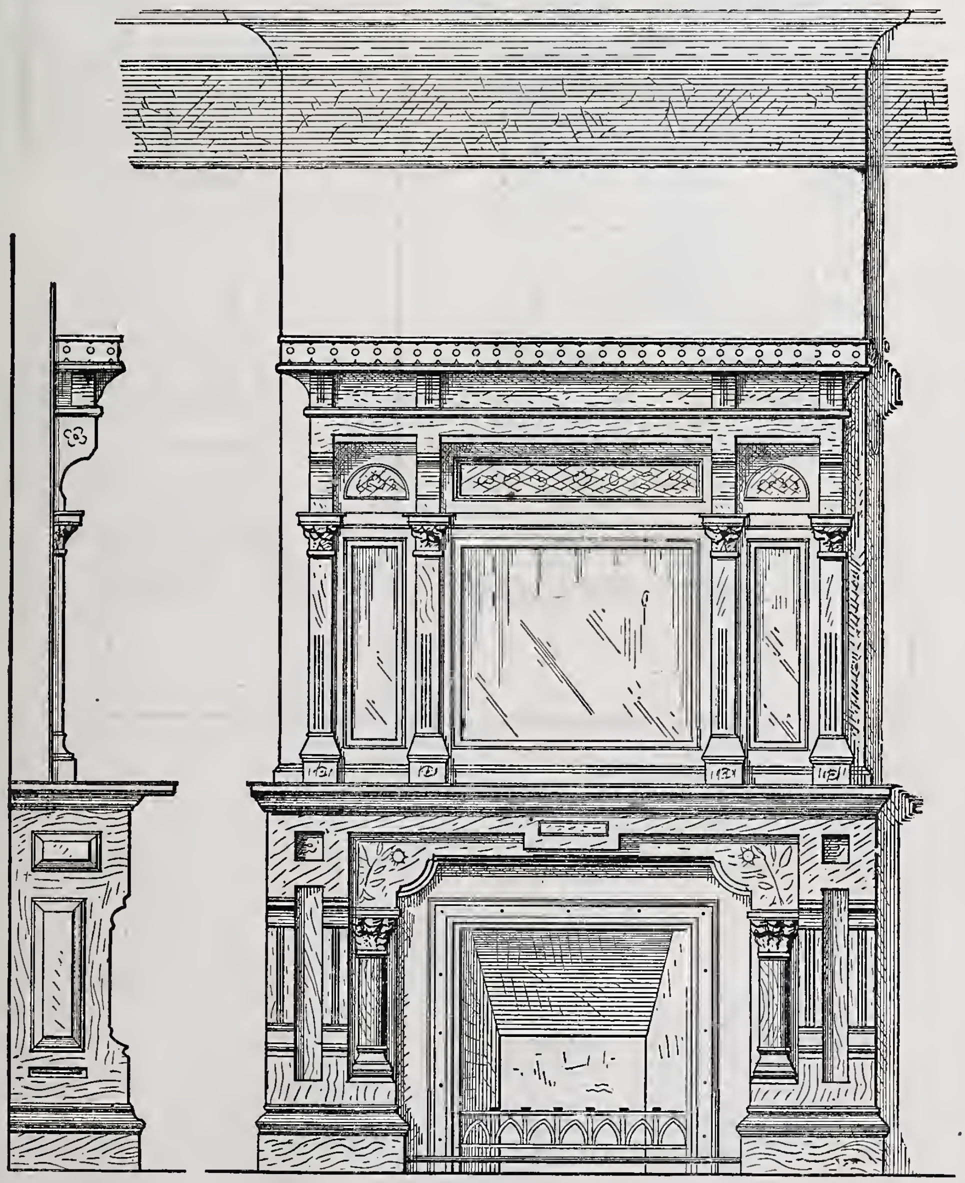
VOLUME I. NEW YORK = AUGUST, 1879. NUMBER 8.

Design for Wooden Mantel-Piece.

The design in the accompanying illustration, which is furnished by Mr. Joseph Ireland, architect, of Cleveland, Ohio, is a characteristic specimen of work in the newer styles of architecture, as now constructed under the supervision of the leading architects throughout the West. The construction is so thoroughly indicated by the several plates of details to be found on the following pages, that little is necessary to be said in description of it. As designed, it was used in a house recently erected upon Euclid avenue, in Cleveland, from drawings furnished by Mr. Ireland. It was constructed of black walnut, with mirrors in the panels above the shelf. Including grate, glass and polishing, it was estimated to cost $250. The parts are so simple that it is especially adapted to construction by mechanics who do not make a specialty of fine cabinet work. The details of the ornaments are clearly shown in Figs. 2, 3 and 4. The mantel-piece, as a whole, presents a fine appearance, and it is a design which will wear well. Its characteristic features are such as will render it more pleasing the better acquainted one becomes with it, and it is not of a style of which one gets tired because it has passed out of fashion.

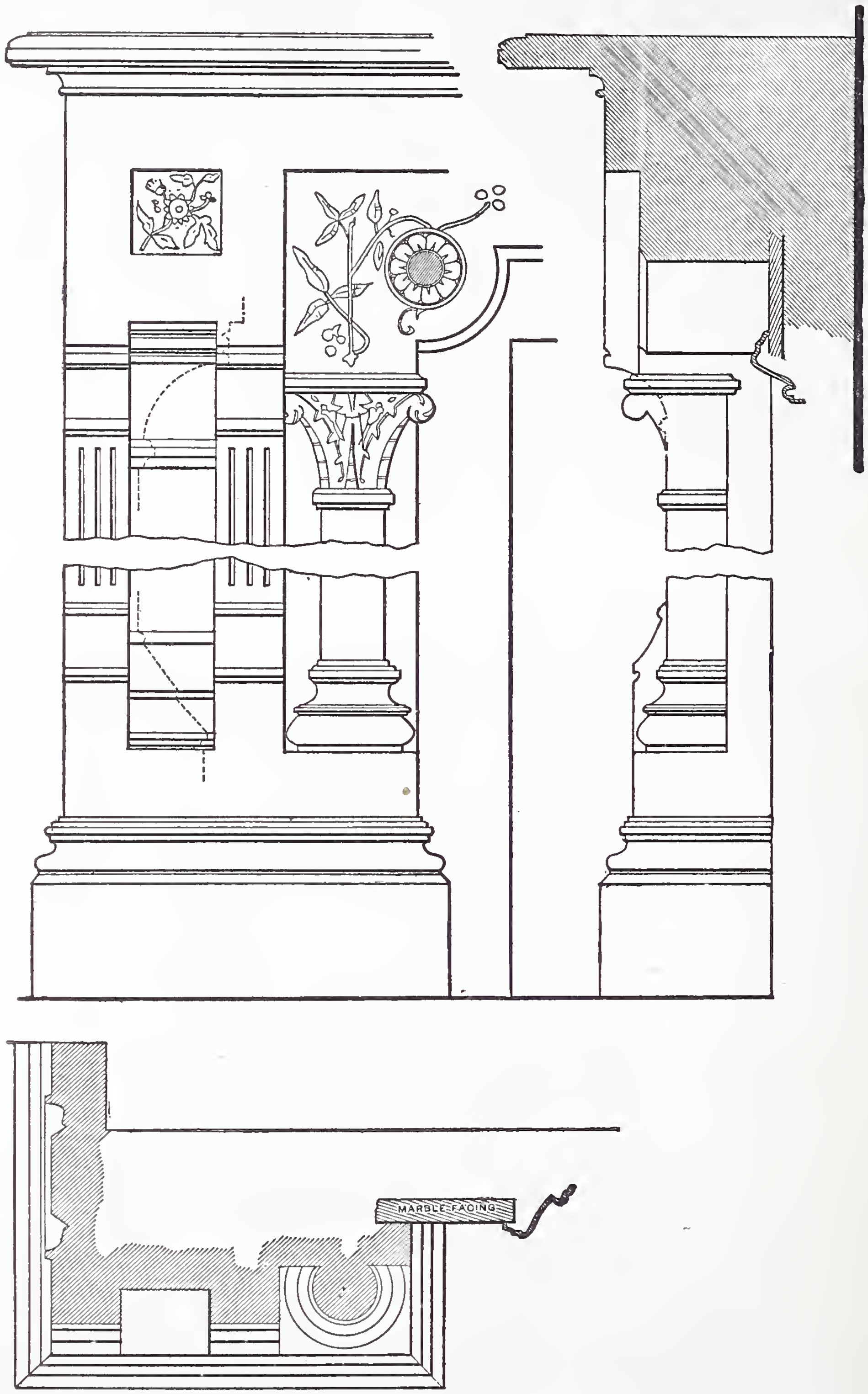


Design for Wooden Mantel-Piece, Contributed by Mr. Joseph Ireland, Architect, Cleveland, O.—Fig. 1.—Front and Side Elevation.—Scale, ½ Inch to the Foot.

Cheapening Fire-Proof Buildings.

Experience has shown that supposed fire-proof floors, supported on brick arches springing from iron beams, fail to stand the intensity of a great conflagration, the beams warping and springing, the arches crumbling to pieces and allowing the floors to fall. In the buildings where corrugated iron ceilings are used, the arches remain almost uninjured by fire, and require little more than painting to put them in good condition again. The arch of corrugated iron formerly made rested upon iron girders, which, although they did not require to be as heavy as the girders for supporting brick arches, were nevertheless heavy and costly, and this expensiveness prevented the introduction of the corrugated iron ceilings into many classes of buildings, in which they certainly would have been used but for the cost. That objection has now been obviated, and the cost of construction of these ceilings and floors largely reduced, by substituting for the rolled iron beams perfectly protected wooden beams, the exposed parts of which are inclosed in a casing of mortar and a sheathing of iron. The improved ceiling has received the indorsement of the architects of Chicago in a public meeting, at which it was stated that the cost of these new ceilings having wooden beams, corrugated arches and mortar or concrete filling, was but little more than for the ordinary finish of wooden ceilings for store-rooms. The sheathed or cased beams cost only one-ninth as much as the iron beams, even at the present low rates for iron. The object of fire-proof construction is to confine a fire to the room in which it originates, but, as the

Chicago and other large conflagrations have demonstrated, a fire-proof building may be destroyed by a fire exterior to it, or one which develops enough heat to crumble stone and brickwork. In other words, fire-proof construction must be generally introduced before it can avert the dangers of such sweeping conflagrations as those of Chicago and Boston; hence the importance of any improvement cheapening the cost of fire-proof ceilings and floors, and making them available in all classes of buildings.



Design for Wooden Mantel-Piece.—Fig. 2.—Details of Shelf and Shelf Supports.—Scale, 1½ Inches to the Foot.

The Abolition of Apprenticeship.

There are some people who still deplore the fact that at the present day the old system of apprenticeship has become obsolete; but we think that the change in our custom should not be regretted, as it is the necessary result of changed circumstances, and, taken all in all, the advantages overbalance the disadvantages.

The changed circumstances referred to are the invention and universal introduction of new and improved tools and machinery. This has exerted a twofold influence, namely, it has upset the old routine way by which employers taught apprentices the old traditional methods, because new machinery made it necessary for the employer to continually learn himself some new way of doing a thing; at the same time machine work did away with the drudgery with which apprentices used to be charged and bored, resulting in a loss of much of their time without learning anything. The world has found out that it is much better to keep boys at school a longer time, when, after having received a more complete education, they will, on entering a modern shop at a maturer age, learn more of the business in three months than very young apprentices in former times learned in three years; and we need only point out this fact to convince anyone of the advantages which the youth of the present age enjoy in this country over the youth of years gone by, and over the youth in old stagnating countries of Europe. This is one of the chief reasons why we are at the head of all the world in useful, practical appliances, and generally acknowledged to be so.

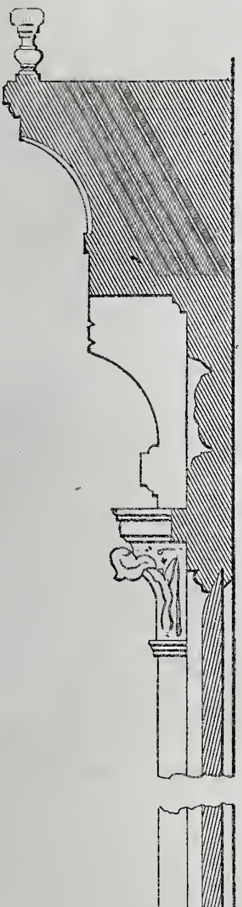
What we have said applies to nearly all trades, especially to woodworking and carpentry, in which great improvements in machinery and tools have been introduced, with the result that the trade is much more readily learned, the improved tools making it easier to do good work, if the eye is only correct and the hand steady.

Measurement of Plastering.—Plastering is generally measured by the square yard, and, according to custom, no deduction is generally made for doors, windows or other openings which do not exceed 63 square feet. In most places it is customary in measuring closets to add half of the contents to the contents, and if the shelves and strips are in before plastering, it is customary to double the contents. Small gables and other triangular pieces are generally counted square. These extra allowances are made to make up for the extra labor of plastering such pieces of work.

Open Fire-Places.

BY CLARENCE COOK.

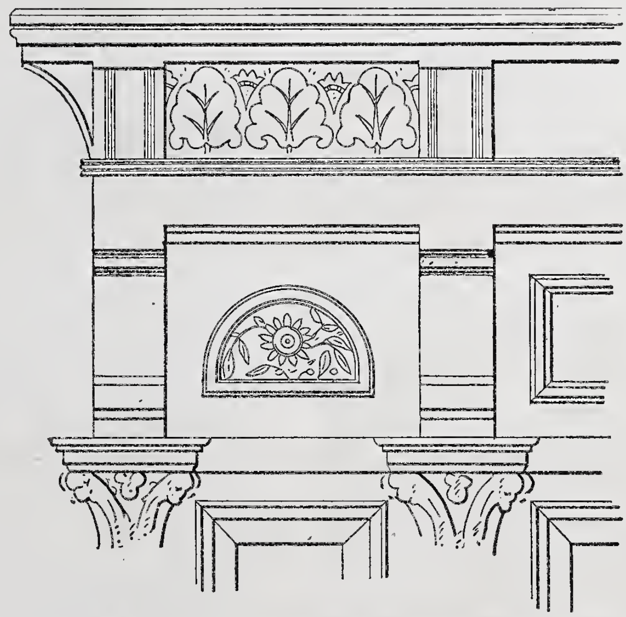
Nothing has been more pleasant to note in the home life of the winter that is just now over and gone, than the growing use of open fires in our living rooms, either of soft coal in grates or of wood on the hearth. Furnaces are certainly going out of favor as a sole means of heating our dwelling houses, though it is not likely they will ever be given up. We shall continue to use them for tempering the air of entries and passageways, and of those rooms that are only opened now



Design for Wooden Mantel-Piece.—Fig. 3.—Section through Mirrors and Cornice.—Scale, 1½ Inches to the Foot.

and then. We cannot be governed in this matter by English example. Our climate is so very different from that of our island cousins, that the "robust" theory of living they put so splendidly into practice would neither be healthy nor comfortable for us. Certainly we may come in time to live more hardily than we now think we can bear; children will be less cockered and coddled by their elders, and the elders themselves will take more liberal doses of whatever weather is going, and so cut down their doctors' bills.

But to get all the good possible out of our open fires, we want two things—fire-places properly built for burning wood, and grates for burning coal, that shall be both pretty and economizing of fuel. Owing, probably, to our long disuse of wood as fuel, we have lost the rules for building fire-places that shall throw the heat well out into the room and let us look our fill at the fire. We make our fire-places too square and too deep, with sides too nearly at right angles to the back. The fire is hid in a cave and the chimney eats up nearly all the heat. The fire-places in the old Dutch and New England houses are low in proportion to their breadth, and shallow, with sides well splayed. This way of building has a single eye to use, but as always happens when use is honestly put first in devising useful things, the ends of beauty are also served. The old fire-places were not only sufficient for their work—they were well proportioned, handsome to look at and showed the whole beauty of the fire. We cannot make a fire-place for burning wood that shall be either serviceable or handsome by simply taking the anthracite coal grates out of our chimneys and lining the hole that is left with tiles or soapstone. Out of such a hole it is not easy, it is probably impossible, by any device, to make what we want. But if a man is building a house and wishes to have an open wood fire, he must look to it that the chimney is rightly built from the start. So long, however, as our American bituminous coals



Design for Wooden Mantel-Piece.—Fig. 4.—Detail of Finish above Mirrors.—Scale, 1½ Inches to the Foot.

are as plentiful, good and cheap as they are at present, burning wood will be only a luxury for the rich, and soft coal, as we have agreed to call the bituminous fuel, will be more and more used. We are greatly in need of the right sort of grate for burning soft coal, and it were much to be wished that some one of our dealers in grates would either import such from England, where they are cheap and plentiful, or would have them made at home. We have one kind of grate, broad, low and generous, in which either soft coal or wood can be burned indifferently, but these grates are too large for the rooms in the greater part of our houses, and they are not economizing of fuel—a small fire is lost in them.

Now, in general, a New York house, if it be not on a corner, does not need a large fire in any one of the rooms. Our houses, with their party walls, keep one another warm, and only the narrow ends of the packing boxes are exposed to the air. What is wanted, then, is the small English grate, holding but little coal, but throwing out into the room almost all the heat produced in combustion. Such a grate is figured in the book "The House Beautiful," on page 230, but this is only one design out of many manufactured in England. They are made in shapes that admit of a good deal of ornament, the bar strongly and gracefully curved, with brass posts, or iron posts brass-mounted at the sides, and back pieces with bold patterns cast in relief, and sometimes the grate is a coal-basket, or made to look like one, and supported on large andirons, with a great deal of brass ornamentation. Sometimes even a grate border of plain pattern (like the one referred to above) is cast in brass instead of iron. But when there is a brass fender, and brass-handled fire-irons, and a copper or brass coal-hod, the brass grate border is sure to be too much. If it is decided to have it, it would be better to have less brass in the other belongings of the fire-place.

In the best of these English grates the ornamentation is kept simple, and is accented here and there to avoid commonplace. In one I have in my own house the pattern on the frame is only a running vine in narrow lines that run parallel to the sides, both on the sides of the frame and on the top, not changing their direction; then round the opening there is a narrow border set with small whorls. All this is clearly designed and cast with neatness; but the effect is quiet, not at all striking. If, now, the face of the grate were kept straight, and were plain faced, the grate would have a monotonous look. This is avoided by giving a double curve to each bar, and ornamenting the face of each with a bead on the upper and lower edge, and a running vine between the beads. This enriches the whole grate, and gives it character. Then comes the small movable (and, at pleasure, removable) hob, and seems to put forth a hospitable hand of welcome to the guest as he draws near the laughing fire. These grates are cheap in England. What makes them dear here is the custom duty, the expense of packing, and the cost that always goes with any single importation. If they could be imported by some firm in quantities, they would not cost so much; for though the duty would be the same, the charge for packing and handling them would be distributed. But there is no reason why they should not make them here.

As an *envoi* take to-day this verse attributed by an old writer to Homer. This gives us an authority of respectable antiquity for taking pleasure in an open fire. "A man is proud of his children, a town of its battlements, a plain of its horses, the ocean of its navies, riches ornament the house, just judges seated in the hall of justice are a noble spectacle; but the most pleasant sight, in my opinion, is that of a fire on the hearth, when Jupiter decks the ground with snow and frost."

Lathing.—In common lathing the spaces between the laths should be one-quarter of an inch. If they be made less than that, the clinches will not be strong enough, and if more, they will sag down on the ceiling, and drop off with their own weight on the sides; and in no case should the spaces exceed two-fifths of an inch, except when the furring is very thin, like strips of lath nailed on inside sheeting or ceiling. Most lathers break joints every sixth lath, and some every tenth; but it is still better to break joints every second lath. When ordinary laths are used, of from one-quarter to two-fifths of an inch in thickness, the studding joists, &c., should never be over 16 inches apart—12 inches would be better. Lathing is estimated by the square yard, and is measured the same as plastering, without deducting openings for doors, windows, &c., except when the opening exceeds 63 square feet.

ARCHITECTURE.

Competition Designs for Cheap Dwelling Houses.—The Design Receiving the Second Prize.

As announced in our last issue, the decision of the committee to whom was entrusted the examination of the designs submitted in the competition for cheap dwelling houses, awarded the second prize to Mr. David S. Hopkins, of Grand Rapids, Mich. We present herewith, for the consideration of our readers, the elevations, plans and details, together with the specification and schedule of estimate accompanying same, as presented by Mr. Hopkins in competition.

Specification

Accompanying the design submitted by Mr. David S. Hopkins, of Grand Rapids, Mich., receiving the second prize.

MASON WORK.

Excavation.—Do all of the excavation required to put in a cellar and trenches, as shown on foundation plan. Remove all earth not required in grading lot from premises.

Foundation.—Provide field bowlders and build foundation and cellar 7 feet deep, interior hammer-faced and laid to line, exterior above grade to be course-faced and laid up in regular bond, all to a line, and in even courses. Walls above grade, under porches, to be 8-inch brick walls, all work well bonded throughout and laid up with the best of stone lime mortar. Build pier footings of stone, and piers of brick, all as located on foundation plan; point up interior of cellar with fresh mortar at completion, and point exterior coursed work with colored mortar, to imitate stone, and pencil with white putty joint at completion. Grade up against foundation and prevent water running into same; build outside cellarway of stone; set all window and door frames in walls in construction.

Chimney.—Build chimney of shape and size as shown on plan; line all fire flues with brick on edge, on all outside exposures; lay all true and smoothly on the interior. Provide all thimbles required, and leave openings at floor in ventilating flues for 8 x 8 inch registers, brick for same to be first quality. The top to be of repressed or tile brick of uniform color.

Lath and Plastering.—Provide as dry laths as market will afford, and lath the walls and ceilings that are to be plastered. Laths of first quality, joints broken every sixth lath throughout. Plaster same with two-coat hard finish work, brown-coat work to have one bushel of hair to every barrel of lime used for making same. The sand to be of good, coarse, clean quality, and lime of the best stone lime; said mortar to be made at least one week before using. All angles and corners to be straight and true throughout. Finish flush and true to all grounds and casings. Repair up after carpenters have got through with their work any damaged places, &c.

CARPENTER WORK.

For general dimensions and subdivisions of house, see plans. Execute the framing in the manner known as balloon framing, and in the most substantial and skillful manner.

Size of Materials.—Size of material as follows: Sills, 6 x 8 inches; floor joists, 2 x 8 inches, 16 inches on centers; side and partition studding, 2 x 4 inches, 16 inches on centers; rafters, 2 x 4 inches and 2 x 6 inches, 20 inches on centers; all other materials not mentioned to be of proper sizes.

Bridging.—Bridge all flooring joist with one row of cross bridging, well nailed in; double the joists that carry partitions and spike together; all joists and studding sized to width.

Sheathing.—Sheathe the outside of frame with ⅞-inch square-edged boards, dressed, from wall to plate, all well nailed to studding; joints broken where practical.

Papering.—Paper over same with resin-sized building paper before siding. Roofs to be covered with boards, well nailed to rafters and joints well broken.

Shingles.—All roofs to be covered with shingles of first quality, laid 5 inches to weather on main roofs, 4½ inches to weather on porches and bay window. Tin gutters

Second Prize Design for Cheap Houses.—Fig. 1.—Front Elevation.—David S. Hopkins, Architect, Grand Rapids, Mich—Scale, ⅛ Inch to the Foot.

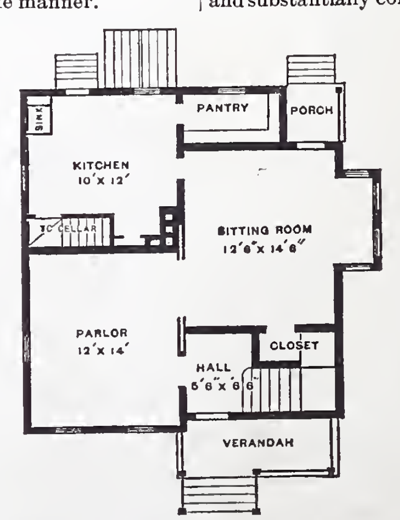
shingled in as near eaves as practical throughout.

Siding.—Said house to be inclosed with 4-inch pine siding of good quality, and laid not to exceed 3 inches to weather in a straight and workmanlike manner.

All exterior work about said house to be done as shown on elevations and detail drawings. Provide the window and door-frames in cellar, and outside batten doors over cellarway, all hung complete; all cellar windows fitted and hung with hinges; the necessary cellar stairs outside and in to be built in a very substantial manner. Construct cornices and window and door frames, corner boards, beltings and water table as required by design; also all outside steps to all outside doors. Do any and all other work required to carry out the design as shown by the drawings. All frame materials are to be sound, square-edged and free of shakes or large knots, and the finishing materials to be well seasoned and show a good clear surface exteriorally.

Interior Work.—Lay the floors throughout the house of mill worked, select common flooring of pine, blind nail to joist, form a scuttle, case up the same in the ceiling of hall in second story, with cover all complete.

Stairs.—Build the principal stairs in front hall from first to second story in form as shown in plan. Same are open-box stairs; treads, 1⅛ inches thick; risers, ⅞-inch thick; nosing and cove at edge of treads. Division between stairs at turn to be 4 inches. Beaded ceiling, both sides dressed. Same to continue around landing to wall. Provide and set a cherry rail, rabbeted on top of same, 2 x 3 inches in size, molded, all neatly and substantially constructed. The side-finish strings are to be molded, same as hall base of first floor.



Second Prize Design.—Fig. 2.—First-Floor Plan.—Scale, 1-16 Inch to the Foot.

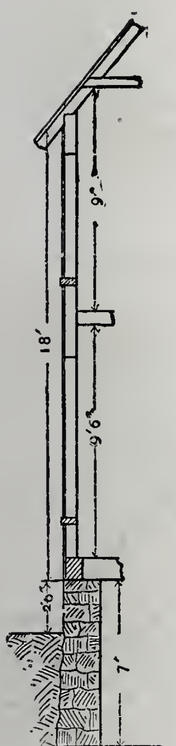
Partitions.—Set all partitions as required by plans; form all angles solid, and well spike together; double all door posts and corners.

Grounds. — Set grounds around all rooms, except closets and kitchen for base, straight and true; finish all projecting angles with wood corner beads. All doors and windows are to be cased up with narrow casings, same to form grounds for plastering, and the band molds are to go on after the plastering is dry, same projecting over on to plastering, all as shown on details for finish. The kinds of finish for various rooms to be as designated on drawings, all to be put up in a smooth, true and workmanlike manner throughout. The pantry, closets and kitchen are finished with plain 4½ casings, and plain base for closets.

Doors.—Provide good 1⅜-inch five-paneled pine doors for first story, 7 feet 6 inches by 2 feet 8 inches, and 1¼-inch four paneled doors for second story, 7 feet by 2 feet 6 inches, all O G raised, paneled both sides. The sliding doors are 1¾-inch five-paneled, 8 feet by 2 feet 6 inches. The front door of same thickness; style as per plan, oil finish, if preferred. Putty up all work before second coating throughout. Grain the front door imitation of oak, exteriorally, and varnish.

Sash.—All sash for said house to be 1⅜ inches thick, counter check, two lighted windows, all to be neatly fitted into sash

Door Bell.—Provide a gong door bell, attached to front door, with lever attachment. All lumber used in interior finish is to be well seasoned, and to show a good clear surface when finished; all other materials to be first class of their various kinds, and the workmanship to be first quality throughout,



Second Prize Design for Cheap Houses.—Fig. 4.—Side Elevation.—Scale ⅛ Inch to the Foot.

Fig. 3.—Section.

Fit and hang all doors workmanlike, providing loose pin butts of suitable size.

Door Trimmings.—Provide mortise locks for all principal doors, and spring mortise latches for the balance, all of good medium quality; provide the Hatfield shive for sliding doors and good iron track, flush mortise latch and pulls; provide front door with bronze knob and fixtures. The interior door knobs for first floor to be white porcelain or black jet, as preferred. Dark trimmings for second story.

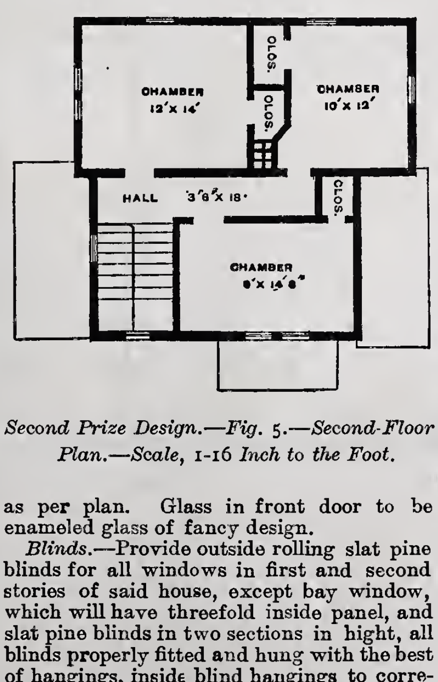
Wainscoting.—Wainscot the kitchen and pantry 3 feet high with 4-inch pine ceiling, beaded and set vertically, and finished with molded cap.

Pantry.—Build cupboard in end of pantry in two sections, with shelves and cleated doors, all hung and trimmed complete. Set wide shelf at one side of pantry, form flour and meal bins beneath, and a chest of four drawers. Place raised shelf at floor, and necessary shelves above said wide shelf. Put up cleats with wardrobe.

Closets.—Hooks in closets, with two shelves to each closet. Build stoveware closet in kitchen, furnished with required shelves and pot-hooks. Make a wood sink in kitchen; case up a cupboard under, and set cleated door properly hung.

Painting.—All exterior porch floor joints are to be laid in paint. Paint the exterior of house with two coats of linseed oil and paint, of such colors as may be desired by owner. Putty up all nail holes before second coating. Shellac all interior wrought wood finish throughout, and paint two coats of paint such colors as desired, or a three-coat and provided with good sash locks for top and bottom sash.

Glass.—Glass for all windows to be first quality American single thick; sizes of glass



Second Prize Design.—Fig. 5.—Second-Floor Plan.—Scale, 1-16 Inch to the Foot.

as per plan. Glass in front door to be enameled glass of fancy design.

Blinds.—Provide outside rolling slat pine blinds for all windows in first and second stories of said house, except bay window, which will have threefold inside panel, and slat pine blinds in two sections in hight, all blinds properly fitted and hung with the best of hangings, inside blind hangings to correspond with other trimmings, and complete, to a true intent and meaning of the plans and specifications.

Estimate of Cost

In detail, by Richards & Stearns, builders, accompanying the design submitted by David S. Hopkins:

Excavation	$10.00
50 perch stone, $1.40, laid in wall	70.00
5000 brick in foundation & chimney, $8, laid.	40.00
600 yards plastering, $14	84.00
6000 feet common lumber, $10 to $14, put up.	84.00
3600 sheathing and roof boards, $7 to $9, put on	32.40
14,000 shingles, $2.40 per M., $3.25, laid on roof	46.50
2000 siding, $9 to $13, laid on building	26.00
1850 flooring, $13 to $17	31.45
450 yards painting, 15c	67.50
19 windows, all complete, $7	133.00
16 doors, all complete, $6	96.00
Cornices and gables	60.00
Cellar window and door	8.00
All stairs	40.00
Front and rear porches	30.00
Corner boards, water table and belts	15.00
Bay window (not included in windows)	15.00
Two pediments, finials and cresting	15.00
All ouside steps	10.00
Pantry, complete	15.00
All wardrobe closets, strips, &c	5.00
143 feet first floor base, 10c., put down	14.30
185 feet third floor base, 8c., put down	14.80
68 feet 3-foot wainscoting, 20c. per foot, put up	13.60
Extras	23.00
Total	$999.55

Certificate.

The firm of builders above named are first class, as good as any in our city, and are responsible for all they agree to do.

LEON S. GRAVES.

Special Uses of Different Woods.

Spruce is used for the top boards of violins, guitars and sounding-boards for pianofortes. Its more common use, however, is for beams and posts, it being light and strong.

Maple is used for the backs of violins and guitars, but most of it is used for carpenters' tools. Sugar maple is used by wheelwrights for axletrees and spokes, and for the lining of runners of common sledges, while red maple, as well as sugar maple, are used for saddletrees. Maple is also used as a substitute for boxwood for wood type and coarse wood cuts.

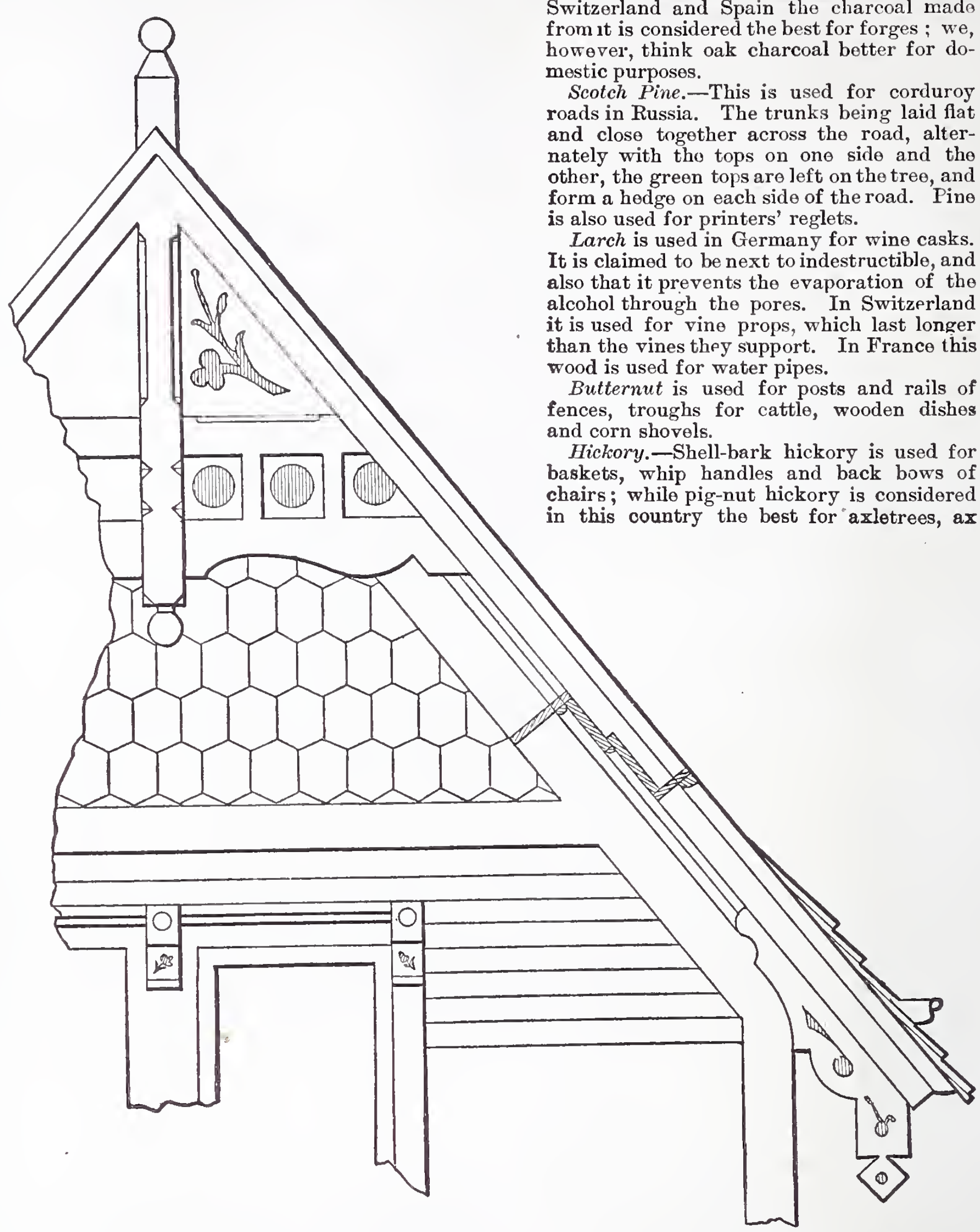
Boxwood, imported principally from the Mediterranean, is mostly used for engraving upon and making wood cuts. For this purpose the trunks are cut into transverse slices of about 1 inch thick, and after being thoroughly seasoned, they are further cut up into rectangular pieces, and glued together if large blocks are wanted; in all of which the fiber stands on end, so that the engraving tool will cut no fibers. Boxwood is also used for making fine ornaments, either curved or turned on the lathe, for this purpose standing next to ivory. Printers' quoins and shooting-sticks are also often made of boxwood.

Ebony.—This is chiefly used for ornamental work and expensive furniture; but as its appearance is easily imitated by staining other hard woods, it is not in such general favor as it used to be in olden times.

Dogwood.—As this has a very tough and equal texture, being almost as strong transversely as longitudinally, it is a favorite wood for turners for making wooden chucks, screws and nuts for bookbinders' presses, small vises, mallets, handles for light tools, &c. Farmers use it for harrow teeth, the harness of horse collars, &c.; also, being naturally smooth, for the runners of light sledges.

Tulip was used from time immemorial by the Indians for canoes. It is now much used for wooden bowls, the heads of hair brooms and sweeping brushes, and for eating and drinking troughs for cattle.

Holly.—The wood of the holly is principally used as a substitute for ebony. It is dyed black and used for the handles of metal teapots; the strong, straight shoots are deprived of their bark and made into walking sticks and whip handles.



Second Prize Design.—Fig. 6.—Detail of Front Gable and Cornice.—Scale, ½ Inch to the Foot.

The *Lime Tree* forms the best planks for glovers and shoemakers to cut leather upon, and is used in the manufacture of toys, pill boxes, &c., while the inner bark is made into ropes and matting.

Tho *Orange Tree* is the finest wood for tooth picks, and is used for many other purposes.

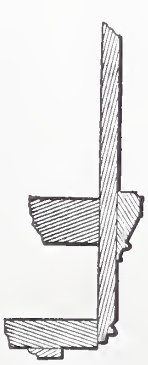


Fig. 7.

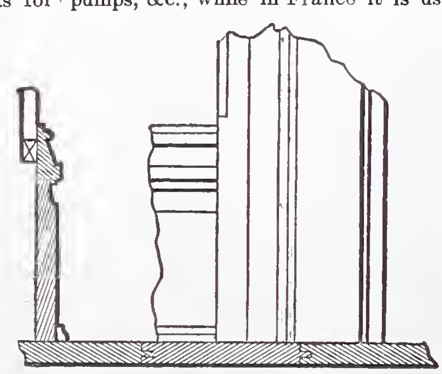


Fig. 8.

Second Prize Design.—Details of Finish in First Story.—Scale, 1½ Inches to the Foot.

Sycamore, besides being occasionally used for the backs and sides of violins and guitars, is used for mangles, cider and cheese presses, wooden dishes and spoons; also for beetling beams in printing and bleaching works, and for patterns in iron foundries.

Yew is used for turning snuff boxes, vases and for musical instruments. It is not subject to rotting in the ground, and lasts longer under ground than any other kind of wood; it is therefore used for posts, water pipes, pumps, &c., while in France it is used for axletrees, for which it is claimed to be better than any other wood.

Beech is used for planes, screws, shoe lasts, wooden shovels, stocks of muskets and fowling pieces, and for staves of herring barrels.

Horn Beam is used for cogs of wheels, and the very best for this purpose, much better than yew or crab. It is an excellent fuel, perhaps the very best of all kinds of wood, burning surprisingly long and giving an excellent charcoal, preferred in Europe for the manufacture of gunpowder.

Sweet Chestnut is used for gate posts, railings, hop poles, barrel staves, &c., while in Switzerland and Spain the charcoal made from it is considered the best for forges; we, however, think oak charcoal better for domestic purposes.

Scotch Pine.—This is used for corduroy roads in Russia. The trunks being laid flat and close together across the road, alternately with the tops on one side and the other, the green tops are left on the tree, and form a hedge on each side of the road. Pine is also used for printers' reglets.

Larch is used in Germany for wine casks. It is claimed to be next to indestructible, and also that it prevents the evaporation of the alcohol through the pores. In Switzerland it is used for vine props, which last longer than the vines they support. In France this wood is used for water pipes.

Butternut is used for posts and rails of fences, troughs for cattle, wooden dishes and corn shovels.

Hickory.—Shell-bark hickory is used for baskets, whip handles and back bows of chairs; while pig-nut hickory is considered in this country the best for axletrees, ax handles and the circle around sieves. The best quoins and shooting-sticks for printers are made of hickory; they last longer than those made of boxwood.

Cherry is preferred by printers for furniture, reglets, side-sticks, &c., being far better than pine, which is also used a great deal, being cheaper.

Laurel resembles boxwood, and is used as its substitute for handles of light tools, little boxes, small screws, &c.

Birch is used for bowls and trays, and the young branches as hoops for rice casks. The twigs of the red birch, which are stronger than those of other kinds, are used in Europe for common brooms. The black variety is used for shoe lasts, but are inferior to those of beech.

Alder.—The European variety is there largely used for wooden shoes, especially in France. They are made while the wood is green and wet, seasoned and dried afterward.

Locust is also a substitute for boxwood, and used by turners for making spoons and forks for salads, sugar bowls, salt cellars, candlesticks, boxes and other small articles.

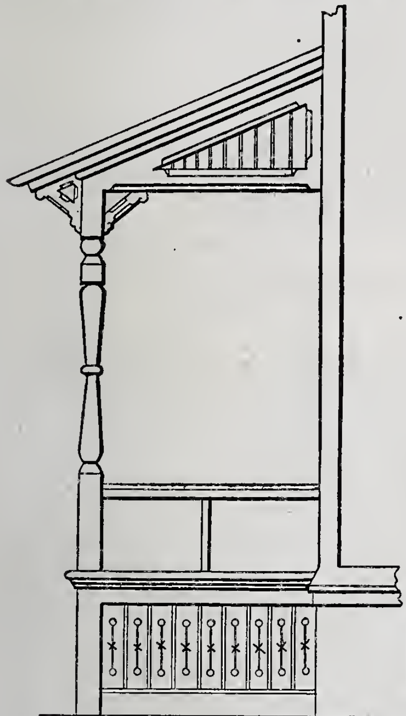
Olive is used for light ornamental articles, such as dressing-cases, tobacco boxes, &c. The wood of the root is considered especially valuable, and used as veneer and for inlaying, being most beautifully marbled.

Persimmon is the best article for the mallets of tinmen, large screws, shoemakers' lasts and the shafts of carriages; it is preferred to ash for the latter purpose.

Lancewood is the very best for handles of lances and for shafts of chaises.

Elm is used for cannon carriages, the gunwale and blocks of ships. The naves and felloes of wheels are preferred by wheelwrights of this wood.

Cedar.—White cedar is used for wash-tubs, pails and churns; its advantage is that it always looks clean, and instead of growidg dull and dark by age, it becomes whiter and smoother from use. The hoops are



Second Prize Design.—Fig. 9.—Front Porch. —Scale, ¼ Inch to the Foot.

made of young cedars, split. It makes a good fuel and an excellent charcoal. Red cedar is used for staves, stop-cocks, stakes, boxes, &c., and in Europe often for coffins.

Gum.—The sour gum is the best wood for hatters' blocks, while the sweet gum is sometimes used for picture frames.

Willow is used for baskets.

Ash is used for the bottom part of sieves.

To Test Glue.—An article of glue which will stand damp atmosphere is a desideratum among mechanics. Few know how to judge of quality, except by the price they pay for it. But price is no criterion; neither is color, upon which so many depend. Its adhesive and lasting properties depend more upon the material from which it is made, and the method of securing purity in the raw material, for if that is inferior and not well cleansed, the product will have to be unduly charged with alum or some other antiseptic, to make it keep during the drying process. Weathered glue is that which has experienced unfavorable weather while drying, at which time it is rather a delicate substance. To resist damp atmosphere well, it should contain as little saline matter as possible. When buying the article, venture to apply your tongue to it, and if it tastes salt or acid, reject it for anything but the commonest purpose. The same operation will also bring out any bad smell the glue may have. These are simple and ready tests, and are the ones usually adopted by dealers and large consumers. Another good test is to soak a weighed portion of dry glue in cold water for 24 hours, then dry again, and weigh. The nearer it approaches to its original weight tho better glue it is, thereby showing its degree of insolubility.

Tracing Paper.—Sometimes it is useful to have strong tracing paper, especially in transferring designs with many colors, when the paper has to pass through many hands. To produce this it is only necessary to damp the paper with pure, freshly-distilled benzine. The thickest paper may be thus made as transparent as common tracing paper, and the design traced on it with either pencil or ink; the benzine will soon evaporate, and then leave the paper white and opaque as before; if the design should not be finished before the benzine has evaporated, it is only necessary to damp it anew. This process will furnish a design on untransparent paper.

Windows Made to Imitate Stained Glass.

The appearance of stained glass may be given to windows by the use of painting with varnish colors, diaphanie and vitremanie. There is but little difference between the latter two processes. Vitremanie is perhaps the simplest, and is as follows: The materials necessary are a bottle of enamel varnish, another of glucine, a sheet of designs, blotting paper, a roller, three brushes and some sheets of lead foil. In order to have the window to be decorated perfectly clear, it should be taken out of its frame, cleaned with whiting, and rubbed with wash leather. Having selected the design, coat its face with glucine with a flat brush. Draw on a sheet of paper the exact outline of the window, putting in a pencil line wherever a join takes place in border, grounding or subject, to guide in putting on the lead foil. Having cut the lead foil in ¼-inch strips, lay the glass upon the paper outline, and cement upon the glass with strong gum the strips of lead foil over all the lines marked in pencil. All the lines having been thus covered, leave the glass for an hour, to allow of the gum drying. With an agate flatten out any creases in the foil. Place the design in position, so that its edges will overlap the lead foil and come quite to its center. With clean water wet the picture and the glass, and with the roller press it firmly on to the glass. Insert the point of a penknife under one corner, between the paper and coloring matter, and take the paper off entire, leaving the colored surface on the glass. With a camel's hair brush, dipped in cold water, wash the film of color left on the glass, and to take up the moisture, lay blotting paper over the glass. Over this blotting paper use the roller, and press the coloring matter firmly and evenly on to the glass, to which it will adhere. The lead foil should be gummed on the glass extra pieces when quite dry, so that the edges of the design are secured between two strips of foil, and varnish the whole of the glass with enamel varnish when the foil is dry. Two coatings of this varnish must be applied, putting on the second when the first is dry, and when the last coat is dry the window can be replaced. Some knowledge of coloring is required in order to paint glass with varnish colors. The powder colors may be mixed with mastic varnish and turpentine. The necessary colors are brown, pink, raw and burnt umber, rose madder, burnt sienna, yellow lake, ultramarine, verdigris, carmine, gamboge, Prussian blue and ivory black. Lay your window glass flat upon the colored picture you wish to copy, and trace all its chief outline on to the glass with ivory black, mixed with varnish. Use a coarse pen. Tho outline being dry, raise your glass to a slanting position and fix a piece of white paper to its back, enabling you to see the work as you proceed. Begin by laying on flat washes of color, to match the prevailing tints of the copy. When dry, shade these a little. Spread a thin wash of lac varnish over the finished painting.

Fig. 10.

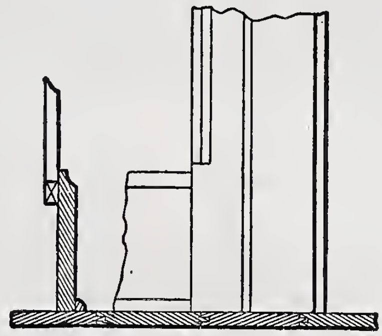
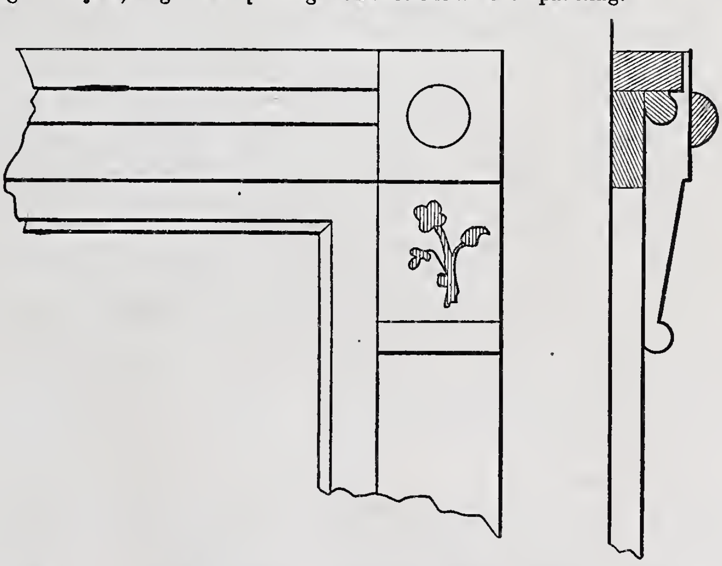


Fig. 11.

Second Prize Design.—Details of Finish in Second Storg..—Scale, 1½ Inches to the Foot.



Second Prize Design.—Fig. 12.—Details of Window Frames.—Scale, 1½ Inches to the Foot.

We notice that Mr. W. James, of Camden Town, England, has patented certain improvements in ornamenting glass. The object of his invention, says *Design and Work*, is to ornament glass which is used for the panels of doors or for windows, or for other purposes, by tinting it in various colors, according to any desired pattern, in a more economical manner than heretofore. In carrying out the present invention, Mr. James takes a sheet of plate, crown or sheet-glass, and coats it with wax or other suitable "resist." He then removes a portion of the wax and exposes so much of the glass as is intended to receive the pattern in color, and the exposed surface of the glass is submitted to the action of fluoric acid, which will eat into the glass to any required depth. When this is effected, the "resist" is removed from the plate and all traces of the acid washed away. He then overlays the ornamental parts with various vitreous colors, according to the pattern desired, with a brush or other convenient instrument, without troubling to follow the lines of the pattern, but being careful that the various portions of the pattern shall be well colored with their appropriate color. The glass so prepared is placed in the kiln to fuse the colors and burn them well in. When this is effected, the glass will exhibit undefined dabs of color more or less approximating to the colored design intended to be reproduced, and to bring them to their proper form the plate is subjected to the operation of grinding. This process will remove the superfluous color, and grind the clear glass; but the pattern being in *intaglio* is not touched or injured by the grinding. Where the pattern admits of it, it may be shaded by hand with a darker color, or lights may be formed theron by removing portions of the color before firing.

Smoking While at Work.

The only advantage that can be alleged in favor of smoking at any time is that it produces a mild narcotism which is soothing to some people, and perhaps adds to the sense of relaxation during a period of rest. Most of its disadvantages have been often recapitulated. Besides its intrinsic harmfulness, the habit is open to special objection when practiced during working hours, and to this point both employers and employed would do well to give more consideration than appears commonly to be accorded. There are three good reasons why workmen should not smoke while at work, namely, it reduces the physical energy by the very sense of relaxation which it imparts; it often causes the smoker to stop work altogether until his pipe is out; and it is dangerous. We do not believe that any man can properly see what he is about with a cloud of hot smoke and gas rising into his eyes; neither can he bestow his full attention on what he has to do when the pipe must be kept going at the same time. It may be said that even if he stops for a few puffs no harm will be done. Perhaps not so far as one man is concerned, but if all the men in a large concern stop for puffs, the aggregate sum of the stoppages will amount to considerable time lost. A correspondent writes to say that ho recently timed the smokes taken in a day by 12 journeymen painters, who were engaged on a job requiring especial haste. The total number of minutes footed up over a quarter of a day's work, and the employer soon discovered that he could not afford any such loss, and promptly forbade the practice. Not long ago we saw carpenters smoking in an unfinished house while putting in the woodwork. The floors were littered with shavings, and large quantities of other combustible matter were lying about. The accidental dropping of a few sparks from one of the pipes might easily have determined a serious conflagration. If smoking must be practiced, it is much better to confine the indulgence to off-work hours.

Polishing Wood Carving.—Take a piece of wadding, soft and pliable, and drop a few drops of white or transparent polish, according to the color of the wood. Wrap the wetted wadding up in a piece of old linen, forming it into a pad; hold the pad by the surplus linen; touch the pad with one or two drops of linseed oil. Pass the pad gently over the parts to be polished, working it round in small circles, occasionally rewetting the wadding in polish, and the pad with a drop or so of oil. The object of the oil is merely to cause the pad to run over the wood easily, without sticking; therefore, as little as possible should be used, as it tends to deaden the polish to a certain extent. Where a carving is to be polished after having been varnished, the same process is necessary, but it can only be applied to the plainer portions of the work. Plain surfaces must be made perfectly smooth with sand paper before polishing, as every scratch or mark will show twice as bad after the operation. When the polish is first rubbed on the wood it is called the bodying in; it will sink into the wood and not give much glaze. It must, when dry, have another body rubbed on, and a third generally finishes it; but if not, the operation must be repeated. Just before tho task is completed greasy smears will show themselves; these will disappear by continuing the gentle rubbing without oiling the pad.

Ventilation and Acoustics.

A new advantage has been shown to arise from perfect ventilation in public buildings. It was ascertained by Prof. Tyndall that air currents of varying density are a great obstacle to the passage of sound waves, and Mr. Jacques, of the Johns Hopkins University, Baltimore, observed lately that tho sound transmitted through such air strata loses not only in intensity, but in distinctness. The effect was most marked on a man's voice, or a musical instrument (liko a flute) with few overtones. In the former case each syllable seemed to be repeated several times in very close succession. The explanation given is, briefly, that the original ray is partly reflected and partly transmitted at each variation of the density. The reflected portions are not wholly lost, but in passage backward are re-reflected and divided like the primary wave, so that a series of secondary waves comes to the ear after the primary and masks the distinctness of the original sound. Some interesting observations were made in halls in connection with the subject, especially in the Baltimore Academy of Music. The acoustic properties of this place (which seats 1600) are very good; the weakest voice is audible to every seat; sounds like a sigh or a kiss can be heard at the most distant parts, and music is exactly rendered. Now, tho supply of fresh air comes in behind the stage, crosses this horizontally, passes through the proscenium, then somewhat diagonally to the roof in one great volume of about 15,000 feet per minute, with gentle motion, and almost without minor air currents. The exhaust is partly by a center outlet to the roof, partly by numerous registers in the ceilings of the galleries; from these the air passes into the ventilating tower over the great chandelier, whence it escapes through valves allowing free egress, but refusing entrance That the good acoustic qualities of the hall were largely due to the condition of the air was shown thus: Persons were stationed at different parts of the house during a performance (without knowing of the experiment to be made) and were simply asked to note, at several intervals during the evening, the comparative ease with which they could hear the performers. At various intervals the valves controlling the ventilation were reversed, so as to entirely interfere with the unbroken state of the air and give rise to currents of circulation. Almost invariably the testimony of the hearers would be that at times corresponding to the interruption of the ventilation (soon after the interruption) "the sound was dead, was confused, and indistinct," and it would be observed that people all over the house would make an effort to listen. These experiments were repeated at various performances and always with like results, proving a distinct effect of air currents on the acoustic qualities of an auditorium.

Silicate Paint.

Silicate paint, which has been extensively used in England for a number of years, has been comparatively recently introduced into this country. It possesses merits which make it deserving of the attention of architects and builders, and those interested in the preservation of wood against the destructive influences of the atmosphere.

This paint is superior to any of the ordinary paints that have a basis of white lead. Comparing specimens of white-lead paint and the silicate enameled paint, exposed to like influences, when the former has turned a very dark brown the latter will have retained its original whiteness and purity. Further, silicate paint will endure 500 degrees of heat without blistering. This paint has a glossy appearance and a beautiful surface. It can at any time be washed with water without injury, while its surface is such that no dirt or dust can light upon it. After years of use, it looks quite as fresh as when first applied. It is manufactured of any desired color.

The basis of silicate paint is a flint from a very choice formation of silica existing in Wales. There are none of the annoyances attending its use which are peculiar to the employment of white lead. There is no unpleasant odor, and there is no liability to experience nausea or other disagreeable effects. It dries very quickly, and throws off no deleterious or unpleasant smell.

As compared with white lead, the first cost of silicate paint is somewhat greater, but it is said to be cheaper per square foot of painted surface. It is permanent in color, of good body, damp proof, and suitable for either interior decoration or the most exposed out-door wear. Howard Fleming, of No. 10 Pine street, New York, is general agent for this country.

The Exportation of Machine-made Joinery.

The Baltimore *Sun* describes a new American enterprise in the exportation of machine-made doors, window sashes, window blinds, and similar articles of joinery. The first shipment to England of this sort of goods took place in 1877, and although it was confined to doors for the cheaper class of houses, it at once met with a demand that justified the expectations of the shippers. A few window sashes and blinds were also sent; but they were chiefly intended for the British provinces, as Venetian blinds are not used in England. This new trade is, however, only in its infancy. For the first time, in 1877, some 19,000 doors and 6284 pairs of sashes and blinds were shipped from New York to England, the greater part of which went thence to Australia and New Zealand. Since then California has supplied machine-made joinery to Australia, sending there 27,000 doors last month, as against 5000 sent direct from New York. But the transfer of the Australian demand for machine-made doors to California, and its consequent loss to the Eastern States, has been compensated for by an increase in the British demand for local use. The shipments of doors to England and Scotland in 1878 were about 45,000, as against 2800 in 1877. Up to June of the present year these shipments show a slight increase. It is a trade that is evidently capable of great extension, for all the pine lumber used in England is brought from Norway and the United States. It is a trade, too, that affects the English workman in two ways. For many years past there has been a large annual demand upon England from Australia and other British dependencies where wood of the proper kind is scarce, for the doors of warehouses and private dwellings, and to economize the cost of the doors so exported, they were made up into packing boxes, four doors placed longitudinally forming each box, the two ends being doors for small closets. As all the doors were hand-made, the trade of making them gave employment to quite a large number of English workmen, and the diversion of this trade to California, coupled with the demand that has sprung up in England itself for the machine doors of the Eastern States, must cause a good deal of anxiety among English joiners and carpenters in the present depressed condition of the labor market there.

Colorless Spirit Varnish.—Try mixing a small quantity of oxalic acid with the varnish. There is another way of making a colorless varnish, as follows: Dissolve about 5 ounces of shellac in a quart or so of rectified spirits of wine, boil for a few minutes, with about 10 ounces of good, well-burnt animal charcoal, draw off a small quantity of the solution and filter it; if not pale enough add more charcoal, afterward filter it, first through silk and then through blotting paper.

Self-Instruction in Wood Carving.

BY N. R. HARRIS.

II.

In my last article I mentioned the importance of modeling, valuable not alone for its artistic training, but because of its applicability, through the great variety of forms that may be produced in plastic substances, to every branch of mechanical art, as well as to those that rank among the fine arts. It may be sufficient that we be able to make a drawing intelligible to others, but the ex-

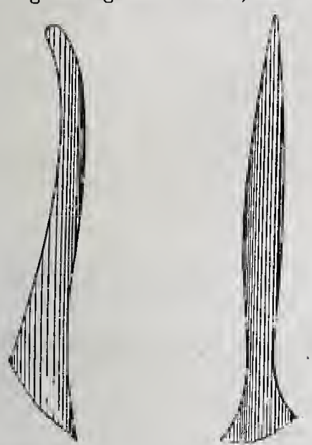


Fig. 1. *Fig.* 2.
Tools Used in Modeling, ⅓ Full Size.

pression of our purpose in a decided manner in clay, will be found a great auxiliary in promoting boldness of conception and freedom of execution of any work requiring the slightest exercise of the artistic faculty, certainly necessary to the wood carver.

All workmen having connection with art labor may acquire the artistic instinct by carefully studying the expression of their work, and by studying nature's forms and following her laws, closely observing the

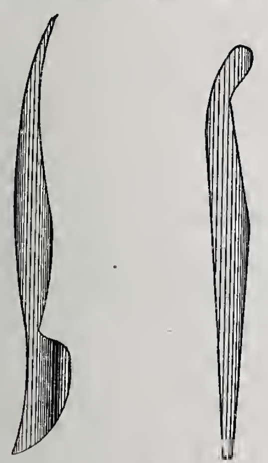


Fig. 3. *Fig.* 4.
Tools Used in Modeling, ⅓ Full Size.

evidences of her skill and masterly handicraft; nor is it necessary to have a special teacher, who may be qualified only to drag them through the mazes of high-sounding generalities, when the principles sought to be acquired may be more easily understood by reference to the simple rules governing all true art productions. To the wood carver or other art worker, this constant study and analysis of sound examples is indispensable, in laying a ground plan upon which to raise the superstructure of masterly skill.

It will not be necessary for me to enlarge concerning modeling, as the general principles having been given, the materials employed noted and the mode of working explained, with proper study there is no reason why any intelligent person may not become a successful modeler. An evidence of this is Mrs. Brooks, the self-taught Kansas lady, whose beautiful *alto-rilievo* of "Iolanthe," modeled in butter, has won for her a fame that might well be coveted by others of more pretension.

In using clay or other plastic substances, where they form a solid body standing free and clear from all support, the term "round" is applied. Should the work have a back-ground it is called "relief." There are "alto" (high), "mezzo" (medium), and "basso-rilievo" (low relief). Where clay is worked in the "round," it will be necessary to secure lightness and strength to make it hollow, and as near as possible preserve an equal thickness. When hard it may be burned in a kiln, which process gives it the name of "terra cotta."

I have heard that a celebrated sculptor said he could model a figure with a knife, fork and spoon, and I have no doubt that an expert could make a very fine production with those implements. I mention this to show the simplicity of the tools necessary; but my advice to beginners is to follow the guidance of our forefathers, and use the knife, fork and spoon for their originally intended purpose, and make or procure the more suitable tools here indicated. Experience will teach the student what he requires, and when the want is felt I would suggest that he at once proceed to make them. It is only necessary to procure a rasp and file such as cabinet makers use, shape your tool to the angle or curve desired, and finish with a steel scraper and sand paper. Some tools are notched on the edge, while others have

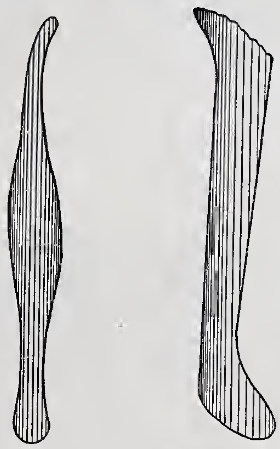


Fig. 5. *Fig.* 6.
Tools Used in Modeling, ⅓ Full Size.

a small indenture on the rounded edge to make it a little rough, thus giving a hold on the clay. The student will find the use of the bare fingers of great advantage in shaping or molding certain forms; the most celebrated sculptors make large use of those tools supplied by nature, and use but few others.

There is some superiority in wax over clay for certain purposes; being much lighter than clay, it sustains its weight better, and it requires no attention when laid aside, but clay is preferred by the most experienced workers. Wax may be used for small objects, and lady amateurs may find it, from

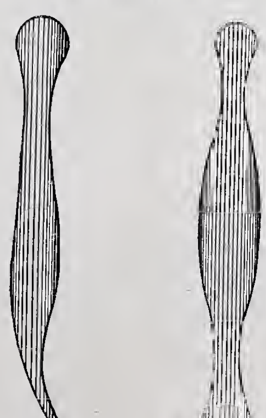


Fig. 7. *Fig.* 8.
Tools Used in Modeling, ⅓ Full Size.

its cleanliness, more congenial to use in their study.

The tools marked 1, 2 and 3 are simply pieces of brass wire, bent to the desired shape, and inserted in handles; all others are made as before described, and may be from 5 to 6 inches long.

The wood used in every description of carving is various, and embraces almost all the known qualities. In selecting it, take care to choose such as is free from knots, shakes and cracks; the grain should be even, and, where possible, without curl or figure. After clay, wood is the substance most in use for decorative ornament upon articles intended to last for a considerable time. Many works of art in this material

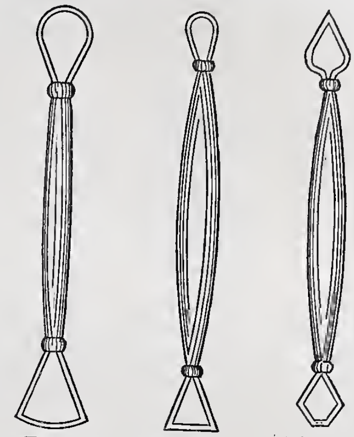


Fig. 9. *Fig.* 10. *Fig.* 11.
Tools Used in Modeling, ⅓ Full Size.

have been found in the tombs of Egypt, Hindostan and Greece, whose early artists used it long before stone or metal came into general use. It is a strange fact that there has not yet been found the vestige of a model used by these early artists, and whether or not they employed models is unknown. Writers of antiquity on this art-labor, have put in evidence that sycamore, cypress, ebony, oak, box, citron, cedar, beech, fig, myrtle, poplar, pine, and other woods were used. Those used by the moderns embrace but a few of the above, together with the American walnut, mahogany and rosewood, all of which are well adapted for their purpose, particularly the softer class of American walnut, known as Albany walnut, which is used in a variety of articles, not only in furniture, but in church interiors, public buildings and private residences. Maple, pear and limetree are excellent woods, where a fine and fragile appearance is necessary, as they may be cut into very delicate forms in consequence of the closeness of the grain. For a considerable time of late years there was a great demand for fine wood carvings from the hands of skilled artists, until some vandal conceived the idea of producing it by machinery, when all artistic inspiration vanished and the quality immediately deteriorated. It is only human skill and human intelligence, developed in the production of artistic wood-carving, that can give any value to the work, or make it interesting, for where it can be readily produced by the yard, it degenerates into a mere mechanical pursuit, with neither spirit in conception nor freedom in execution.

In my next I shall prepare the art student for the use of tools, and explain their quality and character, and also give some information about the bench and other appliances to facilitate operations.

To Match Old Furniture.—In repairing old mahogany furniture it frequently happens that the original wood cannot be matched. In such cases, after the repairs are completed, the pieces introduced should be washed with soap-lees, or with quicklime dissolved in water. The mixture should be rather weak when first used, and if not sufficiently dark repeat the process till the wood is of the required color. Stains may be taken out of mahogany by spirits of salt (muriatic acid).

Finishing Green Wood.—A correspondent says that the difficulty of finishing a piece of green wood may be overcome by scorching the piece after it is shaped out. A few lighted shavings will do the work, and one can then file and sand paper the wood without trouble.

JOINTINGS IN WOOD.

Scarfing, Fishing and Lapping.

(Continued from page 112.)

In designing joints and fastenings the carpenter should bear in mind not only the present position and form of the parts he places in contact, but also the changes that will certainly occur from the shrinking and settlement of the timber. Otherwise pressure will come upon parts not intended to receive them, and the pieces will frequently be crushed or split at the points of contact.

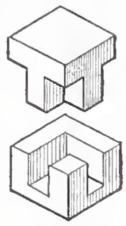


Fig. 17.

The principles which should be adhered to in designing joints and fastenings are laid down by Prof. Rankine as follows:

1. To cut the joints and arrange the fastenings so as to weaken the pieces of timber they connect as little as possible.
2. To place each abutting surface in a joint as nearly as possible perpendicular to the pressure which it has to transmit.

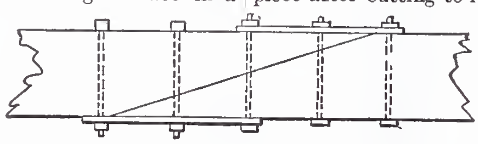


Fig. 18.

3. To proportion the area of each surface to the pressure which it has to bear, so that the timber may be safe against injury under the heaviest load which occurs in practice, and to form and fit every pair of such surfaces accurately, in order to distribute the stress uniformly.
4. To proportion the fastenings so that they may be of equal strength with the pieces which they connect.
5. To place the fastenings in each piece of timber so that there shall be sufficient resistance to the giving way of the joint by the fastenings shearing or crushing their way through the timber.

These principles, so clearly stated, apply to other joints besides scarfs, but perhaps in no other class of joints is their application more essential to accomplish satisfactory results.

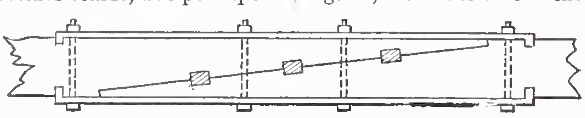


Fig. 19.

In all cases the simplest forms of joints are the best, in order that the parts may be fitted with the least inconvenience Double abutments and similar forms are objectionable, because they are difficult to fit. Besides, when the timber shrinks the whole strain may be thrown upon one of them. Much ingenuity has been expended in devising scarfs of intricate form, and many of the complicated forms given in the books, one or two of which are illustrated herewith, are almost useless. The simplest forms are always to be preferred. They are the easiest to fit accurately together, which is the prime requirement.

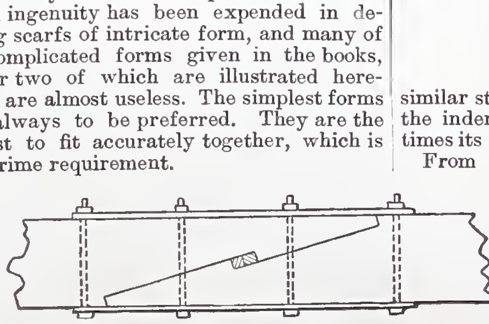


Fig. 20.

To determine the length of a scarf in joining beams, it is necessary to know the force that will cause the fibers of timber to slide upon each other. It is plain that the strength of the timber, after cutting away to receive the indent—for example, Fig 11, page 113—must be exactly equal to the force that would cause the fibers to slide upon each other along the line upon which the rupture would occur if the joint were to be rent by tension; for if the part remaining after cutting to receive the indent were less, the joint would not be as strong as it is possible to make it. Also, if the depth of the indent be too small, it would be crushed by the strain. Consequently, the parts must have a certain proportion, so that the joint may be equally strong in each part.

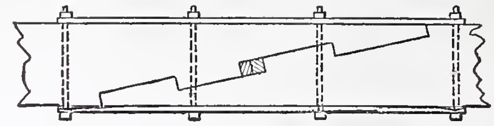


Fig. 21.

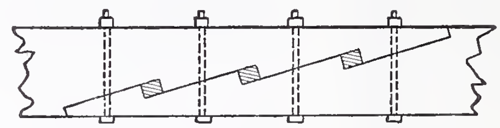


Fig. 22.

In the first degrees of extension and compression the resistance is equal; therefore, the depth of the indent must be equal to the portion of timber remaining in the opposite piece after cutting to receive the indent, in order that the strain may be equal. It is, therefore, evident that when there is only one indent, as in Fig. 11, the depth of it should be one-third of the whole depth, the other two-thirds being equally divided between the other parts. Where there are more indents than one, the sum of the depths of all the indents must be equal to one-third the depth of the beam.

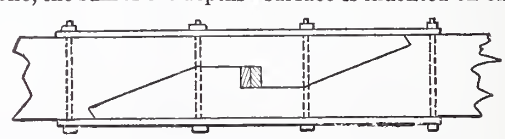


Fig. 23.

To determine the length of the indent in Fig. 11, we must know the ratio between the force to resist the sliding and the direct cohesion of the material. Careful tests have determined that in oak, ash and elm the length of the indent must be equal to from 8 to 10 times its depth. In fir and other similar straight-grained woods, the length of the indent must be equal to from 16 to 20 times its depth.

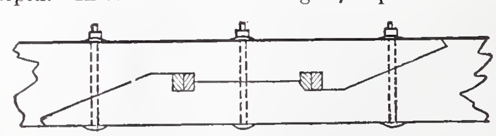


Fig. 24.

From these general principles Tredgold derives the following maxims, which are sufficiently accurate for practical purposes:

1. In oak, ash and elm the whole length of the scarf should be six times the depth or thickness of the beam, when there are no bolts.
2. In fir, the whole length of the scarf should be about twelve times the thickness of the beam, when there are no bolts.
3. In oak, ash or elm, the whole length of a scarf depending on bolts only should be about three times the breadth of the beam; and for fir beams it should be six times the breadth.
4. When both bolts and indents are combined, the whole length of the scarf for oak and hard woods may be twice the depth; and for fir or soft woods, four times the depth.

In Fig. 17 of the accompanying illustrations is shown a joint for resisting longitudinal compression.

Fig. 18 shows a joint made by part of the thickness of the timber being cut obliquely from the end of each of the two pieces, for the purpose of lapping them over each other. The joint is secured by bolts, upon which it depends entirely. Iron plates are interposed between the nuts of the bolts and the face of the timber, to prevent injury in drawing the bolts up to place.

Fig. 19 differs from Fig. 27 only in having keys instead of being tabled together, and is also a very desirable form of scarf.

Fig. 20.—This is a modification of the joint shown in Fig. 16, page 113. It is an improvement upon it from the fact that its surface is indented on each joint and a key driven between. In this example, also, continuous plates are used to prevent injury to the beam by the bolts.

Figs. 21, 22, 23 and 24 are still further modifications of the same thing.

Fig. 25 shows a joint that will answer equally well for posts or ties. The oblique joints shown in Figs. 19 and 27 are avoided, while the same degree of strength is obtained. At the same time it is very simple and quite easy to execute.

In Fig. 26 the beams are halved together vertically, as shown by the several views presented. They are keyed in the center and secured by iron straps.

Fig. 27 represents a very desirable form of scarf. It is easy to make, and when used in connection with bolts—and they are always necessary in pieces exposed to considerable strains—is very good and very strong.

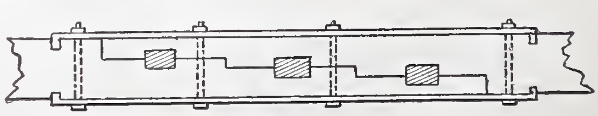


Fig. 25.

Fig. 28 is another modification of the general form of joint shown in Fig. 16.

In Fig. 29 the joint is made quite large and is halved. The end of each beam is scarfed and keyed, and the joint is secured by straps and bolts.

Figs. 30 and 31 are examples of scarfs formed by tho interposition of a third piece.

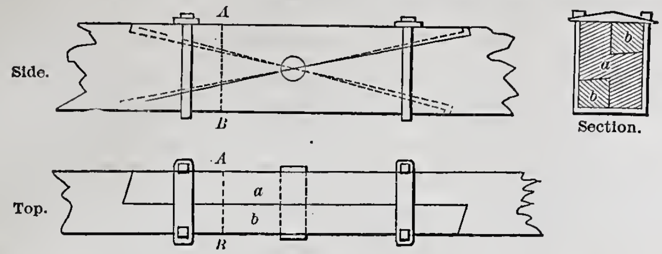


Fig. 26.

Fig. 32 is still another modification of the joint shown in Fig. 16.

Fig. 33 shows a joint made to resist transverse strain. The ends of the two pieces abut, and fish plates are used on the four sides.

Japanese Art.

Chatel says: "We must remember that in Japan decorative art has been forced to its extreme limits, and the acknowledgment of this is shown in the fact that other countries make almost slavish copies of Japanese work in their stuffs, their bronzes and their porcelains, not to mention their inimitable

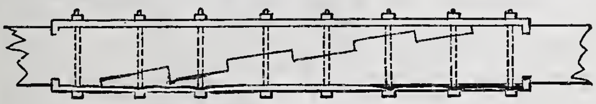


Fig. 27.

lacquer ware." In this country a great impetus was given to the reproduction of Japanese styles in all goods by the superb exhibit made by that people in the International Exposition of 1876. The section of

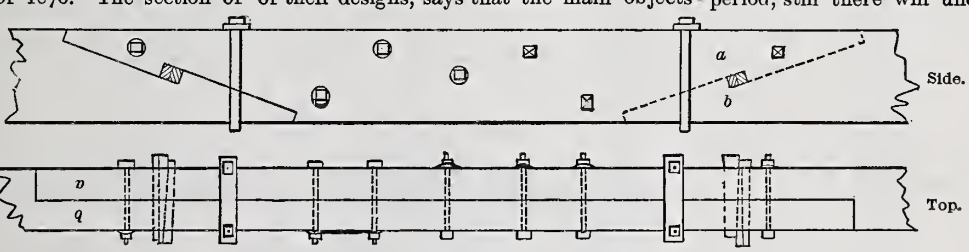


Fig. 29.

the main building devoted to the display of their wondrous works of art was probably the recipient of the greatest admiration shown to the contribution of any nation. It threw open, as it were, the portals which had so long and so jealously excluded from the rest of the civilized world all excepting occasional glimpses of the grandeur of the art knowledge possessed by a nation which we, in our ignorance, had always previously deemed as being but little less than barbarians. And since then, to even fairly imitate the exquisite works of skill they then exhibited, has been considered a triumph among our manufacturers. From this beginning, the love of the quaint has gone on increasing daily in vigor, and becoming more and more demonstrated in the fruits

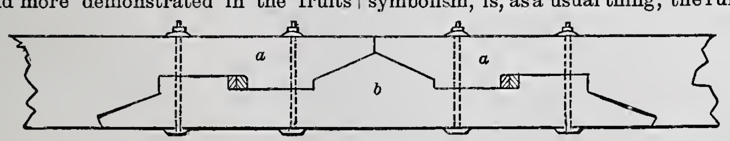


Fig. 30.

of the constant attempts made to counterfeit originals, of which, even at the best, we have so far succeeded in making only tolerable semblances. We are, as a nation, too impulsive ever to excel in this peculiar

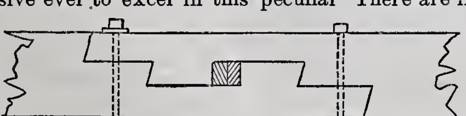


Fig. 32.

line of work. Where a Japanese artist will spend months, if not years, to complete a single specimen, we expect and endeavor to produce the same result in the course of a few days or hours, and will devote neither the time nor patience that they do to produce a perfect and harmonious creation. We have not the slow, plodding industry necessary to fully present, a subject in all its minor details. Excessive minuteness is not in our line, our forte lying more in broad effects, which, although they may

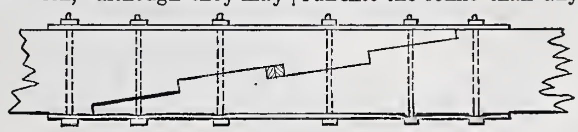


Fig. 28.

dazzle the eye at first, will not so well stand the test of close and critical examination.

The figures in a piece of Japanese work each tell their own story in the most striking manner, even though they may seem at first sight to be unnatural. The birds seem to fly, the men and women to move, and when carefully examined there is real life in all of them. A distinguished author, in speaking of their designs, says that the main objects of them all are emblematical, and convey lessons. The pine tree and stork represent longevity; the willow and swallow, death; the bamboo and sparrow are indicative of gentleness; and so on through a long list of

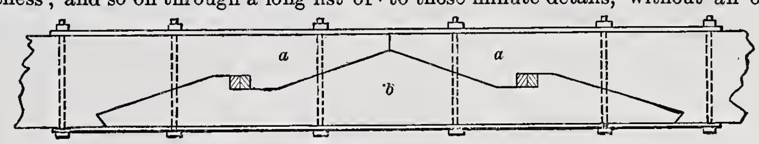


Fig. 31.

symbols which are used in their decorative work. In the designs especially in use among us "outside barbarians," and which are original with ourselves, prettiness, not symbolism, is, as a usual thing, the rule. We don't invest our tea and dinner plates with poetical attributes, or make our vases and plaques the medium usually of conveying religious, moral or historical instruction. There are instances where this is done, of course, but then these cases are in the minority. To a cultivated Japanese, the bronzes and porcelains of his country speak oftentimes many valuable lessons.

In the Report of Awards of the Centennial Exhibition the highest praise was given to the works of art in this line of this nation, both for the fine coloring of their decorations and for the admirable anatomical drawings of the human figure where it was displayed in motion. Even in caricaturing they have shown themselves to be admirable artists and possessed of an inexhaustible fund of imagination. The popular verdict in favor of their goods has been in no way more strongly expressed than by the constant effort made by amateurs in porcelain painting to copy even the monstrosities and myths painted by the subjects of the Mikado. While praising their birds, flowers, &c., we cannot however say conscientiously that we admire their taste in every respect. They do not show much love of beauty, so far as the faces of their men and women are depicted, seeming rather to run into the comic than any other style in that respect. Possibly we are not yet sufficiently cultivated to properly appreciate their idea of "good looks," and our embodifications of the same may in turn seem as hideous in their eyes as their own are to us; still, where it is needed, they succeed admirably in conveying the desired expression into a face.

Not only do the Japanese excel in their decorated procelains, but they also stand pre-eminent in their enamels and lacquer works; and in both they are almost assiduously imitated. Although the present popular rage for their wares may, and probably will, like all the fancies of modern times, fade away after ruling for a brief period, still there will undoubtedly be one good result left, in the effect of the lessons taught in the study of their styles and the tendency given to make our manufacturers, or rather decorative artists, more attentive to those minute details, without an observance of which no art work can be considered, or even will be esteemed, by good judges as being finished.

Blackboards.—If on laths, plaster with three coats, as follows: Scratch coat of good hair mortar, gauged with stucco (plaster-of-Paris). When dry, brown with a coat of mortar described as "stucco-plastering," but using a larger proportion of cement. When that is dry, finish with a good coat of hard finish, colored black with drop-black, or lampblack dissolved in alcohol; and when the finish is dry apply two coats of liquid slating, made as follows: One pound white shellac, one-half pound powdered pumice-stone, one-quarter pound lampblack cut in one gallon pure alcohol. If the blackboard is to be put on a stone or brick wall, the scratch coat may be omitted. Warranted to give satisfaction.

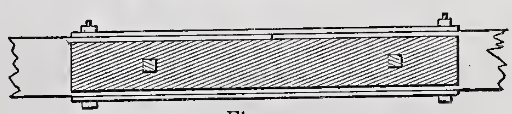
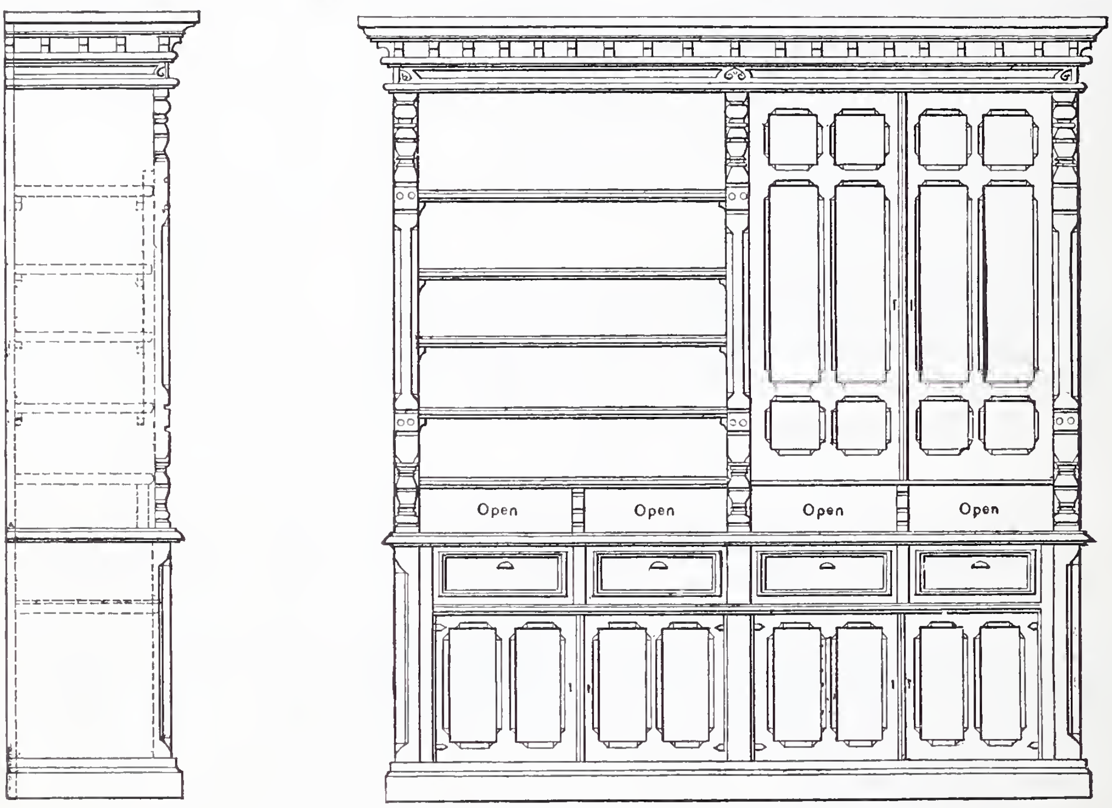


Fig. 33.

Design for a Kitchen Dresser.

We show in the accompanying cuts, Figs. 1 and 2, the design for a kitchen dresser adapted for use in houses of the better class. As will be seen by the elevation, the arrangement of shelves and drawers is such as to make it quite commodious, and the details of ornamentation and construction are such as to constitute it a very handsome piece of furniture. Nothing of convenience or of good construction is sacrificed in the effort to present a fine appearing article and one in keeping with the architecture of its surroundings. The details in Fig. 2 are sufficient to enable any cabinet maker or joiner to construct it, while the dimensions, as indicated by the scale of Fig. 1, may be varied in order to adapt the article to any room or special position in which it may be desired to place it.



Design for Kitchen Dresser.—Fig. 1.—Elevation.—Scale, ½ Inch to the Foot.

Characteristics of Different Styles of Architecture.

I.

With a view to remove the prevailing ignorance as to the characteristic features of the different styles of the past, we have compiled the following article elucidative of the several architectural styles which are more or less the basis of all construction. Before passing on to that subject, however, it may be well to give a word of warning as to any indiscriminate following of the features in these styles which, although well adapted to stone and such-like building materials, may be inappropriate to wood.

The architecture of the Greeks and Romans was regulated by certain rules and canons of proportion which were invariable, and were followed by the professors of the art with a superstitious reverence which almost amounted to a religion. It was never a question with them whether a thing looked well or not, but whether it had been done before. The rules of Vitruvius, and afterward of Palladio, who was the great apostle of the revival of classic art, were obeyed with a deference and blindness to all consistency which appears ridiculous to us nowadays. Everything was regulated by certain rules which were framed to meet every contingency, and it was not possible to infringe these rules without incurring the suspicion of artistic heresy, or without being convicted of ignorance or presumption. The canons of taste and propriety being thus laid down, it required but little ingenuity to design a building in harmony with the accepted ideas, and the art of criticism was confined to noting departures from what were deemed infallible laws of composition. It may be inferred from this that it did not require any very extensive acquaintence with art to become a master, the chief requisite being the committing to memory of a certain set of rules, and the study of only one phase of the science of building, everything which was not conceived in the classic manner being considered unworthy of attention, except as matters of archæological interest. The student would also find less difficulty in mastering the details of one style than if his attention were directed to the various styles which prevailed in his own country and abroad.

The publication of the illustrations of British mediæval buildings by the elder Pugin, and still more the writings and designs of Augustus Welby Pugin, created an extraordinary enthusiasm for the native art of Great Britain which is almost without parallel in the history of art in England. It speaks well for the influence of the pen when it is possible for one man, assisted, it is true, by the industry of his father, to awaken an interest in the buildings of his own country which had not only been overlooked, but had been decried and condemned as barbarous by the most eminent men of his own as well as of many previous generations. And this Pugin did. The *dilettante* patronage of Walpole and the poetry of Scott had, it is true, called attention to the treasures England possessed in the mediæval castles and cathedrals scattered over the country, but to the two Pugins, father and son, and more especially to the latter, is due the credit of having excited that fervor and zeal for the study of the arts of the Middle Ages which spread like a crusade through Great Britain and the neighboring countries, and which in a short time completely revolutionized the popular taste in architecture and the kindred arts.

Up to this time the study of architecture as it was then practiced was a comparatively simple matter, a knowledge of the five orders and the ability to discriminate between Greek and Roman productions being nearly all that was required. Mediæval buildings of every kind were grouped together into one inharmonious family, and were called barbarous, monkish, Gothic, by which last name (derived from the hordes which in the Middle Ages occasionally overran Gaul and the northern parts of Italy), although it is a misnomer, inasmuch as the Goths had no architecture of their own, they have been distinguished to the present time.

While the buildings of Greece and Rome, and those which were imitated from them, were governed by few simple and almost immutable rules, the buildings of the Middle Ages, on the contrary, were constructed with little regard to precedent, and established rules of taste and construction were employed or discarded as occasion required, in a manner which induced at first the belief that the builders of the Middle Ages had no respect for those canons of art which regulate the productions of professors in all countries and throughout all ages.

It seems far from the truth to suppose that the mediævalists had no fixed rules to guide them, and that those magnificent monuments which were designed and executed during the Middle Ages were the result of chance, or of the genius and application of individuals. That the architects of that day were governed by certain rules and traditions in their works, seems certain, but these rules and traditions were so elastic and were so modified by circumstances, that it has been and still is a matter of great difficulty to trace their operations in the various walks of art to which they were applied. Attempts have been made to define and formularize the principles which formed the groundwork of the success of mediæval artists, but hitherto with only partial success, as must be acknowledged from the small number of buildings in the style of the Middle Ages which have reproduced the sentiment, as distinguished from the mere proportion, of the architecture they are designed to imitate.

The rapid variations in the manner of building, and the difficulty of discriminating the dates and differences of style which belong peculiarly to Gothic work, rendered the study of architecture more difficult than it had been under the old classic *régime*, and as a natural consequence the laity, and even those engaged in the arts of furniture and decoration, take far less interest in the pursuit and study of architecture than was common during the last century, and even at the commencement of the present, up to the beginning of the period of the so-called Gothic revival, which dates from about the year 1835 to 1840.

It is unquestionable that the study of the art of building requires nowadays more time and application for its mastery than was formerly necessary, when the extent, variety and mutual relation of the various styles in different countries were but imperfectly understood, if, indeed, they were understood at all. To-day our horizon is immeasurably extended, and our stores of information have greatly increased.

The buildings in England erected before the Norman Conquest are so few in number and so unimportant (except from an antiquarian point of view) that they may almost be disregarded in a sketch which is only intended to give an easily intelligible account of the salient characteristics of styles of building. Antiquarians are even at issue upon the point as to whether the Saxons had any architecture, properly so called, some contending that their churches and other buildings of any note were of wood, similar to the churches of Norway and Sweden, which have all perished, and that the buildings which have been considered to be Saxon work were erected by the Normans at a date anterior to the Conquest. A more patriotic view is that the Anglo-Saxons had a style of their own (as they had a church of their own), a little ruder in design, perhaps, than that practiced by their neighbors the Normans, but sprung, nevertheless, from the same root, and exhibiting great similarity in its essential features.

Be this as it may, it is certain that there are some buildings which have been clearly identified as having existed previously to the Norman Conquest, and are in consequence called Saxon, or pre-Norman, as some prefer to style them.

They are, however, as we have already remarked, so few in number that it is scarcely necessary to describe them. They chiefly consist of towers at the western end of parish churches, the most remarkable of which are the towers of St. Mary-le-Wigford, Lincoln; the churches of Earl's Barton and Barnack, in Northamptonshire; Sompting Church, Sussex; St. Benet's, Cambridge; a portion of the nave of St. Alban's Abbey; the nave and chancel of Worth, Sussex (which have unfortunately lately been restored); and the nave of the Church of St. Michael's, St. Alban's.

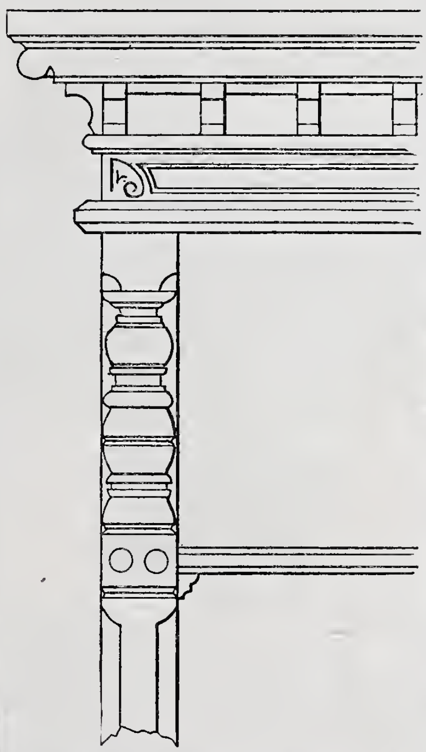
These towers are square on plan; the lower part is unpierced, except by a doorway on the western side, which has a circular arch, the half-circle or tympanum inclosing it being sculptured with a rude bass-relief; the upper story, or ringing loft, is pierced with a two-light window, one on the east and another on the western side, the column dividing the window having what is called a cushion capital, the column being set in the center of the wall, and having a kind of corbel placed upon it, projecting at each side, to carry the arch over. The angles of the towers have quoins (from the Norman-French word *coign*), or corner stones, alternately vertically and horizontally, called long and short work, which is an infallible test of pre-Norman buildings, this feature being never found in any structure built after the Conquest.

There can be no doubt as to the period when the Norman style was introduced into England. The Conquest by force of arms had scarcely been accomplished when the Conqueror, imitating the example of the Romans, at once set to work to introduce the Norman tongue, Norman laws, customs and observances, and, among other things, the Norman style of building. In this art they were, of course, greatly superior to the Saxons. Their nation had already furnished the architects for some of the finest buildings on the Continent, and Saxons, while acknowledging their supremacy, were not slow in learning from them.

The great feature of Norman buildings is the employment of the round arch in every part of the building throughout the whole period that the style flourished, which is from 1066 (the date of the Conquest by William Duke of Normandy) to 1145, or about ten years after the accession of Stephen, which took place in 1135. It is, of course, impossible to fix the limits of the duration of the style with the same accuracy with which we are able to assign its commencement, but it has been ascertained that what may be called the round-arched style continued during the reigns of the two Williams, Henry I, and the early part of the reign of Stephen.

The buildings of this period are remarkable for their great breadth, massiveness and simplicity, and the employment of the round arch not only over doors and window openings, but in every other part of the structure, makes it easy to distinguish the monuments erected during the period. If we find, for example, that all the openings in a building, that is to say, not only doors and windows, but the arches carrying the upper portion of a church or cloister are round, we may safely affirm that the building belongs to the period intervening between the Conquest and the early part of the reign of King Stephen. That is quite sufficient for most purposes, and we may leave to antiquaries to discriminate as to which reign it may be referred to.

The White Tower of the Tower of London was probably one of the earliest, because one of the most necessary, buildings erected by the Norman invaders, and is a remarkably well-preserved specimen of the Norman style, in spite of the coat of cement and the modish little turrets at the angles, which were added by Sir Christopher Wren. The chapel of the White Tower is a complete example of a Norman church, and has lately been cleared out and restored to its original purpose. The Church of St. Bartholomew the Great, Smithfield, is another very interesting example of Norman building. It was begun in the reign of Henry I, and was completed, as far as it exists at present (the nave and Lady Chapel apparently never having been begun), in 1130.



Design for Kitchen Dresser.—Fig. 2.—Detail. —Scale, 1½ Inches to the Foot.

The transepts and nave, or western portion of St. Alban's Abbey, the naves of Rochester, Winchester, Carlisle and Norwich Cathedrals, the choir or eastern part of Waltham Abbey, Durham, Norwich and Peterborough Cathedrals, all belong to this period. The Norman western doors of parish churches have, in many cases, been preserved, they having been frequently richly carved, while the rest of the church has been rebuilt.

How to Prepare India Ink.—Procure a stick of fine quality ink, and a sloping tray of porcelain or slate (the latter is best); at the end of the slope should be a well to contain and give depth to the ink. Put into the tray rain water sufficient to make the desired quantity of ink, and then grind the stick of ink into the water upon the sloping bottom of the tray until it becomes of the desired degree of blackness, when it is ready for use. It should be thus freshly ground each day that it is used; by standing over night it precipitates or changes, so that when dry upon the paper it cracks and is easily removed by the rubber. Many inexperienced persons seek to prepare the ink by shaking and dissolving it in water; it cannot in that manner be sufficiently pulverized to either flow readily or to give a solid black line. A very delicate and pleasing effect is imparted to lettering and drawing by first using a light shade of ink, and then retouching the shaded portions with darker ink. This will not do, however, for work designed for reproduction by either the photo-engraving or lithographic processes; these require clear, strong, black lines, and the pencil lines should be removed with soft sponge rubber. —*From Ames' Alphabets.*

The Necessities of Fire-Proof Qualities in Buildings.

One of the directions the present building movement is taking tends toward an improvement in the fire-proof qualities of the buildings erected, and an exchange, speaking of this tendency, says: "The number of fires in our country, and the amount of the losses, compared with those throughout Europe, are enormous, while at the same time the fire departments in our principal cities are more energetic, prompt and much better equipped than those of the European forces, and no blame can be laid upon them. Let a small fire once get fairly started in any one of our tinder boxes, and no power on earth can ever arrest the progress of the flames until they have completely consumed everything within their reach, circumstances determining entirely how disastrous the conflagration will be. Take the amount of the losses and the cost of supporting a fire department large enough to have any control over the flames, and add this to the cost of buildings when first erected, and it will be found much cheaper to construct in a safe manner at the start than to pay high insurance rates and the heavy taxes for a competent fire department. Private residences need not be fire-proof, if built carefully, and the old song, 'defective flue,' be not allowed to be given as the reason of fires. In a recent fire, by which one of our finest churches was consumed, the main ventilating flue, which ran through the entire roof of the church and had numerous connections, served as a conductor of the flames, and in an almost incredibly short time the whole edifice was a mass of flames. This flue was, of course, built of wood. The cost of the building was about $180,000. This is a fair specimen of the way costly buildings are secured against probable loss by fire. Large stores and warehouses, with heavy walls and iron or stone fronts, are ceiled over head with wooden ceilings. Experience is a severe master, but we will learn after a while that it is cheaper in the long run to do well what we do at all."

Plaster of Paris.—Plaster of Paris may be made to set very quick by mixing it in warm water to which a little sulphate of potash has been added. Plaster of Paris casts, soaked in melted paraffine, may be readily cut or turned in a lathe. They may be rendered very hard and tough by soaking them in warm glue size until thoroughly saturated, and allowing them to dry. Plaster of Paris mixed with equal parts of powdered pumice-stone makes a fine mold for casting fusible metals; the same mixture is useful for incasing articles to be soldered or brazed. Casts of plaster of Paris may be made to imitate fine bronzes by giving them two or three coats of shellac varnish, and when dry applying a coat of mastic varnish and dusting on fine bronze powder when the mastic varnish becomes sticky. Rat holes may be effectually stopped with broken glass and plaster of Paris. The best method of mixing plaster of Paris is to sprinkle it into the water, using rather more water than is required for the batter; when the plaster settles, pour off the surplus water and stir carefully. Air bubbles are avoided in this way.

The Growth of Trees.

Illustrating Some of the Defects in Timber, and Explaining the Natural Law Governing the Shrinking of Wood.

A thorough knowledge of the nature and properties of different kinds of timber is very important to the architect and builder. The timber used in building and engineering work is obtained from trees of the class known by botanists as "exogens," or outward growers. In trees of this class the stem grows by the depositing of successive layers of wood on the outside under the bark, while at the same time the bark becomes thicker by the deposit of layers on its under side. Upon examining the cross section of such trees, au illustration of which is shown in Fig. 1, we find that the wood is made up of several concentric layers or rings, each riug consisting, in general, of two parts, the outer part being usually dark in color, denser and more solid than the inner part, the difference between the parts varying in different kinds of trees.

These layers are called "annual riugs," because one of them is, as a rule, deposited every year. Thus the age of the tree can be ascertained from the number of annual rings, yet this is not always the case. Sometimes a recurrence of exceptionally warm or moist weather will produce a sec-

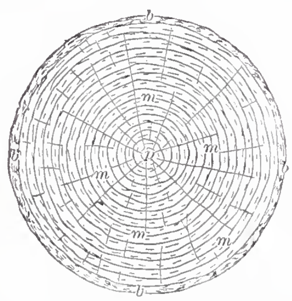


Fig 1.—Growth of Trees, Showing the Pith, the Annual Rings, Medullary Rays, or Silver Grains, and Bark.

ond ring in the same year. As a tree increases in age the inner layers are filled up and hardened, becoming what is called "heart-wood;" the remainder is called "sap-wood." Sap-wood is softer and lighter in color than the heart-wood, and can generally be easily distinguished from it.

In the center of the wood is a column of pith, shown by *p*, Fig. 1, from which planes, seen in section as thin lines, *m m* (in many woods not discernible), radiate toward the bark, and in some cases similar lines, *m m*, also shown in Fig. 1, converge from the bark toward the center, but do not reach the pith.

These radiating lines are kuown as "medullary rays." When they are of large size and strongly marked, as in some kinds of oak, they present, if cut obliquely, a beautiful figured appearance, called "silver grain."

The annual rings are generally thicker on the side of the tree that has had most sun and air, and the heart is therefore seldom in the center.

The heart-wood is stronger and more last-

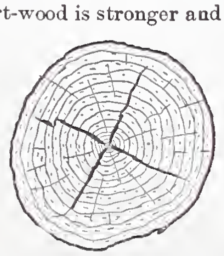


Fig. 2.—Defects in Timber—"Heart-Shakes."

ing than the sap-wood, and should always be used in good work. While the heart-wood is the strongest during the time the tree is growing, it is the first to decay after the growth is stopped. It is important, therefore, that the tree should be felled at the right age. The proper age varies with different trees, and even in the same tree under different circumstances. The induration of the sap-wood should have reached its extreme limits before the tree is felled; but the period required for this varies with the soil and climate. Trees cut too soon are full of sap-wood, and the heart-wood is not fully hardened.

The characteristics of good timber may be briefly mentioned before describing some of the defects in timber. Good timber should be uniform in substance, straight in fiber, free from large or dead knots, flaws, shakes or blemishes of any kind. If freshly cut it

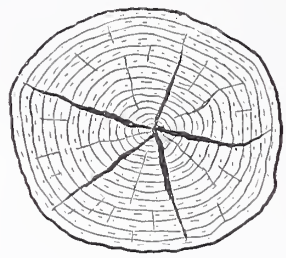


Fig. 3.—Defects in Timber—"Star-Shakes."

should smell sweet; the surface should be firm and bright, with a silky luster when planed; it should not be woolly, nor clog the teeth of the saw. A disagreeable smell betokeus decay, and a dull, chalky appearance is a sign of bad timber.

The annual rings should be regular in form; sudden swells are caused by rind-galls. Closeness and narrowness of the layers indicate slowness of growth, and are generally signs of strength. When the rings are porous and open, the wood is weak and often decayed. The color of good timber should be uniform throughout; when it is blotchy, or varies much in color from the heart outward, or becomes pale suddenly toward the limit of the sap-wood, it is probably diseased. Good timber is sonorous when struck; a dull, heavy sound betokens decay within.

Of defects in timber there are several

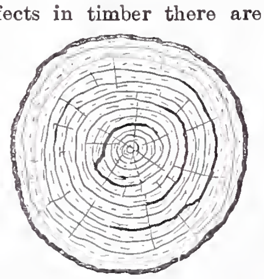


Fig. 4.—Defects in Timber—"Cup-Shakes."

which are caused by the nature of the soil upon which the tree was grown, and by the vicissitudes to which it has been subjected while growing.

"Heart-shakes" (Fig. 2) are splits or clefts occurring in the center of the tree. They are common in nearly every kind of timber. The splits are in some cases hardly visible, while in others they extend almost across the tree, dividing it into segments. The worst form of heart-shake is one in which the splits twist in the length of the tree,

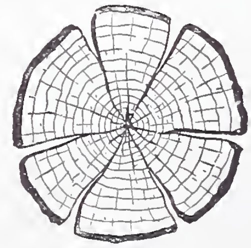


Fig 5.—Effect of Shrinking—Splitting in Radial Lines from the Center.

thus making it impossible to convert the tree into scantlings or planks.

"Star-shakes," as shown in Fig. 3, are those in which several splits radiate from the center of the timber.

"Cup-shakes" are curved splits, separating the whole or part of one annual ring from another, as shown in Fig. 4.

"Rind-galls" are peculiar, curved swellings, caused generally by the growth of layers over the one remaining after a branch has been imperfectly lopped off.

"Upsets" are portions of the timber in which the fibers have been injured by crushing.

"Foxiness" is a speckled stain peculiar to beech and some kinds of oak.

"Twisted fibers" are caused by the action of the prevailing wind turning the tree constantly in one direction.

The manner in which timber shrinks is very clearly explained in the following extract from a lecture by Dr. Anderson, before the Society of Arts:

"Notwithstanding the extent to which timber is used in the mechanical arts, it is singular that the natural law by which the direction of shrinking of wood is governed is too much disregarded in practical operations. It is a subject which seems to have been entirely neglected by writers.

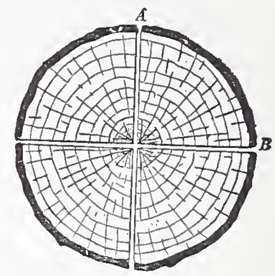


Fig. 6.—Log Cut in Quarters—Appearance before Seasoning.

