

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XII.

Copyright, 1882, JAMES K. USGOOD & Co., Boston, Mass.

No. 366.

DECEMBER 30, 1882.

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

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THE contractors for the State Capitol of Indiana have found themselves in a predicament which will enlist for them the sympathy of many of their fellows who have had experiences of the same kind. It has long been obvious that they were losing money on their contract, and two weeks ago, having added up the total of their profits and losses, they drew up and submitted to the State-House Commissioners a formal statement, showing that while they have received six hundred and fifty thousand dollars for their work and materials, and would, if their contract were complete, be entitled to sixty-five thousand dollars more, which is reserved under their contract as a guaranty, they have spent nine hundred and thirty thousand; or in other words, that they are two hundred and eighty thousand dollars out of pocket; and as the prospect before them is only that of continued losses, they are sensible enough, before going into bankruptcy, to state their case plainly, and ask for the consideration of the Commissioners. The latter, it seems, have no fault to find with the execution of the work, and it has been done with all reasonable prudence and economy, but the great advance in the cost of materials and labor since 1878, when the contract was signed, accounts for most of the difference between receipts and expenditures, while, it is said, an unexpectedly strict interpretation of the specifications on the part of the Commissioners has helped to make up the remainder.

UNFORTUNATELY for the contractors, the Commissioners happened to be men of a sort such as is seldom concerned in the execution of public buildings, and not only has the literal interpretation of the specifications been insisted upon, but the contractors find themselves held by a strict contract, strengthened by heavy bonds, and they have no resource but to throw themselves upon the mercy of the Legislature. It is very common in such cases for city or State governments, where real hardship is evidently inflicted upon well-meaning men, to make an appropriation of an additional sum large enough to save the contractors from loss, and in this case the contractors offer, if their bare outlay is made up to them, to carry on the work to completion without any profit to themselves, and without charge for their own services in supervision; but whether the Commissioners can properly recommend the adoption of this course is a nice question. The law authorizing the construction of the building restricted its cost in most emphatic terms, and as the Commissioners have only to call upon the bondsmen to complete the undertaking, if their principals abandon it, it is inconsistent with their duty to advise the State to relinquish the security which they have obtained for it. Perhaps the best way would be for the bondsmen themselves, if the State authorities refuse any relief, to come to the rescue of the contractors and help them to finish their work. The cost of doing so would certainly be less than that of taking it up after the bankruptcy of their principals, and they might, we think, rely with reasonable certainty on being indemnified in the end for their outlay.

RENEWED efforts seem to have been made recently, not without a suspicion of interested motives in some cases, to compel the companies which own electric wires to bury them underground. In East St. Louis, the city council is said to have voted to cut down the poles of the Western Union Telegraph Company in the town, and to have purchased a quantity of axes for that purpose; a proceeding which has very much the air of a ridiculous attempt at black-mailing the company. In New York and Philadelphia, the new and very promising scheme of the Brush Electric-Light Company for placing storage-batteries in houses along the line of the streets which are illuminated by its arc-lamps, to be filled during the day by the same current which at night is turned into the lamps, and discharged again during the evening through the Swan incandescent lamps which have been adopted by the Company for domestic lighting, seems to have awakened the hostility of its rivals, and in the former city a strong effort has been made to compel it to place all its wires immediately underground at whatever cost, while in New York, the astute Secretary of the Edison Company has made an attempt to prejudice public opinion in advance by a characteristic speech to a reporter, about the dangers of the Brush Company's plan for placing "death-wires" in the cellars of houses; the "death-wires" being the conductors by which the current is to be carried to the storage-batteries. Considering how greatly extended the use of electricity is likely to be in future, there is at least a satisfaction in the thought that the officers of so many corporations are on the alert to warn innocent citizens in regard to the risks which await them at the hands of their unscrupulous rivals.

MR. BRUSH's storage-battery, which his company is to make use of, is at last in operation in New York, and seems to possess some excellent features. The first trial of the apparatus was with Swan incandescent lamps, twenty-seven of which were kept brightly burning for five hours by one storage-battery of twenty-four cells, charged by the current from the wires used to supply ordinary arc-lights in the neighboring street. If the Brush Electric-Light Company succeeds in escaping without serious harm from the suits which are threatened against it for infringement, not only of the Faure patent for storage-batteries, but of the Edison patents for incandescent lamps, it may, we think, look forward to a very extensive adoption of its ingenious plan for utilizing electrical energy. It will be interesting to learn whether the quality of the current with which the storage-battery is charged has any influence upon that which it furnishes to the incandescent lamps. As every one knows, the current used for arc-lights is of about ten times the intensity of that intended exclusively for incandescent lamps; the difference in quality being determined by the electro-magnets of the dynamo-machine, which, for operating arc-lights are wound with a great length of fine wire, but for incandescent lights with a comparatively small quantity of thick wire. If, as seems probable, the character of the charge in the storage-battery is independent of the form in which it is received, there must, at least, be a difference in the time necessary for charging with intensity or quantity currents, as well as in the relative economy of producing a given charge of each kind.

THE Brush battery itself, like that of Faure, and many others, is a modification of the original Planté accumulator, and consists of a number of pairs of corrugated lead plates, covered with some substance, the composition of which is kept secret, and immersed in water acidulated with sulphuric acid. When once in condition for use, the Brush battery is said to keep its properties unimpaired for an indefinite length of time. There is no change, either in the lead plates or the acid, and nothing is necessary but to add water to make good the loss by evaporation. The gradual deterioration which takes place in the Planté battery by the polarization of the plates is said to be avoided in Mr. Brush's cells, and the still greater annoyance caused by the scaling away of the oxide of lead with which the plates are coated, which is obviated in the Faure system by rolling tightly together alternate layers of lead and felt, is not experienced at all with Mr. Brush's composition.

ACCORDING to a reporter of the New York *Evening Post*, an explosion took place the other day in that city which, if it was, like the previous ones, due simply to the blowing out of

the packing of a valve, offers a prospect for the future condition of the public thoroughfares which is far from encouraging. The explosion occurred at the corner of Nassau and John Streets, and, as the *Evening Post* says, "lifted an express wagon from the pavement," "drove paving stones about in an alarming way," "spattered passers-by with mud and lamp-black, and destroyed the stock of an apple-woman on the sidewalk." The latter individual was intelligent enough to go at once to the office of the company which owns the pipes, and claim a round sum for damages, which was promptly paid; but the passers-by who were spattered with lamp-black or were struck by the flying paving-stones probably considered their condition not much worse than that of ordinary pedestrians in New York streets in winter, and bore their mishaps in silence. The *Evening Post*, however, finds in the accident occasion for an indignant editorial, characterizing the tearing up of the streets by the steam-heating companies as an "outrageous imposition," and saying that the city government "appears to be permitted to make substantially free grants of valuable franchises and at the same time allow them to be used in such disregard of the common popular rights in the streets." All this is perhaps natural, considering the chronic state of indignation with the condition of their streets which is usual among the people of New York, but the diatribes of the newspapers would have more force if they would suggest a remedy for the evils of which they complain. That it is a public advantage in many ways to have steam delivered under pressure wherever required we suppose will hardly be denied, and although it would be desirable to carry the pipes in some other way than through the streets, no one has suggested any better mode of accomplishing the same result.

THE scheme for forming a public park about the Falls of Niagara, which has been so long discussed in the newspapers, seems to have been abandoned, at least so far as any legislative action is concerned. Even in Canada, where the plan first proposed by Lord Dufferin has found much favor, the Government is unwilling to take any steps for appropriating public money to carry it out; and the State of New York is still less likely than the Dominion to make any sacrifices for such an end. It seems, however, that in default of action by the general authority something is to be done by private individuals, who are determined, if possible, to prevent for the future what they consider the desecration of that noble scene, and a company has been formed for the purpose of acquiring at a reasonable valuation the territory bordering the Falls on the Canadian side, removing unsightly structures and putting the ground in good order to be held as a pleasure resort. The company, if an act of incorporation is granted it, will erect suitable and necessary buildings, and charge visitors a reasonable admission fee. It is much to be hoped that this company might find its prospects of financial success so encouraging as to induce it to obtain authority for taking land on the American as well as the other side of the river. There can certainly be no objection to the charging of an admission fee which would repay the cost of preserving the world-renowned cataract of Niagara from being hidden by vile sheds, and we are inclined to think that the number of visitors would increase rather than diminish if the vicinity of the falls were once cleared of the annoying objects which now encumber it.

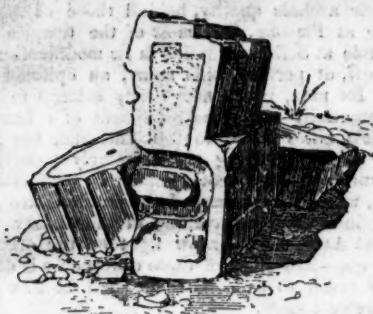
A LITTLE light is thrown upon the mystery of the Keely motor by the text of the caveat filed in the United States Patent Office to protect his claim. According to this document, Mr. Keely's invention consists in "an improvement in a new force and machinery for the evolution thereof, and its utilization as a motive power for the propulsion of machinery, for the firing of guns, etc." The full description of the invention is placed in the confidential archives of the Patent Office, where neither the stockholders of the Motor Company nor any one else can get at it, and there it is very likely to remain, as the caveat can be renewed indefinitely. Meanwhile, it is at least permitted to indulge in a little speculation in regard to the nature of the force which is "evolved by machinery," and is used "for the propulsion of machinery." To most persons the thought would naturally occur that a force so produced and so applied would be usefully employed in propelling the machinery by which it was itself evolved, and the renowned motor would then resolve itself simply into a perpetual-motion machine, not very different, except in its enormous cost, from the scores of others which crowd the shelves of the Patent Office Museum. It is true that no perpetual-motion

machine hitherto has been applied to the firing of guns, but if, as some suppose, Mr. Keely's invention consists simply in an apparatus for compressing air, and transmitting it to machinery at a little distance, there is no reason why the force so obtained should not be used by means of sudden expansion in a gun-barrel.

AT last accounts, the suit of Mr. Belt, the sculptor, against one of the London journals, for libel in denying his artistic capacity, is likely to be decided in favor of the plaintiff, if indeed anything can be called a favorable decision which involves the payment of fees amounting, it is said, to about seventy-five thousand dollars. Mr. Belt, as was expected, brought his materials into court and produced a bust for the edification of the jury, and although the sculpture was pronounced by all the expert witnesses to be very bad, it must have produced an impression on the audience. Another point was made for Mr. Belt during the testimony of Sir Frederick Leighton, the President of the Royal Academy. Every one remembers that Sir Frederick, although a painter by profession, exhibited not long ago a brilliant piece of sculpture, and Mr. Belt's counsel, after hearing his testimony that his client was an ignorant deceiver, suddenly retaliated by asking him whether his own statue was entirely the work of his hands, and by ingenious cross-questioning forced him to admit that he had been obliged to employ assistance. We may be sure that Sir Frederick Leighton's assistants did not work at night, or disappear through trap-doors when visitors were announced; but that view of the question was kept judiciously in the background. On the whole, it is worth remembering that however ridiculous Mr. Belt may have been made to appear, the dispute which the court is called upon to decide is not whether he is or is not a first-rate artist, but whether he is a sufficiently good one to be entitled to protection against the attempts of a certain newspaper to drive him out of the profession entirely, by destroying his chance of making an honest living in it; and most persons including, we imagine, the jury in the case, will think that, considering the quality of much of the art which finds a market, a sculptor's methods must be very objectionable to make him a lawful prey to any newspaper which may find profit, not in criticising his works, but in systematic endeavors to ruin him.

