THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. X. Copyright, 1881, JAMES R. OSGOOD & Co. NO. 310.

DECEMBER 3, 1881.

Entered at the Post Office at Boston as second-class matter.

CONTENTS.

IT is reported, we hope incorrectly, that an attempt is to be made to obtain the dismissal of Mr. James G. Hill, the Supervising Architect of the Treasury Department, in favor of a gentleman who was once employed as a subordinate in the Department, and has since held important offices in New York State, but claims, so far as we are aware, no distinction in the profession. On the contrary, it is feared that the movement to substitute him for Mr. Hill is inspired by the hope of certain politicians that they may find him more ready to use his influence in aid of their plans than the present incumbent has shown himself. As we know little of the technical attainments of the new candidate, we cannot pretend to say that a change in the direction of the government building operations would be necessarily injudicious, but during the five years of Mr. Hill's administration the vast and difficult business of the office has been managed with so much ability, faithfulness, and success that we should view with grave apprehension any movement to displace him, particularly if such movement, as appears at present to be the case, were founded on nothing better than a fancied political expediency. If the Government architect should show himself at any time incompetent to solve successfully the difficult problems continually presented to him; if any construction designed under his care should fail, or even give plain evidence of insecurity; still more if the smallest violation of the trust under which he controls the expenditure of vast sums of public money should be traced to him, we should be the first to demand his removal, but the same view of professional and official responsibility which would lead us to exclude unsparingly from the public service all men who might in a single instance be found wanting in skill or uprightness makes it seem the more desirable to retain as long as possible those who have fully proved their capacity.

THE foreign correspondent of the Chicago *Tribune* gives some details regarding Bartholdi's great statue of Liberty, soon to be erected in New York harbor, which may be new to our readers, or at least may have been forgotten in the years which have elapsed since the enterprise was first undertaken. The statue represents a draped female figure, crowned with rays after a conventional fashion well known to students of French sculpture, and holding in the right hand, extended above the head, a flaming torch. The total height of the figure from the toe to the top of the torch is one hundred feet, and the base is fifty feet square, so that with a plinth of the usual proportion the total distance from the water to the summit should be nearly two hundred feet. The torch is to be furnished with a real lamp, and is intended to serve as a beacon in the centre of the harbor, while a halo of light will also be emitted at night from perforations around the head. The interior will contain a spiral staircase for use in managing the beacon, and for the convenience of visitors. The whole of the statue is composed of copper, cast in sections and riveted together. One of the pieces, — the right fore-arm holding the torch, — has been for four years exhibited in Madison Square, New York; the remaining portions are now finished, and on the twenty-fourth of October the first rivet of the series which will join them into a complete figure was fastened in Paris, in the presence of a large number of distinguished French and American citizens. It will be about two years before the plinth can be built and the statue set in position upon it, but aside from its merit as a work of art, the huge figure will henceforth possess a great and increasing interest for American tourists.

THE first, and we hope the greatest sacrifice which civilization will be called upon to make in pursuing to its conclusion the stupendous task of piercing the American Isthmus has been already offered in the person of the heroic Gaston Blanchet, Chief of Construction for the Panama Canal Company, who fell a victim early last month to the fearful malaria of the Central American swamps. Though only just entering upon middle life, M. Blanchet had already gained a reputation as one of the best administrators of public engineering works in Europe, and the Isthmus Canal Company was fortunate in being able to secure his services to direct its great undertaking at Panama. After taking part with the commission of engineers in surveying the ground for a preliminary report, he was recalled to France, to advise in the organization of the work, and returning to the Isthmus in January last with full powers he entered upon its excavation with an enthusiasm which in the end proved fatal to him. Anxious to be everywhere present to control and direct, and thinking that his past experience in malarious countries might have acclimated him in some degree, he exhausted himself by over-work and fell an easy victim to the fever. It may well be believed that the shock of his death has seriously interrupted the operations on the Isthmus, and the whole civilized community will sympathize with the Canal proprietors in deploring their loss.

MR. EDWIN CHADWICK, one of the most eminent English sanitarians, has recently made a report to a Royal Commission on the results of sanitary work in Great Britain, which is full of interest. Although the agitation of matters relating to public health began at least twenty years ago, it is not unfair to regard the last decade only as representing the period of effective and intelligent use of those principles which the experiments of the preceding one had shown to be the true ones; and the difference in the death-rate between the two decades, as shown by statistics, offers a striking proof of the beneficent results which sanitary reform has already accomplished. Taking England and Wales together, the average annual death-rate between 1860 and 1870 was twenty-two and five tenths in the thousand; from 1870 to 1880 it was but twenty-one and five tenths, a reduction of nearly four and one half per cent, although it must be borne in mind that the efforts for clean and proper living have been hitherto confined to a portion only of the cities, and that in the larger of these very little has yet been attempted, while the rural districts are for the present actually retrograding in wholesomeness as population advances. As might be supposed, the principal improvement is seen in the diminishing mortality from the severe diseases best recognized as zymotic, the proportion of deaths from these being twenty per cent less during the past decade than in the one preceding. In the death-rate from fever a still greater diminution is reported, the ratio having fallen steadily from eighty one-hundredths per thousand in 1870 to thirty-two in 1880. No doubt something of this may be due to the advance of medical science, which would be likely to assign some of the cases once ranked indefinitely under the head of fever to a more specific class, but the main fact that the English community is beginning to find relief from the most distressing of maladies is beyond doubt.

AN article in the Boston *Medical and Surgical Journal* describes the method of sanitary inspection adopted in Belgium for improving the construction and management of school-houses, and promoting the health of scholars. In 1874, on the establishment of the Bureau of Public Health, five physicians were selected, who should have sole charge of the medical inspection of schools. Besides observing, and so far as possible securing the correction of faults in construction, heating, lighting or ventilation of the buildings under their care, the inspectors are required to study all other circumstances which may affect the health or comfort of children, such as the dimensions and form of desks and seats, with the length of lessons, time of study, gymnastic exercises, and so on. The personal hygiene of the scholars also receives attention, and they are systematically instructed in proper care of their eyes, teeth, skin, and general regimen. Accurate records of the constitutional and intellectual development of the children are kept as a means of suggesting further improvements, and to the inspecting physicians is committed authority to close the schools summarily when the temperature exceeds 82° Fahrenheit, and to control and direct the excursions, swimming lessons and gymnastic exercises. The good results of this professional supervision are said to be already evident; while repeated epidemics of infectious disease have visited other parts of Belgium, Brussels has been spared, or the cases have been comparatively few; the general health of the children has improved, and it is said that a decrease has taken place in the number of persons applying for public charity or subjected to public correction.

A General Exhibition of objects and appliances relating to public health is to be held in Berlin in 1882, opening June 1, and closing October 1. An invitation is extended to foreign inventors and manufacturers to send exhibits, which will be admitted free of duty by the Prussian government, and transported over the Prussian railways without charge. Mr. H. W. Fabian, 31 East Fourth Street, New York, has been appointed Special Commissioner to receive applications and give any information required in regard to the exhibition. As in most enterprises of the kind in Europe, a portion of the cost is defrayed by requiring the payment of a moderate sum for space and for entry of exhibits. The fee for entry of books, pamphlets, or drawings relating to any of the matters included within the scope of the exhibition is six dollars; larger objects pay an entry fee of twelve dollars. Space is allotted in the main building at the rate of six dollars per square yard for floor space, and three for wall space, and in the annexes for three dollars per square yard of floor space, and in the enclosure outside at the rate of one dollar per square yard. The Chairman of the Executive Committee in Berlin is Herr Hobrecht, lately a Secretary of State, and distinguished experts from all parts of Germany and Austria have been selected as members of the sub-committees.

The exhibition is to comprise four sections, the first relating to the sciences which have as their subject the soil and air, the construction and maintenance of streets, roads and public places, the removal of sewage and refuse, water-supply, public lighting, the food supply of cities, public baths, heating and ventilating, and all the other topics which we ordinarily include under the title of hygiene; while the second includes literature and drawings illustrative of the same; the third section comprehends all appliances and devices for defence against fire, lightning, inundations, explosions, dangers incident to travelling by land or sea, the perils of mining, submarine work and other peaceful pursuits, besides apparatus for diminishing the hardships and risks of war; and the fourth includes the literature appropriate to these subjects. There can be no doubt that the exhibition will be very interesting and instructive. Whether American inventors will care to take a prominent part in it remains to be seen, but judging from past experience we fear that unless in the department of electric lighting, the many ingenious devices which excite the astonishment and admiration of foreign visitors to our shores will be conspicuous mainly by their absence. In scientific heating and ventilation, both of public and private buildings, we may justly say that the best work of the Americans surpasses anything yet accomplished in any other part of the world, and although many of our best plumbing appliances, and most of our sanitary knowledge, is derived from England, we have added some things of our own which we have a right to be proud of.

Dr. Le Plongeon, the explorer of Yucatan, has returned to New York with a vast amount of interesting information, which will probably form the substance of a book to be published before long. Meanwhile, the indefatigable reporters of the New York papers have obtained from him an account of some facts which indicate the character of the rest. As in the case of other investigators of Central American archæology, Dr. Le Plongeon has been constantly more and more impressed with the advanced civilization of the ancient people whose remains he studied, and has, together with his courageous and enthusiastic wife, who accompanied him to Yucatan, devoted great, and at last successful efforts to the search for the key to the ancient Maya alphabet, which will enable him to interpret the sculptured inscriptions already known by casts and photographs, as well as to read at some future time the manuscripts which he believes are still in existence among the ruins of Uxmal. The wisdom of beginning his work with this difficult undertaking is apparent. Less sincere or less competent archæologists would have been likely to devote themselves to the collection of as great a number of casts, photographs and sketches as possible, thereby saving themselves much time and mental labor, besides gaining a transitory fame as great discoverers; but Dr. Le Plongeon has had the good sense to secure first the talisman which will unfold to him the meaning of his future discoveries, direct his efforts, and enable him to make a greater advance in real knowledge of the ancient history of Central America in a single season on the spot than would be accomplished by years of study of detached fragments stored in museums.

Unfortunately the material obstacles thrown in the way of Dr. Le Plongeon's work were not only annoying but very serious. The ruins of the great city of Uxmal are now private property, and like all ignorant persons, the proprietor no sooner found that his possessions were an object of curiosity to strangers than he became filled with the wildest notions of their value, and not only refused absolutely to allow any sculptured stones or other objects to be removed from the spot, but opposed anything but the most superficial explorations. By concealing his movements Dr. Le Plongeon succeeded in making an opening in one of the ruined walls, and discovered within a noble colossal statue, in the best possible preservation, representing the god or autocthonous hero Cay, crowned, and surrounded with the attributes of his race and station, and sculptured with inscriptions. Of the meaning of some of these there can be no doubt, and they serve to give a key to the ancient alphabet of the Maya language in which they were written. This language is still spoken in Yucatan by the descendants of the subjects of Cay and Chac-Mol, so that the clue was quickly followed, and interpretations confirmed and rectified by comparison until their meaning was rendered nearly certain. According to Dr. Le Plongeon, the ancient Maya language closely resembles the Etruscan, which has never yet been read, while the characters and mode of writing have some resemblance to those of Egypt; and he believes that in it will be found the etymology of many names of nations and places which have hitherto puzzled philologists. Whether all these anticipations will be realized it is impossible to say, but we have at least to be grateful to the explorer for a great increase in our store of archæological material.

A kind of ancient building hitherto little studied has recently been investigated by certain archæologists in Scotland. Throughout the counties of Sutherland and Caithness, and among the Orkney and Shetland Islands, are found the remains of structures called "brochs," built of dry stones, circular in plan, and of considerable size, most of them being from fifty to sixty feet in diameter. At the ground level the buildings consisted of little else than a wall of immense thickness, eighteen feet being common, enclosing a circular court, and pierced only with a single opening, which was defended by two sets of doors, and had a small guard chamber attached to it. Toward the court, however, four or five tiers of windows gave light to rows of small chambers constructed in the thickness of the wall, and rudely vaulted over. Access to these was obtained by a single staircase leading from the court, and opening upon galleries in each story. In some cases wells have been found in the interior of these buildings, which were evidently built during the period of anarchy which prevailed on the Scottish border after the departure of the Romans from Britain, as places of refuge for the peaceful inhabitants of the districts in which they occur, large enough to shelter their families and flocks during a short siege, and strong enough to resist any force which the rude marauders of that day could bring against them. Many other fortified houses are found in various parts of Europe, but the brochs have an element of community of interest and effort on the part of a comparatively large number of people which distinguishes them from all others of the class.

BUILDING SUPERINTENDENCE.—XII.

Whether a larger or smaller number of these precautions shall be adopted will depend on circumstances. If wooden laths are to be used for the plastering, the superintendent should see that they have the requisite number of nailings, and are not placed too near together. Three-eighths of an inch is the proper distance: if nearer together the mortar will not be effectually pressed through the intervals, and its hold will be feeble: if farther apart, it will not, while soft, sustain its own weight. It is usual to specify that the joints shall be broken every six courses; but it is much better and not much more troublesome to break joints at every course: and care should be taken that the laths above the door and window heads extend at least to the next stud beyond the jamb (Fig. 132), so as to prevent the radiating cracks which are apt to appear at that point. Where the men meet with a small space, whose longest direction is

Wooden Laths.

Breaking Joint.

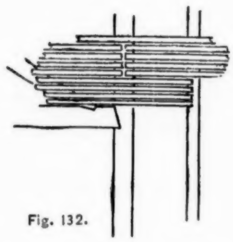


Fig. 132.

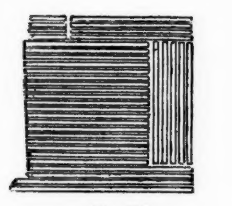


Fig. 133.

perpendicular to that of the other lathing, they are apt to fill it up with laths set at right angles with the rest. (Fig. 133.) This should never be permitted, as cracks are sure to appear afterward where the change of direction takes place.

After the application of the laths, if not before, the furrings should be verified. The soffits of dormer windows, the under side of stairs, and all angles of walls and ceilings should be carefully observed to see that their surfaces are plane. Chimney-breasts should be tried with a carpenter's square, to make sure that their external and internal angles are right angles, and the position of the chimney-breasts in the room should be finally examined. All laths which show knots, portions of bark or stains should be pulled off on the spot and thrown away, and their places supplied with fresh ones, as such imperfections in the laths are liable to cause discoloration in the plaster over them; and for the same reason all brickwork which is to be plastered should be cleared from soot, tobacco juice or soluble defilements.

At least seven days before the lathing is finished all the mortar for the first coat of plastering should have been mixed and stacked; if possible in some place outside the house, since the evaporation from so large a mass of wet material, if stored, as is often done, in the cellar, causes the timbers to swell through dampness. The lime must be of the best quality, free from every trace of underburnt "core." If the lumps, on being covered with water, slake for a time with considerable violence, but leave a residue which must be crushed by the hoe, the whole should be rejected. Such lime, unless it can be stored long enough to insure this conversion of every portion not absolutely inert, will surely cause the plastering made from it to blister and "chip-crack," sometimes after the lapse of months; and with the best lime it is unsafe to put the mortar on the wall until it has "cooled" for a week or more, to allow all the particles to become hydrated. The ancient method, by which the slaked lime was stored in pits and not drawn upon for use until after one or two years' seasoning, unfortunately has become obsolete.

Loamy sand is nearly as much to be dreaded in plastering as underburnt lime. Some varieties contain particles of compact clay or soil which will, after a season's drying, assume a powdery condition, expanding as they do so, and throwing off the mortar in hundreds of little pits, like the scars of small-pox. Moistening the sand and rubbing it on the hands will usually give sufficient evidence of the presence of loam or clay by the stain which it leaves on the skin.

Sand.

