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CONTENTS.

THE building of the Broadway Underground Railroad is seriously opposed by a number of the largest property-owners in New York, among others, by the Corporations of Trinity and Grace Churches, the Stewart, Van Rensselaer, Moffat, Lorillard, Spencer and Wolfe estates, and many private individuals. It is understood that the Commissioners appointed to report on the expediency of authorizing the construction of the road will report favorably unless some good reasons for the contrary are brought to their notice at once, and a meeting of the objectors was recently held to provide for having their opinions properly presented. The main trouble which seems to be anticipated by the owners of the Broadway buildings is the undermining of their foundations by the excavation, particularly in the sandy portions of the route; but the obstruction to surface travel through the street is also mentioned as likely to prove injurious to the interests of neighboring property. The projectors of the railroad profess to be able to carry on their operations without any material interruption to travel, and the undermining of cellar walls by the excavation of a tunnel in the middle of the street might be prevented by very simple means; but several of the speakers called attention to the reported fact that none of the subscribed capital of the road had been paid in, and that there might therefore be difficulty in holding the company responsible in case of damage.

A CHIMNEY at the corner of Lewis and Broome streets, in New York, fell some four months ago under singular circumstances, killing a man who was at work upon it. The inquest was delayed until last week, when the testimony of Mr. William P. Esterbrook, Superintendent of Buildings, was taken as to the probable cause of the accident. The chimney was being taken down, and the bricks and other debris were thrown down into the shaft, and in Mr. Esterbrook's opinion the accumulation in the cylinder exerted a kind of hydrostatic pressure, which forced out the walls at the foot. No doubt this explanation is correct, and the Superintendent's deduction from it, that in all such cases an opening should be made at the bottom of the chimney, and planks placed in it to direct the falling material to the outside where it can be carried away, may be commended to the attention of all architects and builders. Nothing is more common than to see the most careless mistakes made in the construction or treatment of walls which are required, either temporarily or permanently, to retain a mass of earth or other loose material. The best engineers are often tempted, by reason of the great cost of good work of this kind, to sacrifice the durability of their constructions to a false economy, and inferior builders commit similar or worse errors out of pure ignorance and incapacity.

THE village of Schaghicoke, near Albany, N. Y., has been visited by malarial diseases of peculiar virulence since the construction of a railway embankment through it, which checked the course of some small streams, and caused the formation of stagnant pools. The town is beautifully situated among the hills of the upper Hudson Valley, and has been until lately renowned for its healthfulness, but the outbreak of the ague has been so violent as to affect in one way or another almost the whole community. As a proof of this, it is said that one thousand grains of quinine, on an average, are daily sold in the village, a quantity which to any one experienced in malarial fevers represents an incredible amount of suffering and helplessness. If the cause is really the formation of the embankment, there can be no great difficulty in applying a remedy, and it is to be hoped that the inhabitants of the place will take measures to see that this is done before the further progress of the infection deprives them of the necessary energy.

MR. WALTER G. ELLIOT, a civil engineer of some reputation, has exposed himself to a good deal of criticism by the publication of some very hasty and inconsiderate notes upon the drainage of Southern cities. His account of New Orleans, founded upon most inadequate information, was effectively commented upon by Col. Waring; and the last number of the *Sanitary Engineer* contains a similar reply to his discourteous, as well as erroneous remarks in regard to the sewerage of Montgomery, the capital of Alabama. Mr. Elliot says, in speaking of this place, that "The general condition of the South and Southwest to-day is as well indicated by the state of the sewerage of their principal cities as by any other circumstances with which the writer is acquainted;" illustrating this rather sweeping proposition by the assertion that "in Montgomery, Alabama, a city of sixteen thousand five hundred inhabitants, there is *not a sewer*. A large square wooden conduit passes through the main street to the river, and is utilized only to carry off the overflow from a couple of artesian wells located near the upper end. Like many of its sister cities in the Southwest there is not a pavement in the place, and the streets are in a horrible condition all the year, the mud being literally up to the hub of an ordinary carriage." To this unattractive description Mr. S. T. Campbell of Montgomery gives a flat contradiction. Instead of a single wooden conduit there is a large, well-ventilated brick sewer through the principal street, discharging into the river, and flushed by the abundant overflow from the artesian wells near its head. With this main drain are connected smaller brick sewers, which extend through nearly all the streets, and receive the house wastes and surface water. Almost every house is provided with bath and water-closet of the most improved construction; the supply from the city water-works is abundant, and of excellent quality, and the principal thoroughfares, far from being wastes of mud, are paved with brick or stone, and regularly washed from the fire hydrants.

ONE cannot read this description without feeling that Mr. Elliot might have found places quite as deserving of his criticism as Montgomery, without going far from home, and that his inferences as to the political or social condition of the Southwestern States from what he erroneously imagines to be their backwardness in sanitary matters might be retaliated with considerable effect upon the older communities in the North. The town of Newton, Massachusetts, for instance, is very slightly more populous than Montgomery, containing some sixteen thousand nine hundred inhabitants. Unlike the impoverished Southern cities, however, it is enormously wealthy, the valuation *per capita* exceeding that of any other place of its size in the rich commonwealth of which it forms a favored part. Like Montgomery, it has introduced of late years an abundant water-supply, but unlike the Alabama town, its enterprise has stopped at that dangerous point; and in place of public drainage by well flushed and ventilated sewers, the cesspool and privy vault still reign supreme. Situated as it is upon high land bordering a tidal river, within easy reach of brick-yards and pipe manufactories, a fourth of the effort which has made Montgomery one of the healthiest towns in the world would have converted Newton into a sanitary paradise, but the local pride which has done so much in the South of late years to stimulate intelligent enterprise was wanting, and the opportunity passed by unimproved.

THE subject of fire-resisting construction now occupies the minds of our Continental neighbors, as well as our own. The Society of Science and Agriculture of the city of Lille, in French Flanders, offered recently a prize for the best essay in answer to the questions, "In what degree is it possible to render buildings incombustible by the choice of their materials, or the mode of employing them?" and, "What are the best means of reducing as much as possible the extent and importance of conflagrations in public and private buildings?" The premium was awarded to M. Nicole, an architect, whose essay is in process of publication in the French technical journals: and the Société Industrielle of Mulhouse, in Alsace, has emulated the example of its rival, and now offers a reward of five hundred francs and a silver medal for the best memoir upon "the construction of incombustible buildings, and the modification of those now existing so as to diminish the risk of fire." The competition remains open until February 15, 1882, and the detailed programme may be obtained by writing to the president of the Société Industrielle de Mulhouse. We are inclined to the opinion that notwithstanding the inflammability of our ordinary buildings, the science of fire-proof construction has nowhere been carried farther than in this country, and it might be worth the while of some American expert to enter the lists with the rest.

A work of great magnitude has been undertaken by the city of Paris in the enlargement and reconstruction of the buildings belonging to the ancient college of the Sorbonne. Some of these were erected by Cardinal Richelieu, and their occupation, first by the great school of French divinity, and later by the University of Paris, has given them an historical interest which it is certainly wise to take advantage of. As reconstituted, the new Sorbonne will comprehend the Academy of Paris, and the Faculties of Theology, Belles-lettres and Science, all of which will have accommodations in the buildings. The constructions proposed will occupy the space bounded by the streets called Saint-Jacques, Victor Cousin, Cujas, de la Sorbonne, and des Ecoles; and the total cost is fixed at twenty-two million two hundred thousand francs, half of which will be paid by the city, and the rest from the treasury of the Republic. The numerous operations of rebuilding and restoration which have been undertaken in Paris within the past few years form a notable feature of modern architectural history. The Palais de Justice, the Hôtel de Ville, the Hôtel Dieu, the Sorbonne, and the Tuileries constitute a series of works which do not derive their least interest from the expression which they present of a respect for historical associations which survives even the most violent political changes.

An account is given in *La Semaine des Constructeurs* of certain experiments made to determine the effect of dynamite as an agent for destroying structures of iron. It is found that by confining the explosion to a limited area, wrought-iron plates can be cut through in a given line, fixed by laying the cartridge, in the form of a long cylinder, upon it. Zinc tubes are employed for the purpose, and after bending them so as to fit closely the surface of the metal to be severed, they are covered with clay and fired by an electric spark. Under ordinary circumstances the interior diameter of the zinc tube is made equal to the thickness of the iron plate to be cut, and this is found to hold a sufficient charge. In one instance, where the girders of an iron bridge had fallen into the water and obstructed the stream, their removal was effected by means of dynamite cartridges from three to thirteen feet long, carefully bent to fit the section of the girders, and lowered with wires into the current, which drifted them against the masses of iron. A spark from a battery determined the explosions, which severed the girders into lengths small enough to be easily removed. In this case it was necessary to employ somewhat larger cartridges than would be requisite if they could be covered with clay, and care was taken to apply the dynamite at the top or side of the plates, so that fragments of iron might not be thrown into the air.

After encountering so many mishaps and difficulties, the contractors for the St. Gothard Tunnel have triumphed over most of them, and the entire undertaking will very probably be completed within a year. The contract value of the work done is a little less than eleven millions of dollars, leaving four hundred and twenty-five thousand still to be earned. Three thousand three hundred and nineteen men are employed in the tunnel, and work proceeds night and day without intermission. Six million cubic feet of compressed air are used in driving the rock drills and the service locomotives every twenty-four hours, and in the same time nearly a quarter of a ton of dynamite is exploded. The tunnel proper comprises only a part of the enterprise. In order to connect the various existing railways north and south of the Alps with the tunnel line, no less than ninety-nine miles of subsidiary road have been built, through a very difficult country, as may be imagined from the fact that fifty-one tunnels, large and small, are required on the subsidiary lines alone, besides ten million cubic feet of brick and stone masonry for viaducts and bridges. The main tunnel is nine and a quarter miles in length, but its cost has been exceptionally large, on account of the treacherous nature of the rock pierced, as well as the inconvenience of access on both sides. The French cannot observe with equanimity the approaching completion of a line which will prove of great value to the German Empire, and a third tunnel into Italy from the French side will undoubtedly be soon begun. Although some sentimental considerations favor the piercing of Mt. Blanc, which is at least partly within the territory of France, it is much more likely that the Simplon route, extending from Brieg, at the terminus of the railway which extends from Geneva up the valley of the Rhone, under the mountain to Isella on the Italian side, will be finally adopted. The tunnel will be eleven and a half miles long, but the easy approaches and lower grade will give it some advantage over its rival.

The Panama Ship Canal is still being pushed with some energy, but the reports given by correspondents of the various daily journals indicate that the circumstances under which the construction is carried on are in many respects deplorable. Mr. Hersent, a partner of the firm of contractors who have undertaken the construction of the canal, will arrive soon at the Isthmus, and his executive ability is expected to bring order out of the chaos which prevails there. The rainy season will begin before long, and all out-door operations must be suspended until that is over, but much can be done meanwhile in making preparations for the work of the next year. The transfer of the Panama Railroad from American to French ownership and management has very much changed the political aspect of affairs, and it is reported that England and Russia are on the point of establishing naval stations near the mouth of the canal, to protect their own interests. After the display of zeal which was made in Congress last year in favor of the complete control of the Canal by the United States, it certainly seems a little strange that foreign nations should venture to thrust themselves uninvited into a position which would seem to indicate a distrust of the impartiality of our government, but all this will probably be explained some time. At the best, very little work has been done on the excavation, and it seems not unlikely that the visit of Mr. Hersent is intended to settle finally the question whether it is really advisable to proceed with vigor or quietly to abandon the whole enterprise.

Americans are somewhat familiar with the ways in which the names of eminent men and public bodies are made to do duty in advertising the projects of unscrupulous quacks, but in this country the unauthorized use of names is not often resented as it should be. In France the case is different, and the effrontery with which a certain association, the Electric Power and Light Company, headed by a renowned speculator who had but recently returned from a precipitate visit to countries beyond the French jurisdiction, ventured to use the name of the Society for the Encouragement of Science, and of its venerable President, M. Dumas, in support of its ridiculous promises, has been met by a grave and severe rebuke. "M. Faure," the *Bulletin* of the society says, "had been authorized to present, at the meeting of April 22, the results of his studies upon the secondary batteries invented by an eminent physicist, M. Gaston Planté, and while the society was considering with a lively interest one of the most interesting acquisitions of electrical science, its Executive Committee learned, not without surprise, that a speculator proposed to explain before it the profits promised by this new application of knowledge. Leave to address the society was not granted him." "The Council of the Society," the *Bulletin* goes on to say, "appreciates inventions and improvements. It accords to them gladly its encouragement and praise; but it never acts as judge of the profits which may be derived from them, and it is improper to give the authority of it and its president to financial schemes resulting from conceptions and calculations into which it absolutely refuses to enter." This, with the less dignified, but not less vigorous, criticism with which the scientific press in general received the attempt to make M. Dumas, as the French papers say, "the barnum" of a questionable enterprise, seems likely to be fatal to its success.

BUILDING SUPERINTENDENCE. — X.

As it would be difficult to lay heavy timbers on a row of isolated piers without overturning them, the girders are generally held in place by shores set beneath them until the floor beams are all on, or sometimes even longer; and the piers are then built up beneath them. These should never be less than 12″ x 12″, of hard brick, laid in cement mortar. Piers 8″ x 8″, as often seen, soon bend, while those of soft or "pier" brick are liable to be worn and kicked away at the foot. The proper spacing for piers depends on the size of the girders, and the load upon them, but should not be over 8 feet, for fear of deflection, even with strong timbers.

Under-Floor.

In the Eastern states, the next step always is to lay an under-floor of planed hemlock or spruce boards, over which the men move freely, while it forms a roof to the cellar, which can immediately be used for storage of tools and materials. Whether this is done or not after the floor is made practicable for the passage of workmen across it, the large posts should be set up at the angles, and at the intersection of interior partitions with the outside walls. These should be 4″ x 8″, at least, even in a "balloon" frame, not so much for strength as to give good nailings for the angles of interior furrings, wainscot and base-boards (Fig. 96).

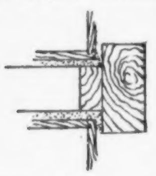


Fig. 96.

The subsequent steps depend upon the mode of construction adopted, — whether a "balloon" or a "braced" frame is specified; and it is of importance to the young architect to understand thoroughly the nature and advantages of each.

Braced Frame.

Supposing a "braced" or "old-fashioned" frame to be called for, the next step after setting the corner posts firmly into their mortises will be to secure them in their upright position by means of the braces (Fig. 97), which have been previously fitted to mortises cut in the sill and post, and on being

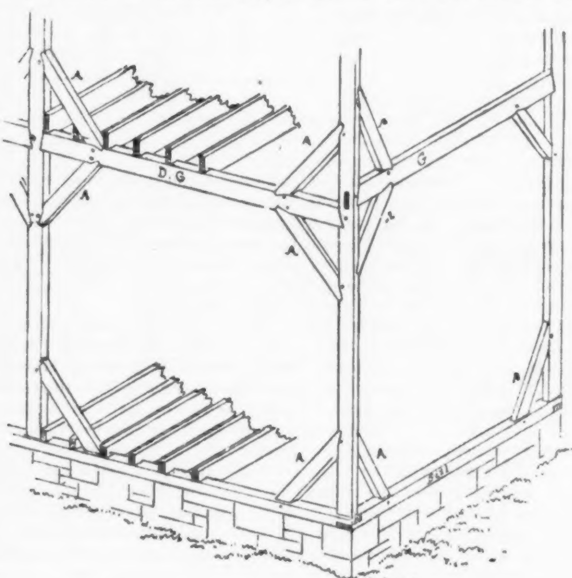


Fig. 92.

inserted and a hard-wood pin or trenail driven through the hole, hold the post fast. The shape of the tenons is shown in (Fig. 98).

