THE BRICKBVILDER

DEVOTED TO THE INTERESTS OF ARCHITECTVRE IN MATERIALS OF CLAY

PVBLISHED MONTHLY
BY ROGERS AND MANSON
OFFICE, 85 WATER STREET BOSTON MASS.

INDEX, VOLUME SEVEN

JANUARY—DECEMBER

1898

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MASONS' DEPARTMENT.

RECENT BRICK AND TERRA-COTTA WORK IN AMERICAN CITIES.

Finished Grd

Present Grad

e Sheet Nº 1)

THE ASTORIA HOTEL, FIFTH AVENUE AND THIRTY-FOURTH STREET, NEW YORK CITY. H. J. HARDENBERGH, ARCHITECT.

Attention is called to the fact that some 61,000 cu. ft. of terra-cotta are used on this building and the Astor Court Building, seen in the distance. This includes the work made for the interior, on the ground and first floors. The total weight was about 2,200 tons, which is equal to 600 truck loads of 7,333 lbs. each.

VOLVME VII JAN. 1898 No. 1

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

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RETROSPECTIVE.

THE first of January has come to be associated with the turning over of new leaves and a certain amount of retrospection preparatory to a plunge into the hopes and fears which are supposed to lie before us; and though moralizing can hardly be called a branch of the burnt-clay arts or industries, by a somewhat circuitous association of ideas we are led to some reflection. This is a rapid age. Rapid transit is in the air, and not only in our streets and in our commercial structures, but in our professional life as well has the necessity for haste been made to seem to be paramount. Surely no one material has contributed more to the exigencies of haste, at least as regards the external finish of our buildings, than that which is the product of the burnt-clay industries, and the feeling of perpetual rush which is such a factor of our modern professional and mechanical life is quite as strongly felt in the particular lines of industry and industrial art which this journal represents as in any other department of human production. The old story of the artist painter who claimed that the secret of his success was that he mixed brains with his pigments is applicable to every industry which depends for its final character upon intelligence and direct, concerted effort. Now, the application of brains to the arts and sciences means time, and a lot of it. It has come to be a trite saying that we live too fast, but the necessity for deliberate thought, for making haste slowly, though ever present with us, can hardly be emphasized too strongly. There are some natures whose genius is most available at high pressure, and who need the excessive voltage to develop their illuminating power. There are other fortunate mortals who can handle fifty different enterprises at once, make a success of each, and keep on a keen jump for years, finally going up with a shout, closing the chapter in full fighting trim. But for those of us who are just plain mortals, time is a very important and indispensable adjunct to the production of any really excellent work, though it is one which is unfortunately very often neglected. We permit ourselves to be rushed, we know full well that we do not give the cautious, deliberate thought and study to our work which we know it deserves, and we have no one but ourselves to thank for the inchoate, ill-digested aspect of so much of our current architecture. We know how to do things right, but we are too prone not to take time to do it.

The good Book tells us that no man by taking thought can add to his stature. Nevertheless we know that by taking thought we can add continually and indefinitely to our mental and artistic stature. We need at times to sit down quietly by ourselves and forget that there is a client who is in a terrible hurry to have a building done on the first of the month, or a contractor who is impatiently calling for details, and to collect our thoughts, striving to formulate our ideas and turn our problems over and over in our head until we can feel the familiarity with them which is very likely to lead to the best kind of a solution. Annie Besant is quoted as saying that if she has a very serious problem to consider, she gathers all the facts before her and then goes to sleep over them. A little more of this same procedure would give us better buildings, more systematic planning, and more artistic treatment of details; would go further, in fact, to give us what is so often sighed for and which we are but slowly approximating, — a national, distinctive style of work. Our busy men do not give themselves time for thought. We remember a short time since having a very interesting interview with one of our leading architects, who confessed to being so tired out and rushed with work that his digestion had been impaired, he was troubled with insomnia, and he felt thoroughly used up. But the stirring necessities of his practise, as he viewed them, kept him at the mill, when by rights he ought to have been out in the woods, or fishing, or doing something entirely different from his daily work, to give his tired brain a chance; and when we recall the really excellent work which he was able to turn out year after year under these excessive conditions, we cannot but think how much easier the same could have been accomplished, to say nothing of the possibility of better results, had he simply refused to be hurried, and demanded time to think and to study.

PROF. F. W. CHANDLER, who is at the head of the Architectural Department of the Massachusetts Institute of Technology, has recently been appointed official architectural adviser to the mayor of Boston. An office of this kind is not entirely new in municipal matters, but it has not been created and filled so often that there has yet been any definite precedent. Consequently, there is an added pleasure in noting the appointment. It is pleasant to think that the city of Boston has a mayor who appreciates the conditions sufficiently to admit that he does not know everything about architecture. The average city official is so seldom troubled with this kind of modesty that such an appointment is not what one would ordinarily expect, but the mayor has shown himself capable of rising above the level of the politician, and his selection is one that will receive the approval of all who are interested in good municipal architecture, properly selected and properly supervised. Professor Chandler is an eminent architect, abundantly qualified to give the best sort of advice, while at the same time his connection with the Institute removes him from the suspicion of interested advice and takes him out of active competition with his brother architects.

WE had occasion some time since to observe the construction in a building which had been in place for some thirty years, and which presented several points of interest. The floors were composed of wrought-iron beams connected by brick arches, the brickwork being laid in Rosendale cement mortar. The building was an average one, subjected to the ordinary conditions, not as good as the best and yet not especially exposed at any point. The beams rested upon brick walls laid up in cement. A careful inspection failed to show any signs of rust about any of the beams. Furthermore, the paint, which appeared to be red lead, was intact over nearly the entire surface of the iron. It is frequently asserted that cement acts as a preservative for iron or steel in construction. Lime certainly attacks the iron to a limited extent, but sufficiently so as to effect a marked change in the course of years; and plaster of Paris likewise attacks iron slightly, though we imagine the cause in this case is due rather to the extreme avidity with which plaster of Paris will absorb moisture from the air and then give it out to the iron; but whether the cement really protects the iron or not, there is every reason to believe that it protects the paint, and the paint in its turn protects the iron. Consequently if the iron beams are carefully painted before being enclosed, and the brick or terra-cotta used therewith is thoroughly bedded in cement so the cement protects the paint, there is pretty good evidence that we can safely depend upon freedom from corrosion for an indefinite period.

PERSONAL AND CLUB NEWS.

C. A. BREHMER, architect, has opened an office at 215 West Jefferson Street, South Bend, Ind. Catalogues and samples desired.

MORGAN M. RENNER, architect, has taken offices in the Hartford Building, Broadway and 17th Street, New York City. Catalogues and samples desired.

EDWARD J. DOUGHERTY and F. Dickinson Shaw have formed a copartnership under the firm name of Dougherty & Shaw, for the practise of architecture, with offices at 317 Market Street, Camden, N. J. Catalogues and samples desired.

GEORGE OAKLEY TOTTEN, JR., chief designer in the office of the supervising architect at Washington, during Mr. Aiken's administration, has resigned that position, and formed a copartnership with Laussat Richter Rogers, under the firm name of Totten & Rogers, for the practise of architecture. The new firm has taken offices at 931 Chestnut Street, Philadelphia.

THE president and officers of the T Square Club, of Philadelphia, held a reception on the evening of January 24, at the Pennsylvania Academy of the Fine Arts.

THE Chicago Architectural Club is having its usual lively and interesting midwinter season. Among the recent events were the Annual Christmas Celebration, on the evening of December 29, the first exhibition of the Projét Drawings, January 10, and the "Club Souvenir Night," December 20. Refreshments were served at each of these gatherings, a group of members acting as hosts for each occasion.

THE Annual Meeting of the New Jersey Society of Architects was held Friday, January 7, at Board of Trade Rooms, Newark, N. J., President Albert Beyer presided; Mr. James H. Lindsley, as chairman of committee on society insignia, which was open to competition among the members, reported that the committee had selected a design which was finally adopted by the society. The code of ethics and professional practise, as recommended by the board of governors, was adopted as a whole and referred back to the committee to be incorporated in the new draft of the constitution and by-laws.

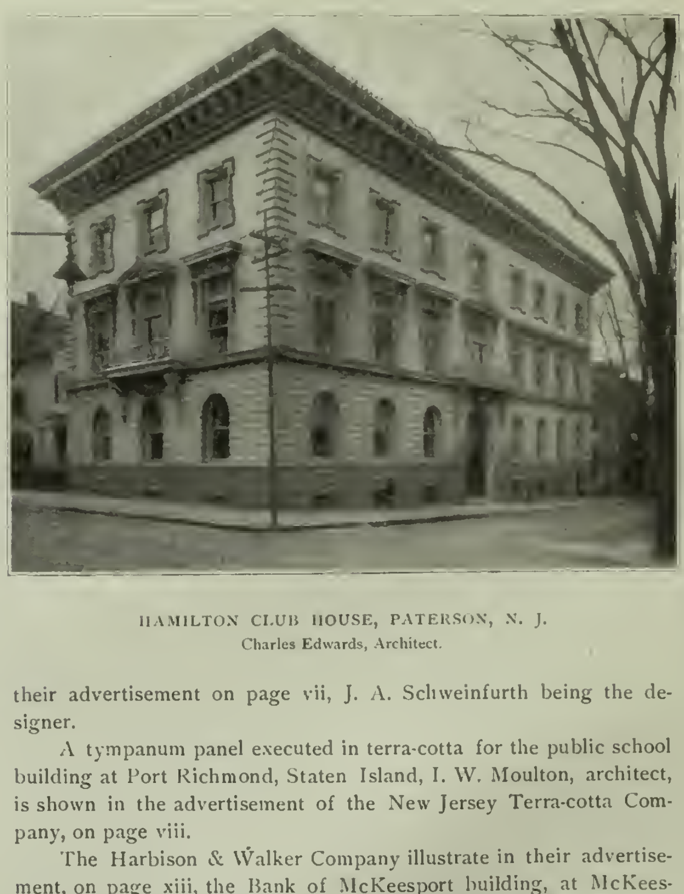
The election of officers and members to the board of governors resulted as follows: President, Albert Beyer; first vice-president, Paul G. Botticher; second vice-president, James H. Lindsley: secretary and treasurer, George W. von Arx. Board of governors, vacancies to board, three-year term, Herman H. Kreitler and Rudolph W. Sailer.

After adjournment the members were invited to partake of a collation provided by the newly elected officers.

ILLUSTRATED ADVERTISEMENTS.

THE New York Architectural Terra-cotta Company send for illustration a print of the Hamilton Club, Paterson, N. J., designed by and executed under the superintendence of Mr. Charles Edwards, of that city.

Number seven of the series of brick and terra-cotta fireplace mantels especially designed for Fiske, Homes & Co., is shown in



HAMILTON CLUB HOUSE, PATERSON, N. J.
Charles Edwards, Architect.

their advertisement on page vii, J. A. Schweinfurth being the designer.

A tympanum panel executed in terra-cotta for the public school building at Port Richmond, Staten Island, I. W. Moulton, architect, is shown in the advertisement of the New Jersey Terra-cotta Company, on page viii.

The Harbison & Walker Company illustrate in their advertisement, on page xiii, the Bank of McKeesport building, at McKeesport, Pa., Longfellow, Alden & Harlow, architects.

Number three of the descriptive series of the roofing tiles made by the Celadon Terra-cotta Company, Charles T. Harris, lessee, is given in the company's advertisement, page xxvii.

Examples of bond, showing blocks of the Gilbreth Seam-Face Granite laid up in two styles of bond. is illustrated in the company's advertisement, page xxxiv.

The American Schoolhouse. III.

BY EDMUND M. WHEELWRIGHT.

IN considering the costs of the Brighton and Brookline high schools I neglected to state in my last paper that the Brighton school is but a part of the building which eventually will be built, and that it was planned with reference to its ready junction to the future construction; it therefore has features which are adequate for the enlarged structure, and the cost per cubic foot is somewhat greater than it would have been had it been constructed of the size that it will be in the future.

To continue the consideration of the cost of schoolhouses, that of those of the grammar grade will now be considered, and incidentally certain different features of plans and construction will be pointed out.

The Pierce Grammar School, at West Newton, Mass., may fairly be considered as a fourteen-room building with assembly hall, or as having accommodation equivalent to sixteen schoolrooms. The building is of brick for two stories in height, and has an assembly hall in the roof. The schoolrooms have a stud of 12 ft. The wardrobes are in part separate rooms, shut off from the main corridor and with outside light, and in part are wire netting enclosures in the corridors. The brick walls of first and second stories are 16 ins. thick. The interior partitions are of wood studding, fire stopped and wire lathed. The blackboards are of slate. The schoolroom windows, except on one long side, the south, have double run of sash.

The ground area of this building is 11,536 sq. ft. The cubical area is 611,408 cu. ft. About one third of the attic is left unfinished, as it is space which cannot advantageously be utilized for schoolhouse purposes. The cost of this building, not including grading, fencing, and paving of the yard, and deducting architect's commission, was $70,102, or 11 cts. per cubic foot. Reckoning the assembly hall as two schoolrooms, the cost per schoolroom was $4,125.

The Agassiz Grammar School was built for the city of Boston before the passage of the building law of 1892, which materially increased the cost of building schoolhouses, as will be shown hereafter. This school has fourteen schoolrooms and an assembly hall in the third story. The stud of the schoolrooms is 13 ft. 6 ins. and in third story 16 ft., the assembly having a stud of 20 ft. The blackboards are of slate. The minor partitions, where not of brick, are of terra-cotta lumber. In short, the building is constructed in the main as is recommended in my earlier papers on this subject.

The ground area of this building is 9,618 sq. ft. The cubical area is 605,934 cu. ft. The cost was $91,783 or 15 cts. per cubic foot, and $5,736 per schoolroom.

An analysis of the reason for the differences in cost of these two schools leads to interesting conclusions.

As will be seen by the perspective sketches here given, the Agassiz School is of a more elaborate design than is the Newton school, and further, the former school has exterior walls of Perth Amboy terra-cotta brick with terra-cotta trimmings, while the latter school has exterior lining of selected Eastern water-struck brick with free-stone trimmings.

Calculations of the proportionate increase expense of schoolhouses when of architectural design, and of like buildings with the exterior features of a well-constructed factory, lead me to the opinion that the excess of cost of the architectural features of the Newton school is about $3,000 above that of a wholly utilitarian structure serving the same ends, while that of the Agassiz School is about $7,000. Therefore if the design had been stripped of all architectural features, and brought to the condition of a factory building, being otherwise unchanged in its several features, it is probable that the Newton school could have been built for about $67,000. Under the same conditions the Agassiz School could have been built for about $85,000.

This difference of cost, $18,000, can be almost wholly accounted for by the consideration of the difference in cost of foundations and brickwork, together with the difference in the construction of the interior partitions and heat and vent shafts. The external walls of the Agassiz School are 19 ft. higher and 4 ins. thicker throughout than are those of the Newton school. The interior partitions of the Newton school are of spruce studding, wire lathed. The interior partitions of the Agassiz School are for the most part 12 in. brick walls, and where not of brick are of terra-cotta lumber. All the heat and vent shafts of the Agassiz School are of brick, while two of the large shafts of the Newton school have galvanized iron vents enclosed by stud partitions.

A survey of quantities of this brickwork, the cost of the Perth Amboy brick being left out of the calculation, and the exterior surface being considered as of the same material as in the Newton school, shows that these features in the Agassiz School are worth between $15,000 and $16,000.

Further calculation of cost of certain features of the Agassiz School in excess of features performing like functions in the Newton school account for between $2,000 and $3,000 of the difference of cost of the two buildings. These features may be noted in part as follows.

In the Agassiz School the basement floor was of asphalt, that of the Newton school of concrete. The Agassiz School had double run of sash in all schoolrooms, the Newton school had single run of sash upon the south side; while the former school had seven windows at least for all corner schoolrooms, the Newton school had but six.

The Agassiz School had Keene's cement door and window finish and hospital base, the customary ash finish being used in the Newton school.

We thus see that with the evidently greater cost of the external treatment left out of calculation, the difference in cost of the two buildings can be closely accounted for, and that the excess of cost of the Agassiz School is due to features which better the construction and improve the lighting of the building. It should be said, however, that $5,000 or $6,000 of the expense might have been saved if the Agassiz School had been built in Newton instead of Boston, as the Newton building laws would have allowed, with perfect safety, a less heavily constructed building than those of Boston permitted.

If built under the Newton building laws, and if of no more elaborate external design than that of the Newton school, but otherwise unchanged in its requirements, the Agassiz School would have probably cost not more than $83,000; and taking into consideration the general greater cost of building in Boston than in the cities and towns immediately adjoining, we may fix the probable cost of a school of the construction and type here contemplated at about $80,000. Hence a fourteen-room and assembly hall grammar school, three full stories in height, constructed as was the Agassiz School, but having 16 in. instead of 20 in. external walls and general exterior design and materials no more expensive than that of the Newton school, can probably be built, where the cost of building is the same as in Newton, for $5,000 per schoolroom.

It will be interesting to compare the cost of another grammar school of nearly the same accommodations with that of the Pierce and the Agassiz Schools. To this end the plans of the Brooks School at Medford are here given.

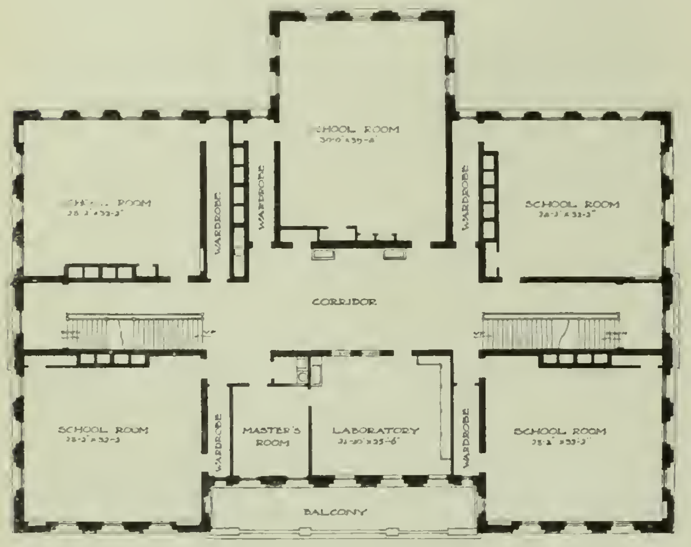
The building has a ground area of 11,333 sq. ft. and contains 600,649 cu. ft. Upon the same basis considered above, this building cost $60,304, *i. e.*, 10¼ cts. per cubic foot and $4,285 per schoolroom. The Brooks School is a two-story brick building with assembly hall in the roof and with twelve schoolrooms. The cost per schoolroom of the Brooks School is $160 greater than that of the Newton School. It is to be expected that the larger the building of a given type the less will be the relative cost. We might suppose that this probable decrease in cost, about 4 per cent., or $165, would account for the greater relative cost per schoolroom of the Medford school, but other varying conditions of the two buildings must be considered to satisfactorily understand this difference of cost. The Brooks School is of a sufficiently simpler design than the Newton school to amount to about $50 per schoolroom of the difference.

The Brooks School has single run of sash, while the Newton school has double run on the north, east, and west sides; but the Newton school has but six windows in a corner schoolroom, while the Medford school has in such rooms seven windows. The Medford school has schoolrooms of the maximum dimensions for the grammar grade 28 by 32 ft., while those of the Newton school are 26 by 32 ft. The Newton school, however, devotes a greater proportionate area to wardrobes, since they are placed in this building as adjuncts of the schoolrooms, but enclosed by solid partitions and each having two doors. the arrangement of wardrobes generally required in our graded schools.

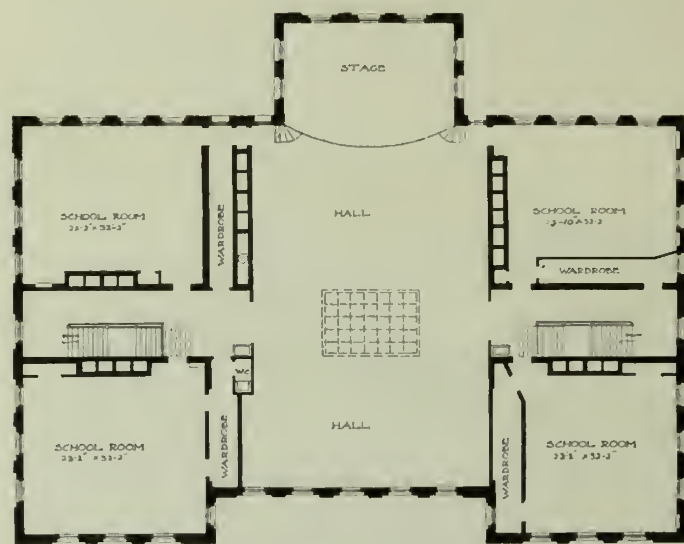
In the Medford school two large wardrobes serve on each floor six schoolrooms. The wardrobes are practically a part of the corridor, but are arranged with more ample vent ducts than are usually provided for corridor wardrobes. The schoolrooms in the Medford school have a stud of 13 ft., and the stud of the schoolrooms in the Newton school is but 12 ft. There is, however, about the same amount, relative to the size, of foundations and exterior brickwork in each building. The Medford school has wooden-lathed ceilings above basement, and the Newton school has wire-lathed ceilings throughout.

From the foregoing comparison of costs we may credit the Newton school with about $210 per schoolroom; but as we have debited it with $165 on account of its size, we have yet to discover

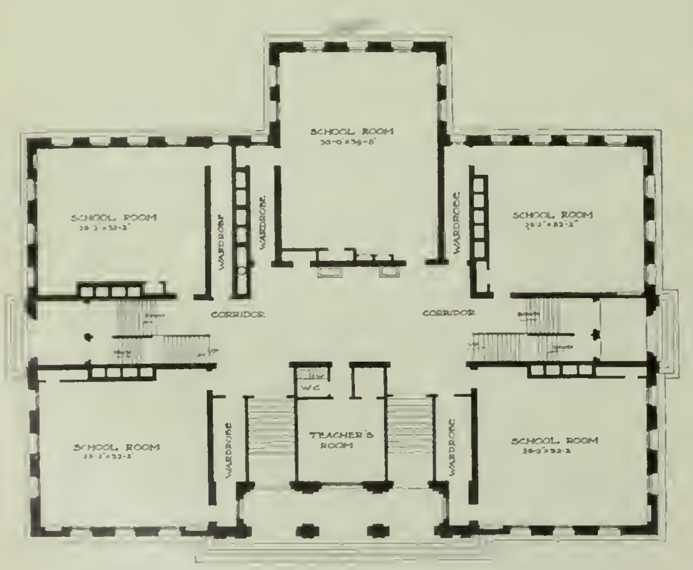
AGASSIZ GRAMMAR SCHOOL, BOSTON, MASS.
Edmund M. Wheelwright, City Architect.



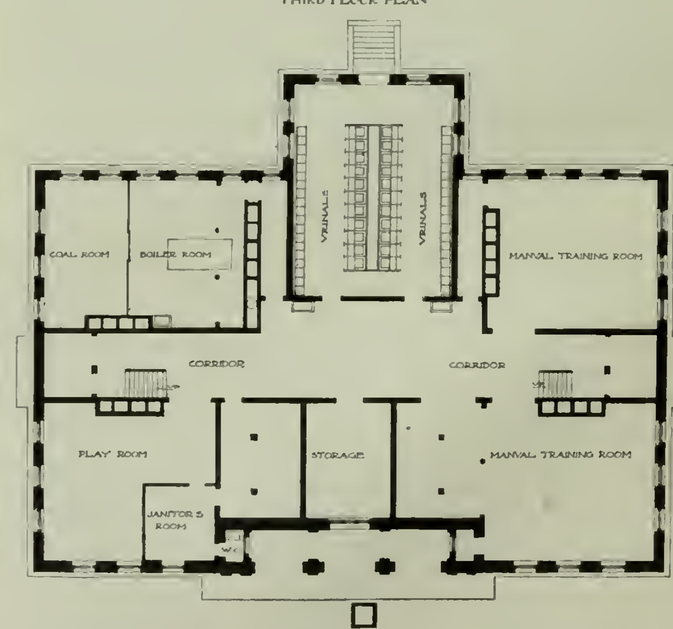
SECOND FLOOR PLAN



THIRD FLOOR PLAN



FIRST FLOOR PLAN



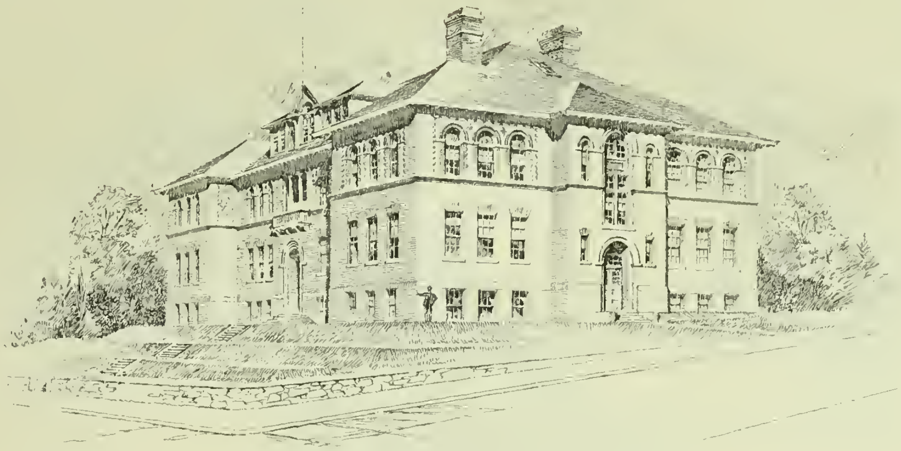
BASEMENT PLAN

AGASSIZ GRAMMAR SCHOOL, BOSTON, MASS.

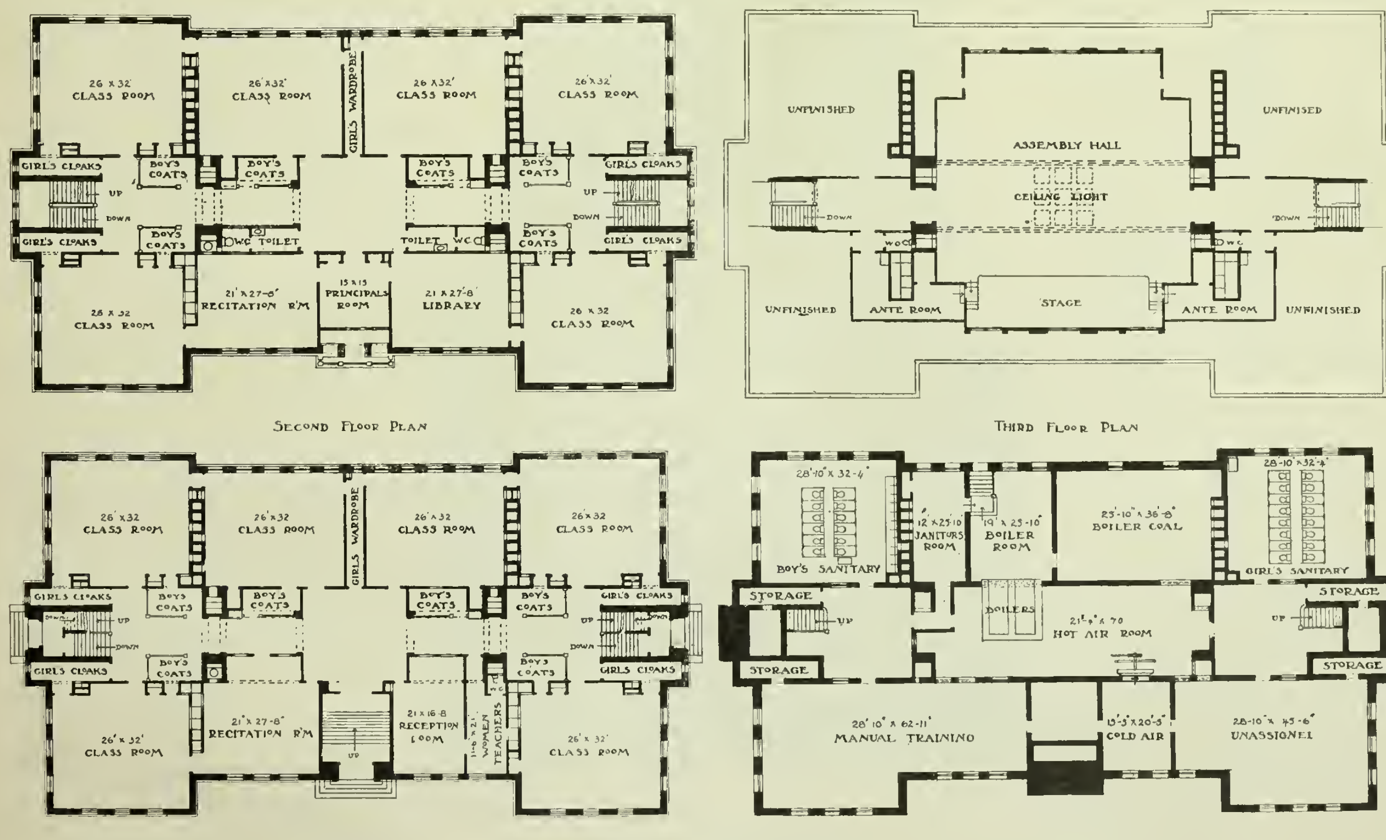
the reason for the difference of cost of the two schools. Examination of the plans of the Medford school will show, however, that there are elements of cost which more than account for this apparent discrepancy. In both schools the basement partitions are brick, but the bearing interior partitions in the Brooks School are also all of brick or steel columns and beams, while those of the Newton school are spruce studding; and in the Brooks School all the heat and vent shafts are brick, but in the Newton school two of these shafts are of galvanized iron cased in stud partitions. It is evident, by the sufficiently accurate calculation of the relative cost of these different forms of construction, that the greater expense per schoolroom of the Brooks School is caused by the interior brickwork which the Newton school lacks. The Brooks School, as a result of the consideration of all these factors of cost, presents a relative advantage of economy over the Newton school of about $50 per schoolroom, which may in part be ascribed to the possibly less general cost of building in Medford than in Newton.

The architects of the Newton school would have preferred to have used the more solid construction adopted in the Medford building, but the necessity of meeting within a limited appropriation the fixed requirements of the buildings precluded the possibility of this construction if other and possibly more essential features were to be embodied in the structure. As the partitions and floors of the Newton school are fully protected by fire-stops and wire lathing, and as all the basement partitions, as in the Medford school, are of brick, the chief practical disadvantage in having the bearing partitions of studding is the probability of trouble from shrinkage. In cases where interior brick walls involve too great expense the light steel bearing partitions covered with wire lathing and cement, which have lately come into use, while somewhat more expensive, are certainly to be preferred to partitions of wood studding, even when they are wire lathed and fire-stopped. Certainly in a schoolhouse no bearing partition should be constructed without fire-stops. We have fixed at $80,000, or $5,000 per schoolroom, the normal cost of a building of the type of the Agassiz School, when given no richer external treatment and no thicker brick walls than the Newton. Why is it, then, that the Brooks School, a smaller building, and hence, other things being equal, normally more expensive per schoolroom, costs but $4,285 per schoolroom?

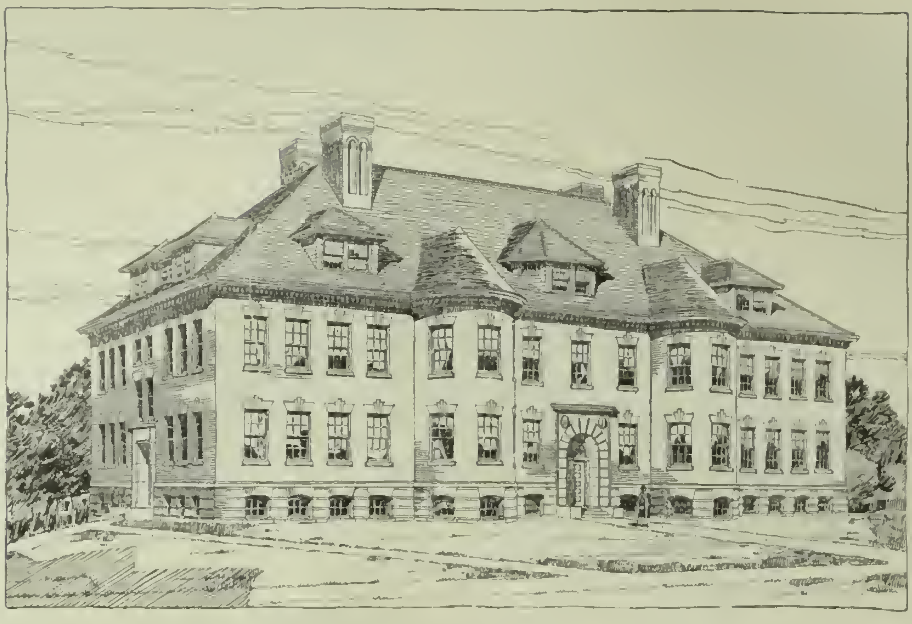
Of this difference in cost of $715 per schoolroom we can account for about $150, by taking into consideration the more expensive external treatment predicted for the Agassiz School, together with certain features noted earlier in this paper, which, while desirable, are more costly than the substitutes used in the Brooks School. Further,



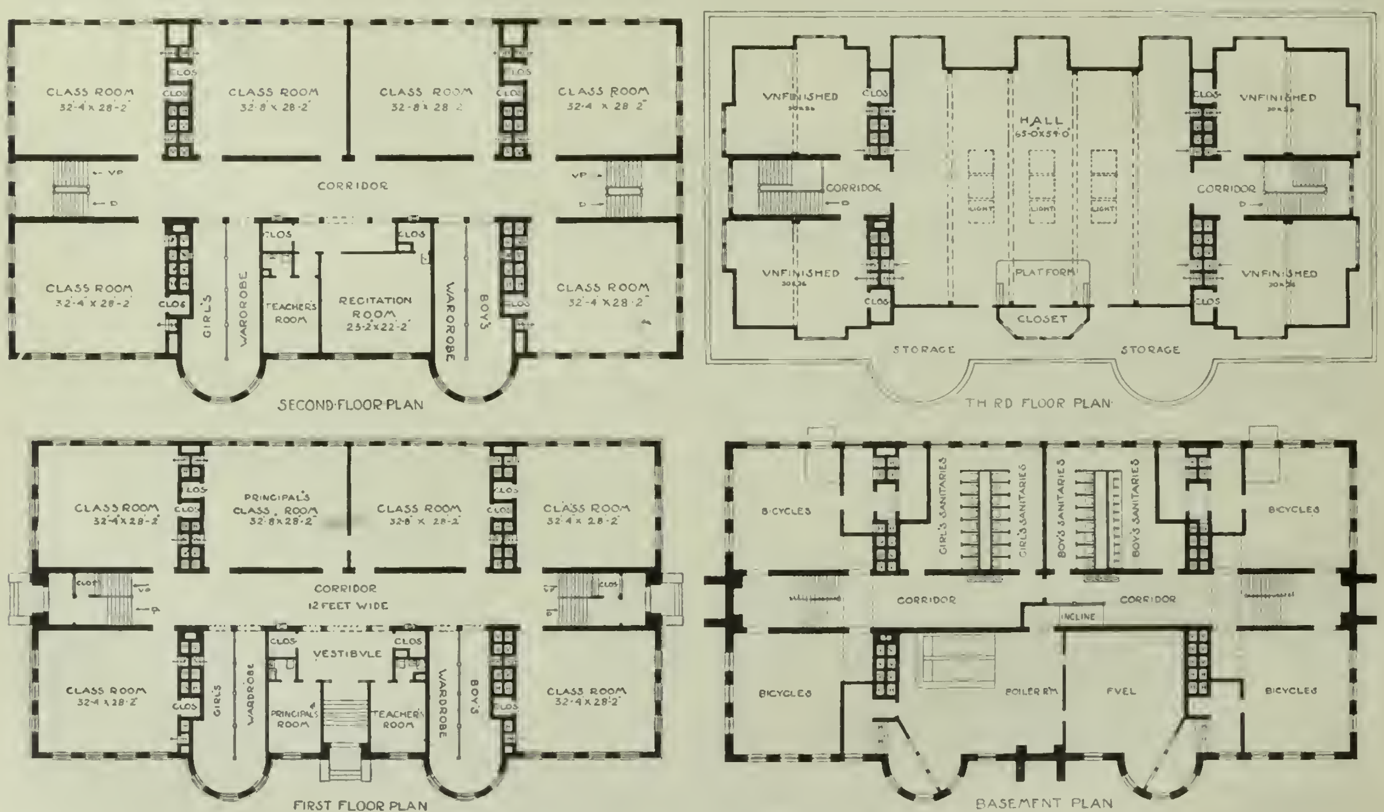
PIERCE GRAMMAR SCHOOL, WEST NEWTON, MASS.
Stickney & Austin, Architects.



PIERCE GRAMMAR SCHOOL, WEST NEWTON, MASS.



BROOKS GRAMMAR SCHOOL, MEDFORD, MASS.
Wales & Holt, Architects.



BROOKS GRAMMAR SCHOOL, MEDFORD, MASS.

the Agassiz School has 19 ft. greater height from basement floor to top of exterior brick walls. The interior partitions are brick or terra-cotta lumber, while in the Brooks School the carrying partitions only are of brick and the others are of ordinary wood studding. The arrangement of separate wardrobes adjacent to schoolrooms given in the Agassiz School increases the amount of partitions and the number of doors, as well as adding to the proportionate area of the building. The Agassiz School has double run of sash in all schoolrooms, while the Brooks School has single run only; the former school has first floor of mill construction and wire lathed in the upper stories. The Brooks School has wood-lathed ceilings, except in basement, where the ceiling is wire lathed.

An estimate of the difference of cost due to these differences in construction shows that the Agassiz School cost $600 more per schoolroom on account of these features.

Adding these to the difference of cost found above, we find that there is to the credit of the hypothetical Agassiz School now under consideration, $35 per schoolroom.

We have not yet taken into account the percentage of lessened cost due to the larger size of the Agassiz School. This is, as noted above, about 4 per cent. for each additional pair of schoolrooms, amounting in this case to $190 per schoolroom. There stands, then, to the credit of economy of construction of the Brooks School above that of a building of the type of the Agassiz School, constructed under the assumed conditions, $155 per schoolroom; *i.e.*, the Brooks School would appear to have been 3½ per cent. less expensive than the hypothetical building with which we have compared its cost, while giving credit for value to be received in the school of the Agassiz type, as above considered, from the features of plan, construction, and detail, which will be recognized as desirable when they can be afforded.

It might be possible by closer comparative survey of quantities and closer study of other conditions to account satisfactorily for this slight difference of cost. This appears, however, to be unnecessary. The result attained, taken with the preceding analysis, sufficiently demonstrates that the cost of schoolhouses, where designed by skilled architects, depends upon the demands of the clients in regard to plan and construction.

Architectural Terra-Cotta.

BY THOMAS CUSACK.

COOPERATION BETWEEN ARCHITECT, ENGINEER, AND CLAY-WORKER.

IN that branch of the main subject on which we have recently been engaged, the use of steel as an auxiliary support has received some attention. It has, of course, been viewed chiefly from the standpoint of the terra-cotta manufacturer, but without prejudice to the allied interests involved. An effort has been made to facilitate the whole process of execution by avoiding cumbersome or needlessly complicated methods of construction. It is by adopting simple expedients, and by using the most readily obtained or easily made appliances, that we get a maximum stability at a minimum cost. We shall endeavor to illustrate this general proposition in greater detail, as heretofore, by the help of typical examples taken from current practise. The connection between steel and terra-cotta in its widest sense, however, may now be reviewed as a useful preliminary to a purely technical discussion of the several branches of our subject.

While the introduction of the steel frame gave an undoubted impetus to the use of terra-cotta, it did not in anywise tend to lessen the numerous exigencies already incident to its manufacture. With an increased demand, and a very alluring vista of possibilities, there came peremptory calls for unfamiliar, if not impossible, shapes and sizes. Coupled with these came newfangled notions of attaching them to the skeleton, which, when not altogether visionary, were often rather perplexing. Methods and maxims which had withstood earlier vicissitudes, and whose existence hitherto was obviously a survival of the fittest, were soon at a discount. The ways and means that had been sufficient in a modest, self-supporting class of work were no longer adequate under new and more exacting conditions. In fact, the business that followed was to some extent a new one; and, being greatly increased in volume, the ranks of those engaged in it became filled with men of necessarily limited experience. This also, for a time, placed the terra-cotta manufacturer at an additional disadvantage. Hitherto he had been able to discuss and determine all questions with the architect; who, in view of the points involved, would usually agree to any well-considered alternative that might be proposed in jointing or otherwise. With the advent of an independent skeleton, he soon found that a new terror had been added to his already onerous existence. The architectural engineer — a veritable man of iron — had now to be reckoned with.

This last-named gentleman was also a new, but very necessary, element, though at first — and we think with great injustice — considered one of doubtful import. He has been called an intruder, a Philistine, and, cruelest cut of all, a man "incapable of esthetic emotions." During the early years of his existence he received scant recognition, more especially from such as could not brook a rival near the throne. The first of these allegations has been abundantly disproved, and for the other two, he seems to have allowed judgment to go by default, as he could well afford to do. In reality he is but a product of altered conditions, possibly a little forced as to time, but withal a perfectly natural growth. There was a place for him; and, perhaps, owing to his training in that regard, he managed to find it without undue effort on his own part. Whether acting in a purely professional capacity, or in the dual rôle of contracting engineer, we have, in the course of business, had many opportunities of detecting flaws in his armor. There have been differences of opinion, arising chiefly from the different points of view, but on no occasion has there been reason to question his credentials, or regard him as other than a friend and a brother. We shall have to take issue with him presently on certain points wherein he has at times shown a lack of consideration for men and things other than himself and his belongings. This, however, will be done in good faith, and with the respect due to a coworker.

FIG. 48. THE DUN BUILDING, NEW YORK CITY.
Harding & Gooch, Architects.

A basis of agreement between architect, engineer, and terra-cotta manufacturer, on which mutual help may be rendered, is suggested by the interdependence of the two materials called into service in every operation on which they happen to be conjointly engaged. While each of them is serviceable, and, to some extent, necessary, neither of them is absolutely indispensable. They have widely different duties, it is true, but their several performances are part of a complete whole; the more perfect when performed in conjunction rather than isolation, in agreement rather than discord. Thus, if terra-cotta has in some cases to be re-enforced by iron, so, also, and to a much greater extent, is the skeleton dependent upon the clothing with which it is made presentable. Deprived of this protection, its existence would be imperiled by atmospheric action. By such protection, and by it above all others, if not by it alone, may the structure be rendered invulnerable when attacked by fire. The analogy holds good, and applies with equal force to the relationship existing between men whose business is to make the best composite use of these increasingly popular materials.

The advantages of consultation and cooperation such as that on which we are about to insist must be apparent; yet we are not sure that the importance of that line of procedure is so generally recognized and acted upon as it ought to be. The need for a common understanding is, we believe, conceded on all sides as an abstract proposition; but its application in every-day practise is too frequently overlooked, and if not altogether forgotten, is sometimes resorted to as an afterthought, in the hope of surmounting consequent exigencies that need not have arisen. Theoretically, our proposal is not a new one, but we would give it a new reading, encourage its development, and make it more of a tangible reality than heretofore.

So far as this plan has been tried the results have been reassuring, and encourage the belief that it is the logical outcome of existing conditions. Cumulative and confirmatory evidence as to this could be adduced by citing the favorable opinion of leading architects in support of it; but it is hardly necessary to add such indorsement to that which is not likely to be seriously contested.

It may be opportune to note at this juncture that the examples of steel and terra-cotta construction selected for illustration in THE BRICKBUILDER during the past year were the result of consultation, concession, and mutual agreement. They do not, for instance, represent the individual opinion of any one man, but may be considered the embodiment of the best possible advice made by, or accepted by a number of men, each one something of a specialist in his own particular line. It is to this fact, no less than to the actual test of service, that they owe whatever of interest or value they may be said to possess.

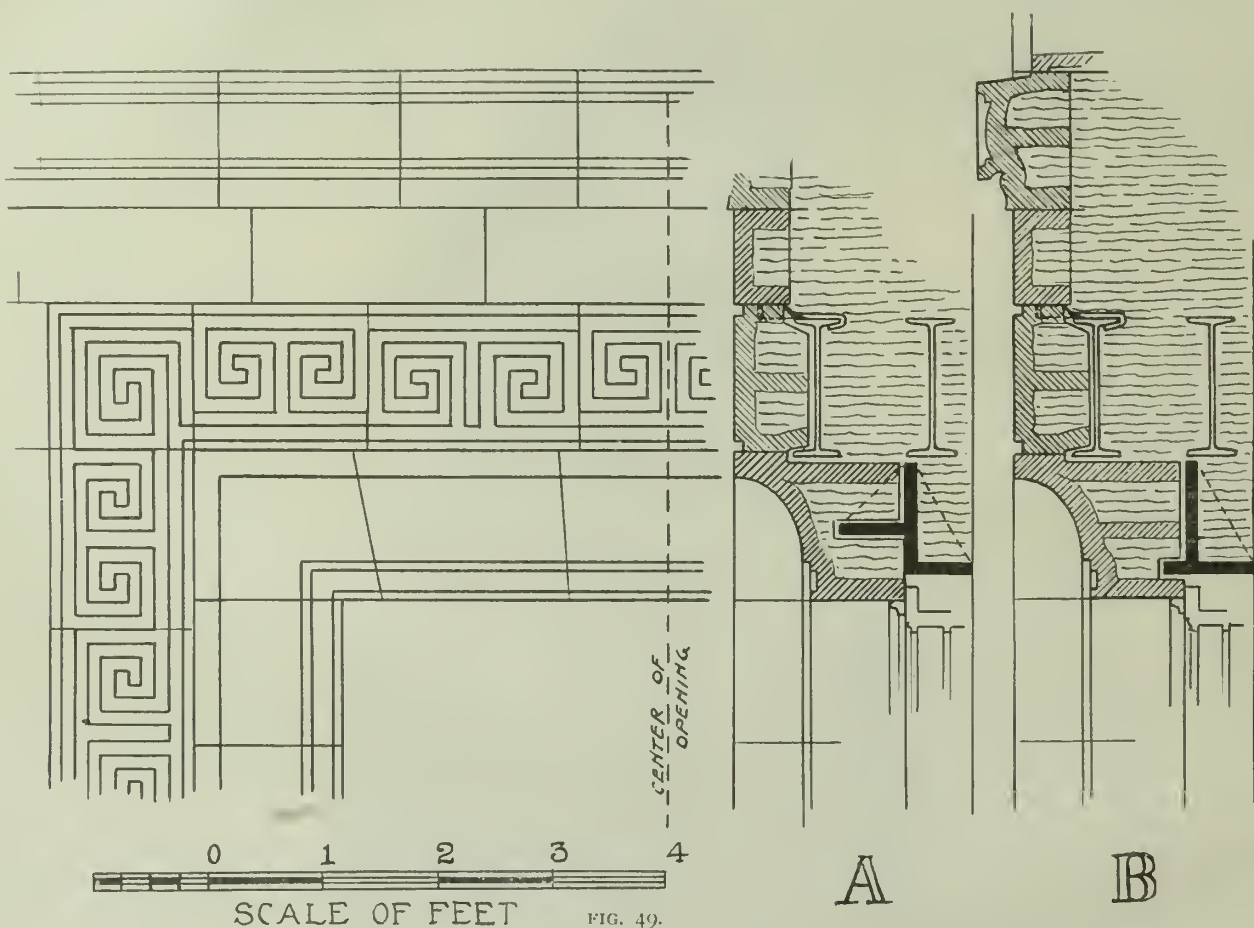


FIG. 49.

At Fig. 48 we have an advanced type of the steel frame with terra-cotta and brick walling in process of erection. Here, too, the several interests referred to have contributed something towards the sum total of its maturity, as it emerges from below the sidewalk, rising rapidly into space. At the date of writing it is nearing completion, the very substantial envelope of terra-cotta having proved a remarkably good fit for its anatomy of riveted steel. The skeleton had reached its full height before any of the terra-cotta had been set, and similarly, the manufacture of the latter was being advanced while most of the former existed only on paper. This made it incumbent on all sides that the points of contact between the two materials should be predetermined with the greatest accuracy, and adhered to in the execution of each from start to finish. The methods of attaching them had not been settled beyond recall when the contracts were closed, but were ultimately — within reasonable limits — based on the advice or concurrence of those who were responsible for the due performance of that duty.

We know of a building in which it had been proposed to insert the flange of a cast-iron lintel in the manner shown in section at *A*, Fig. 49. The terra-cotta voussoirs were of sufficient depth to be self-supporting, and were not obliged to depend on these iron lintels. Had that not been so, however, the insertion of this flange at the point indicated would have been a doubtful expedient. It is placed too high, and enters so far into the block as to become a source of weakness. The voussoirs, being deficient in tensile strength, would have had a tendency to crack from chance knocks or unequal pressure at this, their weakest point; in which case the portion suspended below and not resting on the flange would have had no support whatever. This objection having been pointed out to the architects' representative the cast-iron lintels were at once modified to the extent shown at *B*, Fig. 49. This apparently unimportant change was an undoubted gain in the strength and security of the terra-cotta arches, with rather less expense on the part of the iron contractor. On the whole, we think there has been no reason, here or elsewhere, to regret the introduction of the principle for which we are contending.

In the practical application of this process of adjustment an occasional hitch may occur on small questions of precedence and priority, etc., but a little time and patience will bring about the needful assimilation, and the force of circumstances can be relied on to regulate conflicting ideas, where other influences appear inadequate. If the parties concerned are actuated by an honest desire to obtain the best possible solution of a given problem, they will not throw away time or thought upon trifles, but welcome the wisest suggestion to that end, without much regard to its parentage or antecedents. Good ideas may be, and, indeed, have been damned by faint praise; they may suffer a temporary eclipse at the hands of those who do not understand, or are prejudiced against them; but if sound and practicable, whatever their origin, they usually command a respectful hearing, and in the end cannot fail of adoption. Meanwhile, few will deny the validity of the words attributed to the wisest of men: "In a multitude of council there is safety."

REPORT OF THE COMMITTEE ON ARCHITECTURE AND GROUNDS OF THE TENNESSEE CENTENNIAL EXPOSITION.

THE report of the Committee on Architecture and Grounds of the Tennessee Centennial Exposition, a portion of which is herewith presented through the courtesy of Mr. Ernest Flagg, a member of the committee, is of interest to those who have visited Nashville as well as to those who know of the buildings only in a general way. Intelligent criticism of architectural work is seldom obtainable, and honest expression of educated judgment, free from either lavish condemnation or indiscriminate praise, should always be welcomed. The report considers the buildings and the grounds in a perfectly impartial light, and the conclusions are logical, and based upon sound principles of architectural taste. If our public buildings were more often criticized in this same way the profession would be a vast gainer thereby.

GENERAL REPORT ON BUILDINGS AND GROUNDS.

In all great expositions the chief exhibits are the buildings and grounds. These are more in evidence, more seen and commented on than all the rest besides, and upon their success or failure in fulfilling their functions must hang, to a great extent, the fortunes of the enterprise. These functions are twofold, esthetic and practical. Their beauty should attract multitudes to see them, and they should tend to elevate and improve public taste. They should be arranged so as to display the exhibits to the best advantage, and as far as the means will permit, the buildings should themselves be an exhibition of modern methods of building of the most advanced type as regards construction, materials, and design.

The grounds should be laid out with a view both to convenience and beauty. They should be planned to preserve the natural advantages of the site, if any, to serve as a setting for the buildings, and to facilitate communication between them.

The buildings and grounds are necessarily so closely connected that one cannot be intelligently planned independently of the other. They each form a part of a general ensemble, the plan of which should be laid out and controlled by one mind.

In judging of the present exposition, it is necessary to take into account the financial limitations and the other difficulties encountered in carrying out the work. It is not always possible to realize the ideal, however distinctly conceived, with unlimited means at command. It is still more difficult, if not impossible, to do so when, through inexperience, no correct ideal exists in the minds of those in charge of the work, and the means are limited. In the present case it was extremely unfortunate that no competent supervising architect was employed as director of the general scheme of the buildings and grounds, and it was unfortunate that the plan which was adopted should have been interfered with and injured by the demands of certain of the exhibitors and by local interests.

While candor compels one to admit that the general effect of the exposition might have been greatly improved by a more skilful disposition of the parts (as will be indicated hereafter), yet the plan was so far successful as to give generals atisfaction to the majority of visitors.

The site is a fine one on the high land to the southwest of the town, toward which it slopes, so that from all parts of it there is a fine view of the city. Any view of Nashville is interesting, and from no place more so than from the exposition grounds. The capital city is dominated by the Capitol Building, which stands upon an eminence in its very heart, its base being well elevated above the roofs of the surrounding buildings. The central axis of the exposition was made to coincide with the main transverse axis of this building. It was a very happy thought to place the chief building of the exposition upon this axis. The other buildings of the group were, in general, placed about it so as to enclose an irregular quadrangle, having a broad opening in the center of the side toward the town. This opening was occupied in part by an artificial lake of irregular outline, spanned at its narrowest point by a bridge, an imitation of the Rialto at Venice, also located on the main axis. Here, evidently, was the place for the main approach, and here it appears to have been placed in the original plan. If this plan had been carried out, nothing in the way of an approach could well have been finer; but local interests interfered, and the scheme was abandoned. Nor was this the only detrimental change in the original plans. Buildings were allowed to encroach upon the quadrangle in such a way as to almost completely destroy its effect. Thus, instead of a grand entrance, as originally intended, by a broad avenue connecting the exposition and the town, located on the main axis of both, the approach was relegated to a corner of the grounds, and the quadrangle was cut up and disfigured by buildings, generally the poorest of the group, placed without regard to the others; so that upon entering the grounds one would never suspect that there had been any preconceived general plan, but rather would suppose that the buildings had been placed about at haphazard. So completely was the first plan damaged by these unfortunate changes, that it was only from the bridge that one could understand what the effect might have been.

If we consider the general appearance of the buildings themselves in relation to one another, one cannot but regret the difference in scale between them, and the irregularity of their placing. If the simple expedient adopted at Chicago, of keeping their main cornices at the same level, had been used here, the general effect would have been far more harmonious, and if the lines of the great quadrangle had been laid out with regularity so that its sides were parallel, and the buildings in line, there would have been a decided gain in dignity, and in the simplicity which always accompanies it. The effect of the group might also have been improved if the Parthenon had been placed farther back, that is to say, to the southwest, which would have given it greater importance, as there would have been more space in front, and a finer approach. Moreover, the very inharmonious effect of the Commerce Building as a background would have been avoided.

The chief feature of the exposition, and the one which will make it memorable, was the full-size restored model of the Parthenon at Athens, just referred to; a copy in plaster of the exterior of the greatest work of art the world has ever seen; a monument which will doubtless ever stand as the highest achievement of the handiwork and taste of man. Though in the nature of things this model was scarcely more than a scenic reproduction of the glorious Athenian temple, it served better than a description or drawing could to give the beholder an idea of the original appearance of its exterior. Though constructed of flimsy material, of imperfect workmanship, and in the midst of uncouth and inharmonious surroundings, this model was beautiful beyond the power of words to express. Who, that saw this poor shadow of the original building, has not asked himself, What must the building itself have been, when it stood in its perfection the shrine of the goddess, with its incomparable setting on the Acropolis of Athens, surrounded by masterpieces of Grecian art, constructed of the great blocks of purest Pentelic marble, filled together with a perfection of workmanship surpassing the skill of modern times to imitate, alive with statuary of such exquisite beauty that the very battered fragments which have come down to us serve as the criterion of plastic art? What has the world not lost in the destruction of this pile?

Having seen the exterior, one could not help wishing that an attempt had been made to complete the model by restoring the interior also. This might have been accomplished with little loss, for as an art gallery (for which it was used) it served the purpose only fairly well. It did not lend itself happily to such usage. The light was too feeble and too high, and the wall surface of limited extent, so that many of the pictures were skyed for lack of space.

Although comparisons are odious, one may say, without injuring the feelings of the most sensitive, that this model of the Parthenon, imperfect though it was, was immeasurably superior to any of the other buildings of the group. Its simple majesty and masculine beauty dwarfed them into insignificance, but their presence was annoying; one could not help wishing for a view of this extraordinary structure without their disturbing influence, and it is much to be hoped that the model may be preserved for a time, at least, after the other buildings are removed, so that it can be seen by itself.

As a lesson in art it ought to serve a very precious purpose. Who can look at it and not blush for the art of the nineteenth century? Who can look at it and not wish that we Americans might emulate the ancient Greeks and produce an art of our own, and a national style that might vie with theirs?

It is believed that the prototype of the Grecian Doric order is to be found in Egypt, and doubtless this is true. An architectural style cannot be created offhand, it is invariably the result of evolution, depending for a basis upon what went before, and developed by countless minds working in unison through the ages, rising or falling in artistic excellence with the taste of the times. We have no national style, we copy whatever suits our fancy, and make little progress in art, for we are working at cross purposes.

TENNESSEE CENTENNIAL EXPOSITION.
This illustration is made from a lithographic print, issued by the management, and is intended only to give a general idea of the grounds and buildings.