"An examination of the end section of any exogenous tree, such as beech or oak, will show the general arrangement of its structure. It consists of a mass of longitudinal, fibrous tubes, arranged in circles that are bound together by means of radial springs, or shoots, which have been variously named. They are the "silver grains" of the carpenter or the "medullary rays" of the botanist, and are in reality the same as end wood, and have to be considered as such—just as much so as longitudinal wood fiber—in order to understand this action. From this it will be seen that the lateral contraction or collapsing of the longitudinally porous or tubular part of the structure cannot take place without first crushing the medullary rays; hence the fact of the shrinking finds relief by splitting in another direction—namely, in radial lines from the center, parallel with the medullary rays, thereby enabling the tree to maintain its full diameter, as shown in Fig. 5.

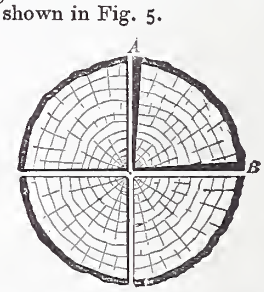


Fig. 7.—Log Cut in Quarters—Appearance of one of the Sections after Seasoning.

"If the entire mass of the tubular fiber composing the tree were to contract bodily, then the medullary rays would, of necessity, have to be crushed in the radial direction to enable it to take place, and the diameter would thus be as much injured in proportion as would be the case in crushing the wood in the longitudinal direction. If such an oak or beech tree is cut into four quar-

Fig. 8.—Log Cut into Five Planks, Showing Effect of Seasoning on Each Piece.

ters by passing the saw twice through the center, at right angles, before contracting and splitting has commenced, the lines shown from A and B to the center, in Fig.

6, would be of the same length and at right-angles to each other; or, in the technical language of the workshop, they would be "square." But after being stored in a dry place, say for a year, it would be seen that a great change had taken place, both in

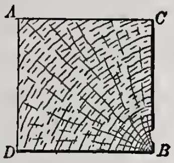


Fig. 9.—Appearance while Green of a Square Cut from one of the Planks Near the Outside.

form and in some of the dimensions. The lines from A and B to the center would be the same length as before, but would have contracted from A to B very considerably, and the lines drawn to the center would not be at right angles to each other by the portion shown here in black in Fig. 7. The medullary rays are thus brought closer by the collapsing of the vertical fiber.

"But supposing that four parallel saw cuts are passed through the tree so as to form it into five planks, let us see what would be the behavior of the several planks. Take the center plank first. After due seasoning and contracting, it would then be found

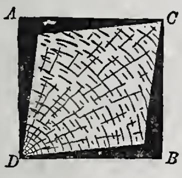


Fig. 10.—Appearance of the Same after Seasoning.

that the middle of the board would still retain the original thickness from the resistance of the medullary rays, while it would gradually reduce in thickness toward the edges, for want of support; and the entire breadth of the plank would be the same as it was at first for the foregoing reasons, as shown in Fig. 8. Then taking the planks at each side of the center, by the same law, their change and behavior would be quite different. They would still retain their original thickness at the center, but would be a little reduced on each edge throughout; but the side next to the heart of the tree would be pulled round or partly cylindrical, while the outside would be the reverse or hollow, and

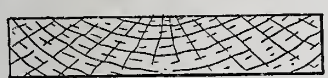


Fig. 11.—Appearance of the End of a Plank Cut from the Outside of a Log.

the plank would be considerably narrower through its entire length, more especially on the face of the hollow side, all due to the want of support. Selecting the next two planks, they would be found to have lost none of their thickness at the center, and very little of their thickness at the edges, but very much of their breadth as planks, and would be curved round on the heart side, and made hollow on the outside. Supposing some of these planks to be cut up into squares when in the green, the shape that these squares would assume after a period of seasoning would depend entirely on the part of the tree to which they belonged. The greatest alteration would be parallel to the medullary rays. Thus, if the square

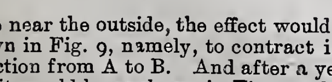


Fig. 12.—Appearance of the End of a Plank Cut from the Center of a Log.

were near the outside, the effect would be as shown in Fig. 9, namely, to contract in the direction from A to B. And after a year or two it would be as shown in Fig. 10, the distance between C and D being nearly the same as it was before, but the other two are brought by the amount of their contraction closer together. By understanding this natural law, it is comparatively easy to know the future behavior of the wood or plank by carefully examining the end wood, in order to ascertain the part of the log from which it has been cut, as the angle of the ring growths and the medullary rays will show, as indicated in Fig. 11. If a plank has this appearance it will evidently show to have been cut from the outside, and for many years it will gradually shrink all to the breadth. While the next plank, as shown in Fig. 12, clearly points close to the center or heart of the tree, where it will not shrink to the breadth, but to a varying thickness, with full dimensions in the middle, but tapering to the edges. And the planks on the

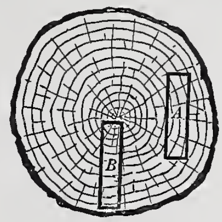


Fig. 13.—Of Two Pieces of Timber Cut From a Log, that shown at A will be Stronger than that at B.

right and left will give a mean, but with the center sides curved round and the outside still more hollow.

"The foregoing remarks apply more especially to the stronger exogenous woods, such as beech, oak and some of the firs. The softer woods, such as yellow pine, are governed by the same law, but in virtue of their softness another law comes into force, which to some degree affects their behavior, as the contracting power of the tubular wood has sufficient strength to crush the soft medullary rays to the same extent, and hence the primary law is so far modified. But

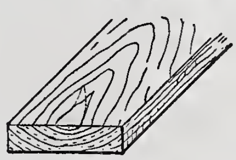


Fig. 14.—Appearance of Floor Boards when the Heart shows on the Surface of the Finished Board.

even with the softer woods, such as are commonly used in construction of houses, if the law is carefully obeyed the greater part of the shrinking, with which we are too familiar, would be obviated."

Experiments have shown that timber beams which have the annual rings parallel to their depth, are stronger than those which have the rings parallel to their width. Thus in the log shown in Fig. 13, the piece cut from A will be stronger than that cut from B.

Again, the purpose for which the timber is intended should be borne in mind. Thus, in preparing flooring boards, care should be

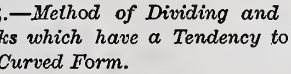


Fig. 15.—Method of Dividing and Joining Planks which have a Tendency to Shrink to a Curved Form.

taken that the hearts should not appear on the surface of the finished board. If they are allowed to do so, as in Fig. 14, the central portions will soon become loose and will be kicked up, as shown in the dotted lines, and will form a rough and unpleasant floor.

When planks which have shrunk to a curved form have to be used to form a flat board, they are sometimes sawn down the middle and glued together, the alternate pieces being reversed, as shown in Fig. 15. Thus the curvature in each piece is so slight as to be almost inappreciable, and the reversal of the alternate pieces causes each to be a check upon the shrinkage of its neighbors.

A practical application of the laws governing the shrinkage of timber is exhibited in some of the methods of converting oak, several of which are described in "Gwilt's Encyclopedia of Architecture," from which Fig. 16 is taken, with very slight modifications.

Fig. 16 represents the log first cut into

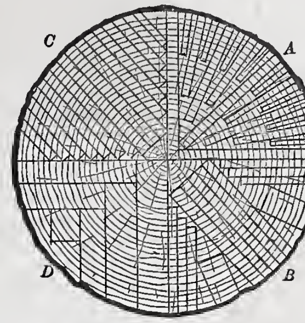


Fig. 16.—Methods of Converting Timber.

four quarters. Each quarter may then be converted in either of the following methods. The best method is shown at A, in which there is no waste, as the triangular portions form feather-edge laths, suitable for tiling and other similar purposes. This method cuts very obliquely across the medullary rays, and thus exhibits well the silver grain of the wood, which is so much admired for cabinet work and other ornamental purposes. The next best method is shown at B. That

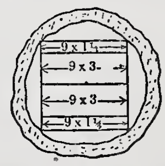


Fig. 17.—Manner of Sawing Timber to Produce Merchantable Sizes.

at C is inferior; while D is the most economical when thick stuff is required.

The attention which is given to the subject of converting timber in the older countries, where timber is a scarcer article than in our own, is clearly illustrated in the practice current at the great saw mill in Sweden and Norway. Each log is carefully inspected before it is sawn, to find out how many of the most marketable sizes can be made out of it. Thus, if boards four inches wide are in demand, or battens, they will arrange so as to cut more of this size, and fewer of the regular three-inch boards, and *vice versa*. The two methods of doing this are shown in Figs. 17 and 18. Fig. 17 shows an arrangement in general use at the

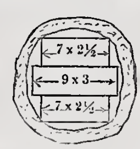


Fig. 18.—Another Illustration of the Same, as Described in the Last Figure.

present time. The 9 x 3 stuff is in general demand in the English market; while the 9 x 1¼ goes into the French market. Fig. 18 shows the method that was adopted until the French market improved. It will be observed that the center pieces would include the pith, and it is in such a case subject to dry rot.

New Buildings and Unsafe Houses in New York.—In the monthly report of the Building Department, Superintendent Dudley announces that during the month of June 176 new buildings were begun, and that 961 new buildings are in course of erection. The owners of 225 tenements were notified to place fire-escapes on their buildings, 59 unsafe buildings were reported, 60 were made safe and 7 were removed. Notices of prosecution were served on the owners of 154 unsafe buildings, and 145 violations of the Building law were proceeded against.

Antiquity and Usefulness of Bricks.

The universal use of brick as a building material at the present day, its unparalleled applicability and its wonderful resistance to the ravages of time, make it of some importance to the builder to know something of its antiquity, and the method of building with it in Europe and other places. So far as we can discover, it appears that before the time of Nimrod the inhabitants of Assyria lived chiefly in tents and caves, but during his reign the people over whom he ruled were united and lived together, and the first city was founded and known in history as Babel, and the tower by that name is generally ascribed to this prince. The city of Babel was much improved under the rule of Semiramis, and the art of brick-making advanced very much during her lifetime. At the Birs Nimrond, which is supposed to be the ruins of the Tower of Babel, there are found masses of vitrified brickwork; these masses, however, are found on the summit of the pile, and were evidently vitrified by subsequent conflagration.

Babylonian bricks are found to be of two kinds—the sun-dried and the kiln-burnt. In countries where the sun is powerful, as in Chaldea, and where there is seldom rain, sun-dried bricks were sufficient for most purposes. The first walls of Mantinea were built with sun-dried bricks, and they resisted the warlike engines of those days better than stone. These bricks were made of pure clay, and were so solid and compact as to ring if placed on their edge and gently stricken by any metallic body; they were shaped in molds, supposed to be of wood, having figures and inscriptions, and were beaten up with straw or rushes to increase their cohesion, and bound in their courses by layers of mortar and reeds.

The kiln-burnt bricks were of far superior induration. They compose the piers and arches of a bridge mentioned by the prophet Baruch, and still remaining; some of them were varnished and adorned with figures, and they have been found disposed in mosaics in the figure of a cow, the sun and moon. The color is a bright red or pale yellow; in the unburnt, that of stone. The sizes vary from 12 to 13 inches long, 3 or 4 inches thick; the largest known, however, measure 19¾ inches square and 3½ inches thick, with written characters along the sides. Some bricks have been found of a cylindrical form, inclined to a barrel entasis; they are made of the finest furnace-baked clay, and inscribed with a small running hand, from the perforation of some they are supposed to have been worn as amulets or talismans. These ancient users of brick knew the necessity of bond, but were not aware of the methods now employed for strengthening a wall by bonding; they, however, used reeds and rushes for that purpose. Herodotus says, "that they (the reeds or rushes) were placed at every thirtieth course; but modern travelers find them at every sixth, seventh and eighth course in Aggarkuff, and at every course in some buildings in Babylon.

In Egypt, in such parts as were subject to inundation of the Nile, towns could not be founded except upon artificial substrata made above the level of its rise; and from Herodotus we learn that the Ethiopians, when they seized Egypt, killed none of the conquered, but employed them in raising heaps on the banks of the river, which were composed of rubble surrounded with inclosures built of bricks. Pliny gives us the statement of some old writers, who say that in the construction of the Pyramids causeways were constructed of bricks made of mud, which on completion of the work were distributed among the private houses. It appears, however, that the Egyptians not only used brick as an accessory to erecting these enormous piles, but also built some with it; for a recent Egyptian explorer thus describes one he met: "About two miles to the east of the last Great Pyramid, on lower ground, and near the east edge of the mountain, is a pyramid built of unburnt brick. I observed, on the north side, the bricks were laid lengthways from north to south, but not everywhere in that direction; however, I took particular notice that they were not laid so as to bind one another. It is much crumbled and ruined; it is 157 feet on the north side and 210 feet on the west, it being much broken away on the east and west sides; it is 150 feet high."

It appears that from all accounts no improvement has taken place in the manufacture of this important material in Eastern countries, for it still continues to be made and used in the same primitive way that the children of Jacob employed previous to their delivery by Moses; and many Eastern houses are still built of unburnt bricks made of earth and chopped straw dried in the sun.

If we follow this subject to more classic ground, we find that the native materials of Greece led men to form their superstructures in accordance with the gifts of nature, which in a great measure superseded all auxiliaries, and the style of their architecture rendered stone or marble more convenient and effective; but it was not altogether rejected in their buildings. And here we have that consideration given to form and size that made the work executed appear not only more agreeable to the sight, but also more solid in construction. Hence Vitruvius tells us the Greeks had three kinds of bricks; two sorts only were used in public buildings; each sort had half bricks made to suit it, so that when a wall was executed the course on one side of the face of the wall shows sides of whole bricks, and being worked to the line on each face, the bricks on each bed bond alternately over the course below; and so particular were they to having their bricks properly seasoned, that he says the inhabitants of Utica allowed no bricks to be used in their buildings that were not at least five years old, and also approved of by a magistrate; and the example mentioned by him is that part of the wall at Athens toward Mount Hymettus and Bentilicus and the temples of Jupiter and Hercules, in which the cells are of brick.

The remains of walls and buildings in Greece executed with this artificial material are so few at the present day, and so imperfectly described in the works of those scientific men who have visited that interesting country, that we are left in some doubt as to whether they used sun-dried or kiln-burned, or both, as was the custom in Persia, Egypt, and other Eastern countries; for, in the chapter wherein Vitruvius mentions them, he does not state that they were burned, but rather leads us to suppose that they were made according to his rules. But in a recent letter to the London *Times*, Dr. Schliemann, giving an account of his excavations at ancient Troy, seems to have solved this doubt. The Doctor's language in this connection is as follows: "Having, in company with these friends (Prof. Virchow and Mr. Bournouf), most carefully examined many heaps of bricks, we have all three become convinced that the latter have been slightly burned in ovens before having been employed for building, because they are too uniformly burned to admit that their burning should have been produced solely by the great conflagration; besides, even in compact masses of bricks, we never found a raw, merely sun-dried brick."

In Pompeii much less has been discovered relating to architecture and the arts generally, and which, indeed, forms the link wanting to connect our perfect acquaintance with the customs of Rome and Greece. The use of brick became a very necessary and useful appendage to their materials in building; and not only did the nature of the soil prove favorable for its manufacture, as brick became of indispensable and universal service in the construction of their walls and buildings, forming a bond to the shapeless pieces of rubble-work of which they composed some of their walls, and giving solidity to others built of either squared volcanic stone, ferruginous scoria and tufa; indeed, few of the public buildings of Pompeii were erected without its application; and the eye of the traveler upon first entering the forum is struck favorably with these buildings, from the high, dark masses of brick contrasting with the verdant mountains at their back, and the low, limey-looking buildings around them.

The bricks are united together by mortar or puzzolano, and in some of the walls it is found to be very bad. The thickness of the walls of houses very seldom exceeds 18 inches, and is oftener less; their preservation, indeed, seems rather owing to the stucco on the surface than the mortar used in building them. The roof of the Basilica, or Court of Justice, the largest building in Pompeii, was supported by a peristyle of 28 Ionic columns, which are curiously constructed of bricks, molded so as to form the volutes to the columns, the exterior of which was afterward covered with cement.

In some of the remains of ancient Rome we find brick, both sun-dried and kiln-burnt, but most of the old houses were built of the first kind. The Romans used several sizes of bricks, one of which they called bipeda, or two Roman feet long; another didoron, about 6 inches broad and 1 foot long. In Palladio's time artificial stone or bricks were called quadrels, and according to Pliny those chiefly used were 1½ feet long and 1 foot broad, which also agrees with the size mentioned by Vitruvius, though Alberti says, "We see in some of their buildings, and especially in their arches, bricks 2 feet every way;" but he afterward remarks that in several of their structures, particularly in the Appian Way, were several different sorts of bricks, some smaller and some larger; and he mentions having seen some not longer than 6 inches, nor broader than three, and 1 inch thick, but these were chiefly used in their pavements and set edgeways; and Palladio says that bricks may be made larger or smaller, according to the nature and quality of the building, and the use to which they are designed. They also made bricks of other forms than those enumerated.

Furniture Woods of the Future.

Black walnut for furniture uses is about the poorest hard wood that could have been selected. It became fashionable from no known cause, but simply from one of those strange freaks that attack human beings, and it has had a run unequaled by any other wood. The demand for it has developed many improvements in finishing and cutting, so as to exhibit the grain to the best possible advantage, until now one may get a handsome suit of walnut (we are speaking only of the wood), so far as the eye sees it. Had the same finish been adopted when the wood was first used for furniture, the demand for it might be explained; but its qualities were not then understood, and there is no denying that the way in which it is now put on the market has the merit of attraction. Yet it is not a good wood for furniture; it is not lasting. The very nature of it prevents its ever standing the test of years. It will stand for a decade or a generation, but who, in years to come, will be able to show a walnut bedstead that belonged to their grandfather? Some may smile as the question meets the eye, and ask, Who wants to have a bedstead a hundred years old? Yet a feeling of stronger reverence is growing, and, in time, the attachment to old things will be deeper and more as it is in England; and old furniture will be one of the choice things to prize, much as old china now is by a large class of people.

As long as walnut is the popular wood, there is little likelihood of this idea being carried out. It is too soft and too porous to be enduring. It shrinks and swells, no matter how well cured; it will drink in moisture in damp weather, and then dry so quickly as to start the glue joints and loosen the dowels. Everybody knows how it will crack and creak as it expands and contracts, going off like a pistol shot, awkening one out of a sound sleep with the impression that the bedstead is falling to pieces.

Whether its bad qualities are being found out, or people, ever ready for a change, are getting tired of it, certain it is that a demand is growing for other kinds of wood. Ebony (or ebonized wood) struggled for recognition last winter, and had a partial success. But, except for small articles of fancy cabinet ware and some styles of parlor funiture, ebony is too somber. Ash is gaining in favor, but experience has proved that this wood comes up periodically, has a run and drops back again. If a change is to take place, and we know that a change always suits the masses, it is to be hoped that rosewood and mahogany are to be the woods of the future. These have the necessary qualities to make elegant and lasting furniture, and the time has arrived to put good designs in these woods upon the market.

CORRESPONDENCE.

The Study of Architecture.

From W. P. E., *Harrodsburg, Ky.*—Will you please publish a list in *Carpentry and Building* of the first and most important books to be used in the study of architecture? Will you also name some good text books upon drawing, especially upon perspective? I shall be pleased to have your views upon the study of architecture; also some statement of the relation of mathematics to architecture. Can you give me the name of an architectural institute?

Answer.—Answering our correspondent's last question first, we would refer him to the Cornell University, Ithaca, N. Y., which, for a number of years, has maintained a special department devoted to architecture. We have no doubt that the course of study (a description of which may be obtained by addressing the president of the University) as pursued in that institution employs text books which are most likely to be of service to our correspondent, and that the list of books, obtained as suggested above, will fully meet his requirements if he wishes to pursue a regular course of study. What books to recommend to a student of architecture depends very much upon the manner in which he proposes to study. If he desires to go into the subject exhaustively, there are few of the sciences which cannot be made tributary to it; and, therefore, the books to be recommended would include a large number. If, however, he desires the practical part, exclusive of the theoretical and scientific, fewer books will be required. We know of no work better calculated to give a general view of the subject in all its branches, and which will enable a student to judge of what special collateral branches are best for him to pursue, after in part mastering the contents of this, than "Gwilt's Encyclopedia of Architecture." This book is divided into three parts, entitled, respectively, historical, theoretical and practical. It is a work which should find a place in the library of every architect, and can be made of great use to the student and to the common mechanic. There are other and more modern works which treat of some single phase of the subject, and which it would be well to use as auxiliaries with the one above named. But for a single book which shall give a comprehensive view of the whole subject, we know of none quite so satisfactory as "Gwilt's Encyclopedia."

In the book above mentioned will be found a chapter upon drawing, in which the principles of perspective are carefully explained, by means of a number of practical examples. "Minifee's Mechanical Drawing," is perhaps as good a work, at a cheap price, as any treating upon mechanical drawing in its application to architecture, as well as to machinery. It also has a chapter upon perspective. "Appleton's Encyclopedia of Drawing," is exhaustive, and is invaluable to the student who wishes to take a comprehensive view of the entire subject.

The relation of mathematics to architecture is a subject altogether too wide in its scope to admit of discussion in the columns devoted to correspondence. Briefly, mathematics may be considered the foundation of architecture. In one form and another, mathematical principles manifest themselves at every step in the study and practice of architecture. A thorough knowledge of mathematics, practical as well as theoretical, is of the utmost importance in the successful pursuit of that study.

Troublesome Gutters.

From J. W., *Elmore, Wis*—I have read the account of C. J. F.'s gutters with a good deal of interest. I think it is probable that the trouble is owing to contraction and expansion. The house is very probably a large one. If the gutters were laid in hot weather they would be very likely to contract enough in cold weather to break the joints, already weakened by the operation of forcing the tin into the box. Repairing them after they were broken would only fit them for repeating the fractures at the next change of temperature. I see no remedy save taking the gutters out and replacing them by others put in in a workmanlike manner.

Parallel Ellipses.

From J. H. M., *New York.*—In the June number of *Carpentry and Building* I notice that W. S., of Toronto, Canada, asks for instruction how to draw parallel elliptical lines, and in reply a drawing and explanation is given in which he is told to increase his major and minor diameters equally, find

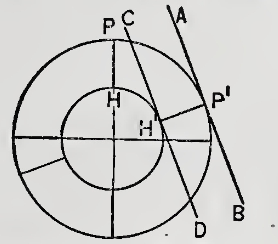


Fig. 1.—Parallel Lines.

new foci and proceed to draw another elliptic line outside of the given one. Now, what I want to say to W. S., and to the gentleman who was kind enough to answer W. S., is that parallel elliptic lines are among the impossibilities; certainly the instruction given is a mistake.

A parallel tracing may be made by setting off points equidistant from a true ellipse, but that trace line will not be an elliptic line, nor can parallel elliptic lines be drawn by trammel or string. The mathematical law of the ellipse is that approximate elliptic

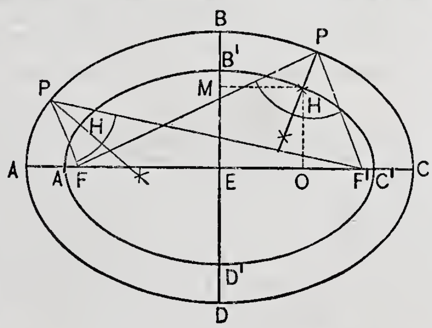


Fig. 2.—Parallel Ellipses.

lines will have proportionate diameters; therefore given an ellipse whose minor diameter is 6 and major diameter 12, and apply the law of proportion, say increase the minor diameter to 10, then the major diameter must be 20; or, again, increasing the given major diameter to 16, the minor diameter must then be 8.

An easy, practical illustration of the law of proportionate elliptical diameters, may be secured by boring a hole lengthwise through a cylindrical solid and sawing the end of the

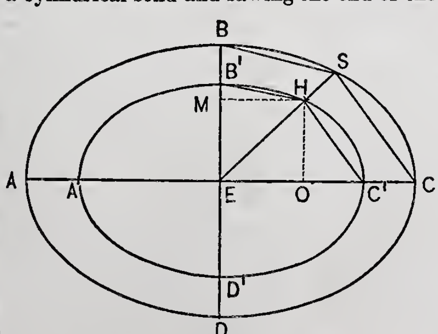


Fig. 3.—Similar Ellipses.

solid off obliquely; then upon comparing the diameters of the inner ellipse with the diameters of the outer ellipse, they will be found in all cases to bear a perfect mathematical proportion.

Note.—To begin at the beginning, parallel lines are those which are always the same distance apart, and this distance is measured on a line drawn perpendicular to the parallel lines. Thus, in Fig. 1, A B and C D are parallel, P^1 H^1 is the perpendicular distance between them.

Advancing a step from straight lines to circles, we say that the two circles in Fig. 1 are parallel because they are the same distance apart, when measured on the normal P H to the circle, or, in other words, when measured on the perpendicular P^1 H^1 to the tangents A B and C D.

Now, advancing from circles to ellipses, we say that the two ellipses shown in Fig. 2 are parallel, because they are the same distance apart when measured on the normal P H. This line P H is obtained by bisecting the angle contained by the lines F P and F^1 P, drawn to the foci from any point P in the curve. Of course, when we reach the diameters of the ellipse, this distance becomes B B^1 or C C^1, which is equal to P H. The circumferences of the ellipses then are parallel.

Our correspondent asserts that approximate elliptical lines will have proportional diameters. Therefore, given an ellipse whose minor diameter is 6 and major diameter is 12, and apply the law of proportion, say by increasing the minor to 10, then the major diameter must be 20. We are uncertain of the meaning intended to be conveyed by the term "approximate ellipses," but we presume our correspondent means similar ellipses, and we readily grant him that similar ellipses will not have their circumferences parallel. In order to demonstrate this, in Fig. 3 we show an ellipse of the same dimensions as the larger one in Fig. 2, and through the point H, which is in the same position in both figures, we have drawn in Fig. 3 a small ellipse A^1 B^1 C^1 D^1, similar or poroportional to the ellipse A B C D. The two figures may be easily compared. In Fig. 2 the circumference of the ellipse A^1 B^1 C^1 D^1 is parallel to the circumference of the ellipse A B C D, but the ellipses are not similar, and their diameters are not proportional. In Fig. 3, on the contrary, the ellipse A^1 B^1 C^1 D^1 is similar to the ellipse A B C D, their diameters are proportional, but their circumferences are not parallel.

The experiment suggested in the last paragraph of our correspondent's letter, that of boring a hole lengthways through a cylindrical solid and sawing through the same obliquely, in order to obtain a comparison of the resulting elliptical shapes, clearly demonstrates the relationship between proportional ellipses, as exhibited in Fig. 3. It, however, has no bearing upon the question of drawing parallel elliptical lines.

Drawing Ellipses.

From H. D. C., *Philadelphia, Pa.*—I am a constant reader of *Carpentry and Building*, and believe it just the thing for mechanics—something that has long been wanted.

In the June number, W. S., of *Toronto, Canada*, asks for information concerning striking parallel elliptical lines. I have long felt the need of this information, and therefore appreciate the reply which you gave him.

I desire to make some remarks concerning striking ellipses in general. I prefer using string and pencil to the trammel, because it is most convenient, and also because it is most correct. It may be objected that the string will stretch. To provide against this I recommend the use of fine wire. I also have in use for such purposes a pencil attachment, which greatly facilitates the operation. This attachment consists of a simple shield or sleeve, which fits tightly over the pencil. To one side of it is soldered a wire which extends downward, and is bent inward so as to carry the wire along the cut of the pencil, the end of the wire coming very nearly down to the lead of the pencil. The end of the wire is formed into a hook or ring. This hook or ring is used around the string or wire by which the ellipse is to be struck; it avoids the annoyance of the pencil slipping off. This attachment may have the joint open so as to allow it to be pushed on or off readily, and to adapt it to different sized pencils, operating like a clamp. The cost of this device is a mere trifle, and I think many of your readers will find it to their advantage to provide themselves with it.

Placing Brackets in Cornices.

From W. S. H., *Lewisburg, Pa.*—Can you give me, through *Carpentry and Building*, any information as to the proper distance between brackets in cornices, or, more especially, as to whether the distance between the brackets, and the position of the brackets, should be governed by the openings in the walls below them. I have a house 30 feet long, with five windows. The windows measure some 3 feet in width, while the distance between is nearly 4 feet. From either corner of the building to the first window is about 2½ feet. Now if I place a bracket about the center of each space between the windows, they will all come the same distance apart, save the corner ones, which would have a greater space. Which would be the correct thing, to place them equidistant, without reference to windows, or be governed by the windows, and have the distance between those at the ends greater than that between the others?

Answer.—We believe the general practice followed by cornice makers, and one sanctioned by the usages of architects, is to place the outside, or corner brackets, near the angle of the building, in such position as they will look best. Then place the intermediate brackets either over the center of the spaces between the windows, or over the openings, or both, as the case may be, spacing them as nearly equal as possible. A little greater or less distance between the corner brackets and the ones nearest them is seldom detected by the eye, because the general uniformity throughout the cornice tends to cover up and conceal such discrepancies. There is no arbitrary rule applicable in such cases. In connection with houses of modern architecture it is altogether a matter of taste, and the individual builder or architect, as the case may be, is entitled to please himself to whatever extent he is able, by following his own preferences. We think the arrangement above suggested has as little about it that is offensive to good taste as any plan that could be named.

Raw and Boiled Oil.

From C. W. C., *Burkville, Ohio.*—Which is the best for outside painting, boiled or raw oil?

Answer.—The object in boiling oil is to impart greater drying qualities. Raw oil is preferable for first coats; being more limpid than boiled oil, it readily penetrates the pores or grains of woods and secures the same against moisture. Boiled oil is the best for finishing coats.

A Good Front Mortar.—Method of Cleaning Fronts.

From W. H. W., *Baltimore, Md.*—From experience I am able to recommend the following as a good front mortar, not affected by frost:

Take two parts of good lime, one part clean, ground, white marble dust, one part water; mix well and run into a box with sieve. Stir well, cover up and let it remain three or four days to cool off and set before using. It is then to be used in the same manner as other mortar. The bricks should be wet, so as not to dry the mortar too quickly by absorption.

The following is a cheap plan for cleaning down fronts when they become dirty by rain and dust:

Take two parts pure cider vinegar, one-quarter part muriatic acid, and the balance pure, clean water. Mix in a wooden bucket and apply with a sponge. Rinse in clear water. This will give the front the same bright luster as when first put up.

Referring to the mortar above mentioned, I may say it will become as hard as white marble itself. I built a row of houses some ten years ago, and the mortar in them is quite as hard at present as when the houses were first built. The fronts have been cleaned since at a cost one-half less than oiling and penciling with white lead.

The Utility of a Live Journal Devoted to the Building Trades.

From W. C., *Zanesville, Ohio.*—From a casual view of the current number of *Carpentry and Building*, I write to say that I am much pleased with the amount of valuable matter it contains. I am sure it fills a want long felt by the building trades.

I note with great interest the very good and substantial style and finish which characterize the buildings of to-day. The buildings at present erected are more suitable for the purposes intended, and present a more pleasing and cheerful appearance than those erected but a few years ago. This is attributable, in the main, to the numerous popular works issued of late years upon the subject of architecture, which a spirited journal like *Carpentry and Building*, devoted to the special discussion of subjects interesting to the building trades, must supplement in an effective and desirable manner.

In this town, as in many others of its size, we have no professional architect. Many of our carpenters who are able to draw, assume the title of architect. Most of them have read but little, and few of them are really intelligent in this part of their business. *Carpentry and Building* cannot fail, therefore, to be of great use to this class.

I am sure I express the feelings of a large majority of those in the building trades, in wishing *Carpentry and Building* the greatest success.

Water-Proofing Outside Walls.

From W. H. W., *Baltimore, Md.*—The following method of making outside exposed walls water-tight is not only cheap, but, from experience, I know it will resist rain better than the so-called "iron-clad" paint.

Mix one-quarter good cement with one-half water, resulting in a mass of the consistency of milk or cream, which apply with a painter's brush in the same general manner as paint is applied, until the entire surface is covered. Let it dry until it becomes entirely hard, then paint with two coats of good boiled linseed oil paint.

Comments on the Design Receiving First Prize.

From K. O. A., *Newark, N. J.*—I noticed with much interest the announcement of the competition in designs for cheap dwelling houses in *Carpentry and Building* some two months since, and awaited with quite lively anticipations the publication of the designs which should be sent in response to that advertisement. In the July number, which is before me, appear the design, specification and estimate receiving the first prize.

In general, I am well pleased with the design. The house presents a neat, home-like appearance. There is nothing gaudy or flashy about it. It is temperate in its appearance throughout, and in its arrangement there is much to be commended. There is little or no waste room. Every inch of space seems to be utilized in the best manner. The absence of a chimney to which connection can be made from the parlor, seems to me to be a very serious objection. This also applies to the front bedroom on the second floor; and both of those rooms, it appears to me, would be improved by the introduction of mantels. The general features of the house are such as favor economical construction. The shapes work advantageously. There is very little expensive ornamentation; yet withal, I cannot see how such a house can be built for the price stipulated, and to this point I desire to speak particularly.

The specification, which to me appears to be a model of brevity and conciseness, leaves very little loophole for the builder. A good house must, of necessity, be constructed by whoever attempts to fill the bill laid down; and that brings me again to the point of saying I do not see how it can be built for $1000. I have carefully inspected the items in the schedule of estimate, and, being a practical builder myself of long experience, I am perhaps justified in taking exceptions to some of the figures therein contained. The fourth item in his estimate is: Plastering, $73 42. I figure 635 yards of plastering in the building, which, at 25 cents a yard, the price current in this neighborhood, is $158.75. Passing over the other items in the first column, the first item in the second column is: Cornices, $46. The best estimate I am able to make on the cornices is $105, not including finials. Windows are put down at $98, which I figure at $140. Painting and oiling is put down at $80, while the best bid that I have been able to obtain from painters in this vicinity is $150.

The conclusion at which I have arrived in this matter is, that while that house may be worth only $1000 in some sections of the country, it cannot be built for that figure in this neighborhood, or, to put it otherwise, anywhere in the vicinity of New York.

Having made an estimate somewhat carefully from the design and specification, as published in the last number, I inclose it herewith, thinking it may be of some interest to your readers. The total, as will be noticed, is $1778.46—almost double the total of the schedule as published in connection with the specification. This price, $1778.46, is as low a figure as I would feel justified in taking the contract to build the house shown and described. Of course, it represents a small profit to the builder. Perhaps the schedule of estimate as published in connection with the design did not include any profit. It is stated to be a schedule of estimate of actual cost. Possibly that means actual cost to the builder. My figure is cost to the owner, or, in other words, the contractor's selling price. The following is the estimate as I figure it:

Mason Work.

119 yards excavting, at 20c	$23.80
164 cubic feet concrete footing cause, at 12c.	19.68
20,790 Hard Jersey brick in foundation, at 90	187.11
3024 " " " in chimney, at 12c.	36.28
Thimbles and covers	1.80
936 square feet concrete cellar bottom, at 3c	28.03
635 yards plastering, at 25c	158 75
Area complete	12.00
Carting and traveling	15.00
Total	$482.50

Carpenter Work.

4779 feet spruce timber frame, at $26 per m.	$124.25
197 hemlock boards, put on, at 21c	41.37
Bridging floor	9.30
Exterior shingles, put on, at 10c	22.40
275 clap boards, put on, at 16c	44.00
38 pine weather boards, including putting on and battens, at 48c	18.24
275 2 x 4 inch wall strips, set	49.50
152 hemlock roof boards, put on, at 21c	31.92
Leaders and tubes	9.00
1368 feet shingling, put on, at 5c	68 40
3 finials, complete	15.00
Cornice, complete	105.00
Water table and corner boards	20 00
Front stoop	12.00
264 feet tin	18.48
Tank	10 00
Windows, complete	140.00
358 1 x 4½ T and G pine floor boards, laid, 20c	71.60
Doors and frames, complete	155.00
Base fitted, complete	43.50
Pump and sink, complete	20.00
Closets and pantries	13.00
Privy	12.00
Stairs	47.00
Nails	15.00
Carting, traveling, &c	30.00
Painting	150.00
Total	$1,295 96
Add Mason Work	482.50
Total amount	$1,778.46

Note.—We are pleased to publish the estimate prepared by the above correspondent, together with his remarks concerning the same. The question of discrepancy in price, we have reason to believe, is somewhat one of locality. Prices in New York and vicinity are undoubtedly higher than those current in other places nearer to the sources of supply of some of the principal building materials, and in localities where labor is cheaper and the cost of living less. We are inclined to think, however, that K. O. A.'s estimate is high for even this locality—not that we think the entire difference between his figure and a thousand dollars is what he has allowed for builder's profit, but that if a house to this design was to be built, and the contract was put in open competition, much lower figures would be obtained from bidders in the vicinity of New York who are entirely reliable. While we are altogether confident that the house could be built in Rochester, N. Y., at a cost not exceeding the figures named in the estimate furnished by the author of the design, we admit it would be probably impossible to build it at that figure in this vicinity. We understand the figures in the schedule of estimate furnished with the design to mean builder's cost, not the builder's selling price.

Referred to our Readers.

From A. J. O., *Rockville, Ont.*—Can any of the readers of *Carpentry and Building* give me a remedy for the cracking of paint and cement around chimneys and battlement walls? I want something that frost will not affect. By referring this to your readers you will greatly oblige.

From W. J. M., *Painted Post, N. Y.*—Will you please invite communications from your readers as to the best and cheapest method for deadening sound in floors. We have a school-house in which one room is placed over the other, and we desire to devise some plan which will overcome the annoyance caused by the noise.

From S. A. M., *Steward's Mill, Texas.*—Will some of your correspondents please give me the best method of laying shingles on the corners of a hip-roof.

From L. S, *Saint Paris, Ohio.*—Will some of the readers of *Carpentry and Building* kindly give me the ingredients used with cement to make sidewalks that will stand freezing?

From A. J. H., *Lowell, Mass.*—I desire to ask the experience of the practical builders among the readers of *Carpentry and Building*, as to the best method of ventilating a house which has been constructed with no provision for ventilation. I have thought of putting ventilators in the chimney flues near the ceiling, but fear that will affect the draft of the fires. If any of your readers who have had experience in this general direction will send information for publication, they will greatly oblige.

From P. T. C., *New York.*—Will some of your readers please give me the necessary rules for preparing and graining wood for picture frames? I desire to imitate different woods, root of walnut, &c.; also obtain various colors—gray, blue, &c. I would also be pleased to have stated the rule and material used for coloring an engraving in the angles of frames.

From H. R., *Pierson, Mich.*—Will some of your readers who have had experience in correcting defective acoustics in churches, halls, &c., kindly send an account of the methods they have found effective, for the benefit of your correspondent and other readers of *Carpentry and Building?* We have a church building in this place in which the echo and a ringing sound in connection with it are so considerable as to almost overcome the speaker's voice. We wish some method by which to correct this difficulty.

From J. E. M., *Montreal, Canada.*—I desire to ask, through *Carpentry and Building*, what is the best way to disguise the sapwood of pine so that it cannot be detected when used in sash, doors, &c.

From J. S., *Cameron, Texas.*—To state that I am much pleased with *Carpentry and Building* is not saying enough; therefore I put it, I am highly delighted with the new publication. I am certain it will prove a valuable aid to both beginners and advanced mechanics.

Will some of the readers of *Carpentry and Building* furnish a design for a small village school-house—frame—to cost from $1200 to $1500?

A Cheap Black Stain for Pine or White Wood.—Take 1 gallon of water, 1 lb. of logwood chips, ½ lb. of black copperas, ½ lb. of extract of logwood, ½ lb. of indigo blue and 2 oz. of lampblack. Put these into an iron pot and boil them over a slow fire. When the mixture is cool, strain it through a cloth and add ¼ oz. of nutgall. It is then ready for use. This is a very good black for all kinds of cheap work.

Hard-Wood Joinery.

We gave our readers, a couple of months since, some idea of the magnitude to which the trade in American joinery had already attained, but our observations then were principally confined to those productions which necessitated the consumption of pine; but a trade is gradually being developed by our enterprising cousins in hardwood joinery that promises before long to form no inconsiderable portion of their timber exports, and several large American firms already established here are pushing this branch of the trade, with every prospect of its becoming sufficiently lucrative to encourage competition on a large scale with those of home manufacture. In walnut, especially, the American manufacturers have great advantages for doing a profitable trade, as it is a wood spread over the principal part of the United States, and sufficiently ornamental in grain, as well as close in texture, for almost any work that this description of wood is generally used for.

In most of our public buildings, such as banks and other large public edifices, mahogany is the wood generally selected for the internal and exterior fitting, and this sort forms at least four-fifths of the hard-wood joinery of the country, and is at present wholly prepared at home, but it is with this portion of the wood trade that the Americans will at once come in contact. Now, it is well understood that in mahogany there is no chance of any foreign competition, as we, having such a direct trade with Honduras and the Spanish main, can always obtain the raw logs even cheaper than they could get them in the States. If we look at the prices (which are, by the bye, seldom quoted) mahogany fetches in the States, we shall find it quite as dear as it is here; consequently, it is hardly likely they could work it up cheap enough to make such a difference as the long freight between here and there would come to; but with walnut it is quite another matter altogether, and if they can put it on the market at considerably under the cost of mahogany, there is every probability that it will grow into favor, though as far as official buildings are concerned we do not think it likely that mahogany will be superseded by any other wood for a long time to come. Our ideas of office desks, bank doors, counters, "board" tables, &c., are so intimately associated with mahogany, that it would cause something like a revulsion of feeling to see them replaced by any other kind of material. Occasionally we meet with oak highly polished into that yellow tint so familiar to the eye in the Bank of England and some government buildings, but the chief of the fittings in most official residences are, as we said, mahogany, especially in private offices, and we expect it will be a long time before walnut will replace it for a similar work; but where the Americans expect to do a large trade is in doors for the superior class of houses and mansions, and no doubt every kind of furniture work where fancy woods other than mahogany are now used. They profess to prepare even this latter for our market, but we have given our reasons why we do not think there is any field for their enterprise in that direction, and no doubt they will make it secondary to the trade in walnut, which really promises them a fair prospect of success.

One peculiar feature of this manufacture among Americans is their preference for veneer over solid doors. Now, we confess to having always had a predilection for the latter, but after inspection of one of these walnut veneer doors, and hearing the arguments in its favor from the lips of one of the partners in a large joinery firm—a practical man—we were more than half convinced that veneer for doors was, as they put it, the best, solely on the ground of non-shrinkability Being made of pine cores, or small pieces, the door, when veneered over with quarter-inch walnut, has a toughness that those made out of the solid cannot attain, and the cores forming the frame are so adjusted with reference to grain that the greatest strength may be obtained. This method of veneering on a door made of pieces is quite novel. It must not be understood that the Americans do not manufacture solid doors from walnut, for they do very largely, and several consignments of such are now in store here; but they give the preference to the veneers, though more costly.—*British Timber Trades Journal.*

Japanning.

First provide yourself with a small muller and stone to grind any color that you may require; secondly, provide yourself with white hard varnish, japan gold size, and spirit of turpentine, which you may keep in separate bottles until required; thirdly, provide yourself with flake white, red lead, vermilion, lake, Prussian blue, king's and patent yellow, orpiment, spruce and brown ocher, mineral green, verditer, burnt umber and lampblack. Observe that all woodwork must be prepared with size and some coarser material mixed with it, in order to fill up and harden the grain of the wood; such, indeed, as may best suit the color intended to be laid on, which must be rubbed smooth with glasspaper when dry; but, in case of accident, it is seldom necessary to resize the damaged places, unless they are considerable. With the foregoing colors you may always match any one in use for japanning, always observing to grind your colors smooth in spirit of turpentine; add a small quantity of turpentine and spirit varnish, and lay it carefully on with a camel-hair brush, then varnish with brown or white spirit varnish, according to color.

For a black, mix up a little good size and lampblack, and it will bear a good gloss without varnishing over. To imitate black rosewood a black ground must be given to the wood, after which take some finely lixiviated red lead, mixed up as before directed, and lay on with a flat, stiff brush, in imitation of the streaks in the wood, after which take a small quantity of lake, ground fine, and mix it with brown spirit varnish, carefully observing not to have more color in it than will just tinge the varnish; but, should it happen on trial to be still too red, you may easily assist it with a little umber, ground fine, with which pass over the whole of the work intended to imitate black rosewood, and it will have the desired effect.

Work done by a good japanner by the foregoing rule, when varnished and polished, is scarcely to be distinguished from the real wood.

Varnishes.—A coat of varnish ought to possess the following properties: 1. It must exclude the action of the air. 2. It must resist water; for otherwise the effect of the varnish could not be permanent. 3. It ought not to alter such colors as are intended to be preserved. Rosins are the only bodies that possess these properties, and consequently must be used as the bases of varnish. For this purpose they must be dissolved, as minutely divided as possible, and combined in such a manner that the imperfections of those which might be disposed to scale may be corrected by others. Before a rosin is dissolved in a fixed oil it is necessary to render the oil drying. For this purpose the oil is boiled with metallic oxides, in which operation the mucilage of the oil combines with the metal, while the oil itself unites with the oxygen of the oxide. To accelerate the drying of this varnish it is necessary to add oil of turpentine. The essential varnishes consist of a solution of rosin in oil of turpentine. The varnish being applied, the essential oil flies off and leaves the rosin. This is used only for paintings. When rosins are dissolved in alcohol the varnish dries very speedily, and is subject to crack, but this fault is corrected by adding a small quantity of turpentine to the mixture, which renders it brighter and less brittle when dry. The colored rosins or gums, such as gamboge, dragon's blood, &c., are used to color varnishes. To give luster to the varnish after it is laid on, it is rubbed with pounded pumice stone and water, which being dried with a cloth, the work is afterward rubbed with an oiled rag and tripoli. The surface is last of all cleaned with soft linen cloths, cleared of greasiness with powder of starch, and rubbed bright with the palm of the hand.

Ornamental Tiles.

The earliest notice of tiles in the Scriptures occurs in the Book of Kings, in the description of Solomon's Temple. They have been made and used in China, for both interior and exterior decoration, from a date something like 2000 years B. C., at least so it is alleged. Whether the manufacture was carried from China into India and Persia, and thence into Egypt, Phœnicia and Assyria, or whether it was a native and spontaneous product of the countries named, is still a disputed question among authorities upon the subject. Indeed, it is uncertain whether India and Persia, or Egypt, Phœnicia and Assyria can justly claim the greater antiquity for their tiles. It was undoubtedly from the latter countries that the art found its way into Europe through Greece, where it was soon carried to great perfection, as described by the early writers, and as seen in the ruins of the temples and princely houses erected even some centuries B. C. Pliny speaks of a pavement composed of *tesseræ* or *lithostrata*, called the *Asaroton Œcon*, or the "Unswept Hall," which was a perfect representation of a floor after a banquet, showing the crumbs and fragments scattered about. From Greece the art naturally found its way to Rome, where the small pieces forming mosaic work were called *tesseræ* or *tesselæ*, from their resemblance to gamblers' dice. Hence the origin of our English word "tesselated." The legions of Rome, carrying civilization with them wherever they went, carried, of course, the art of pottery and tile making, so that examples or copies of Roman pottery and tiles are to be found scattered over Europe from ancient Gaul to Asia Minor. Then followed a period of darkness and decay. "Art was not quite dead, but it scarcely breathed." It was to be revived again, and from an unexpected quarter. Europe, which owes the preservation of its literature, science and art to the monastic system, which reigned supreme during the Middle Ages, owes the revival of tiles to the Mussulmans, Saracens and Moors, the former overrunning Southern Europe until totally defeated and hurled back by Charles Martel of France, in 732, the latter holding possession, more or less complete, of Spain until 1492. Granada, Cordova, Valencia, Seville and several other places were famous for their tiles and other ceramic productions, specimens of which can be seen in the fortress palace of the Alhambra at Granada, in the Alcazar at Seville, and scattered throughout Spain generally. Nor was it only in Spain that the manufacture of tiles was engaged in during the Middle Ages. Throughout India and other Mohammedan countries the art was extensively carried on in the decoration of buildings, mosques and the like, and very largely in the dwellings of the higher classes. The tomb of Solyman the Magnificent, at Constantinople, is lined with tiles of unsurpassed beauty of design; the pre-eminently grand mosques of Samarcand, the glittering capital of Tamerlane, are renowned for the splendor of their tile walls and floors; and so the list of conspicuous examples might include tombs, palaces, mosques, &c., not only in the principal, but also in many of the smaller cities of India, Asia Minor, and wherever the cry of "Allah and his Prophet" is heard. In Europe there was but little done in this art until our own day. Germany made large quantities of common tiles during the sixteenth century, followed by Holland with her famous "Dutch tiles." During the last century England and France, which had been making common tiles for several hundred years, manufactured considerable quantities of them, principally imitations of the Dutch, Roman and Moorish. It was not until 1840 that Mr. Prosser, of England, took out his patent for making tiles from dry, instead of plastic, clay in molds, which is the method now employed in making the plain tiles, so called. About the same date, after many years of experimenting, several other patents were taken out by different persons for various improvements in the manufacture, adding greatly to their quality, finish and capabilities, so that the modern manufacture of tiles dates back no further than some forty years.

Executive Ability.

Very few men are blessed with the talent of doing more than one thing well. In the economy of nature our gifts, as a rule, are few. One may be able to plan, but cannot excute, while his neighbor's executive ability is his strong point. This man is good at the bench, but lacks financial ability; another one can design china and earthenware, for example, of superior style, but falls short of success as a business manager. Similar experiences are met with in every trade. Men may succeed in the routine of designing, and in other departments, but when their success in any one of these encourages them to essay manufacturing, they are all at sea, simply because the latter position calls for the exercise of entirely different qualifications. Now and again we find notable exceptions to this rule. We meet occasionally with men who possess a combination of different and varied excellences, superior wherever they are placed; but on the whole such instances are rare—so rare, in fact, that the exception only proves the rule. Such men are successful. They must be, for they possess every requisite in the whole range of mechanical and executive ability. Other men, who know nothing practically about the details of construction and qualities of material, sometimes succeed, but they have an executive power well developed, and, supported by a clear judgment trained by experience, they master all difficulties. One class of men may not know how to draw the simplest pattern, but, on the other hand, they may possess good taste, which will enable them to decide whether a design is good or bad, and their discernment foretells its reception with the trade. Give them a basis and a plan, and they will complete the structure. On the other hand, those who have the practical routine thoroughly by heart, but lack the executive power, generally fail in their attempt to do business. What we wish to impress is the importance of executive talent. It is the all-powerful lever. It is not always a gift. In nearly every man there is a germ, which, with proper cultivation, will develop this trait to a certain degree. Young men learning the business should study it in all its bearings, and afford it every opportunity for growth. With it success is possible, even if mechanical genius and practical apprenticeship is wanting; but without it the best workman is unfitted for independent business operations. We do not urge this point to the exclusion of others, but we know its possession is imperative. Too much knowledge concerning the details of a business cannot be had, and, whatever else you lack, do not fail to cultivate the executive faculty.

Fine Polish to Wood.—There are a number of ways for finishing wood. The pores of the wood should be filled first with some composition for the purpose. "Wheeler's," Bridgeport, Conn., may be recommended. This is used by thinning the composition with turpentine to the consistency of flowing varnish; apply it to the surface of the wood with a brush, going over no more surface at a time than will admit being cleaned off before hardening. After the filler has set (having the appearance as if the gloss had left it), rub off with excelsior or cloth, rubbing across the grain when practicable; then clean out the crevices in the ornaments or moldings with stick and cloth or stiff brush; after which, with cloth or rag, thoroughly wipe the work off. Should the filler at any time wipe off too hard, or dry too fast or light for the work, add a little raw linseed oil, just sufficient for the purpose intended. Allow the filler eight hours to dry, if possible, and then apply varnish or whatever may be preferred to finish with. Different qualities of this come for different woods. It is necessary to use shellac or varnish after the wood filling to produce a high polish, leaving a day or two for each coat to dry; then scatter pumice-stone over the surface, and with a piece of hair cloth rub down well with oil, to remove all roughness left by the varnish Another method is to cover the wood with two coats of shellac, sand-paper and polish the surface with a flannel moistened with shellac and a very little oil. Or four coats of varnish may be applied, each being rubbed highly and allowed to dry for two days, when the surface must be rubbed with pumice-stone and water, and a coat of polishing varnish added.

Diseases of Trees.

Dr. James Brown, who has made the diseases of trees a special study, classifies them under: 1st, bark binding; 2d, lichen growth on the bark; 3d, stag-horn tops; 4th, scale; 5th, premature seeding; 6th, dropsy; 7th, ulcers; 8th, wounds; 9th, stunted growth; 10th, final decay. To these may be added the complaints of users of timber, which are excess of sap, doatiness and weariness.

1. Bark bound, means when the bark closes in such a way around the tree as to prevent the circulation of the sap and deposit of woody fiber, which always takes place between the bark and the outer layer of the wood. Longitudinal slits will remedy this, and may be as useful as horizontal slits are injurious.

2. The lichens are caused by a derangement of the bark, which gives them a foothold. The remedy is to clean them off.

3. Stag-horn topped is a derangement of willows and poplars, when growing in a soil too dry for them; and of elm, oak, and ash when the soil is too wet for them.

4. Scale is a parasite, an insect very common on the young ash.

5. Premature seeding means premature decay, and cannot be remedied; it is the result of unfavorable conditions surrounding a tree.

6. Dropsy is the result of an excess of stagnant moisture and of fat soil. The roots absorb what the tree cannot assimilate, and swellings are the result. Improved drainage of the ground is the remedy.

7. Ulcers are similar to dropsical swellings, but confiued to corniferous trees. They are like running sores on men, and give exit to the natural juice in the form of gum or resin.

8. Wounds are accidents to the bark, and if extensive are always fatal to the life of a tree; if not extensive and the tree otherwise sound, wounds will heal up, as they do in man.

9. Stunted growth is a consequence of the natural law of the survival of the fittest. In a forest many young trees have to die, as there is not room for all that attempt to grow up.

10. The final decay does for old tree what disease does for the young—it puts an end to their existence, as with man.

Finishing Carvings.—If oil is used, take care not to use too much. It is better to use yellow beeswax. Slightly warm it, rub it on a brush and apply it to the work, warming the work also. It darkens the walnut nicely, not too much, and takes a high polish with continued rubbing. But to pure beeswax many prefer the wax melted up with a little turpentine. This rubs on more easily, darkens the wood more and polishes beautifully. White woods must be stained, unless they are sufficiently white to look well when simply varnished. The best stains are oak and walnut stain without oil, particularly that rich brown stain used by the Swiss carvers.

Staining and Varnishing Boards.—Have the boards clean and let them be quite dry before you begin operations. Get some Brunswick and mix it with turpentine until it stains the color desired. Then paint the boards over with it, and when quite dry wash it over with glue size, and when this is quite dry, varnish with oak varnish. This is by far the best method, as it wears well, the boards being really stained and not painted only.

To Remove Spots from Furniture.—Take four ounces of vinegar, two of sweet oil and one of turpentine; mix and apply with a flannel cloth.

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ARCHITECTURE.

Competition Designs for Cheap Dwelling Houses.

Design Receiving the Third Prize.

We present in this number of *Carpentry and Building* the designs, details, specification and estimate of the house receiving the third prize in the competition advertised in the May number of *Carpentry and Building.* The author of this design is Mr. Thomas J. Gould, of Providence, R. I., who in a letter, not originally designed for publication, calls attention to the following special features in the arrangement of the rooms.

1. The sewing bay, with its little closet for work.

Third Prize Design for Cheap Houses.—Fig. 1.—Perspective View.—Thos. J. Gould, Architect, Providence, R. I.

2. The bedroom, which is so planned that an additional door or two would turn it into a nice little dining room and connect it with the closet.

3. The cellar stairs, which go directly out of the kitchen.

4. The room in back entry for refrigerator, and the coat and broom closet opening from the entry.

5. The central location of the chimney, which serves for the whole house.

6. The arrangement of rooms on the second floor, and the ample provision in the way of closets. Also the place for trunks under roof over pantry closet.

Specification

Of materials to be furnished, and labor to be performed, in the erection of a dwelling for ——— ———, in accordance with the plans, elevations and detail drawings made and to be made, and this specification prepared by Thos. J. Gould, Providence, R. I.

MASON WORK.

Excavation.—Cellar to be excavated so as to be 7 feet 6 inches deep from top underpinning when finished.

Walls.—Cellar walls to be of ledgestone, 16 inches thick, laid dry and started on good ledgestone, laid in trenches one foot below cellar bottom. Walls to cellar entrance to be laid in same manner up to the level of grade, and capped with 3 x 8 inch bluestone.

Underpinning to be laid up of good, hard-body North River brick, laid in lime mortar, the mortar to be colored black.

Foundations under chestnut posts to be large, flat stones, well bedded below cellar bottom.

Chimney.—Build chimney of hard-body brick, laid in lime mortar and topped out through roof with selected North River "Whitbeck" brick. Build in cast-iron funnels where chimney passes through rooms.

Painting.—Paint the inside of the cellar walls and whitewash the same.

Openings to be left for drain, gas and water pipes.

Lathing and Plastering.—Lath all the walls and ceilings in two stories with spruce laths, four nails to each, the end joints broken at every sixth lath.

Plaster all walls and ceilings, two stories, one good coat of brown mortar, and trowel-smooth it for papering.

CARPENTER WORK.

Frame.—The house to be framed from sound, square-sawed spruce timber of the following sizes: Beams in cellar, 6 x 8 inches, resting on chestnut posts; sills, 4 x 6 inches; posts, 4 x 6 inches; window and door studs, 3 x 4 inches; intermediate studs, 2 x 4 inches, 16 inches from centers; floor joist, 2 x 8 inches, 16 inches from centers, doubled at partitions; plates, 4 x 4 inches; rafters, 2 x 6 inches, 2 feet 6 inches from centers; hip and valley rafters, 3 x 8 inches.

Outside boarding and under floors to be 1-inch hemlock, planed to thickness, laid close joints and well nailed.

Shingles.—Shingle the roof with good quality Eastern-shaved cedar, laid not over 5 inches to the weather and well nailed. The shingles on the side-walls, second story, to be sawed pine, those in the gables over windows to have the corners clipped.

Clapboards—To be of good quality sap clear pine, planed and jointed, laid 4¼ inches to the weather, well nailed and nail-heads set. One thickness of paper under clapboards around finish.

Gutters—To be built on top of roof boards and lined with I C roofing tin. Valleys and flashings to be furnished and put in.

Conductors—To be furnished and put up of galvanized iron, 2½ inches in diameter.

Trimmings—To be of clear white pine, worked clean and smooth, and put up straight and smooth, and well nailed.

Window Frames—To be made of 1⅜-inch white pine, jambs and architraves. The cellar window frames to be made of 2-inch clear white pine.

Sash.—Furnish and put in sash 1 5/8 inches thick, made from clear white pine, and glazed with second quality of French sheet glass, well bedded, puttied and tinned.

All sash to be sprung with good stout springs, and to have thumb-pieces.

Verge Boards—In the gables to be made of 2-inch white pine, worked straight and true, as per details.

Third Prize Design for Cheap Houses.—Fig. 2.—Front Elevation.—Scale, 1/8 Inch to Foot.

Outside Blinds—To be a rolling slat blind, well hung, and to have good stout trimmings.

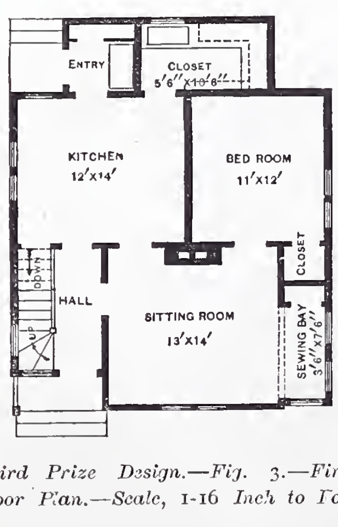
Porch—To have a 1 1/8-inch hard pine floor, the steps to be made of 2-inch clear white pine.

Partitions—In the interior to be of 2 x 4 inch spruce studding, set 16 inches from centers, studs doubled at doorways, and a header cut in over. All partitions and floors to have one row of cross bridging.

Cross Pin all the ceilings in the first and second stories with 7/8 x 2-inch spruce strips, 16 inches from centers.

Gas Pipe the house, putting in drop lights in the two main rooms, and side lights in all others.

Floors.—The finished floor in the first story to be 1-inch dry spruce, narrow boards, planed and matched, and have one thickness of paper between upper and under floors. Second story floor will be single spruce floor.



Third Prize Design.—Fig. 3.—First-Floor Plan.—Scale, 1-16 Inch to Foot.

Stairs—To be built as shown on plans with 1 1/8-inch white pine treads, 7/8-inch risers, 4 inch hard wood rail, 2-inch turned balusters, and 5-inch turned newel post. String to be pine and bracketed. The newel and balusters to be of white wood.

Interior Finish—To be of clear white pine, the windows and door casings to be 5 and 5 1/2 inches, as the case may be, and to be made in one piece of 7/8-inch stock, with molding on each edge; and in the best rooms five scratch beads through the center of the architrave. All windows to have molded sills. Base boards to be 7 inches wide, with molding on top edge.

Doors.—The front and back doors to be 1 3/4 inches thick, paneled, as shown on elevation, and to have brass-faced mortise locks and night latches. The knobs and bell-pull to be of solid brass. All inside doors between rooms to have good mortise locks and latches, and all press doors good mortise latches.

The doors of living room, hall and bedroom to have white porcelain knobs and escutcheons; all other knobs to be dark mineral knobs. All doors to be hung with good cast iron loose joint butts.

Closets.—The pantry closet to have shelves and drawers and cupboards, and to have in the counter shelf a cast iron 3 foot 6-inch sink supplied with water, and to have waste pipe to drain.

Bell.—Furnish and put in a bell in kitchen and connect with front door with wire, and furnish bell-pull to match door knob.

Hardware.—Furnish and put on all the hardware and trimmings of the various kinds for closets, clothes presses, &c., and of good quality.

Mantel.—Carpenter to put up a pine shelf in living room, with iron bracket under.

Painting.—Paint all the exterior woodwork two good coats of pure white lead and oil in dark colors. Putty-stop all nail-heads and cracks between priming and second coats.

Draw all sash two coats pure lead and oil inside, and India red and vermilion outside. Paint all interior finish, except floors, three coats of pure white lead and oil in colors; putty-stop all nail-heads and cracks, and put on one coat of gum shellac, dissolved in alcohol, between first and second coats.

The hard wood to have the grain filled and have three coats of gum shellac, and when hard, rubbed down with pumice stone and oil. The whitewood to be shellaced. Kitchen and back entry painted in dark colors. Porch floor to be oiled.

Estimate

Of materials and labor in house submitted by Thomas J. Gould. (Third prize.)

MASON'S WORK.	
Ledge stone laid dry	$70
Body brick laid in lime water	50
Plastering	100
Blue stone	3
Total	$223
CARPENTER'S WORK.	
Spruce timber	$58
Hemlock boards	35
Spruce floors	30
Shingles	58
Clapboards	12
Pine lumber	112
Tinning	15
Sash, blinds and doors	80
Painting	112
Labor	200
Hardware	65
Total	$777
Recapitulation.	
Carpenter's work	$777
Mason's work	223
Total cost	$1000

Dry Rot in Timber.

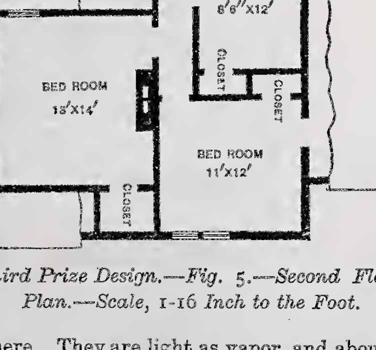
To understand the nature and effects of dry-rot we must first glance briefly at the structure and properties of wood. The mass of the trunks of timber-trees consists of slender, short fibers, with tapering ends, which overlap each other; but this overlapping does not prevent the passage of sap through them. At first these fibers are hollow, but are gradually filled by the deposition of solid matter from the sap within them. The strength of wood is due to the shortness and overlapping of the fibers, and to the presence of this deposit. Woody fiber pervades the tree from the tips of the roots to the extremities of the branches, and is the chief organ of circulation. A current of sap passes upward through it, from the roots to the leaves; and another current, containing the products of leaf action, passes back from the leaves and is distributed for the uses of the tree. As wood grows older it grows darker, particularly in the center of the stem or heart. This darkening is due to the deposit within the fibers, and when a tree reaches maturity, the fibers are so filled as no longer to join in the general circulation. Now, this inner or heart wood is less liable to decay than the outer or sap wood, and sap, as is well known, is the agent of destruction. Sap is water, with sugary, saline, albuminous, mucilaginous and gummy matters dissolved in it, and such solutions ferment easily and rapidly. Fermentation is a state of vegetable matter in which the various molecules—sugary, oily, albuminous, &c.—exert their peculiar attractive and repulsive powers, forming new combinations, which at first change and at length destroy the texture of the substance of which they were formerly a part. Every one knows the smell of pure, fresh wood. If you bore into wood in which the sap has just begun to ferment you get a vinous smell, which is soon followed by the smell of putrefactive decay, unless means are taken to arrest the chemical changes that are in progress. This decomposition of wood containing sap is ordinary rot, or wet-rot. It is the most general and the most fatal cause of decay in wood; but it has attracted less attention than the more startling, but less common, evils of dry-rot, and the destruction of timber by insects.

The seasoning of wood, whether naturally or artificially, is simply the evaporation of its sap. Decay cannot occur in well-seasoned wood if it is kept dry. It matters little whether wet is applied to timber before or after the erection of a building; it cannot resist the effect of what must arise in either case; for heat and moisture will produce putrid fermentation. In basement stories with damp under them, dry timber is but little better that wet, for if it is dry it will soon be wet, and decay will only be delayed while the timber is absorbing moisture; and the amount it receives will depend upon the closeness of the deposit within its fibers. This mixture dissolves the substance held in solution by the sap, and fermentation begins, with its usual train of consequences.

Third Prize Design for Cheap Houses.—Fig. 4.—Side Elevation.—Scale, ⅛ Inch to the Foot.

Dry-rot is one of these consequences. Ordinary decay must have begun before dry-rot sets in. When the moisture in wood begins to ferment, whether it be the natural sap, or the water absorbed by seasoned timber, the conditions are ripe for the inroads of dry-rot, which can no more occur without moisture than wet-rot. The immediate agent of destruction, in this case, is of vegetable origin. It takes its name from the dust to which it reduces timber. The degree of moisture which is favorable both to natural decay and to the growth of plants is essential to the process of dry-rot. The vegetation that produces it belongs to the natural group of fungi. This group is made up of plants having distinct vegetative and reproductive systems, and their best known representative is the common mushroom. If you examine the mold on which this singular plant is seen to grow, you will find it penetrated with delicate, whitish, interlacing filaments which are the vegetative system of the plant. This part of a mushroom is called the *mycelium*, and from it arises the reproductive portion which grows above ground. But the only part of this aboveground portion that is essential, and that is found in all fungi whatever, is just that part which escapes ordinary observation. Everybody has seen the umbrella-like cap with the radiating vertical plates on its under surface. These plates are covered by a membrane which has the same office as the seed-vessel of the higher plants. It bears the minute reproductive bodies of the fungi, analagous to common seeds, and called spores.

The only parts of a mushroom which are common to all fungi are the mycelium or thready, interlacing portion which grows underground, and the minute, microscopic spores which are cellular in structure and so small that thousands of them are required to form a body the size of a pin's head. The fungi differ among themselves in many ways; but mycelia and spore production always occur in them, and are their essential characters. Every plant of which this mycelium forms a part, spreading its web throughout the substance on or in which it grows, belongs among fungi. Most of the species are either quite invisible, or else their parts are so small as to be indistinguishable. But some sort of reproductive organs exist, and spores are always produced. The mycelium is often so minute as to traverse living plants and the pores of solid wood. It grows rapidly and causes quick decay. Potato-rot, the yeast and vinegar plants, mildews, rusts and smuts of grain and molds of all kinds, are part of this immense group of plants that lives upon decay and fills the air with its countless myriads of spores. These subtile, germinal particles are lodged everywhere. They are light as vapor, and abound in air, in water, in dust, in sand, ready, when warmth and moisture favor, to burst into life. As has been said, the dry-rot fungi flourish upon the products of wet-rot. Different stages of decay produce food of different qualities, adapted to different species of fungi. One species takes up the process where another leaves it, and carries it further and further forward.

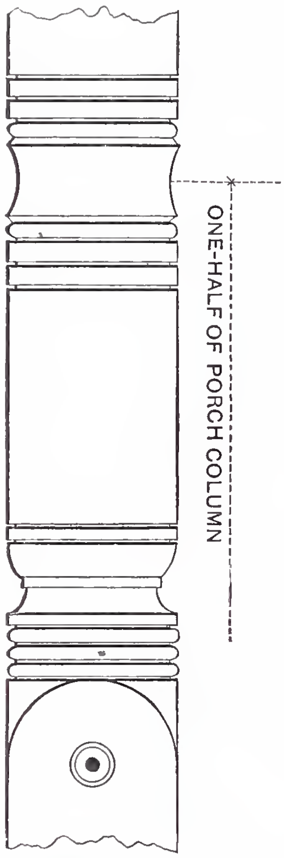


Third Prize Design.—Fig. 5.—Second Floor Plan.—Scale, 1-16 Inch to the Foot.

Dry-rot may begin its ravages in the interior of timber as easily as upon the surface. As atmospheric dust is filled with the spores of fungi, they may be conveyed by rain into the earth, absorbed by the roots of vegetables and diffused with the sap throughout the whole plant. There are numerous species of dry-rot fungi adapted to different conditions of life and present different aspects. Nor are they restricted to timber. They may flourish in the earth, where they present a perfectly white mycelium, branching and interlacing like roots; and when workmen are employed on grounds which are affected by the dry-rot fungi their health is often disturbed. A few years since, while a London builder was putting up some houses at Hampstead, his men were never well. He afterward learned that the ground was affected by rot, and that, within one year after the house was erected, all the basement floor was in a state of premature decay. In cases of dry-rot, where the mycelium passes through substances from the external surface, it separates into innumerable small branches; when it proceeds from slime in the fissures of the earth, the mycelial fibers shoot in every direction and are very much tangled. Arising from the roots of trees, they look at first like hoar frost, but soon show regular toadstools. When they grow in very damp situations, they feel fleshy and extend equally around a circular space, which they wholly cover unless obstacles interpose.

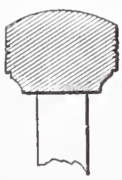
Without attempting to discriminate among the fungi causing dry-rot, it may be stated generally that, in timber that has been only superficially seasoned, this disease often arises internally, and has been known to convert the entire substance of a beam, excepting an inch or two at the surface, into fine, white, and thread-like vegetation, which forms a thick, fungous coat at the ends of the beams, otherwise appearing perfectly sound. This has often been observed in large girders of yellow fir which have seemed sound on the outside. Major Jones, R. E., states of a building in Malta, that "the timbers had every external appearance of being sound, but on being bored with an auger they were found internally in a total state of decay."

The first symptoms of dry-rot in timber are swelling, discoloration, moldiness and a musty smell. As the disease advances the fibers shrink lengthwise and break, presenting many deep fissures across the wood; finally, the cohesion of the wood is utterly destroyed, and at the least disturbance it crumbles to powder. Before it has time to destroy the principal timbers in a house, it gets behind the skirtings, dadoes and wainscotings, drawing in the edges of the boards and splitting them both horizontally and vertically. When cleared of the fungus they look like wood that has been charred. Though affected but a short time, a slight pressure will break them asunder; and, when examined, the fibrous fungus will be seen closely attached to the decayed wood.



Third Prize Design.—Fig. 6.—Detail of Porch Column—Scale, 1½ Inches to the Foot.

Timber that is floated down rivers and conveyed from place to place in ships is very liable to this disease. It is said of the exports of timber from Canada to England that few cargoes in the log arrive in which, in one part or other of almost every log, you will not see the beginning of this rot, either as reddish, discolored spots, which, when scratched by the nail, show that the texture to some little depth has been reduced to powder, or else the white fibers themselves may be seen growing. If the cargo was shipped dry and had a rapid passage, the case is not so bad; but when



Third Prize Design.—Fig. 7.—Detail of Hand Rail—Scale, 1½ Inches to the Foot.

shipped wet and the voyage has been prolonged, white fibers will be seen growing over nearly every part of the surface of every log, especially if they are of yellow pine, red pine and oak.

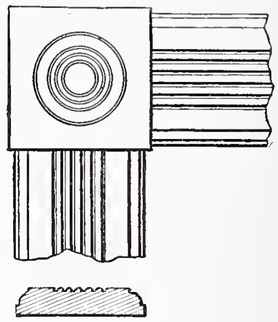
When deal (pine planks) is shipped wet in Canada, it is also covered with a network of white fibers on its arrival in England, and even when shipped tolerably dry the fungus will be found upon some of the pieces. When they have been floated down our rivers and shipped as soon as they were taken from the water, at the end of the voyage they are often so covered with this network of mycelial fibers that force is necessary to separate them, and they will grow together again in the barges before being landed. If deals in this state are piled flatwise, a whole pile will become deeply affected with rot in six months. In some instances the rot penetrates to the depth of one-eighth of an inch. The decay may be arrested by sweeping the surface of each deal, and repiling them upon their edges during dry weather. The ships which carry this timber, though built of good, sound, well-seasoned oak, must be carefully dealt with, or they will become affected. It is usual to scrape their surface as soon as they are clear of the cargo, and sometimes the hold is washed with a desiccating fluid. The effects of dry-rot upon European deals are very similar to those exhibited by Canadian deals. Decay is more rapid in white deal than in yellow, for the white deal absorbs more water than yellow deal. In the same way yellow deal absorbs more water and decays faster than red deal.

An example of the rapid decay of timber from dry-rot was given by Sir Thos. Deane in 1849, before the Institution of Civil Engineers in Ireland. It occurred in the Church of the Holy Trinity in Cork. On opening the floors under the pews a most extraordinary appearance presented itself. There were flat flungi of immense size and thickness, some so large as almost to occupy a space equal to the size of a pew, and from one to three inches thick. In other places fungi appeared growing with the ordinary dry-rot, some of an unusual shape, in form like a convolvulus, with stems from a quarter to half an inch in diameter. When first exposed the whole was of a beautiful buff color, and emitted the usual smell of the dry-rot fungus.

During a part of the time occupied in the repairs of the church the weather was very rainy. The arches of the vaults having been turned before the roof was slated, the rainwater saturated the partly decayed oak beams. The flooring and joists, composed of fresh timber, were laid on the vaulting before it was dry, coming in contact at the same time with the old oak timber, which was abundantly supplied with the seeds of decay, stimulated by moisture, the bad atmosphere of an ill-contrived burial place, and afterward by heat from the stoves constantly in use. All these circumstances accouut satisfactorily for the extraordinary and rapid growth of the fungi.

The decayed state of a barn floor attacked by rot is thus described by Mr. B. Johnson: "An oak barn floor which had been laid 12 years began to shake upon the joists, and on examination was found to be quite rotten in various parts. The planks, 2½ inches in thickness, were nearly eaten through, except the outsides, which were glossy and without blemish. The rotten wood was partly in a state of snuff-colored, impalpable powder; other parts were black, and the rest clearly fungus. No earth was near the wood."

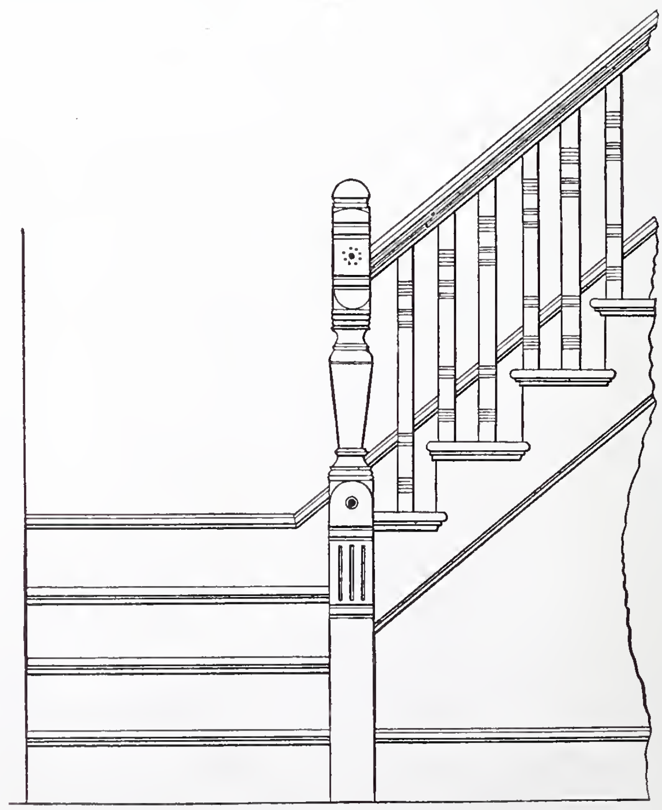
An indication of dry-rot in a damp pantry will be a coating of fine powder, like brick-dust, upon the shelves and earthenware, which consists of myriads of reddish spores shed by the dry-rot fuugus. When these



Third Prize Design.—Fig. 8.—Detail of Door and Window Trimming.—Scale, 1½ Inches to the Foot.

spores fall upon a wet surface, the red skin cracks at both ends, and fine filaments are sent out, which grow and ramify in all directions, aud do their work of mischief with the timber of the closet.

Ventilation as a remedy for dry-rot in buildings is of doubtful service. If dry air be admitted in such a way as to absorb the moisture which sustains it, the fungus will, of course, be destroyed; but the trouble is that the circulating air will carry the spores along with it, and so spread the disease to unaffected parts. This is the great danger with dry-rot, while the wet-rot or ordinary decay is only communicated by actual contact. Another difficulty in ventilating for dry-rot arises from the fact that air, in passing through damp places, soon becomes humid and loses its efficacy, or even does more harm than good. Intestinal decay is not reached by ventilation, for the air cannot penetrate the spongeous exterior rottenness of timber so affected.

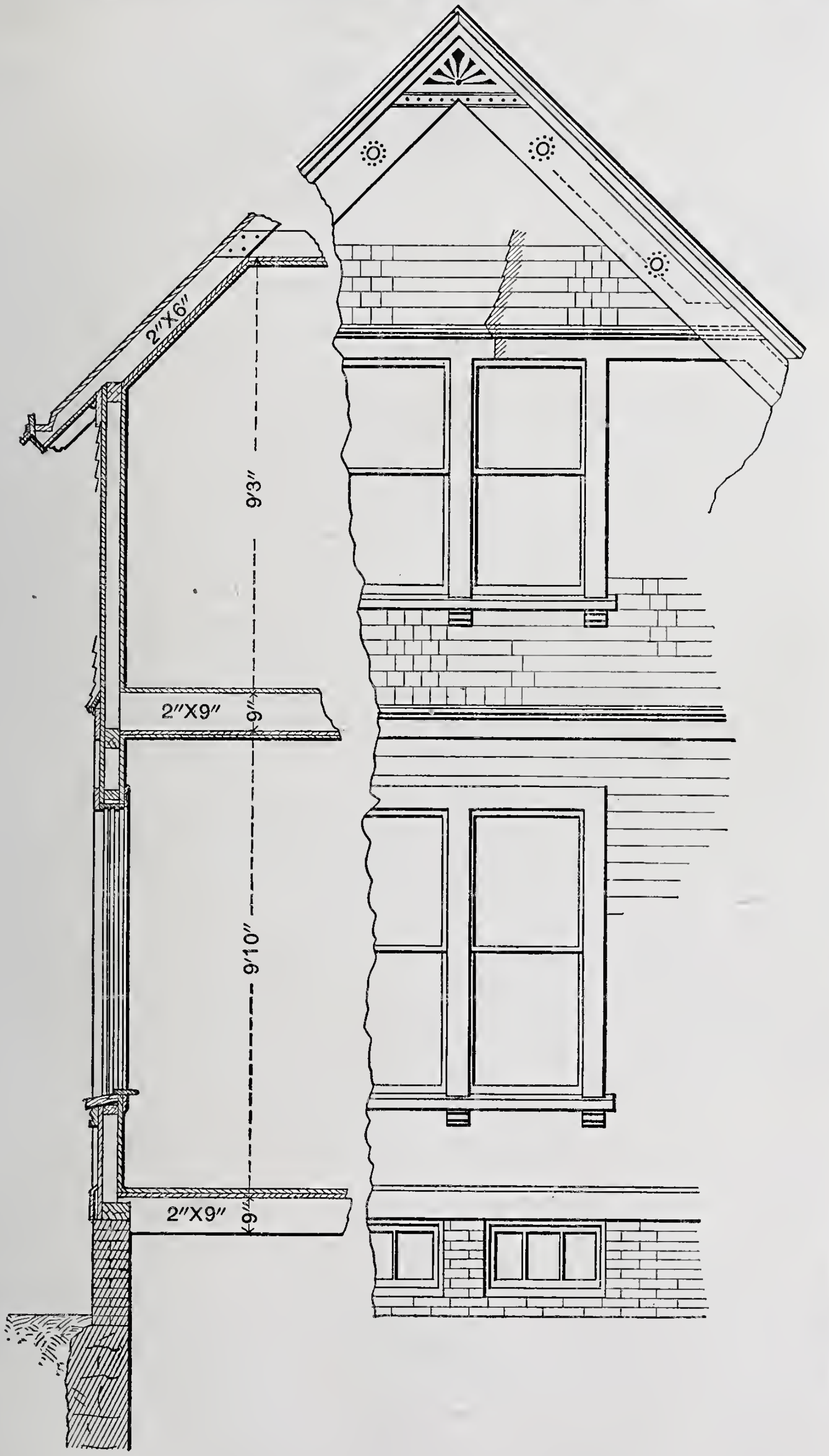


Third Prize Design.—Fig. 9.—Stairway.—Scale, ½ Inch to the Foot.

The temperature at which dry-rot proceeds most rapidly is 80° F. At 90 degrees it is slower, and at 100 degrees slower still, and from 110 to 120 degrees is generally arrested. Its progress is rapid at 50 degrees, slow at 36 degrees and is arrested at 32 degrees, but will return if the temperature is again raised to 50 degrees. But in a constancy and equality of temperature, timber will endure for ages. The wooden piles on which Venice and Amsterdam are founded, remain sound because of the constancy of the conditions that surround them. Nothing is more destructive to wood than partial wetting. If it be kept always wet or always dry, and at a steady temperature, decay does not begin. It is recorded that a pile was drawn up sound from a bridge on the Danube that parted the Austrian and Turkish dominions, which had been under water 1500 years. It has been remarked that the part of a ship which is constantly washed by bilge-water is never affected by dry-rot, and that the planking of a ship's bottom which is next the water remains sound for a long time, even when the inside is quite rotten.

As the decay of wood is chiefly due to the presence in it of sap, and as dry-rot can only thrive upon decaying timber, it is apparent that the best protection against both these evils is careful seasoning. When wood dries gradually in the air by the process of natural seasoning, it should be placed in a dry yard and sheltered from sun and wind. This method may be recommended for specimens of moderate thickness, and the time needed is two years for timber used in carpentry, which in this period loses one-fifth of its weight. Four years are needed for timber that is to be used in joinery, in which time it will lose one-third of its weight. It is important that timber be reduced to its proper size for use before seasoning, for, however dry it may become, when it is cut smaller it will shrink and lose weight. At first the seasoning should proceed slowly, and the pores upon the surface should remain open to permit the free evaporation of internal moisture. It should be set on bearers to admit a circulation of air all around it. The sleepers at the bottom of the pile should be perfectly level and solid, for timber bent in seasoning will retain the same form when dried. The time required for drying under cover is shorter than in the open air in the proportion of five to seven. Three years are required to season ship timber; the timbers are shaped a year before they are formed, and then left a year in a skeleton shape to complete the seasoning.

Sappy timber that must be seasoned quickly, in cases where strength is not chiefly required, should be immersed in running water as soon as felled. It should be chained down beneath the surface, as partial immersion is very destructive. Boards placed end on at the head of a mill race for two or three weeks, and then set upright in the air and turned daily, are said to floor better than timber that has been years in dry seasoning. The longer wood has been under water the faster it dries. The process of water seasoning is easily explained. Sap is denser than pure water, and it is inclosed in membrane. By osmotic action pure water takes the place of the sap, and so renders the wood less liable to ferment. Again, pure water evaporates more readily than water which contains certain principles in solution, and hence water-soaked timber dries more rapidly. Timber steeped in water has some of its substance dissolved thereby. Boiling and steaming are said to prevent dry-rot by getting rid of spores and coagulating albumen.



Third Prize Design.—Fig. 10.—General Detail of Construction.—Scale, ¼ Inch to the Foot.

Durability of Shingles.

A correspondent of one of the agricultural papers calls attention to his experience with chestnut shingles. He says: "A dozen years ago the buildings at Maplewood farm were roofed with chestnut shingles, and although shingles of this kind were highly recommended by many, they have proved a poor investment. The buildings need new roofing now.

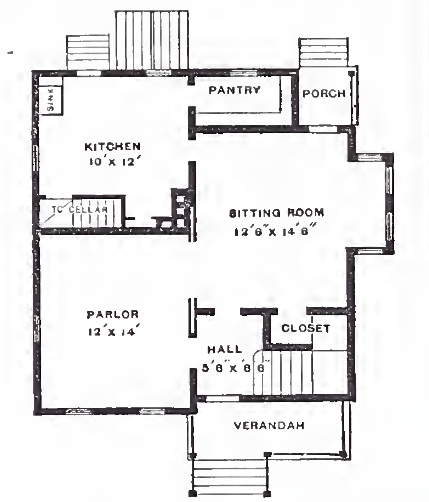
"The advantage claimed for chestnut shingles was their durability. So far was this claim from being well founded, that it is evident that hemlock shingles will remain undecayed longer. Chestnut shingles make an excellent barometer. During dry weather they warp and curl up badly, causing the roof to present an unsightly appearance, but on the approach of rain they become flat again. This peculiarity loosens the nails and injures the roof. It is true that on this account they do not retain moisture as long as other shingles, but after all they do not make a nice roof, and it is proven that they are not durable. Good white pine shingles are, in my opinion, the cheapest, all things considered.

"One of my neighbors tells me that he has tried the experiment of dipping shingles in whitewash before using them, with the best results. Their lasting qualities are much improved, nearly doubled. It is a simple process, yet of much benefit if the results stated are obtained. I have seen buildings roofed with shaved pine shingles which remained good for thirty years. A good coat of paint in many cases, applied every two or three years, will prove a profitable investment. Yet many people believe they cannot afford it."

Roman Mortar.—The famous Roman mortar, which has stood the test of use better than any other known to man, was prepared with great care. D'Avigdor says that the material now called Roman cement was quite unknown to the Romans, nor did they use natural hydraulic limes or artificial Portland cement. Their mortar was composed as follows: One part slaked (rich) lime; one part brickdust (known in India as Toorkee, and used there for the same purpose), and two parts clean river sand. If quarry or pit sand was to be had (which they preferred), three parts of the latter were substituted. The care used in storing the sand, lime and brickdust far exceeded the precautions now taken even by the strictest resident engineer. They excavated immense pits, lined them with masonry and erected a roof, or even a vault over them. Here the sand, after being screened, was secured from the influence of the weather. The lime was specified to be slaked a year before using. It was spread out in large sheds, and the slaking was carried on by the influence of the air almost without any admixture of water. When hydraulic mortar was required, the Romans substituted puzzolana for the brickdust. This was carefully screened and kept dry; in short, the mortar makers of ancient Rome, who never did anything all their lives but mix mortar, went through their work with much care and accuracy.

A Correction.

By an error upon the part of our engraver, which we failed to detect until our last number had gone through the press, the first-floor plan of the second prize design was made to appear without a door between the hall and the sitting-room. An apology for the error is due Mr. Hopkins, with this explanation. We herewith reproduce the first-floor plan of



Second Prize Design.—Fig. 2.—(*Corrected.*) *First Floor Plan.—Scale,* 1-16 *Inch to the Foot.*

the second prize design, with the door shown as it appears upon Mr. Hopkins' original drawing.

Lightning Rods.

There is a great deal of ignorance and misapprehension shown in the construction of these intended protectors, many of which are so defective as to be worse than useless, inviting the very destruction they should avert. The senseless quackery of "magnetic points," "insulators" and "twisted tube" is insisted on, and the important things—thorough connection with the earth, continuity and weight of metal—are overlooked by those who make the articles to sell. The scientific principles involved are for the most part simple and perfectly understood; the only question is how to accomplish the object economically. In respect to this there is undoubtedly room for difference of opinion, as some important data are still uncertain, but there is not the slightest difficulty, if one is willing to bear the expense, in arranging a system of conductors which shall be an absolute protection.

The lightning rod has two distinct offices to perform—one purely prophylactic, the other remedial—it prevents, or tends to prevent, the lightning from striking by silently drawing off the charge of the cloud as it approaches, or, failing in this, it furnishes a safe channel for the fire. The preventive action does not require a large, or, in many respects, carefully constructed conductor. A mere wire, as large as an ordinary telegraph wire, armed at the top with a sharp point, well elevated above the building to be protected, will do all that can be done in this line, even if its earth connection be very imperfect. Whether, however, the amount of electricity thus drawn off amounts to much as compared with the whole charge of a thunder-cloud, and whether the number of actual lightning strokes is materially diminished by this prophylactic action, is a question warmly disputed and not easily settled. It is quite certain that any rod worth putting up must be adequate to protect from an actual discharge. To do this, it must be large enough, continuous, and thoroughly connected with the earth. Just how large is "large enough" is not easy to determine. Unquestionably, a solid rod of iron one inch in diameter, or one of copper of half the size, fulfills the condition. There is no case on record, so far as we are aware, of such a rod having been melted, or even heated red hot, by lightning. Probably a somewhat smaller conductor (say ¾-inch diameter) would answer; but smaller than that could hardly be warranted as absolutely secure, though in multitudes of cases heavy charges have been safely disposed of by rods of not more than half an inch in diameter. There is a trifling advantage in giving to the metal a form exposing more surface than a round rod does, because the conductor becomes less heated by the discharge. But no amount of spreading out of the surface can atone for want of material. An iron rod weighing much less than 24 ounces to the foot is hardly worth putting up; 8 ounces would do for a copper rod. Of course, it is not necessary, or even desirable, that all the metal should be concentrated in a single conductor; for several reasons, two rods are better than one weighing as much as both together, but they cost more.

It goes without saying that the conductors must be continuous from the pointed summit to the earth. In this respect the rods now commonly erected are unexceptionable, the joints being effected by screw couplings, the conductivity of which fully equals that of the rod itself. The most difficult condition to fulfill is that of a satisfactory earth connection. It is not enough that the rod should reach and penetrate the ground a few feet, nor even that it should reach wet earth or terminate in a well. It ought to expose a surface of many square feet under ground, and it is safe to say that in the country and in ordinary cases the underground portion of the rod ought to cost more than that exposed to view. In towns, where gas or water mains are accessible, the best possible "earth" is obtained by carrying the rod under ground directly to the pipes, provided they are not less than an inch and a half in diameter. If they are smaller than this, a heavy discharge of lightning might cause leakage. The connection should be made under ground rather than inside the building, because less damage would result from any imperfection in the connection. Where it can be avoided, the rod ought not to be allowed to come within several feet of any pipes above ground. However perfect and adequate a rod may be, there is always a powerful tendency in the lightning to distribute itself to every earth conductor in the neighborhood, so that if a gas or water pipe comes near a conductor, a part of the charge is almost certain to strike to the pipe, shattering or setting fire to the intervening substance, whatever it may be. If the rod cannot be kept away from the neighborhood of the pipes, it should be carefully put in metallic connection with them at the point of nearest approach. The only danger then is, that the service pipes in the house, not being large enough for safe conduction of the lightning, it may cause leakage, or even inflame the gas. But the risk is less than it would be from a discharge without the connection. In England, where lead gas pipes are much used, a number of fires have occurred of late from lightning striking through the wall of a building between a rod on the outside and a gas pipe inside—the pipe melted and the gas took fire.

In the country, where no earth connection can be obtained through a system of metal pipes, it is necessary to be at a considerable expense of labor and material. The rod should run under ground to a horizontal distance of not less than 30 or 40 feet, penetrating deep enough to reach permanent moisture, and the ditch in which the rod is laid should be partly filled with scraps of metal, such as old cans and clippings from the tinsmith's, which greatly increase the surface of contact between the conductor and the earth. Charcoal will do, if metal clippings cannot be had, but is not so good. The point at the top of the rod should be gilded or platinized, to prevent rusting. It is not of much use to try to make it such that it will resist lightning without being blunted by melting; if struck, it should be examined and the damage repaired, which will only cost a trifle. The glass insulators which are usually employed are of no use whatever. A discharge too feeble to jump across an inch or two of wet glass will do no harm any way. Still, they are probably harmless, and if people like to pay for them nobody need object. The faults of ordinary lightning-rods are usually defective ground connection and an insufficiency of metal in the rod. A conductor too slender is likely to fail in emergency; one with a poor "grounding" is a standing invitation to destruction—not a protection, but a menace.

Without a Trade.—In every country, notably in every large city, men are always wanting employment without any training to do any particular thing. Ask them what they want to do, or what they can do, and they cannot tell. They are anxious to earn money, without understanding how to earn it. They have neither trade nor vocation; yet they wonder why they are not employed. This has been the case with thousands and tens of thousands here and everywhere during the last five years of dull, hard times, owing partially to the fact that nowadays boys in cities have not the chance they used to have to engage in mechanical pursuits. Thirty years since, an American father could select a trade for his son or sons, and have them learn it thoroughly, so that at maturity they could be skilled workmen. Many men of means put their boys at a trade, that they might, in case of need, gain a livelihood by it. They found out the boy's aptitude for this or that branch of labor, or consulted his inclination, and set him to learn what he was fitted for, or wanted to undertake. This is no longer feasible. A boy cannot, as a rule, exercise any choice. He must accept what offers. The rules of trade unions exclude, even prohibit, boys from entering worshops, and many industrial establishments are closed against them. This is a serious evil. Certainly, Americans should be encouraged, not deterred, from giving their sons a useful trade.

The Export Trade in Staves, Shooks and Hoops.—"The great majority of the sugar and molasses hogsheads which are emptied of their contents in this city," says the Boston *Commercial Bulletin*, "find their way back to the West Indies again. The hogsheads are purchased from the refiners by an enterprising firm, who take them apart, clean the staves and bundle them up into shooks, and export them, together with their heads, to Cuba. This firm have one yard in South Boston in which they thus prepare 2000 hogsheads per week for export. The export trade in new shooks to the West Indies is also an important one, these last selling at from $1 to $1.75, while the second-hand shooks bring but 50 to 75 cents. The stave trade of Boston is nearly all in the hands of one firm, and as more than $300,000 worth of cooperage stock of various kinds are exported, in addition to what is used in this vicinity, their business is a large one. The staves which are so largely exported from Boston to the Mediterranean and to England are white oak. Sugar barrels are also made from elm, and in New York are being made of a single piece cut out for the purpose. The oak staves come from the West, largely from Michigan. Staves are usually exported in the rough or unfinished state, and range all the way from $60 to $150 per thousand for hogshead staves, and $80 to $200 per thousand for pipe staves."

Varnishing Wood.—After smoothing wood with veneer scraper, brush on thick coat of shellac varnish; then use fine sandpaper, No. O. Do this three times for close-grained woods, such as black cherry, and four times for porous woods, such as chestnut. Have two dishes. Into one put finely-ground pumice; into the other, raw or boiled oil. Apply a mixture of these with a piece of haircloth or broadcloth. Don't rub too hard. Finish up with rotten stone, which will remove pumice and oil. Above is a good dead varnish. Another: Take encaustic wax, heat and apply with a cork; rub in well; brush on thin coat of shellac varnish, and finish with pumice and oil.

A Word to Our Readers.

Those who have made a practice of reading the columns of *Carpentry and Building* devoted to correspondence, have already no doubt been convinced of our willingness to answer any and all questions which can be of any possible interest to any considerable portion of our readers Nevertheless, we deem it desirable at this time to call the attention of our subscribers generally to the fact, and. in connection therewith, to solicit from them questions for answering, in order that the usefulness of this department of the paper may be still further extended. The series of articles entitled "Some Problems in Framing," one of which appears in this number, was suggested by the wants of a correspondent who came to us with his difficulties. The care with which these articles have been prepared, which we believe fully meet the wants expressed by our correspondent, is to be taken as a measure of our willingness to serve others of our readers in the same general manner.

On the other hand, we solicit from our readers communications on various practical topics likely to be of interest to all those who have not had as much experience as the writers. From time to time we shall refer questions to our readers for answer, in the hope of drawing out such communications, which we feel convinced will render these columns of the greatest possible interest and benefit. We desire to make this department a convenient means of inter communication between mechanics in all parts of the country.

No trouble or expense will be spared in working up in the best manner the materials which our readers may furnish us. We consider it no hardship to illustrate letters which require engravings to make them entirely serviceable, and we are ready at all times to publish such information as our readers may be in want of.

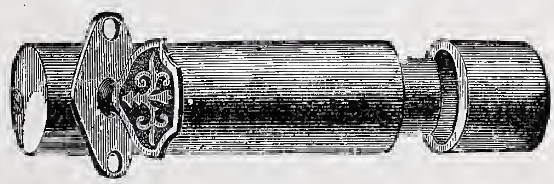
From several correspondents we have received inquiries concerning the manner in which their communications must be prepared in order to make them acceptable for these columns. In answer we would say that, while we prefer communications prepared in the manner usually prescribed by printers, and written on one side of the sheet only, we are ready to take the material in whatever shape our correspondents are best able to send it. Write either in ink or pencil, as is most convenient. Send sketches either drawn according to rules or by free-hand. Designs may be in ink or in pencil, as is most convenient. Send along such information as you have in the best manner you are able for our comprehension, and leave to the Editor and his assistants the labor of arranging it in such shape as will make it most readable.

We trust our subscribers generally will accept this broad invitation to co-operate with *Carpentry and Building* in the dissemination of useful information, and that none will be backward in communicating with us by reason of their inability to present their ideas in as polished a manner as they would like. If you can write so that the editor will understand what you mean, you will have accomplished all that is necessary.

Wooden Steeples.—One of the silliest things about American churches is the wooden steeple. It is a sham and a fraud, and a positively dangerous nuisance. Many fires in this and neighboring cities have been intensified and made more desolating by these inflammable structures catching fire and falling, and hurling the flames to localities that would otherwise have been free from immediate danger. The latest instance of trouble from this source was the burning of the Third Presbyterian Church of Trenton, N. J., on the 4th of July. A patriotic rocket began the mischief, and the wooden steeple, which was 180 feet high, furnished fireworks enough for the whole neighborhood. A sudden rainstorm did what the Trenton Fire Department was unable to do, and but for which the disaster would have been far more widespread. The church was a total loss, but was insured for $40,000, which is enough to build another fire-trap with shingle roof and wooden steeple, and have it ready for pyrotechnic display by the 104th anniversary of American Independence.

Burglar Proof Door Bolt.

We illustrate herewith what is known as Ives' Patent Burglar Proof Door Bolt. Fig. 1 shows the general appearance of the article, while Fig. 2 shows the internal construction. By inspection of the engravings it will be seen that its parts are very few and the construction exceedingly simple. Its application to the door is by means of a round hole bored for the purpose. The striking plate is inserted into the jamb or casing in the same manner.



Ives' Patent Bolt.—Fig. 1.—Outside.

The bolt proper is operated by means of a knob, attached to a square spindle shank, the latter fitting into a suitable seat attached to the bolt by a pitman. Movement is communicated to the bolt after the manner of a crank by simply turning the knob. To temporarily lock the bolt in either of its two positions, the pitman is constructed and arranged to operate in the manner of a lever spring.

The knob is provided with a suitable escutcheon, which is shown in the engraving (Fig. 1), by which also it is held in place against the face of the door, and the spindle in turn, to which the knob is attached, serves to hold the bolt in place in the door. A 13-16-inch bit is required for the hole in the edge of the door to receive the bolt, and a ⅜-inch bit is used for the knob or thumb key. A 13-16-inch bit is also used for the striking plate, the latter being made large enough to admit of driving into position to insure a close fit. There is no other cutting or fitting required. Two small screws fasten the escutcheon in place. The hole in the striking plate to receive the end of the bolt is somewhat elongated in a vertical direction, thereby compensating for the sag usually incident to doors just hung.

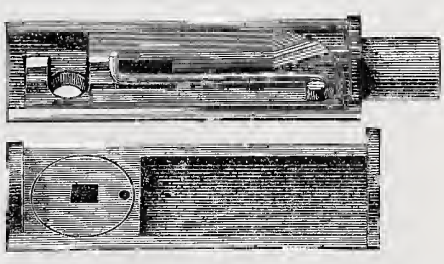
This bolt is designed for use upon either inside or outside doors. Hobart B. Ives, of Fairhaven, Conn., is the patentee and manufacturer, by whom the trade is supplied. The article is sold by hardware dealers generally.

Woodenware.—The woodenware trade has grown to be a great interest, both in export and home consumption. At the present time it employs a capital of more than $4,000,000. An ingenious mechanic named Pickerson began the manufacture of broom handles and nest boxes in Hingham, Mass., in 1830, and from this small beginning the woodenware trade has grown to its present dimensions. Pails, tubs, churns, bowls and clothes-pins were soon added, and now the export trade is extensive with Germany, England, Russia, France, Austria, Central and South America and Australia. The display of American woodenware at the Paris Exposition attracted much attention. Much of this work that formerly was done slowly and tediously by hand is now done by machinery, with much greater accuracy and perfection. The inventive skill of American workmen is plainly shown in this woodworking machinery, and in the production of woodenware the manufacturers of the United States no longer fear rivalry from any quarter.

Useful Application of Paper.—Paper is now substituted for wood in Germany in the manufacture of lead pencils. It is steeped in an adhesive liquid, and rolled round the core of lead to the required thickness. After drying, it is colored, and resembles an ordinary cedar pencil. The pencils sell in London to retailers at about 65 cents a gross.

Preservation of Wood.—Some hints regarding the preservation of wood by means of lime have been recently urged by M. Lostal, a Frenchman, who simply piles the planks in a tank, and places over all a layer of quicklime, which is gradually slaked with water. Timber for mines requires but a week to become thoroughly impregnated, and wood for any purposes more or less time, according to thickness. It is claimed that wood prepared by this simple, inexpensive process acquires a remarkable consistency and hardness, and will not rot, no matter what the lapse of time or the kind of exposure. Beech wood has been treated in this manner, for hammers and various other tools employed in iron works; it is said to become not only as hard as oak, without losing any of its well-known elasticity or toughness, but to last much longer than when in its natural state. We often notice that coal tar is recommended as a preservative of wood, but those who advise its use should add that it must have the acid in it destroyed by mingling fresh quicklime with it. Half a bushel of lime freshly dissolved and mingled with a barrel of tar, has kept posts saturated with it and planted in clay ground perfect for over 20 years.

Old Mahogany.—If you have handsome old mahogany chairs or sofas, never use red or crimson for the covering of seats, as those shades completely spoil the rich color of the wood; green, purple or dark blue you will find contrast well with the wood, and bring out its fine tint admirably. Ma-



Ives' Patent Bolt.—Fig. 2.—Internal Construction.

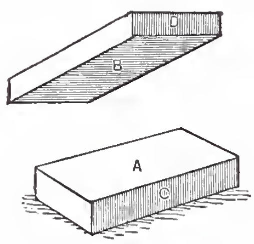
hogany grows darker from age; and old furniture repaired with new wood can only be made to match in color by moistening the new parts with linseed oil and exposing to the sun until it darkens. When mahogany is broken, the damaged parts can be restored in color by applying linseed oil several times, or using a very weak solution of lime water and then varnishing afterward. For varnishing furniture, follow directions given below. First wash off the article with soft sponge wet in cold water; then take a clean chamois skin and, after rinsing and wringing it as dry as you can, wipe off the article with the damp skin, wiping only one way. Dry chamois skin should never be used on varnished work. If the varnish is defaced and shows white marks, apply linseed oil and turpentine with a soft rag till the color comes back; then wipe the mixture entirely off with a clean, soft, dry rag. The oil and turpentine should be used in equal quantities, and shaken well in a bottle before using. In deeply carved work use a stiff paint-brush instead of sponge. In varnishing old furniture, rub it first with powdered pumice-stone and water to remove the old varnish; and then, with an elastic bristle brush, apply varnish made of the consistency of cream by the addition of turpentine.

MASONRY.

Determining the Shapes of Stones for Certain Positions.

VI.