THE well-known Dr. Christopher Dresser not long ago made a visit to Japan, to study the peculiarities of decoration in that country, and has published an account of his experiences which must, to judge from a review of it in the *Builder*, be very interesting. Not to speak of the various comments which the author makes upon the painting and architecture of the Japanese in general, his description of a certain piece of construction which he examined is curious enough to repeat. The building in question was a pagoda, one of those towers whose outline is so familiar to us from pictures; and Dr. Dresser was surprised on entering it to find it supported by a mass of timber framing. In the centre, particularly, was a vertical timber, two feet square, which extended to the top, and was stiffened for a certain distance from the bottom by two similar timbers bolted to its side. This seeming to him a foolish waste of material, he complained to a native friend who was with him, and was told that the framing of the sides held up the central timber, instead of being held up by it, as he imagined, and on further inspection he discovered that the middle shaft was suspended clear of the ground, like an immense pendulum, and served simply to maintain the balance of the tower during earthquakes, which are very common in Japan. It is not quite clear how such a swinging weight could do much to preserve or restore the equilibrium of the pagoda during a series of vibrations, at least in any other way than by lowering the centre of gravity to some extent; but the idea seems to be quite original, and might some time prove useful in structures for a different purpose.

ANOTHER ancient mansion in the West of England. Clevedon Court in Somersetshire, was recently destroyed by fire, and with it furniture and books of great value. Some portions of Clevedon were of great antiquity, the original structure having been founded under Edward II, but remodelled during the reign of Elizabeth, and altered in various ways since. One of the rooms contained a beautiful chimney-piece of the Elizabethan period, and near the house was the ancient conventual church of St. Andrew, always associated with the history of the manor. The place belonged to the Elton family, who came into possession of it at the beginning of the eighteenth century.

THE EXPLORATIONS AT ASSOS.¹—II.

THE temple is built of the trachyte of the neighborhood, a rough, hard stone which would not have lent itself to very delicate cutting, but whose hardness has preserved its shapes in their freshness. The natural rock of the acropolis is its foundation, roughly levelled, so that in part it forms a bed for the pavement of the temple or receives

directly the lower step of the platform. At some points its inequalities are levelled up with coursed rubble to carry the steps. It is likely that the rough stone was covered with a thin facing or priming of stucco which the Greeks commonly used on rough material. Of this Mr. Clarke sees evidence in the grayish dust which he noticed in the chinks of the pavement, but naturally the weathering of twenty-two or three centuries has worn it away.

The building was small, its stylobate, surrounded by only two steps instead of the usual three, being about forty-six feet by one hundred. The whole height of the order was twenty-four feet, and the height of the columns fifteen and a half. These are very nearly the dimensions of the Theseum at Athens, with which, as we shall continue to see, the temple has striking analogies. It was hexastyle peripteral, with thirteen columns on the flank—in this, too, like the Theseum. The explorers found absolutely nothing in position above the platform, but this was in very good preservation and fortunately retained clear indications of the plan of the building which had stood upon it. The upper step had been torn away from either end, but elsewhere was nearly perfect. A great part of the pavement of the peristyle remains, and some fragments of that of the cella. The risers of the lower step still show the rough lugs like those that Hittorff found at Segeste, which were used, it is assumed, to hoist the stones by; and a raised margin, such as has also been found elsewhere, may have been meant to guard the joints from spawling—curious survivals which become a greater puzzle as we find them more and more common in Greek architecture, and are dismissed by Mr. Clarke with the off-hand remark that the obliteration of them was contrary to the spirit of Greek workmanship.

The platform when laid bare, was found to be paved outside the cella with rectangular slabs of stone, the bed for which was the roughly-levelled surface of the natural rock, its depressions levelled up with stone chips. The slabs, usually laid with random lengths in bands, were in some places laid irregularly, and curiously joggled together. This pavement, says Mr. Clarke, was half an inch lower than the upper step which formed its curb, and in which stood the colonnade, as if it had been covered with a coating of cement, but it is only in the north aisle that his plan shows a straight margin, against which this cement could have stopped. The account of the indications from which the plan of the building was deduced illustrates the care and keenness of the explorers. When the upper step had been carefully washed, the slight traces of weathering on the surface of the stone betrayed the position of the columns. The portions covered by the feet of the shafts had been protected by them long enough to be left in very faint relief which could be clearly made out only in the low light of the setting or the rising sun, or by artificial light on a dark night. By these helps the outlines of even the flutings could be seen wherever the step was left, and in this way the position of ten columns on the north flank and eight on the south were recognized.

The position of the cella walls was marked by a delicate line incised upon the pavement which had evidently been used in place of a stretched cord or chalk-line for laying out the work. Two mortises marked the places where the door-jambs had stood, and the positions of the antæ and the cross wall were clear, while the faint traces of the two columns in *antis* of the cella were left by the weathering. There was evidently no door in the rear of the cella, and no indication of any division in it, so that the interior of the cella lacked even a posticum and must have been a single room. Part of the floor of this room was revealed in two diagonally opposite corners of a mosaic pavement of black and white marble in cubical *tesserae*, of a lozenge-like diaper pattern bordered by a wave

ornament. It covered, apparently, the space reserved for adoration in front of the statue which the temple must have contained. Two small sinkages in the pavement of the pronaos, or vestibule, probably mark the positions of *cippi*, or pedestals, small enough to need the support of a socket, monuments such as it was customary to set in front of Greek temples, though commonly not within the vestibule itself. Above the platform the construction had to be made out by inference. Fortunately material was found for determining almost all the essential parts of the building, and the care and precision of the explorers make their inferences very trustworthy. A great many drums of columns were found and several hundred measurements of them were made that the investigators might be fully satisfied with their conclusions. The weatherings on the upper step and between the *antæ* of the vestibule proved a striking anomaly in the placing of the columns. They were all set so that in elevation they showed an arsis in the centre, and not a flute; and this indication was verified by the neckings of the capitals. The columns in *antis* of the vestibule had eighteen flutes, while those of the peristyle had only sixteen. The lower drums of the columns could be identified by fitting the weatherings on the platform, and the upper drums by fitting the capitals, of which twenty were found on the site. By carefully measuring the intermediate drums, taking as many as eight measurements from the same drum, the unexpected discovery was made that the taper was uniform in all the

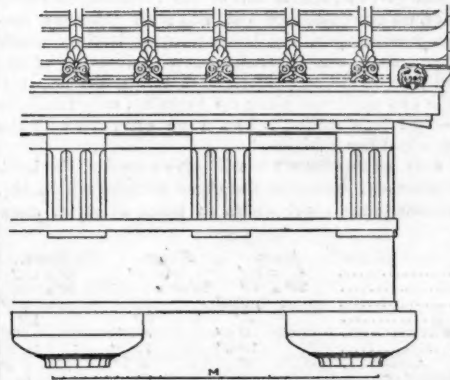
drums; that is, that the columns had no entasis. There was a single incised necking, and three flat reveals made the annulets at the bottom of the capital; the flutes stopping squarely

against the lower one. "The outline of the echinus," says Mr. Clarke, "is of great vigor and beauty," but Mr. Clarke's drawing belies him, and if we may trust that, we must frankly call it clumsy and cushion-like, what a French artist would call *mou*.

We spoke in our preceding article of the extraordinary restoration in which Texier set his sculptures in the architrave of this temple, in defiance of all known precedent, and to the scandal of French architects. We had expected to find Mr. Clarke upsetting this restoration, and he himself had supposed it to be an error, but as we have seen, his examination has fully confirmed it. He has, however, discovered here a singular anomaly in construction. The architrave, though comparatively small, being only thirty-two inches on the soffit, and of equal height, is built in three blocks, or slabs, on edge. These are put together in a very surprising way, if we trust Mr. Clarke's restoration of the entablature. The middle block is let into the outside blocks, which are roughly rebated for it and meet above it, enclosing it on three sides. It is difficult to explain this whimsical, laborious, and extravagant method of construction; unless, indeed, Mr. Clarke has taken an accidental peculiarity of a few stones for the rule of construction, which hardly seems likely. The

other marked peculiarity of the order is that although the usual *regulae* are found under the triglyphs there are no guttae upon them nor upon the mutules.

This odd characteristic might, if the date of the temple could be fixed with certainty, prove to be of consequence in the history of the Doric style. Mr.



Clarke, who, as we saw, assigns the temple to the culminating period of Greek architecture, passes very lightly over this point. It is worth remembering that the importance of the temple at Assos depends on its antiquity. If it can be shown to be very old, dating, for instance, from the time of the greatness of Assos under Cræsus; or if the unparalleled peculiarities of its order are survivals of a primitive Doric, then it throws a valuable light on the development of the style. But the idea of a survival is not tenable in the absence of other examples; and if we have here only the chance tricks of a provincial architect at the time when the perfected type of Doric temple was taking shape in the Theseum, then the building, standing in an eddy outside the current of development, though still curious has lost its historic importance, and its peculiarities are as insignificant as they are forbidding. The rake of the pediment cornice was given by one of the corner blocks of the corona; another block gave its junction with the tympanum. A bit of a corner gutter was also found, — or at

¹ Papers of the Archaeological Institute of America, Classical Series. — I. Report on the Investigations at Assos, 1881. By Joseph Thatcher Clarke. With an Appendix containing Inscriptions from Assos and Lesbos, and Papers by W. C. Lawton and J. S. Diller. Printed at the Cost of the Harvard Art Club and the Harvard Philological Society. Boston: A. Williams & Co. London: N. Trübner & Co., 1882.

least the lion's head which served as gargoyle for it. This head, whose carving Mr. Clarke praises, was of finer and softer stone than the rest of the building. Fragments of the flat tiles of the roof were found, and also one antefix. Tiles and antefix were of terra-cotta, glazed with black, the antefix painted in black and red. There was nothing to show how the peristyle had been ceiled, though Mr. Clarke had noticed, high up in the wall of a mediæval tower, a coffered stone which may possibly have covered one of its *lacunæ*.

"The bed-mouldings shown by Texier," says Mr. Clarke, "are wholly imaginary." Not only were none of them found, but the corner blocks of the corona indicated that there had been none.