The lesson which the Parthenon teaches, if we understand it aright, is this: That good art must be modern art. No work has ever retained a lasting reputation as a masterpiece of art which was not modern, and in the style at the time it was made. And no such masterpiece has ever been created which did not belong to a great art epoch. Masterpieces are not isolated productions. They can only be created when the whole artistic feeling of a race has been elevated to a high plane. If art is to reach a high plane here, the growth must be along healthy and natural lines. We will not reach it by copying the works of others, even though they be the Greeks. Our art must be based on reason, that is, it must call into play the highest faculties with which we have been endowed by the Almighty. We must think. The forms must be adapted to the materials used, the purpose for which they are used, and to the mechanical methods used. The Greeks worked in this way, and so have all other people who have achieved distinction in art. In architecture, our crying need now is for a national school, where our young men may be taught how to think, and to understand that good design must be based on common sense; where they may receive instructions from the foremost men in the profession, just as the architectural students in the great French School of Fine Arts receive their instructions from the foremost practising architects of France.

An excellent illustration of what has been said is furnished by the building represented by the Parthenon model and the Auditorium Building of this exposition. The Parthenon model represents a building built twenty-five hundred years ago, which, at the time it was built, was the very personification of reason, and the highest development of the modern art of the times; every feature tells its story, every detail is fashioned in such a logical way to serve the purpose for which it was designed, that any one can see its use, and follow the beautiful working of the mind that designed it. With such simplicity are the parts assembled that a little child can understand their meaning, yet with such skill that the most impassive soul must be moved to awe and reverence as he beholds its sublime beauty, its calm dignity and perfect repose. On the other hand, let us in all kindness examine the Auditorium Building. Is there anything about its exterior to express the purpose for which it was intended, the method of its construction, or the nature of its plan? From the outside it appears to be a rectangular temple with a square tower piercing its center. Inside it is an oval apartment, and the tower has disappeared. Outside it indicated stone construction, for the forms of the moldings and other details are adapted to stone construction. Inside we find it is built of wood. Outside it appears to be a building of the debased art of the sixteenth century; inside it appears that it is a temporary wooden building of the nineteenth century. Is this logical? Could the Parthenon ever have been produced among people who employed such methods? Can good art ever proceed from falsehood? If we have an auditorium to build in wood for an exposition of the nineteenth century, why should it not appear to be what it is? Why do we not use the material at hand in a natural way, adapt the forms to the materials, and make the outside tell the story of the inside, letting it frankly appear as a building of the present day? What is there to be ashamed of? To expect a good result with the methods of design and construction used here would be as senseless as it would have been for the builders of the Parthenon (supposing they could have done so) to have designed the Parthenon to represent an auditorium for a fair of the nineteenth century, and then expect it to be successful as a temple to an Athenian goddess. The same thing is true to a greater or lesser degree of all the buildings of the exposition. The designers are not so much at fault as the taste of the times. They did the best they could according to their lights, and did they not have the illustrious example of the Chicago Fair before their eyes to lead them astray?

Let us hope that a new epoch will dawn, that the time will come when we may design our expositions in the light of reason and common sense; when, profiting by the example of the French, we may seek to make the buildings mean something, as illustrating modern methods of construction, and the use of the new materials which are being almost daily placed at the disposal of the architect by modern science, and also illustrating modern design suited to the present requirements.

When that time comes, we shall be on the high road to a national style, a style adapted to modern wants, and we shall be on the high road to good art, the same road trod by the ancient Greeks, which made the Parthenon possible, and the Greek name a synonym for art.

REPORT UPON THE BUILDINGS IN DETAIL.

Considering the buildings, then, not as structures which speak their function in the character of the exterior, but as examples of composition along classic lines, it is interesting to refer to a few details.

Many of the designs show schemes of composition that would, with study, produce excellent results. The Government Building is probably the best on the grounds, after the Parthenon, and it is to be regretted that its effect was marred by its surroundings. Its general proportions were pleasing, and its details simple and good; the segmental ends terminated the building gracefully, and were in harmony with the central dome. The dome, however, may be criticized for its heaviness and dry outlines, and it is not easily understood why such awkward pedestals should have flanked the main entrance.

In the Commerce Building, especially, has a noble scheme been poorly carried out. While its general grouping was one of the best, the central motif was confused, the first story flat, and the pediment sculptures inadequate. The dome with glass enclosures produces a flimsy effect, and the corner pavilions were badly cut horizontally.

The Hygiene Building had an excellent porch, but the doors behind the columns were too contracted and the sculpture masses against the sky too slight. This is better than the Commerce Building, however, in that it is less pretentious.

Again, in the mass the Negro Building, the Machinery Building, and the Agricultural Building were pleasing, the first perhaps the best of the three and most festive, although the central entrance was too diminutive, and the cross-bar filling to the openings overdone. The second was small in scale, but the high-up windows afforded excellent wall space for exhibits. Of the third, the lack of simplicity is the chief criticism; at one and a half the size the parts would not be so crowded. Many of its individual parts are excellent, and the exterior conforms to the arrangement of the plan.

The History Building and the Children's Building were smaller than the others, and very attractive. In the former, the portico, which we suppose is a copy of the Erectheum, was gracefully comprehended, and in the latter the composition was very well expressed, although the ornament was of an inferior character.

The Auditorium, already mentioned, was, with perhaps one exception, the least attractive of the buildings; its lack of harmony in plan and exterior, and the absurdity of the tower over the center of the assembly room are in keeping with the awkwardly arranged corners and the unstudied details.

The exception referred to is the Women's Building. It scarcely seems possible that columns could be so clumsily designed, that they could be made to support so ridiculous a cornice, and that any one should think of crowning such a building with a temple, the absurdity of whose scale is only equaled by its function as a roof garden.

The Minerals and Forestry Building, the Horticultural and Transportation Buildings scarcely call for mention.

It is a pity that the Memphis Building should have had so important a place; its color, form, and details did not in anywise warrant it.

It was a happy thought that provided so much green lawn, and it was a kindly summer that kept it green. Great credit is due to the gardeners who laid out the trellises and the flower beds. The radial design at the end of the Forestry Building, and the hanging vines in the basin of the Water Nymph Fountain were most charming.

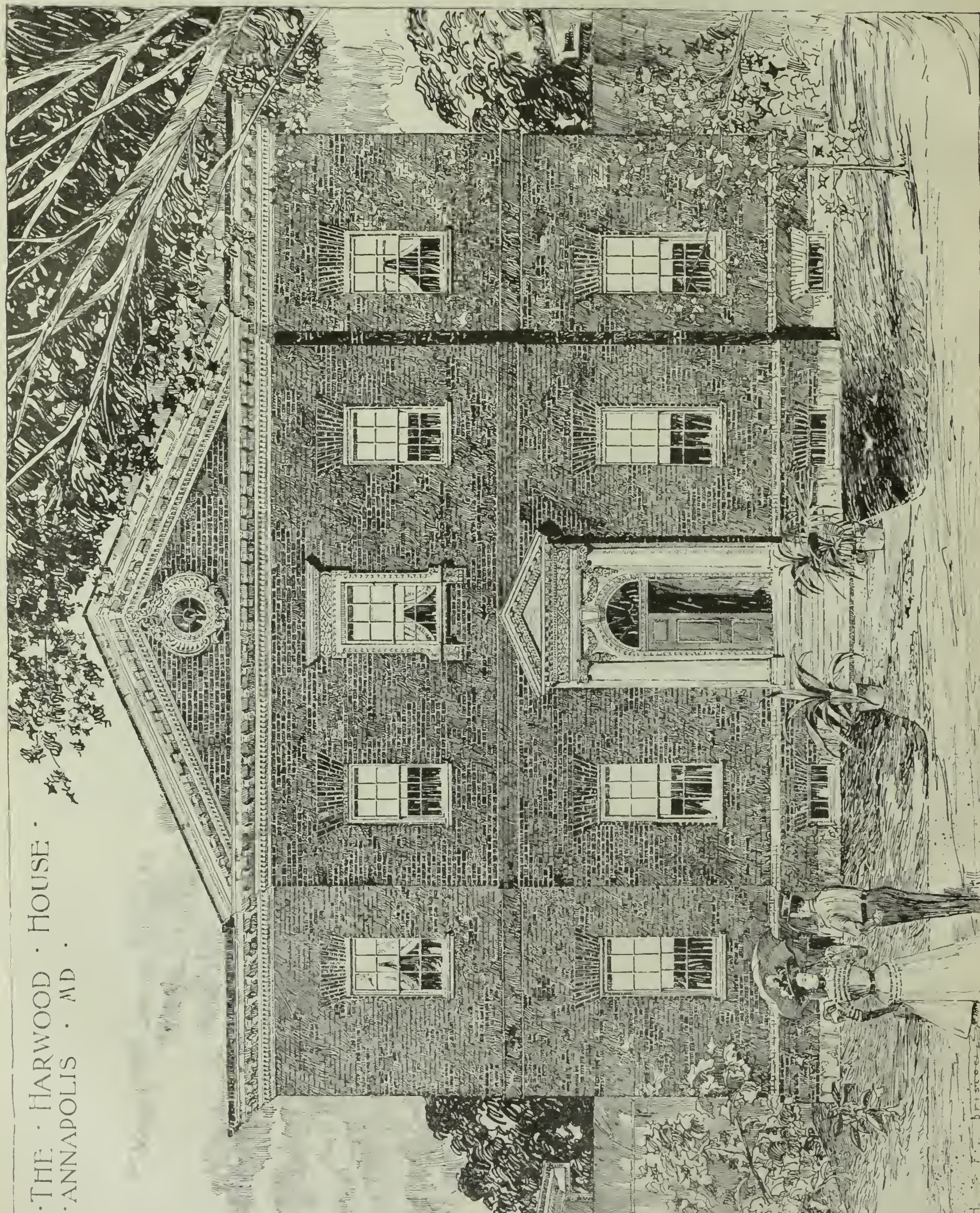
THE DISINTEGRATION OF CLAY BY FROST.

THERE are many experiments to prove that water expands in the act of passing into ice. It may be useful to briefly describe one of these; then, when we come to the application of the principle to the disintegration of clay, it will be plain sailing. An experiment, which might be termed classical, was performed by Major Williams at Quebec. He took a 12 in. shell and filled it with water, closing the orifice with a wooden plug. He then exposed it to the open air, the temperature of which was, at the time of the experiment, 18. degs. below zero (Fahrenheit). The consequence was, that when the water froze the plug was driven to a distance of about 100 yds., and through the orifice there immediately came an icicle 8 ins. in length. The bulk of this icicle, of course, represented the amount of expansion. In another case the shell itself was rent, and a sheet of ice came through the crack. This evidently settles the case of the bursting of the water-pipes. Indeed, the very fact that ice will float on water shows that water expands in freezing. It may be mentioned, by the way, that all liquids do not behave like water in solidifying; for while on the one hand we have ice, bismuth, and cast iron contracting as they pass into a liquid, on the other hand we have mercury, phosphorus, paraffin, and spermaceti contracting as they pass into a solid.

The effect of freezing water on rocks may be seen in quarries, in the weathering of cliffs, and in the production of landslips. If the rocks are not very porous, plenty of water will still find its way through them by means of cracks, and on the freezing, and consequent expansion, of this water there will be a dislodging of blocks of rocks, sometimes of great size. This disruption of the rock by frost is, of course, of great utility sometimes, and is accordingly taken advantage of by the quarrymen. In very porous rocks, however, the tendency of frost is to crumble and disintegrate them. When, for example, a stone full of its "quarry water" is exposed to intense frost, it will often fall to pieces.

There can be no question that the exposing of the clay to the open air, and its consequent weathering for some months, is of distinct benefit to the clay. Some brickmakers, however, seem to think that it is hardly worth while to let the clay ripen in this way, and accordingly they use it freshly dug, contending that "the weathering of clay is of no real benefit to the finished article, but will only lessen the labor and expense of mixing and preparing the clay before use." With this statement we cannot agree at all, for the exposure of the clay to the weather has a twofold effect, both tending to improve the quality of the clay, and thus to benefit "the finished article."—*British Clayworker.*

THE first half of the last century was rather remarkable for the development of the brick and tile industry. At Mount Vernon, for example, which was built in 1734, a curious variety of plain and molded bricks, paving tiles, and copings is still to be seen, and examples of molded brick water-tables and of floor-tiles, both square and octagonal, dating from the same period, are still quite numerous in the Eastern States.—*American Architect.*



·THE · HARWOOD · HOUSE ·
·ANNAPOLIS · MD ·

Fire-proofing.

MR. HOWARD CONSTABLE, in a recent address before the Boston Society of Architects, made the statement that he believed he could with cement construct a fire-proof floor which would be equal to the best terra cotta construction, and, on the other hand, he could with terra-cotta make a floor fully equal to the best construction of concrete. We would not carry the comparison quite as far as Mr. Constable, or even hardly to the extent of admitting that either proposition represents entirely our personal belief, as we have yet to be convinced that any material has as yet been suggested and put on the market which can hold its own, after fair, impartial tests with terra-cotta; but we interpret his statement as implying that in the present state of the market and of the science, the value of fire-proof constructions lies very largely in the details, and that the success of any application in this direction is measured not unfairly by the ease with which it can be adapted to practical exigencies and made readily available in the hands of the ordinary workman. We have repeatedly emphasized the necessity for increased attention to details. Terra-cotta undoubtedly has the large lead over anything else at present offered for the protection of steel in a building, and its efficacy has been tested in the very best manner, that is to say, in constant daily practise, but it will not do for our manufacturers of fire-proofing material to feel that the last word has been even suggested. The principle involved in the use of terra-cotta is admittedly a correct one, but in order to insure the best results we need not only the proper material, but its proper application, a proper variation of its employment for specific cases, while beyond this there must be a constant attention to matters of pure arrangement and plan. It is not fair to build a structure in such a way that a slight conflagration can develop the heat of a blast furnace, and then complain if the fire-proof material yields. We would admit at the very start that under certain conditions nothing is absolutely fire-proof. Therefore, if we wish to have fire-proof buildings, we must have not only the fire-proof material, must not only use it in the best and most advantageous way, but must so plan our structures that the inertia of conflagration, which is a very large element of danger, can be checked at the very start; and though the chief reliance can be upon the protection of the steel skeleton, the building as a whole must present decided obstacles to the spread of a fire, even through its contents. It is safe to say that in no building where these principles were fairly considered has the terra-cotta ever been found wanting. The cases where it has failed to give efficient protection are those wherein the details were either improperly considered in manufacture or were not thoroughly carried out in execution. A workman laying terra-cotta skew-backs along a built girder, for instance, is quite as likely as not to disregard any inequality in the metal, such as splice plates, stiffening angles, etc., and make up for that irregularity by such cutting and so called fitting of the blocks as would weaken them and cause them to fail at a critical time. We have known an instance of terra-cotta arches between steel beams which were put in place in such condition that upon the application of a certain amount of heat the lower flange revealed a crack, allowing the material to drop and admitting fire into the interior of the rod to such an extent that the steel tie-rod was melted entirely off. Manifestly, such condition was no fault of the material, but was chargeable to poor construction, and we have no doubt that there are many points in the fire-proofing of our large buildings which would fail in an excessive test and would apparently give ground for the condemnation of the particular style of construction, whereas the fault would be chargeable entirely to the lack of proper supervision of the work and the carelessness in which the details had been carried out. We are rapidly developing our building operations into a condition of exact science. When we take the same care with our protecting envelope of terra-cotta that we do with the steel skeleton itself, and are equally rigid in inspection, tests, and supervision, the chances of failure to fulfil all the conditions of fire-proofing will be greatly lessened.

THE LONDON FIRE.

FIRE-PROOF construction can be fairly claimed as an American development. We say this without any forgetfulness of the very valuable work which has been done in France and Germany, especially in the former country, where a species of fire-proofing, which has answered a certain purpose, has been in constant use for indefinite generations. The fire-proofing which meets the requirements of French construction would not, however, answer for us, and it surely does not operate in France to prevent pretty disastrous results at times. We doubt if any modern fire-proof buildings of this country have ever passed through a more disastrous conflagration than that which destroyed the large Magazins du Printemps, in Paris, a number of years ago, a structure which, according to French standards, was strictly fire-proof, was certainly planned better than the Pittsburgh buildings to resist fire, but which was totally wrecked, far less of its construction surviving the fire than was the case in the Pittsburgh fire. The fact that there are so comparatively few fires in France is very largely due to the methods of construction, which, though by no means fire-proof to the extent that we expect in our first-class buildings, are certainly much more capable of resisting a conflagration than the average structure in this country. Besides this, the French go about heating their buildings in a manner far different from our own, and one of our most fruitful sources of fires, defective flues, are by no means as dangerous there as they are with us. We have been obliged from necessity to develop our fire-proof constructions, because the majority of our buildings are so ill adapted for resistance, or to put it perhaps more truly, are so admirably planned to facilitate the spread of fire, and in order to secure any reliable protection we must carry our systems much further than is necessary abroad, and they are materially modified by contingencies which are not thought of elsewhere. It still remains a fact, however, that, *per se*, the foreign fire-proofing methods are, as compared with our own, unscientific and unreliable when tested in extreme cases. The recent conflagration in London affords an illustration of what has not been done abroad, and we notice by reports in technical journals that the official inquiry which has been undertaken to determine the causes of the fire and to investigate the possibilities for prevention for the future has developed the fact that in the opinion of the property owners the expense of making the reconstruction of this district of a thoroughly fire-proof character was such as, in their judgment, to be prohibitory, though the Goldsmiths' Company, which owns the land upon which the building stood, is perfectly willing to agree to a subdivision of the various structures in such a way as to check the spread of fire. We haven't a great deal of confidence in official investigations, especially when directed towards the premises of a wealthy and powerful corporation, and we are almost inclined to doubt whether such an investigation as will result from the London fire can be anything more than one-sided. That is to say, what is considered good fire-proofing practise abroad is not up to the standard which we should expect, and we can hardly expect the investigators to appreciate the necessities which are considered so paramount with us. We believe that the theory of fire-proofing as developed by us is scientifically perfect, our failures being due to lack of attention to detail, or to our not carrying our own systems to a logical and perfectly natural conclusion; whereas, the English systems of construction, if considered as means of preventing the occurrence of a large fire, are radically wrong, though many of the details of construction, such as stairways, arrangement of flues, subdivisions of premises, are better than are usually enforced in our large cities. London has had abundant occasion to learn her lessons in fire-proofing, but, large as that metropolis is, the fire losses there are so much less than the value of what is destroyed annually in our larger cities, that we can quite understand the reluctance of the Goldsmiths' Company to enter upon expensive and radical change in methods of construction. The Englishman is nothing if not conservative, and the fact that such systems have stood or given satisfaction for generations can easily be alleged as reason for reluctance in making the change.

Mortar and Concrete.

CHARACTERISTICS OF VARIOUS BRANDS OF AMERICAN NATURAL CEMENTS.— *Continued.*

BY CLIFFORD RICHARDSON.

Pennsylvania Magnesian Cements. Some magnesian cements are, or have been, made in Pennsylvania at Milroy, and a few other places, and classed as Rosendales. These have not proved of the highest quality. The hydraulic limestones either contain an excess of magnesia or a deficiency of silicates, and as with some others from the same State, free from magnesia, do not seem to be suited to the production of a high-grade natural cement. This part of the country is, in consequence, devoting itself more and more to the development of the Portland cement industry, for which its limestones, free from magnesia, seem entirely suitable.

Cements of the Middle West. The vast quantity of natural cement in use from the Gulf to the Lakes, and from Ohio to the Rocky Mountains, is supplied chiefly by brands made near Milwaukee, Wis., Louisville, Ky., and Utica, Ill., with smaller amounts made at Fort Scott, Kan., and Mankato, Minn., and a few other less important works. These cements are all magnesian, but vary very considerably in their composition, and consequently in their character.

Analyses of samples of these cements have already been given, but the physical tests recorded have been more or less incomplete. For the purpose of comparison among themselves, the results of tests made at Minneapolis, to which reference has been made already, will serve, although they are much lower than would be the case were the test pieces made to yield the best results with dry mortar and the proper compression.

AVERAGE RESULTS OF CEMENT TESTS FOR A SERIES OF YEARS FROM 1888 TO 1895.

BRAND.	Tensile Strain per Square Inch.											
	Neat.											
	24 hours.	7 days.	1 month.	2 months.	3 months.	4 months.	6 months.	1 year.	2 years.	3 years.	4 years.	5 years.
Louisville	131	142	202	271	327	353	368	416	443	460	384	493
Milwaukee	106	120	156	232	302	309	327	372	434	411	....	434
Mankato	109	119	218	238	259	273	280	319	336	317	335	392
Utica	53	153	246	236	257	268	242	259	282	320	281	322
Buffalo	119	172	260	294	305	336	290	346	...	....	....	....
Akron	91	151	216	308	317	373	364	369	410	....	....	....
1 CEMENT. 1 SAND.												
Louisville	70	85	118	150	178	213	257	271	311	329	285	294
Milwaukee	59	84	120	158	186	208	214	235	257	286	....	342
Mankato	49	67	140	163	179	171	182	195	186	183	....	....
Utica	21	100	160	164	182	192	156	196	212	292	240	315
Buffalo	60	73	128	191	209	222	212	167	...	....	....	....
Akron	65	78	145	203	219	220	213	202	160	....	....	....
1 CEMENT. 2 SAND.												
Louisville	37	50	71	95	110	129	144	161	173	172	165	155
Milwaukee	32	53	94	118	135	148	152	156	191	202	....	279
Mankato	31	43	98	116	120	125	126	153	128	179	...	201
Utica	19	96	117	111	122	128	121	134	172	213	179	228
Buffalo	29	39	73	92	115	110	103	97	...	....	...	....
Akron	38	47	96	155	152	173	149	115	110	....	....	....

Milwaukee Cement. This cement, as at present made, carries a large amount of magnesia, over 20 per cent., and has all the properties which are to be expected of a cement of that kind. The alumina and iron are not high, and a considerable part of the silicates are not decomposed and combined with the alkaline earths, owing to its being lightly burned. The result is that it gains strength more slowly than some other brands, but at a considerable age is quite equal to them in strength and toughness, and is often stronger in mortar and concrete, as can be seen by reference to the tests made at Minneapolis and from the examination of concrete in which it has been employed. The slow way in which it at times acquires strength necessitates care in using it during cold weather. It requires a medium quantity of water to make a mortar, and it will also be found to harden better in air than when immersed in water or allowed to remain in damp surroundings. It makes a smooth mortar, trowels well, and works easily in concrete. At its best no Western cement has given more satisfactory results. Vast quantities of work have been satisfactorily done with it, but, like all natural cements, there are variations in the quality, and it is reported to have been better some years ago than to-day. In general it is free from excessive expansion like the Western New York cements, but it resembles them in its composition very closely, and has now and then caused ridges in concrete.

The color of Milwaukee cement is a gray with a brownish tinge, more nearly like Portland cement than any of the Western brands except that made at Mankato.

Utica Cement. The natural cement made in La Salle County, Illinois, near Utica, is derived from a rock carrying a large amount of magnesia. To produce a satisfactory cement, it is now burned so that but a relatively small part of the silicates of the stone are decomposed and combined with lime, as compared with many other brands, and all the carbonic acid is not expelled. It has the usual characteristics of cements high in magnesia, and resembles the Western New York and Milwaukee cements in certain respects; but it is even more distinctively a magnesian cement than these, as it contains, in the specimen analyzed, but about 9 to 10 per cent. of combined silica, less than 5 per cent. of alumina and iron oxides, and as much as 17 per cent. of sand and silicates remaining undecomposed. On this account much of its hydraulic properties and strength must be attributed to the magnesia which is uncombined with silica, and in this respect it is probably unique in this country.

It is the lightest colored natural cement made, being a little more than off white, is very plastic, making a clay-like mortar with a medium amount of water, which has considerable covering powers, and trowels well. As made to-day, at its best, it has a high initial strength both neat and with sand, and continues to gain for long periods.

Louisville Cement. Louisville cement is put upon the market by a large number of different mills, and is made from rock obtained at various quarries, although all from the same formation. It is consequently a more or less variable article. As a whole, this cement has much less magnesia than either the Milwaukee or Utica brands, and in this respect is more like that made at Fort Scott, Kan., and Mankato, Minn. It is, like the latter, more thoroughly burned than those cements containing more magnesia, such as Utica cement, a small proportion of the silicates and silica only being left undecomposed. It requires more water to make a mortar than the lighter-burned cements, being quick setting as a rule, and it acquires its strength more rapidly. In time, however, no better results are obtained in sand mortar than with many other cements. Some of it is very quick. As a whole it requires to be used with care, and, as there are several different brands of Louisville cement, there may be as much variation in the supply as is the case with the Rosendales. Concrete constructed with Louisville cement has proved as satisfactory, in the opinion of those who have used it, as that made with any of the Western natural cements.

Fort Scott Cement. This cement is a pretty thoroughly burned product from a stone having about 12 per cent. of magnesia and not very rich in silicates to afford alumina. Being so well burned, it sets very fast if not previously hydrated. It varies in strength according to the care given in burning it, and high or low results may be obtained with different brands, in which respect it differs not more than many other kinds of cements. It eventually seems to give a strong mortar even when initially weak. It works smoothly, but requires more water in making a mortar than any of the natural cements, being quite peculiar in its action when first mixed, a preliminary reaction seeming to take place with the absorption of much of the water. Mortar made with it should be worked for some time and not made too dry.

Its color is characteristic, being quite a bright yellowish brown.

Mankato Cement. This cement is well burned, and similar to the Fort Scott and Louisville in composition, being, like them, somewhat deficient in alumina. It requires a medium amount of water, and gives good returns in strength soon after use. The mortar is not quite as plastic as that of the more magnesian brands. The writer has had no extended experience with this cement, but the Minneapolis tests, however, show that in ordinary sand mortar it continues to increase in strength for a long time, and compares favorably with the other Western natural cements, while in street work in that city it has been tried most severely and successfully by being exposed to travel for some time in concrete before being covered with an asphalt surface. Its color is similar to that of Milwaukee cement, a dull brownish gray.

Maryland Lime Cements. Of the same nature as the Round Top, which was selected as a type of these cements, are several other brands in use to a considerable extent in the markets of Washington, Baltimore, and the country adjacent to the places of manufacture, which are located along the Potomac in Western Maryland. Some recent tests of these cements have been published in the report of Mr. A. W. Dow, Inspector of Asphalt and Cements, of the Engineer Department of the District of Columbia, which are as follows: —

Brand.	Round Top.	Cumberland.	Cumberland and Potomac.	Cedar Cliff.
Tensile strength: —				
Neat, 1 day	81	169	146	88
7 days	203	218	204	185
2 parts quartz, 7 days .	122	156	188	85
1 month .	255	297	225	195
3 months	342	356	403	255
6 "	387	350	397	299
1 year .	515	438	436	364
Per cent. of water, neat	32.	32.	32.	32.
quartz	14.	15.	15.	15.

These lime cements set very quickly and acquire strength very rapidly, especially in sand mortar. It has been found, also, that they are not as much affected at early stages by the use of and excess of water as the magnesian cements. They have often a tendency to set too rapidly, heating strongly on mixing with water. This, however, it has been shown, can be avoided by proper sprinkling of the burned stone before grinding. Owing to the rapidity with which strength is acquired, these cements are peculiarly suited for arch work where it is convenient to draw centers soon after the completion of the work. In masonry work they are not as attractive, as the mortar often sets too quickly and does not trowel as well as that made with the magnesian cements. Especially in the form of neat mortar some of these lime cements become at times more or less brittle with age, owing to crystallization, but this is not as apparent in concrete, although with some brands the concrete has a greater relative tensile strength than toughness, fracturing more readily under a blow than concrete of magnesian cement.

Lime Cements of the Lehigh Valley. A cement is made along the Lehigh River, at Copley and other places, which is similar in some respects to the lime cements of the Potomac Valley. It is quite free from magnesia, sets with great rapidity, and is, as a rule, fiery. It gives a great initial strength, but in other respects cannot equal the Potomac cements. It is more often, since the establishment of the Portland cement industry in the same locality where it is made, mixed with a certain proportion of the second grade of this cement and sold as an "improved" natural. Much of it in its original form is very inferior. It is made from a rock which is now largely devoted to the manufacture of Portland cement when mixed with a purer limestone.

Other Cements. There are a number of other cements upon the market which are not as important commercially, and with which the writer is not personally acquainted. Their quality has not warranted, as a rule, their manufacture on a large scale, and they are employed only locally.

From the examination and comparison which has been made of the several kinds of natural cements which are made in the United States, it appears that there are such decided differences in their character that they may be classified as follows: —

I. Lime cement, containing only 2 or 3 per cent. of magnesia, 13 to 15 per cent. of oxides of iron and alumina, and about 20 per cent. of combined silica.

II. Lime cements with as little magnesia but with less silicates than class I., and consequently less satisfactory and more fiery.

III. Magnesian cements, with, at their best, about 15 per cent. of magnesia and the same amount of oxides of alumina and iron, with 15 to 20 per cent. of combined silica and considerable uncombined silicates, being not thoroughly burned.

IV. Magnesian cements with a large amount of magnesia, over 20 per cent., less alumina and iron, and less undecomposed silicates than in the preceding class.

V. Magnesian cements deficient in alumina and iron oxides and in combined silica, being lightly burned, but high in magnesia.

VI. Magnesian cements thoroughly burned, made from rock having a smaller amount of silicates than those of class IV., with only a medium per cent. of magnesia and little uncombined silicates.

Cements of the first class set and acquire strength rapidly, and increase in this direction for long periods. The final result is a more brittle mortar than is obtained with the magnesian brands.

The lime cements of the Potomac Valley are included in this class.

The second class has not as favorable a relation of silicates to lime, and consequently the cements are apt to be fiery and not as satisfactory. They are generally subjected to improvement by the addition of Portland cement, and are then used successfully. They are found in the Lehigh Valley.

The third class is represented by the best Rosendale brands, which set and acquire strength slowly, but which continue to develop it for long intervals and are eventually very strong and tough.

The fourth class includes cements like those of Western New York, which have been, while containing an unusually large amount of magnesia, burned so hard that little of the silicates have remained undecomposed and uncombined with the lime and magnesia, and in consequence are apt to expand a long time after use unless carefully hydrated before grinding.

The fifth class is one in which the cement is essentially a light-burned, highly magnesian material, in the preparation of which the heat has not been sufficiently high or prolonged to bring the greater portion of the silica into combination with lime and magnesia, in this respect being in contrast with the preceding class. The hydraulic properties and strength are due, therefore, largely to the magnesia and carbonates rather than to the silicates and aluminates. The cements of La Salle County, Illinois, represent it.

The last class contains the Louisville and Fort Scott cements, in which there is much less magnesia than in the two preceding, and less alumina and iron oxides than in the cements of the third class, although they are burnt so thoroughly that there is but a small per cent. of silicates and silica uncombined.

Notwithstanding all this variation in the character of the natural cements of the United States in practical use, they will all of them, when properly burned and carefully handled, give results which are only in the most exceptional cases failures. The writer is unaware that there has ever been an actual failure in masonry due to the natural cement used in its construction, although some important and extensive bridge work has been laid with it, and although it has frequently been used in the most careless way, being retempered after its original set or employed in the form of a very sloppy mortar. In concrete, inferior results are now and then obtained, especially in cold weather, or when the cement has been of some brand that has not been most carefully burned and put into the work. As a rule, with sufficient time, a natural cement mortar will acquire a satisfactory strength, even if originally weak, or unfavorably influenced by the conditions under which it has been used and the environment to which it is subjected.

The Masons' Department.

BRICK VENEER CONSTRUCTION.

BY FRED T. HODGSON.

THERE is a species of construction in which a facing of 4 ins. of brickwork is applied to the outside of a wooden frame, giving the simulation of a solid brick structure. This device is seldom met with in the East, but is quite common in the North and the West and in the Canadas; and though owing its origin to conditions of a time when framing lumber was cheap and bricks were expensive and not easily obtained, it has persisted in spite of its manifest sham, and has ascribed to it virtues which are hardly offset by its illogical character. Most people who desire to use this construction have the impression that a frame house veneered with bricks will cost considerably less than would a similar house if the walls were solid and of the usual thickness. In an experience of many years I have seldom been able to persuade a client to substitute a solid brick-walled house for the intended veneered sham; and yet the difference in the cost is in favor of the solid wall, if the veneering is figured as being properly done, and the woodwork for the skeleton built in a thorough and substantial manner.

The foundation walls required to sustain a veneered house must of necessity be as costly as those for a brick superstructure of corresponding dimensions; consequently there can be no saving in the foundation work. All bricks used in veneering must be good facing bricks of good quality, and, as the veneering is but 4 ins. in thickness, all the brickwork, excepting quoins, must be formed of stretchers, no "bats" being permitted; consequently the bricks will cost from 25 to 40 per cent. more than would bricks required for a solid wall, while the labor of laying a 4 in. brick course, including tying or bonding the bricks to the woodwork, is nearly double that of laying bricks in a solid wall. Then, the brick veneer must be laid from an outside scaffold, an expense not always necessary in the building of a solid wall; and iron, japanned, tarred, or galvanized ties or anchors to hold the bricks in position must be employed, at the rate of three to every hundred bricks laid in the wall, and these ties must be fastened to the woodwork on the frame and the projecting ends built in the brickwork. This is another expense which does not obtain with a solid wall.

As a rule, wooden window sills are used in veneered houses, the use of stone being almost prohibited because of the shallowness of the reveal. If stone sills are used, it is quite evident the cost of sills and setting them will exceed the cost of the same sills if used in a solid wall. The window and door frames required for a veneered house will cost just as much, and, in most cases, a trifle more than will corresponding frames for a solid wall, and the chances of a tighter connection to the wall are greatly in favor of the latter.

The opportunities for fashioning ornamental brickwork on a veneered building are so few and expensive that they are rarely embraced, unless the ornamentation is of the crudest and most primitive sort, conditions that do not obtain in solid brick walls. The arching over windows and doors in veneered work is of the flimsiest kind, and the least disturbance in the building is sure to make itself felt in these weak spots by cracking or displacing joints, as it is impossible to properly bond or tie the work at these points.

Inside the brick veneer there is erected a frame-studded skeleton. On the studding is nailed 1 in. pine or hemlock square-edged boards. Sometimes the stuff is dressed and matched, which adds to the cost; at other times it is nailed on the studding diagonally, with a view of giving strength to the structure. When this is done and the frame is boarded in both sides, the boards are so nailed that the joints cross each other, thus forming a double bracing. In the Northern, Northwestern, and Western States and the Canadas the outside boarding is covered with felt or building paper before the brickwork is commenced; and some builders also line up the inside of the house with suitable paper under the lathing. This, when carefully done, makes a warm wall, but it takes a great deal of time and care to paper around the openings and well in between the joists, and in contract work it is next to impossible to get workmen to make wind-tight joints with the paper at these points.

It is easy to see that the labor and materials used in the construction of the necessary frame ready to be veneered would cost very much more than the extra bricks and labor required to make the wall a solid one, and the walls of a veneered house, built as they ought to be, cost from 15 to 25 per cent. more than would good solid 9 in. walls.

Now, then, let us see some of the defects of a veneered house, and what is likely to result from these defects. Everybody knows that wood expands and contracts with every change of atmospheric conditions, thus causing a quiet but sure tearing away of the bonding connecting the two materials together, a condition that in the end must bring ruin to the building. It is almost impossible to fit bricks around window and door frames sufficiently tight to keep out wind when the wall is only 4 ins. thick. If, however, in veneering, care is taken and labor expended in having the joints between the frames and boarding properly covered with paper, well tacked on, it is possible to make the joints fairly tight, and they will remain so until the paper becomes broken, or falls away from the brick from decay or other causes. This expenditure of labor and time, however, adds materially to the cost of the veneering. That brick veneering is a sham goes without saying, for the experienced eye knows as soon as it looks at the building that it is veneered. A wall showing nothing but stretchers cannot deceive even the apprentice boy, and if, as I have known in several instances, an attempt is made to cheat the eye by making every sixth course of bricks appear as headers, by using "bats," a glance at the reveals and at the ornamental work will convince the experienced in a moment as to the true character of the walls.

After a careful consideration of the whole matter, and from facts gleaned from actual observation and experience, I have arrived at the conclusion that there is nothing to be gained, but considerable lost, both in economy and in efficiency, from building brick-veneered houses instead of houses with solid brick walls.

CRACKS IN PLASTERING.

HASTE is one of the drawbacks to good construction, and the results of hurry manifest themselves in nearly every department of building. The cracking of plaster cannot be blamed entirely to the shrinkage of wood or settlement of the foundations, for a certain kind of cracking in all lime mortar is due solely to haste in preparing the material. Lime mortar hardens by a species of absorption and a drying process quite distinct from the action of hydraulic cement. In order that the drying shall be uniform throughout the mass of lime mortar, it is essential not only that the lime be slaked for a long period before it is mixed with the sand, but also that the mortar should be mixed a considerable time before it is to be used, and that it be thoroughly manipulated, so that the particles of lime are evenly distributed, and the mixture perfectly homogeneous. Of course this is on the assumption that the lime is good to start with, which, unfortunately, is not always the case. Plasterers pay little attention to preparing mortar; this is usually left to the cheapest kind of labor, and if any one watches the average mechanic mixing mortar, it is evident that such a thing as a careful proportioning of materials received very little thought. We often find mortar which has stood for generations and is thoroughly hard, comparing very favorably with cement, but this is in the old buildings, and is a result of the care which was at times expended upon such work. It was formerly the custom to not only mix the mortar and sand together in the bed, but also to work it over carefully on a stone slab, thoroughly kneading it and mixing it before applying to the wall, securing thereby a perfect uniformity of composition which would insure a gradual drying of the plastering.

Brick and Terra-Cotta Work In American Cities, and Manufacturers' Department.

NEW YORK.— With the dawn of the new year comes the realization of our prophecies and dreams as to our great city, now Greater New York indeed, the second city in the world in population, and equaled by none in area. The event was ushered in amid scenes of great rejoicing, music, firing of cannon, and singing. The buildings surrounding City Hall Park were gaily decorated and brilliantly lighted. Of course there is still more or less confusion resulting from such a radical change of government, especially in the smaller boroughs, and it will be some time before everything will run smoothly.

DETAIL ON THE JEWELERS' EXCHANGE BUILDING, BOSTON.
Winslow & Wetherell, Architects.
Executed by the Perth Amboy Terra-Cotta Company.

Mr. Thomas J. Brady has been placed in charge of the Building Department, with two deputy commissioners. It is expected that some changes in the existing building laws will result, in which case they will be fully noted in these letters.

The Thirteenth Annual Exhibition of the Architectural League will be held in the Vanderbilt Gallery, Fine Arts Society Building, 215 West 57th Street, during February. The dates of the important events are as follows: —

Press View, Thursday, February 10, 10 A. M. to 4 P. M.

Annual Dinner, Thursday, February 10, 7.30 P. M.

League Reception, Friday, February 11, 8 P. M.

Public Exhibition from Saturday, February 12, to Saturday, March 5, inclusive. Hours, 9 A. M. to 6.30 P. M.; 8 P. M. to 10.30 P. M.; Sundays, 10 A. M. to 6 P. M.

Public Lectures, Wednesdays, February 16, 23, and March 2.

Smokers, Saturdays, February 19, 26, and March 5.

These exhibitions have been eminently successful in the past, and have been a tremendous factor towards the advancement of architectural taste and criticism. The League will collect and return, free of charge to exhibitors in Greater New York, Philadelphia, and Boston, all exhibits that have been entered.

At the monthly dinners of the League recently, the subjects discussed have been of vital interest, not only to architects, but to the general public. The subject at the January dinner was "Bridges," and the matter was thoroughly and intelligently dis-

TERRA-COTTA MANTEL, HOUSE AT PHILADELPHIA, PA.
Peabody & Stearns, Architects.
Terra-Cotta executed by the Standard Terra-Cotta Company.

cussed by the members. There was a strong sentiment in favor of more monumental bridges, enriched by sculpture, etc., than are now being built. With one notable exception, — the Brooklyn Bridge, — our bridges are not particularly ornamental structures.

At a previous dinner the subject was "Small Parks and Gymnasiums in the Crowded Districts." This subject was also intensely interesting, and was made more so by a score of clever plans prepared by different members and explained by them.

Among important competitions recently decided are: The Ellis Island immigration stations, for which the plans of Messrs. Boring & Tilton have been accepted. There will be five buildings, to be built of brick, stone, and iron, thoroughly fire-proof; cost, $570,000. Erasmus Hall High School, Brooklyn, a brick and stone building to cost $400,000, in which the successful architects were Messrs. Glover & Carrel. The College of the City of New York, Morningside Heights, for which the plans of Mr. George B. Post have been accepted.

These buildings are in the Collegiate Gothic style and will form a handsome group. The site could not be excelled. The cost will be about $1,000,000.

Plans are being prepared by Bruce Price for a large hotel to be built on Madison Avenue, corner of 42d Street,

TERRA-COTTA DETAIL, BAY WINDOW CURTAIN WALL, ATWOOD BUILDING, CHICAGO.
Executed by the Northwestern Terra-Cotta Company.

FIRST FLOOR PLAN, HOUSE AT PITTSBURGH.
Alden & Harlow, Architects.
Elevation shown on Plate 8.

McKim, Mead & White are preparing plans for the new Union Club House, to be erected on 54th Street and Fifth Avenue, at a cost of about $1,000,000.

CHICAGO.— Chicago had an epidemic of fires about Christmas week. One of the losses was the Quadrangle Club Building, the club headquarters of the professors of the University of Chicago. This building, previously referred to in THE BRICKBUILDER, was designed by the late C. B. Atwood. It was colonial in design, and was executed in rough, red sandmold brick, with large white mortar joints, and laid with Flemish bond. The cornice and broad white frieze were of wood, and the roof was of green slate. In rebuilding, the same design will be used, but with a wing for a necessary enlargement of the building. Architect Howard Shaw is working on the drawings.

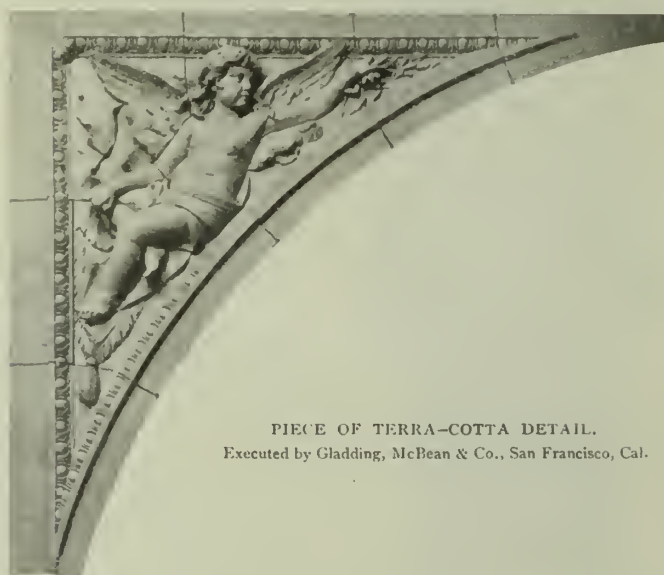
Another building burned was a gymnasium. This was connected with the academic department of the university, and was located in Morgan Park, a suburb.

The most serious fire loss was that of the "Coliseum," which was used for general exposition purposes, from a horse show to a bicycle race or a football game. This building, which was erected since the World's Fair, and near the site of same, gained notoriety from its collapse and almost total destruction during construction, when the great steel arches were, about half of them, in place and covered with an expanse of wood plank roof.

Building news reporters say that architects are smiling over projects, although the amount of work actually going ahead is not great. A certain amount of activity in real estate, however, gives some promise for the spring season. Mr. Phipps, of Pittsburgh, has bought ground on Monroe Street, and commissioned Jenney & Mundie to design an addition to the New York Life Building.

Studebaker Brothers are having S. S. Beman design a new building, and also add a tenth story to their Michigan Avenue structure.

Several transfers of property in the business center seem to hold promise of new buildings of a commercial character. A recent loan of so small an amount as $12,000 at 4¼ per cent. on property not in the central district is taken as an important example, showing the tendency toward lower interest rates, and possibly a corresponding increase in building operations. Curiously enough, it is said that the largest proportion of building the past year has occurred in the World's Fair district, which was thought to have been most seriously overbuilt.



PIECE OF TERRA-COTTA DETAIL.
Executed by Gladding, McBean & Co., San Francisco, Cal.

The Union Mutual Life Insurance Company (D. G. Hamilton, resident director) has had contracts let for the erection, at Cottage Grove and 34th Streets, of thirty-two houses to cost about $228,000. They expect to build fifty more as soon as these are finished.

Shepley, Rutan & Coolidge are designing a group of buildings for the Chicago Orphan Asylum at Grand and 51st Street Boulevards. The exteriors will be colonial in style, with brick facing, terra-cotta trimmings, and slate roof.

The brick business in Chicago during the past year certainly has been far from satisfactory. Common brick have been delivered at buildings from $3.20 to $4.00 per thousand; since October, however, the price has risen to $6.00. The Chicago Hydraulic Brick Company say that 33 per cent. less pressed brick were sold during 1897 than in 1896, and that the price was 20 per cent. less.

TERRA-COTTA PANEL, AMERICAN BAPTIST PUB. SOCIETY BUILDING, PHILADELPHIA, PA.
Frank Miles Day & Bro., Architects.
Executed by the Conkling, Armstrong Terra-Cotta Company.

GOES TO ST. LOUIS.

MR. HENRY E. MACK, for many years the general manager of the Eastern Hydraulic-Press Brick Company, has been called to St. Louis to assume the general management of the Hydraulic-Press Brick Company's immense business. Mr. Mack's achievements in developing the substantial success of the Eastern Hydraulic-Press Brick Company's business have long been recognized in the burnt-clay market of the East; it is therefore natural that the St. Louis Company, the parent of all other hydraulic companies in the country, should desire to have the direct association of his astute abilities in the management of its vast enterprises.

NEW CALENDARS AND CATALOGUES.

F. B. GILBRETH, 85 Water St., Boston, has again issued his novel and interesting calendar, which is intended as an advertisement for his system of waterproofing cellars. It is attractively gotten up, and made especially interesting to seaboard people, from the fact that the hours of tides serving are given for each day of the year.

WE are in receipt of a very handsome calendar for the coming year from A. Miller & Son, of Bradford, Pa., manufacturers and dealers in fine pressed brick. The illustration on the calendar is a half-tone reproduction of Wirkner's famous painting, "Diana and the Fawn."

SAMUEL H. FRENCH & Co., of Philadelphia, manufacturers of Peerless Mortar Colors, send their New Year's greetings in the form of a very attractive and useful calendar of the memorandum pad style, each leaf of which is divided into the seven days of the week, with liberal space opposite each date for memorandums.

BOSTON ATHLETIC CLUB BUILDING.
Sturgis & Cabot, Architects.

PLANTER'S HOTEL, ST. LOUIS.
I. S. Taylor, Architect.
Front brick furnished by the Hydraulic-Press Brick Company.

A VERY attractive calendar for 1898 has been issued by Jas. A. Davis & Co., 92 State Street, Boston, New England agents for the Alpha Portland Cement. Particular interest is attached to the illustration of this calendar, namely, two thoroughbred Boston bulldogs, from the fact that they were raised and are owned by Mr. Davis.

R. GUASTAVINO CO., fire-proof construction, Boston and New York, have issued the first of their bi-monthly calendars, the illustration of same being a three-part view of the roof over St. Anthony's Chapel, St. Matthew's Church, Washington, D. C.; Heins & LaFarge, architects. It is the intention of this company to send out a new calendar bi-monthly throughout the year, each having as a subject some illustration of their method of construction as employed on some prominent building.

F. W. SILKMAN, 231 Pearl Street, New York, importer of minerals, clays, chemicals, and colors, has sent us one of his very attractive hanging calendars, at the top of which is a striking picture in colors of two fine specimens of Gordon setters.

THE Correspondence School at Scranton, Pa., has issued a booklet the contents of which is a substantial endorsement of the architectural courses conducted by them, eighty students bearing testimony to the value of these courses.

WE are in receipt of a new catalogue just issued by the American Enameled Brick and Tile Company, illustrating and describing their "standard colors, sizes, and special shapes of enameled and patent interlocking enameled wall tile."

A valuable feature of the catalogue is the practical description given of the details required for arch brick (enameled) in English, American, Roman, or Norman sizes. These details are accompanied by explanatory diagrams. Particular attention has also been given to the illustration of some ninety-five different shapes of molded brick which the company manufacture, and also to the variety of colors which they make. In order to facilitate selection in these there has been incorporated in the catalogue a colored chart showing fifteen different shades of brick.

The closing pages of the book are devoted to the description of a patent interlocking tile owned and manufactured exclusively by this company. These tiles are especially designed for the facing of walls, or for use in floors or ceilings. They are described as "an economizing brick or bonded tile for walls."

We can heartily recommend to our readers a perusal of this little volume as being a work which contains considerable information on enameled brick.

HOUSE AT ST. LOUIS.
Barnett, Haynes & Barnett, Architects.
Terra-Cotta executed by the Winkle Terra-Cotta Company. Front Brick furnished by the Hydraulic-Press Brick Company.

INTERESTING NEWS ITEMS.

Charles Bacon, Boston, representative of Sayre & Fisher Company, has been awarded the contract for enameled brick for the new Southern Terminal Station, Boston.

Atlas Portland Cement is being used on foundations for new building on India Street, Boston; W. T. Sears, architect.

The Grueby Faience Company is supplying the enameled tiles for the Subway Station, Haymarket Square, Boston.

The patent Cleveland Steel Wall Ties made by the Cleveland Wire Spring Company, Cleveland, Ohio, have found a ready recognition among architects and builders throughout the country, excellence of manufacture and price giving them preference in the market; Samuel H. French & Co. are the handlers for Philadelphia, and Meeker, Carter & Booraem for New York.

The Dagus Clay Manufacturing Company has closed a contract to supply 170,000 brick for a new factory building at Straights, Pa.

Charles Bacon, 3 Hamilton Place, Boston, has been appointed agent for the Celadon Roofing Tiles.

Fiske, Homes & Co. have just completed the building of twenty-four brick and terra-cotta fireplaces for the Rauleigh Chambers on Mountford St., Boston.

R. Guastavino Company propose this present year to devote especial attention to fire-proof staircase construction, of which they have always done more or less.

The Dagus Clay Manufacturing Company, of Dagus-cahonda, Pa., are putting a fine line of Pompeian brick on the market in standard and Roman sizes.

DETAIL OF ENTRANCE, HOUSE AT ST. LOUIS.
Barnett, Haynes & Barnett, Architects.

The Ridgway Press Brick Company, through their Pittsburgh agent, James R. Pitcairn, are furnishing the mottled gray Roman bricks for a new office building, and a residence at Pittsburgh.

Wm. Wirt, Clark & Sons, Baltimore, Md., agents for the Union Akron Cement, report that this cement is now being used by the Pennsylvania Railroad Company at Sunbury, Pa., and by the West Maryland Railroad Company at Hagerstown, Md.

There will be a large amount of architectural terra-cotta used in the new building for Jordan, Marsh & Co., Chauncy and Bedford Streets and Avon Place, Boston. This contract has been awarded to Waldo Brothers, agents for the Perth Amboy Terra-Cotta Company.

DETAIL OF WINDOW OVER ENTRANCE, HOUSE AT ST. LOUIS.
Barnett, Haynes & Barnett, Architects.

THE Navy Department has adopted the Mason Safety Tread for use in vessels, after the favorable report of an examining board, and requisitions have been made for the material for application to stair treads and other places on half a dozen battleships and cruisers.

ON the thirty-story Syndicate Building, Park Row, New York, the "Brooklyn Bridge Brand" Rosendale Cement is being used exclusively. Sixty-five thousand barrels of this cement were used on the New York Croton Aqueduct in 1897.

SAYRE & FISHER COMPANY front bricks will be used in the new residence for Mr. Fay on Commonwealth Avenue, Boston; J. T. Kelly, architect; also for the Jordan Building, Boston; Winslow & Wetherell, architects.

THE EXCELSIOR TERRA-COTTA COMPANY, through their Boston agent, Charles Bacon, will supply the architectural terra-cotta for the Spalding house at Pride's Crossing, Mass.; Little & Brown, architects; also for the Wood, Pollard & Co. Building, Boston; Shepley, Rutan & Coolidge, architects.

THE GRUEBY FAIENCE COMPANY, Boston, have executed a frieze, 125 ft. in length, of painted tiles in Delft blue, representing a panoramic landscape in Holland, for the grill room in the new addition to the Reynolds House, Boston; Arthur Vinal, architect.

ST. LOUIS DAIRY COMPANY'S BUILDING.
W. Albert Swasey, Architect.

THE RIDGWAY PRESS BRICK COMPANY, through O. D. Person, their New York agent, will supply 150,000 mottled and 4,000 ornamental brick for the new high school building at Newark, N. J. Also 120,000 stiff mud buff and gray bricks for the new school building at Newtown, L. I.

THE BERLIN IRON BRIDGE COMPANY is building the new 180 ft. drawbridge over the South Shrewsbury River, N. J.; also rebuilding the boiler house for the Riverside Worsted Mills at Providence, R. I. This building is to be made fire-proof, the walls are of brick, the roof being of tile with metal supports.

BOARD OF EDUCATION BUILDING, ST. LOUIS.
I. S. Taylor, Architect.
Front brick furnished by Hydraulic-Press Brick Company.

THE BURLINGTON ARCHITECTURAL TERRA-COTTA COMPANY will supply terra cotta on the following new contracts: residence 38th and Ludlow Sts., Philadelphia, A. S. Wade, architect; stable at Caldwell, N. J., Jeans & Taylor, architects; and a new building at Philadelphia, for which H. E. Flower is the architect.

THE CELADON ROOFING TILE COMPANY, Charles T. Harris, Lessee, have closed contracts for roofing tile for two houses for Sanford P. Ross, Newark, N. J., H. E. Reeve, architect; 8 in. Conosera. Engine House, New York City Fire Department, Percy Griffin, architect; close shingle. Correspondence School at Scranton, W. Scott Collins, architect; 8 in. and 2 in. Conosera in combination.

W. T. BIRCH, Corcoran Building, Washington, D. C., writes as follows in regard to his use of Cabot's Creosote Shingle Stains on bricks: "I used them in two instances on old and discolored press-brick fronts, and with most gratifying results. The brickwork now, after several months' exposure to sun and rain, looks quite as well as new."

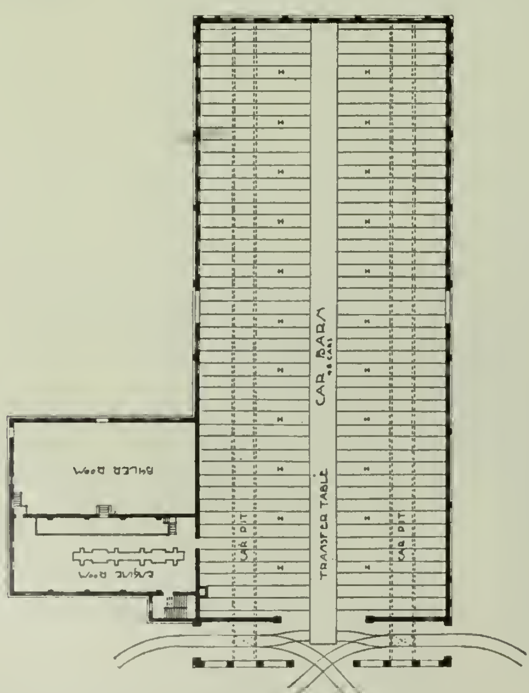
THE C. P. MERWIN BRICK COMPANY, Berlin, Conn., established in 1880, has withdrawn from the Central New England Brick Exchange Company. Theirs is one of the largest and best equipped brickmaking plants in New England, if not in the whole country. Their product is a superior quality of pallet face, building, sewer, paving, molded, and hollow brick. The plant is located on the main line of the N. Y., N. H. & H. R. R.

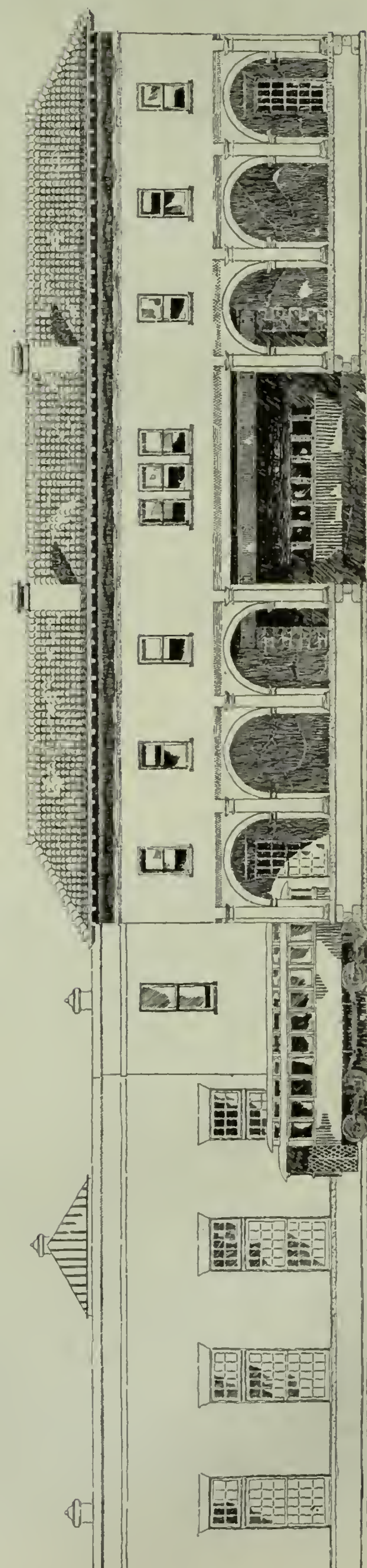
THE COLUMBUS BRICK AND TERRA-COTTA COMPANY are supplying their front brick on the following new contracts: Dark-gray Romans for three dwellings at Newark, N. J.; B. F. Hurd, architect; dark-buff standards for public school, No. 19, at Jersey City, N. J.; C. F. Long, architect; light-gray Romans for residence at Cincinnati, Ohio; M. H. Burton, architect; light-buff Romans for Journal Building, Dayton, Ohio; Williams & Andrews, architects; light-gray Standards and Romans for residence at Germantown, Pa.; George F. Pearson, architect.