After seeing that the mortar is well pushed through the laths with the trowels, so as to bend over on the inside, the straightness of the angles, both vertical and horizontal, between walls and ceilings should be assiduously criticised. In two-coat work, such as is used throughout the Eastern States for dwelling-houses of moderate cost, there is no opportunity for bringing the surfaces to a true plane after the first coat is on, since the second or "skim coat" is a mere varnish, less than ⅛ of an inch in thickness; and the plasterer must use his judgment in laying on just mortar enough to fill out to the line after it has been trowelled down enough to force it well through the laths. This can seldom be done with any accuracy over the larger surfaces, but by applying the long, thin-edged board which is used to finish against the angle beads as a ruler, any reasonably careful man can insure the straightness and accuracy of the corners, and this should be insisted upon, as the eye immediately detects any irregularity in the angle between walls, or between the wall and ceiling, while inequalities of the intermediate portions are unnoticed. With three coats it is easy to obtain surfaces absolutely plane, by using the proper means. The scratch-coat is to be very strongly trowelled and well scratched up with a sort of comb, made of sharpened laths, nailed in a row on a stick. After this is *thoroughly dry*, "screeds" should, for a first-class job, be run all around the margin of the ceiling, consisting of strips of mortar, carefully put on, and brought to a perfectly plane and horizontal surface by means of the spirit level and a long straight edge, applied diagonally across the corners as well as along each strip. For a small ceiling this will be sufficient, but a large one requires intermediate screeds, brought accurately to the plane of the first ones. When the screeds have hardened a little, the space between them is filled with "brown" mortar, which is easily made perfectly even by means of the straight-edge. Similar screeds should be formed in the vertical angles of the room, plumbed, and the intermediate spaces filled up to a plane surface. If cornices are to be run, which is always done before the last coat of plastering, the angles should be as rough as possible, to give them sufficient "key." The superintendent should study the profile of the proposed mouldings, and if a large mass of mortar will be left in the angle, he should order nails to be driven to hold up the coarse mortar which is used for "dubbing out" the cornice before the finer material is applied. (Fig. 134.) Some care is necessary to see that the final coat of plastering is not injured by freezing in winter or by too rapid drying in summer. From the latter cause the finished work near the windows is often found covered with a network of minute cracks, particularly on the side which the wind strikes, while a breeze barely at the freezing point will cover the surface with radiating crystals, disintegrating it so that on thawing again the mortar will scale off in patches. The remedy for this is to keep all openings protected by temporary windows or screens, consisting of wooden frames covered with cotton cloth, well fitted to the openings. Whether the plasterer or the carpenter shall provide these screens or temporary windows depends on the terms of their respective specifications. Perhaps the best way is to require the carpenter to supply and fit them, and the plasterer to shift them in such a way as to secure his work against freezing or unequal drying.

Trowelling.

Angles.

Straight-edge.

Three Coat-work.

Scratch-Coat.

Screeds.

Cornices.

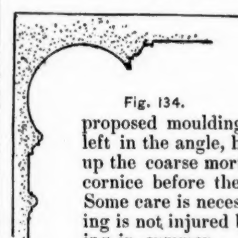


Fig. 134.

Screens.

As soon as the plastering is completed, the plumber must be summoned to finish his work, so as not to delay the joinery. The pipes will be first put up, and the superintendent must thoroughly understand the purposes and requirements of each. Cast-iron pipes should be carefully scrutinized, especially where cut or broken. The metal, unless double-thick pipes are specified, will be very light, and in the poorer makes it is apt from careless casting to be much thinner on one side than the other. If any particular kind is called for, or known to be good, the shape of the "hub" will serve to distinguish it, if the name of the maker is not cast upon the pieces. In some places iron pipes are coated with asphaltum at the factory, for the use of the best plumbers; the inside as well as the outside being treated. Elsewhere, painting with red lead is customary; and this is generally confined to the outside, as the inside would soon lose its coating. The asphaltum forms the best covering, but whatever is used, the exterior of the pipes must be completely coated before they are brought to the building. The joints should be made with oakum, not paper or shavings, driven in tight, and finished with melted lead, which, *after* the pipes are fixed in position, is to be thoroughly calked all around. It is often much more convenient to calk the joint before securing the pipes in place; but the jarring so occasioned may loosen the lead, and where the joint will be accessible after fixing its completion should be deferred. It must not be forgotten that the melted lead by itself will not make a tight joint, since the shrinkage of the metal in cooling draws it away from the iron, and it must be forced again into contact with the calking iron, applied at every point of the circumference. A first-class workman will use three or four pounds of lead for each joint, filling the hub completely, and showing the marks of the tool all around. Inferior plumbers leave a little space above the lead, which they afterwards fill up with putty, smoothing it neatly, and, if possible, getting a coat of paint over it before the superintendent comes. Such joints will pass the test, but are not durable if there has been any carelessness in calking the lead. Intentional swindlers fill the joint with shavings, paper, mortar or anything else which happens to be at hand, and daub the top over with putty, or perhaps with a little lead, ladled out of the pot.

Plumbing.

Soil Pipes.

Rust joints, of sal-ammoniac and iron turnings, are sometimes, though rarely, used. They are said to be tight and durable, but likely, if unskilfully made, to burst the hub by the expansion of the mass. All iron pipe should be very strongly supported, by iron straps and hooks, never by wires.

Lead pipes should be examined as delivered. The weight per foot, or the letters denoting the same thing, are stamped on the ends of the coils: after the lengths are cut off, it is more difficult to ascertain whether they comply in weight with the requirements of the specification. Most lead manufacturers furnish cards showing the thickness of metal corresponding to a given weight for each calibre, but the saw used to cut it spreads

Lead Pipes.

out the lead, increasing the apparent thickness. In general, lead supply-pipes, unless for a tank or other very light pressure, should not be *less* than $\frac{3}{16}$ of an inch in thickness of metal. Waste and air pipes will be little more than half of this. There is some difference in the quality of lead pipes, but it is not easy to detect it except by analysis or the test of use. Honey-combed or corroded pipe, and any which shows unequal thickness of metal, should however, be at once rejected.

Brass Pipes.

In certain localities the seamless brass tubing, drawn over a mandril in the same way as lead pipe, is much in favor for plumbing work, and where the pressure is very heavy or the water is so soft as to attack lead, it is well worth the additional cost, which is not usually more than ten to fifteen per cent on the whole amount of the plumber's contract. They can be had either plain, or coated inside and outside with tin, or, for use in conspicuous situations, plated with nickel and polished; and couplings, unions, bends, tees, and all varieties of cocks and fittings are furnished to correspond with each kind of pipe. Where the brass tubing is employed throughout a house, it is common to have the cold-water supply tinned inside, while the hot-water, which is not likely to be used for drinking, is conveyed in the ordinary kind. If there is no danger that either brass or lead will be corroded by the water, it is not unusual in the best work to make the hot-water pipes only of brass, using lead for the others. In this case the harder metal possesses the advantage that if properly put up, with the angles left free to move a little back and forth to accommodate the expansion and contraction of the pipe between them, it is not injuriously affected by repeated alternations of heat and cold, which with the inelastic and ductile lead first stretch the pipe by contraction, and then, as it does not possess elasticity enough to recover its shape, cause it, on being again extended by the passage of warm water through it, to sag down between its supports, this effect increasing by repetitions of the cause until the undulations of the pipe become sufficiently pronounced to retard or stop altogether the flow of water through it. Where, however, the brass tubing is tightly confined at the ends of a long line, the joints and fittings often become strained and leaky by the contraction of the pipe in cold weather, since the very rigidity of the metal prevents it from accommodating itself, like ductile lead, to the force exerted upon it; so that it should be used intelligently to obtain the full benefit of its good qualities. One last precaution should be observed: at the completion of a piece of brass-pipe plumbing all exposed portions of the metal must be varnished with a good coat of shellac, or it will soon become corroded and unsightly. This may be made a portion either of the plumber's or the painter's contract, but unless the duty is distinctly imposed upon one or the other, it will be neglected. Paint, which was once generally applied both to brass and lead pipes, is best omitted unless required for appearance.

Wrought-Iron Pipe.

As a cheap substitute for brass tubing, where there is reason to fear the corrosion of lead pipe from the softness of the water, or its bursting from the heavy pressure under which it is delivered, iron is often used, galvanized or enamelled in various ways. It may be obtained with a lining of pure block tin, forming a very strong and pure channel for water, and glass-lined iron pipe is sometimes used; but the ordinary coating is one of coal-tar or paraffine enamel, giving a shining black surface. A smooth, red covering is sometimes seen, which is said to have a base of vulcanized rubber. Whatever may be the protecting medium employed, the unions, bends, and other fittings are treated with the same, and if well put together the water nowhere comes in contact with the metal. The galvanized or zinc-coated pipes are more expensive than those merely enamelled, but more durable, unless in acid waters.

Zinc Casings.

The same precautions against the straining of the joints which are necessary with brass pipes should be observed with those of iron. Moreover, iron being a very rapid conductor of heat, cold-water supply-pipes of that metal will in warm, sultry weather condense a great deal of water upon their surfaces, which trickles down them and may in time cause serious injury to paper or other decorations beneath. Where there is any risk of this the pipes should be encased in a tubing of zinc, which will catch the condensed drops and conduct them to a place of safety. This is even done with lead and brass pipes in city work of the best character. Where costly decorations or papers are in danger of being injured by a possible leak, it is always advisable and is generally required of the plumber by the best architects, to enclose all supply-pipes in zinc tubes, which will retain the jet from a lead pipe burst by freezing or water-hammer, or the drops of condensed water, and conduct them to a safe outlet.

The course, joints and fastening of all the pipes, whatever their material, should be carefully observed, and the hand of a skilful and conscientious plumber will be more quickly recognized in this than in any other detail of the work. Such a man can always arrange his pipes so that they will fall naturally into their proper places, without that dodging over or under each other which characterizes the "botch's" work; his lines will be perfectly straight, and all hot-water pipes separated by a small distance from the cold, to avoid loss of heat from one to the other; the supports will be neatly put up, at equal and small intervals, so that no sagging of the pipes will be possible between them; and all will be laid with a continuous fall toward some faucet by means of which the water can be thoroughly drained from them.

Boards should be put up by the carpenter, well secured to the walls or ceilings, wherever pipes are to run, and similar ones fitted in between the beams where it is necessary to conceal them between floor and ceiling. To these boards the pipes must be attached at intervals of about four feet where they run vertically, two feet where they follow the underside of a ceiling, and six or eight feet where they simply lie on a horizontal surface. Horizontal pipes should be secured by stout brass bands screwed to the boards; and where several pipes run side by side, a first-rate plumber will separate them far enough to allow screws to be put into the band between them. Vertical pipes, in order to prevent them from creeping downward by alternate expansion and contraction, must be fixed in place by hard-metal "tacks" soldered to the pipes and screwed to the boards. All joints in lead pipes should be "wiped joints," excepting only those connecting the couplings of basin, sink, or other wastes to the pipes, which cannot easily be wiped, and do not require to resist a pulling strain, so that a "cup joint" is sufficient.

Brass and iron pipes are connected by means of unions, or short pieces of cast-brass, tapped at each end to receive the screw thread cut on the lengths of tubing. In the case of brass, the joint is covered with red lead before screwing up. Enamelled or galvanized iron fittings may be put together without such luting.

If the workman shows a disposition to neglect any of these niceties of his art, he should be always under suspicion of greater errors, and should be watched to see that he does not fasten the pipes in out-of-the-way corners by means of hooks, or leave them suspended from a ceiling, or between beams, by attachments so far apart that alternate expansion and contraction will in time cause them to sag down, forming a hollow from which the water cannot be drawn off, so that the pipe is likely to burst there if the house should be left vacant in freezing weather. The opposite fault, of allowing the pipe to take an upward bend in any part of its course, is still more to be avoided. Such a bend, whether accidental or made by ignorant intention soon becomes filled with the air always carried in bubbles through the water, forming an "air trap," which may stop the passage of water entirely unless relieved by opening the pipe at the highest point of the curve.

The number and courses of all the pipes should be minutely described in the specification. If, however, no details are given, as sometimes happens, the superintendent will have a little difficulty in deciding upon the arrangement which he can require with justice both to the plumber and the owner. Much depends upon the customs of the locality, and something also upon the price for which the work is to be done. In Massachusetts or New York, for instance, under a mere agreement for a "first-class job," *with an adequate consideration*, the plumber would be expected, without special orders, to provide stop-cocks in convenient positions for shutting off both hot and cold water from any part of the house at pleasure, and draining the pipes; and in Massachusetts he should arrange a tank in the roof, itself supplied by a rising main and ball-cock from the regular house service, to contain water for the copper bath-boiler below, and carry up an "expansion pipe" from the highest part of the hot-water system to this tank, turning over the edge just above the water-line, so as to allow steam and froth to escape freely; and in any large city he would be expected to put separate traps under all fixtures, and provide air-pipes to the same, and to carry up such air-pipes, as well as the soil-pipes, above the roof; and finally, to fit up separate cisterns over each water-closet, for their exclusive supply, and place "safes" of sheet-lead turned up around the edge under all plumbing fixtures above the first story, or over furnished rooms in the basement, with waste-pipes of their own, emptying over a sink or bath.

In States which have statutes for the regulation of plumbing work, the provisions of the constituted authority must be taken in the absence of specific details, as forming a part of the plumber's contract. In New York and elsewhere, however, it is customary to fit up bath-boilers without the tank in the upper story, rising main and expansion pipe, and in some small country towns the old-fashioned pan water-closet, supplied without the intervention of a service cistern by a valve with branch from the main pipe, is still used in the best ordinary practice.

In cases where a first-rate job is clearly not intended, the superintendent may still do much by attentive study of the subject to secure, if not the best possible arrangement, at least a safe and strong one. When the time comes for setting in place the sinks, baths, wash-bowls and water-closets, this special knowledge will be still more necessary, for without an adequate and constantly advancing acquaintance with the improved apparatus continually placed upon the market, he can neither criticise justly that which may appear to him valuable or the reverse in the construction or fitting up of new appliances, nor make suggestions to meet peculiar needs.

Such knowledge must, however, be gained from technical books and journals; a general treatise can do little more than indicate a few main principles; as for instance, that waste and supply pipes should, for any kind of apparatus, be large, to insure speedy filling and discharge; and the construction as simple as possible; that putty joints, rubber washers, and inaccessible floats, check-valves or other moving parts are to be avoided: and that the ideal of every plumbing appliance would be a solid glazed stoneware basin, in one piece, supplied by a quick and copious flow of water through a large pipe, and discharged through the shortest possible waste-pipe and ventilated trap, all connected with calked lead joints, into a thoroughly aërated, porcelain-lined soil-pipe.

BUILDING STONES.[1] — II.

CIRCUMSTANCES beyond my control will prevent my taking up building-stones in any geological order, or according to any system, other than to present to the readers of this journal such conclusions as are first arrived at in the course of a series of experiments and investigations, that it requires time to complete.

In this article I shall speak of the limestones and marbles of Vermont.

Prof. J. D. Dana, supposes, that at the close of the Lower Silurian, there was a time of mountain-making in North America, and that at this time, the Green Mountains, from Canada to southern Connecticut, were formed. The rocks which include a great limestone formation, including also various fragmental rocks, overlying the limestone, were as Prof. Dana believes, folded and crystallized by the heat produced by the disturbance, added to what existed in the earth's depths. Thus, at that time, much was changed from fossiliferous limestones to white and clouded crystalline limestones or marbles, as known to the trade. This change, being more or less perfect, gives us in his opinion all conditions, from the limestone literally filled with fossils, as in the Isle La Motte; to the white statuary marble of Rutland and vicinity. As the Lower Silurian rocks of Vermont, are no less than twenty thousand feet in thickness, the amount of limestone and marble belonging to this upheaval in Vermont, New York, Massachusetts and Connecticut must be practically inexhaustible.

Prof. T. Sterry Hunt looks upon this immense formation from a different standpoint. He believes that the crystalline marbles were never fossiliferous. That the white and light marbles were not bleached out in the change spoken of, but were deposited by water holding pure lime in solution. In his "Origin of Crystalline Rocks," he says: "So many limestones are made up of calcareous organic remains, that a notion exists among many writers on geology, that all limestones are in some way of organic origin."

This he denies, and calls attention to the white marbles of Vermont as apparent examples of deposition of pure carbonate of lime from water, from whence life was excluded. He doubtless considers this deposition crystalline from deposit, which is hardly in accord with some known facts, yet is entitled to consideration. I shall treat it, however, as a metamorphic rock, probably becoming crystalline under more or less heat, and compacted by pressure caused by upheavals and foldings as well as overlying material.

Pure white, mottled and shaded, yet fine-grained marble is quarried most extensively in Rutland, Pittsford, Dorset and other places not far distant; yet some other quarries like those at Middlebury are in good repute, while the darker variegated marbles are quarried or found on the entire line; but whether in Vermont, or New York, or elsewhere in New England, when of crystalline marble they are referable to this same welt of metamorphic limestone, the upper portion of which is of the Trenton formation.

These limestones are almost pure carbonate of lime, free from iron, magnesia or alumina, and contain but a fraction of one per cent of quartz.

That they once held iron in composition would seem probable, and Prof. J. H. Huntington, in speaking of the iron ores in the vicinity of this marble region, in the *Appalachia* for June, 1880, says: "The way in which these ores have been accumulated is clearly shown at the Sutherland Falls marble quarry. The marble here forms an anticlinal[2] axis, and along the axis at various depths there are cavities of several feet in extent which have their longer diameter parallel with the strike[3] of the rock. These cavities are wholly or partially filled with ochre and nodules of iron ore, and at the southern limit of the marble, between it and the limestone, there is a great bed of ochre and iron ore. So it is evident that in the metasomatic[4] development of the limestone in the process of marble making the iron was eliminated, and lies accumulated in the beds where it is now found."

With these preliminary remarks upon the formation of the marble belt of New England and the adjacent country, I will speak in this article of the quarries wrought by the Vermont Marble Company only. This company combines in its incorporation the Sutherland Falls and Rutland marble quarries, yet the character of the marble is quite unlike.