The methods of construction used, except the singular bonding of the architrave which we have already noticed, were such as we have been accustomed to find in Greek buildings. The triglyphs were rebated for the metopes. The stones of the steps had been bonded with iron cramps with lead run in. Here, and apparently in other places, where there was opportunity, the bonding was quite irregular. On the soffits of the architrave at the ends of the blocks were holes, probably where the lintels had been dowelled to the abaci of the capitals. The upper and lower beds of the shafts showed slots in which were doubtless set the pegs on which the drums were turned in a lathe, while in the intermediate beds were holes for round pegs of an inch and three-quarters diameter on which the drums could be revolved and ground together till the beds were perfectly fitted. Here, however, as in the joints of the entablature, the bearing is only for about four inches from the face of the stone, the rest of the joint being worked free, with no bearing whatever — one of the common tricks of Greek constructors, and safe in their low buildings; but which modern builders have imitated with great disaster. The stones of the corona showed in the vertical joints the U-shaped channels which are seen in some of the Sicilian temples and at Ægina, and are assumed to have held the ropes by which the stones were swung into place.

The analogy in arrangement and dimensions to the Theseum is striking, as Mr. Clarke points out, and the dimensions are also nearly those of the temple at Ægina. The mere similarity of measures is, however, less significant than it looks; for the consecrated unit of a hundred feet being assumed for the length of a hexastyle temple, the other dimensions at any one period of the style would follow very nearly as a matter of course. From the probable assumption that the platform of the temple was meant to be a hundred feet, Mr. Clarke attacks, like other authors, the problem of the Greek foot, and finds a value very near those that have been found by Boeckh and others. It is, perhaps, not necessary to assume that the foot in various states and colonies of Greece and in various ages, was kept more invariable than in different countries of Europe in later times. It is by reasoning chiefly from the analogy of plan and considering the archaic character of the order of less significance, that Mr. Clarke assigns the building of the temple at Assos to the time immediately after the Greek invasion of Xerxes, and makes it contemporary with the Theseum. It should not be forgotten that in old times geographical remoteness would offset a considerable difference in age. The difference between the primitive architecture of St. Front at Périgueux and its finished-looking prototype in St. Mark's at Venice, is a striking analogy. Nevertheless, when we set the elevation of the Assos temple, as Mr. Clarke gives it, beside that of the Theseum, and note the primitive look of its straight-sided columns with their few flutings and their pronounced taper, the bulging capitals, the mutules and regulæ without guttæ, the generally coarse execution of the work, and above all the prevailing rudeness of the sculpture, it is hard to imagine the two buildings going up together, only two hundred miles apart, — two days' sailing across a sea crowded with the busy ships of Greece and her colonies.

For the sake of easy comparison we will give roundly the leading dimensions in mass and details of the three temples which Mr. Clarke considers contemporary, but which in point of style, show great differences.

	Assos.	Ægina.	Theseum.
Size of Platform.....	46' x 100'	45' x 94'	45' x 104'
" Cella.....	26' x 73'	20' 6" x 47' (75)	26' 6" x 73'
Width of Peristyle.....	9' 9"	12'	9' 6"
Height of Order.....	22'	24'	25' 6"
" Entablature.....	6' 6"	6' 9"	6' 4"
" Columns.....	15' 6"	17' 3"	18' 8"
Diameter ".....	3'	3' 2"	3' 3"
Height of Shafts in Diameters.....	5½	5½	5½

We may notice here that there is evidently a mistake in Mr. Clarke's tabulation of the Assos temple (p. 97), for he gives the full height of the order as twenty-four feet, (7.36 metres), while the parts of which it is composed sum up only a little over twenty-two feet, (6.8 metres). The last figure, which suits the elevation, is probably the correct one. We find also some embarrassment in tracing out the *provenance* of the different blocks in Mr. Clarke's plan, plate 2, because on pp. 33 and 34, he has said northwest where he evidently means northeast, and northeast where he means northwest. While the dimensions of the plans are nearly the same, as we have said, in the three buildings, those of the order show a progressive advance toward the proportions of the time of Pericles. In the character of the details, the differences and the progress are much more marked. An advance is visible from Ægina to the Theseum, though the two buildings are generally conceded to be almost contemporary, but the gap between Assos and Ægina is far

greater. Apart from the rudeness of their workmanship, the details of Assos are, in their archaic quality, behind those of Agri-gentum, the great temple at Pæstum, and most of the temples at Selinus. The great temple at Selinus contains in its modifications, undertaken, argues Hittorff, at periods wide apart, an epitome of these different changes. Its plan, which necessarily belongs to its earliest epoch, has substantially the same alignment of columns which, in Mr. Clarke's view, allies Assos to the Theseum, but its older work is markedly archaic, having the extremely tapering shafts, the swelling echinus and deep scotia under it, with other signs of very early Doric, while the columns of the posticum are as developed as those of Ægina. The unravelling of the history of either this temple or that at Assos might throw light on the other. The same question comes up, — how much of these differences is due to provincialism and how much to age. But we shall be wise to leave these questions to archaeologists.

SUNDRY WORKING-DRAWINGS. I.— II.



SOON got to love these modest Monmouthshire churches, discovering that their extreme simplicity was completely in harmony with their surroundings, and preferable there to the comparatively greater pretentiousness of modern work generally, and even old work in richer districts elsewhere. I have often in consequence attempted to work on the same general lines under similar circumstances, particularly in cases where commissions have been linked to like cautions as to there being but little money to expend; and though the working-drawings of such structures may look somewhat bare and uninteresting, one often has

the satisfaction of finding the result not, altogether as bald as had been feared.

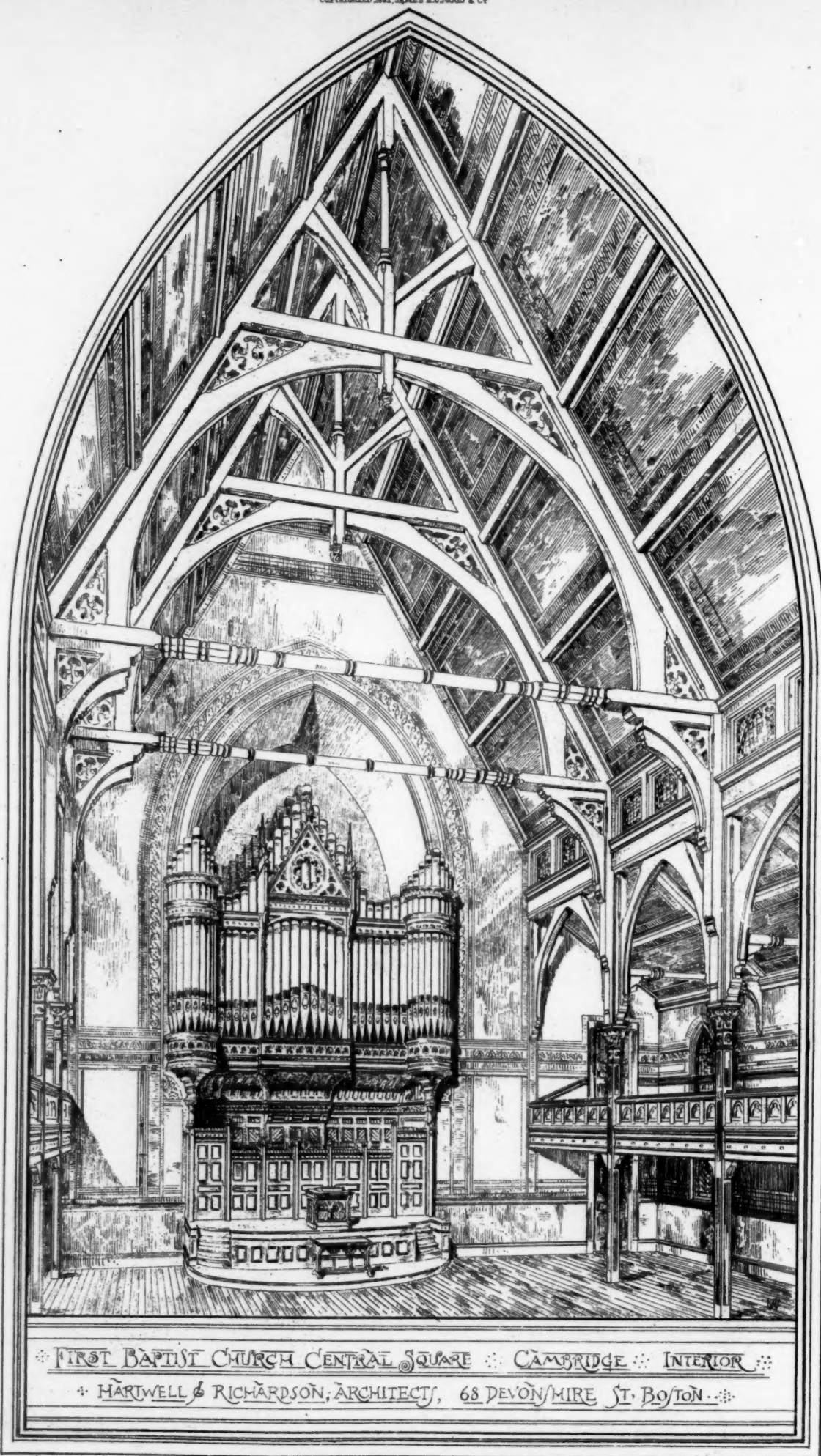
Now, the normal condition of these churches was that their roofs had become decayed, their pins had drawn, and the ties from wall to wall generally removed altogether. The walls had consequently yielded to the outward pressure of the roof, and having been originally built with mortar made with the loamy sand, the only material of that nature formerly procurable in the county, the lime had been killed, and the mortar had become little better than dust. They were usually rent at all the angles and elsewhere, and were in such a condition that a vigorous push would have overturned them. The general character of the roofs of these churches was that known as half-barrel or wagon-shaped; that is, constructed of framed and braced couples, without principals or purlins. The braces were usually curved, and served as cradling for boarded ceilings of segmental, semi-circular, or slightly pointed form, and were decorated beneath with moulded ribs, with carved bosses at the intersections, and there were usually moulded cornices of considerable depth. Most of these churches had doubtless once had massive tie-beams spanning from the opposite wall-plates, which had in course of time become decayed at the ends, and been removed and no others replaced; hence the perilous condition into which the whole of these structures had fallen.

Some of these roofs had certain of the pairs of couples wider and deeper than the rest, to serve as principals; these were moulded on the underside and carried moulded purlins. A good example of this class of roof exists at St. Lythan's, in the county of Glamorgan. It was not ceiled, but may have been intended to have been so, panel-wise, between the purlins. I remember admiring the refined effect of this particular specimen, which had somewhat peculiarly curved but elegant braces, so much that I followed its type in designing a new roof for the chance of Lampeter Velfry, in Pembrokeshire. Another interesting roof existed in the last stage of decay at Old-castle, in Monmouthshire. As it was absolutely necessary entirely to renew this, I reproduced the general character of the old principals, which were peculiar in form. This was an example of an open roof with principals and purlins. The collar was very high up, and arched braces supported it and connected it well with the principal rafters.