OF new contracts the New Jersey Terra-Cotta Company has lately received: School, West New Brighton, Staten Island, N. Y.; John A. Hamilton, architect; school, No. 26, Jersey City, N. J.; H. & W. Newman, architects; grammar school, New Rochelle, N. Y.; George H. Pierce, architect.

This company is now working on the terra-cotta contracts for St. Patrick's Church, Whitinsville, Mass.; Chas. D. Maginnis, architect; apartment houses, 138th and 139th Streets and Brooks Avenue, New York City; Schickel & Ditmars, architects; residence, Seabright, N. J.; DeLemos & Cordes, architects; residence, Hillhouse Avenue, New Haven, Conn.; L. W. Robinson, architect.

A PROJECT is on foot to build a hotel, somewhat after the idea of the Mills hotel in New York, on the corner of Gainsboro and Parker Streets, Boston. The scheme is to erect a seven-story building, where comfortable quarters will be provided for young men at a moderate rate.





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Reed & Stem, Architects, St. Paul, Minn.

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John H. Black,
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Buffalo, N. Y.

Pittsburg Mortar & Supply Co.,
339 Fifth Ave.,
Pittsburg, Pa.

Powhatan Clay Manufacturing Co.,
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R. L. Watson,
Mithoff Building,
Columbus, O.

The Midland Brick & Supply Co.,
226 The Arcade,
Cleveland, O.

B. T. Hazen,
3 Builders' Exchange,
Cincinnati, O.

Holmes, Strachan & Co.,
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Detroit, Mich.

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Toronto, Can.

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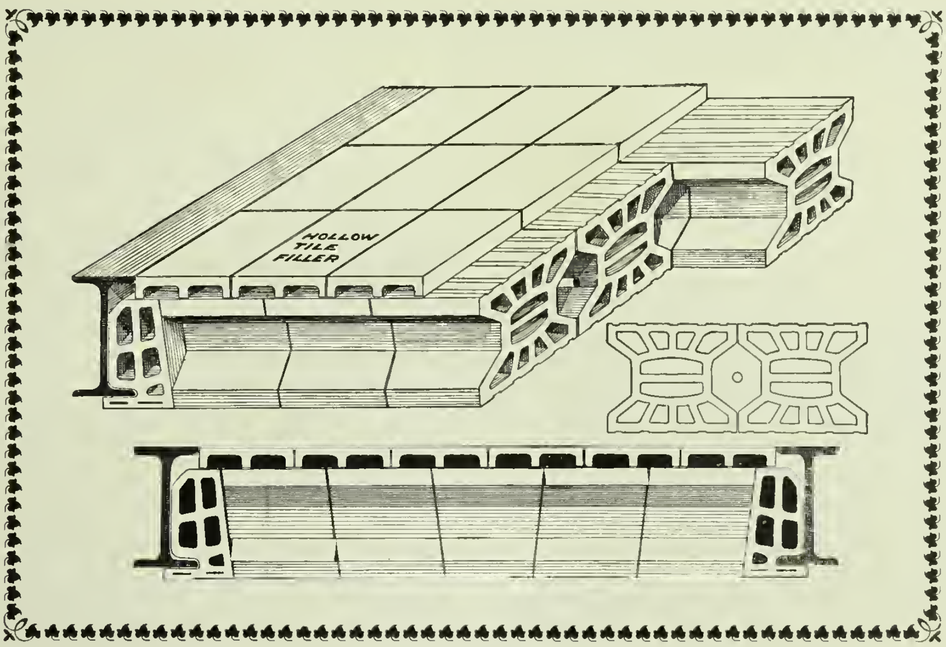

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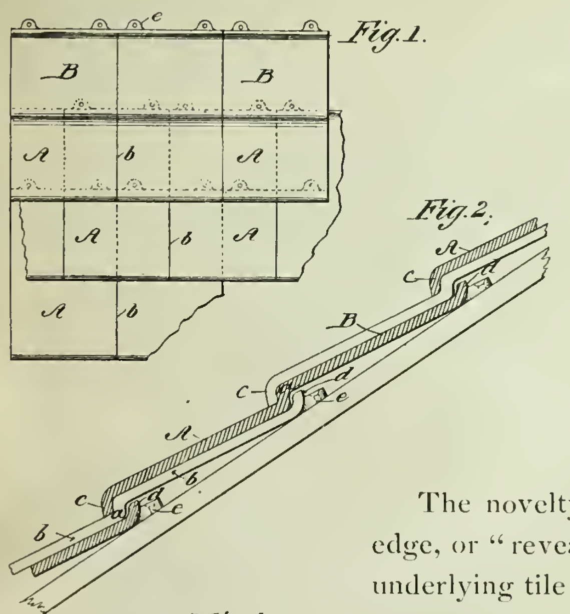

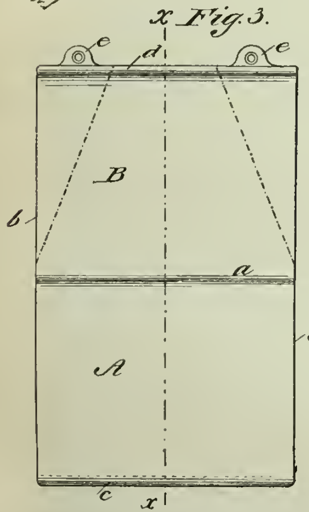

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VOLVME VII FEB. 1898 No. 2

THE BRICKBVILDER

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THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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SMALL OPPORTUNITIES.

A CRITICISM, which is often quoted against the species of architectural training which is afforded by the Ecole des Beaux Arts in Paris, is that the problems treated therein are not practical ones; that the large, monumental style of design which finds favor with the school traditions is not of the sort by which we Americans can most truly profit, and that a young man who follows such a course of training views architecture through the wrong end of the opera glass. Such a criticism springs from a misconception of architecture as a fine art. The difference in the results of American and foreign architecture, and the causes of much of the deficiencies which we cannot but admit and regret in our national civic architecture are due very largely to the bias which we seem to have inherited from our English artistic parentage, of viewing architecture as a development from the individual house to the palace, rather than considering it to be the art of the palace which may be applied to the small house. In other words, architecture, when at its best, is a development of wealth and power; and if we have artistic homes, if our small buildings are successful in an artistic sense, it is because of the opportunities which wealth and power have placed within the reach of the profession, whereby opportunities for study in the large have been afforded. It is only in proportion as we disregard expense, *per se*, disregard the so-called practical conditions, that we are able to produce work which will stand in the artistic sense. We would not be understood by this as saying that practical conditions should not be considered at all; but viewing architecture as a fine art, which it undoubtedly can be and is in the hands of our best practitioners, the practical elements should be considered only in as far as they are essential to a proper artistic treatment of the whole, for, however practicable a building may be, if it is not artistic it is not architecture.

Now, every one does not have the opportunity to build palaces, in this country especially, and most of us have to content ourselves with what crumbs of artistic possibilities may fall to our table. Such a limitation need not imply, however, a lack of appreciation of possibilities for the larger development, if we will bear in mind that art is more than steel construction or foundations, and when we are obliged to delve in the humbler lines of design, will keep our minds ready and trained for the study of the larger solutions. We believe that growth is well-nigh impossible for an architect whose practise is limited to ordinary buildings, if he confines his attention simply to the structures which come to his hand. He must reach out beyond, and undertake in moments of leisure study to grapple with the great problems to test his strength on the broader type, otherwise even his small buildings will deteriorate in quality, and he will find it hard to keep what power he has. No one can afford to know it all nowadays; we must keep studying, keep reaching out, searching for the larger opportunities. A story is told of an architect in Belgium who for twenty years, without any encouragement, spent all his spare time in seriously studying the plans and possible designs for a monumental structure; and when after years of study he was elected, a man almost unknown, to design the new law courts in Brussels, he was able to bring out his previous studies and show how for twenty years he had been elaborating the very scheme. The result of his continued thought shows in the building, which is unique in many ways, and ranks among the best of its kind. Now, that is what we need to do if we would not let our weapons get rusty. The throttling effects of limited opportunities is a factor which every architect appreciates who has the artistic success of his profession at heart, and it is a matter of necessity in these days, when the manifestations of art are spreading so fast, and its possibilities are so much enlarged, that we should be ready when the time comes to meet the higher demand.

But even if it never comes, even if one all his life is to be bound down to the petty, small problems, the spirit which will prompt him to study the large opportunities will manifest itself in the small ones, and his work will be so much the better for it. Architecture is pre-eminently the art which depends upon size for its effect, and yet the large feeling which is manifest in such works as the Temple of Karnac or the south front of the Louvre finds its expression sometimes in even so simple a thing as a library interior in a five thousand dollar house or the treatment of a brick gable. Limited opportunities belittle if treated in a petty spirit, but when viewed with a larger scope, when the opera glass is turned the other way and we approach our architecture from the monumental side, the small opportunities can be magnified into great successes.

WE resume in this number the republication of Street's "Brick and Marble Architecture in Italy," which was interrupted two years ago on account of the pressure of other matter; and we are sure our readers will be glad that the completion of our republication can now be continued without further interruption. The book is of value not only because it still remains, perhaps, the best account in English of the architecture of which it treats, but it has the farther interest, in the insight it gives into the point of view of one of the foremost of the architects who led the Gothic revival in England in the middle of the century. Traveling in Italy was in those days by no means so common, even among architects, as it has since become, and these notes of journeyings in Italy have an added zest if one reads them remembering that they were written as an account of explorations in comparatively unknown regions; for the architecture of which it treats had hitherto been overlooked by most, even, of those who traveled in Italy.

We shall, as before, illustrate the subjects in each successive instalment of the republication, by reproductions from photographs. This will give us the opportunity of offering to our readers a large amount of material from the best of Italy's brick and marble architecture. We shall illustrate especially the brickwork on the buildings in which brick and marble is combined; but occasionally, as in the present number, which treats of St. Mark's at Venice, our text will lead us to show subjects in which brickwork does not appear, though at St. Mark's the structure is of brick, and, indeed, originally the brickwork was displayed, and was not encased with marble as it came to be soon after its construction.

THE American Architect and Building News Company has published a work of considerable interest in the shape of a series of plates illustrating the Georgian or colonial period of American architecture, reproduced from drawings by many of our best-known illustrators, including such names as Gregg, Wallis, Bragdon, and many others. The first part includes thirty-three well-selected plates, the subjects of which, while not altogether unfamiliar to the architectural public, are such as to make the collection of very tangible value. Part II., which is now in course of preparation, is to contain not less than forty-eight plates of measured drawings, many of which have never before been published, together with a number of gelatine prints of details from domestic and public buildings in the New England, Middle, and Southern States. The work is issued at prices of $4.00 and $6.00 for the respective parts. It forms a welcome addition to the available illustrative publications upon the subject.

The Georgian Period: being measured drawings of colonial work in the United States. Boston : American Architect and Building News Company.

PERSONAL AND CLUB NEWS.

GEORGE H. INGRAHAM, architect, Boston, has taken offices in the Tremont Building.

H. C. RUTHERFORD, architect, Scranton, Pa., has removed his offices to the Burr Building. Samples and catalogues desired.

HENRY LOOMIS CURTIS has opened an office for the practise of architecture at 1120 Harrison Building, Philadelphia.

WESTLAKE & HOWARD have opened an office for the practise of architecture in the Johnson Building, Muncie, Ind. Samples and catalogues desired.

MR. GEORGE W. GOUINLOCK, architect, has removed his offices from 53 King Street, East, to the seventh floor, Temple Building, corner of Bay and Richmond Streets, Toronto.

LONG & KEES, architects, Minneapolis, Minn., have dissolved partnership. Mr. F. B. Long has formed a copartnership with his son, Louis L. Long, under the firm name of F. B. Long & L. L. Long, with offices in the Kasota Building.

SHANK & WETHERELL, architects, Observatory Building, Peoria, Ill., have dissolved partnership, Mr. Shank retaining the old office, and Mr. Wetherell associating himself with Richardson & Hotchkiss. Dime Savings Bank Building, under the firm name of Richardson, Wetherell & Hotchkiss.

MR. CHARLES S. FROST, formerly at 604 Pullman Building, Chicago, and Mr. Alfred H. Granger, of Cleveland, Ohio, have formed a partnership under the firm name of Frost & Granger, architects, and after Feb. 1, 1898, will be located at 806 The Temple, southwest corner of La Salle and Monroe Streets, Chicago.

A REGULAR meeting of the T Square Club was held on Wednesday evening, January 19, the subject for competition being, "A Club House for a Country Club."

Mr. Walter Cope led the criticism on the ten designs submitted.

First mention was awarded to Mr. A. M. Githens; second mention, to Mr. W. P. Trout; and third mention, to Mr. George G. Bassett.

CHICAGO ARCHITECTURAL CLUB happenings of recent date are as follows: —

Mr. P. B. Wight, secretary of the Illinois Board of Examiners for Architects, delivered a lecture at the club rooms, Monday evening, January 24, on the new law governing the practise of architecture in the State of Illinois, and its benefits.

On Monday evening, February 7, the members of the club were requested to come to the club rooms prepared with pencils, sketch blocks, and bright ideas, to participate in a competition for the design of a building, the governing conditions of which were announced on that evening.

A time limit of one half hour was set for the preparation of sketches, and a general criticism and discussion of the problem followed.

The second and third exhibitions of Projět Drawings took place on the evenings of January 31 and February 14 respectively. Different squads of members dispensed the hospitality of the club on each occasion.

ILLUSTRATED ADVERTISEMENTS.

ON page vii, in the advertisement of Fiske, Homes & Co., number eight of the series of brick and terra-cotta fireplace mantels is shown.

A new residence at Pittsburgh, Pa., is illustrated in the advertisement of Harbison & Walker Company, on page xiii.

Number four of the descriptive series of the roofing tiles made

TYMPANUM IN CENTRAL DORMER OF A SIXTEEN-STORY HOTEL ON 33D STREET, NEW YORK.
H. J. Hardenbergh, Architect.
Executed by the New York Architectural Terra-Cotta Company.

by the Celadon Terra-Cotta Company, Charles T. Harris, lessee, is given in the company's advertisement, page xxvii.

Examples of bond, showing blocks of the Gilbreth Seam-Face Granite laid up in two styles of bond, is illustrated in the company's advertisement, page xxxiv.

THE LEAGUE EXHIBITION.

THE Annual Exhibition of the Architectural League of New York has come to be one of the artistic features of the year, both on account of the manner in which it has been managed and for what it represents. It is true that the public, properly so styled, gives the exhibition but scanty support, and even the profession in New York does not put itself in evidence either by attendance or by a specially manifested interest, but that it has a very positive influence and a recognized value can hardly be questioned by any one who has had the good fortune to attend during successive years. In the present exhibition there are fewer small subjects than last year, less merely pretty architectural picture making, but there seems to be a more evident sympathy for monumental architecture, and more and better attempts than in any previous year to large and broad treatment.

A very fascinating set of drawings, and in some respects one of the most interesting in the exhibition, is that exhibited by Cope & Stewardson, showing the building for the Pennsylvania Institution for the Instruction of the Blind, a structure recalling the North Italian work, with a touch of the Southern Californian Mission style, with red tile roofs, and walls presumably stuccoed, forming a bright, sunny combination, with excellent proportion and a few carefully studied details, a most pleasing group, and one which would indicate a unique and very successful building. The drawings themselves were extremely clever of their kind.

Another most excellent example of brickwork is shown by the design for the new Court House of Livingston County, at Geneseo, N.Y. The building itself is shown as a colonial combination of Flemish bonded brick, with stone quoins, and a center treatment consisting of a high two-storied colonnade with pediment presumably of wood, a design which, handled with less nicety of proportion and sense of fitness, might easily become commonplace, but which is a charming bit of composition, and is ably presented by the drawing. The perspective is in black and white, and shows the building set in a winter landscape, with a few hunters on horseback in the foreground, the coats of hunters a bright scarlet, as if at the last moment Mr. Bragdon, after having made the whole drawing in pen and ink, had felt the need of a sharp note in the foreground. What makes the drawing all the more interesting is that instead of using hard India ink, the draughtsman has employed a writing ink, just a slight purplish-gray black, which softens the effect wonderfully.

Mr. R. Clipston Sturgis contributes a sketch for a country house, of brick and stone in a semi-Tudor style, with simple quiet treatment of lawn and terraces in front. This house we hope to illustrate in a later issue. Another very pleasing sketch is contributed by Mr. Frank Allison Hays, showing an arrangement of brick gable end with a picturesque group of chimneys, forming addition to an existing house.

Cope & Stewardson also exhibit a design for house for J. S. Morgan, at Princeton, an example of the kind of work the clever Philadelphians have been doing of late in combinations of brick and stone. Charles I. Berg has an interesting drawing, a block of five city houses treated like one continuous eighteenth century palace, with marked end pavilions and Mansard roof, the face being carried out in red brick and white stone. The whole arrangement of the basement, the high principal story, and the grouping of the roofs is quite in the style of the French work.

Mr. E. P. Casey has a drawing for one of the city engine houses, presumably on an isolated plot, a design in red brick and white stone trimmings in the French style, which at present seems to be quite the fashion in New York. Tracy & Magonigle contribute several of Mr. Magonigle's very strong, simply treated water-color sketch designs, especially one for an inn at Bernardsville, N. J., a combination of half timbering, plaster gable work, a green roof, and a long, low-lying ell running off towards the stable, with a blank brick wall tied into the first story brickwork of the main structure; a remarkably brilliant drawing.

The drawing of a house at Bar Harbor, by John Calvin Stevens, is a surprise. It represents a brick-gabled, quiet Tudor style of house, with projecting wings, a pedimented entrance, a broad terrace with balustrades across the front, with a line of high brick wall tying the house and stable together; a very comfortable composition, but so different from Mr. Stevens's usual highly picturesque treatment that we looked twice at the catalogue to make sure it was his. If this is a new manner with Mr. Stevens, he is surely to be congratulated.

A drawing which looks as if it were a page taken from some quiet, sleepy town of Holland is a design for the Wallabout Market Tower, Brooklyn, by W. B. Tubby, architect. The perspective drawing is signed by Robert L. Adams. It shows a queer, quaint combination of gables, long, narrow slitted windows, a huge clock dial, and a picturesque chimney climbing up towards the top of a square, solid brick tower, with quite the flavor which is hanging around Haarlem and Delft. We wish there were more such.

A building which has been previously illustrated in this journal is shown at the League Exhibition by a carefully rendered elevation. In the Crozier Building, Philadelphia, Mr. Frank Miles Day has been able to accomplish what is so often attempted — a design of a tall commercial building which is architectural from grade line to pinnacle, with a well-defined base, a simple shaft, and elaboration into a crowning capital. Whether all commercial considerations will tolerate in other instances a high-pitched roof is a question which does not affect the artistic qualities of this design. It is to be doubted, also, whether many property owners would be willing to sacrifice so much space in the ground story in the shape of heavy piers and arches to afford an adequate and proportional support for the upper stories; but certainly, taken as a whole, it is one of the most successful designs of its kind which we have seen. If we are rightly informed, it is entirely of brick and terra-cotta above the ground floor.

A lack in the exhibition is the absence of any decorative work in tiles or colored terra-cottas. We know there is plenty of this being done, and of a very high artistic quality, but somehow it does not seem to find its way into exhibitions. There are a few samples shown of underglaze on tiles, but they are too amateurish to count as serious work.

An exhibition of this sort is an architectural tonic. Not all that is exhibited is good, by any means, and we miss the work of many representative architects, but the value, as a whole, is quite appreciable, even if not precisely defined. Sometimes we feel the best good from such an effort comes beforehand, in the months of preparation, in anticipation, and in the species of mental restraint which the knowledge that we are going to exhibit will exert over one. Not that the drawings have the appearance, however, of being made especially for show, rather each year there is less of this and more indications that the drawings represent the manner in which architects are working out their ideas in architectural practise. One of the speakers at the League dinner made the witty remark that whenever he went to church he was convinced that an architect not only built the edifice, but must have planned that part of the service which declares he had left undone the things he ought to have done. The point would apply to any exhibition; still, the things which are done and done so well, and which are growing in number every year, are abundant testimony to at least the direction of growth which make this exhibition all that it is.

THE T SQUARE CLUB EXHIBITION.

WE have received the very successful illustrated catalogue of the architectural exhibition of the T-Square Club, Philadelphia. It is interesting to compare this number with those of some of the first years in which the club held its exhibitions and note how marked has been its progress. Indeed, we question whether any other one publication could more fittingly show the change in attitude of the architect than these illustrated catalogues. The club this year has evidently made considerable effort to interest foreign contributors. There are several English drawings, notably R. Norman Shaw's wonderfully clever drawing of the building for the Alliance Assurance Company, London; also some of Ernest George's equally charming interiors. The comparison which this catalogue affords between the work of our foreign brethren and that of some of the trained coterie who have given the T-Square Club its reputation is decidedly interesting and instructive, and while the English work is on slightly different lines, the result is, from our standpoint, by no means to the detriment of our home talent. The catalogue contains an unusual quantity of most excellent material.

THE Managing Committee of the John Stewardson Memorial Scholarship in Architecture announces by authority of the Trustees of the University of Pennsylvania, who act as trustees of the Memorial Fund, a competition for a scholarship of the value of one thousand dollars, the holder of which is to spend one year in travel and in the study of architecture in Europe under the direction of the committee.

Candidates must be under thirty years of age, and must have studied or practised architecture in the State of Pennsylvania for the period of at least one year immediately preceding the first day of March, 1898. Programs of the competition may be had by addressing Mr. Frank Miles Day, Secretary of the Managing Committee, 925 Chestnut Street, Philadelphia.

TESTS OF THE CRUSHING STRENGTH OF BRICK PIERS.

BY PROF. CECIL B. SMITH.

THE following tests of the crushing strength of brick piers are interesting both as regards the absolute loads recorded, and also because, while with lime mortar brickwork the strength of the mortar determines the load which the pier can carry, this is not so where good Portland cement mortar is used. The tests show that the quality of the brick determines the pier strength, as the first and second brands of cement were rather superior to the third and fourth, as is shown by the tests of a cube of mortar from the same mixing: but the superior strength of the pressed brick became evident in spite of this.

Another interesting point always brought out by such tests is that the pier strength per square inch is considerably less than that of a single brick on its flat, but considerably more than cubes of mortar, *i. e.*, beds of mortar are far stronger than cubes, and single bricks than built walls.

The compressions recorded are very small, owing to the rigidity of the mortar, but piers laid in lime mortar give very much greater compressions per unit load.

TESTS OF BRICK PIERS.

McGILL UNIVERSITY LABORATORIES, MARCH, 1897.

Dimensions of Pier.	Mortar	Brick.	Crushing Strength, lbs. per square inch. At 1st Crack.	Crushing Strength, lbs. per square inch. Maximum Load.	Age.	Failure. Initial.	Failure. Final.	Compression per foot. 400 lbs. per square inch.	Compression per foot. 800 lbs. per square inch.	Strength of Mortar. 3 in. x 3 in. cube.
8.1 ins. x 8.1 ins. 11.6 ins. high. Joints, 1/3 in. thick.	1 Canadian Portland. 3 Sand.	Ordinary well-burnt Flat Brick.	822	1,234	3 Weeks.	In the Brick.	In the Brick.	.001 ft.	.0025 ft.	711
8.1 ins. x 8.1 ins. 11.6 ins. high. Joints, 1/3 in. thick.	1 German Portland. 3 Sand.	"	990	1,230	"	"	"	. . .	. . .	. .
8.2 ins. x 8.3 ins. 10.5 ins. high. Joints, 1/2 in. thick.	1 English Portland. 3 Sand.	La Prairie pressed, Keyed on one side.	1 130	1,524	"	"	"	.0025 ft.	.004 ft.	. . .
8.4 ins. x 8 4 ins. 10.75 ins. high. Joints, 1/4 in. thick.	1 Belgian Portland. 3 Sand.	"	1,204	1,985	"	"	"	.003 ft.	.0045 ft.	677

N. B.— The crushing strength of a brick similar to those in piers Nos. 1 and 2, laid on flat and bedded in plaster of Paris, was 1,400 lbs. per square inch for first crack, and 2,400 lbs. per square inch maximum load.

The American Schoolhouse. IV.

BY EDMUND M. WHEELWRIGHT.

IN the Hopedale and the Longfellow Grammar Schools we have an opportunity to compare the features and consequent differences of cost of two schools of the same type, built by the same architect, one in the country and the other in Boston, under the requirements of the building laws of 1892.

The Hopedale is a three-story building, with eight schoolrooms and an assembly hall. The exterior walls 16 ins. of brickwork first story and 12 ins. above, both walls with 2 in. air space, and are 20 ins. of brickwork first story and 16 ins. above. The walls of Longfellow School are also vaulted. The floors of the Hopedale school are calculated to carry a live load of 70 lbs. per square foot; those of the Longfellow School, 150 lbs. per square foot. The first floor of this school is mill construction, and the floors of corridors are of fire-proof construction.

ROBERT GOULD SHAW SCHOOL, BOSTON, MASS.
Edmund M. Wheelwright, City Architect.

The basement floors of Hopedale school are finished in concrete; of the Boston school, asphalt. Both schools have carrying partitions of brick, and minor partitions of spruce studding. The Boston school has three-coat plaster work and wire-lathed ceilings in assembly hall and boiler room; the other school has two-coat work and wood lathing throughout. The Boston school has double run of sash in schoolrooms, which are fitted with bookcases, and the walls above blackboards, and ceilings throughout are tinted with water color. These features are lacking in the Hopedale school.

Both buildings have iron staircases with rubber mats, both have sheathed dadoes and plain ⅞ in. baseboards.

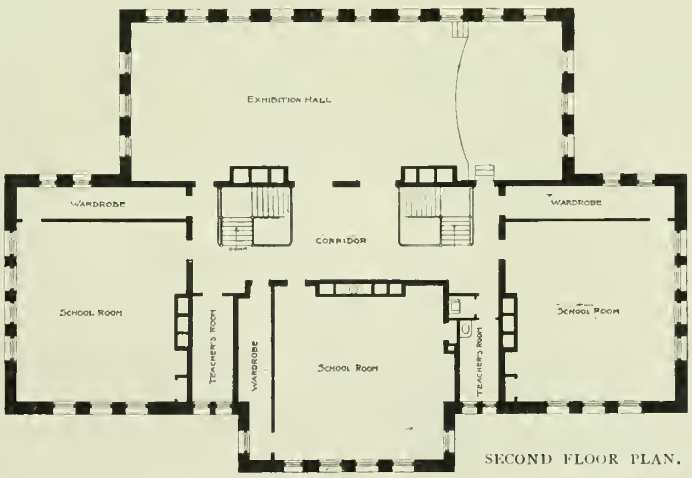
The Hopedale school cost $27,320, or $4,553 per schoolroom.

The Boston school cost $68,308, or $5,692 per schoolroom.

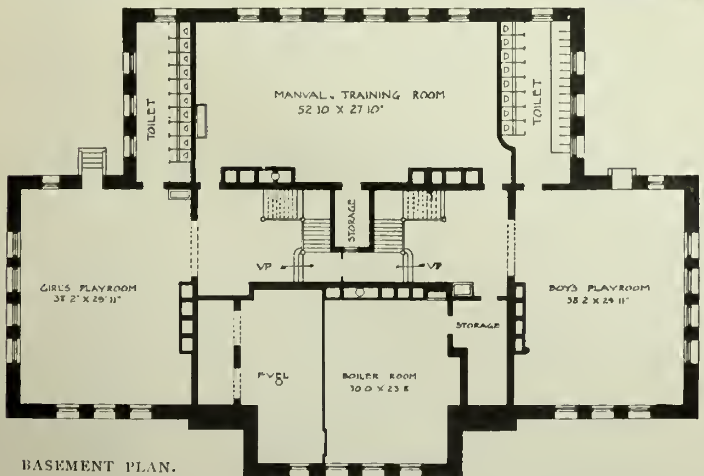
To account for this difference in cost, the first element to be considered is that of the greater expense of building in Boston above that in other places. This would be at least 5 per cent. of the cost in this case. We would, therefore, expect to build at Hopedale a building identical in all its features with the Boston school for $5,307 per schoolroom.

If the Hopedale school had been planned with separate "wardrobes," it would have cost $2,200 more, or $275 per schoolroom, *i. e.*, the cost would have been $4,828 per schoolroom; and further, if the Hopedale school had had as heavy brick and foundation walls, and the same strength of floors as the Boston school, the cost per schoolroom would have been increased $350, or to $5,178, and the general increase in cost of the building, if the Boston building law of 1892 had been followed in the construction of the Hopedale school, would have been $250 per schoolroom, or to $5,428. If the Hopedale school had had fire-proofing between floors, asphalt floors instead of cement in basement, double instead of single run of sash in schoolrooms, three-coat plaster and wire lathing of boiler room and assembly hall, bookcases in schoolrooms, and walls and ceilings above blackboards tinted,—factors of increased cost existing in the Boston school,—the cost per schoolroom would have been increased to $5,698.

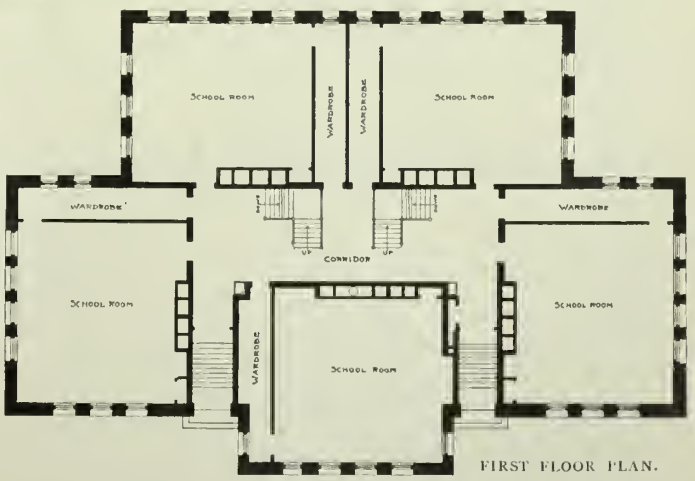
The Hopedale school was heated by indirect radiation. The



SECOND FLOOR PLAN.



BASEMENT PLAN.

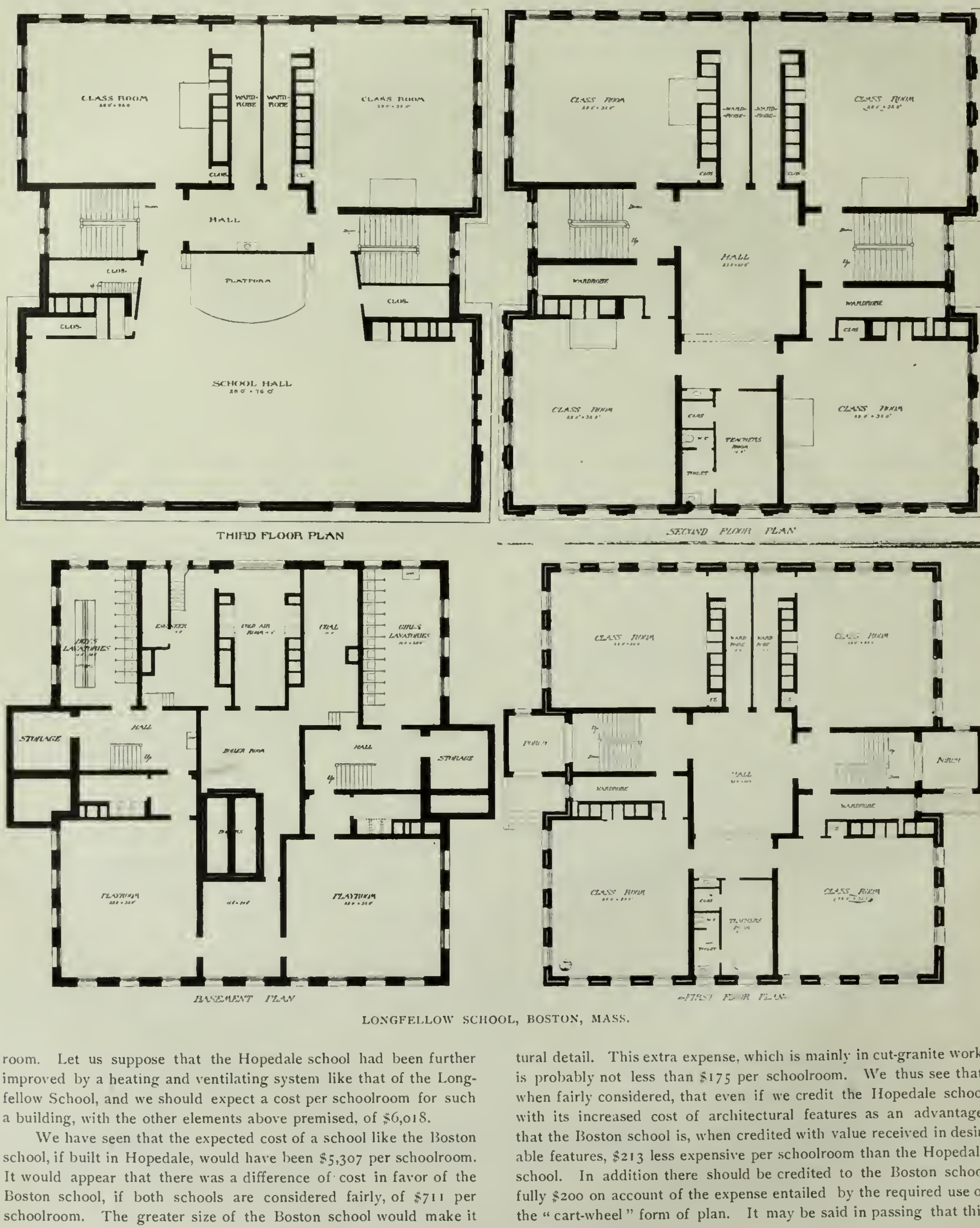


FIRST FLOOR PLAN.

ROBERT GOULD SHAW SCHOOL, BOSTON, MASS.

Boston school had a more perfected system of heating and ventilation, *i. e.*, the heating by direct radiation, and fresh air heated to 70 degs. supplied by a plenum fan. The cost of the heating plant of the Hopedale school was $2,700, or $335 per schoolroom; the cost of that of the Boston school was $7,854, or $655 per schoolroom. Let us suppose that the Hopedale school had been further improved by a heating and ventilating system like that of the Longfellow School, and we should expect a cost per schoolroom for such a building, with the other elements above premised, of $6,018.

We have seen that the expected cost of a school like the Boston school, if built in Hopedale, would have been $5,307 per schoolroom. It would appear that there was a difference of cost in favor of the Boston school, if both schools are considered fairly, of $711 per schoolroom. The greater size of the Boston school would make it normally 4 per cent. cheaper than the Hopedale school; we therefore leave unaccounted for $388 per schoolroom. It is evident that the Hopedale school, while less fully meeting the requirements of plan of the best graded schools, as it lacks separate wardrobes and has not certain important minor features, is more expensive in its architectural detail. This extra expense, which is mainly in cut-granite work, is probably not less than $175 per schoolroom. We thus see that, when fairly considered, that even if we credit the Hopedale school with its increased cost of architectural features as an advantage, that the Boston school is, when credited with value received in desirable features, $213 less expensive per schoolroom than the Hopedale school. In addition there should be credited to the Boston school fully $200 on account of the expense entailed by the required use of the "cart-wheel" form of plan. It may be said in passing that this



LONGFELLOW SCHOOL, BOSTON, MASS.

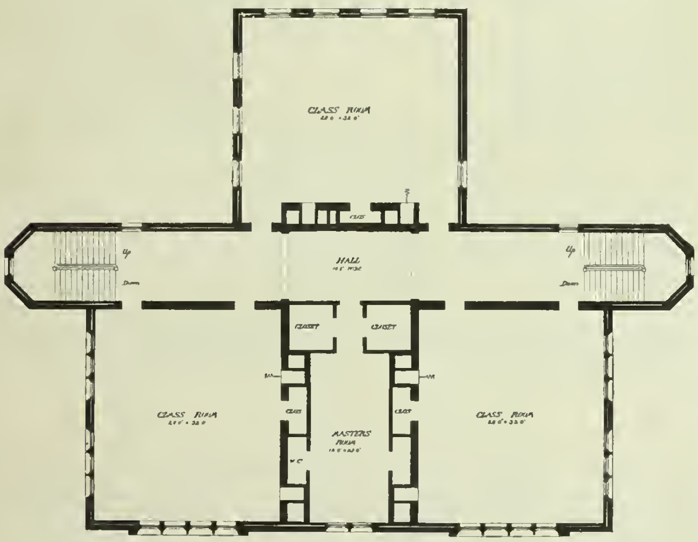
form of plan, while permitting the teacher to sit in all cases with back to a narrow end of a schoolroom and yet keep the principal light on the left of the pupils, has the disadvantage of increasing the cost of construction and of preventing a symmetrical external design. The latter consideration is, of course, a minor one if the method of lighting and control of the schoolrooms proves in practise to be bettered by such arrangement.

The Longfellow School deserves further credit on account of the fire-proof construction of its corridors.

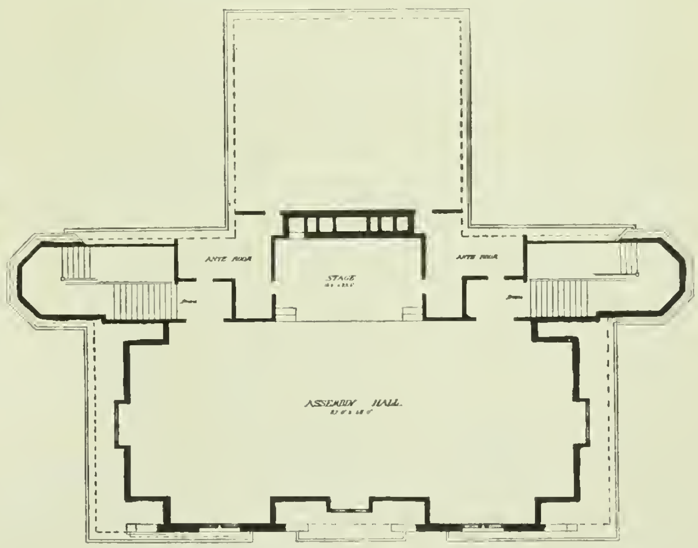
Let us compare the cost of the Longfellow School with that of another Boston grammar school built in its neighborhood previous to 1892 —the Robert Gould Shaw School. This is a building two stories in height, of eight rooms and assembly hall, costing $54,215, or $5,421 per schoolroom. We have seen the Longfellow School cost $5,692 per schoolroom.

We would expect that the Longfellow School, being larger, would cost 4 per cent., and being built under the requirements of the law of 1892, would normally cost 7 per cent. more, *i. e.*, that in this comparison that the Longfellow School should be credited with 3 per cent. of its cost. We therefore credit it with $160 per schoolroom, setting the cost, for purpose of fair comparison, at $5,532 per schoolroom.

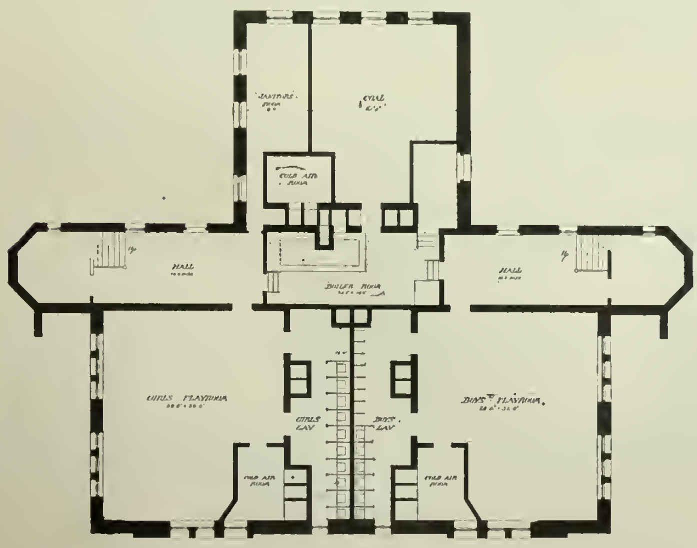
LONGFELLOW SCHOOL, BOSTON, MASS.
Walker & Kimball, Architects.



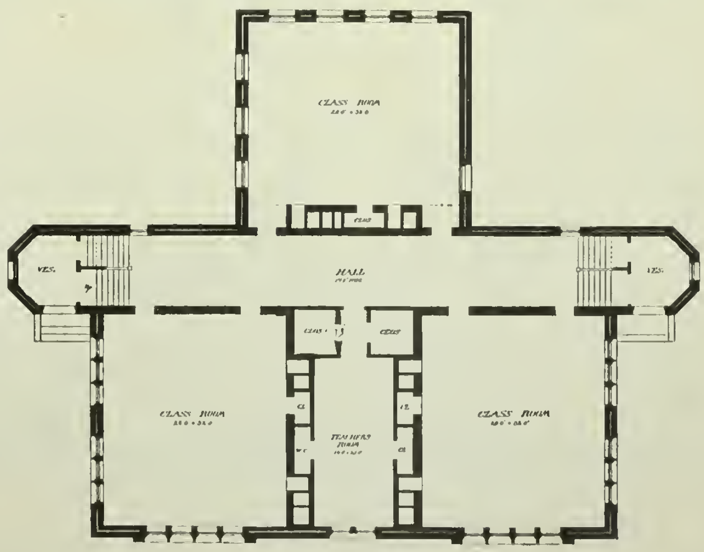
SECOND FLOOR PLAN



THIRD FLOOR PLAN



BASEMENT PLAN



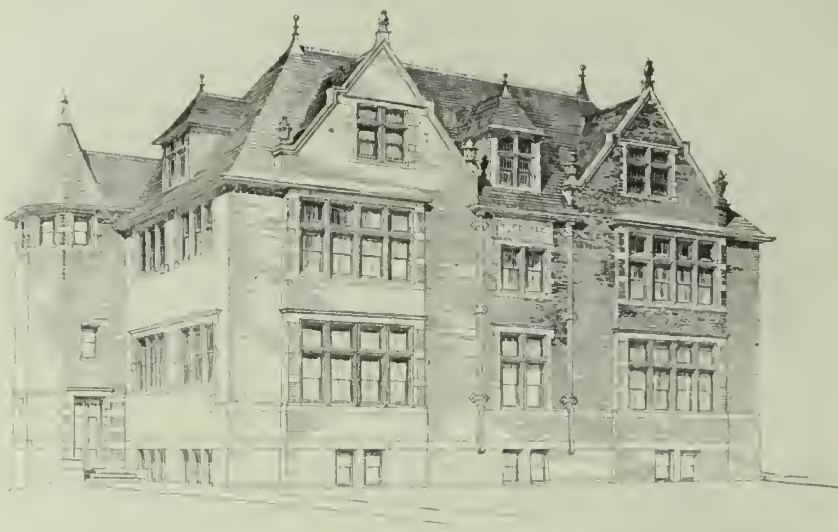
FIRST FLOOR PLAN

GRAMMAR SCHOOL, HOPEDALE, MASS.

The Longfellow School lacks certain desirable features existent in the Shaw School, *i. e.*, terra-cotta lumber minor partitions, cement finish in place of wood, wire-lathed ceilings throughout, hospital instead of ordinary ⅞ in. baseboard. These features add about $60 to the cost per schoolroom, so that to make fair comparison with cost of Shaw School, we should add this amount to the cost of the Longfellow School, making its probable cost, if built under the same law and of the same number of schoolrooms, and under the same specifications as the Shaw School, $5,592 per schoolroom.

The Longfellow School should be credited with its increased cost, due to the adoption of the "cart-wheel" plan, $200, to which should be added $170 per schoolroom on account of fireproof hall and corridor floors.

With this credit given, the unaccounted difference in cost between the Longfellow and the Shaw School appears to be $100 per schoolroom in favor of the former school.



GRAMMAR SCHOOL, HOPEDALE, MASS.
Walker & Kimball, Architects.

The cost of the heating and ventilation of the Shaw School was $564 per schoolroom, or $91 less than that of the Longfellow School. It is probable that the latter school had a greater amount of direct radiating surface, as the Shaw School relied for heat as well as fresh air mainly upon its plenum fan, which was supplanted in the more exposed rooms only by direct radiation.

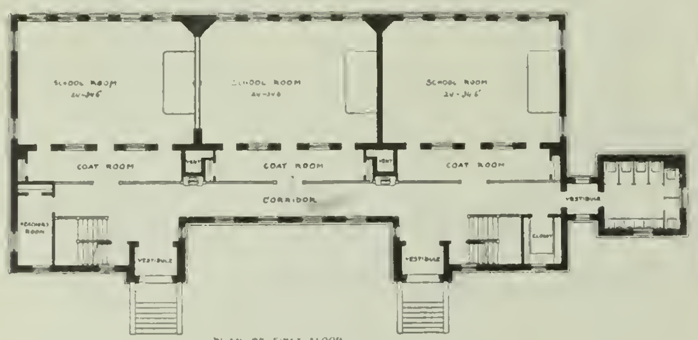
The Shaw School is certainly somewhat less expensive in its external treatment, as but little cut stone is used. If it were profitable to carry the analysis further, we would probably find the net difference in cost between the two schools accounted for by the greater proportionate amount of foundations and external brick wall in the Shaw School, which has the advantage of being two instead of three stories in height, and of not having its assembly hall in the roof.

To more fully establish the fact that where requisite prudence and skill is shown by their designers, the cost of schoolhouses is due to the necessary cost of the features required therein, we will compare the cost of two six-room primary schoolhouses,—the Sewall School in Brookline, and the Margaret Fuller in Boston.

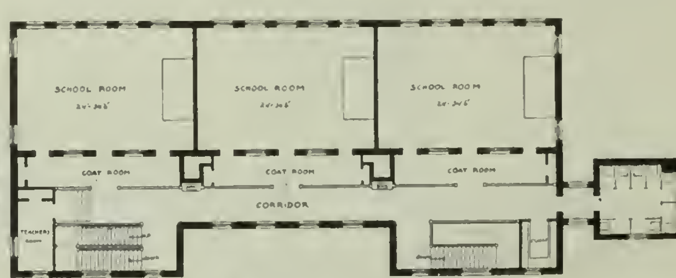
The Fuller School was constructed in accordance with the methods recommended in an earlier paper of this series, and was built under the law which held in Boston previous to 1892. The cost was $6,220 per schoolroom.

The Sewall School cost $5,557 per schoolroom.

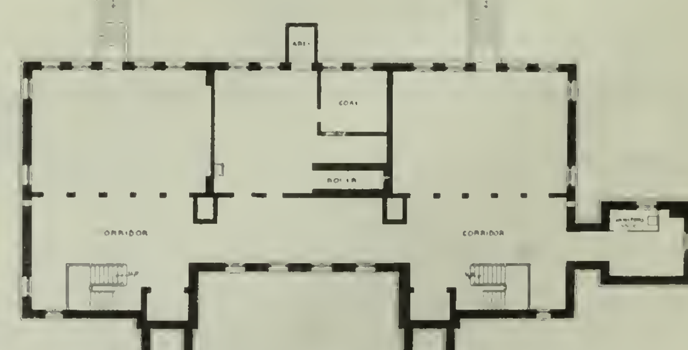
A marked variation of the plan of the Sewall School from that commonly found is the adaptation of the toilet-room tower, a feature of some hospitals. The wardrobes are placed in the corridors enclosed in with screens, as in almost all Brookline schools, and as is, I should judge, the well-nigh general practise in Massachusetts outside



PLAN OF FIRST FLOOR.



PLAN OF SECOND FLOOR.



PLAN OF BASEMENT.

SEWALL SCHOOL, BROOKLINE, MASS.
Cabot, Everett & Mead, Architects.

of Boston. It differs from the Fuller School in the following points of construction: —

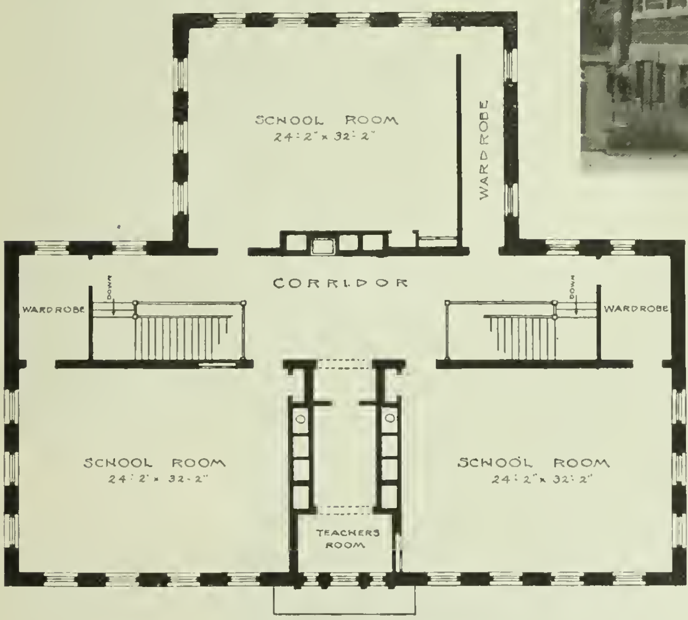
The exterior walls are 12 ins. with 2 in. air space; the interior bearing walls are 8 ins. instead of 12 ins., as in the Fuller School. The sashes are single run, minor partitions are of studding, except ceiling of boiler room, which is wire lathed; all plastering is on wooden laths, the staircases are of wood, the interior finish is of whitewood, the dadoes are of sheathing, and ordinary baseboards are used. The basement floor is of concrete.

If the Sewall School had been constructed as was the Fuller School the features used as substitutes for those noted above would have increased its cost $900 per schoolroom; *i. e.*, if its construction had been that of the Fuller School it would have cost $6,457.

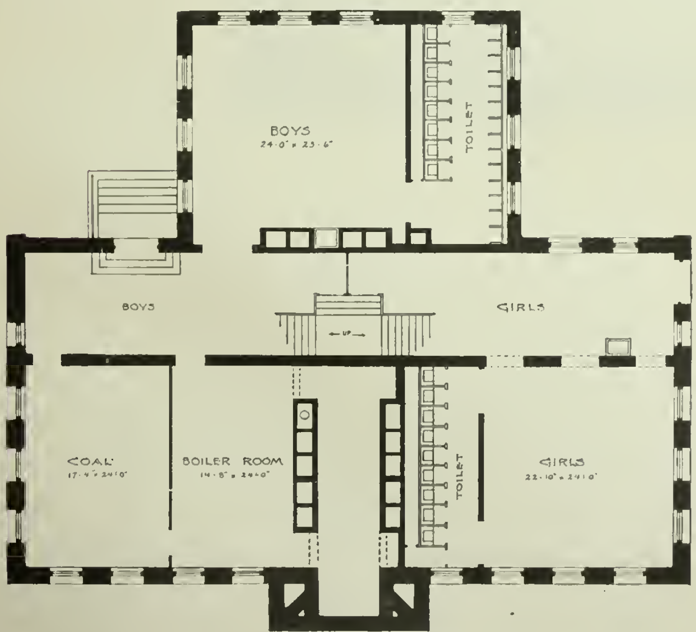
MARGARET FULLER SCHOOL, BOSTON, MASS.
Edmund M. Wheelwright, City Architect.

This excess of cost is probably due in part to the greater length of schoolrooms,— in the Sewell School, 34 ft. 6 ins., instead of 32 ft.,— but more to the toilet-room tower, a feature which scarcely appears to be worth the increased expense, unless the space required for toilet rooms in the basement is needed for some other purpose, for there is no disadvantage in having the plumbing fixtures in the basement providing they are properly ventilated, as they readily may be, without any cost for ventilation, as will be later shown.

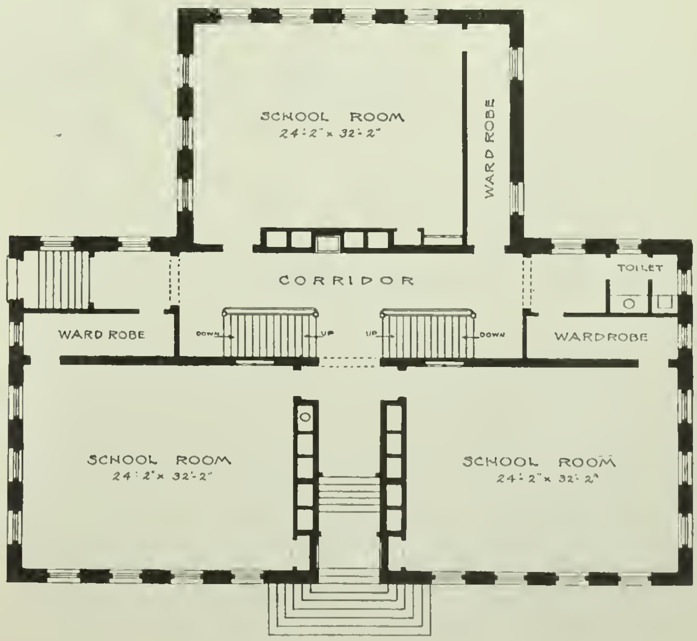
The omission of the middle window in the wall immediately facing the teacher is noteworthy in this plan. It is a method often found in French schools, and would appear to afford sufficient relief to the teacher's eyes to take away the excuse of pulling down the shades in the windows on this wall, as is often done, to the injury of the proper diffusion of light in the schoolroom.



SECOND FLOOR PLAN.



BASEMENT PLAN.



FIRST FLOOR PLAN.

MARGARET FULLER SCHOOL, BOSTON, MASS.

Brick and Marble in the Middle Ages.

BY G. EDMUND STREET.

(*Reprint.*)

I HAVE already spoken of the exquisite beauty of the inlaid marble in St. Mark's; nothing can be better than their effect, and nothing seems more wonderful than that they should not have been used more frequently in later buildings. I was, perhaps, a little disappointed in not finding, as I had expected, the marble arranged generally in geometrical patterns; but this is quite the exception; and one sees only, in a medallion here and there, the exquisite beauty which their arrangement in this way may produce. As a rule, the walls are faced with thin slabs of marble, of the size in which it came to hand, sawn into as many slices as its substance would allow, and then riveted to the walls and held in place securely by projecting thin lines of stonework built into the wall, and cut with indented or billet ornaments along their edges. There is, however, a degree of real as well as apparent weakness which is not at all satisfactory in this system of incrustation, and I thought how much more noble such work might well become, were it to be inlaid only where no strong work was required to be done — as. *e. g.*, in spandrels of arches,[1] or within arches — and not, as here, to the concealment of every one of the necessary constructional features. It is to be observed, however, that the slabs of marble are generally higher than they are wide, so as at once to destroy any thought of their being really constructional.

ST. MARK'S, VENICE. WINDOW IN WEST FRONT.

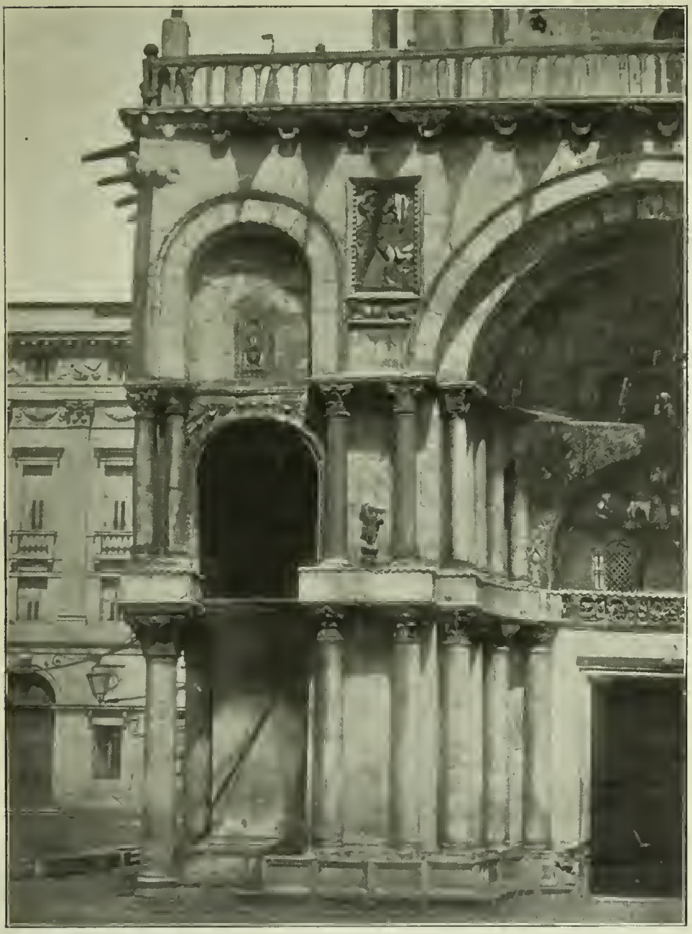
The south side of St. Mark's is, perhaps, the place above all others in Venice where this inlaid work may be seen to the greatest advantage. Some of the great arches which stand in place of gables are divided into four or five square-headed lights by shafts supporting semicircular arches, the tympana of which are filled in with delicate and perpetually varied filigree work in marble, whilst above them a succession of panels or medallions shows all the resources of the rich materials which were to be exhibited. In another case, just over the entrance from the Piazzetta to the church, the tympanum of the arch is filled in with large medallions, one exquisitely carved, the others plain; whilst the arch of the window below the tympanum has its beautiful marble spandrels adorned on either side with medallions, which, for exquisite arrangement of vari-colored marbles in geometrical patterns, are perfectly admirable. There is enough, therefore, in the Venetian system of incrustation, though much unhappily be lost, to give ample food for our study and admiration; and its only weak point is, as I have said, its too frequent neglect or concealment of the constructional features of the buildings it adorns. It is easy, however, to cavil at particular details, and scan with a critical eye the architectural beauties of Venice; but let it not be thought for an instant that all the wonderful pictures which every new turn or new point of view brings before the eyes are unappreciated. A few days spent there suffice almost to fill a lifetime with reminiscences of all that is novel, beautiful, and strange; and days such as I have spent, year after year, rejoicing in the daytime in the full brilliancy of a September sun, and at night in the calm loveliness of a Venetian night, have been just the most delightful in every way that could be passed.