The Sutherland Falls marble is more compact and closer, or more intimately connected in its particles, thus becoming more nearly homogeneous. Its specific gravity ranges from 2.666 to 2.876, and its ratio of absorption from $1 + 345$ to $1 + 388$. This term "ratio of absorption" means that on an average three hundred and sixty-five parts of marble will absorb one part of water; hence the above expression $1 + 342$ means that three hundred forty-three pounds of soaked marble (when it has absorbed all the water possible) contains one pound of water.

This peculiar closeness of texture, when first noticed in a thin section, under the high magnifying power of a microscope, seemed so different from any other marble that I had examined, that I submitted sections of it to Prof. George W. Hawes, special lithologist in the Smithsonian Institution, asking if he saw anything peculiar about it that marked the structure as unlike that of any other quarry. In his reply he says: —

"The specimens of marble which you sent us in thin sections contains a very minute portion of quartz; scarcely any. It appears to me like a very good stone. I suppose you have noticed the twined structures of the grains of calcite, also the compact method in which they are packed together."

I concluded from his coincident vision that this peculiar homogeneous structure was no illusion, and that it might add to its capabilities and durability as a building and monumental stone.

To what extent it does so will be more fully developed by my experiments, now in progress, in reference to the capabilities of standing heat, moisture, and frost, such as it is called upon to stand in the climate of New England.

Subjecting it to heat, it stands all ordinary temperatures without injury, first showing slight scaling at one thousand degrees Fahrenheit by a standard pyrometer, and only injured past further use when kept for some time at twelve hundred degrees.

Its crushing strength, as shown by the testing-machine belonging to the United States Government, when crushed between rigid beds of steel in two-inch cubes, ranges from 12,250 lbs. to 20,000 lbs. per square inch; the dark A layer, which is the most closely united in its particles, standing most, and the Y layer least. The different layers are well known to the trade under designating letters and numbers. Its weight per square foot ranges, according to its compactness, from 166 to 178 lbs.

This quarry is about one-fourth of a mile from Sutherland Falls, on the Otter Creek, which gives its name to the quarry. The mills are on the falls, and the quarry is wrought by compressed air carried from the compressing engine at the mills to the quarry in iron pipes.

The Rutland Company's quarries combined with this quarry are at West Rutland, a few miles above, on the same stream, but are wrought by steam power; while the mills at Centre Rutland, where it is sawed, are run by both steam and water. Of these quarries the range of color is greater, passing from a medium blue through the various shades to white; also mottled and clouded in great variety. While much of it is of fine texture, it is not so closely woven together in its particles, or so peculiar in its structure, but its sugar-like fracture and desirable shades recommend it to the favor of the people at large, and as it is easily wrought, and not given to chipping, it is a favorite marble for the manufactures of head-stones, monuments, etc.

Its specific gravity averages 2.666; its weight per cubic foot 167 lbs.; ratio of absorption, $1 + 342$. At one thousand degrees of heat it cracks and scales very slightly, and is only ruined, as the Sutherland Falls marble, at twelve hundred degrees. Its capability under pressure is from 11,000 to 12,500 lbs. to the square inch. It has long been familiar to the trade in its different varieties, as an easy-working and reliable marble. This company is now working, in addition to the Sutherland Falls and four pits at West Rutland, a stratified marble called the "Mountain Quarry." This is about two miles from the Falls, but it is sawed at the same mills as the Sutherland Falls quarry. Tests of this will be given in future.

This company has a capital stock of three millions, and employs seven hundred and fifty men. The sawed product last year was 3,100,000 two-inch feet, or double that number in board measure.

The other quarries situated in Rutland and vicinity, wrought by other parties, will be the subjects of my next article.

[1] By Hiram A. Cutting, Ph. D., State Geologist, Vermont.

[2] *Anticlinal:* Noting an axis or imaginary line where strata dip in opposite directions. — BRANDE.

[3] *Strike:* The direction or line of strata which is always at right angles to their prevailing dip. — LYELL.

[4] *Metasomatic:* Relating to the conversion of a rock into a new form, both as regards structure and substance, as by long-continued natural chemical agencies.

TESTS OF FIRE-PROOF MATERIALS.

THE committee having charge of the exhibition of Building Materials, one of the branches of the Fair of the Massachusetts Charitable Mechanic Association, recently held at Boston, has put the matter of testing the materials submitted by exhibitors for that purpose into the hands of Mr. F. E. Kidder, B. C. E.

The most important test yet attempted by Mr. Kidder, was a test of fire-proof materials which was made a fortnight or so ago.

The principal test was made in a building measuring 10′ x 20′ and about 10′ high, erected for the purpose, containing all of the materials to be tested, so arranged as to be fully exposed to the action of fire and water.

The walls of this building were mostly eight-inch brickwork, excepting one end which consisted of a frame-work of small timber joists partly filled in between with hollow partition-blocks of the Hydraulic Lime of Teil manufactured and used by the Fire-Proof Building Company of New York; by hollow blocks of the same size and shape made of Patent Selenitic Cement and ashes by the Selenitic Cement Company; and the remainder furred off, and protected with different varieties of Loring's tiles. The top of this end wall consisted of five courses of brickwork, supported by a wooden beam, which was built for the purpose of giving a solid wall for the wire-cloth ceiling, which covered that end of the building, to anchor into. All of the timber in this end was protected by Loring's tiles. The other end wall of the building, which was of brick had a doorway-opening, 2½′ wide and 6½′ high. This opening was closed by a wooden door hung on the outside of the wall, and covered on the inside with tin which lapped over the edges of the door and three inches on the back, where it was secured by nails. The door was made of two thicknesses of boards nailed crosswise of each other. The tin was fastened together with a hook joint, so as not to depend upon the solder for making a tight joint.

In the side walls of the building were built seven pieces of terra-cotta coping, and thirteen 8″ x 9″ terra-cotta tiles with an ornamental pattern on their face. This terra-cotta was manufactured by the Boston Terra-Cotta Company, Messrs. Lewis & Lane proprietors. There were also built into the side walls, seven varieties of ornamental building stone, about two dozen moulded brick, of the same lot as those used in the Exhibition Building, and three thin hollow terra-cotta blocks manufactured by the Fire-Proof Building Company. In the end wall was also built a large block of architectural terra-cotta.

Across the building about seven feet from the floor was placed a 4″ x 9″ wooden beam, which was covered on the top and bottom by Loring's bricks which were hollowed out on one side; the sides of the beam being covered with twelve-inch tiles made of the same material as the bricks, viz.: fire-clay. About twenty of these tiles and as many bricks were used on the frame-work end of the building.

In one of the side walls were also built quite a large number of the porous terra-cotta bricks used by the Wight Fire-Proofing Company for lining brick walls and for fire-proof partitions.

In one end of the building were placed two *unloaded* columns. One was an unprotected four-inch cast-iron column, with three-fourths inch shell, and eight feet four inches high, including the cap. The other column was one of Wight's Standard Columns, consisting of a four-inch cylindrical column, with four flanges projecting two inches, making the extreme diameter of the column eight inches. The column is of cast-iron, nine feet six inches high, and has about sixteen and one-half square inches of metal in its cross-section.

This column was protected by means of Wight's porous terra-cotta tiles for protecting columns, and was finished with an ornamental base of Portland cement, and a plaster cap, the body of the column being finished with plaster-of-Paris.

This is the same column that was in the Wight Fire-Proofing Company's exhibit at the Mechanic Fair. Both columns were stayed at the top with iron bars, and their tops were protected so that no heat should get into the interior of the column except by being transmitted through the iron shell. In the centre of the unprotected column were suspended some strips of sheet-lead. The ceiling was divided near the middle by a light ten-inch iron beam placed across the building, which was protected with porous terra-cotta tiles by the Wight Fire-Proofing Company. On one side of this beam was an ordinary wooden floor, consisting of 3″ x 10″ spruce beams, placed twelve and one-fourth inches on centres, whose ends were supported by the end wall of the building and the iron beam just described. These joists were covered with hemlock boards and one inch of cement, to protect them from the weather. This floor or roof was protected on the under side by twelve-inch square tiles of porous terra-cotta, which were fastened to the joists by means of screws, according to the Wight system of fire-proofing under wooden joists. On the other side of the iron beam the building was covered with two brick arches, springing crosswise of the building, and about three feet long. These arches were supported by nine-inch I-beams, which were protected by Wight's porous terra-cotta skew-backs. Between these arches and the next piece of ceiling, which was put up by the Clinton Wire-Cloth Company, was a space of about eight inches, which was covered by a two-inch plank, protected on the under side by Wight's tiles.

All of the ceiling thus far described was put up by the Wight Fire-Proofing Company, of Chicago and New York, under the personal superintendence of the manager, Mr. P. B. Wight.

The remainder of the building, consisting of a space about five and one-half feet by the width of the building, was covered by four-inch hard-pine planks, tongue-and-grooved, and spiked to 6″ x 6″ wooden plates, which rested on the top of the brick walls. These planks were protected on the under side by plaster on wire-cloth. The wire-cloth was such as is manufactured by the Clinton Wire-Cloth Company, and used by them for fire-proof ceilings. It was fastened to the planks by iron staples, and was kept at a distance of three-fourths of an inch from the wood, by means of strips of iron, $\frac{1}{8}$″ x $\frac{3}{4}$″, placed on edge. The cloth was turned down on the sides and end, so as to protect the wooden plate, and was fastened to the brickwork. On the edge which came next to the other ceiling, the wire-cloth was carried up over the edge of the plank and onto the top, so as to protect the plank, should the other ceiling fail. This wire-cloth received two coats of plastering, the first being pushed through so as to fill the space between the plank and the wire. This ceiling was put up by the Clinton Wire-Cloth Company, of Clinton, Mass., under the personal superintendence of Mr. Brown, the superintendent of the works.

All of the ceiling and walls of the building were plastered, with the exception of the architectural terra-cotta, the moulded brick, and the specimens of stone. As it was desired to have the test as early as possible, all of the plaster was gauged with plaster-of-Paris.

The plaster on the ceiling put up by the Wight Fire-Proofing Company had about five days in which to dry, the plaster on the protected column had about four, and the last coat of plastering on the wire-cloth had just four days in which to dry. Some of the plastering on the walls, and the plastering on the wooden beam protected by Loring's tiles, had but two and one-half days in which to dry. The weather during most of the time was very unfavorable for drying plaster.

Along the top and bottom of the side walls of the building were built eight-inch vents for draught. The fuel used for the fire consisted of one-half cord of birch strips for kindling, three cords of dry split pine, and one-half cord of hard wood, the whole being piled up loosely over the entire floor of the building, so as to form a pile about seven feet high. No oil or coal-tar was employed, except a few gallons of oil used in starting the fire.

The fire was started November 15, at 2.10, P. M., and was allowed to burn one hour and twenty minutes. Owing to the direction of the wind, the fire burned more readily in the end of the building protected by the Wight Fire-Proofing Company, and consequently that part of the building was more severely tested than the other end. While the fire was burning, the following observations were made: —

At 2.25, fifteen minutes after the fire was lighted, smoke was seen coming through between the boards in the upper part of the wooden door, but the wood did not feel hot to the touch. At 2.50, forty minutes after the fire was lighted, flames were coming through the door in the place where the smoke was first observed. From carefully observing the door during the test, we are convinced that the burning was not caused by flames licking around the edges, but by the charring of the wood behind the tin, after which, as the air could get to it, the charred wood soon broke out into flame. The door was kept from burning down by means of water. At 2.53, the external side of the ceiling or roof put up by the Wight Fire-Proofing Company was warm to the touch, the top of the brick arches naturally being the warmest. The ceiling protected by plaster on wire-cloth was very cool, except at a spot over a joint between two of the planks, which was quite warm.

At 3.20, one hour and ten minutes after the fire was started, all of the exterior surface of the roof was very warm, excepting that protected by plaster on wire-cloth, which was still cool to the touch, except in two or three places where the planks came together. At this time there was a roaring fire on the inside.

The wooden frame-work in the end of the building was at this time uninjured by the fire, and the outsides of the tiles were not hot enough to burn the hand. At 3.30, one hour and twenty minutes after the fire was lighted, two streams of water from a hydrant were thrown into the building by a detachment of the Boston Fire Department, one being directed against the iron columns, and the other over the ceilings and walls. After the walls and ceiling had been well wet down, the fire was put out — as it was supposed — and an examination of the interior of the building was made, as far as was then possible. The building was so filled with steam, however, that no accurate examination could be made, except in the case of the columns. Both the protected and unprotected columns were apparently uninjured, except that the plaster on the protected one had of course been mostly washed off by the hydrant streams. The Portland cement base on the latter stood the test remarkably well, the outer skin only being injured. The wooden beam covered by Loring's tiles and bricks was observed to be in place, but its condition could not be examined. Minute examination of the effects of the test was then postponed until the following day, after the building should have become sufficiently cool to allow of taking off the several protecting coverings, so that the condition of the materials protected might be accurately ascertained. Unfortunately, the next morning it was found that the fire, which the firemen supposed to be extinguished, had sprung up during the night, and passing through a hole which some meddlesome person had made the previous afternoon in one of the tiles on the end built up of timber-work, had burnt much of the timber-joist and furring from the outside, but the tiles were still in place.

Nevertheless, on removing the tiles it was found that the timbers which were protected by these tiles, where they were not burned from the outside, were not even discolored by the heat of the fire, but looked as bright as when first put up. Some of this wood was creosoted spruce.

After the fire of the afternoon, some other meddlesome person punched one or two holes in the ceiling of wire-cloth and plaster, and the fire of the night charred the wood over these places to a considerable extent. The wire was uncovered in seven places, but in only two of these (except those which had been punched with a stick) was the plaster between the wire-cloth and the wood missing, and even in these places the wood had not charred to a great extent. Four-fifths of this ceiling was apparently uninjured except that the plastering was roughened, but the wire could not be seen in any place on this four-fifths. Observations made directly after the fire, and examination of the ceiling on the following morning, warrant the conclusion that had the fire not broken out during the night, the planks which were protected by the plaster on wire-cloth would have been found uninjured. It must be admitted, however, that during the original test-fire this end of the building was not exposed to as great or as long-continued heat as that which attacked the other end of the building, and as no one was present during the second and accidental fire, it is impossible to say how severe this unauthorized test really was; but as there was at least one-third of the fuel unconsumed after the first fire, and as the high wind which had proved so troublesome during the actual test went down with the sun, it is fair to suppose that this second fire was a very hot one, and that its influence was more equally distributed over the building. The absence of soot on this part of the building indicated a very great heat. The wooden beam which was covered with Loring's tiles and bricks was burned and destroyed during the night. This can readily be accounted for by assuming that the water washed the plaster from the joints between the tiles, and thus gave ready access to the second fire. Whether the beam was injured by the first fire or not it is impossible to tell.

The brick-arch ceiling resting on iron beams protected by porous terra-cotta skew-backs was uninjured by the fire and water, as was also the ten-inch iron beam protected in the same way.

The plaster on the tiles over the remainder of the ceiling was mostly washed off by the water, and the joists to which the tiles were suspended were badly charred in four places and slightly discolored in several places. It is impossible to tell whether this charring was caused by the first or second fire. There was but little wood left in that end of the building after the first fire, and it would seem that there could not have been much heat on that part of the ceiling during the night; still it is not in the least improbable that the charring was caused by the second fire acting through cracks where the plaster had been disturbed by the hydrant streams the previous afternoon. In either case the charring was caused by the heat penetrating the joints between the tiles, and not through the tiles themselves.

The porous terra-cotta brick of the Wight Fire-Proofing Company, the moulded brick, the partition-blocks of selenitic cement, and the thin, hollow tiles of the Fire-Proof Building Company, were uninjured by the fire or water.

One of the hollow partition-blocks of hydraulic lime of Teil had two holes on the inside, which penetrated into the vertical holes running through the tile. These holes must have been caused by the fire, the water, or by both. The other two blocks of the same material were uninjured. The blocks of selenitic cement and ashes, and the blocks of lime of Teil were placed side by side, so that they must have received the same amount of heat and water. Of the seven pieces of terra-cotta coping, three were found to be cracked, two pieces had one crack each, and the other, two cracks. These cracks were so fine that they were not at first perceived. Of the thirteen 8″ x 9″ tiles, six were cracked, but the faces were not blown off, and the cracks were quite fine.

A slab of New Brunswick freestone, 16″ x 26″, and 2″ thick, was uninjured. A block of the Bay of Fundy Quarrying Company's stone, from Mary's Point, N. B., and a piece of Norcross Brothers' Long Meadow stone were also uninjured. Three pieces of brown and light-colored sandstone were badly blown, one having its whole face for a depth of an inch and a half blown off.

On taking down the unprotected iron column, the pieces of lead which had been suspended in it were found melted into a solid mass at the bottom. As an indication of the degree of heat of the fire, it may be stated that some bent pieces of iron which were suspended from one of the brick arches were straightened out by the heat of the first fire.