The most simple species of stone-cutting is obviously that which concerns itself with the production of plane surfaces, and of rectangular and other solids bounded by plane surfaces. The figure most easily given to a block of stone is that of a rectangular description. Of this kind are the parallelopipedons to which stones are cut for walls of buildings, and which may be defined as having three pairs of opposite parallel sides, the boundary arrises of which form right angles. Considered mechanically in relation to what is known as "statics," this shape is not the best. Stones of a cubical or square form would offer more resistance to the forces acting upon them when used in a wall or edifice. But cubes would have the great drawback that it would not be practicable to make good "bond" with them, so that it is necessary to sacrifice on the side of solidity in order to gain on that of good bonding. A just medium in the matter of shape should, where stones of proper size can be had, be adhered to; and upon this point no subsequent authority has given more clear and succinct rules than Rondelet in his



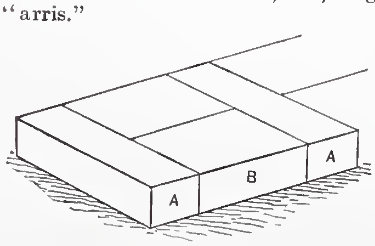
Masonry.—Fig. 1.—Upper and Lower 'Beds.'

great work upon the art of building, which we append:

1. For stones of a tender nature, a length and a breadth of from once to twice the space between the upper and lower beds may be given.
2. Stones having greater consistence than the above, may have a length or breadth of from one to three times the distance between the beds.
3. For hard stones, from one to four times the aforesaid space may be alloted; and,
4. For extra hard stones, even five times the space between the beds may be allowed for their length and breadth.

It is presumed that the reader is familiar with the usually recognized technical terms applied to a block of stone employed in masonry. They are, however, given below:

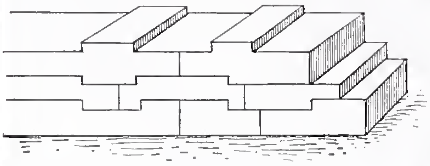
The horizontal surfaces of each block (as laid) are termed the "upper" or "top bed," A, (Fig. 1), and the "lower" or "bottom bed," B. The surface that is visible in the front of the wall is the "face," and this will be in the direction of the length of the stone in a "stretcher," B (Fig. 2), or of its breadth in a "header," A (Fig. 2). The opposite side is the back, and the remainder "sides" or "ends," according as the blocks are headers or stretchers. The angles of the stone are termed "arrises," or, singly, an "arris."



Masonry.—Fig. 2.—"Headers" and "Stretcher."

In building a wall of whatever description the following axioms are all-important:

1. In any wall whatever, the stones forming it must be so disposed that their beds are perpendicular to the direction of the force which acts upon and tends to compress them.
2. So far as the nature of the work will permit, the beds and the headings of the joints should be plane surfaces, because plane surfaces are more easily formed correctly than any other.
3. In order that the stones may have the greatest power of resistance possible, their surfaces where applied to each other should touch equally throughout, as experience shows that stones superposed upon each other have the greatest power of resistance as the bearings may be more perfect—in other words, as, in consequence of their sur-



Masonry.—Fig. 3.—Tenoning Stones Together.

faces being very level, they touch at a greater number of points.

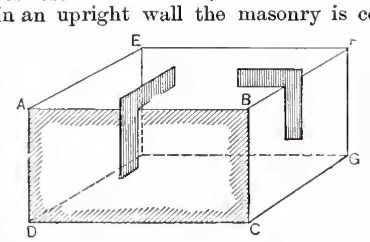
4. Whatever the work may be, the adjacent faces of the stones should always form right angles, never acute ones, unless there are imperative reasons for departure from this rule.

From these rules it follows: 1. That the beds of the stones forming a perpendicular wall should be disposed horizontally, because the stones have to sustain the weight of the courses above them, which act vertically.

2. That the beds and the joints should be plane surfaces.
3. That the beds should be dressed with the greatest care, so that the stones should have an equal bearing throughout.
4. That the forms of the stones should be rectangular parallelopipedons, so that all their contiguous faces may be right angles or squared.

It is also necessary that all the stones of a course should be of the same hight between their beds. If this were not the case it would be impossible to keep bond with the preceding and succeeding courses, and it would be necessary to tenon the stones together, as shown at Fig. 3, and in this case it would not only be very difficult to make their surfaces coincide, but the effect to the spectator would be very bad. We find, however, that the Greeks and Romans sometimes resorted to this expedient.

In an upright wall the masonry is com-



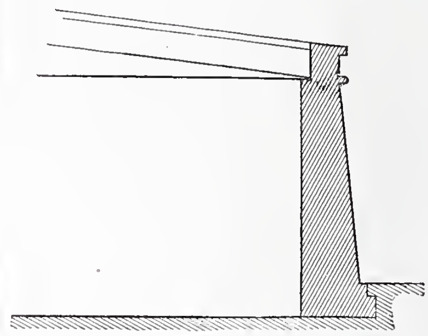
Masonry.—Fig. 4.—Dressing Large Stones.

prised between two vertical planes parallel with each other. The stones are therefore rectangular, and for the production of each a block is selected of sufficient cubic contents to contain required form. The surface A B C D (Fig. 4) is first brought to a true plane. Next the second face, A B F E is dressed to a right angle with that first formed. The two lines, B C and B F, are then marked by the square, perpendicular to the arris A B, and these lines determine the face B C G F. The opposite one is similarly got at by drawing the lines A D and A E, each perpendicular to the arris B A. Lastly, by carrying these dimensions of the stone upon the corresponding arrises, the remaining surfaces are easily worked.

Retaining (or revetement) and breast walls bring in other forms of block than the rectangular kind used in ordinary walls. The former are employed, as their name imports, in retaining the earth at the sides of railway cuttings or sloping grounds; and also as seawalls and to bound docks and wharves, &c.

One face of this kind of wall has usually a "batter"—that is to say, the vertical section of the principal face is not perpendicular to the horizon. This is sometimes called the "talus" line, from a French architectural term, signifying a slope. The horizontal distance between the foot of the talus line and that of a plumb line passing through its upper extremity is called the amount of batter, and the plumb line from the top of the talus line to the level of its foot is termed the vertical of the batter. Retaining walls are often made with a batter of one part base to six parts of perpendicular, although the proportion may differ considerably from this. The batter is formed at the side opposed to the pressure exercised. Fig. 5 is a section of a retaining wall of this kind, furnished with a parapet.

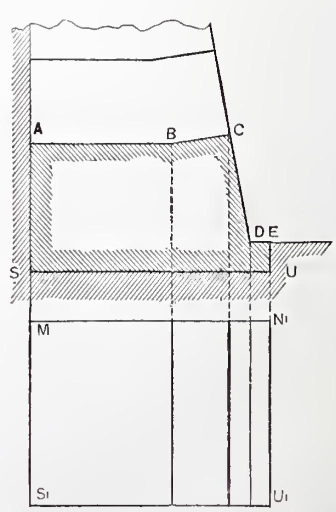
If the batter should be very slight, the beds of the stones may be continued horizontally to the face of the wall itself. But in such a case it is evident that the beds make two unequal angles with the battering face of the wall, of which angles one will be acute, a form which is above all others objectionable in masonry. In order to avoid this prejudicial form, the beds may be worked plane until within about 2 inches or 3 inches of the battering face of the wall, then from that point formed perpendicularly to the face of the wall, as at B C (Fig. 6). This plan of avoiding an acute angle is not, however, without its drawbacks. In the first place it di-



Masonry.—Fig. 5.—Section of a Retaining Wall Finished with a Parapet.

minishes the horizontal surface, or bed, by which each stone reposes on that below it; and, secondly, each stone comes into contact with that next to it at an irregular surface. If it were possible to secure exactness, this might be of little consequence; but if, for instance, the obtuse salient angle, A B C, is not worked to a perfect equality with the re-entering angle with which it should agree, the upper stone will not have an equal bearing along its whole extent, and the superincumbent weight of the upper portion of the wall may tend to fracture at that point the stone which has the unequal bearing, or cause it to slip on the inclined part of the bed. It is well, therefore, to avoid much irregularity of this kind, unless circumstances render it inevitable.

It is well in stone cutting to augment, as much as possible, plane surfaces as joints where stones come into contact; to avoid making the stones touch at curved or unequal surfaces, and to avoid acute angles wherever practicable.

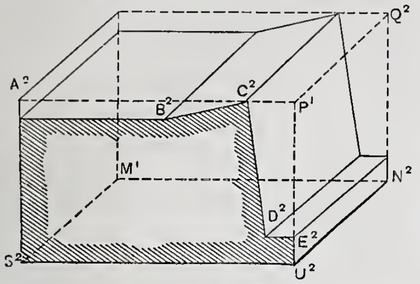


Masonry.—Fig. 6.—Method of Working Stones Composing a Retaining Wall.

To escape the acute angle which the battering face of the revetement wall under consideration would make with the soil, the part of the stone which enters into the earth may be cut vertically at the point D. It is still better to let the stone be of sufficient size, D E (Fig. 6), so that the vertical plane

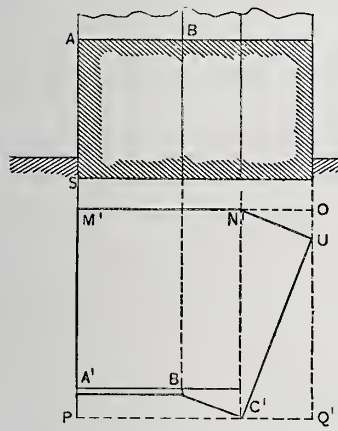
E U may be worked on it. Although the first plan takes less stone, the second gives much more solidity.

To form the first stone of the wall shown as Fig. 6, the lower bed $S^2 U^2 N^2 M^1$ (Fig. 7)



Masonry.—Fig. 7.—Shaping the First Stone for a Retaining Wall.

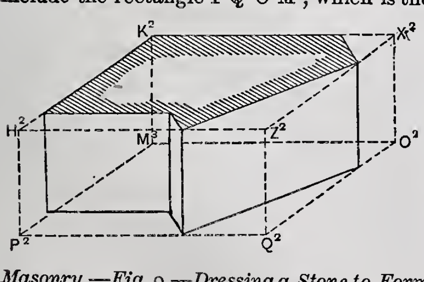
is first dressed so that it is equal to the rectangle $S^1 U^1 N^1 M$, which shows the horizontal projections of the stone to be cut. The two surfaces $S^2 U^2 P^1$ and $M^2 N^2 Q^2$ are then dressed perpendicular to the lower bed. A template of tin or zinc should then be made of the exact figure A B C D E U S, which gives the exact profile required for the stone. This being placed upon the face $S^2 U^2 P^1$ in such manner that S U falls on $S^2 U^2$, the contour ($A^2 B^2 C^2 D^2 E^2 U^2 S^2$) of the template is traced upon the block, and the operation repeated upon its opposite surface. The stone is then dressed down to this outline in such manner that a straight-edge applied transversely from face to face will coincide with the surfaces everywhere, and the stone is finished. The others used in the wall require no further description.



Masonry.—Fig. 8.—Method of Forming an Angle in a Wall.

In some cases a wall is comprised between two vertical planes which are not parallel – in other words, which make an angle with each other (Fig. 8). In such a wall the beds of the stones will of course be, as in a straight wall, horizontal in all their extent in each course, but vertical joints perpendicular to one of these faces would make an acute angle with the other face. To avoid this these joints, $A^1 B^1 M^1 N^1$ (Fig. 8) are taken a certain distance toward the opposite face of the wall, and the cutting then directed perpendicularly to that face, as at $B^1 C^1 N^1$ U.

In producing suitable stones for this purpose, a block is selected of sufficient size to include the rectangle P Q^1 O M^1, which is the

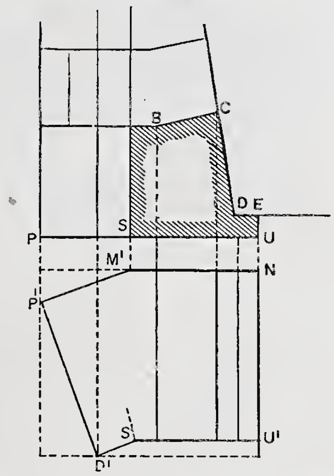


Masonry.—Fig. 9.—Dressing a Stone to Form the Angle shown in the Preceding Figure.

plan of the required stone. Having dressed the top and bottom beds parallel, and so that their distance apart is equal to the hight A S (Fig. 8) a template of the form $A^1 B^1 C^1$ U $N^1 M^1$ (Fig 8) is applied and marked off both on the upper bed, $H^2 K^2 X^2 Z^2$ and the lower, $M^2 O^2 Q^2 P^2$. The superfluous stone having been then removed, the block is left of the required shape.

In a wall of the preceding kind, having also a batter (Fig. 10), two templates will be required for working the stones. These are first dressed, as in the last instance. The template formed to the plan $D^1 S^1 U^1 M^1 P^1$, is then traced round on the two beds and the stone dressed to the lines. A second template, B C D E U S, is then cut to the required form, this being then set off on the two faces $S^2 U^2 Z^2$ and $M^2 N^2 X^2$. The remainder of the operation is evident (Fig. 11).

Where voids or openings occur in the external walls of buildings, lintels or archi-

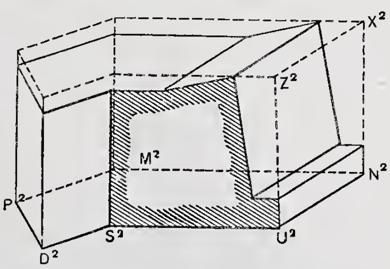


Masonry.—Fig. 10.—Method of Forming an Angle in a Retaining Wall.

traves of stone are sometimes employed. These should not exceed 6 feet in the clear if in one block. The difficulty of sometimes obtaining stones of sufficient dimensions causes other expedients to be resorted to. In very ancient masonry we find arches turned over extremely small openings, the present plans of building up a composite lintel not being known, apparently.

A lintel or architrave may be formed of several stones in such manner that its top and soffit (or under service) may be level, and its joints present vertical lines on either face. A lintel thus constructed is in fact a concealed arch formed in the thickness of the stones.

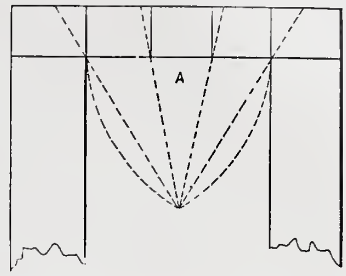
At Fig. 12, A, the upper part of a void, provided with a lintel of this kind, is shown. The center of the radiating (and concealed) joints is the vertex of an equilateral triangle, as indicated by the dotted lines. Fig. 13, shows the top of the lintel, giving the thickness of the radiating joints, and that of the square joints on each side of the concealed arch. In Fig. 14 is a view of the



Masonry.—Fig. 11.—Dressing a Stone to Form the Angle shown in Preceding Figure.

soffit, exhibiting the joints perpendicular to both faces of the lintel, the radiating and vertical joints both terminating in these lines. In Fig. 15, D is the first abutment stone above the pier, E the first lintel stone, and G the keystone. Duplicates of D and E are required for the other side, in reverse order. The stones here given show the manner of securing by "joggles," these being only continued for half the depth of the block in order to regulate the soffit.

The Great Wall of China.—An American engineer, who, being engaged in the construction of a railway in China, has had unusually favorable opportunities of examining the famous "Great Wall" built to obstruct the incursions of the Tartars, gives the following account of this wonderful work: The wall is 1728 miles long, 18 feet wide and 15 feet thick at the top. The foundation throughout is of solid granite—the remainder of compact masonry. At intervals of between 200 and 300



Masonry.—Fig. 12.—A Concealed Arch Formed in the Thickness of the Stones used as a Lintel.

yards towers rise up 25 to 30 feet high and 24 feet in diameter. On the top of the walls and on both sides of it are masonry parapets, to enable the defenders to pass unseen from one tower to another. The wall itself is carried from point to point in a perfectly straight line across valleys and plains and over hills, without the slightest regard to the configuration of the ground, sometimes plunging down into abysses a thousand feet deep. Brooks and smaller rivers are bridged over by the wall, while on both banks of larger streams, strong flanking towers are placed.

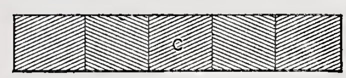
Characteristics of Different Styles of Architecture.

II.

During a time of such change and turbulence as that which marked the period which ensued upon the death of Henry I, it

Masonry.—Fig. 13.—The Top of the Lintel.

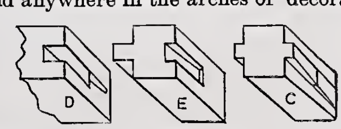
is no matter of surprise to find that the architecture of the time partook of the character of the age, and was marked by the presence of two antagonistic forces which, so to speak, carried on a war for a period of about 50 years, which warfare ended in the



Masonry.—Fig. 14.—The Soffit of the Lintel.

utter discomfiture of the one and the triumph and elevation of the other. The characteristic features of these two forces were the round arch and the lancet-shaped or pointed arch. From the commencement of the reign of Stephen to nearly the close of the reign of Henry II (1145–1190), these two kinds of arches were used in combination, and this combination forms the most marked peculiarity of the period, which is termed Transitional, indicating the transition from the Norman manner to the lancet or early English style.

The pointed arch made its appearance during this period, being at first only used as a constructive part, but later on, in what may be called decorative features, that is to say, such as are not essential to the body or framework of the building, as, for example, in windows and doors, panels, &c., and if found anywhere in the arches of decoration



Masonry.—Fig. 15.—The Several Stones Composing the Concealed Arch.

is generally to be seen in the clerestory or highest part of the building, and consequently the latest in point of construction. The capital became less heavy in outline, and was adorned with a curled leaf or volute, the windows and doors are less stumpy in proportion and an increased appearance of lightness is imparted to the whole building, although the massive character of the Norman work was by no means lost. The side aisles and sometimes the center aisles also are vaulted, that is, covered by a concave roof carried upon ribs or groins of stone, with the spaces between the ribs filled in with chalk. The system of vaulting employed is a very sure test as to the date of a building. During the Norman period buildings were covered either with a plain, or semicircular, or barrel vault without ribs, or they had flat ceilings. During the Transitional period the vaulting was what is called quadripartite, that is, divided into four parts, and the vaulting shafts in section have very nearly the shape of a pear.

The Transitional period lasted, as we have seen, from the reign of Stephen to the end of the reign of Henry II, or about 45 years. Short as was the time, these few years embraced a very remarkable period in history. With Stephen ended the direct Norman line; and with Henry II (the son of the Empress Maud and Gooffrey of Anjou), commenced the line of the Plantagenets, which for more than 300 years bore rule in England, conquered Ireland and Wales, waged constant war with France and Scotland, and made itself felt everywhere by its restless, crafty and ambitious policy.

During this latter reign occurred the first struggle between the Church (or rather the Pope) and the King, and in the transitional part of Canterbury Cathedral, Thomas-a-Becket was basely murdered by the King's adherents.

The Lancet or acute-pointed arch triumphed at last, the semicircular arch was discarded, and toward the close of the 12th century a new style of building sprang up, founded, it is true, upon the style that had preceded it, but so graceful and varied in design, so sparkling and inspiriting to the mind, so admirably adapted to the wants of time. that it is difficult to conceive that it sprang from the massive, somber and somewhat forbidding Norman style. It is impossible to overvalue the exquisite beauty of the buildings which were produced during this period. The angel choir of Lincoln Cathedral is worthy of comparison with the finest productions of the best age of Greek art; and Salisbury Cathedral, which was almost entirely completed in this style, between the years 1220–1258, and is perhaps the only monumental building in England without any admixture of other stylos, is unrivaled for the harmony of proportion, fitness and symmetry which it exhibits throughout the whole of its construction. The term Early English was first applied to this period, but this term has been now largely discarded for the more appropriate and discriminating expression of Lancet or First Pointed style —a term which was first employed to distinguish it by Mr. Edmund Sharpe, an eminent authority upon mediæval antiquities, and a laborious and painstaking student of architectural remains in England.

The most important feature in this style is the prevalence of the laucet-shaped window (this form which had been rarely employed in the preceding style for constructional purposes) singly or in groups of two or three, or even four, five or seven. The The windows are plain, commonly without cusps (although they are used occasionally), and are always without any ornamental filling-in or tracery. This feature will serve effectually to distinguish this style from that which preceded it, as well as from that which came after. In addition it may be remarked that the columns are slender and delicate. A hood mold or projecting member, resting on a small carved head or boss, is usual over the window openings. A peculiar enrichment called the "dog-tooth" ornament constantly occurs in the moldings over arches, and indeed in every part of the building, both within and without, whenever an opportunity presents itself. Carving is, however, as a rule sparingly employed, and what is introduced is of conventional character; that is to say, it does not affect to imitate natural objects, except in an arbitrary manner, direct imitation being always avoided.

The principal buildings in England in this style are the choir of Lincoln Cathedral, Worcester Cathedral, Fountain's Abbey, the west fronts of Wells and Peterborough cathedrals, the chapter houses of Lichfield and Oxford cathedrals, and the round part of the Temple Church.

The Geometrical period, which succeeded the Lancet, lasted from the end of the reign of Henry III to the beginning of the fourteenth century, and was almost contemporaneous with the long reign of Edward I. The chief feature of this period is the employment of tracery, or filling in, to the heads or upper parts of windows and other openings, panels and arcades. This tracery was first of a simple form, consisting chiefly of circles, but afterward of other simple geometrical forms which give the distinctive name to the period. The art of sculpture made very great progress during the reign of Edward I; figures were employed more largely in the decoration of buildings, and every part was finished with the greatest care and delicacy. The art of carving may be said to have attained the highest perfection in England during this reign, for although the sculpture of later periods shows examples of greater ingenuity and patient elaboration, it was never so appropriate in character or so well subordinated to the architecture as it was during the Geometrical period.

The triforium, or middle horizontal division, in church architecture during this period, became greatly reduced in size and importance, and the uppermost division, or clearstory, at the same time increased in hight, and was more elaborately decorated. The dog-tooth molding of the preceding period disappears altogether, and in its place an ornament called the ball-flower, which is peculiar to this epoch, is employed in the hollow moldings of the arches and in other places. The center and side aisles are generally vaulted, and have the ribs and bosses beautifully molded and carved.

The principal ecclesiastical buildings in this style in England are the choir, transepts and chapter-house of Westminster Abbey, which are very beautiful specimens of the period; the chapter-houses of Salisbury and York cathedrals; the nave and north aisle of Chichester Cathedral; the choir of St. Alban's Abbey; the choir and transepts of the ruined abbey church of Tintern; the west front, also ruined, of Newstead; the Lady Chapel of Chichester, and numerous parish churches in various parts of the country.

In the next period—the Curvilinear, to distinguish it from the Geometrical period —we find signs of the commencement of the corruption of taste which ended in the debasement and ultimate overthrow of the Gothic style, and its replacement by other forms of art. The simple geometrical forms which were used with so much success during the reign of Edward Longshanks were now discarded, and most complex and elaborate forms of tracery were introduced, the peculiarity being that whereas, before, the whole of the lines of tracery were produced by the compass, they were now drawn by hand, and were of a more free and florid character. A new form was also introduced called the ogee, which is formed by two curves of contrary flexure, and this form is found to prevail throughout the whole of the various features of the buildings of the period, extending not merely to the openings, doors and windows, tracery, &c., but also to the profiles of the moldings, which are all marked by this peculiarity.

Attention now began to be drawn off from the proportion and general arrangement of buildings, and too much care and elaboration were bestowed upon things of merely secondary importance, such as tracery, canopies, carving and the like. Some noble buildings were, however, erected in this style, among which may be mentioned the chief part of Ely Cathedral, the choir and Lady Chapel of that of Wells, Heckington Church, and the nave of St. Giles's Church, Sleaford, both in Lincolnshire.

In the next division we find the debasement already perceptible in the preceding age carried still further, and that in a remarkable and unexpected manner. The architects of the Curvilinear period having exhausted the resources of flowing lines in their tracery, &c., those of the next period divided their buildings into compartments or squares, by means of right lines, both horizontally and vertically giving to them "the appearance of a huge gridiron." The plain two-centered arch was no longer employed, but low, flat arches struck from four to six centers were used instead. The windows were divided into narrow lights by perpendicular mullions or sash bars (hence the name of Perpendicular sometimes applied to the style), and these were again subdivided by horizontal divisions. Square headed windows are not uncommon, particularly in the upper part of buildings. The capitals of columns, bosses, &c., instead of being carved with foliage are molded in a rich manner, and the carving is mostly restricted to heraldic decorations. The ceilings of this period are very elaborate, and are covered with paneling, center flowers, &c. The ceilings of King Henry VII's Chapel, Westminster, and of St. George's Chapel at Windsor are very fine specimens of the style of ceiling prevalent at this date.

Brick now began to be used in domestic buildings, and some very fine mansions were constructed of this material, the quoins and dressings of the window openings being constructed of stone, and in some cases, toward the end of the period, of cement.

The most remarkable buildings of the Rectilinear period aro the transept and nave of Canterbury and the nave of Winchester Cathedral, the west front of Beverley Minster, St. George's Church, Doncaster, part of Rotherham parish church, the Beauchamp Chapel, Warwick, and Henry VII's Chapel, Westminster.

"The misfortune of this style," says Mr. Fergusson, "was that it fell on evil days. Used as it was at first, or as it might in a better age have become, it may be considered as nearly the perfection of tracery. It possessed, however, within itself a fatal facility which brought down the art to the meanest capacity, and afforded no scope or exercise for the highest intellects. The tendency of the age was for the greatest possible effect at the least possible expense; hence the perpendicular tracery soon became prosaic to the last degree, and utterly unworthy either of its predecessors or of its own capabilities."

During the long period (nearly two centuries) which elapsed from the commencement to the end of the Rectilinear style, comprising the reigns of Richard II, the three princes of the house of Lancaster, the three Yorkist kings, and the two first sovereigns of the Tudor dynasty, considerable changes, of course, took place in the architecture of the country. The buildings of the time of Richard II and Henry IV were very different to those of the reign of Henry VIII. The principles which regulated their design were, however, the same throughout, although the external manifestations may differ. In this style, unlike those which had gone before, we are struck by a parade of resource, a pomp of material and achievement, and an air of self-assertion which is nowhere to be found in the earlier styles. There is, however, great beauty and adaptability in much of the design, and in the later buildings, as those of the reign of Henry VIII, there is a breadth of character that is particularly refreshing, and which has been supposed by some to best reflect the British temperament.

Dangers of Moving Into Empty Houses.—A house while empty becomes a breeder of sickness. The reason is clear; disuse means want of the ordinary precautions for cleanliness, of dusting and scrubbing, and often also of ventilation; the contents of cisterns, pipes and drains become stagnant, while the air in the rooms becomes impure, all of which is favorable to the processes of putrefaction and the development of the germs of diphtheria, typhoid fever and other zymotic diseases. Parties moving from the city to the country, or from the country to the city, should remember this, and take care to have a thorough cleaning and airing performed before moving into a house that has been unoccupied for a season. Above all, clean out all rubbish from cellars and closets. Among the disinfectants to be recommended, if their use is deemed advisable, carbolic acid is among the best.

Effect of Steam Heat on Woodwork.

A correspondent of the *Northwestern Lumberman* makes a statement which has a bearing on all buildings in which steam-heating pipes are laid near woodwork, as well as on the dry kilns with which he was interested more particularly. He says: A few days ago, opportunity presenting, I made a careful examination of a dry kiln, heated by steam pipes, which has been in operation for the past three years. Cutting slivers from the ceiling and inside walls I found, in each case, that the wood had lost all tenacity of fiber, and was simply a mass of white charcoal. Holding a piece fully a half-inch square in the blaze of a match, it burned more freely than the match itself. On closely examining it I came to the conclusion that the resinous qualities of the wood were dried to such an extent as to become a portion of the mass, and were thoroughly distributed through it, while the fiber was so effectually disintegrated that on rolling the wood between the thumb and forefinger it rolled up in punk, and this punk flashed almost before it came in actual contact with flame. I am persuaded that, under favorable conditions, dry steam heat in its effect upon lumber but places it in proper condition for ignition under the sultry and piercing rays of a summer sun. A piece of glass upon the roof supplies at once the lens, which, concentrating the sun's rays upon a particular spot, will produce combustion almost at the instant. I have two suggestions to make, although so slightly skilled in chemistry that I do not consider myself competent to enter into the subject to any extent. There are paints manufactured with a base of silica. I have seen buildings covered with this paint resist a conflagration which, having eaten up two blocks of houses in a village, found no barrier to its progress until the walls covered by this silica paint were reached, when its resisting quality manifested itself in stopping the onward progress of the flames. Could not the inner walls and roofs of dry kilns be thoroughly treated at intervals with this preparation—the cost would be very trifling—and thus obviate the risk from fire? It is worth a trial. A friend who has a somewhat extended intimacy with the dry-kiln question has suggested an experiment once tried by him, the results of which were, to my mind, extraordinary. Its application, however, was confined to the roof. After putting up his walls he placed 6 x 8 joists across, from side to side, upon the upper surface of which he nailed laths about 1 inch apart; upon these he placed another tier of joists, 2 x 6, upon which he laid a floor; upon this floor he placed a layer of common earth from the prairie, to the depth of 6 or 8 inches; the roof was then put on about 12 inches clear above the earth and with the natural slope. No matter what heat was maintained in the kiln, the under side of the roof was at all times coated with moisture, and this of itself would obviate the possibility of the rosin in the wood of the roof becoming albumenized or carbonized.

A New Method of Coloring Woods.—A German paper lately published the following directions for giving colors to woods: The surface to be smeared with a strong solution of permanganate of potash, which is left on a longer or shorter time, according to the shade required. The woody fiber decomposes the permanganate, precipitating protoxide of manganese, which is fixed in the fiber by the potash, set free. In most cases five minutes suffice for the operation. Cherry and pear-tree wood are most easily attacked, but a few experiments will serve to show the most favorable circumstances. When the action is excited the wood is carefully washed, dried and afterward polished in the ordinary way. The effect of this treatment on many woods is said to be surprising, particularly on cherry wood, to which a very beautiful reddish tone is communicated. The color is in all cases permanent in light and air.

Grant's Reversible Filter.

Our illustrations show a new form of filter, or strainer, intended for use upon the ordinary faucets, bibbs and basin cocks. The engravings show very clearly the method of construction and the mode of operation. In Fig. 1 we have an outside view of the filter ready for attachment to an ordinary faucet with a screw thread. Figs. 2 and 3 show the internal construction. The filter

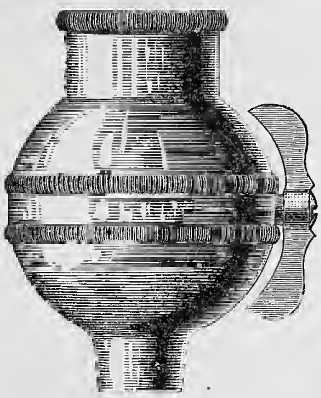


Fig. 1.—*Outside View.*

consists of a globular shell or case, made in two parts and fastened in the center by a screw thread. This case contains a globe of metal, in which the filtering material (bone black) is placed. As filtration must of necessity check the flow of water, the globe or filter box is made with a tube running through the center, so that the water may, when desired, flow directly through

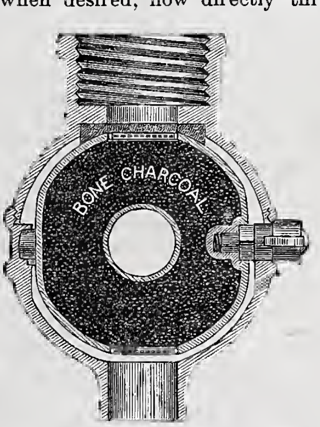


Fig. 2.—*For Filtered Water.*

without filtration. For a great variety of purposes unfiltered water answers just as well as that which has been filtered, and for washing and similar purposes it is quite desirable that the water should flow as rapidly as possible. The central globe which contains the filtering material is, therefore, hung upon pivots and arranged with a thumb-latch or handle upon

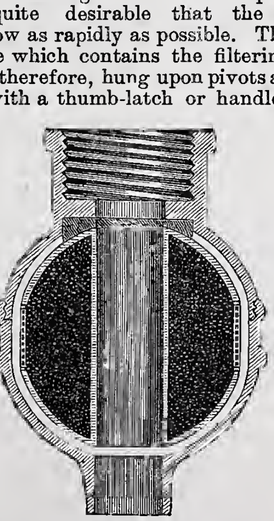


Fig. 3.—*For Unfiltered Water.*

the outside in such a manner that, when it is desired to have all the water filtered, it is only necessary to turn the latch into a horizontal position, as shown in Fig. 2, when all the water will pass through the filtering material. When a rapid flow of unfiltered water is wanted the latch is placed in a vertical position, as shown in Figs. 1 and 3, and the water flows directly through the open tube. Another advantage of the reversible bone charcoal holder is that the filter may be turned over, so as to reverse the direction of the water flowing through it, and thus wash out the impurities which have been collected from the water. As we have frequently remarked, a filter is useless if it cannot be cleaned at short intervals. The dirt collected will not only stop up the filter, but will also undergo a process of decomposition which will be as injurious to the water as the dirt itself. By turning the holder over so that the direction of the water through the bone coal is reversed, nearly all the collected impurities can be washed out and the coal be made to do duty for a long time. In order to prevent the water from passing down the outside of the inner chamber or globe, and so escape filtration, a leather packing (shown in both the sectional drawings) is introduced. The openings through which the water passes into the filter are protected by a wire gauge, held by a wire ring sprung in place, so that the bone coal may be readily removed and replaced by a fresh charge.

The manufacturers put up the coal in small boxes of one charge in each, or in larger packages. In order to make these filters applicable to any nozzle, whether plain or having a screw thread, a very neat arrangement, not shown in the engravings, is used. This consists of a screw cap, containing a pair of elastic rubber washers, which, when slipped over the nozzle and jammed tight by the screws, not only hold the filter fast, but make the joint water tight.

Mr. Clinton E. Page, No. 11 East Fourteenth street, New York, is the sole agent for the State of New York.

Shellac.

Of all the gum rosins, there is perhaps none more peculiar and interesting in its origin than the substance known as shellac, which is obtained from several trees growing in the East Indies, but particularly from *Croton tacceferum* and two species of ficus, *reliegiso* and *indica*. The stick-lac, or original exudation from which shellac is made, is found in the form of a crust enveloping the twigs of these trees, and is supposed to be an exudation of their sap, occasioned by the puncture of the bark by an insect belonging to the genus coccus. By some it is thought to be an exudation from the bodies of the insects themselves. Be this as it may, the insects are imbedded in the substance, and serve to give it its peculiar color and character. It is of a deep red color, inodorous, has a slightly bitter taste, is punctured with numerous holes the size of a fine needle, and contains cells in which the insect that created it is lodged.

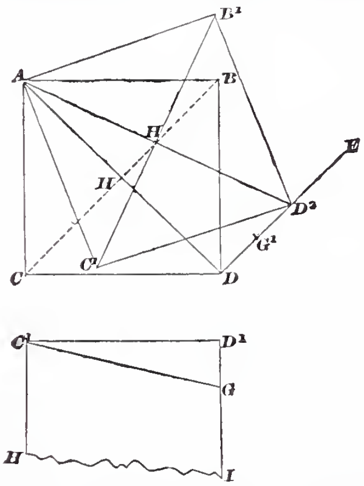
Shellac is prepared by melting the stick-lac, previously deprived of its soluble coloring matter, straining it, and then pouring it on a flat, smooth surface to cool and harden. In the manufacture of varnish from shellac, alcohol is the solvent. The soluble coloring matter, strained off previous to this process, is the well-known lac dye of commerce, now almost superseded by the aniline colors obtained from coal tar. Shellac was formerly considered merely a secondary product of the manufacture of this dye, but with the decrease of the demand for the dye, it has become the main object for which stick-lac is procured. Stick-lac is gathered by the natives in the interior and carried to Bengal and Calcutta, the places of export. There are two crops in each year—the Nagoll, gathered in October and November, and the Bysackee, gathered in April and May. The former of these crops produces the lac of which fine leaf and button are made; an inferior button-lac and garnet are made from the latter crops. Latterly the natives have learned the tactics of Wall street, and store it—corner it—to advance the price. The local manufacturers have also learned to adulterate by the addition of rosin, and to such an extent has this practice been carried, that from 50 to 60 per cent. of adulteration has been detected by analyzing, and analysis is now almost invariably resorted to before buying. Aside from the matter of adulteration, the value of shellac varies greatly on account of difference in quality.

Some Problems in Framing.

(Continued from page 133.)

The next step following those described in the last article, is what is technically known as "backing." The corner posts, as represented in Fig. 1, and also in the enlarged view, Fig. 2, are to be so shaped that when in position their horizontal plane shall be square, at least so far as concerns the two outer faces. In other words, if square timbers were set up as shown in Figs. 1 and 2, when in position the corners of the building formed by them would not be square; therefore their section must be reduced by an amount sufficient to render the corners square or parallel with the face of the sill. The lines by which this operation is performed may be obtained in either of two ways. One is by drawing an end section of the timber, and from it constructing a section as it would appear when cut to the bevel necessary to fit the post to the sill, from which to take the angle to use in scribing the timber. The other method is by the use of the square applied directly to the end of the post after it is cut to the bevel to fit it to the sill.

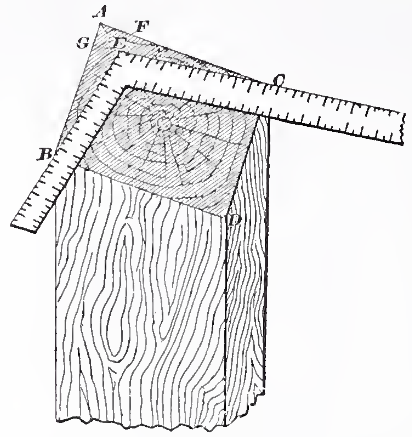
The first method above mentioned is illustrated in Fig. 10. Draw A B D C equal to the square of the timber. Draw the diagonal line A D. It is necessary from these parts to construct a section of the timber as it would appear when cut to the bevel of the foot of the posts. C^1 D^2 I H represents in elevation one side of one of the corner posts,



Problems in Framing.—Fig. 10.—Finding the Lines for "Backing" by Means of a Drawing.

C^1 G being the line of the bevel as it would require to be cut to form the foot. It will be remembered that, in explaining the manner of scribing the posts for the bevel, we first marked one face of the timber and then an adjacent face commencing where the first terminated. In other words, on account of the timber inclining equally in two directions, the gain was double the amount shown by the elevation, and therefore we doubled it by repeating the operation on the second face. Therefore, to get the length of the diagonal line of the beveled section corresponding to the diagonal line A D of the square section, we must lay off twice the gain shown by the elevation. From D at right angles to A D, lay off D E indefinitely, and upon D E set off twice the gain shown in the elevation by D^1 G, all as indicated by D G^1 D^2. From D^2 draw a line to A. Then A D^2 is the length of a line from corner to corner of the beveled section of the post. A moment's reflection will make it evident that the line from corner to corner in the opposite direction is not modified in this operation, and therefore through the middle point in A D^2, as indicated by H^1, we draw a line at right angles to it, as shown by C^1 B^1, making it equal to C B of the square plan. Connect the points thus obtained, as shown by A B^1, B^1 D^1, D^2 C^1, C^1 A. The figure thus bounded is a representation of the bevel section of the post. Therefore, outer faces of the post are to be reduced to the angle shown by C^1 A B^1.

The other method of performing the operation above referred to, is shown in Fig 11. Let B A C D be the end of the timber after it has been cut to the proper bevel. Draw the diagonal line A D. Place the heel of the square upon this line, and the tongue and blade, respectively, against the corners B and C. Scribe along the outer edge of the square, as shown, from B to E and E to C. Then B E C will be the lines to which the



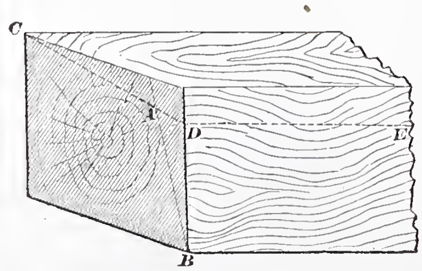
Problems in Framing.—Fig. 11.—Finding the "Backing Lines," by Applying the Square to the End of the Post after being Cut to the Bevel.

timber is to be cut in order to make the corners square.

In Fig. 12 is shown the end of the timber scribed to the angle C^1 A B^1 of Fig. 10. One of the lines of cut is transferred by gauge along a face of the timber, as indicated by D E, to which the face is reduced. The second line of cut is then applied in the same manner, care being taken not to use the gauge as first set, but to place it to the line shown in the end of the timber, measuring from it along the new face formed by the cut already made. The same remarks apply to cutting the timber when scribed by the use of the square, as shown in Fig. 11. Produce the line B E (Fig. 11) to the point F; with the gauge draw a line corresponding to F, and reduce the timber by taking off the section B F A. Then set the gauge, measuring from F to scribe a line corresponding to E, after which reduce the timber by the section C E F.

The next matter which we have to consider is the shape of the ends of the girt to fit against the corner posts. In the operation of "backing" already described, we have remarked that it need be applied only to the two outer faces of the post. This is a matter of circumstance and individual preference, however, to a certain extent. In the following description of the cut of ends of the girt, we have chosen to consider the two inner faces of the corner post unchanged. It is evident, upon a moment's reflection, that if the inner faces of the corner posts were backed in a manner corresponding to that described for the outer face, the cut for the ends of the girts would be quite different from what it is otherwise required to be.

The problem of cutting the end of the girt presents itself something in this manner: If the frame inclined in but one direction,



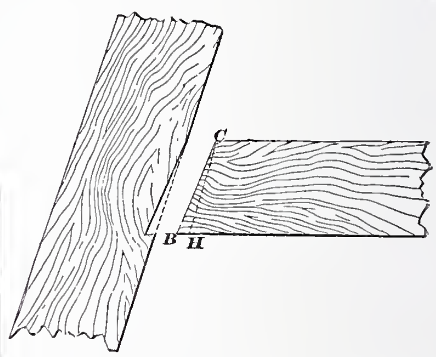
Problems in Framing.—Fig. 12.—Using the "Backing Lines."

cutting the end of the girt by the bevel set to the pitch taken from the elevation would be entirely correct, but the frame inclines in two directions, therefore a modification of this cut is necessary in order to make a joint.

To state the same thing in a different way, if the end of the girt were to be cut by the pitch taken from the elevation and was then put in place, its face being set vertically, it would be found to fit, but this is not the position in which the girt is to be placed. It is to be turned so as to make its face coincide with the face of the corner post. Now, if we turn it into this position we find that the joint will open at the top, supposing that we use a line through the bottom face as an axis in turning. Or, if we hold a point in the upper face fixed and turn the girt, it would cut into the corner post something after the manner shown in Fig. 13. Therefore, we must modify this cut, so far as concerns the face of the girt, to the extent of compensating for cutting into the post, as shown in Fig. 13, or, what is the same, compensate for the opening of the joint in case we turn the girt about its opposite face.

To obtain the line upon the face of the girt for the cut of the end, we proceed as follows: First mark the end of the girt to the bevel of the face of the building, as above described, as shown by B C in Fig. 14. In this figure, as well as in the succeeding figures, we have exaggerated the pitch of the building in order to make the lines and points clearer. Set the compasses to a space equal to the width of the timber employed, as shown by A B. From C as center, with radius A B, describe an arc D E, cutting the line C B in the point F. Square down from F, as shown by G H. Obtaining the point H on the lower edge of the face of the girt, connect H and C. Then H C will be the line of the cut upon the face of girt.

This same operation may be performed by the use of the square alone, as illustrated in Figs. 15 and 16. As before, lay off the line B C, corresponding to the pitch taken from the elevation. From C along this line measure with the square a distance equal to the width of the timber (A B), obtaining the point F. Next, as shown in Fig. 16, square down from the point F, obtaining the point



Problems in Framing.—Fig. 13.—Face Line of Cut for Ends of Girts.

H. Connect H C, as indicated by the dotted line, which will be noticed is the same as H C of Fig. 14.

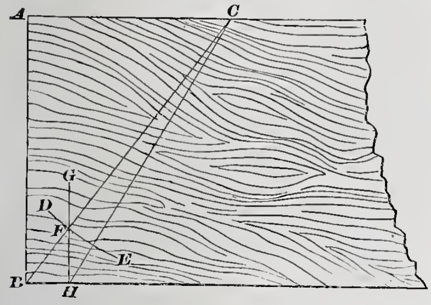
The continuation of this line across the top of the girt will be described next month.

American and Japanese Lacquer Work.

The question is frequently asked why American and European lacquer work cannot be executed to equal that of Japan.

If the writer had asked why Americans could not pull th ir mustaches and whiskers as the Japanese do, instead of shaving them, or subsist upon a penny a day, as they do in Japan, the answer would be the same, viz., because the value put upon time and the mode prescribed by custom is beyond all comparison so different between the localities named. Japanese lacquer is, undoubtedly, very different from our own, but it is a somewhat open question whether it is any better. For our part, we are pretty decidedly of the opinion that it is not, and adhere to the notion that if equal pains be taken, equally splendid results can be obtained through the use of our own lacquers as through the use of any other.

There are various opinions as to what Japanese lacquer is. Some suppose it to be a sap drawn from the trunks of living trees, with perhaps a little doctoring afterward. In appearance it is a thick fluid somewhat resembling molasses, both in color and consistence. It is not affected by either hot water or ordinary acids, and seems to partake more of the character of gutta-percha than of a rosin. Its great peculiarity is, however, its highly corrosive nature. A portion of it dropped on the hand will eat its way through the flesh with great rapidity. Whether this corrosive quality subserves any important purpose—whether it is imparted by the addition of some subtle acid or other escharotic to the virgin compound, we do not know. Nobody appears to know outside of the Japanese lacquerists, and they will not tell. So active is this quality, however, that persons visiting lacquer factories who are unaccustomed to do so, are



Problems in Framing.—Fig. 14.—Obtaining Face Line of Cut for Ends of Girts.

frequently attacked with a fever from its effects.

Thus much we know, and it is about all we do know concerning the material used, but regarding the mode of using it we are better informed.

An almost valueless commodity among the Chinese and Japanese is time. They seem to pay no regard to the man with the scythe and hour-glass, but work patiently on until the one cuts them down and the other runs out, and then others step in and take their places and go on with the unfinished work. The great prevailing idea seems to be, not so much the accomplishment of a cer tain task as to keep busy. The Mongolian is a time-killer in the best sense. Applying this to the lacquer business, he produces a small box ornamented in such a manner by lacquered work that it is worth and sells for $500 in Japanese markets. If we take into consideration the low estimate at which even skilled labor is held, in a pecuniary point of view, in Japan as compared with us, some idea of the labor necessary to bring out such a piece of work may be gained. The fact is, it is immense. Some of our readers may have read an account of a small article in ivory which was exhibited in New York some years ago, and on which a Chinaman had spent a whole life time of labor. Thousands of such little monuments to patience abound among the Chinese and Japanese, and the lacquer work of the latter is peculiarly rich in them.

A good piece of lacquer work has ten or eleven coats, each coat being polished before the next is applied, by rubbing with charcoal. If the article is to be decorated, it is done after all this labor has been performed upon its plain surface. The raised lacquer work sometimes seen in the market is not, as many suppose, the result of carving, but of simply laying on coat after coat of the material in certain places, and then grinding and polishing until the proper appearance is produced.

Think of an American workman resorting to such an expedient to bring out an *alto-rilievo*. His Yankee ingenuity would be all of a boil at the suggestion of such a thing; but the Japanese plods on in the path of his fathers, never thinking of altering his mode of execution, never complaining of the amount of time consumed in attaining even an insignificant result. Unlike the American, he is not straining for the passage of an eight-hour law; he is not looking forward to the time when a whistle shall blow, or a bell ring to discharge him from his day's toil; he is simply content to toil on and on and on, and when his present task is accomplished, he is satisfied abundantly if it brings him only the amount of rice necessary to supply his cupboard while he is engaged on the next. Wages are with him a secondary consideration, perfect work his pride. His ambition is not a lofty one in the sense in which we understand it; the works which he essays are not grand ones, such as Europeans delight to accomplish; his credit and his joy is simply to do a little thing wonderfully, surpassingly well.

Let those who propound the question which prompts this article weigh the peculiarity we have called attention to on the part of the Japanese workman, and in the other scale place the opposite peculiarity of the American artisan, and we are constrained to believe that they will think with us, that the peculiar excellence of the work in question is due not to some particular and astonishing excellence inherent in the material used, but rather to the tireless, painstaking, patient labor with which it is applied.

Modeling in Clay.

BY EDWARD A. SPRING.

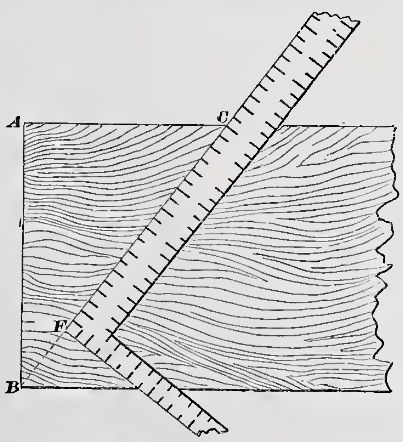
[In the last number of *Carpentry and Building*, in connection with an article upon self-instruction in wood carving, we presented engravings and description of a number of the tools in common use for modeling. The following description of materials and tools used in modeling, and practical hints for modelers, which we clip from the *Art Interchange*, will be of interest to our readers in this connection:]

By carefully observing the following rules, and studying their principles, almost any one can indulge in the fascinating occupation of modeling in clay, with fair prospect of most gratifying results. No process could be simpler. A lady has been known who began clay modeling at the age of 70, and, without any instruction, made several good medallion portraits; at the other extreme there are Indian children who make life-like animal figures from the clay found in natural beds.

Notwithstanding these facts, all beginners must expect to encounter difficulties, and must regard repeated failure only as beneficial experience. Palissy himself confesses that he learned most by his failures. Above everything else, the modeler should endeavor to start right. These five maxims meet the difficulties of most beginners, and, if pacticed, will save much time.

MATERIALS FOR MODELING.

1. Clay, such as potters use, free from grit and wet with water.
2. Modeling wax (used for very small work). Beeswax, colored with Indian red or other dry color, melted together with a little rosin, Venetian turpentine, Burgundy



Problems in Framing.—Fig. 15.—Obtaining Face Line of Cut for Ends of Girts by means of the Square—First Step.

pitch, and tallow. (Price, $1.50 to $2 a pound.)
3. Plaster. ("Casting plaster" costs less, and is stronger than the "superfine.")

TOOLS FOR MODELING.

1. The fingers and thumbs, first and best.
2. Modeling Sticks (boxwood, red cedar, pine.) A knife, spoon, crochet needle or hair pin.
3. Wire, size of horsehair, to cut clay.
4. Small sponge.
5. Place to wash the hands, with abundance of water.

PRACTICAL HINTS FOR MODELING.

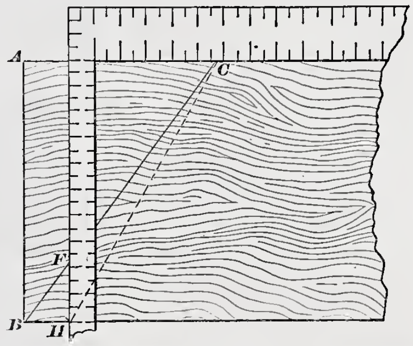
1. How to use the clay.

See that in adding clay to clay both surfaces are smooth. Rugged surfaces of moist clay will not stick together.

Leave no air confined, and the claywork will stand firmly, and, if terra-cotta clay is used, can be baked in a kiln.

2. How to see the work.

A strong light is wanted from above the level of the eye. Turn an object in the hand, or the hand itself, and you will see that the slightest roughness of surface is clearly visible only between the lightest and the darkest places—*i. e.*, in the "half light." Therefore, in finishing especially the delicate modeling must be done by frequently turning the clay or moving the light, so as to work on the "half light."



Problems in Framing.—Fig. 16.—Obtaining Face Line of Cut for Ends of Girts by means of the Square—Second Step.

3. How to be neat in claywork.

Whenever clay begins to dry on the hands, wash them with a few rapid sweeps of a wet sponge and rinse them well in several waters. This will keep the hands soft. Do not dry them on a dusty towel. If clay dries upon the hands, it falls at every movement and gets tracked about. It also scatters on the work and destroys the finish.

Avoid touching the clay with wet hands, as that makes mud. The finger tips are sometimes used dry and sometimes wet. A modeler generally keeps a damp sponge, to be touched by the tips of the fingers and the tools.

4. What kind of tools to use.

In modeling there can be only three kinds of surface to make, viz.: Plane, convex, concave, and their combinations. Any tool that will produce a given result with the fewest motions of the hand is the best to use. Clay could be shaped by simply pricking and scratching it with a point. But as such a point would be the least effective and slowest kind of tool, we may conclude that, to accomplish the most at each stroke, the largest tool should be used. It is the knowledge of these details of manipulation that saves the learner from discouragement or loss of time.

5. The use of plaster molds.

If there is a wish to produce the same, or nearly the same, form in clay several times over, it would be convenient to have a tool so shaped that by simply pressing, the form could be repeated. Such a tool is found in a plaster mold. The resources for accurate scientific study and comparison, and the various practical ways of utilizing this method of work, it will doubtless take years to develop.

To make the mold:

1. Surround the area for each mold, or piece of mold, with a "fence" of clay or other material.
2. Spray it with a solution of soap.
3. Mix plaster and fill the space so prepared, and in half an hour the mold can be used.

PRICES OF MATERIALS AND TOOLS.

1. Clay—Three cents a pound at retail. A tub with 40 lbs. of prepared clay	$1.00
2. Tools—A set of four wooden tools and fine wire	1.00
A "potter's" sponge	.10
3. Plaster—$1.75 a barrel. Small box of plaster for molds, &c	.50
Total	$2.60

PRACTICAL MAXIMS FOR MODELERS.

1. Add smooth to smooth.
2. The modeling is in the half light.—*Hunt.*

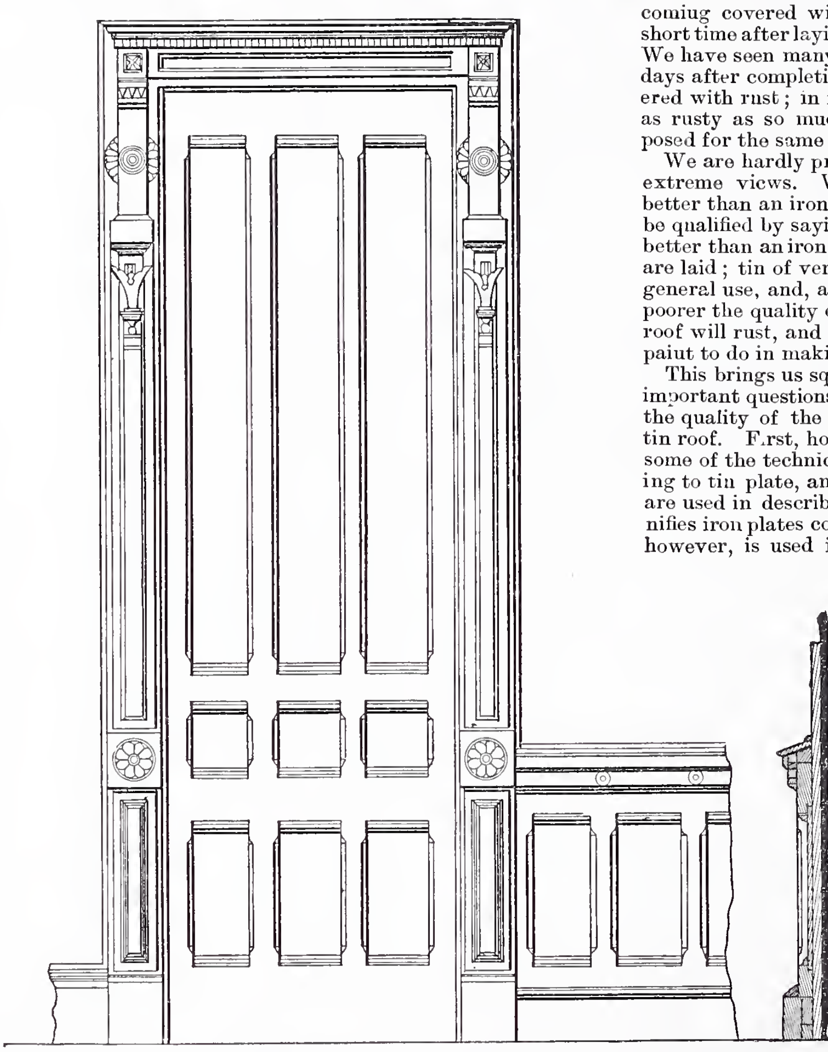
3. Be neat. Keep the hands free from dry clay. Do not work in mud.

4. Use the largest tools.—*Ward.*

5. Make plaster molds, when needed, to serve as modeling tools.—*Spring.*

Design for Door, Trimming and Wainscoting.

The design shown in Fig. 1 and the details shown in Fig. 2, represent a door trimming and wainscoting of a character employed in some of the houses of the better class at the present time. In general appearance the design reminds one somewhat of the shapes that were in fashion years ago, and which still, to a certain extent, may be seen in the older houses existing in some sections of the country. It is adapted to use, however, with higher ceilings than were formerly employed. It fairly represents the revival of so-called old fashions. The parts are quite simple; the construction is such that by the aid of the details shown, any carpenter will have no difficulty in understanding how it is to be put together. When carefully worked out in either pine or some of the hard woods appropriate for inside finish, it presents a very handsome appearance.



Design for Door and Wainscoting.—Fig. 1.—Scale, ½ Inch to the Foot.

Where the Lumber Goes.—To make shoe pegs enough for American use consumes annually 100,000 cords of timber, and to make our lucifer matches, 300,000 cubic feet of the best pine are required every year. Lasts and boot trees take 500,000 cords of birch, beech and maple, and the handles of tools 500,000 more. The baking of our bricks consumes 2,000,000 cords of wood, or what would cover with forests about 50,000 acres of land. Telegraph poles already up represent 800,000 trees, and their annual repairs consume 300,000 more. The ties for our railroads consume annually 30 years' growth of 75,000 acres, and to fence all our railroads would cost $45,000,000, with a yearly expenditure of $15,000,000 for repairs. These are some of the ways in which American forests are going. There are others also. Our packing boxes, for instance, cost in 1874 $12,000,000, while the timber used each year in making wagons and agricultural implements is valued at more than $100,000,000.

Some Good Results from the Blue Glass Delusion.—The blue glass mania, which has now almost disappeared, was not destitute of good results. It led to a great deal of scientific study of the influence of certain rays of light on animal and vegetable life. There is a paper on the subject in the *Comptes Rendus*, by a French experimenter. He found that the blue rays are least necessary in spring and winter, while the red rays are more requisite to sustain life and prevent too rapid development. He notices the fact that most leaf buds have a brown or reddish covering. Red glass, by withdrawing the blue rays, sustains while it retards life; green glass, by intercepting the red rays, causes most plants to become weak, and ultimately to perish; while the unadulterated sunlight, as nature gives it, is the best of all, and cannot possibly be improved upon by colored glass; all that is sometimes needed is a little shade for delicate plants.

Tin Roofs.

I

We propose in a series of short articles to consider the subject of tin roofs from a builder's standpoint, giving him that information concerning the material and methods of working the same which shall make him entirely intelligent in the management of the tinners whom he may engage to cover roofs for him.

A tin roof is peculiarly an American institution. Although our principal supply of tin plates is from England, the English do not roof with tin; they do not consider tin a fit material for roofing purposes. They employ instead zinc, lead, copper and corrugated galvanized iron, materials which are used to a limited extent in this country, but which are not received with general favor. With zinc, in the limited use that has been made of it in this country, so many difficulties have arisen that the public has become prejudiced against it. While, doubtless, many of the objections to zinc roofs are occasioned by bad workmanship and lack of knowledge of the peculiarities of the material with which they are dealing, upon the part of the mechanics who lay the roofs, there is still the objection of greater cost, which is sufficient in many cases to keep any material, however good, out of use so long as a cheaper article, tolerably satisfactory in character, is to be had. For this latter reason copper and lead are but little used in this country, although they find much favor with the builders of England and Continental Europe.

Tin, which is the almost universal roofing material in some sections, and which is used extensively all over the country, has, in the opinion of some, very little to recommend it other than that it is better than still poorer materials, and that it is comparatively cheap in first cost. According to their notion, it serves a good purpose in the way of a smooth surface to which to apply paint, and that the paint in reality constitutes the roof. Those who hold this extreme view bring up the fact of the extensive use of black iron for roofing purposes. Iron, as is well known, if exposed to the atmosphere without any protection, soon rusts away, but by being thoroughly painted it lasts for a considerable length of time. The manufacturers of iron roofs, from experience, have become so thoroughly satisfied as to the durability of their roofs when thoroughly protected by paint, that in many cases they guarantee them equal to, if not better than, tin roofs. An additional argument is found in the fact of a tin roof becoming covered with rust when left for a short time after laying without being painted. We have seen many tin roofs, in a very few days after completion, become entirely covered with rust; in fact, they became almost as rusty as so much unprotected iron exposed for the same period.

We are hardly prepared to support these extreme views. We believe a tin roof is better than an iron roof, and yet this should be qualified by saying that a *good* tin roof is better than an iron roof. Many poor tin roofs are laid; tin of very poor quality is in very general use, and, all things being equal, the poorer the quality of the tin the sooner the roof will rust, and the more there is for the paint to do in making the roof durable.

This brings us squarely to one of the most important questions to be considered, that of the quality of the materials to be used in a tin roof. First, however, we must consider some of the technical terms in use pertaining to tin plate, and which to some extent are used in describing roofs. Tin plate signifies iron plates coated with tin. This term, however, is used in a broad sense, and is very generally applied to plates coated with an alloy in which very little, if any, tin is used. Plates of this kind are known to the trade as terne plates, or, as they are more commonly called, roofing plates. Roofs composed of terne plates are still called tin roofs. We shall use the term tin roof in these articles in its broad sense, meaning a roof covered with sheets of metal coated with tin, or with sheets coated with the composition above named, referring specifically to the kind of plates whenever it is necessary to designate them particularly.

The character of tho iron in the plate is of considerable importance in determining the quality of the roof.* Plates in the market are of two grades—" charcoal " plates and " coke " plates. These terms—" charcoal " and " coke "—were derived primarily from the process employed in making iron, but at present they are used to designate the grade of plates in an arbitrary manner. Charcoal plates in general are better than coke plates, yet it is true that a good coke plate is much more preferable for use than a poor charcoal plate. The appearance of the finished sheet is no guide by which to determine the character of the plate. A coke plate may be as perfectly coated and have as fine a surface as a charcoal plate. The only test that can be applied to determine this question is working it. If the plate will bend backward and forward repeatedly in a given spot without breaking; or, to speak from a tinner's standpoint, if it will " double seam " without cracking, it is to be considered of satisfactory quality. The original packages in which plates are put up by manufacturers are branded either "coke" or "charcoal," according to the grade of the plate contained in them, and where the builder is able to inspect the boxes, the brand discovered may be ordinarily considered satisfactory evidence as to the grade of the plate. This cannot be depended upon implicitly, however, for in some cases coke plates are branded "charcoal," and in other instances the grade of the tin is omitted entirely in branding the boxes.

Besides the brand indicating the grade of the plate upon the boxes, there is always to be found some name or arbitrary device known distinctively as "the brand," such as "M. F.," "Pontymister," "Melyn." These brands are trade-marks. They are names and devices used by the makers to designate the particular goods which they produce. There are so many of these brands in use that it is impossible to give a list of them in a manner which will be of any practical advantage to the builder. Very few tinners are thoroughly posted in the matter of brands. This much may be said, however, in a general way. The same brand is not ordinarily applied to both "coke" and "charcoal" plates. In other words, if by experience a certain brand of tin is found to be entirely satisfactory, it may be specified again with the assurance that the same quality will be obtained. It is the pride of manufacturers to maintain the grade of particular brands which they put forth. Especially is this true of plates of the better grade.

Another set of marks to be found upon tin plate boxes is that designating the thickness of the plate, or the "gauge." These marks are, "IC," "IX," "IXX," &c. "IC" represents a plate in gauge about No. 29, as measured by American wire gauge. It is the thickness of tin plate in most common use. It is familiarly termed by tinners as "single" tin or "common" tin. "IX" corresponds to No. 27 wire gauge, and is familiarly termed "thick" tin, "cross" tin, "double thickness" tin, &c. These marks refer entirely to the thickness of the plate. The coating on a thin plate is quite as heavy as that upon a thick one. Accordingly, all other things being equal, of two roofs, one covered with "IC," and the other with "IX" tin, the latter will have a little thicker surface of iron spread over it than the former, but the coating will be the same in both cases. There will be no more tin to protect the iron in one instance than in the other.

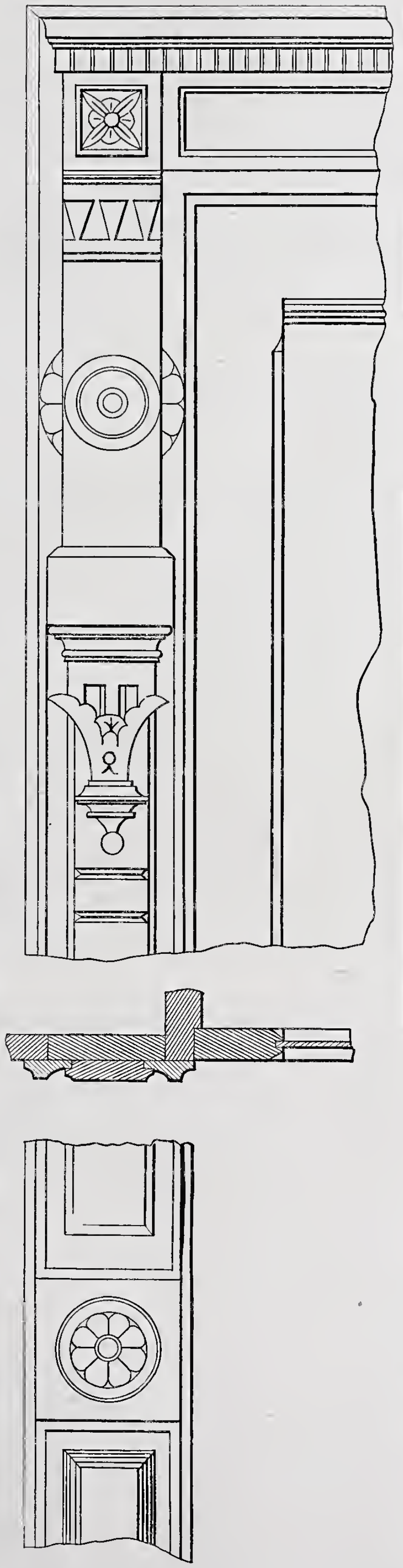
Self-Instruction in Wood Carving.

BY N. R. HARRIS.

III.

I now come to the tools used by carvers in wood. They are of various shapes and sizes, varying from one-sixteenth of an inch upward, according to the character of the work to be executed. I have known some artists to have over 200 tools, and sometimes they have found it necessary to alter the shape of one or more tools to meet the exigencies of their work. These tools are called gouges, and for the most part are straight, like a cabinet-maker's chisel; some are bent at the cutting extremity, with a longer shank between the shoulder and the extreme edge. There is also what is known as a parting or V tool, varying in size and of great use to the carver, for by it, after the use of the pencil or crayon, he lays out the lines of his work with great facility. I have, while instructing others in this branch of art labor, invariably put this important tool first into the hand of a pupil, and by its use he more easily learns the manner of holding and guiding the other tools. In my estimation the proper mode of instruction to be pursued, is to allow the novice to use a parting-tool of medium size; fasten a piece of straight-grained pine in the screw of the bench; let him draw with a pencil such lines as his fancy dictates, then let him follow these lines as best he can with the tool, and he will soon become accustomed to it, and find it fitting his hand with ease. In the use of all carver's tools, both hands are in constant use. The right grasps the handle of the implement firmly, yet easily, while the left hand guides it to its destined work. The guiding power comes from the wrist of the left hand. With the aid of a mallet, a parting-tool and a few gouges, I have seen artists produce exquisite work.

In sharpening tools the greatest care must be taken. It will be found necessary in



Design for Door.—Fig. 2.—Details.—Scale, 1½ Inches to the Foot.

most cases, particularly where hard wood is used, to sharpen the tool from both sides; by so doing greater strength is given to the edge, enabling it to cut without breaking, which is always a danger where hard wood is used. In preparing tools for pine or other soft woods, it will be found necessary to sharpen the tool from one side only, except to merely rub off the wire edge, and this is done by gently rubbing the oil slip on the inside of the gouge, while that side which is ground on the stone must have a longer bevel than ordinary, so as to cut off the soft wood with ease. With these few hints and a little practice in the handling of the tools, the learner will soon become familiar with their use.

A bench is the next thing required, and it may be of any convenient length, about 4 feet 6 inches long, and about 24 inches wide, the top to be a flat surface, and the hight in accordance with the stature of the workman. The most convenient hight is to have the top of the bench reach to the navel of the abdomen. This gives relief to the back and shoulders during long continued work. In appearance, a carver's bench is much like a cabinet-maker's bench, having a tail screw and iron dogs to hold the work firmly and solidly in its position. A movable vice is requisite in many instances, and will be found necessary for certain classes of work, together with a mallet, rasps, files, &c. These make up a carver's outfit. All tools are laid on the bench, with the handles turned *from* the worker, which necessarily places the edge of the tool before the eye, and by this means the carver is enabled to select the required tool without delay.

The tools made by Addis are considered the best by carvers, on account of their shape and the excellence of their temper, a most important requisite in the selection of tools.

In taking casts and impressions from figures, medals, leaves, &c., plaster of paris is generally used. It is easily mixed with water, is so fine that it will take the most delicate impression, and it hardens quickly. It is fitted for the double purpose of making casts and molds.

The particular manner of making casts depends on the form of the subject. Where there are no projecting parts, or such only as form a slight angle with the principal surface, it is simple and easy. But where parts project in sharp angles, or form curves inclined to the surface, the work is more difficult.

The first step to be taken is that of forming the mold. The original, or model, must first be well oiled and placed on a proper support. It must be covered with the soft and almost liquid plaster of paris to a proper thickness, and this covering must be left to set firmly, so as to bear dividing without falling to pieces, or being liable to be put out of its form by slight violence. It must then be divided into pieces, in order to its being taken off from the model, by cutting it with a knife or thin blade, and, being divided, must be cautiously taken off and kept until dry. The art of properly dividing the molds in order to separate them from the model, requires some dexterity and skill in the art of casting and does not admit of rules. When the subject is of a round or spheroidal form, it is best to divide the mold into three or more parts, which will then come off in a very easy manner from the model, and the same operation holds good in any regular curved figure. The mold being thus made and allowed to dry, the parts must be put together after being well oiled, and placed in position. The mixed plaster must then be poured into the opening left for such purpose and allowed to set and dry; when taken out of the mold and repaired where found necessary, the whole operation will be finished.

The New Capitol at Hartford.

A writer in one of the daily papers likens the new capitol at Hartford to one of the visions recorded in the book of Daniel. When the General Assembly occupied this costly structure for the first time, last winter, great alarm was caused by the announcement that the massive granite piers at the base of the building and in its center, which support the dome and lantern and much of the center superstructure, were settling and breaking into pieces. Investigation revealed that these piers, instead of being of solid stone, as they should have been, were of brick, covered with a deceptive veneer of granite. The weight fell upon the edges of these granite blocks, and some of them are badly cracked and out of place.

Workmen labored day and night for weeks pouring melted type metal into the holes which were behind the granite surface. Many tons of this metal now lie packed away in these piers, and it is believed that in this way the settling which threatened to ruin the building has been arrested. The commissioners who have had charge of the erection of this edifice have recently decided to gild the surface of the dome, which is sheeted with copper, and which measures some 4100 square feet. Taking these two circumstances together, the dome above, which is soon to shine with gold, and the foundations below, which have proved insufficient, this writer refers to the vision of Nebuchadnezzar, in which he saw a statue which Daniel interpreted for him, whose head was of fine gold, whose breast was of silver, and whose feet were partly of iron and partly of clay. Its destruction began at its feet, which were probably no stronger than a combination of cracked granite and type-metal, and after these had been broken, "then were the iron, the clay, the brass, the silver and the gold broken to pieces together, and became like chaff of the summer threshing floors, and the wind carried them away." It is to be hoped that this comparison, which, it must be acknowledged, up to this date has points of resemblance, is not to be completed. The Capitol at Hartford is an imposing building, and, aside from some bad workmanship, is a credit to the commonwealth to which it belongs, and we sincerely trust that the defects in its construction are not sufficient to cause this prophetic fate to be realized.

Mineral Wool.

A material which is coming into general use in places wherever a non-conducting substance is required, is variously named "Mineral Wool," "Silicate Cotton" and "Slag Wool." In appearance this material resembles wool somewhat, or it may be described as more nearly like "ginned" cotton in appearance. It is one of those materials which to the unscientific is a surprise both in its appearance and its qualities, as well as by reason of its origin. It is a mineral substance, and is obtained by forcing a blast of steam through the molten slag which is the product of blast furnaces. The slag is allowed to flow out in a small stream into a steam-jet, by which it is propelled forward in the shape of fibers and globules, somewhat in the fashion of snow flakes in a whirlwind. There is this material difference, however, in the comparison, the flakes in the manufacture of mineral wool are red hot instead of being a frozen substance, as in the case of snow. These fibers cool as they settle on the floors over which they are blown, and become intermixed with such particles as are blown by the steam into the space in the shape of globules or "shot," as they are frequently called.

This process, it will be seen, is simply a mechanical conversion of slag into a material the nature of which admits of its use in various directions for which the slag itself would be totally unfit. Slag consists, to the extent of upward of 95 per cent., of strong chemical combinations of silicates and aluminates of lime and magnesia, which makes it entirely fireproof and indestructible by water or atmospheric influences. Slag weighs from 160 to 190 pounds per cubic foot, while the wool under even pressure, according to quality, weighs only from 8 to 28 pounds per cubic foot. By this it will be seen that mineral wool, as applied, contains from 6 to 24 times its own volume of air, subdivided into innumerable air spaces between the fibers, which are not hollow like hair, but solid.

The density of bodies, generally speaking, determines the rapidity with which heat is transmitted through them, and accordingly it is found that metals are the best conductors, and stone, earthenware and plaster not so good; while porous or air-confining substances constitute so-called non-conductors. Heat is conveyed through air by the motion of its particles; therefore, if the circulation of air is prevented by some suitable obstruction, the passage of heat is retarded. A substance to be a superior non-conductor for application on heated surfaces, should combine great air-confining capacity with indestructibility. These properties are combined in mineral wool. The immense expansion of slag which takes place in its conversion into wool, is illustrated by stating that 1 cubic foot of slag makes something like 24 cubic feet of mineral wool, enough to cover 192 square feet of surface 2 inches thick.

The uses to which mineral wool are applied are various. It is brought into most common notice as a covering for steam pipes, boilers, brewer's steam kettles, and other surfaces to be protected on account of the loss of heat by radiation. Its application for such purposes is very simple. A plain board casing or, preferably, a sheet-iron casing, somewhat larger than the pipe or other part to be protected, is provided, which is held in position around it by suitable means, and between the two surfaces the wool is loosely stuffed. It is stated that 1 inch thickness of mineral wool protects as much against heat as 1½ inches of paper, 2 inches of wood, 3 inches asphaltum and 4 to 8 inches of brick or sandstone. From this statement an estimate may be formed of the advantage to be gained by the use of this material.

Besides its use for protecting heat surfaces from the loss incident to radiation, it is also useful in protecting surfaces against the influence of heat. In other words, it is equally serviceable in protecting ice houses, cold-water pipes, water tanks, refrigerators, &c It is also highly recommended for lining iron buildings, for which it is specially adapted, as it prevents the frequent sweating of the iron, which is the condensation of moisture caused by too rapid interchange of temperature through the walls. This may be illustrated by a simple comparison. When a vessel which contains ice-cold water sweats on its outer surface, it is a sure sign that its walls are not thick enough, or composed of proper material to keep the cold in; and if it is a vessel filled with hot water the condensation of moisture will take place inside, as may be seen by raising the lid of such a vessel. Roofs and walls made of iron, which is one of the best conductors of heat, act in this same general manner, and should, therefore, be properly lined with a non-conducting substance in order to prevent loss of heat in winter and radiation in summer.

Mineral wool is not only specially adapted to use in connection with iron buildings, but also to use for much the same purpose in connection with wooden buildings and in roofs of brick buildings. A thickness of wool 1 to 1½ inches between two courses of sheeting boards upon the roof of a building, is sufficient to ward off in summer the direct sun heat, and to save about 25 per cent. of the coal usually consumed in winter. It likewise prevents condensation of moisture, which is caused by too rapid interchange of temperature taking place through ordinary roofs and corroding the tin underneath. It is used in frame buildings for lining the walls by stuffing the wool between the boards and the studs.

Mineral wool is especially valuable for deadening the sound in floors. For this purpose a false floor is laid between the joists below the regular floor, or a floor of rough boards is laid directly upon the joists, the floor itself being supported above it by cleats, the intervening space in either case being filled with the wool. This material has the additional advantage for this purpose of being entirely vermin proof. Rats and mice find no home in spaces filled with it, while moths and other insects find no lodgment in it, a quality not generally possessed by the materials with which it competes.

The above enumeration covers only part of the uses to which this substance may be applied advantageously. The price at which it is sold is so low as to make its application possible, as well as advantageous, in almost all situations. The devices required for using it are so simple that any mechanic of average intelligence can suggest various methods of applying it, in almost any position desired, any one of which would be suitable. Accordingly, it becomes available for use under all circumstances.

Not only in the manufacture of mineral wool from what was formerly considered waste material has a triumph for industry been accomplished, but the product obtained is unquestionably one of the best and most economical non-conducting materials ever adopted. It has been largely introduced in England under the name of "Slag Wool," and is in very general use in Germany, where it is called "Silicate Cotton." The rights for its manufacture and manipulation are controlled in the United States by Mr. A. D. Elbers, 26½ Broadway, New York, from whom further particulars may be obtained.

Lime and Hydraulic Cement.

From various authorities, among which may be named, Vicat, Burns, Haswell and Gen. Gilmore, the following statement of the characteristics of various kinds and qualities of lime and cement has been compiled:

1. The rich limes are the purest metallic oxide of calcium we possess, and the purer the carbonate of lime from which they are obtained, the more distinctly marked are the appearances from which they derive their name. These are that they augment in volume to twice their original bulk, or even more, when slaked in the usual manner, and that they will not set (harden) under water if not mixed with any other mineral material, even though left immersed for years.

2. The poor limes are those which do not augment in bulk at all, or only to a trifling degree, when slaked. They do not set under water any more than the rich limes.

3. The moderately hydraulic limes set under water in from fifteen to twenty days, but do not become very hard. The change of bulk they undergo in slaking is the same as that of the poor limes, but never equal to that of the richer varieties.

4. The hydraulic limes set in from six to eight days' immersion, and continue to harden for some months.

5. The eminently hydraulic limes set within three or four days, and become quite hard in a month.

A classification of rocks with reference to chemical examination is as follows:

1. Pure calcareous rocks, or those containing from 1 to 6 per cent. of silex, alumina (common clay), magnesia, iron, &c., either separately or in combination, give rich limes upon being calcined.

2. The limestones containing soluble silica in the state of sand, magnesia, the oxides of iron and of manganese, in various respective quantities, but limited to between 15 and 30 per cent. of the whole mass, yield poor limes.

3. The limestones containing silica in combination with alumina, magnesia and traces of the oxides of iron and manganese, in various respective proportions, but within the limits of from 8 to 10 per cent. of the whole mass, yield moderately hydraulic limes.

4. When the above ingredients are present in the proportions of from 15 to 18 per cent., but the silica in its soluable form always predominating, the limestones yield a hydraulic lime.

5. When the limestones contain more than 20, and up to 30 per cent. of the above ingredients, but with the soluble silica in the proportion of at least one-half of them, the limestones yield eminently hydraulic limes.

The experiments upon which the above conclusions are based appear to show that limes owe their hydraulicity, or power of setting under water, to the presence of a certain quantity of clay, and sometimes, but rarely, to the presence of a certain quantity of pure, soluble, silica; and upon that principle a large proportion of our hydraulic cement, or water lime, is manufactured by mixing common fresh burnt lime with burnt clay and grinding them together, generally in the proportions of 20 parts of clay to 30 parts of very rich lime, but the proportions vary with the qualities of limestones and clays found in different localities.

CORRESPONDENCE.

Criticisms on the First Prize Design.

From O. O. J., *Philadelphia, Pa.*—I have carefully examined the plan and specification published in the July number of *Carpentry and Building*, and, with K. O. A., must express my satisfaction with it in a general way. There are some points, however, about the plan to which I wish to call attention. I would respectfully ask the authors of the dosign to give me figures by which I may work in constructing a house to the plan they have laid down.

By examination of the first-floor plan, I find that the hall measures 7 feet in the clear. The stairs are 2 feet 6 inches in width. After subtracting the space occupied by the stairs across the end of the hall, it leaves but 4 feet 6 inches. Three steps extend into this space, which, estimated at 8 inches width of tread, occupy 2 feet. This leaves but 2 feet 6 inches between the lower step and the jamb of the door—a space, it seems to me, altogether too small, considering that the door swings back in that direction.

Or, looking at it in another way—counting the steps from the foot of the stairs upward, there are nine risers before reaching the top of the door leading into the dining-room. Estimating the risers at 8 inches each, the extreme hight at this point would only be 6 feet, which is hardly sufficient headroom for a door leading from the principal hall into one of the principal rooms of the house. Of course, my dimensions are taken simply by measurement of the small scale plan, as published in *Carpentry and Building*, and it may be that some inaccuracy in engraving, or some discrepancy in measuring to so small a scale, will account for a part of these difficulties. Perhaps the faults seem much greater than they really are. Therefore, as above stated, I respectfully ask Messrs. Hale & Morrison to provide the readers of *Carpentry and Building* with figures by which the staircase and hall may be constructed in a satisfactory manner. I am much pleased with the general arrangement of the house; I think it very desirable, and I am confident that the difficulties I have encountered can be entirely overcome.

From D. S. HOPKINS, *Grand Rapids, Mich.*—I desire to say a few words in a friendly way, criticising the plan receiving the first prize in the recent competition for cheap dwellings.

It is supposed, among other requirements of plans, that they should be practical in their construction. Allow me to call attention to tho front hall and stairs of the first prize design. The distance from the front doors to the first tread of stairs is less than 2 feet; the front doors are each 2 feet 4 inches wide; consequently one of the doors will open only partially, striking against the end of the first step. The door into the dining room from the hall, under the stairs, at its lowest corner cannot be over 5 feet high, and only about 6 feet high in the center. These dimensions might do for small children or pigmies, but certainly not for adults of ordinary stature. Going into the sitting room, one must stoop or go to one side to avoid contact of the head with the string of the stairs.

I claim that the stairs in this design are impracticable in the several particulars of construction, convenience and appearance; also that the hall is altogether too small. A hall 7 feet square for front stairs cannot be otherwise than impracticable when the stairs are treated as they are in this design, owing to location of openings, &c.

Some may question the good faith of my criticism, and cry "sore head," simply because I was one of the competitors and the author of the second prize design. To such I would say that, not anticipating any prize, I was more than agreeably disappointed when learning of the results of the competition. I had not taken any special pains or study with the design which I submitted. Since that design has been published in *Carpentry and Building*, it is open to the public for criticism. I acknowledge it is not without fault, and therefore it is welcome to such criticism as may be offered.

The general arrangement of tho plan of the first prize design pleases me, the only exception being the hall to which I have referred above. That is a complete failure.

From G. H. H., *Germantown, Philadelphia.*—I desire to ask of the authors of the design receiving the first prize, Messrs. Hale and Morrison, a few questions for my own information, and likewise of interest to the roaders, generally, of *Carpentry and Building.*

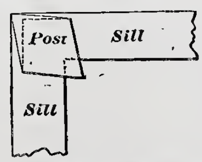
I would like to know how much difference there is between the prices of materials, as published in the price current in *Carpentry and Building*, and the prices used in making their estimate ?

What is the price of labor, per day, to be employed in the different parts of the work—for example, laborers, masons, carpenters, painters, &c. ?

How is the parlor and the two bedrooms opposite the stairs to be kept warm in winter ? The specifications do not provide for any heater.

"Problems in Framing" Discussed.

From G. H. H., *Germantown, Philadelphia.*—The article entitled "Problems in Framing," appearing in the July number, was one of great interest, and to many new beginners in carpentry it will certainly prove of considerable advantage. When correctly understood, the principles explained in it will saye even journeymen many an hour's hard work. There seems to me, however, in the problem of the July number a double quandary, so to speak. It



Problems in Framing.

appears that either the Editor wanted to see if any reader of *Carpentry and Building* knew how to frame such a structure, or else he has surely made an oversight in the solution. I refer to what may be termed the "offstand."

The plan of finding the cuts on the foot ends of the post is very good, but how can any one apply these bevels to the square post with the right effect ? Cut a square post to fit a square corner when it pitches like a hip-rafter, and you will find the end of the post to fit the square corner will have the appearance indicated in my sketch inclosed. A square post cut off any way but square end, or, in other words, at right angles to its sides, will show an end of the shape of a rhombus, or diamond. Therefore the hip-post must be "dressed" to some peculiar rhombus shape, so that when the bevel given is applied to the post and the end cut off, the end will show a perfect square in a horizontal plane—for example, as when applied to the sills. I suggest to the Editor that he look over the problem again and see if he did not begin to frame too soon. Let him be sure he is right and then go ahead.

Note.—We are obliged to this correspondent for his criticism concerning the article entitled "Problems in Framing," in the July number, because it assists us in making some points clearer than otherwise might have been done. The sketch which our correspondent has sent we have had engraved, because it so clearly shows the necessity for what is called "backing," the preparation for doing which is explainod in the continuation of the article contained in this number. We think if G. H. H. reviews the whole matter, he will agree with us that we did not commence to frame too soon, and that it is desirable to make the cuts at the foot end of the post before attempting the process of backing. It certainly seems the logical order of the processes involved, and as we clearly show in the article in this number, the second step is more readily performed by reason of the first one having preceded it. The method of obtaining the required shapo for tho backing, by means of the square applied to tho end of tho timber cut to the bevel, is altogether practical, and is probably the most desirable one for general use. Of course, it could not be used if the foot end of tho timber had not first been correctly cut.

The method of obtaining tho bovel for the foot end of the timber, either by applying the bevel to the drawing, as illustrated in the first article, or by use of the squaro, as also illustrated in that article, is available, whether applied to the timber before or after backing. To the average beginner, however, we think it would be much clearer if performed upon square timber than upon timber which had been previously backed. Where it is desirable for any reason to back the timber before framing, as, for instance, performing the operation by means of a saw-mill where the timber happens to be obtained, the backing may be made the first operation. In that case, the bevel would be obtained by the first method explained in the article in this number, for of course the second method would not be available.

Our correspondent is obviously incorrect when he questions the possibility of applying "these bevels to the square post with the right effect." The extreme outer corner of the post, either, as originally, square, or after it has been backed, assuming the shape of a rhombus, is a straight line. The bevel resulting, therefore, will be the same, whether the plane over which it is drawn be in one position or another; whether the angle of the corner, as indicated by a 3-square cut at the end, is 45, or 40 or 50 degrees. This is susceptible of demonstration by a very simple experiment, which will doubtless suggest itself to our correspondent.

Architect, Owner and Builder.

From G. W. B., *New Jersey.*—In looking over the February number of *Carpentry and Building* I noticed a communication from R. S., New Jersey, entitled "Builder *vs.* Architect." He seems to think that the relations between the owner and the builder, who is also the architect, is likely to be of the pleasantest nature, whereas, where the contractor and architect are two different persons, the architect is apt to assume the role of absolute dictator, and that a constant jarring and pulling in opposite directions is the consequence, and before the awful presence of the architect the owner must shrink into proper insignificance, &c. He says he don't ask you to adopt his views, but thinks that whether you do or not, they are correct.

As far as my experience goes just the contrary is correct. Where the contractor is his own architect and superintends his own work, there is a great deal of dissatisfaction between him and the owner; that is, in most cases. There may be isolated cases where his views would be correct. I do not think an architect ought to be at all arbitrary in regard to the planning of a building. The owner and himself should consult together, and the owner might make a sketch of ground plans, and then submit them to the architect to work out and put in proper shape to be constructed; but I do think the architect, if he understands his business, ought to have full power in superintending, especially in regard to the construction of the work.

Another point is this: If a builder is his own architect and the plans are put out to other parties for proposals, tho first has a decided advantage over others if he is to superintend the work (and I have known cases of this kind). If he gets the job he is his own superintendent, and can do as he pleases about following the specifications to the letter, and the owner is none the wiser at the time. If some other parties get the work he can make them do the work as specified to the very letter, consequently it is hard to get persons to estimate for work against parties who combine the building and architectural professions together. It would, in my opinion, be far better for all concerned if builders were to work after plans drawn by an architect, and the work to be done under the supervision of the architect. It would give all builders a chance alike, and would give better satisfaction to owners, average owners included; and if both builder and architect are inclined to do what is right there need be no clashing whatever, and there would be no danger of the owner having to shrink into very small proportions. I will add that I think your paper the best and cheapest one of the kind that is published.

Shingling the Hip of a Roof.

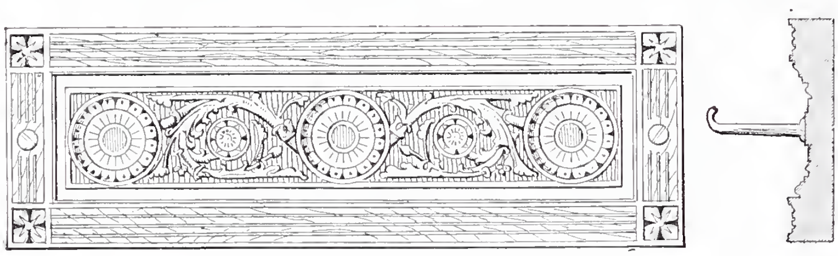
From SMITH AND HOWE, *Architects, New York City.*—Your correspondent S. A. M., in the August number of *Carpentry and Building*, desires to know the best method of laying shingles on the corner of a hip roof.

A very thorough way is to weave the shingles in on the hip from either side of the roof, having previously provided sheets of tin or zinc 20 inches wide, and of a length equal to that of the shingles. As the shingling proceeds bend a sheet of the tin or zinc over the hip and under each new course of shingles, the metal being laid with the shingles in courses.

Note.—Lead is also advantageously used in a manner similar to that described above. Zinc, unless a very heavy grade is employed, we should regard as altogether unsatisfactory for the purpose on account of its rapid destruction by oxidation.

Design for Towel-Rack.

From W. L. M., *Rochester, N. Y.*—I herewith inclose a design for a towel-rack, sent in response to the request of one of the correspondents whose letter was published in a recent number of *Carpentry and Building*. The scroll-work in the center of the panel is adapted to construction either in carved wood or in cast metal. The projecting arms are inserted in the centers of the rosettes.



Design for Towel-Rack.—Scale. 1½ inches to the foot.

A Reply to Questions Asked.

From S. W. H., *Russell, Kan.*—There seem to be but few readers of *Carpentry and Building* willing to give their experience as contractors, or to state prices for labor in performing certain kinds of work. Your correspondent W. P. R. strikes the key to the proper meaning of estimating, when he says no one need make mistakes if he estimates work in detail. Undoubtedly that is true in a general way, but it still remains that work is constantly coming up, different in some respects from what the mechanic has ever done previously. In such instances he must rely upon his best judgment in making prices. He has no better guide, because there is no mechanic who has reached the last round in the ladder of science, or who can say he is a master builder and perfect in all its branches.

If one were to judge from the communication of J. H. P., he must be an exception to this rule. He seems to ignore everything that has been said or published on the subject of estimating. He asserts that because a certain 15 x 32 window may cost, complete, $9, it does not necessarily follow that another window of the same size, differently trimmed, glazed and completed, may not cost $30. I would respectfully ask him who says that it does? Let J. H. P. describe any window frame in the same manner as given in an architect's specification, and then tell us what it is worth to make it, exclusive of material, based upon a certain price per day for labor. This is a sample of the results at which we desire to arrive.

In answer to W. P. R.'s first question addressed to me, I would say that wages in this locality are from $1.25 to $2.25 per day. Replying to his second question, concerning the difference between labor and material for a small building costing from $1500 to $2000—take the design published in the July number of *Carpentry and Building*. The material—consisting of lumber, hardware, tin, lime, sand, cement, plaster, hair, stone, brick and paint—necessary to complete this building according to specifications and drawings, will cost in this vicinity $1000, and the labor requisite to put the same together and complete the building as specified, will not cost to exceed $500.

I am amused at W. P. R.'s attempt to crawl out from the broad assertion in his first letter, that labor will equal material in all cases, which he certainly offered as a rule by which to estimate. It seems to me that his two letters are hardly consistent. The latter asserts that he offered it only as a warning to inexperienced mechanics. In this connection he asks me to tell the difference between labor and material in the production of gold leaf, in the manufacture of brick, black silk hats, bar iron, &c. In reply, I must say that I have never had any experience in the manufacture of any of these articles, therefore I am not able to answer. I have never followed any other trade than carpentry, joiner work and stair-building. I have been engaged upon these for the last 23 years. I served an apprenticeship for five years, and have worked at these trades ever since, and I am still learning something every day with reference to them.

German and French Glass.

From F. P. D., *Erie, Pa.*—Will you please inform me what is meant by the term "German" glass. I would also be pleased to know the particulars concerning French glass and wherein German glass and French glass differ. I have found these terms used in such a way as to make them seem perplexing to the buyer. By publishing full particulars you will no doubt oblige many readers.

Answer.—From inquiry among importers we learn that no glass of French manufacture is imported into this country, nor of German manufacture either for that matter; that the glass works manufacturing the glass which is brought into this country are located in Belgium; that the glass brought to New York is sold in the market under the name of "French," while that which is brought to Boston, coming, in many cases, from the same identical factories, is sold as "German" glass. The two names stand as equivalents, being used in different markets. No. 1 French and No. 1 German glass should be of the same quality, although different dealers may apply different standards, and grade their glass accordingly.

Defective Draft.

From J. L. T., *Skowhegan, Me.*—A neighbor of mine has a chimney in a hot-house which gives him a great deal of trouble. The chimney is made of brick, the flue inside being 8 inches square and 40 feet long. In this length it only rises about 18 inches from the horizontal. At the end of this long and nearly horizontal flue the chimney rises 10 feet perpendicularly. This is made of round clay pipe 8 inches in diameter. It will not draw enough to keep the room from freezing, with a good stove and the best of dry wood. Can anything be done to make it draw is what he wants to know?

Answer.—The flue is so long and so small that it is a difficult matter to heat the whole length of it and the upright chimney as well. Another source of difficulty is found in the fact that the horizontal flue is of brick; its interior is consequently rough, and a good deal of friction results from this. The draft in this chimney is produced by the difference in the weight of a cold air column 11 feet 6 inches high and a hot column of equal hight. Now, the vertical portion of the chimney is so far away that it never becomes thoroughly heated. The greater the difference of temperature the greater the difference in the weight. The cold chimney of course diminishes the draft, and the long flue, on account of the great friction, still further diminishes it. Having got at some of the reasons for a want of draft, it is easier to see what must be done to secure what we desire. Evidently, if the chimney could be kept hotter a better draft would at once result. The same thing might be expected to happen if the hight of the chimney were increased. The chimney is considerably smaller than the flue, and it would be advantageous if the stove pipes were made smaller in area than the chimney itself. To test the value of the suggestion in regard to keeping the chimney hot is very easy. If a small fire be built in the bottom of the chimney or a pail of hot coals be lowered down the chimney, it will be heated and a good draft through the flue may result. It may be found that even with a hot chimney the draft is not good. Should this be the case a longer chimney will no doubt be necessary. The case is very similar to that of a church stove with an immensely long pipe. While the pipe is cold the draft is hardly worth mentioning. After it has become warmed no difficulty is experienced. It is always necessary to waste some heat in order to obtain a draft, but in the case of the green house the flue so effectually cools the smoke that the gases, by the time they reach the chimney, are nearly as cool as the outside air. We see no practicable way out of the difficulty except to add very considerably to the hight of the chimney. This will increase the draft sufficiently to overcome the friction in the long brick flue

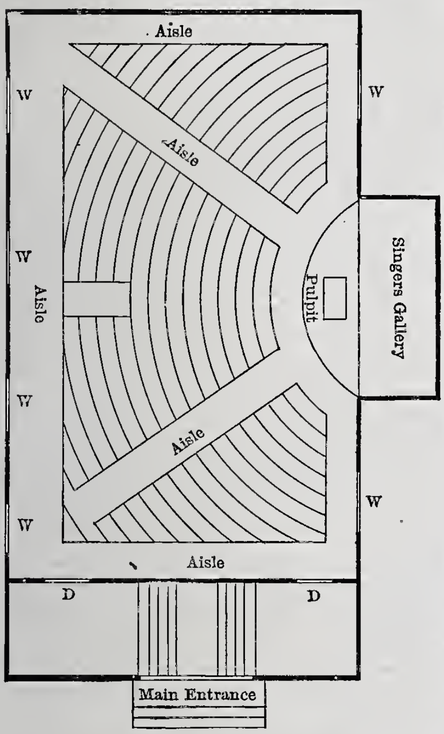
Defective Acoustics in Public Buildings.

From T. M. C., *Boston, Mass.*—Your correspondent from Pierson, Mich., asks for methods of correcting defective acoustics in halls, churches, &c.

Echoes in churches are frequently produced by the cushion of air inclosed in the recess behind the pulpit and in the upper part of the ceiling, quite as much as by the flat walls opposite the entrance. Domed skylights over the halls very often cause an echo below them, and in this case the echo would appear through the length of the hall. Echo from the recess, especially a shallow one, behind the speaker, is also a frequent occurrence. A common remedy is to stretch cloth over the upper corners of the ceiling, and it is one which very frequently gives satisfactory results. Thick wires stretched in the same position, 12 or 18 inches apart, also give satisfactory results, but I do not think it as good for the purpose as cloth. To cut off the echo from the cushion of air behind the speaker is not so easy, as hanging cloths against the face of the wall would not help much. If decorative hangings or screens could be so disposed as to give an elliptical or shell-like form to the recess, it would undoubtedly be an improvement. In some cases it is useful to alter the position of the speaker, carrying his stand further back, if this is admissible. Next to these precautions for overcoming the echo from the cushion of air behind the speaker, hanging cloths on the end wall, as well as that opposite the speaker, are probably the best that can be suggested.

Badly Constructed Audience Room.

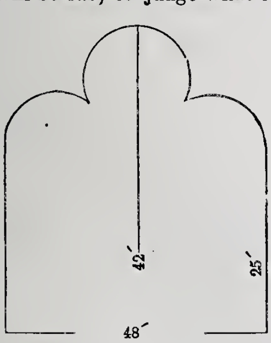
From NEMO, *Ottawa.*—I take advantage of your kindness in replying to questions asked by your readers, to request information upon a subject that is of considerable interest to me. Some months since I had the job of heating a new church, which, when completed, gave satisfaction to all concerned. The acoustic properties of the building are, however, very bad. With some speakers in the pulpit it is with great difficulty that their utterances can be understood, especially if delivered in a loud tone and with rapidity; while with others, speaking in a lower tone and more slowly, the defects are not so much noticed. Take it altogether, the building is a failure, so far as acoustics are concerned. I send herewith sketches of plan and section of church. The ceiling and walls are plastered. The pews are arranged on the circular plan, the pulpit forming the center of the circle, and the floor is on an inclined plane, rising upward from the pulpit. There are two small galleries, one immediately over the pulpit in a recess, and the other over the main entrance, likewise in a recess. The



Audience Room.—Plan.

gable end is plain and flat, without any gallery or other work to break the dead flat surface, and I am inclined to the opinion that if a gallery were erected at this place, it would break the waves of sound and kill the echo, which I think is the cause of the defect. Fine wires have been tried in various positions as a remedy, but without any good effect. Can you make any suggestions?

Note.—The question asked is by no means an easy one to answer, without seeing the building and trying for oneself the effects of various methods of speaking. By hanging drapery of any kind upon the flat gable end so as to cover the greater part of the surface, it will be easy to judge what the effect



Audience Room.—Section.

of a gallery across that end will be. As we understand the sketches sent, which we have had engraved, the form of the audience room is a most unusual one. From the fact that speakers who use a low tone of voice are easily heard, we should almost think that the fault of the room was its being too good for speaking—that is to say, the speaker is too easily heard. The fact that the speaker is placed upon the side of the room, which is very long as compared with its breadth, doubtless increases the evil, while the form of the roof is such as to act somewhat after the manner of an old-fashioned sounding board. As to the remedy we can say little. Curtains or drapery of some kind upon the walls will destroy the echo. They must be of sufficient size to really break up the reflecting power of the surfaces in front of which they are hung. The experiment can be easily tried with pieces of sheeting, which need not be cut, but merely unrolled and hung along the walls, or draped in festoons in the curves of the roof. As we have said, the form of the roof probably plays no unimportant part in producing an echo; hence, if the cloth can be made to break up the sounding-board action, an improvement would result.

Deadening Sound in Floors.

From W. K. B., *Oaks Corners.*—If W. J. M., Painted Post, will lay a floor between the joists down about 3 inches, and cover the same with mortar about 1 inch in thickness, his difficulty will be overcome. A thin coating of mortar with a dead air space, as above described, is an effectual method for deadening the sound in floors. I have seen tan-bark and sawdust employed for the same purpose, but consider mortar enough better to justify the extra cost.

Note.—In another column, describing the use of mineral wool, we have referred to its adaptability for deadening floors. It may be applied in the same general manner as described for the mortar, and is likely to give more satisfactory results than mortar or either of the other materials our correspondent refers to.

From J. P. B., *Princeton, Ill.*—A method of deafening floors that I have used with success is to lay a floor of common surfaced boards on the joists. After the building is plastered cover this floor with heavy carpet felting, and over this lay the upper floor of well-seasoned flooring. This makes a tight and non-conducting floor. The same feature may be employed in old buildings by laying a new floor above the old floor, putting the carpet felting between, in the manner above described.

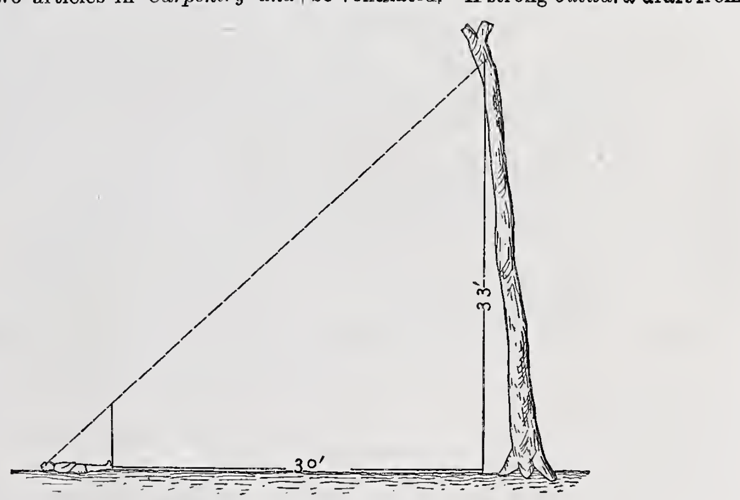
Measuring Standing Timber.

From L. D., *Ross, Ohio.*—As I have noticed one or two articles in *Carpentry and Building* on the subject of measuring the hight of standing timber, I propose to give a method which I have used, and which is sufficiently accurate in cases where a workman wishes to know if a standing tree will make a stick of timber of a given length.

Suppose a 30-foot piece of timber be required. If the selected tree does not lean, measure 30 feet from its root as nearly on a level as possible, and there fix a stake perpendicularly in the ground, making it come just level with the eyes when standing perfectly erect. The workman then lies upon his back, with his feet against the stake, as indicated in the accompanying sketch, and in this position sights over the top of the stake to the tree. The point upon the tree upon which his eyes fall in this manner will be the required point for cutting off the given length of timber.

In using this method allowance must of course be made for unevenness of ground and for any variation in the trees from vertical lines. The plan described gives about 3 feet for stumps and cutting, which occurs by reason of the eyes being somewhat above the surface of the ground during the operation of sighting over the top of the stake. The principle upon which this operation is founded is that of similar triangles, and the mark upon the tree to be absolutely correct requires the eye to be upon the level of the ground. Of course it is not in that position by the thickness of the operator's head. In using this method for measuring a greater hight, as for instance 60 feet, the allowance for the stump will be proportionately reduced, and therefore it must be taken into account as an extra in estimating what the tree will yield.

This same plan may be applied in a more accurate manner by making the top of the stake as much higher than the eyes as the eyes are above the surface of the ground when the operator is lying down.



Measuring Standing Timber.

Ventilating School Rooms.

From C. & B., *Machias, Me.*—We have a school-house to ventilate and would like to know the best method of doing it. First, where is the best place for the register, at the top or bottom of the room? Second, should the ventilating pipe from the registers connect directly with the ventilator or cowl, or the roof, or is it as well to run them into the attic and let the air circulate through the ventilators on the roof above? If you can answer these questions and give us a little instruction it will greatly aid us in carrying out our project.