We were at Venice on the festival of the Nativity of the Blessed Virgin, — a great feast day, which it had been my fortune to spend some two or three times before in Roman Catholic countries. I confess that here we were not edified. We came in, as we went from church to church, for rather more than the usual number of the *désagrémens* which always seem to attend the decoration of the churches, and especially the altars, for such festivities abroad. The strongest impression left on my mind was one of wonder at the paltry character of the long array of what by courtesy are called, I suppose, wreaths of flowers, manufactured of pink gauze, or some equally unnatural material. These, with vulgar draperies hung outside the church doors, and in additional quantity about the altars, with the most noisy and gladsome ringing of bells, completed the external demonstrations; all the shops were most studiously closed, and the churches and open places were thronged with people. At St. Mark's, we heard[2] some abominably light opera music, which sounded, as may be imagined, very discordant within its solemn walls.

One morning we devoted partly to the ascent of the campanile in the Piazza. The ascent is entirely by inclined planes; the outer walls of the tower are, in fact, double, and in the space between them these inclined planes are formed, and it is worth notice that to this day, in all buildings which we have seen in progress in this part of the world, inclined boards are used instead of ladders for obtaining access to scaffolding, and in one of the mosaics in the entrance porch of St. Mark's, where the building of the Tower of Babel is depicted, precisely the same kind of arrangement is shown. This is interesting, as showing the tenacity with which old customs are adhered to. The view, when the top is reached, quite repays the labor of the ascent, as it gives the best possible idea of what Venice really is. We get an impression of a very densely populated town, hemmed in on all sides by water, and looking very flat and low; in the distance small islands pave the way to the mainland, or shelter us from the

[1] It was only so used in the Ducal Palace.

[2] I have heard a polka played by the organist in St. Mark's!



ST. MARK'S, VENICE. THE NORTHWEST CORNER.

It is not without purpose that I have held silence with regard to the churches and buildings generally of the Renaissance school in Venice. These have had in their time many more admirers than have the examples of architecture which it was alike my business and my delight particularly to examine; and to the present day I doubt not that nine people out of ten, led by their *valets-de-place*, go to see what is worst in point of taste, and so reap the reward of allowing themselves to be made to see with another's eyes, instead of enjoying the intense pleasure of working out and exploring for themselves all the treasures of this mine and storehouse of ancient art. It is partly because I feel the greatest repugnance to the buildings themselves, and partly because I fear to make my notes, already lengthy, far too long for the patience of my readers, that I do not venture upon this additional field of study; but not in the least degree because I doubt the result, for I believe firmly that, tried by the fair rules which must regulate merit in a constructive art, the Renaissance buildings of Venice would be no nearer perfection than those of any other city. Something perhaps there is in the gloomy grandeur of their vast masses, rearing their rusticated walls and deeply recessed windows darkly above the comparatively cheerful and bright-looking walls of the neighboring Gothic palaces, which may impress the minds of some, but they must be of a somber temperament who really love them. Still more must they be of a tasteless temperament who can endure with patience the succession of eccentricities with which Palladio and his disciples have loaded their churches. I pretend not, however, to discuss the point. I had not time for everything, and preferred giving up the attempt to like what from my heart I have ever disliked, and what nothing that I saw in Venice would make me dislike at all less heartily.

Neither do I pretend to say anything about Venetian pictures; guides without number may be found of more service and more knowledge, and to their hands I leave their proper charge. A word

sea; these, where they are more distant, look like mere black spots on the smooth, unrippled expanse of water, and in the far horizon we see to the west the purple outline of the mountains about Vicenza; and to the north of these, and rising grandly into the sky, the snowy peaks of the southern range of the Friulan Alps. Below and around are countless churches, all placed confusedly without respect to orientation — a neglect, if anywhere excusable, surely so here, where land is the exception and water the rule.

The last day we spent in Venice was most enjoyable. We had been all day in our gondola, now stopping to sketch some Gothic palace, anon shooting into some narrow canal to escape the bright heat of the sun, winding our way now here, now there, just as the fancy of the moment siezed us, and realizing more than ever that "the longest summer's day was all too short" for a last day in so fair a place. In the evening, just before sunset, we went out into the Lagoon, and, rowing round the small island of Giudecca, watched the gradually waning light reflected on the smooth, calm water, which seemed too silent and too soft to be disturbed by a word from any of us; and then at last, turning back and coming suddenly through a short canal into the main stream just opposite the Dogana, we moved on gently till we came abreast of the Ducal Palace. The moon was rising behind us in all her beauty, and in front, lamp after lamp was suddenly lit along the Piazetta, then along the palace front, all along the Riva dei Schiavoni, until at last, before we landed, the bright lights, reflected in a hundred gleaming, flashing lines, were fitfully dancing in long streams of light upon the bosom of the waters.

We stepped on shore, to find ourselves led on by the sound of military music, and to be tempted by the luxury of ices eaten *al fesco* in the Piazza; and then, when the crowd gradually dispersed, we, too, among the last, found our way to our hotel, charmed so much with our last night in Venice that it is impossible not to recollect that evening with the deepest pleasure.

ST. MARK'S, VENICE. SOFFIT OF ARCHIVOLT OF CENTRAL DOOR, MAIN FRONT.

ST. MARK'S, VENICE. VIEW IN THE NAVE.

only upon one point — their adaptation, namely, to the sacred edifices of which they are the most notable ornaments.

Now I must at once say that there is no church, so far as I saw, in Venice, with the single exception of St. Mark's, which is to be compared in this respect (in its effect, that is, as heightened by color) with such buildings as the Arena Chapel at Padua, or the church of Sta. Anastasia at Verona — the one an example of the very noblest art working under strict architectural limitations; the other, of simple decorative painting. The fact is, that the Venetian pictures give the impression that they might do elsewhere as well as in a church, and therefore entirely fail in identifying themselves with the walls on which they hang; whilst no one can ever think of the noble works of Giotto at Padua without recalling to mind the religious order of his works and their identification with the building which contains them; and at Verona the result of the system adopted in the painting is marvelously to enhance the effect of the architecture without in any way concealing or damaging it. In Venice the case is quite different. The church of San Sebastiano, in which Paul Veronese is buried, and which internally is almost entirely covered with his paintings, is an example of what I suppose I must call the best Venetian treatment. This consists, however, of immense oil paintings covering entire walls, and absolutely requiring, in order that they may be at all properly appreciated, that the spectator should stand in a particular spot,— in some cases by the side of the altar,— and that the windows should first have blinds drawn down, and then, when he goes to look at another painting, have them drawn up again. This is all very unpleasant. But besides this, there is no very sensible advantage to the color of the buildings from these decorations; certainly they are far behind mere decorative paintings as vehicles for bringing out the architectural features: and so they are visited very much as pictures in a gallery, and without in any case being identified with the churches in which they are preserved. The mosaics at St. Mark's are, on the other hand, some of the very grandest examples of the proper mode of decorating interiors with representations of religious subjects, all conceived and arranged with some order and relation to each other. But of the other Venetian churches there does not seem to me to be any one whose artists at all succeeded in equaling the example so early set them.

I do not pretend, in these pages, to speak at all of paintings irrespective of architecture, or I might find much to say upon the store of works of a very noble school in which this great city is so rich. The immense rooms of the Ducal Palace, covered as their walls and ceilings are with the works of Tintoretto, Titian, and Paul Veronese, cannot be forgotten, still less can the many works of Giovanni Bellini, and of other painters in the churches, and in the collection in the Accademia — rich among others in the works of that great and interesting painter, Carpaccio,— be passed over, whilst the decorated walls of the various Scuole are in many cases of hardly inferior interest. I am sorry that I was obliged to take the great merits of some of the grandest works somewhat on faith; it was in vain to think of actually studying them in a short time, and, educated as I have been, to love the works of an earlier date and another school more heartily than these, I must confess, barbarous as the confession may appear to be, that I was not thoroughly pleased with what I saw. The magnificence of the chiaroscuro and coloring of these great pictures scarcely atoned to me for the degree to which, owing generally to the immense array of figures and confusion of subject, I failed to carry away distinct conceptions of the story intended to be told. It may be said that this is the result of want of taste or education, but still the feeling is so different when for the first time pictures by Fra Angelico, Giotto, Raffaelle, Perugino, or Francia are looked at, that it is hard to avoid believing that, though their power over color may have been somewhat less, their power of attaining to the highest point of the true painter's art, that of leaving indelible impressions on the minds of all beholders, was immeasurably higher. Thus much only by way of excuse for not saying more about what the world in general rightly conceives to be one of the great glories of Venice.

ST. MARK'S, VENICE. THE NARTHEX.

Fire-proofing.

THE LIVINGSTON BUILDING FIRE.

APROPOS of the recent fire in the Nassau Chambers in New York, Chief Bonner is quoted as saying that there is no such thing as a fire-proof building. The experience of the Livingston Building points to a very different conclusion. This structure was designed and erected by Hill & Turner, in New York, and has been occupied for about a year for light manufacturing purposes. The building is fire-proof in its construction according to the most approved types. The beams are protected by 8 in. end construction, hard, hollow-tile arches of spans of about 6 ft., the bottom flange of the beams being protected by the terra-cotta being carried underneath. Each story is practically undivided, a narrow stairway being carried along one of the party walls adjoining the elevator, both the stairway and the elevator being enclosed by a solid plaster partition. The doors and door casings are of wood covered with asbestos and a surface of metal. Late in the afternoon of January 18 a fire was discovered in the fourth floor, which was occupied by furriers, and was stored full of highly combustible material, besides having a quantity of low wooden partition work. The outside windows on two streets were quite large and the glass was speedily broken so the flames had ample supply of air, and all the conditions were favorable for developing an intense heat. The fire had headway of about twenty minutes before the firemen were able to get at it, and there is abundant evidence of the extreme heat developed, as shown by the brass castings of some of the steam radiators which were melted entirely off, as well as by the fact that the steam pipes became so softened that they sagged out of shape. In fighting the fire, three or four lines of hose were carried up the stairway and jets of water directed from the door opening directly into the undivided room. Tarpaulins were banked up across the inside of the threshold to form a dam, which enabled the firemen to flood the whole story with water until it ran over outside the window sills. A water tower also threw a heavy stream of water in from the outside.

The contents of the story and the wooden finish were destroyed. In one place on the ceiling, in such location as would indicate that it was a special focus for the streams from the firemen's hose, a section of the bottom flanges of the floor arches was broken or burned away, this whole section being somewhat less than 3 ft. square. The vertical webs of the terra-cotta were intact. At another position near one of the outside windows, a space of a few inches square was missing from the bottom flange of one of the floor arches. As far as could be ascertained, this was the only damage to the terra-cotta. The ceiling throughout was heavily plastered with machine-mixed mortar. This plastering had come off in a number of places, but nowhere, except at the points mentioned, was there any appearance of damage of any sort to the terra-cotta. None of the ironwork seemed to have been affected a particle. The flames lapping outside the building communicated to the upper story, but beyond the smoke and water no damage was done above the floor in which the fire started. In the story below, occupied by a tailor shop and crowded by material, a relatively slight amount of water came through from above, but not sufficient to cause any damage. The heat against the outside walls in places was so intense that over considerable areas of the brickwork, which is of hard, thoroughly well-burned red brick, the surface was entirely gone for a depth of from one eighth to one fourth of an inch. On the exterior of the building, which is finished entirely in brick and terra-cotta, there was some damage to the projections of the belts and cornices in the lower stories caused by the firemen. In a few places, also, the corners of the brick piers in the fourth story were slightly corroded by the heat, and, of course, the smoke made the building appear to be damaged considerably in the upper stories. The extent of the structural damage, however, can be appreciated by the fact that though the building cost over $100,000, we are informed that the insurance companies have offered to settle all the fire loss for $5,600. The fire occurred on Wednesday afternoon. The following morning the electric plant and the elevator were in operation and constant use, and on Friday morning manufacturing was started in the lower story.

There was sufficient heat developed to have utterly destroyed any ordinary construction, and the lessons of this fire are particularly valuable as showing that it is perfectly possible to so construct a building with terra-cotta rightly used that no fire from within can any more than burn out the contents.

REPORT ON A RECENT FIRE-PROOFING TEST.

WE have had occasion to make several comments upon tests of building materials, and though the subject is one which probably will never be permanently settled, and there will always be an irrepressible conflict between the various mediums which are used for the fire-proofing of building constructions, and differences of interpretations of tests, no less than the differences of measurements of values, will always be biased by the point of view, we feel that, in justice to the burnt-clay industries which we represent, it is fair to call attention to some points which ought to be considered in forming a judgment of a recent comparative test in New York. Our readers can draw their own conclusions as to the value of such tests and the importance thereof. On November 19 a fire test was made of two constructions, one a suspended concrete system and the other a terra-cotta block end construction. The terra-cotta was purchased in the open market, and theoretically represented the product that is put forward by the manufacturers; but the deductions from the results of the test were so at variance with recognized facts that Mr. H. M. Keasbey, the president of the Central Fire-proofing Company in New York, felt that it was desirable to investigate a little more closely the conditions under which the terra-cotta was tested. This investigation was conducted by Mr. Julius Franke, architect, who reported as follows: —

"On October 19, when I made my first inspection, the hollow-tile arch had been built, and as no concrete had then been put on top of the same, I noticed that the key of the arch was not in the center, that tiles of different patterns, not made to be built into the same arch, were used, and that some of the cement mortar which I took off the top was very poor, the same crumbling between my fingers.

"I found that the concrete arch, which had been built alongside of the tile arch as per drawing attached hereto, was so placed that if the space, about one fourth of an inch between the plates, marked 'A' on the drawing, were filled up, the expansion of the concrete arch, which could be caused by fire, would deflect the beams, causing a lateral thrust along the top of the hollow-tile arch. This would cause damage to the latter, particularly as its key was not in the center.

"After the fire test I examined the arch again and found that the middle third, including the skew-backs, had fallen, and that the two thirds remaining had joints open at the bottom; but that most of the mortar with which the bottom of the tiles had been plastered had remained on the tiles, and that the space between the plates marked 'A' on the drawing had some cement or mortar in the same. I also found that the concrete filling on top of the arch was very poor, not being strong enough to resist any strains.

"The fact that the mortar remained, and also that the sides of the kiln or oven were damaged very little, showed that the damage done to the arch by fire must have been very slight. I therefore came to the conclusion that the arch failed because it was improperly built, having the key off the center, being constructed of different patterns, and because the cement was not of the best; and also because when the concrete arch and concrete beams formed by boxing the tie-rods became hot they expanded and caused a movement in the joints of the tile arch by a lateral thrust. This weakened the arch sufficiently to allow the weight which was on top to act upon the arch block marked 'X,' causing it to slide and break the arch.

This could all the more readily happen as the style of arch employed was an end construction of a pattern that had very little bearing surface at the joints of the arch, and very little or no side bond, and also because the concrete filling was very poor; so that if only one key or arch block gave way and let down its load, the rest would follow, particularly with a load of cobble stones such as was on this arch."

This report and the results of the test seem to emphasize what is admitted by all experts on fire-proof material, namely, that terra-cotta, though of itself admittedly a perfectly satisfactory medium for fire-proofing, must be set right in order to accomplish its purpose, and that no test of a material is reliable which shows failure to be caused by improper workmanship.

FAILURE AND EFFICIENCY IN FIRE-PROOF CONSTRUCTION.

UNDER the above title an article appeared a short time since in the so-called technical department of the *Architectural Record* which undertook to compare some existing systems of fire-proof construction, drawing conclusions therefrom that terra-cotta was a failure as a fire-protecting medium, and that the only proper material to use was a system of concrete construction as designed and applied by a particular firm. The fact that the article in question appeared in what would more properly be styled the advertising department of the *Record*, and that it was evidently inspired by the firm whose product was placed at the head, robs it of its value as a statement of exact conditions. It is perhaps hardly worth while to undertake a criticism of an advertisement except in as far as appearing in the form referred to it may have seemed authoritative. It takes up terra-cotta, weighs it in the balance, finds it wanting, and summarily disposes of it so that nothing is left; and yet, strange to say, the very instances which the article quotes as demonstrating the failure of terra-cotta are the very ones which are quoted by the warmest advocates of burnt clay, to support their claims in regard to this material as a fire protector. On the other hand, judging from this article, concrete is impregnable, and whether attacked by fire or water, no matter what the degree of exposure, it is absolutely unyielding. Now a little common sense will show that this is not a correct statement. While our position is that terra-cotta affords all the needed protection for the most severe exposures to which any ordinary building is subjected, it is beyond question that even the best of terra-cotta applied in the most thorough way could be destroyed utterly by a sufficient degree of heat; but long before the best kinds of terra-cotta would begin to melt and run down, a condition which, judging by the *Record* article, is a usual concomitant of exposure, any cement construction would be heated to redness if not entirely destroyed, and concrete which is red hot is not a very efficient protection for structural steel work. The question of fire-proof material is really a very simple one, and any one who is so disposed can make the most convincing sort of test by taking a small fragment of ordinary porous terra-cotta and a small fragment of the cinders concrete which is usually employed for concrete constructions, and holding a piece of each in his hands, expose the other end to the flame of a blowpipe. He will drop the piece of concrete first. Some time afterwards he will have to drop the terra-cotta. If while hot they are dropped directly into a bucket of water, the most casual inspection will satisfy any one that what is left of the concrete is hardly the material that is most desired for the protection of a building. Concrete is cheap, terra-cotta is not; therein lies the secret of the possibilities of the use of the former material.

Another point. If terra-cotta arch blocks are set in place with only ordinary care, they can be depended upon to serve their purpose. Concrete, on the other hand, has to be mixed most carefully in order to secure a uniform and reliable product. As, in a large building, the bulk of the work is of necessity entrusted to laborers who can be depended upon *not* to think or be careful, the chances are decidedly against a satisfactory mixture of concrete, thereby largely increasing the odds in favor of terra-cotta.

Mortar and Concrete.

WE publish below a circular recently issued by the Committee of the American Society of Civil Engineers, on the Proper Manipulation of Tests of Cement, and we would specially direct the attention of our readers to the questions contained in this circular and to the request of the committee for information upon this important matter. It is well recognized that the testing of cement, unlike the testing of metals, rests upon a very insecure foundation, and different manipulators succeed in getting from the same material, results varying sometimes by several hundred per cent. It is for the purpose of devising, if possible, some rules of manipulation which will prevent such diversity that this committee has been appointed, and it is hoped that it will receive the support of those who manufacture or use cement. The attention of our readers is specially directed to the fact that copies of the circular may be obtained from the chairman of the committee, who desires that this circular may reach all persons who would be likely to give the committee the benefit of their experience.

BOSTON, Jan. 15, 1898.

Dear Sir: — The Committee on the Proper Manipulation of Tests of Cement earnestly requests that you will give full and careful consideration to the following questions, and that you will, as soon as convenient, send to the chairman complete and explicit replies, giving the result of your experience and the embodiment of your views. Any additional suggestions or information bearing upon the subject which you may desire to communicate will be thankfully received by the committee.

This circular has been sent to every member of the American Society of Civil Engineers, and to many others, but in order that it may reach everybody whose opinion will be of value, you are requested to mention the names and addresses of any persons, not members of the Society, who, in your opinion, should receive it, and who will be likely to assist the committee in its work.

You are also requested to send with your answer copies of any specifications for cement which you may have used, or any other information bearing upon the subject, which you think would be of interest.

As the duties of the committee will require considerable time and labor, you are earnestly requested to respond as promptly as is consistent with a careful consideration of the questions asked.

Yours very truly,

GEORGE F. SWAIN, *Chairman;*

O. M. CARTER, W. B. W. HOWE, ALFRED NOBLE, L. C. SABIN, GEO. S. WEBSTER, HERBERT W. YORK, *Committee.*

Address: Prof. GEO. F. SWAIN, Massachusetts Institute of Technology, Boston, Mass.

SAMPLING.

1. In the works which you have carried out, how much cement have you been willing to accept on the results obtained with a single sample?

If this depends upon the kind of work or reputation of cement, please indicate.

2. What method do you recommend for obtaining a sample from a package?

3. Do you mix cement taken from several packages to obtain a sample to use in testing, or are the samples from the several packages kept distinct?

CHEMICAL ANALYSIS.

4. When do you consider a chemical analysis essential or desirable?

5. What elements or compounds should be determined?

6. What do you consider the best methods of determining these compounds with sufficient accuracy?

MICROSCOPICAL TESTS.

7. Are microscopical tests of value, and, if so, when?

8. What power microscope is required, what observations should be made, and what are the indications?

FINENESS.

9. What sizes of mesh should be used in testing fineness of Portland cement? What for natural cement?

(If these questions are answered by stating the number of meshes per linear inch, please mention, also, the size of wire without reference to any wire gauge.)

10. What should be the diameters or sizes of the screens ?

11. How large a sample should be tested ?

12. Should any machine for shaking be used, and if so, what form, and what should be its manipulation ?

13. How long should the shaking be continued ?

14. Should there be any difference in manipulation for fine and coarse screens, or for different kinds of cement ?

APPARENT DENSITY OR WEIGHT PER CUBIC FOOT.

15. What is your opinion of the value of this test ?

16. What apparatus do you prefer, and how should it be used ? (Please state any special precautions to be observed.)

TRUE DENSITY OR SPECIFIC GRAVITY.

17. What is your opinion of the value of this test ?

18. What apparatus do you prefer, and what is the method of manipulation ? (Please state any special precautions to be observed.)

STANDARD SAND.

19. What kind of sand should be used in tests of mortars ? Would you recommend a natural sand or crushed quartz ?

20. What fineness should be specified, and what degree of variation in size of grain should be allowed ?

PREPARATION OF PASTES AND MORTARS FOR TESTS OF TIME OR SETTING, SOUNDNESS, AND STRENGTH.

21. Should the same method of preparation be used for each test ?

22. How should proportions be stated ?

23. What should be the consistency of the pastes and mortars for the various tests, and how may this consistency be specified and determined in order that similar results may be obtained by all operators ? (This question is intended to embrace, not only the correspondent's views as to what consistency should be used, but also as to devices for determining when the proper consistency has been obtained. It is hoped that this question will receive full and careful consideration.)

24. What should be the temperature of the materials used in mixing ?

25. What should be the temperature of the air at mixing ?

26. How should the quantity of water used in mixing be defined ?

27. What should be the method of mixing ?

28. Do you prefer hand or machine mixing ? If the former, please describe manipulation in detail.

29. If the latter, what machine do you prefer, or what form would you suggest for trial ?

30. Do you know of any machine that has given good results ? If so, what is the method of manipulation, and what are its advantages and defects ?

31. How long should the mixing be continued ? Should this be defined by stating the length of time, or by reference to the character of the resulting mortar ?

TIME OF SETTING.

32. What do you consider the best method of determining the time of setting ? (Please describe apparatus and manipulation.)

33. How shall the beginning of the set be defined ?

34. How shall the end of the set be defined ?

35. Should this test be made on neat cement paste, or on mortars, and if the latter, what proportions of cement and sand should be used ?

36. What should be the consistency of the mortar ? (See 23.)

37. What should be the temperature of materials and of air, quantity of water, and method of mixing ? (See 24, 25, 26, 27.)

38. What should be the method of making the pats, or of filling the molds, if they are used ?

39. How shall the pats or briquettes be treated during setting ?

40. What should be the temperature of the water in which pats are placed ?

SOUNDNESS.

41. What do you consider the best test for soundness in the case of Portland cement ? What in the case of natural cement ? (Please describe in detail the process recommended, and indicate any necessary precautions to be observed. If the process you prefer is too elaborate for any but a well-equipped laboratory, please indicate, if possible, any modifications for ordinary use, and give your opinion of the reliability of such simpler tests.)

TENSILE STRENGTH.

42. What proportions of cement and sand should be used in mortar for tests of tensile strength ?

43. Do you advocate adhering to the American Society of Civil Engineers' form of briquette in future requirements ? If not, what form do you prefer ?

44. Is your preference based on comparative experiments, or is it the result of satisfactory experience with one form ?

45. Upon what sort of a surface should the briquette be made ?

46. Should the briquette be finished with a trowel on both sides ?

47. What should be the consistency of the mortar ? (See 23.)

48. What method of filling the molds do you advise ? Do you recommend the use of a machine for molding, and if so, what form would you suggest ?

49. Have you used the machine you suggest, and have the results been satisfactory ?

50. How should the briquettes be treated during the first twenty-four hours after molding ?

51. How should they be treated during the remaining time until tested ?

52. If placed in water, how often should the water be renewed, and is it important that it should be maintained at a nearly constant temperature ? What should that temperature be ?

53. At what age should briquettes be broken for acceptance tests on ordinary work ?

54. Under what conditions would you deem it essential to make longer time tests ?

55. Will weighing briquettes before testing give information of value, and, if so, what ?

56. What form of clip do you prefer ?

57. What should be the distance between opposite gripping points of the same clip ?

58. What should be the rate of applying the stress ?

59. What style of testing machine do you prefer ?

60. Can you suggest any desirable modifications to machines now in use ?

61. What special precautions are necessary in breaking briquettes ?

COMPRESSIVE STRENGTH.

62. Do you advise compressive tests, and, if so, why ?

63. What form and dimensions of test piece do you prefer ?

64. Should the test piece be treated differently as regards manipulation of mortar, mixing or setting, from tensile specimens ? If so, please state in what particulars, and why.

65. How should the specimen be prepared for the testing machine ?

66. What form of testing machine do you recommend ?

67. What should be the rate of applying the stress ?

TRANSVERSE STRENGTH.

68. Do you advise bending tests ? If so, under what conditions and why ?

69. What form and dimensions of test piece do you prefer ? What span ?

70. Should the test piece be treated differently as regards manipulation of mortar, mixing and setting, from tensile specimens ? If so, please state in what particulars, and why ?

71. What form of testing machine should be used ?

72. What should be the rate of applying the load ?

MISCELLANEOUS.

Under what conditions do you consider the tests indicated below necessary or desirable ? What should be the manipulation for the test if used ?

I. — Adhesion.

II. — Abrasion.

III. — Resistance to freezing.

IV. — Resistance to action of sea water.

The Masons' Department.

CONCERNING THE RIGHTS OF CONTRACTORS AND AUTHORITY OF ARCHITECTS.

IN response to the application of Lynch & Woodward for an injunction against Josiah Quincy *et al.*, Judge Richardson, of the Massachusetts Superior Court, has passed upon the merits of the case in a decision which is of unusual interest to architects, contractors, and mechanics. The facts which led up to the legal proceedings are briefly these: Messrs. Lynch & Woodward obtained the contract for heating a public bath house now being built for the city of Boston, on Dover Street. In their contract with the city was a clause which has of late been inserted in all contracts for city work, providing that "preference shall be given to union labor." Messrs. Lynch & Woodward had up to the time of signing this contract run what is known as a non-union shop — that is to say, they did not discriminate between union and non-union labor in the employment of their help. When these contractors started to perform their work at the bath house they claim that they announced their willingness to employ members of the union to do this particular work provided they could obtain a sufficient number of efficient workmen of this class — that is to say, union men. Apparently the Steam-Fitters' Union thought, under the existing conditions, they had an opportunity to force the contractors to run a union shop, and so union men stayed away from the job. The contractors, after making known their readiness to employ union labor and finding that they could not obtain a sufficient number of skilled mechanics of this class, and having, as they thought, fulfilled the conditions of their contract as regards this particular condition, then proceeded to perform the work with non-union men. The contractors began work under the contract about Nov. 1, 1897. On November 4, and again on November 13, they were ordered to suspend work for a time; finally, on January 8, the mayor caused a letter, signed by the architects, but prepared by him, to be sent to the contractors, ordering them to "discontinue all further work under the contract," and caused members of the police force to forcibly exclude the contractors from the building, thereby preventing them from finishing their work, which was nearly completed. The decision reads, "there was no evidence that at any time any of the materials furnished by the plaintiffs was not suitable, or that their work in any respect was unworkmanlike, or that they employed incompetent workmen, or that members of the labor unions were more competent than the workmen whom the plaintiffs had, or that the work was not in all respects being properly done." In a letter signed by the architects, which on Jan. 6, 1898, the mayor caused to be sent to the contractors after referring to a previous notice to suspend work, is the following paragraph: —

"You are now notified to proceed with all possible despatch to complete your work under said contract as if said notice of November 13 had not been given; but you are further notified that if any non-union men are employed by you on such work you will again be requested to dismiss them under article 3 of said contract, and that you will not be allowed to proceed to finish your work with non-union men."

Relative to this action the decision says (and all architects should take notice): "At the hearing it was admitted that this letter also was prepared in the mayor's office, and the only part which the architects had in it was to sign it at the mayor's request. The provision in said article 3, construed in view of the obvious purpose of it, and with other parts of the contract, did not, in my opinion, give the architects the power to arbitrarily order the plaintiffs to dismiss all their workmen and thus to effectually end the contract for no reason, or for the reason merely that they employed non-union men. The right reserved to the architect in that article 3 was to be exercised only for causes which pertained to the fitness or qualifications of the workmen for the performance of their work." This opinion as to the architect's control of laborers on a piece of work is an important point for him to be familiar with and is in violation of many of the conditions of building contracts which, as a rule, architects seem to consider valid.

The decision then goes on to state that at the hearing the mayor claimed that he did not rely on the breach of any stipulation in the written contract for his right to take the work away from the plaintiffs, but upon the oral promise of one of the contractors to him that he would employ union men only. On this point the decision says, "Such a promise, if made, had, in my opinion, no validity, and if it was given and not kept, the plaintiffs' failure to keep it was, upon the evidence, more the fault of the defendants than the plaintiffs." Reference is then made to the fact that the plaintiffs were evidently ready to carry out the spirit of the contract if they had not been prevented from doing so by conspiracy (this referring to the refusal of union men to work on the job, with the hope of forcing the contractors to employ union men exclusively on all their work). The decision then says: "This interference by the members of the labor unions with the plaintiffs' work to force the plaintiffs to employ union men only by the means above stated, and by the use of the police to exclude the plaintiffs from the building in which their contract work was to be done, was an unlawful interference with the plaintiffs' rights, and if permitted and continued would, in the language of the Supreme Court in the discussion of a similar question, 'tend to establish a tyranny of irresponsible persons over labor and mechanical business which would be extremely injurious to both.' There is no authority in law for any officer of the government, State, or municipality to force such a discrimination as was attempted in this case between workmen in respect to the privilege of labor on public work paid for by taxes levied upon all, for no reason except that some workmen belong to a certain party, society, or class, and others do not, thus giving labor and the benefit of it to one class and denying it to another regardless of their rights, needs, qualifications, or merits, or the public welfare. Such discrimination in the employment of labor is not in accord with our ideas of equal rights, and seems not to be consistent with an impartial administering of public business, and any agreement that such discrimination shall be made is contrary to public policy, and is, in my opinion, void. The Constitution of Massachusetts declares that 'No man, nor corporation, nor association of men have any other title to obtain advantages or particular or exclusive privileges distinct from those of the community than what arises from the consideration of service rendered to the public" also that 'Government is instituted for the common good . . . not for the profit, honor, or private interest of any one man, family, or class of men.' The right of every man to labor, and the benefit of his labor according to his ability, opportunity, and desire, should not be abridged. The corresponding right of an employer to procure labor suitable for his business, subject only to such general laws as the health, safety, morality, and welfare of the community may require, should be allowed." The remainder of the decision is mainly taken up with a discussion as to the liability for damages, and the ground is taken that as the acts by which the plaintiffs were deprived of their rights were unlawful, they can recover from the defendants as individuals but not as officials. And as a matter of fact, preliminary steps have already been taken to bring suit against the mayor, the architects, and the superintendent of buildings; all of whom were concerned in the controversy. The facts in this particular case are so clearly defined, and the language of the court in the decision granting the injunction is so clear, that little comment is necessary. Probably the decision presents few, if any, new points of law, but it certainly defines with unusual clearness the merits of the case, and a careful reading of the full text of the decision, which was published in most of the daily papers of January 26, should leave little doubt as to the opinion of the Massachusetts courts, at least on the matter of undue or unlawful interference with legitimate business by labor organizations or unions; and also with regard to the right of an architect to say whom a contractor shall or shall not employ, so long as his work is in accordance with the contract and specifications.

Brick and Terra-Cotta Work In American Cities, and Manufacturers' Department.

NEW YORK. — The architects of this city have been busier for the past month putting their best work in shape for presentation at the thirteenth annual exhibition of the Architectural League than in work upon actual building undertakings, and perhaps it is just as well that the exhibition occurs during the midwinter month, when building operations are hibernating. It is very gratifying that so much interest is taken in this exhibition, not only by architects and devotees of the allied arts, but by the general public, and every member of the league feels that it is greatly to his advantage to be represented there by his very best work.

A discussion has been begun as to the advisability of holding a great exposition in New York in 1901. Assuming that an exposition would benefit New York, we agree with the *Herald* in that the date mentioned is too soon after the Paris Exposition; and merchants who spend considerable money in making a creditable showing in Paris will scarcely be willing to repeat this expenditure during the year following. If an exposition be held at all, it should be several years later. It is a question whether the New York public will care to consider an undertaking of this magnitude, when the after effects of the Columbian Exposition upon the city of Chicago are borne in mind. The suggestion of ex-Mayor Wurster, of Brooklyn, that the exposition be confined to exhibitors in the city alone, making it strictly a New York exposition, and commensurate with the size and importance of the great city, seems very sensible.

Not only New Yorkers and their immediate neighbors, but all public-spirited Americans should interest themselves in the disgraceful destruction of the Palisades, whose noble cliffs have sheltered the American Rhine since the days of Henry Hudson. In spite of the vigorous protests of the press, no prohibitory legislation can be secured, and day after day the destruction continues, thus bearing out the oft-repeated expression that Americans sacrifice everything for money. This month's *Cosmopolitan* contains an interesting article on the subject, with illustrations showing what a charge of three tons of dynamite effected upon one of the most beautiful spots in our fair land.

TERRA-COTTA DETAIL, RESIDENCE AT CHICAGO.
Shepley, Rutan & Coolidge, Architects.
Executed by the Northwestern Terra-Cotta Co.

DWELLINGS IN NEW YORK CITY.
Frank Miles Day & Bro., Architects.

Another instance of the power of great corporations is shown in the ease with which the trolley companies of Brooklyn gained the right to run their cars over the bridge, taking up most of the space formerly used for vehicles, and crowding the bicyclists off almost entirely, although this means of locomotion to and from business has been rapidly growing in favor.

To the dissatisfaction of many, the new mayor has expressed himself as against the underground rapid transit system, and it now seems further off than ever, in spite of the unsightly appearance of the elevated roads and their accompanying nuisances and dangers.

Among new building projects are: —

A fourteen-story fire-proof building for the Tide Water Building Company, in which the Astors are interested. The building will contain offices and stores, and will cost $850,000. George B. Post is the architect.

The Lord & Burnham Company have filed plans for an horticultural building to be built in Bronx Park, at a cost of $200,000. The building will be constructed of brick, stone, and iron.

Architect Robert Maynicke has drawn plans for a new six-story building to be erected by the Germania Bank, on the northwest corner of Bowery and Spring Streets. Cost, $200,000.

Mr. Solomon Loeb, of Kuhn, Loeb & Co., will erect a seven-story home and office building, which will be presented to the United Hebrew Charities. About $150,000 will be expended.

Architects N. Le Brun & Sons have planned a five-story brick, stone, and terra-cotta building for the Marist Brothers of the Church of St. Jean Baptiste.

The Knickerbocker Realty Improvement Company will erect a twelve-story hotel on the site of the old Fourth Presbyterian Church on 34th Street, near Sixth Avenue.

Architects Babb, Cook & Willard have planned a five-story brick dwelling to be erected on Fifth Avenue, near 88th Street, for Mr. G. H. Penniman. Cost, $65,000.

Architects Child & De Goll are preparing plans for a velodrome similar to the one in Paris, which will soon be erected in New York. The building will be devoted exclusively to bicyclists, and will cost about $250,000.

The New York Metal Exchange will erect a ten-story fire-proof building at the corner of Pearl Street and Burling Slip.

Hill & Turner, architects, are preparing plans for a church for the Washington Heights Dutch Reformed Congregation. Cost, about $125,000.

PHILADELPHIA.— Philadelphia has lately had an example of the phenomenon, probably not unknown in other localities, when a reduction in the amount of work has resulted in an increase in the number of architectural offices. Few of the usually busy architects have been able to hold their full complement of men. Some of these men have thus been tempted to begin practise with small houses or alterations to carry on, which would have been lost in the routine work of the larger offices. And just so have many of our best-known men commenced.

There is just finished at the Northeast corner of 4th and Chestnut Streets a most charming addition to Philadelphia architecture. A two-story bank by Wilson Eyre, Jr., built of Sayresville red brick in Flemish bond, having wide joints of cement, with white marble doorway, string-course and cornice, and slightly pitched copper roof treated so as to show already green. It all seems so natural a bit of colonial architecture that a stranger seeing it in a few years must take it for a well-preserved specimen of the old town. On the interior the colonial idea is faithfully carried out: a yellow plastered barrel vault, cut into at the sides by round-headed windows and recesses opposite, and resting on white painted pilasters with mutuled cornice; even the counters and screens are designed to correspond, in white painted wood relieved only by a few lines of mahogany molding.

The Annual Architectural Exhibition just closed, conducted by the T Square Club at the Academy of the Fine Arts, has been fully up to the average; some good English work by Colcutt, Shaw & Ernest George, and French work of the students at the Beaux Arts.

ST. CHRISTOPHER'S HOUSE, NEW YORK CITY.
Barney & Chapman, Architects.
Terra-Cotta by Conkling-Armstrong Terra-Cotta Company.

Frank Miles Day & Brother showed a rendered elevation and photographs of the lately finished brick and terra-cotta Crozer Building on Chestnut Street, above Broad. Very rich terra-cotta ornament around the tenth story and above, breaking out into pinnacled dormers around a peaked tile roof, gives the building a striking appearance from a distant point of view, for which it has evidently been designed. Cope & Stewardson were largely represented by rendered drawings of current work: Two fronts of dark red brick and light stone, on Walnut Street; the gabled entrance to a country house in English style; also two huge renderings of buildings for the Pennsylvania School for the Blind, at Overbrook. A curious fact about the exhibition is that of the hundred and more practising architects in Philadelphia, only some twenty were represented. It is likely an effort will be made to increase this number largely in future exhibitions.

Real estate at Broad and Chestnut Streets has reached a value little dreamed of a few years ago. Already two corners have their thirteen and fifteen story office buildings, and now a third corner is to have one, this of seventeen stories. It has been designed by Edgar V. Seeler, and is to be built of granite for the first and second stories, to be occupied by the owners of the building, the Real Estate Trust Company; the upper stories of light brick and terra-cotta surmounted by a terra-cotta frieze and cornice. In planning the building considerable extra ingenuity and engineering was required, as a long, narrow strip is to be built and finished before the remaining frontage on Chestnut Street is begun. This gives a problem of wind bracing which would have been much simplified had the whole structure gone up at once.

A twenty-story building from the plans of J. Huston is projected on Broad Street below Chestnut. Huge candelabra, carrying electric lights around the sky line, are a proposed feature of the design.

CINCINNATI.— The year 1897 has been an extremely dull one, and the records of the Building Inspector's office will show that we have done less in proportion to our population than almost any other city west of the mountains.

Up to this time it looks as though the dulness would continue during the coming year, as very little new work is talked about.

TERRA-COTTA DETAIL,
ST. CHRISTOPHER'S HOUSE,
NEW YORK CITY.
Barney & Chapman, Architects.
Executed by the Conkling-Armstrong Terra-Cotta Company.

The Cincinnati Chapter of Architects, under the aggressive leadership of its Secretary, Mr. A. W. Hayward, has awakened from its slumbers and gives promise of becoming useful to the profession and the community. They are now at work upon a revision of our building laws, and are also actively pushing a license law.

Messrs. Samuel Hannaford & Sons have just completed the drawings for the new Pearl Street Market House, and are now taking bids. This covers a space of 47 by 403 ft. It is naturally a very simple building in plan, but will be constructed of good materials, and will be quite elaborately finished with enameled and ornamental brick, with color decorations in friezes, and panels of Mosaic encaustic tile.

Messrs. Des Jardines & Hayward will remodel the old Masonic Temple, transforming it into a modern office building, at a cost of about $100,000. This will be an interesting bit of work, and we imagine, quite a serious problem, as the old story heights and the tremendously heavy construction of the old building renders any change of existing lines rather difficult.

Next year the Golden Jubilee of the North American Saengerfest Association will be held in Cincinnati. The committee in charge of the affair will, within the month, issue a circular to the local architects, inviting competition drawings. The building will be of a temporary character, to cost about $50,000, and the structure will be required to seat about twenty thousand persons, including audience and chorus. It is a pity that this building cannot be made a permanency, as the city needs a large hall of this character for conventions and other large gatherings.

The Cincinnati Edison Electric Light Company have entrusted the work of their new building to Messrs. Elzner & Anderson, who have about finished the drawings. This is an extremely interesting building, and is remarkable for its very heavy steel construction, as the boilers and other heavy loads are carried on the upper floors.

Outside of the work mentioned there is very little in sight. There are a few moderate-priced dwellings on the boards in several of the architects' offices, but in large office and commercial buildings we are wofully lacking.

ST. LOUIS.— The outlook for the coming year is far from being as encouraging as was hoped for. Usually, anticipated work is well under consideration by this time, but there has been little activity in that direction up to the present. The conservative investor has not loosened his purse strings sufficiently to cause much of a ripple in building circles, although there is some satisfaction to be gotten from the report of the Building Commissioner for January, which shows continued improvement in the class of buildings being built.

The past year has the most notable fire record of any in the history of the city. Early in the year the Lionberger Building, a noble work by Richardson, was destroyed, which, with its contents, amounted to a million and a quarter dollar loss; while later the old landmark, the Polytechnic Building, met a similar fate. During the closing month of the year the F. O. Sawyer Paper Company's building, and the Mermod, Jaccard Building were burned. The latter fire occurred on December 19, totally destroying the building, which was occupied as a jewelry store by the above-named firm. The enterprise shown by the firm, which is one of the largest of its kind in the West, was at least unusual, they having by the following morning purchased the entire stock of another firm, and opened for business without an hour's loss of time, the fire being on Sunday morning.

The new year also gives promise of a fire record. On January 8 a portion of the Christian Peper Tobacco Company's warehouse was consumed, entailing a loss of $125,000. The building was six stories, of heavy timber construction. Brick walls divided the building and confined the fire to the one wing. Each of these burned

TERRA-COTTA DETAIL,
ST. CHRISTOPHER'S HOUSE,
NEW YORK CITY.
Barney & Chapman, Architects.
Executed by the Conkling-Armstrong Terra-Cotta Company.

buildings form an interesting study, fully illustrating the necessity of more thorough inspection of buildings and stricter enforcing of the building ordinance.

On January 26 the Union Elevator was burned, causing a loss of $750,000. This was located on the other side of the river, but was a St. Louis enterprise.

HOUSE AT ST. LOUIS.
Barnett, Haynes & Barnett, Architects.
Terra-Cotta executed by the Winkle Terra-Cotta Company. Front Brick furnished by the Hydraulic-Press Brick Company.

St. Xavier's Church, on the corner of Grand and Lindell Streets, has been completed with the exception of the tower, and was dedi-

DETAIL OF ENTRANCE, HOUSE AT ST. LOUIS.
Barnett, Haynes & Barnett, Architects.

cated on Sunday, January 16. The building is 212 ft. long by 120 ft. wide, and 66 ft. high in the center of nave. The ceilings are groined, springing from highly polished marble columns. The style is the early English, and it was designed by the late Thomas Walsh, who commenced the building in 1883. Later the plans were revised by Henry Switzer, who had charge of the work until its completion.

The bells which will be placed in the tower when it is completed have a considerable historical interest, having been cast in Spain in 1761. On the night of July 25, 1812, the bells were broken by a shell thrown by the French from the Trocadero, and were later recast.

Within the last few months St. Louis has lost one of her most prominent firms of architects, Wheeler & McClure having gone to New York.

A movement has been inaugurated by the labor organizations to have an exposition here in 1903, in commemoration of the hundredth anniversary of the Louisiana Purchase.

The Master Builders' Exchange closed their year's work on December 27, with a banquet and the installation of the following officers for the ensuing year: —

President, L. J. Evans; First Vice-President, J. D. FitzGibbons; Second Vice-President, George Ittner; Secretary, C. D. Morley; Treasurer, Adam Baurer; Trustees, Jas. H. Bright and C. Linnenkohl.

At the annual meeting of the St. Louis Architectural Club, on January 8, Mr. Wm. B. Ittner was re-elected President; F. A. P. Burford, First Vice President; H. G. Eastman, Second Vice President; Emile Neiman, Secretary; J. C. Stephens, Treasurer; R. G. Milligan and Benno Jansen, Executive Board.

CHICAGO.— Mention has been previously made of the Illinois State law entitled, "an act to provide for the licensing of architects and regulating the practise of architecture as a profession." Subsequent to Jan. 1, 1898, an architect obtained a license only by passing an examination, or making an "exhibition" to the Board of Examiners, which was considered by them an equivalent.

The first grant of licenses to architects who were not practising when the law was passed resulted in qualifying twelve on examination (one of whom was a woman.) and six on exhibition of their work.

NEW SYNAGOGUE AT TORONTO, ONT.
J. W. Siddall, Architect.

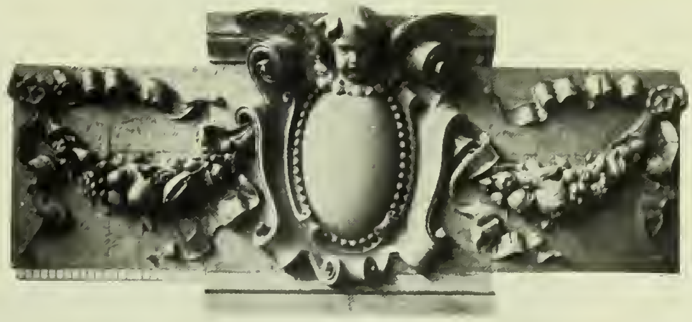
Only one was rejected. It is of interest to note that the man ranking first in this examination had had six years' experience with a contractor, but no technical training aside from that gained in an architect's office. The second in rank, on the contrary, had had an exceptionally extensive education. The woman was the third in rank, and she included in her experience a course at the Boston Institute of Technology, and travel abroad. Some of those ranking lowest had had four years' training in architectural schools.

The Chicago building ordinances are undergoing revision, although nothing radical is contemplated. Joseph Downey, contractor and ex-commissioner of public works, is chairman of the revision committee, which includes in its membership real estate and material men, a representative of the Building and Trades Council, and Mr. Shankland, the engineering member of the firm of D. H. Burnham & Co.

TERRA-COTTA DETAIL. JEWELERS' EXCHANGE, BOSTON.
Winslow & Wetherell, Architects.
Executed by the Perth Amboy Terra-Cotta Company.

Amongst the work of interest announced this month are noted a Jewish synagogue of brick, designed by Mr. Paul Gerhardt; a brick and terra-cotta high school building, by N. S. Patton; alterations to an office building at Lake and La Salle Streets, by D. H. Burnham & Co.; an apartment building by architect Eisendrath; and some important fire-proof manufacturing buildings, by Mr. Fritz Foltz.

Jenney & Mundie are nearly ready to let contracts on the addition to the New York Life Building. Two stories of this structure will be granite, but the other ten stories will be terra-cotta. The floor and partition construction will be hollow tile.



TERRA-COTTA DETAIL, CONVERSE BUILDING, BOSTON.
Winslow & Wetherell, Architects.
Executed by the Excelsior Terra-Cotta Company.

A NEW FORM OF ENAMEL TILING.

THE catalogue of the American Enamel Brick and Tile Company presents, in addition to the ordinary shapes, a form of enamel tiling intended to replace enamel bricks where economy of space and freight charges is necessary. The bricks or tiles are all grooved along the top and bottom edges, the walls of the upper grooving being of even length, while the inner wall of the lower groove is shallower than the outer one. This allows the outer joints to be laid close, at the same time leaving space enough between the outer walls for a nail, which can be driven at any point within the length of the tile, whether the same crosses a horizontal or a vertical joint of the wall behind. In applying these tiles to an upright wall or backing they are built on each other from the bottom or lower part of the wall or backing upward, and as each course is laid the several tiles in the course are nailed to the wall or backing by one or more headed nails, the heads of the nails overlapping the interior of the inner wall of the groove. In bedding the tile the cement seizes the nail and fills the groove, bonding all together into the wall. Screws or shorter nails can be used where these tiles are set as linings over wooden partitions, also economizing materially in space, and, owing to the secure bond between the tiles effected by the cement tongue in the middle groove, it is not necessary to nail each individual tile.

The tiles are made to lay as standard English size brick, namely, 3 in. by 9 in. face, and are made 2 ins. thick. Where economy of space is an object this tile is an excellent device, and for wainscoting of lavatories in wooden houses, where brick nogging is not desired or impracticable, this tile can readily be put in place with combined economy and absolute surety against falling out after the work is finished. Corners and quoins, rebated vertically to fit into the tiles, are manufactured to go with this facing, together with special moldings for top of wainscoting fastened in similar manner.

TERRA-COTTA DETAIL, CONVERSE BUILDING, BOSTON.
Winslow & Wetherell, Architects.
Executed by the Excelsior Terra-Cotta Company.

NATIONAL BRICKMAKERS' CONVENTION.

THE twelfth annual convention of the National Brick Manufacturers' Association was held at Pittsburgh, Pa., Tuesday to Friday, February 15 to 18. It was one of the most successful conventions ever held by the association. These annual gatherings, which are attended by many of the larger clay workers of the country, are productive of a distinct betterment of the burnt-clay industries as a whole. Not only do the workers freely discuss the more important problems connected with the business, but the greater part of the time is given over to the reading of important papers of a technical nature, which are prepared by those well versed in the art of clay working. We doubt if there is another industry in this country where the people interested give more thought and careful attention to the end that their product shall meet the requirements of an exacting market.

CURRENT ITEMS OF INTEREST.

THE Fawcett Ventilated Fire-proof Building Company, James D. Lazell, Boston agent, have completed a vault floor for the Five-Cent Savings Bank, Boston.

THE AMERICAN ENAMELED BRICK AND TILE COMPANY, of New York, have appointed W. G. Weaver, 22 Clinton St., Newark, N. J., their sales agent for the State of New Jersey.

WALDO BROTHERS have secured the contract for furnishing the glazed tiles for walls of Adams Square Station of Subway, Boston. The tiles will be manufactured by the Atwood Faience Company.

GROSS & HORN, 506 West Broadway, New York, have been appointed agents for Samuel H. French & Co., manufacturers of Peerless Mortar Colors, who report a rapidly increasing demand for their product.

THE Brick, Terra-Cotta, and Supply Company, of Corning, N. Y., are furnishing the architectural terra-cotta required for the 119th Street, 89th Street, and 20th Street schools, New York City ; C. B. J. Snyder, architect.

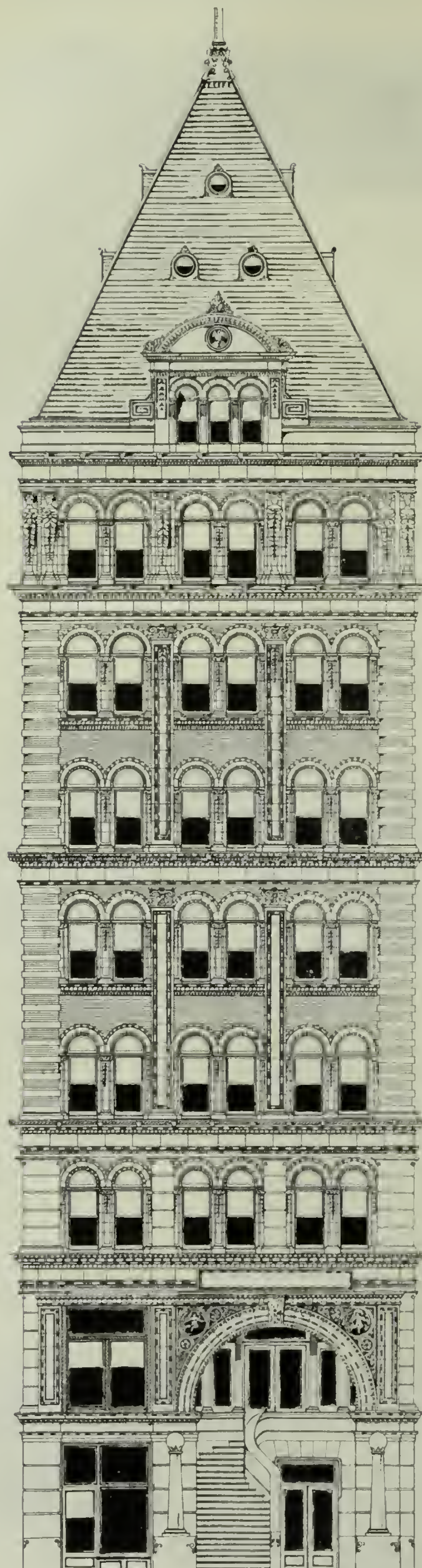
THE Burlington Architectural Terra-Cotta Company are supplying terra-cotta for the new shoe factory being built at Burlington, N. J.; also for a residence at Germantown, Pa., of which H. E. Flower is the architect.

THE name of the Akron Hydraulic-Press Brick Company, of Cleveland, O., has been changed to the Cleveland Hydraulic-Press Brick Company. The management of the company is in no way changed, it being a branch of the Hydraulic-Press Brick Company of St. Louis.

THE Wallace Manufacturing Company, at Frankfort, Ind., have sold since Jan. 1, 1898, nine of their Wonder Brick-making Machines. This is pretty good evidence of two things,— increasing business among the brickmakers, and the popularity of this particular make of a machine.

THE Mason Safety Sidewalk Light is attracting the attention of architects very generally. A good example of its use is shown in front of the Oriental Tea Company, on Court Street, Boston. It has a perfectly level, non-slipping surface, a great desideratum in wet or frosty weather. Its lighting capacity is very large.

PRECIPITATED CARBONATE OF BARYTES, a preventative for scum and discoloration, neutralizing the sulphate of lime in the clay and water, finds a ready demand among those who investigate its merits. Gabriel & Schall, importers, 205 Pearl Street, New York, report a most gratifying growth of this part of their business.



PROPOSED BACHELOR APARTMENT HOTEL, NEW YORK CITY.
Franklin D. Pagan, Architect.

CHARLES E. WILLARD, 171 Devonshire St., Boston, has recently closed the contracts for 150,000 Standard and Norman sized brick for the new building now being erected by the Boston Wharf Company, Boston; M. D. Safford, architect; and 150,000 white brick for the Westminster Chambers, Copley Square, Boston ; H. E. Creiger, architect.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., have closed the following new contracts: Steel roof for the Boston Gas Light Company's new building; steel framework, new power house for the American Coffee Company, at Brooklyn ; furnishing and erecting a new building, to be known as the Tower Building, for the Benjamin Atha & Illingworth Company, at Harrison, N. J.

THE COLUMBUS BRICK AND TERRA-COTTA COMPANY have supplied their brick on the following new work: Bank building, Columbus, Ohio; L. L. Rankin, architect; residence for W. M. Taylor, Columbus; Yost & Packard, architects; Spahr-Glenn office building, Columbus; D. H. Burnham & Co., architects; Citizens' National Bank Building, Charleston, W. Va.; Yost & Packard, architects; Police Station at Detroit, Mich.; Louis Kamper, architect.

THE C. P. Merwin Brick Company, Berlin, Conn., report the following buildings lately completed, in which their hollow brick were used: Insane ward Connecticut State Prison, First National Bank, Police Station, and Brown Street School, all in Hartford, Conn. They are also furnishing hollow brick for Lowell Block, Worcester, Mass., Cutting, Bardwell & Co., contractors; and both hollow and pallet brick for St. Patrick's Church, Whitinsville, Mass., Chas. D. Maginnis, architect; H. P. Cumming & Co., contractors.

G. R. TWICHELL & CO., 19 Federal St., Boston, report the following recent sales: 150,000 enameled brick for the new building now being erected at South Boston for the Boston Electric Light Company; a large quantity of Ridgway gray Roman brick and Massachusetts wire-cut red brick for the same structure; buff brick for an apartment house at Hartford, Conn.; chocolate-colored brick for a front on Bay State Road, Boston; buff brick for eight new apartment houses at Brookline, Mass.; and a large number of brick for fireplaces for a dormitory at Harvard College.

THE regular annual gathering of general managers of the various branches of the Hydraulic-Press Brick Company was held, as usual, in St. Louis early in February.