Owing to the uncertainty regarding the effects of the first fire on the ceiling of the building, it would be very desirable to test that part of the building again, by making an intense fire and allowing it to burn entirely out before the building was opened. It would also be desirable to test a wooden door protected by tin on both sides.

During the same afternoon that the test above described was made, a separate test of the six-inch square tiles of porous terra-cotta manufactured under Mr. S E. Loring's patents was made, by building a fire in a box lined with these tiles. The box was 4 feet wide, 4 feet 6 inches deep, 4 feet 6 inches high, and was made of strips of 1″ x 2″ spruce, placed four and a half inches on centres. The tiles were nailed to the inside of these strips, and the joints pointed up with mortar. The box was about half filled with fuel, which was allowed to burn, and the heat was increased by pumping kerosene oil onto it. The tiles were tested for about an hour by alternately pumping oil onto the fire, and then throwing a small stream of water over the tiles. At no time during the test were the outer surfaces of the tiles sufficiently hot to pain the hand, and after the test, the strips of wood were found not to be charred in the least by the heat. The tiles were fastened onto the box the same day on which the test was made, and the mortar pointing was absolutely fresh.

A separate test of the porous terra-cotta manufactured for Mr. Loring under his patents, and of a brick of selenitic concrete, was also made by placing the specimens in the back of the furnace used for heating the steam-boilers in the Exhibition Building, where they got the full effect of the heat from the burning fuel, and allowing them to remain there about one hour, when they were taken out and immediately immersed in water, experiments which gave the following results: — A brick of porous terra-cotta (made from fire-clay), hollowed on one side, when taken from the furnace was red-hot. It showed no cracks, and did not crack on being immersed in water. It was, however, rendered very soft, and when taken from the water would easily crumble in the hand. Another brick of the same kind, which did not get heated quite so much, was not cracked by the fire or water, and was not as much softened by the latter. These bricks hardened somewhat on drying, but did not regain their original strength. A six-inch square tile of porous terra-cotta (made of a low grade of fire-clay) was not cracked or warped by heat or water, but was considerably softened. These tiles are never very strong.

A porous terra-cotta brick, of a lower grade of clay than the fire-clay brick, but harder burned, was uninjured by the heat, but on being taken from the water showed some very fine cracks. This brick was not softened as much as the others, and retained considerable strength.

A concrete brick of selenitic cement was heated red-hot. It did not crack under the action of the heat, though it was somewhat softened. On being immersed in water, it disintegrated badly, and became very soft. After a few days it had regained considerable of its original strength.

In conclusion, we must say that we are very far from deeming the trial either satisfactory or convincing, and anything but a conclusive comparative test, and we hope that the manufacturers and patentees most interested will aid the committee in charge in their endeavor to conduct a second and more satisfying experiment.

While the building was under observation, that part of it which was built with the material furnished by the Wight Fire-Proofing Company was certainly subjected to the fiercest and most satisfactory test, and that portion of it which was protected by the Clinton Wire-Cloth ceiling was just as certainly not subjected to as severe a test, while some of the building-blocks furnished by the Selenitic Cement Company and the Fire-Proof Building Company were placed so low down in the wall as to be below the level of the line of greatest heat, and we do not consider that in the original fire the lower blocks were tested at all. How far the second fire tested these portions of the building, no one can say, but there is every reason to believe that it did so very severely; but as no one was on hand to note its effects, and as the integrity of the building had been tampered with by meddlesome persons, between the two fires, the results of neither fire can properly be accepted as testing the real merits of the several materials.

Nevertheless, the results were very surprising, and distinctly proved that every material had very considerable fire-resisting qualities, and gives foundation for a very live belief that a future test will develop the fact that some of the materials or some method of employing a single material or several in combination can be accepted as substantially if not perfectly solving the problem of fire-proof construction.

The shortness of the time during which the materials were exposed to the fire was due to two causes: first, the impatience of the members of the Fire Department, who arrived on the ground an hour before the time agreed on, and who declared that they could not waste their time by waiting longer: and second, the unequal combustion of the fuel, caused by the high wind; so that in order to throw a stream of water on the iron columns and the other material at that end of the building while they were exposed to the greatest degree of heat attainable, it was necessary to interrupt the experiment and prevent the fire from deserting that end of the building for the other, where there was still a great deal of unconsumed fuel.

THE ILLUSTRATIONS.

INTERIOR SKETCHES IN HOUSE OF ROBERT SENEY, ESQ., BERNARDSVILLE, N. J. MESSRS. LAMB & RICH, ARCHITECTS, NEW YORK, N. Y.

As we have not space in this issue for the perspective view of this house, its publication is postponed for the present.

HOUSE OF MR. E. SALOMONS, F. R. I. B. A., MANCHESTER, ENGLAND.

This design is copied from the *British Architect.*

HUDDINGTON-COURT HOUSE.

This house, which is copied from the *Building News*, has lately been despoiled of nearly all its interior fittings, which were till very recently in an almost complete state of preservation. They were taken down to be refixed in the proprietor's house elsewhere. Externally the building has been untouched since the days of Elizabeth, and is in every way an admirable specimen of a timber manor-house. It was the old moated manor of the Winters, who, owing to their connections with Gunpowder plot, in 1606, were obliged to leave this residence, and have not resided here since. To this circumstance no doubt the escape of the house from alterations is due, and the recent removal of its internal wood-work, including the richly-treated chimney-piece of oak, which bore the date of 1534, is much to be regretted. The building is enriched by the finest stack of elaborately moulded brick chimneys to be found in the county, and the solid staircase, opposite the entrance, deserves mention.

STAIRCASE HALL AT ST. CLOUD, FRANCE. MR. THEODORE A. HOWARD, ARCHITECT.

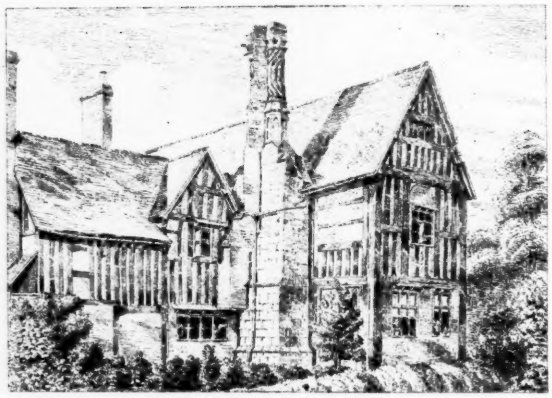
This illustration, which is copied from the *Building News*, shows the staircase hall in one of three houses about to be built at St. Cloud, France. From the bay window, shown on right hand, also from the windows of principal rooms, a magnificent view of Paris and the Seine valley is obtained.

KENTISH GABLES.

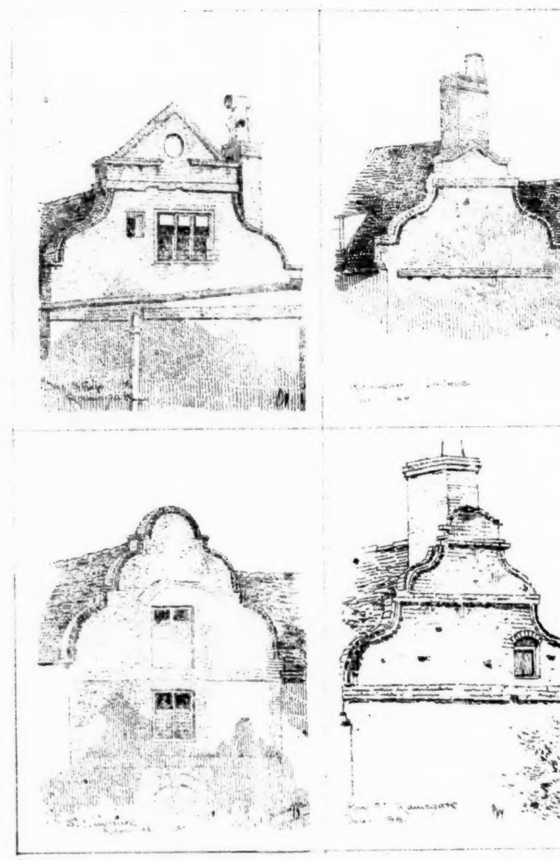
A few years ago there were several picturesque gables in the Isle of Thanet of a similar type to those sketched by Mr. Weir, but they are fast disappearing. Mr. Seddon published drawings of some of them, and the sketches now given, which are copied from the *Architect*, will also be valuable as a record of interesting examples of Kentish work. They represent the period between 1615 and 1678.

HOUSES IN "THE BUTTERWALK," DARTMOUTH, ENGLAND.

These houses, which are copied from the *Architect*, which date from 1634, are of wood; the front is supported by stone pillars, which recall a prominent feature in the street architecture of many Brittany towns. The upper portion has suffered by being modern

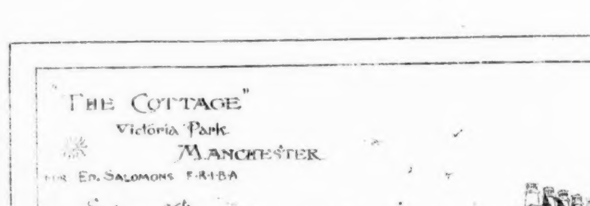


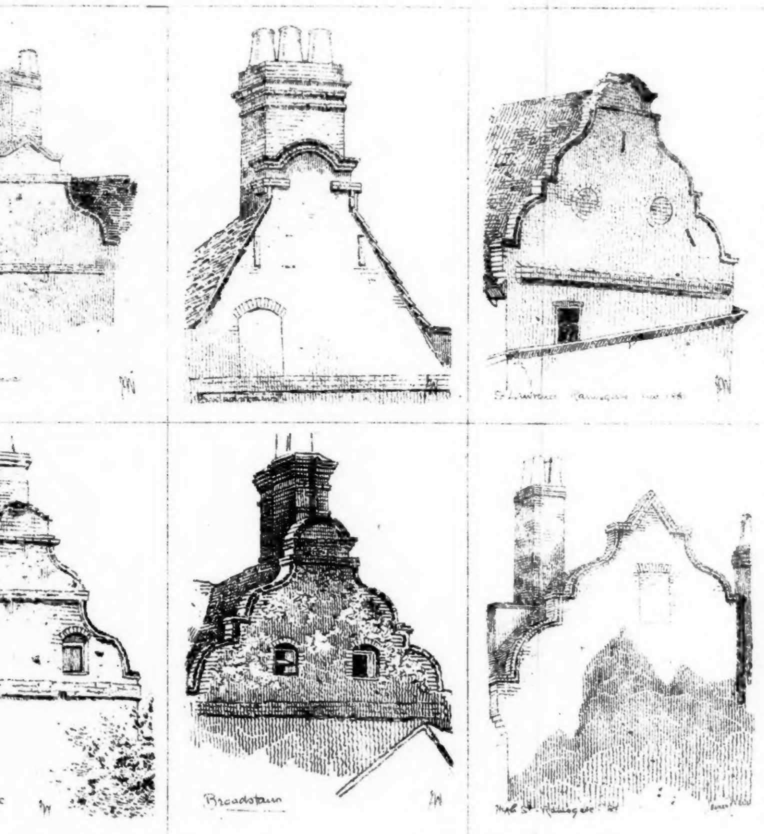
The Building News



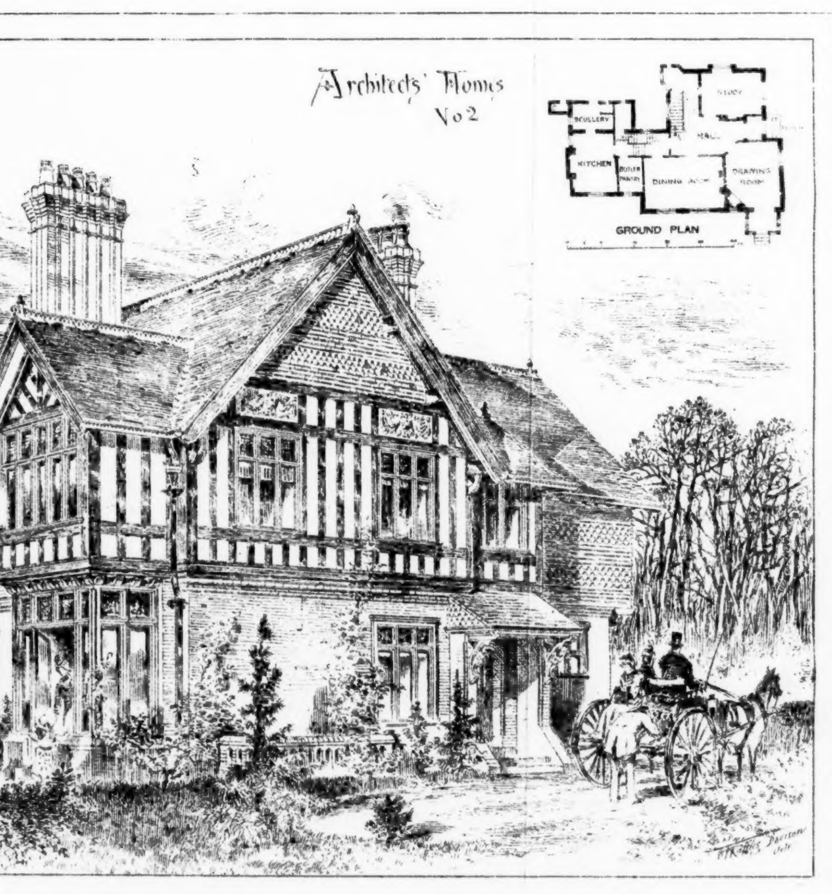
The Architect.

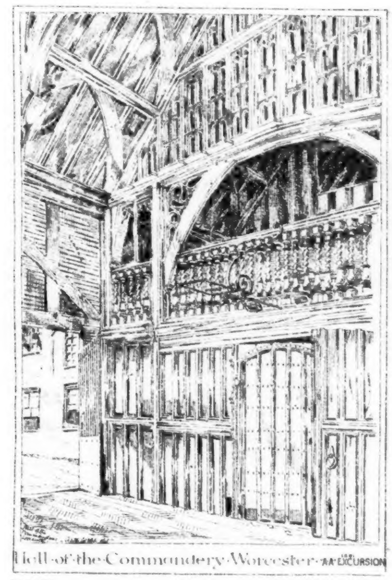
The Architect.





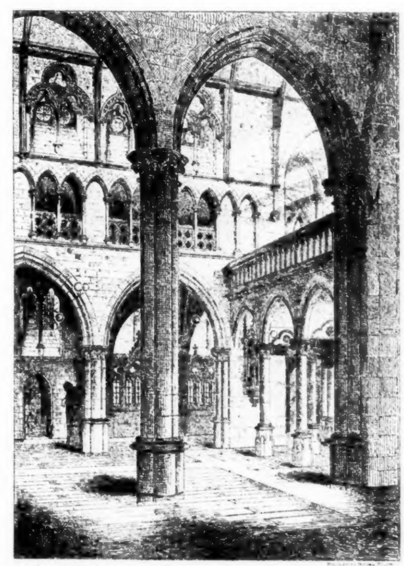
KENTISH GABLES





Hall of the Commandery, Worcester. A.A. EXCURSION

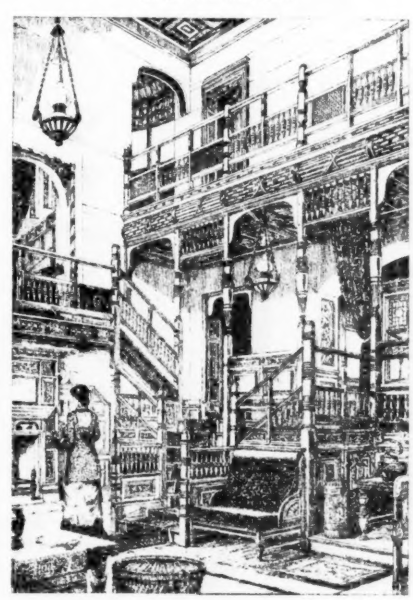
THE BUILDER.