Answer. — Without knowing anything about the rooms to be ventilated, how they are to be heated and the number of children to occupy them, it is, as our friends can readily see, a somewhat difficult task to give general directions which shall be of any great service to them. We will do the best we can, and hope that we may be able to give some hints that will be useful. As will be seen from the remarks made in our answer to the preceeding letter, there should be means for removing foul air, both from the top and bottom of all rooms that are to be ventilated. A strong *outward* draft from the bottom of a room, by means of a connection with a chimney, is exceedingly valuable, not only in equalizing the temperature in the room, but in removing the cold, foul air which accumulates to some extent in the lower portion of all large rooms.

We think that the registers should communicate directly with the cowls or hoods upon the tops of the building, and not be allowed to pour their foul air out into the attic. One reason for this is that the heated air from below is likely in the winter time to be loaded with moisture; consequently, if allowed to circulate in the attic, "sweating," or condensation, might result to the injury of the building. The flues by which the air is to be taken from the building should be arranged so that they may always be warm.

Thus a draft through them will always be certain.

Many people have an idea that there is always an upward draft through a chimney or a flue built like a chimney. This is a great mistake, which is constantly leading to grave errors of construction and operation of ventilating apparatus. For example, in our own office we have a long flue reaching to the roof and built in the same way as a chimney. During a large portion of the year the current in this shaft is upward. During the last two or three weeks, the draft has been several times reversed, and has been from the top to the bottom. The reason for this is easily seen in the fact that the house was colder than the external air, and consequently the column of air in the chimney was much heavier than an equal column of the external air, and so fell downward through the flue. As this brought all the smells from the water-closet into the house instead of carrying them to the roof, we had to correct this tendency to a down draft by lighting a gas jet, by which we heated the flue and obtained a draft in the right direction. At this time in the year, when the air outside is warmer than that within the house, down drafts in chimneys without fires is very common. And it is to this that the stains around stove-pipe holes are due. The soot and dust in the chimney is carried down, and as it escapes into the room stains the paper around the hole.

Ventilating Kitchens.

From J. M. R., *Boston, Mass.*—There is at the present time a great need of improvement in the ventilation of kitchens. Most of the cook stoves and ranges now in use are constructed without any reference to ventilation, and while they make a great deal of smoke and steam, they make no provision for carrying them off. Consequently, odors formed in the kitchen permeate all parts of the house. To remedy this, I would build the kitchen chimney like the old-fashioned fire-place, making the recess from 5 to 6 feet high. From the top of the recess I would start two flues. These flues would connect, or, what would be better, I would have them independent of each other to the top of the chimney. Into one of these flues I would have an opening for steam and smoke as near to the spot where most of the cooking is done as possible.

Note.—We do not consider the suggestion of J. M. R. entirely practicable. It is not in accordance with modern ideas and customs in architecture to build great, wide-mouthed chimneys, except in dwellings which imitate the old English style and have an appropriate inside trim. The practical method of dealing with the problem as we find it to-day, would be to utilize the waste heat of the kitchen flue for the purpose of maintaining a current in a ventilating shaft, which should not take up valuable room, and which could be put in, with necessary modifications, with any kind of range or stove.

Number of Nails to the Pound.

From J. R. S., *Hillsborough, Wis.*—Will you please publish in *Carpentry and Building* the length of iron nails and the number to the pound ?

Answer.—According to our correspondent's request we annex the table he desires :

NUMBER OF NAILS TO THE POUND.

Name.	Length Inches.	Number Per lb.
3d. Fine	1	557
3d. Common	1¼	385
4d. Common	1⅜	254
5d. Common	1¾	200
6d. Finish	2	215
6d. Common	2	154
6d. Fence	2	80
7d. Common	2¼	140
8d. Finish	2½	150
8d. Common	2½	90
8d. Fence	2½	50
9d. Common	2¾	76
10d. Finish	3	84
10d. Common	3	62
10d. Fence	3	34
12d. Common	3¼	50
12d. Fence	3¼	29
16d. Common	3½	32
20d. "	4	18
30d. "	4½	18
40d. "	5	14
50d. "	5½	12
60d. "	6	10

Note.—Nails of different manufacturers vary somewhat in size, and tables published by the different manufacturers accordingly differ in the number of nails to the pound of the different sizes. The table as given above is compiled from various data and in the main is an average between extremes.

Better than Cement.

From J. P. B., *Princeton, Ill.*—Referring to the inquiry of A. J. O. for some weather-proof cement for use around chimneys, I would suggest that if he will use tin flashing around his chimneys and in similar places, he will not require any paint or cement to keep the water out.

Black Brick.

Mr. Thomas F. Adams, president of the Peerless Brick Company, Philadelphia, Pa., calls attention to the receipt published in a recent number of *Carpentry and Building*, entitled "How to Make Brick Black," which named the method pursued with those used in the construction of the Morse Building, with the remark that, in his estimation, the Morse Building is seriously blemished by using bricks colored by the method described. He says: "They are not durable. They become discolored, and also discolor other brickwork, and they have a dirty, sticky appearance. Brick to be durable should have the color burnt into them. The black brick manufactured by the Peerless Brick Company are not liable to any of these objections."

Smoky Chimney.

P. Miham, Room 10, No. 1 Pemberton Square, Boston, requests W. H. G., of Colchester, Conn., whose letter concerning smoky chimneys was published in the April number, to communicate with him.

REFERRED TO OUR READERS.

Removing Oil Stains from Granite.—Creosote Stains on Walls.

From E. L., *Portland, Me.*—Will you please invite from the readers of *Carpentry and Building* a receipt for removing linseed oil from granite ? In oiling the front of brick buildings oil is occasionally dropped on sills, &c., which makes a stain that is, as I understand it, almost impossible to remove. I have thought that very likely some of your readers would know a remedy for this, if any exists.

At the same time I desire also to inquire, Is there anything that will remove creosote which has soaked through a chimney and stained the ceiling and walls of a room, without whitewashing the entire surface ?

Design for an Eastlake Sideboard Wanted.

From J. A. M., *Wingham, Ont.* —Will some of the cabinet makers and furniture manufacturers who are readers of *Carpentry and Building*, kindly favor me with the design of an Eastlake sideboard, costing not to exceed $50 ? I desire a front and side elevation to scale. If not too much trouble, I would like to see one with an open top and another with an inclosed top, both accompanied with all details necessary to construction.

Figures on Steel Squares.

From Z. Y. K., *Dodgeville, Wis.*—Will some of the readers of *Carpentry and Building* favor me with a practical exposition of the uses of the various figures stamped on the tongue and blade of an ordinary carpenter's square ? I am aware that these figures in different squares vary. I would like to see the subject thoroughly discussed in *Carpentry and Building*, with illustrations. I am certain that some of the practical readers of the paper will take pleasure in giving others the benefit of their knowledge.

Gelatine Molds.

From J. E. S., *Brunswick, Me.*—Will some of your readers please furnish for publication, for the benefit of your correspondent and others, the *modus operandi* of making gelatine molds for plaster ornaments ?

Cheap Ice House.

From W. K. B., *Oaks Corners.*—Will some of the readers of *Carpentry and Building* please give me, through its columns, a design for a cheap ice-house of moderate size ?

Fresh Air in Our Dwellings.

Ventilation in dwelling houses is important at all seasons, and especially during summer. In discussing the general subject, the London *Lancet*, high authority on all hygienic topics, pertinently remarks that if a man were deliberately to shut himself for some six or eight hours in a musty room with closed doors and windows (the doors not being opened even to change the air during the period of incarceration), and were then to complain of headache and debility, he would be justly told that his own want of intelligent foresight was the cause of his suffering. Nevertheless, this is what the great mass of people do every night of their lives, with no thought of their imprudence. There are few bedrooms in which it is perfectly safe to pass the night without something more than the ordinary precautions to secure an inflow of fresh air

Every sleeping apartment should, of course, have a fire-place with an open chimney, and in cold weather it is well if the grate contains a small fire, at least enough to create an upcast current and carry the vitiated air out of the room. In all such cases, however, when a fire is used it is necessary to see that the air drawn into the room comes in from the outside of the house. By an easy mistake it is possible to place the occupant of a bedroom with a fire, in a closed house, in a direct current of foul air drawn from all parts of the establishment.

Summer and winter, with or without the use of fires, it is well to have a free ingress for pure air. This should be the ventilator's first concern. Foul air will find an exit if pure air is admitted in sufficient quantity, but it is not certain pure air will be drawn in if the impure air is drawn away.

So far as sleeping rooms are concerned, it is wise to let in air from without. The aim must be to accomplish the object without causing a great fall of temperature or a draft. The windows may be drawn down an inch or two at the top with advantage, and a fold of muslin will form a ventilator, to take off the feeling of draft. This, with an open fire-place, will generally suffice and produce no unpleasant consequences, even when the weather is cold. It is, however, essential that the air should be pure.

The New Eddystone Lighthouse.—The resident engineers in charge of the Eddystone works, have succeeded in placing the iron shaft in the socket prepared for it in the solid rock at the central point of the new tower. This important piece of machinery is 28 feet long and 16 inches in diameter, and weighs just upon 3 tons. To sling a mass of such dimensions and weight, and then pass it in mid-air from the ship to the rock, a distance of 45 yards, was in itself a work of no ordinary difficulty, and its accomplishment argues well for the future execution of the work. The difficulty was increased by the necessity of having to do it with the aid of a merely temporary pair of shear legs, nearly 40 feet long, which had to be first placed in position on the rock and made secure by guys to the old tower and whatever other point could be so utilized, and the whole to be completed within the four or five hours which the tide permits to be spent upon the rock. When the cumbrous machine was fairly landed and placed in position, the flag of the steam-tender Hercules was run up to the mast-head, followed by a similar display at the lighthouse; and the whole body of men on rock, ship and tower, gave three times three hearty cheers. The mast already alluded to is destined to play a most important part in the future work, being, in fact, the central shaft of the crane, by means of which all materials will be passed from ship to rock, including the granite blocks of which the entire tower will be built, and which on an average weigh about 3 tons.

CARPENTRY AND BUILDING

A MONTHLY JOURNAL.

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ARCHITECTURE.

Competition Designs for Cheap Dwelling Houses.—The Design Receiving the Fourth Prize.

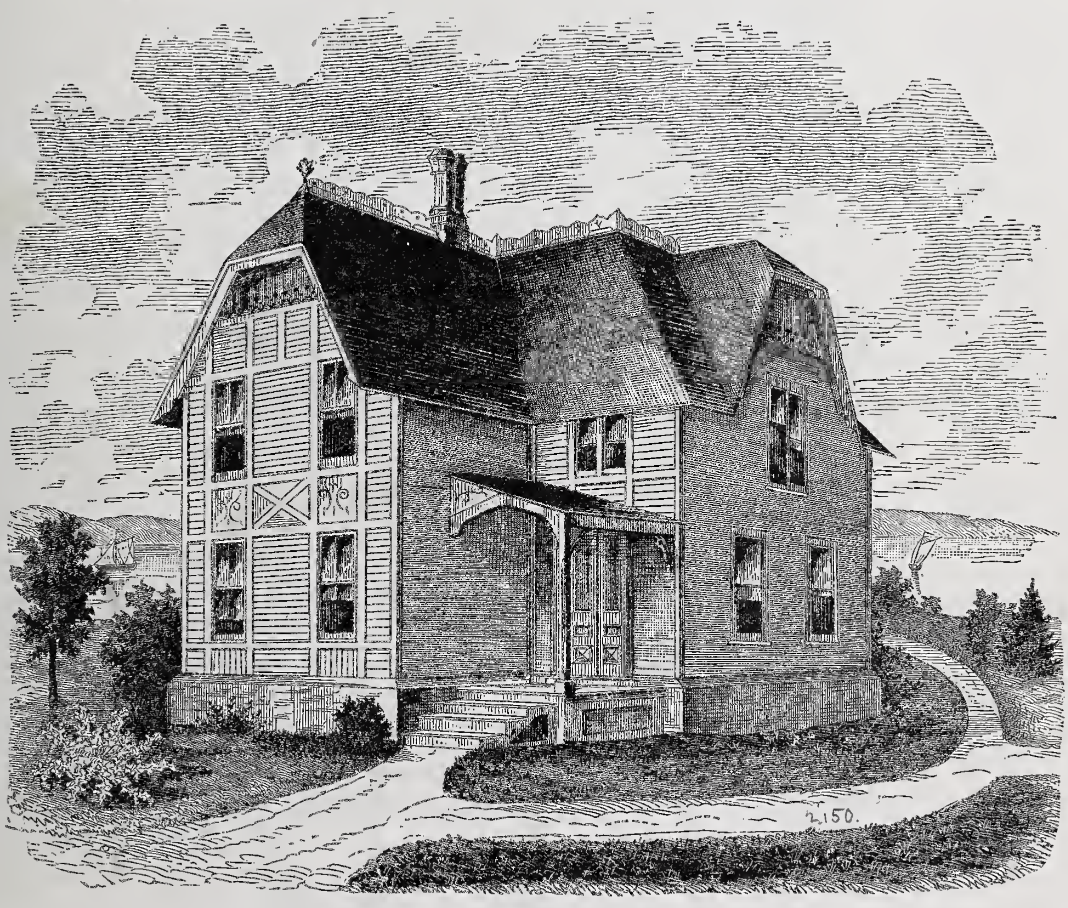
The design published herewith, and which received the fourth prize in the competition for cheap dwelling-houses, brings the series to a close. The authors of the design are Messrs. Clarence W. Smith and Augustus Howe, Jr., of this city. Their specification annexed describes the building so well that there is little we could say in addition.

No detailed estimate was submitted with this design. It was accompanied by an estimate in gross, the figure being placed at a trifle less than the limit, $1000, and was certified to by an experienced and reliable builder. Accordingly, we have no other figures of cost to publish with it. After careful examination of the drawings presented, the committee to whom was intrusted the decision in the matter of awards, was satisfied that this estimate was sufficient to erect the building in the vicinity of New York. It will be noticed that this house is much plainer and less pretentious than those receiving the other prizes. As remarked in connection with the publication of the first prize design, the competition, by the absence of more specific conditions, resolved itself into a contest between localities. Those sections of the country in which building material and labor were low in price, had a marked advantage over other sections in which higher prices ruled. New York and vicinity may be considered a region of high prices, and therefore her architects were placed at a disadvantage in comparison with those of other places. The design presented herewith being one out of some seven or eight sent in from New York and neighboring cities, was about the only one of the number which it was deemed possible to build for the sum stipulated. Nearly all, in attempting to get up attractive designs, overstepped the limit.

This design, aside from the fact that it represents a cheap house, has much to recommend it. It will repay a careful examination as to its merits upon the part of all who are interested in this subject.

In bringing this series to a close, we desire once more to tender our thanks to those who contributed to the contest. Undoubtedly, more substantial reward than our thanks has been obtained by all, even though a prize did not reach every expectant competitor. Much good, we believe, has been accomplished in giving attention to the designing and planning of inexpensive houses.

We congratulate the successful competitors upon the satisfactory issue of their labors. The good-natured criticisms which some of our sharp-eyed correspondents have been offering, do not necessarily detract from the real merits of the designs, and do not prove by any means that they are not as good, relatively, as the committee considered them in making the awards. We have thought it profitable, both to the authors and also to the general reader, to publish these criticisms in full, leaving it to the judgment of our readers to say whether the opinion of the committee or that of the correspondents is nearer right. Without doubt some of our readers will incline to one side and some to the other. It is only by a comparison of views that a just decision is possible to be reached.



Fourth-Prize Design for Cheap Houses.—Fig. 1.—Perspective View.—Messrs. Clarence W. Smith and Augustus Howe, Jr., Architects, New York City.

Specification

Of work to be done and materials to be used in the construction of a small frame dwelling house, according to plans prepared by Messrs. Smith & Howe, New York city, and submitted in competition for prize offered by *Carpentry and Building*.

CARPENTRY.

Frame.—Building to be framed in the style known as balloon frame. Studs, floor beams and rafters to be placed 16 inches from centers.

Sills to be 3 x 5 inches, halved at corners; corner studs, 4 x 6 inches; door and window studs, 3 x 4 inches; studding, 2 x 4 inches; side girts, 1 x 5 inches, gained in; plates, 2 x 4 inches, doubled; rafters, 2 x 4 inches; floor beams, 2 x 9 inches, and bridged. The frame to be of good timber, securely nailed.

Boarding.—The outside of the frame to be boarded with mill-worked boards well nailed, and then covered with felt paper and weather-boarded with first-quality clapboards.

Flooring.—The floors to be covered with good mill-worked pine boards 9½ inches wide.

Roof.—The roof to be covered with first-quality 18-inch pine shingles, laid 5 inches to the weather. The roof of porch to be covered in same way.

Windows—To be of size shown on plan. Sash, 1¼ inches thick, glazed with second-quality French glass; all sash hung with weights and proper fastenings.

All outside finish to conform to elevation.

Blinds.—Blinds are to be put to all windows; to be in four panels, 1⅛ inches thick.

Doors.—Doors throughout to be 1½ inches thick (except closet doors, which will be 1¼ inches); to be molded and hung with 3½-inch loose-joint butts. Suitable cottage locks will be put on all doors.

Casings—To be 5 inches wide, properly beaded and finished. First story to have band moldings and molding on base.

Staircase.—To be of easy rise and tread, and provided with walnut rail and newel.

Cornice.—The roof to project 18 inches, with suitable finish. The gable to be finished as shown, with braces of 2-inch plank filled in with cut work. Three-inch tin leaders to be provided to convey water from roof.

Mantels.—There is to be a neat wooden mantel in front room of first story and front room of second story.

Sink.—A cast-iron sink is to be set in kitchen and be inclosed underneath with door, and have suitable waste pipe.

Painting.—All woodwork and tin roofs to have two good coats of first quality white lead. All knots and sap to be shellaced, and nail-holes puttied.

Cellar.—Cellar under whole house to be dug out 3 feet deep and the dirt graded off.

MASONRY.

Foundation Walls.—Walls in foundation are to be 8 inches thick, laid with good hard brick in lime and sand mortar. The joints to be well pointed up, and the cellar to be made 6 feet high in the clear.

Cellar Steps.—The steps to cellar will be of spruce, 8 inches rise and 10 inches tread, to extend from grade of foundation outside, to cellar bottom.

Coping to area to be of blue stone, 2½ x 10 inches.

Sills to be provided for and set to cellar windows.

Chimney.—The chimney will be of fire-proof material, 14 inches square with 8-inch opening, carried out above roof and capped with terra-cotta chimney top. Five-inch stove pipe holes are to be cut where necessary in the chimney, and thimbles provided therefor.

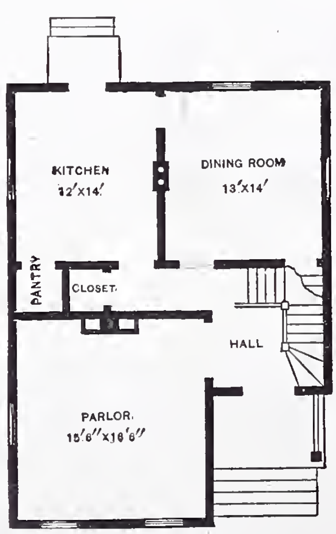
Plastering.—The first and second stories to be lathed with good quality lath and covered with one heavy coat of brown mortar, with a sufficient amount of hair to insure a good strong wall. This to be covered with a coat of hard finish, properly put on.

Staining Pine.—The *Northeastern Lumberman* recommends the following manner of staining pine to represent black walnut: Put pulverized asphaltum into a bowl with about twice its bulk of turpentine, and set where it is warm, shaking from time to time until dissolved; then strain and apply with either a cloth or a stiff brush. Try a little first, and if the stain be too dark, thin it with turpentine. If desirable to bring out the grain still more, give a coat of boiled oil turpentine. When the wood is thoroughly dry, polish with a mixture of two parts shellac varnish and one part boiled oil. Apply by putting a few drops at a time on a cloth and rubbing briskly over the wood.

Fourth Prize Design.—Fig. 2.—Front Elevation.—Scale, ⅛-Inch to the Foot.

Fire-Proof Construction.*

The effort to diminish danger by fire to our constructions is one of the greatest importance, and should enlist the energy and all the solicitude of our profession; and even more so in this country, where the difficulties occasioned by the influences of our climate are indeed vastly greater than in the countries of the Old World, whence we are apt to take our precedents.



Fourth Prize Design.—Fig. 3.—First Floor Plan.—Scale, 1-16-Inch to the Foot.

The large conflagrations to which many of our cities have lately been exposed have at least taught us this lesson—that the most destructible of our building materials is wood, and the least destructible brick. We should, therefore, as much as possible discard wood, and instead use brick for our principal building material. Among the many suggestions made after our large fires, there has not been mentioned one system of fire-proof vaulting, especially adapted for warehouses and some kinds of factories, to which I beg to draw your attention for a few moments.

This system, which is very common in the North of Germany, where it has existed since the Middle Ages, is well worthy of imitation, not only on account of its easy and practical execution, but also on account of its inexpensiveness. This vaulting consists of a series of strong elliptical arches, built parallel to each other across the building at intervals of, say, 10 to 12 feet from centers; the spandrels of these arches are regularly built up to a level, and serve to support flat segmental arches turned between them. As a general thing, the cellars in all buildings (dwelling houses and others) are arched over in this manner; and in store-houses, breweries, distilleries, &c., you often find four or five stories, one above the other, arched over in the same manner. These buildings are built entirely of brick, and are often finished in this manner to the very roof, for which the arches are laid with the proper inclination, and then covered directly with cement, tile or metal. With stairs of brick, stone or iron, and inclosed in brick wells, and having doors, windows and shutters of iron, you have a construction as fire-proof as can be made, particularly adapted to storehouses, factories, or to cellars of dwelling houses, and one not more costly, if so costly, as the more modern system of wrought-iron beams filled in with brick arches. A fire from the outside cannot attack such a building, vaulted over from cellar to garret, and a fire originating inside of it will in most cases be confined to the story in which it started.

Our system of wrought-iron beams filled in with brick arches or arches of other fire-proof materials, has some great advantages; not the least one is that it gives more available room on each floor, and that it requires less thickness of walls than the former system of all brick. But it is not as fire-proof, on account of the exposure of the iron to the fire; this danger ought to be overcome.

In order to diminish this danger to the iron beams, a thick coat of plaster-of-Paris can be stuck to the under side of the beams for protection. For this purpose the arches may be started one-half inch below the lower edge of the beams, and this will give a coat of at least one inch thick the requisite support from and attachment to the arches.

To protect from the end beams at well holes, also iron girders composed of two I-beams, and to give them at the same time an inexpensive finish, I have lately used stout hoop iron (3-16 by ¾ inch), stretched and bound tightly and riveted around the beams and girders every 8 inches from centers; the open channels at the sides of the

* A paper by Detlef Lineau, F. A. I. A., read at the Eleventh Annual Convention of the American Institute of Architects.

beams are then filled in and built up with brick laid in cement. The hoop iron keeps the bricks in their places till the cement has set; afterward the sides and bottoms are plastered, and moldings run on them if desired. If the girder beams are far enough apart to allow the mason to reach with his hands inside, then the cavity between them is filled in with brick likewise. This device gives some considerable protection against heat in case of a fire, and has the advantage of not being costly.

Fourth Prize Design.—Fig. 4.*—Side Elevation.—Scale, ⅛-Inch to the Foot.*

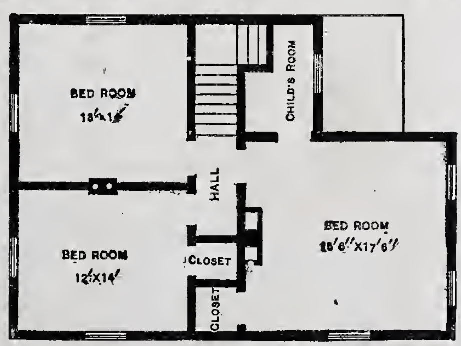
For storehouses, factories, &c., where the danger of fire is greater, a good protection to cast-iron columns and wrought-iron girders might be built by inclosing the columns in brick piers. Suppose an 8-inch or 12-inch column—build an 8-inch wall around it; this would make a pier of 24 or 28 inches square. To protect the girders, turn, in direction of the same, from pier to pier 8 inches segmental arches 24 or 28 inches wide, the extrados of the same to touch the bottom of the girders; then level up the haunches, and build 8-inch dwarf walls on each side of the girders to the top of the same. This will give an excellent protection against fire, and where it is most wanted in this kind of buildings.

In most cases, a 4-inch instead of an 8-inch wall would be sufficient; but in extreme cases of storage of inflammable materials, the 8-inch walls and arches would be necessary.

In all our buildings the effort should be made to build with fire-proof materials—that is, with stone, brick, iron, and some of the plaster compounds for partitions and furring. Iron beams, which are the most costly of our materials, should be used as sparingly as possible, and we ought to calculate the strength required at every step of our building operations, so that no more iron may enter into our buildings than is absolutely necessary. In order to economize in the right direction, let us use as little wood as possible.

A French architect completes his buildings with less than one-half the amount of wood which we put into ours in the way of finish. The less wood we have in them, the less danger there is in case of fire.

In the matter of roofing, there exists on the Continent of Europe a very safe kind of tile, which might well be adopted here. Not that new fancy tiling that has lately been introduced and is not good for our purpose. The tile I mean is a plain rectangular tile, with a hook at the top to hook behind a wooden or iron lath, 13 or 16 inches long, 6 or 6½ inches wide, with a thickness of half an inch, which is laid three thick in mortar, showing 4 or 5 inches to the weather, and rendered underneath with cement or mortar; in other words, it is laid like slate. This tile roof can be laid at a pitch of 3 to 4 inches to the foot, and is not only a great security against fire, but also, when of the proper materials, a very lasting roof. When the sparing use of iron is advocated above, it is for the reason of reducing the cost of the iron construction, and in order to popularize the same. And that this can be done there is no shadow of a doubt. To put the beams as wide apart as their more or less length of bearing requires, would in many cases reduce the weight of iron to a very considerable extent.



Fourth Prize Design.—Fig. 5.*—Second Floor Plan.—Scale,* 1-16*-Inch to the Foot.*

The more we do in this direction, the nearer we come to the period when we can expect to have structures which will stand with credit an attack of fire from both the inside and the outside of the building.

Larch Wood.—Any one who has undertaken to fell a larch tree, even with the help of the sharpest ax, has found that he has to deal with wood of very unusual toughness. How much the wood is used in this country we do not know, but it has such valuable properties that the tree deserves cultivation. It was well known to the Romans, who highly prized it for the sake of its low degree of combustibility. Cæsar, in his Commentaries, speaks of it as *igni impenetrabile lignum.* Mr. J. Wheeler, in a treatise on the "Best Timber for Paving or Building Purposes," speaks of it in high terms, and Prof. Koch, of the Berlin University, an eminent botanist, in his "Dendrologie," commends its tougness of fiber and its power of resistance to moisture. The qualities of the larch are well known in the European countries where it is indigenous. In Switzerland, where the vine props made of it support the vines through successive generations, it is so highly valued that a piece of larch wood is worth more than a piece of oak wood; while in France it is used for water-pipes, as it resists decay almost equally well whether buried in the ground or exposed to air. The weight of larch per cubic foot is about 32 pounds, while oak (English) weighs about 50 pounds; oak will endure a strain, lengthwise of the grain, of 3 to 8 tons per square inch, while larch will endure from 2 to 5 tons only; oak has a stiffness represented by 100, larch is represented by 79, yet larch, according to Tredgold, has a strength of 103, while the strength of oak is represented only by 100. Its color is honey yellow, and its grain has a silky luster not unlike satin-wood, and is straight and free from large knots. Still, in spite of its strength and durability, it shrinks and warps a great deal unless it is seasoned with perfect thoroughness. Brown, in his "Forester," calls it "decidedly the toughest and most lasting of all the coniferous trees."

Room Decoration.

I am not astonished at the fact that many persons have gray and white drawing rooms, when I think of the hideous effects sometimes shown me as decorations, where, perhaps, a pale emerald green, a gray and a ghastly pink—the very pink that will not harmonize with the crude green in question—are the colors employed. The hideousness of some decorations, so called, is beyond expression, and white walls are infinitely preferable to such. A dining room we generally make rather dark; citrine, or blue of medium depth and with grayish hue, looks well for the walls of a dining-room, and a maroon dado is very suitable. The emblems of the feast—fish, birds and beasts—may sometimes be incorporated with the decoration of a dining room with advantage. The effect of lightness is usually given to drawing rooms. I think we generally make these rooms too light; we give to them a coldness which is freezing, rather than that depth of tint which gives a snugness, and that cheerfulness which promotes conversation. Furniture cannot look well against a very light wall, and against this as a background every object seems cut out with offensive sharpness and hardness. Bedrooms are wrongly made very light. The decorations of a bedroom should be soothing. In the hour of sickness we all feel this; it is not whiteness to dazzle that we want, it is that which is soothing and which conduces to rest. There must be an absence of spots or specially attractive features from all good decoration, but in a bedroom this is especially necessary. A smoking room, or "sanctum," is one room where we may indulge in the grotesque and humorous, but the grotesque must always be clever and vigorous. In these days of competition, when the brain is ever active, and the nerve force is kept for many hours together in constant play, it is peculiarily desirable that our rooms be soothing in effect and snug in appearance. If special richness is to be indulged in, bestow it upon the library.

If the woodwork of a room is simply varnished, or stained and varnished, then the decoration of the walls and ceiling must harmonize with it, for it is a tint we cannot alter; if, however, it is painted, then it can be colored as may be required. Whatever acts as a frame to something else is better darker than that which it frames, or in some way stronger in effect. A cornice, as the frame of a ceiling, should be stronger in effect than the ceiling; in like manner, a skirting which frames the floor should always be dark. I have never yet seen a room which was altogether satisfying to the eye where the skirting was light. I often make the skirting black, but in this case I generally varnish the greater portion of it, yet leave parts "dead," thus getting a contrast between a bright and dead surface. I sometimes run a few lines of color upon its moldings, but I never in any case ornament it. It should be retiring, yet bold in effect; hence its treatment must be simple. If not black it may be brown, rich maroon, dull blue or bronze green. A dark color gives the idea of strength; that portion of a wall on which weight appears especially to rest should be dark. I like to see the woodwork of a room generally of darker tint than the walls. A door should always be conspicuous. I find that a room almost invariably looks better when the doors are darker than the walls, and the advantage of dark architraves must be obvious to all who have tried them. A door should rarely, if ever, be of the color of the wall, even if of darker tint; this is a resort of those who cannot form a harmony with the wall color. If a wall is citrine, the door may be dark, low-toned Antwerp blue, or it may be of dark bronze green, but in this latter case a line of red should be run round the inside of the architrave. If the wall is blue a dark orange green will do well for the door, but a line of red around the door will improve it, or the door may be an orange maroon. If the wall is bright turquoise in color the door may be Indian red (vermilion brought to a bright tertiary shade with ultramarine). These are mere illustrations of numerous harmonious combinations which may be made, but they serve to show my meaning. The architraves of doors may often be varnished black, or consist in part of bright and in part of "dead" black; if the architraves of doors are black, one or two lines of color may be run upon them. If the lines are very narrow, say 1-16th inch in width, they may be of the lightest colors; if broad, say ¾ inch, they should be much subdued in tone, and hardly brighter in tint than the color of the wall. I rarely find it necessary to decorate the panels of doors and shutters, and I never place ornaments on the "styles." If an ornament is placed on a panel, it is better quaint or slightly heraldic in appearance. A monogram may, in some cases, be applied to a door, but it must not be frequently repeated.

Perhaps the best treatment of walls is that of arranging a dado upon them. Let a room be 12 feet high; the cornice will take 6 inches from the top of the wall, and the skirting will be 12 inches from the bottom. Let us now draw a line 3 feet above the skirting, or a little over 4 feet from the floor. The wall we make cream color, but the dado, a portion below the line, we paint maroon or chocolate; on this lower portion we place a pattern called a dado rail. A cream color wall comes well with a dark-blue dado. In this case the blue should consist of ultramarine, with a little black and a little white added to give a certain amount of neutrality; a ceiling must look pure—a wall somewhat neutral. A citrine wall looks well with a dark-blue dado; a gray-blue wall of middle tint looks well with a slightly orange-maroon dado. Dados may advantageously vary in hight. In some cases they may be two-thirds the hight of a room. This gives quaintness of effect. Dados may vary from 18 inches to 7 feet in hight, according to circumstances. A wall should never be divided into equal parts; the more difficult to detect proportions the better. A dado in relation to a wall may be as four to eleven, as seven to twelve, and so on, but not as three to six.

Nothing in the way of decoration is so difficult as to rightly color a cornice. Each member occupies a particular place and has a particular sectional form. We have to color a cornice so that every member shall appear to be in its proper position, and look to be exactly what it really is. A cornice is the frame to the ceiling and the uppermost boundary of a wall. It should, therefore, be stronger in effect than the wall. It is also much smaller, as a quantity, than either walls or ceilings; it may, therefore, be more "colory" in effect. Strong colors may generally be used with advantage on a cornice, even pure vermilion, carmine and ultramarine. But with these colors it is often necessary to have a much paler and somewhat gray shade of blue, and it is generally necessary to have also a soft shade of yellow (formed of middle chrome and white). Yellow is an advancing color, and should, therefore, be used in advancing or convex members. Red, as a color, is about stationary; that is, a red object looks neither nearer nor further from us than it actually is; it should therefore be used chiefly on flat surfaces. It looks best in shades; in light it is too attractive. Blue is a receding color. It is adapted for hollows, as covings or concave moldings. Now, the difficulty in coloring a cornice rests in our having to render every member distinct, and in so modifying our yellows, blues and reds, or whatever colors we employ, as to cause each separate member to appear to advance or recede to the exact extent that it actually does. If a cornice is uncolored, it is often impossible to judge of its sectional shape. If there are flat members in a cornice of 1½ inches or more in breadth, these may be enriched with simple patterns in blue and white, or red and white, or in any colors demanded by the situation of the member; a coving, if sufficiently large, may be enriched. Care must always be taken not to cause a cornice to look liney; there must be a certain amount of breadth of treatment. If the cornice only consists of narrow lines it cannot look well. There must be broad members, as well as those which are narrow. It is often necessary that the colors employed in the decoration of a cornice, especially if they be "primaries," be separated from each other by a white line, or by a white member. Red and blue, if of the same depth, produce a "swimmy" effect if juxtaposed, and the production of this dazzling is not desirable; it is prevented, however, by a white line interposing between them.

The principles that apply to the coloring of cornices also apply to the treatment of all relief ornament. Red is best in shadow, blue on receding surfaces, yellow on advancing members. I will say a few words, in conclusion, on the necessity for harmony in all parts of a room. Harmony between the various decorations can be achieved in many ways. A ceiling in which blue prevails, or even a plain blue ceiling, a suitable colored cornice, citrine walls and a rich maroon dado will produce a harmony. A ceiling in blue-green, general effect, walls of of low-toned yellow-orange, and a dado of deep-red purple, will produce a harmony. In both these cases the doors might be of bronze-green and the architraves black. A plain blue ceiling, I have said, will harmonize with a citrine wall and a maroon dado; but if the ceiling decoration presents various pure colors, so arranged that its general hue is olive, and the wall ornaments are formed of bright colors so disposed that they yield a citrine tint, and the dado is made of such an admixture of colors that the general tone is russet, the three will produce a harmony; for olive, citrine and russet are the three tertiary colors, and they together form a harmony, and the harmony produced will be refined, intricate and peculiarly pleasant to dwell upon. When rooms open one into the other, it is often desirable to give to one a general citrine hue, to another a russet hue, and to another an olive hue; for in such a case the three, when seen through the openings which lead from one to the other, produce a harmony. If there are but two rooms adjoining, one may have a red hue and the other a green hue, or one may have a blue tone and the other an orange tone; in either case a harmony will be produced. It must be especially noticed that I speak of hues and tones of colors only, and not of positive tints, which are always too strong for walls.

If your readers will follow out these simple yet truthful instructions, which I have gleaned from proficient masters in the decorative art, also from thirty-five years' practical experience, I will venture to say they will feel satisfied with the result of their labors.—*W. Hodgson in American Builder.*

The Annual Rings of Trees.

Does a single zone of wood invariably indicate the entire annual growth of a tree? This is a question that has not yet been satisfactorily answered. Generally speaking, the number of concentric rings present in a cross section of a trunk will afford a tolerably correct idea of the age of that particular part of the trunk from which the section is taken. To obtain, as nearly as possible, the age of a tree, the section must of course be taken from the base of the trunk. It is not easy, however, to prove whether two or more rings are sometimes formed in the trunk of a tree in one year, because it would be necessary to know beforehand the exact age of the tree, and cut the tree down to determine the point. Several writers have given it as their opinion that two rings are occasionally formed in one year, caused by an interruption and resumption of growth. Some of them agree that when there are two rings formed in one season they are not so sharply defined as when there is only one in each season. Last season Mr. L. Kny made some observations and experiments in England with a view of obtaining some more satisfactory and positive results than previous writers had placed on record. At the end of June he completely stripped a number of young trees of their leaves, thinking he would be able to determine the point from their autumn shoot; but being in a nursery quarter they made too little growth for the purpose. But nature herself gave him the best opportunity. The caterpillars stripped a large number of trees of their foliage about the same time, and many of them made strong autumn shoots, so that Mr. Kny was able to determine that, in some instances as least, a second distinct ring is formed in one summer; and these rings are sharply defined and as distinct from each other as the autumn growth of one year's ring and the spring growth of a succeeding year's ring. On the other hand, he observed a noteworthy difference in the degree of distinctness in different species of trees, and in the same tree at different hights, and even in the same internode. Moreover, there was a difference in the degree of distinctness of the two rings on the upper and under sides of the horizontal branches of the lime. Respecting the degree of distinctness at different hights, it was ascertained in the branches examined that there was a gradual decrease in distinctness from the younger to the older internodes, until all traces of a second ring seem to disappear. But there is this limitation to it—the two rings are not most distinctly separated in the uppermost internode, but in the second or third from the top. These investigations, as far as they go, seem to show that summer interruptions of growth are too brief to affect the whole system of a large tree; consequently, the number of concentric rings of wood in the trunk of a tree represent very closely the actual age of the tree.

Balanced Derrick.

In the accompanying engraving we show a portable balanced derrick manufactured by Frank Lyons, 14 Center street, New York, which possesses some features that are of interest to our readers. It is hardly necessary for us to remind anyone acquainted with the derricks in common use for hoisting building materials, that they are of primitive construction, very troublesome to move about, and that the ropes intended to keep them in position are inconvenient; such derrieks always require an attachment of back guys to a point of anchorage in the rear. A still greater inconvenience than this is, that the material has to be brought directly in front of them, as they can only lift, being incapable of sideward transportation.

The derrick shown in our engraving corrects these defects to a marked degree. The first improvement consists in standing it upon a platform which rests upon a car, the wheels of which run on rails laid down for temporary use. By this arrangement a derrick is easily moved sideways, even when the load is hanging upon it. A second improvement is that the ropes supporting it in position, or the "back-guys," as they are commonly called, are not attached to an immovable anchorage in the rear, but are fastened to the end of the platform which carries the frame. A counterpoise upon the platform serves to keep the derrick in position. The counterpoise can be increased at will, thereby enabling it to overcome any load which the derrick may be required to lift. This way of steadying the derrick possesses the advantage of securing motion in all directions, and makes it possible to apply the third and the most important improvement, which is that the car supporting the platform has on its top a circular rail with a set of rollers the axes of which are placed like the radii of a circle. On the top of this rail another circular rail turns easily. This second rail is attached to the lower side of the platform carrying the derrick, counterpoise, &c., and thus the whole arrangement may be turned as required. By this device a stone, for example, lying behind the derrick can be lifted and brought inward and carried to its place of deposit. Thus, the derrick can not only be moved from right to left with the greatest ease, running, as it does, on a straight track, but it can also be turned around on its circular track between the platform and the car.

There is a turnbuckle in the guy ropes intended to lengthen or shorten them, and thus change the angle in which the frame is placed. Steadiness is secured by having all the supporting parts as low as possible. The top of the platform is raised but a very little above the ground. All the parts are very strong and constructed of the best materials.

A larger size than indicated in our engraving is also made, to which steam power is applied to do the hoisting. The hoisting-engine and boiler are placed on the rear end of the platform, serving at the same time as counterpoise to the load in front. For this purpose the platforms are larger and heavier. An extra rail is laid down in the middle, between the others, one rail supporting the center of the car, thereby securing the equal working of the circular rail.

Balanced steam derricks of this kind are quite suitable for building bridges and viaducts, and for use about buildings in which large stones are employed. They are also adapted to work in quarries, on railroads, along docks in foundries and at all other places where heavy material is to be moved or hoisted. Such derricks are especially useful on docks, where a track is laid longways, upon which they can be moved for unloading vessels and depositing the goods on the pier or upon wagons, or for loading vessels by taking merchandise directly from wagons, by turning, bringing it directly over the vessel and depositing it in the hold.

Balanced Derrick.

The Art of Brickmaking.

The use and manufacture of bricks is of great antiquity. Probably Tubal Cain, who was the first "instructor of every artificer in brass and iron," was familiar with sun-dried clay, the blocks which form the germ of the well-known bricks. There is evidence that so early as the days of Noah (2247 B. C.), plastic substances were molded into suitable forms, and dried either in the sun or burned in a primitive kiln, the result being "brick." In the remains of what is said by some authorities to be the Tower of Babel, but what are, undoubtedly, remains of very remote antiquity, blocks are found so firmly embedded in the bitumen used as mortar, that it is no easy matter to detach one.

The massive palaces of the ancient Babylon were, no doubt, mainly of brick, Herodotus distinctly affirming that from the clay thrown out of the trench surrounding ancient Babylon, bricks were made and burnt which were used in building the massive walls of the city. The peculiar custom of the ancient brickmakers of making every brick with the name and title of the king in whose reign it was made, and with the name and place where it was to be used, has facilitated the identification of the veritable bricks used for the palace of Nebuchadnezzar. This buried palace in the Euphrates is said to have furnished bricks for all the buildings in its neighborhood for many years past. "There is," says a traveler, "scarcely a house in Hillah that is not built with them." The Assyrian bricks resemble thick tiles, being 12½ to 14½ inches square, and about 4 inches thick. Generally they were of a pale yellow or red color, but occasionally they are found glazed with a thick coating of different colors, with subjects traced on them, and enameled bricks are also often met with of various colors—a very brilliant blue, a deep yellow, red, white or black.

The Pyramids of Egypt are, as is well known, excellently preserved samples of ancient brickwork. The mud of the Nile doubtless furnished the whole of the material for these colossal tombs. The process of brickmaking carried on now at the banks of the Nile is, strange to say, identical with that of the exodus of the Hebrews—the children of Israel—when released from the bondage of Pharaoh. Brick-making in Egypt was in all probability a royal monopoly. Nearly all bricks of ancient or modern Egypt are sun-dried. Some few burnt bricks have been discovered in river walls or hydraulic works, but their use was limited. A painting on one of the walls of a tomb at Thebes illustrates most clearly the whole process of brickmaking. It shows not only the closeness of the Bible narrative to the pictorial description, but also resembles in the most striking manner the manufacture as carried on at the present day. In a pamphlet issued by Messrs. Wood & Ivery, of the Albion Blue Brick and Tile Works, West Bromwich, this painting is described. "Some of the workers are depicted as engaged digging the mud and mixing it in heaps with sand, while others carry the material thus prepared in baskets to the brickmaker, who is seen shaping it in the mold. Others, again, are employed either in laying out the bricks thus formed upon the ground to dry in the sun, or bringing from the river in jars upon their shoulders the water required for tempering purposes. Laborers, too, are busily engaged in removing the dried bricks upon flat boards, two of these being slung by a rope attached to each end of a yoke placed across the shoulders. Taskmasters are also seen watching over and directing the operations, and ready, stick in hand, to infliet summary punishment on the idle or refractory." Brick arches are found at Thebes and in Lower Egypt. The Egyptian brick was not unlike the brick of the present day, being generally from 14½ to 16 inches wide, and of a thickness varying from 5 to 7 inches. In the older pyramids they were larger, measuring 20 inches in length and about 8 inches in width. It is clear, from scriptural reference, that bricks were used in Palestine in the construction of private dwellings. The Greeks placed the manufacture of bricks under legal supervision, and brought it to a very high state of perfection. The walls of the city of Athens, on the side toward Mount Hymettus, were built, according to Pliny, of brick, three distinct varieties of brick being enumerated.

Blackboard Paint.—The following is said to be a good recipe: One quart of shellac dissolved in alcohol, 3 ounces of pulverized pumice-stone, 2 ounces of pulverized rotten-stone and 4 ounces of lampblack; mix the last three ingredients together, moisten a portion at a time with a little of the shellac and alcohol, grind as thoroughly as possible with a knife or spatula, after which pour in the remainder of the alcohol, stirring often to prevent settling. One quart will furnish two coats for 80 square feet of blackboard not previously painted. The preparation dries immediately, and the board may be used within an hour if necessary.

Protecting Instruments from Rust.—A practical mode of protecting Swiss drawing instruments from rust, is to coat the warm metal with a very thin lacquer of shellac dissolved in alcohol.

Some Problems in Framing.

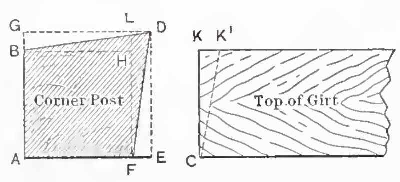
(Continued from page 172.)

We continue the discussion of the various cuts required in framing the support for a tank, illustrated in the July number of *Carpentry and Building*, resuming the consideration of the cut for the ends of the girt at the point where we stopped in the article in the Septeuber issue.

Now, if the face of the girt be cut to the line H C, as shown in Figs. 14 and 16, and the top cut to a line square across from the point C, there would appear, when the piece was put in position, an open joint across the top. Iu other words, since tho inner faces of tho corner posts havo not been backed or modified in a way to make the angle contained by them, when cut through horizontally, a right angle, a square cut across the top of the girt will not fit against them. This is illustrated in Fig. 17. The corner post is shown as it would appear if cut through horizontally. The two outer faces, B A and F S, it will be seen, form a right angle, while the two inner faces, B D and D H, form an acute angle. The discrepancy which would exist between the face of the post and the end of the girt in the event of the latter being cut square, is shown by the differenco between the line C K, representing the end of the girt, and the line F D, representing the side of the post. In other words, to meet this requirement we must obtain a line across the top of the girt parallel to the inner edge of the post, as shown by C K[1] in the engraving.

At this point, however, we are met by another condition in the arrangement of the parts with which we are dealing, which still further modifies the cut. Since the outer face of the girt is to be pitched corresponding to the outer face of the corner post of the building, the top of the girt will not be horizontal across its width, but will incline toward the interor of the building. Hence, to duplicate the line C K[1], as it appears in Fig 17, would not give us the required shape. It must be modified somewhat in the same manner as the cut across the face of the girt, illustrated in Fig. 13, and described in a former article, save that in this case the piece is required to be longer than shown in the plan, instead of being diminished, as in the former instance. In other words, on account of the top of the girt being inclined toward the center of the building, the line of the required cut runs from C to some point between K and K[1], which point must be determined.

When we revolve the girt in order to get it into proper position, keeping the corner on which C is marked fixed as an axis, the inside upper corner of the girt marked K in Figs. 17 and 19, necessarily meets the post at a point lower down than it would if the



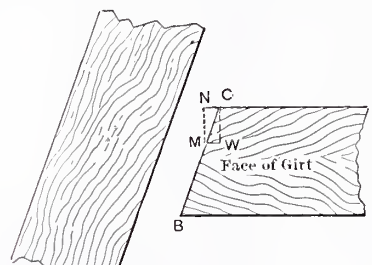
Problems in Framing.—Fig 17.—Plan View of Corner Post and Girt.

girt were so revolved; therefore, our plan for obtaining the point which we have named as existing somewhere between K and K[1] (as shown in Fig, 17), is first to obtain the line across the top of the girt which would be made by the girt meeting the post after being turned, as we have above described, supposing, for the time being, that the post had been "backed" on the inner faces; and second, to measure from this line on the inner upper corner of the post a distance equal to the space C D in Fig. 17, or, in other words, a distance equal to the backing required to make the inner faces of the post square. Having by this means obtained the required point upon the upper inside corner of the girt, we can readily obtain the cut of the girt across the top by drawing a line from it to the point C upon the upper outer corner, already established.

Perhaps we can make all this clearer to our readers, as well as show the reasons for the steps which follow, by introducing at this time the sketches shown in Figs. 18 and 19. In Fig. 19, by the outline the girt is shown as it would appear against the inner face of one of the posts when placed with its top, C K, horizontal. By the shaded part it is shown turned arouud into the position it is required to occupy, the corner marked C being used as an axis in turning it. Keeping iu mind the relationship of the parts, as shown in Fig. 19, let us examine Fig. 18, which represents a face view of the same parts.

The end of the girt is shown cut parallel to the pitch of the post, as indicated by B C. In this respect Fig. 18 corresponds with Fig. 13, described in the last article. In describiug Fig. 13 we showed that the corner B of the girt, unless modified, would cut into the post during the operation of turning it, the corner C being used as an axis. We allude to that description now, in order to make our explanation of what takes place in other portions of the girt by reason of turning it, clearer, perhaps, than we could in any other way. For the same reason that the corner B cut into the post, the upper inside corner of the girt, as shown by K in Figs. 17 and 19, must move away from the post.

So far, our remarks have been upon the supposition that the end of the girt is cut square across from the point C. Therefore, when the girt is revolved, using the corner C as an axis, the point K, representing the end of the girt upon its inside upper corner, must drop down in a vertical line, as shown by C W in Fig. 18. By knowing the length of C W, thus obtaining the point W, we are able to measure the increase which must be



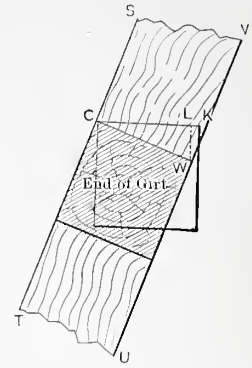
Problems in Framing.—Fig. 18.—Front Elevation of Corner Post and Girt.

added to the girt upon the corner K, in order to make it fit against the inside face of the post after being turned. In other words, after obtaining the point W, measuring horizontally to the line B C, as shown by W M, gives us the amount necessary to be added to the length of the girt at the corner marked K. Further, it will be noticed by examination of Fig. 18 that squaring up from M gives the point N, showing the increased length in the line representing the upper outside corner of the girt. By squaring across the top of the girt from N, we can readily obtain a corresponding point on the upper inside corner, which point will form the basis of measurement for the next step. Our next inquiry, therefore. is for a means of obtaining the length C W.

By comparing Figs. 18 and 19 together, it will be seen that the distance C W in Fig. 18 corresponds to L W of Fig. 19. In other words, it represents the vertical distance through which the point K passes in the girt, being turned.

Let us examine Fig. 19, in order to determine what L W is, considering, for the moment, angles only, irrespective of their connection with the problem in hand. It will be seen that C W is drawn at right angles to S T and V U. It will also be seen that C K is a horizontal line. Then L W, being drawn at right angles to C K, measures the vertical hight between the angle C W V and the horizontal line C K. C W represents the thickness or width of the girt. Since at one extremity it meets a line V U, representing the pitch of the post, and at the other extremity meets a horizontal line, if we lay off at right angles from any liue representing the pitch of the post the thickness of the girt at such a point that its other extremity shall meet a horizontal line, we will have obtained a point corresponding to W in the angle C W V. By erecting a vertical line from the point W, cutting the horizontal line, we will obtain a point corresponding to L.

The application of this is shown in Fig. 20. B C represents the pitch of the corner post, somewhat exaggerated, as already employed in Figs. 14, 15 and 16. O W repre-

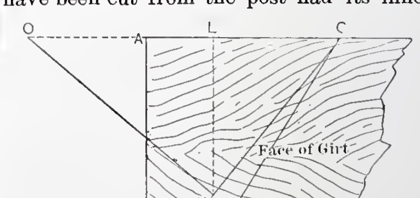


Problems in Framing.—Fig. 19.—Side Elevation of Corner Post, Showing a Section of Girt.

sents the thickness of the girt. Now, if we lay off O W at right angles to C B, at such a point in C B that O shall fall in the horizontal line A C prolonged, we will establish the point W, corresponding to W of Fig. 19. In other words, the angle O W C of Fig. 20 is equal to C W V of Fig. 19. Having obtained the point W, if we square up from it, as shown by W L, we obtain the point L, corresponding to L in Fig. 19.

We took some trouble to show that the point W, representing the inside corner of the girt when turned, fell somewhere in the line C W, shown in Fig. 18, and that the distance from this point, measured to the line representing the pitch of the corner post (C B), equaled the length which must be added to the girt, measured upon its inside upper corner, in order to form a joint. We showed that W M and N C (Fig. 18) were the same, and that the point N might be obtained as well by squaring up from W as setting off the distance W M, measuring from C. Returning, now, to Fig. 20, we think it will be evident, without further argument, that L C is the same as N of Fig. 18. In other words, if we square across the top of the girt from L, as shown in Fig. 21, we will obtain a point, P, which will represent the length to which the girt must be cut on the upper inside corner in order to fit against the corner post, supposing the same to have been backed.

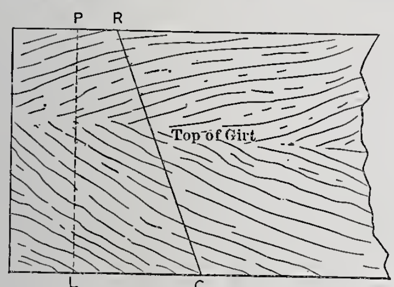
We have proceeded so far upon the supposition that the inner sides of the post were backed; in other words, that their inner faces were square with their outer faces when cut through horizontally; but, as shown in Fig. 17, this is not the case; therefore the point P is not the point to which the timber must be cut from C. From P must be set off a distance equal to what would have been cut from the post had its inner



Problems in Framing.—Fig. 20.—The Method of Obtaining the Point W on the Face of the Girt.

faces been backed. By examination of Fig. 17. it will be seen that if the inside faces were square with the outer faces, so much of the post as is represented from L to D would have beeu cut away. Since it remains in the post, we must make a corresponding allowance upon the end of the girt fitting against it. In other words, the girt requires to be as much shorter than it would be if the inside of the post were square, as the distance L D. Therefore, from P (Fig. 21) set off the point R, making P R equal to L D of Fig. 17. (It is to be remembered that Fig. 21 is an exaggerated view, and, therefore, in our engravings the distance P R does not correspond literally to L D of Fig. 17.) Having by this means obtained the point R, we connect R and C, which is the required cut across the top of the girt.

In Fig. 22 is shown the practical application of these operations (the reasons for which we have been attempting to explain) to the timber by use of the square. Lay off the line B C corresponding to the pitch of the corner post. Lay the blade of the square against B C, moving it along until the point 10 (the girt being 10 inches square) of the tongue coincides with the corner of the timber, as shown, and mark the point W. Square up from W, as shown in Fig. 23, obtaining the point L. Square across from L, obtaining the point P. From P set off a distance equal to the thickness of the timber which would have been removed from the inner face of the post in case it had been "backed." This distance P R may be obtained by measuring on the end of the post in the process of backing, as illustrated in Fig. 11. It is equal to A G or A F of that figure. Or the same may be determined by a drawing, in case one is made, as shown in Fig. 17, it being L D of that figure. From the point R draw R C. Then R C is the cut across the top of the girt, as already mentioned.



Problems in Framing.—Fig. 21.—The Lines Across the Top of Girt.

We will bring this series of articles to a close in our next, by giving some account of the method of determining the length of the various timbers used.

Tin Roofs.

II

Continuing our description of the brands to be found upon the boxes containing tin plate, we come next to that of the sizes of the plate. Boxes will be found branded: "10 x 14," "14 x 20," "20 x 28," &c. These figures refer to the dimensions of the sheets; 14 x 20 is the common size plate in use for roofing purposes, although 20 x 28 has of late years come into somewhat general use. 10 x 14 is a size seldom used for roofing purposes, but enters into the construction of gutters, spouting, &c.

The terms "terne" and "bright," the latter signifying "tin" plates as we have described them, are almost always branded upon the box, thus indicating the character of the coating upon the plates contained within. In a few cases, the term "bright" will not be found—its absence indicates a "tin" plate, and never a "terne" plate.

Still another class of terms, which are sometimes branded upon the boxes of tin, are "Best Charcoal," "Prime Charcoal," &c. "Best Charcoal," as at present used, is altogether a misnomer. It does not represent the best grades of charcoal plates by any means. It represents a fair average of the plates generally used. But a strictly first-class article, which will bear inspection in all particulars, is never branded "Best Charcoal." Plates of the best quality are known entirely by the maker's brand or trade-mark, independent of a mark indicating general classification of this character. "Prime Charcoal" is a term at present meaning more than "Best Charcoal." It is used more nearly in the sense in which it would be understood than the term "Best Charcoal," but it is fast losing its significance and becoming a trade term of special application.

Another term sometimes found upon boxes of tin plate is that of "waster," frequently contracted to the simple initial "W." It is sometimes found upon boxes in connection with the gauge mark, as: "I C W," "I X W," &c. In other cases it will be found branded apart from other symbols, in full. "Wasters" are plates in which some imperfection exists. It may be that there are holes in them near the margin, or that the edges are irregular, or that the coating is imperfect, or that the plate is of uneven thickness. They are the sheets which are thrown out in assorting plates for boxing. In quality, aside from the defects mentioned, they are fully as good as the perfect plates of the same brand. Wasters are very frequently used in roofing purposes, as well as in the construction of tinware, and, when judiciously employed, less objection exists to their use than may at first be supposed. They are sold in the market from 50 cents to $1 per box less than perfect brands of the same grade. Accordingly, there is considerable temptation toward their use upon close contracts. In the use of wasters the plates must be carefully assorted; those which have holes and those which have imperfections in the coating must be cut so as to throw aside the defective part. The edges of those which are irregular or imperfect must be trimmed so as to obtain straight lines, and in other particulars extreme care must be exercised in working them. The extra expense in working wasters in the manner just described is so great that it leaves but little advantage to the tinner to employ them; what he saves in the cost of the material will be consumed in the increased labor of working it. Accordingly, wherever wasters are used, suspicion of something less than fair play may reasonably exist.

What we have said upon the subject of plates and their coatings and the brands to be found upon the boxes, may be summarized as follows:

Tin Plate is sheet iron coated with tin.

I C, I X, I X X, &c., refer to thickness of plates.

"*Charcoal*" and "*Coke*," refer to the quality of the iron in the plates.

"*Bright*," "*Terne*" and "*Leaded*" refer to the coating of the plates.

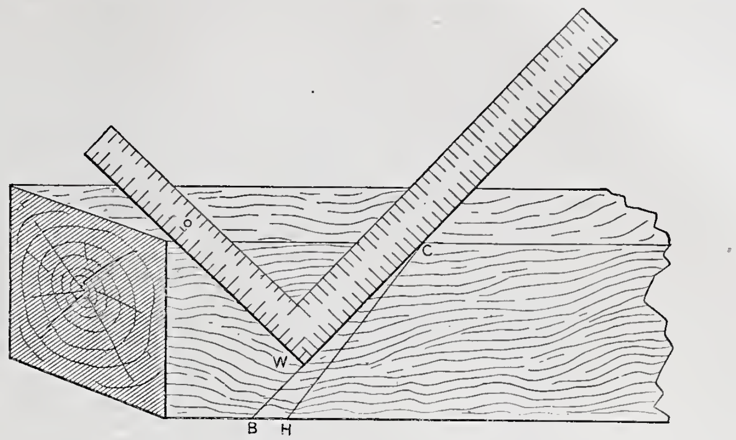
10 x 14, 14 x 20, 20 x 28, refer to the size of the plates.

The *brand* or *trade-mark*, as "M. F.," "Pontymister," &c., designates the special make of the plates, and is the name by which they are known to the trade.

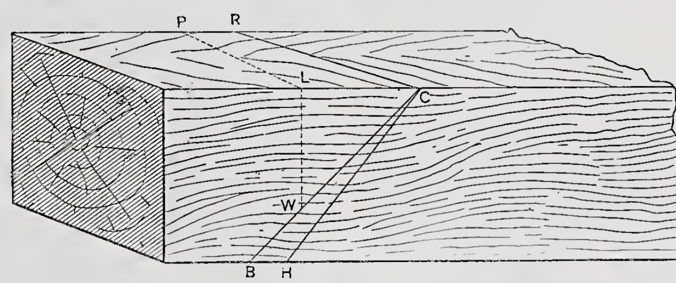
"*Wasters*" indicates imperfect plates of the class described by the other marks on the box.

After the selection of the plates out of which to construct the roof, there remains choice between two general styles of tin roofs; one is commonly known to the trade as "flat-seam" or "flat-lock" roofing, and the other is "standing seam" or "standing groove" roofing. Of each of these two roofs much may be said which is favorable and also some things unfavorable, comparing one with the other. In some sections of the country flat-seam roofs are used exclusively, while in other sections of the country standing-seam roofs are considered the only kind of tin roofs fit to be employed. The most reasonable opinion seems to be that flat-seam roofs are suitable and appropriate for some places, and standing-seam roofs are quite as suitable and appropriate in other places. A certain amount of pitch is necessary for a standing-seam roof, while a flat-seam roof may be laid upon a surface having the smallest inclination sufficient to throw off the water. Standing seams are, therefore, used upon the steeper parts of roofs and flat seams are used upon the flat portions, or decks.

The question of the size of plates to be employed is determined in some measure by the character of the roof which is to be laid, as well as the preference of the tinner and others interested; 14 x 20 tin, up to a period quite recent in date, was the tin exclusively used for roofing purposes; 20 x 28 sheets, just twice the size, have been employed only a very few years. As may be very naturally supposed, each size of tin has its advocates among builders and tinners. Some are in favor of the large sheets, because a smaller number of seams are necessary in making the roof. Leaks and breaks in the roofs ordinarily occur at the seams, and the advocates of this size argue, therefore, that the less seams there are the less liability to breaks and leaks. On the other hand, other mechanics claim that the breaks in the seams are caused by the contraction and expansion of the tin, or by what is known as the buckling, and that the larger the surface between the bearings or fastenings the greater liability of the seams to be broken; hence they argue that 14 x 20 tin—and some are so extreme as to advocate 10 x 14—makes a much more perfect roof than 20 x 28. Buckling and rattling of the tin roof, which is always a great annoyance,



Problems in Framing.—Fig. 22.—The Use of the Square in Establishing the Point W.



Problems in Framing.—Fig. 23.—The Girt in Perspective, Showing all the Lines.

is undoubtedly greater in a roof covered with 20 x 28 than in one composed of 14 x 20. The fastenings which are used to secure the tin to the sheeting boards are necessarily placed around the edges of the sheet, and, therefore, in the use of 20 x 28 tin the spaces between them are greater than in the use of 14 x 20. These seem to be about all the arguments that can be brought forward, either for or against the two sizes of tin used for roofing purposes. So inconsiderable is the difference between them after all, it seems ridiculous that much argument or discussion should exist. In standing seam roofs, working the tin so that the standing seams come at the ends of the sheet in 14 x 20 plates, which is the ordinary method, and working them so that the standing seams come along the sides of the plates in 20 x 28, which is also the ordinary method, the same conditions are produced in both roofs so far as the fastenings against the sheeting boards go. There is this difference, however, that in the use of 20 x 28 only one-half the number of cross seams exist that would occur in the same surface covered by 14 x 20 tin. It would seem to us, therefore, that if any choice exists, 20 x 28 is to be preferred for standing seam roofs. Careful consideration of the subject fails to show us sufficient advantages in either over the other to warrant a decided preference. It becomes, therefore, for the most part a matter of individual choice, independent of other reasons.

Characteristics of Different Styles of Architecture.

III

After the death of Henry VIII the Gothic, or native style of architecture, appears to have died out, and was supplanted by a style in which the Gothic and Classical forms were blended in a curious, but picturesque and effective manner. This change was, no doubt, brought about by the dissolution of the religious houses, and the consequent withdrawal of the patronage of the clergy, which was formerly exercised with regard to ecclesiastical buildings. However, even earlier than this, "from the death of Henry VII, the ecclesiastical architecture may be said to have terminated, and as the nobility now emulated each other in the pride of building, domestic architecture may be said to increase, and the decoration of monumental architecture had been cradled in Gothic infancy, and now burst into gorgeousness with its maturity."

The wealth which had accrued to the nobility by the distribution of the abbey lands, increased luxuriousness of living, the importation of foreign goods, the introduction of coal and other causes, exercised great influence upon the buildings of this date. The unsuitability of the Gothic styles for the wants of domestic life, however well they may have been adapted for ecclesiastical purposes, now began to make itself felt. This unsuitability became more apparent as civilization increased; the race of monastic architects was dispersed, old traditions were lost, the science of building fell into the hands of a less competent class of men, builders rather than architects, who, borrowing some of the best characteristics of the Tudor or Perpendicular style, produced a new combination which, from the fact of having attained its perfection under the Virgin Queen, has been called the Elizabethan style. The reintroduction of the round arch, the boldness and extent of the window spaces, the extensive use of woodwork, both constructionally and as decoration, and the employment of flat pilasters decorated with bands called strapwork, are the most noteworthy peculiarities of this style.

The staircases of the Elizabethan period are remarkable for their size, originality and variety, and many are illustrated in Nash's "Mansions of the Olden Time." It cannot be denied that, however difficult it may be to reconcile the buildings of this age with the accepted canons of criticism, they are remarkably picturesque in appearance and comfortable in arrangement; they have a charm of their own which is very attractive to the student, and at one time (about 30 years ago) there seemed a strong disposition on the part of architects to adopt this as the style for the future.

Under the classical and pedantic James I the style of building became still more classicized, and in a short time it almost entirely lost its original character. The Jocobean style is ponderous, ungainly and inharmonious (resembling in this respect the sovereign from whom it derives its name), but it is not devoid of some features of the picturesque. The woodwork of this time, although the outline is usually inelegent and the detail coarse, has a certain massiveness and sobriety which recommends it to the amateur, and it is at the present moment much in demand.

The reign of James and Charles I is immortalized by Inigo Jones, an accomplished architect, who, having resided and practiced in Italy for some time, exercised a very extended influence over the taste of the time, and to him, there can be no doubt, is largely due the revival of the fashion of classical art in this country. To show how complete was the transition of taste, and how entirely the interest in mediæval art had become extinct in this country, we may mention that Inigo Jones designed and carried out a Roman Doric portico to the western end of the Gothic Cathedral of St. Paul's, although it was scarcely 100 years since the Gothic had been the only style in England. Jones' chief work is the beautiful Banqueting House at Whitehall, the only portion completed of a magnificent palace projected by him for his royal patron James I.

The Stuarts had a decided taste for art, and a strong ambition to imitate the example of Augustus is observable in the family. Charles I was a liberal patron of art, according to his means, and it must never be forgotten that we owe to him the possession by the nation of the masterly cartoons attributed to Raffaelle. Under the Stuart dynasty the pure Italian style prevailed, and a large number of handsome and original buildings in this style were erected in various parts of the country.

To this period belongs that extraordinarily gifted and versatile man, Sir Christopher Wren, who, beginning life as a mathematician and an experimental philosopher, became, with an incredibly small amount of previous training, an accomplished and most original architect, and produced, alone and unaided, baffled and thwarted at every step, and by means of only a single tax, an edifice which has excited the admiration and envy of surrounding nations, and will successfully vie with the cathedral of St. Peter at Rome, which was the joint effort of some half dozen architects, backed by the almost unlimited exchequer of the whole of Catholic Christendom. The life of Wren, who, as the inscription over the north door of St. Paul's informs us, "lived more than ninety years, not for himself, but for the public good," is a wonderful record of industry, patience, forbearance and self-sacrifice. The number of buildings that he designed and carried out is surprising. They are of every description, in all parts of the country—palaces, churches, guildhalls, mansions, theaters, almshouses—nothing is too large or too small for him. Now he is called upon to make a design for rebuilding London; then to devise a means of diminishing the effect of the wind upon Salisbury spire. He is immersed in business, and yet finds time for communications to the Royal Society, and for the cultivation of the friendship of his peers. A truly noble life, unsullied by avarice or self-seeking, was Wren's. His talents were not appreciated in his lifetime, and his removal from his post of Surveyor General was an eternal disgrace to the government of the day (*temp.* Geo. I), which allowed Wren to descend unhonored to the grave.

Wren left no direct successor (his pupil, Nicholas Hawksmoor, was an unmistakable failure), but he had, during his rebuilding of St. Paul's and the parish churches of London, created a school of art workmen who carried on for a considerable period the traditions of building they had acquired under their master.

The accession of the Prince of Orange to the English throne in 1688, who brought a number of his countrymen in his train, to some extent modified the English fashion with regard to domestic buildings. A simpler and more formal style of architecture was introduced, which, for want of a better name, has been called the Queen Anne style. This is acknowledged to be a misnomer. It really commenced as early as the reign of Charles II, most of the houses of the merchants in the city of London having been rebuilt in this manner after the destruction of the city by the great fire of 1666, and it continued in use as late as the reign of George I. It, however, serves to mark an epoch in the history of architecture in this country, and for want of a better definition, the name has been retained to this day.

The Queen Anne style was the last regular style in England, and was very complete and agreeable in its way. It has none of the beauty and capability of expression to be found in the higher achievements of Wren or of Inigo Jones; but it was peculiarly adapted to the wants of the age; and if, on the one hand, it does not strike one by its grandeur, on the other, it never offends one's sense of propriety. It gradually died out in the reign of the First George, and since that time there has been no style of architecture in England worthy of the name. The works of the Brothers Adam (who built the Adelphi-terrace, which was named after the architects) are perhaps the only examples of a consistent style until we come to the time of Sir William Chambers. Chambers's style was a revival of the manner of Palladio, and was very good in its way, but it did not exercise any considerable influence upon public taste. To this succeeded a craze for Grecian art, which was, again, followed by other ephemeral tastes for various styles which have continued to our own times.

"Architecture in England," says Mr. Sharpe, in his "Seven Periods of Church Architecture," "from its earliest existence down to the sixteenth century, was in a state of constant progress or transition, and this progress appears to have been carried on, with certain exceptions, in different parts of the country very nearly simultaneously. It follows from this circumstance (1) that it is impossible to didvide our national architecture correctly into any number of distinct orders or styles, and (2) that any division of its history into a given number of periods must necessarily be an arbitrary one. It is, nevertheless, absolutely essential, for the purpose of conveniently describing the long series of noble monuments which remain to us, that we should adopt some system of chronological arrangement which may enable us to group and to classify them in a distinct and intelligible manner; and, although no broad lines of demarkation in this connected series are discernible, so gradual was the change, yet so rapid and complete was it also, that a period of fifty years did not elapse without a material alteration in the form and fashion of every detail of a building." The following shows the periods of English architecture:

Romanesque, or Round-arch Style.

The Saxon or pre-Norman prevailed from date not known to 1066.

The Norman period prevailed from 1066 to 1145, or from the accession of William the Norman to the middle of the reign of Stephen.

The Transitional period, or from the middle of the reign of Stephen to the end of the reign of Henry II—1145 to 1190.

Gothic, or Pointed Arch Style.

Lancet period, or from the beginning of the reign of Richard I to very near the end of the reign of Henry III—1190 to 1245.

Geometrical period, or from near the end of the reign of Henry III to the suppression of the orders of Knights Templars by Pope Clement V (A. D. 1312)—1245 to 1312.

The Curvilinear or Edwardian period, from about the birth of Edward III to very nearly the close of his reign, which occurred in 1377—1315 to 1360.

Perpendicular or Rectilinear period, or from the close of the reign of Edward III to the end of the reign of Henry VIII—1360 to 1550.

Mixed Classic and Gothic Style.

Elizabethan period, or from the middle of the 16th century to the commencement of the 17th century—1550 to 1609.

The Jacobean period, from the commencement to the first quarter of the 17th century—1600 to 1625.

Italian Style.

Renaissance or Italian revival, from beginning of the reign of Charles I to the accession of William and Mary—1625 to 1688.

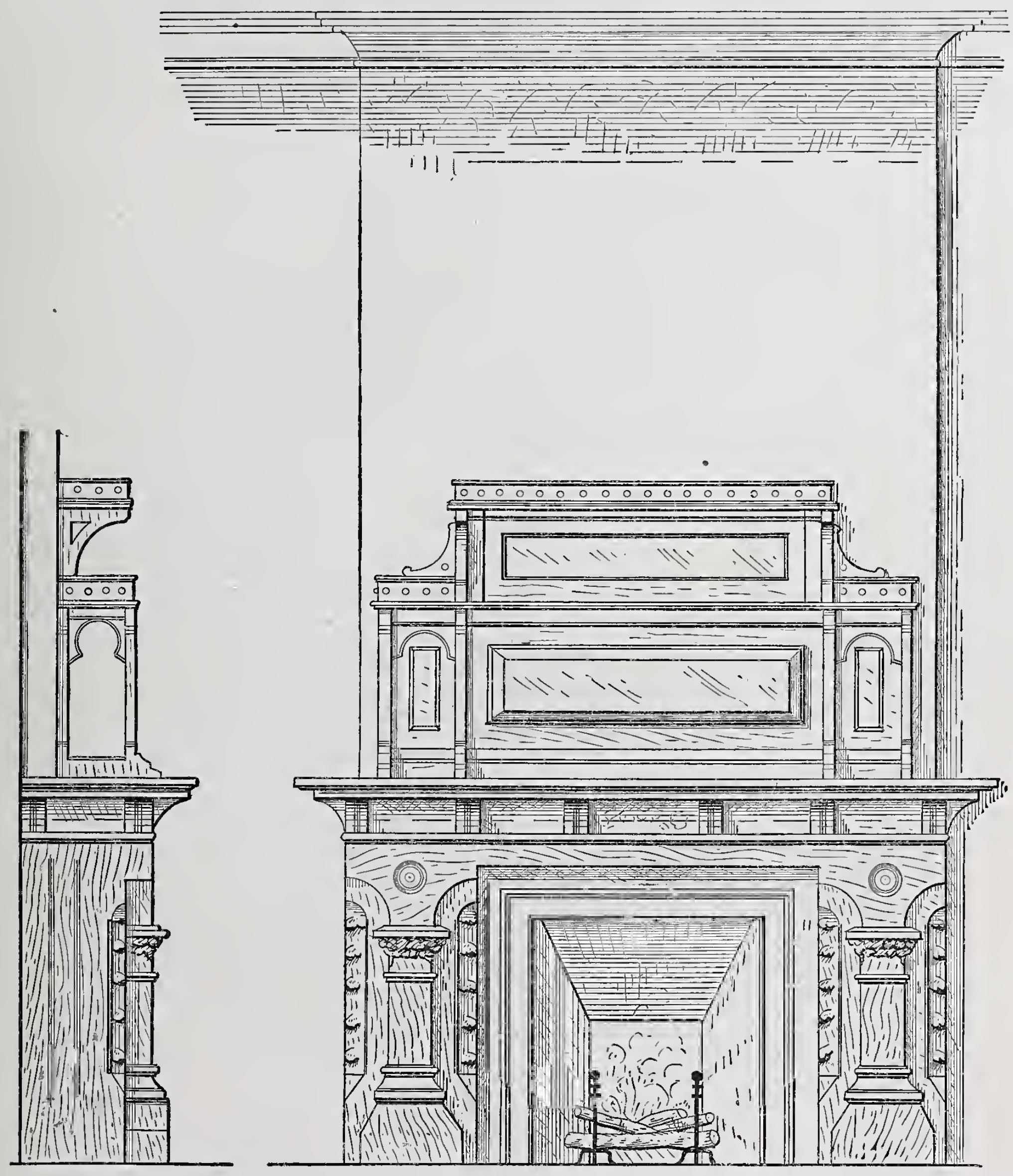
Mixed Italian and English Style.

Queen Anne period, from the accession of William and Mary to the reign of George II—1688 to 1727.

Designs for Wooden Mantels.

The illustration upon this page, as well as that upon page 194, are contributed by Mr. Joseph Ireland, of Cleveland, Ohio. They are from a set of designs made by him and executed under his superintendence for a residence recently erected upon Euclid avenue, Cleveland. The design used for the parlor mantel in the same house was published in our August issue.

These designs, by the neatness of their parts and their adaptability to the material of which they are constructed, recommend themselves to use. Their characteristics are such as make them more pleasing the better one gets acquainted with them.



Design for Wooden Mantel, Contributed by Joseph Ireland, Architect, Cleveland, Ohio.—Scale, ½ Inch to the Foot.

The Term "Penny" as Applied to Nails.—Many persons are puzzled to understand what the terms "fourpenny," "sixpenny," and "tenpenny" mean as applied to nails. "Fourpenny" means four pounds to the thousand nails, or "sixpenny" means six pounds to the thousand, and so on. It is an old English term, and meant at first "ten pound" nails (the thousand being understood), but the old English clipped it to "tenpun," and from that it degenerated until "penny" was substituted for "pounds." When a thousand nails weigh less than one pound they are called tacks, brads, &c., and are reckoned by ounces.

The New Eddystone Lighthouse.

The foundation-stone of the new Eddystone Lighthouse was laid August 19 by the Duke of Edinburgh. The formal commencement of the structure on the 21st of June, as first proposed, was prevented by the roughness of the sea. On the day of the final celebration the weather was rainy, but the water was sufficiently smooth to permit the carrying out of the programme.

The Eddystone rocks are situated in the English Channel, 14 miles southwest of the port of Plymouth and 12½ from Rame Head. They are almost in the line which joins the Start and Lizard points, and in the fair way of all vessels coasting the southern shore of England. So exposed are they to the ocean swell from the south and west that even in comparatively calm weather the waves go raging and thundering over their ledges, and their name indicates the incessant swirl of the deep about them.

The new lighthouse will stand 127 feet from the present tower on the South Reef, a rock which the House Rock protects from the southwest, but which has the disadvantage of being much lower, its highest part being never uncovered before half tide, while the lowest parts, on which most of the foundation rests, are 4 feet beneath the low-water level of an ordinary spring tide.

Most of the work done thus far has had to be done under water, and owing to the force of the waves the work could be carried on only at brief and specially favorable intervals. It is expected that the high-water level will be reached early next year, when the work will proceed more rapidly, as the courses of stone are all accurately fitted together on shore. It is thought that it will take five years to complete the lighthouse, which is to follow generally the lines of the present one, though it will differ from it slightly in form and considerably in size. To a hight of 25.6 feet above high-water mark the tower will be solid, with the exception of a space for a water tank. The side walls, beginning at this level, will be 8.6 feet thick, diminishing to 2.3 feet at the top. Nothing but granite will be used, and the blocks will be large enough to form the entire thickness of the hollow portion of the tower. Under the cornice, to the top of which it is 138 feet from the rock, the diameter of the tower will be 18.6 feet; it will contain nine rooms besides the lantern, each being 10 feet high, and the seven uppermost ones 14 feet in diameter. The focal plane of the new lighthouse will be 130 feet above high water, as compared with 72 feet in the present building, and the actual useful range of the light will thus be extended from 14 to 17½ nautical miles. About 5100 tons of granite will be employed in the construction, and 50 tons of iron for door casings and the like. The fog bell, erected in 1872, will be replaced by a powerful siren, and the electric light will probably be used. The estimated cost of the entire work is between $300,000 and $350,000.

MASONRY.

The Use of the Flat Arch.

VII.

The employment of the flat arch in lieu of a solid lintel, mention of which was made in the last article, is not a feature of antique architecture. The Greeks, who did not even employ the circular arch, would undoubtedly have looked upon the flat arch as a vicious form of construction. The large openings which occurred in their temples or public buildings were headed by single horizontal blocks of stone, upon which the masonry rested. The Romans followed the same plan in general, but exceptions may be found. Some of their architraves were formed of voussoirs, which were in many cases provided with joggles, to prevent the stones from sliding on each other. Bartholomew gives some ancient examples from Roman sepulchers, in which the three lower courses are prevented from sliding by a wedge-shaped joggle, formed on the top bed of one stone,

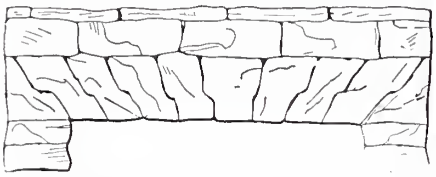


Fig. 1.—Example of the Flat Arch, from Diocletian's Palace at Spalato.

entering into a corresponding cavity cut to receive it in the lower bed of the next stone. Fig. 1, taken from the ruins of Diocletian's palace at Spalato, is one of the most ancient specimens extant of a similar expedient. From the Romans this contrivance appears to have been adopted by the Gothic invaders, and subsequently by the Normans. It is employed in the tomb of Theoderic at Ravenna, and even in the gateway of the Alhambra, the work of Saracen architects.

Fig. 2 gives an example from the chimney of Coningburgh Castle, Yorkshire, one of the most ancient ruins of a feudal stronghold remaining in England, and supposed to have been of Saxon construction. This is also

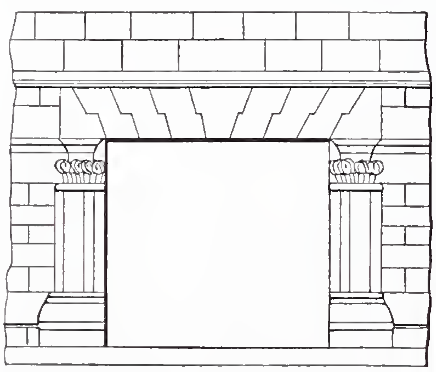


Fig. 2.—Chimney in Coningburgh Castle, Yorkshire.

one of the earliest extant examples of a regular fireplace. The mantel is formed of nine stones, cut in such a manner as to hang on each other and preserve a level at their lower surfaces, and having, in fact, all the characteristics of a flat arch. Above this runs a level molding, on which the masonry rests, beveled over so as to gather the chimney into the thickness of the wall. The opening is 7 feet 3 inches and depth 1 foot 6 inches; on each side is a triple column, with capitals and bases.

The elbows, or oversailing portions of the voussoirs, shown in both the above examples were not unusually employed in these ancient forms of the flat arch. This is, however, by no means the only expedient resorted to. For instance, at Fig. 3 is shown the transom of the Norman west doorway of Rochester Cathedral, in which tenons having a circular shape are introduced. In Fig. 4, from the mantel of a fire-place in Edlingham Castle, Northumberland, a triple circular tenon is employed in each stone.

It may be well here to speak of the principles governing the stability of compound lintels, or "plate-bands," as they are sometimes termed, having the form of the flat arch, or "French arch," as it is frequently called, and the best shape to give the voussoirs employed.

In constructious of this kind it is evident that the voussoirs, taken as a whole, form, in elevation, a trapezium, or figure of which two sides are parallel and the remaining

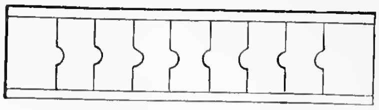


Fig. 3.—Transom of the West Doorway of Rochester Cathedral.

two inclined, as at A B C D (Fig. 5), the span of the extrados, C D, being greater than that of the intrados, A B, which latter is equal to the width of the opening to be covered. It is also plain that each of the voussoirs participates in the trapezoidal form in such manner that the distances D S, S R, R Q, Q P, P O, O N, and N C are greater than the corresponding distances A G, G H, H I, I K, K L, L M, and M B. This is requisite, not only to prevent slipping, but in order that the stones should present a plane surface at the soffit.

In order to give the radiating joints the proper angle of inclination, several plans may be resorted to, the most usual being to construct an equilateral triangle, A X B (Fig. 5), of which the front of the soffit forms the base-line; then to divide this latter line into an uneven number of equal parts, and to draw from the vertex of the triangle X, lines through each of these points, and produce them to the extrados. These lines will indicate the radiating joints or beds of the voussoirs, the angle of inclination of which is least for the central, or keystone,

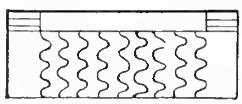


Fig. 4.—Mantel in Edlingham Castle, Northumberland.

and increases as the imposts of the opening are approached. The size of the stones employed depends upon the width of the opening, and the nature of the supports and load; but in all cases their number must be uneven, to enable a keystone to be used and avoid a central joint.

If, now, we investigate the manner in which the load that it has to bear acts upon the lintel or transom so formed, we find that in the event of rupture the two stones, C F, D H (Fig. 6), next to the keystone E, will open at their intrados, and that, on the contrary, the stones next to the piers will open at the upper part of their joints, as shown at Fig. 6. The intermediate stones, to the right and to the left of the keystone, remain meanwhile immovable and with their beds in contact. This fact is amply confirmed by experience.

It results from this that the two portions of the arch, A F C G and H B I D, have a tendency to fall into the opening over which

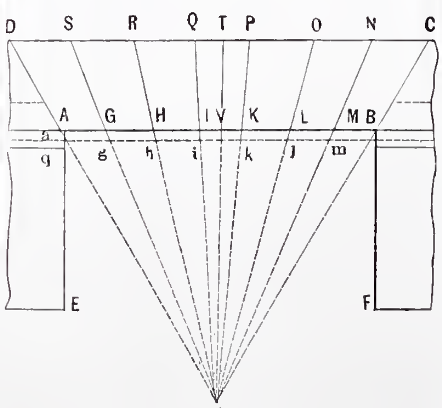


Fig. 5.—Principles of Stability in Compound Lintels.

they are placed; but as stone is practically incompressible, they cannot do this unless they can first throw down the jambs, or at least force them back considerably, for the right lines A C and B D, being greater than the right lines A F and B H, the first is not able to turn upon the point A, nor the second upon the point B, unless these two points A and B should be forced apart from each other.

The natural deduction from the above is that the weight of the arch, and also the load which it supports, may be considered as suspended from the point E, where the two prolonged right lines, A C and B D, meet. Now, it is evident, or at least easy to ascertain experimentally, that the smaller the angle A E B, formed by the two lines A E and B E, the less likely weight suspended from the point E will be to thrust back the imposts. It follows, then, that to

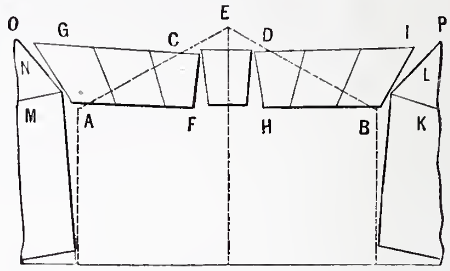


Fig. 6.—Action of the Different Parts in the Event of Rupture.

strengthen an arch of this character we must diminish the angle A E B, or what comes to precisely the same thing, lengthen the joints near the keystone. Thus, then, the form of arch shown at Fig 7 is more solid and stable than that given at Fig. 5, supposing the beds of the stones toward the abutments to be of the same length in either case.

But the form of arch at Fig. 7, although desirable on the score of stability and in other respects, is inconvenient, at least in walls of ashlar masonry, because, as is shown in the figure, the stone above the keystone is deeply cut in its center in such a manner that it is almost divided. In walls of this kind, therefore, flat arches, of which the

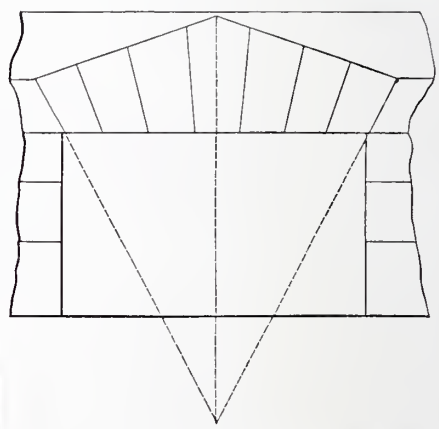


Fig. 7.—Form of Flat Arch Stronger than that shown in Fig. 5.

voussoirs have the forms shown at Figs. 8 and 9, are to be preferred. Here the base of the triangle employed to set out the joints of the stones of the transom, &c., is a little above the soffit, or rather, in designing the elevation, short perpendiculars are let fall from the points G H I K L M (Fig. 5), where the joints meet the base-line of the triangle to the points *g h i k l m*, and a horizontal line drawn through these latter points then indicates the actual soffit. This is shown perhaps more clearly at Fig. 8, where the lower portion of the beds of the voussoirs is vertical from *n* to N, *g* to G, &c. By this modification of form the flat arch gains very considerably in stability.

Another variation in the shape of some of of the stones, which has also the effect of considerably strengthening a construction of this description, is shown at Figs. 8 and 9. At Fig. 8 the two springers K and P, in place of having the beds A H and B C carried up to the back of the arch, have them directed horizontally, as H I and C D, the two adjacent voussoirs having a portion of their lower beds similarly cut. It is clear that this expedient strengthens the lintel very much on the imposts, and where the system is extended to two more stones, as at Fig. 9, additional security is afforded.

If we suppose the flat arch spoken of above to be considerably prolonged, we have the form of construction frequently termed a flat vault. In such a case the two imposts or abutments of the arch are replaced by two parallel walls, and the vault itself is formed of stones having as close resemblance to the voussoirs of the flat arch as it is possible to retain consistently with attention to breaking joint.

Flat vaults covering a square plan may be supported by four walls, within which they are comprised. The rows of voussoirs here make concentric squares, those of the angles being common to two of the sides, and the keystone having a square form and serving to lock the whole vault together.

This latter description of vault is not frequent in this country, and calls for the exercise of no inconsiderable degree of skill in

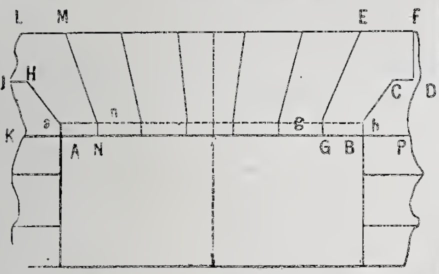


Fig. 8.—Form of Construction More Desirable for Use than that of Fig. 7, and Still More Stable.

its formation. It should be strengthened by an iron tie, or should have very substantial abutments, to guard against probable yielding at the joints of the stones.

Flat vaults, constructed upon a plan which is circular, have a concentric arrangement of the voussoirs, which are locked by a central keystone of a conical form.

When the supporting media for a flat vault consist of four pillars or columns placed at its respective corners, a different arrangement may be resorted to. In this case the rows of voussoirs are parallel to the inner faces and intersect at right angles on the diagonals, on which are placed voussoirs common to the two sides. The last row on each side is cut down to receive the diagonal voussoirs.

At Fig. 10 is shown the plan of a flat vault covering a square hall and supported by the four walls. The key is square and tapering. At Fig. 11 the form of the first angle blocks is given, the horizontal projection of which is, as will be seen, contained within the lines M N P Q Z (Fig. 10). The vertical elevation has the form of the end voussoir of the flat arch shown at Fig. 8. The template formed to that figure has, therefore, to be applied to these two vertical faces M N and Z P (Fig. 10) of the block, and the stone worked according to those outlines until it assumes the appearance of Fig. 11.

The flat vault, if properly constructed, exercises little or no thrust upon the walls or abutments, and presents in this respect a marked difference to groined vaulting. This

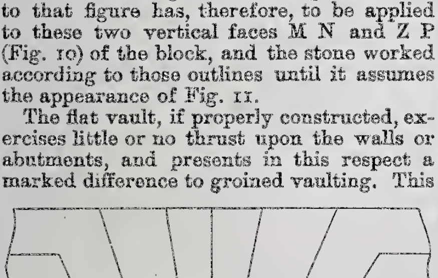


Fig. 9.—A Variation of the Construction shown in the last Figure.

would be by no means the case, however, if the stones were simply given the shape shown at A (Fig. 12), but by giving an elbow to each stone, as at B (Fig. 12), the thrust that the simple trapezoidal form at A would exercise is almost entirely neutralized. Indeed, the whole vault may then be considered as a series of concentric rectangles locked the one in the other, and resting upon the horizontal beds of the elbows. But by giving each stone the vertical section

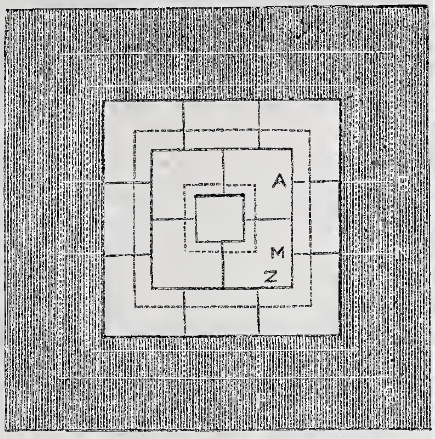


Fig. 10.—Plan of a Flat Vault, Covering a Square Hall, Supported by Four Walls.

shown at B (Fig. 12) yet more is secured. In that case the stones are capable of mutually sustaining each other, as each rests upon the one preceding it. And not only so, but all liability of the stones sliding on their beds is obviated. As a consequence of this, it is not only practicable in a flat vault thus constructed to dispense with the key entirely, but even to omit several of the central rows in order to obtain an extensive opening to light the hall or building.

Fig. 13 represents a similar vault thrown over two intersecting galleries or corridors. In this case flat arches are built from one to

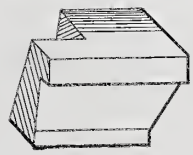


Fig. 11.—Form of First Angle Block in the Flat Vault shown in Fig. 10.

the other of the four pillars or abutments, A B C D, and the central space then vaulted, as in the last example.

A flat vault on a circular plan is given at Fig. 14, accompanied by a section through the key.

Two of the stones for the same are shown at Figs. 15 and 16. Of course separate

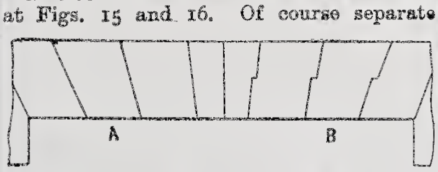


Fig. 12.—Vertical Joints Used in Flat Vaults.

templates are required for each size. These diagrams are self-explanatory.

New Building for the Bureau of Engraving.

Considerable attention has recently been attracted by the new building designed for the Bureau of Engraving at Washington. When the appropriation for this work was made by Congress the cry for economy in public expenditures was upon every lip, and nothing served to procure the appropriation except the pressing necessity for some relief to the overcrowded Treasury Building, and the belief, which had at that time just penetrated the heads of our law makers, that any project originated or indorsed by Mr. McPherson, chief of the bureau, was certain to be carried out wisely and economically. The sum asked for was $300,000, and was deemed absurdly small for the construction of a great public building. Predictions were quite generally made that a large deficiency would be created before the structure would be ready for occupancy. The outer walls, however, have been nearly completed, and the building is at present about ready for roofing; almost all the material for the completion of the work is upon the ground, and the indications are that the building may be finished before the 1st of January next. It is a remarkably short time, in the opinion of architects and builders, because not more than a year has elapsed since the work of excavating for the foundations was commenced. What seems still more remarkable is that the cost of the work will fall within the appropriation.

One of the chief features of interest about this building is its ornamentation. A water line of gray granite and a continuous sill of the same material mark the floors of the first and second stories; the window sills and a portion of the ornamental work around the en-

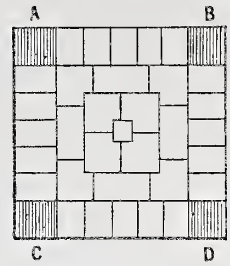


Fig. 13.—A Flat Vault Supported by Four Pillars.

trance are of brown stone; all the remainder is of brick in two colors, but molded into a great variety of patterns. Each story has its special pattern of ornamentation of pressed brick, while over the whole runs a series of springing window arches, supported upon piers which extend from the ground to the roof. The entrance may be described as a study "in brick and stone." Delicate columns of brick support the arch; panels

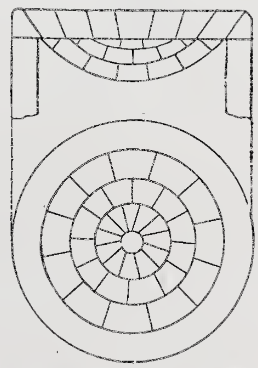


Fig. 14.—A Flat Vault Circular in Plan.

of brick, with molded sunflowers, fill the space, and overhead hangs a graceful balcony, supported upon half arches of the two materials combined. Ornamental work of a still higher order, also in brick, is contemplated in the interior finish.

When completed, this building will contain nothing that can burn except the paper of which the money is made, the process of printing which is to be carried on in the building. The floors will be of brick and concrete; the furniture in the working room will be of metal and other uninflammable materials. The fact that a building of the character and capacity of the one described above may be built for the sum of money named, is a strong commentary upon the cheapness with which building operations can be conducted at the present time. With-

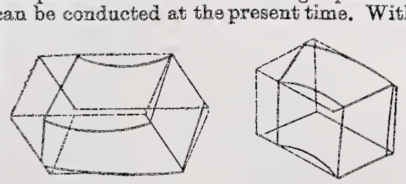


Fig. 15. *Fig. 16.*

Two of the Stones Used in the Vault shown in Fig. 14.

out some such figures before us, it is hard to comprehend the great reduction that has taken place in the price of labor and materials entering into buildings during the past few years. The extensive employment of brick, by which some of the principal features of ornamentation are obtained in the building above described, is to be credited with a portion of the economy practiced in the construction of the building. Brick is fast becoming a leading feature of construction in buildings of the better class, both for purposes of stability and ornamentation, and it is altogether desirable that one of the prominent buildings of the government should so aptly illustrate the usefulness of this material at this particular time.

JOINTINGS IN WOOD

Fastening the End of One Piece to the Side of Another.

In the preceding articles we have considered the method of lengthening timbers by the various plans of scarfing, fishing and lapping. We now come to the consideration of the methods employed for fastening the end of oue piece of timber to the side of another.

"Housing" consists in letting the whole end of one piece of timber for a short distance into the side of another. This is illustrated in Fig. 1. This term is sometimes applied to a very short tenon, used in places where it is only required to prevent lateral movement. For example, to keep a post in its place upon a sill. But properly this term is restricted to joints in which the whole end of oue piece is housed into another.

"Notching" is illustrated in Figs. 2 and 3. Other forms of this joint are in common use. Joists are sometimes fitted to

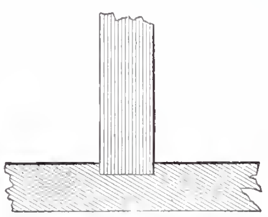


Fig. 1.—*Housing.*

wall plates by cutting a notch into their lower sides. When joists differ in depth, the depth of the notches is also varied, so as to bring the upper surfaces to the same level. When the end of the joist does not project over, there is nothing to tie the wall plate in toward the center of the building. Notching is also applied in cases where the end of the joist projects and is left on. It then grasps the wall plate and holds it in. "Double notching" is a term applied to a joint made by taking one-half of it out of each of the two timbers joined. When each timber is notched to half its own depth, its joint is called "halving," concerning which we will have something to say further on. There are various fanciful forms of notching, among which may be named "the dovetail" notch. Sometimes the inside of the joint is dovetailed and the outer side is left straight. Occasionally the joint thus formed is tightened up by a wedge driven into the straight side. The general defect applying to dovetails is partially remedied in this class of joints by the grasp the projection of the upper beam has upon the lower.

Fig. 3 illustrates a form of notch devised by Tredgold, a celebrated authority in

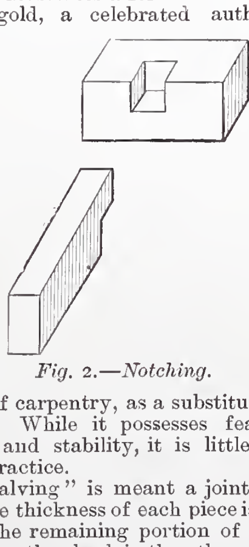


Fig. 2.—*Notching.*

matters of carpentry, as a substitute for the dovetail. While it possesses features of strength and stability, it is little used in general practice.

By "halving" is meant a joint in which half of the thickness of each piece is checked out, and the remaining portion of one joist just fits into the check in the other, the lower and upper surfaces of the pieces being flush. This is a common way of joining wall plates and other timbers at the angle where there is no room for their ends to project so as to cross one another. In Fig. 4 is shown this same joint applied to timbers one of which meets the other at a point removed from its end. The joint may be either plane, as shown in Fig. 4, or beveled, as shown in 5. In such joints the surface of the

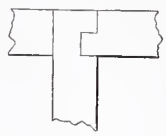


Fig. 3.—*Tredgold's Notch.*

checks is splayed up and down, as shown. If the lower beam is firmly bedded and the upper beam has a weight upon it, so that the surfaces are kept close together, their splayed form prevents the upper beam from being drawn away in the direction of its length and greatly strengthens the joint.

In Fig. 6 is shown a form of halving, called, for the sake of distinction, "single halving," in which but one of the timbers is cut away. This differs from the form of notching described above only in the extent of the cut, the term halving being applied to cases where one-half of the thickness of the timber is removed, and notching to where less than one-half is cut away.

In Fig. 8 is shown a case of halving where the joint is applied to timbers the ends of which cross. This joint is sometimes called "locking."

In Fig. 7 is shown still another form of halving, which is called, on account of its shape, "dovetail halving." A dovetail halving may be described as a joint in which the dovetail is half the thickness of the piece upon which it is cut, and the notch to receive it is half the thickness of the other piece. Dovetails are so called from the shape of the pieces cut to fit one another. In general, they are objectionable in carpentry, because the wood shrinks considerably more across the grain than along it. The conse-

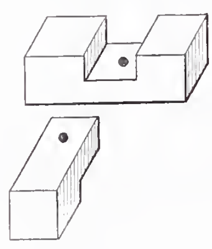


Fig. 4.—*Halving.*

quence is that, in such a joint as shown in Fig. 7, the upper piece shrinks crossways more than the lower piece shrinks endways; hence the upper piece, after a time, may be easily drawn away from the lower one. This joint is, moreover, very weak at the angles at the sides. Dovetails are not liable to the same objections when the grain in both pieces runs the same way, but in that case, if the timber shrinks or is strained in the direction of its length, the checks are very liable to be split off.

In Figs. 9, 10 and 11 are shown various forms of what is known as "cogging," or "caulking." In such joints the notch on the lower beam is only partly cut out, leaving pieces cogged, like that of a cogwheel, uncut, and the upper beam contains a small notch only wide enough to receive the cog.

Cogging has several advantages over notching. The upper beam is kept at its full thickness at the points of support, and is therefore slightly stronger than when notched. The cog gives the upper beam a hold upon the lower, even when its end does not project beyond the latter.

Joists or binders are sometimes cogged on to wall plates by means of the joint illustrated in Fig. 10. The cog is made broader or narrower, according as the joists do or do not project. Where the joists project the cog may be made broad and be located in the middle of the wall plate, as shown in Fig. 10; but in case the joists do not project, the cog must be narrow and be kept toward the inside of the wall plate, so that there may be sufficient timber on the joist beyond it to resist the strains.

Foundation Work.

Foundation work, as practiced in America, like most other constructive features of public works, has been subject to limitations and requirements unknown to European countries. In America time is always pressing, distances are magnificent, and investment capital limited and urgent for speedy returns. In earlier days scientifically educated Americans were few, and engineers were largely ignorant of the precedent of foreign practice. Their main reliance was on their "home" experience, and that peculiar faculty of adapting one's self to circumstances that almost all mechanics in a new country possess in a greater or less degree. Work, to be done at all, had to be done cheaply, expeditiously, for capital could not afford to remain passive, and effectively, to avoid future losses and repairs. Had the fathers of American engineering been men of greater education or scientific culture, they doubtless would have

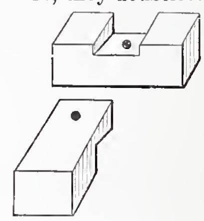


Fig. 5.—*Beveled Halving.*

been far less successful in their works, and fewer enterprises would have been undertaken. Strongly self-reliant, the men of the earlier days of American engineering accepted fully the requirements of a new country, and set to work to solve the problems appertaining thereto.

