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CONTENTS.



THE prospectus of the *American Architect and Building News* for the ensuing year will be found on page 274.

WE are glad to welcome a new and promising associate in the field of technical journalism, *Le Génie Civil*, the first number of which, under date of November, 1880, has just reached us. The circumstances of its establishment are interesting. It seems that a year ago the *Ecole Centrale* celebrated its fiftieth anniversary, and, amid the interchange of friendly courtesies and comparison of professional experiences, which naturally followed the assembling of a multitude of the former pupils of the school, a wish was strongly felt for the establishment of some permanent medium of communication, not only between the graduates of the school, now scattered through many lands, but between professional men generally, who might be interested in the same technical subjects. In the hope of accomplishing the desired end, a joint-stock company was formed, consisting of some five hundred engineers, civil and mechanical, chemists, metallurgists, manufacturers and architects, and a committee was appointed to draw up a scheme of which the present enterprise is the realization. The list of stockholders comprises many distinguished names; among others, of three Americans, besides engineers in Russia, China, Africa, Greece, Poland, Germany, and Italy. The facilities for obtaining interesting matter, afforded by so large a constituency, must be of great value, and *Le Génie Civil* proposes to take advantage of them in keeping its readers informed of the progress of all branches of technology, seeking unceasingly, as it says, the knowledge, both of what has been accomplished, and of that which is in the way of accomplishment, so as to present always the most advanced state of the arts with which it deals, instead of being, like all text-books, constantly a little in the rear. We wish our contemporary the utmost success, and hope that many of our readers will have the opportunity of profiting by an acquaintance with a journal at once so practical and so scientific.

THE first number of *Le Génie Civil* contains an account illustrated by well-drawn diagrams of the new iron viaduct at Garabit, on the Marvejols-Neussargues railway in Auvergne. The most interesting feature of this viaduct is the immense iron arch, or, perhaps more properly, arched girder of parabolic form, which, spanning the bed of the stream which flows through the valley, sustains the middle portion. This enormous structure rises to a height of four hundred and four feet above the river, not very far from twice the height of the renowned suspension bridge at Freiburg, and the springing points of the arch are five hundred and forty-four feet apart. The author of the diagram illustrates the scale of the work by showing in dotted lines under the arch the front of Notre Dame, with the Colonne Vendôme on top of it. Their combined heights barely reach to the soffit of the arch. New Yorkers can imagine it by supposing Trinity church to have another spire, from the foot of the octagon upward, set on top of the present steeple, the uppermost point just touching the underside of a vault starting from the middle of the new bank building at the corner of Wall Street and Broadway, and descending to the ground on the other side somewhere beyond the Rector Street station of the elevated railway. The construction seems to have been economical, the whole cost of the viaduct, fifteen hundred feet long, including foundations and masonry, having been but about six hundred thousand dollars. The applicability of the system to roofs, of a span hitherto hardly dreamed of, will occur to every architect, while to engineers this successful experiment rivals in interest that of the St. Louis bridge, and gives prophecy of a new era in the bridging of deep chasms.

A PAINFUL accident occurred just as we were going to press last week, at the new iron bridge, now constructing across the Harlem River, for the Metropolitan Elevated Railroad. The bridge is of simple construction, consisting of a series of iron trusses, resting on piers some forty feet apart, and one of the trusses, weighing about two tons, was being placed in position on the piers, when one end slipped from its place, and the sudden strain upon the chain or rope, by which it was suspended from the derrick, broke it, letting the truss fall on the scaffold beneath. At the same instant another truss just placed in position close by, was dislodged, and also fell, and the united shock of the two trusses falling together carried away the staging, precipitating it, together with the men on it, into the river below. One man was instantly killed, and four seriously wounded. The first feature of the account which strikes us is the inadequacy of the means to produce the sad result unless some carelessness had added to the danger. A load of two tons is trifling for a good derrick, or the tackle with which it should be furnished, and the occurrence of a jerk sufficient to snap the ropes on the sudden movement of the load seems to us proof of a want of precaution in allowing the windlass to be slackened before the truss had been moved securely into its place, which should merit severe condemnation. No doubt the necessary turning of the truss after it reached its abutments added to the difficulty of keeping it properly suspended, but such turning is so often necessary with large pieces that the needful precautions are well understood. Probably no one will be held responsible for the accident, but it may still teach its lesson to those who have the care of similar operations.

A DISCUSSION is now taking place in regard to the system of sewerage which shall be adopted in the city of Newport, R. I., two different schemes having been presented; one by a commission appointed by the city government, of which Captain Joseph P. Cotton and Mr. E. S. Chesbrough, of Chicago, sign the report; and the other by a private corporation, styled the Drainage Construction Company, which has employed Col. George E. Waring, Jr., as consulting engineer. The two plans differ essentially in this respect: that by the former it is proposed to admit the ordinary rainfall to the sewers, while the latter contemplates the removal only of the house-drainage through small pipes, storm-waters being left to pass off over the surface. There is something interesting in this meeting of the two rival systems face to face, although there are in Newport circumstances which weigh unduly against the small pipe system, and will perhaps in this case counterbalance the effect of Colonel Waring's remarkable success by the same plan at Memphis. A description and discussion of both schemes is contained in the Newport *News* of November 24, to which we can at present only briefly refer. One very good point is made by Colonel Waring, in answer to a criticism of his plan as deficient in man-holes for cleaning the pipes, by the assertion, which we think experience will bear out, that the larger part of the obstructions which occur in drains get in through the very manholes which are built for the purpose of clearing them out. In Memphis there are no openings whatever in the six-inch street drains more than four inches in diameter, and the presumption is that substances which can pass through these openings will not remain in the larger drain, flushed as this is in the most efficient manner by siphon tanks. As to the comparative cost, which is a very important point, the small pipe plan can be executed for one hundred and fifty thousand dollars, draining twenty miles of street, containing two thousand house lots, with new, clean and tight work throughout; while the other system will cost, for outfalls and intercepting sewer alone, one hundred and thirty thousand eight hundred dollars, and will make use of the old street drains, of which there are already about ten miles, serving one thousand house lots. As between the two systems in a town unprovided with any sewerage whatever, the difference in cost per house would be still more striking. We commend to the notice of town authorities and others interested, the deduction which a simple computation gives: that even with the disadvantages of Newport, the cost at the outset of a complete system would be less than a dollar and a half per lineal foot of the streets served, or, more exactly, seventy-one cents per front foot of the lots facing on such streets, and this cost would be much lessened as the system was extended. Such proposals as this should soon bring the inestimable blessing of good sewers within the reach of hundreds of towns now suffering for want of them.

ONE of the most difficult problems which presents itself to architects and builders, at this season, is the determination of the question, how soon mason work ought to be stopped on account of frosts. For extensive buildings, the erection of which will, at the best, occupy several seasons, the ordinary rule of covering over the walls from November to April is well enough; but in smaller structures, such as dwelling-houses and mercantile buildings, where every day's delay involves a money penalty or a loss of rent, it is of great importance to continue operations as long as is consistent with safety. In practice, many contractors never cease building as long as the mortar can be made to remain unfrozen long enough to spread it, but this course involves great risk, not perhaps of the failure of the walls so constructed, but of permanently weakening them, and rendering them porous and permeable to moisture. A brick or stone chilled by cold weather, and laid even in hot mortar, condenses the moisture on its surface, where it freezes, forming a film of ice between itself and the bed of mortar, which, unless very soon thawed again, before the lime begins to harden, effects a permanent separation between the brick and the mortar, so that it can be lifted from its bed after the masonry is dry, without the mortar adhering to it. If a wall so laid is exposed to the sun, so as to thaw one side partially, it will bend toward that side, sometimes to a serious extent. Cement, although useful for cold weather work on account of the rapidity with which it hardens so as to be out of danger, is very injuriously affected if frozen too quickly, the "initial set" being so broken up as to prevent subsequent induration. No doubt the safest mode of conducting winter work is to heat the brick or stone by piling them in a sheltered place near a stove. The warmth which they slowly acquire is retained for a very long time, especially in the interior of walls laid with them, and a superficial freezing, if it should take place, is easily remedied by pointing when milder weather returns.

THE theories in regard to the extinguishing of fires by steam, to which we have once or twice adverted, are strongly combatted by a writer in the *Fireman's Journal*, who warns his readers to be on their guard against accounts circulated for a concealed purpose, — that of pushing the interests of the various steam-heating companies. This gentleman, Mr. J. B. Moore, says that as steam is acknowledged to be only effectual in subduing fires in closed rooms, there is no advantage in introducing it, since the fire would go out of itself under the same circumstances, for want of oxygen. Without pretending to judge of the merits of the main question, it hardly seems to us that this is a fair statement. The effect of introducing steam in an average room would be to drive out, by its superior pressure, the air which would otherwise enter at the various small openings to feed a flame, in the same way that a leak is sometimes stopped in a ship, by forcing air into the hold so rapidly that the water is driven out by the same opening through which it entered. How easy or desirable it may be to introduce steam in such quantities, we cannot say. Mr. Moore thinks that carbonic acid is generally preferable to steam, and in this we quite agree with him. He gives an illustration of its good effect as shown recently in Boston, where an immense tank of naphtha and oil caught fire, and, after raging a quarter of an hour, though four or five engines threw water upon it, was extinguished in three minutes by a chemical engine, throwing a tiny stream of water saturated with carbonic acid. Undoubtedly this is the true mode of attacking petroleum fires, and we must express our astonishment that any fire engineer should have allowed water to be thrown on such a tank, when its only possible effect would be to sink below the blazing oil, and cause it to overflow, spreading the flames in all directions.

A RECENT circular of the Manufacturers' Mutual Insurance Company calls attention to the property which most bituminous or soft coals and some semi-bituminous varieties possess, of taking fire spontaneously when exposed to moisture or even dampness in a place without free circulation of air. This quality of coal has long been known, especially to ship-owners, who have learned by sad and costly experience the danger of storing fuel in unventilated bunkers; but in regard to the comparatively trifling quantities kept in the bins of dwelling-houses, it has been thought unnecessary to take any precautions, and nothing is more common than to see coal sprinkled with water before putting in to keep down the dust, a carelessness which has undoubtedly often led to serious consequences. At the best, the storage of coal in the cellars of inhabited houses is very objectionable. Aside from the danger of fire, the same causes which when acting strongly cause spontaneous combustion, are likely when present in a less degree, to give rise to injurious vapors of sulphurous acid, carbonic oxide and other products. Even with anthracite coal, a suffocating effluvium, perhaps of sulphurous acid, is often perceived when the contents of the bin are disturbed. Under the usual arrangement of hot air-furnaces this acrid gas is at times, particularly through the night, taken directly into the air-chamber and distributed to the rooms, while under the best of systems it is drawn quite freely through the floors into the house above. Perfect security can only be attained by keeping the coal in vaults by itself, entirely outside the house, and with separate ventilation to the air. Where the small extra expense can be afforded, it is well to bear in mind how much can be accomplished for the healthfulness and security of the house by this simple means.

A CASE was recently decided in England of considerable importance as a precedent in the interpretation of contracts. In this dispute (Marsden vs. Sambell), the plaintiff had made an agreement with the defendant, a builder, who was erecting certain houses under an arrangement of loans, including the stipulation that they should be completely finished and ready for habitation by the 24th day of June. The time of completion was expressly declared to be "of the essence of the contract," and the landlord was empowered, in case this condition was not fulfilled, to enter upon and take possession of the premises. Another stipulation was made, that no materials should be removed from the ground without the written consent of the landlord or his surveyor, and right of entry was given in case of violation of this condition also. On the 24th of June the houses were unfinished, but the landlord took no immediate notice of this breach of the contract, and three days afterwards advanced a sum of money to the builder. On the 5th of July, the landlord requested a neighbor to "keep his eye on the builder," and ten days afterward, himself informed him that he considered the houses forfeited to him from the 24th of the preceding month. On the 31st of July, and again in September, the builder, although forbidden by the person in whose charge the premises were placed, came and took away a quantity of materials, whereupon the landlord brought an action praying for an injunction to restrain the contractor from trespassing further on the premises, which were claimed to be forfeited, and for damages on account of the materials already removed. The contractor argued that the landlord, by neglecting to demand the forfeiture on the 24th of June, the day when it became due under the contract, or within a reasonable time afterward, virtually waived his claim to enforce it; and the court coincided with this view, saying that a man who under such a contract, neglected to take advantage of his rights within a reasonable time, so that the other party, thinking them tacitly waived, was induced to go on and do acts which he would not have done if he supposed the claim was to be enforced against him, lost his right to profit by the stipulation to which he might have held the other party at the proper time. In the present case, the defendant was, however, condemned on a different ground, the judge deciding that as the plaintiff, by neglecting to claim a breach of the contract, had waived the circumstances which gave him a right to do so, the contract must be considered as continuing to exist, since no breach had been committed on the plaintiff's side, until the unlawful removal of materials by the defendant. This, by a separate stipulation, was also to involve forfeiture of the premises, and the plaintiff's claim having been made within a proper time after this breach of the contract, it was sustained on that ground, and the defendant ordered to pay damages for the removal of materials, as well as to lose the buildings.

## VAULTS.[1] — V.

### RIB-VAULTING.

IN fully developed rib-vaulting the surfaces, termed panels, are sustained by a skeleton structure of ribs. The ribs are of hard stone, while the surfaces are usually of lighter material, tufa, brick, pumice-stone, sometimes even of wood. The pieces forming the panels may run straight from rib to rib, in which case the surfaces are either cylindrical, elliptical-cylindrical, conical, or straight-sided conoidal. Or the surfaces may be arched from rib to rib, being then convex-conoidal, or spheroidal. The ribs may be of circular or of elliptical curvature, and may form semi-circular, pointed, elliptical, three-centred or four-centred arches. They are laid, as it is evidently proper that they should be, in vertical planes; that is to say, they are straight on the horizontal projection. There are occasional exceptions, but in these the panel on one side prevents the rib from falling sideways, and the two mutually sustain each other.

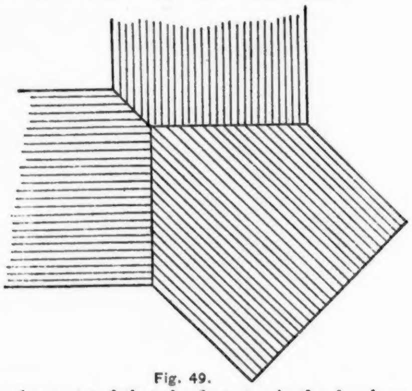


Fig. 49.

It is sometimes stated that the first step in the development of the rib system of vaulting is the thickening of the cross-band in barrel-vaults, and making it an independent arch, as in Fig. 3, with the vaulting surface above it. But such a rib, while it may add to the stiffness of the whole structure, and while it is certainly a pleasing break in the intolerable monotony of a long barrel-vault, does not, in Romanesque work, carry the vault, which must be thick enough to stand by itself, and is just as well able to do so at the points over the cross-arches as at any point between them. And as a matter of fact, true ribbed barrel-vaults, in which the pieces that form the surfaces are supported at their ends on the backs of the ribs, are very rare until after the invention of compound rib-vaults. We know of but one or two Roman examples, and of no Romanesque. We must look elsewhere for the beginning of the rib system. We shall find the first step to consist in the substitution of a square-cornered arch for the groin-stones of a compound solid vault, as in Fig. 49, from San Ambrogio, Milan. Here, there is a great advance in ease of construction.

The shaping of the groin-stones in a Roman vault is quite a problem in stereotomy. The springer has seven surfaces, and every

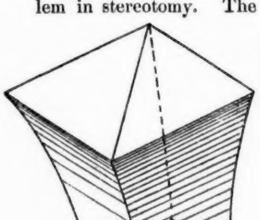


Fig. 50.