The Hydraulic-Press Brick Company, of St. Louis, find it both interesting and profitable to entertain all their general managers once a year; when thus assembled, some twenty or more practical men of experience in the business discuss and advise with each other concerning the various difficult problems connected with modern methods of brickmaking. As these gentlemen represent various plants scattered through nine States of the Union, and producing annually over three hundred million of bricks in endless variety of colors from many different clays, they are each able to furnish valuable suggestions from their various experiences under widely varying conditions. The care, energy, and ability devoted by these gentlemen to the problem of producing at the least cost the high grade of bricks required by modern standards is apparent in the product resulting from their efforts, which may be seen in their exhibit rooms in St. Louis, Kansas City, Omaha, Chicago, Minneapolis, Cleveland, Rochester, Pittsburgh, Baltimore, Washington, Philadelphia, New York, and Boston. They are prepared to offer in any section of the country all the various shades of color in bricks, made from the different varieties of clay throughout the United States.

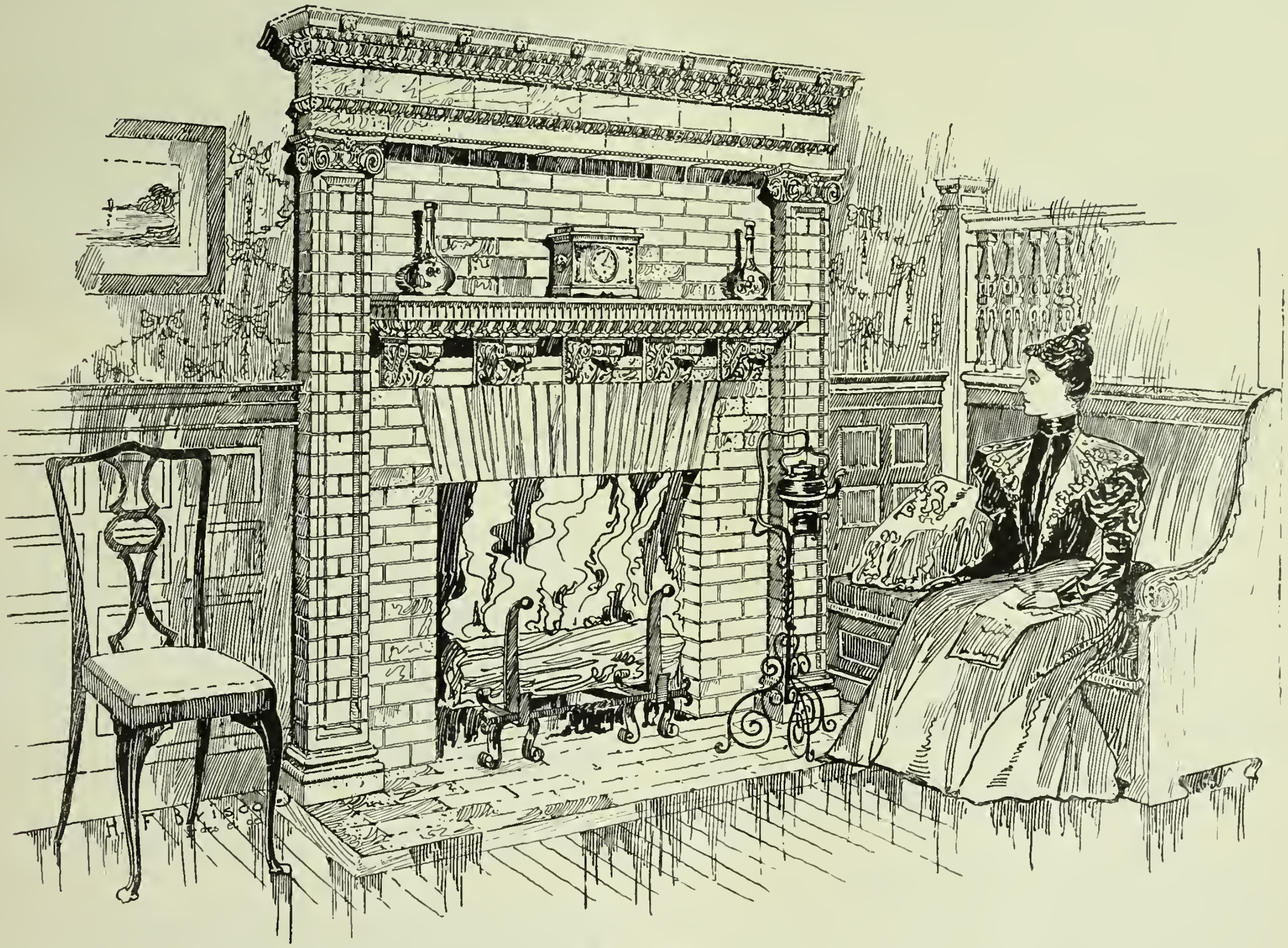
These meetings, continuing through several days, afford an opportunity for pleasant social intercourse and much pleasant companionship between the gentlemen in charge of the various branches of this widely extended manufacturing business.

INDEX TO ADVERTISEMENTS.

9' 0"
2nd Floor
12' 8"
1st Floor

Something New

In Brick and Terra-Cotta Fireplace Mantels.



Designed and Delineated by H. F. BRISCOE. Modeled by TITO CONTI.

We are now prepared to furnish an entirely new and complete line of Fireplace Mantels

Designed in classical style to produce rich, yet dignified architectural effects.

Modeled entirely by hand in the highest perfection of the art.

Pressed with great care to give clear-cut outlines and smooth surfaces.

Burned in a suitable variety of soft, rich colors.

Assembled from standard interchangeable pieces in any desired combination, thus giving a great variety of size and detail with no additional cost.

In general producing all the desirable effects of special mantels, made to order, without their excessive cost, or their uncertainty of manufacture.

FISKE, HOMES & CO.,

166 Devonshire Street, Boston, Mass.

Dealers also in Architectural Terra-Cotta and Building Bricks in all colors known to clay working.

Fire-Proofing and General Building Materials.

VOLVME VII MARCH 1898 No. 3

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

ROGERS & MANSON,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

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ENAMELS ON BURNT CLAY.

THERE appeared in *Harper's Weekly*, a short time since, a very interesting account of the artistic porcelain and pottery makers of Japan, from which it appeared that their industry is by no means a thing of the past, but on the contrary exceedingly alive and growing all the while, and that many of the effects, such as the peach blows and the *sang de bœuf*, which have been the despair of modern manufacturers, are imitated so cleverly by the modern Japanese artists that the best connoisseurs are sometimes at fault. Following this article we had occasion to pay a visit to a large tile works in a neighboring city, and were greatly interested and pleased at the results which were there being accomplished, as well as at the similarity of methods and aims which we found as compared with those of the Japanese artists. We doubt if, on the whole, there has ever been a time within the past few centuries when the ceramic arts were in as prosperous and promising a state as they are now; and if we can judge of the future by the past, the United States will in the next one or two decades produce work of a quality which will hold its own not only with the work of our cousins in Germany and England, but with the more imaginative work of the Japanese artists. We have seen bits of porcelain, examples of glazes and enamels, which were thoroughly in the spirit of the Oriental work, and the natural possibilities of our soil are sufficient to satisfy the demands of the most exacting artists.

The difference between our enameled terra-cottas and the delicate work of the Mongolians is one of application and fineness of workmanship rather than of material, and although we do not usually class Canton tea-cups or Imari ware with such prosaic products as enameled bricks, the artistic, decorative, and practical possibilities of the Japanese potter are all implied in the capacity for the production of first-class enamels laid over burnt clay. Our recent national development has been especially promising along these lines and there have been some notable works produced in enameled terra-cottas and glazed bricks which show not only the capabilities of our manufacturers, but appreciation on the part of our architects and constructors of the capabilities of this fascinating material. We call it a fascinating material, for we have yet to know of a designer who has made a serious attempt to use it who has not sooner or later developed a mania for it. The color possibilities are so large and the effects produced thereby are so permanent that there is no other one medium which is on the whole so satisfactory. The designation, enameled brick or terra-cotta, usually suggests to most minds a perfectly bare uninteresting white wall with a glossy slippery surface. Our manufacturers, indeed, take a pride in the purity of the white enamel which has been applied to bricks and terra-cotta, but the palette of the designer in enamels is so large that almost any color effects can be produced, and we have recently seen some examples wherein blues, reddish browns, and greens have been used with very marked success. The stations of the Subway are lined with a very high grade of enameled brick and tile, and for white work they are very successful. A feeling is manifested at times that so long as enameled brick and terra-cotta is given a half-hearted opportunity in back halls, boiler rooms, and lavatories, that is all the manufacturers could reasonably expect; but if there be infused into the design some of the elements which make the Japanese ceramics so fascinating, there is not the slightest reason why such material could not be adapted for some of the best uses. The Reading station in Philadelphia has in one of the large waiting rooms a considerable quantity of most excellently designed and manufactured enameled terra-cotta work in strong colors and carefully elaborated designs. There is a private hotel in Boston in which the vestibule is treated in enameled terra-cottas, one of the earlier examples, but in a limited way quite satisfactory, and interesting in showing what might be done if the public and our designers were educated to a proper use of a certain material. More recently the baptistery of one of our large city churches has been finished throughout in enameled ware, in low relief, with a very successful color treatment. There is, of course, no lack of historical precedent even closer at hand than Japan for applying this material in the choicest work, but we are only beginning to use it understandingly.

We must not think of enameled brick and terra-cotta as a constructive material at all, but rather treat it purely as a finish, as a material which will take the touch of the designer and the sympathetic tones of the colorist, and will hold both for generations after the color of marble or stone have faded entirely away. A handicap which our manufacturers have been under in the past is the extremely limited market for a really first-class product. The English glazed bricks, — and, by the way, we imagine some of our readers would be surprised to know that some of the best English glazed bricks are made by the Hon. Mr. Gladstone, — set the pace in this country for many years, and our manufacturers thought the limit of their skill was reached when they equaled the foreign production. But we can now do better than that. It is not unfair to say that we have a certain measure of the artistic sense which has made the Japanese potteries so famous, and when the public can appreciate more truly what exquisite effects can be produced in enamels and glazes, and how artistic a combination can be made with these materials applied to colored terra-cottas, it will not be necessary to finish our vestibules in mahogany to secure a rich effect, nor will enamel work suggest nothing more interesting than a perfectly uniform creamy white surface. The prime recommendation of terra-cotta was formerly that it was cheap. Now it ranks as the foremost art industry associated with the building trades; and in like manner its companion, enameled and glazed terra-cotta, can become one of the most notable mediums in which the artist can express the subtlest designs and produce the most permanent rich effects. We have always had a great faith in this material, and believe that the time will come when terra-cotta more generally will be enameled or glazed before it is applied to our commercial structures. The enamel will keep its color intact, and if we may judge by examples which have come down to us from the medieval period, there is no limit to the life of even the most delicate tones.

THERE are begun in this issue three articles of more than passing interest. To those familiar with his earlier work on "Masonry Construction," the paper on "The Strength of Brick Masonry," by Ira O. Baker (M. Am. Soc. C. E., Professor of Civil Engineering, University of Illinois), will be a welcome contribution upon this subject. The paper will be concluded in the April number.

"How to Build Fire-proof" forms the basis of an article by Francis C. Moore. As president of the Continental Insurance Company of New York, and delegate of the New York Board of Underwriters to the Board of Examiners of the New York Building Department, Mr. Moore has had exceptional opportunities to observe the efficiency of the various methods intended for fire-proofing, as well as the deficiencies in plans and construction of many of the so-called fire-proof buildings, hence his deductions and recommendations will be found to be of especial interest and value. Mr. Moore's paper will be concluded in the April number.

A paper "On the Saline Efflorescence of Brick, the Causes Leading to It, and the Practical Means of Avoiding Same," by Oscar Gerlach (Ph. D., Berlin), will commend itself to those who have experienced the annoyance which results from this disfigurement of brick wall by the accumulation of efflorescence, or scum, upon the brick. Prof. Edward Orton, Jr. (Department of Ceramics and Clayworking, Ohio State University), endorses this paper by Dr. Gerlach as being of "great practical and scientific value."

The printing of these papers in this number has necessitated the discontinuance of the Mortars and Concrete Department for this month.

PERSONAL AND CLUB NEWS.

ARTHUR CONNELLY, architect, Newark, N. J., has removed his office to 673 Broad Street. Catalogues desired.

ALFRED H. GRANGER, of Granger & Meade, architects, has withdrawn from that firm and removed to Chicago, where he has formed a partnership with Charles S. Frost. Mr. Meade has formed a partnership with Mr. Abram Garfield, under the name of Meade & Garfield, at 731 Garfield Building.

OWING to the death of Mr. Forrest A. Coburn, of Coburn & Barnum, the firm of F. S. Barnum & Company, architects, has been organized, with the following members: Frank S. Barnum, Harry S. Nelson, Albert E. Skeel, Herbert B. Briggs, and Wilbur M. Hall, with offices in the New England Building.

BOHEMIAN NIGHT was observed by the Chicago Architectural Club, Monday, February 28. The entertainment was arranged by Messrs. Richard E. Schmidt, Arthur Heun, Chas. E. Birge, A. G. Zimmerman, Myron H. Hunt, John B. Fischer, Adolph Bernhard, and E. H. Seaman, who served as hosts for the evening.

THE third annual banquet of the Cleveland Architectural Club was held at the Hollenden, January 20. President Herbert B. Briggs was toastmaster, and responses were made by Messrs. J. N. Richardson, Stephen C. Gladwin, Chas. W. Hopkinson, W. Dominick Benes, Louis Rohrheimer, and Starr Cadwallader. A feature was the presence of the ladies.

A REGULAR meeting of the T Square Club was held on Wednesday evening, February 16. The program of the competition for the evening, entitled "The Nucleus of a Town," had been arranged by Mr. Edgar V. Seeler, who led the criticism on the drawings submitted, and spoke in an interesting way on the possibilities of the general planning of cities.

The mentions were awarded as follows: First, Ira E. Hill; second, Arthur S. Brooke; and third, W. P. Trout.

ON Monday evening, February 21, Mr. H. J. Maxwell Grylls spoke on "Roman Architecture," the third paper of the series on the "History of Architecture," at the Museum of Art, Detroit, before a liberally attended and appreciative audience. It was well illustrated by stereopticon views, and drawings by members of the club.

The public are greatly interested in these lectures and take advantage of the opportunities offered.

The next paper will be given, March 7, by Mr. James E. Scripps, on "History of Gothic Architecture."

ILLUSTRATED ADVERTISEMENTS.

FISKE, HOMES & CO., in their advertisement, page vii, illustrate number nine of their series of brick and terra-cotta fireplace mantels.

The new Telephone Building at Cleveland, Ohio, C. F. Schweinfurth, architect, is illustrated in the advertisement of Harbison & Walker Co., page xiii.

PANEL, SCHOOL BUILDING, 108TH STREET AND AMSTERDAM AVENUE, NEW YORK.
C. B. J. Snyder, Architect.
Executed by the New York Architectural Terra-Cotta Company.

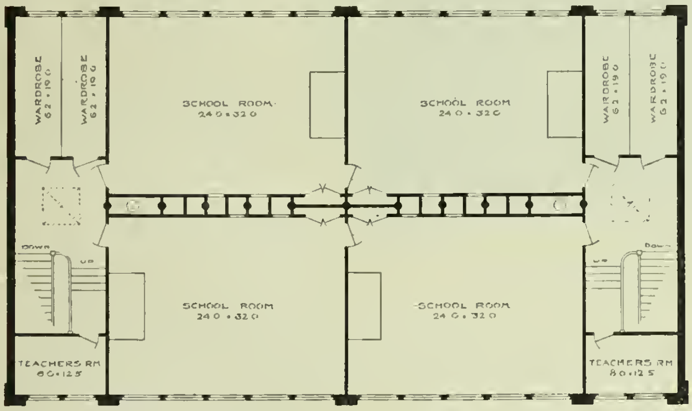
Some interesting Chicago buildings roofed with Celadon tiles are shown in the advertisement of the Celadon Terra-cotta Company, Charles T. Harris, lessee, page xxvii.

The American Schoolhouse. V.

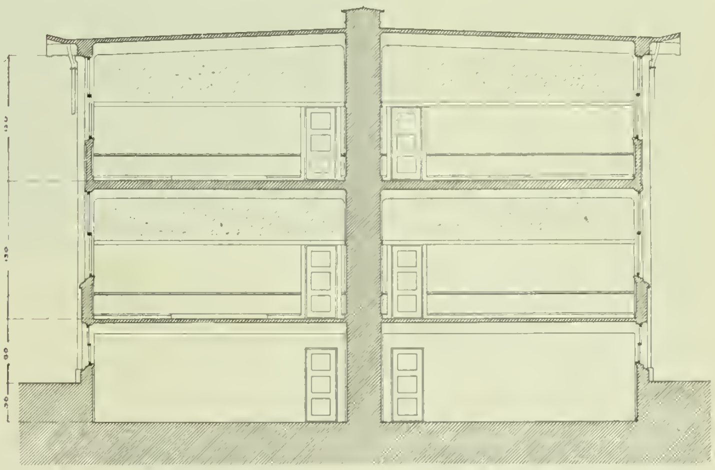
BY EDMUND M. WHEELWRIGHT.

IN a pamphlet on "The Construction of Schoolhouses," published in 1895, Mr. Edward Atkinson gives the following "rough and ready computations upon the cost of schoolhouses," constructed upon the principles of "mill construction."

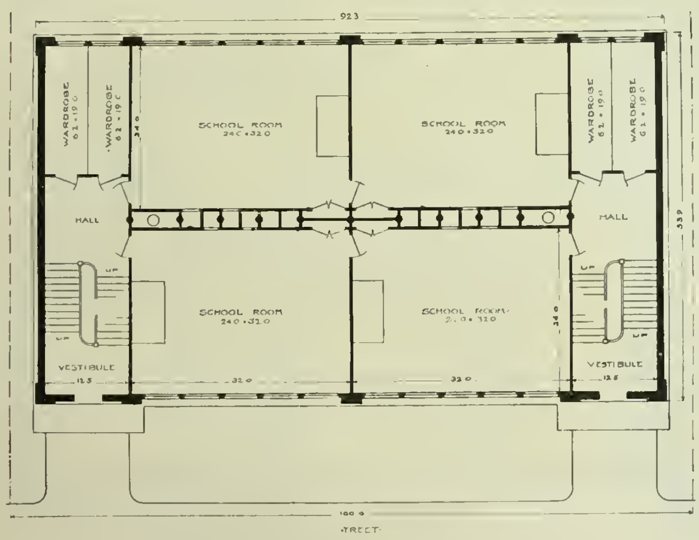
The leading idea of this pamphlet is that schoolhouses are made needlessly expensive on account of expenditure for architectural effect, and that there are conditions of essential economy in so-called "mill construction" which make the use of this method one of radical economy. Careful consideration of the schoolhouse work of several architects and my own experience leads me to a contrary opinion as to both propositions. While there are a few cases to be found where the expenditure for architectural effect on schoolhouses has been somewhat greater than good economy, if not the best taste,



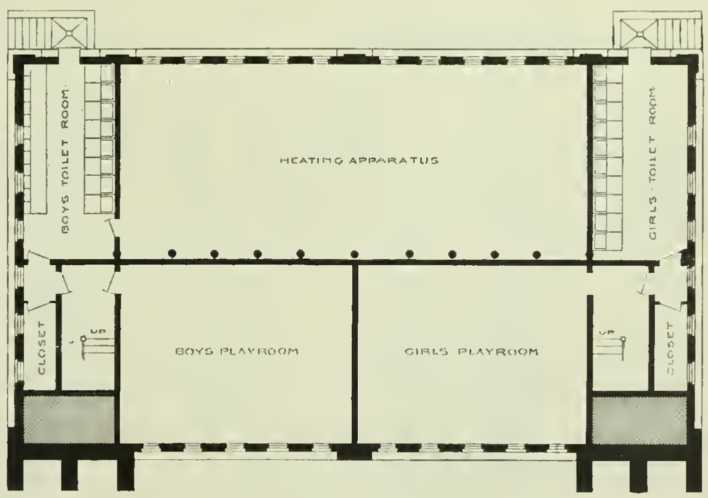
SECOND FLOOR PLAN.



SECTIONAL VIEW.



FIRST FLOOR PLAN.



BASEMENT PLAN.

PRIMARY SCHOOLHOUSE.
William Atkinson, Architect.

would suggest, in the main the increased cost of a pleasing architectural design bears but a very small proportion to the cost of a well-constructed schoolhouse. The elements upon which good effect depends are found in the very conditions of the problem, and with but small expenditure above absolute needs, a skilful designer can bring a satisfactory result. The additional expense mainly comes out of the pocket of the architect, who seeks to give proper proportion and expression to the structure entrusted to him.

As to the greater economy of "mill construction" above that commonly employed, I believe that all who have calculated the cost of the two have found that "mill construction" is slightly more expensive, and has the disadvantage of being troublesome on account of shrinkage of the large-sized stock, and the advantage of being practically safe from danger to the inmates from a fire in the basement.

As to the use of thinner brick walls than ordinarily employed, this is not an essential characteristic of "mill construction," and, indeed, the use of 8 in. brick walls is not to be recommended if plastering is to be laid directly thereon as it should be as a fire and vermin precaution. An exposed interior wall, if painted and properly constructed to receive painting, does not make for economy as against a plastered brick wall.

Mr. Atkinson states that "in a broad and general way one may compute the cost of a school building, without plumbing and appliances, midway between the cost of the factory building and the hospital" constructed on the "mill" principle. "That would be $1.35 per square foot of floor, counting all floors.

"The schoolhouse of least cost in construction would be one placed on a moderate slope, consisting of basement story and two floors to be occupied by pupils, the main entrance being on the lower side of the slope by a door into the basement, the stairway being wholly within." These conditions are, by the way, not to be considered sufficiently normal to serve as a basis for consideration of cost of a typical schoolhouse, and they have not been strictly followed in the plans of Mr. William Atkinson, here shown, which are published at his request to illustrate the type of building contemplated by his father's pamphlet. The plan described in the pamphlet indicated that of a building with a central entrance, which would have necessitated that the schoolrooms would give off a common corridor and would have required that the two staircases should have been placed in staircase halls at right angles to the main corridor, which is practically the same plan as that shown in the Wyman School. Mr. Atkinson's plan differs in two essential points from the accepted arrangements of our graded schools. First, certain schoolrooms can be reached from others only by passing through a third schoolroom, and all the "wardrobes" are not placed in conjunction with the schoolrooms for whose pupils they are designed.

Each of these variations from accepted conditions are nonconducive to the ready maintenance of order and discipline as well as convenience.

Mr. Atkinson's plan contemplates the use of 12 in. brick walls for first story and 8 in. brick walls for second story. The central floor support by steel columns and girders has the objection of cutting through the heat and ventilation pipes, and of increasing the expense of construction over that given by a brick carrying wall.

EUSTIS STREET PRIMARY SCHOOL, BOSTON.
Edmund M. Wheelwright, City Architect.

"We will assume," says Mr. Atkinson in his pamphlet, "an eight-room schoolhouse in which the pupils are to be provided for on two floors of four rooms each, such schoolrooms to be of the dimensions of 28 by 32 ft. each, for the accommodation of 56 pupils each,—or 448 pupils in all. Four rooms of 28 by 32 ft., 896 sq. ft. each room, would require in all, square feet of floor 3,584

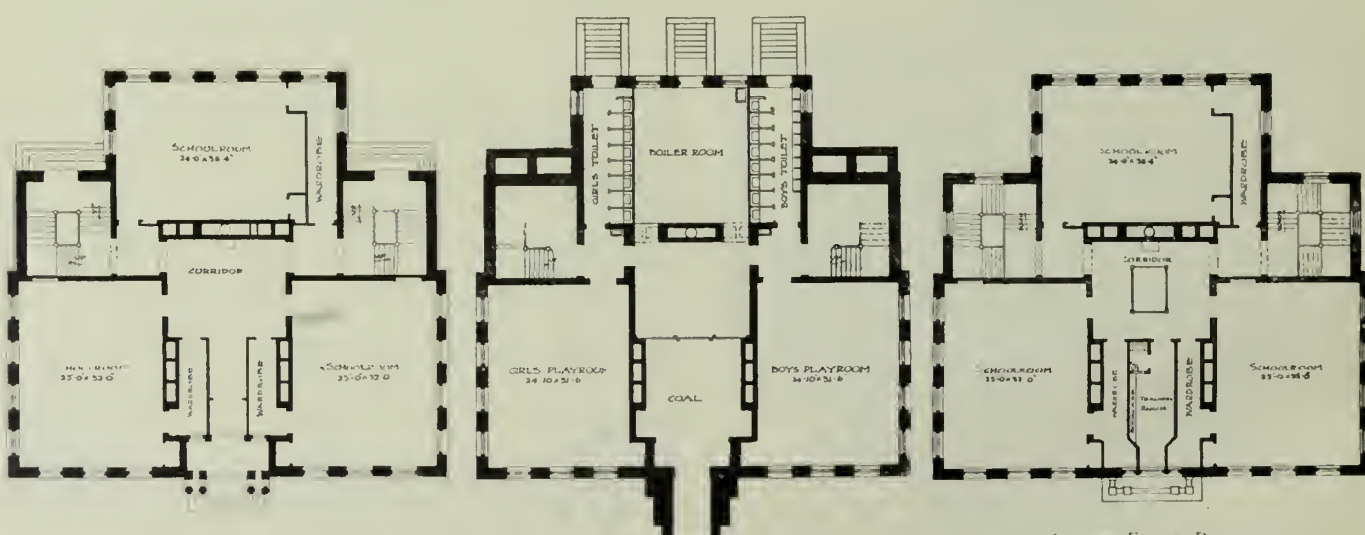
"We find that the minimum of hallway, stairway, teachers' room, and lavatories bears the proportion of 60 per cent. to the space in the schoolrooms on each floor. That would add square feet of floor 2,150

The basement would therefore cover square feet of floor	5,734
First floor	5,734
Second floor	5,734

"We assume that this building is to be covered by what is called a flat roof, that is to say, a roof of $\frac{1}{2}$ in. pitch, without any enclosed space above it. The total floor area, therefore, comes to, square feet of floor . . . . 17,202 divided by the number of pupils, this gives 38.56 sq. ft. to each pupil.

"We will add for contingencies and assume that there would be 40 ft. to each pupil in such a building. At the midway ratio between the factory without plumbing and appliances, and the hospital with plumbing, heating, and all appliances, $1.35, this would bring the cost of a brick building of the most substantial kind to $54 per pupil. Multiply by 448 and we get $24,192.

"To this should be added architects' fees, plumbing, heating, ordinary grading, and contingencies. It would seem as if 25 per cent. added should suffice. If so, we reach a total cost of $30,000. In some instances, notably in crowded cities, the size, situation, and neighborhood may make it necessary to arrange the schoolrooms with reference to the sun, and to place hallways and stairways where a larger area than 60 per cent. of each floor will be occupied by them. In that case, the additional number of square feet of floor must be added at the normal rate of cost per square foot. I am unaware whether or not that cost is greatly more or less than the cost of buildings previously constructed to meet a similar want. The only test of these estimates is that plans and specifications should be made upon these lines for submission to any one of the thoroughly competent builders who will not scrimp the work or vary from the highest standard in every respect. My judgment is that this estimate can be attained in practise in the city of Boston, subject to such additional expense as may be imposed by compliance with the building act."



FIRST FLOOR PLAN

BASEMENT PLAN

SECOND FLOOR PLAN

EUSTIS STREET PRIMARY SCHOOL, BOSTON.

WYMAN STREET PRIMARY SCHOOL, BOSTON.
Edmund M. Wheelwright, City Architect.

It will be noted that the dimensions of the schoolrooms shown in the plan here published are 24 by 32 ft., and not 28 by 32 ft., as premised in the pamphlet; but, as the architect writes me, if the size of the rooms were thus increased in the plans under consideration, the total floor area of all floors, including walls, would be about that given in the pamphlet, *i. e.*, 17,202 sq. ft.

Mr. Atkinson is of the opinion that such a structure as that contemplated by his plan, but with rooms of the larger size, can be constructed outside of Boston, not including plumbing and heating, for about $1.30 per square foot of floor area. He would use iron staircases, slate blackboards, fire-stops and expanded metal partitions, and wire-lathed ceilings. Aside from the excess of cost of requirements of the Boston Building Laws previous to 1892, the school would differ little in its features from those of Boston schoolhouses built about that time. The only points of such difference would be single instead of double sash, wood instead of cement and plaster finish, ordinary base in place of hospital base; for all the Boston schoolhouses built at this time had "mill-constructed" first floors.

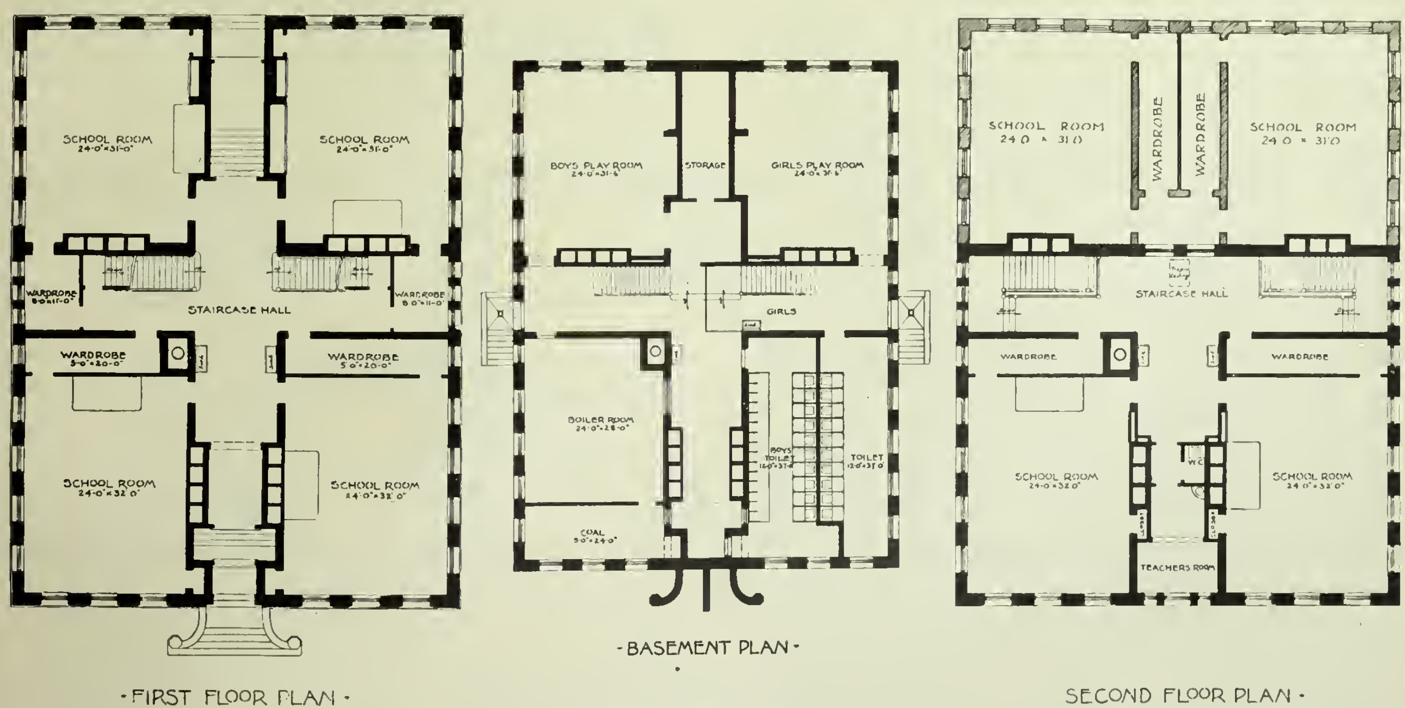
Such being the case, it is difficult to see how Mr. Atkinson's expectations of cost can be borne out in an actual construction of such a building as he has planned. As this building he suggests is of a very unusual and not normal form of schoolhouse plan, it would appear more fruitful of satisfactory result to consider first the cost of an eight-room schoolhouse of a more normal type.

Let us then consider the cost of the Wyman School built in 1891 and 1892 in Boston. It is a building of very simple type, with mill-constructed first floor, flat tar and gravel roof, and of such slight architectural pretensions as to bring it very close to the category of a factory building. It is a six-room building, but, planned for the ready addition of two more schoolrooms, the additional cost of such further construction, if done at the time of the first construction, would have been, say, $2,000 additional to the actual cost, or about $30,000. Mr. Atkinson's estimate of $1.35 per square foot of floor area did not contemplate the cost of heating and plumbing. These features of the Wyman School cost about $3,200, making the cost under consideration about $35,000.

The floor area of the Wyman computed as an eight-room school was 15,744 sq. ft.; its cost per square foot of floor area without heating or plumbing was, therefore, about $2.27.

If this building had been built for grammar grade, with schoolrooms 28 by 32 ft. instead of 24 by 32 ft., its cost would have been increased about $1,500, or about 10 cents per square foot, that is, to $2.37 as against $1.35, the price set by Mr. Atkinson as the price for his mill-constructed school of this type.

The heavier brick walls required in the Boston school above that of the mill-constructed school involved an increased expenditure of about $2,200; the cost of asphalt floor above concrete, double instead of single sash, and other items of more expensive finish, involved not more than $1,800 in addition; and if the slight departures from the strict requirements of necessity in external features



WYMAN STREET PRIMARY SCHOOL, BOSTON.

did not amount to more than $700, I am safe in saying that no saving would have been made if columns and girders had been substituted for brick carrying partitions, but possibly $1,500 might have been saved by not using brick vent and heat flues, and some of the non-carrying brick walls.

About $6,200 is all the saving that would appear if the building had been constructed under building laws that would have permitted the construction upon which Mr. Atkinson bases his calculations.

The area of an eight-room grammar school building, on the same plan as the Wyman School, would have been about 18,000 sq. ft. If a building of this plan were constructed as Mr. Atkinson suggests, we would expect its cost to be about $31,500, or, $1.75 per square foot of floor area. I cannot, judging from my own experience in the cost of actual construction, believe it possible to reach the low cost of $1.37 per square foot of floor area given in the pamphlet.

NORTH BRIGHTON GRAMMAR SCHOOL, BOSTON.
Edmund M. Wheelwright, City Architect.

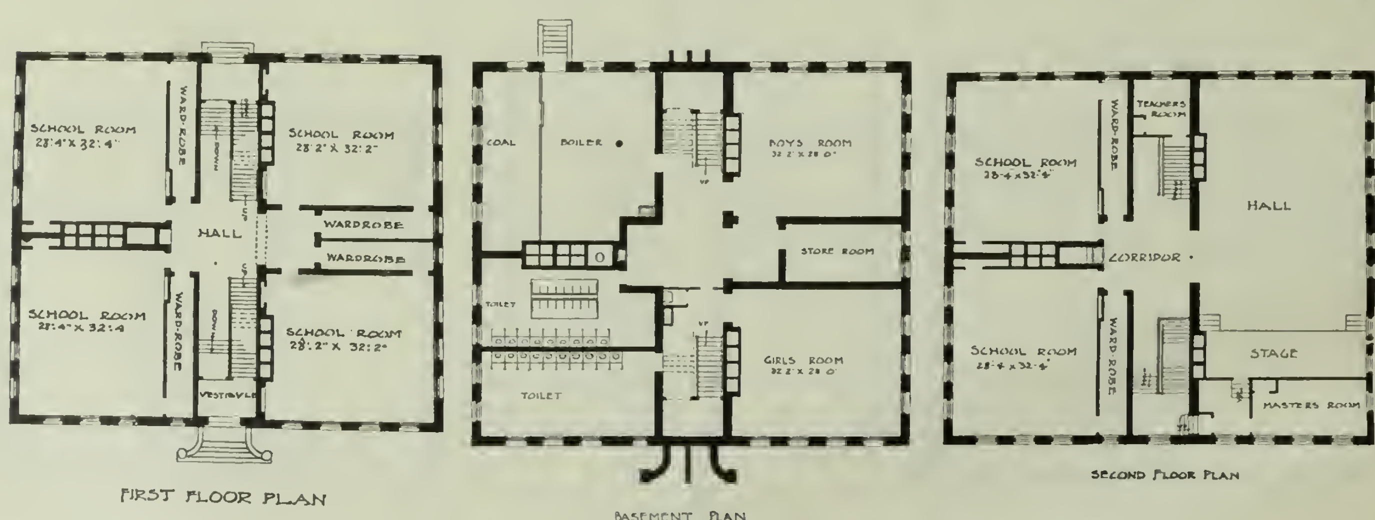
Let us consider another Boston schoolhouse of very plain external treatment,— built at the same time as the Wyman School,— the Warren Grammar School. As this is a six-room building with an Exhibition Hall, it is practically the equivalent of an eight-room building. This building contains 18,648 sq. ft. of floor area, and cost, exclusive of heating and plumbing, about $35,000. It is even plainer in design than the Wyman School, and if the deductions on account of extra thickness of walls and other variants from Mr. Atkinson's hypothetical school are made, we may set the minimum cost of such a building at about $30,500, or about $1.64 per square foot of floor area.

This could again go to show that such low cost of schoolhouse construction as calculated in the pamphlet and by the estimate of the schoolhouse indicated by Mr. Wm. Atkinson's sketch plan is impossible, even if other than "thoroughly competent builders, who will not scrimp the work or vary from the highest standard in every respect," are employed. There is an evident fallacy in the method of striking the mean between the cost of a factory and the cost of a hospital as the basis of cost of a schoolhouse. There are no such elements of a greater cost in a hospital above that of a schoolhouse which would justify such a basis of computation; indeed, the greater floor spans required in a schoolhouse make this class of building little if any more expensive than a hospital of the same grade of workmanship and architectural (or non-architectural) treatment. In my own experience I have found but little difference of cost in schoolhouse and hospital construction.

In a schoolhouse expense for fire protection and for hygienic reasons is equally if not more necessary than in a hospital. The expense of blackboards fully offsets the expense of marble fittings in the ordinary operating room.

The cost of $1.64 per square foot of floor, is, I believe, the minimum cost at which a small grammar schoolhouse, two stories in height, can be built, if constructed as contemplated by Mr. Atkinson's plan. Any departure from the regularity of this plan, or the addition of any of the desirable features not contemplated therein, will make an additional cost.

It should be borne in mind that this cost does not include heating or plumbing. These items will add about 22 cents to the cost per floor area; and the cost of the double sash, with the thicker walls necessitated thereby, asphalt floors and other features requisite for a schoolhouse of the first class, will add 10 cents additional. We may, therefore, set the minimum cost of an eight-room schoolhouse built in a first-class manner, with all features desirable for health of pupils and permanency of construction, and with no architectural pretension, at $1.96 per square foot of floor area, if the building



NORTH BRIGHTON GRAMMAR SCHOOL, BOSTON.

is of as compact a plan as the Warren School; and that as the area is increased in meeting the same conditions, that the cost is increased by about $1 a square foot of such added floor area.

Let us apply this method of estimating to a building of the area of the school predicated in the pamphlet.

The Warren School had 18,648 sq. ft. of floor area, which, at $1.96, amounts to $36,550. The Warren School has more floor area than the school described in pamphlet by about 1,500 sq. ft., which, at $1 per square foot, would decrease the probable cost of such a building to $35,000; the cost of grading, paving, and fencing the schoolyard of such a building would probably not be less than $3,500. The architects' commission would be $1,925, making a probable total cost of first-class, well-constructed, eight-room grammar school not less than $40,425, and which, if shorn of certain desirable features not contemplated in Mr. Atkinson's program, could not cost much less than $38,000, instead of $30,000, which is stated in the pamphlet to be the probable cost of such a building. I regret that further communication received from Mr. William Atkinson cannot be printed in this issue, but it will be given in the next paper.

It has appeared desirable to analyze this subject for two reasons: First, to, if possible, lessen the number of adherents to the idea that the expense of schoolhouse construction is greatly increased through regard for architectural appearance, which appears to be the main point which Mr. Atkinson has sought to establish; and, secondly, to remove the impression which this pamphlet has produced upon the minds of some, that thoroughly appointed and well-constructed schoolhouses are extravagant in cost, because they are found not to tally with the calculations there found. The question of the amount of cost due to architectural design in schoolhouses and the general artistic views of this subject will be later considered.

To follow out further this consideration of schoolhouse costs, the following table relating to a six-room schoolhouse built in Boston under the Building Laws of 1892 is given. The increased size of building due to these laws will be noted, in comparing the plans of the Eustis and Fuller Schools, to be due to the requirement of the later law that staircases should be enclosed and shut off by tinned fire doors.

Three items here given show the excess of cost of method of construction and features in Boston schools of that time above those of schools outside of that city.

Greater thickness brick walls	$1,173.00
Increase through special requirements of law as in relation to enclosed staircases, etc.	1,500.00
Floor framing to carry load of 150 instead of 80 lbs.	1,000.00
Iron above wood staircases	468.00
Fire-proofing of floor and fire-stops	300.00
	$4,441.00

Wardrobes in separate rooms	$1,600.00
Double instead of single run of sash	420.00
Asphalt instead of cement basement floors	500.00
Fire-proof instead of stud partitions	121.00
Wire-lathed instead of wood-lathed ceilings	296.00
Slate instead of composition blackboard	209.00
Keene's cement finish instead of wood	96.00
Hospital instead of common base	106.00
Bookcases and other special finishings	180.00
	$3,528.00

These tables will be found useful in comparing the costs of different schools, but in such use it should be borne in mind that costs of schoolhouses vary on account of the number of schoolrooms, and also whether built for primary or grammar grades. This will be pointed out in detail later and an attempt will be made to fix certain proportions by which calculations may be made from one grade to another and from smaller to larger buildings, and *vice versa*.

Architectural Terra-Cotta.

BY THOMAS CUSACK.

COOPERATION BETWEEN ARCHITECT, ENGINEER, AND CLAY WORKER.

IT has already been assumed, as a matter of course, that the first step towards the erection of a building is to employ a competent architect; not only to plan, but to supervise its erection. If the building is one on which structural iron (or steel) is to be used, he will require the help of an equally competent engineer. There are many ways in which such help may be obtained, but the usual course of procedure resolves itself into a choice between three alternatives. First, he may associate with himself a consulting engineer of repute, who takes charge of the constructural ironwork, and for which service is paid a separate commission. Second, he may employ competent help of this kind to work in his own office at fixed salaries. Third, he may arrange with a capable, trustworthy firm of contracting engineers, who will devise a scheme of construction; for which, as well as for the execution thereof, they will hold themselves responsible, subject to agreement as to cost.

On the relative merits of these three systems a divergence of opinion may reasonably be expected; but as the terra-cotta man is sure to have enough troubles of his own, he had better ask to be excused from any part in a question that does not directly concern him. He is not called upon for advice in regard to the steel structure as such, except in so far as his own work is likely to be affected; and in that it is mechanical rather than business methods that he is forced to consider. Forced, we say, for a stage has now been reached where the settlement of these points is to him and his work a matter of vital importance. It often happens that they have been settled *for* him; sometimes, indeed, before he has obtained the contract for his part of the work, or, at all events, before he has seen the details or has had time to make any recommendations concerning them. If settled in this way, the chances are that the best possible solution has not been thought of, because the man best qualified to render needful assistance, by reason of his special knowledge and experience, has not been consulted. In this we do not impute intentional discourtesy to either architect or engineer; nor do we charge them with any desire to discount the claims, much less ignore the existence of a terra-cotta maker. As a general rule, the facts warrant a distinctly opposite conclusion. It is the *system* under which contracts are usually awarded that is responsible for most of the anomalies that arise in the course of their fulfilment.

Instead of the terra-cotta being one of the first items pushed forward to a definite settlement, it is often allowed to drag until nearly the last, or until some general contractor can make satisfactory terms with one out of many subcontractors. Meanwhile, the iron construction has been determined, and is then, perhaps, too far advanced at the works to admit of any modification being made, however freely certain oversights may be admitted. They may be too palpable to be denied, but these admissions are valueless when accompanied by a statement to the effect that "the shop drawings are all out," or that "the holes have been punched at the mill," and so cannot be altered except at an expense to somebody, which nobody is willing to defray. The terra-cotta manufacturer is usually thereupon advised to do the best he can under these untoward conditions, and with that consolation is expected to rest and be thankful. In all instances of this kind he becomes a scapegoat on whose back a multitude of sins are carried into the wilderness of forgetfulness, while the iron construction, however much at fault, is allowed to pass unimpugned, as though a thing of divine origin.

There are at least two ways in which these grievances may be remedied, or — which would be better — rendered non-existent. The points of contact between iron and terra-cotta might be reserved, and held subject to revision until such time as the successful bidder has had an opportunity of assenting to, or of offering a substitute in lieu of the proposed arrangement. The better plan, however, and we are glad to say one frequently adopted by the best architects, is to give out the contract for terra-cotta direct, and at the earliest possible date. If, for business reasons, all payments be made through the general contractor, it is a very simple matter to have that item in-

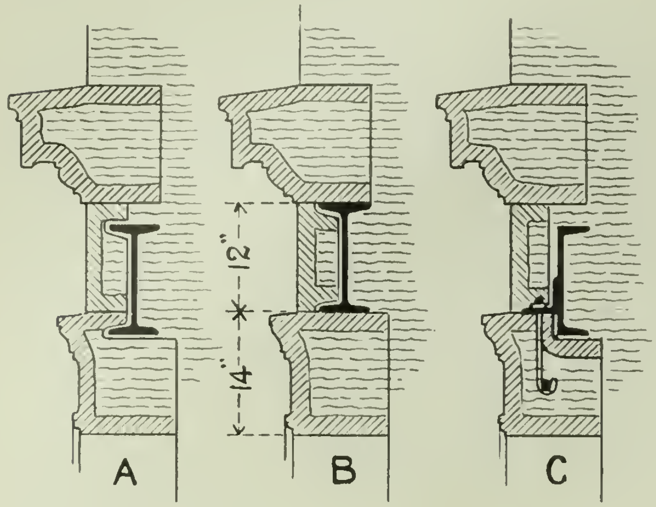


FIG. 50.

cluded in his contract. Much remains to be said on this branch of the subject, but to avoid a confusion of ideas, it is reserved for another chapter.

The questions at issue may be further elucidated by the few simple illustrations now added to those already given. If, for example, an I beam should be placed arbitrarily as at A, Fig. 50, provision would have to be made in the blocks forming lintel to receive the lower flange. To do so, however, would at once render the blocks more difficult to make, without adding any equivalent support to the lintel. In such a case the I beam should be raised, or the lintel lowered to position shown at B, thus allowing the cornice course to rest directly on beam, the fascia being molded to fit in between the flanges. If, for any reason, the relative positions of I beam and of lintel could not be altered, then a channel might be substituted, and on it an L riveted at any desired height, as at C. A lintel of this kind would be considered self-supporting up to 4 ft., beyond which width of aperture it could be suspended by hangers, inserted in the manner indicated in section, and elsewhere explained with sufficient detail.

Another objectionable arrangement is shown at A, Fig. 51, and in it, too, the remedy is, we think, equally obvious. Just why that 12 in. I beam should have been placed in its present position it is rather difficult to imagine. It cannot be supposed that a beam of that size was necessary to carry the wall above, there being but a few feet of brickwork between it and the sills of a similar tier of windows in the next story. Ostensibly it is intended as a support for the terra-cotta lintels; in reality it reduces these lintels to a shell, rendering them liable to snap along the chase made for bottom flange; manifestly the line of least resistance. Had the engineer's intention been to rob these lintels of their own inherent strength, and at the same time cause the maker of them the utmost inconvenience, he could hardly have hit upon a readier means of doing both. The truth is, he had not mastered the rudiments of the business in which he was engaged; or, having done so, acted with selfish indifference as to consequences.

The change which we would advise in all cases of this kind is shown at B. An arch lintel 14 ins. deep and 16 ins. reveal would be quite safe over an opening of 5 ft., without any auxiliary support. Beyond that width, instead of a 12 in., we would use two 6 in. I beams, placed so as to carry the brickwork above and relieve the lintel below. It is rarely necessary to insert the flange of cast or of rolled sections, and it is better to avoid doing so wherever possible, except at a joint, where it can come between two courses.

An equally objectionable use of iron is illustrated at C, Fig. 51, where a 12 in. I beam is placed so that the flange cuts into back of panel to within 2 ins. of the face. Had this beam been reduced to 8 ins., the flange could then have come into the joint, and so would not have impaired the stability of the panel. This panel, it will be observed, could not be jointed to suit the flange because of the ornament on its face, which would thereby have been mutilated beyond redemption. If, however, a 12 in. beam *had* to be used, for some structural reason not apparent in this section, it could have been placed at least 2 ins. further back, thus increasing the thickness of panel to 4 ins. at its weakest point; in which case the existence of the beam would have been less mischievous.

We can recall an instance of this kind in which the opposite course was adopted by the contracting engineer, and that, too, without any notice being given to the terra-cotta makers, whose work had been made to the original detail. Instead of moving it further back, he actually brought it 2 ins. farther out, without the least regard to the fact that the flange would then come clear through the terra-cotta panel. This, of course, was seen to be quite impracticable, but not until the work was being set; and then an expedient had to be resorted to which was not only expensive, but very unsatisfactory. Whether this unwarranted change was made in ignorance, or from sheer perversity, we know not. Perhaps he suffered from an overweening desire to get the center of beam into the center of column, and so be able to save a little by using standard connections. The excuse is certainly a lame one, but it is the best we can offer on his behalf.

At Fig. 52 we illustrate the design of a conventional balcony, such as might be projected from a second or third story window by way of embellishment. The manner in which it was constructed is likewise shown in section below; in this instance, as an example of how not to do it. In the first place, the cantilevers were of a strength out of all proportion to the load that could, by any possibility, be

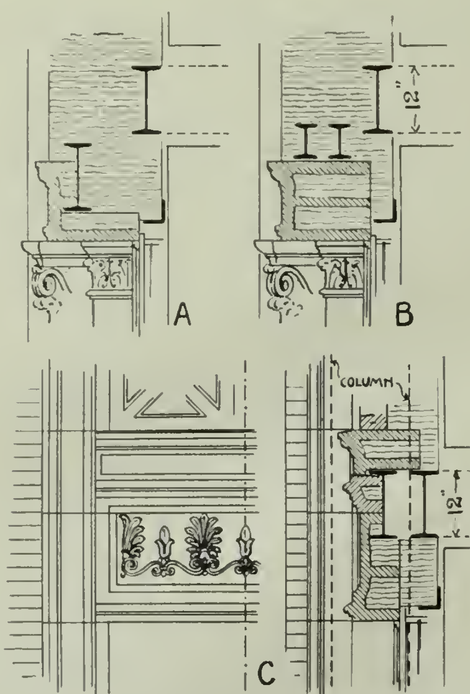


FIG. 51.

put upon them. They were placed about 7 ins. too high, cutting through the top bed of modillions and into the bottom bed of the blocks forming platform, thereby causing an incurable weakness in both. The inverted tee resting upon them was not only quite unnecessary, but positively suicidal, so far as the terra-cotta was concerned. There is no reason why the blocks in that platform should have been severed longitudinally at this point, in order that a superfluous piece of iron might be inserted in the joint; thus creating another source of weakness no less mischievous than the one just referred to. Yet it is in this way, we regret to say, that a number of such balconies were actually constructed on a certain building of which they are supposed to be an enduring feature.

The people who made the work are conscious of these defects, but excuse themselves at the expense of the architect, alleging that it is "made according to detail." He, in turn, contends that they were long enough in the business to have known right from wrong, detail or no detail, and that, as specialists in their line, they were expected to make good just such deficiencies. On the whole, we think he has the more valid half of the argument. Meanwhile it may not, perhaps, be without reason that those best acquainted with the facts are said to prefer the opposite sidewalk.

The quality of the terra-cotta, as such, is excellent, being artistically modeled, sufficiently fired, and of good texture, but those who made it did not fully realize the extent of their responsibility. Had they done so, their first duty would have been to see that the proposed construction was fairly practicable, and that it could be attempted without endangering their own reputation. If not, their next step would have been to point out its defects and offer a feasible alternative, which, in all probability, would have been accepted with thanks by the architect.

A plan such as this is shown in sections A.A., B.B., and C.C., which, being simple and direct, would have been really much less expensive in point of execution. The modillion in this case would be made with four walls and one horizontal partition, forming two open chambers, as at C.C. Into the upper one of these we would insert a 3½ by 5 in. I beam, the end of which would be attached to floor beam, and the surrounding space then well filled with concrete, as at B.B. In this way we would get the full strength of the cantilever cased in cement, without weakening the modillion by needlessly cutting through its outer shell. There need not then be any doubt as to the reliability of two such brackets of composite construction. The platform would be made in three complete blocks of moderate size, two of them resting directly on the brackets, the center block joggle jointed on two sides, with a third side built into wall. As the simplicity and security of this arrangement will not be denied, it may be allowed to rest on these merits without further comment on that behalf.

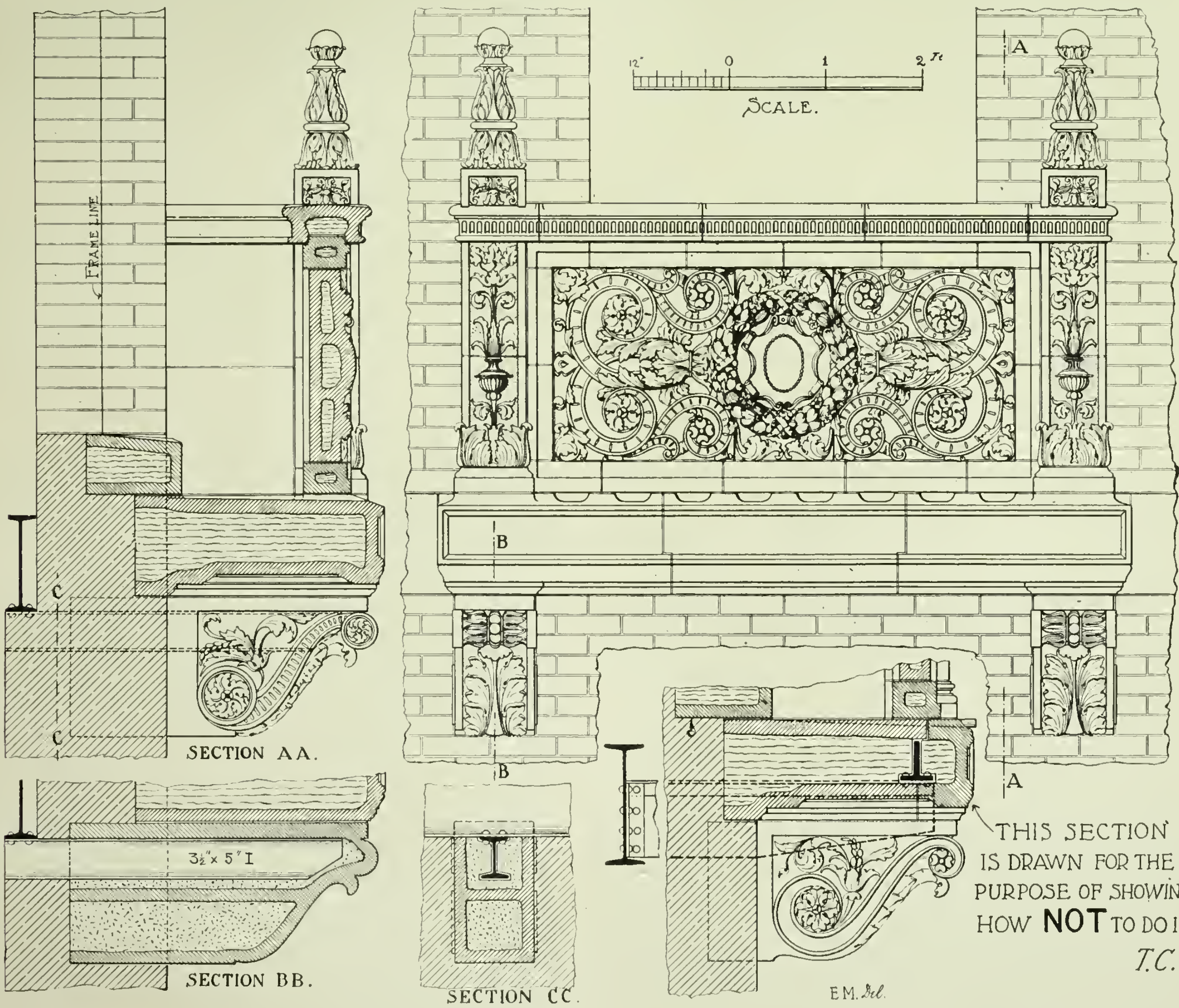


FIG. 52.

Strength of Brick Masonry.

BY IRA O. BAKER.

M. Am. Soc. C. E., Professor of Civil Engineering, University of Illinois, Champaign.

An excessive estimate of the strength of a structural material results in a weak and possibly dangerous construction; but, on the other hand, a failure to appreciate the possible strength of the material used needlessly increases the cost of the structure. From the very nature of the case, the architect or the engineer is more ready to accept the second condition than the first. If he overestimates the strength of the material he uses, he endangers his own reputation and possibly the lives of others; but if he underestimates, the client pays the bill without being any the wiser. In case of doubt, it is proper to lean toward the side of safety, but the architect or engineer owes it to his client to make a safe but not excessively strong structure. This requires that the designer should know the strength of his structural materials and the method of using them most economically.