In the matter of foundations, these men availed themselves, almost from the beginning, of the great abundance of cheap timber for their works, and time has proved the wisdom of their course and the excellence of their judgment. In fact, the free use of timber may be regarded as the chief difference between American and European methods of founding masonry in deep water or river crossings. Many of the most important railroad bridges have their piers founded on timber cribs filled in with stone, the timber work being carried up to within a couple of feet of the lowest water mark before starting the masonry. On bottoms subject to erosion, a plentiful supply of riprap is dumped around the foundation, and repleuished from season to season until well solidified. This is the most common system employed throughout Pennsylvania and New York, and in fact in all States where the character of the river bottoms is of such a nature that a solid bearing on rock, hard pan or gravel can be insured. Where a soft material overlies a hard bottom, loose stone is thrown in, which soon

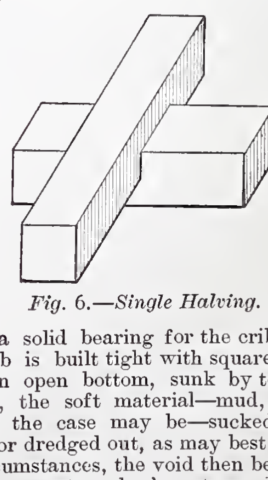


Fig. 6.—*Single Halving.*

forms a solid bearing for the cribwork, or the crib is built tight with square timbers, with an open bottom, sunk by temporary loading, the soft material—mud, sand or silt, as the case may be—sucked out by pumps or dredged out, as may best apply to the circumstances, the void then being filled in with concrete or broken stone. In case of rough or sloping bottom, the lower courses of the crib are made to conform to it as nearly as possible, from previously determined soundings. Many of the cribs are of round logs, notched at their intersections and secured with long drift boats. For bottoms ill adapted to cribwork, the most usual practice is to drive piles, the area of the foundation having been previously dredged below scour, if possible. The piles are cut off truly level by means of a horizontal saw on a vertical shaft, or the simple device of a pendulum saw, and as close to the bottom as possible. The interstices between the piles are leveled up with stone. On the bottoms so prepared a crib is sunk, economizing the masonry up to near low-water mark, or a timber caisson is floated over the piles, the bottom of which forms the platform for the masonry, which is carried up in the usual way, as in the open air. To control the flotation, a valve is sometimes provided in the caisson, through which water may be admitted, to be pumped out again as occasion requires. The sides of the caisson are detachable, and are used again should there be more than one pier to found. A modification of the former method has been practiced by depending on the piles for the immediate bearing of the platform, and using a timber crib as a protecting envelope surrounding them, all voids being filled up with stone or concrete. In this case the plies, of course, are cut off at the distance below low water

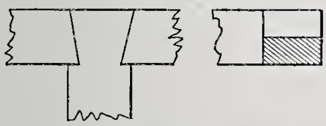


Fig. 7.—Dovetail Halving.

that it is desired to commence the masonry. In all cases where there is any possible chance of scour, it is usual to protect the area surrounding such foundations by means of rip-rap.

Exceptional works often require expensive methods; but such works in this country are of very recent dates. The applications of the pneumatic system, so long practiced in Europe, to the foundations of the East River and the St. Louis bridges, are examples familiar to tho profession, having been detailed at length in the printed reports of their respective engineers. They are probably the most extended examples of the system extant, and required great boldness and constructive skill to carry out. Two notable improvements were developed in the construction of the St. Louis bridge piers, viz., the use of the water column for driving out the sand through pipes, and the placing of the air-lock at the bottom of the well, leaving the long ascent and descent of the workmen to be accomplished in the ordinary atmosphere. The common European practice of using iron cylinders with the pneumatic system has been applied in this country to but few bridges, of which that at

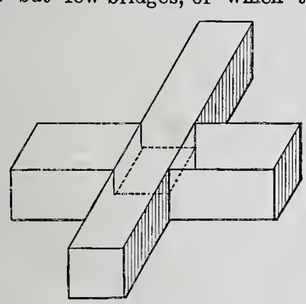


Fig. 8.—Double Halving or Locking.

Omaha is the most extreme example. The Poughkeepsie bridge, now building, has its enormous piers founded on huge square-timbered cribs, sunk by dredging through the wells formed by the cross walls of the cribbing, to a depth of 110 feet and over. Tho cribwork, being filled with concrete, forms a solid base for the masonry commenced 25 feet below low water, and towering 135 feet into the air above high-water mark. This is the boldest example of timber foundation work on record, and perhaps meets the most extreme case of deep water foundation that the engineering needs of the country will ever call for.

Out of the persistent demand for accomplishing results cheaply and rapidly, grew what American engineers know as the Cushing system, which consists of square timber piles driven to their full bearing in intimate contact with each other, forming a solid mass of bearing timber. Surrounding the pile cluster so driven is an envelope of cast or wrought iron, sunk sufficiently in the mud or silt simply to protect the piles, all voids between piles and cylinders being then filled with hydraulic concrete. The piles

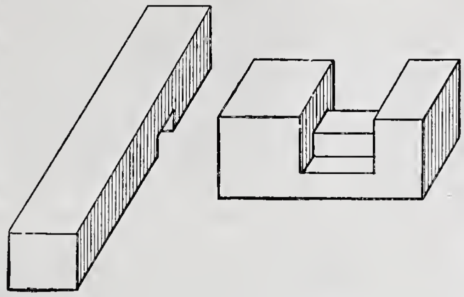


Fig. 9.—Cogging or Caulking.

alone support the load. Several such foundations have been used, and answer an admirable purpose. Time alone will tell whether the only objection that can be used against the system, viz., "dry rot," has any foundation in fact.

The water jet has been used economically and with good results for sinking piles in soft bottoms, notably in the case of Tensas bridge in Alabama, where iron cylinders were put down by simply directing through gas pipe a system of jets driven by an ordinary steam pump.

The preceding description fairly covers the leading features of foundation methods

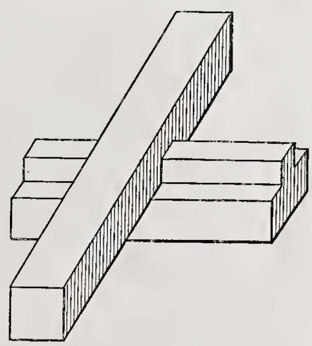


Fig. 10.—Cogging or Caulking.

practiced in this country—except, perhaps, coffer dams, of which no mention has been made. As a rule, coffer dams are avoided, excepting in comparatively shallow waters, and where there is some reasonable certainty of getting a tight bottom. The uncertainty of what future trouble and expense a coffer dam will develop before the bottom is laid bare, causes engineers to select some of the several methods previously outlined. A novel floating coffer dam has been built in New York that has been experimentally successful in laying dry a mud bottom, but no work has thus far been laid with it; it is simply a long, rectangular, double walled caisson, with an inside court as it were, having sheet piling sliding in guides in the inner wall of the caisson, which, when driven into the mud or clay (it is only practicable on a homogeneous mud or clay bottom), acts as ordinary sheet piling. The caisson is sunk by filling its walls with water, and is rigged with steam pumps for exposing the bottom and clearing the caisson of its water ballast. The ends of the caisson are movable, permitting of its removal as a whole from the completed work.

Screw piles, so largely used abroad, have been used but little by American engineers.

Looking to the future, it is not probable that demands will be made upon the skill of American engineers for much more difficult foundation work than has already been accomplished, and it may be many years before projects arise which will match those already executed in this class of constructions. But be that as it may, American foundation work will long be characterized by a free use of timber in the form of cribs, caissons, platforms and piles, and a very limited use of iron, pneumatic processes or coffer dam work, in which particular, as was remarked in the commencement, lies the distinguishing characteristic between American and European systems of foundation.

The Way Houses Were Built Eighty Years Ago.

In making some alterations in an old house at Montclair, N. J., a short time since, tho method of building in practice at the commencement of the present century was graphically revealed. It is thus reported by the *American Builder:*

In removing the siding at the bottom of the posts, it was found to be nailed with flat-headed wrought-iron nails, whose tenacity astonished the modern workman. The siding was of hard pine, and seems to have been perforated with a gimlet or nail bit for each nail, as the holes were somewhat larger than the necks of the nails. The house had been kept well painted, and there was not the slightest appearance of decay in the siding or other woodwork. The corner posts were of pine 10 x 10 inches, and were tenoned into the foundation timbers and fastened with two pins of hard wood into them. All the studding was tenoned into both sills and girts, and pinned with ¾-inch hard-wood pins; the studding in the outside walls were 3 x 10 inches, and on the sides of the openings, 4 x 10, and were all hewn out with the ax. The joists below were formed of round timbers flatted on one side, and varied in dimensions from 12 to 7 inches in diameter; they were gained into the outside sills and pinned, and ran across the whole width of the building. The original floor must have worn out 30 or 40 years ago, for two thicknesses of flooring had been laid over it—one, 1½ inches, and the last 1 inch thick. All the doors had been cut off to suit these new floors, but not a single door had sagged or changed its shape. The first floor had been about 2 inches thick hard pine, tongued and grooved by hand; the thickness was not uniform, and had been "dubbed" off to a given thickness on the under side where it lay across a joist. The flooring does not appear to have been "blind-nailed," as some of the nails were found near the center of the boards, and seem to have been "set" deep into the boards. The nails used in laying the flooring had different-shaped heads to those used in the siding, the latter having flat, round heads, the former having square, oblong heads, something like a horse-shoe nail. The base-board or skirting was "rabeted" into the flooring about three-quarters of an inch, and had been driven in tight on wet paint, which held it tighter than glue, and prevented wind or vermin from entering the house through the walls at that junction.

The partition walls were formed with studding of various thicknesses, but always

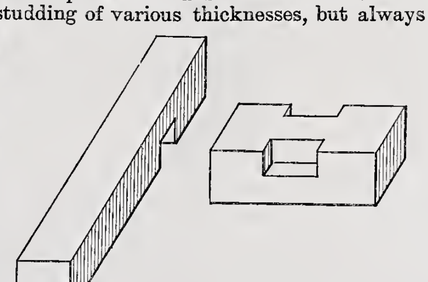


Fig. 11.—Cogging or Caulking.

6 inches wide, which made the partition walls about 8 inches thick. The trimmers over each door and window were framed into the studs or posts with mortise and tenon, and were firmly pinned and drawn home until the joints were as close as joiner work. Besides having the trimmers all framed into the posts, the partitions were braced with strips 4 inches wide and 1 inch thick, let into the studding, on its flat, until it was flush with the face of the studs. This was done on both sides of the partition, beginning at the trimmer over the door and running at an angle down to the floor, being well fastened to each stud with nails or pins, rendering it impossible for the partition to move or the door frame to get out of shape.

The upper joists were formed of timbers

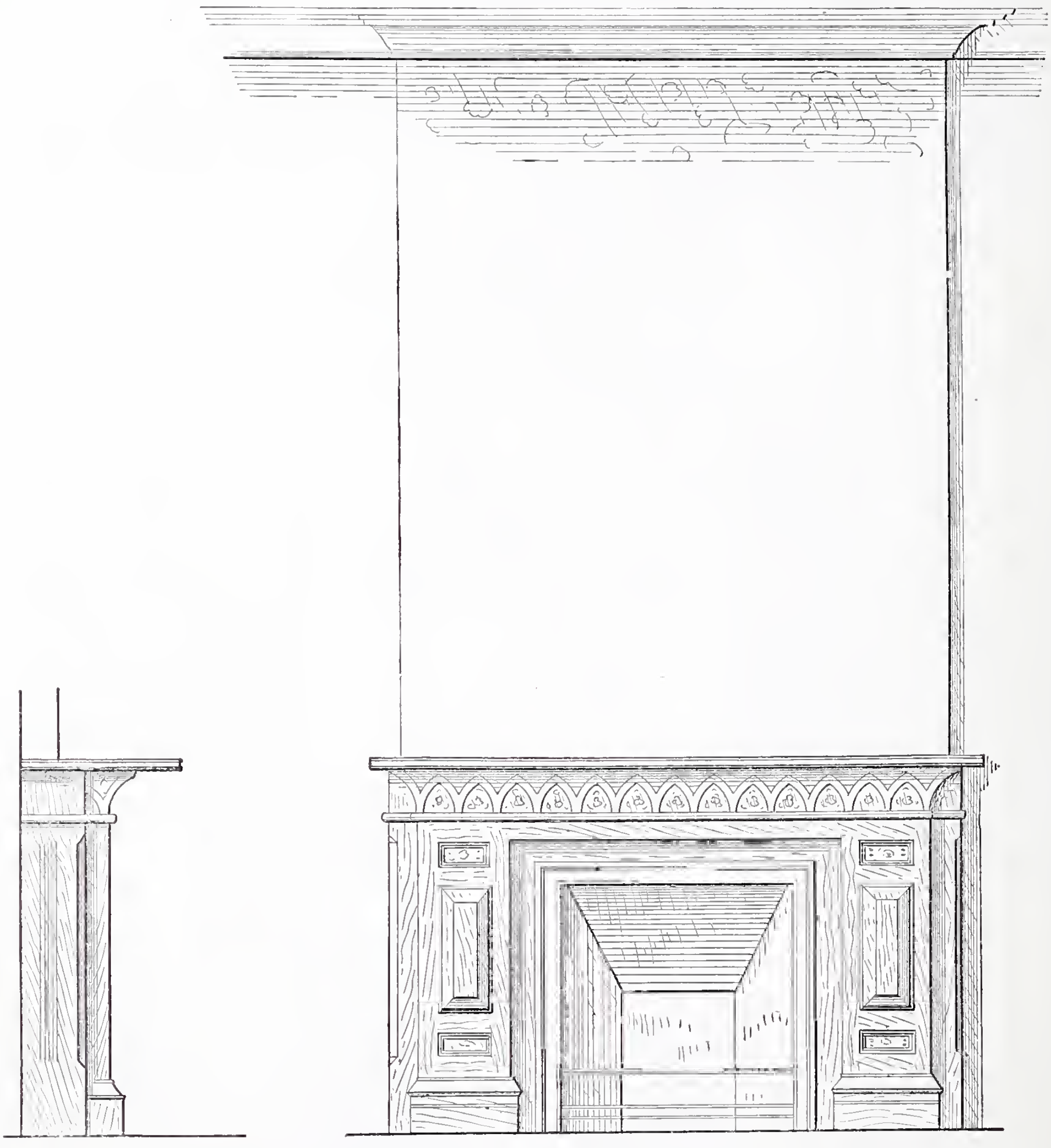
flattened on two sides, top and bottom, and rested on girts on the outside and a bearing timber in the center of the building, which was supported by a partition that ran the whole length of the house. The upper story was finished nearly the same as the lower one, with the exception of having a greater number of closets, cubby-holes and hiding places.

The windows were small but numerous, and were formed with small panes of glass, none of them being more than 7 x 9 inches in size; all were double-hung, however, and had been so well fitted and so nicely adjusted that the day they were taken out they worked better and with greater ease than many of the windows in our first-class houses, although they had done service for 75 or more summers. The sashes were all dove-tailed at the corners, and each muntin was doweled into its neighbor, through the bar, and into the stile; they were made to last and wear, and their maker, if he was in the land of the living and could know his own work, would be unreasonable if he was not satisfied with the length of time his work had done duty. As much may be said of the doors, which were all five-paneled, for although they had nearly 3 inches cut off the bottom, an operation that every joiner knows seriously weakens the whole door, they would stand more wear and hardship than half the doors that are made nowadays. The hardware used on the doors and windows was of the most primitive kind, and consisted of square shot bolts, latches and brass-trimmed locks. The knobs of the locks, which were of brass, were no larger than a common-sized walnut, and must have formed inadequate leverage to turn back the bolt when the locks were new and stiff. The cases and works of the locks were made of wrought iron and brass, and not a particle of cast iron could be found in or about them. They bore evidence of long and hard usage, but we could find no trace of their having been repaired or replaced, but in nearly every instance they were fairly and honestly worn out. No name of maker or mark indicating the place of manufacture could be found on any piece of the hardware, but it is safe to suppose it was of English make.

From documents in possession of the owner, it was ascertained that the house was three years in building, and that one of the years was occupied in plastering the house and building the chimneys.

Before the alteration was commenced we examined every room in the building, and not a crack or flaw could be found in the plastering anywhere, and the walls were as sound and tough as could be desired. The chimneys were massive and deep, the fireplaces having been prepared for burning timber in the log, and were provided with swinging cranes and massive andirons. There were no grates or provision for burning coal in the house except a modern range. It was easy to see that the original builders of the house had never thought of such a thing.

The stairs were built of hard wood and were very strong and solid, but cramped and inconvenient. They finished at the bottom with a curtail step and cluster of balusters; the rail was of walnut, very heavy and clumsy; the balusters were square and tapered, but each one was in its place as solid as a rock, and although the style of the work was such as we could not recommend at the present day, it bore on its face evidences of an earnestness and honesty that is getting scarcer and scarcer every year.



Design for Wooden Mantel, Contributed by Joseph Ireland, Architect, Cleveland, Ohio.—Scale, ½ Inch to the Foot.

The Newark (Ohio) Court-House.

In the June number of *Carpentry and Building* we called attention to the destruction, by fire, of the new court-house at Newark, Licking County, Ohio, which had but just been completed. The building was a very fine one in outward form, and its location, in the center of a large square, gave it a commanding appearance. It had four fronts, a feature which the architect had improved in the way of architectural display. The building was surmounted by a tower, in which was a clock having illuminated dials. The light for these by night was supplied by gas jets, from some carelessness in adjusting which the building took fire one night and was destroyed. The building was substantially built in the lower part, having, among other features, iron floor beams with corrugated iron arches between, but it was covered by a wooden-framed mansard roof. The tower was also of wood, incased with galvanized iron. In the former reference to this building we called attention to the fact that, on the score of economy, all fireproof features were omitted in the upper part; while, on the other hand, extra work, in the shape of blue limestone casing, was added to the outside of the building, for the purpose of making its appearance finer than if constructed with exposed brickwork, as originally contemplated. The county commissioners have not been slow in rebuilding. We stated in the June issue that they had contracted with Mr. Tinsley, a well-known architect of Columbus, Ohio, for new plans. It seems we were misinformed upon this point. Mr. David W. Gibbs, of Toledo, Ohio, furnishes the plans and superintends the erection of the new building. In design the new edifice is to be the same as the one destroyed. The mansard roof and tower, however, in this case are to be fire-proof, as well as the lower part of the building. The mistake of adding a tinder-box on top of a well-constructed basement and principal story, is not to be repeated. The work has already made considerable progress, and no time will be lost in getting the building ready for occupancy. Messrs. Miller, Frayer and Sheets, of Mansfield, Ohio, who were the contractors for the building destroyed, have also the contract for the new structure. This firm built the new asylum at Athens, Ohio, also the court houses at Mansfield and Sandusky, Ohio, and are probably quite as well qualified as any firm in the State for carrying out the plans of an architect. Not the slightest blame, we understand, attaches to them for the destruction of the former building.

Non-Alcoholic Shellac.

In the September number of *Carpentry and Building* we described shellac, giving its origin and some account of its preparation for use in the shape of varnish. As there stated, alcohol is the ordinary solvent used. An article, however, has been recently introduced to the trade which has the peculiarity of being made without alcohol. Ordinary shellac varnish is quite expensive, and there are certain difficulties attending its application which require considerable skill and experience upon the part of the painter. In the use of ordinary shellac varnish it is quite difficult to avoid what are technically known as "laps" on account of its drying so quickly. The non-alcoholic shellac avoids this difficulty entirely. The solvent employed is colorless, tasteless and odorless; and it has the very desirable property of being non-inflammable, so that there is no extra fire risk in connection with storing quantities of the prepared material. Non-alcoholic shellac varnish is used the same as ordinary shellac varnish. It has the great advantage of costing much less, being about one-third the price of alcoholic shellac. It dries with a smooth, hard surface and a high luster. It takes a smooth, satin finish when rubbed down with pumice-stone and water, and is suitable for use by furniture and cabinet manufacturers, carriage and car builders. It is also suitable for application to ironwork.

The manufacturers are William Blondel & Co., No. 91 Liberty street, New York. The article has been introduced something over two years, and has given entire satisfaction to all who have tried it. Among other purposes for which it is extensively used is a finish on lead pencils. Non-alcoholic shellac is sold direct to the consumer without the intervention of agents, and is, therefore, afforded at a very low price.

After examination of work finished with this article, we take pleasure in recommending it for trial to any of our readers who desire a cheap substitute for ordinary shellac.

Terra Cotta in America.

The following, clipped from a recent number of the London *Building News*, shows how the present status of the terra cotta industry in this country is viewed from an English standpoint. We commend to the attention of our manufacturers the experience of English establishments in the matter of stock patterns narrated below:

Terra cotta, we are informed, is gradually supplanting the use of galvanized sheet iron in America for architectural purposes. We lately drew attention to the extensive employment of sheet iron in the cornices, dressings and other architectural finishings of American buildings, in lieu of stone, the metal being generally painted and sanded over to imitate that material. This unreal kind of ornament has been for years a reproach to American architecture, but at length there appears to be a growing appreciation for terra cotta as a substitute, which is already largely manufactured in Chicago, where its manufacture was commenced in 1868 by the firm of Hoey & Nichols. Soon afterward a company was formed, Mr. Sanford E. Loring, architect, of Chicago, taking a very active part in the manufacture, and the services of Mr. Taylor, formerly a foreman to Mr. Blashfield, well known as one of our foremost manufacturers of terra cotta at Stamford, was engaged as superintendent. From this time the manufacture of terra cotta has gone on increasing, and the rebuilding of Chicago after the great fire of 1872 gave an impetus to the material. The architects of the city, through the energy of the president, Mr. Loring, have at length realized the artistic capabilities of the new material, and its adaptation to brickwork has been exemplified largely, we hear. Glazed terra cotta, according to an American contemporary, has been employed for inlays with good effect. The ornamentation is hand-wrought; the finer kinds, as panelings, tympana, &c., are modeled or carved in semi-dry clay, and afterward baked. We are told the modelers are adepts in the modern Gothic school. We advise them to let Gothic alone. If manufacturers and architects would plainly master the material and treat it in a common-sense manner before they "grind their teeth" upon any style, it would be better for them. The fault of English manufacturers of terra cotta was undoubtedly that of collecting a number of stock patterns for cornices, modeled string courses, tracery, pinnacle and buttress heads, and getting architects to use them whenever they could. The result disgusted both architects and the public. We are just tiding over this phase in the history of the manufacture, and with the attention of a few of our leading architects, we have no doubt that terra cotta in this country will regain its former repute as a building material. Let America take the lesson to heart.

REFERRED TO OUR READERS.

Hard Wood Fillers.

From H. P., *Hudson, Wis.*—Will some of the subscribers for *Carpentry and Building* please furnish directions for making fillings for different hard woods, and greatly oblige your correspondent?

Laying Out Dome-Rafters.

From W. F. McQ., *Fort Omaha, Nebraska.*—Will some of the readers of *Carpentry and Building* please contribute what, in their opinion, is the best method of laying out dome-rafters? I would like a rule applicable to domes the profile of which is a regular curve, and also those of elliptical shape.

Designs for Stair Brackets, &c.

From J. C. A., *Bayfield, Ont.*—Will some of the readers of *Carpentry and Building* furnish a few designs for stair brackets; also for molded strings? This is a country place, where we have very little to do with first-class architects, and, consequently, carpenters are compelled to design nearly all the buildings that are put up. I would like to become familiar with the new styles that are becoming popular.

Calculating Floor Beams.

From Formula, *New York.*—I have a large room which I wish to use for an audience room, the size being 24 feet by 45 feet. The floor beams cannot be supported by either girder or post, and I want to know what size scantling I ought to put in.

If some of your correspondents will give me a simple formula for working out a problem of this character, I will esteem it a great favor.

Finding the Length of Braces.

From L. R. C., *Tribe's Hill, N. Y.*—I desire to know from the readers of *Carpentry and Building*, what is the best method of finding the length for braces for any run?

Cheap Farm Buildings.

From L. R. C., *Tribe's Hill, N. Y.*—Will you ask some of the experienced readers of *Carpentry and Building* to furnish in your columns some designs of ice houses, hen houses, and small barns or stables of a character that can be erected cheaply for farm buildings?

Design for Stable.

From R. P. C., *Cleveland, Ohio.*—Will some of the readers of *Carpentry and Building* furnish a design for a frame barn about 20 x 40 in size, with accommodation for three horses and carriages? Cost not to exceed $500.

Asphaltum Sidewalks.

From W. K. B., *Creston, Iowa.*—Will some of the readers of *Carpentry and Building* furnish me with particulars in regard to asphaltum sidewalks? I desire to be informed particulary as to its durability, also whether it is covered by a patent, and the composition usually employed for the purpose.

Wing Roof Joining a Main Roof.

From L. R. C., *Tribe's Hill, Y. Y.*—I will be obliged for illustrations of the method of joining the roof of a wing to a main roof in the center, the roof to be gable style. If some of your readers will furnish practical rules for this operation, and also show the method of finding the cuts of the rafters for the wing in forming the valleys, they will confer a favor.

Construction of Sliding Doors.

From J. H. W., *Due West, S. C.*—I desire to ask the experience of builders among the readers of *Carpentry and Building* concerning sliding doors. There are many places in buildings where sliding doors would be much better than swinging doors. If some of your readers will send for publication the best plan for the construction of sliding doors, they will confer a favor.

A Difficulty in the Use of India Ink.

From W. H. C., *Woodland, Cal.*—I am in want of a little information, which I hope some one will give me through the columns of *Carpentry and Building*. Sometimes it becomes necessary for me to make tracings of drawings on cloth, and on doing so I find difficulty in getting the ink to flow, and therefore am unable to make a clean, sharp line. This difficulty is peculiar to the use of tracing cloth; the same ink will flow well on drawing paper. Will some one be kind enough to tell me how to overcome the difficulty?

"Neo-Jacobean" Style.

From E. S. M., *Waterbury, Conn.*—I am much pleased with *Carpentry and Building*; it is just what I want. I wish it great success.

Will some of your readers kindly inform me what is the "Neo-Jacobean" style in architecture, and give me as many particulars concerning it as may be convenient? I have access to a library of about 25,000 volumes, but have been unable to find out anything concerning this style—not even the name is mentioned. I will be greatly obliged with reference to the slightest trace concerning it.

Observe any number of trees growing in the woods or the orchard, and notice how few are exactly perpendicular. There is only one tree which always grows exactly plum.

The shingle is fast disappearing before the march of improvement, but it has been discovered that very fair promises can be elicited from a boy with a piece of slate roofing.

CORRESPONDENCE.

Design for School House.

From Clarence W. Smith and Augustus Howe, Jr., *Architects, New York*.—The communication of I. S. Cameron, Texas, in the August number, requesting a design for a small village school-house that will cost from $1200 to $1500, has led us to offer the accompanying design, which we hope may meet his wants.

The building is of frame, the timber being of the following sizes: Sills, 4 inches by 8 inches, resting on a stone foundation; beams, 3 inches by 10 inches, mortised into the sill; posts, 4 inches by 8 inches; studs, 3 inches by 4 inches; roof and ceiling beams, 2 inches by 6 inches; plate, 4 inches by 6 inches. The whole frame is inclosed with narrow clap-boards up to the hight shown, and the 9-inch tongued and grooved boards put on vertically, the joints covered with battens; a neat piece of cut work put on below these, as the design shows. The roof is covered with shingles laid on shingle strips, except that portion beyond the line of the building, where the shingles are to be laid on narrow matched boards, laid with the smooth side down. The foot of the rafters must be planed and neatly cut. The outside woodwork of window frames, water tables, corner boards, piazzas and bell tower, will be of the usual sizes and thicknesses. The flooring of class rooms and of entrance wardrobes is of yellow pine. The rooms are all lathed and plastered, the finishing coat of plaster of Paris. In the ceilings ventilators are to be cut in, having cord and pulley attached so that they can be opened or shut at will. There will he a chimney in both of the rear wardrobes, carried out and topped above the roof. The class rooms are all wainscoted, 3 feet 6 inches high, with narrow beaded boards, and have a suitable cap molding. Outside blinds are put on all windows, hung and fastened.

A noteworthy feature of this design is that the class rooms are rendered cool by reason of the great projection of the eaves of the building, which serves to protect them from the direct rays of the sun.

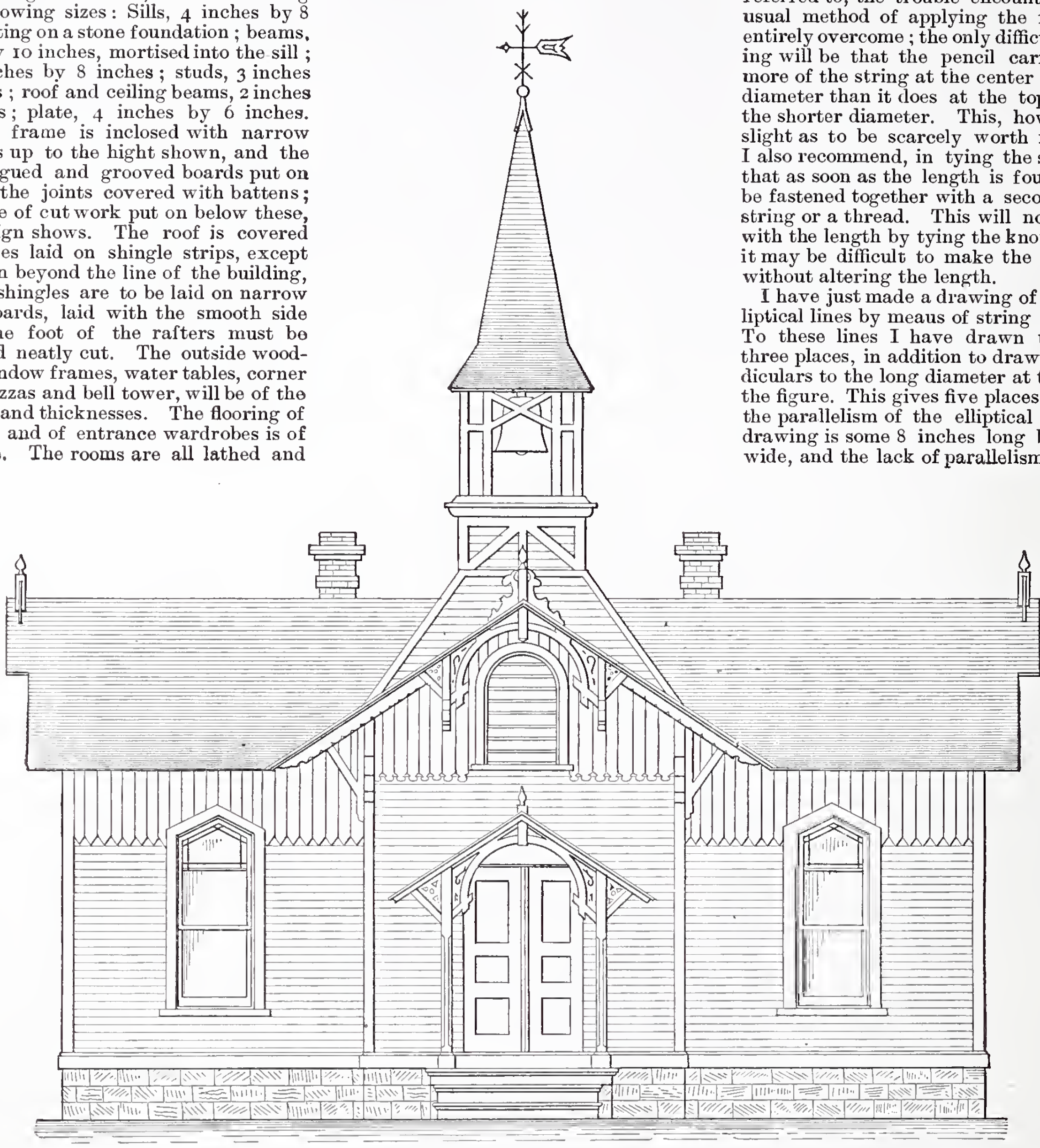


Fig. 1.—Elevation of Schoolhouse, Contributed by Clarence W. Smith and Augustus Howe, Jr., Architects, N. Y. City.—Scale, 1/8 Inch to the Foot.

Drawing Parallel Elliptical Lines with String and Pencil.

From H. D. C., *Philadelphia, Pa.*—In the August number of *Carpentry and Building*, J. H. M., of New York, by means of quite a lengthy communication, informed your readers that parallel elliptical lines are among the impossibilities, and that correct elliptical lines cannot be produced by means of the string and pencil. This, I thought at the time of reading it, put me somewhat in the shade, since my recommendation of the string and pencil as the best means of drawing ellipses was published in the same number. However, the demonstration given in answer to J. H. M.'s letter probably convinces him that his points were not well taken.

Let me say as a hint to J. H. M. and to other readers of *Carpentry and Building*, that simple as the use of the string and pencil for drawing ellipses may appear, there are few persons who know how to use it with accuracy. In the first place, after the foci have been obtained and the pins placed, a loop is ordinarily made at one end of the string. The string is then hooked around the pin at the left; the other end is carried around the second pin and held down with the finger, so as to increase the length of the string in order to get the proper hight of the figure. Then the operation of striking the curve is commenced. The curve produced in this manner will not, however, in all cases agree with the points laid down. It will frequently be found to fall short of the points at the center of the long diameter, thus making the figure incorrect. The next step, naturally, is to condemn the rule and say it is not correct. The difficulty encountered lies in the method of using the rule, and not with the rule itself. The loop end of the string will always revolve, carrying its proper length, while the other end, being carried around the pin and held down tightly, will not revolve, but winds and unwinds as the movement may be from right to left or left to right. By this winding and unwinding the length of the string is decreased or increased. Considering this fact, it is no wonder that the figure produced does not agree with the dimensions originally laid down.

I advise those who desire to use string and pencil for drawing ellipses to loop both ends of the string, thus affording both of them a chance to revolve, thereby maintaining a uniform length throughout. By avoiding in this manner the winding and unwinding above referred to, the trouble encountered in the usual method of applying the rule will be entirely overcome; the only difficulty remaining will be that the pencil carries a little more of the string at the center of the long diameter than it does at the top or across the shorter diameter. This, however, is so slight as to be scarcely worth mentioning. I also recommend, in tying the second loop, that as soon as the length is found the two be fastened together with a second piece of string or a thread. This will not interfere with the length by tying the knot, otherwise it may be difficult to make the knot secure without altering the length.

I have just made a drawing of parallel elliptical lines by means of string and pencil. To these lines I have drawn tangents in three places, in addition to drawing perpendiculars to the long diameter at the ends of the figure. This gives five places for proving the parallelism of the elliptical lines. The drawing is some 8 inches long by 4 inches wide, and the lack of parallelism, if any exists, is too small for measurement. I hope this statement and explanation will be sufficient to convince all that parallel elliptical lines can be be drawn by string and pencil, and in the manner described in the August number of *Carpentry and Building*.

The explanation of the movement in the string above referred to I believe has never before been given, and I think it important enough to be laid before the building public.

Proportions of the Diamond or Lozenge.

From W. M., *Lawrence, Kan.*—In looking over the back numbers of *Carpentry and Building*, I see you are willing to answer questions on all practical matters. I would like to know what are the proportions of a perfect diamond? Some are long and narrow, others are made short and broad.

Answer.—It may be that we fail to understand the nature of our corrrespondent's inquiry, but if we do not the proper answer is, that it depends entirely upon the taste of the designer and the position in which the shape is used.

A Day's Work at Shingling.

From S., ———, *Indiana.*—I have lately become a subscriber to *Carpentry and Building*, which, I hope you will allow me to say, is just what I have been looking for and desiring for some time. I think I have already received the worth of my money in the suggestions I have found therein. My attention was attracted by the question of "What constitutes a fair day's work at shingling?" in one of the back numbers of the paper (May, page 99), in which R. L. says that he has heard men claim to be able to lay four squares of shingles, showing 5 inches to the weather, in a day of 10 hours, but has never seen it done. Now, I wish to say to R. L. that I think if he will try it according to the rules here given, he can put on 4 squares in 10 hours himself, and that, too, without slighting his work in any particular. In the first place, lay aside your hatchet and get a No. 1½ Maydole hammer, so as to be free from the temptation of trimming too much. (I wish to say right here that I think there is no excuse for hacking and trimming an average pine shingle, as they are all made a trifle narrow at the points anyhow.) Put one nail close to the edge of the shingle in the lower course, and two in the upper course, nailing just low enough down the shingle to be sure the nails go through the points of the next course below. In this way you get three nails through each shingle of average width, and they will hold it till it rots off. I am always careful to never pick up a shingle until I have a place for it, so I don't waste any time "guessing" round to find one that will fit the place. And above all things, get out of the habit, or better yet, don't get into the habit, of striking three or four blows on a nail after you have it started. One stroke is as good as 40 and takes much less time. In shingling up a valley, strike your lines on the tin, making it from 1 to 1½ inches wider at the bottom than at the top, so that any obstruction such as dead leaves, &c., will readily wash out. I select the widest shingles for the valleys, lay one down in place so it lays plumb up the roof, and mark the points at bottom and side where the line crosses the shingle, and take a "hawk-bill" knife and cut through the shingle in two draws of the knife. I use this shingle for a templet and cut enough for the valley while I am at it, stick them along the sheeting where I can reach them, and wouldn't accept a hatchet as a gracious gift. I have laid 109 feet of roof with pine shingles in two hours time in the presence of witnesses, and am prepared to lay 4 squares of plain shingling in 10 hours at any time "just as easy." Let R. L. try this plan and report.

Designing Club.

From C. A. D., *Burlington, Iowa.*—A little while since some one suggested that there should be an architectural designing club encouraged by *Carpentry and Building*. As I have seen no further suggestions concerning this measure, although an invitation was extended for further communications, allow me, at this late day, to make the following suggestions: Would it not be a good plan for you to request one or more architects from each State to contribute one or more designs a year, say an original study of some building, church, school-house, or article of furniture; or some feature of interior decorations, the same to be published in *Carpentry and Building* for the benefit of all concerned. If space did not permit all of the designs to appear in the body of the paper, they could be published in supplementary form. It seems to me that such a set of designs would form a novel collection and would be of great value. Each designer should enter into the spirit of the scheme and give truthful expression to the requirements, taste and culture, so far as possible, of the people whom he may represent, in the "frozen music of lines."

Answer.—It occurs to us that an invitation addressed to particular individuals, which we understand the suggestion of C. A. D. to be, would hardly produce as satisfactory results as the broad invitation already expressed in *Carpentry and Building*, at several times, to all who may be interested, to contribute to its columns anything they may have of a character likely to benefit others in the trade. Instead of selecting a single person from each State, and instead of requesting a single design from them each year, or in some other given period, we extend the broad invitation to all architects and designers who may feel interested in the work that *Carpentry and Building* has undertaken to perform, to send us as many designs per year as they may feel disposed. We prefer studies in work of a cheap to medium grade. *Carpentry and Building*, as a journal, appeals to the mechanics and small contractors of the country, rather than to the large operators, and, therefore, prefers to show in its columns designs suited to their needs, rather than to give designs of elaborate finish and upon which mechanics would not generally be engaged save under competent supervision.

Will our correspondent from Burlington open the ball by sending us a design (we leave the subject to his own selection) adapted to the wants of the readers of *Carpentry and Building*, upon the general basis which we have attempted to describe above?

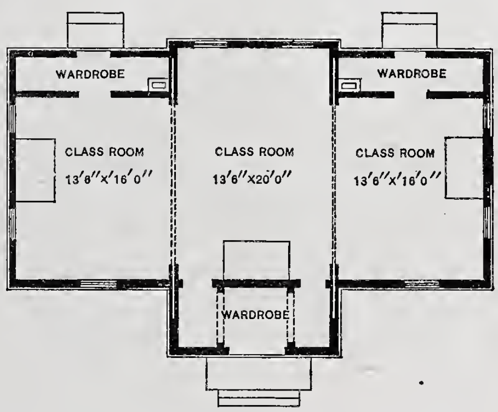


Fig. 2.—Plan of Schoolhouse, by Messrs. Smith & Howe.—Scale, 1-16 Inch to the Foot.

The Value of an Apprenticeship.

From P. C. M., *West Sandlake*, ——.—My attention is called to the article in one of the recent numbers of *Carpentry and Building* concerning the binding out of apprentices. I am opposed to any custom or rule that holds a boy to serve for a certain length of time, and thereby compels him to receive such treatment during that time as many are obliged to take. Carpentry at the present day is made easy through the use of machinery, and a house can be built in much less time at present than it could 30 years since. Still, it is an open question whether a young man can learn the trade now in any shorter time than it required 30 years ago.

In many instances a man will call upon his carpenter, and giving him the size and general idea of about what he wants in the shape of a house, leaving it to him to manage the construction of the building as his best judgment directs. If the carpenter thoroughly understands his business he is able to go on and build the house under such circumstances, without the supervision of an architect, giving entire satisfaction to his employer. But in the event of an inexperienced man obtaining a job under such circumstances, the building is spoiled by being finished in a bungling manner, and does not give satisfaction, the house remaining an eye-sore as long as it stands. I contend that there are too many of this kind of carpenters now in business. I speak of carpenters, among mechanics, for it seems to me there are more of the kind alluded to in this trade than in any other. Serving a length of time under instruction, whether indentured or otherwise, is calcuated to qualify a man for conducting his business intelligently. I will cite my own case for an example, to show to what extent a thorough knowledge of the trade may be made useful.

I worked six seasons under instruction before taking a day's work to do on my own responsibility. During this time I contented myself with the smallest pay, my object being to learn all there was in the trade. When I did start for myself I was master of it; I had accomplished the object for which I worked. Since I have been in business for myself I have made out bills of timber, have gone into the woods with the men, cut and hewed the timber and built the house complete. In another instance I cut timber and built a mill, and with it sawed the timber necessary and then built the house. Now, where is the man that starts at the present time with simply a few months' instruction that is competent to do the same? Or, to put the question differently, What difference is made in the price per day between the man that is thoroughly competent and the man who has a smattering of the trade? If there could be some way provided by which carpenters should be paid according to their skill, I think it would improve the craft. Under such management there would be more who would try to get the trade well mastered before commencing business on their own account. To hire a man for a few months and then compete with him on the first contract that is let, is a hard thing to endure, but such is the condition of things at present. The persons having buildings put up by such help are the direct losers, but the trade at large suffers by reason of such men being in the business.

The Ventilation of Houses.

From A. D. N., *Worcester, Mass.*—Answering the inquiry of your correspondent A. J. H., in a recent number of *Carpentry and Building*, I would say I do not approve of ventilating into the chimney. An ordinary chimney is a rather poor institution, both for the upward flight of smoke and the downward fall of brick. Knocking a hole into the chimney is objectionable by reason of the poor construction usually employed. Masons almost always half do their work in connection with chimneys. When a house is provided with a furnace and the air supplying the furnace is taken from the outside, an open window in the upper story is as effective as simple for purposes of ventilation. Where the hall is ventilated either by skylight or by a pipe through the roof, it will generally be found sufficient. People in the habit of thoroughly airing a house in the morning by a general opening of windows, never catch cold thereby in the coldest weather. One room is aired at a time, and no one need stand in a draft of air.

Ventilating Ice Houses.

From Architectus, *New York.*—At various points on the shore of the Hudson River may be seen the storage houses of the several ice companies. As I understand it, the construction of these houses is something like this: Between the double outside walls sawdust is packed as a non-conducter; the roof is an ordinary king or queen post roof, and on the ridge, at regular intervals, are placed ventilators. In filling the house, the ice is carried up to within some feet (about 10) of the ridge-pole and covered with salt hay; above this is an empty space for the circulation of air. Now, I can understand why a refrigerator for containing meats, vegetables, &c., should be ventilated, but why a storage ice house should be constructed with a circulation of air at top is something upon which enlightenment would be thankfully received.

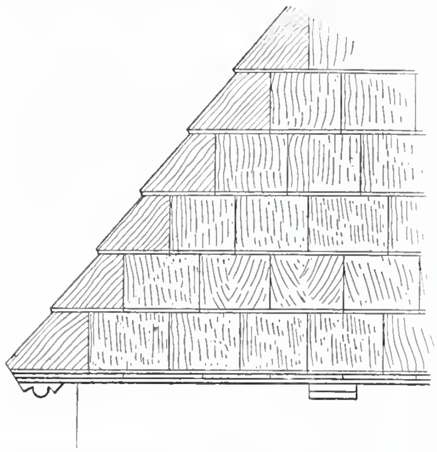
Cement for Use Around Chimneys.

From J. K. S., *Waterbury, Conn.:* Answering the question asked by A. J. O., Rockville, Ont., in a recent number of *Carpentry and Building*, would say that the McCoy elastic soapstone cement is an article which may be used around chimneys, &c.,

without liability of cracking. It is not affected at all by heat or cold. I think it the best thing ever gotten up for roofs of any kind. I speak from experience in using it.

Shingling the Hips of Roofs.

From X. Y. Z., *Springfield, Ill.*—With reference to the method of finishing the hips of a shingle roof, I desire to lay before the readers of *Carpentry and Building* a plan which I have used for several years, and which I consider quite valuable. I send you herewith a small model that shows the operation better, perhaps, than the inclosed sketches, and which will at least serve to explain the rough drawings to your engraver. Upon the model I have numbered the shingles, in order to make the description intelligible. Fig. 1 shows an elevation of one side of the roof, the hip being shown in profile at the left. Fig. 2 shows a perspective view, looking directly in line with the hip, and Fig. 3 shows the shape to which



Shingling Hips.—Fig. 1.—*X. Y. Z.'s Method Shown in Elevation.*

the shingles are cut in order to make the joint.

By inspection of the sketches it will be seen that the triangular shingles forming the joint are cut in such a manner that their grain runs parallel with the hip. In laying the roof I carry the hip courses up a little in advance of the other courses. I generally keep them about two courses ahead of the main work. I place shingle No. 1 with the edge to the hip, and to obtain its shape line across it at right angles to the eaves for the side, and parallel to the eaves for the bottom. After placing and nailing this shingle its edge must be dressed down to correspond to the face of the other side of the roof. Then No. 2 and after it No. 3 are laid and dressed down in like manner, then 4 and 5 are laid over them and dressed down, continuing in this way, running two courses on a side at a time.

By carrying the courses up this way in pairs, it gives the shingles of the hip the appearance of each course being lapped over another, while if laid singly in this general manner, the appearance would be as though the shingles had all been carried up on one side, and then those of the other lapped over upon them.

The advantages of this arrangement, I think, will be quite apparent to all practical men who will inspect the sketches. It will be seen by thus alternating the courses in pairs the joint on the hip is made very complete, so far as shedding water is concerned, and that those portions of the shingles most likely to curl up when laid in the ordinary manner are thoroughly fastened. Further, since the grain of the shingle runs parallel to the hip, the tendency to curl is taken away from the line of the hip to a point in the other side of the shingle, where it can do no harm. I consider the joint thus made a perfect joint. In addition to the advantages already named, the fact of its being clean in general appearance, having no outside work put upon it, makes it quite desirable, in my estimation. No metal flashings are required to make it weather-tight. In the event of valleys occurring in the roof, the part cut from the shingles in obtaining the triangular pieces for the hip, as above described, may be worked in without loss.

From H. M. R., *Springfield, Vermont.*—Answering the question raised by S. A. M., of Steward's Mill, Texas, I send sketch of roof (Fig. 4.) showing a hip after completion as it would be made upon a piazza. In laying this roof I proceed as follows: Snap or draw a line parallel to the hip on each side, about 6 inches from center. Shingle up from each side of this line, so that the lower corner of the butts of the shingles come to the line. Cut the hip shingle in the form of a trapezoid, or as shown at C in the engraving, the length of the shorter side being equal to the distance from corner to corner of the butts at the end of the courses. Half of the shingle should be the width of the space from the center of the line, the other half 1 inch wider. In commencing at the bottom the taper course should be sawed off after nailing. Lay on a narrow shingle to commence with, then a wide one from the other side, lapping over an inch. Then the narrow one on this, and so on. Laying first from one side and then the other.

C. H. R., of *Middletown Village, N. J.*, sends us a very neatly made model of the same kind of a hip joint as illustrated in the above engraving, which was reproduced from the sketch furnished by H. M. R. There is this difference, however, between his model and the roof shown in the engraving. Our correspondent C. H. R. works entirely from one side, instead of matching the shingles alternately, as above shown. By this means he claims the advantage of using but one width of shingles, while in the plan illustrated in the engraving two widths would be required, as will be evident upon inspection.

From J. P. B., *Princeton, Ill.*—I inclose a diagram (Fig. 6.) showing a way of laying shingles on hip roofs, which I find works satisfactorily. Lay the first course of shingles to the hip and cut to fit. On the corner lay a shingle of suitable width, say 4 inches, parallel with the hip and cut the upper inside corner off, so as to lay the next course of shingles to fit against it. On top lay another hip shingle and start the next course as before. The dotted line shows the shape of the hip shingles. This way of shingling holds the regular course in place, and leaves no weak corners to curl or break, and when done presents the appearance of an extra course of shingles laid up the hip.

From C. M. M., *Malden, Ill.*—In answer to S. A. M., Steward's Mill, Texas, I would suggest that he try the following method for shingling hips: Drop the first shingle to the bottom of the preceding course, letting the outside edge come on a line with the course to be laid on opposite side. This will give a double course on hip. Select shingles of like width, say from 4 to 5 inches.

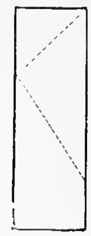
The Blue Process for Copying Tracings.

From A. C. C., *Cincinnati.*—Will you please publish in *Carpentry and Building* directions for making copies from tracing-cloth by means of the "blue process." This method comes very handy in cases where more than one copy of plans are desired. I wish to know how to make the solution and full particulars with reference to using it.

Answer.—The following description of the "blue process" is from a paper read by Mr. T. Barnes before the "Instituto of Mining Engineers," a short time since:

The sensitizing solution is composed of 1⅞ ounces citrate of iron and ammonia and 8 ounces clean water; and also 1¼ ounces red prussiate of potash and 8 ounces clean water. Dissolve these separately and mix them, keeping the solution in a yellow glass bottle or carefully protected from the light.

Any good hard paper may be employed which will bear the necessary wetting. The



Shingling Hips.—Fig. 3.—*Shape of Shingles Used by X. Y. Z*

paper may be very conveniently coated with the solution by the use of a sponge of 4 inches diameter with one flat side. The paper may be gone over once with the sponge quite moist with the solution, and a second time with the sponge squeezed very dry. The sheet should then be laid away to dry in a dark place, as in a drawer, and must be shielded from the light until it is to be used. When dry the paper is of a dull yellow or bronze color. Under exposure to the light the surface becomes a darker bronze and the lines of the tracing appear still darker on the surface. Upon washing the paper the characteristic blue tint appears, with the lines in vivid contrast.

The manipulations required are of the simplest possible kind, and are entirely within the skill and comprehension of any office boy who can be trusted to copy a letter in the ordinary press. These operations may be summarized simply thus:

1. Provide a flat board as large as the tracing which is to be copied.

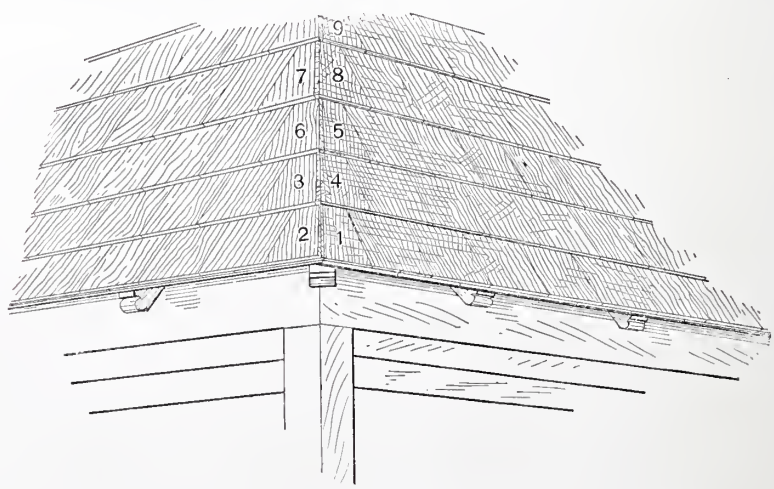
2. Lay on this board two or three thicknesses of blanket, or its equivalent, to give a somewhat yielding backing for the paper.

3. Lay on the blanket the prepared paper, with the sensitive side uppermost.

4. Lay on this paper the tracing, smoothing it out as perfectly as possible, so as to insure a perfect contact with the paper.

5. Lay on the tracing-paper a plate of clear glass, which should be heavy enough to press the tracing close down upon the paper. Ordinary plate glass of ⅜ thickness is quite sufficient.

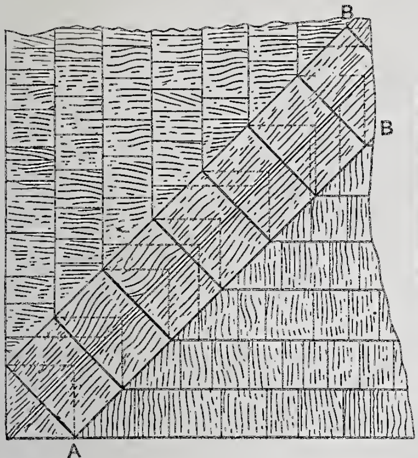
6. Expose the whole to the clear sunlight by pushing it out on a shelf from an ordinary window, or in any other convenient way, from 6 to 10 minutes. If a clear sky-light only can be had, the exposure must be



Shingling Hips.—Fig. 2.—*X. Y. Z.'s Method Shown in Perspective.*

continued for 30 or 40 minutes, and in case of a cloudy sky 60 to 90 minutes may be needed. Remove the prepared paper and drench it freely for one or two minutes in clear water, and hang it up by one corner to dry.

Inasmuch as copies can be made in this manner from tracings only, it may be well to suggest and urge that drawings can be completed, or nearly so, in pencil upon paper in the usual way, and that the inking can be done upon tracing cloth laid upon the penciled work. In this way the cost of



Shingling Hips.—Fig. 4.—Plan Recommended by H. M. R.

tracing, in the ordinary sense, can be wholly saved, and the single tracing can be made in the usual manner to the best possible advantage.

A ready means of adding to or correcting the blue copies may be found in the use of a solution of carbonate of soda and potash, used with a pen or brush.

Can Steam Pipes Set Fire to Wood?

From W. M. A., *Walpole, Mass.*—A question which I have heard discussed lately is whether steam pipes can be made hot enough, in ordinary use, to set the wood on fire which touches them. I have heard a good pipe-fitter say this is impossible; on the other hand, I have heard men in whose opinion I have confidence say it has been done. Will you please say which of the two opinions is right?

Answer.—It is commonly believed that a steam pipe cannot set fire to wood, but it is not improbable that a pipe carrying steam at a pressure of 100 pounds per square inch, and amounting to about 337° F., may set fire to dry material. It was recently found, at the Crescent Steel Works, in Pittsburgh, that a steam pipe, 2½ inches in diameter, carrying from 90 to 100 pounds pressure, had charred its casing of 1-inch pine boards, and apparently burnt about three-fourths of the thickness of the wood, the other fourth being partially rotted. Considerable evidence was shown of actual ignition; the entire inside of the casing was charred, and spots of ashes were found here and there. It is altogether likely that if the pipe had been exposed to the air it would have blazed and been completely consumed. This may explain the origin of many mysterious fires that so often puzzle the insurance associations and fire departments. It indicates, at least, that great care should be taken to prevent the close proximity of combustible material to steam pipes carrying high pressures.

Cost of Tile Floors.

From T. A., *Tautville, Ohio.*—Please inform a reader of *Carpentry and Building* what will be the probable cost of putting down a tile floor in a room 20 x 40 feet, using ordinary square tile?

Answer.—Tile floors vary in price according to the colors used in the design and the number of pieces composing it. A very fair arrangement could be made to cover the space our correspondent names for about 50 cents per square foot.

Comments on the Prize Designs.

From G. W. B., *Chatham, N. J.*—As making comments on the prize designs seems to be the fashion, I thought I would take some exceptions to the estimate on the design receiving the third prize. I am very well satisfied that design No. 2 could not be built in this section for the estimated price as given; but as the price of materials seems to be (lumber especially) only a little more than half what it is here, it is possible it might be built for that sum in Michigan. But the price of material here and in Providence, R. I., cannot vary much. I like the design of the house very well, but think the specification very loose. Notwithstanding the looseness of the specification, there are some things called for that have been entirely overlooked in the estimate.

The first thing specified is the excavating for the cellar, and the item is entirely omitted in the estimate. The same thing occurs in regard to the gas pipes and stairs. Having had considerable experience in estimating on plans, I am perhaps justified in taking exception to some of the figures, and adding what has been left out altogether. Some of the figures I have not changed. His estimate for sash blinds and doors I think is extremely low, but the specifications are so very indefinite on that point that almost any kind of doors could be used and fill the bill.

I have taken my prices of material from the current prices, as published in the May number of *Carpentry and Building*, they being considerably lower than the prices in the September number. The following is the estimate as I figure it. The difference is not as much as made on the first-prize design by K. O. A., of Newark, N. J., but it is considerably over the stipulated price of $1000, and a proportionate advance on a house costing from $6000 to $8000 would be enough to build a small house.

ESTIMATE ON THIRD-PRIZE DESIGN.

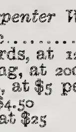
Mason Work.

136 yards excavating, at 25c	$34.00
Ledge stone laid dry	70.00
3584 brick laid in foundation, at $8.50	30.46
3000 " " chimney, at $10	30.00
600 yards plaster, at 20c	120.00
Blue stone	3.00
Total	287.46

Carpenter Work.

5000 ft. spruce, at 18c	90.00
4000 ft. hemlock boards, at 12c	48.00
1500 ft. spruce flooring, at 20c	30.00
10,780 cedar shingles, at $5 per M	53.90
4277 sawed pine, at $4.50 "	19 24
1100 ft. clapboards, at $25 "	27.50
Pine lumber	112.00
Tinning and leaders	18.00
Sash blinds and doors	80.00
Painting	112.00
Hardware	65.00
Stairs	30.00
Gas pipes put in	35.00
Labor	200.00
Total	$920.64
Add mason work	287.46
Total cost	$1208.10

From A. D. N., *Worcester, Mass.*—*Carpentry and Building* is more than could be expected. I hope the correspondent's column will be kept up. I have looked over the designs for cheap dwelling houses and consider plan No. 2 excellent. Plan No. 1 I do not think so well of. It resembles an old-fashioned "lean-to" in general appearance, and, moreover, there are too many mistakes in it to be overlooked. It would be very amusing to see a six-foot-one-and-a-half-inch man, wearing a "stove-pipe" hat, going up the front stairs without a light on a dark night, and I can imagine the astonishment depicted on the face of the lady of



Shingling Hips.—Fig. 5—Shape of Shingle Employed by H. M. R.

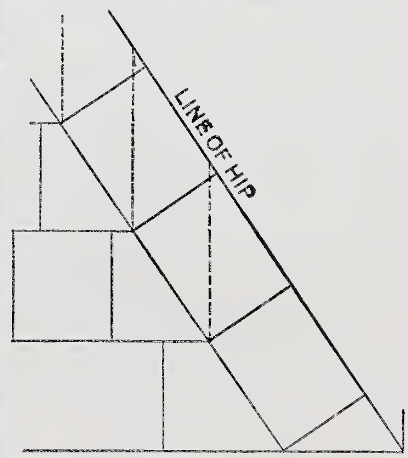
the house when she opens the 7 ft. by 2 ft. 6 in. door into the closet over the front entry for the first (?) time. Again, the door from the hall into the sitting-room seems to be a superfluity for a cheap house, as the cat and dog could go by way of the parlor, as all representatives of the human race would have to in going to the kitchen in order to look at the pantry. In "properly making head-room" for the cellar stairs the pantry is forgotten, and is found to occupy part of the wall, to the discomfiture of the flour barrel.

The architects forgot to state where all those 21 single doors called for in the specifications were to be hung. It is quite probable that if the carpenter were in as great a hurry as the designers seem to have been, he might forget (?) to hang nine of them. In the details for outside finish, the gutter is shown as put on before shingling; but the house should be first shingled and the gutter put on afterward.

How the "committee of experts" could call this plan worthy of a prize and place it before the public in the August number, is recommended as a subject for discussion by a rural debating society. The plans submitted by Mr. Hopkins are convenient and in good taste. Probably a door from the front hall into the sitting-room would be called for.

As for the cost of these houses, I am very much of the opinion of your correspondent at Newark, N. J. However, I would put up 100 houses after plan No. 2 above the foundations for $1000 apiece.

From H. F. L., *Elmira, N. Y.*—I have read with great interest the various criticisms upon the first prize design, and hope Messrs. Hale and Morrison may favor us with



Shingling Hips.—Fig. 6.—Plan Contributed by J. P. B.

a reply. I was somewhat surprised to find that one of the critics is the winner of the second prize. In the course of his remarks this gentleman says: "I had not taken any special pains or study with the design which I submitted," and invites public criticism.

Now, although much pleased with the general arrangement of the house, I think a careful examination of the drawings and specifications will fully convince the reader of the truth of the above extract from the gentleman's letter. I would, in an entirely friendly and respectful way, call attention to the following points: First, upon the side elevation we discover the profile of a dormer window roof which is omitted in the front elevation, possibly for the reason that the main roof would totally eclipse the window if one were so placed.

The side window of the front chamber would present a striking contrast with the front windows of the same room, which measure 6 feet 6 inches high, while the side window must shrink to but little over 4 feet. I would suggest that the stray dormer roof on the side elevation be captured and fastened over this modest opening.

The good people of Michigan are justly celebrated for being tall, but I fear none could be found who could open, shut or clean the front hall window from the stairs below, and it would require a practical gymnast to accomplish these feats from the second-story hall. The chimney measures 2 feet 4 inches square and contains six flues. Suppose three of these to be fire flues, lined according to the specification, and the result is that the flues are a trifle over 3 x 7 inches—say, 23 square inches in area. No comments upon this are necessary, for every builder and housekeeper knows that a flue three times this size is barely large enough to insure a good draft or to be available for ventilation.

I have not found time to make a careful estimate for this house, but by roughly cubing from the cellar bottom both this and the first prize design, I find that, while the last mentioned contains about 16,000 cubic feet, the second prize design contains over 20,000 cubic feet. As to finish, the second prize design is the more elaborate of the two. I can scarcely credit the estimate upon the first prize design, it is so very low; and how can the second design, which is one-fourth larger, be carried out for the same money?

I admire the thoughtfulness displayed in the pantry and in specifying a gong door bell, but should I ever occupy the house I should pray for sunny weather. In case of a vigorous shower, my roof, entirely without flashings, would prove to be a sieve, and my streaming gutters, destitute of conductor pipes, would preclude any possibility of escape. Sadly gazing at my dissolving plaster (if the smoky chimney did not drive me to the cellar), I would bewail the fact that my architect had not taken more "special pains and study" for my comfort.

From G. W. C., *Fostoria, Ohio.*—In the side elevation of the design receiving the second prize in the recent competition for cheap dwelling houses, I notice that the window in the front of the right-hand wing is drawn in the roof of the gable, over the side window. Is it an error in the original drawings or simply in the cut made for printing?

Answer.—We are very sorry to acknowledge that the error in the side elevation to which our correspondent above calls attention, occurs in the architect's original. It was not noticed by any one before receipt of his communication. The window shown in the front of the right-hand wing, as may be seen by the front elevation, occurs directly over the porch, while the hood projecting over the roof belonging to it is shown in the side view against the line of roof, surmounting that portion of the building to which the bay window is attached. The error is trivial, being altogether unimportant, but it serves to illustrate how easy a certain class of mistakes are to be made in drawings, and when made how slowly they are sometimes discovered.

From S. E. M., *Worcester, Mass.*—I am a builder and a subscriber to *Carpentry and Building*, and I am well pleased with the paper. I have been much interested in the plans for cheap dwelling houses, and I like the design receiving the second prize, which was published in the August number; but the first prize design, published in the July number, I think will bear criticism.

Inclosed find rough diagrams of hall, made to scale. I would like to know how to get a door under the stairs, from the hall to the dining room? I would also like to know how to construct a closet over the hall? Further, I would inquire if 5 or even 5½ feet is considered sufficient head-room for front stairs? The figures on my diagram show just how the design works out in this respect. I would also respectfully inquire of the architect where he expected to put the 21 single doors that his specifications call for?

I agree with K. O. A., Newark, N. J., that the lack of a chimney in parlor and front bedroom is a serious objection; and, like him, consider that the house cannot be built for the amount of the estimate. I do not think that the second prize design can be carried out for the amount of the estimate—at least not in this market, although it might in Michigan.

I should have written with respect to these points some time since, but thought that your regular correspondents would call attention to the above-mentioned points.

From J. P. G., *New London, Conn.*—I have just received the August number of *Carpentry and Building*, with design for cottage, &c. I do not know and cannot conceive why it is that you publish such estimates. Any builder East knows that the design in the August number cannot be built for any such price as is given. When I received the first number I was very favorably impressed with it; but since you have commenced your "prize cottage" arrangement, I must say I am disappointed. Every one knows that labor is away down below par, and that there is a big competition in the building line; and also every builder knows that the houses shown in the last two numbers cannot be built for any such price as given—at least not in Connecticut nor anywhere in New England. I am a builder myself, and think I can figure somewhere near what it is worth to put up a building. Would it not be better policy, and

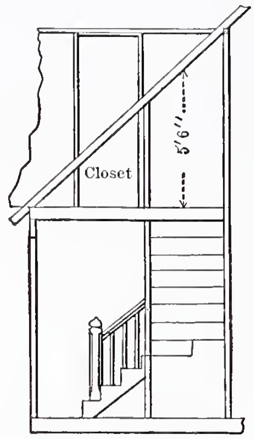


Fig. 1.—S. E. M. on First Prize Design.

more for the builder's and mechanic's interest, if you should make your estimates high enough? Around here extras are not in the fashion. Excuse me if I have spoken plainly. I have said what I believe to be true—that I think you are wrong in giving too low estimates, which you certainly have done.

Answer.—We must remind our correspondent that *Carpentry and Building* is not published exclusively for New England, nor for any other section of the country, but that it reaches builders in all parts of the land. We have reason to believe that the prize designs, as published, can be built in the sections of the country from which they were sent at the figures expressed. If any one is

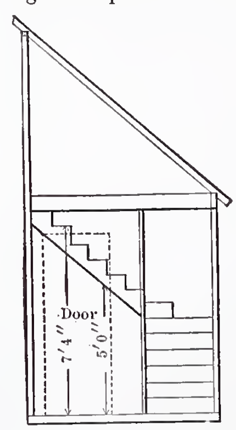


Fig. 2.—S. E. M. on First Prize Design.

to criticise them in this respect, it should be the builders in the localities from which they come.

One correspondent (from Newark, N. J.) showed, in a communication published in the August number, what he considered the first-prize design worth to build in his vicinity, and others have expressed themselves in a similar manner with respect to other localities, although they have not submitted detailed estimates. One set of figures cannot be made to suit all sections of the country. If the designs were all figured at New York city or Connecticut prices, they would evidently be too high for other sections of the country. Hence it is quite unfair for our correspondent to criticise the course of *Carpentry and Building* in this matter simply from a New England standpoint.

It will be a matter of great interest to the readers of *Carpentry and Building* if the correspondent whose letter appears above, will figure out an estimate on either the first or second prize design for his neighborhood, which we shall be pleased to publish, thereby affording them the opportunity to compare different estimates with each other, and to become acquainted with prices ruling in different sections of the country.

Note.—In justice to the architects of the first-prize design, it is proper for us to say in this connection that the "21 single doors" alluded to by several correspondents is of the nature of a typographical error; and that the error in engraving the first-floor plan of the second-prize design, omitting the door between the hall and the sitting room, has already been noticed and corrected by republishing the floor plan in the September number. As annoying as such errors are, they still succeed in escaping detection even with the utmost diligence possible in examining matter as it passes through the press. We are amused at the good-natured fun in A. D. N.'s letter. We doubt not the architects, in due time, will have something to say to the weightier objections which have been raised against their plans.

Deadening Sound in Floors.

From W. F. McQ., *Fort Omaha, Nebraska.*—I am highly pleased with *Carpentry and Building*, and believe every carpenter and joiner should be a subscriber to it.

Your correspondent W. J. M. asks for the best method of deadening sounds from rooms above. The only plan that I consider desirable consists in placing strips about 6 inches below the top of joists upon which a false floor is laid, and then fill in with tan bark to the level of the top of the joists. This is a very cheap and very effective means. The tan bark is very light, and it deadens sound most completely. I tried it in a large schoolhouse which I erected in Kansas, where it was a complete success.

From A. D. N., *Worcester, Mass.*—Replying to your correspondent W. J. M., who desires some method of deadening the noise in the floor of a school-house, I would suggest that if the second floor be carpeted over with a couple of layers of building paper, the first floor will be much relieved from noise. All the scholars should wear slippers.

A Remedy for Defective Acoustics.

From D. F., *Cleveland, Ohio.*—I must say that I am very much pleased with *Carpentry and Building*, and take quite an interest in reading it; and now I take pleasure in offering to H. R., Pierson, Mich., a method to regulate the acoustics in churches, and hope it may have the desired effect.

Take fine wire and stretch it across from one side of the hall to the other, about 2 feet above the level of the speaker's head. This will break the vibration of sound which causes the trouble. The number of wires may be ascertained by trying them, commencing with two or three, and keep adding till the sound is satisfactory. It is simple, and may be effective.

Mineral Wool.—It is said that during the last two years the Pennsylvania Railroad Company have used about 117,000 pounds of mineral wool for deadening floors of passenger cars, 10,000 pounds for covering water pipes, 6000 pounds for covering boilers in shops and 12,000 pounds of superior quality for covering boilers in ferry boats, steam tugs, &c.; the whole amount being enough, at an average thickness of 2 inches, to cover 32,000 square feet.

Sunken Timber.—During the past summer a number of gangs of men have been employed in raising from the bed of the St. Lawrence, in the neighborhood of the Lachine Rapids, logs of white oak and black walnut which have sunk in consequence of the wrecking of drives and rafts during the last 30 or 40 years. Some of the logs raised from the bottom of Longueville Bay are 2 feet in diameter and 60 feet long.

CARPENTRY AND BUILDING

A MONTHLY JOURNAL.

VOLUME I. NEW YORK = NOVEMBER, 1879. NUMBER 11.

ARCHITECTURE.

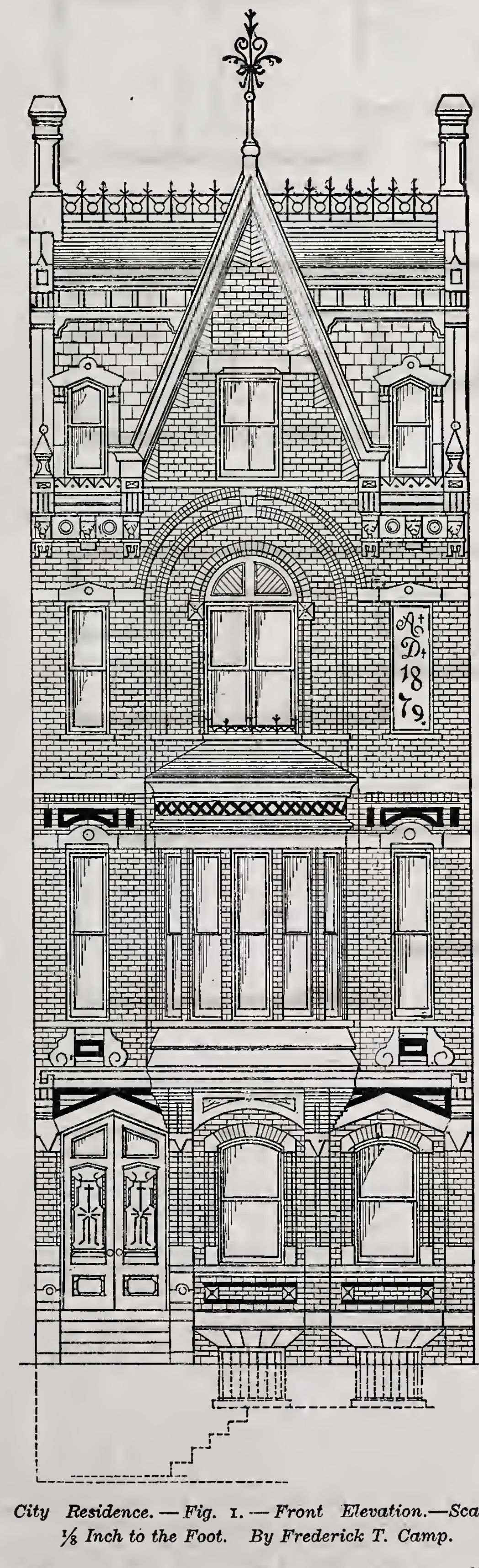
A Modern City Residence.

We present our readers herewith the elevation, floor plans, details of front and general description of a city residence. By examination of the engravings it will be seen that the building is, in many respects, a radical departure from the conventional New York house with which many of our readers are familiar. It differs from it in several important particulars. The design presents many new and pleasing features, while the planning of the several floors departs from the almost stereotyped character of our modern city houses. Something else than brown stone is used to make the front, and an attractive dress is thereby obtained. Philadelphia pressed brick is used in its composition, yet the house in its architecture is not a Philadelphia house. Desirable features in designing, in planning and in materials employed, have been combined to form a harmonious whole—making it a house suitable for our own city, with its peculiar ideas and special requirements in building, and also suitable for use in any other city in which conditions are not necessarily the same as here. It is a house which, according to the character of the finish put into it and the grade of materials employed in its construction, can be made suitable for the most fashionable parts of our city, or for back streets, as a rent from which the return to be derived from the investment is the principal object considered.

The architect is Mr. Frederick T. Camp, of this city, who has furnished us with the following description of the drawings:

This city residence is planned for erection on a lot 20 feet wide, and of course can be duplicated in rows on any number of 20-foot lots, with some economy in cost of side or party walls. The front is composed of Philadelphia face brick and Nova Scotia or Ohio sandstone—the brick on the corners, in bands and in panels, to be of patterns made by the Peerless Brick Company, of Philadelphia. The general style is what is known as English basement, from the fact that the parlor or drawing-room is on the second floor. Such a disposition of the most imposing room in the house is most desirable, when part of so narrow a front as 20 feet must be taken up considerably by the entrances and hall passages.

The planning is a little different from most New York houses, and accomplishes the accommodation of 18 rooms, exclusive of the cellar. If the number should seem too great to any intending builder, it could be lessened by running the rear part up only two stories instead of the three that are shown. The idea in planning has been to do away with the long, attenuated-looking rooms general in the old style, and to provide rooms of more comfortable shape—nearer square—and at the same time to light and ventilate every one from the external air, to have the stairs central and well lighted, and to dress the whole in a street costume of the latest style.



City Residence.—Fig. 1.—Front Elevation.—Scale, 1/8 Inch to the Foot. By Frederick T. Camp.

The court and passage to the rear yard are especial novelties in the New York building style, but they furnish light and air to the central parts of the house, and when houses are built in pairs or blocks, these open spaces will be much more considerable, and therefore more valuable, than in the single ones.

By reference to the plans it will be seen that the ground floor contains a reception-room, which, on the occasions of parties, &c., can be thrown into one with the dining-room—a large, well-lighted apartment, convenient to the stairs and kitchen.

The butler's pantry provides abundance of room for china and glassware, silver and the lighter stores, besides being a passageway so that the waitress can attend the front door without passing through the dining-room, the door for that purpose being under the head of the stairs out into the hall. The kitchen is of a sufficient size, and well lighted and supplied with all the conveniences; and a laundry at the extreme end completes the first story. The back stairs, between the laundry and kitchen, have under them a kitchen larder and steps to the cellar. By the elegant circular stairway we reach the parlor floor and find a set of two parlors, the front one the larger, connected with the rear one by a large double sliding door. This rear parlor could of course be used as a bed chamber, being provided with a closet. The front parlor is embellished and enlarged by a bay window of segmental plan, pierced with five openings, which, perhaps, would give light enough, but to make assurance doubly sure, there are two additional narrow openings, one on each side of the bay. The opening into the bay is spanned by a tasteful arch. Further to the rear we have two chambers and a bath-room, the passages connecting the rear stairs with the front part of the house.

All the chambers except two are provided with ample closets, and there is also a closet in the third story rear for use of spare and clean bed linen. A trunk room in fourth story, over the stairs, is a convenient locality for the purpose, and the dressing closet for third story front chamber completes a very fine apartment. Numerous chimneys give plenty of room for smoke and ventilation flues.

Of external features, a pleasing one is the flower shelf, inclosed by a light iron railing, over bay window; and the French roof on each side of the gable, slated in black and red patterns, relieves the central features in an artistic way.

To Stain Wood with Aniline Black.—Dissolve 50 parts of aniline in 100 parts of muriatic acid and 1000 of water, and steep in it the wood, previously prepared in permanganate of potash. The wood is then washed in soap-lye or in bichromate of potash

Painted Glass.

From a recent article in *Harper's Magazine*, entitled "Painted Glass in Household Decoration," we extract the following:

The glass used in glass paintings is, in its original manufactured state, either white or colored. The ingredients of white glass, of which silex and alkali are the most important, are incorporated by fusion in the melting-pot of the glass-house, having been in general previously "fritted"—*i. e.*, roasted

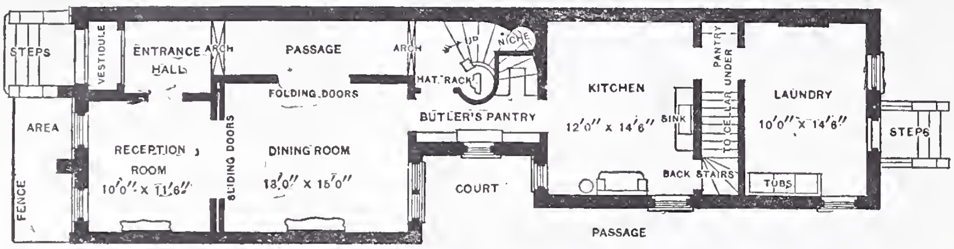


Fig. 2.—First Floor Plan.

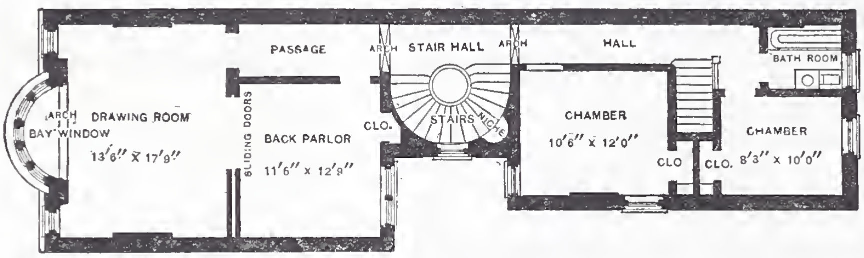


Fig. 3.—Second Floor Plan.

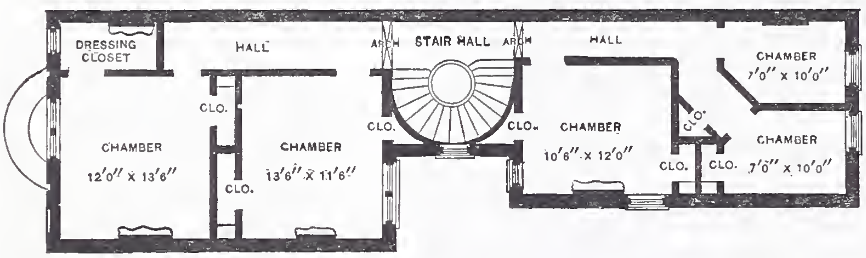


Fig. 4.—Third Floor Plan.

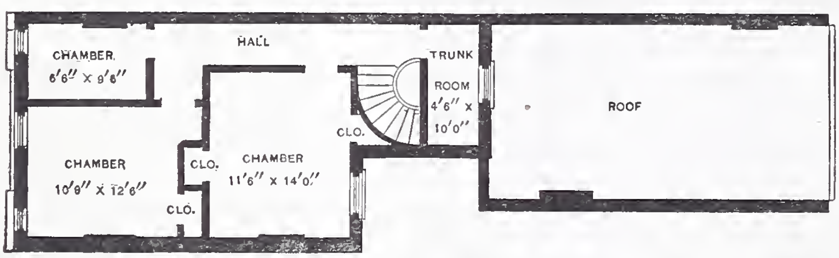


Fig. 5.—Fourth Floor or Attic Plan.

City Residence.—Floor Plans.—Scale, 1-16 Inch to the Foot.

with a strong fire in order to facilitate their union. When the vitrification in the melting-pot is complete, the glass is formed into sheets. These are afterward annealed—*i. e.*, suffered to cool very gradually—a process which renders them less brittle, and they are then ready for use.

Colored glass is of two kinds. One kind is colored throughout its entire substance, and is called pot-metal glass; the other is colored only on one side of the sheet, and is termed covered or coated glass—*i. e.*, white glass covered with a coat of pot-metal color.

Red or ruby glass is almost invariably coated glass; other kinds of colored glass are generally pot-metal glass, but they are not unfrequently manufactured as coated glass.

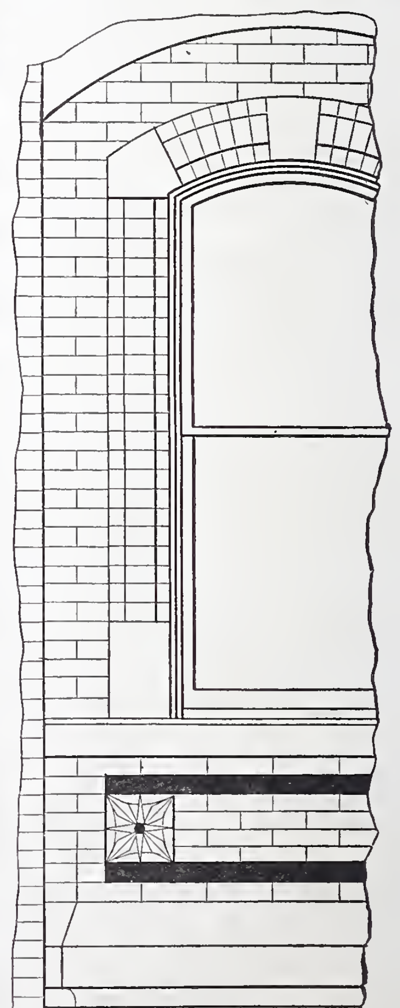
Colored glass is formed by adding a certain quantity of coloring matter (metallic oxide) to the materials of white glass, and incorporating these ingredients by fusion in the melting-pot of the glass-house. It is manufactured into sheets in the same way as white glass, and is of the same transparency

The glass painter possesses the power of coloring white glass, and even of varying the tints of colored glass, by the use of stains and enamel colors. All shades of yellow, to a full orange red, may be imparted to white glass by the use of silver for staining it; other colors are produced by means of enamels. A stain penetrates the glass to some little depth, and is properly as transparent as white glass itself. An enamel color only adheres to the surface of the glass, without penetrating it, and is always more or less opaque.

There are three distinct systems of glass painting, which may be termed the mosaic method, the enamel method and the mosaic-enamel method. Of these the most simple is the mosaic method. Under this system glass paintings are composed of white glass—if they are meant to be white, or only colored with yellow, brown and black—or else they are composed of different pieces of white and colored glass, arranged like a mosaic, in case they are intended to display a greater variety of colors. The pieces of white glass are cut to correspond with such parts of the design as are white, or white and yellow, and the colored pieces with those parts of the design which are otherwise colored. The glass painter in the mosaic style uses but two pigments—a stain which produces a yellow tint, and a brown enamel called enamel brown. The main outlines of the design are formed, when the painting is finished, by the leads which surround and connect the various pieces of glass together, and the subordinate outlines and all the shadows, as well as the brown and black parts, are executed by means of the enamel brown, with which color alone a work done according to the mosaic system can be said to be painted. The yellow stain is merely used as a color. Under the mosaic method each color of the design, except yellow, brown and black, must be represented by a separate piece of glass. A limited number of colors may, however, be exhibited on the same piece of glass by the following processes: Part of a piece of blue glass may be changed to green by means of the yellow stain. The colored surface of coated glass may be destroyed by attrition or the application of fluoric acid, and the white glass beneath it exposed to view. This may, of course, be wholly or in part stained yellow, like any other white glass. Two shades of yellow may be produced on the same piece of glass by staining some parts on both sides. But unless he adopt one or other of the above-mentioned processes, the glass painter under the mosaic system cannot have more than one color on the same piece of glass. A variety of tint or depth may often be observed in the same piece of colored glass, arising from some accident in its manufacture. Of this a skillful glass painter will always avail himself, to correct as much as possible the stiffness of coloring necessarily belonging to this system of glass painting.

It is a remarkable fact that the early artists, before or at the time of Albert Dürer, not having the aids of modern chemistry and large factories as now, formed their glass in small disks; yet they obtained from their impure and compound oxides effects and colors unknown in modern glass. This "defect effective" was so highly appreciated by Pugin that he established small glass works in London to produce disks not exceeding 6 inches in diameter, conveying similar effects of color.

Under the enamel method the picture is painted on white or tinted glass with enamel



City Residence.—Fig. 6.—Detail of First Floor Window.—Scale, ½ Inch to the Foot.

colors and stains. The mosaic-enamel method consists in a combination of the two former processes, white and colored glass, as well as every variety of enamel color and stain, being employed in it. The practical course of proceeding under each of these three methods is nearly alike. A cartoon of the design is made, upon which are also marked the shapes and sizes of the various pieces of glass. The glass is cut to these forms, and is afterward painted and burned —*i. e.*, heated to redness in a furnace or kiln—which fixes the enamel colors and causes the stains to operate. The number of burnings to which the glass is subjected varies according to circumstances. It is in general sufficient to burn glass with only one enamel color once or twice, the self-same operation sufficing also to give effect to the

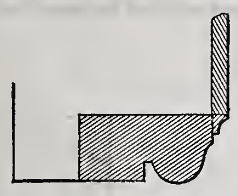


Fig. 7.—Detail of Jambs of Front Door.

stain, if any is used. Where several enamel colors are employed, it is necessary to burn the glass more frequently, each color in general requiring to be fixed by a separate burning. It only then remains to lead the glass together, and to put it up in its place.

Incombustible Wood.—M. M. P. Folbarri claims that he has discovered a method by which wood of any kind can be rendered

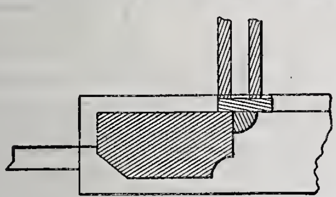


Fig. 8.—Detail of Jambs of Gable Window.

incombustible. It becomes, as it were, petrified without any alteration in appearance. Intense heat chars the surface, slowly and without flame, but does not penetrate to any extent, and leaves the fiber intact, whereby in case of fire the firemen would

Fig. 9.—Detail of Jambs of Window in Third Story.

have no occasion to fear that the materials on which they tread would give way beneath them, if this operation has been undergone by the wood composing the staircases, floors, &c. The following chemical compound is said to produce the result: Sulphate of zinc,

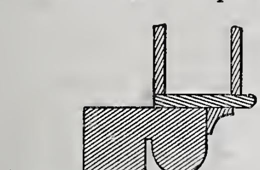


Fig. 10.—Detail of Jambs of Window in Ground Floor.

55 pounds; American potash, 22 pounds; American alum, 44 pounds; oxide of manganese, 22 pounds; sulphuric acid of 60 degrees, 22 pounds; water, 55 pounds; all of the solids are to be poured into an iron boiler

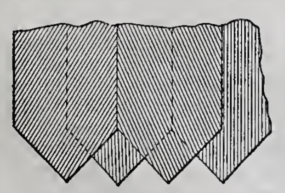
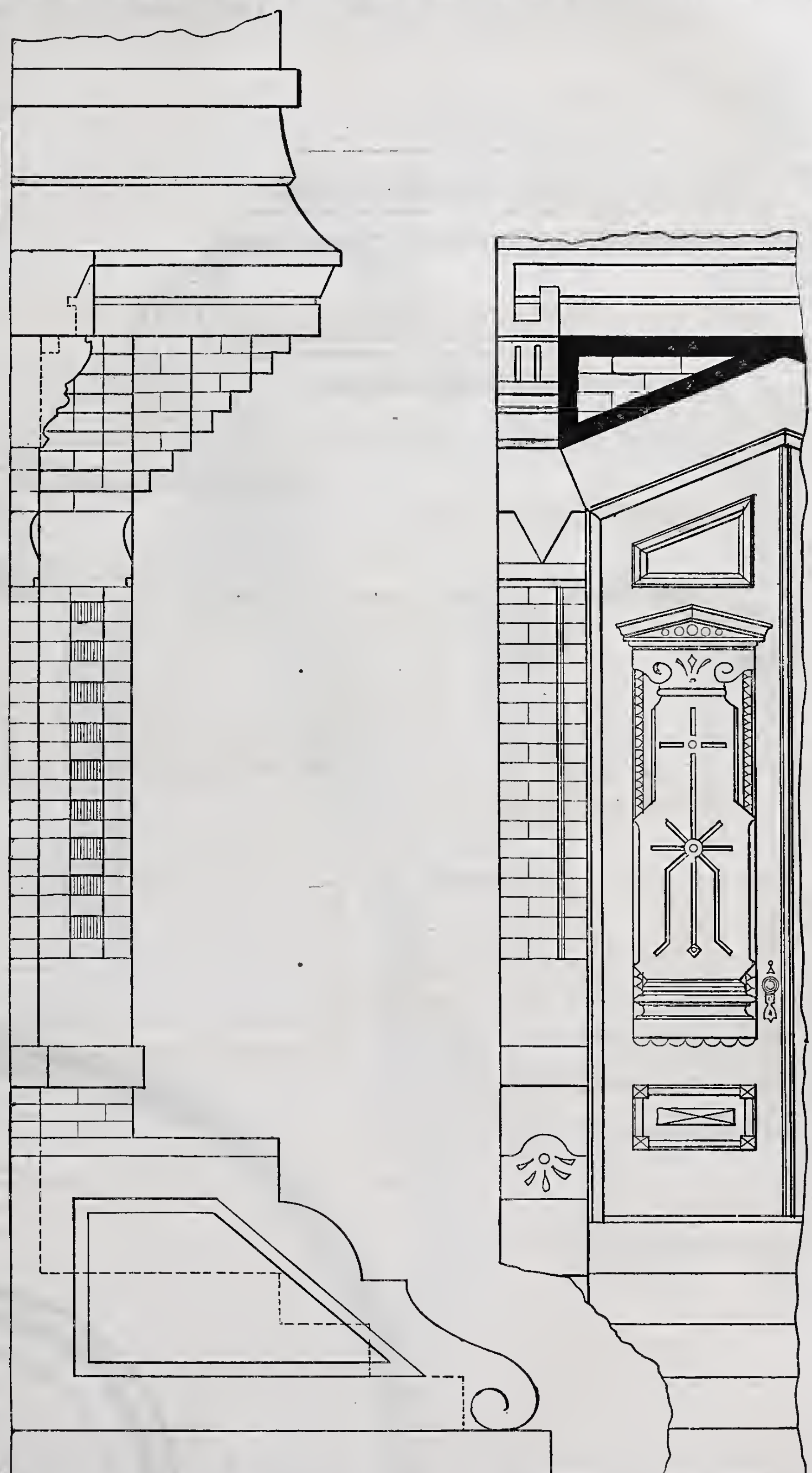


Fig. 11.—Detail Under Stone Bond, Between Second and Third Stories.

containing the water at a temperature of 45° C., or 113° F. As soon as the substances are dissolved the sulphuric acid to be poured in little by little, until all the substances are completely saturated. For the preparation of the wood it should be placed in a suitable apparatus, and arranged in various sizes (according to the purposes for which it is intended) on iron gratings, care being taken that there is a space of about half an inch between every two pieces of wood. The chemical compound is then pumped into the apparatus, and as soon as the vacant spaces are filled up it is boiled for three hours. The wood is then taken out and laid on a wooden grating in the open air, to be rendered solid, after which it is fit for uses of all kinds, as shipbuilding, housebuilding, railway carriages and trucks, fence posts, wood paving —in short, for any kind of work where there is any liability to destruction by fire.

Black Oak.—To turn oak black so as to cause it to resemble ebony, the wood should be immersed for 48 hours in a hot saturated solution of alum, and then brushed over several times with a logwood decoction, prepared as follows: Boil one part of best logwood with ten parts of water, filter through linen, and evaporate at a gentle heat until the volume is reduced one half. To every quart of this add from ten to fifteen drops of a saturated solution of indigo, completely neutral. After applying this dye to the wood, rub the latter with a saturated and filtered solution of verdigris in hot concentrated acetic acid, and repeat the operation until a black of the desired intensity is obtained. To imitate rosewood, a concentrated solution of hypermanganate of pottassa is spread on the surface of the wood and allowed to act until the desired shade is obtained. Five minutes suffice ordinarily to give a deep color. A few trials will indicate the proper proportions. The hypermanganate of potassa is decomposed by the vegetable fibers with the precipitation of brown peroxide of manganese, which the influence of the potassa, at the same time set free, fixes in a durable manner on the fibers. When the action is terminated, the wood is

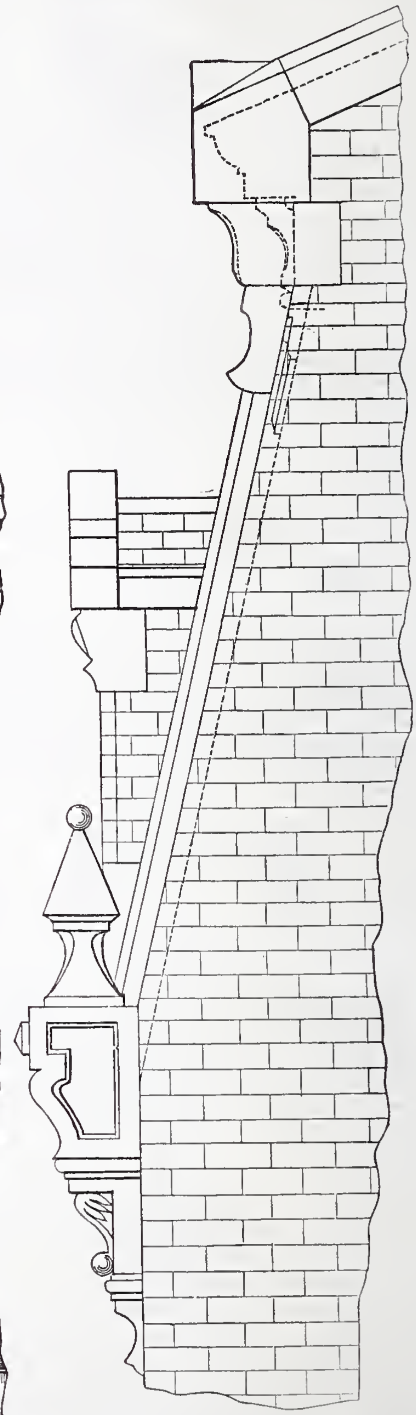


City Residence —Fig. 12.—Detail of Front Entrance.—Scale, ½ Inch to the Foot.

carefully washed with water, dried, and then oiled and polished in the usual manner. The effect produced by this process on several woods is remarkable. On the cherry, especially, it gives a beautiful red color.

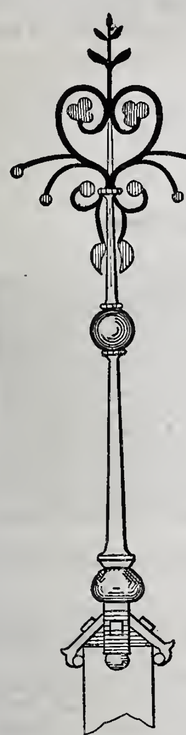
Methods of Testing the Quality of Glue.—Glue which will stand damp is a desideratum. Few, however, know how to judge of quality, except by the price they pay for it. But price is no criterion ; neither is color, upon which so many depend. Its adhesive and lasting properties depend more upon the material from which it is made and the method of securing purity in the raw material ; for, if that is inferior and not well cleansed, the product will have to be unduly charged with alum, or some other antiseptic, to make it keep during the drying process. Weathered glue is that which has experienced unfavorable weather while drying, at which time it is rather a delicate substance. To resist damp atmosphere well, it should contain as little saline matter as possible. When buying the article apply the tongue to it, and if it tastes salt or acid reject it for anything but the commonest purposes. The same operation will also bring out any bad smell the glue may have. These are simple and ready tests, and are the ones usually adopted by dealers and large consumers. Another good test is to soak a weighed portion of dry glue in cold water for twenty-four hours, then dry again and weigh. The nearer it approaches to its original weight the better glue it is, thereby showing its degree of insolubility. Glue frequently cracks because of the dryness of the air in rooms warmed by stoves. An Austrian paper recommends the addition of a little chloride of calcium to glue to prevent this.

City Residence.—Fig. 13.—Details of Roof, Gable, Dormer, &c.—Scale, ½ Inch to the Foot.



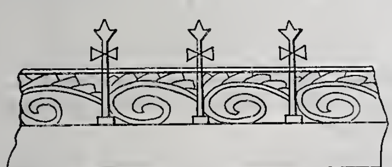
City Residence.—Fig. 14.—Section of Roof, &c.—Scale, ½ Inch to the Foot.

Boxwood.—It appears that, in consequence of the continued increased cost of boxwood and its rapid decrease in quality, one of the principal importers of this and other hard woods into this country has succeeded in introducing two American woods to be used instead of boxwood in the manufacture of shuttles, a purpose for which immense quantities of boxwood have hitherto been used. The woods so substituted are those of the cornel and persimmon. The first is apparently the *cornus florida*, a deciduous tree about 30 feet high, growing abundantly in woods in various parts of North America. The wood, though of small size, is hard, heavy and close-grained, and is chiefly used in America for the handles of tools and for shuttle making, and, when properly sea soned, is much superior to Persian boxwood. The same may be said of the persimmon (*diospyros virginiana*), a tree belonging to the ebony family, a native of the United States, where it grows to a hight of from 50 feet to 60 feet, and a diameter of 1 foot or 18 inches. The heart wood is of a dark brown color and very hard. The trunk is covered with a very thick, hard and rugged



City Residence.—Fig. 15.—Detail of Finial on Front Gable.—Scale, ½ Inch to the Foot.

bark. One great point to be particularly remembered in the preparation of these woods for shuttle-making is the very gradual drying by artificial means; this is more particularly recommended in the case of the cornel, undue haste in seasoning, it is said, having in some cases created a prejudice against the wood. As an illustration to some extent of the effects of the Turkish war, it may be stated that while in 1876 over 10,000 tons of boxwood were

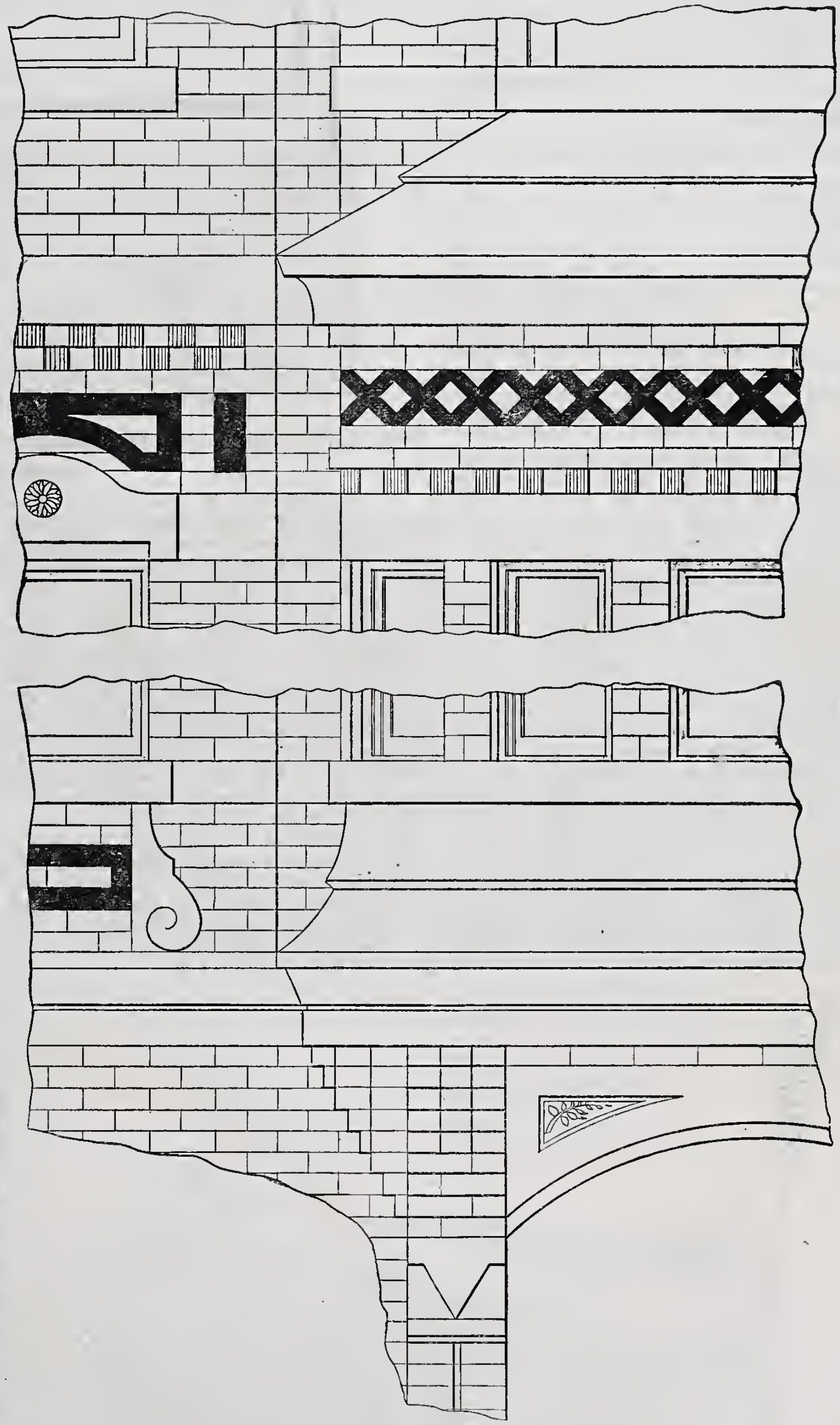


City Residence.—Fig. 16.—Detail of Cresting. Scale, ½ Inch to the Foot.

imported, the year 1878 shows a return of only between 4000 and 5000 tons. A large proportion of this wood is the produce of the forests on the Caspian Sea. Though the supply from the Black Sea provinces has for some years past been decreasing, it is well known that untouched forests of the wood exist in Russian territory, and it is hoped and expected that at no very distant day these forests may be opened up, so that we may get abundant supplies of good wood for some time to come.

Sandal Wood.

This wood grows entensively in the forests of Mysore, but its cultivation has been restricted from the remotest period; at present about four lacs of rupees accrue to the state revenue from the sale of Mysore sandalwood alone. The shade cast by the sandal tree is said to be injurious to the growth of vegetation. In Mulnad the trees grow hardy, straight and stout, the planks being used for the manufacture of boxes, &c. The trees growing on the plains are stunted in growth, but they surpass the Mulnad wood in perfume. The wood is put to several uses besides the making of curiously-carved boxes, fans, and other fancy articles. The dust left after sawing is used for incense. The oil makes the attar which is used as a sweet scent. The sea-borne exports of Mysore wood for 10 years have been, on an average, 380 tons a year. The distillation of oil from the roots is carried on chiefly at Mangalore. Five cwt. yield 40 seers of pure oil, thus giving a profit of nearly 37 per cent. The market for sandal-wood is an ever open one, and, much as we may desire to use the wood for cabinet purposes, we are not likely to see much of it at present. As opium ministers to the sensual gratification of the Chinese and others of the same class, so sandal-wood ministers to their superstition. Without it no religious ceremony can be conducted, and its absence is a mark of poverty, so that the Oriental of India and China will sacrifice anything rather than suffer that, on the proper occasion, sandal-wood should not be burned.



City Residence.—Fig. 17.—Details of Bay Window.—Scale, ½ Inch to the Foot.

To Face Oil Stones.—Take a piece of even or straight-faced iron (if planed it is better); scatter a little emery or fine sand, about as coarse as No. 1½ sand paper, on the iron plate; add a little water and rub the face of the stone, renewing the emery, or sand and water, when necessary, finishing with water alone.

Preparing Wood for Polish.—Walnut or similar woods are best finished with fine glass paper, No. 0; then color linseed oil with alkanet root and rub into the wood, and afterward let it stand for a time until the oil has thoroughly soaked in; then proceed to fill the pores with a composition of plaster of Paris, three parts, tallow, one, and a little red polish. This is to be thoroughly worked until it is mixed and becomes a crumbly mass. It can be rubbed into the wood with a piece of rag, after which all the superfluous parts are removed, and the surface is ready for the final polish, which may be put on with a brush, or after the French method—with a tampon; in the latter case only shellac dissolved in alcohol is used. With the brush you can use any kind of varnish.