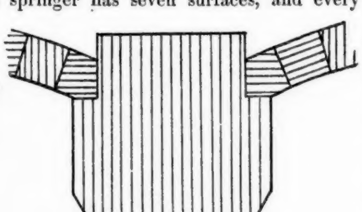


Fig. 51.

other stone, up to the key, which is still more complex, has eight, viz.: two cylindrical soffits, two cross-joints in vertical planes, two planes of the leading joints on the bottom, and two more on the top, as in Fig. 50. Besides this, no two stones are alike, as the groin-angle varies continually, increasing as it rises. But the groin-arch substituted is a comparatively simple thing, and all its voussoirs may be cut from one pattern. We now have solid vaulting with groin ribs. This is not properly rib-vaulting, because the vault is still thick enough to form an arch, and rests upon an auxiliary support only at the groins. Indeed, the stability of such vaults is often quite independent of the groin-ribs, which are then rather ornamental than useful. The ruins of the Bishop's Palace, at Lincoln, present a case in which the ribs have fallen away, leaving the vault, which is built of rubble, quite sound. There are, however, some small rib-vaults, having only groin and wall ribs. The latter are not necessary to the construction, as the ends of the surface-pieces might be let into the wall; but the former are. There are also vaults with *transverse* and wall-ribs only, but they are of a much later date than those we have just mentioned, and of a different shape.

[1] These papers, by Professor Charles Babcock of Cornell University, will be printed in monthly parts.

The name "groin-ribs" is usually given to those which lie at the intersections of the main vault with the transverse-vault, and therefore cross the compartment diagonally. Strictly used, it should be applied to any rib which carries two panels that are not portions of the same surface, but make an angle with one another, as in Fig. 51, which may occur on a transverse rib, if the panels are spheroidal, or if the vault is domical. We shall use the term in the ordinary sense.

The next step, undoubtedly, was the conversion of the heavy cross-arch of the Romanesque vaults into the light transverse rib of the Gothic system. This was a slow process. For a considerable time after the introduction of the groin-rib, the cross-arch remains, some-

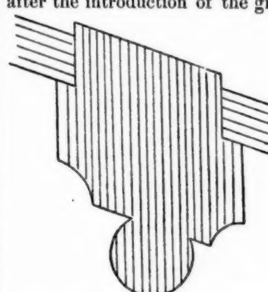


Fig. 52.

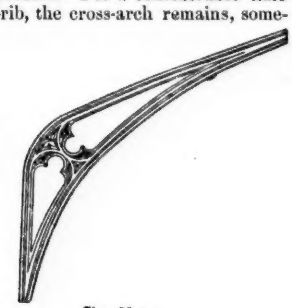


Fig. 52 a.

what reduced in size, lightened in effect by mouldings, and often in substance by being made compound, but still two or three times as large as the groin-rib. This relation between the two, however, prevails mostly in France, Germany, etc., but is rare in England. On the continent it continues almost until the Renaissance. In England the transverse rib is nearly or precisely of the same size and section as the groin.

Then follows the wall-rib, which shows half, or a little more, of the section of the transverse, and is built into the wall. It is really the transverse rib of the side vault.

The next is the intermediate rib, which lies between the groin and transverse, or groin and wall. If it lies in a surface which is continuous from the groin-rib to the transverse, or wall-rib, its section must be distorted, as in Figure 52, and variable, because the lines of joint-

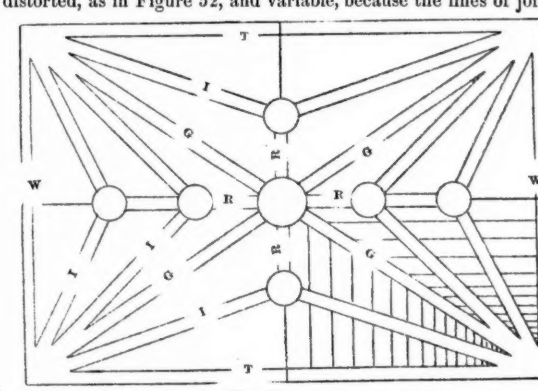



Fig. 53.

ing, or rather the elements of the surface, strike it higher up on the side next the groin than on the other; or else the rib must be curved sideways. Both difficulties are avoided by making the panels spheroidal, in which case the intermediate is, strictly, a groin rib.

With the intermediate comes the ridge rib. Its use is often said to be merely to conceal the somewhat awkward interlocking of the panel pieces when the joints are not parallel to the axis. This, how-

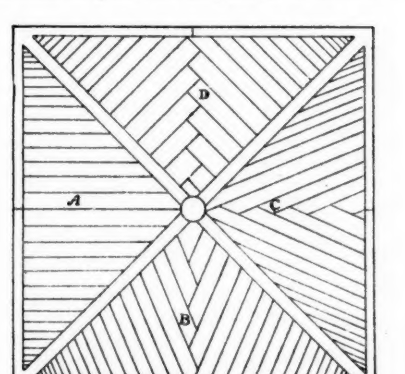



Fig. 54.

ever, is a mistaken view. The ridge-rib was at first a structural not an ornamental piece. Its function is to connect the apex of the intermediates with the centre. The two halves of the intermediate, not being opposite each other in the same vertical plane, would fall towards the centre unless prevented by this strut. No ridge-rib is required between the apex of the intermediates and the apex of the transverse, or wall, ribs, and accordingly in early examples none appears in that position.

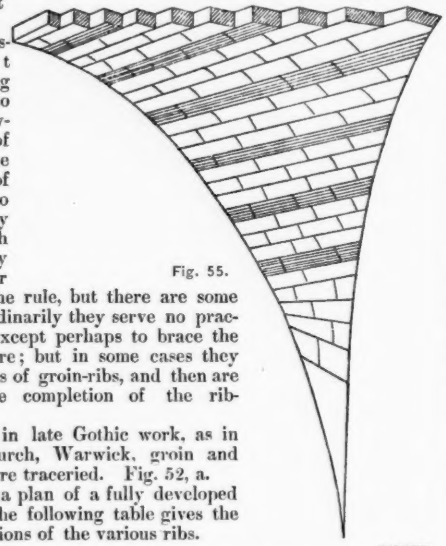


Fig. 55.

*Liernes*, or cross-ribs, are short pieces running from one rib to another, following the form of the panel, the curvature of which they do not affect. They lie underneath panels already formed by other ribs. This is the rule, but there are some exceptions. Ordinarily they serve no practical purpose, except perhaps to brace the skeleton structure; but in some cases they are continuations of groin-ribs, and then are necessary to the completion of the rib-arch.

Occasionally, in late Gothic work, as in St. Mary's Church, Warwick, groin and transverse ribs are traceried. Fig. 52, a.

Figure 53, is a plan of a fully developed rib-vault; and the following table gives the names and positions of the various ribs.

| POSITION. | ENGLISH NAMES. | FRENCH NAMES. | MARKS ON PLANS. |
|---|---|---|---|
| Diagonal. | Groin. | Croisée d'ogive. | G |
| Across the main axis. | Transverse. | Arcs doubleaux, or Nervures. | T |
| Against the Walls. | Wall. | Formerets. | W |
| Between the groin and transverse, or groin and wall. | Intermediate. | Tiercerons. | I |
| At ridges. | Ridge. | Liernes. | R |
| From one rib to another. | Liernes, or cross. | | L |

Ridge angles without ribs are indicated on the plans by single lines.

At the points where ribs meet we often find key-stones, called bosses. They receive the ends of the ribs, and do away with the

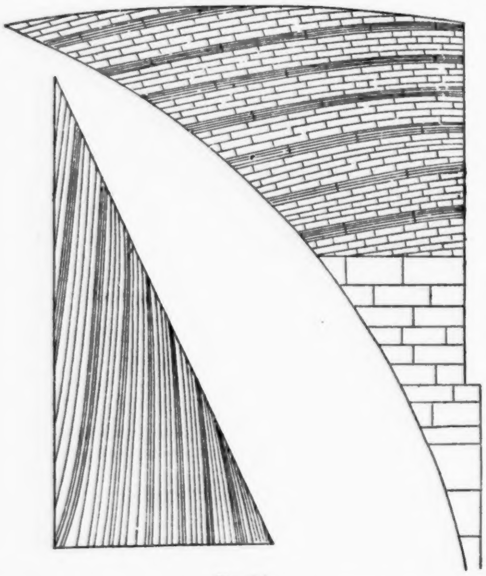


Fig. 56.

necessity of mitering the mouldings. Their lower ends are richly carved. At centres, bosses are sometimes moulded, the mitres being cut on them, and there is only a bit of leaf-work covering the intersection of the soffit mouldings, or none at all.

SECTIONS OF RIBS.

Ribs are generally moulded by chamfering, by coves, or by combinations of rolls, fillets, hollows, etc.

JOINTS.

The joints of the panels may run in almost any direction, and are often quite irregular. The most common systematic methods of laying them out on the plan are shown in Figure 54. In the part A, they are parallel to the axis; in B, perpendicular to the line that bisects the lower angle of the panel; in C, perpendicular to the line bisecting the lower angle of the opposite panel; in D, perpendicular to the groin rib. If they are kept level, A is applicable only when the ridges are level, and B, C, and D to domical vaults. But in A, they may rise from the transverse, or wall, to the groin rib, making a domical vault. In B and D they may fall, except a few at the bottom, and the ridge may be level, as in Figure 55, from the cloisters of Westminster Abbey. In C they must rise. Figure 56 gives a plan and elevation of a panel from the nave of Westminster Abbey, banded with occasional courses of dark stone, which is not common.

## THE DISCOVERY OF UNDERGROUND SPRINGS.

(From the French of Daniel Ramée.)

WATER is a necessity for construction, in preparing mortar and for other uses. A proprietor is often embarrassed unless he has some means of ascertaining whether the site on which he wishes to build offers an accessible supply of the fluid which is indispensable to the work which he contemplates. It is therefore useful to have in mind certain principles of the art of tracing underground veins of water.

Every one knows the definition of valleys, — depressions of considerable width, which extend from a mountain ridge downward, usually ramifying into several branches, and ending at some river; of defiles, or gorges, which lie between the spurs of the mountain chain; of ravines, the narrow and deep passages, formed usually by a stream of water; and finally, of gullies, or longitudinal depressions of slight depth. The slopes which enclose these different varieties are called the flanks of the valley, gorge, ravine or gully. The usually sinuous line of intersection where the two sloping flanks meet at the bottom is called in German the *thalweg*, or the path of the valley, indicated in Fig. 1 by A A.

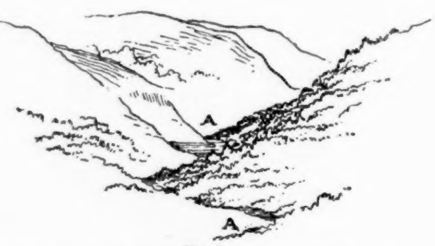



Fig. 1.

In those dales and valleys which have no visible water-course at the bottom to indicate the line of greatest depression, the true *thalweg* can be determined by careful study of the path which such a stream would take if it existed. This line must be ascertained with great care, as it is of the highest importance in fixing the position of springs.

Valleys have a mutual relation to each other which should be understood. Every principal valley forms a main trunk, ramifying into branches, or lateral gorges; each lateral gorge ramifies in its turn, receiving a large number of inferior depressions, which again branch more or less.

The wide spaces, apparently horizontal, which are called plains, really present also low ridges, or water-sheds, branching variously, and between them slight depressions, forming shallow valleys, in which water-courses often wind. Although at first sight it may not be apparent in what direction the plain is inclined, by a little attentive observation the general slope can be detected, and also the various basins and depressions, with their ramifications.

So much may be said of the superficial conformations which it is necessary to study; but beneath the surface may exist a variety of conditions not less important. By stratification in geology, is understood the arrangement by successive layers of the different sedimentary deposits which have taken place, one after the other, whether these consist of recent alluvium, or have, in the course of ages, hardened into beds of rock. Each of these layers differs in thickness, density, constitution and color from those above and below it, and as the surface of the primitive mass upon which they were deposited presented irregularities, — elevations and depressions, — so the beds of the sedimentary rock, clay, sand or gravel follow the inequalities of the underlying body. Among the alluvial or stratified rocks are included many kinds of lime-stone, slate, sand-stones, and other hard or soft mineral substances which lie in well defined beds, whether horizontal or inclined. Granite, chalk, tufa, porphyry, and many other rocks which present no division into layers, or only a very faint one, are called unstratified. The stratified layers rest as a rule upon a mass of unstratified rock of indefinite extent, which is often buried under many successive beds of sedimentary deposits. If the layers had always been left undisturbed, they would form a continuous covering to the unstratified rocks, consisting of a greater or less number of concentric coats, but continual movements are taking place in the interior of the earth, by which the deeper lying rocks are pushed up in some places and sink in others, and these movements of the inner mass disturb and break up its stratified envelope, sometimes tearing it asunder in deep clefts, sometimes pushing up separated edges until the layers are turned vertically. The character of the stratified layers varies exceedingly in different places. Sometimes the primary rock is bare, or thinly covered with sand, clay, gravel or other alluvium; sometimes it is buried thousands of feet below many beds of alternating stone and softer substance. Hence it follows that the rain which falls on the earth is received by surfaces of very various powers of absorbing it. Clayey grounds, or tracts of bare unstratified rock, are nearly impervious, and the water is obliged to run off over their surface, or to collect in pools in the hollows. Into other soils, on the contrary, such as gravel, sand or loam, with such rocky masses as present numerous seams and crevices, the water sinks immediately, continuing to descend until it meets with an impenetrable stratum, above which it collects much in the same way as if the hard layer had formed the original surface. If this inclines also, the water runs downward over it, just as it would over a sloping rock above ground, only somewhat more slowly.

Thus the innumerable streamlets which are formed by rain on the sides of mountains and hills of permeable surface run partly over the grass toward the valleys, and partly sink into the ground until they meet an impenetrable stratum. The strata in such situations usually keep a direction parallel, or nearly so, to the surface, and the water which reaches an impenetrable layer flows down over it in the same direction as that which runs over the grass above. Often the upper soil is so absorbent that all the water that falls on it sinks in immediately, and the streams in which it descends the slope are entirely beneath the surface. Whatever may be the nature of the ground, the water which falls on it, except the small portion that is lost by evaporation, finds its way, either above or below the surface, to the *thalweg*, or line of greatest depression. In every valley, gorge, ravine, gulley, or hollow, there is thus in rainy weather a water-course either apparent or concealed. If apparent, it runs over the surface of the soil, because it is retained there by an impenetrable stratum; invisible, it exists none the less upon the surface of some impenetrable stratum beneath, covered from view by a layer too porous to be able to retain it at the top.

The commencement of a subterranean rivulet or spring is sometimes in an elevated plain, dry, slightly hollow in the middle, and a little inclined, sometimes at the end of a deeper valley, which forms a kind of amphitheatre. When a spring rises in a mountain tract constituting a single basin, all the first streamlets of water converge to one centre, at the lowest point. If the tract comprises several hollows of unequal depths, one can always be traced, deeper and longer than the others, into which they ultimately empty the streams which they collect.

In order to give an exact idea of the manner in which a subterranean spring is formed below any depression of the ground, it is only necessary to go to the spot during a heavy rain, and observe how the little rivulets of rainwater unite to form the watercourse which for a moment runs over the surface; it may be regarded as certain that the subterranean and permanent rivulets move beneath in the same manner, and that their tributary streamlets follow, in the ground, about the same lines as the superficial waters.

In dry weather, the collection, movement, and accretion of the rain-water streams may be studied, in order to ascertain the formation of underground springs, by careful observation of the ground. When a spring rises at the end of a valley closed at the end, all the little veins of water which run down from the plateaus and slopes above converge nearly as the radii of a semicircle toward the central point of the basin, and there unite to form a spring. The centre of such a basin is always at the foot of the steep semicircular slope which encloses it. From this point the *thalweg* begins, and the rivulet, proceeding from the spring at the head of the valley, follows this *thalweg*, or lowest line, however tortuous it may be, and whether the flow of water is above or below ground. From time to time lateral valleys contribute their streamlets, and the main current usually diverges a little at such points as if to meet these branches.

The subterranean brooks, not being disturbed by artificial constructions, or by excavations and embankments upon the surface of the ground, always follow the true valley bottom, which, in many cases, does not correspond with the course which a surface stream would take, so that, in studying the course of the underground water, any alteration of the surface by artificial means must be noted, and a suitable allowance made for it, which can generally be done without difficulty. If it is desired to sink a well to reach water in a place where the visible bottom of the valley seems to have been changed by adventitious circumstances from its natural position, or where the lower part of the ravine is so filled up as to present a nearly absolute plain, the angle between the two inclined planes formed by the slopes enclosing the valley, should be observed carefully, and the watercourse will be found at their line of intersection. Thus, if the slope of the two banks is equal, the subterranean stream runs midway between them; if one bank is steeper than the other, the stream will approach the steep side in proportion to the rapidity of its slope; and if one of the two banks is a precipice, the concealed brook passes at its base.