There are now so many different theories on the subject of restoration that I cannot hope to have satisfied all. Mine, then, was to replace matters as nearly as possible as I found them; and I have considered it a compliment when I have been told, as I was by the late Sir John Harding in connection with the restoration of Rockfield Church in Monmouthshire, that had he not been informed he should not have known that anything had been done to it. I was but recently told, however, by a zealous member of the Society for the Protection of Ancient Buildings, that I am only one of the more destructive members of my craft in consequence of the confusion thus wrought for future archaeologists. There are in truth so many and grave questions that continually arise in dealings with old buildings,

¹ By J. P. Seldon. Paper read at the meeting of the Architectural Association, November 24, 1882.

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FIRST BAPTIST CHURCH CENTRAL SQUARE :: CAMBRIDGE :: INTERIOR ::
 :: HARTWELL & RICHARDSON, ARCHITECTS, 68 DEVONSHIRE ST. BOSTON ::

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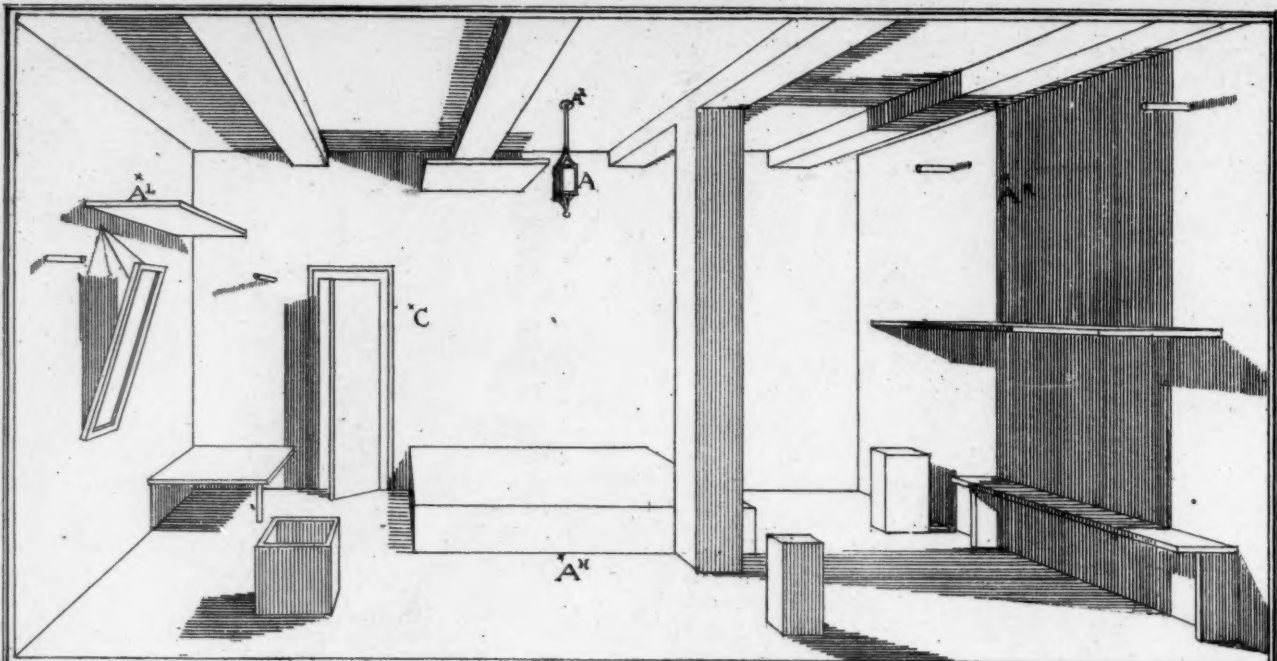


FIG. 86.

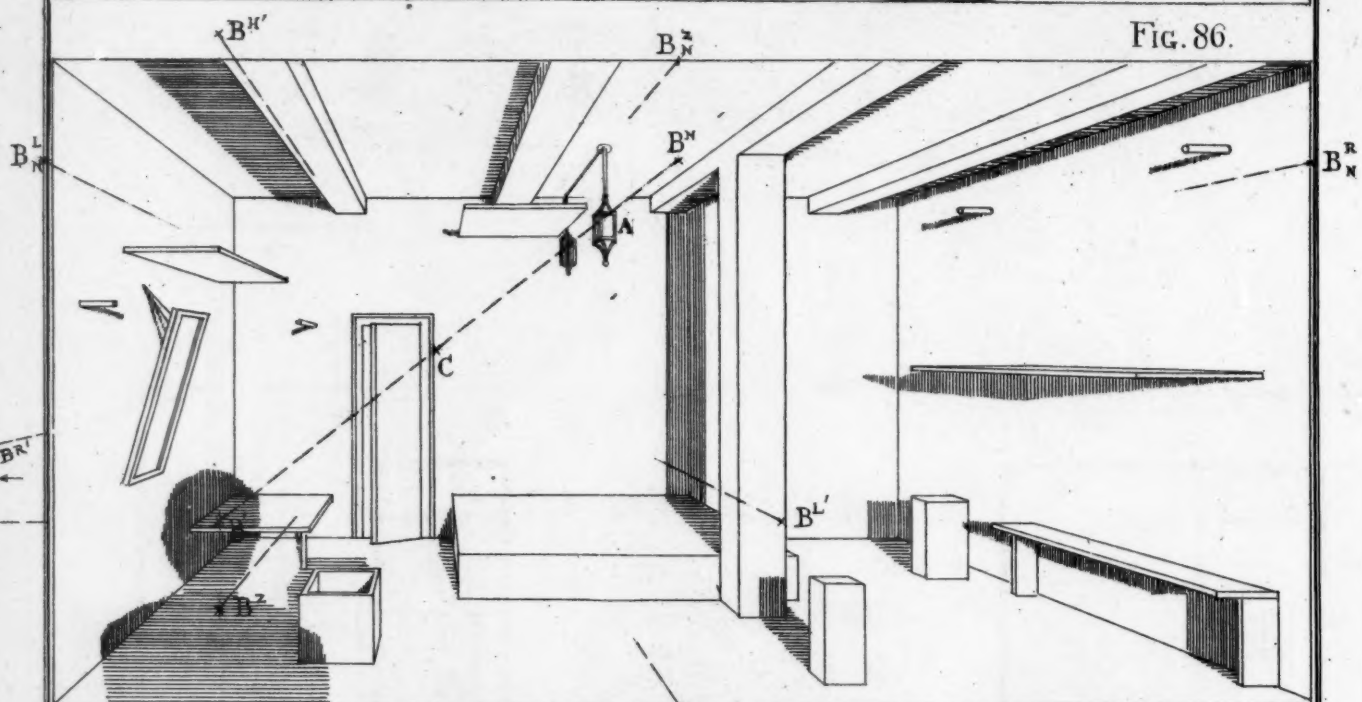
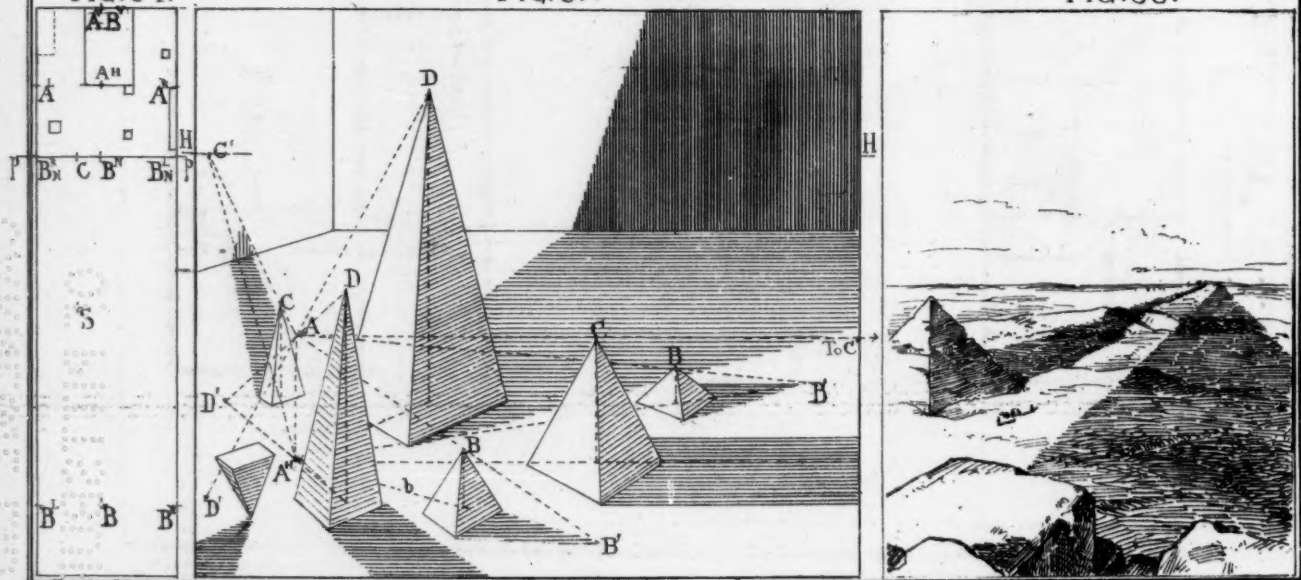


FIG. 84.

FIG. 87.