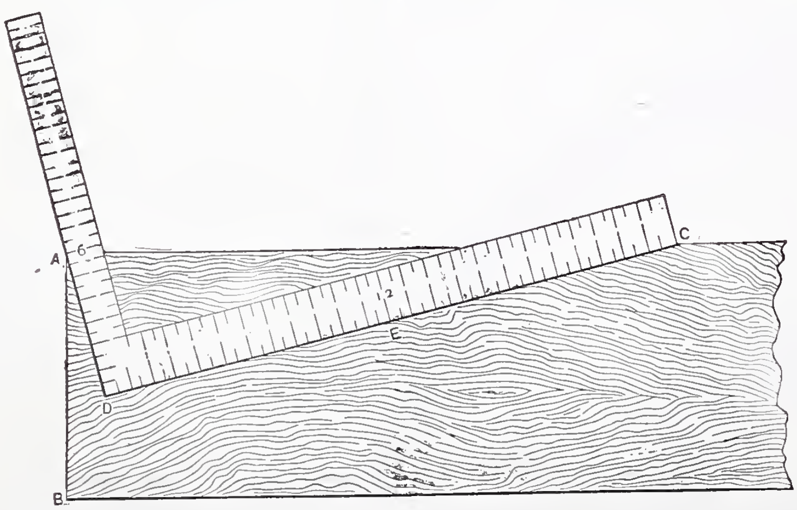
Hydraulic or Aquarium Cement.—Take of plaster of Paris, fine white dry sand and litharge each one gill, and powdered resin one-third gill; mix thoroughly, and make into a paste with boiled linseed oil to which dryer has been added. Beat well together, and apply after it has stood four or five hours—no longer, for it will lose its strength.

Some Problems in Framing.

(Concluded from Page 187.)

We have now explained two methods of framing the several joints required to be made in erecting the structure shown in the elevation in our first article (July number, page 132). There are one or two joints which we have not described specifically, but they are of such a character that we think none of our readers will have difficulty in working them out. They involve no other principles than those we have described in detail, in connection with other joints of a similar nature. We feel confident, therefore, that no further explanation is necessary. Before leaving these problems, however, it may be well to glance at the methods of obtaining the lengths of the various timbers required.

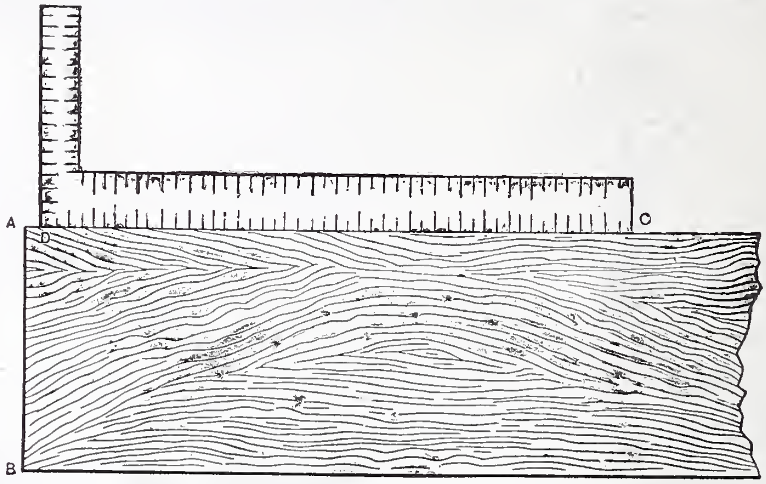
In Fig. 9 (page 133), we showed the method of obtaining the bevel for the foot of the posts by the use of the square. By applying the same principles the length of the posts may also be obtained. Before describing the operation we would remark that, in connection with the use of the square for such purposes, it is quite convenient to consider each inch of the square as equivalent to one foot in actual measurement, and, consequently, each twelfth of an inch of the square as one inch in actual length. Most squares are divided on one edge or the other into twelfths of an inch, thus affording a scale for use in such cases. In the following operations we use the square in this manner. By inspection of Figs. 24 and 25, it will be seen how the length of the posts may be obtained by the use of the square if they inclined in but one direction. Since the pitch is 6 feet in 24 feet, place the square as shown in Fig. 24, bringing the 6-inch mark of the tongue to some fixed point on the edge of the timber; for convenience, we use the extreme corner, A, placing the outside or 24-inch inch mark of the blade against the same edge of the timber, falling in this case at C. Then swing the square around, keeping it firmly fixed at C as an axis, until it is in the position shown in Fig. 25, in which case the distance between A and D represents the difference in length between D C and A C (Fig. 24), or the difference between the perpendicular hight from the sill to the plate and the hight between these two parts measured on the pitch of the post. This space will be found to measure, by actual trial, ¾ of an inch on the square, which, by the scale, is equivalent to 9 inches of actual length. Hence, if the post in-



Problems in Framing.—Fig. 24.—Obtaining the Length of the Corner Posts by the Square. Placing the Square.

clined in one direction only, its length would be 24 feet and 9 inches.

The same principle may be applied to the case we have in hand, where the posts incline inward in both directions. A simple preliminary calculation, however, must be made. The actual pitch of the post must be obtained before the principle we have illustrated in Figs. 24 and 25 can be successfully applied. This may be accomplished by a diagram, as given in Fig. 26, which shows a corner of the plan of the building. C A B represents the sill at the bottom, and D E F represents the plate at the top. Then A E represents the corner post as it would appear in plan. In other words, the pitch of the corner is represented by the length of the diagonal line A E. If we obtain this length, therefore, (A E) and in the use of the square substitute its equivalent by the scale for 6 inches, we shall be able to accomplish the same result for the post pitching in two directions as we have just accomplished for it when inclined



Problems in Framing.—Fig. 25.—Obtaining the Length of the Corner Posts by the Square. The Measurement.

in but one direction. By drawing the plan shown in Fig. 26 to scale, the length A E can be obtained by measurement upon the drawing. The same result may be also accomplished by the use of the square, by an operation very familiar to carpenters and which is shown in Fig. 27. Since the post inclines equally in two directions, pitching 6 feet from either side, place 6 of both blade and tongue of the square against the edge of the timber, as shown by G and H. Mark the point at which the heel of the square comes, and square down from it as shown by A K. Then A K of Fig. 27 is the same as A K of Fig. 26, or, in other words, is equal to one-half of the length A E required.

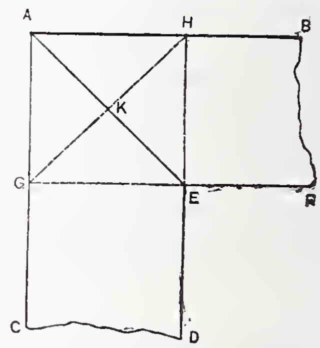
By inspection of Fig. 26 it will be readily seen that the two diagonal lines A E and G H must be equal in length. Therefore, we have the choice of using the distance G H of Fig. 27, which corresponds to G H of Fig. 26, or doubling A K of Fig. 27, either plan giving us the length of A E.

From this it is evident that in practice all that is necessary is to measure across the square itself from 6 of the tongue to 6 of the blade, using for the purpose either a pocket rule or another square.

Whichever plan is used, either the drawing first described or the diagram constructed by means of the square, or measuring direct upon the square the distance obtained, which will be 8½ inches, is to be substituted for 6 inches in placing the square as shown in Fig. 24. Hold the end of the blade fixed as an axis and bring the square up as shown in Fig. 25. Note the difference in the length, which when reduced to inches by use of the scale will show how much longer than 24 feet the post is required to be.

The length of the corner post may also be obtained by a drawing. Construct a right angle triangle the base of which is equal to the line A E of Fig. 26, and the altitude of which is equal to 24 feet, by the same scale. Draw the hypothenuse. Then the length of this hypothenuse will be the length of the corner post.

The length of the girts may be obtained by measurement from a scale drawing, or by the use of the square. In the latter



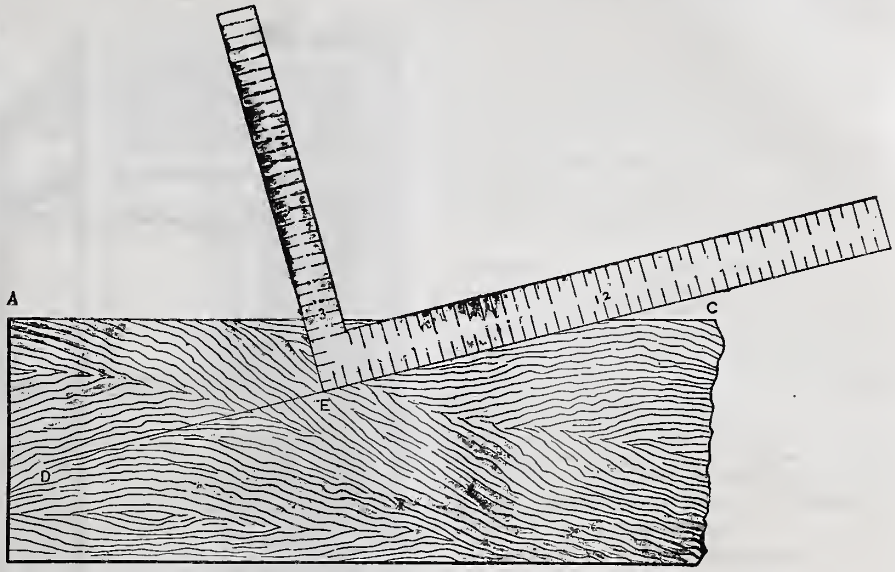
Problems in Framing.—Fig. 26.—Plan of One Corner of the Building.—Scale, ⅛ Inch to the Foot.

method we proceed in very much the same general manner as in measuring the corner posts.

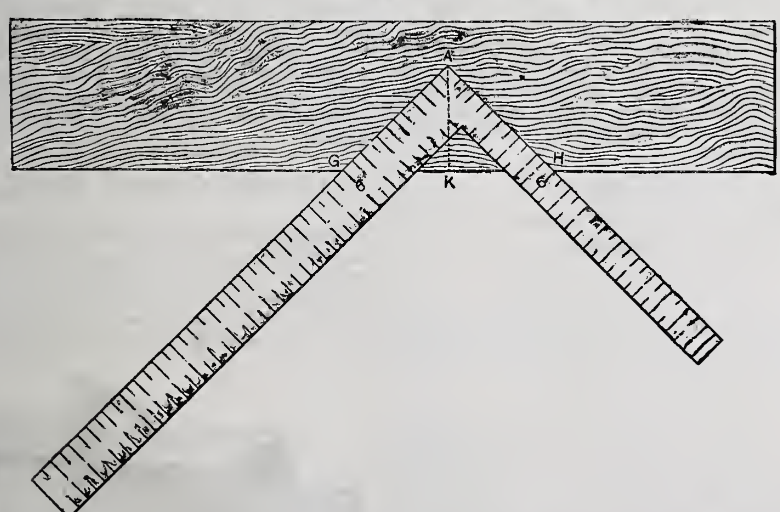
In the condition of the problem as originally stated, the lengths of the sills and the plates were both given, being respectively 24 and 12 feet; the girt was specified to go midway between the plate and the sills. Now, when the square is in the position, shown in Fig. 24, the line A C represents the corner post of the building in elevation, and the line D C represents the vertical hight. If we mark a point midway between D and C we obtain a point corresponding to the position of the girts in the building; or, to look at it in another way, since the vertical hight of the building is 24 feet, if we mark opposite the point 12 of the square, as shown at E, we obtain a point midway between D and C at which the girt passes a vertical line dropped from the top of the post to the sill. Having established the point E, if we measure the perpendicular distance from E on the line D C to the line A C, as shown in Fig. 28, we will obtain the difference between the length of the girt and the sill at one end, or what is the same, will obtain the difference between the length of the plate and the girt at one end. Double that distance—which in this case is 3 feet, making 6 feet in actual measurement—and either add it to the length of the plate or substract it from the length of the sill, and the result will be the length of the girt.

The square may also be used for measurement of the length required for the corner posts in cases where they incline unequally in two directions, it being necessary only to maintain corresponding conditions in measuring by means of a diagram, or upon the square itself, to obtain the actual pitch of the post.

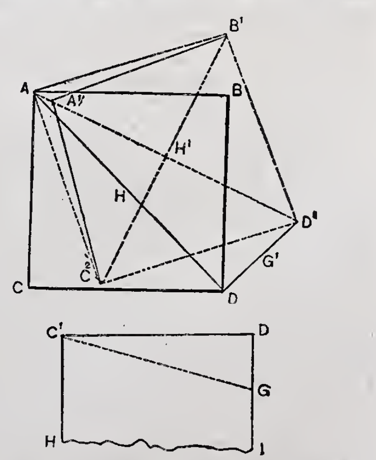
Before leaving these problems we desire to call attention again to the matter of backing corner posts, our description of which, by some inadvertence, in the September number was left in such shape as to be likely to mislead. We present herewith, in Fig. 29 a new diagram, which should be substituted for Fig. 10, page 172. In our description of Fig. 10 we showed the method of obtaining the representation of the timber as it would appear when cut to the level required to fit to the sill. We showed that A B^1 D^2 C^1 was that shape. The conclusion derived therefrom, that the angle C^1 A B^1 is the angle to which the corner of the post is to be reduced, is in error, and the omission of two lines from the diagram and a misprint of two letters, makes the error of a character not likely to be readily corrected by the reader. The lines missing in Fig. 10 are supplied in Fig. 29, and the letters are correctly inserted, but in all other respects it is the same as the former figure. After obtaining the representation of the post as it would appear when cut to the proper bevel to fit it to the sill, all as shown by A B^1 D^2 C^2, the angle to which the corner faces of the posts are to be dressed is obtained as follows: Take the distance A D in the dividers, and measuring from D^2 set off the space D^2 A^1 equal thereto. Connect A^1 B^1 and A^1 C^1, as shown. The angle C^2 A^1 B^1 is the angle to which the outer faces of the posts are to be reduced.



Problems in Framing.—Fig. 28.—Obtaining Length of the Girts by Use of the Square.



Problems in Framing.—Fig. 27.—Method of Obtaining the Diagonal Pitch by the Square.



Problems in Framing.—Fig. 29.—Finding the Lines for Backing the Corner Posts by Means of a Drawing.—Correction.

A Sanitary View of Paint.

In a paper entitled "The Chemistry of Dirt," read before the Sanitary Institute of Great Britain during its recent congress at Stafford, Dr. H. C. Bartlett, after strongly recommending the abolition of absorbent surfaces on the walls of dwellings, continues:

If we have lath and plaster, let it be painted, and if we cannot have wainscot or mahogany kept brilliant by continued cleanly friction and polish, let us have a clean-painted wooden surface, as artistic in tint and disposal of colors and decoration as taste and means will permit; but to carry out a determined war against dirt and disease, let us have paint. These are no longer notions peculiar to the Dutch; they are sanitary axioms which we cannot afford to ignore.

But there is another side to the proposal "to paint and believe in paint," sometimes the very means taken to keep our dwellings clean adding to the real dirt. So it is with paints, for there be paint and paints; some leave little to be desired from a hygienic point of view; others, as I shall show, are injurious to health, and even deadly in their direct effects.

In July, 1873, I was instructed to investigate the cause which brought about, I believe, some of the severest cases of lead poisoning ever made public. I found at Devonport dock-yard 24 cases that had occurred among the shipwrights working there, dating between May 3 and June 30. There were 64 painters employed, and on the average about four cases of lead poisoning per annum were reported of these men, or at the rate of 8 per cent. of those engaged in laying on the white-lead paint. When the space to be painted was confined and ill-ventilated, the symptoms were as follows: After a few weeks' work a pasty, lusterless look appeared upon their faces. There was a sense of great depression and weakness, together with headache and loss of appetite. A metallic taste was sometimes complained of, and a blue line was observed upon the margin of the gums. It was only after persevering for some weeks that the graver symptoms were produced, and the men, becoming wholly incapacitated for work, sought medical advice.

But it was among the shipwrights that the symptoms appeared in a still more aggravated form. These men were employed in cleaning off Day's cement, together with the paint and red lead. All the symptoms previously enumerated were presented, but in a more intense degree, attended with greater depression, and in every case epigastric pain was described as a dull, heavy pain, giving the sensation of the bowels being drawn toward the spine. Cramp in the muscles of the extremities was common, and of great severity, but it was observed with surprise that there were no cases of paralysis. The most stringent precautions have since been taken; perfect cleanliness of the skin and frequent washing of the working clothes were insisted on. A chemical respirator was recommended to be worn while at work, and sulphuric-acid drinks were always to be kept in readiness. No precautions, however, prevent the use of white or red lead paints being exceedingly injurious both to the painters and to those who inhabit rooms in which the paint has not properly dried.

Now comes the important question, how long a time must elapse before white-lead paints can be considered to be so perfectly dried as to be absolutely free from diffusing their injurious influence? I will reply that it depends upon circumstances over which we have frequently no control. I state this feelingly, as in my own house, a few doors from Grosevnor square, London, the whole staircase from top to bottom has paint upon it which is not dry now, although it was laid on at Easter last. The slightest greasy deposit upon the old paint will prevent white-lead paint from ever drying, and while a skin of apparently hard paint cheats the superficial observer, there is a continual exosmosis of volatile poisons being given off. The truth is not revealed until a general tone of depression and lowered vitality throughout the house arrests the attention of observers on the lookout for such causes and effects. Or, perchance, the spirit of cleanliness, the handmaiden of the goddess Hygeia, insists upon an early cleansing of the paint all over the house, with the unpleasant result of detaching the false skin of the new paint, and leaving the greasy under-coat which no length of exposure will ever dry. It is no exaggeration to assert that very little paint, containing white lead as its basis, becomes so hard and dry within months of its application as to preclude the possibility of poisonous matters being given off.

I have had distinct proof that the injury accruing from the diffusion of lead in the air exists to an extent far surpassing the well-known poisonous influence of minute quantities of lead in drinking water. I have, therefore, always recommended the substitution of zinc white for white lead, for the all-important reason that it is harmless. Many reasons, however, tend to limit the use of the ordinary zinc white (oxide of zinc), the weightiest of which are, that it does not possess the body of white lead, will not cover so much surface, and is therefore not so economical either in labor or in cost. Several coats of zinc oxide are required to equal the opacity of white lead, and in mixing with other colors, a much larger quantity of zinc oxide must be used. * * * Oxysulphide of zinc is then brought forward as being as dense as white lead (and opaque), its covering qualities even exceeding those of the lead paint; and as it does not change color like white lead, is as cheap, all things considered. We may welcome another powerful auxiliary, which, while innocent of itself, will help us immensely in our campaign against dirt.

Note.—These facts are very interesting, but our readers need not be alarmed in regard to the use of lead paint in this country. Here lead paint in almost all cases dries so very quickly that no evil results to the occupants of rooms need be feared. Painters suffer, but to a much less degree than in the Old World. A dry climate prevents the annoyance of half-dried paint. The use of zinc, however, is not to be esteemed harmless by any means, the statements of Dr. Bartlett to the contrary notwithstanding.

Automatic Parlor Elevator.

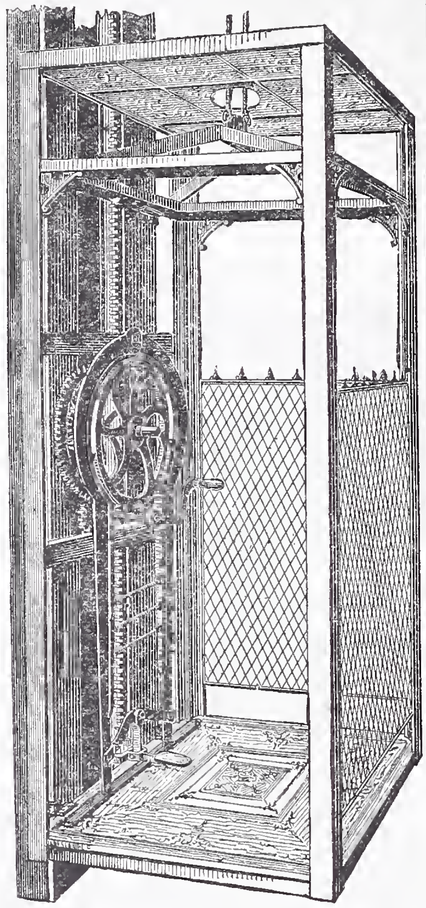
Every person knows the difficulty and labor of ascending stairs, and consequently the great convenience of elevators, which have of late become a common feature in first-class hotels and business blocks. The application of the same improvement to dwelling houses has heretofore been attended with difficulty, owing to the absence of steam power, and the expense of maintaining and operating the same. Dumb waiters and kindred devices are in common uso in our best houses, but there is room for great improvement before the modern house can be pronounced perfect in the way of conveniences for ascending and descending from story to story. Particularly desirable is some invention for this purpose in the high houses which are becoming so common in all our cities.

One of the greatest novelties on exhibition at the American Institute Fair, now in progress in this city, is what is known as the Automatic Parlor Elevator, an engraving of which we pesent herewith. It is an invention which is calculated in a great measure to overcome the difficulties in employing passenger elevators in dwelling houses. A working model is upon exhibition, and having repeatedly made the trip in it we are able to speak the more positively of its merits. The general features of the device are so clearly shown in our engraving that extended description is not necessary. (The boxing is removed to show the machinery). At first sight it might seem that one was obliged to work his way at the expense of considerable labor, but this is not the case. The elevator car and the operator are counterbalanced, so that but little force is required to propel the car. The weights which form the counterpoise are so arranged that more or less may be put on according to the load to be carried. Besides this, there is an arrangement of compound leverage by which a heavier load can be carried, without adjusting the counterpoise, the car, however, moving proportionately slower.

The extreme simplicity of the invention in all its parts is what first impresses the observer. There are no complicated devices likely to get out of order. The car is under perfect control of the operator at all times by a friction brake, controlled by the foot treadle shown in the cut. It can only be moved when the foot is upon the treadle. Removing the foot fastens the car instantly at any point, no matter at what speed it is moving.

The elevator is useful in a great number of places. It may in some cases be made to take the place of back stairs, and it may be used as a dumb waiter, for conveying baggage and other loads, in addition to its use in conveying passengers. The circular well in the stairway of the house illustrated upon the first pages of this number of *Carpentry and Building*, would be a suitable place for it as a passenger elevator, and that it can be used in such a place illustrates its applicability in general.

Mr. H. Y. Lazear, of No. 8 Gansevoort street, this city, is the manufacturer. A



Automatic Parlor Elevator.

number of the elevators have been put up in Chicago (it having first been introduced there), and with the most satisfactory results. One is also in use at the New York Catholic Protectory. Several of them have already been put up in this city, and we think it is an invention likely to come into general use.

Requirements for the Drainage of Every House.

In the light of present knowledge, the following seem to us the essential requirements for the drainage of every house. Time and further experience may suggest other features or modifications of these:

Every vertical soil or waste pipe should be extended at least full size through the roof. No traps should be placed at the foot of vertical soil pipes to impede circulation. Traps should be placed under all sinks, basins, baths, wash-trays, water-closets, &c., and as near to these fixtures as practicable. All traps under fixtures, wherever practicable, should be separately ventilated, in order to guard against syphonage. Such vent pipes should not branch into a soil pipe below where any drainage enters it. In some cases it is preferable to carry it to outer air independently. Rain-water leaders should not be used as soil pipes, and when connected with house drains they should be made of cast iron in preference to galvanized sheet iron or tin, there being less liability of corrosion. Joints should be gas and water-tight, to preclude possibility of drain air entering open windows. No safe waste should connect with any drain, but it should be carried down independently to a point where its discharge would indicate the existence of a leak or any overflow above. No waste from a refrigerator should be connected with a drain. Unless the water supply is ample, so that it will rise to every part of a building, ensuring at *all* times the proper flushing of fixtures and traps, a cistern should be provided into which the water will rise at night, or into which it may be pumped. Said cistern should be large enough to hold an ample daily supply, be kept clean, covered, and properly ventilated. The overflow pipe from it should never be run into any drain under any circumstances. The supply for drinking water should not be drawn from it, but from a direct supply—*i. e.*, direct from the street main.

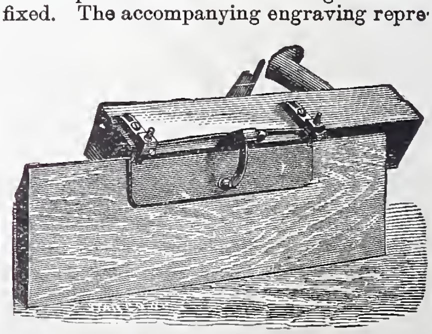
Water-closets should not be supplied direct from street pressure or by a pipe from which branches are taken for drinking water. Where the valve closets are preferred to those that are supplied from a small cistern immediately over them, then the supply should be taken to a storage tank, from which it can be conveyed to the valves on the closets, thereby insuring an equable pressure and securing more reliability in their working.

All drain pipes within a house should be of metal in preference to stoneware, owing to the liability of the latter to crack and the difficulty of keeping the joints tight. It is best to run them along the cellar wall or ceiling with a good incline. They should never be hidden underground, as then leaks will not be perceptible. In some places it is common to paint pipes white, so that any leakage will show itself to the most careless observer. All drains should be kept at all times free from deposit; and if this cannot be effected without flushing, special flushing arrangements should be provided, so as to effectually remove all foul matter from the house drains to the public sewers. All drains should be laid in a straight line, with proper falls, and should be carefully jointed and made water-tight. No right-angled junction should be allowed.

A drain passing under a dwelling house should be constructed of cast-iron pipes, with lead caulked joints, laid so as to be readily accessible for inspection. Whenever dampness of site exists it should be remedied by laying sub-soil drains, which should not pass directly to the sewer, but should have a suitable break or disconnection. Water supply and drain pipes should be concentrated as much as possible, and not scattered about a building. Horizontal pipes are objectionable. Plumbing fixtures should not be hidden behind walls and partitions where their condition is never apparent. They ought to be made easily accessible and so situated that any leak will be readily detected.

Adjustable Gauge for Jointing.

Every practical man knows the inconvenience and loss of time occasioned by striking a gauge and then watching for the mark when a number of pieces have to be beveled, as compared with a tool having the bevel fixed. The accompanying engraving repre-



Adjustable Jointer Gauge.

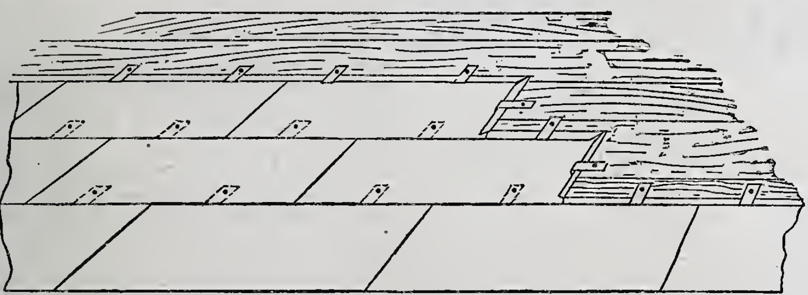
sents an adjustable gauge of great convenience and usefulness, manufactured by the Millers Falls Co., of Millers Falls, Mass., whose office is at 74 Chambers street, New York, and sold by the trade generally. As may be seen by inspection of the cut, it is fastened to the side of the plane by screws. It is so arranged as to be quickly removed when not in use. It is adapted to square as well as bevel work. Its use obviates the necessity of frequent reference to the bevel or try square, and by it even inexperienced workmen can produce satisfactory work.

Tin Roofs.

III.

The general appearance of a flat-seam roof is shown in Figs. 1 and 2 of accompanying cuts. Fig. 1 also illustrates the manner of laying a roof with cleats, and Fig. 2 illustrates the manner of laying a roof with nails.

As between these two methods of laying a tin roof, there is considerable choice. The employment of cleats is much to be preferred. The objection to the use of nails consists in the fact of holes being made through the sheet which is to cover the roof. This is not only very bad in itself, but it also has the further objection of so holding the nail that the process of expansion and contraction in time either works the nail loose or tears the hole in the sheet larger.



Tin Roofs.—Fig. 1.—A Flat Seam Roof Laid with Cleats.

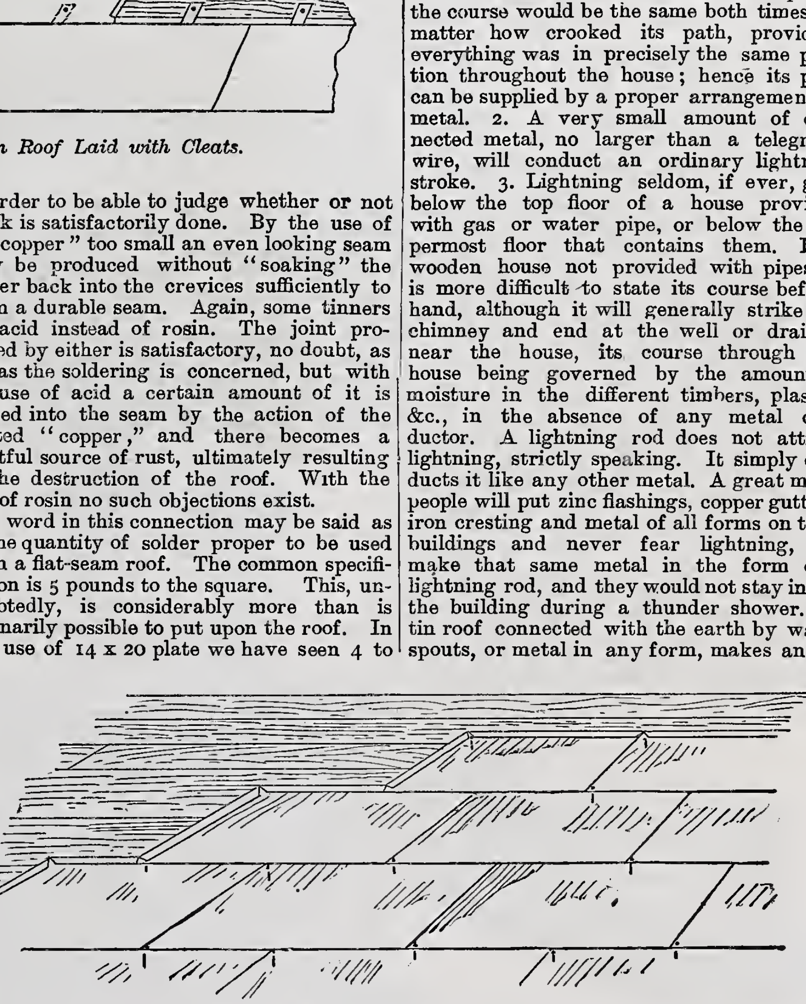
From the engraving it will be seen that the nails are placed in the corners of the sheet in such a manner that the overlapping edge covers them. They are located where it is presumed the solder flowing into the seam will thoroughly embed and cover their heads. While this is quite plausible in theory, in practice it is never fully realized.

In the use of cleats, as shown in Fig. 1, no such objections exist. There are no holes made through the sheets, and the method of fastening the cleat to the roof is such as to allow all necessary contraction and expansion without damage to the roof. The cleat consists of a simple strip of tin from 2 to 3 inches in length and from 1 to 1½ inches in width, on one end of which is bent an edge corresponding to the edge of the roofing sheets, which locks into the edge of the lower sheet, all as shown in engraving. It is covered by the overlapping edge of the upper sheet. The nail is placed near the opposite end of the cleat, and is so far removed from the sheet that the effect of contraction and expansion is altogether compensated for by the action of the cleat itself. Consequently, no strain is produced upon the seams on account of the fastening.

Some preference is occasionally expressed with reference to the kind of nails to be employed in fastening a roof. This applies not only to the flat-seam roof, but also to the standing-seam roof, full particulars concerning which will be described further on. The nail in general use for this purpose resembles in shape an ordinary slating nail, or barrel nail, as known to the trade. It is short and thick, with a bulge midway between its ends. It is so strong that it readily drives through the thickest tin employed, without bending, and it is not sufficiently long to project through the under side of the sheeting. A barbed nail is in use to some extent in some sections of the country. Whatever may be the style of nail employed, there is choice between using nails black and using them tinned or galvanized. While it would seem that a tinned nail, although costing about double that of the black nail, would be more appropriate than any other for a tin roof, the fact that it is very smooth, and, therefore, readily draws from the sheeting, makes it somewhat objectionable. This same objection does not apply to the galvanized nail. The nature of the zinc, which is the coating employed, is of such character that it produces a roughened surface, thus making a common nail quite as desirable in point of roughness for ordinary purposes as the barbed nail.

After applying the tin to the roof, as indicated in the accompanying engravings, the next process is malleting it down or closing the seams. Quite a little of the quality of the roof depends upon the skill with which this is performed. The awkward or bungling use of the mallet which is employed for this purpose may be made to break the seams, or close them in an uneven manner. The next process in order is that of "soldering off" the roof. The seams are carefully rosined, after which the solder is applied by a flat-bottomed copper of sufficient size to melt the solder to the extent of making it flow into all the crevices of the seam. We are thus particular in describing the various processes incidental to laying a roof from the fact that carpenters ordinarily become the superintendents of buildings, and it is desirable for them, as well as many others of our readers, to know all the points in connection with the roofer's trade in order to be able to judge whether or not work is satisfactorily done. By the use of a "copper" too small an even looking seam may be produced without "soaking" the solder back into the crevices sufficiently to form a durable seam. Again, some tinners use acid instead of rosin. The joint produced by either is satisfactory, no doubt, as far as the soldering is concerned, but with the use of acid a certain amount of it is forced into the seam by the action of the heated "copper," and there becomes a fruitful source of rust, ultimately resulting in the destruction of the roof. With the use of rosin no such objections exist.

A word in this connection may be said as to the quantity of solder proper to be used upon a flat-seam roof. The common specification is 5 pounds to the square. This, undoubtedly, is considerably more than is ordinarily possible to put upon the roof. In the use of 14 x 20 plate we have seen 4 to



Tin Roofs.—Fig. 2.—A Flat Seam Roof Laid with Nails.

4½ pounds applied, but seldom is there more than this used; with 20 x 28, a quantity proportionally less will be required to make joints equally satisfactory in character. An arbitrary statement of the amount of solder to be applied per square is, after all, of comparatively little service to the builder. Inspection of the seams themselves will do more than any set rules in the way of satisfying his mind concerning the character of work which is being done. The seams should be thoroughly filled and left even and smooth. Very much depends upon the quality of the solder used. A dauby look about the seam, a granulated surface, or a mottled look upon the solder in the seam are bad indications, and may be accepted as signs of a very poor grade of solder, or a solder in which more or less zinc is present. The same appearances may arise from what tinners sometimes call a "dirty" solder. In either case they may be taken as unquestionable proof that the solder has not flown readily under the "copper."

Solder of an entirely satisfactory character is known to the trade as "half and half." This means solder composed of equal parts of tin and lead. "Patent metal" solders, "No. 1" solders, and other solders indicated by similar names, are not generally satisfactory, and are to be avoided. A "half-and-half" solder costs a trifle more per pound than these other grades; but it works more freely, spreads more evenly, and is in reality the cheapest for the tinner to use. The saving of 2 or 3 or 5 cents per pound which he will effect by using a "patent metal" solder, is more than offset in the loss of greater time consumed in making seams, to say nothing of the quality in the finished work.

(To be continued.)

Lightning Rods.

A correspondent in a contemporary gives in brief form these useful facts about lightning rods: 1. The course of lightning is constant or prearranged, and if a building should be struck twice in the same place, the course would be the same both times, no matter how crooked its path, providing everything was in precisely the same position throughout the house; hence its path can be supplied by a proper arrangement of metal. 2. A very small amount of connected metal, no larger than a telegraph wire, will conduct an ordinary lightning stroke. 3. Lightning seldom, if ever, goes below the top floor of a house provided with gas or water pipe, or below the uppermost floor that contains them. In a wooden house not provided with pipes, it is more difficult to state its course beforehand, although it will generally strike the chimney and end at the well or drain if near the house, its course through the house being governed by the amount of moisture in the different timbers, plaster, &c., in the absence of any metal conductor. A lightning rod does not attract lightning, strictly speaking. It simply conducts it like any other metal. A great many people will put zinc flashings, copper gutters, iron cresting and metal of all forms on their buildings and never fear lightning, but make that same metal in the form of a lightning rod, and they would not stay inside the building during a thunder shower. A tin roof connected with the earth by water spouts, or metal in any form, makes an excellent lightning rod; there is no need of separating your tin roof from the wood with glass; the electricity will never leave metal for wood if the metal continues to moist earth. All metals conduct sufficiently well for a lightning rod. The principal requisition is a perfectly continuous rod going in the most direct line from the highest points to the moist earth. Theoretically, copper is six times better as a conductor than iron; but practically, for a lightning rod, iron is nearly as good a conductor as copper. It makes very little difference what shape or form the metal is worked into, provided it is strong and substantial. Sir W. Snow Harris is perhaps the best authority on lightning rods, but, probably to be on the safe side, he recommends a large rod. He advises the use of a rod three-quarters of an inch in diameter, although he admits that probably never in the experience of mankind has a rod one-half inch in diameter been melted, and in every case where a rod a quarter inch in diameter has been melted, it has been in the form of a chain—this, of course, giving small connecting points between the links, offers great resistance; consequently, great heat and explosions at every link. There is little doubt but that a solid iron wire, one-quarter of an inch in diameter, will conduct any ordinary charge of lightning in safety, observing the necessary arrangements, the most important of which is the ground connection.

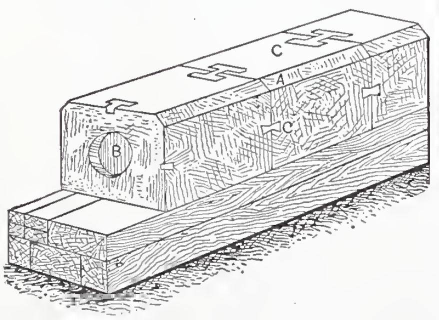
MASONRY.

Joggles, Dowels and Cramps.

The first builders evidently early entertained the idea of employing some contrivances to aid in securing close and durable connection between the masses of material with which they built by using adjuncts for what we may term the linkage of both wood and stone. In the former material we know that the mortise and tenon and analogous expedients were freely and judiciously used by the mediæval builders, and it is not surprising that methods nearly similar should have been put into practice in masonry at a date very early in the history of the art.

Theoretically, the blocks of stone used in the construction of edifices should preserve their position by the mere fact of superposition, in obedience to the laws of gravitation, always supposing that their beds are rendered perfectly parallel with each other, and their faces are kept precisely vertical. If we imagine an infinite series of blocks, perfectly quadrilateral in form, posed on each other with beds parallel to the horizon, such a structure must be, theoretically, stable, and needs neither mortars, cements, cramps, dowels, or any such extraneous aid. But, as a matter of fact, such ideal perfection is never attained, and mortars and cements, as well as joggles and dowels of various kinds, are by no means without their respective values.

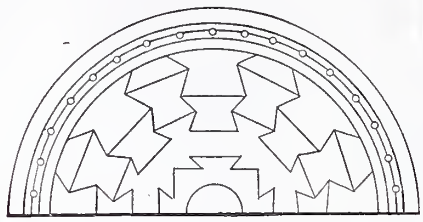
These latter aids to the stability of masonry can lay claim to a very respectable antiquity. The Greeks and Romans, who both employed gigantic masses of stone in their edifices, had recourse to various expedients of this description. We find in ancient architecture abundant evidence of the employment of both the dowel and the cramp. For the former iron bronze, copper, and hard wood were used, and sometimes the dowels were of very considerable size. Some used in the temple at Baalbec, which appear to have been of iron, must have been of im-



Masonry.—Fig. 1.—Example of the Use of Iron Cramps from the Remains of a Grecian Aqueduct, near Patara.

mense size, if we may judge from the cavities found in the blocks of stone forming the shaft of the column. Some of these recesses are a foot deep, and nearly as much in circumference. In the Colosseum, as was shown at the derangement of a part of the wall during the earthquake which occurred at Rome at the beginning of the seventeenth century, copper cramps, set in lead, were adopted. Bronze, so much employed in antiquity, was also largely used for cramps in early times. Even wood was not uncommonly employed for dowels. In the columns of the Parthenon, a square hole, worked at the quarry, was formed in the center of the shaft, which was occupied by a square dowel of hard wood, in which was a hole to receive a circular pin, also of wood. St. Jerome, in his Commentaries on Habakkuk, mentions wooden cramps as being, at his era, placed in the middle of walls to impart security to them. Le Roi, in his "Ruins de la Grèce," tells us that the course of a very ancient column which he had discovered near the mountains of Laurium had been provided with dowels of a hard red wood, some of which were still remaining, the holes for their reception having a depth of 4 inches and a breadth of 3 inches. The remains of an aqueduct of Grecian masonry, discovered near Patara, on the Lycian coast, had iron cramps in the form of the letter H, which were run with lead (Fig. 1).

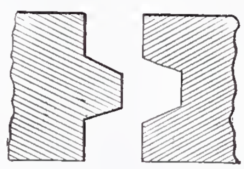
Long-continued metal ties were also used in ancient masonry, especially in entablatures where the spaces left in intercolumniation were great. Remains of these ties have been found connected with metal dowels and vertical bars, and inserted between the architrave and the frieze, the dowels in such instances being not infre-



Masonry.—Fig. 2.—Example of Dovetailing in Masonry, from the Eddystone Lighthouse.

quently metal rods long enough to go through capital, architrave, frieze and for some distance into the cornice.

By the architects of the Middle Ages, iron ties were frequently resorted to as a means of extra security. In the Early English work of Westminster, Salisbury, &c., such ties are employed at the springings of arches as linkage. In the spires of the cathedrals of Strasburg and of the church of St. Stephen, at Vienna, iron cramps and ties are

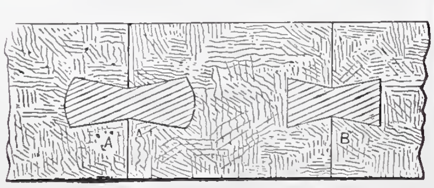


Masonry.—Fig. 3.—Common Joggle Joint, used in Staircases, Balconies, &c.

freely employed both in securing stability and in attached ornamental parts. In the Later Perpendicular also, iron ties are common, sometimes extending in connected lengths through the windows and piers.

The massive nature of the masonry and the styles in use throughout the Gothic periods rendered a remarkably free use of these expedients unnecessary, but with the rise of the Renaissance, when the horizontal construction, and especially the flat arch formed of voussoirs, came in, cramping was very freely used, particularly by the French masons, by whom it is still practiced to a considerable degree.

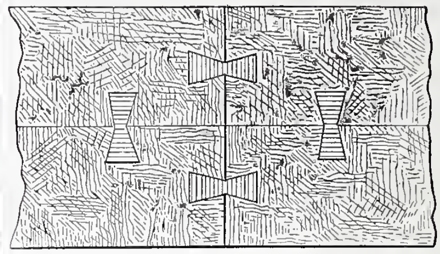
Of these various aids to the security of stonework joggling may be first taken, because nothing but the stone itself is required for the operation. Joggling is, in fact, precisely equivalent to the mortising and tenoning of the carpenter and allied expedients.



Masonry.—Fig. 4.—Ordinary Dovetail Dowel made of Hard Wood, Granite or Metal.

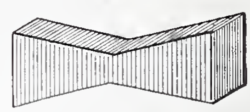
In this case one stone has a projection (sometimes called the male joggle) formed on its end, and the other stone is provided with a groove or recess (termed the female joggle) to receive it, as for landings of stairs, &c. Dovetail joggles or joints are used in lighthouse work with great success. Smeaton says, relative to the Eddystone:

"This made me turn my thoughts to what could be done in the way of dovetailing. In speaking, however, of this as a term of art, I must observe that it had principally applied



Masonry.—Fig. 5.—Oaken Dovetail Dowels, Sometimes Used in Mill Work, &c.

to works of carpentry. Its application in the masonry way had been but very slight and sparing; for, in regard to the small pieces of stone that had been let in with a double dovetail across the joint of larger pieces, and generally to save iron, it was a kind of work even more objectionable than cramping; for though it would not require melted lead, yet, being a superficial bond, and consisting of far more brittle materials than iron, it was not likely to answer our end at all. Somewhat more to my purpose, I had occasionally observed in many places in the streets of London that, in fixing the curb of the walking paths, the long pieces or stretchers were retained between two headers or bond pieces,



Masonry.—Fig. 6.—Enlarged View of the Dowels Shown in the Preceding Figure.

whose heads, being cut dovetail wise, adapted themselves to and were confined in the stretchers, which expedient, though chiefly intended to save iron and lead, nevertheless appeared to me capable of more firmness than any superficial fastening could be, as the tie was as good at the bottom as at the top, which was the very thing I wanted; and, therefore, if the tail of the header was made to have an adequate bond with the interior parts, the work would in itself be perfect. Something of this kind I also remember to have seen in Belidor's description of the stone floor of the great sluice of Cherbourg, where the tails of the upright headers are cut into dovetails for their insertion into the mass of rough masonry below.

"From these beginnings I was readily led to think that if the blocks themselves were, both inside and out, all formed into large

Masonry.—Fig. 7.—Common Form of Horizontal Cramp.

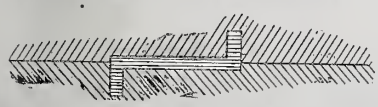
dovetails, they might be managed so as mutually to lock one another together, being primarily engrafted into the rock; and in the round and entire courses above the top of the rock, they might all proceed from, and be locked to, one large center stone.

"It is obvious that by this method of dovetailing, while the slope of the rock was making good by cutting the steps formed by Mr. Rudyard also into dovetails, it might be said that the foundation stones of every course were engrafted into, or rather rooted into, the rock, which would not only keep all the stones in one course together, but prevent the courses themselves, as one stone, from moving or sliding upon each other. But after losing hold of the rock by getting above it, then, though every stone in the same course would be bonded in the strongest manner with every other, and might be considered as consisting of a single stone, which would weigh a considerable number of tons, and would be further retained to the floor by the cement, so that, when completed, the sea would have no action upon it but edgeways, yet as a force, if sufficiently great, might move it, notwithstanding its weight and the small hold of the sea upon it, and break the cement before time had given it that hardness which it might be expected to acquire afterward. I had formed more expedients than one for fixing the courses to one another, so as absolutely to prevent their shifting."

Fig. 2 represents the kind of dovetail Smeaton used in the construction of this famous Pharos, which has for long defied the full fury of the Atlantic billows, but whose giant strength is now beginning to fail.

Fig. 3 shows a joggle joint in which the projecting portion fits into a corresponding recess. The terms "joggle," "dowel," "cramp," are often differently applied, according to local custom.

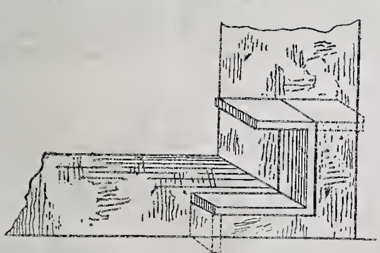
A dowel usually means a vertical or horizontal plug of wood or other material used



Masonry.—Fig. 8.—Another Form of Horizontal Cramp.

to obviate any slipping between the surfaces it connects, as in the stone courses of a column, already alluded to. Fig. 4 shows the ordinary dovetailed dowel, which may be either of hard wood or granite or metal. If the latter, bronze is preferable to iron. Iron dowels should be warmed and rubbed over with oil before they are run in. Lead is usually employed for this purpose in the case of iron, bronze, copper or bell metal, and Portland cement for wood and stone dowels; but the latter is now frequently used also for metals. Bed-dowel joggles are those where the dowel is not allowed to run through to the outer face of the work. Sometimes oak trenails or round dowels are used to prevent courses of stones slipping. Fig. 5 shows the dovetailed oaken dowels often used for connecting bed stones of steam engines and in millwork. The dowel is given separately in Fig. 6. The dowels should be of thoroughly seasoned stuff, and be boiled in oil before using.

Cramps are employed to tie in ashlering to a backing of brickwork, and for other similar purposes. Fig. 7 shows the common horizontal cramp, which is simply a flat piece of metal bent down at right angles for a short distance at each end. Fig. 8 is another form. At Fig. 9 is a modification of this, which forms a horizontal and vertical cramp in one. This latter is shown in section at Fig. 10. Figs. 11, 12 and 13 exemplify the plan

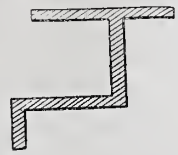


Masonry.—Fig 9.—Example of a Horizontal and Vertical Cramp in One Piece.

of tieing the ashlering and brick backing, Fig. 11 being a front section; Fig. 12 transverse ditto; and Fig. 13, the cramp with its pin. Bronze or bell-metal is better for cramps than iron, as the latter is liable to exfoliate from air and damp, which may cause splitting of the stone. During the restoration of the Cathedral of Cologne, the cornice which surmounts the 55 high windows, and is 3 feet 7 inches in hight, was secured by a number of iron cramps. These were put hot into the holes prepared for their reception, the latter being then immediately filled up with asphalt. This preserves the iron from rusting for centuries, and is superior to lead, sulphur or cement.

Ties are metal bars or rods, of considerable length, used to act against the effects of outward thrust, to connect different points, or to obviate displacement during settlement. To the former class belongs the iron chain bond, sometimes used in foundations, and the chains employed in the dome of St. Paul's.

Iron bolts, palisades, &c., are leaded in the masonry, as shown at Fig. 14, A being



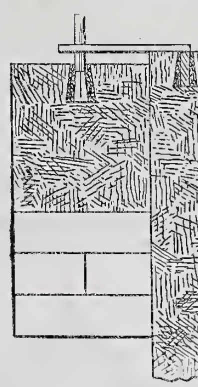
Masonry.—Fig. 10.—Section of Horizontal and Vertical Cramp, the Use of Which is Shown in the Preceding Figure.

the shank of an upright bolt, placed in a hole in the stone, molten lead being afterward poured around it. Where the hole is in the vertical face of masonry, as at B, a cup of plastic clay is molded below and around the iron to retain the lead until set. Care must always be taken that the stone be not damp when the lead is poured.

(To be continued.)

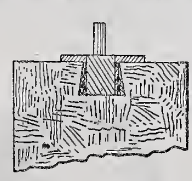
Trees and their Ailments.

At first thought it may seem odd that trees should be almost as liable to disease as man, but such is undoubtedly the case. A comparison of the diseases peculiar to trees and those afflicting the human race would develop many points of similarity. The causes of disease in trees very much resemble some of the causes of disease in man. Diseases in trees may arise from accident,



Masonry.—Fig. 11.—Method of Tieing Ashlaring to Brick Backing by Use of a Cramp and Pin. Transverse Section.

from lack of proper nutriment, from unfavorable surroundings, and from bad management. A prominent writer in a recent number of an English periodical states that the principal diseases likely to be brought on forest trees by bad management are: 1st, bark-bound; 2d, moss or lichen upon the bark; 3d, stag-horn tops; 4th, scale; 5th, premature bearing of seed; 6th, dropsy; 7th, ulcers; 8th, wounds; 9th, stunted growth of the young wood. Now, in addition to these defects, we have in the manufactured timber such matters to contend



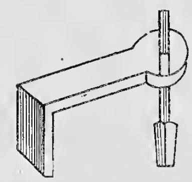
Masonry.—Fig. 12.—Front Section of Ashlaring, Showing Cramp and Pin.

with as dotiness and the excess of sap and weariness, concerning which so many complaints are made. The disease called bark-bound is caused by the bark being girded or bound about the wood of the tree, thereby preventing the proper flow of the sap, and also arresting the descent of woody matter between the wood and the bark. In this case, if the cause of the disease be not checked in proper time, the vital fluids become gradually checked, till at last the passages became entirey closed, and as the natural consequence the tree dies.

The appearance of lichen on the bark of trees is not always a decided symptom of disease in them, but may be occasioned by a temporary derangement in the outer bark; and if observed in time, like any other disease, may be arrested by removing the cause before it has had time to become decidedly fixed in the constitution of the trees affected.

Willows and poplars, which luxuriate in a soil rather damp than otherwise, generally become stag-horn topped when grown in a soil too dry for their healthy development. Elm, oak, ash, plane, &c., generally become in the same condition when the soil in which they may be growing is too damp for maintaining them in a healthy state.

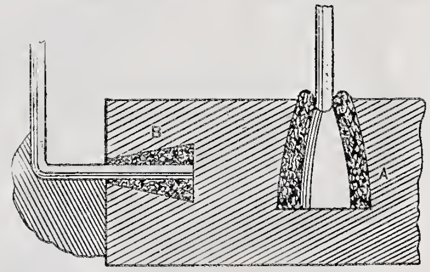
Scale is a small white insect found clinging to the bark of some species. In forest trees it is most frequently found upon the



Masonry.—Fig. 13.—View of Cramp and Pin Employed in the Operation Shown in Figs. 11 and 12.

ash while in a young state. The scale is easily distinguished by the appearance of the insect upon the surface of the bark. It presents itself as very numerous small white spots, like those on the bark of the birch; and if the observer take a stone and draw it roughly along the tree, he will kill many of the insects and see their blood give a red tinge to the bark. As to premature bearing of seed, trees in a healthy, rapid-growing state are seldom found to produce seed until they have arrived at a considerable age and size. Generally speaking, any forest tree bearing much seed under 40 years of age is not likely ultimately to arrive at a valuable size. When a young tree produces a profusion of seed, there can be no doubt that it is in a state of premature decay; therefore we may be at once assured that such trees will not become valuable as timber.

Dropsy generally takes place in forest trees, either where the soil is too rich for them or where there is an excess of moisture about the roots. The cause of it appears to be that the roots take into the system of the



Masonry.—Fig. 14.—Method of Inserting and Fastening Iron Bolts and Ties in Stone Work.

tree an excess of juice, which the bark and leaves cannot assimilate. In this disease unnatural swellings are observed on some part of the stem, which begin to rot and throw off the bark. It is incurable, and the only thing is to prevent it by attention to the ground being well drained and not over rich.

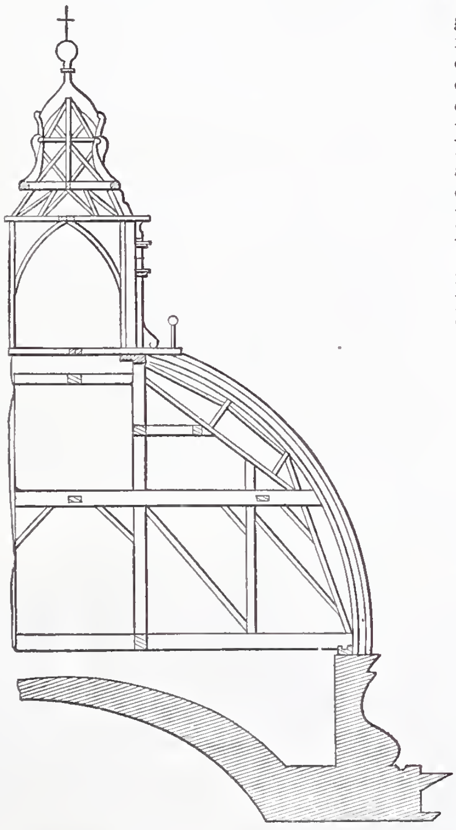
An ulcer much resembles dropsy, but it is mostly confined to the larch and others of the coniferous tribes. Its appearance is that of a running sore upon the side of the stem, where the natural juices escape in the form of a hard resinous matter. This disease is mostly found upon young trees of these tribes, and is frequently occasioned by insects lodging their eggs in the inner bark, where the young live for a time and destroy the albumen.

Wounds are often caused by the trees receiving damage on their stems by having the bark peeled off by accident in some way or other, which may prove injurious to their health, and not unfrequently be the cause of death; but any simple wound made upon a healthy tree is seldom, if ever, found injurious, but soon heals up.

The stunted growth of young wood is at once apparent by the very short annual growth of young wood upon all the lateral branches, and may be in general the natural result of any of the diseases already described. Every tree, when it has attained its full size and the development of its nature, however healthy it may have hitherto been, gradually begins to fail in making young wood. This is the work of time, doing to the old tree what the disease does to the young.

Dome Roofs.

The dome, or cupola, as a form of roof, does not appear so early in the history of architecture as might have been expected, there being various suggestive rude constructions—for example, a wattled hut with its osier withes gathered together at the top, and hence assuming a roughly spherical contour. The Egyptians, the Assyrians, and even the Greeks, were ignorant of the dome; and it was reserved for the Romans to become the bold constructors of domical roofs of masonry. It is possible that they owed this, as many other of their distinctive architectural methods, to the Etrurians of northern Italy. The ruins of several temples and thermæ, or hot baths, still remain to attest their skill in this plan of roofing, among these being the Pantheon at Rome,

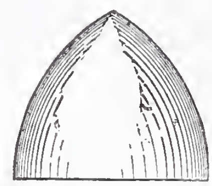


Dome Roofs.—Fig. 1.—Section of the Dome of the Val de Grace, Paris.

the most magnificent dome of antiquity, the internal diameter of which is no less than 142 feet 8½ inches, and its hight from the top of the attic 70 feet 8 inches. This was built during the reign of Augustus, at the grandest period of Rome's power. Not inferior, however, to this is the famous basilica erected when that power was already beginning to wane, the Church of Santa Sophia at Constantinople, now a Turkish mosque. This is the first dome built on pendentives.

The term "dome," we may here remark, should properly be only applied to the external part of the roof, and "cupola" to the internal. The words are now frequently, but perhaps incorrectly, taken to be synonymous.

In framed domes or cupolas of timber, the principal difficulty consists in obtaining accurate framing, as if this is well done the roof is almost certain to be stable, whatever be its form; in fact, domical or conical roofs are of all others the most easy of construction. A dome cannot fall except some part of the bottom of the truss springs out, and this liability is easily provided against. An iron hoop or chain around the base, or a strong timber circle or straps uniting the trusses and the purlins, will effectually obviate the danger. Any inclination to fall inward is hindered by the trussing. As also beauty demands that a dome should spring at its base almost vertically from the supporting walls, there can be scarcely any thrust upon the latter, as in roofs of different form. The only part, indeed, where this may be feared is where the tangent is inclined from 40 to 50 degrees to the horizon, and at this place a ring of strong ties is advisable. Domes in which horizontal tie-beams can be used have greatest strength, and these can be elevated to accommodate

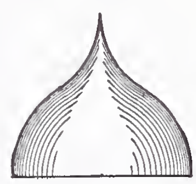


Dome Roofs.—Fig. 2.—Dome Composed of Two Arcs of Circles.—Contour of St. Paul's Cathedral, London.

demands for internal space until they form a species of collar.

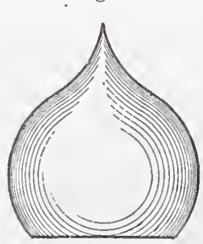
The variety of forms of domes is very great, and depends mainly upon the plan from which they spring, which may be either circular, polygonal, or elliptical. The circular form again admits of variety, as spherical, spheroidal, paraboloidal, &c. A dome which rises higher than the radius of the base is termed a surmounted dome; such as are of less hight than the radius are diminished, or surbased, domes; and the term cupola is by many restricted to a dome having a circular base.

Upon the circular base, however, many forms may be raised. Thus Fig. 2 is a pointed dome, composed of two arcs of circles meeting. This is the contour of St. Paul's Cathedral, London. At Fig. 3 we see a



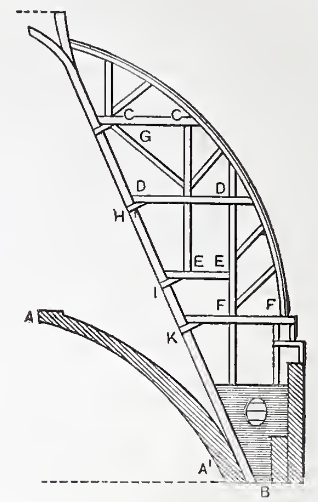
Dome Roofs.—Fig. 3.—Dome Springing Perpendicularly from Base, Having a Concavity Toward the Top.

dome springing perpendicularly from its base, and having a slight concavity directed upward. A similar contour is presented at Fig. 4, with the exception that the lower part spreads outward; and Fig. 7 is similarly shaped, but with a quicker convexity. These two latter forms are often seen in Saracenic, Hindu, or Russian architecture. They appear to have been introduced into England about the reign of Henry VII, and came into general use during that of his son. The surmounting turrets of the octago-



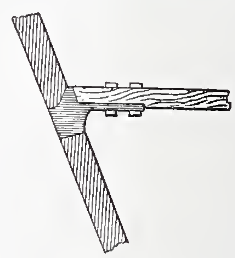
Dome Roofs.—Fig. 4.—Dome Swelling out Above the Base, and Having a Concavity Toward the Top. Found in Saracenic, Hindu and Russian Architecture.

nal buttresses of Henry VII's chapel at Westminster Abbey are of this shape, and the summits of the towers of King's College Chapel, Cambridge, and the turrets of Christ's College, Oxford, the work of Sir Christopher Wren, are crowned with similar domes. The axial section of a dome on a circular base may also adopt a segmental form, as at Fig. 8, which was the shape



Dome Roofs.—Fig. 5.—Half Section of the Dome of St. Paul's Cathedral, London.

usually adopted by the Romans, and is that of the exterior dome of the Pantheon at Rome. The semicircular contour, as at Fig. 9, was also in fashion among the Romans, and has been more adopted in modern architecture than the segmental shape. Ellipsoidal domes, Fig. 10, whose axes are greater than their semi-axes, and those of a parabolic, or hyperbolic, shape, Fig. 11, can be raised on a circular plan. The pointed dome, Fig. 2, and



Dome Roofs.—Fig. 6.—Detail of Iron Cramps Used in Connecting Framing to Masonry in Dome of St. Paul's Cathedral.

the semicircular, Fig. 9, have also been adapted to a square plan. So likewise have the Turkish, Fig. 12, and the bell or inverted chalice shape, Fig. 15. The bell-shaped dome succeeded the convex shapes of the reigns of the later Henries, and were adopted in England during the reigns of Elizabeth and James I. Specimens are to be found at the Tower of London, and at Audley End, in Essex. Pointed ellipsoidal domes, and those formed by the meeting of arcs, are adapted

Dome Roofs.—Fig. 7.—A Dome Similar to that Shown in Fig. 4, and also Found in Saracenic, Hindu and Russian Architecture.

to octagonal bases, as at Fig. 16 and Fig. 18, the latter being the contour of the dome of the Cathedral Church of Santa Maria del Foire, at Florence.

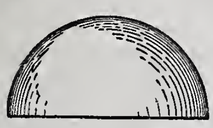
The arrangement of the plans of the trusses for domes may vary considerably, according to the requirements of the construction. At Fig. 21 is a series of trusses, placed so as to correspond with the diameter of the lantern which surmounts the dome, the interspaces being filled in with half trusses. In the plan Fig. 20, on the other hand, all the trusses radiate from the center, and are of one kind. At Fig. 22 another radiate method is shown in plan.

Of domes in which the beams of the roof trusses are carried across the whole internal space, we may instance that of the Val de Grace at Paris, Fig. 1. This is formed of four main trusses, of which two cross the others at right angles, leaving an opening to the central lantern with its cupola. Sixteen half-trusses are placed equidistantly around the dome, converging to the center, and these carry the rafters which bear the external covering. Where the exterior effect only is studied, this species of framing can be applied, and also in cases where it is simply requisite to hide or protect an inter-

Dome Roofs.—Fig. 8.—Segmental Form of Dome.—Employed in the Exterior Dome of the Pantheon, Rome.

nal dome of masonry; but it is obvious that it can present no internal cupola, with the advantages of its lofty space and capacity to receive ornamentation.

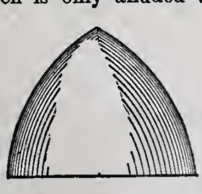
The celebrated roof of the Hotel des Invalides at Paris, is another example of a framed timber dome, composed of four principal trusses, which cross at right angles in the center, and join in a vertical double post (Fig. 14). Each quarter or interspace between these principal trusses contains two semi-trusses of a similar kind and four smaller trusses, the whole being retained in their proper places by powerful interties. The external diameter of this dome is 90 feet, and the hight of the building to the top



Dome Roofs.—Fig. 9.—Semicircular Form of Dome Used in Roman Architecture.

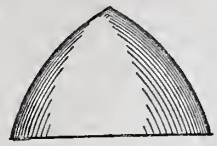
of the cross surmounting the lantern, 330 feet. It is covered with lead like St. Paul's, but its framing is much heavier. This roof was constructed by J. Hardouin Mansard, and, despite the severe strictures of Rondelet in his magnificent French work upon carpentry, is a skillfully framed and well-balanced arrangement.

About the same period that Mansard built this roof, the dome of St. Paul's Cathedral was designed by Sir C. Wren. The system of the framing of the external dome of this roof is given in half section at Fig. 5. The internal cupola A A[1] is of brickwork, two bricks in thickness, with a course of bricks 18 inches in length at every 5 feet of rise. These serve as a firm bond. This dome was turned upon a wooden center, whose only support was the projections at the springing of the dome, and which is said to have been unique. Outside the brick cupola, which is only alluded to in order



Dome Roofs.—Fig. 10.—An Ellipsoidal Dome.

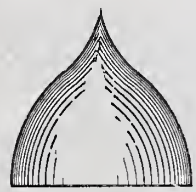
that the description may be the more intelligible, rises a brickwork cone, B B. This is 18 inches thick, and plastered and painted. A portion of this can be seen by a spectator on the floor of the cathedral, through the central opening at A. The timbers which carry the external dome rest upon this conical brickwork. The horizontal hammer beams, C D E F, are curiously tied to the corbels G H I K, by iron cramps, well bedded with lead into the corbels and bolted to the hammer beams, as shown more in detail at Fig. 6. The stairs or ladders by which the ascent to the Golden Gallery, or the summit of the dome, is made, pass among the roof trusses. The dome has a planking from the base upward, and hence the principals are secured horizontally at a little distance from each other. The contour of this roof is that of a pointed dome or arch, the principals being segments of circles; but the central opening for the lantern of course hinders these arches from meeting at a point. The scantling of the curved principals is 10 inches by 11½ inches at the base, decreasing to 6 inches by 6 inches at the top. A lantern of



Dome Roofs.—Fig. 11.—A Parabolic or Hyperbolic Dome.

Portland stone crowns the summit of the dome. The method of framing will be clearly seen in Fig 5. It is in every respect an excellent specimen of roof construction, and is worthy of the genius and mathematical skill of a great architect.

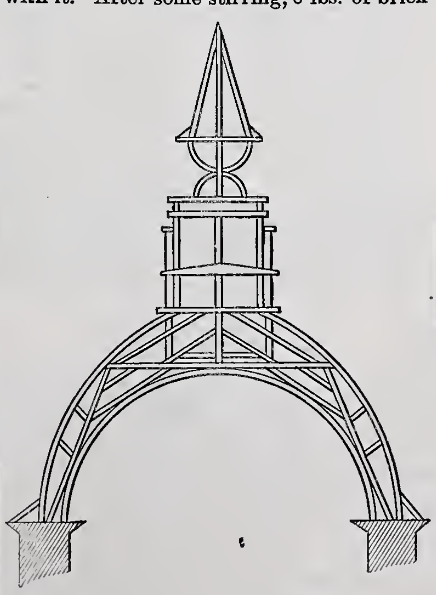
Fig. 17 is a dome designed by Jousse, and is of very simple construction. There are eight principal trusses which support the lantern. Fig. 13 is a dome with radiating trusses from a design by Stierme, respecting which technical opinions have been some-



Dome Roofs.—Fig. 12.—A Turkish Dome.

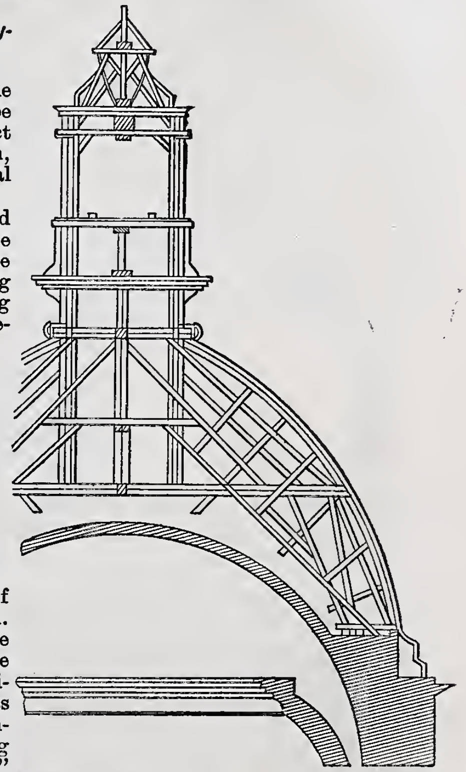
what divided, but which has the merit of being a very light and elegant composition. Fig. 19 is a section of the roof of the Register Office at Edinburgh, built by the brothers James and Robert Adam, the architects also of Exeter Hall. This roof was highly commended by the late Prof. Robinson, an authority on sound framing, as being "very agreeable to mechanical principles." Its span is 50 feet clear, and the thickness only 4 feet 6 inches.

Drying Damp Walls.—The following procedure is described by a German paper as a reliable means of drying damp walls. The wall, or that part of it which is damp, is freed from its plaster until the bricks or stones are laid bare, next further cleaned with a stiff broom, and then covered with the mass as prepared below, and dry river sand thrown on as a covering. A hundredweight of tar is heated to boiling point in a pot, best in the open air; keep boiling gently, and mix gradually 3½ lbs. of lard with it. After some stirring, 8 lbs. of brick-



Dome Roofs.—Fig. 13.—Dome of Light and Elegant Composition, Designed by Stierme.

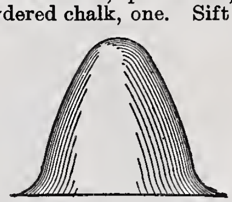
dust are successively put into the liquid and moved about until thoroughly disintegrated, which has been effected, when, on dipping in and withdrawing a stick, no lumps adhere to it. The fire under the pot is then reduced, merely keeping the mass hot, which in that state is applied to the wall. This part of the work, as well as the throwing on of the river sand against the tarred surface, must be done with the trowel, quickly and with sufficient force. It must be continued until the whole wall is covered both with the tar mixture and the sand. The tar must not be allowed to get cold, nor must the smallest possible spot be left uncovered, as otherwise damp would show itself again in such



Dome Roofs.—Fig. 14.—Section of the Roof of the Hotel des Invalides, Paris.

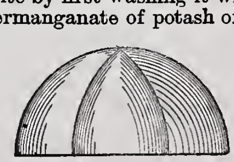
places, and where no sand has been thrown the following coat of plaster would not stick. When the tar covering has become cold and hard, the usual or gypsum coating may be applied. It is asserted that if this covering has been properly dried, even in underground rooms, not a sign of dampness will be perceived. About 300 square feet may be covered with the quantities above stated.

To Clean Marble.—Common soda, two parts; pumice stone, pulverized, one, and finely-powdered chalk, one. Sift through a



Dome Roofs.—Fig. 15.—A Bell Shaped Dome.

fine sieve and mix with water. Rub all over the marble until the stains are removed. Then wash the stone with soap and water. Marble that is yellow with age, or covered with green fungoid patches, may be rendered white by first washing it with a solution of permanganate of potash of moderate



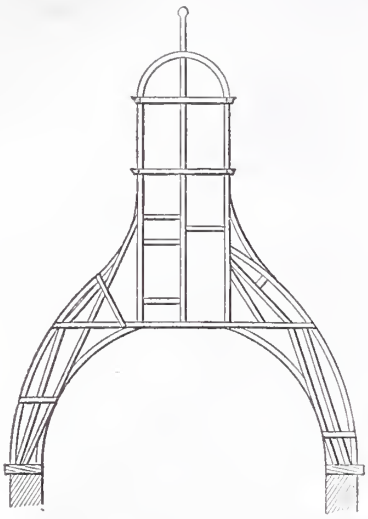
Dome Roofs.—Fig. 16.—A Dome Formed by the Meeting of Arcs.

strength, and, while yet moist with this solution, rubbing with a cloth saturated with oxalic acid. As soon as the portion of the stone operated upon becomes white, it should be thoroughly washed with pure water to remove all traces of the acid.

CORRESPONDENCE.

Comments on the Prize Designs.

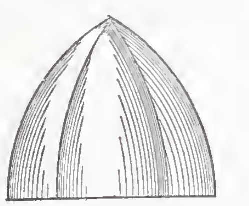
From J. C. N., *Shasta City, Cal.*—I am an ex-New Jersey carpenter who came out here about three years ago, bringing my chest of tools and expecting to work at the trade, but have found other and more remunerative fields, and therefore do not handle my kit now, except to polish them up now and then. But though the tools I used



Dome Roofs.—Fig. 17.—Dome Designed by Jousse, Having Eight Principal Trusses Supporting Lantern.

—some of them for 25 years—are now honorably mentioned on the retired list, still I must have my *Carpentry and Building* sent to me regularly, and peruse its contents from beginning to end, for the trade and I were always good friends, although I did fail of gathering up much wealth while at it. For myself I will freely confess that I never found it press on me like the shackles of a bondage. In fact, the original curse in the garb of carpentry I think not a bad road-fellow.

But what I started out to speak of was the first prize design in the recent competition for cheap dwellings. I think the critics who have taken it in hand—they are, I presume, both carpenters and architects—have forgotten one extenuating circumstance, general in character, but which it might be well to bear in mind. Every carpenter who has erected a building to a set of plans by an architect knows—and every architect probably knows, even though he does not care to remember—that in the course of the erection of the building which the archi-



Dome Roofs.—Fig. 18.—Contour of the Dome of the Cathedral Church of Santa Maria del Foire, Florence.

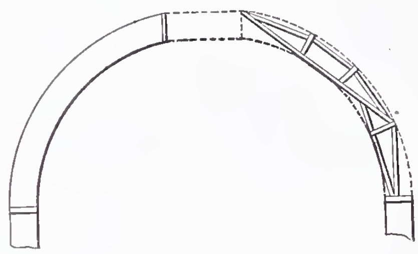
tect has mapped out, there are almost always features in which the builder has to bring his wider experience to bear upon the matter, in order to draw things to a successful consummation ; or else it is that there are particulars which look all right as represented in scale, but won't quite work in practice. Let me illustrate by one of the more exaggerated types, in order to fully show what I mean :

I had the contract to build a very handsome barn—it was while I lived in New Jersey—the plans being gotten out by an architect of some repute. The barn was L-shape, and the roof of both main part and wing were drawn to be of the same hight in the front and only elevation, while in plan the wing was considerably narrower than the main part. The effect of viewing the two gables so constructed in quick succession can be imagined ; one would have been a "lightning splitter," and the other moderately steep only.

For my part I agree with the evident belief of the "committee of experts" who decided on the plans, that the presence of minor and unimportant discrepancies are not to be allowed too cogent a power in one's passing judgment on anything. It would be as just to execrate George Washington because of his hatchet and cherry-tree exploit. I consider it no condescension on my part to say that I would rather have the house as built after the first prize plan than after any of the others—architects to the contrary notwithstanding. Though I think, if it were mine, I would case down even with the outside strings of the front stairs, and use the space under them as a pantry, opening, as it does, into the dining room.

I think the architects of that plan have utilized space to great advantage, and, furthermore, have given a house which, in my opinion, and I am the more confident because the "committee of experts" are behind me, is outwardly of such an appearance that no man who pays $1000 for a house need be ashamed to live in. It is neat, compact and offends the eye in no particular.

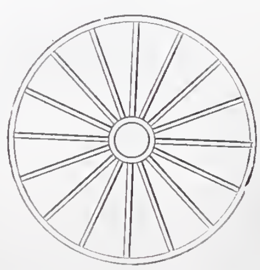
From W. B., *Springfield, Mass.*—I am a knight of the plane, saw and square, and I consider it more honorable than the Star or Garter. In fact, sir, I place my business right up among the liberal professions, such as doctoring, lawyering or schoolmastering. I am also the hero of many hard-fought battles, and though my implements of warfare are not wanting in teeth, and their proper use tends to greatly increase the size of my board bills, they are not the same that



Dome Roofs.—Fig. 19.—Section of the Roof of the Register Office at Edinburgh, Scotland.

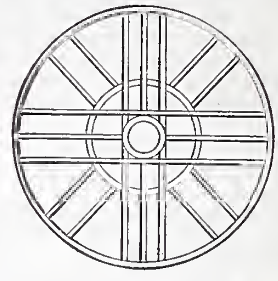
our friend Sampson is said to have employed in his encounter with the Philistines.

I have been in the building business since 1856, and have during that time taken and carefully read all the publications relating directly or remotely to my business that I could get, and have been a correspondent of most of them. If I told one of them it was the most effulgent luminary of the 19th century, called the Editor an intellectual giant, and said that the paper was the lever that had raised the toiling millions of America from the most abject poverty to comparative affluence, my communication was printed, and my reference to the paper or Editor would be certainly put in capitals. But if I intimated that the mental Hercules had better return to the editorial chair from his vacation and relieve the office boy of editorial duties, then in the next number I should read that a press of other matter had "crowded out the commu-



Dome Roofs.—Fig. 20.—An Arrangement of Trusses, all Radiating from Center.

nication of our talented contributor, W. B. (which we believe stands for Wood Butcher), from the Cannibal Islands" or some other well-known place, and that would be the last I would hear of it. Now, Mr. Editor—or, if there are two of you, Messieurs Editors—you do not seem to be of that kind, and that is one great reason why I like you, for I notice that you print in full the communications from those who criticise you unfavorably. But perhaps you are young and do not know the ways of the veterans of journalism, and you may take the hint from what I have written and change to their ways. If so, I shall class you with my



Dome Roofs.—Fig. 21.—An Arrangement of Trusses and Half Trusses Corresponding to the Diameter of the Lantern.

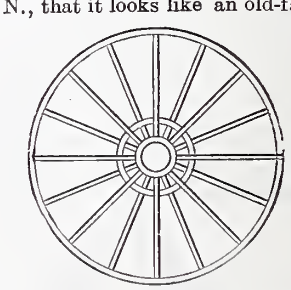
cucumbers, because I like you best when you are green. Not only do I like you because you let even the grumblers have their say, but also because you take so much pains in making cuts to illustrate the ideas of your correspondents. By this we have the means for a complete interchange of modes of doing different kinds of work in all sections of the country, and from it we can choose those plans best adapted to our purposes.

But my object in writing at this time is to give my ideas concerning the competition designs and of some of the criticisms which have been published. When I read the advertisement offering prizes, it occurred to me that the man who sent in the picture of a beautiful landscape, showing a bevy of pretty girls engaged either at croquet or archery, with a love of a cottage—no matter how impracticable in arrangement and construction—rising from a prominent point in the grounds, would surely receive the first prize. Now, I am obliged to say that my surprise at the actual result is only surpassed by my gratification. As the designs are all in, discussion is in order.

I think that design No. 1 is entitled to the first prize for the following reasons :

1. It has more rooms.
2. The rooms are larger.
3. The arrangement is more convenient for doing the work of the family likely to occupy such a house.

I cannot agree with your correspondent A. D. N., that it looks like an old-fashioned



Dome Roofs.—Fig. 22.—An Arrangement of Radiating Trusses.

"lean-to." A tasty builder (and a builder should have tastes as well as an architect) will execute that design in a way to give it a fine appearance, and will make a more attractive looking house than the cuts indicate. I do agree with that correspondent, however, when he says "it would be very amusing to see a six-foot-one-and-a-half-inch man, wearing a stove-pipe hat, going up the front stairs, without a light, on a dark night; but I think the amusement would be in the attempt to see him without the light rather than any accident likely to occur to him. The head-room of those stairs, it is true, is scant, particularly at the point where the hip rafter crosses the stairway, but it is not so bad as your correspondent intimates. Possibly he has attempted to work it out "without a light."

I desire to say to A. D. N, and also to T. E. M., both of Worcester, Mass. (a singular coincidence ; is it possible thereby hangeth a tale?), that I can take those plans and construct a house that shall have a door under the stairway of sufficient hight for any person to pass through, also sufficient head-room up the stairway, without departing more from the plans as given in *Carpentry and Building* than we as builders are obliged to do in nine-tenths of the plans as they come from the hands of the architects. I know it will be said that if I change one of the dimensions given it changes the plan ; it ceases to be that plan and becomes another one. But every builder of experience knows that plans from even the best of architects have to be changed in very important particulars before they "will figure out," as the workmen say. At any rate, with an experience under some 50 different architects in four different States, I do not now recall a single exception. So much is this recognized as the case, that the stair-builders have coined an expression for steep stairs and low head-room, and call it "hauling you through an architectural rat hole." These mistakes are often, and I think I may say usually, corrected by the carpenter without the knowledge of the architect, and it will not surprise me at all to have the designers say that their plans are practical because they have been executed from the same drawings. An example of this came under my notice but a short time since when a professor of "carp. and join." told a professor of "pure orders and beautiful forms" that a roof could not be put on as he had drawn it. The latter told him he was taking the absurd position of saying that what had been done could not be done. Prof. Carp said it had never been done and never would be. Each to convince the other went some 15 miles to the house, only to find that the carpenter had quietly changed the plan to the only practical way of putting the roof on ; and to the inquiry what right he had to change a plan, he replied: "I knew the house had to have a roof, and thought I would get it on as quietly as possible.

Perhaps the closet over the hall is not all the uninitiated might expect, yet I think that, from expressions I have heard, many a housewife dwelling in a more pretentious cottage would be glad to exchange some ornamental portion of her house costing more, for so good a closet as that.

A great deal of what I have written will also apply to the criticisms of plan No. 2 by your correspondent A. F. L. His criticisms are those mostly of omissions, and he is probably aware that most of the architects protect themselves by a final clause in their specifications, something like this : "And everything necessary to make a complete house shall be performed by said builder, even though omitted in plans or specifications, without extra charge." But if H. F. L. cannot make a tight roof without flashing, I have only to say that his mechanical education has been sadly neglected.

I have made a much longer letter than I intended, but perhaps you will be as gracious as the first young lady on whom I made a long call. After three hours of incessant talking, I said : "I must go," and asked her if I could come again? "Well, yes," she said, "you have talked so much this time that I think you will not have much to say next time, so come."

Hale & Morrison Reply to Their Critics.

From F. A. Hale *and* W. L. Morrison, *Authors of the First Prize Design, Rochester, N. Y.*—We notice in the September number of *Carpentry and Building* several unfavorable comments upon our design lately published. In justice to the Committee of Award and to ourselves, we feel called upon to intrude upon your columns.

To "O. O. J."—It is of course absurd to suppose that printed drawings at a scale of 1-16 of an inch to the foot can be relied upon for scale measurement. In our original plans, which are accurately drawn to a large scale, the hall measures 7 feet broad by 7 feet 6 inches deep. This leaves an abundance of room for the front door to swing. In the printed plan the width of the dining room scales only 9 feet 8 inches, while it should be 10 feet 6 inches, as figured. The hall likewise scales too little. If correctly scaled, the space admits of another riser before the stairs reach the dining-room door. This gives practically 6 feet 5 inches headroom. Very little, we admit, but enough to make the door of service if required.

To "G. H. H."—According to the best sanitary authorities it is very conducive to health to sleep in a cold room. Holding fast to this idea, the authors of the design have carefully avoided placing any temptation in the shape of another chimney before the unwary future occupants. A modern baseburner, placed in the sitting room, would heat both sitting room and parlor in zero weather—yes, and in all ordinary weather, the dining-room, too. The size and hight of these rooms must not be lost sight of. As regards labor and material in this locality, we beg leave to refer G. H. H. to the builder who revised our estimate. Mr. Arnold is a builder of well-known abilities and of acknowledged integrity, and is better posted than we are upon that subject.

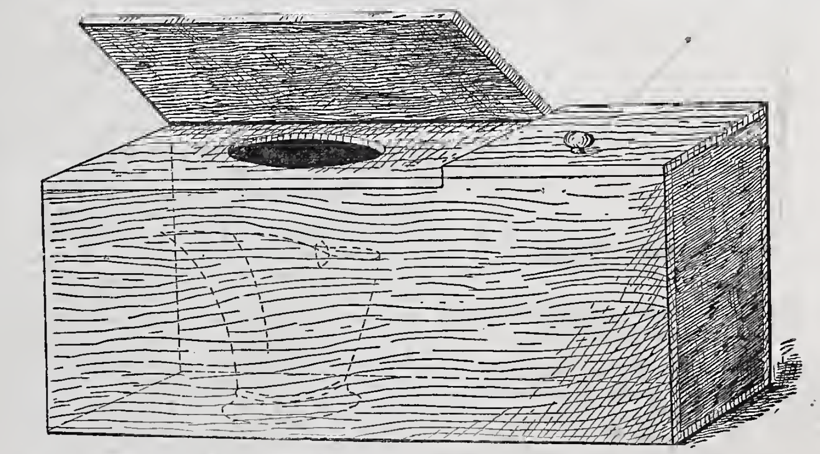
To All Readers.—One of the pleasantest features of a competition of this kind is the amount of wit displayed by some of the unsuccessful competitors and their friends, which, but for such an opportunity, would have been entirely lost to the world. One man, whose eyes, we judge, are more penetrating than his mind, speaks of "seeing a man go up stairs on a dark night without a light." If this party will turn those eyes upon our specifications he will find a provision made for head-room for the cellar stairs. As regards the 21 doors, the error lies in a misprint. In our original specifications was written "1 (one) single door, 2 feet 10 inches by 7 feet 4 inches." While convulsed with laughter at the wit of this gentleman, we must confess that its underpinning is rather weak. It will be noticed that nearly all the comments refer to the lack of something in the design. One party deplores the lack of an additional chimney ; another complains of the hall being small and the head-room close. To be sure, we would gladly have added a billiard room, boudoir and conservatory, and, indeed many other luxuries, but we have conscientiously endeavored to carry out all the conditions of the competition. What success we have attained in this respect we leave to the fair judgment of the numerous readers of *Carpentry and Building.*

A Cheap Earth Closet.

From C. B. S, *Burr Oaks, Mich*—Will you please give directions for making a cheap earth closet in an early number of *Carpentry and Building?*

Answer.—A convenient form of earth closet is shown in the accompanying illustration. It is a box without any bottom and with a double cover, as shown. The reason for omitting the bottom is that anything that may spill around the receiver is more easily removed with a broom by moving the closet than it would be if the box had to be overturned, and so emptied. The receiver is an ordinary galvanized coal hod of large size. The box need be only high enough to allow this to stand within it. When not in use both covers are to be kept closed. When used the outside or top closet is thrown back. After use, the seat is raised and a quantity of dry earth, or the fine siftings of coal ashes, is thrown in with a small fire shovel. The earth or ashes is kept at hand in any convenient receptacle, or the box constituting the closet may be divided into two parts, as shown in our illustration—one for the seat or receiver, and the other for the earth or ashes. The cover of the earth-box should in this case be a continuation of the seat; so that when the seat is raised the earth-box is uncovered at the same time. A small quantity of earth or ashes should be thrown into the receiving vessel before it is used, to absorb the liquid excrement and prevent the solid sticking to the metal surface. If as much ashes or earth is thrown into the receiver every time it is used as is necessary to cover the offensive matter completely, the receiving vessel will require no attention until it is full. It is then emptied and returned to its place. If the closet is managed with a due regard to decency, the work of emptying it is no more disagreeable than that of emptying a bucket of damp ashes.

The form of closet recommended above has the advantage of being the cheapest known to us. We further regard it as the best form with which we are acquainted. The earth closets manufactured under the various patents are unsatisfactory and are seldom retained in use. The mechanical contrivance for throwing down a certain quantity of earth every time the closet is used by raising a handle or moving a lever are convenient for lazy people, but they are not always, if ever, satisfactory in their operation. The cost of such a closet as we have described ought not to exceed $3, complete.



A Cheap Earth Closet, with Ash Box.—Answer to C. B. S., Burr Oaks, Mich.

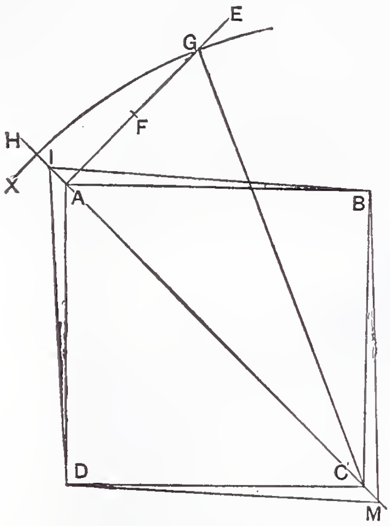
Having tried everything available as a medium of deodorizing the contents of the receiver, we find the siftings of anthracite ashes the cheapest, cleanest and best. It is difficult to get earth dry enough unless it is dried artificially, which is troublesome. Every family makes ashes enough in a year to run one earth closet on the fine siftings, than which nothing better is to be found.

Problems in Framing.—Another Method of Constructing a Diagonal Section of Corner Posts.

From J. W. F., *East Orange, N. J.*—Have read the articles entitled "Some Problems in Framing" as they have appeared up to this time, and consider them by odds the most practical and interesting, as involving the principles of pure carpentry, of anything that has yet appeared. Not only are they covering all the points of difficulty that arise in course of framing this proposed California tank tower—and these are by no means few—but they go down to the root of the principles brought into play, and will serve as rules or formulas for the framing of any building involving the same principles in these countless combinations possible in architecture, and which make it such an inviting study.

In the September article you give two processes of finding the amount necessary to be trimmed or taken from the faces of the post in order to make them square with the building when put into position. One is by means of the square, the process, I suppose, most likely to be used when the trimming-off was done at the place of framing; but in case the timber was sawn to the proper shape at the mill, then the amount would have to be found by a diagram. In place of the method given in the September number, I propose the following, which I think has some advantages. As explained in connection with the sketch inclosed, it is as follows:

Let A B C D be the end section of the post when cut off square. Draw the diagonal A C, prolonging it indefinitely, as shown. At the point A of this diagonal erect a perpendicular, as shown by A E, on which lay off twice the amount of the bevel of the proposed cut, as measured by



J. W. F.'s Method of Constructing a Diagonal Section of the Corner Posts.

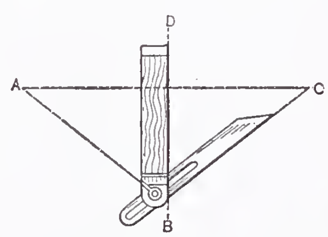
the grain of the cut in the width of the post, all this being similar to the processes given in the September article. These distances are shown by A F and F G. Then, of course, C G will represent the diagonal of the parallelogram or rhombus shown at the foot of the post when cut off to the proposed bevel. From the point C as center, and with this diagonal C G as radius, strike the arc G X, intersecting the prolonged diagonal of the square in the point H. Then of course A H represents the difference in length between the diagonal of the square and the diagonal of the parallelogram or rhombus we are seeking to find; while, as remarked in the demonstration in the September number, the short diagonal of this parallelogram or rhombus will coincide in length with that of the square, then bisect the line A H, as shown by A I and I H, and lay off the distance I H from C, as shown by C M. Connect I and M with lines drawn from B and D, and the figure bounded by I D M B will be the rhombus representing the required section of the post.

Of course this process is not materially different from that given in the September number of *Carpentry and Building*. The advantages of it are, it seems to me, that it is shorter, simpler, and when completed furnishes at once, by the fact of the square section inclosed, just the amount which must be trimmed off the post.

Applying the Bevel to Timbers Before and After Backing.

From G. H. H., *Germantown, Philadelphia, Pa.*—I have read the Editor's remarks in connection with my letter published in the September nnmber, concerning "Problems in Framing." In the note the assertion is made that in applying the bevel to a post it makes no difference in the result whether it be while the post is square or after it has been backed. I really must differ, at least until I can see wherein I am wrong. I have experimented by dressing a piece exactly square, then cutting it off to a set bevel, afterward dressing the piece to a rhombus, and then applying my bevel again. The line last obtained does not coincide with the line obtained upon the post when it was square. I write for information, not simply to criticise.

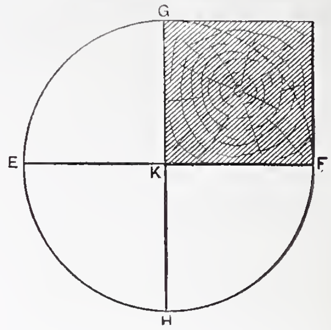
Answer.—We think we comprehend our corespondent's difficulty. Our remark in the September number was as follows: "The extreme outer corner of the post, either as originally, square, or after it has been backed, assuming the shape of a rhombus, is a straight line. The bevel resulting, therefore, will be the same, whether the plane over which it is drawn be in one position or another, whether the angle of the corner, as indicated by a square cut at the end is 45, 40 or 50 degrees." We suggested that the above was susceptible of proof by a simple demonstration, which in all probability would occur to the reader. If G. H. H. will take his bevel and set it to any pitch whatever, and revolve it in space, keeping an imaginary line along the stock corresponding to the edge of the blade as an axis, he will discover that it will describe the shape which might be likened to the envelope of a cone. In other words, in this experiment the imaginary line that we have described above takes the position and function of the axis of a cone, while the edge of the blade describes the envelope of the cone. We have attempted to show all this in Fig. 1, in which A B C is the cone supposed to be described, and B D the axis, the angle D B C being the angle to which the bevel is set. Now, if we imagine that the shape which we have described in space really existed as a solid, or as the envelope of a solid in some material that could be cut, and that we cut it at any point by a plane drawn through the axis, the profile obtained would show the same angle as was employed in setting the bevel by which the shape was described. In other words, the half of the profile of the cone when cut at any point must be the angle D B C in Fig. 1. Now, if we go a step further and suppose the plane which is employed to cut through the shape be one of the faces of a post, the axis of the cone being the corner of the post, it is clear that the angle which would be described upon that plane would correspond to D B C of Fig. 1. We can make this still clearer by introducing a plan of the cone which we have supposed to have been described by means of the bevel, and showing, by means of lines, cuts through it at differ-



Use of Bevel.—Fig. 1.—Revolving the Bevel upon the Axis D B, thereby Generating a Cone.

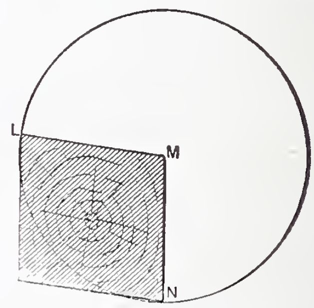
ent points. In Fig. 2 we show the cone cut in four pieces by the lines E F and G H. The center K represents the axis of the cone, or the line D B in the elevation. Now, it must be clear to any one that a section of the cone, whether cut upon the line K G, K F or K H, will be the same. G K F is a right angle, G K and K F may be supposed to represent adjacent faces of a square post, shown by the shaded portion of the outline. It is evident that the angle described upon the two faces, G K and K F, by means of the bevel, would be equal to D B C of Fig. 1. In Fig. 3 we introduce an obtuse angle, as shown by L M N, which may be supposed to represent the corner of the post as represented by the shaded portion of the diagram. From what has already been said, it requires no argument to prove that the sections of the cone upon the lines L M and M N must be alike, and also the same as the sections upon the lines G K and K F of Fig. 2, all of them corresponding with the angle D B C of Fig. 1. Hence we think it will be clear to the reader that the use of the bevel upon a post having an obtuse angle will give the same result as upon a square post. In Fig. 4 the same thing is shown applied to an acute angle. If we suppose O P R to represent the corner of a post, shown by the shaped portion of the diagram, O P and P R representing adjacent faces, it is clear that the section would be the same upon each of them as upon either of the others already described.

So much for the theory of the matter. Now, it is clear that the line D B of Fig. 1, or the axis of the cone, is a line in fact; that is, having length without either breadth



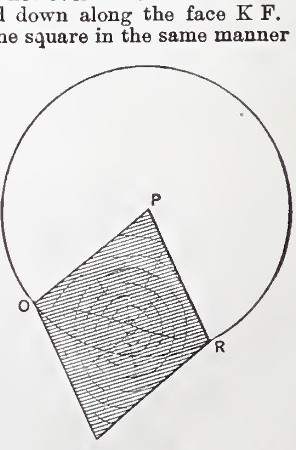
Use of Bevel.—Fig. 2.—Plan of the Cone, Sections Taken at Right Angles Being Applied to the Faces of a Timber.

or thickness. We imagine our correspondent's difficulty when using the bevel, either upon an acute or an obtuse angled post, has been owing to the thickness of the stock of his bevel, or in case he used a square—for the same principles apply to the use of that tool in cutting timber—his difficulty may have been the dropping down of the blade,



Use of Bevel.—Fig. 3.—Plan of the Cone, Showing Sections as Applied to a Post Having an Obtuse Angle.

by either of which causes the direction of the line would be determined, not by the actual corner of the timber—which corresponds to the imaginary axis of the cone that we have been talking about—but by that part of the surface of the timber with which the edge of the stock of the bevel or the blade of the square come in contact. To make this clearer, let us imagine the square to be applied to the several sections of timber shown in Figs. 2, 3 and 4. When applying the square to the timber shown in Fig. 2, it is evident that the line to be drawn by the tongue across the face K G will not be affected, however much the blade may be dropped down along the face K F. If we apply the square in the same manner to the

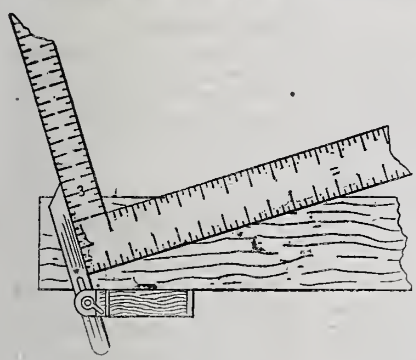


Use of Bevel.—Fig. 4.—Plan of Cone, Showing Sections as Applied to Post Having an Acute Angle.

shape shown in Fig. 3, intending to draw a line across the face L M, and the blade falls down to some point on M N, it is evident the tongue will be thrown out to a degree determined altogether by the point in M N against which the blade rests. It is evident that the same conditions apply to Fig. 4. For the same reasons, it is clear that using a bevel, the stock of which has more or less thickness, upon an obtuse angle, the direction of the line described along the blade would be determined not by the corner line, which, as we have described, corresponds to the axis of the imaginary cone, but by that point in the face of the timber which is touched by the corner of the stock of the bevel. In these remarks concerning the stock of the bevel we restrict ourselves to obtuse angles, because in acute angles the face of the timber does not project, but recedes, thereby being out of the way of interfering with the bevel in any manner. An acute angle, on this account, more nearly approaches the theory of the case than either of the other two. If we have not convinced G. H. H. or any other of our readers of the correctness of our position in this matter, we shall be pleased to hear further.

The Backing of Hip Rafters.

From G. H. H., *Germantown, Phila., Pa.*—From perusing the several articles entitled "Problems in Framing," I am led to send a rule which I have used on several occasions for finding the backing of hip rafters.

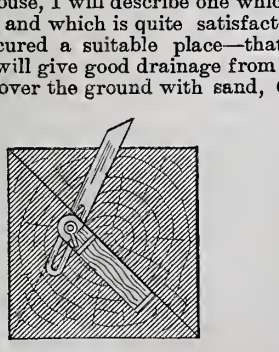


Backing a Hip Rafter.—Fig. 1.—Method of Setting the Bevel.

Take the length of the hip rafter on the blade of a square and the hight of the pitch on the tongue, Fig. 1. Apply these figures to a straight-edge. Scribe along the tongue. Put the stock of the bevel to the straight-edge. Set the blade to the scribe mark, and the resulting angle gives the required cut for the backing. The application is made clear by Fig. 2.

Cheap Ice House.

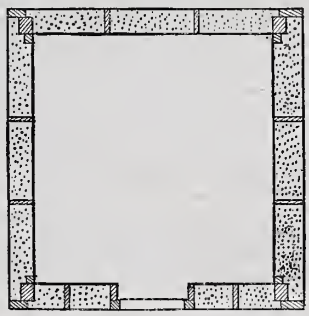
From R. M., *Glastonbury*, ——. —Answering the inquiry of W. K. B. in a recent number of *Carpentry and Building*, for a cheap ice-house, I will describe one which I have in use and which is quite satisfactory. Having secured a suitable place—that is, one which will give good drainage from the building—cover the ground with sand, 6 or 8 inches deep, to the size of the building to be erected. The purpose of this sand is to allow the molted ice to filter through. Upon the sand place a layer of sawdust or planer shavings about 8 inches deep. Upon the shavings the ice is to be packed.



Backing a Hip Rafter.—Fig. 2.—Applying the Bevel to the Square End of Rafter.

Our ice-house is 12 feet square and $6\frac{1}{2}$ feet high to the eaves, with a steep roof to accommodate packing and carrying off the heat of summer well above the ice. The outside covering is hemlock boards; the roof is made of the cheapest grade of pine shingles. We are taking out ice now (September) very nearly as thick as when it was originally packed away. There are no sills; the posts are cut square at bottom, and stand upon stones level with the sand, allowing the filling between the walls to go down to the ground, so as to prevent air drafts coming in underneath the walls. This is a very important thing, and should be carefully considered in erecting the house. Ice requires free filtration at bottom, to be well protected at sides and top with sawdust or shavings, and to have liberal ventilation at the highest part of the roof. By the inclosed diagrams you will understand the construction which we employ. A 4 x 6 and 2 x 6 make the corner posts. A 2 x 6 and 2 x 4 make the posts at each side of doorway. After the ice is packed, short boards are placed across the doorway, back of the 2 x 4 projection, and shavings are filled in between them and the ice. It is better to have the ends with the doors facing north. The outside door is 3 feet wide, in order to give plenty of room for placing the ice. The door is made in two sections; the top of the lower door comes just under the cross-tie, and the bottom of the upper door shuts against the face of the cross-tie. Between the ice and wall there should be 4 inches or more of sawdust, packed in as the ice is laid. Upon each end of the building, across the face of the posts at the top ends, there is spiked a 2 x 6 piece of spruce as a tie, and also for support of the gable ends. The gables are one thickness, boarded up and down upon the face of the cross tie and face of rafter, battened. A lining is nailed upon inside of rafters about two-thirds of way from eaves upward, and is filled the same as the walls of the house. The lining boards of the walls are nailed across the ends first, then a piece is nailed up and down, against which the sides are nailed at corners. The plates are 2 x 6, spiked upon tops of posts and intermediates. Since the space between the walls is 8 inches, the use of a 6-inch plate leaves a space along the side walls for the purpose of filling. The end is exposed the whole width level with the eaves. From this description and the sketches which I inclose, Figs. 1 and 2, I think your correspondent will understand how we have built a cheap ice-house which is entirely satisfactory.

Cheap Ice House.—Fig. 1.—Elevation.—Scale, ⅛ Inch to the Foot.



Cheap Ice House.—Fig. 2.—Plan.—Scale, ⅛ Inch to the Foot.

Cement for Repairing Roofs.

From E. J. R., *Cincinnati, Ohio.*—Answering the question of one of the correspondents in a recent number of *Carpentry and Building*, I would say that the following is a good cement to use in connection with a tin roof as against brickwork, and also in repairing: Take 25 lbs. of yellow ocher (or $12\frac{1}{2}$ lbs. of ocher and the same amount of paint skins, boiled and skimmed), 1 lb. litharge, 6 lbs. of black lead and 1 lb. of fine sand. Boil well in oil. To repair leaks in roof, take strips of cotton cloth about 2 inches wide, soak in the above and put the strips on the seam. This is a sure cure in places where solder would be entirely useless.

Our Price List and "Poplar" Lumber.

From J. W., *Wheeling, W. Va.*—The quotations of building material in *Carpentry and Building* I find quite valuable. I beg to suggest, however, that quotation of the price of poplar lumber would make it of additional service. I have several times looked for it in your quotations, but always failed to find it mentioned. This item is of particular interest to persons in this locality. Considerable poplar lumber is shipped East from this part of West Virginia.

Answer.—The lumber known as "poplar lumber" in West Virginia and through most sections of the West, is recognized in the New York market as white wood, the term "poplar" being used here in altogether a different sense. Our correspondent, by examining the quotations in *Carpentry and Building*, will find white wood quoted. With this explanation we trust "J. W." will consider our list of building materials more complete.

Accurate Estimates.

From R. W., *Cape May City, N. J.*—In reading *Carpentry and Building* I notice considerable discussion about the proper way to make an estimate for a building. I have been making estimates for 17 years; my work has been nearly all frame. In this place we have occasion to estimate on some very fine houses, and frequently very large ones. Now, my idea of the matter is that there is only one correct way by which to make an estimate. We are obliged to make estimates correct hereabouts, or we would never get out on a job. We must either be accurate in our figuring, or else lose what little money we have.

Make out the bill of lumber just the same as you would make it out when about to buy. In other words, list every stick with its proper length and extend the number of feet. Make out the mill bill in the same manner. Insert the exact sizes of sash and doors, moldings and brackets, and all other items that come from the mill. Make out the hardware bill in detail also. In the same careful manner obtain the surfaces to be covered by paint and plaster. Plastering I estimate by the square foot, surface measure. After these items, take the brick and stone work; and last, the labor. In connection with the carpentry I say last, because by the time you have made bills out for the other items you have studied the house sufficiently to form a pretty correct idea of the worth of the labor to be performed. I don't believe that carpentry work can be estimated by any rule but that of long experience. I have tried, for curiosity only, a number of the given rules, but they won't work. The cubic foot plan of estimating is sheer nonsense. All such rules are calculated to mislead inexperienced people. I like the views expressed by J. H. P., Paterson, N. J.

After I have made an estimate, if I get the job I have no occasion to make out any more bills; I simply keep my estimates. I always file away estimates in such shape that I can find them on demand. I am able to produce estimates that I made 10 and 15 years ago. When I commence a building, I at once begin a cost account, giving particular attention to the carpentry work. This I keep in a book arranged for the purpose. Such precautions and expedients as these go to make up the record of experience. As remarked above, experience is the only rule by which a correct estimate can be made.