The underground channel is also often indicated by temporary appearances of water on the surface. In many places, and always in rocky regions, a heavy rain is followed by an overflowing of the subterranean stream, which rises above its channel, just as a surface river overflows its banks. By observing the spots where the water first breaks out, and sinking a well there, a permanent supply may generally be found, and at a small distance below the surface. Every valley of some hundreds of yards in length, whether wide or narrow, rocky and dry, or nearly filled with alluvial soil, may be assumed with tolerable certainty to be traversed by a subterranean stream, whose course, however sinuous it may be, can be traced with sufficient accuracy by the means just described, and followed step by step.

It does not always happen, however, that all points upon the course of the stream are equally favorable for reaching it. The vertical distance from the actual surface to the water vein varies greatly, and the depth of a well dug at different spots would vary accordingly.

The points where the vein lies nearest to the surface are:

1st. The central point of the first depression in the ground where the original streamlets are collected.

2d. The centre of the amphitheatre at the head of the valley;

3d. The foot of each slope in the line of the *visible* valley bottom;

4th. The approach to the outlet of the valley.

First. When a spring commences in an elevated pasture-land, the point where the water lies nearest the surface is that toward which all the primary brooklets tend which unite to form it. This point can be recognized by its position near the middle of the depression, and because the *thalweg*, or trough, is seen to commence there. If, descending the stream, a well is sunk at some point below, water will be found, perhaps more abundantly than at the spring, through the addition of that brought by lateral tributaries, but it will lie at a greater depth, since the effects of cultivation, the accumulation of detritus brought down by storm waters, and other obstructions increase with the distance from the source.

Second. When a spring rises at the extremity of a valley, enclosed on three sides, the point where the water will be found at the least depth is in the centre of the semicircle which forms the end of the valley. Lower down the trough it will be found by digging, but at a greater depth.

Third. In general, throughout the course of a subterranean stream, the points where it lies nearest the surface are found at the foot of descents. Ordinarily, the longitudinal slope of valleys is composed of meadows, level or slightly inclined, alternating with steep descents or land-slides. These two kinds of surface are analogous to those presented by streams which display by turns rapids and deep pools. Whenever a ledge of rock, a stratum of compact earth, or even a wall, crosses a valley so as to form a dam, there will be above it a gently sloping meadow, formed by alluvium, and below it a steep descent, or dry cascade, which the action of the elements tends rather to erode than increase, so that the hard primitive substratum, and with it the water which flows over it, will be found with less depth of excavation here, than in the places covered with foreign deposits.

Fourth. Where a subterranean spring descends without too steep a fall toward a visible and permanent brook or river, water can always be found by digging near the point where the course of the spring would meet the river, and this water, in case the excavation extends below the river level, will generally be derived from the spring, and not from the river, although it may fluctuate in correspondence with the rise and fall of the river surface.

The most abundant springs, as well as the most easily accessible, are those situated at the foot of a descent, and this point should be approached as nearly as possible, even when it is itself inaccessible.

Under some plains, alluvial or otherwise, water flows in the form of thin sheets, no depression existing suitable for gathering it into a stream. In such places water can generally be found at any part of the surface, but in small quantities.

However, such grounds as a rule comprise several strata of different density, one above another, and each of the harder strata has its own sheet of water above it, so that if a well sunk as far as the first impervious stratum fails to reach water in sufficient quantity, a further supply can usually be found by sinking deeper, until another hard layer is found, or even a third or a fourth. In general, also, these springs become more abundant in descending.

When a mountain or hill is terminated by a ridge, or by a peak, conical or rounded, no water will be found near its top, but if the summit is formed by a plateau, level or gently sloping, and covered with some depth of soil lying above an impermeable stratum, it rarely happens that a spring cannot be found near the middle, or the lowest part of the plateau.

On the slopes of lofty and extensive mountains or hills copious springs are almost always to be found, but they should be sought on the gentle declivities covered with a thick layer of soil, rather than on the sides of steep, rocky cliffs, where, if they exist, they will be scanty and unreliable.

## FRENCH SCHOOL-HOUSES.

We give below some of the rules which regulate the construction and lighting of French school-houses, lately issued in the form of a ministerial decree. These rules have been drawn up after much labor and study of the conditions of the problems which usually present themselves by a commission of able men, and merit serious consideration:

The site for a school-house ought to be central, airy, easy of access, removed from every noisy, unhealthy, or dangerous establishment, and at least a hundred yards distant from existing cemeteries. If the soil is not quite free from moisture, it should be drained.

The area of ground needed for a school-house should be reckoned at ten square metres per scholar, and in no case should it be less than five hundred square metres.

The orientation of a school-house must be determined by the climate and the hygienic qualities of the place where it is to be built.

In towns where the same building is used as town-hall and school-house, the rooms must be entirely separated from one another, and the school-rooms must be on the ground floor.

The relative position of the several buildings of one scholastic establishment must be determined by the orientation, the size and shape of the lot, the amount of direct free light obtainable, and the nearness of neighboring buildings. The school-house and the teacher's dwelling should be built on distinct sites, or at least be independent of one another.

The school-rooms and the covered play-ground, connected one with the other, should be free on at least two opposite sides, so as to receive the utmost light and air. This arrangement, favorable to healthiness, has, moreover, the advantage of facilitating the surveillance of the pupils.

The thickness of the walls should not be less than sixteen inches when of rubble, nor less than thirteen when of brick. Permeable materials, such as half-burned brick, must not be used in construction.

For roofs, tile must be used in preference to slate, and especially to metal.

The ground-floor must be raised two feet above the ground. The ground must be so graded that rain-water will flow away from the building.

If it is not possible to have a cellar under the building, there must be at least air-spaces.

In every group of school-buildings, the boys' school, the girls' school and the primary school (*salle d' asile*) must be distinct, one from the other; but the primary school must not be placed between the other two.

A school-house should never contain more than 750 pupils, divided as follows: boys' and girls' schools, 300 each; primary school, 150.

The maximum number of scholars in school-houses of one room, must not exceed 50; where there are several rooms, the number must not exceed 40.

The floor area should be so calculated as to allow for each pupil between 1.5 and 1.7 square yards, and the capacity of each school-room shall be such as to allow each pupil a minimum of 5 cubic yards.

The rooms must be rectangular in shape.

Lighting from one side only, must be adopted every time the following conditions obtain:

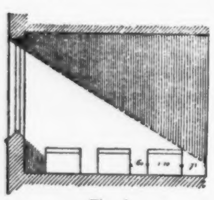



Fig. 1.

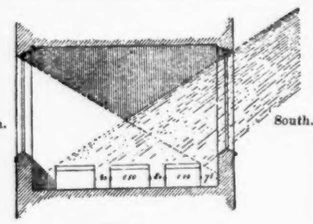



Fig. 2.

1. Possibility of obtaining sufficient light.
2. Proper proportion between the height of the windows and the width of the room.
3. Openings, 3 feet 6 inches by 6 feet 6 inches, in the wall opposite the windows, closed by shutters, which may be used for airing the room, and for the introduction of sunlight during the absence of scholars.

When the light comes from one side only, that side must be the one at the left of the pupils.

When the foregoing conditions cannot be realized, recourse must be had to lighting from both sides; but the strongest light must come from the left.

Windows must never be cut in the wall which faces the master's table, and still less in that which fronts the scholars.

Lighting from the ceiling is forbidden. Windows must be rectangular.

In case the room is lighted from one side only, the window-head must be at a height equal to two-thirds the width of the room. In any case, the under-side of the window-lintel must be on a level with the ceiling.

The window-sill must be cut with a slope on the inside and on the outside (*en glacis*), and must be at least 3 feet 8 inches from the floor.

Whether the rooms are lighted from one side or from several sides, by a single window or by many, the dimensions of these openings must always be calculated so that they will admit light to all the desks.

The mullions separating the windows must be as narrow as possible.

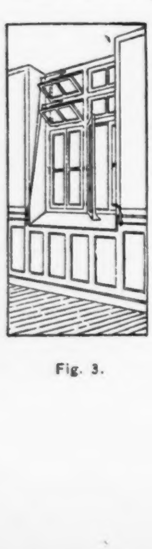


Fig. 3.

The windows must be divided into two parts. The lower part, the height of which must be equal to three-fifths of the whole height, must be a casement window, and the upper part, transom lights opening inwards.

The least height for a room must be 13 feet. If the light comes from one side only, the height of the room must be equal to at least two-thirds of its width plus the thickness of the wall in which the windows are placed.


Fig. 4.

The ceiling must be of plaster, level and uniform. On it must be traced a line indicating the direction of the North pole.

There must be no cornices around the top of the wall.

The angles formed by the junction of the walls with floor and ceiling must be replaced by concave surfaces.

All the walls of the school-rooms must be covered with some substance which will form an even, smooth surface — stucco or plaster, oil-painted. The best color for the wall is the gray tint of flax.

Up to the height of four feet from the floor, in default of wood-work, the walls should be rendered with slow-setting cement.

The floors should be lined with hard-wood parquetry, set in bitumen, when this is possible.

The doors must be of one valve and be 3 feet wide, and, according to the necessities of their uses, may be solid or glazed. Doors of communication may connect two adjoining rooms.

In mixed schools, the boys must no longer be separated from the girls by a partition, but they must be grouped in different parts of the same room; the boys, for instance, nearest the master, and the girls behind them; a space 2 feet 6 inches separating them.

The stoves must fulfil the following conditions:

1. The heating surface must be proportioned to the space to be warmed, so that the average temperature of the room shall range between 14 degrees and 16 degrees C. Each room must be provided with a thermometer, placed at a suitable distance from the stove.
2. There must be a stove for each room, or one stove may serve two adjoining rooms.
3. The stove must draw from the outside the air needed to support combustion and ensure proper ventilation.
4. It must have a water vessel with a sufficient evaporating surface.
5. It must have a double envelope of metal or terra-cotta.
6. It must be surrounded by an iron grating.
7. It must have neither oven nor plate-warmer.
8. It is expressly forbidden to carry the smoke-pipe obliquely above the pupils' heads.
9. There must be a space of four feet between the stove and the pupils.
10. When a janitor has the care of the stoves, their feed-doors must open into the passage-way.
11. Stoves of cast-iron, in which the fire acts directly on the iron, must not be used.
12. The smoke-pipe must be so arranged as to help the ventilation.

A space at least 6 feet 6 inches wide must be left between the front row of desks and the wall, so as to make place for the master's desk.

The desks must never be less than two feet from the wall.

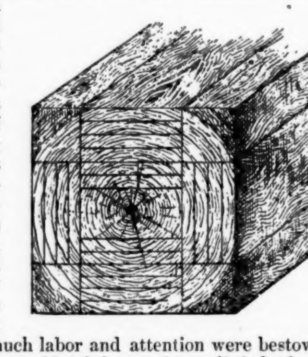
The longitudinal passages between the desks must be at least twenty inches wide.

A space of at least four inches must be left between the back of each chair and the front of the desk next behind it.

## FLOORING-BOARDS.

When in a previous chapter commenting upon the old wooden floors formerly found in the mansions of the nobility, or the houses of the merchants and the higher classes of society, we made allusion to the particular class of log timber out of which were cut the boards of which these floors were constructed; some allusion to the special quality of the logs was necessary, for the reason that similar wood does not now reach us, and it was the peculiar character of the wood that it alone furnished the flooring-boards which, at the period to which we are referring, were held in such high esteem.

For the purpose of substantiating our statement as to the excessive attention which was exercised in the production of a perfectly clean floor, and to better elucidate the method adopted for the cutting up of the logs, we furnish with the present chapter a sectional sketch, showing the mode by which at what may justly be called an extravagant outlay these boards were produced. The sketch to which we refer shows that the logs were cut so as to produce a number of boards, each board having the same relation to the heart of the wood, so that the figure or feather of the grain ran up the centre of the board, and thus produced when laid the highly-figured appearance and perfectly clean floor upon which so much value was set, and for the attainment of which so much labor and attention were bestowed. It should be noted that the heart side of the wood supplied the face of the board, and by this arrangement the figured effect, was obtained. The square centre, or heart of the log (as shown to be left uncut in the figure) was not, in consequence of the usual presence of shakes and absence of figure, used for the purpose of flooring, it generally being employed for small beams, or scantling purposes, and the same remark, in consequence of the attendant sapwood, applies with equal force to the four corner pieces of the log.



To again illustrate our remarks as to the excessive care used for the obtainment of a perfectly clean floor, it will be observed by glancing at the above sketch that in cutting the logs by the plan adopted, fully one-half of the wood was discarded for flooring purposes. No inconsiderable amount of credit is due to the individual whose ingenuity first planned this cutting arrangement.

The practice of builders cutting their redwood boards for joinery purposes from the best Sweedish logs is, we believe, still adhered to in many towns, notably Lichfield, Coventry, and Warwick; and throughout Lancashire a large quantity of yellow pine log timber is yearly converted. The practice, although still largely existing, is gradually dying out, and we fully expect that in the next decade it will be as obsolete as the old floor-laying system now is.

The logs from which the boards forming the subject of this chapter were cut usually averaged from about 14 to 15 inches square, and the boards were cut in various widths, no two widths, however, being used for the same floor. The width of the boards ranged from 7 to 11 inches, and occasionally, though not often the case, boards 12 inches wide were laid; generally, however, 9 inch boards were employed. The first shipments of 7 inch battens were brought over for flooring purposes, and doubtless from this fact has been established what may be considered as the now existing standard size of 7 inch flooring-boards.

The logs were cut up by hand sawyers, and the ordinary frame-saws worked by two men were employed for the purpose. For drinking and profane swearing the sawyers of the eighteenth century were, it is reported, terrible fellows; and their proficiency in the latter accomplishment is said to have been such as might have well fitted them for members of the British army which in Flanders gained such high notoriety. But it was their drinking propensities which caused their employers the greatest trouble, and indeed vexation of spirit, for there was no dependence to be placed on these fellows. In the daytime, when the advantage of a good sunlight invited their labors and should have invoked their energies, these sad souls were most likely to be found in the region of a neighboring or distant tavern imbibing deeply of the essence of John Barleycorn, and from their stronghold they were rarely to be dislodged either by bribe or persuasion. The same evening, perhaps, these "lords of the building trade" might have been found toiling hard the night through at the saw-pit, the top-sawyer lighting his strokes by the glare of a lantern held betwixt his knees, and the pit-man his, by a tallow candle stuck upon his hat. When the boards had been thus laboriously produced the process of planing them followed.

It was customary in those days for a builder, when he had secured a contract, to erect a wooden shed, under the cover of which to have his boards planed, or, as it was in those days termed, "flogged."

It was the lowest grade of workmen only who undertook the labor of "flogging" boards — those, in fact, who by disposition, or in consequence of their unsteady habits, were unfitted or reluctant to be bound down to continuous daily labor. All the work was done by piece labor, and so laborious was the work considered that, as we have written, it was customary to term it "flogging" boards, it being considered the most excessive portion of the joiner's work, and the next most laborious, the making of mouldings, was termed "striking" moulds, a term which has been retained and is customary to the present day.

No first-class workman would condescend to do such work, it being considered to be decidedly derogatory, in consequence of the number of drunken and dissipated wretches employed at it. Sometimes it happened that a young hand, an apprentice perhaps, "just out of his time," would be induced by the prospect of the large wage to be earned, to join a gang of "floor-floggers." Unlike his fellow-laborers, it might happen that the young man was of steady and industrious habits, and so, in spite of the severe labor, he would stick to his task; such a case was beknown to the gentleman who has furnished the writer with the notes from which this chapter is formed. This young man stuck to his work for six months, but at the expiration of that time, although he was at the commencement young, strong, and vigorous, his frame was completely shattered; nor did he afterwards recover, but died at a prematurely early age.

The "floor-floggers" were noted for having humps on their backs, and these malformations were jocularly termed "Billys," and the shipwrights of the present day are usually more or less similarly affected, and among themselves they speak of the malformation as "Charleys."