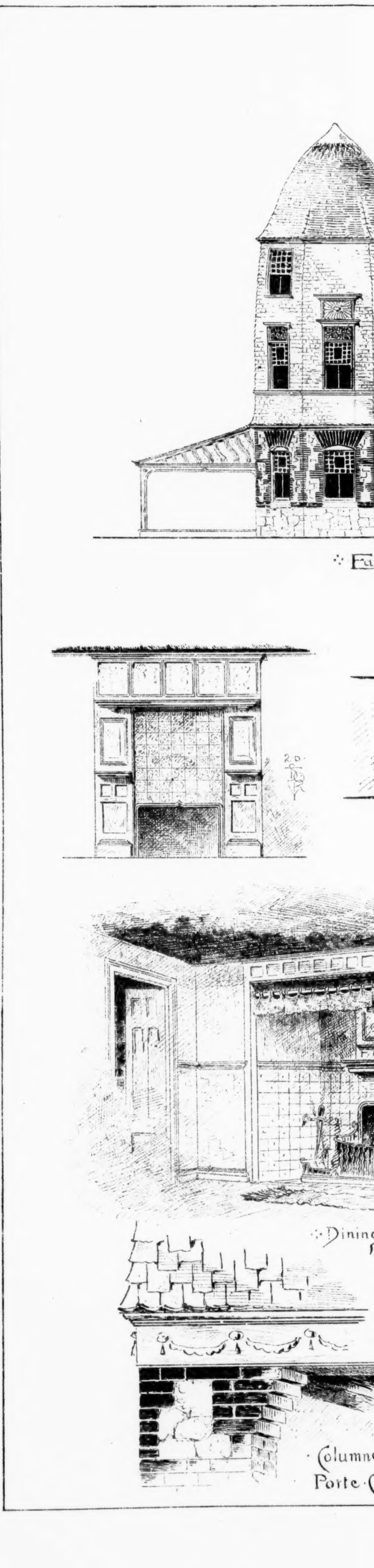
THE BUILDING NEWS

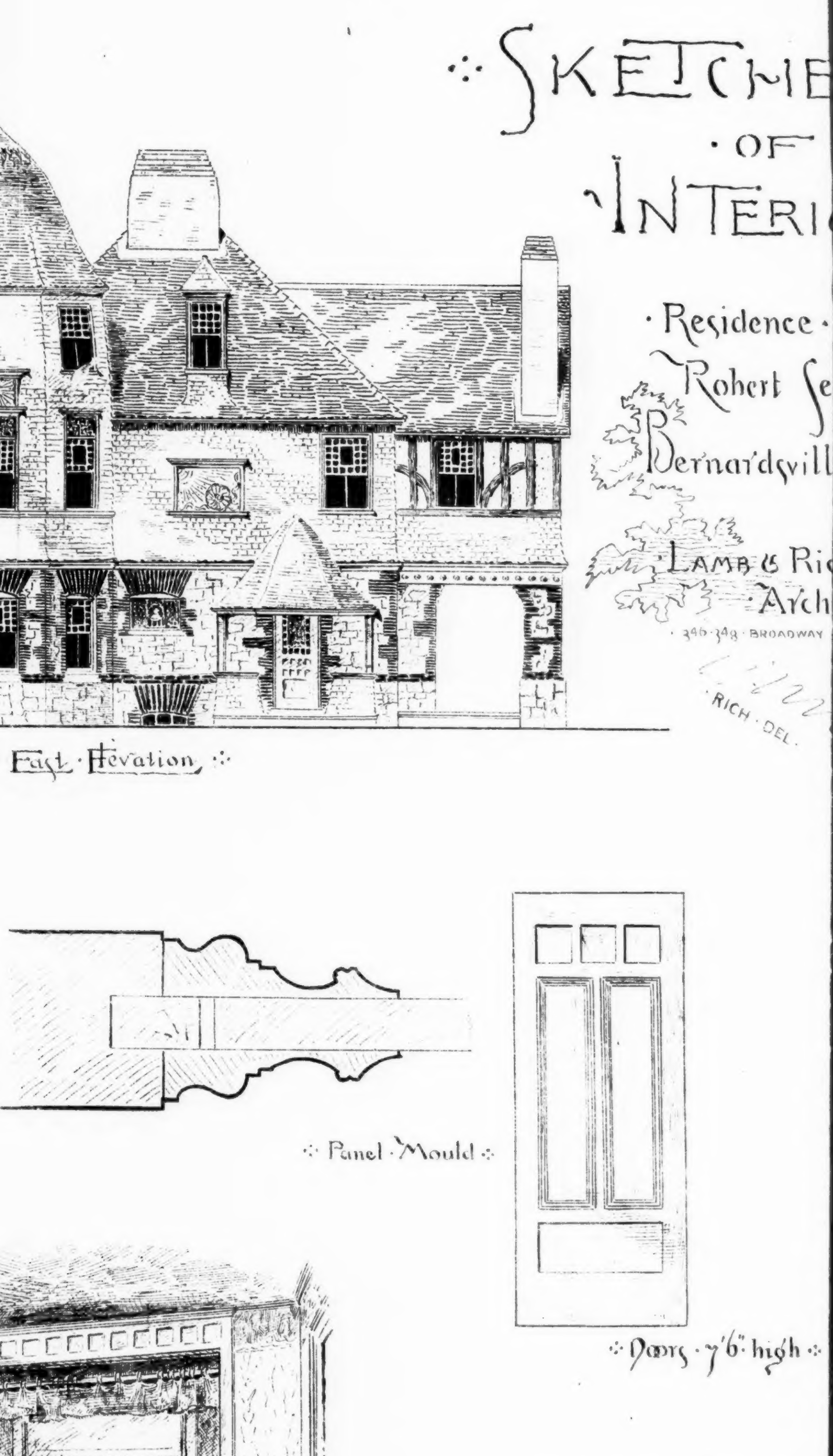
THE R.C. CHURCH OF OUR LADY AND ST. DENIS, AT ST. MARYCHURCH, TORQUAY

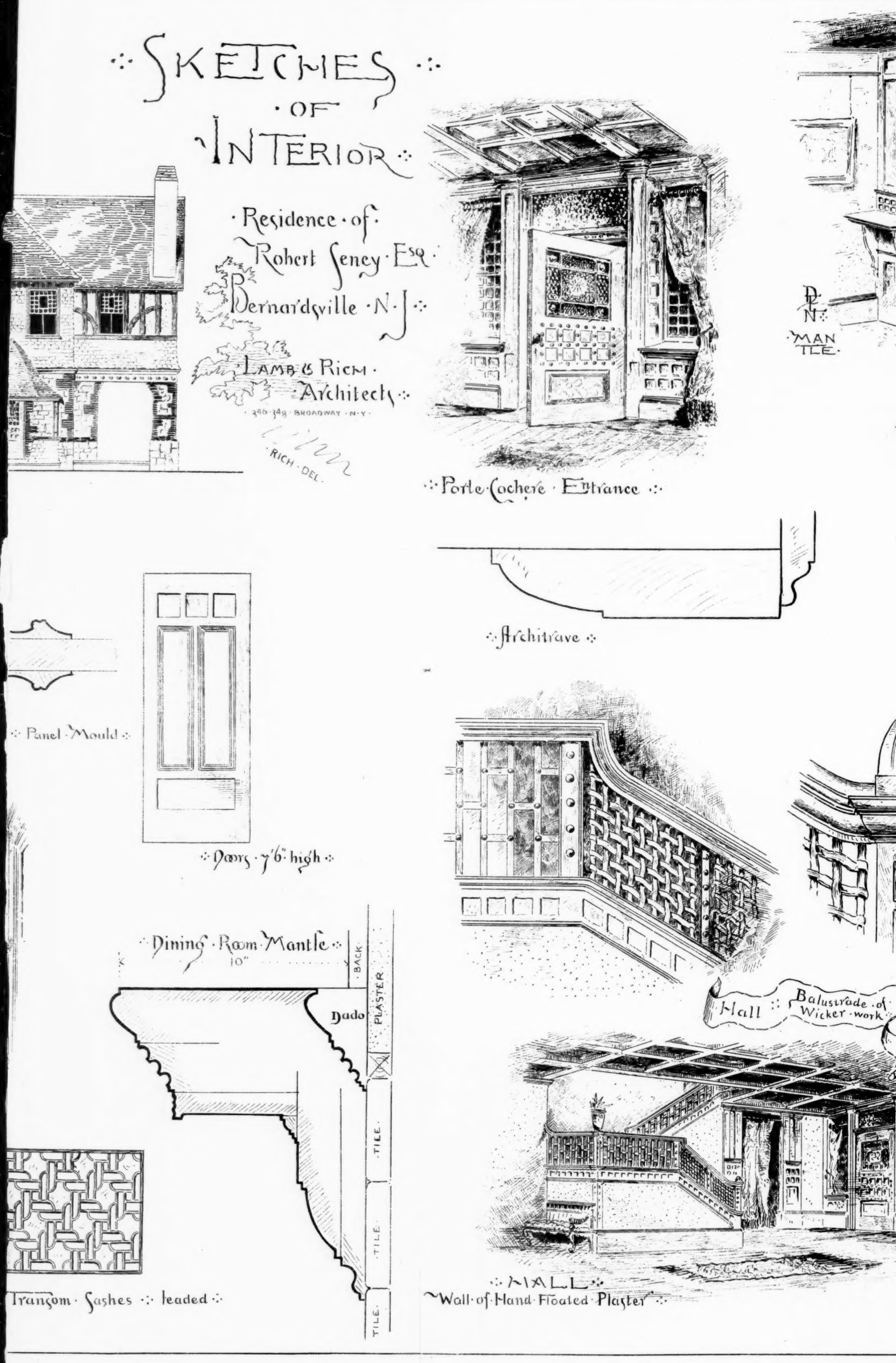
Messrs. Joseph A. Hansom & Son, Architects.

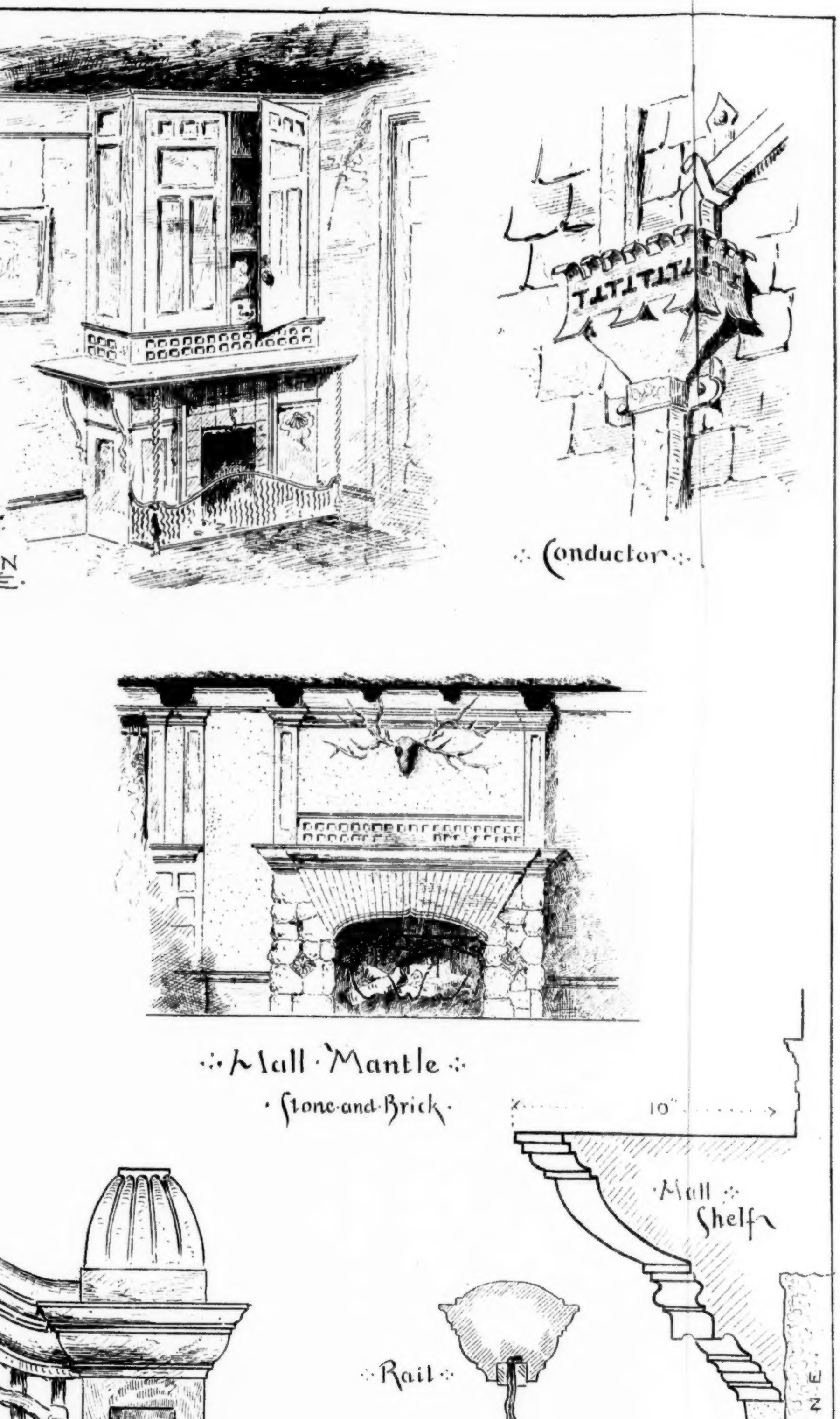


STAIRCASE HALL IN HOUSE [illegible] CLOUD, PARIS


∴ Fa
20
∴ Dining
· Columne
Porte · C


SKETCHE
OF
INTERI
Residence
Robert
Bernardsvill
LAMB & RI
ARCH
346-348 BROADWAY
RICH. DEL.
East Elevation
Panel Mould
Doors 7'6" high
Dining Room Mantle
10"
Transom Sashes leaded


SKETCHES OF INTERIOR
Residence of Robert Seney Esq.
Bernardsville N. J.
Lamb & Rich Architects
280 . 348 . BROADWAY . N. Y.
RICH DEL.
Porte Cochere Entrance
D. R. MANTLE
Architrave
Panel Mould
Doors 7'6" high
Dining Room Mantle
10"
BACK
PLASTER
Dado
TILE.
TILE.
TILE.
Transom Sashes leaded
Hall
Balustrade of Wicker work
HALL
Wall of Hand Floated Plaster



The Heliotype Printing Co. 211 Tremont St. Boston.

ized, and by the insertion of ordinary windows. The interior contains some panelled plaster ceilings and carved wood-work.

HALL OF THE COMMANDERY, WORCESTER, ENGLAND.

The Commandery, or Hospital of St. Wulstan, retains in its hall, shown by Mr. Aston Webb's sketch, copied from the *Building News*, a very interesting remnant of Late Gothic wood-work, with its balustrade of still later date. It is situated in Sidbury, which leads from the Edgar tower over the canal. Originally the hospital staff consisted of a master, chaplain, and four poor brethren. Founded and endowed with considerable possessions in the eleventh century, it was seized by Henry VIII in 1545, and sold to a Worcester clothier, one Thomas Wylde, for £498. The large handsome perpendicular window, with the repetition of "Emmanuel" on its "glass windowe quarrelles," is to be noted in the Hall, which is the principal apartment now remaining. It is, at present, used as a college for blind sons of gentlemen.

ST. MARYCHURCH, TORQUAY.

We copy from the *Builder* an internal view, taken from the north porch, looking across the nave and two aisles to the Lady Chapel, which does not occupy the usual place at the east end, but is placed for necessary reasons at the south side of the south aisle, at its western extremity, and measures 30' x 12'. To the right of the picture is a large tribune for the orphans under the care of the nuns of the third order of St. Dominic, to whose convent the church is attached. It consists of a chancel, 30' x 20', with nuns' choir on the south side, and sacristies and presbytery on the north; nave, 103' 6" x 22' 3"; north aisle 88' 6" x 12' 6"; and south aisle, 103' x 12' 6"; the Lady Chapel already alluded to; and the tower and spire at the west end of the north aisle, the baptistery forming the lower part. The internal dimensions are 133' x 47' 3". The church is built in local limestone and Chudleigh limestone. The spire is, however, all built in Portland stone, and terminates in a copper cross, which communicates with and forms part of the lightning conductor, which is a ribbon 4" broad x $\frac{1}{8}$" thick. The top of the cross is 176' above the floor level, which is nearly 300' above the level of the sea. The whole of the works are from the designs of Messrs. Joseph A. Hansom & Son, architects, South Kensington.

THE FIFTH AMERICAN ARCHITECT COMPETITION.

As those who take part in our competitions may be weary of having their efforts confined to the designing of the internal portions of a building, we have decided to announce a programme for the present competition which may afford a welcome relief.

PROGRAMME.

The subject of the fifth competition will be the exterior of the small country hotel upon whose interior decoration our competitors have expended their ingenuity. The hotel is to be large enough to accommodate thirty guests in addition to the hotel employees; may be built of wood, brick, or stone; may be of one, two, or three stories, and of such size or shape as the designer finds best suited for providing the requisite amount of space. We find it necessary to insist on the fact that this is a country hotel in a small rural village, whose chief attraction and ornament it is to be, because in the former competitions a number of competitors have offered designs which were far from being suitable for a quiet country hotel. The cost of the building should not exceed $30,000.

Required: Two drawings, each measuring 14" x 22" within the inner framing line, upon one of which is to be a perspective view of the hotel; and upon the other two floor plans, at least; an outline elevation of one of the façades not shown in the perspective; and either a section or sketches of any bits of exterior detail that the competitor may deem most effective.