At another time, if you care to hear about it, I will be pleased to give you my ideas about the trouble and difficulty a carpenter has in making accurate estimates, in competition with (so-called) carpenters who make estimates by rules.

Note.—We trust R. W. will not delay long in giving us further expression of his ideas on the subject of estimating. Any one who has taken such extreme care in the making of estimates, and in the keeping of a cost account in connection with the work performed, must certainly have a fund of experience from which he can draw many lessons for the benefit of the trade at large. We shall be pleased to hear from him whenever it may suit his convenience.

Calculating Floor Beams.

From G. M. H., *New York.*—I will reply to the question asked by Formula, in the number for October, concerning the floor in an audience room 24 x 45 feet, to be carried without either girder or post. Formula does not state whether there is any framing of stairs, &c. I shall suppose that there is not, and also that there will be a plastered ceiling under the proposed audience floor.

The following formula will be appropriate for timbers in dwellings and assembly rooms in which the load is not more than 200 lbs. per superficial foot: this is, within the limit of elasticity or injurious bending of beam. The formula is:

$$c\,l^3 = i\,b\,d^3$$

c = distance from centers.
l = length.
b = breadth, and
d = depth.
(i) is an expression for the coefficient $\frac{F}{1875}$ in which (F) is the symbol for the resistance to flexure.

The value of i for six of the more common woods:

For Georgia pine............i = 3.15
" locust....................i = 2.69
" oak.......................i = 1.65
" spruce....................i = 1.87
" white pine................i = 1.55
" hemlock...................i = 1.49

By inversions we derive the following rules, namely:

The distance from centers, $c = \dfrac{i\,b\,d^3}{l^2}$

The length.......... $l = \sqrt[3]{\dfrac{i\,b\,d^3}{c}}$

The breadth............. $b = \dfrac{c\,l^3}{i\,d^3}$

The depth........... $d = \sqrt[3]{\dfrac{c\,l^3}{i\,b}}$

The floor joists should be thoroughly well herring-bone bridged, with 2 x 3-inch strips nailed with two 20-penny nails at top and two at bottom, in each 6 or 8 feet of span. It is well to have the floor joists wrought, so as to crown three-quarters of an inch in every 20 feet of span.

Remedy for a Difficulty in the Use of India Ink.

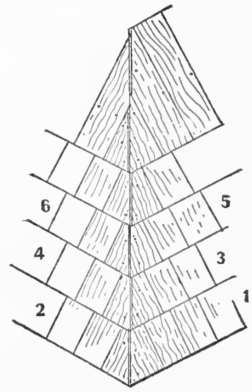
From A. C. H., *New York City.*—Answering your correspondent W. H. C., of Woodland, Cal., with reference to the use of India ink upon tracing linen, would say: Use dull back tracing linen, inking on the dull side. Buy a small quantity of ox gall, sold wherever drawing materials are kept. Mix the ink very black and add a very small quantity of the ox gall to it before using. The quantity of the ox gall to be employed depends upon the moisture in the atmosphere at the time. The use of the ox gall not only remedies the difficulty mentioned by your correspondent, but also prevents the drawings from being eaten up by flies. India ink, mixed as above described, is not fit to be used on drawing paper on account of running. If ox gall cannot be obtained, use instead strong brandy or alcohol. This will answer, but is not quite so satisfactory as the ox gall.

"Our" Paper.

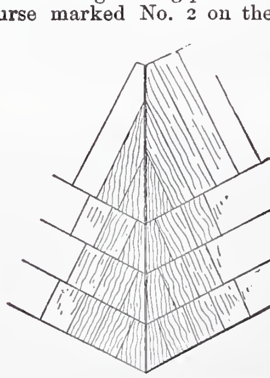
From E. H. C., *East Rochester, N. Y.*—I have read with much pleasure every number of *Carpentry and Building* to date. It is the finest thing I ever saw pertaining to building. I have been a builder for several years, and have taken several works at high prices relating to the trade, but I have failed to find anything that is as practical as *Carpentry and Building*. You can count me for a subscriber as long as the paper continues to be what it is now. I think it is a most excellent idea for brother builders to ask questions through the columns of *our* paper, for certainly *Carpentry and Building*, by the policy it is pursuing, is *our* paper. We must not fear each other. No one man knows it all. Let us be free to ask and answer questions; by discussion of this kind much good is to be accomplished.

Shingling the Hips of Roofs.

From G. H. H., *Germantown, Philadelphia, Pa.*—In the inclosed sketches I show two methods of shingling the hips of roofs which may be of some interest in the way of an answer to S. A. M., Steward's Mill, Tex. Fig. 1 represents the method of covering a hip which I know to have given perfect satisfaction so far as being water-tight. It is not without fault, however, in other respects. The shingles, as seen in the sketch, are cut so as to have the grain always running straight up and down the roof. For this reason the point which comes against the line of the hip is weak. The sun and wet will, in time, work the nails out, so that the points will curl up and drop off. In laying shingles as shown in Fig. 1, the courses should be laid in the following manner: The course marked No. 1 should be first laid all the way out to the line of the hip, the last shingle being planed off so that the course marked No. 2 on the adjacent side of the roof will lie perfectly tight down upon it. Next lay No. 3, which dress down in the same manner, after which lay No. 4, and proceed in this manner, working first from one side and then the other.

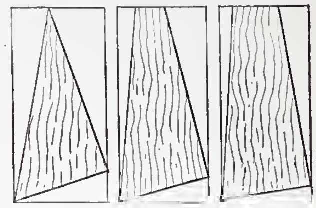


Shingling the Hips of Roofs.—Fig. 1.—Common, but Objectionable Method.

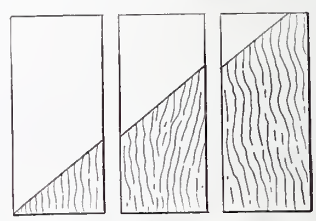


Shingling the Hips of Roofs.—Fig. 2.—A Better Method.

The manner of shingling the hip shown in Fig. 2 employs shingles upon the hip so cut as to bring the grain of the shingle nearer parallel to the line of the hip. This method overcomes short cross-grained points, which I cited as objectionable when shingles are laid as shown in Fig. 1. Accordingly, the shingles, when laid as shown in Fig. 2, are not so liable to crack and warp as those shown in Fig. 1. The first method has the advantage in economy of shingles over the second. The points cut from the shingles used in Fig. 1 can all be used in laying the valleys if there be such in the roof, and in point of labor they are more easily applied. Fig. 3 shows the manner of cutting the shingles in order to lay them as shown in Fig. 2. Fig. 4 shows the manner of cutting the shingles as employed in Fig. 1. I would say in this connection that shingles to make a first-class roof should never be wider than 4 inches. They should be straight-grained and laid with the heart side to the weather.



Shingling the Hips of Roofs.—Fig. 3.—Cutting the Shingles for Use in Method Shown in Fig. 2.



Shingling the Hips of Roofs.—Fig. 4.—Cutting Shingles for Use in Method Shown in Fig. 1.

Objections to the Use of Slate for Roofing Purposes.

From J. A. H., *Roslyn, N. Y.*—I have noticed with great pleasure the course which *Carpentry and Building* is pursuing. As soon as the carpenters become aware of the many practical hints contained in the paper, they will be sure to take it. There is one thing, however, at the outset with which *Carpentry and Building* will have to contend; so many papers at present and heretofore have been of so little real value to the trade that, as a class, mechanics are shy of all new comers. Continue to make the paper as useful as the numbers already published and this difficulty will be successfully overcome. The correspondence department will do much to help in this.

I desire to call attention to one or two facts in connection with slate roofs. One of my neighbors has a carriage-house covered with slate, one side of which slopes to the south. In winter, when snow is on the roof, it is subject to slides, and upon several occasions there have been narrow escapes from serious results on this account. I consider this a very important objection to the use of slate. Snow would not slide from shingles under the same exposure. Another objection to slate roofs, it appears to me, is the fact of their retaining heat in summer, thus making the upper rooms warmer in hot weather. They are also colder in cold weather for the same reason. Still a third drawback in connection with the use of slate for roofing purposes is the difficulty of repairing roofs—of replacing broken and cracked slates.

These objections to the use of slate for roofing purposes appear to me to deserve more attention upon the part of builders than they have received heretofore. It is commonly supposed that slate makes a roof almost perfect. From study of the subject I am convinced to the contrary, and lay these views before the readers of *Carpentry and Building*, hoping that others will have something to say upon the subject.

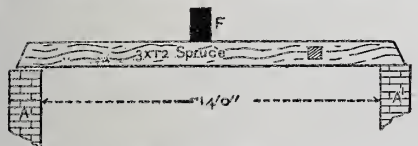
Cement for Use Around Chimneys.

From A. C. H., *New York City.*—Answering the inquiry of a correspondent in a recent number of *Carpentry and Building*, I would state that the cheapest and most durable cement with which I am acquainted for the purpose, is composed of perfectly slaked lime, mixed with pine sawdust to proper consistency. Apply the same as ordinary mortar. It will stand for years. It is very light and will not crack.

REFERRED TO OUR READERS.

Answers to the inquires made by correspondents and published under the head "Referred to our Readers," are solicited from all who are able to give any information upon the questions raised. Besides those published in the present number, there are several to which we invite answers that appeared in former issues, which have as yet failed to receive the attention their importance and general interest would seem to entitle them to. Replies are solicited to the following letters already published. In the August number, page 159:

L. S., St. Paris, Ohio, cement sidewalks.
A. J. H., Lowell, Mass., ventilation of house.
P. T. C., New York, graining wood.
J. E. M., Montreal, disguising the sap wood of pine.

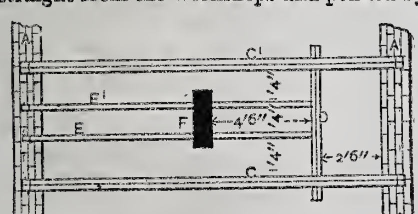


Strength of Materials and Proportion of Parts.—Fig. 1.—Sectional View.

In the September number page 180:

E. L., Portland, Me., removing oil and creosote stains.
J. A. M., Wingham, Ont., design for Eastlake sideboard.
Z. Y. K., Dodgeville, Wis., figures on steel squares.
J. E. S., Brunswick, Me., gelatine molds.

With the intent to make this department of the paper a medium of intercommunication between practical men, we refer many questions to our readers to which satisfactory answers, in all probability, could be written by us at the time. We recognize the fact, however, that answers coming straight from the workshops and penned by



Strength of Materials and Proportion of Parts.—Fig. 2.—Plan View.

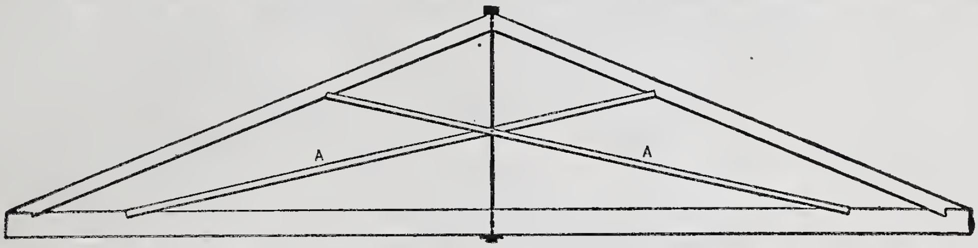
men who are habitually familiar with what they are discussing, are worth far more to our readers than replies made exclusively from this office. While our editorial corps embraces men throroughly practical in every branch of the building trades, we have no desire, by using their information alone, to curtail interest in this department of the paper. Several answers to one question, coming from as many different men, are better than a single reply. Our readers are likely to derive greater practical benefit from the exhaustive presentation of a subject, which occurs when a number undertake to answer a question, than when only a single mind gives attention to it. We trust all will be ready to contribute to the extent of their ability. Questions for answer in this department are solicited upon all practical topics connected with the building trades.

Strength of Materials and Proportion of Parts.

From G. H. H., *Germantown, Philadelphia, Pa.*—I desire to propose a problem to the practical readers of *Carpentry and Building*, the solution of which will be a benefit to me and possibly to others. I inclose sketches, an explanation of which will indicate my needs. Let A and A[1] (Fig. 1) be the bearing points of the framing, 14 feet apart, the joists being 3 x 12 in size. C and C[1] (Fig. 2) represent trimmers. D the headers. E and E[1] the tail joists, and F a weight bearing upon the tail joists alone. Now, I desire to know the following:

1. The breaking weight when placed as shown by F.
2. The safe weight that can be placed as shown at F.

And last, the correct size of the mortises and tenons to carry the weight from F through E and E[1] to D, and through D to C and C[1]. I suppose the frame as here described is not well proportioned. I give it of the dimensions named, because in this vicinity it is the general way of doubling timber to gain strength. These are questions which any ordinary carpenter will ask himself before commencing to frame joists: What is the safe weight, and how shall I make the tenons and mortises? He seldom makes himself a satisfactory answer.



Sketch Accompanying Inquiry from E. H. C.—Scale, 1/8 Inch to the Foot.

Use of Certain Braces in Truss Roofs.

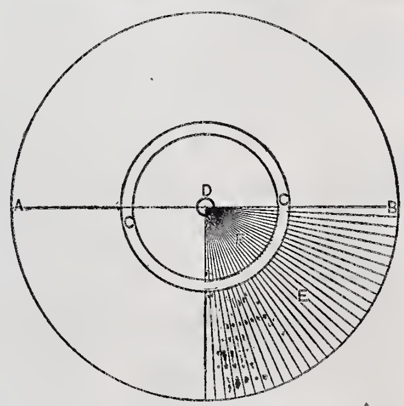
From E. H. C., *East Rochester, N. H.*—I inclose a sketch of a truss roof. I desire to ask brother architects and practical builders of what use are the braces marked A A. Are they of any benefit whatever to the truss? If so, in what consists their usefulness?

A Puzzling Question.

From T. G. D., *Quebec.*—From examination of several copies of *Carpentry and Building*, I have come to the conclusion that it is just the authority to which I should apply in the settlement of a vexed question. I am living in a terrace of five houses having only one gate leading to the various back premises. I am continually annoyed by neighbors leaving that gate open during the whole night, exposing the neighborhood to trespass. "What is everybody's business is nobody's business," and consequently nobody attends to that gate. I have been puzzling my brains for months to devise some means by which my fellow tenants would be compelled to keep the gate closed, or some manner of arranging a lock by which, when the gate is open, the key could not be withdrawn, thus giving the one who closes it the possession of the key. If any of your readers can in any way aid me by giving me an idea of how I can arrange the lock as suggested above, or by what means I can keep that gate shut without quarreling with my neighbors, I will be greatly obliged.

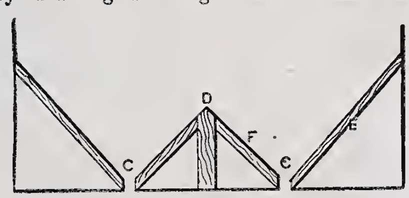
Problem of Tapers and Bevels in Circular Work.

From R. K. H., *Philadelphia.*—I take the liberty to introduce myself to you as one of the readers of your valuable little paper, *Carpentry and Building*. The illustration given, Fig. 10, page 172, September number, for finding the backing lines of an inclined corner post brings to my mind a difficulty I experienced some four years ago in performing a piece of work. I was, at that time, foreman for a builder who had contracted to put wooden bottoms in some 36 large circular iron main bins. They were to be placed in the bins in the position which I will endeavor to show by a rude sketch which I send you, Fig. 1. The center was to be conical and sides slanted as shown by cross section, Fig. 2. The object being to entirely empty them of grain when required by means of openings in bottom. The difficulty was to get the proper slant or taper and bevel of the pieces. There were some 700 pieces to be beveled and planed. They were much thinner than my sketch shows—they were not over 3½ inches at wide end. We planed them to the proper bevel and taper on steam power planer, but had first to make counterpart patterns to plane them on, which passed through the planer with the pieces on; and in so doing we found that slight variations of patterns made considerable variation in putting in the pieces



Problem of Tapers and Bevels.—Fig. 1.—Plan of Bin.

in the bins. The space filled with 20 pieces or so would vary an inch out of true center of circle. We made, I think, two complete sets of patterns (each set was composed of 6 pieces, the object in having so many being to keep the planer continuously fed by carrying back the patterns) before we got them exactly true. Now, what I would like to ask of you or the readers of *Carpentry and Building*, is an illustration by drawing showing how to obtain the



Problem of Tapers and Bevels.—Fig. 2.—Section of Bin on line A B, Showing Bevels to which Staves must be Cut.

bevels and tapers of pieces which will form bottom as shown by my rude sketch—say the pieces to be 5 inches wide at the widest end and 6 or 8 inches deep. If some one will take it upon himself to consider this and give it to the readers of the paper illustrated, I think it would serve as valuable information, to some at least.

The Slide Rule.

From W. A. McC., *Tippecanoe, Ohio.*—Where can I get a slide rule for making calculations as spoken of in the "Carpenter's and Joiner's Pocket Companion?" Will you please furnish a simple illustration of the use of the rule?

Design of Roof Trusses.

From G. A., *Pittsburg, Pa.*—I am a regular reader of *Carpentry and Building*, and take a lively interest in the subjects of architecture and building. I desire to call attention to a matter of considerable interest to the building trade at large. In the January number of *Carpentry and Building* were published several designs of trussed roofs, which in the accompanying comments were described as being well adapted for certain kinds of buildings there mentioned. The braced truss shown at Fig. 3, page 2, has been recommended by many architects and authors, and is extensively used in all parts of the country.

In this connection, however, I would refer the readers of *Carpentry and Building* to page 283, Fig. 240, of "Hatfield's American House Carpentry," in which the author condemns the use of this and other similar construction of trussed roofs as being "seriously objectionable" and "always to be avoided." Further, he says that according to his own observation "many a public building has been all but ruined by the settlement of the roof consequent upon this defective plan." My own experience has been very slight when compared with that of Mr. Hatfield, but I have been engaged in the work for a number of years, and from personal observation can confirm every word that this author has written on the subject. The fact that all roofs settle is not questioned by any writer on the subject. Of couse, when this roof settles it produces an action on the walls tending to overthrow them, which gives the building an unsightly appearance.

The question I wish to ask, and introductory to which the above remarks are made, is, shall we entirely abandon the truss in question, or can we improve upon its plan so as to avoid the objectionable qualities above mentioned? Will practical men among the readers of *Carpentry and Building* give expression to their ideas upon the subject?

Laying Out Hand Railing.

From L. M. D., *Hastings, Minn.*—Will some of the readers of *Carpentry and Building* furnish me a simple method for laying out the rail in a cylinder for stairs? I am now building a number of staircases requiring the shape above described. I am compelled to employ a stair builder to put up the rail. I think some practical man can furnish a rule in such form as will enable a man like me to do this work as well as the other parts, thereby saving the expense and annoyance of employing a special mechanic. I am much pleased with *Carpentry and Building*; I get a great deal of practical information from it.

Designs for Foot Rest and Rowboat.

From C. W., *Des Moines, Iowa.*—I desire to ask a favor through the columns of *Carpentry and Building*. I am in want of a design for a foot rest, to be constructed of walnut inlaid with white wood. I also desire to know where I can find, or see, some designs for a light running rowboat and a small yacht, built after the style of the seagoing vessel, to accommodate about 10 persons? Work is scarce here at present, and I propose to be busy at one of the above named pieces of work, provided I can get the necessary information. Any reader of *Carpentry and Building* who can help me in the above will confer a favor.

Prices of Building Materials in New York, October 20, 1879.

Blinds.—OUTSIDE.

Per lineal, up to 2.10 wide....$ .... @ 0.24
Per lineal, up to 3.1 wide..... .... @ 0.27
Per lineal, up to 3.4 wide..... .... @ 0.30
Per lineal, paint'd and trim'd 0.40 @ 0.50

INSIDE.

Per lineal, 4 folds, Pine....... .... @ .45
Per lineal, 4 folds, ash or chstnut....... .... @ .72
Per lin'l, 4 folds, cherry or butternut....... .... @ .86
Per lineal, 4 folds, bl'k wal't. .... @ 1.00

Bricks (afloat).

Pale.......... ₩ M. $4.00 @ 4.25
Jersey.......... " 5.00 @ ..
Long Island......... " 5.50 @ 5.75
Up-River.......... " 5.25 @ 5.50
Havers'aw Bay, 2ds. " 5 62 @ 6.00
Havers'aw Bay, 1sts. " 6.00 @ 6.25

FRONTS.

Croton—Brown........ ₩ M. .... @ $8.50
Croton—Dark.......... " .... @ 9.00
Croton—Red.......... " .... @ 9.50
Philadelphia.......... " .... @ 22.00
Trenton.......... " 18.00 @ 19.00
Baltimore.......... " .... @ 38.00

Yard prices 50c. ₩ M higher, or, with delivery added, $1.50 per M for Hard and $2.50 per M for front Brick.

FIRE BRICK. (yard prices).

Red Welsh..........$35.00 @ ....
Scotch.......... 30.00 @ ....
English.......... 30.00 @ ....
Silica.......... 45.00 @ 55.00
Stourbridge.......... 55.00 @ ....
American.......... 27.00 @ 30.00
Afloat. 500 ₩ M less

Cement.

Rosendale, ₩ bbl..........$ 0.85 @ 0.90
Portland Saylor's American, ₩ bbl.......... 2.50 @ 2.60
Portland (imported) ₩ bbl.. 2.65 @ 2.75
Roman.......... " .. 2.75 @ 2.85
Keene's coarse..... " .. 5.75 @ 6.25
Keene's fine......... " .. 9.75 @ 10.00

Doors.

RAISED PANELS, TWO SIDES.

2.0 x 6.0.........	1¼ in.	$0.67	....
2.6 x 6.6.........	1¼ in.	.95	....
2.6 x 6 8.........	1¼ in.	1.00	....
2.8 x 6.8.........	1¼ in.	1.15	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾ in.
2.0 x 6.0..........	$1.23	....	....
2.6 x 6.6..........	1.52	1.93	....
2.6 x 6.8..........	1.57	1.95	....
2.6 x 6.10..........	1.59	2.01	....
2.6 x 7.0..........	1.62	2.09	....
2.8 x 6.8..........	1.68	2.32	2.57
2.8 x 7.0..........	1.69	2.17	2.69
2.10 x 6.10..........	1.79	2.26	2.84
3.0 x 7.0..........	1.87	2.45	3.80

2nd quality 15 cts. less.

Drain and Sewer Pipe.

Discount 50 to 60 per cent. according to quality and size of order.

Pipe, per foot.	Bends & Elbows. Each.	Branches Sing.	Branches D'bl.	Traps & V. Each.
2 in.. $ .13	$ .40	$ .48	$ ...	$1.00
3 " .. .16	.50	.61	...	1.25
4 " .. .20	.65	.75	1.30	1.75
5 " .. .25	.85	.90	1.55	2.50
6 " .. .30	1.15	1.05	1.80	3.50
7 " .. .35	1.50	1.20	2.05	5.00
8 " .. .45	2.00	1.45	2.45	6.00
9 " .. .55	2.50	1.70	2.85	7.00
10 " .. .70	3.00	2.00	3.30	8.00
12 " .. .80	3.75	2.52	4.24	10.00
15 " .. 1.25	5.00			
18 " .. 1.60	7.50			

Longer than 1 ft., charged as pipe.

House Branches pr. lin. ft.	Sewer Branches pr. lin. ft.
15x6 $1.75	15 in. $2.25
18x6 2.50	18 " 3.00

Glass.—(American.)

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15....	$7.50	$6.75	$6.25	$5.75
11x14—16x24....	8.50	7.75	7.25	6.50
18x22—20x30....	10.75	9.75	8.75	7.75
15x36—24x30....	12.25	10.75	9.00	8.50
26x28—24x36....	13.00	11.50	9.75	9.00
26x36—26x44....	14.50	13.25	10.75	9.50
26x46—30x50....	15.00	14.00	11.25	10.50
30x52—30x54....	16.00	14 50	12 00	...
30x56—34x56....	17.25	15 50	13.50	....
34x58—34x60....	18.25	17.25	15.00	....
36x60—40x60....	20.75	18.75	17.25	....

DOUBLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15....	$12.00	$11.00	$10.00	$9.25
11x14—16x24....	13.75	12.50	11.75	10.50
18x22—20x30....	17.25	15.75	14 00	....
15x36—24x30....	19.75	17.25	14.50	....
26x28—24x36....	21.00	18.50	15.75	....
26x36—20x44....	23.25	21.25	17.25	....
26x46—30x50....	24.00	22.50	18.00	....
30x52—30x54....	25.75	23.25	19.25	....
x56—34x56....	27.75	25.00	21.75	....
34x58—34x60....	29.25	27.75	24.00	....
36x60—40x60....	33.25	30.00	27.75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 inches, will be charged in the 84 united inches' bracket. Discounts: Single, 60 & 5 % Double, 60 & 5 %.

FRENCH WINDOW, PICTURE AND CAR GLASS.

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15....	$8.00	$6.75	$6.25	$5.75
11x14—16x24....	8.75	8.00	7.50	7.00
18x22—20x30....	11.25	10.50	9.75	8.75
15x36—24x30....	12.75	11.50	10.00	. .
26x28—24x36....	13.50	12.25	11.25	.
26x36—26x44....	14.75	13.75	11.75	..
26x46—30x50....	16.25	15.00	13.00	....
30x52—30x54....	17.25	16.00	13.50	...
30x56—34x56....	18.75	16.75	15.00	...
34x58—34x60....	19.50	18.00	16.00	....
36x60—40x60....	21.00	19.50	18.00	..

DOUBLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15....	$12.00	$11.00	$10.00	$9.25
11x14—16x24....	14.75	13.75	12.75	11.75
18x22—20x30....	19.00	17.75	16.00	....
15x36—24x30....	21.50	19.25	16.50	....
26x28—24x36....	23.00	20.75	18.25	....
26x36—26x44....	25.00	23.00	19.25	....
26x46—30x50....	27.00	25.00	21.25	....
30x52—30x54....	28.50	26.00	22.25	....
30x56—34x56....	30.00	27.75	24.75	....
34x58x34x60....	31.75	30.00	27.00	....
36x60—40x60....	35.50	32.50	30.25	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket.

Discounts: Single, 50&5; Double, 60& 20 %.

GREENHOUSE, SKYLIGHT AND FLOOR GLASS.

Per square foot, net cash.

⅛ Fluted plate..........15 @ 17
3-16 Fluted plate..........16 @ 18
¼ Fluted plate..........20 @ 22
¼ Rough plate..........20 @ 22
⅜ Rough plate..........22 @ 24
½ Rough plate.......... @ 40
¾ Rough plate.......... @ 60
1 Rough plate.......... @ 70

Hair.

Cattle.......... ₩ bushel..$ .... @ 0.12
Goat.......... " .... @ 0.15

Lath.

Cargo rate.......... ₩ M $ 1.45 @ 1.47½

Lime.

Glen's Falls, or Keenan's common, cargo rate ₩ bbl.......... .55 @ .60
Glen's Falls, or Keenan's finishing ₀ Jointa.......... .75 @ .80
Rockland, common.......... .73 @ .80
Rockland, finishing.......... .85 @ .90
Ground.......... .80 @ .85

Add 25c. to above figures for yard rates.

Lumber.

Market firm with upward tendeucy.

Pine, very choice and ex.. dry, ₩ M. ft. thick.......$45.00 @ $60.00
Pine, good.......... 40 00 @ 45.00
Pine, second.......... 2 .00 @ 35.00
Pine, good box.......... 14.00 @ 26.00
Pine, common box.......... 16 00 @ 18.00
Pine, common box, ⅝.......... 12.00 @ 14.00
Pine, tally plank. 1¼, 10 in.. matched, each.......... .40 @ .43
Pine, tally plank, 1¼, 2d quality, matched, each.. .35 @ .38
Pine, tally planks, 1¼, culls, matched, each...... .25 @ .28
Pine, tally boards, match'd, each. good.......... .28 @ .30
Pine, tally boards, match'd, each, common.......... .22 @ .25
Pine, tally boards, culls, matched, each.......... .21 @ .23
Pine, strip boards, merchantable, matched, each .15 @ .16
Pine, strip boards, clear, matched, each.......... .22 @ .25
Pine, strip plank, dressed clear 4½ inch.......... .33 @ .35
Spruce boards, dressed.......... .18 @ .20
Spruce plank, 1¼ inch, dressed.......... .22 @ .25
Spruce plank, 2 by 9 in.......... .28 @ .30
Spruce plank (common).......... .22 @ .25
Spruce wall strips.......... .12½ @ .13
Spruce timber, ₩ M ft.......... 15.00 @ 17.00
Hemlock boards, each.......... .14 @ .16
Hemlock joist, 2½x4.......... .12 @ .14
Hemlock joist, 3x4.......... .14 @ .16
Hemlock joist. 4x6.......... .40 @ .44
Ash, good, ₩ M ft.......... 40.00 @ 45.00
Oak.......... 45.00 @ 60.00
Maple, cull.......... 20.00 @ 25.00
Maple, good.......... 30.00 @ 45.00
Chestnut.......... 45.00 @ 60.00
Cypress, 1, 1½, 2 and 2½ in.. 35.00 @ 40.00
Bl'k walnut, good to choice 85.00 @ 100.00
Black Walnut, 2d.......... 55.00 @ 65.00
Black walnut, ⅝.......... 70.00 @ 80.00
Black walnut, selected and seasoned.......... 110.00 @ 150.00
Bl'k walnut counters, ₩ ft. .12½ @ .20
Cherry, wide, ₩ M ft.......... 85.00 @ 100.00
Cherry, ordinary.......... 60.00 @ 80.00
Whitewood, or Poplar 1 to 1½ inch.......... 35.00 @ 4.500
Whitewood, or Poplar ⅝ in. 30.00 @ 35.00
Whitewood, or Poplar ⅝ panels.......... 35.00 @ 40.00
Shingles, extra sawed pine, 18 in.,.......... 5.00 @ 7.00
Shingles, clear sawed pine, 18 in., 2 md.......... 4 00 @ 5.00
Shingles, cypress, 24x7.......... 20.00 @ 22.00
Shingles, cypress, 20x6.......... 12.00 @ 15.00
Yellow pine dressed flooring, wide, ₩ M ft.......... .... @ 28.00
Narrow ditto.......... .... @ 30.00
Yellow pine girders.......... 28.00 @ 45.00
Yellow pine posts ₩ M.......... 28.00 @ 30.00
Locust posts, 8 ft., ₩ in.......... .18 @ .20
Locust posts, 10 ft.......... .24 @ .25
Locust posts, 12 ft.......... .25 @ .30
Chestnut posts, ₩ ft.......... .3 @ .4
Mahogany, ¼ in. ₩ ft.......... .5 @ .7
Mahogany, ⅜ in. ₩ ft.......... .8 @ .10
Mahogany, ½ in. ₩ ft.......... .10 @ .12
Mahogany, ⅝ in. ₩ ft.......... .12 @ .14
Mahogany, ¾ in. ₩ ft.......... .14 @ .16
Mahogany 1 in. ₩ ft.......... .16 @ .18
Rosewood, 1 in. ₩ ft.......... 16 @ .22
Rosewood, ⅛ in. ₩ ft.......... .11 @ .15
Rosewood, ¼ in. ₩ ft.......... .16 @ .20
Rosewood, ⅜ in. ₩ ft.......... .24 @ .28
Rosewood, ⅝ in. ₩ ft.......... .40 @ .45
Rosewood, 1 in. ₩ ft.......... .50 @ .65
Satin wood, ½ in. ₩ ft.......... .16 @ .30
Satin wood, 1 in. ₩ ft.......... .30 @ .40
Cedar (Cuban and Mexican) ₩ ft.......... .10 @ .14
Cedar (Florida).......... .8 @ .15
Less than 1 inch.......... .8 @ .24
1 inch and over.......... .25 @ .35

Moldings.

45c. to 55c. per inch per 100 feet, according to quality.

Paper.

Rope, waterproof building, ₩ lb .16 @ .17
Rosin Sized Sheating, ₩ lb. .4 @ .5
Dry Sheating ₩ lb.......... .3 @ 3½
Tarred Felt, ₩ lb.......... .... @ .2¼

Plaster.

Calcined City..........$1.00

Sash.

GLAZED.

Dimensions of windows.	12 Lights 1¼pl.	12 Lights 1¼c.	12 Lights 1½c.	8 L's 1½c.	4 Lights 1¼c.	4 Lights 1½c.
2.1x3.6....	$0.87	.92	....	....	....	....
2.4x3.10....	.96	1.02	....	....	1.11	....
2.7x4.6....	1.18	1.24	1.35	.	1.37	1.46
2.7x4.10....	1.25	1.32	1.44	....	1.48	1.59
2.7x5.2....	1.35	1.42	1.53	1.84	1.75	1.87
2.7x5.6....	....	1.56	1.65	1.93	1.88	2.03
2.7x5.10....	....	1.65	1.74	2.01	1.99	2.15
2.10x4.6....	1.29	1.35	1.47	....	....	....
2.10x5.2....	1.45	1.52	1.70	1.87	1.89	2.06
2.10x5.6....	1.53	1.59	1.79	2.01	1 97	2.19
2.10x5.10....	1.74	1.80	2.01	2.07	....	2.30

c. means counted checked—plowed and bored for weights.

Hot bed sash, glazed.......3.0x6.0....$1 90

HEAD LIGHT.

Two or three Lights, Glazed.

Size.	1¼	1½	Size.	1¼	1½
2.6x1.0 ..	45	55	2.10x1.10.	45	59
2.6x1.6...	55	63	2.10x1.6..	59	67
2.8x1.0...	45	55	3.0x1.0...	50	63
2.8x1.6...	55	67	3.0x1.6...	72	86

Slate.

By car load, delivered in New York.

Purple roofing slate, ₩ sq're.$5.00 @ $5.50
Green slate.......... 5.00 @ 5.50
Red slate.......... .... @ 9.50
Black slate, Pennsylvania... .... @ 4.00
Tiles, 1¼ in. rubbed, ₩ sq. ft. .20 @ .25

₩ sup. ft.

Steps and platforms, 1 in. thick........28c
" " 1½ " 35c
" " 2 " 42c
Risers, 1 inch thick........27c
Coping, 1½ " 27c
" 2 " 31c

Lineal ft.

Window sills, 4x7........45c
" 3x7........36c
Window caps, 4x10, plain........65c
" 4x8, " 50c
" 3x10, " 47c
" 3x8, " 42c

Stair Material.

BALUSTERS.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned.....	7c	9c	10c	16c
Neck Turned......	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

OCTAGON PANELED NEWELS.

Panels Veneered with French Walnut.

8-inch Newels, with Cap..........$6.12
9 " " " 6.88
10 " " " 7.60

SOLID NEWELS, WITH CAPS.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned....	$1.60	$1.90	$2.50	$3.40
Octagon..........	2.10	2.40	3.00	3.90

STAIR RAIL.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded..........	40c	45c	50c	53c
Toad Back........	45c	50c	63c	68c

STAIR RAIL, UNFINISHED.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded..........	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ₩ C ft..........$.... @ $0.85
Berlin freestone, in rough... .... @ .85
Berea freestone, in rough.... .... @ .70
Brown stone, Portland, Ct... 1.25 @ 1.50
Brownstone, Belleville, N. J. 1.00 @ 1.50
Granite rough.......... .50 @ 1.00
Dorchester, N. B., stone, rough.......... ₩ foot. .... @ 1.00

BLUE STONE.

Rubbed hearth, 10 ft. or under........ 20c
Rubbed hearth, 20 ft. or under........ 30c
Rubbed hearth, 3- ft. or nnder........ 45c
Rubbed hearth, 40 ft. or under........ 55c
Rubbed sills, imported.......... 28c
Rubbed sills, domestic.......... 33c
Sills and lintels .... @ 17c
Sills and lintels, fine quarry cut sills.......... .... @ 35c
Coping, 11 to 18 in. wide.......... 18c @ 30c
Coping, 20 to 28 in. wide.......... 35c @ 55c
Coping, 30 to 36 in. wide.......... 60c @ 75c
Steps, 8 in.......... .... @ 55c
Steps, 7 in.......... .... @ 40c
Steps, 6 in.......... .... @ 25c
Steps, door. per in. wide.......... .... @ 2c
Platforms, promiscuous, 4 in... .... @ 32c

Vault Lights.

Platform, sq ft.......... ....$3.00
Step and risers, sq. ft.......... 3.25
Floor light, sq. ft.......... 2.25
Roof light, sq. ft.......... 2.00
Platform, 2d quality, sq. ft.......... 2.60

COVERS.

Diameter.	Round.	Hexagon.
14 inch..........	$3.00..........	$0.00
16 "	3.75..........	4.00
18 "	5.50..........	6.00
20 "	8.00..........	8.50
24 "	14.00..........	15.0
26 "	16.00..........	17.0
30 "	23.50..........	25.0
36 "	31.00..........	33.0

Window Frames.

Up to 3.4 x 7.2. put together.. .... @ 2.15

CARPENTRY AND BUILDING

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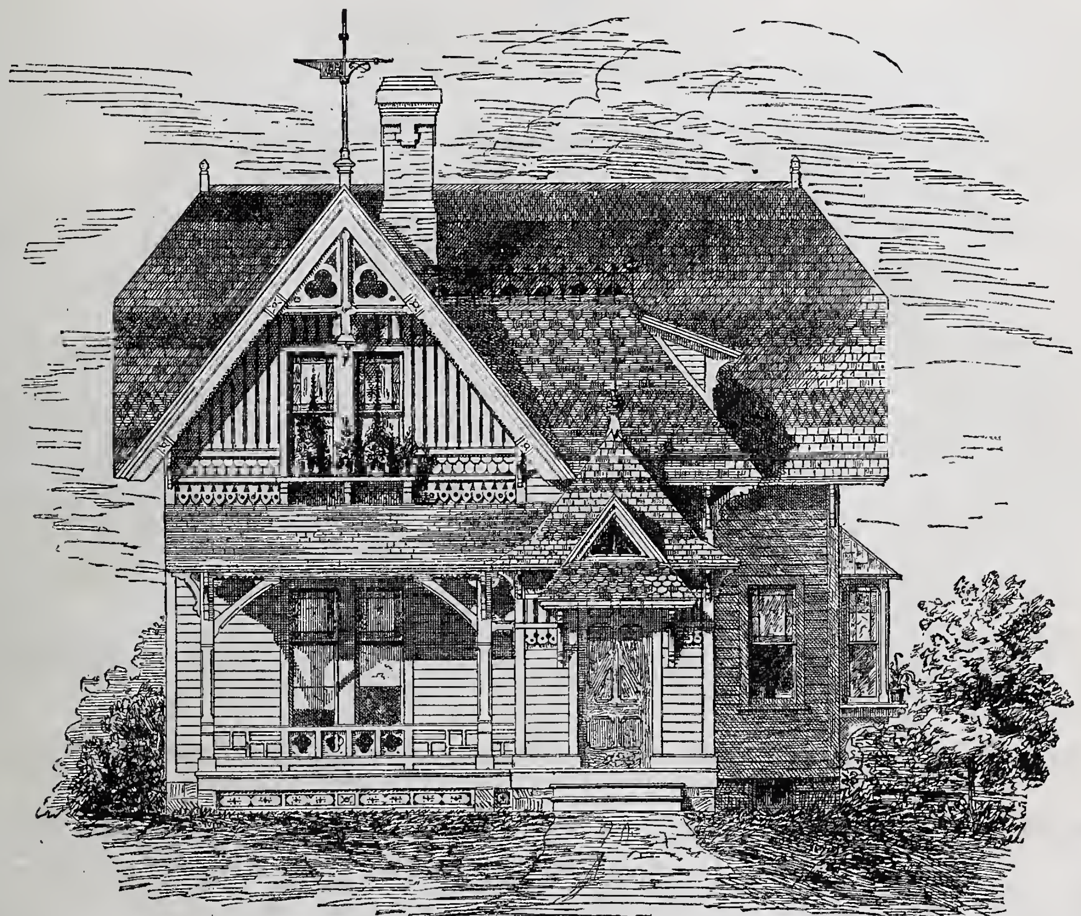
A Moderate Priced Dwelling House.

We present to our readers in this number of *Carpentry and Building*, the elevations and plans of a moderate priced dwelling house, contributed by Mr. C. A. Dunham, architect, of Burlington, Iowa. Concerning the floor plans there is little to be said. The arrangement may be considered an old one, for there are hundreds of houses in the country to-day built upon very much the same plan as here shown. The elevations, however, present some new and attractive features, which our engravings set forth to good advantage.

In the construction of this house the interior finish is designed to be plain and simple. Paint is but sparingly used. The woodwork is touched up here and there with a trifle of bright color on margins of casings and door panels, the general surface being finished with a good filling and best coach varnish. A cellar is designed to extend under the entire house. Open spaces are left at intervals between the rafters and ventilators are placed in the gables, by which means the chambers will be kept cool in summer.

The plant cabinet—a view of which is afforded by the side elevation—is designed to be completed in such a manner as to make it most convenient for the purposes for which it is designed. The bottom is to be finished in zinc or galvanized iron, sunk seven inches below the general surface, and furnished with a tube and plug by which to let off accumulated water. This arrangement has the advantage of allowing the crocks to be surrounded with water when such a condition is desirable for the growth of the plants.

For further description of the house we refer our readers to the annexed specification, prepared by the architect, and to his estimate of cost, which is also presented herewith.



Moderate Priced Dwelling.—Fig. 1.—Front Elevation.—Scale, ⅛ Inch to the Foot.—Mr. C. A. Dunham, Architect, Burlington, Iowa.

Specifications

Of the materials and works necessary in the erection of a wooden cottage house for John Doe, in the village of Blufftown, according to the plans, elevations and sections annexed, and the conditions subjoined, the same being those prepared by C. A. Dunham, architect, Burlington, Iowa.

GENERAL DIMENSIONS.

For size on the ground, see floor plans. There will be cellar under the entire main part of the house 7 feet deep in the clear. Hight of first story will be 9 feet. Second story 4 feet 6 inches on the walls and 8 feet 6 inches in center of rooms. The roofs to have the inclinations shown in the drawings.

EXCAVATIONS.

Excavate for cellar so as to make it 7 feet deep in the clear and 6 inches larger all around than area of plan of main house. Dig trenches for kitchen foundations 18 inches wide and 3 feet below final grade line. Dig for all pier foundations, to support verandas and porch, 3 feet below final grade line, and 18 inches width for walls and 2 x 2 feet for piers. Remove all surplus earth and rubbish from the premises after the stone walls are up and filled in around about and the premises properly graded.

STONE MASONRY.

Build all walls and piers of the best quality of building stone; build up solid in best lime mortar, all to be thoroughly tied in and bonded together and double-faced, laid true to a line on both sides, 18 inches in thickness; large footing stones to all piers, and all to be neatly pointed up at completion of the job.

LATH AND PLASTERING.

Lath all walls, stud partitions and ceilings with the best quality of seasoned white-pine laths; plaster all ceilings with one good coat of stiff, well-haired brown mortar, and all walls and stud partitions with two coats of the same, and finished with a white coat, or sand finish, so called.

CHIMNEYS.

Build chimneys, as shown in the drawings, from the cellar up in main house, and from 3 feet below ceiling line in kitchen, the kitchen chimney to be supported upon brackets; the flues not to be plastered or pargetted, but all cross joints to be flushed up solid; the bricks to be good, hard article. Provide and build in six 7-inch sheet-iron stove-pipe thimbles and top out chimneys, as shown in the drawings.

CARPENTER AND JOINER WORK.

All wood and timber used in the construction of the house to be of a good sound quality of white pine, and as well seasoned as the nearest market affords; to be perfectly free from sappy parts, dead or loose knots, shakes, or other defects injurious to its durability or strength; and all to be framed and put together in the most thorough and workmanlike manner.

Timber Dimensions.—Sills, 8 x 8 inches; girder, 8 x 8 inches; posts to support girder in cellar, 6 x 6 inches.

First and second story floor joists, 2 x 12 inches, 16 inches from center.

All studding, 2 x 4 inches, 16 inches from center; double at all angles and around all openings.

Line all valleys with 14 x 20-inch tin, and form guttering to all eaves of 14 inches wide tin, in form to be what is called a standing gutter. The standing support to be of 2x4-inch scantling, smooth wrought. Provide and put up, where necessary, leader pipes, with goose-neck elbows from the gutters to the ground, and all to be of suitable size to convey off the water from the gutters, and all to be of the best quality of tin and painted on both sides.

Cornices to all roof margins to be formed by smoothly dressing the projecting part of the rafters and covering them over with flooring laid face downward, and beveled in each jamb with ⅜-inch bevel; end of rafters to be covered in part on eaves line with a fillet and cove molding, 1¾ x 4 inches, and gables to be finished with 1¾-inch barge boards, as shown in the elevations. Provide and put up brackets around the entire building, as shown and indicated in the both sides of the sashes. The roof to have heavy corrugated green-house glass, except one light near the center, which will have a 6-inch round register, securely set in lead and putty, for ventilation. The bottom of plant cabinet to be formed and lined with zinc like a sink, at least 7 inches deep, all to be secured upon brackets.

Doors.—All doors to have plumb frames; the doors to be four panels each, double-faced, with chamfered margins to all of the panels; all interior doors to be 1⅜ inches thick, 2 feet 8 to 2 feet 10 in width by 7 feet in hight; all exterior doors to be 1¾ inches thick, and of the form and dimensions shown in the drawings. The top panels glazed with durable strength glass where shown or indicated by shading in the drawings. The door in vestibule opening out on to the veranda to slide into the partition, as shown in the plan. All doors to be hung with proper-sized butt hinges of best manufacture, and all to be

Moderate Priced Dwelling.—Fig. 2.—Side Elevation.—Scale, ⅛ Inch to the Foot.

Wall plates, 2 x 4 inches, double thick.

Ceiling joists, 2 x 6 inches, spiked to rafters.

Deck joists, 2 x 6 inches.

Rafters, 2 x 6 inches, 2 feet from centers.

Veranda rafters, 3 x 4 inches, 2 feet apart; planed and stop-chamfered.

Bridging, 1 x 2½ inches.

Wall Covering.—Sheet all external walls with inch lumber laid with close joints and overlaid with best untarred sheeting paper, and cover in the whole with ½-inch siding and shingles where shown; also the gables with inch tongued and grooved and stop chamfered vertical boarding, as shown and indicated in the elevation drawings.

Floors.—Lay down all floors throughout the entire building with tongued and grooved mill-dressed flooring, blind nailed and the uneven joints flushed off with plane. Select the narrowest and best for roof covering to veranda, porch and floors to same; also the kitchen.

Roof.—Cover in the roof timbers with inch sheeting boards, laid on close and even, and overlay all roofs with the best quality of sawed shingles, laid 4½ inches to the weather, and as shown in the drawings. Cover in the deck to roof with best roofing tin. All to be made weather-tight.

drawings, the same to be 1¾ inches in thickness.

Veranda and Porch.—Construct the same as shown in the plans and elevation drawings, with all ornaments indicated thereon. The roofs of the front and rear veranda to be of narrow flooring, laid face downward and beveled in every joint. Rafters planed and stop-chamfered. Railing, 1⅜-inch lumber; spandrels, 1¾-inch lumber.

Windows.—All the windows to have the usual box frames, fitted with axle pulleys, pocket pieces, parting strips and stop beads for double sliding sashes 1⅜ inches thick. The long windows under the veranda to have box tops to admit one light in hight of bottom sash. All the window sashes to be glazed with the best quality of American window glass, with colored and stained glass introduced in small lights as margins and as indicated in the drawings. All sashes to be hung with weights and best sash cords, and furnished with best bronzed iron meeting nail sash locks. Cellar windows to have plank frames, with sashes hung to swing up and secured with hooks and staples. There will be four of these windows.

Plant Cabinet.—Construct plant cabinet of the size and form shown in the drawings, the sashes to be double glazed, or glass on

furnished with best brass-faced locks and white porcelain knobs of most approved manufacture, and escutcheons corresponding. Sliding door to be furnished with proper bolts.

Stairs.—Construct principal stairs in the most workmanlike manner. Newel post to be 8 inches square, part turned, chamfered and molded; balusters 1¾ inches square, and part turned near top and bottom with fillets and beads; rail 2 x 4 inches, ogee and toad-back molded. Post and rail at top to correspond with those on the stairs. Construct one flight of cellar stairs, the treads to be housed into string pieces, all to be of 2-inch plank. Provide and put up slat railing to same.

Casings.—All internal openings to be cased with ⅞ x 4-inch casings, stop-chamfered on both edges; the windows to have stool pieces, with half-round and scotia nosings, and aprons 4 inches wide, stop-chamfered on lower edges, all to be of perfectly clear lumber and smooth wrought.

Base.—Provide and put down to all rooms, closets and halls, base-boards ⅞ x 7½ inches, with beveled edge on top, all to be closely fitted to floor.

Outside Dressings.—Provide and put up all corner-boards, friezes, belts, bands, brackets, finials, ridge-boards and crestings, as shown and indicated in the drawings. The cresting around deck to be iron. Construct flower shelves at windows, dormer and other windows not hereinbefore specially mentioned, but shown and indicated in the drawings, so as to fully executo the design, as illustrated in drawings.

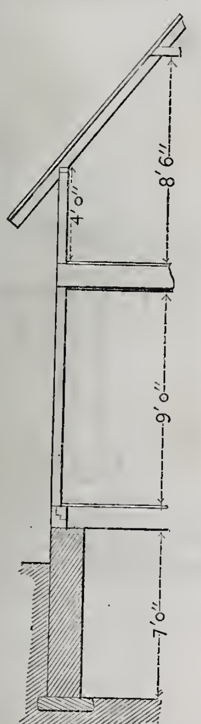
Pantry, Closets and Kitchen Dresser.—Fit up the pantry with shelves, as shown in the plan, also with bins for flour, meal and sugar; drawers for cutlery and spices; also provide a sliding doorway, 20 inches wide by 30 inches high, between dresser and pantry. Provide hand lids to the bins and handles to the drawers. The dresser in the kitchen to be the entire hight of the story, with paneled drawers, properly hung and trimmed, cut in the centers each way. Furnish the same with shelves, as will be directed. All closets to be fitted with two shelves and clothes-hook strips, and the strips furnished with one dozen best heavy double iron clothes hooks. The store room at end of hall to be fitted with wide shelves for the storage of bed clothing, as will be directed by the house-wife.

Sink.—Construct a closet sink with pump-stand in kitchen; provide the sink with a well-trapped 1¾-inch lead waste pipe, and extend the same from the sink out to drain on the outside; provide the waste with plug aud strainer.

Steps.—Construct 2-inch plank steps to all external doorways, smooth wrought and with molded nosings.

PAINTING.

All external wood-work, including all



Moderate Priced Dwelling.—Fig. 3.—*Section Showing Hights of Stories.*

metal-work aud the chimney tops, to have three good coats of best white lead and pure linseed oil, properly mixed and brought to the desired tint or shade of color; the trimmings of the walls and roofs to be made a few shades darker than the body of the walls. All of the interior wood-work, usually painted or varnished, to be filled with best filling and given one good coat of best coach varnish; all of the chamfers and margins, also the turned work on the stairs, to be touched up with burnt sienna before varnishing.

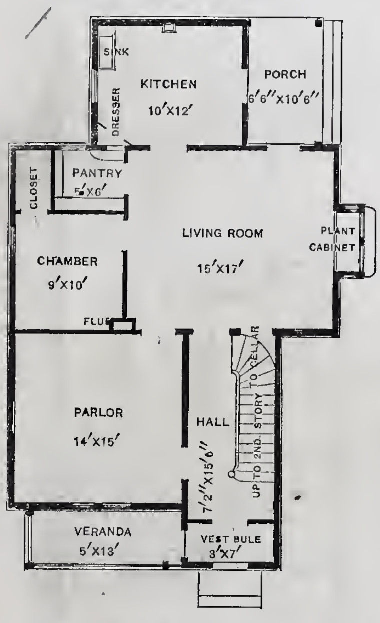
Estimate of Cost.

216 yards of excavation	$43.20
76 perch of stone wall (22 ft. to a perch)	102.60
20¼ squares of flooring (joists and all complete)	42.00
24 squares of wall construction, painted and finished	240.00
16½ squares shingle-roof construction	132.00
775 yards plastering	124.00
36 lineal feet chimney	54.00
12 " kitchen chimney	12 00
1 flight stairs	40.00
Cellar stairs	10.00
17 windows	136.00
3 cellar windows	7.00
1 plant cabinet	42.00
22 doors, cased and finished complete	132.00
1 sink and pump	10.00
Fitting up closets and pantry	25.00
Veranda and porch	40.00
Baseboards	20.00
Tinwork, deck, gutters, valleys and spouts	80.00
Iron cresting and vane	25.00
Partitions	35.00
Cornice molds and brackets	60.00
Kitchen dresser	15.00
Cost	$1,526.80
Builder's profit (10 per cent.)	152.68
Total cost	$1,679.48

Architectural Design.

BY C. A. CUMMINGS.

The worst faults of our architectural design appear to me to lie at present mostly in the direction of unrestrained or undiscip-



Moderate Priced Dwelling.—Fig. 4.—*First Floor Plan.—Scale,* 1-16 *Inch to the Foot.*

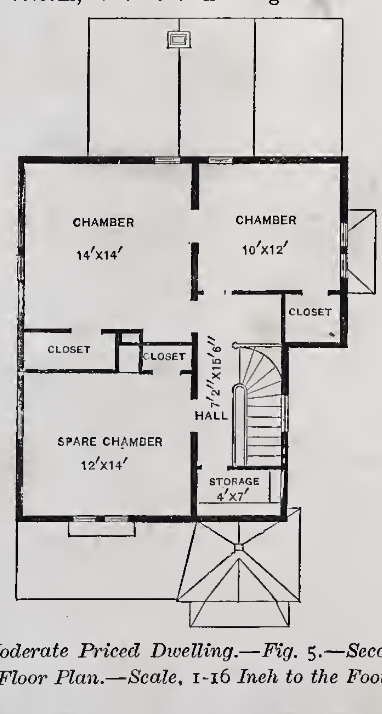
lined ambition, which leads us in the first place to tell all we know, and sometimes more, at a single effort, as if we never expected another opportunity; and, secondly, to strive to produce, at all hazards, something startling and piquant, forgetting that the design, once executed, is to outlive all first impressions, and that what startles one to-day may disgust him to-morrow. Repose is contemned, and in its place we find the buildings, even of our educated architects, characterized too often by a fidgety and over-conscious display of knowledge, which might, under a stricter rule, have produced designs, if less striking at a first view, more admirable at every other.

The conditions under which our profession is practiced to-day are wholly different from those which prevailed 20, or even 10 years ago. The mental equipment and furnishing with which the young architect now starts forth on his career, resulting partly from the extraordinary multiplication of books and photographs, and partly from the admirable course of instruction offered by a few well-organized schools of architecture and architectural drawing, joined to a singular revival, if, indeed, it should not rather be called a new birth, of enthusiasm for this art in a thousand bright young fellows all over the country, offer a very different spectacle from the undirected studies and the rather languid and solitary beginnings which the elders of the profession have to look back upon. The young architect of to-day has only himself to blame if he has not the great examples of all styles and ages at his fingers' ends, as well as in his portfolios and scrap-books. His danger arises, not from want of technical knowledge, but from intemperance and disorder in the use of it.

Another cause, which, so long as it exists, must prevent us from realizing the best results from our increasing knowledge, is the lightness and fickleness of our tastes and their independence of fixed principles. This leads us to follow the prevailing fashion of the day abroad—to design this year after the French Renaissance, the next in the English Gothic, the next again in the Queen Anne. so called. Tho performances, more or less striking, of European, especially of English, artists, are promptly reported to us every week in the various journals, and we are as easily thrown off our balance by any audacious defiance of the plain rules of common sense or the requirements of common convenience, as by a real achievement of art. The French would say this is the natural and necessary result of the absence of an academic standard; and it is certain that there is something imposing in their steadfast adherence to a national style, and their thorough and trained performance in it. This is something impossible to us, and I am by no means sure that in the long run more is not lost than gained by it, even in France; but it would seem as if some mean might be discovered between a restraint so close as this and the wild license of our practice.

Closed Against Lightning.

In an interesting article in the *Building World* it is stated that there is in Carinthia a church which was so often struck by lightning that at length it became the custom to close it during the summer months. This continued until, in 1778, the church was rebuilt and provided with a suitable lightning conductor, since which time the building has been struck but few times and has suffered but little damage. It was at one time held that the best way to protect a building was to repel the lightning from it, and as glass is one of the best non-conductors, a thick glass ball was placed upon the top of the spire of Christ Church, Doncaster, England, but in 1836 lightning struck the church, shattering the ball and seriously damaging the spire. The carrying out of a theory which, in this case, proved so disastrous, has had a happier result in the Houses of Parliament, London, where Sir W. Snow Harris, who was charged with protecting the building, carried the flat copper bands which were used for lightning conductors behind the plastering of the walls; and Faraday caused a spiral channel, following the course of the stairs from top to bottom, to be cut in the granite of the



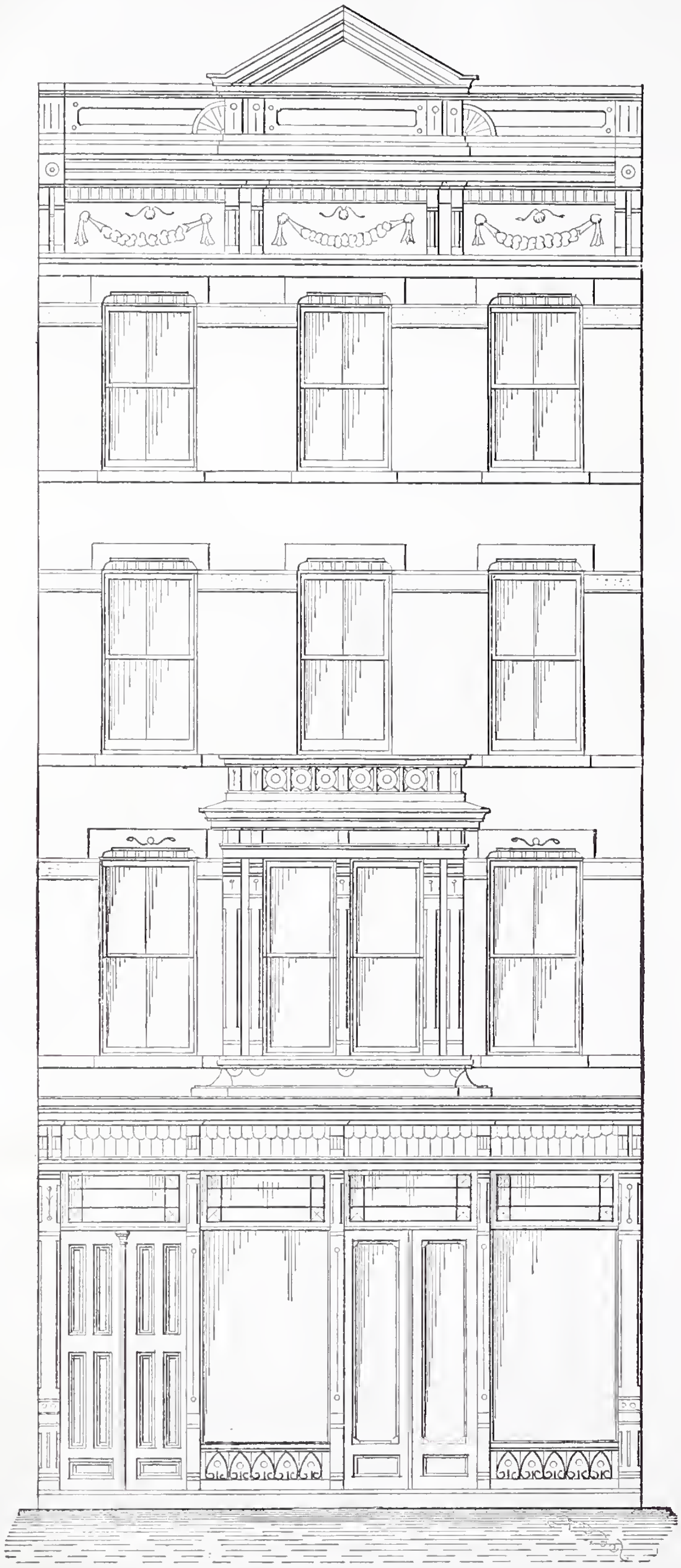
Moderate Priced Dwelling.—Fig. 5.—*Second Floor Plan.—Scale,* 1-16 *Inch to the Foot.*

lighthouse on Plymouth breakwater, in which was laid a massive copper lightning rod. One of the best instances of what may be called natural protection is afforded by the London Monument. This column, some 200 feet high, is crowned by a bronze flame, which typifies the great fire of London; this flame is in contact with the bars of the iron cage in which it was found necessary to inclose the balcony at the top, to prevent persons from throwing themselves over, and the bars in their turn connect with the rail of the balcony and the hand-rail of the staircase which descends to the ground. It is useless to try to insulate the vane spindle or finial upon a tower or spire by using glass rings; it is better to make this rod the upper part of the lightning conductor. The earth end of a lightning conductor should be carried to continually damp earth or running water, but not to a stone-lined well or cistern.

Combined Store and Dwelling.

The accompanying engravings represent a store and dwelling designed by Messrs. Bicknell & Comstock, architectural publishers, New York City, expressly for this journal. The building is 25 feet front by 45 feet deep, with a rear extension of 19 by 25 feet. In preparing designs of buildings which in frontage are restricted to a specified number of feet, and which are flanked on both sides by walls, as is commonly the case with city buildings, there is necessarily a certain fixedness of appearance and arrangement which it is difficult to overcome. We feel confident, however, that in the present instance these defects have been avoided to a greater degree than usual, and that our readers will agree with us in terming the building represented a very symmetrical and tasteful structure.

In the smaller cities throughout the country a demand is arising for a better class of store buildings than are commonly erected. Not only are superior conveniences for the transaction of business demanded, but some regard to the architectural appearance of the building is necessary. Trade is sometimes diverted from one establishment to another solely by the better appointments of the opposition concern. In point of construction, it costs no more to roof a building



Store and Dwelling.—Fig. 1.—Front Elevation.

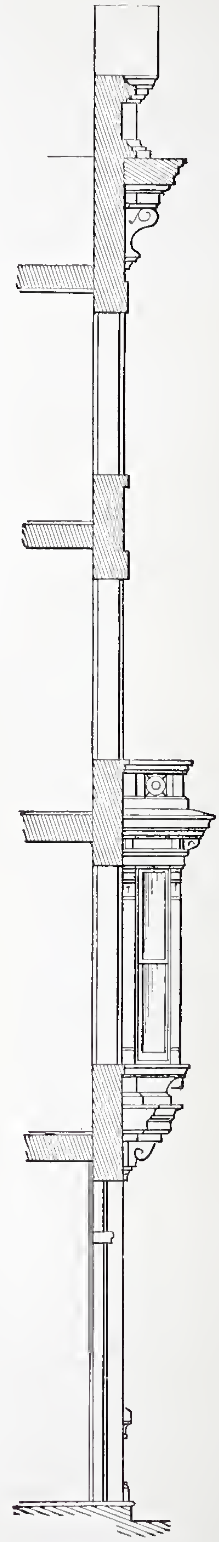


Fig. 2.—Section.

Scale, 1/8-Inch to the Foot.

[Bicknell & Comstock, Architectural Designers and Publishers, New York City.]

of three or four stories than a structure of the same ground plan only one story high, and hight in a store building gives it a commanding appearance. Besides these considerations, the space above the store may be utilized as a dwelling, thus producing an additional return upon the capital invested Builders are often at a loss how to combine all of these requirements into a harmonious whole, and it is in an attempt to present something that will be of assistance to them that the design is published.

In the first story it is intended to employ iron for the posts, or the posts occurring at each side of the entrance may be of iron and the intermediate ones of wood. In the latter construction the front would be supported upon a lintel girder. The cornices in design are adapted to the use of either galvanized iron or wood. Above the lintel cornice the front is to be laid of front brick,

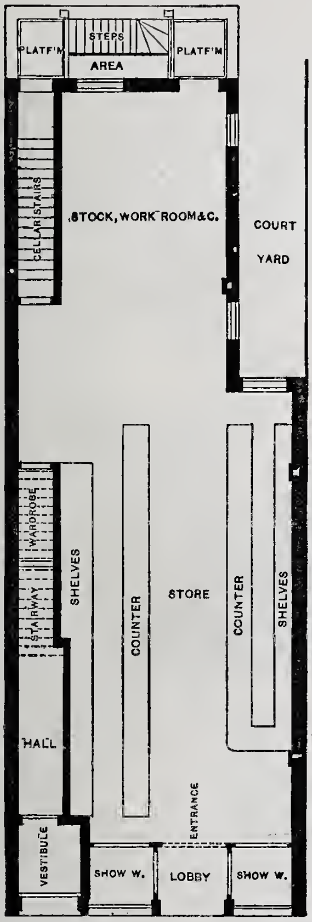


Fig. 3.—*First Floor.*

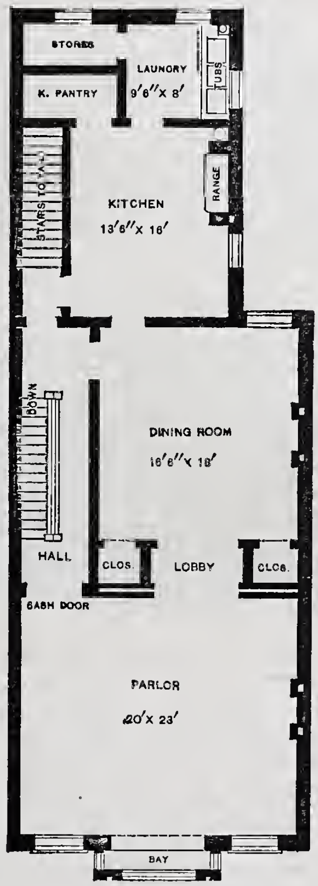


Fig. 4.—*Second Floor.*

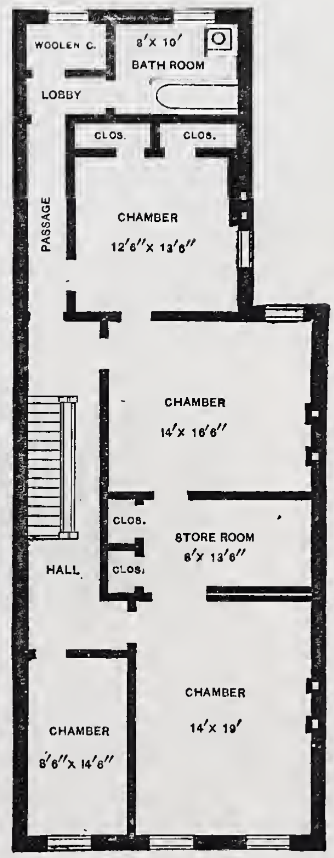


Fig. 5.—*Third Floor.*

Store and Dwelling.—Floor Plans.—Scale 1-16 *inch to the Foot.*

[Bicknell & Comstock, Architectural Designers and Publishers, New York City.]

close joints. Stone sills and stone lintels form the finish to the window openings.

The store floor is arranged with show windows, counters and shelving. The rear extension is adapted to use for counting-room, work-room, stock-room or for other similar purpose, according to the nature of the business transacted. A wardrobe closet is provided under the stairs. In the rear will be found an open area, with area steps, platforms, &c.

The entrance to dwelling has a vestibule with sash doors, fitted with enameled glass. The dwelling, which is planned upon the second and third floors, consists of parlor, dining-room, kitchen, laundry and closets upon the former, and four convenient chambers, bath room and closets upon the latter. The fourth floor, of which no plan is presented, may be arranged similarly to the third, or in some other manner according to the preferences of the occupants, or it may be made to extend only through the main part of the building.

The whole structure is exempt from expensive features, and yet, when carefully built, will produce a fine effect. Its cost is estimated at from $5000 to $7000, according to the style of finish and the locality in which it is erected.

Preservation of Iron Structures.

BY C. GRAHAM SMITH.

The paints used for ironwork are of every description, name and quality. The usual varieties employed for preserving it against corrosion may be divided into lead, iron oxide, silicate and tar paints. Differences of opinion exist as to the relative merits of the first three descriptions, but the experience of three foremen painters connected with establishments in England is decidedly in favor of lead paints, when of good quality and mixed with good oil without spirits. Unfortunately, there are no reliable, practical tests to insure good materials alone being used. Consequently, both the colors and the oils are often inferior in quality and much adulterated. For these reasons and on account of cheapness, iron oxide paints are by some preferred.

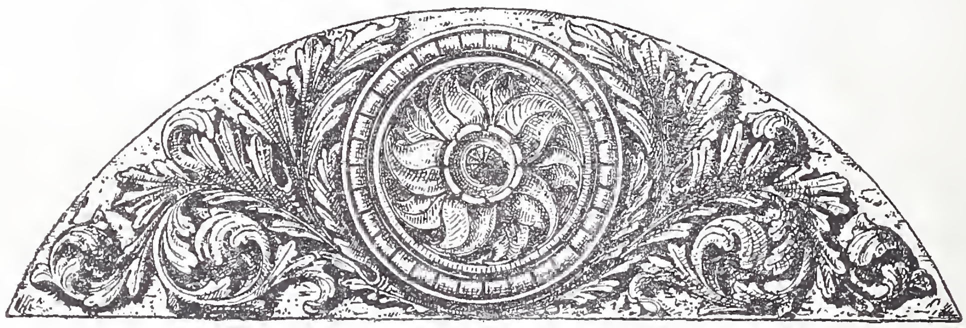
A little white lead mixed with red makes it go further and easier to work into corners. If the first coats are put on with pure red lead, owing to its weight it is liable to run off; but the last coat should consist of red lead alone. The tar paints are more often used for ironwork which is not to be seen, such as water pipes, floor plates for bridges, and girders which are to be built into masonry or brickwork. It is cheap and answers well for such purposes and for sea-work, as it is said not to foul so readily as lead or other paints of a finer description. A good rough paint is made by heating coal tar and mixing with it finely sifted slaked lime, in the proportion of between half a pound and a pound of lime to a gallon of tar, adding sufficient naphtha to render it of a convenient consistency for laying on. This composition should be applied while hot, but not too hot. Do not keep it over the fire too long, or it will lose its essential oils. Some positions admit of the paint being sanded, in which case it should be done, as it adds to its durability. Before painting iron, give it a coat of boiled linseed oil applied hot.

How Old is Glass?—The oldest specimen of pure glass bearing anything like a date is a little molded lion's head, bearing the name of an Egyptian king of the eleventh dynasty, in the Slade collection at the British Museum. That is to say, at a period which may be moderately placed as more than 2000 years B. C., glass was not only made, but made with a skill which shows that the art was nothing new. The invention of glazing pottery with a film or varnish of glass is so old, that among the fragments which bear inscriptions of the early Egyptian monarchy are beads, possibly of the first dynasty. Of later glass there are numerous examples, such as a bead found at Thebes, which has the name of Queen Hatasoo or Hashep, of the eighteenth dynasty. Of the same period, are vases and goblets and many fragments. It cannot be doubted that the story preserved by Pliny, which assigns the credit of the invention to the Phœnicians, is so far true that these adventurous merchants brought specimens to other countries from Egypt. Dr. Schliemann found disks of glass in the excavations at Mycenæ, though Homer does not mention it as a substance known to him. That the modern art of the glass blower was known long before, is certain from representations among the pictures on the walls of a tomb at Beni Hassan, of the twelfth Egyptian dynasty; but a much older picture, which probably represented the same manufacture, is among the half-obliterated scenes in a chamber of the tomb of Thy, at Sakkara, and dates from the time of the fifth dynasty, a time so remote that it is not possible, in spite of the assiduous researches of many Egyptologers, to give it a date in years.

Terra Cotta in Architecture.

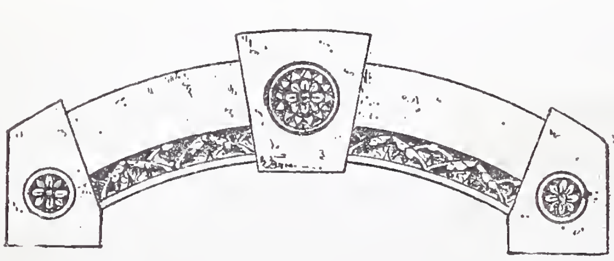
The history of terra cotta, literally meaning "baked" or "burnt clay," may be said to be coeval with the history of pottery, because from the first use of clay for fictile purposes, in the manufacture of domestic utensils, its adaptability for building and ornamental uses must have been soon recognized. That such was the case is evident from the fact that fragments and complete pieces of terra cotta have been found in ruins dating their original construction from periods long anterior to the earliest records of profane history. Indeed, so far from history perpetuating the records of terra cotta manufacture, it may be said that terra cotta has perpetuated the records of history. In the explorations among the ruins of Assyria, Babylon, Nineveh and elsewhere, cylinders and tablets of baked terra cotta and ordinary pottery have been found, bearing the public and private accounts and the historical records of those people in their peculiar hieroglyphic characters. The explorations of these ruins is still systematically carried on under the direction of the British Museum, which has already an immense number of these clay tablets collected, and which is having the inscriptions deciphered and published in English—thus adding vastly to the world's knowledge of the wonderful and but little known people to whom these strange and imperishable records refer.

In ancient Egypt and in Chaldea, terra



Terra Cotta in Architecture.—Fig. 1.—Panel, with Scroll Work in Relief.

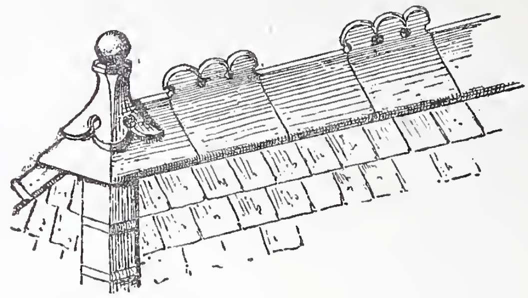
cotta was extensively used for building and ornamental purposes. Beckwith says: "The domestic dwellings of the Chaldeans were ornamented externally, by diapered patterns of colored bricks, sometimes molded into half columns, with a variety of wavy patterns. Internally, the plaster walls were embellished with colored courses of terra cotta imbedded in the plaster, so as to show either their bases, or their points, or a part of their sides, combined in lines." In Europe, the manufacture was more or less extensively carried on during the Early and Middle Ages, but after that for a period of



Terra Cotta in Architecture.—Fig. 2.—Window Cap for Segmental Frame.

several centuries it fell into comparative neglect. The earliest statues were of terra cotta, which was so employed for some centuries before marble and bronze were adopted by the sculptor. The terra cotta of the ancients was generally of a coarse and less homogeneous body, less baked and really loss durable than that of the present day.

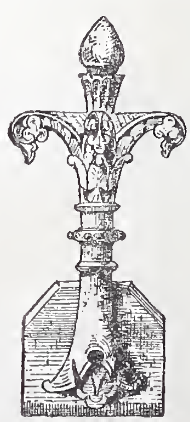
It was not until within the past 20 years that the manufacture entered upon its modern revival, and that terra cotta came into its present extensive employment for all purposes of ornament and utility. It has rapidly grown in favor with builders, and with the public at large, as a knowledge of its qualities and advantages has increased, so that it is now coming into general use in this country and in Europe for architectural trimmings and building material, to replace brick and stone; for statues, fountains and



Terra Cotta in Architecture.—Fig. 3.—Finish for the Comb and Hips of Roofs.

garden vases, edgings and ornamental articles of all kinds, and for a variety of other productions for indoor and outdoor use.

Common as are the component parts of terra cotta, simple as is its manufacture, and general as its use is now becoming, the public are strangely ignorant of almost everything relating to it. It may be said that the popular opinion concerning it is, that it is a cheap "manufactured" material, which may do very well for light ornamental articles that are not expected to last forever, but which is not suitable for substantial work in which strength and durability are primarily essential. It is so difficult to convince the public that man can make something harder and more durable than stone, so difficult to get a certain portion of them (who maintain the absolute perfection of Nature in all things) to believe that man can improve upon Nature in her own domain, that it may not be easy to prove to them anything to the contrary. Yet the contrary must be said. So far as the wants of man are concerned, terra cotta is an improvement upon Nature's geological productions; it is harder and more durable than any stone, including even marble and granite. The proof of this is to be found in the fact that terra-cotta ornaments and building blocks, made 2000 and 3000 years ago, are almost, many of them quite, as perfect to-day as they were when made, while the stones of the ruins amid which they were found have crumbled away to a greater or less extent. A remarkable example is the Sutton House, in Surrey, England, erected about the year 1530; the terra cotta ornaments on it still show the marks of the modeling tools, while the stones of the building have sadly decayed. "It (terra cotta) is more durable than even ordinary granite, as may be seen on the lodge in Merion Square, Dublin, which was built about 1786. The granite moldings there, cut in stone from the Wicklow Mountains, are all worn away and rounded by the action of the rain, while Coade's terra cottas, dated 1788, are as sharp as when they were first placed on the building." There are at Buckingham Palace a number of Portland stone pedestals, supporting terra-cotta vases of handsome design. The pedestals, though only of the same age as the vases, have so far decayed that few of the carved moldings are distinct, while bas-relief figures and delicate foliage on the vases are as sharp and perfect as they were when they left the kiln in which they were burned. Innumerable other cases might be cited, all proving the superiority of terra cotta to stone for building, as well as for purely ornamental purposes; but the few cases cited are suffi-

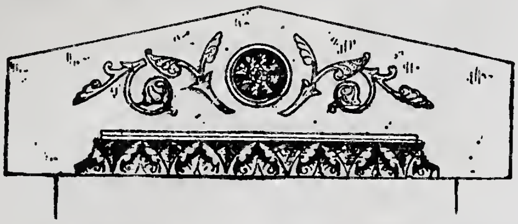


Terra Cotta in Architecture.—Fig. 4.—A Finial.

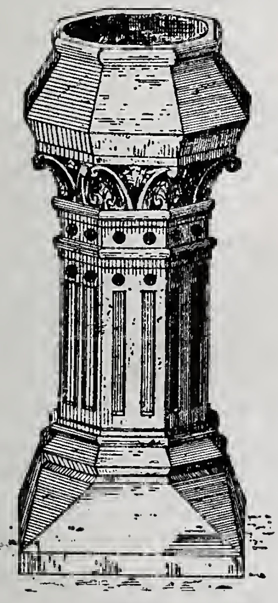
cient to settle the question of relative durability.

The question of relative strength has been determined by severe mechanical tests, which showed that well-made terra cotta required a pressure of 400 tons to the square foot to crush it, a resisting power equal to that of granite, two or three times greater than that of most building stones, and about seven times greater than that of ordinary brick.

Another advantage which terra cotta possesses is its power of resisting the effects of the fiercest fire to which it can be exposed; coming out of conflagrations uninjured, when stones and brick walls would have crumbled or cracked in the intense heat. This is a quality which, in itself, entitles terra cotta to the first and most serious consideration of house owners and householders. Still another advantage is the facility with which it can be molded or modeled into the most elaborate designs When economy and uniformity of ornamentation are called for, the objects may be molded, and thus duplicated to any extent;



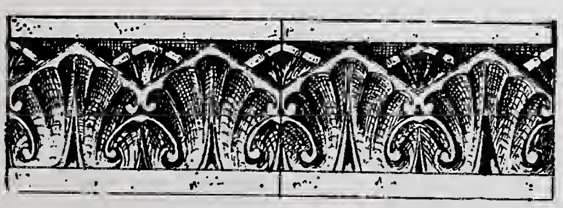
Terra Cotta in Architecture.—Fig. 5.—Window Cap for Square Frame.



Terra Cotta in Architecture.—Fig. 6.—Ornamental Chimney.

but where original artistic work is desired, they are modeled by the artist or sculptor in the usual manner, and are then burned in the kiln, whence they issue as practically indestructible works of art, with the actual touch of the master's hand upon them.

A fifth and last advantage which terra cotta possesses is its cheapness. It costs in simple forms more than brick, but less than dressed stone, while in ornamental work it is very much cheaper than stone, besides being superior to the latter in every building quality, as has been shown.



Terra Cotta in Architecture.—Fig. 7.—Belt or String Course.

So much for the qualities of terra cotta as a building material. For ornamental and other articles, for outdoor as well as indoor use, it will be found equally valuable. For garden ornaments of all kinds—fountains, bridges, steps, statues, vases, pendant flower baskets, garden edgings and horticultural articles generally—it cannot be excelled in merit by any other material, natural or artificial. Properly made and perfectly fired, terra cotta is practically indestructible by time or the elements—standing in the rain and sunshine, and resisting the extremes of heat and cold, without being appreciably affected by them—so that it is exceptionally well adapted for all outdoor work, and particularly so for all delicate molding and ornamental work, which in stone would soon crumble away or be easily injured.

Of the small ornamental articles in terra cotta such as statuettes, groups, vases, and the innumerable other objects which are now made, it seems scarcely necessary to say much, as they are already so well known. It is only within a recent period that the manufacture of these small articles has developed into an important branch of the art. It is even yet devoted chiefly, in this country, at least, to the reproduction of antique patterns in vases and domestic utensils of various kinds. Original work has been done in it, however, some in this country and a great deal in Europe, and, as the manufacture gradually increases, original productions will naturally increase also in both number and artistic excellence.

The reader may ask: "What is the difference between terra cotta and ordinary earthenware?" The question is more easily asked than answered, because the difference between the two is not always apparent, and, as far as the composition of the body and the process of manufacture are concerned, the two terms may in many cases be used interchangeably.

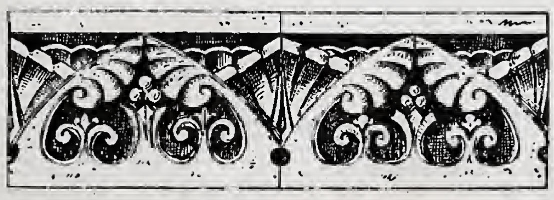
Speaking in general terms, it may be said that, while ordinary earthenware varies greatly in the hardness, texture and color of its different kinds, terra cotta is always extremely hard, semi-vitreous and usually of a red or buff color. Common terra cotta is made of potter's and fire clays, mixed with white sand, alkalies and "potsherds" (*i. e.*, old fire brick and pottery pulverized), which act as vitrifying elements, counteract excessive shrinkage, make the ware harder and keep the color lighter. A superficial distinction between the two is, that terra cotta proper is unglazed and undecorated; but, if a fine piece of it be glazed or decorated, it will at once be placed under the head of earthenware. This is, indeed, the only marked difference in the small ornamented ware. The reader will thus see that while there is a great and unmistakable difference between ordinary colored pottery and terra cotta such as is made for building purposes, pipes and coarse articles, that difference is merely superficial in the case of the finer wares.

The process of manufacture being the same in almost every respect as for ordinary

Terra Cotta in Architecture.—Fig. 8.—Roof Ornament.

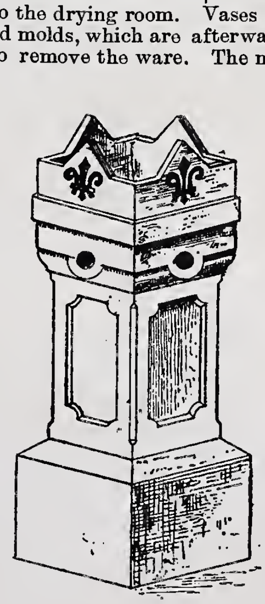
pottery, it is not necessary to repeat the details already given. The manner in which some of the articles are formed may, however, be briefly noticed.

Terra-cotta statuary and figure work of every kind, large and small, is not cast solid, as is popularly supposed, but is molded hollow. The molds, usually of plaster of Paris, are in a number of parts, varying according to the size and complexity of design of the article. The potter, taking a bat or sheet of



Terra Cotta in Architecture.—Fig. 9.—Belt or String Course.

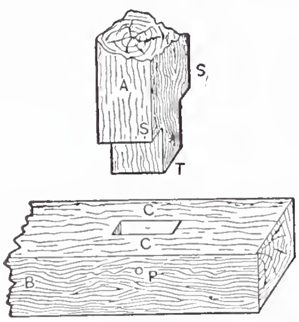
clay, varying from an inch thick for large figures down to a quarter of an inch thick for small ones, presses it into one of the parts of the mold with his hand or a sponge, taking care to press it well into all the concavities of the mold. The different parts are afterward united with "slips" and then sent into the drying room. Vases are made in united molds, which are afterward taken apart to remove the ware. The making of



Terra Cotta in Architecture.—Fig. 10.—Chimney Top.

models and molds for terra cotta is slow and difficult, requiring much patience and great skill. They must be made one part at a time, and that part be allowed to dry and shrink thoroughly before the next one is made to fit it; as there will be quite a difference in size between the dry and the moist part, it requires an experienced modeler to calculate the shrinkage and possible warping, in order to insure an exact fit of the different parts after the whole is completed. In addition to this, the peculiar shape or intricate ornamentation of certain articles will require the molds to be correspondingly peculiar and intricate, in order that they may be taken apart in freeing the ware, which adds greatly to the labor of making them, and demands much experience for their successful use.

When the ware is sufficiently dried it is carried to the kiln, the small and fine articles being placed in seggars, to protect them from the flame and smoke. Terra cotta, like stoneware, to which it is similar in general qualities, requires higher and longer firing than porcelain and ordinary pottery—true terra cotta requiring four, five or six days, according to the thickness of the ware, for the ingredients to fuse or vitrify and form a thoroughly homogeneous body. The ware shrinks greatly in drying, and much more in burning, the total shrinkage averaging about one-tenth the original size. To ensure successful burning, and to prevent warping, great care must be exercised to mold every piece of ware of



Jointings in Wood.—Fig. 1.—Common Mortise and Tenon Joint.

uniform thickness throughout, as any inequalities in this respect are likely to be followed by inequalities in the burning, and by distortion in the unequal parts.

Owing to the vast number of houses now engaged in Europe in the manufacture of all kinds of terra cotta, it would be impossible to notice even the most important of them. Many of them, like the Watcombe and Torquay Terra Cotta companies, are devoted exclusively to the manufacture of the finest kinds of the ware, chiefly for ornamental purposes; but for the reasons already explained, such houses might more appropriately be noticed among the pottery establishments, the difference between the productions of the two being merely superficial.

But while terra cotta has been employed

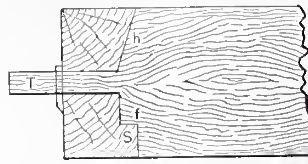
Jointings in Wood.—Fig. 2.—Sectional View of Common Mortise and Tenon Joint.

in Europe for architectural purposes for a period of from 20 to 25 years, and is now a well-recognized material the manufacture of which gives employment to many workmen, its use in this country has been retarded, and to a great extent prevented, by the fact that it has only within a few years been produced here of satisfactory and reliable quality. Most of the garden ware, statuary, &c., made at various points was so defective in color as to require painting to make it presentable.

An establishment devoted especially to architectural work was started in Chicago, about the year 1868, but does not seem to have produced any work of much artistic importance. About 10 years later its projector removed to Boston, and began the manufacture on premises in Federal street. Early in 1879 this establishment passed into different ownership, and is now known as the Boston Terra Cotta Works.

Messrs. A. Hall & Sons, of Perth Amboy, N. J., since organized as the Perth Amboy Terra Cotta Company, after a long course of experiments with different clays and modes of firing, produced their first architectural work in January, 1878.

The Perth Amboy Terra Cotta Company's processes do not vary materially from those heretofore described, and their success in producing ware of good color, hard, sound texture and power of resistance to atmos-



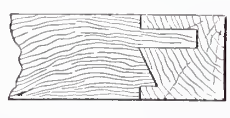
Jointings in Wood.—Fig. 3.—Example of Tusk Tenon, Showing Horn and Shoulder, the Tenon Projecting through the Girder and Pinned on the Outside.

pheric and climatic influences—all primary requisites of good terra cotta—is due rather to skill in the selection and manipulation of the material, and a thorough and careful supervision of all the complicated processes, than to any peculiarity in their mode of manufacture.

Various other concerns, notably some of the small pottery establishments in the central and western part of the country, have undertaken the manufacture of what has been called terra cotta work during the past few years, but all of them, so far as we are informed, have failed to produce hard ware of good color. No concerns in this country, except those named above, have yet produced genuine terra cotta ware. The accompanying illustrations are engraved from designs in the catalogue of the Perth Amboy Terra Cotta Company, and serve to present a fair idea of the style and character of the material.

Jointings in Wood.—Mortise and Tenon.

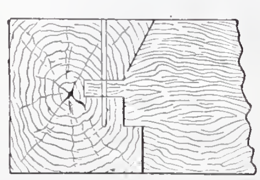
A tenon is formed by cutting out rectangular pieces on both sides of a timber. A mortise is a rectangular hole cut to receive the tenon. The common rule for



Jointings in Wood.—Fig. 4.—Another Example of Tusk Tenon.

cutting a tenon is to make it one-third the width of the timber, thus cutting away a quantity on either side of it equal to it. This rule has frequent exceptions. The tenon may be made of any proportion so long as it is thick enough to withstand the strain upon it.

The simplest form of this joint is when a vertical timber meets a horizontal beam at right angles, as shown in Fig. 1 of the accompanying illustrations; the end view of the same is shown in Fig. 2. In Figs. 1 and 2 the tenon T is formed by dividing the end of A into three equal parts and cutting out rectangular pieces on both sides, each

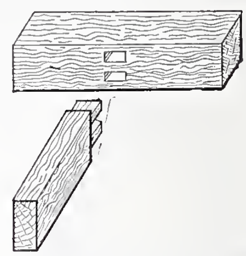


Jointings in Wood.—Fig. 5.—Similar to Fig. 3.—The Lower Edge of Mortise is on the Neutral Axis.

equal to the part left in the middle. The sides C C of the mortise, as shown in Fig. 2, are called "checks." The surfaces C C in Fig. 1, on which the shoulders of the tenon rest, are sometimes called the "abutment cheeks."

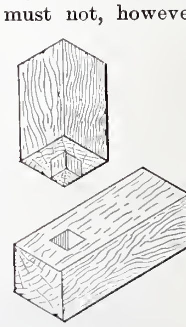
The springing of the tenon from the beam is called its "root," as shown by R in Fig. 2. S S are the shoulders. P, in Fig. 1, is the pin-hole, which is generally placed one-third the length of the tenon from the shoulder, and is, in timber, equal to one-quarter the thickness of the tenon. If the tenons reached exactly to the bottom of the mortice it would take its share of the pressure on the post, but it is difficult to make it fit with such accuracy, especially as the mortise cutting across the grain shrinks more in depth than does the tenon cut along the grain. In practice, therefore, it is made a little shorter than the depth of the mortise, so that the shoulders may bear firmly upon the sill, which is more important. When the post is likely to be subjected to an equal strain on both sides, the cheeks of the mortise should be of equal lengths; if there is likely to be more strain from one side, then the opposite cheek should be made thicker, so that it may offer more resistance to the tenon being forced through it.

When a horizontal beam is framed into another, and they are subjected to a downward strain, as in the case of joists framed into a girder, the position or form of the mortise and tenon will be determined by other considerations. When a beam is sub-



Jointings in Wood.—Fig. 6.—Example of Double Tenon.

jected to transverse strains, the fibers of the upper portion are compressed and those of the lower portion extended. In the central line dividing these portions from one another, there is neither compression nor extension. This line is, therefore, called the "neutral axis." The mortise should be placed in the neutral axis of the girder, where the cutting of the fibers will weaken the girder the least, and where the mortise itself and the tenon within it will be free from tension and compression. With regard to the position of the tenon on the joist, the lower down it is the less likely it is to be broken, because the mutual pressure of the butting surfaces above it protect it from cross strains, and also because there is greater thickness of timber above it to be bent or torn off under a breaking weight. The tenon must not, however, be so low



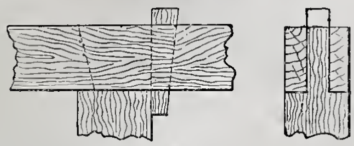
Jointings in Wood.—Fig. 7.—Sub-Tenon or Joggle.

down that there is insufficient thickness of wood left below the mortise to support it.

It is evidently desirable, for the strength of the tenon, that it be as large as possible, but in the ordinary forms, shown in Figs. 1 and 2, this would necessitate large mortises, and very much weaken the girder. That form, therefore, is not adapted for joints intended to bear downward strains. The "tusk" tenon should always be used in such places.

The tusk tenon, shown in Figs 3 and 4, was devised in order to give the tenon a deep bearing at the root without greatly increasing the size of the mortise, which, as we have just said, would weaken the girder. This object is effected by adding below the tenon a tusk having a shoulder, which penetrates the girder to a depth about one-sixth the thickness of the joist. In Fig. 3 T is the tenon, *t* the tusk, having a shoulder S. Above the tenon is formed what is called a "horn," indicated by *h*, the lower end of which penetrates to the same extent as the tusk. It will be seen by this arrangement that the strength of the tenon between *h* and *t* is greatly increased as compared with the common form, while the mortise is not made much larger.

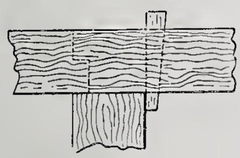
Fig. 3 also illustrates the method in use



Jointings in Wood.—Fig. 8.—Dovetail Tenon and Wedge.

for making this joint in connection with narrow girders. The tenon is carried through the girder and pinned on the outside. In Fig. 5 the same joint illustrated in Fig 3 is shown in use with a thicker girder, in which the tenon is allowed to penetrate a distance equal to twice its own depth, and is pinned through the top of the girder.

For reasons stated above, mortises should be in the neutral axis, or central line, of the girder, as shown in Fig. 3. Practically, however, the mortise is generally placed with its lower edge on the center line, as



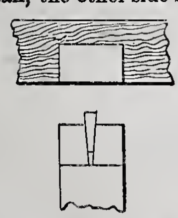
Jointings in Wood.—Fig. 9.—Tenon Notched and Wedged.

shown in Fig 5, by which arrangement the tenon is in the compressed portion, and the tusk in the extended portion of the girder.

Double tenons are often used in joiner and cabinet work, but should be avoided in carpentry, as they weaken the timber into which they are framed. Both tenons seldom bear equally, so that a greater strain is thrown upon one of them than it is intended to support. This form is shown in Fig. 6.

A sub-tenon, or housing, as it is sometimes called, is a vertical tenon, used where it is only required to prevent lateral motion—for example, in keeping a post in its place upon a sill. Housing, as noted in the last article, is not properly applied to this joint. Its use should be restricted to where the whole end of one piece of timber is let for a short distance or "housed," into another. The joint illustrated in Fig. 7 is also sometimes called a "joggle."

Dovetail tenons are those in which one side of the tenon is splayed so as to form half a dovetail, the other side being straight.



Jointings in Wood.—Fig. 10.—Fox Wedging.

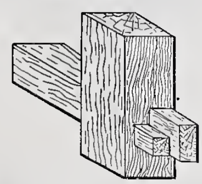
The mortise is also splayed on one side and is made rather wider than the tenon, which is placed in position, pressed well up against the dovetail side of the mortise, and then secured by a wedge driven into the interval left on the straight side. A joint of this kind is shown in Fig. 8.

In Fig. 9 is shown a tenon which is notched and wedged. One side is straight the other is notched—the mortise is cut to correspond. The method of securing by the wedge is clearly shown by the engraving.

Fig. 10 shows what is called "fox" wedging, a device employed to produce a tight joint in mortises and tenons. Its operation is evident upon inspection of the engraving.

Fig. 11 shows a method of keying a simple mortise and tenon joint.

Oblique tenons are illustrated in Figs. 1 and 13. When timbers are joined at an angle, the tenon is to be modified in forming. If constructed as shown in Fig. 12, it would be very difficult to work the mortise to receive it. Moreover, the long tenon would have a tendency to tear up the joint in case of settlement of the inclined beam. Further, it would be almost impossible to get the tenon into the mortise when the pieces to be joined formed a part of the system of framing. These faults are remedied by cutting off the end of the beam, as shown by A, Fig. 13. This is the simplest form of mortise and tenon for oblique joints. But the only resistance it offers is what is afforded by the strength of the tenon, which is liable to be crushed, and would in large constructions be quite insufficient to bear the strains liable to be placed upon it. To remedy these the cheeks of the mortise are cut, as shown in Figs. 14 and 15, to the line D B, so that while the tenon is retained to prevent lateral

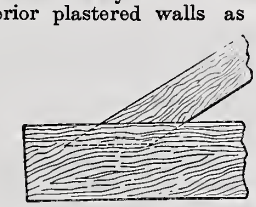


Jointings in Wood.—Fig. 11.—Mortise and Tenon Joint Keyed.

motion, the whole width of the beam itself presses against the abutment A D, by which a much larger bearing surface is obtained. Still greater strength is secured by the use of the bolt, also shown in Fig. 14.

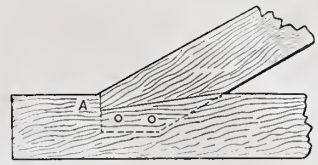
The Right Brick in the Right Place.

Though architects' specifications usually introduce the clause that the "bricks used are to be hard, square, sound and well burned," it is well known that builders avail themselves of a little latitude in the interpretation of this clause. The truth is that the estimate of a brick should be formed upon its suitability for the purpose intended, and, therefore, the only true method of judging of bricks is to know where they are to be placed in the building. The right brick in the right place, to slightly alter a common aphorism, should be the only crucial test. Every builder knows that the bricks he would use externally are not so well suited for interior plastered walls as those of



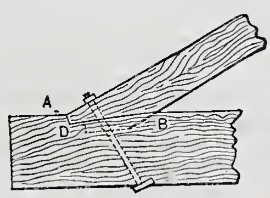
Jointings in Wood.—Fig. 12.—Oblique Tenon Without Modification.

rough and misshapen manufacture, which give a better "key" to the plaster, and which, from their being less burned, are lighter, and more adapted for interior purposes. We may here say that only facing bricks require to be "sound, square and well burned;" and for the sake of being consistent, as well as being correct, a specification ought to have such a clause as the following: "The bricks to be adapted for the purposes for which they are intended, the facings to be of selected, square make, hard and well-burnt bricks, of uniform color, and the other bricks to be of sound and well-burnt quality." For paving, copings and other portions of buildings subject to weight and wear, a hard variety of brick is necessary, and a requirement of this kind should be inserted in the specification of all new works. We may here refer to three varieties of bricks: 1. Ordinary bricks used for walls. 2. Cutters or rubbers, used for arches and other purposes where the bricks require to be cut to some particular shape. 3. Underburnt bricks, suitable only for inside walls. The requirements of ordinary bricks we have already discussed. "Cutters or rubbers" should be made from a mild earth, freed from lumps of all kinds, so that it may be rubbed to a smooth face and leave fine arrises. For exposed outside work it is better to use molded bricks, as they are better burnt. A good rubber should be of uniform texture, and not easily cut by a knife—conditions, however, they do not always fulfill. In "Notes on Building Construction," there are a few useful remarks



Jointings in Wood.—Fig. 13.—Oblique Tenon with the End Cut at A.

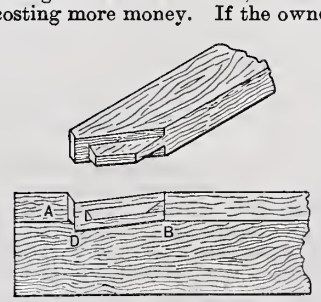
made upon the method of distinguishing between clamp, kiln and machine-made bricks, which we may quote for the good of our younger readers. "In clamp-burnt bricks the traces of the breeze mixed with the clay can generally be seen. Kiln-burnt bricks often have light and dark stripes upon their sides, caused by their being arranged, while burning, with intervals between them. * * * * The best kiln bricks are of a uniform color. Machine-made bricks may easily be distinguished, if wire-cut, by the marks of the wires; if molded, by the peculiar form of the mold, letters on the surface, &c. In distinguishing good from inferior kinds of brick, one point is to notice if they are free from cracks and lumps of lime, which, by slaking with moisture, split the bricks." Another, but secondary point, is the shape and uniformity of size; the edges should be fine, sharp and square. The quantity of water a brick will absorb is another excellent test of its quality. The percentage of



Jointings in Wood.—Fig. 14.—The Usual Form of an Oblique Tenon in Use.—The Parts Joined.

water absorbed varies. In hard paviors the percentage is 9½, in machine-made red it is about 10, but the average absorption is about one-sixth of the weight, and in highly vitrified about one-fifteenth.

What Firemen Say About Underwriting.—As to insurance tending to encourage the erection of cheap and unsubstantial buildings, the fact is so apparent that it needs no argument. Buildings, especially those designed for business purposes, are erected in the hope that they will prove a source of profit to the owner. A cheap and flimsy block, having a showy exterior and tawdry finish inside, will rent for quite as much as a building more substantially constructed and costing more money. If the owner had



Jointings in Wood.—Fig. 15.—The Usual Form of Oblique Tenon in Use.—The Parts Shown in Perspective.

to take his own risk as to fire, he would make his building as nearly fire-proof as possible; but as the insurance companies, for a small premium, will insure the building for all it is worth, or even more, the owner naturally puts up the building that will be the most profitable and cost the least money. Hence we have those architectural abominations and fire-spreading agencies—mansard roofs and modern structures, wherein wood takes the place of brick or stone wherever possible. Insurance tends also to make property owners careless, and even reckless, as to their property, subjecting it to risks and hazardous exposures that they would not tolerate for a moment if they had to foot the bills in case of loss. In view of the facts in the matter, which are apparent to whoever looks for them, we repeat what we said before: It may well be questioned, then, as is now being done, whether fire insurance, as at present practiced, is a blessing or a curse to the country. Properly managed, insurance is a great benefit, but of late the competition for business has been so great among the companies that it has certainly impaired, if it has not destroyed, their usefulness.—*The Fireman's Journal.*

Architectural Proportion.

Messrs. Bicknell & Comstock, architectural publishers, of this city, have recently issued a second and revised edition of "Atwood's Rules of Proportion," some account of which we desire to present to our readers. The book is of moderate size, and is sold at the low price of $1. Considering this figure and the usefulness of the treatise, we unhesitatingly say it should be in the hands of every architect and builder who desires to proportion his work in a way best suited to the ends for which it is intended. The author introduces the subject by some general remarks upon proportion, from which we quote: "In building there are two kinds of proportion, but widely different in their application. One is mechanical or constructive, and the other architectural proportion. The former determines the quantity of materials used in construction and subject to the four kinds of strains, namely, tensile, compressile, lateral and twist strains; the latter determines the relation members should bear to each other when employed to beautify and improve the interior and exterior of buildings. With the latter we have most to do, though both are so intimately blended that it is impossible to fulfill the requirements of "well building" without their union in practice. Our sentiments respecting proportion are derived from experience, the use to be made of the building and the materials that compose it. Walls of iron will support a given weight with less thickness than wood, and brick with less than stone. Walls may be too low for their length or too high for their width. They may not be thick enough to sustain the compressile or lateral strains of the roof. Spires or towers may contain too many or not enough diameters in hight. The same is true of door and window openings or any opening in a wall. When buildings irregular in plan and composed of two or more parts or additions vary greatly in size, one being very high and the other low, we say they are disproportioned, or that the equality of ratio used to determine length, breadth and hight has been either destroyed or never contemplated. And in such cases our judgment confirms the opinion of their lack of fitness; and our conception of a proportion being formed upon the circumstance of its fitness for the subject treated, it is only when we see parts of the building adjusted with due regard to this principle, that they are well proportioned or that the building is in proportion."