The work of planing the boards by hand for a face side was sufficiently laborious, without adding to it the additional labor of thicknessing the boards. To obtain an even floor, they were, when thicker than required, cut away at the part where they crossed the joist with an adze, an implement which was formerly of great importance to the joiner, but which has now almost gone out of date.

These facts remind us of the unutterable benefits conferred upon the joiner by the introduction of steam-power planing machines, and yet the advent of these machines was greeted with the most extreme disfavor by joiners generally.

The greatest care was exercised when laying the boards so as not to betray the presence of nails, and to attain this desire the boards were fastened with dowels.

By these different arrangements a perfectly clean floor was obtained, and the presence in the boards of a strongly marked grain, or feather, furnished no inconsiderable amount of beauty to the floor; but the effect was unfortunately gained at the cost of utility, for the hard part of the grain squeezed or was trodden into the softer part of the figure, and then splinters were raised, which were not unfrequently the cause of grievous accidents.

Concerning these floors, once so general, but now, through the introduction of steam-power machinery, save for the examples to be found in old houses, obsolete, all has been written. Reminded, however, by their excessive cost, it is interesting before closing the chapter, to refer to records of the early part of the present century, and see what the cost of wood then was to the consumer.

Fifty years ago we find from the books of an inland timber merchant who carried on business in the midland counties that the price of a deal 21 feet long and 3 × 11 inches was a guinea, or at the rate of £36 per standard; there was no selling to the consumer by the standard in those days, it was a period in which timber merchants tranquilly made fortunes. Prices varied much in various towns and districts; thus at Newark-upon-Trent the market value of wood was higher than at the neighboring town of Grantham, and it is on record that a poor maker of the long splints of wood which were then dipped and used as matches, dissatisfied at the prices demanded for the wood he required at Newark, essayed the task of carrying a 3 × 11 inches deal from Grantham, reaching which town, however, like Dick Turpin's mare, Black Bess, he completed his task, but dropped down dead at the end of his journey. — *The Cabinet Maker.*

## THE ILLUSTRATIONS.

CHURCH, NETHERWOOD, N. J. MESSRS. ROSSITER & WRIGHT, ARCHITECTS, NEW YORK, N. Y.

THIS little church, the upper walls of which are covered with red tile, was built this year for $4,000.

SCHOOL-HOUSE, COLD-SPRING-ON-HUDSON. MESSRS. ROSSITER & WRIGHT, ARCHITECTS, NEW YORK, N. Y.

COTTAGES FOR THE FOREST FIBRE CO., AND ROMAN CATHOLIC CHURCH, BERLIN FALLS, N. H. MR. F. H. FASSETT, ARCHITECT, PORTLAND, ME.

THE "DEANERY" OF THE EPISCOPAL THEOLOGICAL SCHOOL, CAMBRIDGE, MASS. MESSRS. WARE & VAN BRUNT, ARCHITECTS, BOSTON, MASS.

## WHERE AND HOW TO PLACE A HOUSE.

ON the location of a house much of the comfort and happiness of the occupants will depend; and yet this very important subject rarely receives attention. There are comparatively few who ever give it a thought, and the mistakes that are made in this way are usually not discovered until it is too late to rectify them. When the house is completed, the owner sees that the design has been faithfully carried out; still he is not quite satisfied; in fact, he feels there is something wrong, but what it is, or how it is to be obviated, is past his comprehension. Some day a friend, more observing, or who has bought his experience, asks why, in arranging his house, he put the best rooms where neither the sun nor the summer breeze can reach them. Then the whole thing comes to him, and he finds that he has not only turned his back on the pleasant outlook, which has always been one of the attractions of the place, but that he has also sacrificed what would have been a continual source of enjoyment, to some fancied advantage of a short cut to the road.

One of the first questions an architect should ask, when his client talks of building is: "Where is the house to be located?" To this question there frequently comes the reply, "Oh, I have not yet purchased a site, I thought I would get my plans first, and then, if I think as favorably of building as I do now, I will buy a lot and go on with the work at once." One could hardly make a greater mistake than to proceed in this way. The house should be adapted to the site, for the site cannot be made to conform to the house. By accident — one chance in a thousand — the design selected may happily meet the requirements of the site, but the probabilities are, that it will be found to be wholly unsuited when the purchase of land has finally been made; in which case it must be abandoned. If carried out, the step will be a source of regret in after years.

We are very dependent on our surroundings, far more so than we are aware. We love to look out over a pleasant sweep of country, out on the ocean, and on wooded hills; we like the sunshine and take no pains to exclude it from our dwellings; we hail its advent in the morning, rejoice in its noonday glories, and follow it with loving eyes as it sinks to rest in the evening. It never comes too early, and its stay is never too prolonged; the young are gladdened by its presence, and the old bathe in it and are refreshed. Cold and cheerless is the room that is never enlivened by its presence, and the spot is unhealthy on which it never beams. And so of the prevailing winds. We want to get away from the wintery blasts, but love to open our doors to the breath of spring. A piazza on the north side of a house is a useless appendage. There it stands, neglected and uncared for. Even the vines that we plant around it are slow to send forth their tendrils, and the robin and swallow will never build beneath its roof if they can find a shelter elsewhere. Our winters are too severe to be disregarded, and the summer is too short for us to lose any of the delights that are only to be enjoyed from a southern exposure.

There is one other point connected with the location of a house. I would have with every dwelling a patch of green-sward, and room for a few shrubs and flowering plants. All this, I am aware, involves an outlay, and every prudent man will so govern his expenditures that they do not exceed his means. But if he builds at all, it should be where he can have breathing room, and a few rods of land that he can improve by planting. Land near to great centres may be too high to admit of his indulging his taste in this way; in which case, let him push out a little on the line of improvement, and secure a larger patch, which will increase quite as fast in value as his capital would pile up, if put out at interest.

Detached houses in the suburb are far better than rows of brick houses in town — the latter, all run together, line upon line, with scarce an open place in miles of streets — a dull, dead monotony, an interminable uniformity; with no sign of verdure, save a few sickly trees, no hedgerows and fields, but one dusty way, and one odor from imperfectly ventilated sewers, unwashed gutters and escaping gas. Those who live in such quarters come and go, day in and day out, with the same listless air. No man takes an interest in aught around him, for no one is happy and contented; and while all would appreciate a change, there is no one to lead the way. Bad as this is to one who has become hardened to it, it is worse to one who has known the charm of living in a rural neighborhood. Southey wrote to his wife from Norfolk, in anticipation of a stay in London:

"To walk abroad and never see green fields, or running brooks, or setting sun! Will it not wither up my faculties like some poor myrtle, that in the town air dies in the parlor window?"

But give to every toiler a little patch beyond the confines of a city, and life for him and his family will have new attractions. In a modest building, with his wife and children to help him, he will take pleasure in beautifying the spot he has chosen for his home. So employed, he will be a better and a happier man. Champlin.

## SLOW-BURNING CONSTRUCTION.

Brookline, Nov. 28, 1880.

To the Editors of the American Architect:

*Dear Sirs,*— I have read, with interest, your remarks upon the improvement in the construction of ware-houses, and the greater safety from destructive fire that may ensue.

There are two or three points upon which I shall take issue with you.

1st. The expectation of any intervention of the underwriters. Outside the mutual system, it is the business of the underwriter to take the chances on buildings as they may be, and to seek for a profit on the law of averages. This is all you may expect.

2d. Permit me to give you two examples, one of a loss saved and one of a loss made, which mark a difference in construction that can only come within the province of the architect.

In the one case, the measures by which a heavy loss was saved could only have been assured by the careful supervision of the architect. In the other, the loss was incurred for want of that necessary forethought and supervision.

Premising that the present fashion and the requirements of owners and tenants make it necessary for the architect to plan office buildings and dwelling houses with hollow walls, furrings, hollow partitions, and ceiled floors, the question is, What may be done to assure safety?

The two examples may give some clue to the answer.

No. 1. Fire occurred in an office building of four stories and a finished attic. It caught in the hollow floor of the upper story, where the cause could only have been combustion from the contact of the steam-heating pipe with the floor joist; or from the spontaneous ignition of combustible material carried into the hollow space by rats or mice,— a very common cause of fire. The fire passed about forty feet horizontally in the floor, and on one side reached the space behind the plastering of the outer wall, between the furrings to which the laths were nailed; but the architect had taken the unusual precaution to put in cross or horizontal furrings between the uprights, and of the same thickness; *on each of these horizontal lines he had caused a thick coat of mortar to be placed.* The fire burnt up to the first horizontal line, and was there stopped by the mortar, burning out into the room, but not passing up any further. It was easily extinguished, but, except for the mortar stop, it would have gone into the hollow roof, where it would have done great damage, and perhaps have caused the destruction of the building. The actual damage was very small.

No. 2. Fire occurred in a first-class dwelling house of unusually thorough construction, in which every top floor and stairway was laid in mortar, and most unusual precautions had been taken with a view to safety. The house was tightly closed with shutters, the family being absent. Mechanics had been at work on the drains; the floor boards of the basement were in part removed, and the fire began upon or under the basement floor, next the party wall, where it probably smouldered for some time before it was discovered.

The usual and useless furrings had been used on this party wall, and the mortar of the floors and stairways stopped *on the outside of these furrings.* The small vertical space behind the plastering and behind the furrings, was open from basement to attic, as it usually is. Into this space the fire worked, and when it was discovered it had reached the *fourth floor.*

It was very difficult to extinguish, and it was a very dangerous fire, because a gale of wind was blowing. The greatest care and skill were used, by the firemen, to exclude air and wind as much as possible, and the damage was limited to about $7,500 on the house, and $2,500 on the contents.

How much would it have cost to put mortar stops behind that furring, as in example No. 1? and whose business was it to do it? How much would this precaution have saved?

Permit me, also, to take issue with you on another point, to wit: the relative cost of safe construction.

The *upper stories* of our high city buildings need the most attention, as they are out of reach, and are occupied for hazardous purposes.

If you desire to examine one of the most expensive buildings now in process of construction in Boston, in which one of the most dangerous methods of construction is being used, you may identify it by the solid construction of the lower stories, and by the iron girders below; as you pass higher, you will observe that common floor joist is substituted for iron, and you can now see, before the front store screen is carried any higher, the section of the roof. This roof promises to be an example of all that is bad in a flat roof, whether safety or utility be considered. It has the usual joist construction, and is covered with thin boards; from the joist, wooden hangers about two feet long, carry the wooden frame-work to which the lath and plaster will be fastened. Here you will have the concealed space of about two feet over the whole area of the building, and it is becoming evident that the usual vertical flues behind sheathing or in partitions will connect with this great cavity situated at the most dangerous point in the building, in which fire will be fully protected from water. If you discover this example by this description, please compute the relative cost of this roof as compared to the open timbers wide apart, and the solid deck of not less than two-and-a-half inch plank, which mode of roof construction makes the upper room of the factory often the best and most comfortable; and when you have made your estimate, see whether the rules of common sense and safety require a heavier cost than the methods of stupidity and danger. Very truly yours, E. A.

## THE TENEMENT PROBLEM.

Boston, November 29, 1880.

To the Editors of the American Architect:

*Dear Sirs,*— In July last, I ventured to broach the tenement question in the columns of the Boston *Sunday Herald*, and in the latest issue of that paper the subject crops up among the editorials.

In a city which lays claim to much intelligence and culture, it is rather surprising, to a foreigner, to find the homes of the artisans modelled on such plans as they are. This is the more inexplicable when we know that there are numerous associations for various purposes — charitable and otherwise — from which we might expect some development by coöperation towards providing the artisan class with better dwellings.

The houses built by people to sell, are suited for classes higher in the social scale than the workman, and to the eye of a cursory observer the supply seems quite equal to the demand, but for other classes, there is literally no provision. I have heard it said, that it will not pay to erect specially arranged dwellings for artisans and others; but it is surely reasonable to suppose if a large house — sublet to half a dozen tenants, who have their rooms scattered about in all sorts of inconvenient positions, from garret to basement — brings in sufficient rental, bad enough as the arrangement is, the same cubic space, if subdivided in a convenient form for each tenant, would bring the same if not a higher rental.

The *Herald* informs us that "For years past a number of prominent Bostonians have interested themselves in this subject, and have given a great deal of time and thought to the work, but for one reason or another, the most sanguine of them can hardly assert that definite and satisfactory progress has been made." Perhaps, if the artisans themselves had taken hold of the work, instead of the "prominent Bostonians," there might have been a greater measure of success. One would like to hear why the work did not make satisfactory progress. I cannot believe that any workman prefers the present arrangement, to the better one of having a distinct habitation to himself. In the course of conversation with others, and from general observation, I feel sure that improved dwellings would be rented at once.

In concluding, the *Herald* remarks, "though the (present) tenement-house system saddens those who have occasion to examine into its workings, (this is well said,) it continues to grow in Boston with unabated vigor." The vigor of the growth may be attributable to the increased number of workmen in the city, and the result may be one not of choice but necessity, there being no other buildings suitable.

It only wants some one to take the initiative and build well-planned groups of cottages or tenement-houses, and I think some aid to such reform might be given by architects placing plans of improved dwellings before the public and those interested in the subject.

Yours truly, R. B.

## THE FINISH OF INTERIORS.

The employment of natural woods in the decoration of interiors is now receiving marked attention from architects and house-owners, and the skill of the carpenter, the turner, the carver, and the painter or finisher is oftentimes put to severe tests in satisfying the requirements of the designer. These artisans, then, in order to successfully carry out his plans, should work in harmony, each striving to so prepare the way for his fellow-artisan that the latter's progress toward excellence of handiwork may be as little difficult as possible.

What if the framer makes his joists and beams out of line, or otherwise askew? The joiner then must either put in extra labor or make bad work. He, too, is required to leave a perfect surface for the finisher — well-connected joints, neatly turned beads and corners, and a proper disposition of the carved and turned pieces which go to make the whole; and after all this has been done — after the last nail has been driven and perfection thus far secured, the painter, varnisher or finisher steps in with fully as large a share of responsibility. How easily one particular coating of varnish, paint or whatever, may cause almost the complete ruin of the effect aimed at; not alone in the way of harmony of colors, but by the manipulation of the tools and materials with which the work is done. The carriage-painter — and none can excel him in the production of good work — is frequently beset with troubles in his coatings, and these he has quite properly called "deviltries;" for it would appear at times as if the bad work was caused by the "old boy" himself. "Deviltries," then, are to be avoided, if possible, and we will endeavor to explain some of them, their cause, action or appearance of the work, and how to guard against them.

The employment of inferior materials is of course not to be thought of in this connection, for it is well known that good work cannot be done with poor materials, even if some good workmen can work with poor tools. We sometimes see a varnished surface cracked or broken up into parts more or less minute, as a looking-glass when fractured, and this is one of the most common afflictions or "deviltries" attending the use of varnish. The causes, which are several, may be enumerated as follows: 1. By the application of a coat of varnish over a surface of varnish which is very elastic or not thoroughly dry; 2. By destruction of the oily properties of the varnish through the deplorable habit of thinning the varnish with turpentine; 3. By the action of ammonia or other alkalies, often innocently brought in contact by washing with strong soda or soap; 4. By the loss of the oily properties of the varnish by absorption of the wood or porous under-coating.

The cause last mentioned is, we believe, the most frequent one, and at the same time the one most easily prevented. Dependence upon shellac varnish or the many preparations of starch, flour, electro-silicon, etc., for filling the grain, cannot always be made, as evidence of ill effects by absorption is often met with, where other causes were absolutely impossible, and recourse is had to the carriage-painter's infallible safeguard against absorption. He employs material which closes the pores of the wood against dampness, which renders the foundation excellent for holding up subsequent coatings of either paint or varnish against absorption of the oils from the varnish, which allows the same to remain with the gum on the surface, oxydizing or turning to a gummy or rubber-like substance, which binds the copal gum to the surface and secures elasticity, a feature of prime importance. This is the fundamental principle of that system of painting known as the "American method of coach-painting," and by which the best and most durable mirror-like surfaces are formed on carriages. It may be said the carriage-painter and varnisher aim at greater durability than the house-painter, for the work of the former is expected to be acted upon by the most severe and extended exposure to the elements, while the latter's work is generally unexposed to these destroying agents; consequently, no such care need be taken to secure lasting results. But this is no excuse. Good work is far more economical than medium or fair work, and the cost, when the labor is done properly and the proper materials are used, is no greater, in fact is sometimes less, than even fair work in which no troubles occur.