The conditions governing the competition are the same as those which have governed our former competitions, and three equal prizes of $50 each will be awarded to the best three designs.

PLUMBING APPARATUS AT THE LATE MECHANIC FAIR.

One of the most conspicuous objects in the main hall was a set of Haynes's patent corrugated copper bath-boilers, manufactured by R. Estabrook & Son, of South Boston, and labelled "Handsome, durable, and cheap." We can answer for the handsome appearance, and see no reason why they should not possess the other qualities also. Evidently, they will withstand frost, and should be at least as strong against collapsing pressure as the ordinary form.

Docker & Holton, Boston, exhibited some handsome copper bath-boilers of the ordinary form, and Phillips & Weeden, of Boston, showed seamless bath-boilers warranted to resist a complete vacuum, as well as an outward pressure of two hundred pounds per square inch. The same firm exhibited bibb-cocks of various novel patterns, besides elaborate combination cocks for baths and wash-bowls. Albert Hallowell, of Lowell, Mass., had also some handsome plumbers' goods, including a new spray nozzle for hose.

A. Wentworth, Roberts & Co., of Boston, showed a beautifully finished soapstone sink and draining-board, and E. B. Badger & Son had plumbers' copper-work of the kind for which they already have a high reputation.

Messrs. Henry C. Meyer & Co., as might be expected, occupied a considerable space with an admirably arranged exhibit. The Hellyer long and short hoppers, with the Vortex closet, which is simply a modified hopper made in one piece with the trap, and the Hellyer Improved Valve-Closet, formed the most familiar objects in their collection; but the Royal porcelain bath, a luxuriously clean-looking affair, and their patent cocks, the Fuller-Meyer and the Doherty Self-closing, were equally interesting to the expert, who was particularly favored by being shown the dissected anatomy of all their apparatus. The short hopper, we noticed, was furnished with a great improvement on the early form, in the shape of a long brass ferrule securely connected to the lower end of the trap, by means of which a complete soldered joint can be made with a lead or iron soil-pipe, in place of the unreliable flange connection commonly used.

Mr. John Ross, of Boston, had a modest little exhibit in Messrs. Meyers's section, showing a valve-closet of his own construction, which, although far from possessing all the advantages of the Hellyer apparatus, was yet much improved from the old-fashioned pan water-closet; while near by earth-closets were shown by Mr. C. D. Holmes, of Boston, containing an ingenious and effective automatic supply-valve.

Mr. James Barrett had a set of wash-trays fitted with a new trap, in shape much like the ordinary full S, but supplied with two trap-screws, one on the upper bend and the other on the lower one; while the main drain, into which the smaller traps emptied, was furnished with a larger one of similar construction. On the table near was a dissected specimen, which revealed the existence of a weighted valve at the top of the S, simply and ingeniously hung in such a way as to be easily taken out by removing the upper screw. Where flap-valves are needed, as they will sometimes be, this apparatus seemed remarkably well adapted to the purpose, from the ease with which it can be cleaned from lint or other substances, and we are glad to see that it was awarded a medal. The larger drain-trap was similarly arranged, but with a removable cover, instead of a brass screw.

The Durham system of drainage was shown by a contorted line of pipes, put together with the peculiar joint which forms the subject of the Durham patents, and consisting in huge unions, bends, or branches, into which the soil-pipes, cut with a thread at each end, were screwed. Mounted high in air, on the summit of one of the pipes, was one of Zane's water-closets, which are used, we believe, exclusively by the Durham Company.

H. W. Clapp & Co., of Concord, N. H., had plumbers' cast-iron ware in great variety, some of it very nicely enamelled, together with valve-traps, and a good form of cesspool and sewer-grating, with catch-basin for sand. Under one of their neat little office wash-bowls they had a glass trap of the kind which was first made familiar to us as employed for the overflow of Zane's water-closet, and consisting of a little cup, like the pan of a tiny water-closet, counterbalanced so as to be held up against the mouth of the pipe above, which is furnished with a packing ring. In our opinion, this and all similar valves are defective, in that while the water is passing through them, the flap is necessarily open, and unless the water fills the whole bore of the pipe, which it rarely does, foul air can escape past it upward. We know that in theory the downward rush of the water draws the air in the pipe with it, but in practice we have been able to detect a very decided upward current of sewer-gas through such a valve when in operation.

Wm. Henderson, of Boston, showed a water-closet not unlike the old-fashioned "Worcester hopper," but improved by the addition of a clumsy lead flushing-rim, and provided with a simple automatic flushing arrangement. The top was covered with soapstone, instead of the ordinary lead or enamelled iron. Mr. Henderson had also a urinal furnished with automatic flush from a tilting tank, which unfortunately refused to work at the time of our visit.

W. B. Moore & Son, of Boston, received medals for a variety of apparatus, furnished with ventilation by means of galvanized iron pipes, in which a current was supposed to be maintained by means of a gas-light burning in a lantern at the foot. The same makers had also a very novel form of urinal, which seemed to us to possess some exceedingly good features.

The Wellington overflow wash-bowls were shown in several forms, and the same maker had also a basin, so weighted as to be self-levelling, for use on ship-board, which was considered worthy of an award.

The Eagle odorless excavating apparatus was shown in an exhibit arranged with much care and pains, and including a patent garbage-barrel, with a cover which could be made air-tight by turning a screw. The Boston Lead Company made a beautiful display of their products, the most conspicuous portion being a pyramid of block-tin pipe, shining like silver, and admirably finished.

On the whole, the exhibition of plumbing work and materials, though somewhat scattered, was a brilliant and interesting one. The care which the different manufacturers took to show the construction of their apparatus by means of detached portions, sections cut for the purpose, and glass enclosures for working parts, is especially to be commended. A single dissected specimen of this kind is worth more in explaining the true value of a particular apparatus, even to persons not skilled in mechanism, than the obtrusive eloquence of a dozen attendants, and those exhibitors who kept most strictly to this silent sort of illustration seem to have found their goods the best appreciated. Some articles which are already familiar to architects and plumbers of the best class were conspicuous by their absence. In such an exhibition as that which has just closed, one would naturally expect to find specimens of the Morahan stone-ware or "porcelain" wash-trays, the Maddock basins and other earthenware, the Stanford drain-pipe joint, the Harrison closet bowl and tray, particularly the new form, which is far superior to the old; with some of the nickel-plated baths, the German silver pantry-sinks, and other goods of the finest class which have been recently introduced. Even the various forms of the Mott iron-work, the porcelain-lined soil-pipe and traps, the ingenious and handsome folding wash-bowls and urinals, the Demarest and other closets, the new flushing cistern, and scores of useful appliances which would readily be appreciated by such a public as that which crowded the Mechanic Fair for two months, were missing, to the great regret of the comparatively small number of experts who knew that such things existed, and deplored the loss of an admirable opportunity for extending their use.

FIRE TEST OF IRON SHUTTERS.

THE following account of the trial of some shutters by the Corrugated Metal Company, of East Berlin, Conn., is from one of the local papers, and contains some points of interest:

In one corner of the yard was located a building about 10 feet square with a 3″ x 6″ opening in each side, and into these were fitted the four different styles of fire-proof shutters manufactured by the company, viz.: single and double thick box doors, and a wood shutter door covered with tin. The inside of the building was completely filled to the top of the wall — about ten feet high — with hard wood thoroughly saturated with kerosene oil and covered over the top with corrugated iron to confine the heat. The shutters were all placed in exactly the same exposure, and the fire was lighted. It soon began to burn fiercely; but for the first half hour it did not show itself on any of the shutters, but so great was the heat the walls commenced cracking. The first signs of giving way under this severe heat were shown in about half an hour by the wood shutter covered with tin, which commenced to emit smoke and wood-oil through the holes in the tin where the latches and stays were bolted on. The corrugated-iron shutters at this time showed no effect of the heat, except the single-thick shutter, which became quite warm, so that the paint commenced to smoke. The box door was so cool that a person could hold his hand on it. At the end of an hour the wood shutter covered with tin, which had been for some time throwing off streams of smoke through the cracks, showed unmistakable signs of giving out, and had it not been for the heavy iron bands forming the outer frame it would have fallen from its place. The single thickness corrugated iron shutter was at the same time so hot that the paint was all burned off, and the others began to show the intense heat by the burning paint on the outside, but still held their places, and beyond the burning paint showed no signs of distress. It now became evident that the wood shutter covered with tin could not withstand the severe heat much longer, and soon the flames were seen to eat through it at the top, showing that the inside cover of tin had been burned off and the shutter as a fire protection was useless. The corrugated shutters held their places firmly and closely to the wall. At the end of three hours the fire had nearly subsided, and the shutters were all opened out for examination. On the inside of the wood shutter covered with tin, a large hole had been burned through the inside covering, and when the shutter was opened, about one-half of the inside woodwork dropped out, a mass of burned and charred wood. The shutter had evidently been held together by the wrought iron band about the outside, and the strap pieces forming the hinges, which were all firmly bolted through and through with large washers inside — a form of construction without which the shutter no doubt would have failed completely to do the duty. As it was, it came out of the fire in a very damaged and useless condition, while the corrugated shutters were apparently as good as new, except the single thickness shutter, which was warped a very little on one lower corner, but not enough to allow the fire to leak through. The test was witnessed by several persons, but it is to be much regretted that it had not been more generally advertised, so that more of the large manufacturing companies, to whom fire-proof construction is such an important item, could have been represented. The test was very satisfactory indeed since it showed the merits of corrugated-iron shutters over wood covered with tin. For moderate exposure the wood shutters stood a good test. The building with the shutters still attached is to be left standing, so that parties interested in fire-proof shutters can see the results of the trial if they wish.

SPECIFICATION OF IRON-WORK.

IN the specification of iron-work it is very useful to know what are the market forms and qualities. By specifying for the brand and trade-mark of a well-known maker, the purchaser or engineer may be protected from imposition, though it is not seldom that with the utmost care he may suffer from the trickeries and fallacious marks known only to the trade. There are certain tests which only good wrought-iron can stand, and these ought to be known. Bar-iron, for instance, may be notched and bent cold to show the fibre. B and BB bars should stand a tensile strain of 22 tons per square inch with the grain of the iron, or 18 tons crosswise thereto. Flat bars not exceeding $\frac{3}{4}$ inch thick may be bent with the grain to a radius of two and a half times their thickness without fracture; they should also be able to stand punching and drifting without fracture. Engineers require certain tests; one of the best is to find the ductile quality by the amount of contraction of the area of section before tearing asunder under a tensile strain. Kirkaldy's experiments have shown that the contraction of area at fracture is an essential element in estimating quality, and is more reliable than the breaking strain. For both strength and ductility, the iron for structures should be specified not to break with a tensile stress less than a given amount, and that before breaking it ought to elongate not less than a certain proportion of its original length. The measurement for elongation is soon found, while the reduction of area at fracture is not so readily determined. The iron which shows the greatest tensile strength is generally the hardest, but has the least ductility or power of stretching; but both these qualities are necessary in certain members of a bridge. For plate-iron, the bending tests, when hot, are useful as rough tests. Plate-iron may be bent either hot or cold, with or across the grain, and the angle through which the plate should bend without cracking depends on the thickness and quality of the iron. According to the Admiralty tests BB plate-iron, grain lengthwise, 1 inch thick and under, can bend 120° when hot, and from 15° to 70° cold, the last angle being for $\frac{1}{4}$-inch plate. Crosswise, with grain, the plate will bend, when hot, to 90°, and from 5° to 30° cold, according to the degrees of thickness from 1 inch to $\frac{1}{4}$ inch. For B plate, the angle bent through is 90° hot, and from 10° to 55° cold, while crosswise of grain, the angle through which the iron can be bent is 60° when it is hot, and it will bend from 5° to 20° cold, from $\frac{3}{4}$ inch to $\frac{1}{4}$ inch thick. The angle referred to is that through which the plate is bent from the horizontal. Rivets of good quality should double when cold without fracture, and their heads ought to be capable of being hammered down without cracking when hot. Again, the physical appearances of iron ought to be known. Wrought-iron, when suddenly broken, presents a crystalline appearance — when gradually, a fibrous one; but it has been shown that good iron may be either crystalline or fibrous, according as the stress which caused fracture was sudden or gradual. Bad iron is never fibrous, but no criterion as to quality can be arrived at without knowing how the iron has been treated, and the strains have been applied.

Bars are round, square, or flat, and the ordinary sizes are $\frac{1}{2}$ inch to 3 inches diameter, or sizes increasing by $\frac{1}{16}$ inch. Flat bars are generally from 1 inch by $\frac{1}{4}$ inch to 6 inches by 1 inch, the width increasing by $\frac{1}{8}$ inch.

Among the sections kept in stock are half-round, oval, convex, octagon, and hexagon. Such bars can be had up to 22 feet in length without extra charge. Ordinary bars are sold at usual rates from $\frac{1}{2}$ inch to 3 inches wide; below these dimensions the rates increase 5*s* to 10*s* per ton for every $\frac{1}{16}$ inch reduction. Above 3 inches the prices also increase. Bars of L or T shape are rolled from 1 inch to 8 inches wide. For sections thinner than $\frac{1}{4}$ inch, 10*s* to 20*s* extra per ton is usually charged, and the same increase is incurred for sizes over 8 inches wide. In most of the large manufacturers' lists, however, sections of every useful size can be obtained at ordinary rates. Most of these forms of iron can be obtained in lengths up to 40 feet, above which a few shillings more per ton is charged for every 5 feet of extra length. This length, of course, depends on the rolling-mills, which vary from 20 feet to 40 feet for L-bars, and 20 feet to 30 feet for T-bars. It is stated on good authority that the iron in L-bars is of better and more uniform quality than that in T-bars, as the pressure in rolling is more equally applied. Channel-iron, used in lattice-girder bridges, is made of several sizes, but the rolled iron joist or I-shaped girder is one of the most useful sections in construction, and is manufactured in a variety of forms, proportions, and sizes. It is rolled in depths of from 3 inches to 14 inches, but every manufacturer publishes his own sections, with the weight per foot run and the distributed weight each section will bear. The uses of this favorite section are too well known to need mention; it may be remarked that its employment for fire-proof floors and large roofs on the Continent increases yearly. Small and narrow sections are the cheapest. Beyond 9 inches deep and 4 inches wide the price increases from £1 to £2 a ton. If wider flanges than 6 inches are required, the price is greater. For constructive purposes joists of more than 12 inches deep are better in riveted iron, though sections up to 20 inches deep are used on the Continent, and by riveting two sections together, either side by side or vertically, rolled joists of this section can be applied to almost any ordinary purpose. As regards length, the small sections are rolled up to 25 feet, without extra charge, and the larger sections up to 20 feet; beyond these lengths the price often increases, and lengths up to 40 feet are now commonly supplied at little additional cost. These joists are generally cut to the required lengths, hot as they leave the rolls; if cut to a length cold, a sum of a few shillings per ton extra is charged. Architects who require to specify these forms of iron do well to find out the dimensions kept in stock by merchants before writing; these vary, but lists are generally obtainable giving sections with weights and every particular, which may save much useless trouble and calculation. — *The Building News.*

TESTING WIRE ROPES.

AT the royal colliery of Friederichsthal, near Saarbruecken, a press has been erected for the purpose of testing wire ropes used for mining purposes. The cylinder of the press is supported by cast-iron standards, giving a clear vertical working space of about one metre between the fixed and movable clamps by which the test pieces are held. The latter is upon a cross-head parallel to a second one above the ram, the two being connected by side rods. The length of stroke and diameter of the ram are both 300 mm., and its effective surface is 707 square cm., which at the highest pressure of 200 atmospheres corresponds to a pull of 141.4 tons. The sides of the press cylinder are 100 mm., and the bottom 150 mm., thick; the side rods connecting the two cross-heads are 90 mm. in diameter. The experiments described were made upon three ropes that had been laid aside after use. The first was a round steel rope of 28 mm. diameter, with seven strands of seven wires each, and a hempen core of 10 mm. diameter. The total section of the wires was 250 square mm., and the tensile strength when new was guaranteed to be 28.2 tons by the maker, and proved to be 31.8 tons on trial. As it had been exposed to the air for some time, it was considerably and rather unequally rusted. The second rope, also of round steel, was 29 mm. in diameter, with six strands each of eleven wires 1.65 mm., upon a core of seven (one of 1.65 mm. and six of 1.45 mm.); the whole having a hempen core of 12 mm. The total section, apart from the six thicker core wires, was 200 square mm., and the tensile strength 21.89 tons guaranteed, and 26.63 tons actual. This was much better preserved than the preceding one, and the results obtained are considered as more accurate. The third rope was a flat one of cast steel wire, 60 mm. broad and 13 mm. thick, made up of six round ropes, each having strands of six 1.45 mm. wires and a hempen core of 2 mm., the section of the metal being 238 square mm. When new, the tensile strength guaranteed was 25 tons. There being no means of applying the press to the lifting of heavy loads of known weights, the loss due to friction produced by the hydraulic packing leather could not be directly observed, and was therefore calculated by Reuleaux's formula:

$$\frac{F}{P} = \frac{II}{D}$$

where F is the friction of the ram, D the diameter of the ram, and P the load upon it.