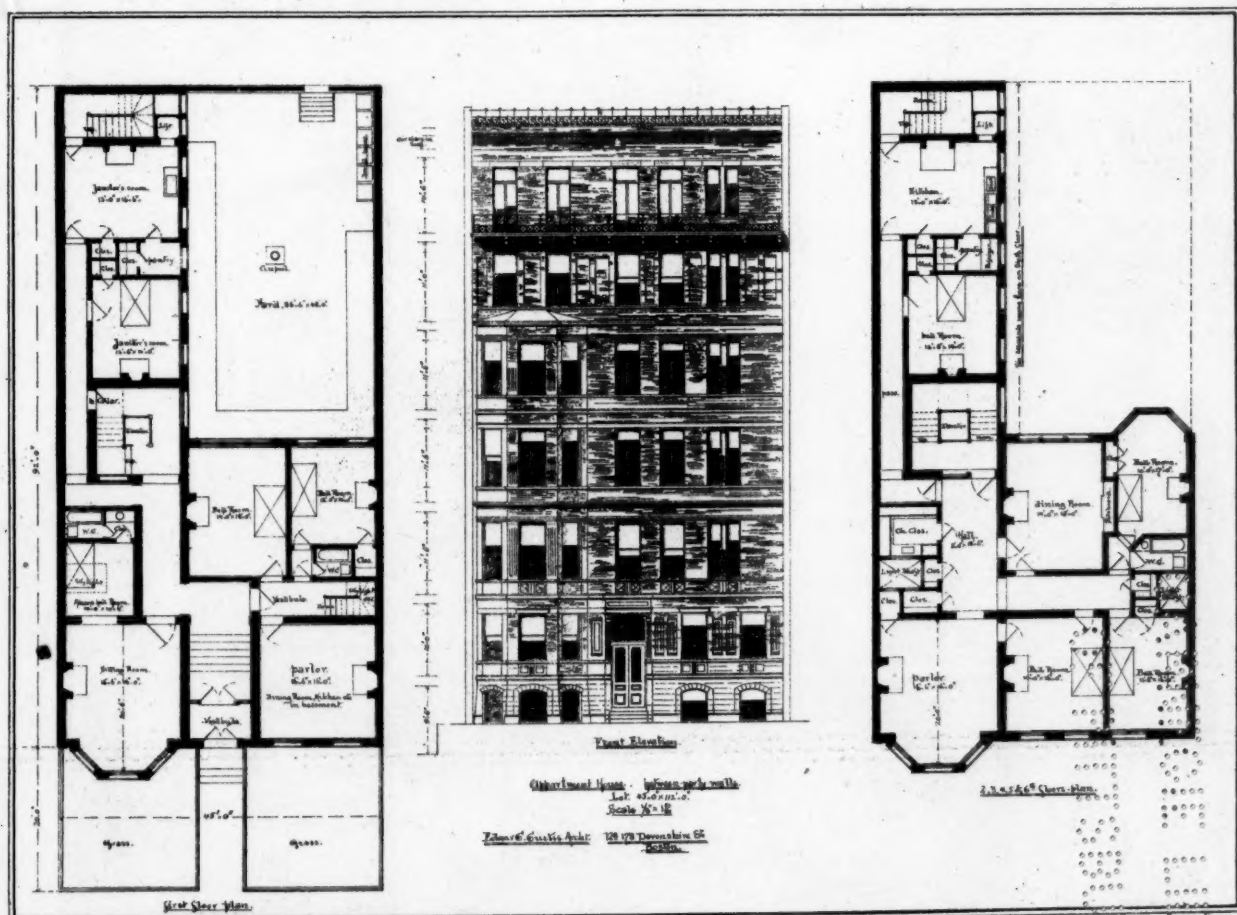
FIG. 88.



Country House.
near Philadelphia.



HAZLEHURST & HUCKEL
ARCHITECTS, PHILA.



Halcyon Printing Co. Boston

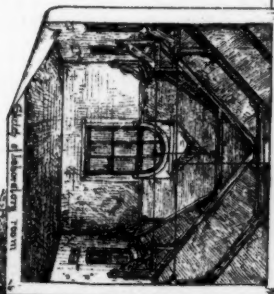
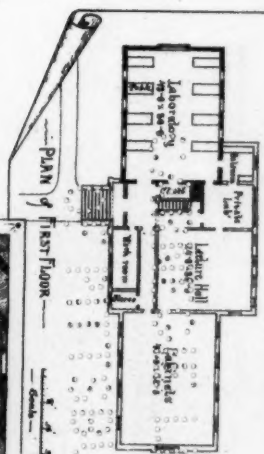
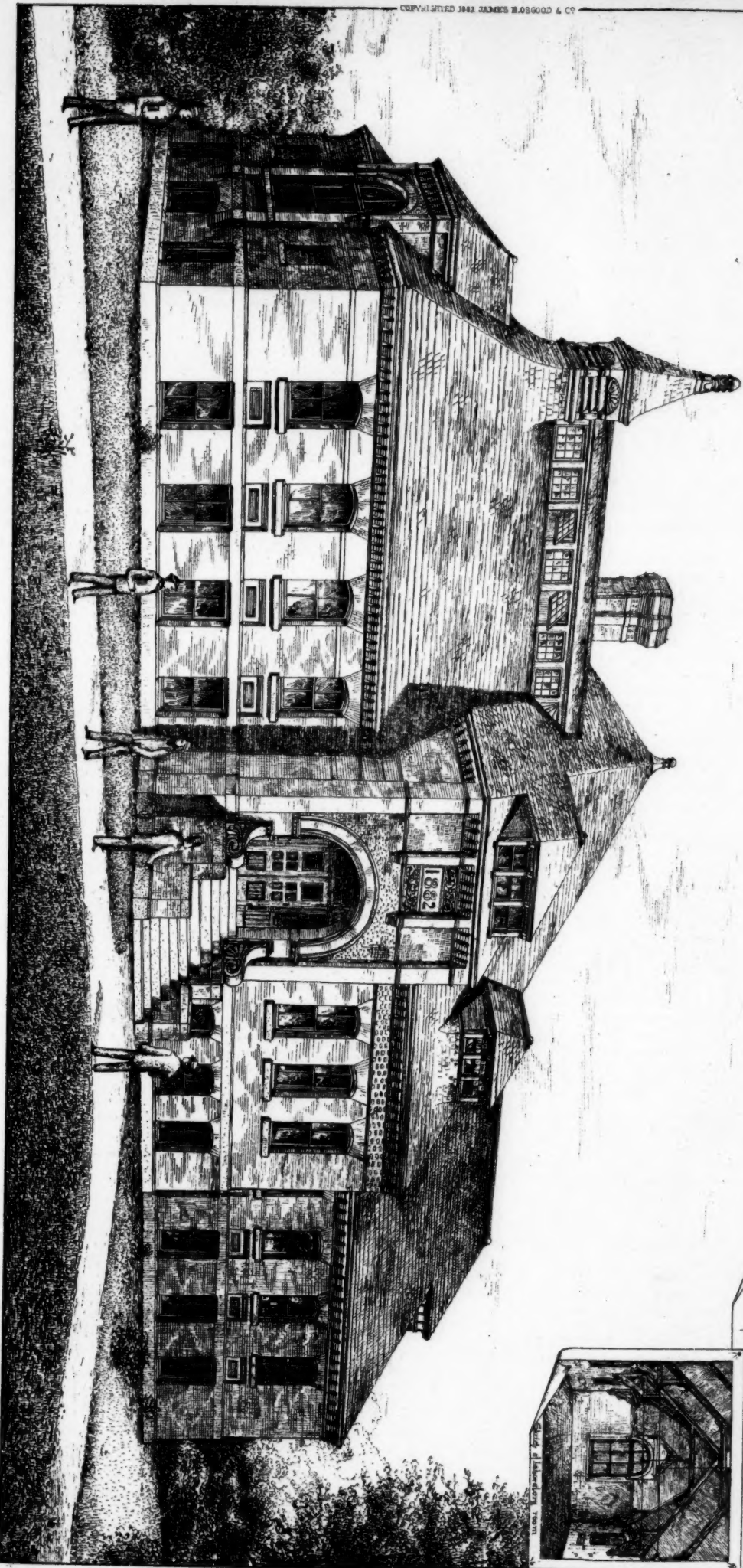
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LABORATORY BUILDING—

for PHILLIPS ACADEMY,
Andover, Mass.

Merrill & Gilber
Architects
115 Central St. Lowell, Mass.



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and so many ways in which each of these may be viewed, that an architect's position in relation to such matters is a difficult one. He has to decide what should be done, and that with certainty that, whatever his decision may be, it will please few and be disputed by some. His only consolation is, that if his censors be asked how they would have acted under the circumstances, they would either have done nothing, which he was not in a position to do, or that each would have done something different to the rest; so that therefore their criticisms neutralize one another. In self-defence I can certainly aver that these village churches then stood, as it were, on their last legs, and that the newly-arisen zeal of the Church would not brook their total loss. After all, an architect is but the servant of the public, and though he may be able to, and if so should, influence the opinion of his employers, he is bound to defer to that in the end.

I have referred above to the subject of roof tie-beams, the essential necessity of which our forefathers frankly accepted, as was their wont, and tried to make the best of. The modern mind, however, seems to abhor ties, and one of the problems that I have continually had to endeavor to solve has been how to construct church roofs without any visible ties, and that often to cover walls of less than mediæval thickness, and of more than ordinary spans. In Kent and some other of the southeastern counties half-barrel-shaped roofs are not infrequent, but they are generally provided with efficient supports in the shape of tie-beams with king-posts and braces. There is one of early date, well moulded, at Salvestone Grange, near Margate. At Eythorne, near Dover, I succeeded in reproducing all these features in the new roofs, which I found it was absolutely necessary to substitute for old decayed ones. But at Great Kimbale, in Buckinghamshire, where I put a similar roof to the chancel of the parish church, it is even now in contemplation to cut away and dispense with the obnoxious tie-beam and king-post, because it happens, from some points of view, to appear to cross the upper part of the eastern window. This leads me to notice and to utter a protest, however unavailing it may be, against the absurd modern craze for an undisturbed vista from one end to another of our cathedrals and churches. All mystery and effect is thus sacrificed, and the interiors of our ecclesiastical buildings become as bald and bare as those of barns.

In the church of Great Kimbale, to which I have alluded, I met with the worst example in my experience of walls having been thrust outwards by the spreading of their roofs, but I succeeded in restoring them bodily to their proper upright position, without having them rebuilt, as at first appeared necessary. This I was able to accomplish by the simple expedient of having them hauled up by ropes attached to windlasses outside passing through the opposite openings, after having previously disengaged the bases of the several columns of the arcades, and subsequently underpinning them.

It is noticeable that all these old church roofs were constructed, however rudely, in oak, and that they have owed their duration to the extreme tenacity of that timber, in spite of all the adverse circumstances to which I have called attention. They have in very many cases been renewed or altered at a far later date than the ages of good church architecture, probably in rude imitation of the former ones, but with inferior construction; or perhaps the timbers of the old roofs had become decayed at their feet only from contact with the damp walling, and their ends having been cut off, they have been re-used and re-framed, and so made to do duty again for a roof of lower pitch than the original. This may generally be discovered by finding the marks of the previous roof against a tower or the end gabling, and I lately found this to have been the case at the parish church at Betchworth, in the county of Surrey. In this case, also, disused and displaced mortise-holes betrayed the fact, together with the construction being inferior to any real mediæval work, the struts having been only nailed to, and not housed into the rafters and collars. The roof had been covered with exceedingly heavy stone slabbing, which had been improperly bedded completely in mortar, which by capillary attraction had rotted the lathings of the tiling and the ceiling between the rafters; these, again, being too close to each other, had left but little intermediate air-space (another frequent cause of similar disaster.) The roof timbers had in consequence sunk under their weight, and become dislocated at their points of junction, and the walls had yielded to their pressure, and so the complete restoration of the whole had become imperative.

The present almost prohibitive cost of oak, and difficulty of getting it seasoned, import another element for consideration into this already sufficiently vexed question of restoration; for the character of construction, what was suitable to that denser material is not so when fir has to be used instead. As an example, therefore, of the manner in which I have endeavored to solve this problem in connection with that of the non-tolerance of ties, I may call your attention to the working-drawings which I have just prepared for this particular case at Betchworth. In the first place, I relinquished the use of the framed couples alone, which I consider is only desirable when oak can be obtained. For this treatment I have substituted one in which principals are introduced at moderate distances apart; and, to avoid the intrusion of ties, I have had to place the collars high up. I have made continuous curved braces to sustain them, and by connecting them thoroughly to the principal rafters reduced their thrust to a minimum.