It is not only our aim to make good and durable work, but to guard against the injury to the work of the artisans, — carpenters, joiners, turners and carvers, — who preceded in the embellishment of the interiors. What if the varnish laid on cracks, and thus disfigures the wood-work? Is that justice to those who carefully prepared the surface for the painter, and is it not likely that anathemas will be poured on the head of the careless varnisher — for no other term can be applied to a workman who will, after one mishap of the kind, go on without that thorough investigation, which would make future operations secure from cracking?

There are several other "deviltries" attending the work of the varnisher, such as the "running down" or "sagging" of the varnish, and these, tending to destroy the appearance of the work, to say nothing of the detriment to future operations, such as rubbing to polish, etc., should be carefully guarded against. The principal cause of runs and sags is the careless or ignorant manner of handling the brush, or the brush may not be of the proper shape or quality of bristles, both of which difficulties may be overcome by a little experience and more care. Varnish, no matter of what grade, should be put on plentifully, and then be brushed only sufficiently to lay it evenly, the most particular care being exerted in "cleaning up" around mouldings or projections from the main surface, for it is here that runs may be expected. If the varnish be rubbed too much — that is, worked over with the brush — it will "set," or begin to thicken, and the marks made by the bristles will remain in the surface, causing it to appear rough or streaked.

"Pitting," *i. e.*, the small indentures similar to those in the skin of a person who has had small-pox, is caused by not properly preparing a varnished surface to receive a second coat of the same, or by adding oil to the varnish, either by mixing it with the varnish or by using a brush fresh from an oil bath. The gloss of varnish should be removed by rubbing with pulverized pumice-stone and water, or by other means, before a second coat is applied.

Sandy or specky varnish is more often caused by cold than by any foreign matter in the varnish. When varnish is chilled, either by being put on in a cold room, or by exposure of the can containing it to dampness and cold, the particles of the dryer used in its manufacture separate from the oil and gum and cause a "specky" appearance; a good warming of the material, by setting the can near a stove, will generally correct this fault.

There are other "deviltries" of which we might speak; but we have mentioned a sufficient number to show that in the attempts of the painter or varnisher to co-operate with the other artisans in producing good results, he bears a heavy responsibility, and in order to lessen it and to reach a plane of excellence where he can look at the "old boy" with contempt for his interference, and snap his fingers at "deviltries," he must keep up with the times; and in no better way can this be done than by devoting a portion of his spare time to the reading of one or more of the periodicals treating upon subjects connected with his business. F. B. GARDNER.

## NOTES AND CLIPPINGS.

THE COMPETITION IN INTERIOR DECORATION. — We desire to remind intending competitors that their drawings are due at this office on or before December 11. Drawings received after this time will be ruled out of competition, but will not for that reason be denied publication.

FICTITIOUS SCHOOL OF DESIGN. — The post-office department forbids the delivery of money orders or registered letters to J. B. Gaylord, the manager of a fictitious school of design at Chicago.

MURAL PAINTING. — Mural painting, says a late critic, must be carried out in accordance with one of two principles. "It must either take the spirit of the architecture into full account and be content to carry its expression to a greater height than structural forms can reach, or it must entirely ignore its surroundings and proceed exactly in the same way as an artist working in his studio, choosing his own canvas and his subject, and knowing that his picture will have no frame but that which he himself puts round it." The latter system is not mural painting at all.

A TANK BURST. — A despatch states that on the afternoon of Nov. 23, the large water tank at the Dayton, O., Bolt Works, on Front street, burst, letting out 179 tons of water, and doing great damage. The tank was built last summer, and was sixteen by eighteen feet. The cause is attributed to the freezing of the water. The engineer was in the immediate vicinity, and narrowly escaped being deluged. The greater part of the water went into the river. The loss is estimated at about $1,500.

SCANDINAVIAN FLOORS. — The chamber floors found in the northern parts of Sweeden and Norway are laid with boards cut from the tree without being sawn parallel, and consequently retaining all the taper of the tree. The edges of the boards are tongued and grooved, and the joiners who cut the tongues and grooves, work in pairs, one pulling and the other propelling the tool that does the work. In consequence of the boards tapering, they are laid with a broad and narrow end meeting alternately, and thus a dovetail is effected along the whole length of the boards, and a very curious appearance is the result. — *Timber Trades Journal.*

A SWIFTER LOCOMOTIVE. — A new and improved engine, constructed at Fort Wayne, is attracting considerable attention. It is the invention of Mr. Engineer Fontaine, of Fort Wayne. While running as an engineer on the above-mentioned road, he was inspired to make his invention by hearing of the increased demand for fast trains. He perfected his plans, and with some difficulty secured sufficient backing to procure the construction of his improved engine, which was completed on Oct. 20. At its first trial it displayed a speed of seventy-five miles per hour, so the inventor says, although the bearings were new and the pumps not working well. The engine is thus described in the Fort Wayne *News*: "In order to describe the Fontaine idea so that everybody may understand it, we shall forbear using technical terms, and compare this engine with the ordinary standard locomotive. In the latter, as everybody knows, the power is applied to the large driving-wheel by a rod connecting directly with the cylinder, and from this wheel another rod extends back and connects with a second driver. In the Fontaine engine, the power is applied by a single rod on each side running from the cylinder to a large drive-wheel located immediately above the front driver on the ordinary locomotive. The upper drive-wheel is of the same diameter as the lower, but it bears upon a flange several inches smaller than the lower driver, and thus brings into play the principle of large and small pulleys in the driving of ordinary machinery. The application of power to a wheel bearing upon another wheel, must strike every one who has any knowledge of mechanics, as being of immense advantage over its application to a wheel on a dead level and with the weight of a standard locomotive on its axle. Another incalculable advantage lies in the fact that the Fontaine locomotive has no dead-centres, for the lower driver acts as a huge balance-wheel, by its momentum carrying the upper wheel past the points in its motion where power is lost. The first test was made with twenty-one cars, carrying 474 tons and 200 pounds of freight. With the utmost ease the Fontaine drew them the entire length of the yard, from the St. Mary's River bridge to Hanna street, a distance of fully a mile and a half. At the second test seven cars were added, and with twenty eight cars, bearing 631 tons and 1,220 pounds, the same trip was made. The third test was made with thirty-three cars, 734 tons and 1,059 pounds, and this also was successful. Finally thirty-nine cars, with 862 tons and 650 pounds, were drawn with ease. These tests demonstrated that, for freight purposes, the Fontaine engine is as powerful as any standard locomotive of her size, and, having this quality, her speed is conceded to be greater than that of any engine ever made."

The First Saw-Mills in England.—The old practice in making boards was to split up the log with wedges, and, inconvenient as the practice was, it was no easy matter to persuade the world that the thing could be done in any better way. Saw-mills were first used in Europe in the 15th century, but so late as 1555, an English embassador, having seen a saw-mill in France, thought it a novelty which deserved particular description. It is amusing to note how the aversion to labor-saving machinery has always agitated England. The first saw-mill was established by a Dutchman, in 1663; but the public outcry against the new-fangled machine was so violent, that the proprietor was forced to decamp with greater expedition than ever did Dutchman before. The evil was thus kept out of England for several years, or rather generations, but in 1768, an unlucky timber merchant, hoping that after so long a time the public would be less watchful of its own interests, made a rash attempt to construct another mill. The guardians of the public welfare, however, were on the alert, and a conscientious mob at once collected, and pulled the mill to pieces.—*The Iron Age.*

Paraffine as a Wood Preserver.—A German scientist recommends paraffine as an efficient means of protecting wood against damp, acids and alkalies. The wood is first well dried, and then covered with a solution of one part melted paraffine in six parts petroleum, ether, or bisulphide of carbon. The solvents evaporate quickly, leaving the paraffine in the pores of the wood. Great care must be taken in the use of this preparation, since paraffine, as well as petroleum, ether, or bisulphide of carbon, is very inflammable; and even the vapor of the two last mentioned substances, if mixed with air, may give rise to dangerous explosions. Paraffine melted, with equal parts of linseed oil and rapeseed oil, is also very useful to protect iron from rust.

A Roman Amphitheatre at Altofen.—On September 26, at Altofen, Hungary, an old Roman amphitheatre was discovered by Herr Charles Torma. The discovery has attracted considerable attention, as the excavations made on the site have shown that the amphitheatre of Aquincum surpasses that of Pompeii in width, height, and length. For, while the small axis of the inner ring of the structure at Pompeii is thirty-nine metres and the great axis sixty-nine metres, the axis of the Aquincum theatre measures respectively, fifty-one and eighty metres. The remaining dimensions are of similar proportions. Some huge pieces of the main walls have been laid bare, while a whole system of thinner walls, parallel to the former, the so-called "baltei" with the "cunei," have come to light. Only the southern part of the theatre has been excavated; the northern part, situated on a little hill, contains the main entrance, and some other interesting features. A little distance to the west of the theatre, Herr Torma hopes to find the foundation walls of the Temple of Nemesis. The remains of a Roman amphitheatre have also been lately discovered at Schneckenberg, near Pesth.

A Monument to Christopher Columbus.—The San Domingo Congress has passed a decree that, considering the proofs sufficient that the remains found in the cathedral on September 10, 1877, are the remains of Christopher Columbus, a monument to enshrine them shall be erected at the capitol. All American Governments are solicited to make subscriptions therefor, the Government of Santo Domingo contributing $10,000.

A Large Stick of Yellow Pine.—A stick of yellow pine lumber, twenty-eight inches square, and sixty-two feet long, was sawed lately in New London, Conn.

# Prospectus for 1881.

During the past year the *American Architect and Building News* has adhered closely to the course which it has followed from the beginning, and its progress has been in a high degree satisfactory. It will be the endeavor of the publishers during the ensuing year to maintain the present character and quality of the journal, while they seek to attain for it an ever higher degree of excellence. To this end those features of the journal which in the past have been found acceptable to its subscribers will be continued in the future.

So far as depends on the editors, the present style and character of the published contributions will be maintained, and they will sedulously seek what may prove of most interest and permanent value to their readers. Even at this early stage of preparation for the coming year, they have made the following arrangements:

Dr. Hiram A. Cutting, State Geologist of Vermont, has agreed to furnish a series of original papers on the Character and Properties of the Building Stones in use in this country, which will give, in comprehensive form, certain technical information which can be found only in books not usually read by architects, together with much original matter, the result of long personal observation, experiment, and research.

Mr. Howard Ellis, a lawyer of repute, and editor-in-chief of the *Reporter*, has consented to report for the *American Architect and Building News* all important Legal Cases, both domestic and foreign, which affect the interests of architects and builders, whether they may arise between themselves, with owners or with the general public. These papers will be treated with legal accuracy and yet in that more intelligible style which is called "popular." It is thought that these papers will go far to supply a want that has long been felt by the profession.

The important matter of Decoration will be treated by Mr. Charles A. Cummings, F. A. I. A., in a series of fully illustrated papers, which will take up each historical style separately, showing its characteristics and its connection with preceding and succeeding styles.

It is probable, too, that the competitions in Interior Decoration, with money prizes, will be continued during the year. To a certain degree this will be influenced by the number and character of the designs submitted in the first competition, which closes December 11, 1880, so that the existence of this feature is largely dependent on the good-will and interest of the profession itself.

An exhaustive series of papers, amply illustrated, on the methods and processes of construction employed in this country, with explanations of the difficulties that arise in the daily practice of the American architect, will be contributed by Mr. Theodore M. Clark, A. A. I. A.

It is the intention of the editors to devote more attention to the selection of the illustrations for the journal, a task which the rapid and marked improvement in draughtsmanship in this country during the past five years will make more gracious than it has been hitherto.

The quadruple Detail Sheets will continue to be published with the first issue for each month, and an endeavor will be made to give to these monthly numbers the greatest practical value, so that students, draughtsmen and builders, who, for different reasons, are unwilling to subscribe for the complete yearly issue, may, by subscribing for the twelve monthly numbers, at $1.75, benefit by the publication in a way that would be otherwise impossible. So far as possible these twelve numbers will be complete in themselves, and in them alone the papers by Mr. Clark will be published.

A new interest will be lent to the illustrations by the sketches of old Scottish Domestic and Ecclesiastical work, which are to be contributed by Mr. John W. Small, F. S. A. Scot.

Another feature that will prove of much interest to subscribers without the limits of the profession as well as within them, will be the Heliotype prints from nature, similar to the illustration of the Boston Museum of Fine Arts, published in the *American Architect and Building News* for October 30, 1880. These prints will be published with such frequency as circumstances may suggest, and will by themselves alone be worth the subscription price.

To the contributors who have so ably seconded their endeavors in the past, the editors would make their grateful ackowledgments, and at the same time would assure them that their assistance in the future will be equally appreciated.

## BUILDING INTELLIGENCE.

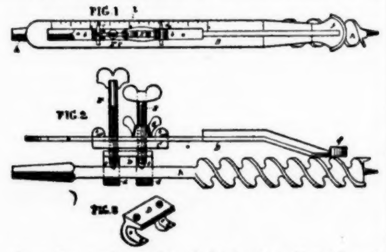
[Reported for The American Architect and Building News].

[*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.

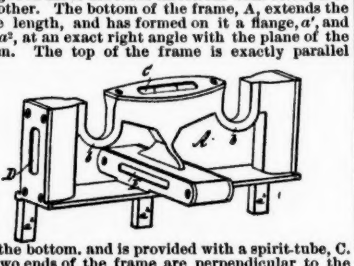
[*Printed specifications of any patents here mentioned, together with full detail illustrations, may be obtained of the Commissioner of Patents, at Washington, for twenty-five cents.*]

232,851. BORING-BIT GAGE. William F. Rutter, Atlantic City, N. J. This invention consists of an adjustable gage-bar, having a foot adapted to bear upon the surface of the wood to be bored, to arrest the action of the boring-bit when the hole has been bored to the requisite depth, in combination with the bit and clamp for connecting the gage-bar with the bit and an index-slide and set the confining screws, the bar having a longitudinal slot, with which lugs of the index-slide are connected, whereby the quick and accurate adjustment of the gage is effected. A is the brace-bit; B, the gage-bar; C, an index-slide, and D,



a clamp for confining the whole in the adjusted position of the bar by means of the screws E and E′. The bar, B, has a longitudinal slot, *a*, which receives the lugs, *b b*, of the slide, C. These lugs have index-points, *c c*, so that the bar may be adjusted with them, pointing to the figure or fractional part of the scale, Z, to indicate the depth of the hole to be bored. The clamp, D, has projections, *d d*, which form openings, *e e*, to receive the shank of the bit, A. The foot, *f*, of the bar, B, is projected toward the side of the bit, so as to nearly or quite touch it, the adjustment in this direction being regulated by means of the nut, G, on the screw, E, and the adjustment of the latter in the slide C by screwing it further through the slide or unscrewing it outward from it, as may be required, and the screw, E′, being regulated by unscrewing for said adjustment, and afterwards screwing it up to hold the parts firmly in their adjusted position.

232,982. SPIRIT-LEVEL. William Langdon, Upland, Penn. This invention consists in a peculiar form of the stock of the instrument, and in the combination and peculiar arrangement of a number of spirit-tubes, whereby provision is made for using the instrument in various positions. A is the stock, cast in one piece of metal. It is provided with recesses for spirit-tubes, arranged in three different directions with relation to each other. The bottom of the frame, A, extends the entire length, and has formed on it a flange, $a'$, and lugs, $a^2$, at an exact right angle with the plane of the bottom. The top of the frame is exactly parallel



with the bottom, and is provided with a spirit-tube, C. The two ends of the frame are perpendicular to the top and bottom, and are provided with spirit-tubes, D D. Between the top and bottom, and midway between the two ends, is a casing containing two spirit-tubes, E E, arranged transversely of the frame, and at right angles with its length, and with the tube C, and also at right angles with the tubes, D D. When used in the position shown, the tube C is horizontal and parallel with the length of the frame. The tubes, E E, are also horizontal, but they lie transversely of the length of the frame, and the tubes, D D, are vertical and at right angles with the tube, C, in one direction and the tubes D in another direction. In this position the tubes C and E E indicate both the level and the plumb. The flange *a* and the lugs $a^2$ provide a convenient means for applying the instrument to a corner, either horizontal or vertical, in order to indicate at once both a level and a plumb surface in one position, or two plumb surfaces in the other position.