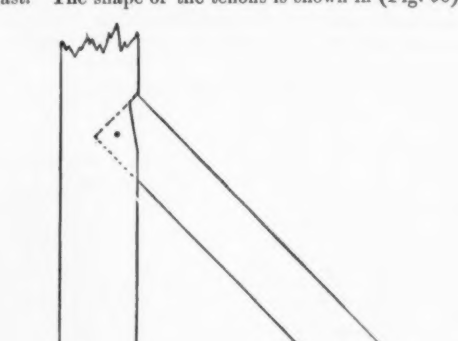


Fig. 98.

While setting and bracing the corner posts, which always extend the whole height from the sill to the plate supporting the roof, the girts (G and D G, Fig. 97), or horizontal timbers which tie the frame at each floor-level, must be put in place. In a simple rectangular frame, like the one shown on the drawing, two of these will run parallel to the floor beams, and are for convenience generally set at the same level with them. The other two, marked D G in the figure, cross the ends of the beams, and are utilized to support them. If it were possible to continue the girts all around at the same level, the beams might with advantage be framed with tenons and thrust into those which run transversely to them, in the same manner as into the girders in the first floor, but as the tenons by which the girts are framed into the posts would, if these were set at the same level, inter-

Girts.

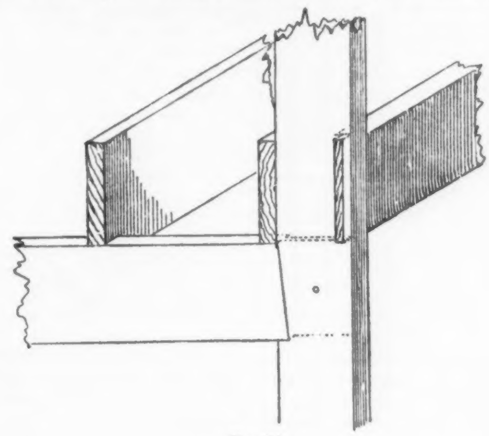


Fig. 99.

sect and cut each other off, it is necessary to place one pair entirely below the others. The latter are called the "dropped girts," and are generally arranged so that the floor-beams may be notched or "sized" one or two inches down upon them. (Fig. 99.)

The proper joint for posts and girts is shown in Figure 100. After setting these and pinning them securely, a second set of braces should be put in to tie the angle between them and the posts, as shown in (Fig. 97), using the same form of mortises and tenons as before. A third set is then placed in the angles between the posts and the upper side of the girts. All these pieces are accurately cut and fitted before any of the work is set up, so that when inserted in their mortises, and the pins driven home, the posts are drawn into their proper position, exactly at right angles with the girts, notwithstanding the bending or twisting which the heat of the sun often causes in them when first set up; and are thus prepared to receive the plate, which will not fit unless the posts are accurately parallel.

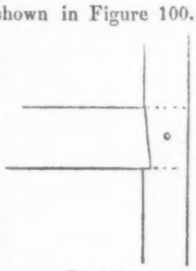


Fig. 100.

Plate.

The angles of the plates are halved together and mortised entirely through, so as to receive a long tenon left on top of the posts; and to facilitate this, as well as to give a certain lateral stiffness to resist the thrust of the rafters, it is common to make the plate 4″ x 6″ or 4″ x 8″, and lay it flatways. If the roof is to have gables, a somewhat simple construction is used, the plate which receives the rafter first being framed on top of the posts, while the gable is supported by a sort of dropped girt, tenoned into the posts below the plate proper. The angles of posts and plate may finally be braced, making a strong and rigid skeleton, as shown in Figure 97, upon which the rafters can be set at leisure, and the framework of the side completed with "filling-in" studs, set at a suitable distance for nailing the laths inside, and the clapboards or other covering outside. (Fig. 101.)

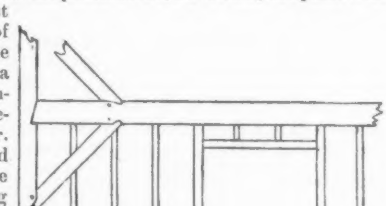


Fig. 101.

Balloon Frames.

The principle of the balloon frame is totally different, and although it may be, as is claimed for it, more philosophical, it is far inferior to the braced frame in many important respects.

If balloon framing were specified for our building, the next step after setting the corner posts would be to secure them temporarily in place by means of "stay-laths," or pieces of board nailed diagonally to post and sill. The "filling-in" studs would then be set all around the building, each stud in this system extending the whole height from sill to plate. The best carpenters mortise the feet of the studs into the sill, but this is frequently omitted, nails being simply driven diagonally through. No attempt is made to cut the pieces to the right length, and their upper ends present for a time an appearance like Fig. 102. To straighten them boards are temporarily nailed on outside, and more "stay-laths" brace the studs inward to the floor. As soon as the boarding is so far advanced as to admit of climbing safely to the top of the studs, a line is marked with a chalked string at the proper height for the underside of the plate, and the studs are cut off at that level. If any prove too short, an additional piece is set on top, and "fished" by nailing a bit of board on each side. (Fig. 103.) When all are brought to the line, a 2″ x 4″ or 2″ x 6″ timber of random length is laid on top, and spikes

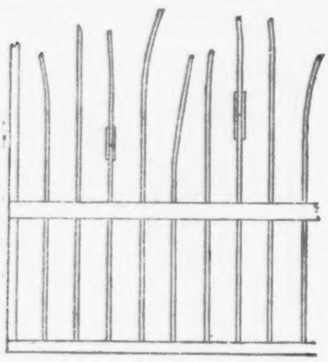


Fig. 102.

Fig. 103.

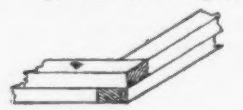


Fig. 104.

driven through it into the top of each stud. Other similar sticks are laid in the same manner until the circuit of the building is completed; when a second row is laid on top of the first, breaking joint with them, and overlapping at the angles. (Fig. 104.)

This operation brings the studs to a vertical and parallel position, but no provision yet exists for supporting the floor-beams. As before, no notching or mortising is done before setting up the frame, but when all the studs are in place, the chalked string is again brought into requisition to mark upon them two lines, 4 inches apart, at such a height that the upper one will be an inch above the proposed level of the underside of the floor beams. Each stud is then notched one inch deep between the lines, and a "ledger-board" or "false girt," consisting of a strip of

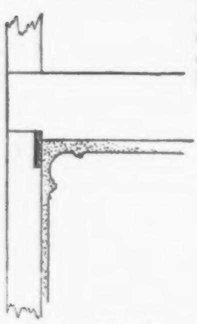


Fig. 105.

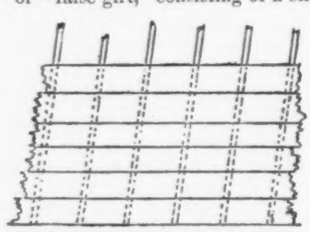


Fig. 106.

board an inch thick and 4 inches wide, is inserted and nailed in place. (Fig. 105).

This gives a support which is strong enough for the work required of it, but excessively slender in appearance, and liable, if fire should get into the spaces between the studs, to be quickly burned off, letting the floors fall.

The bracing of the angles, which forms an important part of the old-fashioned framing, is entirely omitted by most carpenters in setting balloon frames, so that nothing but the resistance of a few nails prevents the building, as the outside boarding shrinks, from leaning gradually in one direction or another, according to the prevailing winds. (Fig. 106). This may, however, be prevented by what is called long bracing, (Fig. 107), consisting of 2″ x 4″ pieces set flatways their whole depth into notches cut in the studs to receive them. The notches are made either on the outside or inside of the studs, but better bracing can be had by placing them outside. A spike is driven through the braces into each stud, and the angles are thus very strongly tied, but at the expense of strength in the vertical studding.

Long Bracing.

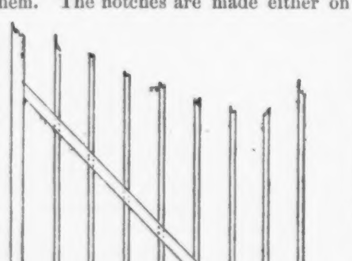


Fig. 107.

By these very different modes the balloon and the braced framing accomplish the same result, the construction of a timber skeleton bounded by sill, plate and corner posts, and included, with all bracings, tenons and fastenings, between two planes, 4 or 5 inches apart, as the case may be, so that laths can be nailed uniformly all over the inner surface, and boards over the outside. All the subsequent steps, until the completion of the building, are the same for either mode of construction. The design of the edifice is, however, somewhat dependent upon the mode employed. In both cases, heavy studs are used to form the sides of window and door openings, in order to give rigid support to the casings, and as in balloon framing all the studs, large and small, extend the whole height of the building, it is quite desirable to place the windows in the different stories vertically over each other, so that one pair of "window studs" may serve for two openings; and any variation from this direct superposition involves a considerable weakening of the portion of the structure involved. With a braced frame, the main posts only extend to the plate, all the filling-in studs, large and small, terminating at the girts; so that the studding of one story is completely independent of that above or below; an important consideration where any picturesque irregularity of fenestration is to be attempted.

As soon as the studding of the walls is in place, the outside boarding is begun. Hemlock or inferior spruce is used for this purpose, and no great care is taken to lay the joints close, but the boards must be mill-planed on one side to reduce them to an even thickness, or the subsequent shingling or clapboards will not lie evenly. While this is going on, the beams of the second floor are to be set. As it rarely happens that the beams extend in one span from the girts in one wall to those opposite, an intermediate support must be provided for them, consisting generally of the head of some interior partition, on which their inner ends are notched or "sized" down, just as their outer ends are upon their dropped girts. As the 3″ x 3″ or 3″ x 4″ piece which forms the partition-head is capable of withstanding a considerable cross-strain, it is unnecessary to set all the studs under it at first, and isolated ones are usually put in, some 3 or 4 feet apart, in order to allow free passing between them. The second-floor beams can then be immediately laid in place, and another partition in the story above, set in the same way, serves for supporting the third floor.

Boarding.

The notching or "sizing" of all beams upon their horizontal supports is made necessary by their inequality in size. Ordinary timbers often vary one-fourth to one-half an inch from their specified dimensions, but by notching them to a uniform distance *from the top* they will, when laid in place, have their upper sides level ready to receive the floor. (Fig. 108.) The undersides will be uneven, but the subsequent cross-furring will conceal this.

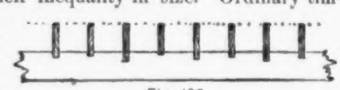


Fig. 108.

It is very common, but not judicious, to set the studs of all interior partitions either on the under-floor or on a horizontal piece resting upon the beams. If the inner ends of a tier of floor-beams are supported, as is usually the case, by a partition extending from the basement, these ends will be subject to a settlement equivalent to the sum of the shrinkage of all the horizontal pieces interposed between the underside of the beams in question and the immovable supports at the bottom of the partition; in this instance, the brick piers in the basement. If the partition studs stand on the beams, with a 2″ x 4″ "sole" interposed, a partition extending from the cellar piers to the floor of the third story will be interrupted by the basement girder, first-story beams, sole of partition, cap of the same, second-story beams, and another sole and cap, in all, from 30 to 40 inches of horizontal timber, the shrinkage of which in such a position would be from one to two inches. The outer ends of the same third-story beams will rest upon the framing of the outside wall, which would with a balloon frame, in which the studs are continuous, present only a six-inch sill and one four-inch ledger-board of shrinkable timber between them and the immovable basement wall. The shrinkage of this 10 inches of horizontal wood would amount to less than half an inch, so that when the wood-work became fully dried, which in our furnace-heated houses is in a year or two, the inner ends of the third-story beams would be an inch to an inch and a half below their outer ends. Such a difference in level is quite sufficient to cause cracking of the plastered walls in the second and third stories, and to distort the openings in the cross partitions (Fig. 109), so as to make the doors fit badly, and "bind," or require to be trimmed, or the hinges "set up" to adapt them to the altered shape.

How to provide against unequal Settlement.

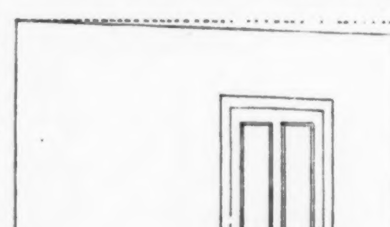


Fig. 109.

These phenomena, which every one has observed in city as well as country houses, depend solely upon the unequal shrinkage and consequent settlement of the two vertical structures by which the opposite ends of the beams are supported, and can be avoided by any device which shall make the settlement the same at both ends. In wooden houses this may be approximately accomplished by setting the studs,— not on the floor or on the beams, but *between* the latter and on the same support, so that the beams cease to form a part of the vertical frame. The studs of the first-story partitions will then stand *on the girders*, extending thence to the under side of the second-story beams which rest upon their cap. The studs of the second-story partitions again, instead of standing on the floor, or on a sole-piece, will extend down between the beams to the cap of the first-story partition (Fig. 110). By this arrangement there will be, supposing the height of the girder to be 10 inches, and that of the partition caps 3 inches, 16 inches only of shrinkable wood in the partitions between the basement piers and the under side of the third-story beams, and the difference of level after drying, between their inner and their outer ends, supposing these to be supported by balloon frame, would be about $\frac{3}{8}$ of an inch instead of three or four times that amount, as in the case previously described.

Settlement in Balloon Frames.

It is desirable to avoid even this inequality if possible, and as it is evidently impracticable to diminish the amount of horizontal timber, and consequent settlement, in the interior partitions, it will be advantageous to *increase* that in the outer walls. As the height of the sill is fixed, the aggregate shrinkage can only be increased by adding to the width of the horizontal timbers on which the upper beams rest. With a balloon frame nothing can be gained in this way, since the ledger-board must be nailed to the studs, and the free portion between the nails and the upper edge of the board is alone capable of affecting the beams by its shrinkage; and with such frames an unequal settlement is practically inevitable. The braced frame, however, sustains the beams upon a wide girt, resting on the corner posts by its lower edge, so that the whole effect of the shrinkage tends to make the upper edge descend, and with it the beams which may rest upon it.

Settlement in Braced Frames.

A braced frame, therefore, with a six-inch sill and a ten-inch dropped-girt, upon which the beams of the third story are "sized" down in the same manner as on the partition-heads supporting their other ends, will give sixteen inches in verti-

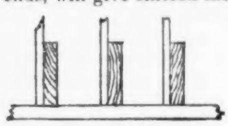


Fig. 110.

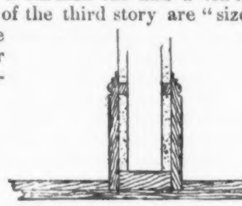


Fig. 111.

cal height of shrinkable timber, and supposing the girders and partition-heads to be as before, the settlement at both ends of the beams will be the same, and the floor will remain perfectly level, the door-frames square, and the plaster probably unbroken, for an indefinite period.