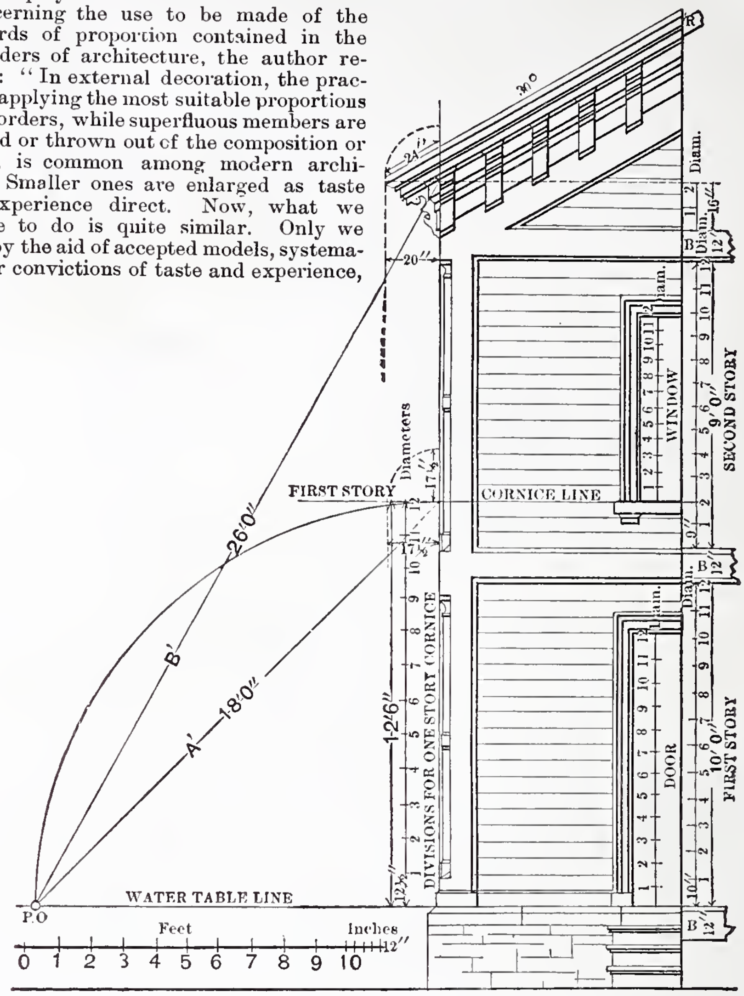
The first part of the book is devoted to a consideration of the proportions of the five orders of architecture, upon which the author has employed considerable originality of treatment. The proportions of these orders display the highest genius of the art, and are probably the most perfect and absolute standards that can ever exist. It is from these proportions that the author derives those practical rules which may be applied in the construction of modern buildings. One radical change which he introduces in considering orders, we should note in passing. The ancients commonly divided a diameter into 60 parts or minutes, and in the examples usually given 10 diameters are used, each being divided into 60 parts. But this author has increased the standard to 12 diameters, and in order to preserve the same ratio, divides each diameter into 50 parts or minutes, instead of 60. His reason for this is that such a number of diameters shall be employed as will most readily resolve hights into feet and inches, and thereby conduce to practical applications. Twelve diameters are undoubtedly more convenient for this purpose than 10 diameters, as heretofore employed.

Concerning the use to be made of the standards of proportion contained in the five orders of architecture, the author remarks: "In external decoration, the practice of applying the most suitable proportions of the orders, while superfluous members are rejected or thrown out of the composition or design, is common among modern architects. Smaller ones are enlarged as taste and experience direct. Now, what we propose to do is quite similar. Only we shall, by the aid of accepted models, systematize our convictions of taste and experience, reducing them to a working standard whose operations, though consistently limited, are clearly defined. We are thus led to devise a standard of measure corresponding to an order of architecture, and hence a standard proportionally ordered."

We think from the above statement of the scope of the book and the quotations which we have made from it, that our readers will be enabled to form an adequate conception of its usefulness. The second part of the work is devoted to the statement of practical rules established as outlined under the laws of proportion, and to illustrations of their use by application to every day construction. We cannot indicate the value of these rules better than by presenting one in detail, together with the author's description, only adding to it so much from other parts of the book as may be necessary to make it fully understood by the reader. The accompanying engraving represents the part elevation of the end of a modern frame house, as commonly built in the country and smaller towns. The plate is introduced in the work to illustrate the method of obtaining the dimensions of the raking and level cornices for the house. The rule is laid down as follows:

"Divide the hight from the bottom of the water-table to the second-story window sills into 12 diameters. Divide one of these diameters into 50 minutes for units of measurement, and give the proper proportions for a one-story cornice without frieze or architrave at this point, namely, 70 parts or minutes. Now enlarge this size in accordance with the directions given for superimposed members above the first story. Reduce the parts so obtained to feet and inches, which would be the horizontal projection at the eaves of the house. Determine the pitch line of the roof and make the gable-end projection equal to the inclined projection at the eaves.

"To determine the proportion of any of the molds required to ornament the projection, increase the unit of measure as many times as there are parts designated in the order for the molding selected."



Architectural Proportion.—Application of the Rules to an Ordinary Frame Dwelling.

The rule referred to above for proportioning superimposed members is too long to quote in full in this connection. Careful study of the diagram and comparison of one part with the other, keeping in mind the standard of measure first obtained, will indicate to the reader the general method pursued by the author.

Besides the illustration which we have presented, there are many other practical examples given in the book—some for elevations, some for interior finish and others for individual members, moldings, &c. The book throughout is of practical interest to all students of architecture as well as to practical men. The work closes with a supplemental chapter of notes, which present some of the most important rules in a condensed form. Concerning Rule 10, which our engraving illustrates, the notes read as follows:

"After the proper proportion of the cornice is obtained, it may be trimmed with few or many members to accord with any of the styles, and in any form, provided the proportions of each member are regulated by the standard proportion of the order. If a cornice mold and *fascia* are used, give each the number of parts designated in the order. If bed mold and frieze are added, give these their respective number of parts, without regard to the intermediate members of the order."

There is also a table of comparative proportions, taking the Temple of Jupiter Stator as the Corinthian example, and the Arch of Titus as the Roman example, from which a third or mean proportion of the several parts is derived. This table of comparative proportions is carefully worked out through all the details of the order, the parts of each individual member being placed opposite its name, thus presenting it in a shape to make it of the greatest usefulness to students and practical men.

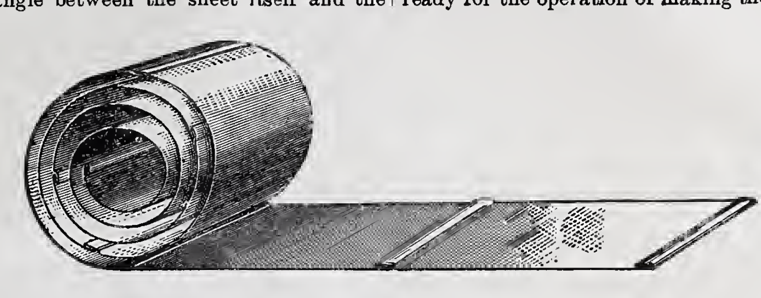
Tin Roofs.

IV.

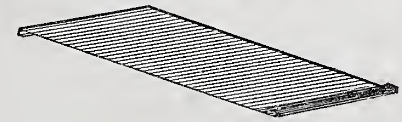
Fig. 1 of the accompanying engravings illustrates the general principles of the standing-seam roof, and at the same time shows the method of using cleats in laying the same. The illustration presents a roof composed of 20 x 28 tin, the length of the sheet lying in the same direction as the rafters of the roof. The cleats in a standing-seam roof differ somewhat from those used in a flat-seam roof, already described, and are shown in Fig. 4 of accompanying sketches. The cleat is applied to the edge of the tin before the seam is made, and is nailed to the roof in the same general method described in connection with the cleat used in flat-seam roofing. Figs. 5, 6, 7, 8 and 9 show the successive operations employed in making a standing seam. The tin is carried to the roof in rolls, is spread in the general direction in which it is to lie, and edges are turned along its sides, that upon one side being a trifle higher than that upon the other. In placing strips of tin together, a narrow and wide edge are placed side by side, as shown in Fig. 5. The extra width of the one edge is turned over against the narrow edge, as shown in Figs. 6 and 7. After this the same general operation is repeated, turning the two edges over together, as shown in Figs. 8 and 9, resulting in what is technically known as a "double seam." Some considerable portion of the edges turned upon the sheets of tin is not consumed in the seam itself. The joint is made sufficiently above the roof to prevent all danger of leakage by means of the seam.

The cross seams in a standing-seam roof are made in the shop before the tin is brought to the roof. They are sometimes formed simply by locking the tin together, sometimes by soldering upon one side, and, occasionally, by soldering upon both sides. As to the manner of forming this lock joint, there is the general way of doing it by hand, and another method of performing the operation by perfected machinery. The latter unquestionably produces work likely to make the most satisfactory roof, yet the machines are not in universal use, and in many sections of the country not enough roofing is done to justify their employment by roofers. A good job can be made by hand. With reference to soldering the cross seams, opinions differ; some would not dare to lay a roof without the cross seams being soldered, while others would consider the soldering of the cross seams a disadvantge to the roof. Where roofs are laid with considerable pitch, and in cases where the material and workmanship are strictly first class, there is no doubt that the soldering of the cross seams may be dispensed with. Tin of a good quality that is locked by the use of the perfected machines above referred to, presents joints sufficiently tight to resist all exposure to which they will be subjected. On very flat roofs, and where the workmanship is questionable and where the tin is not strictly first class, soldering the cross seams is a necessary precaution.

The theory of a standing-seam roof is that the form of the seam provides, to a considerable extent, for the action incident to contraction and expansion. The tin is fastened to the sheeting-boards by the cleats which, in themselves, are sufficiently elastic to provide for all necessary movement without tearing the fastenings. The lateral movement of the tin is further provided for by the angle between the sheet itself and the standing seam. There is chance for considerable movement in this place without any liability to fracture. On the other hand, there would seem to be no provision made for contraction and expansion lengthways of the strips where the cross joints are soldered.



Tin Roofs.—Fig. 2.—Sheets of Tin Joined in a Strip and Rolled, Preparatory to Laying Standing Seam Roof.



Tin Roofs.—Fig. 3.—A Sheet of Tin Edged for Joining in the Strips.

A very slight provision would be made where the seams are formed simply by locking.

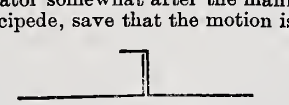
We have referred to the use of machinery for making the cross seams; machinery is also in use for turning the edges prepara-

Tin Roofs.—Fig. 4.—A Cleat Used in Laying Standing Seam Roofing.

tory to making the standing seam, and also for forming the standing seam itself. The usual method for performing this operation is by means of hand tools. Tools called "tongs" are employed for bending up the edges; a roofing-seamer and mallet are used for turning the edges and completing the double seam. A recently introduced tool of the general shape of the "tongs" but which has an additional member operated by a foot treadle, has, in a manner, superseded the use of the mallet and roofing seamer. The tool used in connection with the roof tongs for turning the edges upon the strips, is probably the most desirable tool at present to be had. While its work is not quite so rapid, nor, possibly, quite so accurate as that of some machines which have been still longer before the public, it possesses certain advantages over them destined to bring it into almost universal use. The machines which we have alluded to consist, first, of an edge turner, doing the work of the roofing tongs above described, and which consists of a series of rollers and guides, so constructed and arranged that, when moving lengthwise along the surface of a strip of tin, the rollers or formers turn the edges of the strips in such a manner as to leave ready for the operation of making the seam. One passage of the machine along the length of the strip completes the edges on both sides. In general appearance the machine may be compared to a lawn mower. Very few of these machines are in use, mainly, we believe, from the fact that the utmost accuracy is required in putting together the strip of tin in order to enable it to be used at all. The second machine, which is

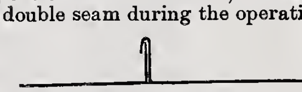
Tin Roofs.—Fig. 5.—Manner of Turning the Edges Along the Sides of the Strips.

familiarly termed the "pony," also consists of a series of rollers, wheels, guides, &c. But, instead of being propelled by hand, carries the operator somewhat after the manner of the velocipede, save that the motion is com-



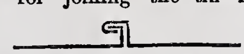
Tin Roofs.—Fig. 6.—The First Operation in Making a Standing Seam.

municated by means of a crank, operated by the hands instead of by the feet. This machine seizes upon the adjacent edges of two strips of roofing tin, and, by being propelled along the course of the roof, forms a complete double seam during the operation.



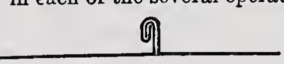
Tin Roofs.—Fig. 7.—The Second Operation in Making a Standing Seam.

We have no hesitation in saying that the most perfect standing-seam tin roofs that we have ever seen have been those made by the use of—first, what is called the "cross seamer," for joining the tin in strips;



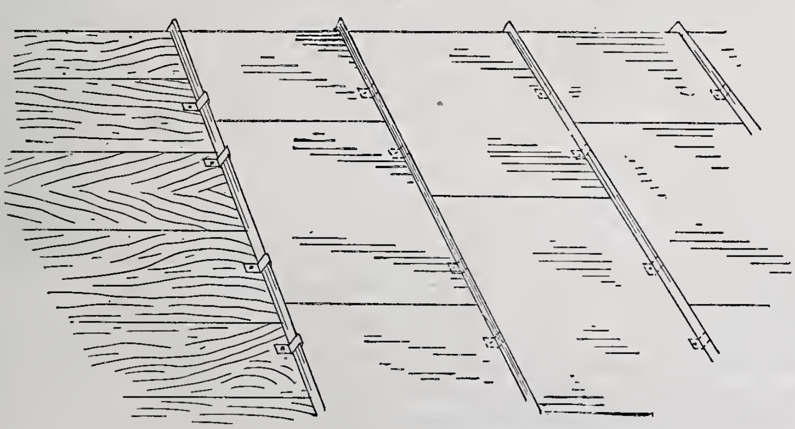
Tin Roofs.—Fig. 8.—The Third Operation in Making a Standing Seam.

second, the "edge turner," above described, for turning the edges upon the strips, and, third, by the use of the pony also above edscribed, for forming the seams. The utmost accuracy in each of the several operations is



Tin Roofs.—Fig. 9.—The Fourth Operation in Making a Standing Seam, and a Section of the Seam when Finished.

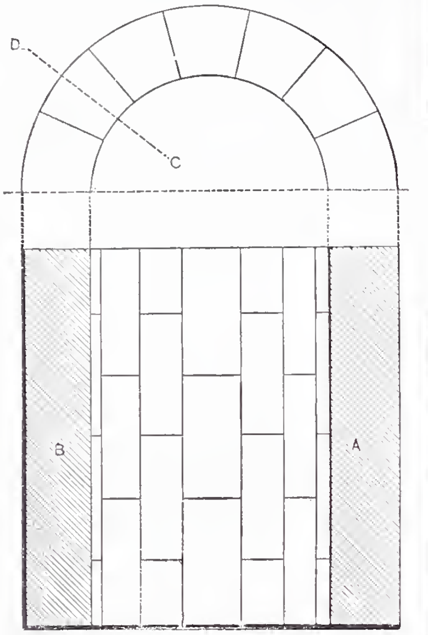
required; the finest joints are produced, and in all respects the roof presents the most workmanlike appearance. The fatal objection to the employment of these machines and the reason that they are not in more general use, seems to be that they are adapted, for economical use, only upon the largest



Tin Roofs.—Fig. 1.—General Appearance of Standing Seam Roof, Showing Manner of Using Cleats.

kinds of work. The use of the edge turner and the double seamer, or "pony," as it is familiarly termed, upon a roof small in size or cut up into small sections, is almost out of the question. Accordingly, the improved roofing tongs, forming seams by means of the foot treadle, above referred to, which may be used under any circumstances, upon roofs either large or small in area, are of far more advantage to the trade.

Very much of the quality of the tinner's work, whether it be in standing-seam roofs or flat-seam roofs, depends upon the character of the sheeting provided by the carpenter. Upon a rough, uneven surface it is practically impossible for him to make a satisfactory job of roofing. On the other hand, if the sheeting provided for him be smooth and clean, free from all irregularities of surface, there is no excuse for bad workmanship upon his part. We call particular attention to this feature of roofing, for we know by experience that, in general, builders suppose that almost anything is good enough for the roofer's use. A moment's consideration of the attending circum-

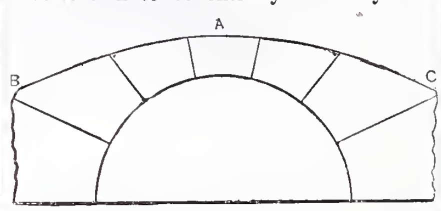


Construction of the Arch.—Fig. 1.—A Cylindrical Vault Shown in Plan and Section.

stances will convince any one that this is a mistake. The plates used are soft and somewhat ductile; they are thin and not over strong; they must be repeatedly passed over in the several operations required in laying them. Any inequality in the surface, as a slight difference in the thickness of adjacent boards; a cavity, as from a knot-hole, or a projection, as from a sliver—each produces its own peculiar effect upon the metal covering which is applied. Probably a smooth surface is more essential to the satisfactory laying of a standing seam roof than of a flat seam roof. In the flat seam roof, the edges being upon all sides of the several sheets, each one has opportunity to accommodate itself to the peculiar location in which it is placed. In a standing-seam roof, however, there is no corresponding compensation, and, accordingly, when a strip is laid, whatever change is caused by irregularity of surface necessarily perverts the course of the strips, and whatever perverts the course of the strips necessarily affects the character of the standing seam, and, by the nature of the joint, it is impossible to make it satisfactorily unless the lines are straight. Nothing poorer in quality than surfaced boards, free from loose knots, should be employed in sheeting, while the use of matched lumber of good quality will improve the roof sufficiently to justify the expense involved.

The same general remarks concerning the preparation of the woodwork for the tinner's use apply to gutters and valleys in connection with slate and shingle roofs. To be serviceable, all should be laid upon smooth and regular surfaces. All sudden angles should be avoided, and in no case should the tin be required to lie, in any part of its surface, away from the support. It should at all places be so arranged as to lie flat upon the woodwork under it.

After the roof is laid—and these remarks apply also to gutters—too great care cannot be taken to protect it during the time of the completion of the building. Very frequently chimneys are carried above the roof after the tinwork is finished. The fragments of brick and the loose mortar which are dropped are fruitful sources of injury to a tin roof. The nails in the heels of the shoes of the mechanics are another source of injury to the roof. Tinwork which is completed before a building is finished, should be carefully protected against these elements of destruction. A cause of many leaks in gutters, and the source of much annoyance and expense to the tinner, is the use of hooks and other devices employed to support hanging scaffolds for the painters. Many a good job of roofing, and many a perfect gutter, we have known to be entirely ruined by care-



Construction of the Arch.—Fig. 2.—Theoretical Proportions of an Arch.

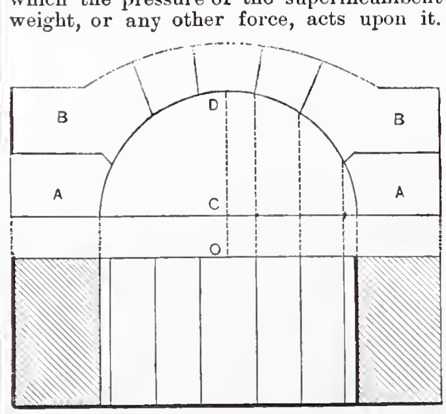
lessness in these particulars. Gutters are frequently used as the highway of travel around the building, without any protection. Nails, mortar, fragments of brick, pieces of slate, naturally gravitate to the gutter, and there, by the feet of the mechanics who travel around the building, are ground into the tin, destroying very much of its coating, if not actually cutting through. The responsibility for these things rests almost altogether upon the carpenter, who is ordinarily the managing superintendent of the building. It devolves upon him to provide, or at least direct to be provided, the necessary protection to avoid these difficulties.

MASONRY.

Construction of the Arch.

In the April number of *Carpentry and Building* we presented a brief historical account of the arch. We now propose to give some details of construction.

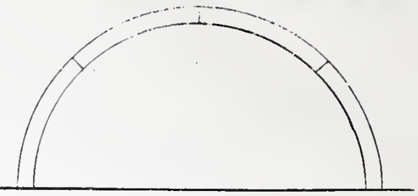
It has been previously remarked that the bed of a stone should be so arranged that it shall lie perpendicularly to the direction in which the pressure of the superincumbent weight, or any other force, acts upon it.



Construction of the Arch.—Fig. 3.—Practical Application of Theoretical Proportions.

Thus in ordinary walls the beds are disposed horizontally, because, by virtue of their weight, the pressure of the stones above is necessarily vertical or in a downward direction. But in flat arches and in those of a circular form the voussoirs act as wedges, which always tends to thrust asunder the neighboring stones. Statics prove that this force acts perpendicularly to the surfaces following those at which the stones are in contact. Consequently, the lower bed of each voussoir should be as far as possible kept parallel to those forces. Thus, in Fig. 1 the bed might be placed parallel to a plane, C D, which divides the voussoirs into two equal parts, although for motives of economy this rule is never rigorously adhered to.

The first consideration in designing any



Construction of the Arch.—Fig. 4.—An Arch Composed of Four Voussoirs.

arch or vault, as indeed it is with every form of construction, is to obtain the outline which science teaches has most stability.

In all cases an arch must have a sufficient number of voussoirs. Arches composed of four voussoirs, Fig. 4, cannot sustain themselves, whatever be the resistance of the piers, if their thickness is less than the seventeenth part of their span.

In Fig. 1, the extrados and intrados of the arch are determined by two concentric circles; but this arrangement is not in conformity with the laws of stability, and is only adapted for a vault or an arch of small span.

Theory and experience both indicate that in those instances where the center which determines the form of curve taken by the intrados is a semicircle, in order that all the stones composing the arch or vault should maintain their proper equilibrium by their own weight and without other aid, it is requisite that the extrados, instead of being a semicircle, should take the form of the curve B A C (Fig. 2), of which the two branches always approach the line of springing without touching it, in such manner that the two stones at the right and left

Construction of the Arch.—Fig. 5.—Illustration of the Catenarian Curve in Arches.

which act as springers have an "infinite length."

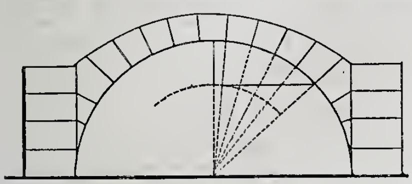
This is the strict theoretical view, which it would be obviously impossible and unnecessary to rigidly satisfy, as the adhesion of the stones, and consequent gain of equilibrium, can be augmented by many means—not only by the use of mortars, but by tenons, elbows, dowels, &c. Still, in order to give lightness to arches, as well as cause them to approach as nearly as possible to the form indicated by theory, they should be arranged as shown at Fig. 3.

The stones A and B form at the right and left two masses, which, by their weight and inertia, form sufficient substitutes for the "infinite length" which should theoretically be given to the springers. The curve of the extrados is in this case determined by the arc of a circle, of which the center is situated at O in such manner that O C is equal to nearly a third of the radius of the intrados C D.

Arches of equilibration (that is to say, those formed upon correct statical principles) being calculated to stand by themselves, are of course best adapted to sustain any superimposed weight, as the entire cohesive force of their parts can be opposed to it; but where an arch does not equilibrate, some portion of cohesive force is wasted in resisting the destructive action of its own parts. "Equilibration," as Mr. Samuel Ware well says, in his excellent treatise on the properties of arches and their abutment piers, "is as important as the construction of the arch." All self-supporting arches hold a *catenarian* curve within their thickness, or an equipollent arch.

The word *catenarian*, occurring in the above extract, may, perhaps, be unfamiliar to some of our readers. As it is a term frequently used in relation to the theory of arches of equilibration, especially as applied to bridges, but secondarily to arches of all kinds, it may be well to give a brief definition of the word. The following, by the celebrated Thomas Telford, is so succinct, that we use it in preference to any definition of our own:

"An important principle is contained in the assertion of the eminent Dr. Hook, that



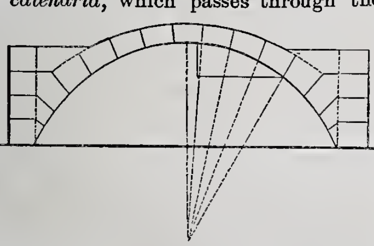
Construction of the Arch.—Fig. 6.—Method of Determining the Thickness of the Several Voussoirs Composing an Arch.

the figure into which a heavy chain or rope arranges itself when suspended at the two extremities, which is the curve, commonly called the *catenaria*, is, when inverted, the proper form for an arch the stones of which are all of equal size and weight. Now, as this idea, strictly just, has been very generally adopted, and affords some useful hints, it may be worth while to examine it.

"Let A C B (Fig. 5) be a string or festoon of heavy bodies, hanging by the points A B, and so connected that they cannot separate, although flexible. These bodies having arranged themselves in the *catenaria* A C B, conceive this to be turned exactly upside down. The bodies A and B being firmly fixed, then each body in the arch A D B, being acted on by gravity, and the push of its two neighbors, with forces exactly equal and opposite to the former, must still retain its relative position, and the whole will form an arch of equilibration.

"This arch, however, would support only itself; nay, a mere breath will derange it and the whole will fall down. But if we suppose each spherule to be altered into a cubical form, occupying all the space between the dotted lines, the stability will be more considerable; and as the thrust from each spherule to its neighbor is in a direct parallel to the tangent of the arch at the point of junction, it is obvious that the joints of our cubical pieces must be perpendicular to that, so as to prevent any possibility of sliding.

"Our arch is now composed of a series of truncated wedges, arranged in the curve of the *catenaria*, which passes through their



Construction of the Arch.—Fig. 7.—Method of Determining the Thickness of the Several Voussoirs Composing an Arch.

centers; and we are disposed, with David Gregory, to infer that when other arches are supported, it is only because in their thickness some *catenaria* is included. This curve is, indeed, the only one proper for stones of equal weight and touching in single points."

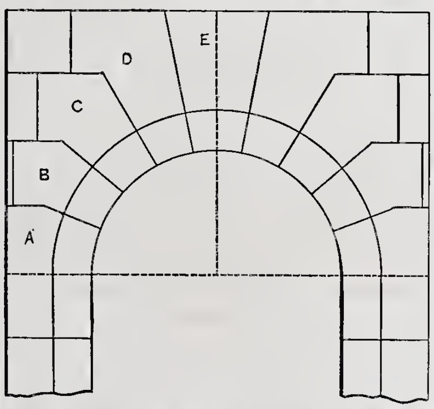
The depth which should be given to the various voussoirs, according to their position in the arch, is also important, and may be determined in the following manner:

In semicircular arches all the joints, if prolonged, intersect or meet at the center. "Consequently," says Creasy, "if a horizontal line be drawn at such a distance from the center that the parts comprised between the joints of the key are equal to the thickness to be given to the arch at the center of the key, the other parts of this line intercepted by the joints will express the differences of the tangents, and the thickness to be given to each corresponding voussoir. To determine the point where the horizontal line should be drawn, draw a parallel to the axis, at a distance equal to half the thickness of the center of the key of the arch, which will cut the joint of the key prolonged to a point, and is that required. By measuring the widths on the straight line, we have the thickness to be given to each of the voussoirs comprised by the two radiating lines; and when the thickness of the keystone is determined, we must set out half this depth on the intrados from the axis of the arch, drop a perpendicular from that point, and when it cuts the radiating line that represents the side of the keystone, draw a horizontal line"—shown at Figs. 6 and 7—"upon which we obtain the depths to the respective voussoirs comprised between the lines. By this means the extrados of every kind of arch, parabolic, hyperbolic or elliptical, can be traced."

Let us now suppose we are concerned with a semicircular arch over an opening—say a doorway.

In masonry the joints of the voussoirs of such an arch are so arranged with the beds and tho vertical joints of the stones of the wall, as to contribute to the ornamentation of the building.

To produce a stone for the voussoir of an arch over an opening in a straight wall, a block is taken of a length equal to the thick-

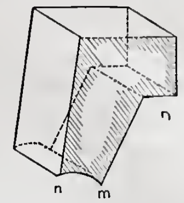


Construction of the Arch.—Fig. 8.—Obtaining the Form of the Voussoir in a Semicircular Arch in a Straight Wall.

ness of the wall, and of depth and width sufficient to take the template of face.

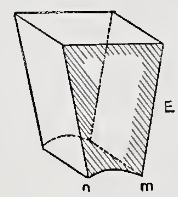
Fig. 8 is an elevation of a semicircular arch over a doorway in a straight wall. To obtain the correct form for the voussoirs, a template for the face of each must be prepared from the working drawing, as at Fig. 9. For each voussoir a stone is then selected of sufficient length, and of superficies on face capable of admitting of the application of the template. The upper bed is to be dressed. Two lines are then marked at a distance apart equal to the thickness desired for the arch, and the two faces at right angles or square with the upper bed are worked. The template is now applied to each of these faces and traced round, all the superfluous stone outside the outline being removed until a straight edge, applied in rotation at all portions of the traced outline, touches either face of the voussoir equally. It must be borne in mind that, between the points *m n*, many points of division should be marked on the stone, as these will assist in determining the parallelism of all positions of the rule, as was mentioned when speaking of round walls.

The investigation of the equilibrium of arches in connection with the laws of statics is of great importance, in order to insure stability. It is only within a comparatively recent period, however, that the subject has received the attention to which it is entitled. The question does not, indeed, appear to have entered into the minds of ancient architects, who based their great works on imitative faculty, and secured good results by means of experience and a sort of mechanical intuition alone. It must, however, be borne in mind that the stability of their works is frequently the result of a lavish expenditure of material, which they appear to have considered the surest method of obtaining solidity. At the present day we look to the results of scientific investigation to give us formulæ for obtaining an equal or greater degree of stability, with the smallest amount



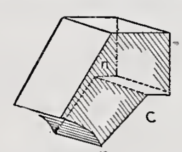
Construction of the Arch.—Fig. 9.—Shape of Voussoir D in Fig. 8.

of material. Vitruvius, the celebrated Roman writer upon architecture, does not make the remotest allusion to such statical matters as the composition and resolution of forces, and subsequent writers have left such questions equally untouched. It was not, indeed, until the end of the seventeenth century that mathematicians took up the subject. In the year 1695, De la Hire, in his "Treatise on Mechanics," made some efforts to arrive at a theory of



Construction of the Arch.—Fig. 10.—Shape of Keystone E in Fig. 8.

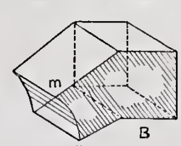
the stability of the semicircular arch. Parent, Couplet, Bernouilli, Gauties, Coulomb, Bossut, Lorgna, Mascheroni, and Bouguer are among the Continental authorities who pursued the subject; while also in Great Britain Emerson, Hook, Gregory, Hutton, Robison, Gwilt, and others, have occupied themselves in researches of a similar character. The doctrines of Rondolet, the celebrated French writer, are now generally accepted, as his formulæ were all verified by actual experiments with models,



Construction of the Arch.—Fig. 11.—Shape of Voussoir C in Fig. 8.

and his reasoning is conducted in such manner that it can be followed out without deep mathematical acquirements.

Black Stains for Wood—Treatment for Oak.—Boil one part of rasped logwood in 10 of water, filter, evaporate carefully to one-half, and add to half a gallon 10 to 15 drops of a saturated solution of neutral extract of indigo. Prepare the pieces of oak by steeping them for 48 hours in a solution



Construction of the Arch.—Fig. 12.—Shape of Voussoir B in Fig. 8.

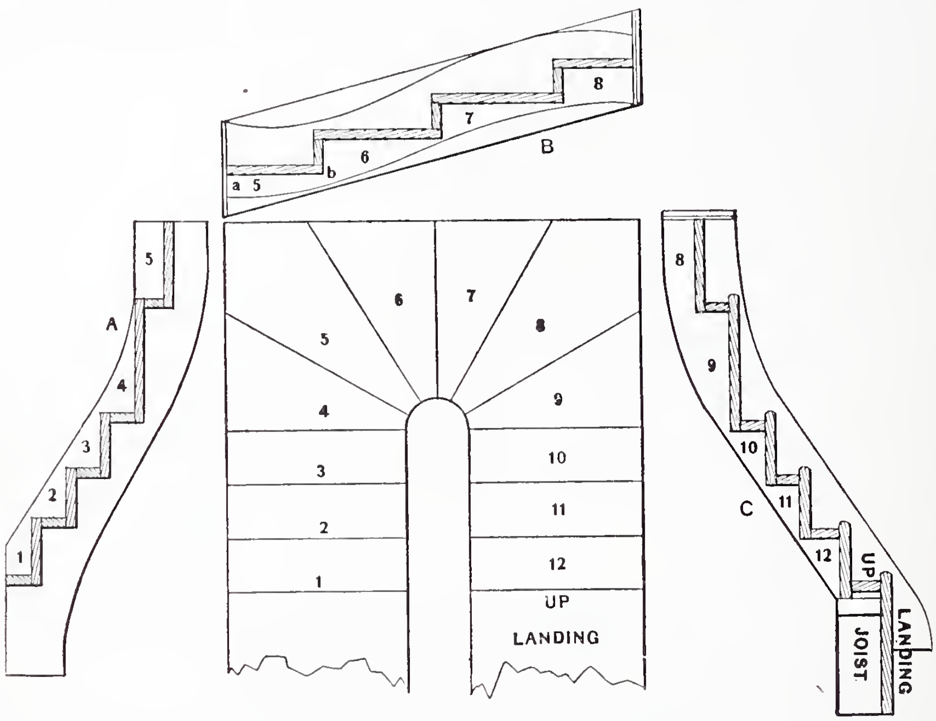
of alum saturated when hot, and plunging them into a decoction of logwood. Sprinkle them then with the liquid above mentioned, and rub them with a cloth moistened with verdigris dissolved in strong acetic acid. If properly managed the oak will become equal to ebony.

CORRESPONDENCE.

Stair Building.

From H. W. C., *Detroit, Mich.*—I have perused with great zest the numbers of *Carpentry and Building* to date. I feel disposed to contribute my share toward making it a paper valuable to all in the building trades, by furnishing certain notes of experience in the practical operations of building and construction. Perhaps some of my brother mechanics will take exception to certain of my ways and methods. If so, all the better. I am willing to be taught, and discussion is likely to be profitable

I am an English-bred mechanic, and have not been in America long enough to drop my preconceived notions of things in favor of American methods. I am not convinced that the English way is not to be preferred in many cases. I will first give some general remarks upon stair building, which necessarily will be written from an English standpoint. As before remarked, I am ready to learn, and therefore if any of the readers of *Carpentry and Building* see fit to criticise, I shall be gratified.



Stair Building.—Fig. 1.—Letter from H. W. C.—Plan of Stairs, with the Wall Strings (A and C) and Cross String (B) Arranged Around it.

Before going into the working part of stair building, it must be understood that great care ought to be taken to place the staircase in any building, and therefore staircases ought to be described and accounted for justly when the plans of a building are made, and for the want of this, sometimes unpardonable errors are made—such as having a little blind staircase to a large house, and, on the other hand, a large and spacious staircase in a small house. In placing staircases the utmost care ought to be taken, it being a difficulty to find a place convenient for them that will not at the same time prejudice the rest of the building. Commonly the stairs are placed in the angle, wing or middle of the front. In every staircase openings are required—first, the opening leading thereto ; secondly, the window or windows that may give light to them ; thirdly, their landings. 1. The opening leading to the staircase should be so placed that most of the building may be seen before coming to the stairs, and in such a manner that it may be easy for any person to find them. 2. The window must be placed in the middle of them, whereby the whole of them may be enlightened. 3. The landings should be large and spacious for the convenient entering of the rooms—in a word, staircases should be spacious, light and easy to ascend. The hight of steps should be from 6 to 7 inches, the breadth not less then 9 inches, and the length about 3 feet—the rule laid down for the hight and breadth of steps. Workmen are, however, not to be so strictly tied to these rules as not to vary in the least from them. They must observe to make all the steps of the same staircase of an equal hight and breadth. To do this they must first consider the hight of their room, and also the width and compass they have to carry up their stairs. To find the hight of each step they ought first to propose the hight of each step, and by that prop sed hight divide the whole hight of the room, which done, the quotient will show the number of steps. If there is a remainder, then take the quotient for the number of steps, and by the number divide the whole hight of the room, and the quotient will be the exact hight of each step.

Example : Suppose the hight of the room is 9 feet 3 inches, and you propose your step to be about 6 inches ; bring the hight of your room into inches and divide by 6 inches, and you have 18 steps and 3 inches over ; therefore, take 18 for the number of steps, and by it divide 3 inches ; the quotient will be 6 3-18 or 6 1-6, which must be the exact hight of each step. You find the breadth of the steps in like manner.

Having determined the hight and breadth of your steps, you then make a pitch-board, which is a triangle of unequal sides, one being equal to the breadth of step, the other equal to the hight, thus giving the rake of stair

In Fig. 2, A is the pitch-board ; B is a template about 18 inches long, 2¼ wide, which is used to form a stop or guide for the pitch-board when you are setting up your steps. The engraving shows the template and pitch-board applied to the plank intended for the wall string.

Having shown the application of the pitch-board to the plank, it is not necessary to go into the details of using it. All carpenters and joiners know what a pitch-board is and what it is used for. If they study what follows, they will be able to overcome all the difficulties in stair-building. I will now show plan of stairs, with six flyers and six winders, and how to set up the wall-string.

It must always be understood that you must lay down a plan of your winders the full size the pitch-board will give the flyers. Fig. 1 shows plan of winders, with the wall-strings. A is the first wall string. Set up the first three steps with your pitch-board ; then set up one riser, take the width of first winder on plan, and mark it on the string square with the riser ; then set up another riser, and take the width of your other winder up to the angle and mark that the same way. (This angle winder is called the kite winder.) You must then allow the string about three-quarters longer, for a tongue to go into the cross-string ; then cut the string off at right angles with the step, and allow about 6 inches from the step upward to form the top easing to carry out the winder. You will see that a piece must be glued on the under side of string. I have shown easing at top, and also shown ramp at bottom to receive skirting, &c.

B is the cross-string. I always glue up my cross-string for stairs of this description 14 inches wide. I then make a line, *a b ;* from that line I square off the end of my string. There is no particular rake for the line, it being marked at pleasure. After squaring the end from the line you must set in the thickness of the other wall string, and set out the groove (to receive the tongue of A) ; then set on the other half of kite-winder ; then set up a riser square with the winder ; set up the other winders, and the half-winder square with the half-winder ; allow tongue, &c., as before described. There will be enough stuff to form all easements, &c.

C is the other wall-string, having half a winder, one winder, three flyers, and up. The up is a riser that takes on to the landing. This string will be set out similar to the first, only you must not forget the up. You must groove the winder end of string to receive tongue of cross-string ; also glue a piece on to carry out your winder and form the easements. When you are setting out strings the pitch-board is the face of riser and top of tread ; so you allow the thickness of the riser in and thickness of tread down, and a little more for wedging. The general depth for housing is half an inch. In all cases you must plow and tongue, glue joints, &c.

In A I have not shown the string finished, but in C it is done. The strings are prepared as in A, and after the steps are glued up, rounded and the hollow worked, they are then marked, as shown in C.

I will now show how the outside or cut-string and well are prepared. In getting out the cut-string I suppose you to have a board, say 10 inches wide, the pitch-board being 9 inches on the going and 6 inches on the riser. Then, by squaring the pitch-board across from the raking side to the angle of the tread and riser, you will have 5 inches, thus leaving 5 inches. Then make a template 5 inches wide, similar to the one shown in Fig. 2, and apply it to the bottom of the string, and the pitch-board to that, and mark off your steps. Cut the going square. The risings are mitered. The back edge of step 3 in Fig. 4 and the front edge of step 10 in Fig. 6 are the springing lines of the well-hole. The string must be left longer for tenoning or halving to the well-string. Before applying the veneer on the cylinder, you must stretch out your well, and when marking the springing line upon the veneer, set up your steps before bending it on the cylinder, so that when you have properly blocked and glued and the work is set, it can be taken off the cylinder and the steps cut. It is then ready to be fitted to the other strings. Fig. 5 shows the veneer set out before applying to the cylinder.

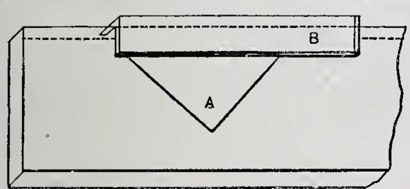
I will now try to explain the best way to sketch out the well. Lay down the size of your well (Fig. 3), divide the circumference into three equal parts ; then draw the lines A C, D B. and E F. Make A F at right angles to A C and D E at right angles to D B. Then E F will be the stretchout of the well. Divide E F into six, the number of winders. Make a pitch-board with one side equal to one of these parts and the other equal to the rise, and set out your veneer the same as the other string. The strings are marked so as to show how they follow.

I shall be much gratified if some of my fellow-readers of *Carpentry and Building* will contribute their methods of stair building.

Further Comments on Prize Designs.

From D. S. Hopkins, *Grand Rapids, Mich.*—In the October number of *Carpentry and Building* appears a criticism on my design receiving prize number two, from H. F. L., Elmira, New York. As I have already stated, my design is not without faults and is open to criticism. But it seems to me this gentleman is near sighted, or else a different standard of measurement is employed in New York than in Michigan. For example, with regard to the chimney, he says it measures 2 feet 4 inches square, while according to United States standard scale it measures 2 feet 6 inches by 3 feet, outside dimensions. This may be verified by examining the second floor plan, which shows a section taken where the six flues occur. Allowing all the flues to be fire-flues and all outside walls to be lined, brick on edge, or 6 inches thick, and the partitions brick on edge, the flues figure out on an average 6¾ by 8 inches, inside measure. That certainly does not look like a smoky chimney on account of the size of flue. It is desirable that the partitions be constructed of brick on edge for the purpose of more readily heating the ventilation flues, thereby rarifying the air and creating a draft. From this statement it would seem that your correspondent need not go down cellar just yet unless it be to hide.

Again, in giving the cubic feet of plans Nos. 1 and 2 he is just as wild. The cubic feet of design No. 1, calculating from cellar-bottom to tie or collar-beam in second story is 18,070. No. 2 plan, figured in like manner

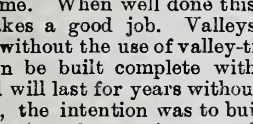


Stair Building.—Fig. 2.—Template and Pitch Board Applied to Plank for Wall String.

shows 17,122 cubic feet. The cellar of plan No. 2 was to be under the kitchen only, so that really there is room in favor of No. 2. The first floor surface measure is 800 feet in No. 1 and 723 feet in No. 2

My critic admires the pantry. I presume he has an eye to that point in case his visual organs are not filled with the dissolving plaster. But we will avoid that sad occurrence. Flashings were intended, although I have built many a house without using any tin or metal flashings. Instead there was employed what was called a "kant" board, wherever one part of the building joined another. One edge of this board was chamfered off, and the siding closely fitted on the same. When well done this arrangement makes a good job. Valleys may be shingled without the use of valley-tins. The whole can be built complete with shingles only, and will last for years without leaking. However, the intention was to build a complete house "to the true intent and meaning of plans and specifications." Flashings and conductors are included. The estimate will cover it as figured at that time.

As to that stray dormer window, it does not belong in the side. It should stand over window in hall. But through haste the side view of it got in the wrong place. As regards the hall window objection, that may

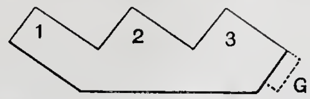


Stair Building.—Fig. 3.—Method of Laying Out the Well.

be overcome without any stilts or extra machinery. Simply send for a Michigan man and he will know how to do it.

From G. E. W., *Royalton, Wis.*—In a recent number of *Carpentry and Building* I notice some criticisms on the prize design published in the August number. I think the critic is rather too severe where he is right, for he is not right in all cases. In the first place, he says: "Upon the side elevation we discover the profile of a dormer window which is omitted in the front elevation." Now I fail to see anything in either elevation, as published, that does not in every respect correspond with the other, and therefore I call the attention of your readers to these remarks.

The objection to the front hall window is well founded, if we take into account everything according to the literal interpretation of the plan. However, it seems to



Stair Building.—Fig. 4.—Lower Cut String.

me that there would be sufficient head-room if the upper floor were extended nearly across the window. This would remedy the defect.

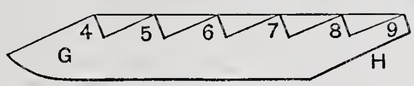
According to my measurement, the chimney on the first floor plan measures 2 feet by 4 feet, with a projection on the side next the parlor 18 inches square. It contains four flues. Supposing the outside walls to be 6 inches and the partitions 4 inches thick, three of the flues could be 9 x 12 inches, and the fourth 6 x 14. These, certainly, are large enough for an ordinary stove. On the second-floor plan we find two additional flues, with the chimney 2 feet 6 by 3 feet, which allows about 37 square inches of section for each flue. This is rather small, I admit, but it is much better than your correspondent makes it. An ordinary sitting-room stove or small cook stove requires a 6-inch pipe. The area of section of such a pipe is 28.27 inches, which, as may be readily seen, is only about three-quarter the capacity of one of the flues.

I admit that I like the design very much. I cannot see any serious fault with it; no fault, in fact, but which any intelligent mechanic would remedy in course of construction.

Note.—We refer the above correspondent to the communication from G. W. C., the first column of page 200, October number, in which he calls attention to the error in the matter of the window in the roof, and to the answer we made at that time. It is evident that our correspondent failed to notice this letter before he wrote us. His communication serves to show further how difficult it is to detect certain kinds of errors and discrepancies in architects' drawings.

Defective Acoustics.

From D. S. Hopkins, *Grand Rapids, Mich.*—In reading the article regarding acoustics and questions by Nemo in the

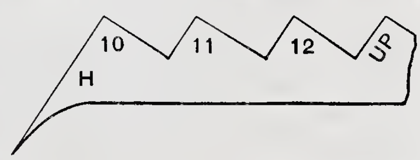


Stair Building.—Fig. 5.—The Well String Veneer, before Applying to Cylinder.

September number of your valuable journal, I feel like saying a few words, with your permission, in regard to this puzzling subject. Thinking it might interest the general reader as well as those directly concerned to know of others' experiences and ideas, and having had considerable experience in designing churches seated on the circular plan, with bowling floor and speaker at side, similar to plan shown by Nemo, I will give my remedy for the bad acoustics of same, which, however, I think can never be complete without making several changes in general plan, one of which may answer, as follows: Form a transept directly opposite to the one back of the speaker, of the same width, 6 feet in depth, carrying side walls up to hight of main audience room, and finish with a break in ceiling conforming with general finish, with exception of the circular or top section of ceiling, which should be finished horizontally. I think this would materially change the acoustics, if not entirely remedy the trouble. Yet with such a very poor-shaped ceiling—one so tending to create an echo from its form—it might be necessary to make the upper or circular section of main building horizontal from about 6 inches above its present base. These two changes, I am confident, would remove the acoustic troubles. The room is badly proportioned--too narrow for its length. The voice of the speaker strikes the wall in front of him sooner than elsewhere. That it rebounds and produces an echo, or rumbling noise, is evident from the fact that the low voice of a speaker is heard with the utmost ease, as the sound does not rebound so quickly, it being thrown out with less force. Consequently the advantages of a transept, equalizing the distances from the speaker and thus avoiding the echo. These are my ideas, expressed from what I can glean from Nemo's description and the plan and section as shown.

Why Contractors do not Employ a Standard of Valuation in their Estimates.

From W. G. S., *Chattanooga, Tenn.*—I have taken considerable interest in the discussion on estimates. Some of the hints on this subject are no doubt correct. A careful estimation of every piece of material used and the amount of time needed to perform the work, is undoubtedly the best plan to pursue. I have no doubt that many men follow this rule; but where one man does, there are a dozen who do not or cannot. Many do not from various motives.



Stair Building.—Fig. 6.—Upper Cut String.

Others cannot, from ignorance of everything connected with the business they attempt to follow. As for a standard of valuation, I think that is impossible. A few might follow it if it were established, but the many would not, for numerous reasons, chief among which is that we are a people of peoples, being composed of all kindreds and tongues. This is why all trades unions have and will continue to fail in this country. The English will not hold together with the Irish, the Irish with the Germans, the Germans with some other nationality, and the native-born Americans with none of them. Each has his own ideas, and will not be governed by the others. Then there is the different estimate that men put on their abilities. Some men will work for a contractor for $1.50 or $2 per day, and if a neighbor or friend wishes him to build a house for him, provided he will bid as low as any one else, he will put in a bid and figure his own wages at the same price as though he were working for another man by the day, ignoring his responsibility in the matter. Another man would rather work all the time for half pay than half the time for full pay. Another will use poor materials, and with an oily tongue get the work off his hands easier than his rival who would have done an honest job. This class of men are sure to bid low, while other men, for the same and other reasons, will bid too high. This is certain to cause a wide difference in estimates. Then, again, there are too many irresponsible men in the business who have nothing to lose and all to gain: and in the next place, there are too many people willing to give work to these irresponsible builders.

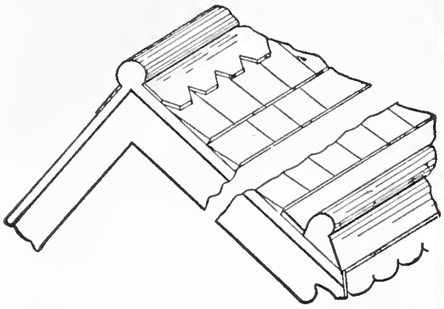
Does 64 Equal 65?

From J. E., *Louisville, Ky.*—I inclose sketches of a problem, the first of which represents a figure 8 inches square, and therefore containing 64 square inches, but when cut as indicated by the dotted lines and put together as shown in the second sketch, measures 5 x 13 inches, and therefore contains 65 square inches, or one inch more than the first shape contained. Will you be kind enough to explain this problem for me, or ask some of your readers to do so?

Answer.—We refer our correspondent to the June number of *Carpentry and Building*, page 119, where this problem was given with full explanation.

Gutter Stop and Comb Finish.

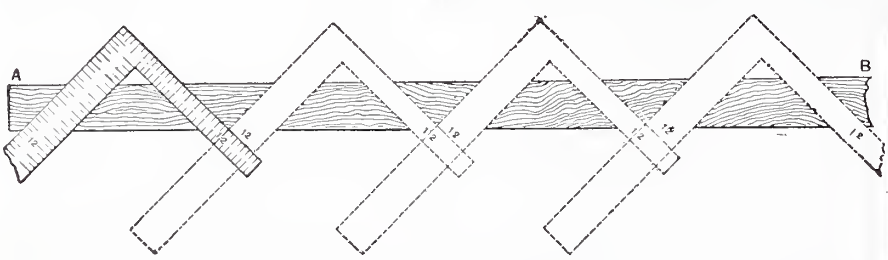
From G. H. H., Germantown, Philadelphia, Pa.—In the inclosed sketch I have shown a modern mode of gutter-stop, comb, and hip covering, which is suitable to be made either of galvanized iron, zinc, tin or wood, at the option of the builder. This covering can be made very attractive, especially on roofs of slate or shingle in which the surface is very much cut up by hips and valleys, dormers, &c. There is quite a range of ornamentation that can be applied by this mode of covering, which in my sketch is shown in a very rude form.



Gutter Stop and Comb Finish.—Contributed by G. H. H.

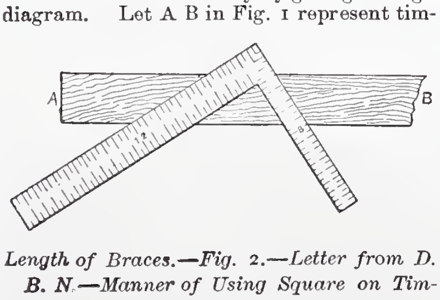
Length of Braces.

From D. B. N., Lewisburg, Pa.—I am a subscriber to *Carpentry and Building*, and would not do without it for five times the price; am glad it is not only theoretical, but practical. The country is full of the former publications, but the latter are not so numerous.



Length of Braces.—Fig. 1.—Letter from D. B. N.—Applying the Square to the Timber for a 4-foot Rise and 4-foot Run.

Your correspondent L. R. C., Tribe's Hill, N. Y., desires to know the best method for finding the length of braces. There are several, all quite simple. One rule is as follows: Square the rise and run, add them together and take the square root of the sum, which will give you the length of the brace. Another is: Draw a draft to scale, and measure the length; but another and better method is to measure with your square, which will also give you the bevel of either end. For example, if you wish to frame a brace for 4-foot run, you lay the stick or piece of timber with straightest edge toward you. Taking the square at 12 inches on blade and 12 inches on the tongue, lay it on the stick, making a mark along the edge at the 12-inch mark on the square. Lay it on along the stick four times, which will give you the exact length between shoulders. The tenons must be added. Perhaps I can make it more satisfactory by giving a rough diagram. Let A B in Fig. 1 represent timber for th brace. Lay the square on four times, as indicated, which will give you the exact length of a square of 4-foot rise and run All square-run braces may be made in same manner. For 3-foot run, lay on three times; 5-foot, five times; 6-foot, six times, and so on.



Length of Braces.—Fig. 2.—Letter from D. B. N.—Manner of Using Square on Timber for 4 foot Run and 6-foot Rise.

In Fig. 2 the method of finding length of brace with 4-foot run and 6-foot raise is illustrated. You will notice the square is laid on at 12 and 8. It is to be repeated six times, as I have explained in connection with the other figure. The blade will give the bevel for one end, the tongue for the other. In all square runs the bevel is the same at both ends. By same method also you can find the length of all kinds of rafters.

Note.—In our correspondent's letter above published, among the plans mentioned for obtaining the length of braces is that of measuring upon a scale drawing. This plan, aside from the trouble of making the drawing, is perhaps a little more convenient than any other. The drawing used must be entirely accurate. This, however, is somewhat difficult to obtain in scale drawings.

A convenient substitute for the drawing, and one which is always correct, is found in the square. It may be readily employed to represent a drawing, with a brace at any angle, and upon it, therefore, the length may be quickly and accurately measured. We think this plan, which we shall proceed to describe in detail, is a better way of using the square than the one cited by our correspondent.

A scale of one-twelfth full size is most convenient in the use of the square for any purpose. We have already called atttention to this in the "Problems in Framing." By this scale each inch of the square represents a foot full size, and each twelfth of an inch of the square an inch full size. By using the square then as a scale, and reading measurements made upon it as feet and inches, instead of inches and twelfths of inches, lengths of braces, &c., are very readily ascertained.

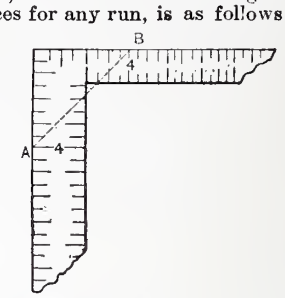
This is practically illustrated in Figs. 3 and 4 of the accompanying sketches, which show this plan applied to the same braces as described in our correspondent's letter, and illustrated in his sketches Figs. 1 and 2. In Fig. 3, for obtaining a brace for a 4-foot run and a 4-foot rise, set off 4 inches from the heel of the square along each arm, as shown by the points A and B. Then, with another square or the pocket rule, measure between the points across the angle of the square, as shown by the dotted line. Note the distance from A to B in inches and twelfths of an inch, and read it feet and inches, which will be the length of the brace between shoulders. The tenons must be added.

The operation for a 6-foot rise and 4-foot run is illustrated in Fig. 4. Set off 6 inches for the rise, as shown by A, and 4 inches for the run, as shown by B. Take the distance from A to B, which read in feet and inches as before explained.

The bevels for the ends of the brace are to be obtained in the same general manner as described by our correspondent, by applying the square direct to the timber. In the last example, it will be noticed that the proportion of 6 to 4 and 12 to 8 is the same, so that, so far as concerns the bevel, it is immaterial which figures are used in placing the square. Eighteen and 12 and 24 and 16 will also give the same bevel.

From R. W., Cape May City, N. J.—Answering the inquiry of L. R. C., of Tribe's Hill, N. Y., I inclose a sketch of a brace having a 3 x 4-foot run. The principle here employed will apply to any run; in fact, it may be described as the whole principle of square rule framing. The runs should be calculated the same as for a stair-horse, and the square should be applied in the same way for the brace; 12 and 16 are the figures used in the example given. Thus, 3 x 12 = 36, and 3 x 16 = 48. Apply the square as in the sketch and repeat it twice, making three times in all. The result thus determined gives the length of the brace. Another fact which is more important, at least quite as important, to which I desire to call attention, is that the application of the square in this manner gives the shape of the shoulders upon which the tenon is to be cut. I think anyone will see, by a very little study, that this rule may be applied to braces of all runs and lengths.

From E. P. M., Greenville, Ohio.—My answer as to L. R. C.'s inquiry in October number, as to method for finding the length of braces for any run, is as follows: Upon an accurate square lay off the hight and run, using inches for feet. Measure across from side to side with a rule; divide to one-twelfth of an inch. This will give the length of the brace; each twelfth of the rule will be an inch of actual size. If short runs are required, use 4 inches to the foot; then every quarter inch will be equal to one foot. This, however, is not mathematically correct. It serves a good purpose for frames, but the only true and accurate way is by square root. To the square of one run add the square of the other; extract the square root of the sum; the result will be the length of the brace. I use this rule also for finding the length of rafters.

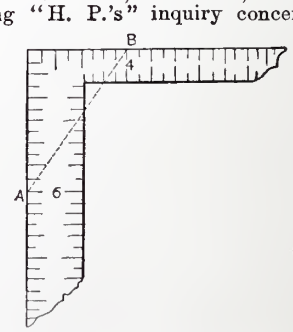


Length of Braces.—Fig. 3.—Note to D. B. N's. Letter.—Using the Square as a Scale for a 4-foot Rise and 4-foot Run.

Note.—We think our correspondent is in error when he says the above method of obtaining the length of the brace by measuring across the square, substituting a scale in order to bring the length within the boundaries of the tool, is not mathematically correct. The method is certainly correct, although it may be described as a mechanical method rather than a mathematical method.

Wood Filler.

From E. P. M., Greenville, Ohio.—Answering "H. P.'s" inquiry concerning a wood filler, I recommend the following: Take three papers corn starch, one quart boiled linseed oil, two quarts turpentine, one-quarter pint japan; cut in half the turpentine before mixing; it will not cut perfectly otherwise. For dark woods add burnt umber to color. When nearly dry rub off with cloths. The above mixture must be used fresh, as it is of no value after it is four or five days old. The cloths used in rubbing as above mentioned should be destroyed immediately after use, as spontaneous combustion is likely to ensue from the ingredients employed.



Length of Braces.—Fig. 4.—Note to D. B. N's. Letter.—Using the Square as a Scale for a 6-foot Rise and 4-foot Run.

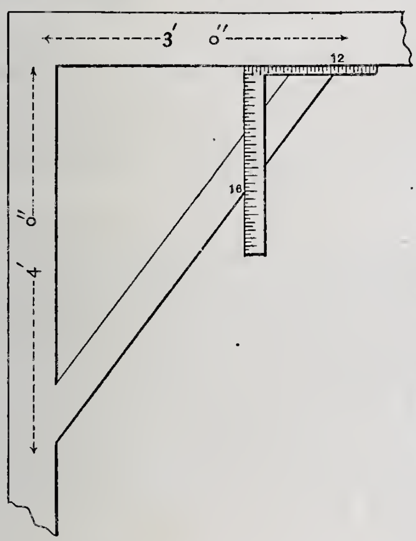
Drawings and Sketches for Publication.

From E. A. W., *Southington, Conn.*—Will you please state, in the next number of *Carpentry and Building*, what style of drawings you require from correspondents? I have some designs on pebble paper, also some on plain white, which I will send if they are in condition to be satisfactory.

Answer.—The process employed for engravings in *Carpentry and Building* is such that we can use sketches or finished drawings cn any kind of paper, and also tracings of drawings. We shall be pleased to see whatever our correspondents have to offer, no matter in what style they are executed. Anything that is likely to be of interest to our readers will be carefully engraved and published, due credit being given to the contributor.

Definitions of Architectural and Technical Terms.

From G. G., *Portland Oregon.*—I beg to suggest that architectural and technical terms in use in connection with carpentry and joinery, carefully defined and explained, would be an attractive feature of the paper. The definitions should be gotten up by some one who thoroughly understands the terms, and who is able to explan their meaning in a way to make them most useful to the ordinary mechanic. It would be well also to have the definitions illustrated by engravings, if possible. Being a contractor and builder myself, I necessarily come in contact with many builders and "jour" carpenters, and I am impressed with the lack of knowledge upon such points evidenced by the men I employ. I trust my suggestion will meet with approval.

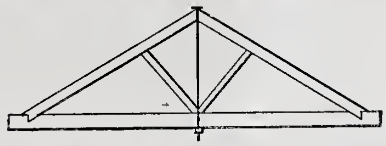


Length of Braces.—Fig. 5.—Letter from R. W.—Manner of Using Square for a 3-foot Run and 4-foot Rise.

Answer.—We have in part anticipated the want expressed by our correspondent, having already defined many terms in connection with various articles which have appeared in the numbers of *Carpentry and Building* already issued. In the articles upon stair-building, in the early numbers, will be found definitions of nearly all the terms in common use in connection with that part of a building, and in the articles upon masonry will be found definitions of many of the terms common to that industry. Most of these definitions have been illustrated. For example, the tools in use in masonry were carefully named and described in the May number. The same policy will be pursued in other issues, our design being to make each article self-explanatory and complete within itself. We think this plan of defining architectural and technical terms will be of more practical advantage to our readers than an attempt to define and illustrate them, independent of any description of their use and application. We therefore respectfully refer our correspondent to the definitions and illustrations already published, as partially meeting the want he expresses. Still additional material of this kind will be found in succeeding numbers.

Braces in Truss Roofs.

From L. V. A., *Paterson, N. J.*—Referring to the inquiry of E. H. C., published in the November number of *Carpentry and Building*, would say, if he will take one rafter and one brace from the truss, cut the other rafter and join it and the brace together, with the proper joint at the intersection, the truss constructed will be a simple truss, one rafter being longer than the other, as illustrated in Fig. 2 of the inclosed sketches.



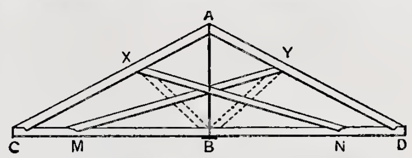
Braces in Truss Roofs.—Fig. 1.—Letter from L. V. A.—"King-bolt A Truss."

Such a truss is capable of sustaining considerable weight when made of timbers of proper size. The truss represented in the sketch published in connection with E. H. C.'s inquiry, will have more than twice the strength of the simple truss. Your correspondent's sketch was published without dimensions of the timbers, and therefore it cannot be calculated, except on assumed sizes, which is too much trouble for the glory attached thereto. Practically, the truss shown in E. H. C.'s sketch is only a clumsy, inefficient and unscientific modification of the old "king-bolt A-truss," where the struts or braces run from the king-bolt to the rafters direct, as represented in Fig. 1 of the inclosed sketches. The braces act in both cases exactly for the same purpose in one respect—that is, their sole office is simply to prevent the rafter from sagging between the head and toe. This they accomplish effectually if they are properly dimensioned. However, between the two trusses there is this difference, that in the one submitted by E. H. C. the braces are longer and act under a much smaller angle, and, therefore, must be heavier to produce the same resistance without fracture. The effect on the tie-beam would be to bend it at the intersection of the brace and tie, if the tie is not large enough to resist it. If the tie is sufficiently large, which is the case in common construction in this neighborhood, this objection would not amount to much practically. If the truss is constructed according to E. H. C.'s sketch, the rafters will sustain a much greater load when distributed over them than they would without the braces. This fact your correspondent can verify by a trial. By the same means he may discover that the king-bolt A-truss, illustrated in Fig. 1 of the sketches, is much stronger, more scientific, more mechanical, better looking and easier framed than that represented in his sketch. He will also discover, by experiment, that more strength is obtained in the A-truss, with much less timber, than is required in the truss represented in the sketch. In this connection it may be remarked, in general, that any one using a long piece of timber under compression, when he can use a short one for the same purpose, can hardly bo considered a master of his trade. He certainly requires to learn his business, for this is conclusive evidence that he does not know it.

Braces in Truss Roofs.—Fig. 2.—Letter from L. V. A.—A Simple Truss with Unequal Rafters.

From J. I. M., *Newark, N. J.*—Your correspondent E. H. C., of East Rochester, N. H., desires to know the use of certain braces employed in a truss roof, and which are the same as X N and M Y of the accompanying sketch Fig. 3. I should like to attempt to give an answer from the standpoint of an ordinary mechanic. Probably there will be some answers from experts who can tell the various sorts of strains involved, and who will solve the question mathematically. I will claim no more high-sounding title for mine than that it is a common-sense view of the matter.

The question asked, to quote exactly, is: "Of what use are the braces marked A A? (Corresponding to Y M and X N of Fig. 3.) Are they of any benefit whatever to the truss?" The question is not, it will be observed, whether there is anything in the range of truss roofs more to be desired. I am not quite certain that I should care to defend this form of a truss as above the claims of all others. But your correspondent asks if there is any use or advantage in these braces. I think there is. In a general way, it must be admitted that the rafters A C and A D are liable to a certain amount of settling in case they are subjected to sufficient weight, depending entirely upon the size of the rafters and the materials of which they are composed. It is to counteract this settling or sagging that the braces are used. Presumably, the correspondent wonders why the braces, instead of running to the points similar to M and N, should not rather run to points nearer B, in the direction in which the strain would seem to act; that is, more nearly at right angles to the rafters. But a moment's study of the diagram will show him how in that case the weight would be thrown upon the center of C D, which in no well-proportioned structure is calculated to bear an indefinite weight; in this case we can only apply general principles. Not but what such a form of roof as that indicated by the dotted lines for braces is of frequent occurrence; not but what there are arguments to be brought in favor of it, some of which, as for instance, those having reference to the direction of the strains, are very salient. But that is not the province of an answer to this correspondent's question. He finds the form of truss illustrated, and asks the use of the braces.



Braces in Truss Roofs.—Fig. 3.—Letter from J. I. M.—Long and Short Braces Compared.

The advantage of putting the braces as shown in the engraving is that it throws the point of support of their ends well out toward the walls of the building. By certain use of A B some of the strain of the weight which centralizes at the point A may be diverted, as it were, from B and passed downward through the braces to the points M and N, which are sufficiently close to the walls to relieve the center of D C.

Perhaps E. H. C. may think this explanation a great deal like the manner in which Columbus solved the difficulty of making an egg stand on end—something any one could do; but the columns of *Carpentry and Building* have been thrown open, and whomsoever will has been invited to partake of the pleasure of seeing his ideas (?) in print freely.

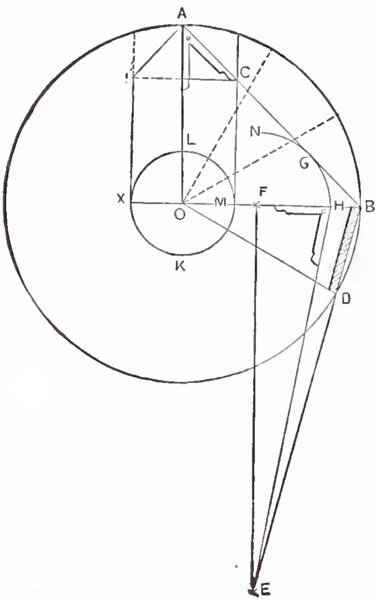
Gelatine Molds.

From E. C., *Moberly, Missouri.*—I have been waiting to see some replies to J. E. G.'s request, published in a recent number of *Carpentry and Building*, concerning gelatine molds. I have used the following method with good results, and perhaps it may be of service to your correspondent.

Take one pint common glue. Dissolve in water in the usual manner, using about the same quantity of water as commonly employed by carpenters and cabinet makers. Add half ounce beeswax and three-quarter pint of water. It is ready for use when about the consistency of syrup. The model must first be carefully oiled, using the best quality of sweet oil. The composition must be used upon it while warm. When set, take off from the model. Oil the mold carefully before using. Some skill is required in mixing the plaster, and judgment must be exercised as to the time it is allowed to remain in the mold. If left too long the heat generated will destroy the mold. I have used molds constructed in this manner upon very fine work.

Frost Proof Houses.

From A. J. B., *Glindon, Minnesota.*—I am highly pleased with *Carpentry and Building.* I much admired the prize designs, although I am compelled to say they would cost double the estimates in a new country like this. Away up here on the Northern Pacific Railroad, building is done very plainly for the most part, for the reason that machinery and tools for ornamenting have not as yet found their way to this locality. There are several features in building our dwelling houses, however, that are worth notice and are suitable for use in all of the colder parts of the country. Of necessity nearly all of our houses are frame. They are generally sheathed, after which building paper is laid on. Next the frames are set, and then they are sided up. Paper is used under the shingles on the roof boards, under the cornice and corner boards, and under all outside casings. The floors are sheathed, then covered with paper, upon which matched flooring is laid. The best of our houses are back plastered. Pieces of boards



Circular Bin Linings.—Fig. 1.—*Letter from A. P. M.—Plan and Section of Cone.*

or two-inch slats are nailed on the inner side of the sheathing horizontally between the studs. The surface is then lathed, the laths being placed vertically, and then strongly, though roughly, plastered from the lower floor to the roof. The inside of the building is lathed upon the inner surface of the studs and plastered in the usual manner, generally up to the window and door jambs ; inside the casings, base-boards, &c., which are put on over all. A house built in this way and set upon a good foundation is almost frost proof even here in this frozen north. The principal object in building at present in this locality, is to get the most comfortable room for the least money. For this I recommend a building as nearly square as may be consistent with the room which may be desired. Some seem to think I am wrong in advocating square buildings. I shall be pleased to hear from some of the readers of *Carpentry and Building* upon this point, also concerning the special features I have mentioned in building frame houses.

Should the Batter of a Retaining Wall be Inside or Outside?

From J. L. T., *Skowhegan, Me.*—In the September number of the *Carpentry and Building* is a treatise on wall building, and as that is my *forte*, as Artemus Ward would say if he could, I desire to put myself on record as opposed to the opinion of that writer in respect to bank walls. He thinks the work ought to be plum on the inside, or bank side, and batter on the outside. My experience is directly contrary to his theory ; and I think mine as good a theory as anybody's, for I carry it into practice and it works to a charm, and that is proof of its correctness. If the author of that article would compare a solid to a liquid and think of a dam built as he builds a wall, he would change his views, perhaps. I will change mine when I find a better theory.

Circular Bin Linings.

From A. P. M., *Cardington, Ohio.*—While looking through the November number of your invaluable paper I read the query of R. K. H., of Philadelphia, in regard to the circular bins. This comes under the head of conical problems in constructive geometry. The problem that especially applies to this case is the unfolding of the surface of a cone and its development in the horizontal plane. The manner of doing this and of finding the various bevels, I shall now proceed to give by the use of drawings and explanations.

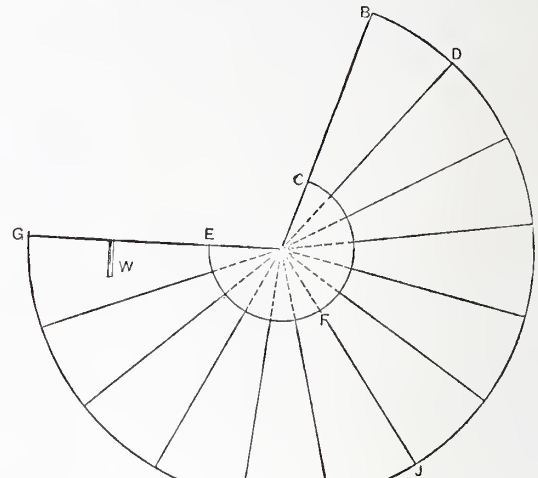
In Fig. 1 we have the plan of the cone laid down, as shown by the circle J A B. With O for a center and O X for radius, describe a circle equal to the shaft, as shown by X L M K ; then draw the line B X and erect the perpendicular O A, which is the axis of the cone ; upon this set off the vertical hight of the cone, which in this case is O A. From A draw a line to B, which is the slant hight. Parallel with O H draw I C ; from B to the intersection C is the length of the staves. Divide the quarter circle A B into any number of equal parts, which will be the width of the staves. From B set off one of these parts to D ; from B through D draw the line B D E indefinitely. This gives the intersection of the inclined plane or face of the stave with the horizontal plane, and from this we are to find the true bevel across the edge of the stave. To do this from any point in B O, as F, draw a line at right angles to it, and produce it until it cuts B E at E. With F for a center describe the arc N H, just touching the line A B, as shown at G, and cutting B O at H. From H draw a line to E. The angle formed at H is the true bevel for the edge of the stave. The bevel tool is applied to either face of the stuff, keeping the stock square with the corner, as shown at W, Fig. 2.

Fig. 2 is the unfolded and developed surface of Fig. 1, and gives the entire shape of the staves. To obtain this, proceed as follows : A, in Fig. 2, is the apex of the cone. With a pair of compasses take the distance A C, Fig. 1, for a radius, and from A as center describe the arc E F C. Again, with the compasses take the distance A B, Fig. 1, and with A for center describe the arc G J B. Now take the distance B D, Fig. 1, and begin at any point in the arc B J G, Fig. 2 ; step off the whole number of staves (in this case 12), thus establishing the length of the arcs. From the points thus obtained draw radii to the center A, and your work is complete ; and if accurately done you need have no fears as to the result.

This system of lines will apply to any regular cone. In referring to Fig. 1, I omitted to state at the proper place that the angle H is the plumb bevel for the ends of the staves ; hold the stock straight up and down the face of the stuff. In practice, you will find that it is not necessary to draw all the lines here given, but they are necessary here to fully explain the principle involved. In practical work, it would only be necessary to develop the surface of one of the staves in Fig. 2. I might state further, in the elucidation of this problem, that the finding of the curves for the ends of the staves, as shown in Fig. 2, is based on the geometric principle that a plane cut through a cone at any point at right angles to its axis, is a perfect circle. The manner of getting the bevels in Fig. 1 is based on the principle that a cone is developed by the revolution of a right-angled triangle around its perpendicular.

For several years I have been engaged in carpentry and stair-building, and have frequently been badly puzzled over many of what are termed the "cuts" in carpentry. This led me to investigate these things, and I called to my aid constructive geometry, which I studied and still study at leisure times.

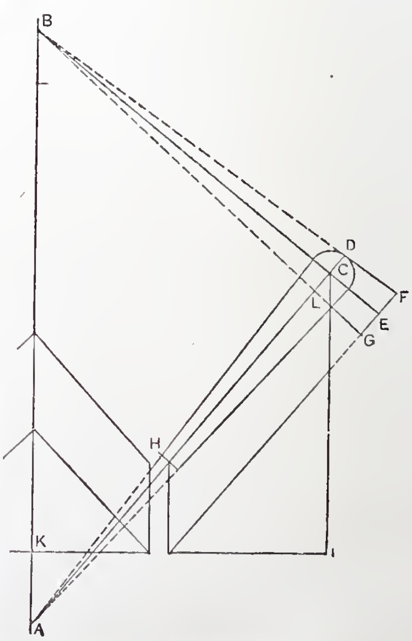
I congratulate my brother workmen in that we now have a true journal in our interests. Let us all do our best to make *Carpentry and Building* doubly useful by a general interchange of ideas. I do not read it to criticise, but to learn, and I am well



Circular Bin Linings.—Fig. 2.—*Letter from A. P. M.—The Surface of the Cone Developed.*

pleased with the quality of its reading matter ; also its illustrations.

From W. H. C., *Orillia, Ont.*—I send a sketch, Fig. 3, which will put R. K. H. in the way of dealing with his problem relating to conical bin linings : A B represents the axis of the cone, H C the incline resting against the wall ; I K is the floor line. Draw C B at right angles to H C, cutting axis of cone at B and extend to E ; make C E equal to depth of timber to be used, and draw G F at right angles to E B, making G E and E F each equal to half the thickness of timber to be used ; connect F B, G B ; then L D F G is the true square section at the large end of the tapered piece. Now from

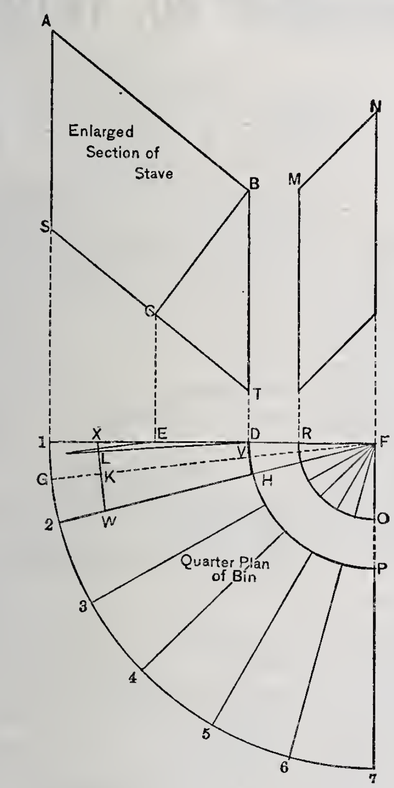


Circular Bin Linings.—Fig. 3.—*Rule Contributed by W. H. C.*

C as center, with C D as radius, describe the semicircle as shown, and extend C H to intersect axis of cone at A ; then the termini of semicircle connected with A shows the lineal taper. The upper dimensions of piece is L D at the widest end, and that of narrow end is seen at H. From what is here explained, R. K. H. will have no difficulty in getting the central cone pieces, if he will just turn the drawing upside down and deal with it as already described, as the principle is universal in its application to this character of work. If this is not sufficient I will be happy to give further explanations.

From A. B., *Camden, N. J.*—I will try to answer R. K. H., of Philadelphia, with regard to finding the bevels for the pieces composing an inclined bottom in a circular bin.

Suppose one of the pieces forming the bottom be represented in plan by the radial lines F 1 and F 2 of the inclosed sketch. Let A B T S be an exaggerated longitudinal section of one of the staves. From B set off the perpendicular B C, which represents the thickness of the stuff employed. From the points B and C drop lines vertically, cutting the horizontal line F 1 in the points D and E. From D draw D H at right angles to F G, the latter being a center line through the plan of the piece. Along this center line, measuring from D H, lay off V K, which in length make equal to B C. Through the point K thus established draw W X, at



Circular Bin Linings.—Fig. 4.—Accompanying Letter from A. B.

right angles also to the center line. From the point E draw a line parallel to the center line, cutting W H in the point L. Connect L and D. Then the angle K L D is the bevel for the edge of the piece forming the inclined bottom. D H represents the width at B, and 1 2 represents the width at A.

In applying this rule I advise, for the sake of accuracy, that instead of taking B C, the simple thickness of the stuff, it be taken two or three times the thickness. Proceed otherwise as above described. The diameter of the circle in laying off the plan, and the width 1 2 of the pieces forming it, must be actual dimensions or scale representations of them. I have used an exaggerated section of stave in my sketch in order to better illustrate the principle. If the pieces incline upward, the bevel on the edge of the pieces would be reversed.

Day's Work at Shingling.

From R. L., *Buffalo, N. Y.*—After reading the account of that great feat in shingling from your correspondent S., I must beg a little of your space to make objections to the rules he lays down.

I do not doubt that he covered 109 feet of roof in two hours, or that he did five times that much in ten hours, if it was all laid according to the rules he names; but such work would not be accepted in this section of the country. In the first place, your correspondent S. says: "Put one nail in under shingle and two nails in the top shingle." That is what I call slighting the work. No shingle, no matter what its width, should have in either upper or under course less than 2 nails. Again S. says: "Get out of the habit of striking two or three blows on the shingle nail. One blow is as good as forty." Now, when I was learning my trade I was instructed not to "shoot" nails into the wood, for the reason that they would not hold so well. Shingles are no exception to that rule. In my estimation, on account of their thinness, greater care should be taken in handling them rather than less. It certainly is not desirable to shoot the nail head half through the shingle. A nail driven into a shingle with one blow, as S. describes, and a roof laid with one nail in each shingle in the under course and two in the top course, are not indications of intelligent carpentry. Such rules may work with S. among the innocent farmers of Indiana, but they will not work in other communities. I would rather employ a man who can shingle from 2½ to 3 squares in 10 hours, with two nails in each shingle and each nail being driven by three blows, than S. from Indiana, with his 5½ squares in 10 hours and work slighted. In my business it is quality which I consider rather than quantity.

From G. E. W., *Royalton, Wis.*—In recent numbers of *Carpentry and Building* I notice some discussion as to the amount of shingling which should constitute a day's work. For my part, I would not like to employ a man who lays only two squares in a day. On the fourth day of July last another man and myself laid a trifle over six squares between the hours of 1 and 7 p. m., with 30 minutes out for supper. The roof was plain, measuring 35 feet in length, with 17-foot rafters. This was no brag work; we can do it as often as required.

From C. N. P., *Port Allegheny, Pa.*—I am very much interested in *Carpentry and Building*, and also in some of the discussions contained therein, as well as sometimes much amused—for instance, the question of how much constitutes a day's work shingling, making estimates on building, &c. In the October number, page 197, S., of Indiana, in his directions to R. L., says: "Lay aside your hatchet and get a No. 1½ Maydole hammer," &c. Now, the Maydole hammer is a first-class tool in its proper place, but I think a good hatchet for shingling or lathing is as much ahead of his hammer as his "hawk-bill" knife would be ahead of a common penknife for the purpose he names, and will give two or three shingling stories to prove the assertion. I will here say that the stories can be proven, if necessary.

In 1867 I knew of one man having laid in one day a little over 5000 18-inch shingles, 5½ inches to the course, he himself carrying nearly all of them from the ground to the roof of the building, about 18 feet. The roof measures 580 feet, or over 5¾ squares. In 1874, myself and one man carried our shingles from the ground up a ladder to the roof of a building, 16-foot posts, 20 x 28, quarter-pitch roof, with about 15-inch projection, making one side measure about 375 feet, and covered one side in 2½ hours. We were racing and I got beaten a little, but in doing so learned something, and that is that one can shingle faster from the right to the left than the opposite way, which is, however, the most natural for a right-handed person. In shingling from right to left you sit on the right hip, and pick your shingles with the right hand, while the left is getting a nail ready. As the left brings the nail to the shingle, this relieves the right, which takes the hatchet to drive the nail. In shingling from left to right you sit on the left hip, pick your shingle with the left hand, put it in place, and hold it with the hatchet (if on a steep roof), while the left hand has to get a nail ready to drive. I think a fast shingler should be in practice of shingling both ways, in order to rest himself. I have given the year in the above to show that the work was not slighted, as one roof has been in use over five years and the other one over twelve years, and both are now and have been good roofs, never having leaked. Only a few days since myself and one other man took our shingles from the ground to the roof of a building with 20-foot posts, and laid 2½ squares in a little less than 2½ hours, having very poor shingles at that. However, this is no criterion to go by, and I estimate 2000 to 3000 shingles for a day's work, according to the description of roof, and my experience has proved this as nearly correct as could well be.

Using India Ink Upon Tracing Linen.

From G. M. H., *New York.*—W. H. C., Woodland, Cal., will find that, by rubbing the India ink in fresh water each time any considerable quantity of tracing, or, in fact, any work, is to be done, the lines will be sharp and clear. Should the latter not be the case, rub a brush upon some soap, or add a few drops of clarified ox-gall, and mix thoroughly.

None but the very best India ink should be employed in making tracings; that which has an odor of musk on being wet is the best.

From J. H. D., *Cincinnati, Ohio.*—One of the simplest ways of getting ink to run well on tracing linen is to take a perfectly dry piece of linen or muslin and with it rub the surface of the tracing linen. Wipe the entire surface carefully if the tracing has been much lolled upon, and rerub it after part of the work is finished.

With regard to making the tracings I have a suggestion to offer, derived from my own experience. The usual practice is to put on all figures and letters the last thing. My practice is to put them on first. Some of the advantages may be named as follows: It is easier to find and read figures and letters before the lines are drawn. When the lines are being put on the figures are revised. If any are discovered that have not been copied, they are immediately inserted. By this means the chances of omission are reduced to the minimum. During the operation of inserting the letters and figures, the tracing linen will have become seasoned and stretched, so to speak, so that by a little attention to the thumb tacks all chances of distortion by change in the shape of linen will also be reduced to the minimum. I recommend this plan to the attention of all draftsmen among the readers of *Carpentry and Building.*

The Slide Rule.

From Stanley Rule and Level Company, *New Britain, Conn.*—We notice the inquiry of W. A. McC. regarding slide rules in your last issue. We manufacture the rule referred to, and also publish a book —"Utility of the Slide Rule"—which latter explains fully the uses of the slide, and gives instructions for any mechanic to make his own calculations thereby. The rules can be found in the hands of almost all hardware dealers. The book we send by mail on receipt of $1.

From Bicknell & Comstock, *New York City.*—In answer to the inquiry of W. A. McC., in your November number, in regard to the slide rule, we would say that we keep in stock a 12-inch slide rule; also a treatise on the "Utility of Slide Rules." Price of each, $1.

REFERRED TO OUR READERS.

Cutting the Gum on Oil Stones.—Pure Sweet Oil.

From W. G. S., *Chattanooga, Tenn.*—I wish to know if any of the readers of *Carpentry and Building* have had any experience with turpentine mixed with sweet oil, to cut the gum, for oil stones? I dislike to use kerosene, as it spoils the stone by hardening it. I have heard that turpentine, in the proportion of ¼ to ¾ of oil, will cut the gum and not injure the stone, but am afraid to try it without further testimony in favor of it

Is there any way by which I may know

the pure sweet oil from the adulterated article when I am purchasing? Is the article put up in bottles and labeled "Huile d'Olive," more likely to be pure than that sold by the ounce?

Wooden Truss Bridges.

From C. C. A., *Cincinnati, O.*—Will some of the readers of *Carpentry and Building* furnish a design for a wooden truss bridge, for a span 80 to 100 feet in width, together with detailed drawings. I desire one that is as simple as possible, and yet shall be perfectly safe for ordinary country travel.

Hollow vs. Solid Walls.

From S. P. S., *Joliet, Ill.*—I desire the opinion of experienced men as to which is the best, a 14-inch hollow wall, well bonded and plastered directly on the brick, or a 12-inch solid wall, stripped and lathed and plastered? There seems to be a great difference between mechanics upon this point. I should be glad to see arguments brought forward which would settle this question one way or the other.

Construction of a Brick Stable.

From G. S. O., *Norfolk, Va.*—I think *Carpentry and Building*, which I have just received, bids fair to supply a want long felt by myself and doubtless by many others. I have a favor to ask of some of your readers. I am in need of information concerning the construction of a stable. I desire to build one of brick, two stories high, to accommodate, say, 10 horses and 2 carriages. I want a room rat-proof for feed, with a capacity of, say, 400 bushels corn and oats. There must also be a small room for hostler to sleep in. If some of your readers who have had practical experience in supplying such wants will commuuicate their ideas to you for publication, they will, no doubt, oblige many others besides myself.

Sanded Roofs.

From W. A. McC., *Tippecanoe, Ohio.*—Are sanded roofs fire-proof? If so, what is the best method of applying the sand? If not, what plan is recommended for making roofs non-combustible?

Heating and Ventilation.

From L. S. C., *East Machias, Me.*—The letters recently published in *Carpentry and Building* concerning the ventilation of rooms do not cover some of the points about which I desire information. I would like to see presented, in a concise manner, some of the most approved methods of ventilation as applied particularly to school-houses. I should also like to have information which would enable me to calculate how much surface of pipes, in the case of steam heating, should be allowed in each room accomodating 60 scholars. In the case of furnace heating, should there be one or two registers to the room, and if but one, should it be near the floor or the ceiling?

Application of Geometry.

From S. F. E., *East Pepperel, Mass.*—Will some of the readers of *Carpentry and Building* furnish a few simple illustrations of the application of geometry to architecture and carpentry? I am a student and ask the above for the sake of information. I desire practical illustrations.

Prices of Building Materials in New York, November 20, 1879.

Blinds.—OUTSIDE.

Per lineal, up to 2.10 wide....$ .... @ 0.24
Per lineal, up to 3.1 wide.... .... @ 0.27
Per lineal, up to 3.4 wide.... .... @ 0.30
Per lineal, paint'd and trim'd 0.40 @ 0.50

INSIDE.

Per lineal, 4 folds, Pine.... .... @ .45
Per lineal, 4 folds, ash or chstnut.... .... @ .72
Per lin'l, 4 folds, cherry or butternut.... .... @ .86
Per lineal, 4 folds, bl'k wal't. .... @ 1.00
Add 20 per cent. to above prices,

Bricks (afloat).

Pale.... ⅌ M. $4.50 @ ....
Jersey.... 5.75 @ 6.00
Long Island.... 6 00 @ 6.50
Up-River.... " 5.75 @ 6.25
Havers'aw Bay, 2ds. 6.25 @ 6.50
Havers'aw Bay, 1sts. " 6.50 @ 6.75

FRONTS.

Croton—Brown.... ⅌ M. .... @ $8.50
Croton—Dark.... " .... @ 9.00
Croton—Red.... " .... @ 9.50
Philadelphia.... " .... @ 22.00
Trenton.... " 18.00 @ 19.00
Baltimore.... " .... @ 38.00

Yard prices 50c. ⅌ M higher, or, with delivery added, $1.50 per M for Hard and $2.50 per M for front Brick.

FIRE BRICK. (yard prices).

Red Welsh.... $35.00 @ ....
Scotch.... 30.00 @ ....
English.... 30.00 @ ....
Silica.... 45.00 @ 55.00
Stourbridge.... 55.00 @ ....
American.... 27.00 @ 30.00
Afloat, 500 ⅌ M less

Cement.

Rosendale, ⅌ bbl.... $ 0.95 @ 1.00
Portland Saylor's American, ⅌ bbl.... 2.50 @ 2.60
Portland (imported) ⅌ bbl.. 2.65 @ 2.75
Roman.... " .. 2.75 @ 2.85
Keene's coarse.... " .. 5.75 @ 6.25
Keene's fine.... " .. 9.75 @ 10.00

Doors.

RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ in.	$0.67	....
2.6 x 6 6	1¼ in.	.95	....
2.6 x 6 8	1¼ in.	1.00	....
2.8 x 6.8	1¼ in.	1.15	....

MOULDED.

Size.	1¼ in.	1½ in.	1¾ in
2.0 x 6.0	$1.23	....	....
2.6 x 6 6	1.52	1.93	....
2.6 x 6 8	1.57	1.95	....
2.6 x 6.10	1.59	2.01	....
2.6 x 7.0	1.62	2.09	....
2 8 x 6.8	1.68	2.32	2.57
2.8 x 7 0	1.69	2.17	2 69
2.10 x 6.10	1.79	2.26	2.84
3.0 x 7.0	1.87	2.45	3.80

2nd quality 15 cts. less.
Add 20 per cent. to above prices.

Drain and Sewer Pipe.

Discount 50 to 60 per cent. according to quality and size of order.

Pipe, per foot.		Bends & Elbows, Each.	—Branches— Sing.	D'bl. & V.	Traps, Each.
2 in..	$ .13	$ .40	$ .48	$ ...	$1.00
3 " ..	.16	.50	.61	...	1.25
4 " ..	.20	.65	.75	1.30	1.75
5 " ..	.25	.85	.90	1.55	2.50
6 " ..	.30	1.15	1.05	1.80	3.50
7 " ..	.35	1 50	1.20	2.05	5.00
8 " ..	.45	2.00	1.45	2.45	6.00
9 " ..	.55	2.50	1.70	2.85	7.00
10 " ..	.70	3.00	2.00	3.30	8.00
12 " ..	.80	3.75	2.52	4.24	10 00
15 " ..	1.25	5.00			
18 " ..	1.60	7.50			

Longer than 1 ft., charged as pipe.

House Branches pr. lin. ft. 15x6 $1.75; 18x6 2.50
Sewer Branches pr. lin. ft., 15 in. $2.25; 18 " 3.00

Glass.—(American.)

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$7.50	$6.75	$6.25	$5.75
11x14—16x24	8.50	7.75	7.25	6.50
18x22—20x30	10.75	9.75	8.75	7.75
15x36—24x30	12.25	10.75	9.00	8.50
26x28—24x36	13.00	11.50	9.75	9.00
26x36—26x44	14.50	13.25	10.75	9.50
26x46—30x50	15.00	14.00	11.25	10.50
30x52—30x54	16.00	14.50	12.00	....
30x56—34x56	17.25	15.50	13.50	....
34x58—34x60	18.25	17.25	15.00	....
36x60—40x60	20.75	18.75	17.25	....

DOUBLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$12.00	$11.00	$10.00	$9.25
11x14—16x24	13.75	12.50	11.75	10.50
18x22—20x30	17.25	15.75	14.00	....
15x36—24x30	19.75	17.25	14.50	....
26x28—24x36	21.00	18.50	15 75	....
26x36—26x44	23.25	21.25	17.25	....
26x46—30x50	24.00	22.50	18.00	....
30x52—30x54	25.75	23.25	19.25	....
x56—34x56	27.75	25.00	21.75	....
34x58—34x60	29.25	27.75	24.00	....
36x60—40x60	33.25	30.00	27.75	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 inches, will be charged in the 84 united inches' bracket. Discounts: 50 @ 50 & 10%

FRENCH WINDOW, PICTURE AND CAR GLASS.

Prices current per box of 50 feet.

SINGLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$8.00	$6.75	$6.25	$5 75
11x14—16x24	8.75	8.00	7 50	7.00
18x22—20x30	11.25	10 50	9.75	8.75
15x36—24x30	12.75	11.50	10 00	.
26x28—24x36	13 50	12.25	11.25	. .
26x36—26x44	14 75	13 75	11.75	..
26x46—30x50	16 25	15.00	13 00	....
30x52—30x54	17.25	16 00	13 50	...
30x56—34x56	18 75	16 75	15 00	...
34x58—34x60	19.50	18.00	16.00	....
36x60—40x60	21.00	19.50	18.00	..

DOUBLE.

Sizes.	1st.	2d.	3d.	4th.
6x 8—10x15	$12.00	$11.00	$10.00	$9 25
11x14—16x24	14 75	13.75	12.75	11.75
18x22—20x30	19 00	17.75	16 00	....
15x36—24x30	21 50	19 25	16 50	....
26x28—24x36	23 00	20 75	18.25	....
26x36—26x44	25.00	23 00	19.25	....
26x46—30x50	27 00	25 00	21.25	....
30x52—30x54	28 50	26 00	22.25	....
30x56—34x56	30 00	27.75	24 75	....
34x58x34x60	31 75	30.00	27.00	....
36x60—40x60	35.50	32 50	30.25	....

Sizes above—$10 per box extra for every five inches.

An additional 10 per cent. will be charged for all glass more than 40 inches wide. All sizes above 52 inches in length, and not making more than 81 united inches, will be charged in the 84 united inches' bracket.

Discounts: Single, 40&10; Double, 60%.

GREENHOUSE, SKYLIGHT AND FLOOR GLASS.

Per square foot, net cash.

⅛ Fluted plate.... 18 @ 20
3-16 Fluted plate.... 20 @ 24
¼ Fluted plate.... 24 @ 26
¼ Rough plate.... 24 @ 26
⅜ Rough plate.... @ 35
½ Rough plate.... @ 45
¾ Rough plate.... @ 60
1 Rough plate.... @ 70

Hair.

Cattle.... ⅌ bushel..$ .... @ 0.12
Goat.... " .... @ 0.15

Lath

Cargo rate.... ⅌ M $ .... @ 1.75

Lime.

Glen's Falls, or Keenan's common, cargo rate ⅌ bbl.... .60 @ .65
Glen's Falls, or Keenan's finishing Jointa.... .80 @ .85
Rockland, common.... .85 @ .90
Rockland, finishing.... .85 @ .90
Ground.... .80 @ .85
Add 25c. to above figures for yard rates.

Lumber.—(Yard prices.)

Market firm with upward tendeucy.

Pine, very choice and ex. dry, ⅌ M. ft. thick.... $56.00 @ $60.00
Pine, good.... 45.00 @ 50.00
Pine, second.... 30.00 @ 40.00
Pine, selected, box.... 18.00 @ 20.00
Pine, common box.... 16 00 @ 18.00
Pine, common box, ⅝.... 13.00 @ 15.00
Pine, 1¼x10, 13 ft., matched, each.... .40 @ .43
Pine, 1¼x10, 13 ft., merchantable, matched, ea.. .35 @ .38
Pine, 1¼x10, 13 ft.. culls.... .25 @ .28
Pine. 1x10, 13 ft., good matched, each.... .28 @ .30
Pine, 1x10, 13 ft., common, matched, each.... .20 @ .22
Pine, 1x4½, clear, match'd, each.... .22 @ .25
Pine, 1x4½, merchantable, matched, each.... .15 @ .16
Pine, 1¼x4, clear, match'd, each.... .33 @ .35
Pine, 1¼x4, merchantable, matched, each.... .28 @ .30
Spruce, 1x9, 13 ft. matched, each.... .18 @ .20
Spruce, 1¼x9, 13 ft., matched, each.... .23 @ .25
Spruce, 2x9, 13 ft., match'd, each.... .32 @ .35
Spruce, 2x9, 13 ft., common matched, each.... .25 @ .30
Spruce, 2x4, 13 ft.... .12½ @ .13
Spruce timber, ⅌ M ft.... 16.00 @ 20.00
Hemlock, 1x10, 13 ft., each. .14 @ .16
Hemlock, 2½x4, 13 ft., each. .13 @ .15
Hemlock, 3x4, 13 ft., each.. .14 @ .16
Hemlock, 4x6, 13 ft., each.. .40 @ .43
Ash, good, ⅌ M ft.... 40.00 @ 45 00
Oak.... 45.00 @ 60 00
Maple, cull.... 20.00 @ 25 00
Maple, good.... 30.00 @ 45 00
Chestnut.... 45.00 @ 60 00
Cypress, 1, 1½, 2 and 2½ in.. 35.00 @ 40 00
Bl'k walnut, good to choice 85.00 @ 100 00
Black Walnut, 2d.... 55.00 @ 65.00
Black walnut, ⅝.... 70.00 @ 80.00
Black walnut, selected and seasoned.... 110 00 @ 150.00
Bl'k walnut counters, ⅌ ft. .12½ @ .20
Cherry, wide, ⅌ M ft.... 85.00 @ 100.00
Cherry, ordinary.... 60.00 @ 80.00
Whitewood, or Poplar 1 to 1½ inch.... 35 00 @ 4.500
Whitewood, or Poplar ⅝ in. 30.00 @ 35.00
Whitewood, or Poplar ⅝ panels.... 35.00 @ 40.00
Shingles, extra sawed pine, 18 in.,.... 5.00 @ 7.00
Shingles, clear sawed pine, 18 in., 2 md.... 4.00 @ 5.00
Shingles, cypress, 24x7.... 20 00 @ 12.00
Shingles, cypress, 20x6.... 12.00 @ 15.00
Yellow pine dressed flooring, wide, ⅌ M ft.... 28.00 @ 30.00
Narrow ditto.... 30.00 @ 35.00
Yellow pine girders.... 30.00 @ 45 00
Yellow pine posts ⅌ M.... 31.00 @ 32.00
Locust posts, 8 ft., ⅌ in.... .18 @ .20
Locust posts, 10 ft.,.... .24 @ .25
Locust posts, 12 ft.... .25 @ .30
Chestnut posts, ⅌ ft.... .3 @ .4
Mahogany, ¼ in. ⅌ ft.... .5 @ .7
Mahogany, ⅜ in. ⅌ ft.... .8 @ .10
Mahogany, ½ in. ⅌ ft.... .10 @ .12
Mahogany, ⅝ in. ⅌ ft.... .12 @ .14
Mahogany, ¾ in. ⅌ ft.... .14 @ .16
Mahogany 1 in. ⅌ ft.... .16 @ .18
Rosewood, 1 in. ⅌ ft.... 16 @ .22
Rosewood, ⅛ in. ⅌ ft.... .11 @ .15
Rosewood, ¼ in. ⅌ ft.... .16 @ .20
Rosewood, ⅜ in. ⅌ ft.... .24 @ .28
Rosewood, ⅝ in. ⅌ ft.... .40 @ .45
Rosewood. 1 in. ⅌ ft.... .50 @ .65
Satin wood, ½ in. ⅌ ft.... .10 @ .30
Satin wood, 1 in. ⅌ ft.... .30 @ .40
Cedar (Cuban and Mexican) ⅌ ft.... .10 @ .14
Cedar (Florida).... @
Less than 1 inch.... .8 @ .24
1 inch and over.... .25 @ .35

Moldings.

50c. to 60c. per inch per 100 feet, according to quality.

Paper.

Rope, waterproof building, ⅌ ℔ .16 @ .17
Rosin Sized Sheating, ⅌ ℔. .4 @ .5
Dry Sheating ⅌ ℔.... .3 @ 3½
Tarred Felt. ⅌ ℔.... .... @ .2¼

Plaster.

Calcined City.... Mill rate..$0.95

Sash.

GLAZED.

Dimensions of windows.	12 Lights. 1¼pl.	1¼c.	1½c.	8 L's. 1½c.	4 Lights. 1¼c.	1½c.
2.1x3.6	$0.87	.92	....	....	....	....
2.4x3.10	.96	1.02	....	....	1.11	....
2.7x4.6	1.18	1.24	1.35	.	1.37	1.46
2.7x4.10	1.25	1.32	1.44	....	1.48	1.59
2.7x5.2	1.35	1.42	1.53	1.84	1.75	1.87
2.7x5.6	....	1.56	1.65	1.93	1.88	2.03
2.7x5.10	....	1.65	1.74	2.01	1.99	2.15
2.10x4.6	1.29	1.35	1.47	....	....	....
2.10x5.2	1.45	1.52	1.70	1.87	1.89	2.06
2.10x5.6	1.53	1.59	1.79	2.01	1.97	2.19
2.10x5.10	1.74	1.80	2.01	2.07	....	2.30

c. means counted checked—plowed and bored for weights.
Hot bed sash, glazed.... 3.0x6.0.... $1 90
Add 30% to above prices.

HEAD LIGHT.

Two or three Lights, Glazed.

Size.	1¼	1½	Size.	1¼	1½
2.6x1.0	45	55	2.10x1.10.	45	59
2.6x1.6	55	63	2.10x1.6	59	67
2.8x1.0	45	55	3.0x1.0	50	63
2.8x1.6	55	67	3.0x1.6	72	86

Add 30% to above prices.

Slate.

By car load, delivered in New York.

Purple roofing slate, ⅌ sq're. $5.00 @ $5.50
Green slate.... 5.00 @ 5.50
Red slate.... .... @ 9.50
Black slate, Pennsylvania.... .... @ 4.00
Tiles, 1¼ in. rubbed, ⅌ sq. ft. .20 @ .25
⅌ sup. ft.
Steps and platforms, 1 in. thick.... 28c
" " 1½ " 35c
" " 2 " 42c
Risers, 1 inch thick.... 27c
Coping, 1½ " 27c
" 2 " 31c
Lineal ft.
Window sills, 4x7.... 45c
" 3x7.... 36c
Window caps, 4x10, plain.... 65c
" 4x8, " 50c
" 3x10, " 47c
" 3x8, " 42c

Stair Material.

BALUSTERS.

Black Walnut.	1½ in.	1¾ in.	2 in.	2½ in
Fancy Turned	7c	9c	10c	16c
Neck Turned	9c	10c	12c	19c
Fluted or Octagon	12c	14c	17c	25c

OCTAGON PANELED NEWELS.

Panels Veneered with French Walnut.
8-inch Newels, with Cap.... $6.12
9 " " " 6.88
10 " " " 7.60

SOLID NEWELS, WITH CAPS.

Black Walnut.	5 in.	6 in.	7 in.	8 in.
Fancy Turned	$1.60	$1.90	$2.50	$3 40
Octagon	2.10	2.40	3.00	3.90

STAIR RAIL.

Worked out and finished ready to put up. Easements and cylinders counted double. Price per foot (Newels and Balusters not included).

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	40c	45c	50c	53c
Toad Back	45c	50c	63c	68c

STAIR RAIL, UNFINISHED.

Price per foot.

Black Walnut.	3 in.	3½ in.	4 in.	4½ in
Molded	11c	13c	15c	17c
Toad Back	12c	14c	16c	18c

Stone.

Cargo rates, delivered at New York.

Amherst freestone, in rough, ⅌ C ft.... $.... @ $0.85
Berlin freestone, in rough.... .... @ .85
Berea freestone, in rough.... .... @ .70
Brown stone, Portland, Ct.... 1.25 @ 1.50
Brown stone, Belleville, N. J. 1.00 @ 1.50
Granite rough.... .50 @ 1.00
Dorchester, N. B., stone, rough.... ⅌ foot. .... @ 1.00

BLUE STONE

Rubbed hearth, 10 ft. or under.... 20c
Rubbed hearth, 20 ft. or under.... 30c
Rubbed hearth, 3 ft. or under.... 45c
Rubbed hearth, 40 ft. or under.... 55c
Rubbed sills, imported.... 28c
Rubbed sills, domestic.... 33c
Sills and lintels.... .... @ 17c
Sills and lintels, fine quarry cut sills.... .... @ 35c
Coping, 11 to 18 in. wide.... 18c @ 30c
Coping, 20 to 28 in. wide.... 35c @ 55c
Coping, 30 to 36 in. wide.... 60c @ 75c
Steps, 8 in.... .... @ 55c
Steps, 7 in.... .... @ 40c
Steps, 6 in.... .... @ 25c
Steps, door, per in. wide.... .... @ 2c
Platforms, promiscuous, 4 in.... .... @ 32c

Vault Lights.

Platform, sq ft.... $3.00
Step and risers, sq. ft.... 3.25
Floor light, sq. ft.... 2.25
Roof light, sq. ft.... 2.00
Platform, 2d quality, sq. ft.... 2.60

COVERS.

Diameter.	Round.	Hexagon.
14 inch	$3.00	$0.00
16 "	3.75	4.00
18 "	5.50	6.00
20 "	8.00	8.50
24 "	14.00	15.0
26 "	16.00	17.0
30 "	23.50	25.0
36 "	31.00	33.0

Window Frames.

Up to 3.4 x 7.2, put together.. .... @ 2.40