Apparently there is more extravagance in the use of masonry than of any other structural material. As an illustration of this may be cited the past and present practise in building masonry arches. The Pont-y-Prydd Bridge, in Wales, is a segmental masonry arch having a span of 140 ft., and a rise of 35 ft. (one fourth of the span), and is built of small, rough rubble masonry in lime mortar. The arch ring is only 1 ft. 6 ins. thick at the crown and the same at the springing. It was built in 1750, and after four generations is still standing. Over against this example may be cited the Westminster Bridge, in London, which has a span of 76 ft., a rise of 38 ft., and a thickness at the crown of 7 ft. 6 ins., and at the haunches of 14 ft. The span of the Westminster is about half that of the Pont-y-Prydd, and the thickness varies from five to nine and one third times that of the Pont-y-Prydd. The first is built of small stones as they come from the quarry, and the second of carefully cut large blocks. Of course the first carries only a country highway, while the latter carries a main street of a great metropolis; but even a little comparison shows that the last is extravagantly designed. Several other almost equally striking comparisons could be made between very early and more modern examples of arch construction. Again, innumerable comparisons could be made between American railroad arches which stand without any signs of failure, and others which are unquestionably many times stronger — in some cases ten or twenty times — and this notwithstanding the fact that all the evidence shows that the former are extravagant. It is nothing uncommon to find arches of considerable size that certainly have a "factor of safety" of, at least, one hundred. The cases of arches have been cited, since they are the only structures in which the ultimate strength of the masonry is even approximately approached. The load on masonry towers, mullions, piers, etc., is often still more extravagant. Of course, in many structures, particularly small ones, other elements than the strength of material determines the dimensions, and in small structures an excess of material is not important; but in larger structures the dimensions of the parts are usually determined by the strength of the material, and an excess is a serious matter.

Within certain limits it can reasonably be said that if no one of a considerable number of structures has ever failed, it is probable that some, perhaps many, of them are extravagantly designed. This principle obtains in the evolution of a machine or of a bridge. A certain part is made too small and breaks; a new and larger one is made, but after a time it also breaks; a third and still larger one is made, which does not break, at least for a long time. In this case it may safely be concluded that the part as last made is of proper design. On the other hand, if a part is made too heavy, competition or economy will prompt some one to make it smaller; and if it successfully does the work, it is proof that before it was uneconomically designed.

Did any one ever hear of a brick pier being crushed, even in a temporary structure, where it would be entirely proper to design on a smaller margin of safety than in a permanent structure? Of course, oftentimes the size of a pier is determined by its resistance to being overturned by accidental blows before its vertical load comes upon it, rather than by the load it is ultimately to support; but the fact remains that since it is very rare to find brick constructions that have failed, owing to excessive loads, it is probable that many such are extravagantly designed.

How comes it that masonry is used so extravagantly? There are two reasons: First, many designers more or less blindly follow preceding practise. Mr. A designs a structure without much knowledge of the strength of the masonry he uses. Next, Mr. B is called upon to design a structure a little higher or heavier than Mr. A's, and he adds to Mr. A's sizes without knowing whether A's structure was extravagant, and without knowing whether the increase in size is proportional to the increased load. Mr. C then treats B's structure as the latter did A's, each saying that as masonry is cheap, he will be sure to make it large enough. With a higher-priced material this process is less likely to take place, since the requirements of economy will probably determine the elements of the design.

A second reason for the unintelligent design of masonry structures is the lack of definite information as to the strength of masonry. Until very recently there have been no experiments to determine either the strength of brick masonry or the law of its variation, and even now there has been no experimental determination of the strength of stone masonry. Therefore, since existing structures give no definite information as to the actual strength of masonry, it is not surprising that the strength of brick and stone have not been utilized scientifically.

RESULTS OF EXPERIMENTS.

Within the past few years several valuable series of tests have been made upon the strength of brick masonry, with the large and accurate testing machine of the United States Arsenal at Watertown, Mass., under the direction of the War Department. The reports of the tests are published annually under the head of "Reports of Tests of Metals and Other Structural Materials made at Watertown Arsenal, Mass.," and are included in the annual report of the Secretary of War. They are also published separately. The experiments on brick masonry are described in the following volumes: —

Report of Tests of Metals, etc., 1883 (Senate Executive Document No. 5, Forty-eighth Congress, First Session), pp. 217–20; *ibid.*, 1884 (Senate Ex. Doc. No. 35, Forty-ninth Congress, First Session), pp. 69–124 and 235; *ibid.*, 1886 (House Ex. Doc. No. 31, Forty-ninth Congress, Second Session), Part II., pp. 1691–1742; *ibid.*, 1891 (House Ex. Doc. No. 161, Fifty-second Congress, First Session), pp. 739–43; *ibid.*, 1893 (House Ex. Doc., Fifty-third Congress, First Session, without a distinguishing number), pp. 323–34.

In all, 97 tests were made of piers built of various kinds of brick and mortar, varying from 2 to 10 ft. in height, and from 8 to 16 ins. square. These experiments are very valuable, but have not received the attention their importance warrants, possibly because the reports of them are scattered through several volumes which are more or less inaccessible. The above volumes contain practically only the numerical results of the experiments, and it is proposed here to discuss these experiments somewhat fully.

Kind of Brick. — Three grades of brick were used. The weakest were second-hand "medium hard-burned common brick," designated in the official report as Bay State brick. The strongest were "hard-burned common brick," designated as common brick. The best were a hard-burned, medium smooth and regular pressed brick, designated as face brick. The brick were tested by grinding the broadest surface approximately flat with loose emery on a face plate and crushing between steel pressing surfaces. The average crushing strength of the first was 11,406, of the second, 18,337, and of the third, 13,925 lbs. per square inch.

In determining the crushing strength of brick and stone it is customary to test cubes, since with specimens broader than high the pressing surfaces materially increase the apparent strength of the material. Judging from experiments made by the writer on the relative strength of cubes and whole brick, it is probable that cubes of the above brick would have shown a strength of only about half the above results, which shows that the brick were not remarkably strong, since cubes of brick frequently test 15,000 to 20,000 lbs. per square inch, or even more.

Method of Building Piers. The piers were built by a common mason under instructions to do ordinary work. The bond was broken every course. After building, the piers were stored under a dry shed.

Age when Tested. The piers were from fourteen to twenty-four months old when tested, unless herein otherwise stated.

Strength of Lime Masonry. Nine piers from 2 to 10 ft. high and 12 ins. square, built of the weakest brick (medium-burned common brick) laid in common lime mortar, showed an average strength of 1,118 lbs. per square inch. Neglecting for the present the effect of the height of the pier, let us see if we can arrive at an adequate conception of the meaning of 1,118 lbs. per square inch. Ordinary brick masonry weighs from 120 to 130 lbs. per cubic foot, or a prism of such masonry 1 in. square and 1 ft. high would weigh not more than 0.9 lbs. Therefore, 1,118 lbs. per square inch is the pressure at the base of a wall of ordinary brick masonry 1,240 ft. (nearly a quarter of a mile) high. This is a fair average for the weakest grade of masonry experimented upon. The highest in this series was 1,270 lbs. per square inch, and the lowest 779 lbs. per square inch. Not infrequently men refuse to buy soft brick, "because they are not strong enough to bear the pressure" of a two or three story house.

Method of Failure. "The first sign of failure was the formation of cracks in the brick opposite the end joints in the adjacent courses. As the load increased these cracks gradually widened and increased in length, final failure occurring by the partial crushing of some of the brick and the enlargement of the longitudinal cracks. This manner of failure was common to all piers." In other words, the piers failed by the brick breaking across, after which the parts separated. The brick break transversely because of the irregularities of form, and because of the unequal distribution of the mortar in the joints — probably chiefly the first.

Effect of Irregularity of Form of Brick. The experiments give significant evidence as to the effect of irregularity upon the strength of masonry. Hard-burned common brick having a strength of 18,337 lbs. per square inch gave, with lime mortar, 1,814 lbs. per square inch; while face brick having a strength of only 13,925 lbs. per square inch gave a strength of 1,814 lbs. per square inch. The quality of brick is indicated somewhat by the fact that the face brick were laid with ⅛ in. joints, and the common brick with ¼ in. The first brick were practically 10 per cent. the stronger, while the masonry was nearly 10 per cent. the weaker. With Rosendale natural cement mortar the face brick gave 15 per cent. greater strength, and with Portland cement mortar the face brick gave masonry 34 per cent. stronger than the stronger common brick. In other words, the weaker but more regular brick gave the stronger masonry. Not infrequently architects and owners, particularly the latter, reject the softer and more regular brick for the harder and more irregular, on the supposition that the latter will make the stronger wall. Within reasonable limits the reverse is more nearly true, as shown above.

(*This paper will be concluded in the April number.*)

THE subject of the John Stewardson Memorial Scholarship, the competition work for which is just commenced, is unique. A farm standing on typical Pennsylvania farm land, with barns, farmyards, gardens, etc., is the problem, and one that the ten young men now at work on it must find full of interest.

THE Pittsburgh Chapter of the American Institute of Architects are arranging for their first public exhibition. It is to be held in the Carnegie Art Galleries early in May. Many prominent architects throughout the country have already expressed their intention of exhibiting drawings.

On the Saline Efflorescence of Bricks.

THE CAUSES LEADING TO IT, AND THE PRACTICAL MEANS OF AVOIDING THE SAME.

BY OSCAR GERLACH (PH. D., BERLIN).

I PROPOSE in the following article, the first of a brief series, to consider the mode of origin of the common saline efflorescence of bricks. A series of researches which I conducted at the *Laboratory for Clay Industries* of Professor Seeger and E. Cramer, of Berlin, Germany, and which were continued in practical work in America, furnished me with results that not only afford a clear explanation of the origin of efflorescence, but also point to the practical means of avoiding the same. The means of avoidance I shall discuss in a separate article.

By "efflorescence" I understand what is commonly termed "whitewash," wherever and whenever such incrustations appear. For the sake of clearness I shall follow the process of brickmaking in all its successive single stages, as commonly conducted, and point out at each step the causes concerned in the production of the chemical salts occasioning the annoying superficial colorations in question.

Most noticeable and most annoying are the *white* efflorescences on red or yellow brick; less striking are the green and yellow incrustations on light brick. The white efflorescences are always of inorganic or mineral origin, being mainly sulphates of lime, magnesia, and alkalies. We shall consider here the formation of the white efflorescences, reserving the green and yellow for another occasion, and as a matter of clearness distinguish carefully between: —

1. The formation of efflorescent sulphates which are found *already formed* in the clay pits, or which are first formed from *allowing the clay to lie unused* for a certain length of time, or which arise at any time *during the making of the clay* into green bricks; and

2. The formation of sulphates which arise during the water-smoking and during the burning of the green material in the kilns.

This distinction is necessary, because practical brickmakers are prone to think that water-smoking alone is the cause of the white-washing sulphates making their appearance on the finished products.

I.

ON THE FORMATION OF THE EFFLORESCENT SULPHATES IN THE CLAY BEDS, ETC.

The majority of clays used in brick and terra-cotta making contain greater or less quantities of mineral salts. Chemical analysis has shown that these salts are sulphates of lime and magnesia, less frequently of iron and alkalies. These sulphates are formed by the weathering of finely and uniformly distributed particles of iron pyrites, which is an almost constant accompaniment of the clay. Through the action of water, air, and heat the iron pyrites (FeS_2) is gradually oxidized and converted into ferrous sulphate ($FeSO_4$), which, being easily soluble in water, is, in union with the carbonates of lime, magnesia, and alkalies, whose constant presence can also be shown, converted into the respective sulphates of these combinations. For example, $FeO.\ SO_3 + CaO.\ CO_2 = FeO.\ CO_2 + CaO.\ SO_3$.

It is readily intelligible now that the more minute the distribution of the iron pyrites is in the clay, and the more the mass as a whole is exposed to the influences of the weather, *i. e.*, to the effects of water, air, and heat, the greater the quantities of iron pyrites oxidized and the greater the quantities of soluble sulphates stored up in the clays. If we are using, for instance, a stony clay belonging to the carboniferous formations, which always contain heavy quantities of iron pyrites (*e. g.*, blue shale), and work the same into green bricks immediately, and at the beds where the clay is found, then certainly the whitewashing is far less apt to be noticeable than if the clay had been suffered to lie for months before using, exposed and in the open air.

To prove this, I analyzed several specimens of clay from the same pit, and so determined the amount of soluble sulphates in each. One specimen was taken from the upper layer of the clay, another from a lower layer quite protected from the air and heat. The analysis showed that the upper layer contained four times as much soluble sulphates as the lower, protected layer.

Another experiment yielded similar results. I took *three* specimens from the *same* layer of clay. Of the first specimen, 100 grams were *immediately* analyzed and the amount of sulphates therein contained determined: of the second specimen, 100 grams were finely pulverized, moistened, and exposed to the weather for three months, and at the expiration of that time analyzed for the amount of sulphates; while 100 grams of the third specimen were likewise finely pulverized and let lie for three months in a dry, hermetically sealed tin box and then analyzed. It turned out that specimens 1 and 3 contained almost equal amounts of sulphates, while specimen 2 showed six times the amount of the others. Another clay, likewise belonging to the carboniferous period, having been let lie for months in the open air, left behind it on the ground where it had been heaped large quantities of beautifully formed gypsum crystals.

But even if such clays are worked into bricks immediately upon being transported from the pits, it does not necessarily follow that the formation of sulphates will be entirely prevented. If the green bricks be let stand a long while in the drying rooms a constant oxidation of the iron pyrites will take place on the surface of the bricks through the action of the moist atmosphere, and, concomitantly with this, the formation of sulphates which, while not visible to the eye in the green bricks, will, after burning, make their appearance in the shape of whitewash. To prevent this, not only is the immediate working of the clay into green bricks necessary, but it is also requisite to dry and to burn the bricks with all the expedition possible.

The oxidation of iron pyrites is accordingly a main cause of the formation of sulphates occasioning whitewash. A second source is the sulphur contained in the water employed in the preparation of the clay. This water frequently contains gypsum; and since many clays require so much as 30 per cent. of water for rendering them plastic, the gypsum present in the water naturally contributes a high quota to the formation of the annoying superficial efflorescences in question. So, too, by various other admixtures, as mineral colorings, oxide of iron, ochre, superoxide of manganese, the whitish efflorescences can be augmented. Wherefore, it is necessary that all such substances when used as admixtures should, without exception, be analyzed for the amount of sulphates they contain.

The quantity of water requisite for working the clay depends wholly on the nature of the clay and on the peculiar methods employed in working it. The greater the quantity of water, the greater the quantity of the sulphates dissolved in it, and the greater the quantity of dissolved salts deposited on the surface of the bricks in drying.

The method of drying is also of paramount importance, both as bearing on the formation of these efflorescences and as affecting their visibility on the surface. The quicker the drying can be per fected, the more advantageous will be the appearance of the burnt product, for in a perfectly dry brick all further oxidation of the iron pyrites is absolutely excluded; and then again, in consequence of the rapid evaporation of the water, the dissolved sulphates are not wholly deposited on the surface of the product, but in large part are left behind in the pores of the clay. The drying process consequently deserves the highest attention at the hands of the practical brickmaker. But since the space at my present disposal is limited, I shall reserve the discussion of the advantages and disadvantages of the different methods of drying for a future occasion.

To recapitulate: the substances giving rise to the efflorescence or whitewash of green clay products are (1) the soluble sulphates contained in the natural clays, and (2) the sulphates formed during the storing and initial treatment of the clays consequent upon the weathering of the iron pyrites and its resultant transformation into sulphuric bases. It remains to be mentioned that the efflorescences which find noticeable lodgment upon the green, unbaked material are subsequently burnt in indelibly on the surface of the brick, and can be removed neither by chemical nor mechanical means.

II.

ON THE FORMATION OF SULPHATES WHICH ARISE DURING THE WATER-SMOKING AND DURING THE BURNING OF THE GREEN MATERIAL IN THE KILNS.

The presence of iron pyrites in the clay is, we have seen, the main cause of the origin of whitewashing sulphates on the surface of the unburnt material, and iron pyrites again is chiefly concerned in the production of whitewashing sulphates during the water-smoking and burning of the green products. This happens in a twofold manner — first, and again, by the presence of iron pyrites in the clay; and secondly, and particularly, by the iron pyrites contained in the coal, which is mostly used as a fuel.

In burning two processes are distinguished: (1) water-smoking, and (2) burning proper.

WATER-SMOKING.

The object of the water-smoking is to expel the water which has been mechanically absorbed by the clay, and which still remains in it after drying,— the so-called "hygroscopic" water,— whereby the clay is thoroughly dried, but loses none of its original physical qualities. The purpose of burning, on the other hand, is (1) the expulsion of the water *chemically* contained in the clay (clay substance being essentially $Al_2O_3(SiO_2)+2H_2O$, (2) the chemical disintegration of the several components of the clay, and (3) a more or less perfect fusion of the individual argillaceous particles, whereby a definitive and permanent alteration of the substance is attained. With the loss of the chemically contained water, the clay loses its plasticity — a property so essential to the manufacture of argillaceous products.

We shall consider the process of water-smoking first, which has for its object the expulsion of the hygroscopic water. Since water is converted into steam at 212 degs. Fahr., this latter is the proper temperature for the process — attainable only by the artificial convection of heat to the products, *i. e.*, by the consumption of fuel. But since the size and the construction of the kiln in which the water-smoking is conducted renders it absolutely impossible for a perfectly uniform temperature to be obtained throughout the whole enclosed space, consequently that portion of the kiln and of the contents of the kiln which first comes in contact with the hot gases from the fireplace will be heated first. At these points a part of the water in the green products will be converted into steam, whilst at points more remote from the fireplace scarcely any rise at all in temperature will be noticeable. At these latter points the water vapor originating at the first points will be condensed and precipitated on the surface of the cold green products, whence, since the clay is strongly hygroscopic, it will be absorbed into the interior of the bricks. If the clay, now, still contains soluble sulphates in its interior, these sulphates will be dissolved in the water, and later, when the points in question have in their turn reached evaporating heat, will be drawn to the surface of the bricks, and, as the heat is increased, be burnt in there. If the green clay does not contain sulphates, or if the sulphates be rendered innocuous by the admixture of appropriate chemicals, the water so condensed will have no injurious effect upon the appearance of the bricks, provided the fuel employed contains no sulphur. But if a sulphurous fuel be employed,— for example, coal, which always contains more or less iron pyrites,—the water will absorb the gases of the sulphurous acids produced by the combustion of the iron pyrites, and this diluted acidic solution will act on the carbonates in the clay and form sulphurous salts, which, as the heat increases, will come to the surface and there be oxidized to sulphuric salts, thus causing again the annoying colorations.

(*Continued.*)

Fire-proofing.

HOW TO BUILD FIRE-PROOF.

BY FRANCIS C. MOORE,

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BY way of preface to the following article, I wish to say that it has been prepared after careful consultation with well-known experts, and after careful observation and study of numerous fires in this class of structures, and especially in those which caused losses to my own company.

I think it advisable, in an article of this kind, to state, as premises, certain propositions which might be treated as deductions. Some of them are axiomatic or self-evident, needing no demonstration, and ought to appeal to any practical mind as being truths, rather illustrated than demonstrated by the experience of the past few years. In accordance with this line of treatment, I desire to state by way of premise: —

First. It may be claimed that no construction is fire-proof, and that even iron and masonry could with propriety be designated as "slow burning." The iron or steel used in a modern building has, in its time, been smelted in a furnace which presented no greater capacity for running metal into pigs than some of our modern buildings, whose interior openings from cellar to roof correspond to the chimney of a furnace, and the front door to its tuyere. If a pyrometer could be adjusted during the progress of a fire it would be found to rise quite as high as in any forge.

Second. Glass windows will not prevent the entrance of flame or heat from a fire in an exposing building. It may seem strange that so obvious a proposition should be thought worth stating, and yet to-day more than 75 per cent. of the "fire-proof" structures of the country have window openings to the extent of from 30 per cent. to 70 per cent. of the superficial area of each enclosing wall without fire-proof shutters. Heat from a building across a wide street finds ready entrance through windows, and the several fire-proof floors serve only to hold ignitable merchandise in the most favorable form of distribution for ignition and combustion like a great gridiron to the full force of a neighboring fire. This was the case in the burning of the Manhattan Bank Building, on Broadway, in New York, and of the Horne Building, in Pittsburgh. The latter building was full of plate glass windows, 16 by 16 ft. Such buildings are not more capable of protecting their contents than a glass show-case would be. A recent article on the Pittsburgh fire in the *Engineering News* aptly expresses this in the following words: "There seems to be some irony in calling buildings fire-proof which opposed hardly anything to a fire from across the street more sturdy than plate glass!"

Third. Openings through floors for stairways or elevators, gas, water, steam pipes, and electric wires, from floor to floor of fire-proof buildings tend to the spread of flame like so many flues and should be fire-stopped at each story. This fault is more generally overlooked than any other. Ducts for piping, wiring, etc., should never be of wood, In the Mills Building, in New York, a fire, not long since, jumped through two or three floors from the one on which it originated, by means of the passageways for piping, electric wiring, etc., comparatively small ducts, but sufficient for the spread of flame. In one instance the fire skipped one floor, where it was cut off, and ignited the second floor above.

FIRE-PROOFING IRON MEMBERS.

Fourth. In view of the fact that it is necessary to cover iron with non-combustible, non-conducting material to prevent its exposure to fire and consequent expansion, and in view of the fact that all ironwork, except cast iron, will rust to the point of danger, it is best to use cast iron for all vertical supports, columns, pillars, etc. It is not advisable, of course, to have floor beams of cast iron (except in the form of Hodgkinson beams thoroughly tested). If a floor beam should give way, however, it might not necessarily wreck the building, whereas if a vital column should give way a collapse of the entire structure might result.

RUST.

At a convention held some years ago in New York, at which were present a greater number of experts in iron than probably ever met before or since in one room, there was not one who contended that cast iron would rust beyond the harmless incrustation of the thickness of a knife blade, whereas there was not one who did not believe wrought iron would rust to the point of danger; and there was not one who claimed to know whether steel would or not, each admitting that steel had not been sufficiently tested as to rust to warrant a reliable opinion. If it could be relied upon as rust proof, it would be superior to all other material for fire-proof buildings because of its great strength in proportion to weight. The use of steel in construction is growing, because it is cheaper than wrought iron, as lighter weights are used for the same strength, but while supposed to be superior to wrought iron, some of the prevailing impressions with regard to it are erroneous. Defects not possible of detection by tests are liable to exist in its structure. Among the first steel beams brought to the city of New York there were instances in which they were actually broken in two by falling from the level of trucks to the pavement, probably due to their having been rolled when too cold, as steel when rolled below a certain temperature becomes brittle. Better beams are now made.

In my opinion, cast-iron columns are superior to steel and more reliable. It is not generally known that American cast iron is vastly superior to English cast iron, and will stand a greater strain without breaking. Cast iron, moreover, will not expand under heat to the same extent as wrought iron and steel, which is another fact in its favor.

COLUMNS SHOULD BE STRIPPED.

No bearing column should be placed in such a position that it cannot be uncovered and exposed for examination without danger to the structure. One of the ablest architects in New York makes it a rule to so fire-proof his columns that they can be examined at any time by removing the fire-proofing to determine whether rust has invaded their capacity to carry their loads. In my judgment, periodical examinations should be made, from time to time, in this way of all wrought-iron or steel columns, as it may happen that a leaky steam or water pipe has worked serious harm. Such a discovery was accidentally made recently in an important New York building.

CEMENT AS A PREVENTIVE OF RUST.

Numerous newspaper paragraphs appear, from time to time, which claim that metal stripped of its covering of cement has been found exempt from rust, with the paint intact, etc., and the fact is cited as evidence that cement is a preservative of iron and that the danger of rust is over-estimated. It is probable that cement will protect paint for a long time, and, of course, paint, if properly put on, will protect iron while the oil in it lasts. Painting, by the way, should be done with the best quality of linseed oil and without the use of turpentine, benzine, or dryers. It should be thoroughly applied in three coats, with about a gallon to 400 sq. ft., and the iron should be first thoroughly cleaned of rust and dirt, by pickling or other process. Paint is rarely properly applied, however, and even when of the best quality, is a preservative of the metal, as already stated, only so long as the oil in it lasts.

Those who claim to have evidence of the exemption of iron from rust rely, I think it will be found, upon iron which has been under exceptionally favorable conditions, free from dampness, the action of gases, etc., overlooking the fact that a leaking water pipe or steam pipe, or the escape of gases from boiler furnaces, will attack iron and gradually but surely consume it. A notable instance of this is the case of the plate girder of the Washington Bridge over the Boston & Albany Railroad, in Boston, where a quarter-inch plate girder was recently found to be entirely consumed in places from the operation of gases from the locomotives passing below.

It is quite common to have advocates of wrought iron cite railroad bridges and the elevated railroad structures of New York as proof of their claims, but if they will take the trouble to examine these structures they will discover that in spite of the fact that they are exposed to view, so that they can be painted frequently, the evidences of rust are unmistakable, especially about the rivets; and one can well imagine what would be the result in the case of riveted iron members in the skeleton structure of a building where such ironwork is entirely concealed from view, periodical inspections being impossible.

Rust is especially liable in the cellars and basements of buildings. The wrought-iron friction brakes of freight elevators in the cellars of stores, for example, are frequently found so consumed with rust as to be easily rubbed to pieces in the hand.

Steel rivets are dangerous and they should never be used, unless of a very superior quality, so soft that hammering will not crystallize the material, and yet with sufficient tensile strength to insure perfect holding qualities. This is difficult to secure. Their use in columns for buildings is objectionable, as they rust badly under certain conditions; columns, therefore, should be without rivets, and the beam-bearing bracket shelf on cast-iron columns should be cast in one piece with the column.

EXPANSION OF IRON.

It is generally supposed and frequently stated that there is a great difference between the expansion of iron and masonry by heat. This is not the case. For example, the length of a bar which at 32 degs. is represented by 1, at 212 degs. would be represented as follows: —

Cast Iron	1.0011
Wrought Iron	1.0012
Cement	1.0014
Granite	1.0007
Marble	1.0011
Sandstone	1.0017
Brick	1.0005½
Fire-brick	1.0005

In the fire-proof building of the Western Union Telegraph Company, in New York, some years ago, a heavy brick pier, 7 or 8 ft. in diameter, adjoined the wall of the boiler furnaces. The difference in expansion in the brickwork next to this furnace wall as compared with that of the remaining brickwork of the pier was so great as to produce a crushing of the material from top to bottom of the pier for a depth of several inches, and it was found necessary to change the furnace wall and leave an air space between it and the pier.

EXPANSION.

While the difference in expansion between masonry and iron incorporated with it is less per running foot than is generally supposed, and while the difference in expansion between a cubic foot of iron and that of a cubic foot of masonry would hardly be noticeable, especially if the iron were covered on all four sides, yet in stretches of 50 ft. or more, as in the case of iron I-beams and girders, the cumulative effect of expansion in uncovered iron might be a serious matter — quite sufficient with the rises of temperature due to a burning building to push out the bearing walls and wreck the building. Especially is this true of temperatures higher than 500 degs. It is unnecessary to suggest that metal differs from masonry in the important respect that heat does not travel throughout the entire length of the latter, while it does in the case of metal.

In other words, while the difference between the expansion of a lineal foot of iron as compared with a lineal foot of masonry, marble, brick, etc., is very slight, the difference in conductivity is very great. The conducting power of silver, for example, being represented by 1, copper would be .845, cast iron .359, gold .981, marble .024, and brick .01 — an important fact to be considered in the construction of buildings. Brickwork raised to a white heat would not raise the temperature of other masonry in the same wall a few feet away, but one end of an iron I-beam could not be raised to a white heat without raising the temperature of the beam for its entire length.

It is a well-known fact that iron responds so readily to temperature that, in surveying land, a surveyor's 100 ft. iron chain will, in measuring the distance of a mile, result in a variation of 5 ft. between winter temperature and summer temperature, resulting in an error of one acre in every 533.

Where iron beams and girders are inserted in walls without sufficient space left for their expansion under heat they are almost certain to overthrow the bearing walls by their expansion thrust. A large warehouse in Vienna in which such provision had been contemplated by the architect was totally destroyed, with its contents, by reason of the fact that an officious subordinate, discovering the space in the wall purposely left at the end of each beam, deliberately poured liquid cement therein, which, having set, effectually thwarted the well-meant intention of the architect, and resulted in the destruction of the building.

The expansion thrust of iron beams may be computed upon the following factor of expansion: Rolled iron of a length of 1,562 ft. will expand one eighth of an inch for every degree of temperature. The heat of a burning building as already stated is enormous — sufficient to fuse most known materials; it may safely be estimated to be at least 1,000 degs.; therefore a length of rolled iron of 1,562 ft. at 1,000 degs. of temperature would expand about 125 ins., and a 50 ft. length of iron girder would expand between 4 and 5 ins., showing that there should be a play at each end of at least 2 ins. if the iron is not fire-proofed. Inasmuch as in iron construction the iron beams and girders are usually anchored to the walls to steady them, the space should be left and the tie to the anchor should be by a movable hinge joint, which would be of the same strength with an inflexible anchor for all tying purposes, but would yield under the thrust pressure like an elbow and allow play of the beam, or stiff anchors should have elongated holes to allow expansion when beams are of great length. Girders are seldom over 25 ft. long, but if bolted together, as is frequently the case, they may be 120 ft. or more long, and a line of columns from cellar to roof of a building may easily have one continuous iron structure of two hundred or more feet. It should be remembered, however, that this danger from the expansion of iron may be almost wholly counteracted by protecting it from exposure to fire through the use of non-conducting material. It is more important to protect girders than beams.

The mistaken pride with which the owners of some buildings point to exposed iron beams in ceilings as evidence that the floors are "fire-proof," actually justifying the supposition that they are left exposed for such display, would be ludicrous if it were not serious. In buildings occupied for offices or dwellings, where there is not sufficient combustible material to endanger the beams, it is not so objectionable; but in warehouses and stores, filled with merchandise, such construction is dangerous; and if one of the upper floors should give way it would come hammering down to carry all below and thoroughly wreck the structure.

In this connection it is well to say that combustible merchandise should never be stored 100 ft. above the street grade even in a fire-proof building, since the average fire department cannot reach it at that height.

ROOF.

Fifth. The roof, that portion of a building which ought to be most carefully watched during construction, is often the most neglected, woodwork entering into the composition, as in the case of the Horne Building, at Pittsburgh, where the cornice was supported on wooden outriggers.

Sixth. Partitions. These should not be erected upon wooden sills, as is sometimes the case — only, however, with ignorant and inexperienced architects, who suppose that it is necessary to use wood in order to nail baseboards and other trim at the bottom of the partition. Porous terra-cotta will hold nails and should be used in preference to wood, which, as soon as it burns out, will let down the entire partition.

WATER STANDPIPES.

Seventh. All buildings over 125 ft. high should be provided with 4 in., or, better still, 6 in. vertical pipes, with Siamese connections at the street, for the use of the fire department, extending to the roof, with hydrants at each story and on the roof. This would save the time of carrying hose to upper floors — a difficult task in the case of high buildings. Ample tanks of water should be provided on the roof supported by protected iron beams resting on iron templates on the brick walls, to supply the building's inside pipe system for fire extinction, and secure pressure by gravity or by some other method constantly operative, especially on holidays and at night. Stone templates should not be used, and care should be taken to secure strong supports so that, in the event of fire below, the tanks will not come crashing through the building to destroy it and endanger the lives of firemen. Two such disasters in fire-proof buildings within a year show how true is this proposition. Tanks in the basement under air pressure are also a great advantage, and recent invention has perfected them to the point of reliability.

Fire Marshal Swenie, of Chicago, urges that standpipes should not be less than 6 ins. internal diameter, and that a check valve should be provided, so that when steamers are attached their force will be added to that of the local pumps. Each floor should have hose connections with the standpipes and sufficient hose to reach to the most remote point of the floor above, and this hose should be frequently inspected to see that it is in order. He recommends that a code of signals by which communication can be established between the firemen and the engineer of the building is essential.

NIGHT WATCHMAN.

Eighth. All high buildings should have constantly present, night and day, some competent person understanding the elevator machinery, fire appliances, etc., so as to aid the firemen in reaching the upper levels; and there should be sufficient steam in the boilers, at all times, to run one elevator.

I quote from the valuable treatise on handling fires in these buildings presented by Fire Marshal Swenie to the International Association of Fire Engineers held in August, 1897. He says: —

"In case the elevators fail it is necessary to use the stairway, and after the truck men should follow the pipe men bearing the necessary hose, and this must be carried on the shoulders of the men. A 50 ft. section of ordinary 2½ in. cotton hose with couplings weighs from 56 to 60 lbs., and 250 ft. of 1¼ in. rope about 65 lbs., either of which is a good load for a man who must climb a steep stairway to the height of 250 ft. With an average rise of 7 ins. per step, that means taking some 430 vertical steps before reaching the scene of action and consuming from 7 to 10 minutes of time. If it is found necessary to use hose instead of the standpipes for taking the water from the street to the floor, the hose should be taken up in the elevator, if it is running, and then lowered until connection is made with the hose below."

STONE STAIRCASE TREADS.

Ninth. Marble, slate, and other stones are certain to disintegrate or crumble when subjected to the joint action of heat and water. For this reason 90 per cent. of the staircases in modern fire-proof buildings would be found utterly unreliable in the event of fire, either for the escape of the inmates or for the use of firemen — a serious consideration. Stone treads are usually let into iron rabbet frames, and as these stone treads would give way in case of fire, it would be impossible for a person to find a footing on the stairways; 2 in. oak treads might actually last longer; but a safer staircase would be one the framework of which is of iron, the tread having an iron web or gridiron pattern, the interstices or openings of which should be small enough to prevent the passage of a foot, underlying the stone or slate, so that if the stone tread should disintegrate the staircase would still remain passable.

It is possible to have the supporting tread of open-work cast iron in an ornamental pattern, which in relief against the white marble tread resting on it would present a tasteful appearance from the underside or soffit of the staircase, with this great advantage that, in the event the action of fire and water should pulverize the marble or slate tread, it would still afford a safe support for the foot. In the case of the burning of the two fire-proof buildings, Temple Court and the Manhattan Savings Bank, in New York, the slate treads yielded early in the fire, leaving staircases with openings the full size of the tread, which, within a few minutes after the fire started, were impassable for either firemen or inmates. It is astounding that this vital fault should be so generally overlooked in fire-proof buildings.

I may here state that the Manhattan Savings Bank Building did not deserve to be called "fire-proof" for the reason that it had hollow spaces under the wooden floor boards, and that the iron beams and girders were not protected. Some of them were large riveted box girders, which yielded quickly to the heat of burning goods and pushed out the side walls.

It is generally supposed that it is not necessary to be careful as to stone treads in buildings occupied solely for offices separated in fire-proof hallways in which, it is claimed, there is nothing to burn; but in the case of one large fire-proof building of this kind in New York I found the space under the staircase in the basement story was used to store the waste paper and rubbish of the building — material particularly likely to cause a fire by concealed matches, oily waste, cigar or cigarette stumps, etc., and to make a lively and quick fire quite sufficient to destroy stone staircase treads. Even where there is no combustible material in the hallway, if the staircase is near windows stone treads may be destroyed by exposure to burning buildings and by the combustion of window frames, dadoes, and other wooden trim.

Tenth. No building should exceed in height the width of the street on which it is located, from the view point of light and health; nor in any case, in excess of 95 ft. for mercantile occupancy, nor a height in excess of 200 ft. for office occupancy.

DESTRUCTIBILITY OF CONTENTS.

Eleventh. It should be remembered that merchandise, furniture, etc., are combustible, no matter whether located in fire-proof buildings or in ordinary buildings. This obvious fact seems generally to be ignored. In fact, combustible material will sometimes be more effectually and thoroughly destroyed in a fire-proof building than in an ordinary building, since the early collapse of the latter may smother the fire and effect salvage, whereas fire-proof floors support the contents of the former and distribute them so that they are more certain to be destroyed. There was not a dollar of salvage in the great stock of merchandise in the Horne Building, at Pittsburgh. The entire household furniture of a tenant in one of the best fire-proof apartment houses in New York was totally cremated, and a fire in the Great Northern "fire-proof" Hotel, at Chicago, seriously burned the automatic organ to the extent of over $4,000. There is no more reason why the combustible contents of a fire-proof building should not be consumed than why the fuel in a stove should not be burned.

Twelfth. Enclosing walls. These should be of brick, the brickwork of the lower stories especially, if not of all, being laid in cement mortar. In fact, the specifications for a building in the compact part of the mercantile section of a city ought to be drawn in contemplation of the possible cremation of its contents and the generation of heat considerably greater than 2,000 degs. Fahr. The heat of a wood fire is from 800 to 1,140 degs.; charcoal, about 2,200 degs.; coal, about 2,400 degs. Cast iron will melt at between 1,900 and 2,800 degs.; wrought iron, 3,000 to 3,500 degs.; steel, 2,400 to 2,600 degs.; and if an architect should be required to draw specifications for a building adjoining others, with the knowledge beforehand that its entire contents, from cellar to roof, were to be totally consumed, and he were under a bond to pay damages to surrounding property, he would not be more severe in his exactions than should a building law protecting neighborhood rights in the enjoyment of property; for a mercantile or manufacturing building sometimes generates a greater heat in combustion than a smelting furnace.

The Masons' Department.

AN EXPERIMENT IN MUNICIPAL WORK.

PROMINENT among the many details of municipal government which must be worked out to a satisfactory conclusion by practical experience is that of the method of awarding contracts for public work. At the present time the law usually provides that all such work amounting to over a certain sum, usually from one to five thousand dollars, must be open to public competition. It has been supposed, until recently, that the most serious objection to this method of procedure was the fact that it resulted in a majority of cases in the awarding of the work to some second or third rate contractor who produced only ordinary or inferior work. But the mayor of one of our largest cities, after having tried to enforce his interpretation of the stipulation in a city building contract providing that "preference shall be given to union labor" (which his honor maintained, until the court rendered an adverse decision, was practically mandatory), has decided that the proper way to construct municipal buildings is to have the work done by union men and by the day. Of course, in order to try such an experiment, the existing laws requiring an open competition and the award to the lowest bidder must be repealed.

This change the master builders have opposed, probably as a matter of principle; but it is a question whether it would not be better in the end to permit the experiment to be made. The present methods are acknowledged to be bad, and certainly the only way to improve such conditions is to try other methods. But while it may on the whole appear desirable to know the result of having a public building built by the day by union labor, there are two serious difficulties which must be overcome before such a system can be successful.

The great objection to day labor on large and important works is, primarily, the fact that the men employed under such conditions have not the incentive to work to the best of their ability, and it is unquestionably a fact that the same gang of men on a contract job would do much more work in a given time than where the work was being paid for by day labor. The reason for this is so obvious that explanation is unnecessary. As things are at the present time, if a city building is built by day work, the length of time necessary for its construction and the bill for labor will probably present an interesting and at the same time an extravagant comparison with similar work done under the direction of an able contractor and his foremen.

The other reason why work done entirely by members of the various unions is likely to prove unsatisfactory is that up to the present time the unions have done but little to improve the quality of work, and this fact is responsible for one of their greatest weaknesses. Although this statement would probably be emphatically denied by union members or sympathizers, the fact remains that to-day most of the best mechanics either do not belong to the union at all, or else are indifferent and passive members.

The unions are now controlled and managed by a class of men who are better talkers than workers, but as soon as the skilled mechanics become enough interested in the union of their particular trade to control its policy and make its membership a guarantee, so far as possible, of the ability of its individuals, both as to ability to do work well and the capacity to do it quickly, then, and not until then, will the labor union feel the support of public opinion, which is absolutely necessary for its successful existence. But although these objections to the plan of having a municipal building built by day labor have been pointed out, and the opinion expressed that the result will be disappointing, nevertheless, let us by all means try the experiment, and very likely valuable lessons will be the consequence. Certainly in any, if not in a majority of cases, the best way to show the fallacy of socialistic schemes is to give them a full and fair trial.

THE ethics of trade are extremely nebulous in the minds of a great many persons. A feeling is often manifested that, considering the keen, sharp competition to-day, and the fact that the supply of work is so far below the desires and demands of the craftsman, the only motto to be considered is the one which has been popularly ascribed to one of our political bosses, "Do others as they would do you." Fortunately there is a saving remnant of those who do not ascribe to such doctrines, but make it their principle to be fair with those with whom they have dealings. The building trades, with their wide subdivision of interests and complexity of departments, offer a large opportunity for a contractor to take advantage of his fellows, especially in his relations with sub-contractors, and we wish to emphasize one evil which is only too prevalent, namely, the trading on sub-bids. A general contractor will make up a figure to be submitted in competition, and will use sub-bids for portions of the work, incorporating them in his own; and then if the contract is awarded him, in only too many cases does he deliberately ignore the sub-bidder over whose shoulders he has stepped to a contract, and, on the principle that he has a right to purchase his wares where he can get them cheapest, will proceed to make new deals with mechanics, and use his earlier bids as clubs to beat down the price. This is all wrong; it leads to demoralization of building interests, it encourages and almost obliges inferior work, and it is a practise which cannot be too severely condemned. The present system of contracting, where everything is awarded to one responsible head, has many advantages, but there ought in principle, as well as in fact, to be the most scrupulous regard for good faith between the general contractor and the sub-bidders, if we are to have the uniformity in the quality of the work which every one desires. Once a bid has been passed in and used it ought to be adhered to, and the sub-contractor whose bid is so used is entitled in equity to the contract.

Another feature which is often not properly regarded is the changing of a bid after it has been once made. There are plenty of owners who will endeavor to take advantage of a tight market, hard times, or scarcity of work, and will make a builder an offer of considerably less than his bid. We are sorry to say that some architects will lend themselves to this practise by endeavoring to please the owner, and will aid in beating down a contractor. We know of one architectural firm, however, doing a very large business, which has made it a rule, which is adhered to pretty thoroughly, never to allow a contractor to change a bid either up or down after it is once put in; and if after a bid has been made in good faith a builder cuts his price, that builder is very apt to find himself dropped out next time bids are called for. The result is that this firm gets bottom prices first time, as no bids are made with the idea of their subsequently being shaved off a bit. This is quite as it should be. We believe in fair and even liberal profits to all mechanics; but if a bid is respected as it should be, the bidding will be closer to start with, and there will be a feeling of honorable treatment between the owner and the contractor which will go far towards securing better work. The same applies exactly to bids between contractors and sub-bidders; and while work might be wanted so badly that the tendency would be to cut the price rather than lose the job, if it were a more general custom to insist upon adherence to the original bid, and the contractors knew they would be fairly treated in the matter, it is probable that every one would be better satisfied.

LIQUIDATED DAMAGES FOR BREACH OF CONTRACT.

A PROVISION in a contract for the construction of a residence that the builder, in case of non-completion of the house by a given date, should pay ten dollars for each day's delay, is a stipulation for liquidated damages. The failure of a subcontractor to fulfil his contract is no defense to the recovery of such damages. And where a builder agrees to construct a building by a certain date, which requires that it shall be done during winter months, the severity of the winter alone is insufficient as an excuse for failure to perform, if the work could have been carried on by the exercise of extra means or effort.—*Supreme Court, Washington.*

Brick and Terra-Cotta Work In American Cities, and Manufacturers' Department.

NEW YORK. — We have just entered upon the third month of our existence as Greater New York, and in view of the criticisms now being passed upon the "machine" administration, it is interesting to recall some of the public benefits dispensed by the recent "reform" administration.

It must surely be a matter of pride to us when statistics prove that our summer death rate has not been so low in twenty-five years as during the season passed. This is a more significant fact than would at first appear to one not familiar with New York, with its great cosmopolitan population and its crowded streets and tenements; and the unusual and vigorous effort to keep these streets and districts clean has been a most important factor in the saving of life, for which great credit is due to Col. Geo. E. Waring, upon whom the responsibility has rested. He organized and directed an army of men, dressed in appropriate uniforms, somewhat similar to the Parisian idea, and no expense or trouble was spared in having the work thoroughly done to the satisfaction of the public rather than the politicians.

Some of the worst slums on the East Side have been demolished and replaced by small parks.

Two recreation piers have been built and others are contemplated. These piers are two storied and are well patronized by those who are not fortunate enough to be able to take their families out of the city during "the heated term." Work has been commenced on the new North River Bridge, and land has been purchased for a second bridge over the East River, which will greatly facilitate communication between the various parts of the metropolis.

RESIDENCES, NEW YORK CITY.
McKim, Mead & White, Architects.

The post-office service has been greatly improved, the most recent innovation being the pneumatic tube mail carrier, which was tested last week and which proved eminently satisfactory.

The projected scheme of a tunnel connecting New York and New Jersey is being pushed, and we may confidently include this among the developments of the near future.

A great botanical garden is to be erected in Bronx Park, one of the most beautiful natural parks in the vicinity. This is a great work and will undoubtedly prove as popular as the gardens at Kew, England, which are visited by great numbers of people, sometimes hundreds of thousands in one day. The buildings will be laid out in such a manner as to carefully guard against destroying any of the natural beauty of the park. Over $500,000 will be expended. Drawings of some of these buildings will soon be reproduced in THE BRICKBUILDER.

It will undoubtedly interest architects to know that a company has been formed which has for its object the sanitary and structural inspection of buildings. It makes examinations and reports on the condition of buildings and premises for owners, tenants, and intending buyers, lessees or mortgagees, and supervises the construction, maintenance, and repairs of buildings, entering into yearly contracts for these services. The idea has met with considerable favor in the city. The names of several architects of high standing who are interested in the venture is a sufficient guarantee of the integrity of the association.

Most of the necessary money has been raised for the proposed monument to the late Richard Morris Hunt which is to be placed in Central Park. The expense of the work has been generously met by contributions from those who knew Mr. Hunt, and who admired his personality, his generosity, and devotion to his profession, and his sympathy and helpfulness to young men. He was one of the founders and one of the most enthusiastic members of the Municipal Art Society, which has for its object the protection of the city against promiscuous gifts of statuary, etc., which, if worthy, are one of the most beautiful adjuncts to landscape architecture, but if not, are an eternal blot. Although still young, the society is highly respected, and has accomplished great good. We can only hope for the time when works of architecture will be tried by some such fire. At present the press nobly seconds the work of censorship in regard to monuments, etc., and people are beginning to discriminate between good and bad work; but criticisms in regard to works of architecture, infinitely more important and more lasting, are cautiously whispered, and the work goes on so that now one of the largest and most important office buildings in New York is the most offensive, and caused a well-known editor to remark in private, "If that building had been designed by a younger man it would have ruined him." Among recent items of news may be mentioned: James Brown Lord, architect, has prepared plans for a new building, to cost $35,000, for the New York Circulating Library. It will be erected on 100th Street, near the Boulevard. Clarence True, architect, has plans drawn for twenty-four five-story brick and stone dwellings to be built on Riverside Drive; Edward Wenz, architect, has prepared plans for a five-story brick flat building on 101st Street, near Columbus Avenue to cost $45,000; Raleigh C. Gildersleeve, architect, has plans drawn for a five-story stone and brick dwelling to be erected on Fifth Avenue near 77th Street; cost, $75,000.

Brite & Bacon, architects, have planned a five-story dwelling, to cost $100,000, to be erected on the corner of Fifth Avenue and 64th

Street; Richard H. Hunt, architect, has completed drawings for the new east wing of the Metropolitan Museum of Art, which will cost $800,000.

PHILADELPHIA.— The workings of the law permitting the supervising architect of the Treasury to give out government buildings amongst architects for competition have just had a practical demonstration here, and given general satisfaction. Some eight Philadelphia architects were invited and submitted designs for a Custom House and Post-Office, to be built in Camden, N. J., in compliance with a strictly business-like program of competition describing in an explicit manner the number of and space required by the various departments, offices, etc. The cost stipulated was liberal without being lavish, the ground for the proposed building large enough to admit of light on all sides, so it may be seen how interesting was the problem, and how it required but an honest judgment and award to place the competition amongst the best. The decision of the experts, of whom there were three, including Supervising Architect Taylor, seems to indicate that, to the end, everything had been carried out satisfactorily. The successful architects, Rankin & Kellogg, are to be congratulated on this the latest of their many successes in professional competitions. Their design shows a dignified building in the style of the Italian Renaissance, having a two-storied-columned portico with pediment in center of façade, remainder having balustraded skyline. It is to be entirely of white marble. It seems perhaps still a great waste of architectural skill to have so many designs thought out with the certainty that only one can be used, but it is a step much in advance to have competition restricted.

TERRA-COTTA KEY.
Executed by the New Jersey Terra-Cotta Company.
Shickel & Ditmars, Architects.

The buildings of the University of Pennsylvania have a peculiar interest to the architect in the variety of their building material. The old-time green-stone University Hall stands side by side with the bright red press-brick and terra-cotta of the library, and seemingly shelters by its towering mass the low-lying Huston Hall with its English-mullioned windows in light stone set in the gray stone of Germantown. Across the way are some buildings in dull rough-red brick and red terra-cotta, while further out is the beginning of the dormitory system in a quaint red brick with bright Indiana limestone lavishly used. Standing at the lately finished Dental Hall, by Edgar V. Seeler, in its rich, warm colors, the walls of the museum close by just being put, in part, under roof, seem composed of yellowish-gray materials, but only a closer inspection shows how curious is the composition. Two rough, small-sized bricks are placed end to end, without mortar, so as to resemble one long brick, then a black or purplish header separated by about 1½ ins. of cement mortar. All the horizontal joints are of this thickness of cement. The scheme of the bond is after that known as Flemish, with stretchers double the usual length. These abnormally wide joints take almost as prominent a part in the general color effect as the red brick, with the result, as before mentioned, of giving the wall a very light tone.

The architecture is Italian, one might even say from Bologna, with round brick columns with the caps to be found there, while some beautiful patterns of colored marbles, eminently Bolognese, are set into the brickwork, in the tympanum of the windows, and in the friezes under eaves; also, curiously enough, between first-story windows under piers of the second story. A domed central structure is to dominate the mass, but of this only the foundations are in, — wide foundations of brickwork, looking now like the ruins of some Roman palace.

PANEL, SPINGLER BUILDING, NEW YORK CITY.
Executed by the Excelsior Terra-Cotta Company.
W. H. Hume & Son, Architects.

PITTSBURGH. — The increase in building operations expected with the beginning of the new year does not seem to have begun as yet; architects report considerable small work in progress, but practically no large office or mercantile buildings definitely decided upon.

Within the past year Pittsburgh has suffered severely from fires. The Horne fire of last summer undoubtedly caused the greatest financial loss, but the Pike Street fire of last month probably nearly equaled it in this respect, and was, in addition, accompanied by a terrible loss of life.

The burning of the building occupied by the Edmunson & Perrine Furniture Store, and of the Union Trust Company Office shortly followed the Horne fire, while a nine-story building on Penn Avenue,

RESIDENCE, BROOKLINE, MASS.
Winslow & Wetherell, Architects.

near 9th Street, was burned in the same week in which occurred the Pike Street fire.

Among competitions recently held but not yet decided have been those for the new Union Trust Company Building; for a new school building in Ward 20; for the First United Presbyterian Church to be erected on Fifth Avenue, near the entrance to Schenley Park; and for the City Deposit Bank, at the corner of Penn and Center Avenues.

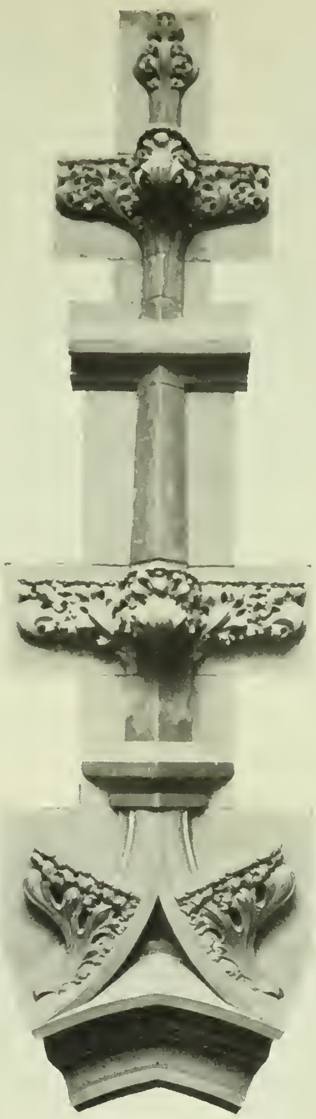
The design of F. J. Osterling for the new Court House at Washington has been accepted; it is estimated to cost about $500,000.

Work has been commenced on the new ten-story apartment house on Forbes Street opposite Schenley Park. It is intended to have the building completed in time for use as a hotel during the triennial conclave of Knight Templars to be held here in October next; Rutan & Russell are the architects. This firm is also at work on a new armory building for the National Guard of Pennsylvania, to be located on Bedford Street.

Pittsburgh contractors are proving that they can erect buildings with as great rapidity as those of any city.

Work was commenced on the eight-story office building for J. G. Murtland, at the corner of Sixth Avenue and Smithfield Street, about the middle of November. It is to be ready for occupancy April 1. It is built of buff pressed brick, terra-cotta, and sandstone. The department store for H. C. Rowe, at North Highland and Penn Avenues, was begun at about the same date and is to be finished the same time. Alden & Harlow are the architects of both.

The new Horne Building is nearing completion. When the old building was burned the steel frame and most of the terra-cotta floor arches remained in place. After a careful examination and test they were found uninjured and it was decided to use them again. Peabody & Stearns are the architects of the present store. These architects have also recently let the contract for a new market house in the East End. It is 170 by 270 ft., is to be built of brick and terra-cotta, and cost $150,000.



TERRA-COTTA DETAIL, ST. CHRISTOPHER'S HOUSE, NEW YORK CITY.

Executed by the Conkling, Armstrong Terra-Cotta Company.
Barney & Chapman, Architects.

BUFFALO.— The new year has opened with a much more favorable outlook than has been in evidence for a long time. On every hand we hear that there is to be a much better season. Prices of building materials are raised, and the class of buildings seems to have been elevated.

The increased price of material will help to throw out a good many of the speculative builders, who have done so much to pull down domestic architecture to the level it is now on.

Buffalo property seems to be gaining in popularity amongst outside investors, as during the past few months large blocks of real estate have been sold to capitalists in New York and Pittsburgh. The new owners express their intention of building soon.

The Pan-American Exposition is making great progress. Contracts have been let for several of the main buildings. These structures, though possessed of some architectural pretensions, are designed for manufacturing purposes. The capital has been advanced by various large concerns, who, after the exposition is over, intend to take over the whole affair; and with the advantages of having electric power so close at hand, there seems to be no reasons why this should not become a great manufacturing center. All the power used at the exposition will be obtained from the Falls.

The largest piece of work in hand to be mentioned is the 74th Regiment Armory. As was mentioned in a former letter, bids had been opened for a stone building, but as the amount ran over $100,000 above the sum given by the State, the specifications were revised. Bids were asked for on various kinds of material, stone and brick, with the result that the building will be of Medina stone, at a cost of $335,585. It was proposed to build entirely of brick, but there was a general outcry against this, as it was thought that the appearance of the building would be spoiled.

It is said that the Iroquois Hotel is to be raised from eight to twelve stories, and that the banquet hall will be placed on the twelfth story, and is to be surrounded by other smaller ones so planned that, by an ingenious arrangement of the architect, Mr. Aug. Esenweim, they can be thrown into one large hall. The rotunda will be finished entirely in Mexican onyx and marble.

The city has had still another experience in letting contracts to the lowest bidder.

Two schools were commenced last year, both given to one man, he being on the second school nearly 27 per cent. less than the next highest. When the bids were before the school committee, representations were made that he had failed to carry out other contracts and that various material men had liens on the property. However, the contracts were given him, with the result that the buildings have been liened upon, and that the city will finish them. The Bond Company found loopholes to escape from fulfilling their bond, one being that the city finishes the work; and as that appears to be the next move, the men who have liens on the property will doubtless lose their money, as, the work being for the city, liens have no force for material, but only for money due. People are wondering why the Surety Company is not being made to finish the schools.

LAND LIABLE WHERE BUILDING HAS BEEN DESTROYED.

WHERE the laws of a State give a lien on the buildings or structures, and on the interests of the owner in the land on which they stand, for work done and material furnished and used in them, on destruction of the building by fire before completion the lien may be enforced against the land on which it stood. — *App. Ct., Ind.*

TRADE PUBLICATIONS.

WE have so often been asked to publish a list of American brands of cement and the particular class of work that each brand is suitable for, that we take pleasure in calling the attention of our readers to a group of pamphlets just issued by the Commercial Wood & Cement Company, Philadelphia and New York. These pamphlets, of which there are four, relate to the brands of American cement for which this concern is agent, namely, Commercial Portland, Commercial Rosendale, Victor Portland, and American Portland. Each pamphlet contains an amount of data and general information pertaining to the particular brand which it represents, that makes it not only interesting, but instructive and otherwise valuable. The more important work in which the cement has been used is enumerated, often illustrated, within these pages. In the pamphlet devoted to the interest of the American Portland brand there is published a most interesting paper by W. W. Maclay, C. E., on the "Testing and General Qualities of Portland Cement, and some Rules for Using It so as to Get the Best Results."

Copies of these pamphlets may be had by applying to the Commercial Wood & Cement Company, 156 Fifth Avenue, New York.

The Use of Terra-Cotta for Interiors.

WE have recently received a few samples of terra-cotta work from Fiske, Homes & Co., Boston, which we think deserve more than passing comment.