The partitions which extend from the first floor through two or more stories, even though no beams rest upon them, as in the case of those running parallel with the beams, should be set in the same way, the studs in the upper story resting on the cap of the partition below; not for the sake of lessening the shrinkage, which would in this case do no harm, but to relieve the floor-beams from the weight of the partition by making the support continuous from the basement girder upward; and partitions enclosing stairs should be similarly constructed.

Besides these, there will usually be some partitions, especially in the second story, which have no corresponding partition below. These must be supported on the beams. The simplest way of setting them is to lay the sole directly upon the under-flooring, where its position can be accurately marked; and the sole may with advantage be $5\frac{1}{2}$ or $5\frac{3}{4}$ inches wide, so as to project beyond the stud on each side by an amount equal to the thickness of the plastering. In the subsequent finishing this projection will be of great service for keeping the base-boards firmly in their proper position, and for nailing them at the lower edge if required (Fig. 111.) Where the partition runs parallel with the beams, it is common to provide in the framing plans for a timber of extra size, or two timbers spiked together, under it, to give the extra support required. A better way is to set two beams equidistant from the centre line of the partition, seven or eight inches apart from centre, instead of close together (Fig. 112.) The same strength will be obtained,

Beams under Partitions.

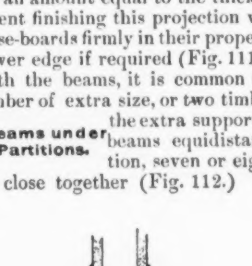


Fig. 112.

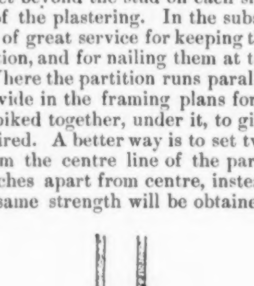


Fig. 113.

and there will be opportunity for a solid nailing at the ends of the floor-boards that abut against the partition, which cannot be had by the other method (Fig. 113.) For the same reason, the framing-plans should always show a beam placed close against outer walls and partitions extending from below. A floor where the ends of the boards, for want of these precautions, are secured only to the thin under-flooring, soon acquires an uneven and slovenly look.

The first studs of the partitions are usually set, and the floors bridged before the roof is begun. In the short spans usual in country houses, this construction is a matter of little difficulty. Where support is needed, it is generally obtained by carrying up the partitions which extend from the firm foundation in the basement, and heavy trusses and purlins are rarely necessary, the weight being equally distributed over all the rafters, which may be tied with "collars" of plank where required. At the same time, the form of such roofs is often very complex, and the framing-plans should be carefully and clearly drawn. Every ridge, valley and hip must be marked in plain letters, and the lengths of hip, valley, common and jack rafters should be calculated and written on the drawings. Without these precautions, the architect is very likely, during the framing, to find a hip substituted for a valley, or *vice versa*, and not infrequently, either by accident or design, the height of a picturesque roof will be materially lessened without consulting the designer, who does not discover until too late the reason why its appearance in execution is so disappointing.

Roofs.

The covering-in of the building gives the signal for a multitude of minor operations, the principal among which is the construction of the chimneys, which should be commenced at the earliest practicable moment, in order to avoid delay in finishing the roof. The bricks furnished for this work should be rigidly inspected. As the chimneys in frame houses are usually plastered outside as fast as built, in order to lessen the danger of sparks passing through the joints of the masonry among the furrings, the opportunity for using soft, half-burnt bricks, without detection, is unusually favorable, and the young architect should look sharply to see that none of that kind are allowed to be delivered on the ground. For the purpose of aiding the meaner builders to impose bad materials upon their employers, it is common at the brick-yards to denominate the half-burnt material from the outside of the kilns "chimney brick," "pier brick," or "place brick." The name, however, does not change the quality, and any work containing bricks whose edges can be crumbled by the fingers should be pulled down at once, and rebuilt with better materials. Unless this is done, no reliance can be placed upon the masonry; the piers are liable to be broken away and bend, and chimneys may crack open at any moment after being enclosed by furring.

Chimneys.

Bricks.

We suppose that the position and size of all the openings made in the floors for the passage of the chimneys have been carefully verified long before. If not, this should be done without delay. Masons rarely think of questioning the accuracy of the carpenter's work, and whenever they find an opening framed, they suspend plumb-lines from its four corners and commence laying bricks between them; and to the endless mistakes made by the inferior workmen who are employed in framing they add others of their own. One fertile source of errors is a want of some common understanding in regard to the system of figuring plans. Most architects, unless very experienced, figure all horizontal dimensions in wooden buildings from the nearest surface of the studs; thus, a fire-place in the middle of one side of a room 16′ long in the clear would generally be figured as 8′ 1″ from the inside of the studs to its centre. Nearly all framers, however, measure to the *outside* face of *outside* studding, although interior dimensions are taken to the *nearest* face; and the workman will probably set his trimmer-beams, or lay out his chimney, by measuring the figured distance on a ten-foot pole thrust between the studs against the outside boarding, the point thus falling four inches short of the place intended; and the mistake, if discovered, is very likely to be rectified by shifting the chimney bodily over, and resting it upon the trimmer-beam. It is safest in any case to figure the openings in floors two or three inches wider on the framing-plans than they are actually intended to be. This gives a little lee-way for contingencies, and it is always easy to fill out an excess of room by nailing pieces to the timbers, while the cutting away of beams to gain necessary space should be avoided.

All flue-doors, ash-doors, stove-rings and ventilating registers should be marked on the plans, and inserted as the work goes on. If left for subsequent cutting they are sure to be forgotten. Rings for furnace smoke-pipes should never come within sixteen inches of the cellar ceiling. All flues must be closed at the bottom, and kept separate to the top. Bad workmen often leave them open at the bottom into the ash-pit, or, where two flues run side by side, omit the partition, or "with," in the lower part. In either case the draught is spoiled. The withs should be four inches thich, and at least once in every eight courses in ordinary chimneys they should be bonded by two bricks roughly mitred with the stretchers of the walls. (Fig. 114.) Without this precaution, which it is not easy to enforce, the with forms a mere tongue of superposed bricks, standing upright in the rectangular shaft of the chimney, and held in place only by the feeble adhesion of the mortar, so that it not unfrequently loses its balance and bends over, stopping up the adjoining flue. Ties of tin or hoop-iron laid in the

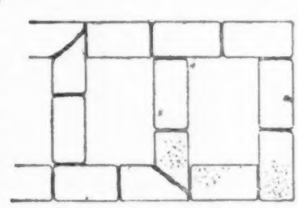


Fig. 114.

Bonding of Chimneys.

joints are sometimes used to sustain the withs, but the other bond is better, particularly in tall chimneys, where a thorough interlocking of the withs with the walls adds very greatly to the strength of the shaft.

Stacks of irregular plan, (Fig. 115), can be better bonded than those of the common form, and are much stronger. If carried up smooth and nearly straight, without twisting or constriction in any part, an 8" x 8" flue is ample for any stove or ordinary hot-air furnace, and is sufficient for an open fireplace of moderate size; but the danger of some obstruction is so great that it is prudent to provide the latter with 8" x 12" flues where practicable.

Flues.

Fireplaces are usually roughly formed during the construction of the chimney, to be subsequently lined with soapstone or brick, but if the latter material is to be used, it is better to finish the whole at once and cover it up with boards to prevent injury during the progress of the work. By this method there will be no danger of settlements and open joints between the rough work and the lining, through which sparks may reach the space behind the furrings. Wrought-iron chimney-bars must be used to support the brickwork above each fireplace opening. Two inches by half an inch is the usual size, and two bars should be used. The whole support should be given by the bars, without any assistance from arches, which are liable to spread and split the masonry. The depth and form of fireplaces depend on the use to which they are to be put. Small hard-coal grates are often set with only a four-inch recess in the masonry, the front of the grate projecting three or four inches beyond the face of the wall, and work very well so if the draught is good, but eight inches is better, and soft coal or wood need at least twelve inches depth. The "splay" or bevel to be given to the sides should conform to that of the grate, if one is to be subsequently inserted, and as they are made with various angles, the choice should be made before the chimney is begun. If this has not been done, a splay of seven and a half in

Fireplaces.

Chimney-Bars.

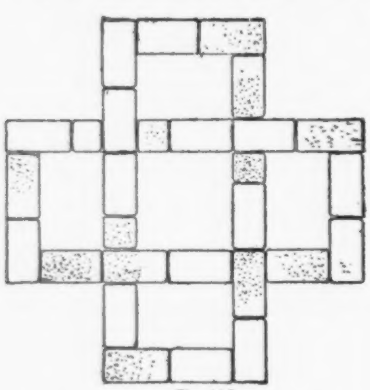


Fig. 115.

Fig. 117.

twelve does very well, and will fit many grates. (Fig. 116.) In vertical section, the back of the fireplace should be built up plumb about six courses, and then inclined forward, making the throat of

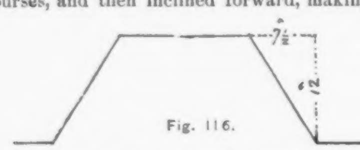


Fig. 116.

the chimney about two inches wide (Fig. 117), finishing with a *level* surface, of cut bricks, about six inches above the level of the chimney bars. By this narrowing of the throat the hot gases are concentrated, and the draught much improved, while the level surface at the foot of the flue checks and repels any downward current, instead of deflecting it forward into the room. In laying out the fire-

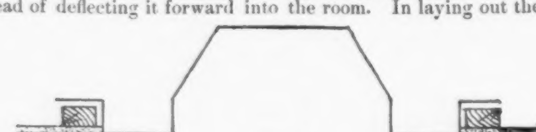


Fig. 118.

places, it should not be forgotten that they must project from the general surface of the chimney at least as far as the line of the plastering. If the chimney is formed with 2" x 4" studs, set flatways, and one inch clear of the masonry, and then lathed and plastered, the plaster surface will be four inches in front of the brickwork (Fig.

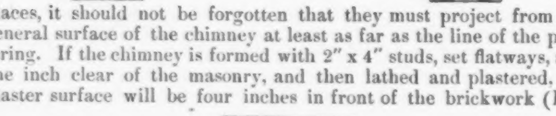


Fig. 119.

118), and if the facings of the fireplace are brought out to this point, a mantel which is flat on the back can be used. Most marble mantels, however, and some wooden ones, are constructed to allow of a further projection of four inches beyond the plaster line (Fig. 119), so that a choice should be made as early as possible. The superintendent must watch the construction of the flues assiduously, as the only means of making sure that they are smooth and uniform in size. Whether they shall be "pargeted," or plastered inside with mortar, depends upon circumstances as well as on local custom. There is some danger that the pargeting may scale off and fall into the flue, dragging with it the mortar from the joints of the brickwork, so as to open a passage for sparks, and for this reason the practice is forbidden in some places, but if the mortar contains, as is advisable, half as much cement as lime, and the brickwork is kept wet, pargeting may be safely used, and certainly assists in giving smoothness and continuity of surface to the flue.

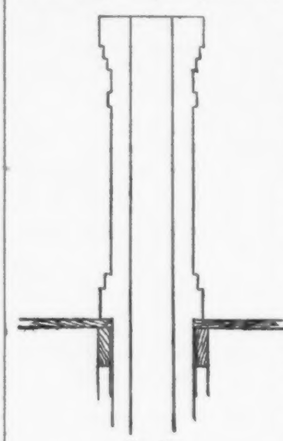


Fig. 120.

In regard to plastering the outside of the chimney, there is no difference of opinion, and where it is to be subsequently concealed by furring, the superintendent must insist upon its being thoroughly covered from the basement floor to the underside of the roof boarding.

The "topping out" of the chimney, above the roof, should be done with mortar containing equal parts of lime and cement. Unless thus made waterproof, every rain will saturate the mortar, dissolving and loosening it until the whole stack begins to lean toward the windward side, and then speedily decays. For the same reason the four upper courses should be laid in clear cement, unless a stone or iron cap is used. Nothing else will long withstand the disintegrating action of rain, added to that of the acid vapors from the burning fuel. No overhanging projection in the shape of a base should be allowed where the chimney leaves the roof. (Fig. 120). In the inevitable settlement of the whole stack the upper portion will be caught upon the rafters, and the remainder sinking away from it, a dangerous seam will be opened just above the boarding.

THE ILLUSTRATIONS.

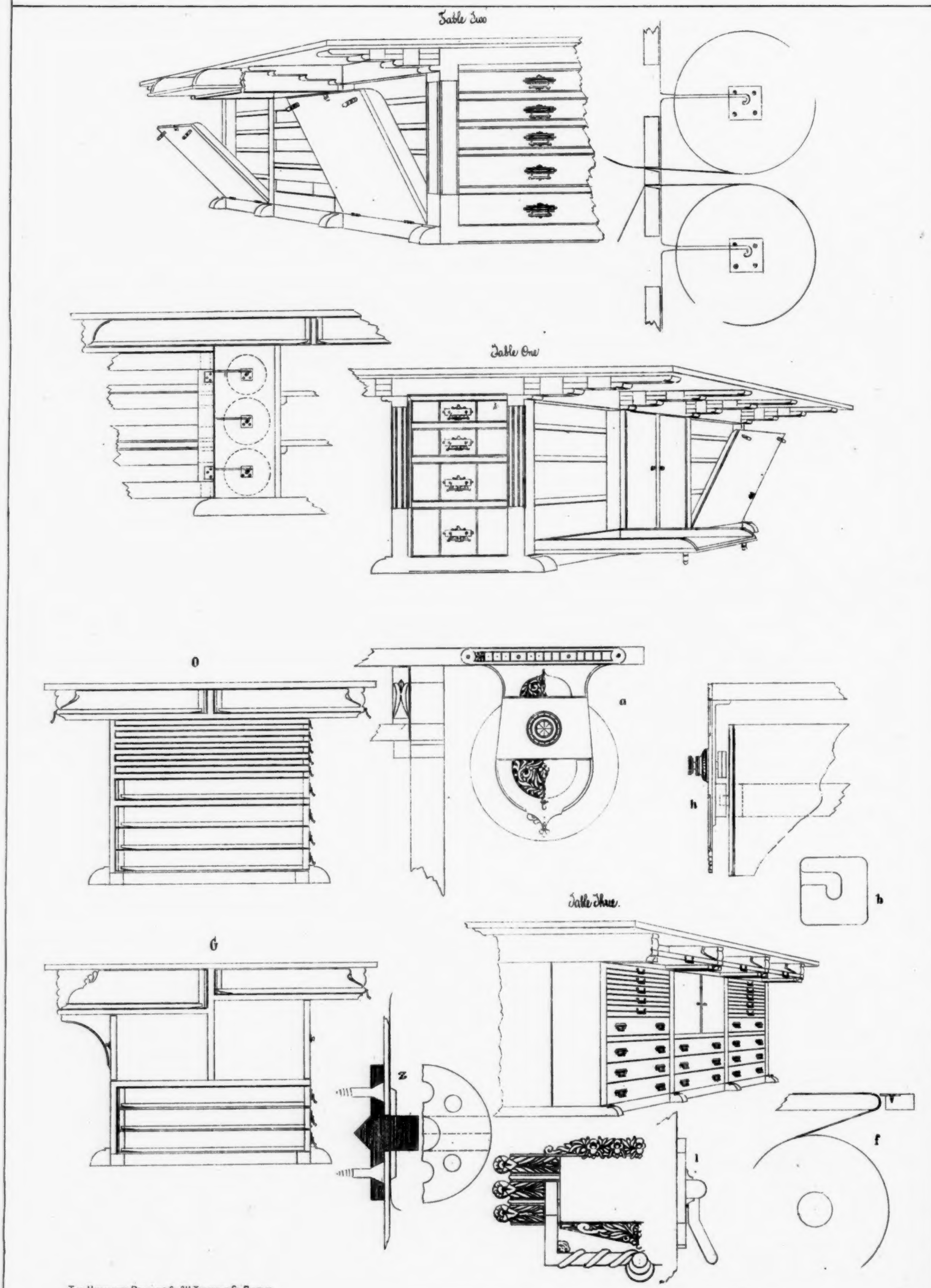
DRAWING-TABLES, DESIGNED BY MR. B. F. LEEDS, NEW YORK, N. Y.