I find, however, in looking over my folios, that in general I seem to have preferred to adopt, whenever I could, roofs with half-barrel-shaped ceilings rather than those left open to the ridge, as in the last

case described. The reason is, that I consider the former the better adapted to maintain an equable temperature within buildings, and to give greater facilities for ventilation by means of the space that is left in them between their outer covering and the ceiling below the collars and braces, and also that they transmit better to a distance the sound of the voice. Then, again, the distance between the covering and ceiling gets rid of the danger of dry-rot, already spoken of as very likely to occur when the covering is of tiles bedded in mortar or cement, and there is but little space for air between it and the ceiling, which, if of plaster, is impervious, whether this be between or below the rafters themselves.

And yet the outer covering of roofs should be made impervious, or else it is of but little use to attempt to warm by artificial means the interior of a church. With the ordinary coverings used for the sake of economy, the heat evaporates through them almost as fast as it is generated, and the air of the interior, getting rapidly cooled by contact with the cold covering, descends, and causes the draughts so bitterly complained of by congregations. The least that ought to be done is to cover the rafters with stout boarding, ploughed and tongued, with asphalted felt laid upon it, and above them battens about 2 inches by 2 inches should be placed diagonally to brace the whole roof, and to allow any rain driven in under the tiles or slates to pass down to the eaves. The tiling or slating battens should be fixed upon these. I should even advise the boarding to be doubled, and to have plain felt between the two thicknesses, as well as the asphalted felt above them. Then the outer covering can be laid, as it should be, without mortar or cement.

The construction of this class of roof will be that in which principals are used with purlins to support the rafters, and cradling to carry the ceiling; and I shall call your attention to the working-drawings of several of such roofs in connection with some of the buildings I am about to mention.

At Great Yarmouth I have had considerable experience in connection with half-barrel-shaped ceiled roofs of large spans. It was in the year 1862 that I received the commission to undertake the restoration of the noble Church of St. Nicholas in that town. This, as you are doubtless aware, is one of the largest, if not the largest, simple parish churches in existence. The special peculiarity of it is that all its aisles have the immense internal width of about 40 feet. This commission was the more gratifying to me as I had been entirely unacquainted with the place and its inhabitants until I was informed that the committee had decided upon offering the work to me. I mention this fact because, although for very many years my relations with this work were of the pleasantest, and I was permitted to control all that was done at the church, in order that one mind might guide the whole, after a time that rule became relaxed, and I resigned in consequence. I am glad, however, to learn that it has lately fallen into the able hands of Mr. Pearson, under whom I trust that the work may be satisfactorily completed.

Some of the roofs and walls had fallen into a similar state of dilapidation to what I have been describing in other cases, and from the like causes. The first of the roofs that I had to replace there was that of the chancel, which has a span of only 25 feet. For this it was desired that I should, and I was able to, follow the old construction of framed couples, and employ the same material as before—that of oak. But when, later on, I had to undertake that of the vast south aisle of the nave, I found that practically neither were admissible, nor could I venture to introduce there any ties, as there had not previously been any. I therefore worked out the problem afresh, with fir for the material, and with principals and purlins and cradling for the ceiling, the result of which was entirely successful.

This church of St. Nicholas, though very impressive from its great scale, is not satisfactory, in that its nave and chancel are less in width than their respective aisles, the former having about 25 feet span, the latter 40 feet. In the new church dedicated to St. James, at the southern extremity of the same town, which is now in course of erection from my designs, I tried while keeping somewhat to the same scale, to correct this disproportion, and so make the width of the central compartment about 35 feet and that of the aisles 25 feet. The site that I had to deal with in this case was almost square, and I therefore adopted the Greek cross as the type for its plan. There are but four columns in the interior, and the central crux compartment is covered by a segmental dome of concrete carried by the four large arches and four smaller ones spanning the angles of the crux in place of pendentives. This it is my intention to have decorated with Rust's mosaic, as I have shown in a view of the interior of this church, which has been reduced by Messrs. Sprague, by their new photographic process, for the journal, *The Architect*, as an illustration to my paper in its pages, from a large colored drawing of it by my friend Mr. Howard Gaye. In the pulpit, seen in the drawing, I used the same material of mosaic in connection with decorative stone-ware from the Fulham potteries, resting on a base of polished serpentine. Such materials, some specimens of which have been sent by Messrs. Belham for your inspection, I have found to give facilities for the introduction of constructional and durable colors into buildings, the want of which I had long previously felt and deplored. The interior of this church is lined with buff-colored brickwork diapered with red, and its exterior is likewise constructed with considerable variety of color in flint-work and red and black brickwork and stone dressings. The roofs are of the character of those described at St. Nicholas's; and indeed in the general size and scale of the

parts I have tried to adapt in St. James's Church such of the characteristics of its mother-church as had impressed me with admiration, and had appeared to me to be desirable to introduce into the ecclesiastical architecture of our own time.

THE ILLUSTRATIONS.

DESIGN FOR LABORATORY BUILDING FOR PHILLIPS ACADEMY, ANDOVER, MASS. MESSRS. MERRILL & CUTLER, ARCHITECTS, LOWELL, MASS.

THE left hand wing is already built. The whole is to be built of faced brick in red mortar with sandstone finish above the base-course which is of granite. The ventilation of the laboratory room is effected by means of seven Eureka ventilators in the walls; the sashes of the lantern are movable, being operated from the floor. Glass cases along the sides of the room are connected with ventilators in the roof by means of pipes laid in the brick walls to carry off the gases from chemical reactions. The remainder of the building is divided into lecture-room, private laboratory, balance-room, work-room, cabinet and store-room. The roof construction is open timbered.

APARTMENT-HOUSE BETWEEN PARTY WALLS. MR. EDWARD C. CURTIS, ARCHITECT, BOSTON, MASS.

These plans were drawn to show the feasibility of building a desirable apartment-house on other than a corner lot, and to illustrate it, a lot, 45' x 112', was selected as the most advantageous. On the first floor to left of front door is a large sitting-room with folding-doors to bed-room, etc., in rear, lighted and ventilated by skylight going through building. On the other side is a suite of rooms with dining-room, kitchen, etc., in basement, and janitor's quarters in rear. The building is provided with elevator and lift to all floors. On the second, third, fourth and fifth, we get a good suite of rooms with all the modern improvements. On sixth floor, in rear, are five or six servants' rooms for the various flats of the building. The servants' rooms diminish the sixth-floor flat, leaving a suite of rooms for a small family with kitchen, etc., in place of some of the other rooms.

COUNTRY HOUSE NEAR PHILADELPHIA, PA. MESSRS. HAZLEHURST & HUCKEL, ARCHITECTS, PHILADELPHIA, PA.

PERSPECTIVE DIAGRAMS. SHADOWS BY ARTIFICIAL LIGHT.

For description see succeeding article.

INTERIOR OF THE FIRST BAPTIST CHURCH, CAMBRIDGEPORT, MASS. MESSRS. HARTWELL & RICHARDSON, ARCHITECTS, BOSTON, MASS.

The following description of the chapel of the Sisters of St. Margaret at Boston, published in our last issue, was unintentionally omitted:—

The stalls, which will accommodate sixty sisters, are returned at the west end against a rich open tracery screen which divides the chapel from the ante-chapel. Both stalls and screen are of oak. The reredos is a carved framing to five pictures, the central panel being the Crucifixion. The rood screen has to be stained and gilded. The floor at the east end has to be of cherry and maple laid in squares and diamonds. The roof and walls are to be decorated.

PAPERS ON PERSPECTIVE.—XVII.

SHADOWS BY ARTIFICIAL LIGHT (Continued).



to cases in which the source of light is, as in the figures already given, in front of the spectator. But the theory of false apexes explained in this chapter (301,) enables us to illustrate also the case, equally common in actual experience, in which the source of light is behind the spectator. Figures 85 and 86 illustrate these two cases. The shadows are cast by the method of Figure 81, *b* and *g*.

318. Figures 84 and 85, Plate XIX, represent the plan of a long room, and the perspective of one end of it. The line *pp*, in Figure 84, shows the position of the plane of the picture. *S* is the horizontal projection of the station point, and *A* and *B* the projections of two gas-burners suspended from the ceiling. The burner, *A*, appears in its proper position in Figure 85; its projection upon the floor is shown at *A^u*, upon the ceiling at *A^z*, on the right and left hand walls, at *A^r* and *A^l*, and upon the rear wall, which is parallel with the plane of the picture, at *A^p*. These points are the points in each surface towards, or away from which the shadows of lines normal to these surfaces are directed when this burner is lighted (314). Each is an apex of the diverging visible shadows, while *A* is the apex of the diverging lines of invisible shadow. The extreme point of the visible shadow of the normal line is in each case determined by the line of the invisible shadow of the extreme point of that line.

In Figure 86 the other burner, *B*, is supposed to be lighted, and we have the case already illustrated in Figures 77 and 80, in which the apex of diverging lines is behind the spectator. Following the method of Figure 80, we find that lines drawn normal to the plane of the picture from these several apexes pierce the picture at the points *B_N*, *B_{N'}*, *B_{N''}*, *B_{N'''}*, and *B_{N''''}*, and the false apexes *B^v*, *B^w*, *B^x*, *B^y*, and *B^z*, are then easily found.

B^v is determined by the aid of the plan, Figure 84, the line *B_NC* being the perspective of the ray normal to the picture, and the vertical line through *b* the perspective of the horizontal ray passing above the spectator. Their point of intersection, *B^v*, is the false apex (303). It lies in the shadow of the spectator's head, just at the point occupied by his right eye, the eye with which he is supposed to be looking. This point is, then, in artificial light as well as in sunlight, the focus of rays of light proceeding from behind the spectator. Lines drawn in like manner from the points *B_{N'}*, *B_{N''}*, etc., through the centre, *C*, will contain the other false apexes, and as the true apexes are either on a level with *B* or are directly above or below it, so the false apexes will be either on a level with *B^v* or directly below or above it; that is to say, they will lie in the intersection of the lines drawn through *C*, with horizontal or vertical lines drawn through *B^v*.

319. It will be noticed that the apex *B^p*, towards which the shadows of the lines normal to the rear wall are directed, occupies the same position as the point *A^p*, towards which the shadows of the same lines were directed in Figure 85. The only difference in the two cases is that the shadows in Figure 86 are shorter than those in Figure 85, being cut off by lines converging to *B^v* instead of by lines converging to *A*; but they coincide with them as far as they go. *A^p* and *A* being near together, the lines directed towards them intersect a good way off, giving longer shadows than do the lines directed towards *B^p* and *B^v*.