234,645. WATER-HEATER. — David K. Allington, East Saginaw, Mich.
234,647. METAL CAP FOR CHIMNEYS. — James Bates, Baltimore, Md.
234,660. FILTER. — George W. Dawson, Indianapolis, Ind.
234,661. THE SAME.
234,669. MORTISING CHISEL. — Richard Hackett, Oshkosh, Wis.
234,686. BORING TOOL. — Frederick Pentlarge, Brooklyn, N. Y.
234,689. PIPE-CUTTER. — Andrew Saunders, Yonkers, N. Y.
234,693. HOLLOW AUGUR. — George N. Stearns, Syracuse, N. Y.
234,703. HANGING DOORS. — William F. Beery, Nodaway, Iowa.
234,759. WOOD SCREW. — John Eckford, San Antonia, Texas.
234,764. BORING MACHINE. — Domaneco Forniraseo, Belton, Texas.
234,828. FIRE ESCAPE. — Thomas Wherritt, Cynthiana, Ky.
234,833. ARTIFICIAL STONE. — George W. Mason, Sharon, Penn.

## SUMMARY OF THE WEEK.

### Baltimore.

BUILDING PERMITS. — Six building permits have been issued since the last report, only one of which is of sufficient importance to be mentioned: —

John Hubner, 6 three-st'y brick buildings, s w cor. Hill and Bloom Sts., five to be 16′ front; one, 18′front.

### Boston.

BUILDING PERMITS. — *Brick.* — *Berkeley St.*, near Columbus Ave., for O. N. Wentworth, 1 tenement-house, 42′ x 80′, four-st'y; Rumery & Maxwell, builders.

*Wood.* — *Wales St.*, near Blue Hill Ave., for Mrs. Francis W. Newhall, 1 dwell., 30′ x 34′, two stories, pitch roof; Manuel Silva.

*Pope St.*, near Chaucer St., for Henry M. Bartlett, for storage of rakes, 100′ x 100′; J. E. Potter, builder.

*Cambridge St.*, rear of, rear Everett St., for John W. Hollis, crimping-machine works, 40′ x 125′; Jacob W. Berry, builder.

ALTERATIONS. — The Freeman Place chapel is being re-decorated and fitted with new altar and sanctuary, for the use of the French Catholic Society of "Notre Dame des Victoires," under the direction of E. A. P. Newcomb, the architect of their future church and Abbé's residence.

Mr. Louis Weissbein, architect, is remodelling the front of the Pilot Building, on Boylston St.

ARMORY. — The members of the first corps of Cadets are now engaged in procuring subscriptions for a new armory building, to contain a hall large enough for battalion drill, the building and land to cost about $150,000, of which sum the Cadets themselves will subscribe not less than $10,000.

CAR-HOUSE. — Arrangements are making by the Eastern Railroad Company for the building of a new car-house at Prison Point. New depots at Ipswich, and one also at Lynn within a year are talked of.

FORT WARREN. — It is estimated that $100,000 will be needed to put Fort Warren in condition to receive heavy guns.

HOUSE. — Mr. O. F. Smith, of Boston, is the architect of a frame house for G. W. Russell, near Cypress Pl. and Gorham Ave.; John F. Haines, contractor; cost, $5,500.

HOUSE. — Messrs. G. R. & R. G. Shaw, of Boston, are architects of a residence for Mr. Walter Hunnewell, opposite Commonwealth Ave., between Fairfield and Gloucester Sts.; size 36′ x 62′; four stories on front and five on rear; contractors, Messs. Vinal & Dodge and Messrs. Boum & Levitt; cost, about $40,000.

WAREHOUSE. — The new building on the site of the old Marlboro' Hotel, belonging to the Hemmenway Estate, is being built from plans of Messrs N. J. Bradlee & Winslow, architects, of Boston. It will be a five-st'y building, 70′ x 160′, arranged for stores and offices. The contractors are J. J. Whidden, mason-work; Morton & Chesley, carpenter-work, and G. W. and F. Smith, iron-work.

Y. M. C. A. BUILDING. — Mrs. Valeria G. Stone, of Malden, Mass., has given $25,000 to the Boston Young Men's Christian Association for the erection of a building for its use.

### Brooklyn.

BUILDING PERMITS. – *Park Ave.*, s s, 56′ west of Broadway, 1 two-st'y frame dwelling, 24′ x 40′; cost, $2,400; owner, George Loeffler. 138 Floyd St.

*De Kalb Ave.*, s s, 100′ east of Tompkins Ave., 2 three-st'y brown-stone flats, 20′ x 60′; cost, $5,000 each; owner and builder, John Hayes, 135 Stockton St.; architect, F. Van Pelt.

*Bremen St.*, *No.* 71, 50′ north of Prospect St., 1 five-st'y brick brewery, 45′ 7″ and 45′ x 48′ 6″; owners, Obermeyer & Liebmann, on premises; architect, Charles Stoll; builders, Henry Grasman and John Rueger.

*Sixth Ave.*, w s, 85′ north of Lincoln Place, 2 three-st'y brown-stone dwells., 20′ x 45′; owner, Isabella Gordon, 2 Willow St.; architect, R. Dixon; builder, John Gordon.

*Tenth St.*, *No.* 164, rear, fronting on Ainslee St., 1 three-st'y brick store and tenement, 20′ x 25′; owner, George F. Stolte, Cor. Ainslee and Tenth St.; builders, George Welsh and H. Tietjen.

ALTERATIONS. — *Eagle St.*, s s, 100 from Franklin St., raised 4 feet and one-st'y brick extension, 25′ x 212′; cost, $2,000; owners, B. C. Railroad Co., 10 Fulton St.; architect, A. W. Dickie; mason, — Ashfield.

*Vernon Ave.*, n s, 200 e Yates Ave.; interior alteration; cost, $2,000; owner, F, Munch, on premises; architect, J. Platte.

*Pulaski St.*, n s, 200 e Lewis Ave., alterations for ice-house; cost, $2,000; owners, Gluck & Shaurmann, on premises; architect, J. Platte; builder, W. Rauth.

### Chicago.

BUILDING PERMITS. — John Scholl, two-st'y brick dwell., 54′ x 44′, Warren Ave., cor. of Staunton St.; cost, $7,000.

G. H. Gibson, 6 two-st'y brick dwells., 72′ x 32′, 69 to 71 Randall Place; cost, $3,700.

—— Delano, 2 two-st'y brick dwells., 48′ x 36′, Center Ave., corner of Munroe St.; cost, $8,000.

Frank C. Vierling, two-st'y brick basement house, 25′ x 50′; 2836 Dearborn St.; cost, $2,000.

James Lusk, two-st'y brick store and dwell., 25′ x 25′, Ashland Ave. and Eighteenth St.; cost, $4,000.

Carl Huel, two-st'y brick dwell., 22′ x 45′, Second St., near Ashland Ave.; cost, $2,700.

W. L. Slatterlee, two-st'y brick dwell., 22′ x 60′, Michigan Ave., near Twenty-Sixth St.; cost, $6,000.

F. C. Vierling, 4 two-st'y brick dwellings, 62′ x 67′, 2347 to 2353 Michigan Ave; cost, $24,000.

J. W. Sherratt, 2 two-st'y brick dwells., 39′ x 62′, Monroe St., near Wood; cost, $9,000.

Allan Pinkerton, 2 two-st'y brick dwells., 32′ x 58′, 70 Laflin St.; cost, $9,000.

Chicago White Lead and Oil Co., four-st'y brick warehouse, 29′ x 121′, 49 N. Green St.; cost, $15,000.

F. Lang, three-st'y brick dwell., 22′ x 50′, 496 Sedgwick St.

LIBRARY AND OPERA-HOUSE. — N. K. Fairbanks of this city, offers to be one of ten to subscribe $1,000,000 for a grand library building and opera-house, if the city will give Dearborn Park for a site. The building is to be presented to the city with the understanding that the revenues of the opera-house are to support the library.

NEW BUILDINGS. — The following new buildings are being erected from plans prepared by Mr. George O. Garnsey, architect. For B. P. Hutchinson, Esq., two blocks of stores on Wabash Ave., near Van Buren St.: three stores and six flats on Clark St., near Van Buren St.; four stores on La Salle St., adjoining the Marine Building; two stores on Fifth Avenue, adjoining the Briggs House; a block of eight stores on Franklin St., adjoining Field, Leiter & Co's new warehouse. Several other new buildings are in contemplation by Mr. Hutchinson. The cost of these buildings will be about $200,000. Mr. Garnsey is also preparing plans for four English modern dwellings to be erected on Prairie Ave., near Twenty-Ninth St., for Mr. Charles L. Hutchinson and others. He is also preparing plans for Mr. Joseph Eastman, and several New York capitalists who are about to erect one hundred and fifty two-story brick dwellings in the northwest division of the city. Work will be commenced as soon as the contracts can be let.

ROLLING MILL. — The work at the new North Chicago Rolling Mills at South Chicago is still pushed with vigor. The foundations are commenced for two more buildings. One of these is to be an engine-house, 97′ x 53′, and the other a boiler-house, 125′ x 16.′

### Cincinnati.

BUILDING PERMITS. — Robert J. Harris, brick house of seven rooms, on Russell St., between Fifth and Sixth Sts.; cost, $2,500.

David Sinton, double brick house of eight rooms on Sixth and Madison Sts.; cost, $3,000.

### New York.

BUILDING PERMITS. — *Fifty-Fifth St.*, s s, 275′ west of Sixth Ave, 2 two-st'y brick stables, 25′ x 99′; cost, $6,000 each; owner, W. C. Lesster, 232 West Fifty-Second St.

*Lexington Ave.*, cor. One Hundred and Ninth St., 5 four-st'y brick flats, 20′ x 52′; cost, $9,500 each; owner, E. M. Meehan, 131 East Ninth St.; builder, H. Meehan.

*One Hundred and Ninth St.*, s s, 63′ west of Lexington Ave., 6 four-st'y brick flats, 19′ x 52′; cost, $8,500 each; owner, E. M. Meehan, 131 East One Hundred and Ninth St.; builder, H. Meehan.

*Ninty-Third St.*, s s, 100′ west of Third Ave., 3 three-st'y stone or brick dwells., 16′ 8″ x 46′; cost, $7,000 each; owners and builders, Robinson & Wallace, 229 East Thirty-First St.; architect, E. D. Garnsey.

*One Hundred and Sixty-Sixth St.*, n s, 150′ west of Washington Ave., 2 two-st'y frame dwells.; cost, $2,150 each; owner, John Spaeth, Washington Ave., between One Hundred Sixty-Fourth and One Hundred and Sixty-Fifth Sts.; architect, Henry Piering.

*One Hundred and Twenty-Seventh St.*, s s, 200′ east of Eighth Ave., 3 three-st'y brown-stone dwells., 16′ 8″ x 50′; cost, $10,000 each; owner and builder, S. O. Wright, 153 East One Hundred and Thirteenth St.; architect, J. H. Valentine.

*Thirty-Ninth St.*, s s. 600′ west of Eleventh Ave., 1 one-st'y brick abbatoir, 50′ x 60′; cost, $8,000; owners, M. & P. Douahue; architect, John M. Forster.

*Thirty-Ninth St.*, s s, 600′ west of Eleventh Ave., rear, 1 two-st'y brick stable, 28′ x 60′; cost, $3,000; owners, M. and P. Donahue; architect, John M. Forster.

two-st'y brown-stone dwell., 17' 5" x 45'; cost, $4,-500; owner and builder, Isaac E. Wright, 153 East One Hundred and Twenty-Eighth St.; architect, J. H. Valentine.

*Ave. A*, e s, 17' 5" north of One Hundred and Twenty-First St., 5 two-st'y brown-stone dwells., 16' 8" x 45'; cost, $4,250 each; owner and builder, Isaac

*Ave. A*, cor. One Hundred and Twenty-First St., 1 E. Wright, 153 East One Hundred and Twenty-Eight St.; architect, J. H. Valentine.

*One Hundred and Twenty-First St.*, n s, 64' east of Ave. A, 2 two-st'y brown stone dwells., 17' x 45'; cost, $4,250 each; owner and builder, Isaac E. Wright, 154 East One Hundred and Twenty Eighth St.; architect, J. H. Valentine.

*Eighty-Second St.*, s s, 80' east of First Ave., 1 four-st'y brown-stone tenement, 26' 6" x 25' 8"; cost, $6,000; owner, Mrs. Sarah Sibbald, 400 East Eighty-Second St.; architect, J. C. Burne.

*First Ave.*, e s, 25' 10" north of One Hundred and Twelfth St., 2 four-st'y brick tenements, 25' x 53'; cost, each, $8,000; owner, Ann M. Jenny, 220 East One Hundred and Fourth St.; architect, J. H. Valentine; builder, J. Jenny.

Alterations. — *Prince St., No.* 72, altered for stable and carriage-house; cost, $2,000; owner, C. E. Larned, 42 John St.; builders, J. H. Parker and C. E. Larned.

*Bond St., No.* 20, front altered and all partitions throughout building removed, girders and columns instead; cost, $2,500; owner, E. P. Dickie, 65 Warren St.; carpenter, G. F. Pendleton; mason, A. F. Knowlton.

*Elm St., Nos.* 115 *and* 117, iron girders and interior alterations; cost, about $2,500; owner, Fred Hollender, Tryon Row; architect, William Huhles.

Alteration. — The American Express Company will have an additional story erected on their building, No. 65 Broadway; Mr. Bassett Jones, architect.

Bar Association Building. — It is now rumored that the Bar Association, in addition to the large extension proposed to their building, on Twenty-Ninth St., near Fifth Ave., will also have an entirely new front on the building they now occupy, and make other important improvements. Mr. Charles C. Haight is the architect.

Hotels. — The Morton Hotel, formerly the Maison Dorée, corner of Fourteenth St. and Broadway, is undergoing extensive repairs and alterations, which are now nearly completed.

The Victoria Hotel is also being improved.

Madison Square Garden. — Mr. J. B. Snook, architect, has prepared plans and specifications for strengthening the foundations and walls of the Madison Square Garden, and for other improvements; to cost about $20,000.

Museum. — The property on the corner of Broadway and Ninth Street, has been leased to G. B. Bunnell, and will be at once altered into a museum. There will be several large halls for the exhibition of living curiosities. There will also be a theatre in miniature.

### Philadelphia.

Building Permits. — *Sixteenth St.*, south of Montgomery, 3 three-st'y dwells., 17' x 60'; Joseph S. Albright, owner.

*Worth St.*, east of, Oxford St., one-st'y bleaching building, 54' x 200'; Wm. Keas.

*Township Line*, cor. Atlantic St., two-st'y stable, 36' x 40'; Wm. Keas.

*Fifth St.*, north of Somerset St., three-st'y dwell., 18' x 29'; Jos. Keenan, owner.

*Canal St.*, north of Girard Ave., five-st'y factory, 41' x 122'; Alex McConnell, owner.

*Fifth St.*, south of Washington Ave., one-st'y shop, 64' x 125'; J. S. Steel, contractor.

*Twenty-Third St.*, cor. College Ave., 6 three-st'y dwells., 14' x 43'; Jas. H. Lyons, contractor.

*Twenty-Third St.*, cor. Thompson S , 6 two-st'y dwells., 14' x 43'; J. H. Lyons, contractor.

*Ash St.*, Bridesburg, shed, 16' x 144'; Bihn & Co., owners.

### St. Louis.

Building Permits. — Thirteen permits have been issued since our last report, of which eight are for frame structures of slight importance. Of the rest, those worth $2,500 or over, are as follows: —

| Owners' Name. | Use. | Sy's. | R'ms. | Cost. |
|---|---|---|---|---|
| West St. Louis Turner Bl'd Hall Association, | Hall. | 1 | 1 | $8,000 |
| E. Renzebach, | Dwell. | 2 | 8 | 27,000 |

### Washington.

Department Building. — Commissioner Le Duc, of the Department of Agriculture, recommends the erection of a new building for the uses of his department, and furnishes plans for the proposed structure, which he would have resemble the Sydenham Crystal Palace.