Moreover, if $p =$ pressure per square cm. $= 1.033$ observed gauge pressure in atmospheres; $p^1 =$ weight of ram and attached moving parts; $q =$ section of ram; $s =$ effective strain on the rope;

$$P = q\,p \quad F = \frac{q\,p}{D} - \frac{p^1}{D}$$

$$s = p\,q - p^1 \left[\frac{p\,q}{D} - \frac{p^1}{D}\right] = \frac{D - I}{D}\,p\,q - \frac{D - I}{D}\,p^1 = \frac{D - I}{D}\,p\,q - C,$$

from which the following expression was obtained:

$$s = 727.75\,a - C,$$

giving the actual strain on the rope from the observed gauge pressure in atmospheres a. C is a constant whose average value varied with the weight of the moving parts from 1375 to 1435 kg. The object of the experiments was to determine the value of different methods in use for attaching ropes to the drawing cages. These were: 1. Baumann's method, in which the end of the rope is fixed in a conical box by three wedges, the strain being uniformly distributed by a hard metal packing, whose surface is accurately moulded to that of the rope. 2. Similar method, but without protecting casing between the rope and the faces of the wedges, which are rough and hardened. 3. The ends of the wire were untwisted so as nearly to fill the conical box, and secured by an annular wedge. 4. Like No. 3, with the end secured by a conical plug. 5. Similar to 3 and 4, the joints being made by running in lead, zinc, or hard composition metal. 6. End turned into a loop and secured by pairs of iron rings, driven home by blows upon an anvil; length of point, 700 mm. 7. Loop with ends secured by three clamps, with two bolts to each; length of joint, 500 mm. 8. Loop with three clamps, having four bolts to each; length of joint, 600 mm.

Fastening.	Breaking strain.		
	Round rope of 28 mm.	Round rope of 24 mm.	Flat rope 60 × 13 mm.
	Tons.	Tons.	Tons.
Roughened vice jaws....................	28.3 — 28.8	24.1 — 24.6	29.7
Clamp..........No. I..................	27.7	24.1	....
Clamp..........No. II..................	23.3 — 25.5	22.6 — 23.4	28.1 — 30.3
Ring Wedge.....No. III....	15.7 — 16.4	6.6 — 12.8	....
Plug...........No. IV....	16.8 — 24.8	15.0 — 22.6	....
Lead joint.......No. V..................	12.1 — 16.1	12.1 — 18.3	5.2
Zinc joint........No. V..................	19.3 — 24.1	20.1 — 23.0	28.5 — 29.2
Hd. met. jnt....No. V........	24.4 — 25.9	23.0 — 23.4	17.5
Loop....... ....No. VI..................	10.2 — 11.3	16.8 — 17.9	....
Loop.... ....No. VII..................	15.3 — 27.7	13.8 — 22.9	24.8 — 29.5
Loop....... ....No. VIII..................	19.7 — 27.7	15.3 — 23.7	29.1 — 30.2

The variations in the above figures are caused by the rope slipping in the holder before the actual breaking strain was reached. This was especially the case with the lead joint No. 5, where the soft metal was invariably compressed and the rope was pulled out of the joint. Better results were obtained with zinc and hard metal, but the individual differences show that the metal must be cast at a high temperature to make a proper joint, when the wire is likely to be overheated, whereby its tenacity is diminished. Fastening No. 1 gave the best results, the strength of the joint being almost equal to that of the rope. The method of securing an eye with rings driven on proved thoroughly worthless, as the rings invariably slipped at a low strain. — *Iron Age.*

THE MECHANICS' SLIDE-RULE, AND HOW TO USE IT.[1]

THE author of *The Steel Square, and its Uses,* having given to mechanics and others a valuable little treatise on that most important article, the Carpenters' Steel Square, now comes forward with a compilation of rules for using an instrument that is almost constantly in the hands of every mechanic, and many professional men, — the slide-rule. To one who does not know what the divisions and numbers on the brass slide of a rule mean, it seems hardly possible that they are capable of performing examples in multiplication and division, the calculation of surfaces and volumes, and many other everyday matters.

By a little study of the rules and explanations given in this little manuel on the slide-rule, one would find that a large amount of time could be saved by the use of the instrument which he had before thought was intended only for the learned. The rules and explanations are so plain and useful and the price of the work is so low (25 cents), that every one who uses the slide-rule should own a copy.

BALLOON FRAMES.

MINNEAPOLIS, MINN., November 12, 1881.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

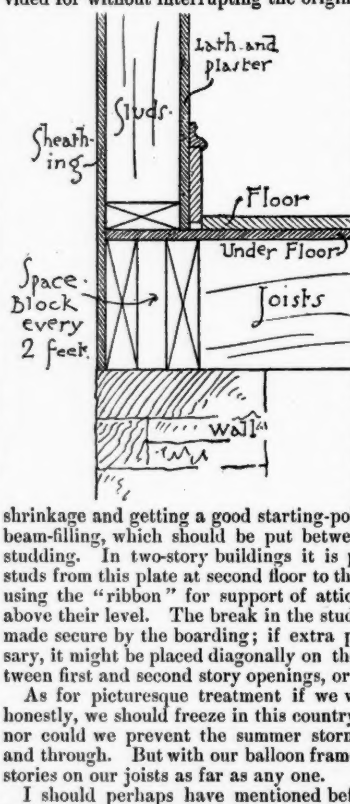
Dear Sirs, — I am one of doubtless many of your readers who find my pleasure and profit in the very valuable articles on Building Superintendence appearing in your columns, further enhanced by the discussion brought out on some points.

Possibly some of the methods employed in our section may add a mite or so to the testimony on the side of "balloon frames."

I would say that I believe the "braced frames" to be unknown in practice in a good portion of the Western States for dwellings and other light work.

The outer boarding or sheathing, properly executed, is a far more efficient bracing than we commonly get by the framing of the braced frame.

Studding should be placed uniformly 12″ or 16″ and openings provided for without interrupting the original spacing. Joists will thus be readily placed in most cases so as to come alongside the studs, and the lathing will be facilitated. Mr. Clark's objection to the support of the trimmer-beam by placing on the "ledger board" (or "ribbon" as it is often termed in some localities), may be readily met by an extra stud or two placed under the trimmer. In most cases of dwelling work, I can hardly agree with J. P. B. in studding the full height of the walls, but prefer to put a two-inch plate at the second floor of all outside and inside studding as a cut-off for fire and vermin. Beginning second-story studding and laying second-floor joists on this plate (stud over stud), thus avoiding appreciable shrinkage and getting a good starting-point for the brick or concrete beam-filling, which should be put between second-floor joists at all studding. In two-story buildings it is probably as well to run the studs from this plate at second floor to the main plate of the building, using the "ribbon" for support of attic joists if the main plate is above their level. The break in the studding at second floor may be made secure by the boarding; if extra precaution be thought necessary, it might be placed diagonally on the outside of the building between first and second story openings, or over the whole.



As for picturesque treatment if we were to display our framing honestly, we should freeze in this country before the first Christmas, nor could we prevent the summer storms from sweeping us through and through. But with our balloon frames we can project our second stories on our joists as far as any one.

I should perhaps have mentioned before the device by which we replace the timber sills. Two joists are placed as per sketch, with space and blocking between so as to be together, say one inch wider than the studding above; these are carried clear around the outer wall and well bedded on the same, and pointed on inside with mortar, after which the under flooring is laid, covering all the first-floor timbers. This under flooring if of wide boards should be placed diagonally, for if parallel with the upper flooring each wide board will in shrinking take several of the upper flooring boards with it.

Among the advantages of this method may be claimed greater stiffness than with sills; greater ease of obtaining materials; greater warmth than with "beam filling" without any of its cost, and with all of its security against passage of fire and vermin; it nearly coun-

[1] *The Mechanics' Slide Rule and How to Use It,* compiled and arranged by Fred. T. Hodgson. The Industrial Publication Co., New York, 1881.

teracts the shrinkage of joists and base from each other; greater height of walls obtainable with the same studs.

It must be borne in mind that the development of the "balloon frame" in the West is due not only to the general scarcity of timber (and money), but also considerably to the fact that even at the lumber manufacturing centres not nearly so many sizes of timber and dimensions are obtainable as at the East, except by special order; therefore three-inch boarding and two-inch dimensions have to be made the best of.

Frederic G. Corser.

THE VAULT OF THE ALBANY CAPITOL.

To the Editors of the American Architect: —

Dear Sirs, — In answer to a letter on the vault of the Albany Capitol, in your issue for November 26, 1881, I beg to refer your readers to my letter of November 12.

Most respectfully, Leopold Eidlitz.

WRITING SPECIFICATIONS.

Clarksville, Tenn., November 11, 1881.

To the Editors of the American Architect: —

Gentlemen, — Will you have the kindness to let me know which is the best book to learn how to write builders' specifications and contracts, and where I can get them. Hoping to hear from you soon,

Very respectfully, H. Probst.

[Address Messrs. Palliser, Palliser & Co., Bridgeport, Conn., for copies of their published specifications and contracts. — Eds. American Architect.]

GRAPHIC ANALYSIS OF ROOFS.

Toledo, O., November 23, 1881.

To the Editors of the American Architect: —

Dear Sirs, — Will you please inform me of the latest and best work making a specialty of the Graphic method for ascertaining strains for trusses (roof), both in iron and wood, and the price of said work. Please state if better than Trautwine. Is there any work on water-color painting superior to Aaron Penley's, and yet not so expensive?

Please answer in the *Architect's* next issue, and oblige

One of its Readers.

[The best book is by Professor Charles E. Greene, called "Graphics for Engineers, Architects, and Builders," published by John Wiley & Sons, New York. Price, ——. A separate volume, price $1.25, discusses Roof Trusses by the Graphical method.

We know of nothing better than Penley's book on water-color painting; but for amateurs, Winsor & Newton's little hand-book, "Hints for Sketching in Water-Colors from Nature," by Thomas Hatton, is extremely useful. — Eds. American Architect.]

FELTING PAPER UNDER SHINGLES.

Boston, November 26, 1881.

To the Editors of the American Architect: —

Dear Sirs, — In the issue of your paper of November 5, in the article on "Building Superintendence," it says that one or two plies of tarred felt are laid under the roof shingles. I have seen many houses built, but only once have I seen paper placed under shingles laid on a roof. Snow will not sift under shingles if they are properly laid. To make the shingles on a roof durable, air should be admitted to the back of them as much as possible. In heavy and long storms they become more or less soaked with water, and the quicker they dry the better.

The tarred felt will hasten decay by excluding the air entirely from the back of the shingles. This is what I have always heard said in regard to shingles on roofs. If it is better to use paper under shingles I would like to have proof of it.

Yours truly, O. F. Smith.

[Mr. Smith's point is an interesting one. So far as I am concerned, I have known snow and rain to come through shingles laid without paper, and never feel safe unless the tightness of the roof is insured by two thicknesses of the best pine-tarred or rosin-sized felt. Very possibly the life of the shingles is shortened by the exclusion of air from the under side, as it certainly is by ordinary painting, but this is a less evil than the risk of spoiling expensive paper or decorations. Possibly some architects or others experienced in building at the seashore or in other exposed situations will be kind enough to furnish us with information on the subject. If so common a precaution is useless, many architects would be glad to know it. T. M. Clark.]

NOTES AND CLIPPINGS.

The Cottonwood Proof against Teredo. — Mr. William Clark, of Victoria, British Columbia, has been experimenting for many years, and watching the result of the submersion of timber called cottonwood, and he has come to the conclusion that the teredo will not touch it. The texture of this wood seems to be too soft and woolly for it to work until the timber itself begins to decay. He says that cottonwood, side by side with fir under salt water for many years, remains intact, while the fir is completely eaten through, and that cutting into it with an ax fully demonstrates that the worm has not been at work on it at all. If cottonwood will bear the test of further experiment, and is all that Mr. Clark claims for it, this discovery is really of very great importance, as the supply of this timber is practically inexhaustible. A wharf built of fir piles in sea water will not last usually to exceed three or four years, and its renewal is accompanied by about as much expense as its first building. — *Northwestern Lumberman.*

Three Great English Railway Stations. — The costliness of the works that are needed for the enlargement from time to time of the railway stations in great towns is indefinitely known. But when it is stated that in eighteen months' additions to three great stations, the London & Northwestern Railway has expended £600,000, the popular opinion of the greatness of the expense will be found to be confirmed. From the beginning of 1880 to the end of the last half-year — in eighteen months, that is — the London & Northwestern Railway Company spent on additional accommodation at its London stations £63,000; in the same period, on additional accommodation at its Liverpool stations, it expended £223,400; and on additional accommodation at its Manchester stations it spent the large sum of £324,000; so that the amount above-named was slightly exceeded. For land and compensation at London, £13,000 were paid in the eighteen months; at Liverpool, the sums paid were £82,700; and at Manchester the lands and compensation charges amounted to £177,600, the remainder of the payments in each case being for works and engineering. These great enlargements and improvements to the stations concerned have been for some time and still are in progress, and thus it may be taken that the large sums that have been named are a portion only of the total cost. During the last few years the development of passenger traffic on the railways has been great, and very naturally the accommodation for them has needed enlarging. When near a railway station masses of building are allowed to rise — abutting, that is, on the line — it is almost certain that the company, which ought to have bought and kept the land, will have to pay for land and buildings, and it is to this that the largeness of the sums that have to be paid is due. The London & Northwestern Railway Company, however, chose its time wisely for the needful purchases, for land and property were never likely to be lower than they now are, and hence its purchases are probably less than they would have been had they delayed them. It may be expected that other companies will now follow the example, and it is possible that at the great towns and ports something will have to be done in the duplication of lines, and in the increase of siding accommodation, so that the liability to accident may be further decreased. All indications point to enlarged trade, and for this the great companies will need to prepare. — *Engineering.*

A Building Case. — A case which involved the question of a builder's responsibility was before the Edinburgh Court of Sessions a few days since. A merchant in Glasgow entered into a contract with a firm of builders to take down a corner building and to erect another in its stead. Adjoining this building was a shop which was occupied by a tenant of the building-owner. The tenant alleged that the operations lasted during the summer, and for the whole period his shop was filled with dust, which destroyed his goods, and that in order to slacken the lime a sort of barricade was erected which interfered with his trade. Actions were taken by him against the landlord and the contractors. The landlord denied that damage arose, and inasmuch as he had contracted with properly qualified contractors for the execution of the work, and had retained no personal control over them, he disclaimed all responsibility for any annoyance or damage caused by them in carrying on their operations. The contractors, on the other hand, pleaded that no damage was caused beyond what could not possibly be avoided in the execution of the contract, and that, being under a contract to execute certain work, they were not liable for damages caused by such work. The Sheriff-Substitute, at the first hearing of the case, exonerated the contractors, but gave a decree against the landlord for £30 damages and costs, and declared him to be liable for the contractor's costs. On appeal, the Sheriff reversed the decision, and found for the defendants, maintaining that the operations were legal, and were carried out without more injury to the tenant's interests than under the circumstances was to be expected. The case was then brought to the Court of Sessions. The judges affirmed the decision of the Sheriff-Substitute, on the ground that damage had been done during the operations which might have been avoided, but their lordships reserved their opinion on some of the questions of law which were raised in the case. At any rate, they have now decided that by the law of Scotland the building-owner is responsible for damage done to contractors. — *The Architect.*

When the Plumbers First Began It. — The ordinances of the plumbers, approved by the Mayor and Aldermen of London, in the thirtieth year of Edward III, ordain "that every one of the trade shall do his work well and lawfully, and that for working a clove of lead for gutters or for roofs of houses he shall take only ½ *d.*, and for working a clove for furnaces, belfrys, and conduit-pipes, 1*d.* Also, that no one for any singular profit shall engross lead coming to the said city for sale, to the damage of the commonalty, but that all persons of the said trade, as well poor as rich, shall be partners therein at their desire." There were many ordinances, both royal and municipal, in the fourteenth century for the sale of various commodities "at reasonable prices." The general standard of "reasonable" or fair price and profit was custom. Where the seasons, as in the case of food, or other circumstances made a customary price impossible, the local authorities or the central Government itself intervened to prevent sellers from taking advantage of the necessities of buyers. There was abundance of self-seeking and greed of lucre, as well as of hypocrisy, in the mediæval world, but they worked not through competition, but through combination; towns, guilds, companies, classes, grasping at exclusive privileges, monopolies, and gains. Men pursued their prey, as it were, in troops and packs. What was sought was not the gain of individuals as such, but of communities, corporations, fraternities, and orders. — *The Fortnightly Review.*

Resurrection of a Tree. — A writer in the London *Times* reports a singular case of the resurrection of a tree. A few years back a great elm was blown down with a large ball of earth at its roots, at Little Houghton. Men were set to work to remove it, but when they had sawed off the great limbs, they were astonished to see the trunk rise up of its own accord and return to its original place, where it stands to this day. It is now throwing out a fresh head.