Indeed, there is much less of shadow altogether in Figure 86 than in Figure 85, as was to be expected, the spectator's eye being so nearly in a line with the source of light. If it could coincide with it, as was supposed to happen in the case of the serenader in Figure 83, he would see no shadows at all.

The shadow of the lantern, *A*, thrown upon the rear wall at *A^p*, or *B^p*, is really, of course, a little larger than the lantern, being at a greater distance from the apex, *B*. But its perspective is smaller than the perspective of the lantern, its distance from the station-point being relatively greater still. If the station-point were exactly on a line between the point *B* and the lantern, the outline of the shadow would obviously fall within that of the lantern itself.

320. The shadows of convergent lines, whether cast by natural or by artificial light, converge, of course, to the shadow of their apex. But if the apex is just as far from the plane on which the shadows fall as is the source of light, its shadows will be at an infinite distance, and the shadows of the converging lines will be parallel to one another and to the shadow of that element of the convergent system of lines which is normal to the plane, and will have the same vanishing-point in the trace of that plane; if it is farther off, they will diverge, being directed towards a point in the plane beyond the source of light. This point is, so to speak, the negative shadow of the apex, being still the point where the line through the apex of the lines and the apex of the rays pierces the plane. It is the same point that would be obtained if the two apexes should change places.

321. Figure 87 illustrates these points, showing the shadows of several geometrical figures cast upon the floor. The point *A^u* is the horizontal projection of the gas-light, *A*. The shadows of the lines which meet at the apex *B*, meet at its shadow, *B^v*. The shadows of the vertical axis are directed upon *A^u*. The apexes *C* and *C* are just on a level with *A*; their shadows upon the table are accordingly at an infinite distance, and the shadows of the lines that meet at these apexes are accordingly parallel in space, and have their vanishing-points upon the horizon. Each point *D* is farther from the table than *A*, and the shadows of the edges of the pyramid of which it is the apex converge towards the corresponding point *D^v*, the "negative shadow" of *D*, being the point upon the horizontal plane where the shadow of *A* would fall if *D* were a source of light.

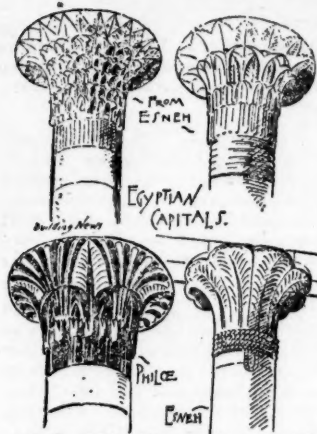
In sunlight, also, the shadows of converging lines are parallel when the source of light is just as far as the apex from the plane on which the shadow is cast. Figure 88 shows how the Pyramids, at sunrise, throw parallel lines of shadow towards the Libyan desert.

The analogy of these phenomena of shadow to those of the perspective representation of converging lines (301, Fig. 77) recalls the analogy, already pointed out, between the shadows of all objects when cast upon a plane by artificial light, and their perspective representation (265, Fig. 60).

STAINING BRICKS.—For staining bricks red, melt one ounce of glue in one gallon of water; add a piece of alum the size of an egg, then one-half pound of Venetian red, and one pound of Spanish brown. Try the color on the bricks before using, and change light or dark with the red or brown, using a yellow mineral for buff. For coloring black, heat asphaltum to a fluid state, and moderately heat true surface bricks and dip them. Or make a hot mixture of linseed oil and asphaltum; heat the bricks and dip them. Tar and asphaltum are also used for the same purpose. It is important that the bricks be sufficiently hot, and be held in the mixture to absorb the color to the depth of one sixteenth of an inch.

"OLD MASTERS."

SAN FRANCISCO, CAL.



LOVERS of art, and especially those who imagine nothing is worthy of approval but the works of old masters, are now having a treat in the exhibition of the Nahl collection of originals and copies of works by Raphael, Rubens, Veronese, Poussin, Van Dyck, Correggio, Rembrandt, Coppel, Ruysdael, and many others, forming a very interesting collection, and as there are some eighty originals, the exhibition is one seldom equalled, for the public to judge of the respective merits of old and modern painters.

As to the copies in general, they are poorly and stiffly drawn, with the exception of a Venus

and Cupid by Correggio, copied by J. W. Nahl, which is very good.

In general, it may be said of all the Nahls running back to a century ago, that their drawings are too set and coloring too heavy, much the same as the "Chinese white" water-color artists affect.

The most attractive painting is the Dance of Cupid, by Raphael. The figures of Cupid and four companions (one colored black), are well drawn and shaded, but if the catalogue did not kindly state that honey was flowing from an upset bowl in the foreground, one might think it was a bowl of hair as nearly as anything.

Another striking picture is the Slaughter of the Innocents, by Guido Reni. The subject is one naturally expected to attract attention, but the navel on one child is outrageously out of proportion, and what at first sight is a black cloud in the background, is, on close examination, a woman with a green-black face and drapery the same: a condition of things possibly peculiar to the female sex in the times of the old masters.

A most striking and disgusting picture is the Death of Cato, by Guiseppe Ribera. All the features are not only expressive of great pain caused by tearing open his wounds, but are beastly and coarse in the extreme, all showing a low and degraded spirit in the painter. The writer has, unfortunately, had many wounds, but none from which the blood did not run more than freely at less provocation than is shown in the above, but here, the blood obligingly stopped that the effect of the wrinkled flesh might be more prominent.

Two paintings by Giorgione, The Nymph (more than life size) and Lucretia, are well drawn as regards the main figures, but all the adjuncts are poor, and the flesh tints all on a dirty green, and the same may be said of nearly all the paintings on exhibition.

The Quarrel of Philip of Macedon and Alexander the Great, by Donato Creti, has two main figures very finely drawn and colored, but accessories poor.

A head of an old man by Coppel, is a very fine piece of coloring, and indeed, the gems of the collection are portraits, the best by Teschbein. Three specimens by Rubens do not do that artist justice, especially the Weeping Magdalen, who has a bad hare-lip, and the whole face is overdrawn and colored.

The landscapes throughout, some by Poussin and Rembrandt, are all very poor and would rank as pot-boilers to-day. Two subjects by Veronese, Interment of Christ and St. Peter delivered from Prison, are poorly drawn.

The subjects in still life by Franz Snyders are well and boldly colored, and the same may be said of Van Lillenberg's.

In general, it may be said that the greatest impression one receives is that most of the paintings are all noticeable for the poor accessories and the general stiffness of figures and green flesh tints.

The Nahl collection is a large and varied one, but the paintings do not do justice to several of the more noted masters. Besides the paintings are many sketches and a copy in plaster of the frieze of the Parthenon at Athens, among which one could spend hours profitably.

Taken altogether, the exhibition is an enjoyable opportunity for lovers of art to judge of the merits of older work. S.

ARCHITECTS' RESPONSIBILITY FOR SANITARY DEFECTS.

NEW YORK, December 13, 1882.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—I am moved to utter a word of expostulation, if not protest, against the omissions of architects in regard to sanitary requirements. In my daily experience as a sanitary engineer I am constantly impressed with the extent of these omissions, which are noticeable, not only in older buildings but in those erected within a few months, but at any rate since the general agitation of and public interest in sanitary matters. It is not to be expected that the best plumbing and drainage should be found in dwellings erected ten, fifteen, or twenty years ago, yet many of the worst cases of criminal carelessness and ignorance in plumbing work in my experience have been in buildings barely completed, and which were in

charge of architects of the highest reputation and experience. The contrast between the handsome exterior, artistic decoration and rich furnishing of these dwellings, and their sanitary defects is so great as to fill one with amazement. I have just completed an examination of a house of this class which occupied several years in its construction, and which is a model of taste and elegance, though the drainage arrangements are wretchedly bad. The underground drains are pitched the wrong way, and not having any man-holes have become choked so as to need digging up to clean them. There is not a single ventilated trap in the building; pan water-closets are used; the safe-wastes connect with the soil-pipe and are supplied by weeping-pipes, some of which have become choked and all of which are liable to fail; the tank overflow is connected in the same fashion; the servants' water-closets and slop-sinks are placed in close compartments without any means of ventilation; the pump to supply the tank is of a bad pattern, and hence there is a deficiency of water for flushing fixtures; the hot-water circulation is defective, so that the occupants complain that they cannot take a hot bath when they want to; and lastly, there is no air-inlet at the front wall, nor traps to the leaders, some of which end close to windows.

This is but one of a dozen similar houses which I have had occasion to overhaul, and it seems time to publicly remonstrate against such neglect and to place the responsibility where it justly belongs, upon the architects' shoulders. In the case just referred to, in which the plumbing cost some \$3000, the specification reads as follows:—"All the plumbing work to be done in first-class manner, with materials of the best kind. It is intended to have a complete and perfect job by this specification, but if anything should have been omitted to make it such it must be done without extra charge." I ask your readers in view of the details given, whether this specification has been carried out, and who is responsible for the failure to do so?

CHAS. F. WINGATE.

BURNING OF THE HALL BLOCK, TOLEDO, O.

TOLEDO, December 20, 1882.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

The burning of the Hall Block, which occurred on the morning of the 15th inst., was a very notable event in the history of Toledo fires; the loss being about \$1,000,000. The building was but about six years old, and had a frontage of about 230 feet on St. Clair street, and 120 feet on Jefferson,—all the frontage elaborately cut in stone. It was four stories high, with basement, and fully occupied throughout. The building formed one end of a square bounded by Jefferson and Madison streets, the famous Boody House, nearly the size of the Hall Block, forming the other end, while between them is the elegant First Congregationalist Church, 70 feet frontage. The entire combination of buildings was pronounced by many visitors and art connoisseurs the finest in contour to be seen in the United States.

It is said that the destruction of the building could have been avoided and confined to the central section where it started, had it not been for certain openings being left in the brick walls in the attic, thus giving the fire easy access to nearly the entire roof. The arched tops to the vaults in the upper stories did not seem to resist the pressure, and were broken, causing, it is said, much loss in the destruction of their contents, thus proving that the common brick arch is a very unreliable dependence for vault coverings.

Two well-known architects, Messrs. Gibbs & Co., and E. O. Fallis, lost their very valuable office accumulations of many years, with little or no insurance.

The building was owned by the Connecticut Mutual Life Insurance Company, and there seems to be a prospect that it may be rebuilt in some form in the near future. *

STRAW LUMBER.

CHICAGO, ILL., December 18, 1882.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Gentlemen.—In reply to letters and editorial inquiry in your issue of September 9, concerning straw lumber, I have made repeated examination of a considerable quantity in place here in large warehouse buildings at the corner of Market and Monroe streets, since September 20.

Of the specimens examined, all were a yellow-brown in color, $\frac{3}{8}$ " $\times$ 3" $\times$ 15' in size, being six (6) layers in thickness. The cement appears a glue rich in resin, and it or the rollers have given a sizing to both sides which is imperfectly cemented,—all is so toward the edges. It cuts well, saws well, and can unquestionably be carved, but is at present unfit for inside finish on account of the rough surface it presents for oiling.