Church — Steps have been taken by the General Christian Missionary Society toward building a new church, the corner stone of which it hopes to lay March 1, 1881.

### General Notes.

Albany, N. Y. — Mr. H. H. Richardson of Brookline, Mass., has finally been appointed architect to the new town-hall, which will cost some $195,000.

Bethlehem, Pa. — Alteration of dwelling for Dr. G B. Linderman; Addison Hutton, architect.

Bridgeport, Conn. — Mr. Stephen Nichols is building a four-st'y block of brick, with Sutherland Falls marble. To be occupied for stores and offices. John Rutherford, contractor.

Hon. W. D. English is about building 14 houses of brick, with Sutherland Falls marble finish. To be rented for tenements. Gould Bros., architects.

Johnstown, Pa. — Plans for a club-house, to cost $20,000; Addison Hutton, architect.

Joliet, Ill. — G. O. Garnsey, of Chicago, is the architect of the new school-house, which will cost $25-000.

Louisville, Ky. — Since last report little of interest has transpired. The only item worthy of special notice is a new depot for the J. M. & I. R. R., to be located on the site of their present buildings, on Fourteenth St. Probable cost, $25,000. Mr. John Mitchell, builder.

Mr. C. S. Mergell, architect, has under way a residence for Martin Bijur Esq. It is of pressed brick, laid in Flemish bond, with stone trimmings. The house will be finished throughout in hard wood. It will cost, complete, about $22,000.

From present indications the spring season promises to be a good one.

Marblehead, Mass. — The corner-stone of the Second Universalist Church was laid Nov. 25. It is to be of wood, of rural Gothic design, 50' x 80', with two towers, the taller to be about 100 feet in height. It will have a seating capacity for 550. The total cost is estimated at $10,000.

Mauch Chunk, Pa. — Private library for Mr. H. E Packer; Addison Hutton, architect.

Milford, Mass. — Building operations are brisk, notwithstanding the lateness of the season.

Newport, R. I. — It is believed that the opposition to a hotel on the beach is so great that permission to build one cannot be obtained.

Newton, Mass. — It has been decided to build a cottage-hospital by private enterprise, and articles of incorporation have been adopted.

Pittsfield, Mass. — Job Poland is building on West Street a three-story double house of twenty-four rooms. It will cost about $3,000.

Reading, Pa. — Two brick houses are building for the Rev. T. T. Jaeger; cost, $6.000.

The Schiller Building Association is building eight brick houses, at a cost of $8,000.

Red Bank, N. J. — Four houses are to be built, from designs of Mr. Jos. M. Dunn, of New York, at a cost of $6,000 each.

Rockaway. L. I. — Three houses are to be erected from designs of Mr. Jos. M. Dunn, of New York, at a cost of $21,000.

Springfield, Mass. — J. C. Parsons and Aaron Bagg have commenced excavating for a block of stores on Main St., to be of brick, with granite finish.

San Francisco, Cal. — James Phelan is to build, beginning Jan. 1, a five-story block of stores, 299' x 303', on Market and O'Farrell Sts. There will be seven stores on the ground floor.

Ware, Mass. — Mr. John H. Storrs is building a block of brick, with Rutland marble finish, corner of Main and North Streets. Size, 42' x 70', three stories. To be occupied for stores and offices. P. McMahon, contractor for marble work.

Wayne, Pa. — Mr. Frank Furness, of Philadelphia, is the architect of the new station which is to be built at this place by the Philadelphia & Reading Railroad.

Waupaca, Wis. — The county board has passed a resolution, appropriating $15,000 for building a new court-house at this city. Work will be commenced as soon as practicable.

Wheeling, West Va. — Mr. S. M. Howard has been appointed architect of the school-house which is to be built for the Fifth Ward.

Windsor Locks, Conn. — E. D. Coogan is building a two-story brick house on Clay hill, James Connell doing the work. There is, however, but little building going on just now, though many more tenements are needed.

Woonsocket, R. I. — Thirty-one thousand dollars left in bequests for a hospital at Woonsocket have now increased to $66,000, and a committee has been appointed to procure a site on which to erect the buildings.

### Bids and Contracts.

Baltimore, Md. — The contract for the construction of Chatsworth Run sewer has been awarded to August Knoop, at $21,500.

San Francisco, Cal. — The Supervising Architect of the Treasury rejected all bids for work and materials required for the construction of side-walks, roadways, fencing, etc., of the San Francisco Appraisers' Building, and directed Superintendent Holt to advertise for separate proposals for the different classes of work. All the granite work will be included in one bid, the iron-work in another, and artificial stone for sidewalk flagging in another.

Philadelphia, Pa. — Contract for the iron work of new train-house of the Pennsylvania R. R. Company has been awarded to the Keystone Bridge Company; sub-contractors, Jones & Benner.

The contract for Merrick St. passenger station of Pennsylvania R. R. Co. has been awarded as follows: Iron-work, Jones & Benner; granite-work, Atkinson & Myhlerty; brick-work, Roydhouse & Atkinson.

Washington, D. C. — The Phœnix Iron Company's bid for furnishing the iron-work to complete the roof of the north wing of the new State, War, and Navy Department building at Washington was $83,-336.

### Industrial.

Auburn, Me. — Measures are taking to build a new cotton mill on the Little Andriscoggin River, about half a mile from the Barker Mill.

Camden, N. J. — Wood Brothers are building a new factory on Fifth St., near the dry dock. The building will be one-storied, 160' x 160'.

Chester, Pa. — Samuel A. Crozer is building a new cotton mill on the Creek, opposite General Patterson's lower mill.

Leavenworth, Kan. — The Leavenworth Sugar Company, whose works were lately destroyed by fire, have reorganized, with a paid-up capital of one hundred and fifty thousand dollars, and will rebuild at once. Fifty thousand dollars' worth of buildings are already under contract, to be completed by the first of February. E. T. Carr, architect, has the work in charge.

Lowell, Mass. — The mills of Foulkner & Sons, and the Chase Mills, which were burned last month, are to be rebuilt at once, both companies having effected settlements with their insurance agencies.

Lowell, Mass. — The Merrimac Manufacturing Company of Lowell, are going to erect a chimney that will be 265 feet high and require 1,300,000 brick in its construction. It will be the highest chimney of its kind in this country.

Limerick, Pa. — Marsh, Brownback & Co., National Stove Works will double their ground-floor capacity and raise the works one story.

Mapleton, Tenn. — Mr. Wm. F. Weber, architect, Baltimore, is preparing drawings for a large tannery building, to be erected for Messrs. Deford & Co., 32' x 500', containing 225 vats.

New York, N. Y. — Mitchell, Vance & Co., 24th St. and 10th Ave., are building a large four-story brick factory on 25th St., in rear of and connecting with their old factory.

Levy Brothers, 145 Avenue D, are building a large cigar factory at the corner of Thirteenth St. and Avenue C.

Philadelphia, Pa. — Louis Belrose is to build a new mill, 100' x 45', extending his present mill westward along Catharine St., and west of Eleventh.

William Arrott will build a new mill on the western half of the square between Twelfth and Thirteenth Sts., along Carpenter St.

Philadelphia, Pa. — J. Brown's Sons, Eighth and Tasker Sts., are building a new warehouse to take the place of the one burned some time since. The new structure will have three fronts, two of 100' each, and one of 50'.

Phœnixville, Pa. — The Phœnix Iron Co. will build a new iron-foundry in the rear of its present foundry.

## Publishers' Department.

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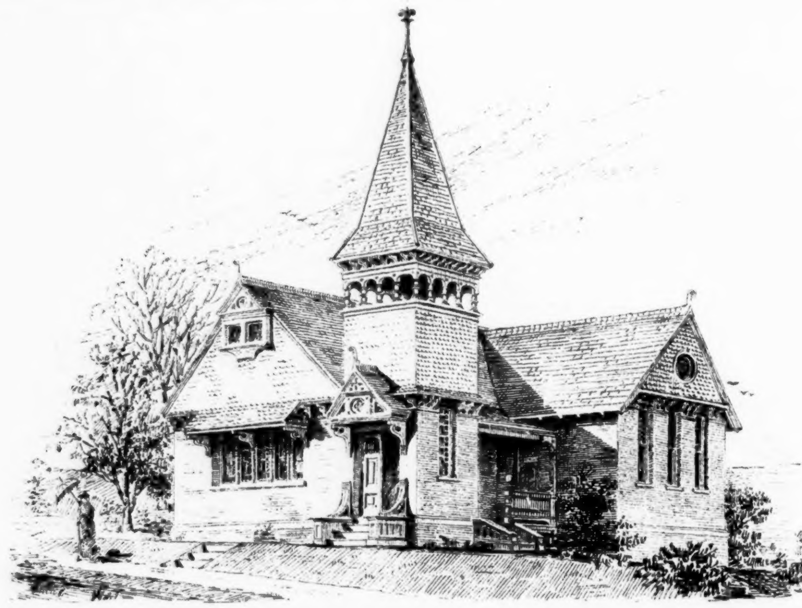

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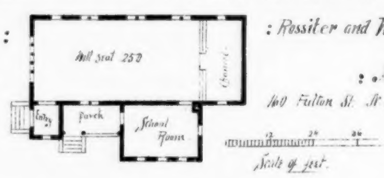


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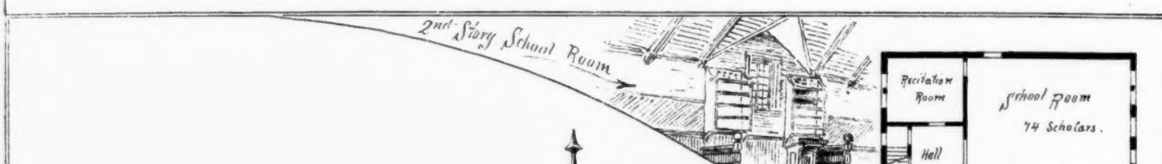


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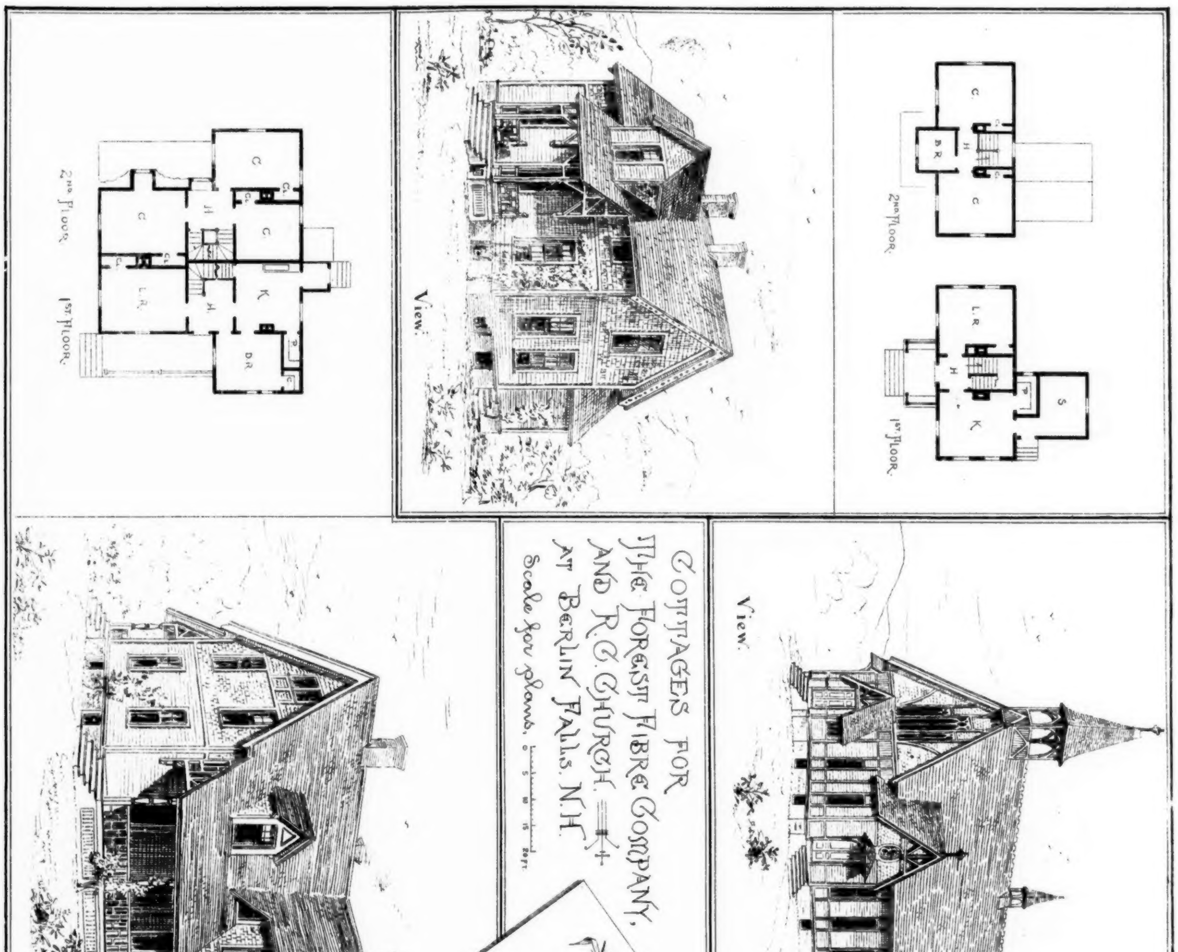


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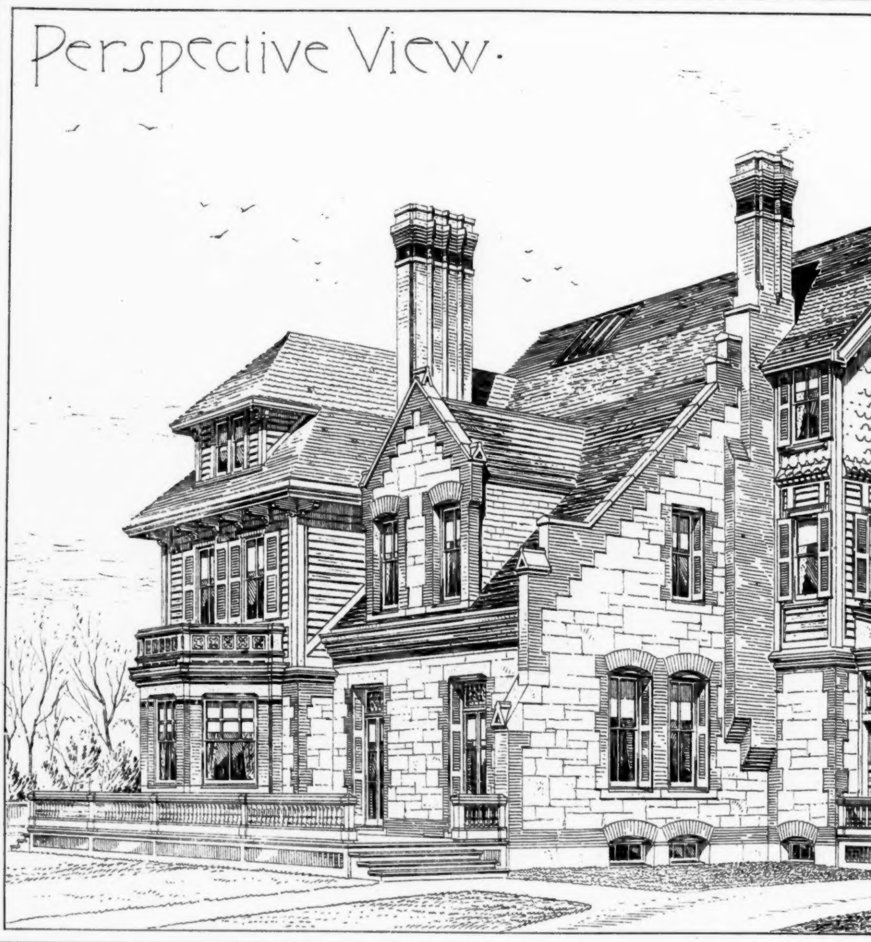