THE drawings show three tables, Nos. 1 and 2 differing principally in the width of the parallelogramic lower portion containing the drawers, etc. This chest of drawers in Table 1, is two feet in width by ten in length, and in Table 2, three feet by ten; the top, or drawing-board, in both instances being seven feet by ten. Table 1 shows one side only, containing two hinged portfolio-holders, with a closet between them. The other side shown in Table 2 has instead of the central closet a recess for rolls of paper, with a railed gate enclosing the same. The intention of this gate will be seen in the detail drawing at the right, where a portion of it is shown in section. Several of the rails, it will be observed, are brought quite close together, leaving very narrow lines of aperture, through which the paper is drawn from the rolls so that it may be turned down at any needed length and creased for cutting. It would be necessary when the rolls were first put in place, to cut the several ends of paper in an acute angle, that they might be easily drawn through the openings between the rails. When once so started, there would be no subsequent difficulty, if due care were taken. The squares held by screws, seen in the centre of the rolls of paper, are castings containing a J-shaped depression. This depression continues along the face of the wood-work to the front of the recess, where it would be widened somewhat so as to admit the pivoted end of the pole around which the paper is rolled. Above the gate (see detail drawing to the left), a tray is held by horizontal brackets, which would move in and out on cleats, and would hold writing and drawing materials. Being two feet six inches in height above the floor, or six inches lower than the table-top, it would serve as a writing-desk. This feature could be repeated on both sides of the table, as in fact has been shown in the sectional drawing. The portfolios in the trays would be suspended by tape or leather loops over knobs. The length of the lower portion of Table 3 is ten feet, and its width three feet. The transverse supporting pieces at each end are two inches thick, and the spaces between them each three feet one inch. The perspective drawing shows three trays directly beneath the table's top, each of which has a clear height of three and a half inches. On the other side of the table the central tray, seen in sectional drawing G, has six inches clear height, and is intended solely for writing purposes. The other trays would hold paper, drawing-materials, etc., and all would draw out.

Below these trays are ten drawing-boards, each of which, as given, is three feet in depth and three feet one inch in width, though of course this uniformity of size is not necessary. Instead of the movable brass handles, as shown attached to these, each board could project two and a half or three inches beyond the front vertical face of the table, and a three-inch wide depression in the under edge of the board would serve as a sufficient handle. A properly-shaped handle for the drawers below is given in profile in detail-drawing *l*. This handle would be easily caught by the hand. For the sake of clearness, the fixture for holding the roll of paper, to be seen in

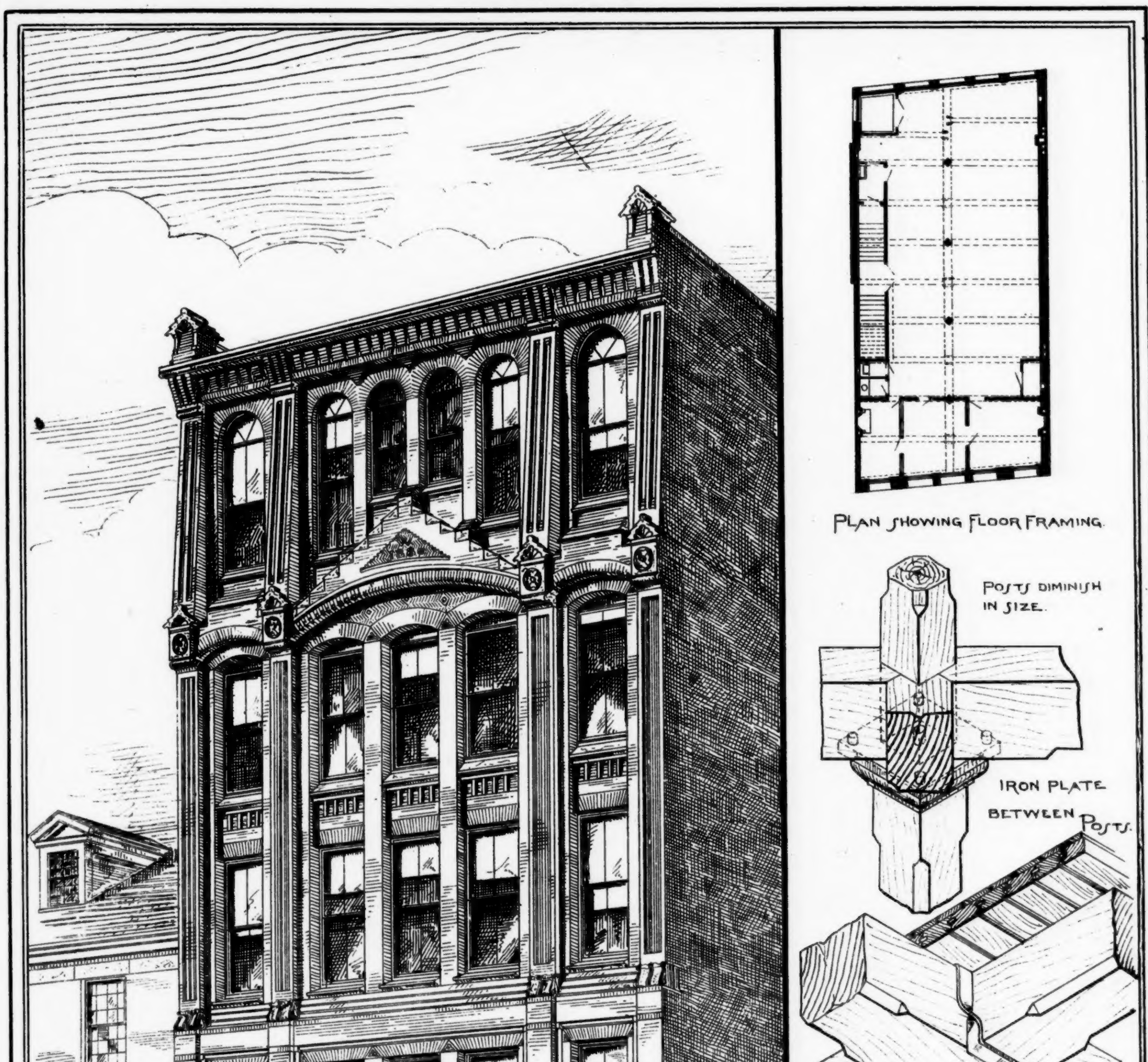
DRAWING TABLES.

B. F. LEEDS. 32 E. 14TH ST. NEW YORK.

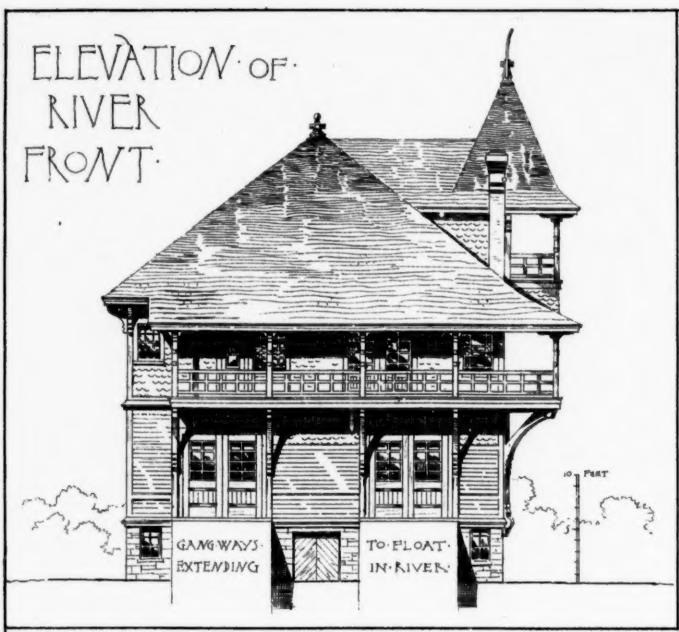


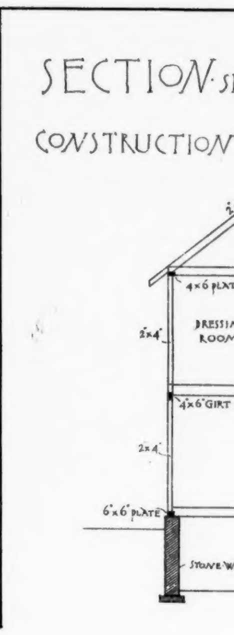
The Heliotype Printing Co. 211 Tremont St. Boston.

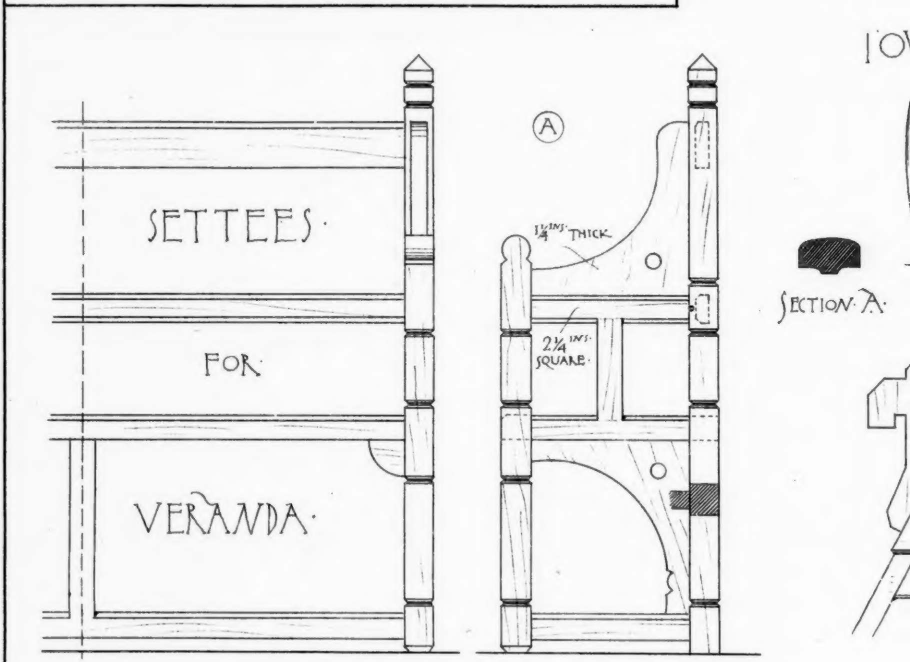
American Architect and Building News Oct. 1, 1881. No. 301



THE HELIOTYPE PRINTING Co. 211 TREMONT ST. BOSTON.