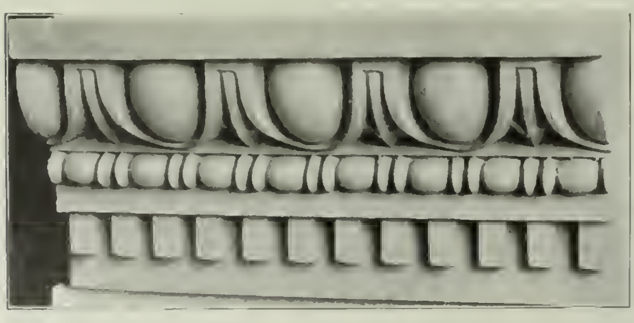
Terra-cotta for the exterior construction of buildings long ago took its place as one of the most desirable materials.

The construction and decoration of the interior of the modern home is. however, something of quite a different order, and requires a class of goods distinctly superior, in nicety of workmanship and careful selection of color, to those employed on the exterior.

In interior work, the structure is of comparatively small size, requiring ornamentation of low relief; the eye, being close to the work, is offended by the boldness and roughness which characterizes exterior designing, while jointing entirely suitable for exterior work appears crude when used on the interior.

Terra-cotta manufacturers have, as a rule, confined themselves to a grade of work suitable for exterior, and the architect and builder have, therefore, not found it desirable to use it extensively inside the building. Such a state of things is not necessary, *per se*, as the delicate product of the modern pottery bears evidence to the fact that burnt-clay products are capable of the finest workmanship.

Why a similar refinement should not be obtained in interior terra-cotta, thus combining the nicety of marble, *papier maché* ornamentation, or even woodwork, with the beautiful blending of colors obtainable only in clay products is a question which we cannot understand: and we believe, when the terra-cotta manufacturer realizes the fact that his work must take its place as a part of the interior furnishings of the room and produces work capable of such use, that it will be gladly accepted by the architect and builder.



The samples of interior terra-cotta illustrated herewith seem to us to be a decided step towards the realization of that perfection which we mention above. This work is produced for use about the fireplace, where bricks have been used from time immemorial, but where there has been a lack of proper clay products for ornamentation. The features which have prevented the universal adoption of brick mantels have been their crudeness of design and roughness of construction. Architects have been accustomed for years to overcome the former difficulty by making their own designs, but have experienced delays of manufacture, uncertainties of color, as well as great expense in the execution of this special work.

Could the architect feel sure of obtaining a good design, executed promptly from stock patterns, and with that certainty as to the nicety of workmanship and color demanded by interior conditions, it seems to us that clay products would be recognized as the most satisfactory in every way for fireplace construction.

These conditions seem to be realized by the work illustrated herewith to a remarkable degree. Not only are the designs good in arrangement and proportion of parts, but the modeling is done with special delicacy and refinement of lines not possible or even desirable for exterior work. The modeler seems to have kept before him the fact that the same perfection is demanded and should be realized in the fireplace as in the woodwork and *papier maché* ornamentation on the walls and ceilings, and even the furniture that stands around the fireplace. The edges are straight and true; the pieces are sufficiently uniform in color and size to enable the use of narrow joints and correct lines through the entire structure, thus largely obviating that crudity in appearance that has been characteristic of such work in the past.

All of the ornamentation of these mantels, where possible, is produced by terra-cotta rather than molded bricks.

Messrs. Fiske, Homes & Co. are well-known terra-cotta manufacturers of long experience. and they appear to have attacked the fireplace question as such rather than as brickmakers.

We believe they have contributed a valuable addition to the desirable materials for interior decoration and have given a new impetus to burnt clay on the inside of the modern house.

CURRENT ITEMS OF INTEREST.

R. Guastavino Co. have removed their Boston office to 19 Milk Street, Room 53.

Waldo Bros. will supply Atlas Portland cement for draw pier, Charlestown Bridge, Boston; Perkins & White, contractors.

Charles Taylor's Sons, Cincinnati, Ohio, manufacturers of enameled brick, fire brick, etc., are in the market for a clay disintegrator.

Whidden & Company have awarded the cement contract for foundation for new Boston Electric Light Company Plant to Waldo Bros., specifying Atlas cement.

John W. Hahn, 166 Devonshire Street, has been appointed Boston agent for the American Enameled Brick and Tile Company, of New York.

Waldo Bros. will supply Atlas Portland cement to the Hartford Paving & Construction Company for government work at Fort Constitution, N. H.

The Powhatan Clay Manufacturing Company will supply 75,000 of their cream-white bricks for the new building which is to be erected at Richmond, Va., as a Home for Incurables.

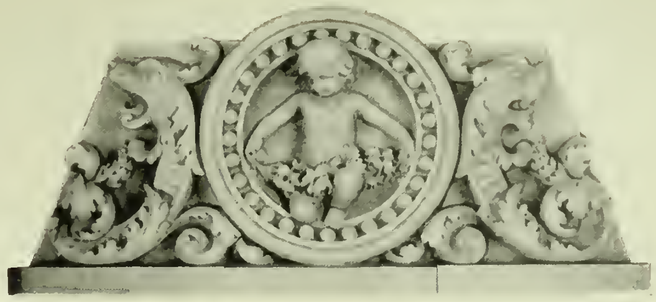
TERRA-COTTA DETAIL, BRAZIER BUILDING, BOSTON.
Executed by the Northwestern Terra-Cotta Company.
Cass Gilbert, Architect.

The Scollay Square station of the Boston Subway will be lined with enameled brick made by the American Enameled Brick and Tile Company, of New York; Norcross & Cleveland are the builders.

The American Enameled Brick and Tile Company have closed a contract with Norcross Bros. for supplying the enameled brick that are to be used in the immense new Southern Terminal Station at Boston.

The Indianapolis Terra-Cotta Company report a good spring business. They are now engaged on contracts for new work in Toledo and Cincinnati. The terra-cotta for the Edison Electric Light Company's new building in the latter-named city will be furnished by them.

The Brick Terra-Cotta and Supply Company, Corning, N. Y., are furnishing the architectural terra-cotta required for the Fourteenth Ward School building, Syracuse, N. Y., M. D. Makepiece, architect.



TERRA-COTTA DETAIL, BLIND ASYLUM, OVERBROOK, PA.
Executed by the Burlington Architectural Terra-Cotta Company.
Cope & Stewardson, Architects.

The Bristol and Plainville Tramway Company are erecting near Plainville, Conn., a new substantial steel bridge, having a span of about 90 ft. The bridge has been designed with a view of being a permanent structure, well able to take care of the increasing and heavy traffic of the road. It has been furnished and is now being erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

The New Jersey Terra-cotta Company has closed contracts for furnishing the following buildings with terra-cotta: Residence and carriage house, Islip, L. I., Lawrence Birdsall, architect; school, Cranford, N. J., Ackerman & Ross, architects, Peter Tostevin's Son & Co., builders; offices, 66th Street and Columbus Avenue, New York City, Neville & Bagge, architects, Robinson & Wallace, builders.

The Berlin Iron Bridge Company, of East Berlin, Conn., are building a new boiler-house roof for the Coe Brass Manufacturing Company, at Ansonia, Conn. The Hartford City Gas-Light Company, of Hartford, Conn., have placed with them an order for one of their steel roofs lined with their patent anti-condensation fire-proof roof lining, which has given such eminent satisfaction in the past.

The Ridgway Press-Brick Company, Ridgway, Pa., have closed the following new contracts for supplying their bricks: 40,000 light mottled Romans and 3,000 dark mottled Jack arches for Harre Robbins's residence, Pittsburgh, S. F. Heckert, architect; sale made by Jas. R. Pitcairn, Pittsburgh representative; 200,000 vitrified gray standards and 2,000 vitrified gray bull noses; power plant for Northwestern Mining and Exchange Company, Brockwayville, Pa.; 100,000 vitrified buff brick for factory building for Wilcox Manufacturing Company, Wilcox, Pa.

TERRA-COTTA KEY, ST. JAMES BUILDING, NEW YORK CITY.
Executed by the Perth Amboy Terra-Cotta Company.
Bruce Price, Architect.

THE CLINTON METALLIC PAINT COMPANY, of Clinton, N. Y., are sending out in little white enamel boxes, scarcely larger than a postage stamp, samples of Elastic Silk Fiber Roof Cement. This is said to be a strictly up-to-date article, combining unusual elasticity with adhesiveness, and a special value is given to it from the peculiar fiber it contains. Its qualities admit of its working in any climate, and on either metal, slate, or glass, and the white enamel boxes which the Clinton Company are sending out are a unique departure in sampling, in the roof cement trade, at least.

FROM building reports which have recently come to hand it is noticeable that Powhatan white bricks are to be used liberally in New York building operations. Among the buildings which are to be constructed of these bricks are: The new Hall of Education; apartment houses on 87th Street west of Park Avenue; building corner 92d Street and Madison Avenue, N. L. & L. Ottinger, architects; new building for the Knickerbocker Realty Improvement Company, 116 West 34th Street; new building on 125th Street near Amsterdam Avenue, Pollard & Steinam, architects; new building at 3d Street and Avenue C, Harry McNally, architect.

THE product of the American Mason Safety Tread Company is being specified for use in a very large proportion of the buildings now in the hands of Boston architects. The Safety Tread is to be placed upon the stairs of the Southern Union and Dartmouth Street railroad stations Shepley, Rutan & Coolidge, architects; the new building of the Massachusetts Institute of Technology, E. B. Homer, architect; the Paul Revere School, Peabody & Stearns, architects; the West Roxbury High School, Andrews, Jaques & Rantoul, architects; the East Boston High School, J. Lyman Faxon, architect; Melrose High School, Tristram Griffin, architect; the Brayton Avenue School, at Fall River, A. M. Marble, architect; school at East Douglas, Clarence P. Hoyt, architect; Massachusetts Eye and Ear Infirmary, Shaw & Hunnewell, architects; Masonic Temple, Loring & Phipps, architects; large buildings of the Boston Real Estate Trust on Beach Street and of the Francis estate on Chauncy and Avon Streets, Winslow & Wetherell, architects; India Street building, Alex. S. Porter, Trustee, Charles E. Park, architect; India Street building, John D. Long, Trustee, Rand & Taylor, Kendall & Stevens, architects; and several other large buildings for mercantile uses. The approval of the Mason Safety Tread by Prof. F. W. Chandler for use in the Institute Building, and, as consulting architect for the city of Boston, for the important new public school buildings, is significant of the favor with which this modern protective device is received by professional men of the highest standing.

A NEW and beautiful thoroughfare has been added to the several leading to Thomas Park and Dorchester Heights, Boston, which is not only in keeping with the general surroundings, but adds greatly to this beautiful spot, says the Boston *Herald*.

This new thoroughfare is to be known as Covington Street, and its unique construction and general appearance for a thoroughfare make it something of a curiosity, as regards the laying out and construction of public thoroughfares.

It shows that although a grade may be very steep, it is possible to overcome it, as far as pedestrians are concerned; for this new street is constructed with artificial stone blocks arranged in a series of flights of steps, with a broad landing of the same material between each flight, making it easy and convenient to surmount.

In starting the work, flights of steps were cut out of the earth embankment. These steps were then covered with a surface of broken stone and cement, so that when the stone steps should be placed in position it would be impossible for any damage to result from cold or frost.

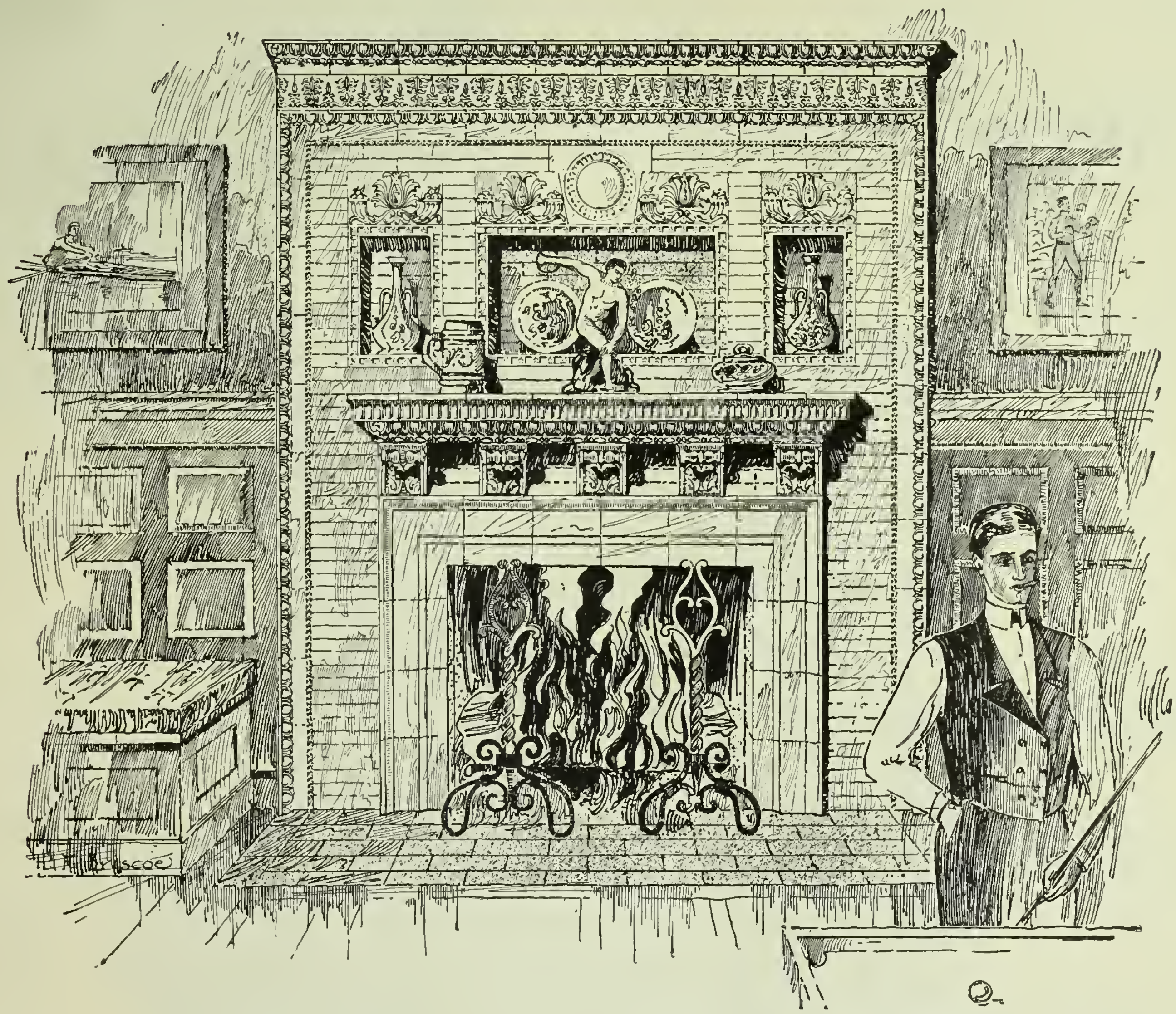
There are seven flights of stairs containing nine steps each, and between each flight is a landing about 6 ft. long and 12 ft. wide, the entire structure being constructed of artificial stone composed of crushed granite and cement.

The W. A. Murtfeldt Company, of Boston, did the work, and the cement used by them was the Dyckerhoff brand.

Esq..

Something New

In Brick and Terra-Cotta Fireplace Mantels.



Designed by J. A. SCHWEINFURTH. Del. by H. F. BRISCOE. Modeled by TITO CONTI.

We are now prepared to furnish an entirely new and complete line of Fireplace Mantels

Designed in classical style to produce rich, yet dignified architectural effects.

Modeled entirely by hand in the highest perfection of the art.

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Burned in a suitable variety of soft, rich colors.

Assembled from standard interchangeable pieces in any desired combination, thus giving a great variety of size and detail with no additional cost.

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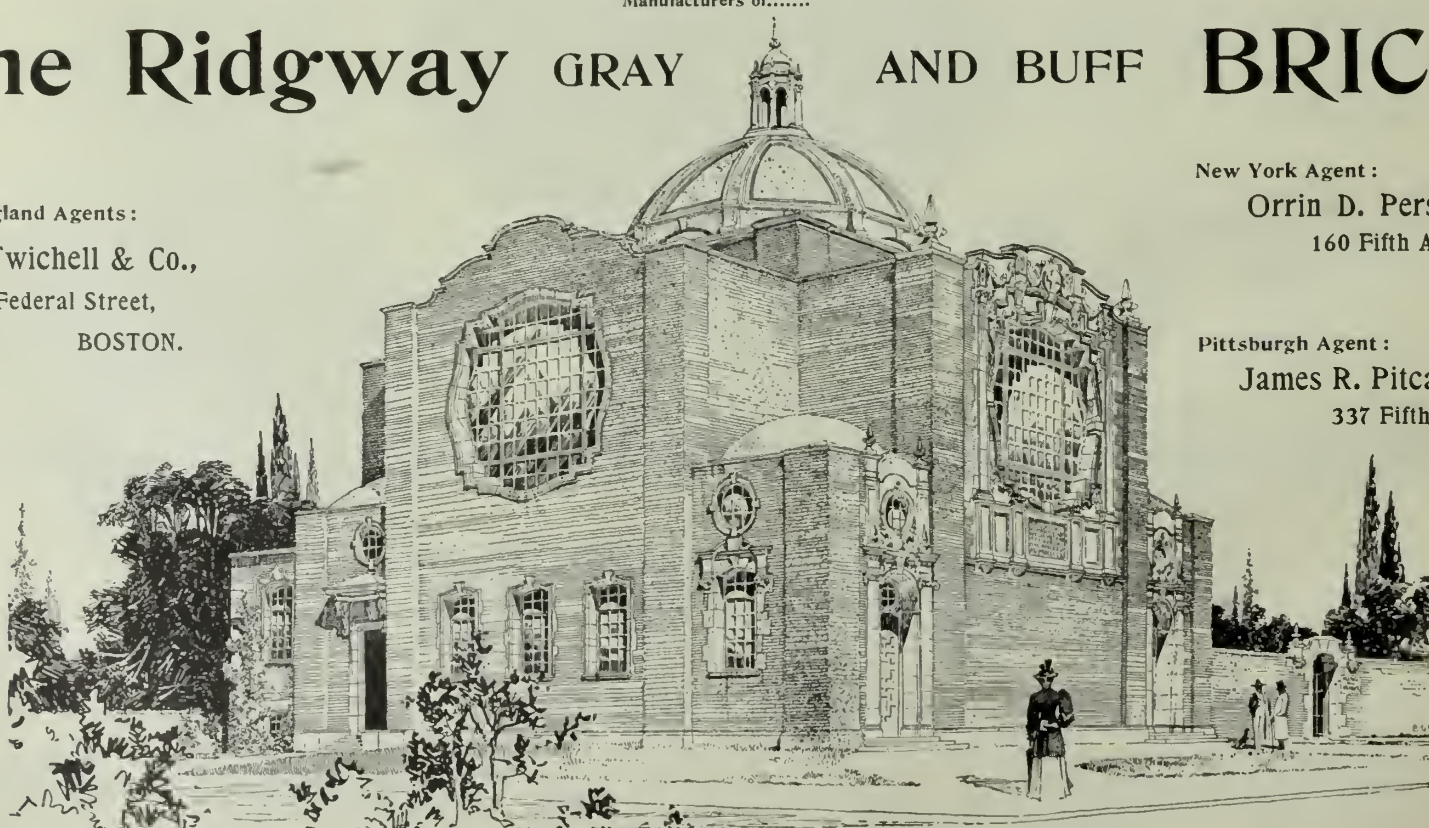
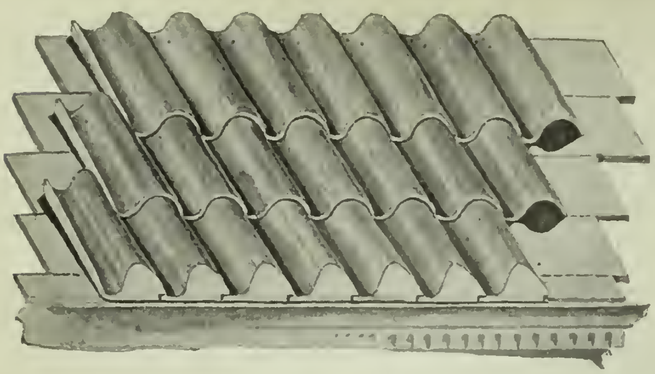
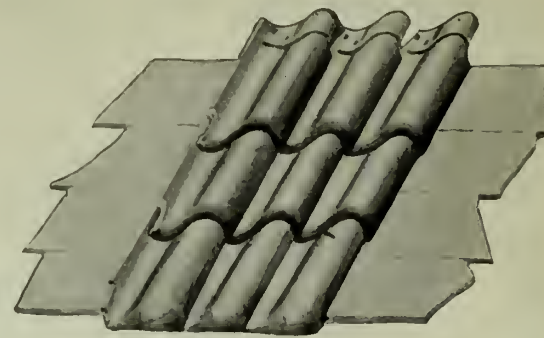
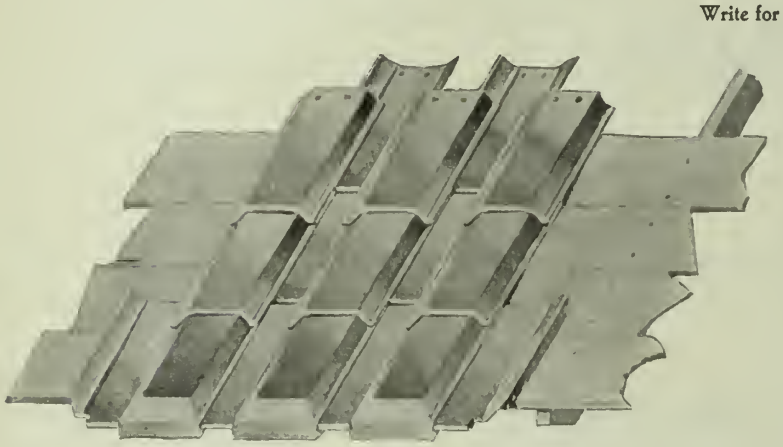


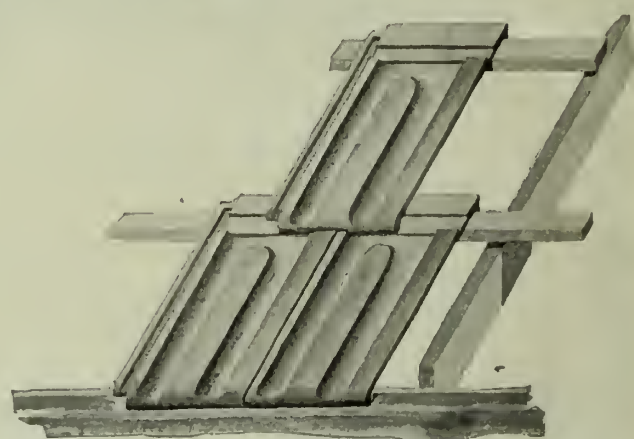
CHURCH AT NEWTON, MASS., CRAM, WENTWORTH & GOODHUE, ARCHITECTS.

The Gray Bricks used in this church were furnished by the Ridgway Press-Brick Co.









THE DELMONICO BUILDING, 44TH STREET AND FIFTH AVE., NEW YORK CITY.

JAMES BROWN LORD, ARCHITECT.

VOLVME VII APRIL 1898 No. 4

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

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EPHEMERAL CONSTRUCTION.

IT is always difficult to properly measure the results of effort of the passing generation. The nearness of view is a bar to clear perspective values, and we cannot properly compare the present with the past or even foretell future developments with any very great surety. At the same time we believe that certain general tendencies are not difficult of measurement even while in process of evolution, and the signs of the times certainly seem to indicate that we are about to begin a period of vast extension in building, or perhaps more properly in architecture. For a number of years now this country has been passing through a financial depression, and that, together with the imminence of war on our very borders, makes the prospect seem gloomy. There is, however, a fair evidence that we are preparing the way for architecture of a kind and on a scale in advance of anything that has gone before. It is only within a comparatively few years that our methods have been such as to admit of real permanence in our constructions. The fire-proofing systems, which are still so young in years as to have hardly attained a majority, have enlarged the possibilities for a degree of permanence which did not exist during the previous generation; and, more than that, we as a people have been awakened to the commercial value not only of good construction but of good looks, and it is believed that when the country has righted itself from the political troubles through which it is now passing and has regained a measure of its native buoyancy we will be ready to construct buildings which will be free from the ephemeral character of most of our recent public works.

The greatest building epoch which the world has ever seen was undoubtedly that which culminated during the first century after Christ, under the sway of the Roman emperors. The architecture produced at this period was characterized more than in any other way by the solidity, the enduring qualities of its construction. Other periods of art have far excelled it in pure art and esthetic perceptions, but the world to-day owes its best constructive ideas to the Romans. Unless we greatly misinterpret the signs of the times, the next quarter century will witness a very widespread return to some of the methods which marked the more important Roman buildings, and especially in the construction of walls and vaulted surfaces there is reason to believe that we are developing into a permanence of construction which will augur well for the possibilities of artistic growth. If any one were to visit a huge structure such as the new South Union Station, now in process of building in this city, an edifice which, taken altogether, is one of the largest which has ever been conceived by human thought, it would seem as if we were in the midst of an iron age, as if steel in its various forms was the important element in our buildings, as if it had come to stay, and was not only indispensable, but was unreservedly approved of by our constructors. Steel and its possibilities have undoubtedly increased the horizon of the architect and have added enormously to the possibilities of construction, and yet we question very often whether in an architectural and constructive sense we have not lost rather than gained by the use of this extremely adaptive material. A wall of huge solid masonry construction seems clumsy and antiquated by comparison with the slender shafts which we find in the basements of some of our tallest buildings, and the whole character of our streets has been changed very materially in the more recent constructions by the possibilities of steel. We will venture the broad assumption that aside from the question of pecuniary gain or commercial necessity there is not one thinking architect in ten who would not prefer to construct of solid masonry from foundation to garret rather than to, of his own choice, select the spider-like constructions which we seem obliged to resort to; and from a standpoint of architecture the constructive values of steel are but a poor compensation for the manifest deficiency of our public buildings in those qualities of breadth, solidity, and permanence which contribute so largely to the success of the old Roman work.

A love for the massive constructions of antiquity does not, however, oblige us to imitate them literally. The Romans used brick and concrete as brute materials which would overcome the thrusts of vaults and arches to such an extent that such things as iron ties or bands were not required, and the actual factor of safety in nearly all the Roman work is, therefore, so far in excess of anything which scientific construction would call for that the same results, namely, stability and permanence in appearance, could be obtained in modern work with far less sacrifice of space and internal arrangement. The very able article by Professor Baker, the first instalment of which appeared in the last number of THE BRICKBUILDER, is a move in the right direction towards the increasing of the possible reliance which can be placed upon good masonry. As the article very justly intimates, a brick pier or wall crushed by superimposed load is so rare a circumstance as to be almost unrecorded. We trust good masonry less than about any other material which is used in building.

The buildings erected from the designs of the late H. H. Richardson are preeminently characterized by the appearance of extreme solidity and permanence, though we imagine that Mr. Richardson was by no means ahead of his generation in his knowledge of constructive values. In one of the largest of his structures he had planned for a brick pier to support a load running up into hundreds of tons. The builder, who was a cautious as well as a thinking man, after putting up the pier and imposing the load upon it, became alarmed at the size in proportion to the load, and, finding that the brickwork was loaded with something over 25 tons per foot, without saying anything to anybody made some experiments. He built a brick pier and proceeded to undertake to crush it, but he found the resistance so great that before it began to show any signs of weakness whatever he gave it up, and was perfectly satisfied that the pier as designed by Mr. Richardson was ample for the purpose, notwithstanding it was loaded with nearly twice as much as any of our building laws would permit. Since then he has always been a firm advocate of the strength of brickwork when properly laid.

We do not need the heavy constructions of the Romans, but we do need the solid character, and that character is only simulated by the use of steel. Furthermore, we feel that with the blessings of peace, and the consequent expansion of our industries and our wealth, we shall see an era of public building such as has never visited this country before, and it looks as if we would be ready for it with methods and ways of building which will give us the right to rank our buildings with the creations of the past which have survived for us. We do not consider a building in Europe which is a couple of centuries old as in any sense wearing out, and yet the average life of our structures here has been up to the present from thirty to forty years. This is not simply because methods of planning have changed, for we are using very largely the same methods that were followed in the time of the Renaissance, and, barring certain questions of practical interior arrangements, some of the old Roman and Florentine palaces could to-day be utilized, with very slight change, for a modern office structure. Consequently the short life of our modern buildings is not due to inadaptability so much as to the innate nature of our constructive methods.

A CORRECTION.

IN the March issue of THE BRICKBUILDER there was illustrated a residence at Brookline, Mass., of which Henry Forbes Bigelow, Boston, was the architect. By mistake, the names of Winslow & Wetherell, were given as being the architects.

PERSONAL AND CLUB NEWS.

PARISH & SCHROEDER, architects, have removed their offices to the Bancroft Building, 3 W. 29th Street, New York City.

FRED M. TRUEX, architect, has opened an office at Red Bank, N. J. Catalogues desired.

THE firm of Wagner & Reitmeyer, architects, Trust Building, Williamsport, Pa., has been dissolved. Mr. Wagner will continue the business of the old firm.

ROBERT S. SOULE, architect, has opened an office in the Hennen Building, New Orleans. Catalogues and samples desired.

D. M. COLLIER, architect, has opened an office in the Lennon Building, Oneonta, N. Y. Catalogues and samples desired.

THE office of James Craddock, architect, Lincoln, Neb., was recently burned out. Mr. Craddock has opened an office in the Oliver Theater Building, and would be glad to receive catalogues and samples.

A COLLECTION of paintings by a group of American artists was exhibited at the St. Louis Museum of Fine Arts on the evening of March 29, and on the evening of April 12 there was shown a collection of paintings and drawings illustrating scenes of the Revolution, and also a collection of Favrile glass.

THE St. Louis Architectural Club held its regular monthly meeting on the evening of March 12 in their new quarters at 916 Locust Street. Drawings in their regular monthly competition were submitted, the subject being an engine house. First prize was awarded to Benno Jensen; Mr. Farberger, second mention; J. C. Stephens, third. J. W. Ginder and R. M. Milligan acted as judges. The problem for this month is a house for the club. In addition to this, Mr. E. Lasser has offered a prize for the best design for a horse stall in iron.

A REGULAR meeting of the T Square Club was held on Wednesday evening, March 16. Mr. Louis C. Hickman spoke on the subject of the "Planning of a City Residence," and made some interesting observations on the possibilities of originality in such planning.

The subject for competition for the evening was "The Façade of a City Residence," *apropos* of which were Mr. Hickman's remarks. First mention was awarded to Horace H. Burrell; second mention, to Edward Gilbert; and third mention, to W. C. Scheetz.

A Club Smoker and Special Competition in Decoration was also held on March 2. First mention was awarded to Nicola d'Ascenzo; second mention, to Horace H. Burrell. Mr. Frank Miles Day led the criticism on the drawings submitted, and also gave an informal talk on the New Congressional Library at Washington.

ILLUSTRATED ADVERTISEMENTS.

THE Commercial Cable Company's building, New York, Harding & Gooch, architects, is illustrated in the advertisement of the Excelsior Terra-Cotta Company, page iv.

The Phœnix Mutual Life Insurance Company's building, Hartford, Conn., Cady, Berg & See, architects, is illustrated in the advertisement of the New Jersey Terra-Cotta Company, page viii.

Number ten of the series of Brick and Terra Cotta Fireplace Mantels, of which J. A. Schweinfurth is architect, is illustrated in the advertisement of Fiske, Homes & Co., page vii.

A residence at Baltimore, J. A. & W. T. Wilson, architects, is illustrated in the advertisement of Harbison & Walker Company, page xv. This building has been shown previously in this advertisement, but by mistake was titled a residence at Pittsburgh, Pa.

DETAIL BETWEEN SIXTH AND SEVENTH STORY WINDOWS, HOTEL MARTINIQUE, NEW YORK CITY.
Terra-cotta and brick by the New York Architectural Terra-Cotta Company.
H. J. Hardenbergh, Architect.

The basement floor construction of the American Soda Fountain Company's new building, Boston, Kendall, Taylor & Stevens, architects, is shown in the advertisement of R. Guastavino, page xxiv.

The Bank of Commerce Building, New York City, James Barnes Baker, architect, is shown in the advertisement of Henry Maurer & Son, page xxv.

The New Hospital Building at Eastern Ohio Asylum for the Insane, Massillon, Ohio, Yost & Packard, architects, is shown in the advertisement of the Celadon Terra-Cotta Company, Charles T. Harris, Lessee, page xxix.

The new Delmonico Building, Fifth Avenue, New York City, James Brown Lord, architect, is shown in the advertisement of the New York Architectural Terra-Cotta Company, page xxx.

The American Schoolhouse. VI.

BY EDMUND M. WHEELWRIGHT.

MR. WILLIAM ATKINSON writes concerning his plan published in the March paper of this series: —

"The plan is an attempt to reduce an eight-room schoolhouse to its lowest terms; in other words, to arrange four schoolrooms and four wardrobes on each floor, in the most compact manner possible.

"As an example of the economy of floor space attained in this plan, take the second floor. On this floor only 23 per cent. of the total area is devoted to hallways, stairways, heating and ventilating flues, and thickness of walls and partitions, or, in other words, 77 per cent. of the whole area is actually utilized.

"The following fixtures will illustrate this point: —

GILBERT STUART SCHOOL, BOSTON, MASS.
Edmund M. Wheelwright, City Architect.

Area of building (53.9 by 92.3) . . . . 4,974.97 sq. ft.

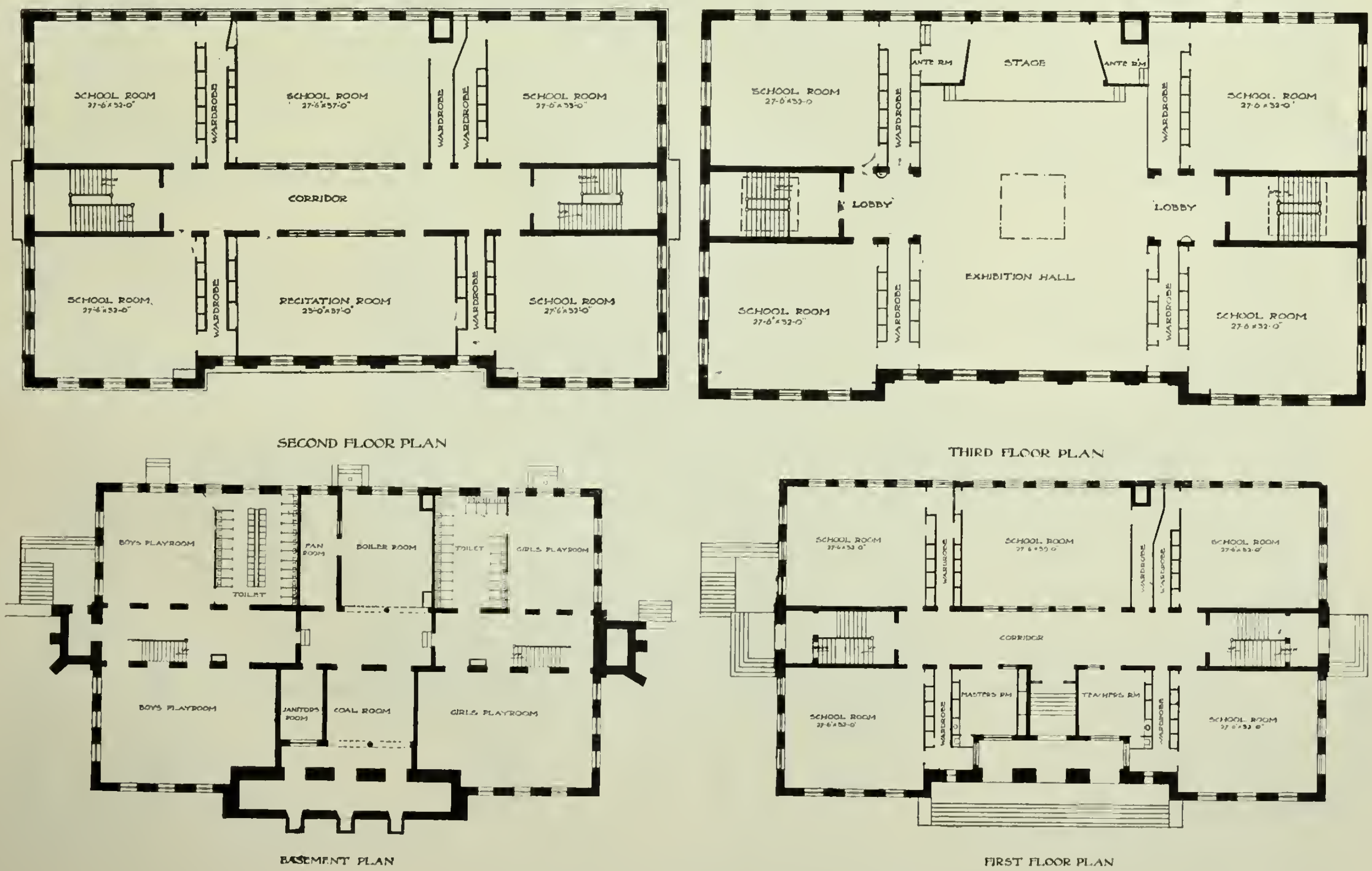
This area is made up as follows, on the second floor: —

Four class rooms at 768	3,072.00 sq. ft.
Four wardrobes at 117.8	471.20 sq. ft.
Two teachers' rooms at 100	200.00 " "
Total utilized area (77 per cent.)	3,743.20 " "
Space occupied by halls, stairs, flues, walls, and partitions (23 per cent.) . . .	1,231.77 sq. ft.
	4,974.97 " "

"In schoolhouse plans of the ordinary elaborate type, in which large areas are devoted to hallways, corridors, and passages, it often happens that less than 50 per cent. of the total area of the plan is utilized in rooms actually devoted to the purposes of the school.

"The amount of money to be spent in floor space devoted to hallways and corridors is a question for school committees to decide in any given case. This plan, as stated above, is an attempt to get the thing down to its lowest terms.

"One important feature of this plan is in the location of the stairways, which are placed at opposite ends of the building and in *separate* hallways not connected with each other, so that if one hallway should become filled with smoke, in case of fire, the other hallway would still give a safe way of egress to the inmates of the building.



PLANS, GILBERT STUART SCHOOL, BOSTON, MASS.

" This plan attains an economy of construction, as compared with the ordinary type of plan, in the following ways : —

" 1. By a reduction of area, as explained above.

" 2. By a reduction in the amount of interior partition wall.

" 3. By a reduction in the height of the building obtained by reducing the thickness of the floors and by running the windows clear up to the ceiling.

" 4. By a reduction in cubical contents by the use of the flat roof.

" 5. By eliminating cut stone as far as possible.

" 6. By simplicity of construction.

" The main proposition of my father's pamphlet is that an eight-room schoolhouse of two stories and a basement, with class rooms of the ordinary dimensions (28 by 32), may be planned to cover a ground area of not over 5,734 sq. ft., and that such a building ought not to cost over $30,000 complete, including grading of lot and architect's commission. This proposition was arrived at by theoretical reasoning.

" It has been my purpose in working out these plans to show that the proposition is a sound one, and capable of being demonstrated in practical form.

" My plan with rooms 28 ft. wide instead of 24 would cover a ground area of 5,713.37 sq. ft., substantially the same as the hypothetical figure given in the pamphlet. This shows that the first part of the proposition is correct. And from estimates which I have made I am satisfied that the plans as shown (but with class rooms 28 instead of 24 ft.) could be executed complete for considerably less than $30,000 in the vicinity of Boston."

My opinion in regard to Mr. Atkinson's proposition is so fully given in my last paper that further discussion of the subject appears to be unnecessary.

As a result of the consideration of schoolhouse costs, previously given in these papers, the following general conclusions may be drawn : —

The addition of a schoolroom would appear to decrease the

PLANS, PAUL REVERE SCHOOL, BOSTON, MASS.

cost of a schoolhouse by about 2 per cent. The percentage of decreased cost will probably be less in buildings in excess of sixteen-schoolroom capacity.

Given an equal number of rooms, the cost of a grammar schoolhouse is 4 per cent. greater than that of a primary school.

The same accommodation can be given at 15 per cent. less cost in a three-story than in a two-story schoolhouse.

Separate wardrobes adjoining schoolrooms, increasing the cost of schoolhouse 4 per cent. over the cost of buildings of same number of rooms in which the clothing is hung in the corridors.

An increase of 4 ins. in one thickness of brick walls increases the cost of schoolhouse construction about 4 per cent.

Leaving out of consideration any additional thickness of brick walls which may be entailed thereby, the cost of double run of sash in schoolrooms increases the cost of schoolhouses about 1¼ per cent.

The unusually severe requirements of the Boston Building Laws as revised in 1892 increased the cost of schoolhouse construction fully 9 per cent. without compensating advantage. The floor, for instance, had to be constructed to carry a live load of 150 lbs. per square foot in addition to the weight of the floor itself. This condition alone increased the cost of construction of Boston schoolhouses 2½ per cent.

When the Boston Building Law was further revised in 1897 and it was required that all schoolhouses should be of "fire-proof" construction, no change in this requirement of excessive strength of floors was made.

Previous to the passage of this law but two schoolhouses had been built in Boston with fire-proof floors, the Latin and English High and the Andrews School. The fire-proof floors in the Andrews School increased the cost of construction about 20 per cent. The Andrews School building was a nine-room, three-story, primary schoolhouse with roof of wooden construction. If such a building were built to-day with roof as well as floors of steel beam and terra-cotta arch construction, the cost would probably have been increased about 25 per cent. above that of a building of the same grade and size but with floors and roof of wooden construction.

CAMBRIDGE HIGH SCHOOL, CAMBRIDGE, MASS.
Chamberlin & Austin, Architects.

ENTRANCE, CAMBRIDGE HIGH SCHOOL.

The Gilbert Stuart Grammar School, built with floors and roof of wooden construction, cost $6,193 per schoolroom. It is a fourteen-schoolroom building with assembly hall. It is probable that if of fire-proof construction throughout, its cost would have been increased 22 per cent., or to $7,555 per schoolroom. Leaving out of consideration the cost of plumbing and heating, the cost per schoolroom of such a building of fire-proof construction would have been $6,855 per schoolroom.

Since the construction of the Latin and English High School, which was completed in 1881, the Paul Revere School is the first wholly fire-proof school building built for the city of Boston. It is an eighteen-room building costing $152,406, or $8,488 per schoolroom. Since the plumbing was more elaborate in this building than in any previous school, bath rooms being here provided, we find that if the plumbing, together with the heating, is deducted, the cost per schoolroom was $7,322. The Revere School was lighted by electricity, the Stuart School was not; the Revere School had upon the stairs Mason Safety Treads in place of rubber mats, and had oak instead of ash finish. These features probably increased the cost above that of Stuart School about $200 per schoolroom. It is reasonable to suppose that the more elaborate external treatment of the Revere School rendered the building 3 per cent., or $350 per schoolroom, more expensive than the Stuart School. On account of the restriction of the site the cost of the Revere School was increased by the necessity of adopting a broken plan so that proper lighting might be given to the schoolrooms; we certainly may judge that this increased cost was $5,000 above that of the Stuart School. This amount would fully account for the remaining difference of cost between the two schools, if we consider the Stuart School as being of fire-proof construction and costing $6,855 per schoolroom, with heating and plumbing not included.

It would appear from the above conclusions that under ordinary conditions of site and architectural treatment, the excess of cost of fire-proof construction above that of buildings constructed under the Boston Building Laws of 1892 would be about 22 per cent., *i. e.*, a building of the form and architectural treatment of the Stuart School can be built in Boston of fire-proof construction, with heating, ventilation, and the customary plumbing, for $7,555 per schoolroom, and that it may be safely reckoned that an equally well-finished and appointed building, constructed in a perfectly safe and satisfactory manner, but of less expensive construction than is permitted by the present Boston Building Laws can be built, including plumbing and heating, for about $6,800 per schoolroom, or for but about $600 more per schoolroom than if constructed with wooden floors and roof under the requirements of existing building laws.

Consideration of the relative decrease in cost of school accommodations due to the size of building and to the use of three instead of two story buildings, leads to the conclusion that if the demands for school accommodation under the best hygienic and structural conditions are to be met with due consideration for economy, that instead of small two-story, large three-story schoolhouses should be built, that school buildings should not be less than three stories in height, that they should not contain less than the equivalent of sixteen rooms, and that where fire-proof construction is required, schoolhouses should not be less than four stories in height.

The schoolhouses lately constructed in New York City are built in accordance with the policy which should maintain in our large cities, if public education is to be given to our quickly increasing population without imposing an unfair burden upon the community. In that city the schoolhouses recently constructed are large fire-proof buildings of several, in some cases seven, stories in height. These later New York buildings are so important that they will later be given extended mention in these papers.

WILLIAMS SCHOOL, BOSTON, MASS.
Edmund M. Wheelwright, City Architect.

It is not only in New York that the method of economically meeting the needs of schools constructed in accordance with the most approved conditions has been adopted. We find that a like policy maintains in the country towns of New England. The system of small district schools is being abandoned in these towns, large school buildings are being built at convenient centers, and thus the benefit of better conditions in school construction are gained at, I believe, no greatly increased cost per pupil, even though the towns pay for the transportation of children living at long distances from the schools.

Although generous appropriations are made in our large cities for school buildings, there is generally complaint of insufficient accommodation for the school children. If building laws are not made needlessly severe, and if large buildings of three or more stories in height are more generally constructed, this condition need not exist. The disadvantage of long flights of stairs for children to climb is largely one of the imagination. This inconvenience can in great measure be obviated by the introduction of elevators, and by the utilization of the roofs for the playground of the children assigned to the schoolrooms of the upper stories. Roof playgrounds are an interesting innovation in school planning lately adopted in the New York City schoolhouses.

The rapid increase of population is often found to soon render small schoolhouses inadequate for the accommodation of the children of the neighborhood they were originally designed to serve. It should be borne in mind that with these small schools not only is the cost per schoolroom fully 20 per cent. greater than in the large three-story schools, but that the cost of grading, paving, and fencing, and the cost of janitor service and fuel, is relatively greater per pupil.

Too often saving in cost is made at the expense of truly economical and safe construction. In one large Ohio city where those in authority pride themselves upon the low cost of the schoolhouses, I found a building, four stories in height with stud interior partitions, furred walls, and no fire stops. It was unprovided with metal or brick ducts for ventilation. The foul air was supposed to find its way through the hollow spaces in floors and walls to the outer air. A more imperfect system of ventilation and a more ingenious fire trap than this method of construction could not well be devised. The rough surface of sawed lumber and the backs of plastered surfaces gave ready lodgment for dust, and the uncertainty of the direction of the air under such conditions gave no warrant that this dust was not breathed in by the occupants of the building.

It is hoped that members of school committees and others interested in schoolhouse construction will recognize that in such work great saving in cost can seldom be made except by sacrifice of desirable features, and that the permanent value of a building depends upon the knowledge, skill, and forethought used by the architect in the disposition of its parts, in the durability and fire-protected character of its construction, in the quality of its appointments and fittings; and finally, that the beauty of the design is no small consideration, but one which may fittingly be restrained within the limitations of brick construction. Such construction may be more or less elaborate, as the neighborhood, the site, and the size of the building may require.

Except in the special cases of buildings built by private gift as memorials, public schoolhouses demand no richer external treatment than can be given by properly designed brickwork with stone or terra-cotta trimmings. Ordinarily, with careful study, a satisfactory building can be produced if constructed of common brick of good quality. Variety can be given by the bondings of brickwork, by the use of various colored mortars in the brickwork of the several stories, and in the accentuation of certain features. To give variety of surface, and as a means of accentuation, different shades of red brick can be used with good results. By such simple means, schoolhouses may be constructed at a reasonable expense which will have a pleasing architectural effect, and few are now found to maintain that the architectural effect of a schoolhouse is an unimportant consideration, and that a beautiful schoolhouse does not do its part in the education of the young. Personally, I have regretted that I have ever built brick school buildings of the factory type. The percentage of cost between a school building designed with regard for architectural effect, and one of a purely utilitarian construction is not great. Under ordinary conditions, satisfactory architectural results may be obtained at an excess of cost of not more than 5 per cent. above that of the most "practical" construction. A careful reckoning of the cost of the Brighton High School, the most elaborate school building designed by me, shows that but 8 per cent. of its cost was for architectural features. It will be generally admitted that a large building demands a greater relative cost for architectural effect than does a smaller one.

In designing a schoolhouse the architect should strive to produce not an English college building, a French chateau, or a "Romanesque" library, but a schoolhouse. The practical requirements of the problem demand in most cases symmetry of plan, and in all cases, lighting of the schoolrooms by wide and high windows. It is requisite that these windows should not have transom bars, and that either a flat roof or one of low pitch should be used. A high, well-lighted basement is also a requisite of a schoolhouse. The important rooms in the basement need ample windows, and a stud of 10 ft. is none too high for the proper installation of the heating apparatus. These requirements for the basement affect schoolhouse designing most radically.

Such being the general requirements which most influence the external expression of our schoolhouses, it will be found difficult to reconcile therewith features borrowed from the late English Gothic and the early English Renaissance.

Aside from economy in planning, which certainly leads to a balanced arrangement of rooms, and which, except in rare cases, precludes a picturesque and irregular disposition of these rooms, the key to the external expression of a schoolhouse is the size, and distribution, and form of windows which experience has shown to be best adapted for the needs of a schoolroom. This consideration of window treatment alone leads the architect who appreciates the economic and practical requirements of the problem to abandon picturesque treatments in a schoolhouse design, and to adopt those suggested by the brick architecture of the Italian Renaissance and by the Georgian work of England and this country. Sufficiently varied motives for the external expression of our schoolhouse plans can be found in these styles. Such motive may be used without sacrifice of the practical requirements of the buildings, while unity in the variation in design is permitted. Ample scope is given the designer by variation in texture and color of brickwork; by variety in detail, division, and accentuation of surface; in the treatment of roof, and in the mass and the proportion of the structure. By these means almost infinite opportunities for the expression of individual taste and skill are offered. Careful study in the application of these styles to schoolhouse construction will certainly tend to the greater refinement and perfection of the architectural expression of what is now a well-defined and generally satisfactory type of American building.

The architect to whom the designing of a schoolhouse is entrusted should accept the limitations imposed by the practical conditions of the problem. He should not seek to be "original," or to gain the semblance of a structure, however beautiful in its own time and for its own needs, which does not meet the requirements of an American schoolhouse. He may well be content to express in fitting architectural form the already well-developed schoolhouse plan. He will find profit by the study of the Cambridge High School. This building was, in my opinion, the first American schoolhouse which was designed in a truly artistic spirit; for here is found, with proper accentuation, good proportion, and refined detail, no sacrifice of the practical requirements which fitted the structure to its purpose.

THE recent earthquake in San Francisco, while proving very destructive to many buildings, offered another evidence of the strength of the modern steel structure. It is reported that the nineteen-story Claus Spreckles building, although swayed like a tree in the storm, was not injured in the least. The damage to buildings of ordinary construction was very considerable, while some, presumably of the older and weaker buildings, made an utter collapse.

The cyclone in St. Louis also gave pretty substantial evidence of the stability of this form of construction; for with all the destruction in that instance to wooden and other structures, the skeleton iron and steel buildings suffered little damage.—*Boston Herald.*

Strength of Brick Masonry.

(*Concluded.*)

BY IRA O. BAKER.

M. Am. Soc. C. E., Professor of Civil Engineering, University of Illinois, Champaign.

Effect of Different Mortars. The effect of the different kinds of mortar is shown in Table I. The results in this table are averages for different kinds of brick, various heights of piers, etc., and hence should be used only as showing the relative strength of different mortars.

TABLE I.

CRUSHING STRENGTH OF BRICK MASONRY.

Ref. No.	Kinds of Mortar.	No. of Tests.	Crushing strength of the masonry in lbs. per sq. in.	Strength of the masonry in terms of that of the	
				Brick.	Mortar.
1	1 lime, 3 sand	21	1,551	0.10	12.5
2	1 Rosendale, 2 sand	36	1,825	0.13	11.3
3	1 Portland, 2 sand	8	2,540	0.16	4.7
4	Neat Portland	1	2,315	0.15	0.7
5	1 Rosendale, 2 lime mortar	1	1,646	0.12	9.0
6	1 Portland, 2 lime mortar	1	1,411	0.10	7.3

Note that the substitution of a 1 to 2 Rosendale natural cement for the lime mortar added 18 per cent. to the strength of the masonry, and that the substitution of a 1 to 2 Portland cement mortar added 66 per cent. There are so few observations with the last three mortars that it is unwise to attempt any generalizations as to these mortars.

The last two columns of Table I. give interesting data as to the strength of the masonry in terms of that of the brick and also of the mortar. The ratio between the strength of the masonry and that of the brick will depend upon the manner of testing the latter. The brick under consideration were ground to a plane and tested on their broad side between steel pressing surfaces. In connection with the last two columns of Table I., see Table III. following. According to that table, brick masonry with mortar composed of 1 part lime and 2 sand has 44 per cent. of the strength of the brick; and with 1 part Portland cement and 2 parts sand the strength of the masonry is 63 per cent. of that of the brick. Nothing is known as to the strength of the mortar in Table III.

In one particular the data of Table I. are disappointing. Evidently the mortar in the second and third lines was abnormally weak. Three six-inch cubes of each mortar were tested by crushing when fourteen and one half months old. The results are given in Table II.

TABLE II.

CRUSHING STRENGTH OF MORTARS.

Ref. No.	Kinds of Mortar.	Crushing Strength lbs. of the mortar in Table I, per sq. in.	Tensile Strength of Ordinary Mortar, lbs. per sq. in.	
			Min.	Mean.
1	1 lime, 3 sand	124	25	50?
2	1 Rosendale, 2 sand	162	180	266
3	1 Portland, 2 sand	545	320	475
4	Neat Portland	3,483	500	680
4a	Neat Rosendale	521	290	385
5	1 Rosendale, 2 lime mortar	183	27	
6	1 Portland, 2 lime mortar	192	68	

The last column of the table shows the minimum and mean tensile strength of ordinary mortar. It is known that the crushing strength of cement mortar is eight to ten times as great as the tensile strength. This shows that the 1 to 2 Rosendale and the 1 to 2 Portland mortars were astonishingly poor. The crushing strength of the 1 to 2 Rosendale mortars at fourteen and one half months was less than the minimum tensile strength of natural cement mortar at one year; and the crushing strength of the 1 to 2 Portland mortar was only 1.7 times as great as the minimum tensile strength of average 1 to 2 Portland cement mortar. In a letter to the writer of this, the officer in charge of the Watertown Arsenal said: "The cement was purchased in the market, and the maker's name is not known. The mortar was mixed by an ordinary mason, and was not tested in tension."

It is very unfortunate that the cement mortar was so poor. Mortar acts as a cushion to distribute the load of compression, and consequently the nearer the physical properties of the mortar approach those of the brick the more strength will be developed in the pier. The crushing strength of 1 to 2 Rosendale cement mortar should have been, say, ten times as much as it was, in which case the crushing strength of the masonry would certainly have been increased. Let us see if we can compute what it would have been. The third mortar in Tables I. and II. is four and one third times stronger than the first, and the third masonry is roughly two thirds stronger; therefore, assuming the crushing strength of the 1 to 2 Rosendale mortar to have been 1,500 lbs. per square inch (about eight times the minimum tensile strength in Table II), and applying the above ratio, the masonry with 1 to 2 Rosendale mortar would have had a strength of about 4,000 lbs. per square inch. Reasoning similarly, the masonry with 1 to 2 Portland cement would have stood something like 5,000 lbs. per square inch.

Effect of Size of Cross Section. The experiments show conclusively that the strength decreases as the area of the cross section increases. Twelve-inch piers are about 20 per cent. weaker than eight-inch piers, and sixteen-inch are about the same amount weaker than twelve-inch ones, — all under like conditions. There are comparatively few exceptions to these conclusions. The greater strength of the smaller pier is doubtless due to the better bonding.

Effect of Height of Pier. Naturally the strength of the pier decreased as the height increased. Averaging all the grades of brick together, and representing the height in feet by H and the diameter in feet by D, the crushing strength of piers may be represented by the following formulas: —

With 1 to 3 lime mortar,

the crushing strength in pounds per square inch $= 2{,}330 - 102\frac{H}{D}$. (1)

With 1 to 2 Rosendale mortar,

the crushing strength in pounds per square inch $= 2{,}520 - 104\frac{H}{D}$. (2)

With 1 to 2 Portland mortar,

the crushing strength in pounds per square inch $= 3{,}350 - 132\frac{H}{D}$. (3)

Hollow vs. Solid Piers. Seven piers 12 ins. square, with a hollow core 4 ins. square running from top to bottom, and four piers 16 ins. square, with a hollow core 8 ins. square, were tested. Nothing significant is shown by these experiments, the crushing strength per square inch of net area agreeing surprisingly with the values for solid piers of the same external dimensions.

Effect of Profile of Pier. One of the most interesting tests of the whole series is that of an 8 by 16 in. pier with a 16 by 16 in. base. The smaller section was connected to the larger by four courses, each of which projected on two sides an inch beyond the course next above it. The pier was 50 ins. high, the small section being 25 ins. high. The pier consisted of thirty courses of "face" brick in lime mortar, and was tested when two and one half months old. The average thickness of the joints was three sixteenths of an inch. This pier failed in the lower and larger portion under a stress of 601 lbs. per square inch, the upper and smaller portion showing no signs of failure under 1,233 lbs. per square inch. The problem is: Why did the pier fail in the larger portion under less than half the stress the smaller portion bore without any signs of failure?