It does fairly well for ceilings and floors, but the success of the product in the future is dependent on more perfect cohesion of the layers, to prevent warping.

I enclose a circular of a Kansas company, whose claims for the constructive use of the product I consider more justifiable at present than for the artistic uses hoped.

I have the honor to forward also for your personal examination, a specimen of some in use, and shall be glad to contribute further facts concerning it on application of your correspondents.

I am, very respectfully yours.

EDWARD A. KENT.

NOTES AND CLIPPINGS.

THE RECENT LONDON FIRE.—Among the most serious obstacles the London Firemen have to contend with is an insufficient supply of water. Three private corporations control the water supply, and under their old foggy system of management water is not available at times when most required. Whether or not there was a deficiency at last week's fires, the accounts thus far do not state. But one thing for which the Board of Works is responsible, and which must have contributed to the spread of the fire, is the small number of men employed by them to man the apparatus. The newspapers have frequently complained of the insufficient number of men in the employ of the Brigade, and that the complaint is well founded, is shown from the fact that there were last year but 536 firemen of all ranks employed, while in New York, embracing but about one-third the area of London, 923 men were employed. London has 38 steam fire-engines and 115 hand-engines, while New York has 61 steam-engines and no hand-engines. Each city has, in addition, hose-carts, ladders, fire-boats, etc., but the above figures show that, for land-service, New York, with one-third the area to cover, has a greater capacity than London for delivering water at fires. The use of hand-engines does not necessitate the employment of so many men, for they rely upon "pumpers" picked up at the scene of the fire to work the brakes for a shilling an hour. But the absence of trained firemen to handle the apparatus, hose, etc., is a serious drawback to the efficiency of the Brigade. In 1881 the entire expenditures for the London Brigade were in the neighborhood of \$500,000, which is about one-half the amount New York paid in the one item of salaries to firemen. The last fire of magnificent proportions that occurred in New York, was in 1835, when the loss footed up to about \$20,000,000. No fire equal to that of London last week has occurred in this country since the Boston fire of 1872. — *Fireman's Journal*.

AN INTERESTING DRY-DOCK.—The dry-dock of the Screw-Dock Company, near Catherine Ferry, New York City, is one of the oldest and also one of the most interesting dry-docks at this port. There are four large hydraulic pumps and four small ones, the four large pumps performing eighty per cent of the work. In the winter-time alcohol is used in place of water, in order to avoid the danger of bursting the pipes due to frost. A large tank, containing about twenty-five barrels of alcohol, is in the engine-room. There is very little waste of this alcohol, and it is used again and again until it becomes so weak that upon testing it is found that it will freeze, when two barrels of additional spirit being added the entire liquid will be found to stand the freezing test. There are three docks of different sizes. The large dock consists of twenty-six sections, each six feet in width; the middle dock, of twenty sections; and the small dock, of twelve sections. These sections are hung in chains that run over pulleys and are attached to screws. When a vessel is run into one of these docks, the screws on each side of the dock are worked by hand until the keel-box on each section touches the keel of the vessel, when hydraulic power is applied and the vessel's keel is lifted above the surface of the water. The docks, as already indicated, are situated on the East River, and the maximum weight which they can lift amounts to about 1,000 tons. — *Iron Age*.

MAKING SPIRAL SPRINGS FOR A STREET-CAR MOTOR.—The experiment undertaken by the Steel-Spring Car-Motor Company, Philadelphia, of running street-cars by spiral springs, wound up at the beginning of a trip, is being successfully pushed forward. The first of the eight coils, each three hundred feet long, has been already cast. The billet, twenty-seven feet long, six inches wide and four inches thick, is passed through the rolls and broken into a length of one hundred feet. It is then heated, thirty feet at a time, and rolled down to a thickness of one-quarter of an inch. In the first experiment it was found that the band was ten feet over the three hundred feet required. A special furnace, of course, had to be built, fired by seven grate places, opposite each of which was a flue communicating with a main flue running the whole length of the furnace. The band has been taken from Pittsburgh to Philadelphia, where it is being tempered and wound into the form of a spring. There are doubts expressed whether springs will be practicable as a matter of applying a power, and the experiment is being watched with much interest. — *Exchange*.

A PURITAN PEDESTAL.—Into the studio of a Boston sculptor came, a month or two ago, a little, dried-up old man, who, after various shrill-voiced inquiries as to what the sculptor had ever done to prove his merit, produced a roll of paper which, when opened, showed a very ugly design for a pedestal. "Now that pedestal," piped the visitor, "is pure Puritan, studied up from authentic documents. The stone-cutter that's making it, he wanted to cut off those corners, but I told him it was a pure Puritan pedestal, and we'd had it studied up from the most authentic documents, and I didn't think it would do to cut 'em off." So he had come for advice on the corners of the "pure Puritan" style, which is new to myself at least, but which may now be seen, "studied up from the most authentic sources," in the pedestal of the Bridge statue unveiled at Cambridge last week. — *Exchange*.

A MEXICAN CROSS.—The stone cross brought by Charnay from Teotihuacan is creating some interest in Paris. It is about 4 feet high, thick-set, with a relief on one of its faces in the shape of a blunted Greek cross, and on the base four crosses in relief. M. Hamy, keeper of the Trocadéro Museum, holds that it is an emblem of Tlaloc, god of storm and rain, one of the oldest of Mexican gods. The presence of such crosses in Mexico caused the Spaniards to believe that St. Thomas, whom they identified with Quetzalcoatl, had preceded Christianity in Mexico.

BAUDRY'S PAINTINGS IN THE PARIS OPERA-HOUSE.—Baudry's paintings in the opera-house at Paris have been cleansed with bread. The *Athenaeum* reports that they have sustained much less damage than was supposed.

A PAPIER-MACHE CHURCH.—A church in Bavaria accommodating one thousand people is said to have been almost entirely built of papier-maché.

DISPENSING WITH THE AID OF A MIDDLE-MAN.—A colored woman has been sentenced to sixty-six and two-thirds days in the work-house of Nashville, Tenn., for stealing a brick pavement. She used the material to build a chimney in her house.

THE LIFE OF TELEGRAPH-POLES.—The Western Union Telegraph Company has estimated the life of telegraph-poles as follows: cedar, sixteen years; chestnut, thirteen; juniper, thirteen; spruce, seven years. Cedar, chestnut and spruce are used in the Northern States; juniper and cypress in the Southern States, and redwood in California. Poles cut in the summer will not last as long as those cut in the winter by five years. Soil and climate, of course, make a difference with the life of poles. — *Northwestern Lumberman*.

DISCOVERIES IN MAGNA-GRÆCIA.—Francois Lenormant has returned from his exploring tour about Magna-Græcia and made report to the Académie des Inscriptions. He has found 200 Latin and 30 Greek inscriptions never recorded, and found a clue to the site of Terina. The ruins of Medina and Hipponion have been found, and the site of the Greek colony Metapontum identified. Lenormant thinks he has evidence that black pottery of a primitive type, like that which he has been noticing in recent numbers of *L'Art*, was once common over the entire southern portion of Italy, and forms a definite period of art. A pottery with geometrical ornaments like that of Cyprus has been found in Apulia. Altogether the tour of this distinguished archaeologist from Lucera to Reggio has proved very fruitful in discoveries and suggestions.

PAINTING CANVAS ROOFS.—One of our readers complains that in painting a canvas roof the quantity of paint necessary to fill the canvas was so enormous, especially in hot weather, that he was quite astounded, using several gallons where he expected to use as many quarts. While this large quantity is an advantage, inasmuch as it is the resisting medium of the roof (and the larger the quantity the better in many respects is the roof), it seems desirable to obtain a coating with a less expenditure of oil and paint. In painting carriages and wagons a very good practice has been to make a quantity of wheat or rye flour paste, and with this give the canvas, after it is laid upon the roof or panel, a good and even coat. The paste should be about as thick as that used for paper-hanging. This will leave the canvas as tight as a drum-head, and, at the same time, fill the surface sufficiently to prevent so great absorption of the oil. Glue size has the same effect and is easily applied. It is said that panels painted in this way are very durable, and that the paint never cracks or scales off. White-lead in oil colored with ochre is probably one of the best paints which can be applied upon the roof. Possibly, for the sake of its fire-proof qualities, a final coat or two of mineral paint might be of advantage. — *Metal Worker*.

ALUMINUM PROCESSES.—A London dispatch, stating that a process for the cheap production of aluminum had been discovered was shown by a *Times* reporter to Charles S. Platt, a gold and silver refiner and assayer. Mr. Platt said that so-called cheap processes for making this metal have been discovered periodically in the last fifteen years, but he had never seen any of them amount to anything. Aluminum is entirely obtained from the Aluminum Society of Paris, who make it from clay. Before the Franco-Prussian war it was said that it was made in England and Germany extensively, but when Paris was under siege it was found that the metal could not be obtained anywhere. No process has yet been found that can compete with the production of this society. Mr. Platt thought the new process spoken of could not be in operation, or the market would necessarily be affected. Aluminum is now worth \$125 an ounce, troy weight, and not more than a ton a year is used in this country. It is the lightest of metals, and is used in various ways, in aluminum bronzes and what is known as aluminum gold, a union with copper. Dentists use it for making mouth-plates for teeth, and it is available for mathematical and some surgical instruments. A bar to its general use in manufacturing processes is the fact that it cannot be soldered and must be riveted. — *N. Y. Times*.

TUNNEL UNDER THE ELBE AT HAMBURG.—The Senate of Hamburg, Germany, as recently reported in an exchange, have had under consideration a scheme for constructing a tunnel under the Elbe, and an elevated railway in the city. The construction of a bridge instead of a tunnel is said to be out of the question on account of the width and crowded state of the harbor, and the author of the project, Mr. Westendorp, has designed the tunnel of such dimensions as would provide both for vehicles and foot-passengers, and a double-track railway for freight and passengers. This he proposes to effect by building the tunnel of two stories, the road for vehicles and pedestrians to be in the upper story, and the lines of railway in the lower story. The crown of the tunnel for a length of 656 feet (the width of the navigable channel of the Elbe) is to be from 20 to 30 feet below low-water mark, and separate openings are to be provided for railway and roadway, the ascent to be very gradual, about 1 in 35. The tunnel is to be an iron cylinder lined with brickwork, the upper story resting upon columns placed between the two lines of rails. The latter would be in continuation of the track of the elevated railway in the city, which is to be of a decorative iron-work, and similar to that of the elevated roads of this city. Three stations will be provided at different points, where pavilions are to be erected for taking up and letting down passengers. The tunnel is to be lighted by electricity, and ventilated and drained by powerful machinery, and provisions are also to be made for taking gas and water pipes, telegraph and telephone wires, etc., through it. The estimated cost of the tunnel and railway is 26,000,000 marks, or about \$6,250,000, and they are to be completed in five and a half years. — *Iron Age*.