BUILDING INTELLIGENCE.

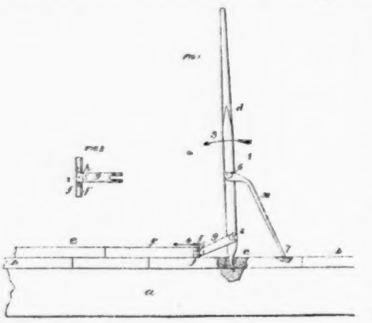
(Reported for The American Architect and Building News.)

[*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.

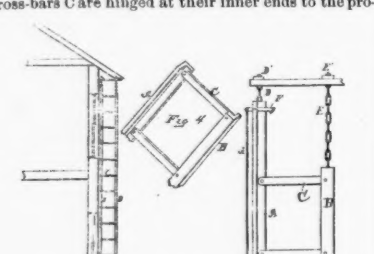
[*Printed specifications of any patents herementioned, together with full detail illustrations, may be obtained of the Commissioner of Patents, at Washington, for twenty-five cents.*]

248,015. FLOOR-CLAMP. — John A. Brown, Marlborough, Mass. This invention relates to an apparatus for pressing floor-boards together before nailing them down; and it consists of a lever having a sharp point to be driven into the under floor or floor-beam to act as a fulcrum, combined with a bearing-block



connected with this lever to press against the edge of the floor-board. The invention further consists in the combination, with the lever and bearing-block of a pawl to retain the lever in position after it has been used to press together the floor-boards, so that the lever will not require to be held by the workmen while the boards are being nailed.

248,607. FIRE-ESCAPE. — George A. Phifer, New Richmond, O. The object of this invention is to provide a simple, cheap, and effective fixed fire-escape, and it consists of a ladder, one side bar of which, of the form shown, is secured to the building; the other side bar, of like form, being connected with the stationary side bar by rounds hinged at each end to permit the outer side bar to fold up onto the stationary bar. A, represents the inner side bar of a ladder which is secured vertically against the building by the side of a tier of windows, and may extend down to the ground, or only to the second story of the building. This side bar reaches to the roof of the building and hangs on a chain or rod, D, secured to the block, D′. Cross-bars C are hinged at their inner ends to the pro-



jecting flange of the angle-iron bar A, and their opposite ends are in like manner hinged to the flange of the outer bar, B. This outer bar is also secured to the cornice by a chain, E, and block E′, but is somewhat shorter than the inner bar. The object of this is to permit the bar B to swing up to clear the cornice. A trigger, F, is secured to the upper end of the inner bar A, and a rod, G, is connected with this trigger, and extends down alongside of the inner bar. The operation is as follows: When not in use the outer bar, B, is folded up against the inner bar, A. The rounds or cross-bars C are thus disposed vertically within the hollow formed by the junction of the two angle-iron bars. The trigger F serves to thus hold them together. When the rod G is drawn downward, it causes the trigger F to release the upper end of the outer bar, which then descends until the chain E is taut. The ladder thus formed being at the side of a tier of windows, the occupants of the adjacent rooms can easily escape in case of fire.

249,737. ROOF-BRACKET. — Sumner F. Black, Wellington, O.

249,745. WINDOW-GLASS. — Samuel Darling, Providence, R. I.

249,749. MACHINE FOR SHEARING METAL. — Bernard Gallagher, St. John, New Brunswick, Can.

249,757. SCAFFOLD. — George W. Green, Wakeman, O.

249,761. DOOR-CHECK. — Charles Hassinger, Plymouth, Mich.

249,764. WINDOW SCREEN ATTACHMENT. — Bernedott T. Herold, Stockton, Cal.

249,767. WATER-CLOSET. — Elias S. Hutchinson, Washington, D. C.

249,784. GAUGE FOR MORTISING-MACHINES. - George L. Muhn, Wheeling, W. Va.

249,789. LOCK. — Emery Parker, New Britain, Conn.

249,799. SASH-PULLEY CORD GUARD. — C. J. Scheekly, Martinsburg, W. Va.

249,805. WOOD-PLANING MACHINE. — Albert W. Stossmeister, Newport, Ky.

249,813. AUTOMATIC FIRE-EXTINGUISHER. — Francis W. Whiting, Chelsea, Mass.

249,821. COMBINATION-SQUARE. — Stephen H. Bellows, Athol, Mass.

249,839. ARTIFICIAL STONE. — Julius Irion, Philadelphia, Pa.

249,846. FIRE-ESCAPE. — Ranald Macdonald, Brooklyn, N. Y.

249,847. FIRE-ESCAPE APPARATUS. — Ranald Macdonald, Brooklyn, N. Y.

249,854. HEATING-STOVE. — James A. Milliken, Biddeford, Me.

249,856. PRESERVING WOOD. — Samuel R. Percy. New York, N. Y.

249,878. TRAP-VALVE. — Cornelius Birkery, Hartford, Conn.

249,902. VARNISH. — Martin Connelly, Philadelphia, Pa.

249,903. WATER-CLOSET. — William S. Cooper, Philadelphia, Pa.

249,945. UNDERGROUND STREET. — Noah Jacobsohn, New York, N. Y.

249,950. BLIND-SLAT-TENONING MACHINE. — Mathias M. Kitz, Oshkosh, Wis.

249,956. CATCH-BASIN VALVE. — John B. Laumann, Cincinnati, O.

249,966. PIPE-CUTTING IMPLEMENT. — Francis I. Maule, Philadelphia, Pa.

249,968. PIPE-WRENCH. — Timothy D. Mernan, Buffalo, N. Y.

249,982. BURGLAR-ALARM. — Francis W. Pearson, Boston, and Andrew M. Eastman, Somerville, Mass.

249,987. BRICK-PRESS. — William W. Potts, Bridgport, Pa.

250,007. BENCH-PLANE. — George F. Sawyer, Liberty, Tex.

250,029. PIPE-TONGS. — Deloss Worden, Oil City, Pa.

9,944. (*Reissue.*) COMBINED ANVIL, VISE AND DRILL. — Joseph L. Ware and W. Scott Fleming, Pine Island, Minn.

SUMMARY OF THE WEEK.

Baltimore.

BUILDING PERMITS. — Since our last reports fifteen permits have been granted, of which the following are the more important: —

Foss & Gorman, 3 two-st'y brick buildings, O'Donnell St., beginning 40′ w of Chesapeake St.

Foss & Gorman, 3 two-st'y brick buildings, Benney St., beginning 60′ s of Dillon St.

Foss & Gorman, 3 two-st'y brick buildings, Harris Alley, 60′ s of Dillon St.

Archibald Teal, 3 three-st'y brick buildings, Patterson Park Ave., between Pratt and Gough Sts.

Henry Mylander, 2 three-st'y brick buildings, Edmondson Ave., between Fremont and Schroeder Sts.

Dr. E. D. Loughery, three-st'y brick building, 20′. x 60′, s e cor. Gay St. and Jones Falls.

John E. Armiger, 15 two-st'y brick buildings, Eager St., between Washington and Wolf Sts.

Female Christian Home, two-st'y brick stable, 28′ x 32′, Pearl St., between Mulberry and Franklin Sts.

Boston.

BUILDING PERMITS. — *Brick.* — 13 *and* 15 *Milford Pl.*, for John Deery, 2 dwells., 20′ x 46′, three-st'y; John Poulter, builder.

249 *Friend St.*, for Thomas Wigglesworth, carriage house, 28′ x 72′ 6″, three-st'y; David Perkins, builder.

Huntington Ave., near Dartmouth St., for John F. Mead, 4 family hotels, 45′ x 80′, five-st'y; John F. Mead, builder.

Wood. — *Vaughn Ave.*, near Geneva Ave., for Michael J. Hurney, dwelling, 22′ x 28′, two-st'y; Yates & Ryan, builder.

Halleck St., near Station St., for G. F. Burkhardt, cooper shop, 45′ x 60′; Rumrill & Stanton, builders.

Hartford St., near Sargent St., for Alonzo P. Clifford, dwell., 26′ x 31′, two-st'y; Alonzo P. Clifford, builder.

Keyes St., for Ferdinand Kelly, dwell. and store, 22′ x 32′; John Gately, builder.

Dorchester Ave., near Blake St., for John Souther & Co., building for storage and setting up of machinery, 33′ x 80′.

East Sixth St., near N St., for Boston Cordage Co., storage building, 40′ x 108′; Scott Bros., builders.

Harvard Ave., near Brighton Ave., for Charles Armstrong, dwell., 30′ x 39′; Samuel Davenport, builder.

Unnamed Place, off School St., for Mrs. E. A. Hunt, dwell., 28′ x 30′; W. H. Bowker, builder.

Rutherford Ave., opp. Winchester St., for Eastern R. R. Co., hay storage, 60′ x 405′; H. Bissell, builder.

Perkins St., rear of, near Prince St., for Wm. Wallace, ice-house, 105′ x 232′.

Marginal St., rear of, near Orleans St., freight storage, 170′ x 416′ and 210′ x 530′; H. Bissell, builder.

Columbia St., near Quincy St., for Aaron W. Spenser, stable, 48′ 2″ x 36′ 4″.

O St., near East First St., stable, 22′ x 80′, for Walworth Mfg. Co.

Unnamed Place, off School St., for Mrs. E. A. Hunt, dwell., 45′ x 80′; W. H. Bowker, builder.

Unnamed Place, off School St., for Mrs. E. A. Hunt, dwell., 15′ x 100′; W. H. Bowker, builder.

Harvard St., nearly opp. Wales St., for George E. Bailey, dwell., 42′ x 33′ 6″.

Washington St., near Atherton Ave., for C. H. Heissling, dwell., 27′ x 30′.

Brooklyn.

BUILDING PERMITS. — *Lexington Ave.*, n e cor. Throop Ave., three-st'y brick store and dwell. and 5 two-st'y brick dwells.; total cost, $35,500; owner, C. Ritchie, 16 Court St., room 3; builder, E. T. Hatch.

Prospect Ave., s s, 80′ w Fifth Ave., 6 three-st'y brick stores and tenements; cost, $5,000 each; owner, Daniel Doody, 598 Fifth Ave.; builder, Peter Donlon.

Greene Ave., n w cor. Throop Ave., 3 three-st'y brownstone dwells.; cost, $4,800 each; owner, M. A. DeRevere, 436 McDonough St.; builder, G. DeRevere.

Troutman St., *No.* 49, two-st'y frame tenement; cost, $2,500; owner, C. Shellwald, 22 Stanhope St.; builder, E. C. Bauer.

Franklin St., *Nos.* 37 *and* 39, w s, 50′ from Quay St., one and two-st'y frame foundry; cost, $2,800; owner, etc., James N. Balston, 128½ Noble St.

Quincy St., n s, 125′ e Throop Ave., 3 two-st'y stone dwells.; cost, each, $3,500; owner, A. E. De Baum, 5½ Pine St., New York.

Adams St., *on pier at foot of*, two-st'y frame coal pocket; cost, $5,300; lessee, Eastern Transportation Line, New York City; architect, John Forman; builder, E. A. Young.

William St., s s, and King St., n s, 80′ e Conover St., one, two and three-st'y brick shop; cost, $12,000; owner, The Pioneer Iron Works, on premises; architect, M. Franck; builders, P. Carlin and Geo. Damen.

Nostrand Ave., w s, 97′ 9″ n Park Ave., one and two-st'y brick factory; cost, $7,000; owner, Richard Dunlap; builder, J. Clark.

Atlantic Ave., n s, 50′ w Boerum St., 2 one-st'y brick stores; cost, $6,500; owner, Wm. C. Schermerhorn, 49 West Twenty-third St., New York; architect, W. A. Southard; builder, J. J. Bentzen.

Head of Grand St., Newtown Creek, one-st'y frame factory; cost, $15,000; owner, Albemarle Fertilizing Co., 60 Cortlandt St., New York; architect and builder, S. M. Weeks.

Head of Grand St., Newtown Creek, one-st'y frame engine-house; cost, about $2,500; owner, Albemarle Fertilizing Co., 60 Cortlandt St., New York; architect and builder, S. M. Weeks.

Lewis Ave., w s, 80′ n De Kalb Ave., two-st'y frame dwell., cost, $2,500; owner, Anne E. Foley, 962 De Kalb Ave.; builders, John Lambert and M. C. Rush.

ALTERATION. — *Foot of Thirty-ninth St.*, two-st'y brick extension; cost, about $3,000; owner, H. W. Johns Manufacturing Co., on premises.

Buffalo.

CHURCH. — German Lutheran Church, Ellicott St.; cost, $50,000; builders, Rumrill & Rupp; contractor, Daniel Dutzer.

HOUSES. — Frame dwell., Niagara St., between Pennsylvania and Jersey Sts.; cost, $5,000; owner, H. J. Tucker; architect, Geo. J. Metzger.

Brick dwell. and barn for Mr. Frank Perew, Sixth St.; cost, $35,000; architect, Richard A. Waite; builders, J. Beier & Son.

STORES. — Brick stores, with apartments, Seneca St., near Hydraulic St., 80′ x 90′; cost, $20,000; owner, F. H. Goodyear; architect, Geo. J. Metzger.

Chicago.

BUILDING PERMITS. — The following building permits have been issued since our last report: —

Mary C. Carpenter, two-st'y brick, rear addition, 20′ x 36′, 24 s Sangamon St.; cost, $2,200.

John Coughlan, two-st'y brick flats, 20′ x 56′, rear No. 78 South Halsted St.; cost, $3,500.

Union Wire Mattress Co., four-st'y brick factory, 50′ x 100′, Erie and Sedgwick Sts.; cost, $10,000.

Calumet Club, three-st'y and basement club-house, 80′ x 132′, n e cor. Twentieth St. and Michigan Ave.; cost, $140,000.

A. E. & S. A. Kent, 2 three-st'y and basement, brick stores and flats, 36′ x 100′, State St., near Sixteenth St.; cost, $15,000.

E. Oleson, two-st'y brick dwell., 22′ x 64′, Lincoln St., near Milwaukee Ave.; cost, $3,000.

M. Sieben, two-st'y brick store-house, 32′ x 40′, 235 and 237 Larrabee St.; cost, $5,000.

Mary Wallcott, two-st'y brick dwell., 20′ x 32′, 125 East Superior St.; cost, $2,200.

John Maas, 3 four-st'y and basement brick stores, 63′ x 85′, n w cor. Ogden Ave. and Van Buren Sts.; cost, $20,000.

D. H. Hammer, 2 three-st'y and basement brick stores and flats, 48′ x 62′, 3526 to 3530 State St.; cost, $15,000.

H. Gillett, three-st'y brick flats, 25′ x 45′, 855 North Clark St.; cost, $4,500.

W. C. Seipp, 2 two-st'y and basement brick dwells., 45′ x 60′, 2971 and 2973 Groveland St., cost, $5,750.

Graham Bros. & Co., four-st'y and basement brick soap factory, 50′ x 170′, West Lake St., near Ada St.; cost, $30,000.

William Bartlett, two-st'y brick dwell., 21′ x 60′, Dania Ave., near Thompson St.; cost, $2,000.

J. Lundberger, two-st'y brick dwell., 21′ x 46′, 560 Market St.; cost, $2,900.

Miller & Umbdenstock, one-st'y brick printing-office, 48′ x 95′, 560 Market St.; cost, $3,000.

D. K. Pearsons, 2 three-st'y brick dwells., 44′ x 63′, State and Scott Sts.; cost, $15,000.

D. K. Pearsons, three-st'y brick flats, 34′ x 40′, Scott St., near State St.; cost, $6,000.

Edwin Walker, two-st'y brick barn, 32′ x 50′, rear 2616 Michigan Ave.; cost, $4,000.

Joseph Vechots, two-st'y brick dwell., 20′ x 44′, 360 West Eighteenth St.; cost, $3,000.

V. Herdo, two-st'y and basement brick dwell., 21′ x 56′, Throop St., near Twentieth St.; cost, $3,700.

N. Thomasson, three-st'y and basement brick dwell., 30′ x 74′, State St., near Goethe St.; cost, $12,000.

E. W. Blatchford, stone foundation, 63′ x 80′, Jackson St., near State St.; cost, $6,000.

D. Benedict, two-st'y brick flouring-mill, 50′ x 100′, Green and Kinzie Sts.; cost, $5,000.

Armour, Dole & Co., 2 two-st'y elevators, 120′ x 322′, Sixteenth St. and Oakley Ave.; cost, $120,000.

D. Hoeber, three-st'y brick brewery, 101′ x 105′, Hinman St., near Ashland Ave.; cost, $50,000.

Cincinnati.

BUILDING PERMITS. — Since our last report the following building permits have been issued: —

John Rolf, two-st'y brick, Hawthorne St., near Price Ave.; cost, $10,000.

(*Continued on next page.*)