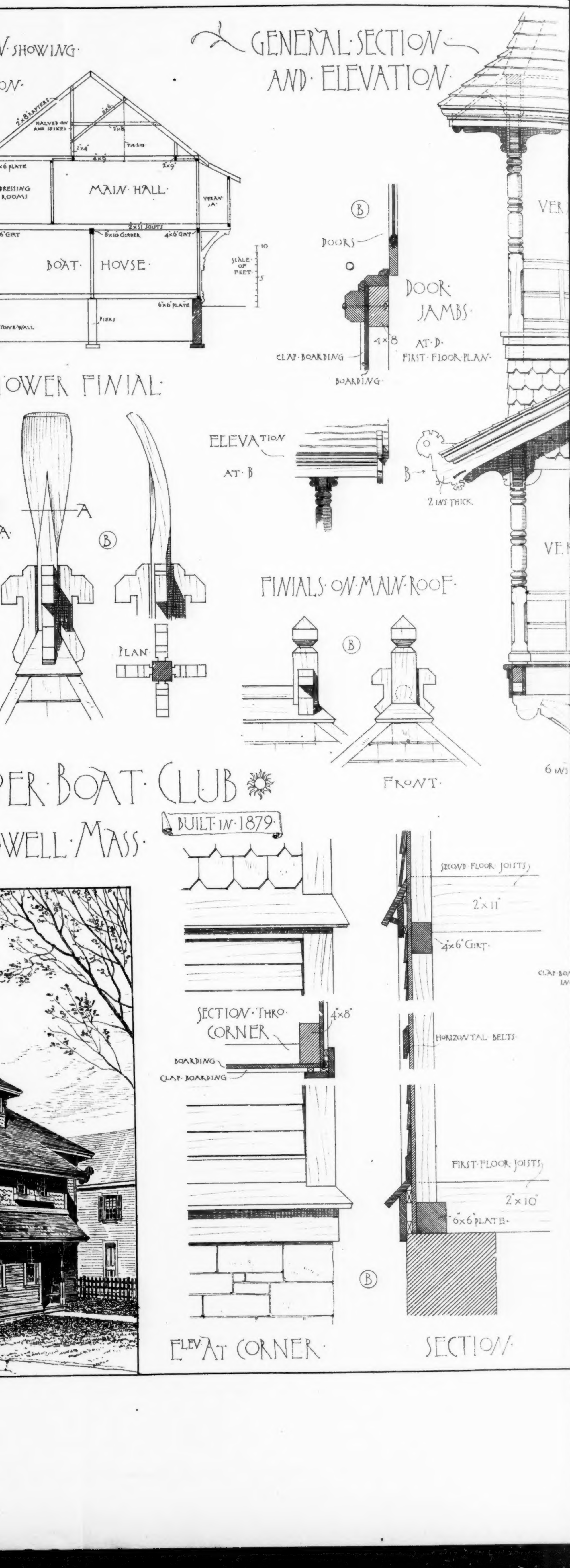




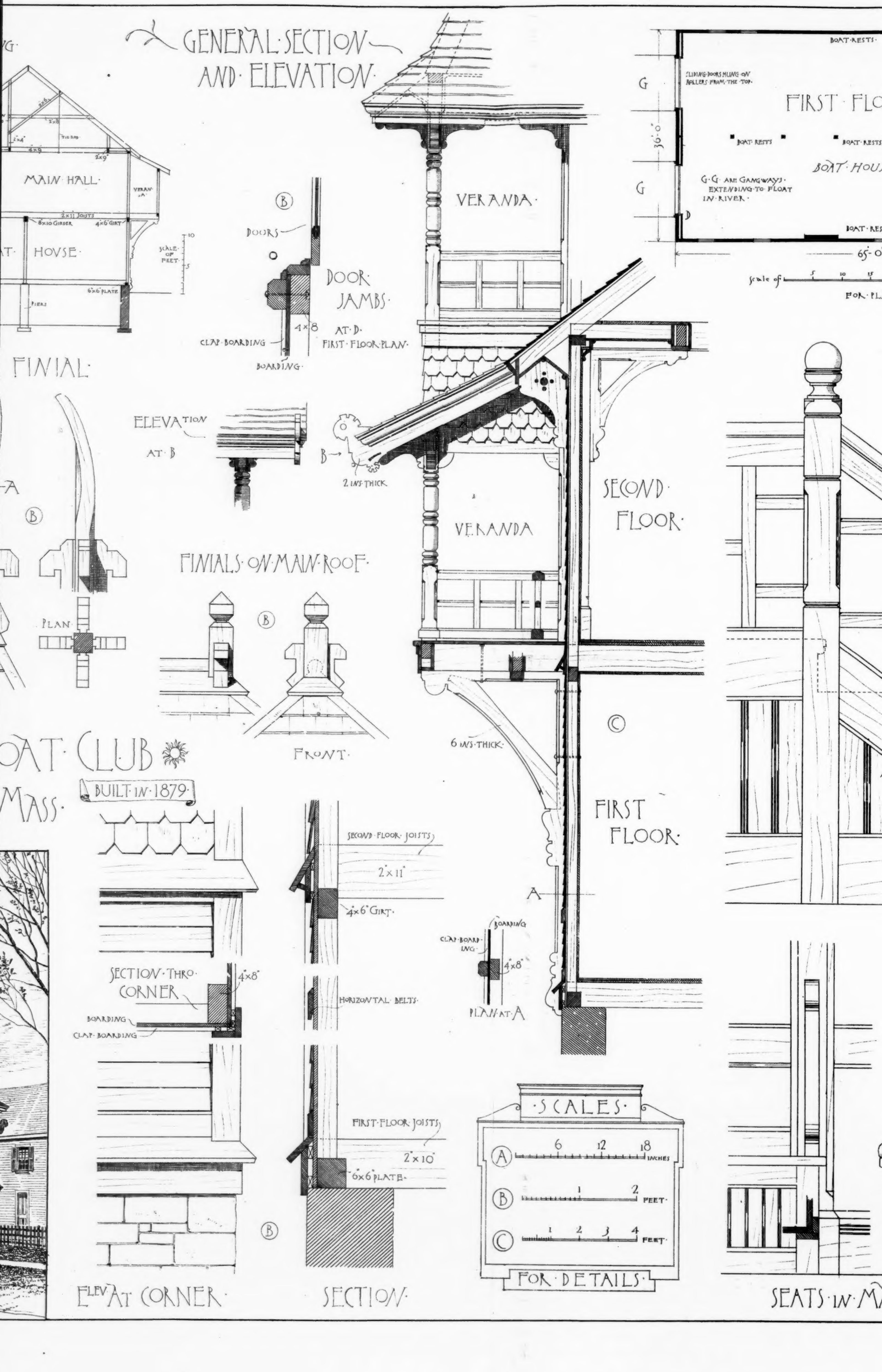
BOAT·HOUSE·FOR·THE·VESPE

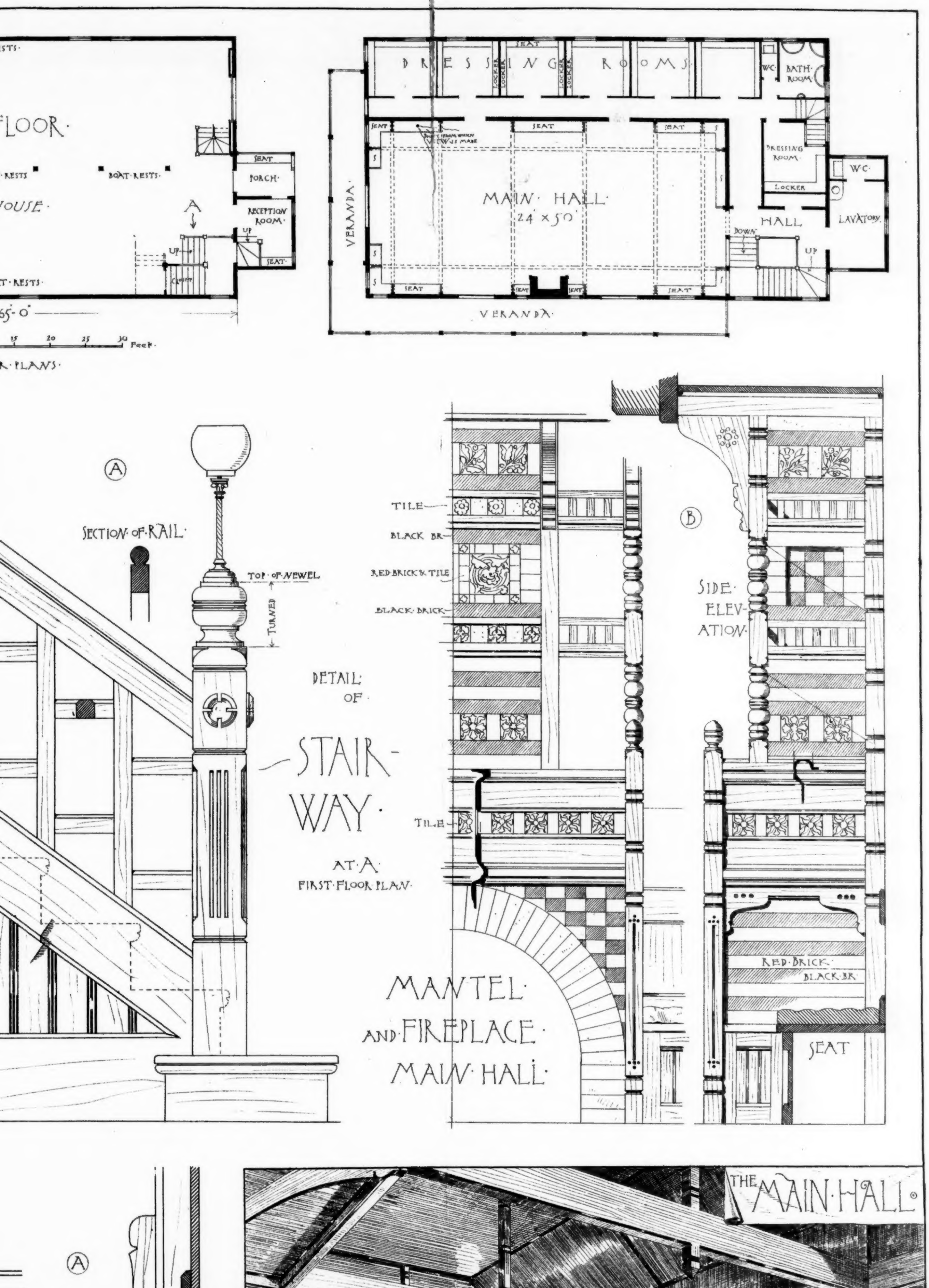
MR·F·W·STICKNEY·ARCHITECT·
31·32·33·RIALTO·BUILDING·BOSTON·
LOWE

PERSPECTIVE·VIEW


N·SHOWING·
ON·
GENERAL·SECTION·
AND·ELEVATION·
2"x8" RAFTERS
HALVED ON AND SPIKED
2x8
2x4
4x9
2x9
6 PLATE
DRESSING ROOMS
MAIN·HALL·
VERANDA
2x11 JOISTS
6"GIRT
8x10 GIRDER
4x6" GIRT
BOAT·
HOUSE·
SCALE OF FEET
10
5
6x6 PLATE
PIERS
STONE WALL
B
DOORS
DOOR·
JAMBS·
AT·D·
FIRST·FLOOR·PLAN·
4x8
CLAP·BOARDING
BOARDING·
TOWER·FINIAL·
A
A
B
ELEVATION
AT·B
B
2 INS THICK
PLAN·
FINIALS·ON·MAIN·ROOF·
B
FRONT·
6 INS
VER
VER
PER·BOAT·CLUB
BUILT·IN·1879
WELL·MASS·
SECOND·FLOOR·JOISTS
2"x11"
4x6" GIRT·
CLAP·BOA
SECTION·THRO·
CORNER
4"x8"
BOARDING
CLAP·BOARDING
HORIZONTAL·BELTS·
FIRST·FLOOR·JOISTS
2"x10"
6x6" PLATE·
B
ELEV AT·CORNER·
SECTION·

American Architect and Building News Oct. 1, 1881.





The Heliotype Printing Co. 211 Tremont St. Boston

details a and h, is not shown attached to the board in perspective. This device will probably need but little explanation beyond the drawings given. The end piece a would be a casting of zinc or iron. On the outer face of this there would be a bell-shaped projecting piece, the screw passing through which would have attached to its inner end a rubber or leather faced disk. After the required length of paper had been drawn off the roll in the manner illustrated at f, the rubber-faced disk would be brought to bear tightly against the larger wooden or metal disk attached to the paper roll, and this one end of the paper would consequently be held immovable. The ordinary paper tacks would fasten the other. The casting b, which is two inches square, is shown in profile at h, and is a close part of the larger casting. At z is given a sectional and front view of the casting to be attached to each end of the pole holding the paper, and attached to the former by screws, the heads of which are seen, in the larger disk, which may be of cast or sheet metal or three-ply wood. The width of the top of Table 3 is five feet, and its length twelve feet, and it would have a roll of paper at each of its ends. These rolls could be of two sizes, say one of them three feet in length, and the other of any length between that and four feet nine inches. This table would hold everything an architect would need, excepting his books, and they might be accommodated, if desirable, by using the closets shown intermediately between the two tiers of drawing-boards.

STORE ON LINCOLN ST., BOSTON, MASS. MR. G. H. YOUNG, ARCHITECT, BOSTON, MASS.

BOAT-HOUSE OF THE VESPER BOAT CLUB, LOWELL, MASS. MR. F. W. STICKNEY, ARCHITECT, BOSTON, MASS.

THE FAIR OF THE MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION. — II.

It has been suggested that the proper function of exhibitions, particularly of periodically recurrent exhibitions is to collect together where all may see them only absolute novelties — materials and processes that have been discovered or perfected within the time elapsed since the closing of the last period. Without giving our adherence to this proposition, let us see what in the way of novelties we can find at the Mechanics' Fair, and first let us look for new materials.

There has been much said in the daily papers and technical journals about paper as a building material, and our curiosity has been stimulated by accounts of paper factory chimneys at Breslau, and a house of paper at the Berlin Paper Exhibition, complete in all its details and furnishing, paper floors, roof and sides, paper doors and sashes, paper furniture and dishes, and even a paper stove and cooking utensils. Remembering this and the statement that this manner of employing paper was the result of American ingenuity, we looked first for a paper house, but there was none. Neither did we see any paper bricks, which we understand are made in some part of this country. It is regrettable, if these things are manufactured in merchantable quantities, that specimens of them should not have been sent to this fair. The success of the observatory domes that have been made of paper shows that the material can, under conditions at present somewhat circumscribed, become a valuable auxiliary. That it might be used with success for much interior work, as for upper floorings and wall linings, is hardly questionable, while the satisfaction given by the observatory domes[1] we mentioned shows that for certain kinds of outside work it answers every purpose. Of its toughness and power to withstand hard usage we once had ocular proof when we saw a six-oared racing-shell, by a miscalculation of the bow-oar, driven full speed into the boat-house float, the result being that the brass-tipped prow tore up a thick sliver of pine some four feet long, while the boat itself ran up onto the float for about one quarter of its length, and remained there without buckling or cracking the paper.

Not finding anything in the way of building paper, as distinguished from sheathing paper, it occurred to us to look for some new methods of using glass as a building material, which we have seen mentioned in certain newspapers. We also remembered to have seen lately in the *Official Gazette* of the Patent Office the record of the issuing of patents for glass building-blocks to different persons, and we hoped to see some specimens here, and to learn from the patentees in what parts of a building he intended to use them, and how be expected them to behave when exposed to fire, but none of these are here. Neither is there any specimen of a glass water-closet bowl, which we understand is thought to possess much merit, nor is there shown a sample of illuminated tile pavements set with prismatic glass studs of such a shape as to deflect in parallel and nearly horizontal lines the rays of light which enter through them to the basement.

But there are some new applications of glass to building purposes shown here, and perhaps the most noticeable is represented by the exhibit of the Glass Veneer Company, of Boston, who show a door, the different sides of which very inadequately imitate black walnut on one side and, we suppose, mahogany on the other. If we imagined that the process could not produce better artistic results than this we should feel that the inventor had spent his labor in vain. But the unsatisfactory result in the present case is evidently largely due to the employment of an incapable grainer. The weak spot in the invention lies in the difficulty of making a satisfactory joint between the different pieces of glass, the rails and styles of the door in this case, the application of the coloring substances to the interior surface of the glass making unpleasantly apparent the splintering of the edges of the glass caused by the rough and ready method of cutting glass with the glazier's diamond, which at present is almost the only method in use.

Another application of glass to building purposes has been invented, curiously enough, by a Maine man who, seemingly not content with Nature's efforts in that rock-bound State, has devoted his energies to the production of imitation polished granites, and it must be said, has succeeded surprisingly well, as any one must acknowledge who compares his glass imitation of a polished granite table-top with the table-top of polished natural granite exhibited by a granite company near by. The imitation is effected by cementing to the underside of the glass grains of sand and bits of sea-shell of the proper size and color, the whole being then backed up with strong opaque cement, and making a slab or panel apparently as capable of resisting hard usage as a similar thin section of stone. The inventor's object was to provide a material to be used as are polished stones, while it should be free from one of the ills to which polished stone is heir, in that its polish does not wear off or suffer discoloration.

We had hoped, too, to find some samples of the lumber made of compressed straw which has been invented by a Texas genius, and thought it might not be improbable that we should find processes exhibited showing how that great waste-product, saw-dust, is being reclaimed, but there were none of these.

An exhibit which certainly cannot be classed but as a novelty is the spring stair-tread shown in the main hall. As one mounts the fragment of a staircase which proclaims this invention to the world, one feels like the frog in the famous algebraic problem who, at every jump that he makes as he tries to escape from the well into which he has fallen, slips back over the slimy stones for a certain portion of the distance covered by his leap. We cannot divine the object of this invention. So far as discoverable it neither is an aid in ascending nor in descending. Possibly the inventor is in league with the doctors, and is to receive a bonus on every fee paid for setting the bones which apparently will inevitably be broken by the catching of a boot-heel as the tread, released from the weight of the descending person, suddenly flies up into place.