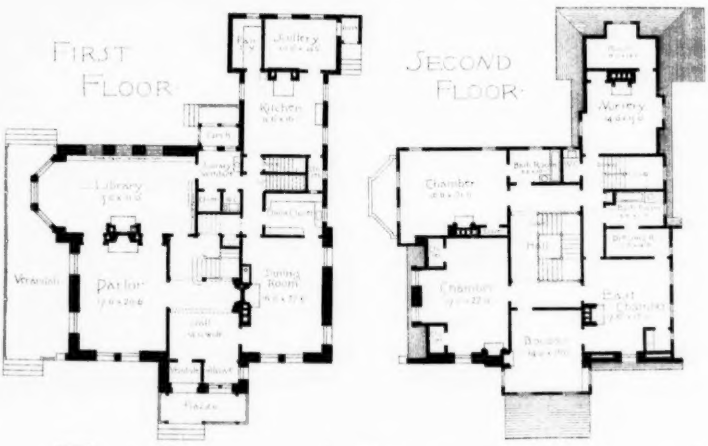


The Episcopal Theological Sc

CAMBRIDG

The DEANERY·

Messrs. Ware & Van

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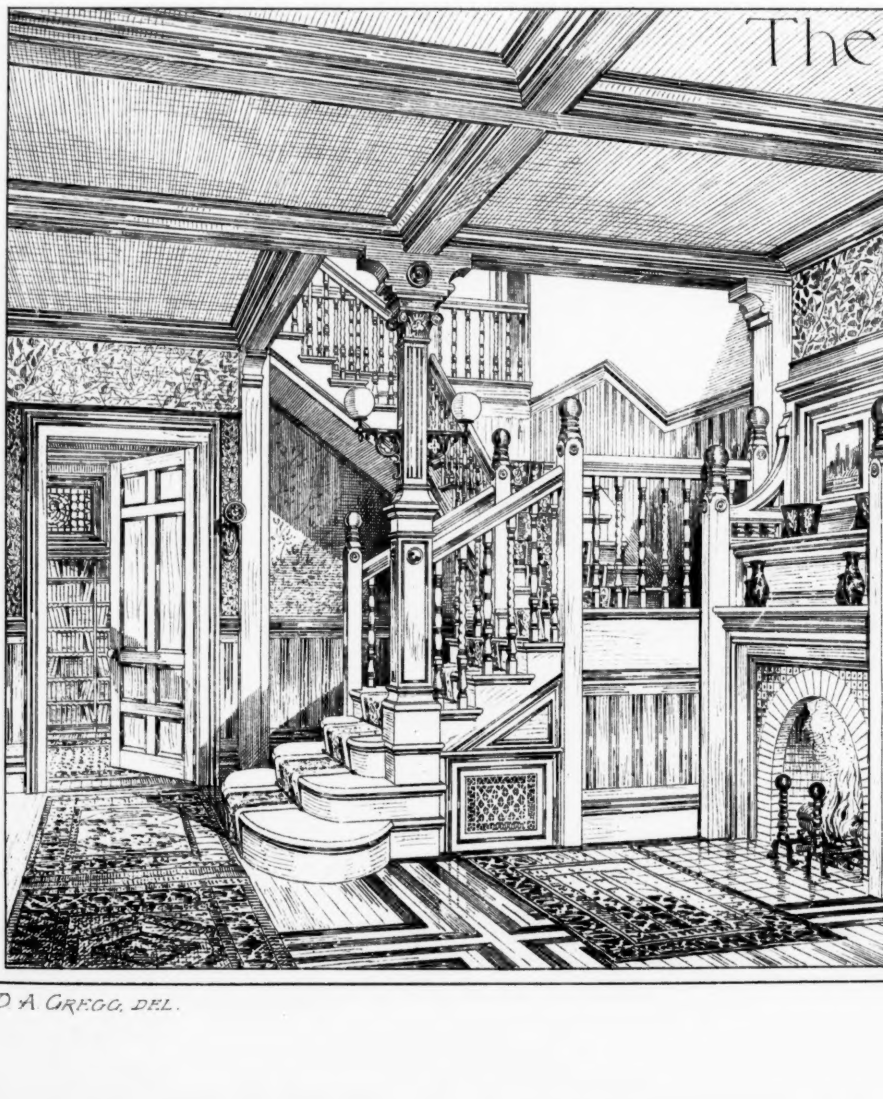


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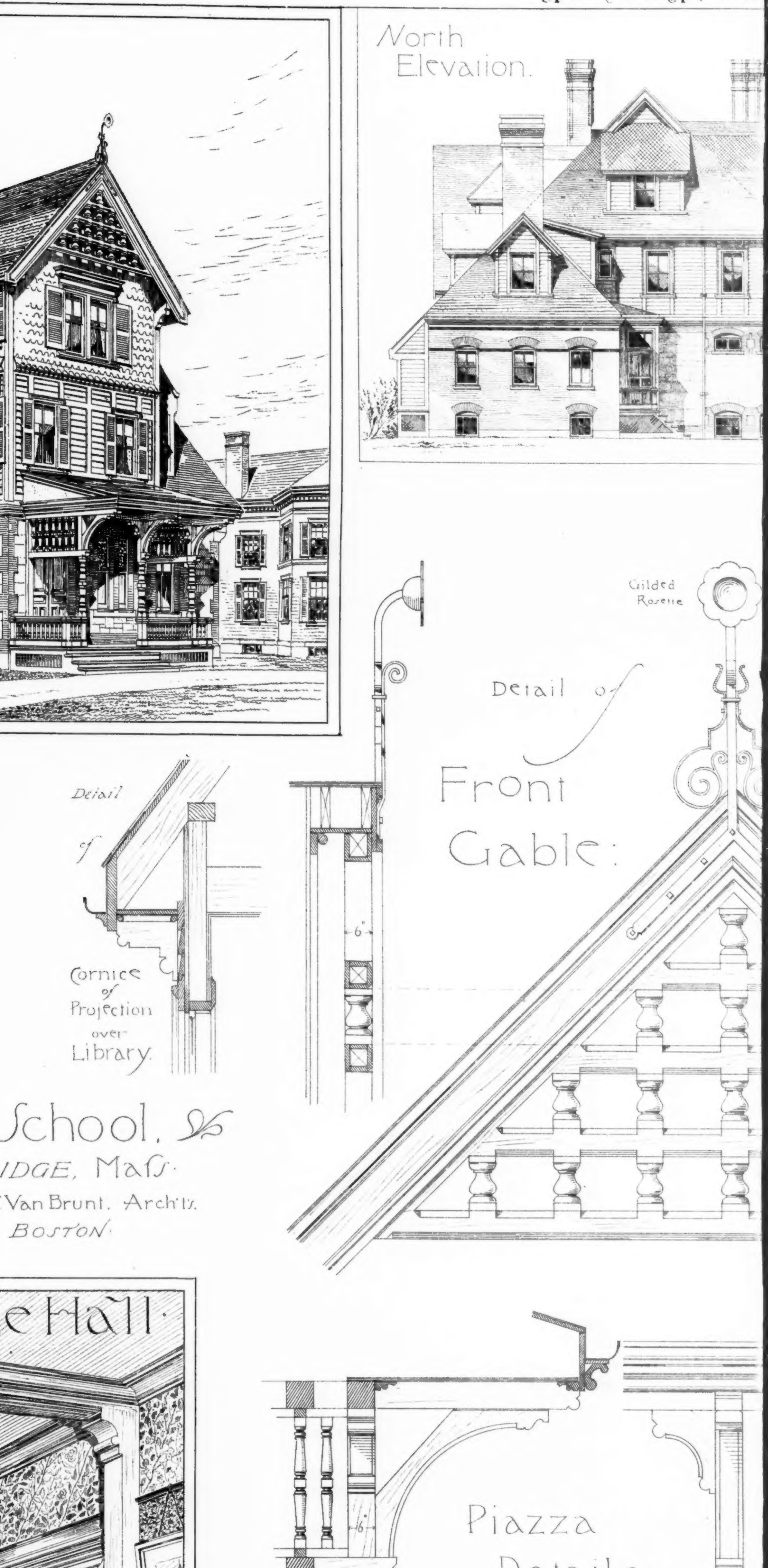
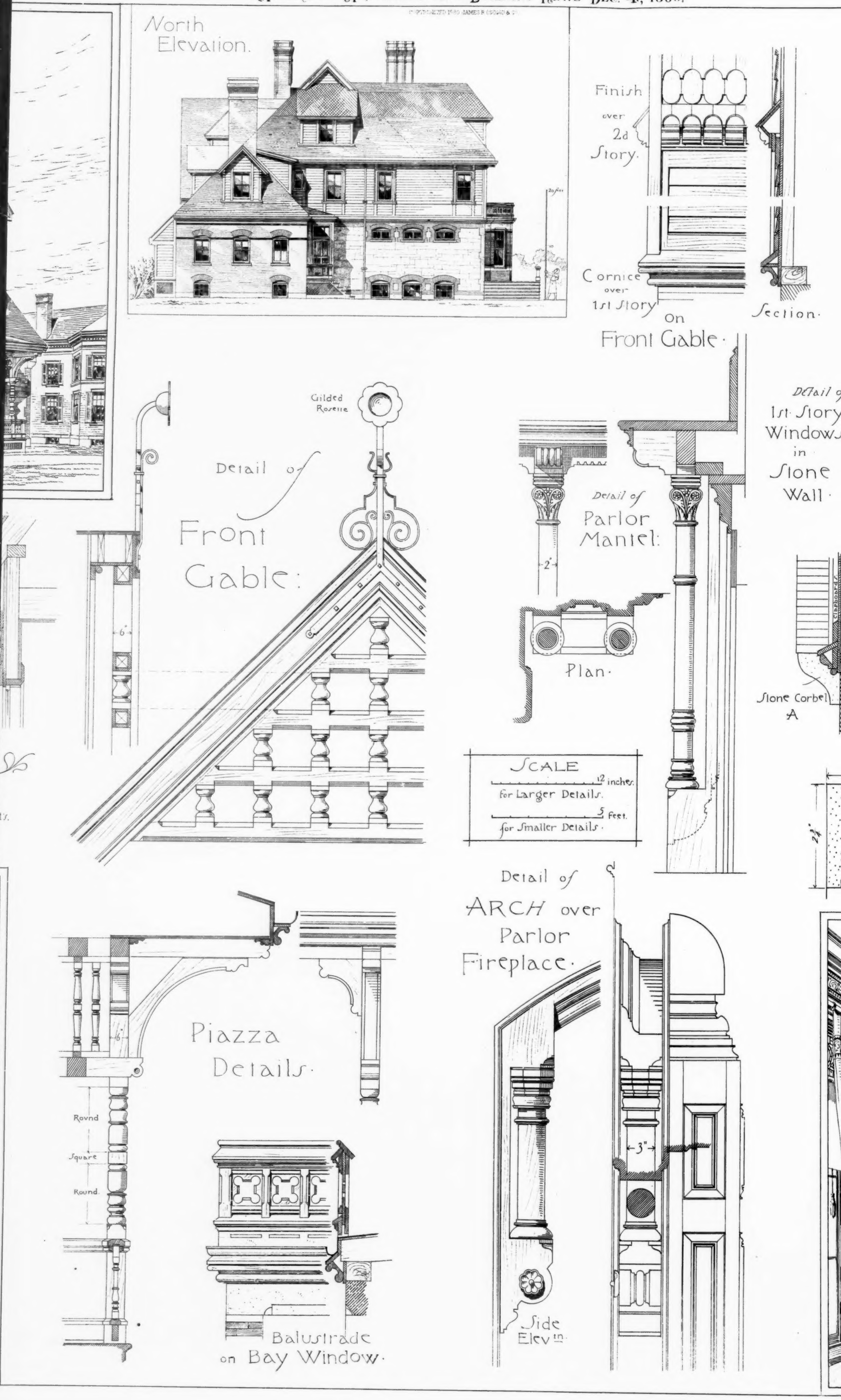
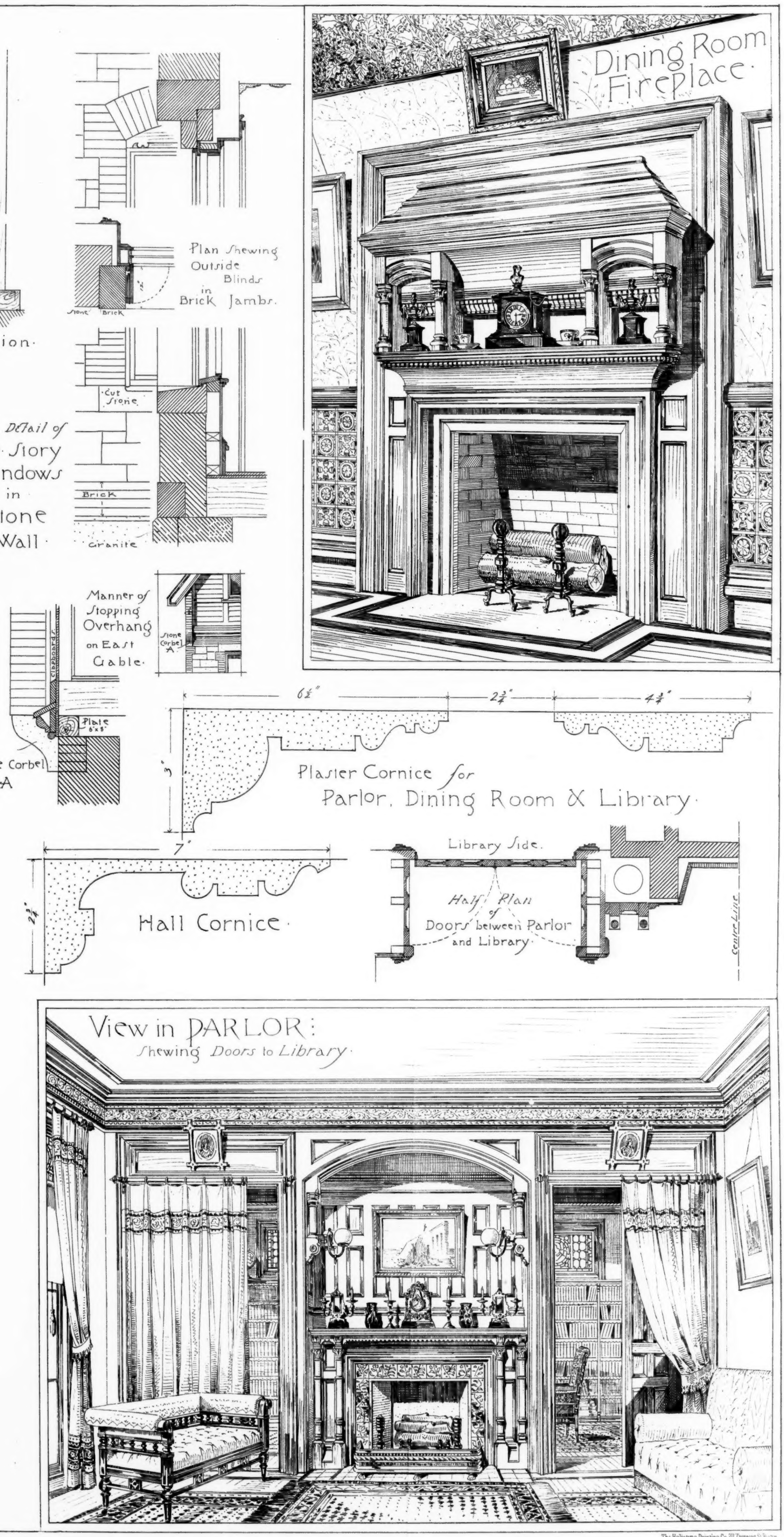

North Elevation.
Detail of Front Gable:
Gilded Rosette
Detail of Cornice of Projection over Library.
6"
School,
IDGE, Mass.
Van Brunt. Arch'ts.
BOSTON.
e Hall.
Piazza Details.
Round
Square
Round
Balustrade on Bay Window.


North Elevation.
Finish over 2d Story.
Cornice over 1st Story on Front Gable.
Section.
1st Story
in
Stone
Wall.
Gilded Rosette
Detail of Front Gable:
Detail of Parlor Mantel:
Plan.
Stone Corbel A
SCALE
12 inches. for Larger Details.
5 feet. for Smaller Details.
Detail of ARCH over Parlor Fireplace.
Side Elev tn.
Piazza Details.
Round
Square
Round.
Balustrade on Bay Window.

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