Those who never look through the issues of the *Official Gazette* of the United States Patent Office can have no idea of the time, labor, and ingenuity that are expended by inventors in trying to get the better of those household nuisances, doors, windows, and blinds. The steps that have already been made good encourage us to believe that sooner or later the slamming, rattling, and banging will be as effectively overcome, and in as satisfactory and unexpected a way, as the Prescott Manufacturing Company have overcome the cognate inconveniences of sliding-doors. Of the various devices of this class, perhaps the most interesting is the Norton Door Check and Spring, which by the interposition of an air-cushion formed between a piston-head and a cylinder end puts a quietus on the "bang" nuisance, while the spring operates so quietly that the presence of the "slam" fiend is hardly suspected. There is something laughable in the way that this spring deceives your expectation. As one sees the rush of a heavy store-door, as it closes, checked and at length overcome by the effort of the air-cushion, one imagines that resistance has won the battle, but when one observes the grim determination of the spring, as it takes up and completes the interrupted motion, closing the door with a quiet click of the latch, one cannot but smile. The principle of the invention is a good one, and even in its present form it is not, perhaps, more objectionable than other door-springs. We recommend, however, the inventor to turn his attention to devising some means by which the spring can be entirely hidden from sight, or the cylinder be so arranged as to be parallel with the door. If he can discover a way of applying atmospheric pressure so as to delay all action of the spring until the passer has had reasonable time to pass through the doorway, he will much increase the value of his invention. It is disgusting to have one's shoulders and legs buffeted, or his fragile parcels crushed by the sudden closing of a door, after one has had all the trouble of overcoming the resistance of a stout spring.

An invention which will help to bring another of our household pests under subjection is Huntoon's Window-Blind Operator and Lock, for it affords a means of opening and shutting window-blinds without raising the window-sash. All it is necessary to do is to pull towards you if you would close, or push from you if you would open a blind, a door-knob, apparently, which hangs just below the window-stool. To the shank of each knob on the outside of the building is attached a species of yoke set horizontally, whose two arms are perforated with slots of contrary curvature, in which travels a stud let into the bottom of the blind. It is hardly to be supposed that this invention has reached its greatest development as yet. The dangling knob, with half its shank exposed when not in use, may be an ingenious self-locking arrangement, but it is not an ornamental feature. We suspect, too, that in attempting to open or close a blind against a strong wind there would prove to be a dead-point in the curves beyond which the blind could not be pushed. However, as an answer to a problem which it is very desirable to

[1] A visit made to the Fair since writing the above, shows that two sections of the paper dome for the United States Observatory at West Point have been set in position by Messrs. E. Waters & Son, of Troy, N. Y. It would have been more satisfactory if they had added to their exhibit specimens of incomplete work showing the processes by which the result had been achieved.

solve, it is so ingenious as to lead us to hope for a better one before long.

Another novelty, on this side of the Atlantic, at least, is Balmain's Luminous Paint, exhibited by A. W. Strauss under very disadvantageous circumstances; but after making all due allowances for these, we cannot help feeling that the *degree* of usefulness of this invention has been somewhat overestimated, although there is hardly room for doubt that its range will prove very extensive. Frequent reference to it in these columns makes further mention of it unnecessary.

Fewer tools are exhibited than might be expected, and of the few shown Goddard's raw-hide mallet strikes us as more of a novelty than anything else. Some manufacturers show a fine line of tools, and that of Messrs. Nichols, Bellamy & Co. must make many a mechanic regret that his week's wages are not larger. What the advance in tool-making has been is hinted at by the old bit-stock in the middle of the show-case. Wooden, clumsy, with the shortest possible leverage and slow-working thumb-screw it but distantly suggests the handsome steel implement above it, with its ratchet attachment, powerful leverage, and its capacity for boring at any angle. It is a pity this firm did not develop their idea a little farther, and prepare a progressive exhibit showing through what stages they or other makers have carried their manufactures, in say, the last hundred years.

We unconsciously did injustice to Messrs. Irving, Casson & Co., in not mentioning that they were associated with the Murdock Parlor Grate Company in making the exhibit we referred to as due to the latter firm alone. The wooden mantel-pieces shown by them are remarkably good examples of design and perfect workmanship. We may also mention that the Magee Furnace Company exhibit some very excellent castings for fire-backs and jambs, which we did not notice before, and which indicate as a very legitimate vein for them to work.

GENERAL RULES FOR THE USE OF CEMENTS.[1]

Some years ago the writer called attention[2] to the fact that quite as much depends upon the manner in which a cement is used as upon the cement itself. The best cement that ever was compounded would prove entirely worthless if improperly applied. Hence we constantly see failures occurring in the use of cements, notwithstanding the fact that we have cements which answer every reasonable demand when they are properly prepared and properly used. Good common glue will unite two pieces of wood so firmly that the fibres will part from each other rather than from the cementing material; two pieces of glass can be so joined that they will part anywhere rather than on the line of union; glass can be united to metal, metal to metal, stone to stone, and all so strongly that the joint will certainly not be the weakest part of the resulting mass. But in order to be successful in the use of any cement, we must understand its character and properties, and conform to them our methods of application.

Every cement may be assigned to one of four classes, according as it (1) dries by evaporation; (2) congeals by cooling; (3) hardens by oxidation, or (4), "sets" by chemical changes. To the first class belong pastes, mucilages, alcoholic and other solutions of gums and resins, and, to a certain extent, glue. To the second belong such cements as ceiling-wax, turner's cement, shellac, etc. The third class includes gold-size, drying-oil, white and red led, etc.; and the fourth class covers plaster-of-Paris, the so-called iron cement, and others of that kind.

If the best results would be attained, the following rules must be rigorously adhered to: —

1. The cement must be brought into intimate contact with the surface to be united. Thus, when glue is employed, the surface should be made so warm that the melted glue will not be chilled before it has time to effect a thorough adhesion; a drop of melted glue allowed to simply fall on a surface of dry, cold wood, and solidify there, will often fail to adhere at all, while if the same drop had been rubbed in, it would have attached itself to it with wonderful power of adhesion. The same is more eminently true in regard to cements that are used in a fused state, such as mixtures of resin, shellac and similar materials. These matters will not adhere to any substance unless the latter has been heated to nearly or quite the fusing point of the cement used. This fact was quite familiar to those who used sealing-wax in the old days of seals and twenty-cent postage. When the seal was used rapidly, so as to become heated, the sealing-wax stuck to it with a firmness that was annoying, so much so that the impression was in general destroyed, from the simple fact that the sealing-wax would rather part in its own substance than at the point of adhesion to the stamp. Sealing-wax, or ordinary electrical cement, is a very good agent for uniting metal to glass or stone, provided the masses to be united are made so hot as to fuse the cement, but if the cement be applied to them while they are cold, it will not stick at all. This fact is well known to the itinerant venders of cement for uniting earthenware. By heating two pieces of delft so that they will fuse shellac, they are able to smear them with a little of this gum, and join them so that they will break at any other part rather than along the line of union. But although people constantly see the operation performed, and buy liberally of the cement, it will be found that in nine cases out of ten the cement proves worthless in the hands of the purchasers, simply because they do not know how to use it. They are afraid to heat a delicate glass or porcelain vessel to a sufficient degree, and they are apt to use too much of the material, and the result is a failure.

The great obstacles to the absolute contact of any two surfaces are air and dirt. The former is universally present; the latter is due to accident or carelessness. All surfaces are covered with a thin adhering layer of air, which is difficult to remove, and which, although it may at first sight seem improbable, bears to the outer surface of most bodies a relation different from that maintained by the air a few lines away, and until this layer or film of air has been removed it prevents the absolute contact of any other substance. The reality of the existence of this adhering layer of air is well known to all who are familiar with electrotype manipulation, and it is also seen in the case of highly polished metals, which may be immersed in water without becoming wet. Thus the surface of a needle retains this film of air so strongly that it will float on the surface of water rather than give it up.

Unless this adhering layer of air is displaced, it will be impossible for any cement to adhere to the surface to which it is applied, simply because it cannot come into contact with it.

The most efficient agents in displacing this air are heat and pressure. Metals warmed to a point a little above 200° Fahrenheit, become instantly and completely wet when immersed in water. Hence for cements that are used in a fused condition, heat is the most efficient means of bringing them in contact with the surfaces to which they are to be applied.

When it is intended to unite two pieces of earthenware or glass together, or a piece of glass or other substance to metal, by means of a cement that is to be used in a fused state, the surfaces that are to be united, should always be made so hot that the cement will become perfectly liquid when brought in contact with them.

In the case of glue, the adhesion is best attained by pressure and friction, combined with moderate warmth. In large establishments, where good glue joints are an important item, a special room, carefully warmed, is set aside for this operation.

2. A very important point is that as little cement as possible should be used. When the united surfaces are separated by a large mass of cement, we have to depend upon the strength of the cement itself, and not upon its adhesion to the surfaces which it is used to join; and, in general, cements are comparatively brittle. At first sight one would suppose that the more cement there is used, the stronger will be the joint, and this is an error into which most inexperienced persons fall. Two pieces of earthenware, joined together by a layer of shellac as thin as possible, will adhere together and will be as strong at the junction as at any other part, while the same pieces united by means of a layer of the same cement an eighth of an inch thick, would fall apart on receiving the slightest jar. The rule which directs us to use as little cement as possible, admits of no exceptions, and as a general thing the only way to obtain thin layers of cements that are to be used in a fused state, is to heat thoroughly the pieces that are to be united, press them forcibly together, and keep them under pressure by means of weights, screws, or cords until the cement has hardened.

3. The third point to which we shall call attention is the necessity for cleanliness, both in the preparation of the cements and in the application of them. It may be safely laid down as a positive rule that every extraneous substance that is mixed with the material of a cement is an injury to it. Glue prepared in a greasy pot cannot be expected to make a strong joint, and the presence of dust and dirt tends to weaken *all* cements. So, too, in the application of cements: if we attempt to glue together two surfaces of wood that are covered with dirt, the substances that are to be united are not wood to wood, but dirt to dirt, and the joint, instead of possessing the strength of wood, united by means of good glue, will have simply the strength of dirt. Moreover, we must remember that the different cements do not adhere with equal force to substances of different kinds. Thus, glue adheres powerfully to wood and paper, but not at all to metal or glass. Shellac, if properly applied, adheres readily to earthenware, glass and metal, but not to some other substances. If then, we apply glue to a greasy surface it will not stick. Hence the necessity for great cleanliness. All surfaces should be kept as clean as possible, or if they should get accidentally soiled, they should be carefully cleaned. The mere rubbing of two wooden surfaces with a dirty hand will weaken the subsequent glue joint by at least ten per cent.

The most common case in which this rule is violated by the inexperienced is in mending articles which have been formerly glued and have been again broken at the old place. Such articles when first mended, frequently last for a long time, but when a second attempt is made to glue the pieces together, the joint seems almost to fall to pieces of itself. Here we are attempting to glue together, not two pieces of wood, but two pieces of old glue, and the result is failure. Soak off all the old glue (do not cut or scrape it, or the pieces will no longer fit accurately together) wash the surfaces with a sponge dipped in boiling water, and when they are dry and warm, glue them together in the usual manner, and you will be surprised at the strength of the joint.

4. See that the opposing surfaces make a close, neat joint, before you attempt to cement them. Two pieces of wood that are to be glued together should be planed up so true that they are in contact

[1] Remarks introductory to a treatise on the *Preparation and Use of Cements and Glues*, by John Phinn. New York: The Industrial Publication Co., 1881. Work Manual No. 1. Price, 25 cents.

[2] Technologist, Vol. I. (1870), page 188.

at every point, and where an article has been broken, the surfaces to be joined should be preserved from being broken or battered. This is particularly the case when articles of glass or earthenware are accidentally broken, and it is not convenient to mend them on the instant. They should be carefully wrapped up in separate pieces of paper, and laid away where they will not be soiled, and where the edges will not be chipped. In such cases the joint will be greatly disfigured, and considerably weakened if the edges are chipped and broken by careless handling, or by being needlessly and frequently fitted together. Keep the pieces from contact with each other and with foreign substances until you are ready to join them, and the joint will then be not only strong but almost invisible.

5. Plenty of time should be allowed for the cement to dry or harden, and this is particularly the case with *oil* cements, such as copal varnish, boiled oil, white lead, etc. These cements are said to *dry*, but they do not dry by evaporation. Instead of losing anything they actually gain in weight by absorbing oxygen from the air, and this process of oxidation is a very slow one except as regards the very thin layer that is in immediate contact with the air. Thus when two surfaces, each half an inch across, are joined by means of a layer of white lead placed between them, six months may elapse before the cement in the middle of the joint has become hard. In such cases a few days or weeks are of no account; at the end of a month the joint will be weak and easily separated, while at the end of two or three years it may be so firm that the material will part anywhere else than at the joint. Hence, where the article is to be used immediately, the only safe cements are those which are liquified by heat and which become hard when cold. A joint made with marine glue is firm an hour after it has been made. Next, in rapidity of hardening, to cements that are liquified by heat, are those which consist of substances dissolved in water or alcohol. A glue joint sets firmly in twenty-four hours; a joint made with shellac varnish becomes dry in two or three days. Oiled cements, (boiled oil, white lead, red lead, etc.), take months.

6. Where neatness as well as strength, is an object, it will often be advisable to use a cement of a color as nearly like that of the materials to be united as possible. Thus a white porcelain cup, mended with black cement, would show some very ugly lines. If, however, a white cement be used, the lines of fracture will be invisible. The same rule applies to other articles, and it is always easy to color a cement to any desired tint.

THE KREMLIN, MOSCOW.

THE following description of the Kremlin appears in one of the letters from the special correspondent of the *Times* in Russia: —

If nothing else could be said in behalf of Moscow, the mere fact that it is a city unlike any other city would be sufficient to awaken the interest of foreign visitors. It boasts, besides a magnificent situation, a thoroughly Russian character, and as much picturesque beauty as may arise from endless variety, from a quaint, eccentric, and grotesque originality, from a profusion of gold and jewelry, and every kind of costly barbaric ornament, and from a blending of all hues and shades, of all the subdued or salient, vivid or pale, chaste or glaring colors in a mad painter's palette. And as Moscow, in the ten or twelve miles' circuit of its walls, may be said to comprehend whatever is Russian, so does the Kremlin, in its few hundred square yards' space, sum up all that is best worth seeing in Moscow. The Kremlin is in no respect like the Athenian Acropolis or the Roman Capitol, with which the guide-books compare it. It has not the commanding position of Bergamo or Biella, Perugia or Orvieto, Spoleto or Narni, or of many other hill-towns of old Italy; it does not even rise to the lofty dignity of the "Dom" of Revel, on which I lately stood in Esthonia. In fact, the Kremlin is not much of a hill; for, on one side, you may walk into it from the Nikolskaja Street, and other long thoroughfares of the town, with hardly any perceptible ascent, and, on the other, you stand on a platform somewhat less than a hundred feet above the bed of the river. On this latter side, however, all the charm of the sight at once breaks upon the beholder, whether he looks round on the strange buildings with which the open parade-ground of the ancient citadel is crowned, or whether his eye scans the vast panorama of the valley of the Moskva — the humble stream from which the city takes its name, and which winds round and again round the spot, as if wooing it, and loth to quit it. Beyond the river and the valley rises, far off, the range of the Sparrow Hills, with other gently-swelling grounds, enclosing a wide expanse of town and country, of land and water, of multitudinous objects, a chaos in which a bewildered stranger is for a few minutes at a loss to single out anything.

Not a little of the architecture of the Kremlin is old, and some of it may be considered respectable; for some of the men who were first at work here came from the southern side of the Alps, and belonged to what are called the Golden Ages of Italian art; men who were indifferent whether they were in the pay of czars or sultans, and who, in the service of these latter, improved upon the model of St. Sofia of Constantinople, and reared up those masterpieces of Moslem temples, the mosques of Mahomet II. and Solyman the Magnificent, which prove that even a Turk can have eyes and understanding. It is to builders of this description that the Kremlin is indebted for its line of battlemented walls, and for the square towers of the five massive gates which give it the character of a mediæval fortress; and it is to them, or to builders still earlier, that we owe our thanks for the simple and severe semi-Gothic style of the interior of the Cathedral of the Assumption, the church which has witnessed the coronation of many generations of Russian sovereigns. But the achievements of these primitive master-masons exhibit only here and there the vestiges of their original designs. They had to withstand the outrages of war and siege, of wind and storm, of flood and fire, and all the disastrous vicissitudes Moscow was doomed to go through; and much of what had escaped the ravages of time and man was in after-years disfigured by the superstructure with which the rude genius and taste of indigenous artists loaded and almost smothered it. Add to this that even the first men who raised these edifices from their foundations were aware of the peculiar instincts of their royal or imperial patrons, and tasked their inventive power to the utmost to hit the fancies of the sovereigns themselves and of their subjects, just as Manchester calico-printers choose the gaudiest colors and the broadest patterns to suit the distant marts of the Levant or of the negroes of the Antilles. For some of these Muscovite Augustuses were ugly customers to deal with, and one can scarcely imagine what might have been the fate of any one who had attempted to thwart and trifle with them, or failed in his task to please them; seeing that the mightiest of them, Ivan the Terrible, did not, if the tale be true (for it has been told of other tyrants), spare even the poor wight whose success had exceeded even his employer's highest expectation, and whose wonder of wonders, the Church of St. Basil the Blessed or the Blessing, was the delight of the grim Czar, yet whose eyes the Czar himself put out to deprive him of the power of building a duplicate church in the service of some rival potentate. It is possible also that even these Western builders caught the infection of this vitiated Eastern atmosphere, and indulged in oddities and extravagances which their sober and correct judgment would have condemned, but by which they transcended even the barbarism of the people they were bent upon humoring. The result is that German critics, putting together Russian artists, ancient or modern, domestic or foreign, dismiss them in two words, by characterizing Russian architecture as "Byzantinischer Pomp mit Asiatischer Verwilderung"— for it is, indeed, Byzantinism run mad.

Of the four or five churches, three of them cathedrals, clustering together in close proximity between the Nicholas Palace and the lofty tower of Ivan the Great, on the Kremlin, not one can be said to have the least pretension to beauty. Still, their gilt or silvered balloon-like domes — usually five to each church, but in some instances as many as nine, eleven, or more, all of them gilt, and one of them with the whole roof gilt, forming chance groups with a hundred towers, belfries, and spires — must be allowed to have a striking effect. And the effect grows upon the beholder at every step, the picture changing as he walks round the edge of the platform, or better, as he goes over the bridge, and gazes at the prospect from various points in the lower grounds on the other side of the river.

The palace, or palaces, for there are two, the convents, the Arsenal, the Treasury, and other plain, square, barrack-like buildings, are out of character with the sacred edifices, and with the mediæval walls and towers that encompass the hill. All those glittering crosses over every church dome or pinnacle, those huge, black spread-eagles on the top of every imperial building, rise before us in a confused, incongruous mass, suggesting the thought that what we are looking at is not the sober, earnest work of men, but rather a mere fantastic child's toy. And the cracked King of Bells (Czar Kolokol) at the foot of Ivan's Tower, and the monster cannon (Czar Puschka), guarding the trophies of the campaign of 1812, strengthen our conceit that this hallowed spot of the Kremlin is, after all, a colossal joke, more creditable to the humor than to the sense or taste of the people who reared its marvellous structures.

Still, the monster of monsters lies outside the Kremlin gates, and precisely close to the Redeemer's Gate, a hallowed spot, which no man dares to pass with his hat on. I allude to that Church of St. Basil the Blessed, of which Ivan the Terrible, as we have seen, was so proud and so jealous. Its architect seemed determined that no part of his building should be in keeping with any other part, and he tortured his brain to bring forth something which, however hideous, should, at all events, have the merit of novelty and originality; and in this his success is unquestionable. The church is a mass of little chapels, surmounted by cupolas, spires, and pinnacles, so strangely jumbled together that one finds it impossible to ascertain either their number or their relative height or size. Those queer nondescript domes emerge out of the muddle, some of them in the shape of Moors' turbans, others pear-like, artichoke-like, like prickly-pears, pine-apples, or melons, or what you will, a hundred fantastic forms, enough to give a man the nightmare, and the whole twisted and wreathed and ribbed and fluted, and inlaid with odd-shaped glazed tiles and bits of glass of all imaginable colors, all glistening like a serpent's scales, and producing the effect of the bright grains of sand in a kaleidoscope. Really a work of art that beggars description.

I have seldom stepped into a Russian church; only into the Isaac and the Kasan Cathedrals in St. Petersburg, and here into the Assumption, and into the great votive temple erected on an eminence facing the Kremlin in commemoration of the signal victories of 1812 — a stupendous edifice, all gold and marble, now just finished after forty-two years of labor, and the outer gilding of the five cupolas of which alone cost one million of silver roubles. All is gold and glitter and malachite and lapis-lazuli and dusky saints' images inside these churches; but I looked in vain for the interior of St. Basil the

Blessed. That church is only thrown open for public worship one day in the year; but I would defy any man to show where a congregation can perform its sacred rites within those walls, if more than two or three, or at the utmost, twenty or thirty, assemble and meet together; for the whole body of the church is divided into little chapels, cut out by screens and partition-walls, forming a labyrinth of nooks and corners, of dark lurking-places, in most of which there is barely room for the priest, and, perhaps, for some fair penitent whom he might wish to instruct and catechise.

Truly portentous are the religious instincts of the Russian people, and Moscow well deserves its designation of the Holy City of Holy Russia; for its citizens do not consider their three hundred and sixty-five churches, with scores of convents and nunneries, sufficient for their spiritual wants; but have also little chapels, open like shops, at the street corners, chapel facing chapel across almost every street, more numerous, alas! than beer-houses and gin-palaces in London; and they have, besides, their miraculous *icons*, or *painted* images (for the Orthodox Church does not allow *graven* images), limned images, all dark, almost black in the face, the faces peeping out of a mass of gold and silver representing their drapery in relief (for the Orthodox Church does not forbid graven *clothes*), and these images are stuck up on every wall in the bazaars, the Exchange, and every public office or private dwelling.

EXPANSION OF CEMENT AND CONCRETE.

Opinions of authorities differ much as to the behavior of cement in setting. An examination of extensive concrete walls, such as those of the New Victoria Docks, discloses a number of vertical cracks, which seem to indicate that a contraction of the mass has taken place. From the experiments made by Messrs. Dyckerhoff, it would appear that expansion and not contraction had taken place. In Mr. Henry Faija's little book, "Portland Cement for Users," which we lately noticed, two tables giving the results of experiments by Messrs. Dyckerhoff on a prism of cement of ten centimetres in length and five centimetres square, lying in water, are introduced. These tests show the amount of expansion in twelve varieties of cement from one week to twelve months old. Mixed with three parts of sand, the expansion is much diminished, and for architectural works, the results need not cause any serious apprehensions. Mr. Faija's remarks point to a possible contraction during the action of setting, which, however, is afterwards replaced by a slight expansion.

This expansion or contraction is not so great that architects or engineers may feel any distrust of the value of cement concrete. It is, in fact, so slight that in practice, as Mr. Faija says, it may be disregarded, and we think it useful to quote the latter gentleman's observations on the experiments. "Ignoring, therefore, Messrs. Dyckerhoff's experiments (although they may have a theoretical value) in practice, when laying any large space, such as a courtyard or a length of footway with a concrete paving, it is advisable to lay it in sections, separating each by thin wooden battens. These battens may be removed in a few days, or when the concrete is thoroughly set and hard, and their space filled up with a similar concrete to that already laid; by this means there will be no danger of the appearance of the work being spoiled by the cracking of the concrete." For the walls of buildings this advice becomes of less importance, if the concrete is filled up in frames or panels, as we have more than once hinted; besides which, the occurrence at intervals of doors and windows, etc., would relieve any large surface.

Where finished surfaces have to be made, Mr. Faija deprecates the practice of putting a differently proportioned concrete as a finishing coat. It is nearly sure to crack or peel off. It is preferable to make the concrete of a finer kind, and work the face up with a trowel or float. Thus treated, the surface may be made to have the appearance of rough-cast, or a smoother finish if desired. The crushing strength of concrete seems to have been repeatedly made the subject of experiment; yet architects and engineers, in applying the ordinary weights given in tables, seem to think that the same results ought to be reached in building everywhere, whereas those tests have only reference to a small cube of an inch each way. A one-inch cube of cement will bear a great deal more than a small pillar of it twice or three times the height and of the same base. — *The Building News.*

A new Prison at Berlin. — The largest prison in Europe has just been completed at Berlin. It is destined for prisoners before their trial, and is attached to the Courts of Justice in the Moabite quarter of the capital. The portion set apart for men contains 732 separate cells and wards for 195 more prisoners in common, whilst there are 26 isolated cells for men accused of grave crimes; that for women has only 70 separate cells, and 15 large dormitories, giving in all accommodation for 220 accused. The dormitories are divided into "boxes," each containing a bed, and the prisoners are locked in when they retire to rest. Each cell has an electrical signal, a *cabinet de toilette*, and is lighted with gas so that the prisoner can read or write at his pleasure at night, light during the day being provided by a window of ample dimensions.

New Use for Vegetable Ivory. — It is proposed to use the chips from vegetable ivory in the manufacture of carbons for the electric light. The chips are carbonized, ground and made into a paste, which is then subjected to hydraulic pressure and made into sticks.

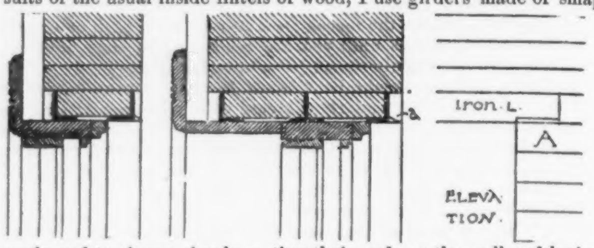
SOME MINOR WAYS OF USING IRON.

Washington, D. C., Sept. 7, 1881.

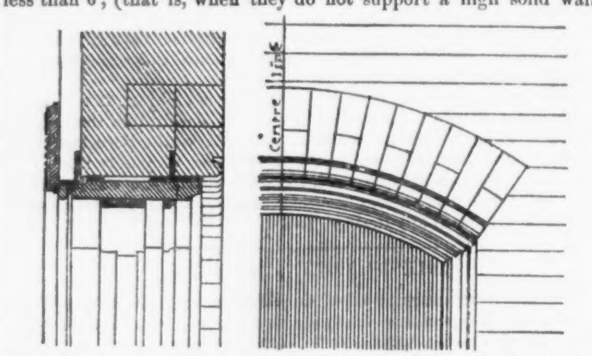
To the Editors of the American Architect: —

Dear Sirs, — In order to increase the stability of buildings, and do away with the usual shrinkage and its unsightly results, I have devised several improvements in building construction, of which I send you several.

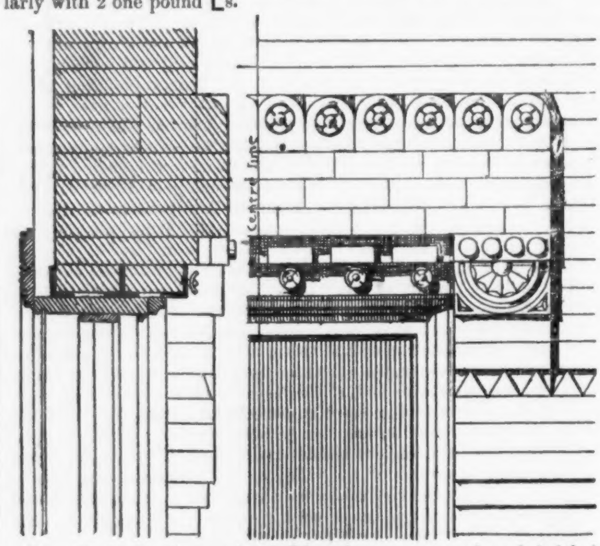
To prevent cracking and breaking of brick arches and the ill results of the usual inside lintels of wood, I use girders made of small



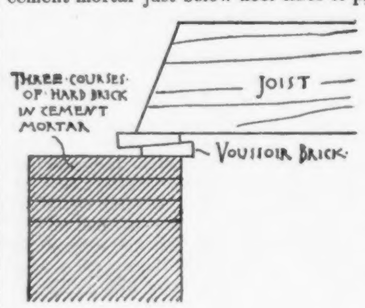
angle and tee irons, simply resting their ends on the wall and laying brick on the flanges. For a 9″ wall I use two 2½ lb. angles, as shown: for a 14″ or 18″ wall I use L s with a ⊥ between them. If desirable to have externally the appearance of a brick arch, substitute for the outside angle a ⊥, bent to any desired curvature; the flange projects under and supports the brick facing, and is out of sight, being covered by the reveal moulding. In all cases the top of the frame is made of $\frac{5}{4}$ stuffs and projects the plaster to take the architrave. These lintels I have found in practise to be good for all openings less than 6′, (that is, when they do not support a high solid wall)



measuring from outside to outside of *boxes.* Cover fireplaces similarly with 2 one pound Ls.



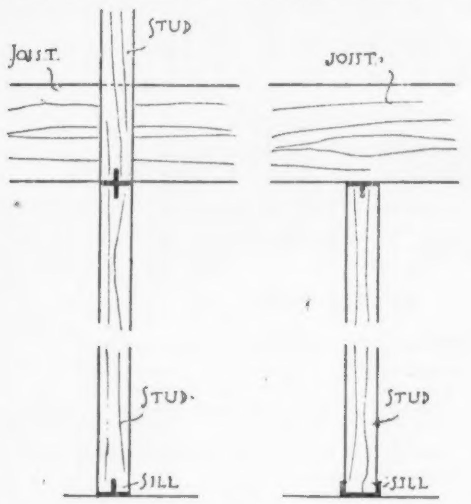
In walls built of same brick I lay three courses of arch brick in cement mortar just below floor lines to prevent the ascent of vermin.



I level up joist with a broken voussoir brick, the inclined faces sliding on each other to give the adjustment thus: —

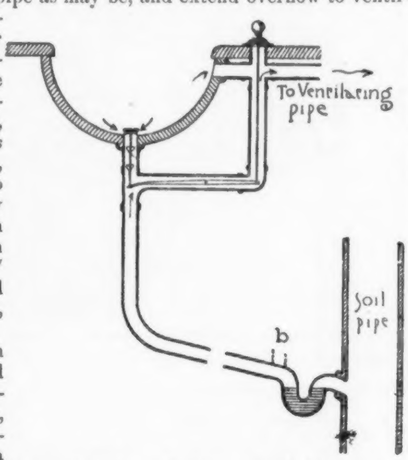
In building partitions I make the sill of ⊥ or ⊔ irons; the studs, when ⊥s are used, being slotted at both ends to receive the web. The sill lies with the web projecting upward; over it I set the studs. In the upper slot I lay a T, web down, or a

+ iron, if the partition is to continue into the next story, I lay the joist directly on the tee or star iron, and also foot the superposed partition directly on the iron, thus avoiding all shrinkage. The best



iron for the purpose is one similar to Carnegies, No. 62 or 66, although for light work No. 161 is good enough.

In ventilating drains from wash-basins and bath-tubs, I place the traps close to the soil-pipe as may be, and extend overflow to ventilating pipes, thus dispensing with one air inlet and one vent-pipe. By making the drain-pipe from bath-tubs and wash-basins, and *having the outlets and plugs equal in size*, they are emptied so rapidly as to be really conveniences, which they are not when drained through a $\frac{3}{4}''$ outlet, and that stopped up with strainers, hair, etc.



When made with such large outlets and drain-pipes, every bath-tub and wash-basin, besides being very convenient, becomes a flushing-tank, thoroughly scouring the soil-pipes at each discharge.

I send you this rough draft in the hope that it may initiate the interchange among architects of ideas as to improvements (either accomplished or desirable) in constructing and arranging buildings, etc. Respectfully Yours,

Chauncy N. Dutton.

[In furtherance of the idea suggested by the last paragraph, we publish the foregoing communication, notwithstanding the fact that several of the devices mentioned by Mr. Dutton have been in common use for a long time, at least in Northern cities. — Eds. American Architect.]

NOTES AND CLIPPINGS.

The Main Exhibition Building. — The main building of the Centennial Exhibition, Philadelphia, which was recently bought at auction by Mr. B. C. Mitchell for $97,000, has just been sold by him to a syndicate of Pittsburg capitalists whose names are as yet kept secret. "I realized from the sale," says Mr. Mitchell, "over ten thousand dollars more than the sum — $165,000 — which parties, whom I understand to represent the Bi-Centennial Association, offered me for the building."

The Algerian Cork Trees. — The recent forest fires in Algiers caused alarming destruction to the cork trees. It is believed that the losses will foot up a total of two hundred thousand hectares, and that it was a preconcerted plan on the part of the natives to start the conflagration. For future protection, it has been decided by the Algerian Government that all natives after receiving proper indemnities, shall be removed from the borders of the cork tree forests.

Foulness of the Sacred Well at Mecca. — A sample of water from the Sacred Well of Mecca has been analyzed, and found to be polluted by sewage to an extraordinary degree of disease-breeding filthiness. In fact, Professor Frankland, who made the analysis, declares that it is nothing less than bottled cholera, and, as this water is in great demand throughout Mohammedan countries, it is manifest that it is likely to be an active agent in the dissemination of disease — *New York Tribune.*

Speculating in Chateaux. — There is a little publication not much known out of France, called *Les Petites Affiches.* It appears daily in the form of an octavo pamphlet of twenty-four or thirty-two pages, filled entirely with advertisements; and most of these relate to houses and estates which are to be let or sold. Anybody wanting a fine château or an historical château with a park deserving such epithets as "magnificent," "picturesque," or "incomparable," has only to turn to the crowded columns of this little sheet, and he will find scores to choose from. *Post-mortem* sales, bankruptcies, and political perturbations are continually throwing old manor-houses and new country halls into the market; and the *parvenus* of politics, finance, literature and art start up to bid for them. At least, they do so in quiet times like the present; and my purpose in writing about châteaux in this letter is to call attention to the curious fluctuations in the value of house and land property which are produced by politics. If the recent general election had resulted in the return of a majority of Intransigeants, châteaux would instantly have glutted the market, and enterprising speculators with ready money might have bought fine houses, full of beautiful furniture, at very low prices. But as the constituencies have elected a comparatively moderate majority, so that there is a good prospect of France remaining quiet for four years, there will be a marked rise in the value of country houses, and an immense deal of business will be thrown into the offices of the notaries, who act here as house-agents and auctioneers. At the same time architects, house-decorators, upholsterers, venders of bric-à-brac, painters of "old family portraits," and many others, who depend for their livelihood on the briskness of the trade in châteaux, will be actively employed. Political crises throw all these people out of work, and this explains how when once demagogues have succeeded in agitating the lower orders, revolutions come on with such startling promptitude. The uneasiness of the well-to-do classes, stopping the demand for luxuries, turns thousands and thousands of workmen into the streets and renders them impatient to bring the crisis to an end as soon as possible. At ordinary times the revolutionary classes form but a small part of the population; but when through the good-natured indulgence which comes of peace and plenty they are allowed to become too turbulent, their ranks are immediately swollen by the hordes of honest but angry and despairing workmen whom their noise has brought to the verge of starvation. — *Paris Letter to St. James's Gazette.*

Accidents to Employees. — The first case of any importance under the English Employers' Liability Act has just been decided. This law, which went into operation last January, increased the liability of employers for injury to their employees, and made them liable, in certain cases, for injuries to the employees that arose from the negligence of their fellow workmen. The case at issue was one for £312 damages, for an accident arising from the alleged negligence of a fellow workman. The men were engaged in decorating a house. In order to reach the ceiling it was necessary to have a scaffolding of some kind, and one was made of boxes. The man who was afterward injured objected to going on it, as it was unsafe, but one of the men who was a quasi-foreman promised to hold it. The work went on for an hour or two, when the structure fell and the plaintiff's leg was broken. The defense urged that no order to use the scaffold had been given to which the plaintiff was bound to conform. The burden of the defence was that the act was only intended to apply to injuries caused by defects in machinery that the employer was bound to keep in order and that the employee had no means of investigating, and did not apply to machinery or appliances that the workman made for himself. The jury found on all points for the defendant. This result is similar to that reached in several cases in this country that have already been reported in our columns — notably one at Pittsburgh, in which damages were sought for an accident resulting from the breaking of a scaffold at the Keystone Bridge Works. The gist of these decisions is that the employer is not responsible for the acts of a quasi-foreman, or of a man who may be left in charge of a "job." Nor are they liable for damages for an accident that results from the weakness or breaking of a structure, if that structure was built by the workman, or if he could inform himself as to its strength and safety. — *The Iron Age.*

St. Petronio — All those who know Bologna know that the façade of its principal church, St. Petronio, is unfinished. For several years a wish has been growing up that it might be worthily completed, and on May 29 last, a large and influential meeting of citizens was held, thanks to the energy and perseverance of a young architect, Signor Giuseppe Ceri, to consider the plans and estimates which he had to lay before them. The Bolognese are proverbially attached to and proud of their city and its monuments, and the meeting represented every class of society and every shade of political opinion; and for this, as well as for its unanimity, it may be regarded as noteworthy. An acting committee of seven was elected, which included the Cardinal Archbishop of Bologna and Count Aurelio Saffi, the eminent patriot and liberal, who spent so many years of exile in England. Of course Signor Ceri is also on the committee, and the brilliant success of this first decided movement is greatly owing to him, for he has devoted himself for many years to this object, and has declared that, whichever design for the façade may be chosen, it shall receive his loyal co-operation and support. What is sought is to follow as closely as possible the design already begun on the lower part of the façade by the original builders. It is proposed to collect the sum necessary (under £50,000 sterling), by small subscriptions throughout the province of Bologna, one of the most public-spirited in Italy; we think, however, that the scheme and the spirit in which it is conceived will not fail to appeal successfully to English lovers of Italy and of her beautiful edifices. — *The Academy.*

Paper Observatory-Domes. — It is expected that the paper dome now being made for the new observatory at the West Point Military Academy, will act as a non-conductor of heat and electricity, and maintain a uniform temperature within the building, thus preventing an electrical disturbance of the instruments used.

BUILDING INTELLIGENCE.

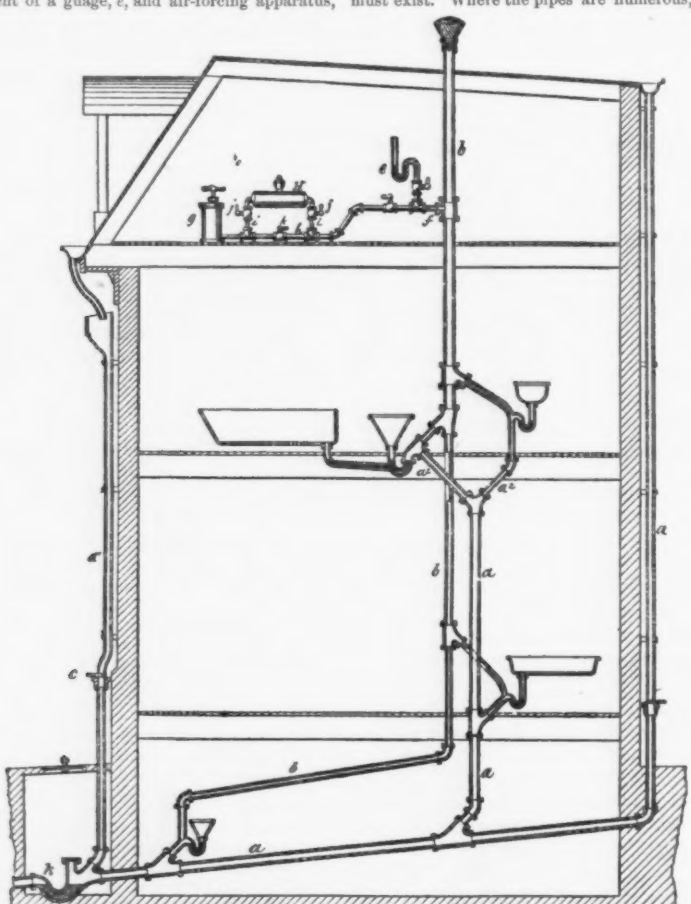
(Reported for The American Architect and Building News.)

[*Although a large portion of the building intelligence is provided by their regular correspondents, the editors greatly desire to receive voluntary information, especially from the smaller and outlying towns.*]

BUILDING PATENTS.

[*Printed specifications of any patents here mentioned, together with full detail illustrations, may be obtained of the Commissioner of Patents, at Washington, for twenty-five cents.*]

243,741. Testing Drain-Pipes. — Frederick Tudor, New York, N. Y. This invention aims to provide a means whereby the drain or waste pipes may be tested conveniently and safely. The drains consist of a main horizontal and vertical pipe, *a*, receiving the rain-water leaders a^1, and also a ventilating-pipe, *b*, which passes through the roof of the house, and from which lateral branches extend within the house to the upper bends of the several traps of the water-closets, sinks, bath-tubs and wash-basins, while the waste from said traps is discharged into separate branch pipes a^2 connecting with the main waste-pipe *a*. It may be now observed that all the openings of the drains, whereby the interior might be in free communication with the outer air, are represented in the drawing as closed, the openings thereof in the house being closed by the water in the traps, which is their usual condition; the ventilating-pipe being closed by a temporary air-tight hood tied over the same, while the rain-leaders are closed by boards or plugs and air-tight packings placed across the pipes at some convenient point in the manner of a roughly-made gate-valve, as indicated at *c c*. Finally the whole system of drains as relates to their contained air is isolated from the sewer by means of a trap at *k*, or, where there is no trap, a plug or valve may be used. Hence the arrangement is such that if air be forced into the drain-pipes by way of one of the branch waste-pipes, whose trap may be emptied for that purpose, pressure will be accumulated if the pipes are tight, but not otherwise. For this purpose, however, the ventilating-pipe *b* — say on the top floor — is provided with a special opening or nipple, *f*, for the attachment of a guage, *e*, and air-forcing apparatus,



which nipple may be closed at all other times. To test the pipes, air may now be blown into the pipes by the breath through the nipple *f* and an attached mouth-piece, and where the drains are not too large or numerous a pressure may be readily accumulated within the drains in this way, if they are not too leaky, and this pressure will be indicated by the guage or manometer *e*, attached to the nipple *f*. In the case of newly-made drains in an ordinary dwelling-house no further apparatus than as just described is necessary, and if the pressure produced by the force of the breath

in the pipes is maintained, which will be shown by the guage, the drains may be considered tight, if not, leaks must exist. Where the pipes are numerous, large or leaky, however, a more powerful blowing apparatus than the human lungs will be necessary, such as a bellows or air-pump, as shown at *g*; the discharge-pipe of which is connected with the testing-nipple *f*. To test the pipes by this apparatus it is only necessary to see that all the regular openings of the drains are closed, as before described, and then to operate the pump *g*. If the pipes and joints are all tight, a pressure will now be speedily accumulated and maintained within the same, and this will be clearly indicated by the guage. If, however, there are small leaks, the

BUILDING INTELLIGENCE.

pressure will slowly diminish, and if the leaks are large, no pressure can be accumulated, all of which will be shown by the action of the guage. The exact location of the leaks can be obtained by forcing the air through a chamber *h*, containing strongly-odorous material — such as oil of peppermint, spirits of camphor, or other powerful and distinctive scent — placed between the air-pump and the nipple *f*, so that the air entering the drains will be strongly scented, and its escape from any leak will enable the latter to be accurately located by scent, which leaks may then be closed so as to render the pipes tight. The chamber H is connected with the pipe *h*, through which the air is forced, by branch pipes *i i* and cocks *j j* at each end, and between the branch pipes *i i* is set a cock, *k*, by means of which the air from the pump may be either forced directly through the pipe *h* or may be passed around through the chamber, as desired, by simply turning the cocks in the proper positions. In case it is desired to obtain a greater degree of pressure than the traps will allow, check-valves can be put into the waste-pipes, or the traps may be securely plugged, when the pressure may be increased to the desired extent. By this means it will be seen that the drains of a house whether new or old, may be quickly tested in a convenient and certain manner, which will avoid injury to the house, insure the detection of leaks, and enable the same to be stopped up so as to render the drains tight and in correct sanitary condition, which has been heretofore very desirable.

246,762. Preserving Wood. — Erwin Hagen, St. Louis, Mo. The logs, or other pieces of wood, of any shape are first submitted to the direct influence of steam or heat, in order to remove all soluble vegetable parts from the pores, thus leaving a spongy skeleton of wooden fibre. In this state the timber is ready to receive the antiseptic solution. The timber is then put into a boiler, in which is introduced a solution of chloride of zinc in water, the antiseptic action of which salt is now well known, and has been for a long time, as shown in the burnettizing process. In this solution is dissolved one per cent (more or less) of sulphate of lime, which in trade is generally known as "gypsum" or "plaster-of-paris." This salt will readily dissolve in the solution of zinc, forming a perfectly fluid compound. The boiler containing the wood is filled with this compound, and an hydraulic or steam pressure of eighty-five to one hundred pounds to the inch is applied. Under this pressure the fluid enters into all the pores of the wood, filling the same, and the fibres absorb the water of the solution, concentrating the solution sufficiently to create a general process of crystallization within the timber. The sulphate of lime, crystallizing, hardens and forms the partitions, holding the chloride of zinc (a very soluble salt) within its cells protected against the influence of decomposition or solution by outside mediums, such as water or air. The proportions of the ingredients are as follows: sulphate of lime, one per cent; chloride of zinc, two per cent; water, ninety-seven per cent, in one hundred parts of the liquid, this always forming a perfect solution of gypsum in the chloride of zinc in the stated proportions.

SUMMARY OF THE WEEK.

Baltimore.

Building Permits. — During the past week fifteen permits have been granted, of which the following are the more important: —

Hope's Artificial Stone Co., stone building, 50′ x 75′, Hollins St., w Monroe St.

Henry Baskell, 12 three-st'y brick dwells., Dolphin St., between John St. and Rutter Alley.

J. J. Sands, three-st'y brick building, Gilinor St., between Harlem and Edmondson Aves.