Fig. 1, made from the pier now in the Masonry Laboratory of the University of Illinois, shows the cracks developed in the base section during the test. The only cracks are those shown in the illustration and similar ones immediately opposite in the back face. The cracks are approximately in the plane of side of the top section. Apparently the failure is due to the compression of that portion of the bottom section directly under the top section, thereby causing the compressed portion to shear off from the uncompressed part of the base section. This fact is very surprising and is important in designing footing courses. Probably if the base section had been thinner the pier would have been stronger, and possibly failure would have taken place in the smaller section.

A pier having an 8 by 8 in. top section of twenty courses, and a 15 by 16 in. bottom section of eight courses, with four contracting courses connecting the larger and smaller portions, laid in neat Portland cement mortar and tested when two and a half months old, failed in the smaller portion under 3,540 lbs. per square inch, the stress on the base section being 833 lbs. per square inch. In this case the difference between the upper and lower sections was too great to secure the effect discussed in the preceding paragraph.

FIG. 1.

Effect of Age. The experiments give little or no information as to the effect of age upon the strength of masonry. Four twelve-inch piers laid in 1 to 2 Rosendale cement mortar, tested when twenty-one months old, are comparable with four tested when six and a half years old. The first four gave an average strength of about 2,100 lbs per square inch, while the second four gave about 2,000 lbs. per square inch. Notice that the younger masonry is the stronger. This difference is greater than can be accounted for by the *probable* error of the experiments: nevertheless, it may be due to error. However, it may be due to unsound cement.

Apparently masonry laid in lime mortar was the same strength at two and a half, fourteen, and twenty-four months of age. This condition is based on only two experiments of each age, and is therefore liable to considerable error. It is interesting, however, as showing the rapidity with which lime mortar gains its strength.

Effect of Various Elements. One twelve-inch pier with joints broken every sixth course, and one twelve-inch pier with the brick laid on edge, were tested, but the result is without special significance. It is impossible to draw any safe conclusions from a single test. The difference between the results for the two piers above and those for piers built in the ordinary way is not greater than the error of the experiments.

Six piers were tested with blue stone cap and base, but the stone did not materially affect the strength of the brick masonry, as might have been foretold.

A pier of face brick 12 ins. square and 6 ft. high, laid up hollow without any mortar, had a strength of 525 lbs. per square inch — about one third of a similar pier with mortar.

VALUES ALLOWED IN PRACTISE.

According to the building regulations of Berlin, the safe load for brick masonry is less than one tenth of the results in Table III.

TABLE III.

ULTIMATE STRENGTH OF BERLIN BRICK MASONRY.*

Ref. No.	Kind of Brick.	Average Crushing Strength of Brick. lbs. per sq. in.	Ultimate Strength, in lbs. per sq. in., of Brick Masonry with Mortar Composed of			
			1 Lime 2 Sand	7 Lime 1 Cement 16 Sand	1 Cement 6 Sand	1 Cement 3 Sand
1	Clinker Stock . .	5,390	2,370	2,590	2,960	3,410
2	Selected Stock .	3,669	1,620	1,760	2,020	2,320
3	Ordinary Stock .	2,930	1,290	1,390	1,610	1,850
4	Perforated . . .	2,759	1,210	1,320	1,520	1,710
5	Porous	2,617	1,150	1,250	1,440	1,650
6	Porous Perforated.	1,195	530	570	650	750

Table III. purports to give the ultimate strength of the masonry, and claims to be derived from experiments. The internal evidence is that it was not derived directly from experiment. If the strength of the brick in any line of Table III. be represented by 1, that of the corresponding masonry in the several columns will be represented by 44, 48, 55, and 63 per cent. respectively, which shows that the results were computed and not derived directly from experiment. However, these per cents. are interesting as showing the relation between the masonry and the strength of the brick, and also as showing the relative strength of the several grades of masonry. These per cents. correspond to the numbers in the next to the last column of Table I. It is not stated how the brick in Table III. were tested, but it is evident that they are very much weaker than those in Table I. (It will be remembered that the latter had a strength of from 11,000 to 18,000 lbs. per square inch when ground flat and tested on the broad side.) Although the brick of Table III. are much the weaker, the masonry is much the stronger. In Table III. the term "cement" almost certainly means Portland cement.

The pressure at the base of a brick shot-tower in Baltimore, 246 ft. high, is estimated at 6½ tons per square foot (about 90 lbs. per square inch). The pressure at the base of a brick chimney at Glasgow, Scot., 468 ft. high, is estimated at 9 tons per square foot (about 150 lbs. per square inch); and in heavy gales this is increased to 15 tons per square foot (210 lbs. per square inch) on the leeward side. The leading Chicago architects allow 10 tons per square foot (140 lbs. per square inch) on the best brickwork laid in 1 to 2 natural cement mortar, and 5 tons for ordinary brickwork in lime mortar. Ordinary brick piers 18 by 24 ins. by 10 ft. have been known to bear 40 tons per square foot (560 lbs. per square inch) for several days without any sign of failure.

Tables I. and III. appear to show that the above practise is very conservative with regard to the pressure allowed on brick masonry. According to Table I., the ultimate strength of ordinary brick masonry with lime mortar is 112 tons per square foot (1,551 lbs. per square inch); and with *good* 1 to 2 natural cement is certainly at least 130 tons per square foot (1,825 lbs. per square inch), and probably twice this amount; and with *good* 1 to 2 Portland cement is certainly 180 tons per square foot (2,540 lbs. per square inch), and possibly twice this amount.

The nominal pressure to be permitted upon brick masonry depends upon the kind of material employed; the degree of care with which it is executed; whether it is for a temporary or permanent structure, an important or unimportant structure; and, it may be added, the care with which the nominal maximum load is estimated. Hence it is illogical to attempt to use a constant factor of safety. The designer must use his judgment and his knowledge of the attendant conditions of the problem in hand.

* From "Abstracts of the Institute of Civil Engineers" (London), Vol. 79, p. 376.

On the Saline Efflorescence of Bricks.

THE CAUSES LEADING TO IT, AND THE PRACTICAL MEANS OF AVOIDING THE SAME.— *Continued.*

BY OSCAR GERLACH (PH. D., BERLIN).

BURNING.

THE efflorescences produced by the sulphates in the green brick or during the water-smoking are always visible on the surface of the burnt product, either in the form of whitewash or in that of minute warty, crystalline kernels. On the other hand, the burnt products may come from the kiln faultless in appearance and without a visible trace of coloration, and yet conceal in their interiors considerable quantities of sulphates, which, when the bricks are later wet by water, are dissolved and make their appearance at the surface. These salts arise always during the burning,— not before,— and are particularly annoying because of their usually appearing first in the finished buildings, where, through the effects of rain and frost, they gradually are drawn to the surface.

Hitherto the opinion has been erroneously entertained that, in *burning*, only the sulphurous acid gas due to combustion participates in the formation of whitewashing sulphates, whereas the undisintegrated iron pyrites still remaining in the clay was left entirely unnoticed. Now Dr. Hans Guenther, of Carlsruhe, has recently shown by a series of instructive experiments that also the iron pyrites *in the clay* participates in the formation of whitewashing sulphates during the burning; and this is readily intelligible when we reflect that the sulphurous acid gas, produced by the combustion, must act mainly on the surface of the bricks and can only gradually penetrate into their interior, whereas the combustion of the finely distributed iron pyrites in the brick itself brings the generated sulphurous acid gas into immediate contact with the finely distributed carbonates of the clay, and so renders possible a perfect absorption of the acid by the carbonates.

The formation of whitewashing sulphates during burning takes place as follows: —

A part of the sulphur in the iron pyrites (FeS_2) is very loosely combined with the iron, and oxidation of this part begins at approximately 650 degs. Fahr., whereas the other part burns only at red heat. The products of the disintegration are oxide of iron (Fe_2O_3) and sulphurous acid gas (SO_2). Expressed in chemical formulæ, we have: —

$$\text{I.}\quad FeS_2 + 2O = FeS + SO_2$$
$$\text{II.}\quad 2FeS + 7O = Fe_2O_3 + 2SO_2.$$

The sulphurous acid gas SO_2, when heated in contact with solid porous bodies, is oxidized by the superfluous oxygen of the air of combustion to sulphuric acid, or converts existing oxides into sulphuric salts. It was for a long time erroneously believed that the presence of water or of water vapor was necessary to the formation of sulphates; but as early as 1856 Plattner in his book, *Der metallurgische Röstprocess*, demonstrated experimentally that sulphurous acid gas in combination with the oxygen of the air and in contact with minute particles, or in contact with porous solid bodies, oxidizes to sulphuric acid, and that the water vapor in the air was not of consequence for the formation of this acid. If the minute particles or porous bodies are or contain oxides, these oxides are converted into whitewashing sulphuric salts. The following of Plattner's experiments is of special interest to the brickmaker. He conducted a mixture of sulphurous acid gas and atmospheric air, once wet and once dry, over some unslacked lime (CaO) in a glass tube. At red heat the lime was converted into calcium sulphate ($CaO + SO_2 + O = CaSO_4$) without a trace of sulphurous acid or sulphuric acid being noticeable at the free end of the tube. All the sulphurous acid, accordingly, was absorbed by the lime and converted by the oxygen of the air into sulphate of calcium. The same experiments were made with other oxides with the same results.

In the burning of clay products the same conditions prevail, provided the fuel contains sulphur and the clay contains carbonates of calcium, of magnesia, or of alkalies — which is to a greater or lesser extent usually the case. At red heat the carbonates, liberating their carbonic acid, are converted into their respective oxides, which, being finely distributed throughout the porous brick by the oxidizing action of the air, combine with the sulphurous acid gas to form whitewashing sulphates.

To turn these laboratory experiments to account for practical brickmaking, the experiments were made on a large scale. Different clays were burnt with different fuels, and the amount of sulphates contained in the products determined both before and after burning.

EXPERIMENT I. *Clay alone contains sulphur.*

Material. Clay containing both iron pyrites and a small quantity of carbonate of lime.

Mode of Burning. Red heat (about 1650 to 1750 degs. Fahr.). Gas furnace. Oxidizing flame. The gas employed showed only the merest traces of sulphur. A kilogram of the *unburnt* clay contained 0.584 grams $CaSO_4$, or calcium sulphate. A kilogram of *burnt* clay contained 2.874 grams of $CaSO_4$. *Result*, Since the fuel contained no sulphur, the *fivefold* increase of the amount of whitewashing sulphates in the burnt product must have been *entirely due to the presence of the iron pyrites in the clay.*

EXPERIMENT II. *Both the clay and the fuel contain sulphur.*

Material. Same clay as in Experiment I.

Mode of Burning. Red heat. Coal fuel. Oxidizing flame. Coal contained 3 to 4 per cent. FeS_2, or iron pyrites. The amount of sulphates was determined in *several* different burnt bricks. A kilogram of the burnt clay contained on an average 12.76 grams $CaSO_4$.

Result. A more than *twenty-fold* increase of the whitewashing sulphates.

EXPERIMENT III. *Fuel alone contains sulphur.*

Material. Clay free from iron pyrites, but containing much carbonate of lime.

Mode of Burning. Red heat. Fuel, coal, etc., as in Experiment II. One kilogram of the *unburnt* clay contained 0.483 grams $CaSO_4$. One kilogram of the *burnt* clay contained 16.85 grams $CaSO_4$.

Result. An almost *forty-fold* increase of whitewashing sulphates.

EXPERIMENT IV. *Clay and fuel free from iron pyrites (at least containing traces only).*

Material. Same as in Experiment III.

Mode of Burning. Gas furnace. Oxidizing flame. Red heat. One kilogram of the *unburnt* clay contained 0.483 $CaSO_4$. One kilogram of the *burnt* clay contained 0.621 $CaSO_4$.

Result. A very *slight* increase of whitewashing sulphate.

EXPERIMENT V. *Fuel free from iron pyrites. Clay containing great quantities of iron pyrites, but only traces of carbonate of lime.*

Material. Clay containing large quantities of iron pyrites, but almost free from carbonate of lime and other carbonates.

Mode of Burning. Gas. Oxidizing flame. One kilogram of the *unburnt* clay contained 0.321 grams $CaSO_4$. One kilogram of the *burnt* clay contained 0.518 grams $CaSO_4$.

Result. A *very slight* increase.

EXPERIMENT VI. *Fuel and clay both contain iron pyrites, but the clay shows only traces of carbonate of lime.*

The materials and the results were the same as in Experiment V.

CONCLUSION.— It follows from the above experiments that the whitewashing sulphates are formed in large and annoying quantities only when sulphurous acids and carbonate of lime, or other carbonates, *occur together* in chemical action. Sulphurous acid has no injurious effect on clays containing no carbonates of lime, magnesia, or alkalies. Such clays, accordingly, can be burnt with sulphurous coal without any fear of an increase of whitewashing sulphates, whilst clays containing carbonate of lime require a fuel free from sulphur.

Fire-proofing.

HOW TO BUILD FIRE-PROOF.

(Concluded.)

BY FRANCIS C. MOORE,

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SUMMARY OF IMPORTANT POINTS.

FOUNDATION.

It is hardly necessary to deal with the foundations of buildings. The question is an engineering problem which hardly requires suggestions from a fire standpoint, and I shall not deal with it here, other than to touch again upon the important point of not having wrought-iron or steel columns in the cellar or basement, where moisture and gas conditions would increase the danger of rust.

ENCLOSING WALLS.

These, as already stated, should be of brick, the lower stories laid in cement mortar, not less than 16 ins. thick at the top of the building and increasing 4 ins. in thickness for every 25 ft. in height to the bottom. This would require a 44 in. wall at the grade for a 200 ft. building. The thicknesses here recommended are for buildings not exceeding 100 ft. in depth. If they exceed this depth without curtain or cross walls, or proper piers or buttresses, the walls should be increased in thickness 4 ins. for every additional 100 ft. in length.

Brick is the best known resistant of fire. Stone yields readily to the combined effect of heat and water, and even terra-cotta or burned clay tile cannot be regarded as a perfect substitute for hard-burned brick.

Under no circumstances should the iron framework of a skeleton building be incorporated in thin enclosing walls. No wall that has not a cross section sufficient to support itself without the iron-work should be allowed, aside from the importance of having it thick enough to prevent the passage of hot air from an adjoining building.

Curtain walls for enclosing walls supported by the longitudinal members of skeleton construction are objectionable; they are liable to be buckled out by the expansion of the framework. The great trouble with modern fire-proof structures, even under the New York building law, is that while the separating fire-proof floors tend to prevent the passage of flame from one story to another, the enclosing walls are often insufficient to prevent heat from igniting the contents of an adjoining building, so that what is gained by preventing the spread of fire vertically is lost laterally.

It should be borne in mind that the thickness of walls herein recommended is not for carrying capacity as bearing walls. Thinner walls would answer for that purpose. It is intended to confine the heat generated by a fire and should be required in the compact portions of cities, where every man should be compelled to build with reference to the safety of his neighbor.

Architects and builders generally seem to have in mind only the carrying capacity of walls and to lose sight of this important fact.

As the contents of a mercantile building and its floors burn they sink to the bottom, where enormously high temperatures are reached, and it is for this reason it is recommended that walls increase in thickness as they approach the bottom, on the same principle that the walls of smelting furnaces are thicker at the bottom than at the top.

It is the generally accepted opinion that a 12 in. brick wall will prevent the passage of fire, but a much thicker wall will fail to confine the heat of a burning building, on the first floor particularly, sufficiently to prevent the ignition of combustible merchandise or other material in an adjoining building. In a fire which occurred in Boston, several years ago, combustible material was ignited through a 3 ft. wall, which became so hot as to thus conduct the heat into the adjoining building. In an isolated location an owner might be permitted to construct his walls with reference only to their carrying capacity, but where he builds in the compact part of a city, storing combustible materials from cellar to roof, he should be required to build so that a fire in his premises will not necessarily destroy his neighbor's property. He may well observe a regulation which, in view of the fact that the buildings of his neighbors outnumber his own a thousand to one, will ensure that he shall be in that proportion the gainer by rules which secure the safety of all though imposed on himself.

I do not believe "skeleton construction" so called should be permitted for stores, warehouses, or manufactories in cities, as the walls are not thick enough to confine the heat of burning merchandise.

In some of our Western cities, Detroit, Chicago, etc., the practise is growing of using hollow tiling, bonded like ordinary brickwork, 12 ins. thick, for enclosing walls, instead of brick, the exposed steel frame being protected by terra-cotta slabs about an inch thick. Such a building would burn more quickly than an ordinary wooden-joisted building properly constructed. The Leonard Building, in Detroit, destroyed by fire Oct. 7, 1897, was an example of the great danger of this style of construction. It was ten stories high, and as fast as the columns or wall girders were warped by the heat the tiling dropped out like loose bricks, leaving the entire structure after the fire a ragged cage-work of iron with very little of the tiling on the enclosing walls and none of the floors intact. The contents were, of course, totally destroyed.

PIERS, BOND STONES, ETC.

Bond stones should not be allowed in piers, especially in the cellar or basement, or in piers vital to the building or carrying great weights. Stone yields readily and quickly to the combined effects of water and heat and, disintegrating at its edges, gradually releases the bricks above it, so as, in time, to destroy the integrity of the pier. Bond stones are employed by the mason to steady his work. A green brick pier while being laid is frequently unsteady, and a bond stone enables him to progress with his work by steadying all below it so as to receive new courses of brick. In all cases the bond should be a cast-iron plate. If the plate should be cast with holes through it about 1½ ins. in diameter, so that the mortar and cement can thoroughly incorporate the plate with the masonry above and below, it would be an improvement. Wrought iron is liable to rust and should not be used. Where bond stones are used in the outer walls of buildings they are less objectionable, but for inside piers they are so dangerous that they ought to be prohibited by law. Strangely enough, only stone for bonds used to be required by the New York building law, and such was the opposition of the stone men to the prohibition of bond stones altogether, when later it was proposed, that a compromise was reached allowing the use of cast-iron bonds as an alternative of stone bonds — an option seldom availed of by architects, builders, or owners, however, and construed generally by the public to mean that either is good enough.

STONE PILLARS.

It not infrequently happens that a building of otherwise admirable construction has its weakest point in the cellar, where a stone pillar forms the basis of support of the entire line of columns through the building. In case of fire and the application of water these stone pillars, no matter how substantial, whether single monoliths or stone blocks, will rapidly disintegrate and bring down the entire structure; and inspectors should carefully examine, especially in the cellars, for such construction. After the great Boston fire, granite piers were shoveled up and carted away like so much sand. It is quite a common practise, but a most dangerous one, to employ single stone columns, often of polished granite, to support the center of a long stone lintel carrying the wall over the ornamental entrance of a building. Such a column would surely yield to the effect of fire and water and perhaps let down the entire front. In almost any city (and New York is no exception) such faulty architecture may be observed. The writer passes every day a costly structure on Fifth Avenue whose corner is supported by a single granite monolith column of this kind. If stone columns are desired for architectural effect they should, wherever they carry heavy loads, contain a center column of cast iron of sufficient carrying capacity to support the superimposed weight.

CAST-IRON VERTICAL SUPPORTS.

The vertical supports, columns, pillars, etc., as already stated, should be of cast iron, cylindrical in form, of liberal thickness, especially in the lower stories, thoroughly tested as to sand holes, thin places, etc. Cast-iron columns should be round, and not square. In the former shape there is less likelihood of defects in casting, sand holes, etc., resulting in uniform sound thickness of the shell. The columns should be planed to smooth bearings, so that the entire system of columns, from the foundation to the roof, may be securely bolted together and form a continuous line with joints for expansion and without any inequalities of bearings. Under no circumstances should wedges or "shims"* be allowed. This most important matter is often neglected. The flanges and corbel brackets for supporting beams should be cast in one piece with the column and not depend upon rivets or bolts. Rivets, aside from the danger of shearing strains, are almost certain to rust to the point of danger. The beams should be riveted or bolted to lugs on the columns, however, as a tie between the side walls, holding the entire structure firmly and consistently together as one rigid whole and yet with play for expansion.

Col. Geo. B. Post, of New York, has devised a form of cast-iron cage construction consisting of pillars and floor beams of the Hodgkinson pattern the members of which lock into each other, without the use of bolts or rivets, forming a very rigid construction and saving the cost of mechanics for bolt and rivet work. While I have not had an opportunity to examine it, I have great faith in his judgment; my impression, from his description of it, is that it would be very rigid construction and admirably adapted to warehouses six and seven stories high. Above this height merchandise should not be stored in any kind of a building.

The factors of safety, in computing strains, should not be less than those prescribed by the standard modern authorities. Better be sure than sorry.

FIRE-PROOFING IRON MEMBERS.

All ironwork, columns and pillars, beams and girders, should be fire-proofed, *i. e.*, covered with at least 4 ins. of incombustible material, terra-cotta or brick. At the floor, and for a height of 4 ft. in mercantile buildings, a metal guard should be employed to prevent the column from being stripped by collisions with rolling trucks for moving merchandise. It ought to be unnecessary to suggest that wooden lagging should, under no circumstances, be used to cover iron, were it not for the fact that in one of the largest and most costly dry-goods stores in New York, the fire-proof covering of the iron columns, which had been seriously damaged by trucks, was being systematically removed in order to substitute wooden lagging, when the fault was, fortunately, detected by an inspector of the underwriters. 4 ins. of good brick-work is a good covering, but porous terra-cotta or even wire lath and plaster may prove effective. Where wire lath and plaster is used the column should first be wrapped with quarter-inch asbestos bound with wire. This would prove reliable and inexpensive.

It is a fact, showing how common is the neglect to cover iron with non-conducting material, that in the State Capitol, Albany, N. Y., in the library, is a large plate girder entirely exposed. This girder supports the ceiling beams, and there is enough combustible material in the oak bookcases, furniture, and flooring to wreck this portion of the building by expansion in case of their combustion. The New

* "Shims" are pieces of slate or iron inserted to secure a true vertical where the two surfaces have not been properly leveled or planed.

York Building Law was enacted in this building. The ceilings of the Assembly and Senate chambers are of heavy, hard wood, attached to the soffits of the iron beams, and they would, if ignited, probably warp and expand the beams to a dangerous point.

A notable instance, showing the necessity of protecting ironwork with incombustible material, and the danger of expansion in long lines of iron girders or beams, was that of the destruction of a fire-proof spinning mill at Burnley, Eng., recently. This mill was 210 ft. long by 120 ft. wide, six cast-iron girders of the Hodgkinson type, each 20 ft. long, spanned the 120 ft. width, being bolted to cast-iron columns, and carrying, in turn, cross girders of wrought iron. The expansion of these 120 ft. girders (they were unprotected) resulted in the disruption of the floor and the destruction of the mill. The cast-iron columns, being unprotected, collapsed under fire and water. The floors were 10 ft. 6 in. bays. As already stated, beams should not be spaced over 5 ft. on centers. Wider spacing results in weak arches, liable to be buckled out by heat or punched through by the falling of safes or of other heavy articles from upper floors.

The probability is that if the 20 ft. girders in this building had been arranged with provision for expansion, and all the ironwork had been thoroughly protected with fire-proof material, little damage would have been done. The effect, if the floors had been loaded with combustible merchandise, would have been more rapid. There was little wood to burn in the contents of the spinning mill, and yet the destruction was thorough. Such buildings with uncovered ironwork are more dangerous than those of heavy wood construction, in which the timbers are 12 ins. or more in diameter, and not more than five stories in height. A properly constructed building with protected iron, however, is, of course, superior to any other form of building. Experienced firemen are afraid to enter buildings supported by iron columns unless they are thoroughly fire-proofed, as they are liable to snap without warning under the influence of fire and water, whereas wooden posts burn slowly and give notice of collapse. They will stand a severe fire without being charred for more than 2 ins. of their surface.

BEAMS AND GIRDERS.

In mercantile buildings and factories beams, as already stated, ought not to be spaced more than 5 ft. apart, no matter what kind of arch is employed; and while many experts claim that a heavy iron I beam, thoroughly encased in fire-proof material on three sides and having only its soffit or under side exposed, would not be expanded enough by the heat of a fire to cause its collapse, it is best to take no chances, but to protect the under side with fire-proof material, which can be cheaply applied with wire lath and plaster, or by having the skew-backs of the terra-cotta floor fillings extend below the soffit or bottom flange of the beam, and made with lips for protecting the iron.

TIE-RODS.

It is a mistake, in my judgement, to dispense with tie-rods, even with the kinds of arches which employ wire cables or other metal ties. The claim is made that these act as tie-rods, but it should be remembered that they cannot be relied on during construction, when derricks for hoisting iron beams and other materials are resting on the girders. Dangerous lateral movements and twistings of the structure may be the result of want of rigidity, which can only be secured by tie-rods.

MATERIAL FOR ARCHES BETWEEN BEAMS.

It is my opinion — but there are many who entertain a different one — that the old-fashioned brick arch is the most reliable for resisting fire; that next to this in safety stands the porous terra-cotta segmental arch, with end construction, *i. e.*, the blocks or separate pieces placed end to end between the beams, instead of side by side in what is known as "side construction." This is said to be stronger than side construction. It is claimed by many experts that porous terra-cotta is a better non-conductor than brick on account of its interior air spaces. The arch should not be less than 4 ins. thick, having a rise of at least 1¼ ins. to each foot of span between the beams, and there should be a covering of good Portland cement and gravel concrete over this to ensure a waterproof floor. Cinder filling will burn — crushed slag from blast furnaces is better, but the Portland cement concrete should not be omitted for waterproofing purposes.

There are many patent floor arches for filling between I beams which have great merit when properly put in, but I doubt if any of them are equal to the two I have named, and it should always be borne in mind that when employed they should be inserted with the same care with which they are prepared for tests. This is almost equally true, however, as regards brick and burnt-clay arches, also. There is less likelihood of poor installation work, however, with brick arches or segmental arches of porous terra-cotta or burnt clay. Arches should be laid in Portland cement, not lime mortar. Under no circumstances should they be laid in freezing weather, and where concrete is used the broken stone or gravel should be carefully washed, and the cement should be of the best quality.

WATERPROOF FLOORS.

It is of great importance that the floors of all buildings should be waterproof, in order that the volume of water thrown by the fire department to extinguish a fire may be carried off without injury to merchandise on the floors below. Neglect of these precautions is criminal in view of their simplicity and inexpensiveness.

After the arches have been set between the I beams they should be covered, for at least a thickness of 1 in., with the best Portland cement concrete, carefully laid, so that all water will run to the sides of the building and be carried off by water vents or scuppers, which may be arranged with pipes through the walls, having a check-valve which would prevent the influx of cold air and yet admit of the outflow of water.

All ducts for carrying steam, gas, and other pipes and electric conduits should be protected with a metal sleeve going above the surface of the floor, and the space between and around the pipes should be filled in closely with mineral wool, asbestos, or some other expansive and fire-proof material to cut off drafts and flame.

FLOOR SURFACES.

Floor boards should be dispensed with, if possible, and asphalt or concrete employed instead. It is hardly practicable in office buildings, however, to dispense with wooden floors. Wherever used they should be so laid, especially in mercantile or manufacturing buildings, that there is no air space to supply a passage for flame and to form a harborage for rats and mice, to which these vermin can carry matches, oily waste, or other combustible material, to be ignited by steam pipes or by spontaneous combustion.

FIRE-PROOFING WOOD.

Various processes, "electric," so called, and otherwise, have been patented for fire-proofing wood. They undoubtedly increase the fire-resisting properties of wood for interior trim, window casings, etc. Whether or not they impair the durability of wood is a matter as to which I am not yet informed, and I doubt if sufficient time has elapsed for a proper test. The United States Navy has made trials of fire-proof woodwork — with what success I am not informed.

VENTILATING AND LIGHT SHAFTS, DUMB-WAITER SHAFTS, ETC.

The enclosures of all ventilating shafts, for water-closets, etc., light shafts, and dumb-waiter shafts should be constructed in the same substantial manner as freight elevator shafts. It is a mistake to use thin plaster board or plaster with dovetailed, or other metal, lath, etc. No enclosure should be relied upon less than 4 ins. in thickness, well braced with angle iron, but brick walls are best, especially in buildings over 60 ft. high. The lights should be of wire glass, set in metal framework, and ventilators should have metal louvers arranged to secure ventilation but not to increase a draft. Slats should be riveted, not soldered, to metal framework, and the metal framework should flange well over the fire-proof material of shaft on both sides. It is possible to finish tin-covered fire-proof doors with wooden trim so as to be ornamental, with bead panel-work, etc.

WELL-HOLES.

These should be avoided if the building is to be regarded as fire-proof. The Horne Building had one 48 by 22 ft. It is almost impossible to control a fire starting in the lower floors where a well-hole opens through those above. Luxfer Prisms are now used to secure light from side windows, it is claimed, with great success.

A recent fire test of the Luxfer Prism, in Chicago (March, 1898), is stated to have been satisfactory to Fire Marshal Swenie, as showing that these prisms afford material protection from the heat of a neighboring fire in an exposing building, and that to some extent they are substitutes for iron shutters.

STAIRCASES, ELEVATORS, ETC.

These should be in hallways cut off from the rooms at each story by fire walls and doors, to prevent drafts. It is not so important, and is not so practicable, in the case of office and hotel buildings as in the case of mercantile and manufacturing buildings; but it is advisable, even in office buildings, to have the staircases, elevators, etc., in a separate hallway, the division walls of which should extend through and above the roof, and any skylights should be covered with glass not less than ¼ in. thick.

SKYLIGHTS.

It is contended by some that skylights should be of thin glass, so that they will break easily and permit the escape of smoke and gas. Smoke is ignitible, and when it accumulates in a building often spreads the fire from story to story, or blows out the walls by the explosion of its gases. But while thin skylights are contended for by many expert firemen, it should be borne in mind that nothing so facilitates the spread of fire as a draft, and it would be better to have the skylights adjusted with appliances for opening them, so that when the firemen arrive on the ground, and not before, they may be adjusted to permit the escape of smoke and allow the firemen to enter the building to see where to work to the best advantage. Under any circumstances a network of wire should be above the glass to guard it against flying embers, and another should be suspended beneath the skylights, so that when the glass cracks and breaks with the heat it will not injure the firemen below.

ROOFS.

These should be of brick or tile on all high buildings, the roof beams being of iron and, where tanks are supported, of sufficient strength to carry many times the actual probable weight of the water and the containing tank itself.

SLATE ROOFS.

Slate roofs, on very high buildings especially, on street fronts are objectionable, as, in case of fire, the slates would crack and, falling to the street, injure the firemen. A flat roof of brick tile is better than any other.

All water on roofs from rain or melting snow should be drained from the front or sides to leaders, so as to avoid drip points, from which icicles could be formed. Too little attention is paid to the great danger of injury to pedestrians from falling snow or icicles on very high buildings. This may not be a suggestion strictly germane to this article, but it is a matter so often overlooked as to warrant its being referred to in an article intended to deal more or less thoroughly with the subject of fire-proof buildings.

ELECTRIC LIGHT INSTALLATION, DYNAMO ROOM, ETC.

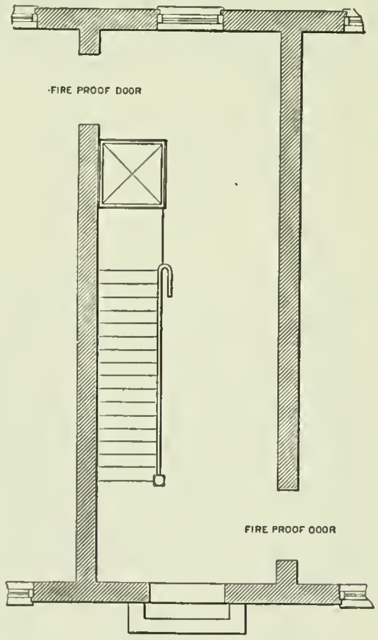
The electric light installation of a large fire-proof building is an important and complicated matter. To insure safety, reference should be had to the rules of the National Board of Fire Underwriters, which can be obtained, without charge, from the nearest local board of underwriters.

The switchboard should be of incombustible material, and no steam, water, or sprinkler pipes should pass over or near it where, in case of a bursting pipe, water could reach the switchboard and cause disaster. This is an important matter almost universally overlooked.

An admirable floor for a dynamo room is one of deck glass, ¾ in. thick, on a wooden (not iron) frame. It will insure that the attendant upon the dynamos will be, at all times, effectually insulated. Such a floor will not become soaked with oil, as would a wooden floor, and can easily be kept clean. A strip of rubber floor carpet stretched over it will prevent slipping. The Continental Insurance Company has, probably, the only floor of this kind in the country in its large fire-proof office building on Cedar Street, New York.

COMMUNICATIONS BETWEEN ADJOINING BUILDINGS.

It is sometimes necessary to have communications between adjoining buildings by doors in the fire walls, and it is not always convenient, for changing merchandise from one room to another, to have fire-proof doors closed during working hours. It is possible to have the fire-proof doors run upon trolleys on an inclined track so as to close by the force of gravity, and held open by fusible metal latches or links which would release them when melted by the rising temperature of a fire. It has occurred to me that this difficulty may also be met by erecting between two adjoining buildings a separating fire-proof hallway of brick, which can be utilized for containing staircases and elevators, and for supporting the water tanks of automatic sprinklers. The doors which open into this hallway should not be opposite each other, but at opposite ends of it, so that fire in one of the buildings passing through the door would come against a blank wall opposite. Even if the fire-proof doors to these openings should happen to be open at the time of a fire in one of the two buildings, it is improbable that it would find access to the other.



SEPARATING FIRE-STOP HALLWAY, GROUND PLAN.

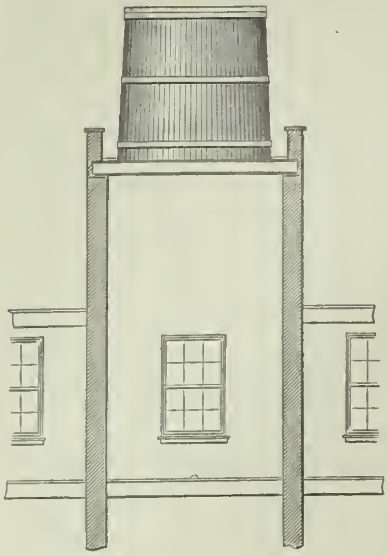
The floors should be both fire and water proof, slightly lower than those of the two separated buildings, and with water vents or "scuppers" for carrying off surplus water thrown by a fire department. Indeed, it is well to have "scuppers" on all floors of every building.

The walls of this separating hallway or vestibule should rise 4 ft. higher than the roofs of the two buildings, and, if there are window or door openings near it, its walls should project beyond the line of enclosing walls at least 1 ft. The following diagrams fully illustrate the idea.

The water tank, as already stated, should be supported on protected iron I beams, resting on the brick walls, with cast-iron templates, so that the tank cannot fall, break down the staircases and wreck the building in case of fire.

It is important always to locate tanks so that they will not be over stairways or elevators and endanger them in case the supports give way. With a fire-proof hallway of the kind recommended, containing no combustible material whatever, the tanks being supported by iron I beams resting on the brick walls, this would not be an important matter, but in all other cases water tanks should be planned so as not to endanger staircases, and the supporting iron beams should be fire-proofed, that is, covered with fire-proof material.

It ought to be unnecessary to state that there should be no combustible material whatever in this separating hallway, and that the staircase, elevators, etc., should be of metal and fire-proof.



SEPARATING FIRE-STOP HALLWAY — ELEVATION OF UPPER STORY AND ROOF WITH WATER TANK.

SEPARATION OF WOODEN BUILDINGS.

Indeed, such a hallway as this could be relied upon to separate wooden buildings. It should, however, for that purpose, be at least 10 ft. higher than the peak of their roofs and should extend 4 ft. beyond their front and rear lines. It is probable that the extensive frame dairy buildings of ex-Vice-President Morton at Ellerslie, which burned several years ago, might have been saved by this simple precaution.

OUTSIDE STAIRCASES.

Where it is not necessary to transfer merchandise from one building to another and only requisite to have a passageway for employees, this may be arranged by an iron balcony, like a fire escape, cutting down the window on each side of the separating wall for a door, so that communication can be had by the balcony. The openings should have fire-proof doors. This would be practically safe. It might, with iron ladders, be utilized as a fire escape, and so prove of great advantage to firemen in fighting a fire, who could hold a hose nozzle at the different windows with perfect safety to the last moment. It is practicable, indeed, to have iron stairways with roofed balconies entirely outside of storage stores so that the floors do not communicate. There is a number of these in Philadelphia.

FIRE-PROOF DOORS AND SHUTTERS.

These should not be of iron, but of wood covered with tin. Solid iron shutters or doors are not reliable. Iron doors yield readily to flame, resulting sometimes in their warping open when exposed to fire in an adjoining building, exposing the one they are intended to protect to the full effect of the flames.

Where window openings are protected by iron shutters on rear courts they are almost certain to be opened by a fire in an exposing building, and cannot be relied upon. The tin-covered wood shutters are alone reliable. There is no recorded instance in which a solid iron door, exposed to the full effect of fire in an adjoining building, has protected the opening, whereas there is, on the other hand, no recorded instance in which the "Underwriters'" door has failed to serve its purpose — two important facts which are significant and ought to settle the question.

The "Underwriters'" door is constructed of ordinary white pine lumber, free from knots, of double or treble thickness, according to width of opening, the boards being nailed diagonally and covered with the best quality of tin, with lap-welded joints.

It ought to be unnecessary to state that on the exposed side of a building, not only the shutter, but the window-frame, sash, etc., should be of metal or covered with metal — riveted, not soldered. Where it is not possible to use a fire-proof shutter for want of room, wire glass in a metal frame will be found a desirable substitute. It will probably hold a fire until the fire department can cope with it.

It is not generally understood or known that fire will travel from one story to others above by way of the windows in the outer or enclosing walls. Especially where a building has an enclosed court it will sometimes reach upper stories in this way, even when the floors themselves are thoroughly cut off, the court acting as a chimney. This happened several years ago in the Temple Court Building, a fire-proof structure in New York. The woodwork on several floors was ignited by the lapping of fire through the windows from the lower stories and serious damage resulted. A recent instance was the Livingston Fire-proof Building in New York, in January, 1898. All windows on exposed sides should be protected with fire-resisting shutters.

It may be well to suggest for the benefit of those who are not familiar with city fires that, as heat naturally ascends, the exposure of a low building is often much greater to a neighbor higher than itself than to a building of its own height, so that a tall, fire-proof structure, surrounded by smaller buildings, should be provided with fire shutters to all openings. These are not necessary where the exposing buildings are occupied for offices, and are themselves fire-proof, as the amount of heat which escapes from the windows of a burning building, so long as its enclosing walls remain intact, is seldom sufficient to ignite a fire-proof building or its contents. The moment of greatest danger is when a burning building collapses and the intense heat caused by its enormous bed of coals exerts its full effect upon surrounding structures. In a recent fire in New York (Feb. 11, 1898), three fire-proof office buildings were more or less damaged with their contents, although many feet away from the burning building.

It is to be hoped that some inventive genius will devise a plan for simultaneously opening or closing the shutters on any or all stories of high buildings by manipulation from the ground floor. They are usually left open at night, always in the daytime, and might thus be closed in case of a dangerous fire in the vicinity. In some cases they are fastened open.

COMPARATIVE TESTS OF FIRE-PROOF MATERIAL.

Tests of fire-proof material, iron beams, pillars, floor arches, etc., to be of any value must be conducted under circumstances which insure uniform conditions. Otherwise comparisons are unreliable. It is quite customary to refer to results of fires in different buildings, having differing forms of construction, as supporting theories of relative merit; but ordinary conflagrations cannot be relied upon, for the reason that in two buildings, side by side, the conditions may be widely different. Eddies and currents of air, changes of prevailing wind, etc., may secure exemption from damage. It happened in the large conflagrations of Chicago, Troy, Boston, etc., that the most phenomenal escapes were observed. In some instances frame buildings, surrounded by brick structures which were totally destroyed, escaped with no further damage than the blistering of paint.

Even where tests are carefully arranged, especially weight tests, obvious precautions are sometimes overlooked. It will be observed, for instance, where bricks are piled on a surface of floor arch and iron beams to secure a certain weight per square foot, the pile of bricks may be so disposed as to have a bearing on both of the iron beams and the full weight may not come upon the fire-proof arch between them. The lateral bond of a pile of bricks a few courses higher than the floor to be tested may have all the effect of a relieving arch and materially reduce the strains. In furnaces constructed to secure high temperatures, drafts and currents of air should be provided for with great care and under the direction of the most competent and intelligent experts.

In conclusion it may be well to state, in view of the general misapprehension which prevails with regard to the interest of the fire underwriter in the improvement of construction, that it makes no difference to him whether a building be fire-proof or not; his rate of premium and the amount which he insures are both based upon the characteristics of each building insured. He would make just as much money on $100 of premium secured at a rate of 5 per cent for $2,000 insurance on a wooden planing mill as on $100 of premium secured on $100,000 insurance on a fire-proof building the rate of which is $1 per $1,000.

The Masons' Department.

THE CONTRACTOR AND THE REFEREE.

NEARLY all the standard contract forms which are used in formulating agreements respecting building operations contain a clause providing for settlements of differences between the owner or the architect and the builder, and although a very large share of power is of necessity conferred upon the architect, and the owner and the builder nominally agree to leave nearly everything to his decision, there is always reserved an appeal to supposedly disinterested referees. In theory a referendum of this sort is a perfectly fair way of settling differences. In practise, however, it fails very often because of the unwillingness of one party or the other to accept the results of the reference, and law suits follow with all their attendant evils. A law suit, at the very best, is an unsatisfactory way of settling differences. If the parties can only agree to finally agree, will only allow disinterested advice to prevail, and will then steadfastly refuse to reopen the question, a recourse to the courts need very seldom be resorted to. There is an opportunity for the master builders' associations throughout the country to accomplish a great deal, and win for themselves a large measure of prestige if they would use their already considerable influence to in some way enforce the value of a referendum, and to put themselves on record in such unmistakable manner that the decisions of the properly constituted board of reference would have the weight which theoretically the existing contract forms give to it. Some of the master builders' associations have already taken steps looking towards something of this sort. One of the largest of these parties recently had under serious consideration a by-law which provided for the appointment of a permanent board of arbitration, to which all questions which should arise. either between members or with members and some outsider, should be submitted for judgment, the association simply offering its good services, and standing ready to arbitrate between interested parties. Unfortunately, the builders who are honestly desirous of fair treatment, even if they are losers thereby, are always in the minority, while the number who feel they are free to do just as they please, who prefer independence of society control, and who claim the liberty to take advantage of every opportunity in their favor, rightly or wrongly, are always on the alert to head off anything which looks like a restriction of what they assume to be their rights. As a matter of fact, however, builders of this sort are the very ones who would profit most by a referendum. So long as the struggle for existence shall continue there will be more workers than there is work, and the minor builders, the ones with limited means, will be those who will have to take chances and are likely to be imposed upon by unscrupulous owners or by fraudulent subcontractors; and if they could lay all their troubles before a properly constituted board, with the assurance that they would be fairly treated, and would then have the courage to stand behind the award instead of rushing into the courts if the judgment goes against them, there is no doubt they would in the long run be vastly the gainers thereby. Indeed, the principle can and ought to be carried even farther. The master builders' associations are, as a rule, self-respecting, influential bodies, which can and should provide opportunities not only for peaceful arbitration of differences, but can go farther and make such arbitration obligatory upon their members both in the submission of differences and the acquiescence in the award, with the penalty of dismission from the body if the award is not accepted.

TESTS OF QUICK-SETTING CEMENT.

BY PROF. CECIL B. SMITH.

BECAUSE of the abuse which our quick-setting cements (the natural set of which may be in ten or twenty minutes) receive at the hand of careless or ignorant users by frequent retempering in order to use large batches of mortar extending over a period of several hours, the following tests were made: —

The proportionate reduction of strength would probably hold true for mortars as well as neat tests.

In the tests a large batch of mortar was mixed up and briquettes were molded from it. At the end of one hour the remaining mass had become appreciably stiffened and was retempered by adding sufficient water and by vigorous working. The same process was gone through each hour, but very soon the activity of the cement was so greatly killed that the setting would not take place for many hours, and very little extra mixing was required.

The "Quebec Natural," corresponding to such United States cements as "Cumberland," "Round Top," etc., has an incipient set of about 30 min. and a full set of 2 to 3 degs. The "Peacock Portland" is a sound, well-burnt, but coarse English cement, having an incipient set of about 20 min. and a full set of 1 to 2 degs.

	Quebec Natural.				Peacock Portland.			
	Time of Set.	Neat Tensile Strength per square inch.			Time of Set.	Neat Tensile Strength per square inch.		
		1 wk.	1 mo.	10 mos.		1 wk.	1 mo.	2 mos.
Original test	3 hrs.	157 lbs.	278 lbs.	520 lbs.	2 hours.	407 lbs.	515 lbs	596 lbs.
1st retempering	4 ,,	123 ,,	210 ,,	485 ,,	5 ,,	202 ,,	341 ,,	425 ,,
2d ,,	4 ,,	80 ,,	163 ,,	435 ,,	4 ,,	184 ,,	290 ,,	382 ,,
3d ,,	19 ,,	73 ,,	153 ,,	405 ,,	very slow.	185 ,,	365 ,,	388 ,,
4th ,,	19 ,,	52 ,,	157 ,,	380 ,,	,,	.....	165 ,,	308 ,,
5th ,,	19 ,,	72 ,,	172 ,,	295 ,,	,,	213 ,,	347 ,,	383 ,,
6th ,,	21 ,,	.....	173 ,,	290 ,,	,,	180 ,,	310 ,,	402 ,,
7th ,,	......	....	.....	265 ,,	,,	220 ,,	332 ,,	367 ,,

This table seems to point out two or three things rather clearly: —

1. That the first and second retempering do all the injury, the subsequent ones being merely the reworking of a mass which has not set.

2. That the strength of retempered cements is roughly one half of those not thus treated.

3. That time does not "heal all wounds," as the strength at ten months with the natural cement, and two months with the Portland, has not recovered to any very appreciable extent. This last deduction does not agree with the student thesis paper on the subject published about two years ago in the *Engineering News*, which claimed a recovery of strength in course of, say, six months.

I trust that such a memorandum as this will bring out some discussion on the matter from men whose experiences on the subject will be of value to the profession.

WALLING UP.

THE present manner of laying brick in dead walls gives one the impression that the quantity of bricks laid is of far more importance than the quality of the work done. The only way to obtain good solid brick walling is to either flush the joints solid with mortar every course or make a shove joint; the former method takes too much time and material, and the latter is very rarely done except in very heavy buildings. The custom generally adopted is to spread the mortar on the bricks (a portion only of which gets in the joints) and lay the bricks on top, each succeeding course being bedded in mortar; but the longitudinal and cross joints are only partially filled, the butting joint of the brick receiving a little dab of mortar gathered on the point of the trowel by cleaning the surplus mortar from the outside joint. Grouting with cement mortar every two courses in height might be adopted for basements and first stories of buildings when great strength is required. Full headers for face bricks are better than clippings and should be specified for all heavy buildings. The face bricks are often built up fifteen or twenty courses high before the backing up is done, a custom that should not be permitted, as it leaves the wall subject to many defects, as it cannot be well bonded or tied together sufficiently strong to be able to resist unequal strains successfully. For good strong work the mortar joints should never exceed five sixteenths of an inch in thickness.— *Canadian Architect.*

Brick and Terra-Cotta Work In American Cities, and Manufacturers' Department.

NEW YORK. — In spite of all the anxiety and uneasiness occasioned by our present foreign troubles, the New York building record is as follows: —

Total number of new buildings, January 1 to April 1, 715 as compared with 908 during the corresponding time in 1897.

Total cost of these buildings, $17,454,325. Cost of the 908 buildings during 1897, $19,342,550.

No very large or important buildings have been reported during the past month, but the general condition of work is good. Too much praise cannot be bestowed upon the new Washington Life Building, C. L. W. Eidlitz, architect. It is now nearing completion, and more than lives up to the promises conveyed in the drawings. The stone is of a beautiful soft color, the carvings are unusually well disposed, the fenestration is excellent, and it is altogether a success and one of our best office buildings. It is not on a prominent enough corner to do it full justice, however.

Among items of new work might be mentioned: Plans have been prepared by Henry M. Congdon, architect, for a new edifice for St. Mark's Protestant Episcopal Church, Brooklyn, to be erected on the Eastern Parkway near Nostrand Avenue; cost, $50,000.

A competition is now being held for designs for the new Franklin Bank. The only competing architects are Geo. B. Post, R. H. Robertson, and Lamb & Rich.

Plans have been filed by Clinton & Russell for the new eleven-story Cheseborough building. The materials will be brick and stone; cost, $430,000. The work of demolishing the old buildings upon the site has been commenced.

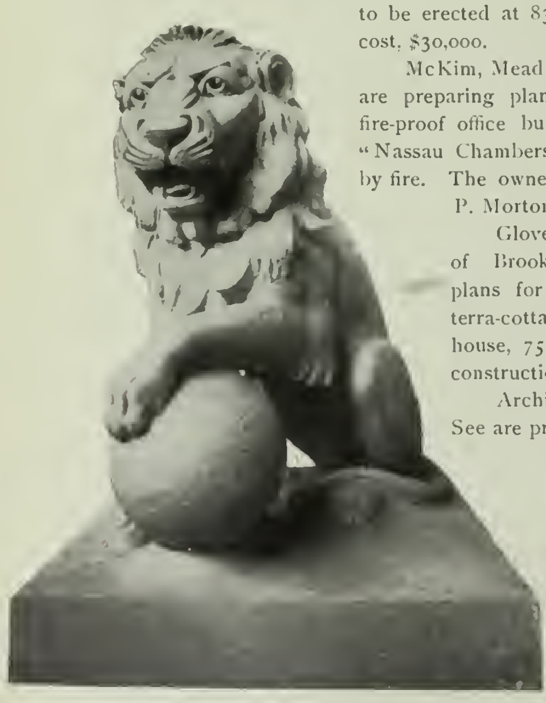
Quinby & Broome, architects, are preparing plans for a five-story red brick and white terra-cotta apartment and studio building to be erected at 83 Washington Place; cost, $30,000.

McKim, Mead & White, architects, are preparing plans for a twelve-story fire-proof office building to replace the "Nassau Chambers" recently destroyed by fire. The owner is ex-Governor Levi P. Morton.

Glover & Carrel, architects, of Brooklyn, are preparing plans for a seven-story brick, terra-cotta, and stone apartment house, 75 by 80 ft., fire-proof construction; cost, $80,000.

Architects Cady, Berg & See are preparing plans for the new buildings to be erected on West 15th and 16th Streets for the New York Hospital.

Work will be commenced at once upon the new building for the University Settlement Society. The cost will be about $90,000. Stokes & Howells, architects.

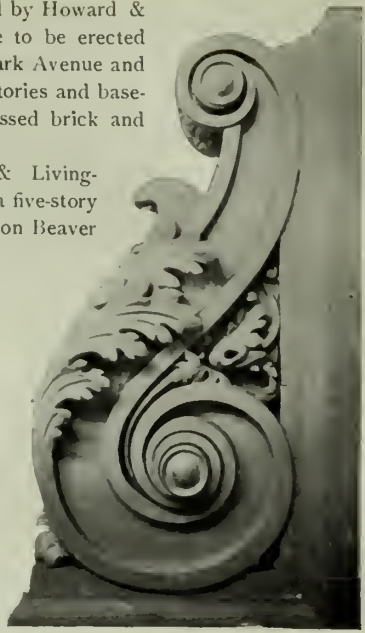


DETAIL, COMMERCIAL CABLE BUILDING, NEW YORK CITY.

The figure is 5 ft. 6 ins. high, located on the building at an altitude of 240 ft. from sidewalk. Executed in terra-cotta by the Excelsior Terra-Cotta Company, Harding & Gooch, Architects.

Plans are being prepared by Howard & Cauldwell for a new residence to be erected on the northwest corner of Park Avenue and 58th Street. It will be four stories and basement, 28 by 100 ft., with pressed brick and limestone front; cost, $50,000.

Architects Trowbridge & Livingstone are preparing plans for a five-story office building to be erected on Beaver Street for the American Cotton Oil Company. It will be a pressed brick and stone fire-proof structure; cost, $95,000.

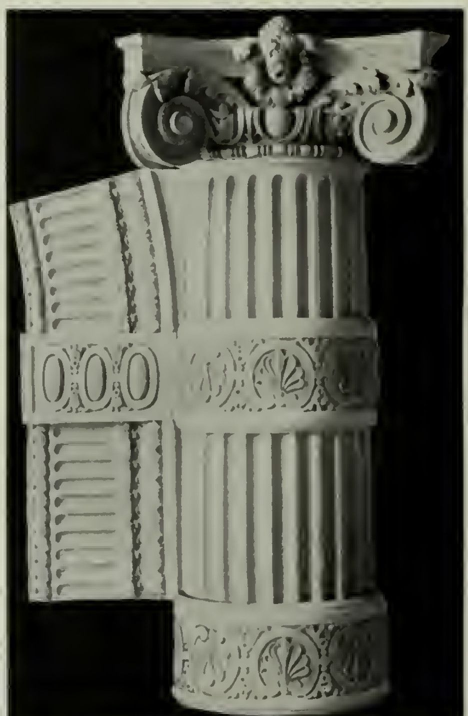


CONSOLES TO DORMERS, COMMERCIAL CABLE BUILDING, NEW YORK CITY.

Executed in white terra-cotta by the Excelsior Terra-Cotta Company. Harding & Gooch, Architects.

CHICAGO.— The possibility of a war with Spain has had a noticeable effect on building projects. Capital has been inclined to hold back plans for new buildings until the uncertainty be ended. Aside from this factor in the situation, however, building operations are not as brisk as those interested would like to see them. Many architects have been reaching out into new territory for their business and they are hoping that their services will be needed more urgently here in Chicago next year than they seem to be this.

Architects and contractors in general seem to be in sympathy with the new State license law. More than seven hundred architects have paid in their twenty-five dollars each, and more than five hundred of these are in Chicago alone. Any shyster architect who could swear that he was practising when the law was passed had to be granted a license. But the commission has the power to prevent unworthy acquisitions to the profession in future, and the Architects' Business Association has taken up the matter in a definite way to assist the Commission or Board of Examiners and to prosecute violation of the law, which, while it allows to con-



TERRA-COTTA DETAIL, GRAMMAR SCHOOL NO. 7, BALTIMORE, MD.

Executed by the Conkling, Armstrong Terra-Cotta Company. Wyatt & Nolting, Architects.

tractors certain independent privileges in designing their own buildings, will not allow any one to call himself an architect or to give out plans for others to bid on unless he holds a license. The revision of the building ordinances just made by the Chicago Council forbids the granting of permits on plans for any building larger than two stories, and 1,200 sq. ft. in area, unless bearing the stamp of a licensed architect.

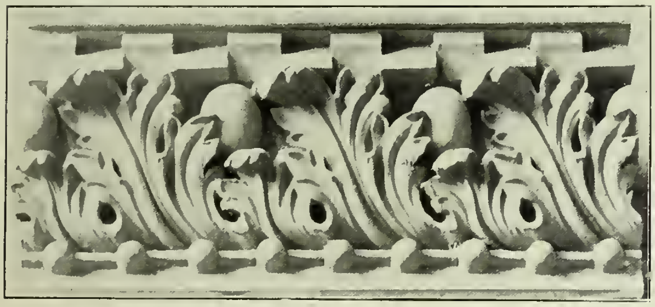
It is of interest to note that in the revised building ordinances referred to the Chicago aldermen have juggled again with height limit of buildings. A year or so ago the limit was reduced to 155 ft., now it stands at 130 ft., or practically ten stories as the limit of height for fire-proof buildings.

This, in the opinion of prominent architects, will discourage capital from investing in the best class of buildings. The aldermen who brought about this result represent the same public opinion which resents concentration of business and is fighting the department stores.

The annual architectural exhibition is the event at the Art Institute at the present writing. The showing was a large one, even though the quality was not uniformly the highest. The exhibits sent by Eastern architects and by the schools were good, but it seems that the most prominent architects of Chicago do not take as active part as they might. It must be that we need an Art League.

One of the interesting features of the exhibition was the work of the several groups into which the Architectural Club was divided last fall. Its particular *projet* was selected by each group, and the several drawings constituting a design (in one case a scheme for an elevated railway station) were the joint work of those in the group under the direction of their leader or "patron," himself a member of the club.

One noticeable feature of the exhibition was Dwight Perkins's design for one of the Omaha Exposition buildings, accompanied by



TERRA-COTTA STRING-COURSE, THE LENOX, BUFFALO, N. Y.
Executed by the Northwestern Terra-Cotta Company.
Loverin & Whelan, Architects.

models of the groups of statuary designed for the building by R. W. Bock.

In conjunction with the architectural exhibition there was held the first annual exhibition of the Arts and Crafts Society, an organization made up of artists, architects, people interested in social settlements, and others who are trying to raise the standard of artistic excellence in the arts and crafts. The exhibit, which included products in wood, metal, and fabric, from jewelry to furniture, was surprisingly good both in quantity and quality.

PHILADELPHIA —The John Stewardson Memorial Scholarship has become the goal of the young architectural draughtsman's hopes here, even as its older fellows in Boston and New York have long been in those cities. It is now six years since the University of Pennsylvania Traveling Scholarship in Architecture was established, and though never funded, it has sent a student abroad for four consecutive years. The sudden death of John Stewardson created the desire among his professional coworkers, admirers, and followers for some tangible evidence of their appreciation of the high place he had reached, and of the good he had done towards the advancement

RESIDENCE, BEACON STREET, BOSTON.
H. H. Richardson, Architect.

of architecture. This culminated in their raising a fund sufficient to insure for all time the continuance of the yearly scholarship with which his name was then coupled.

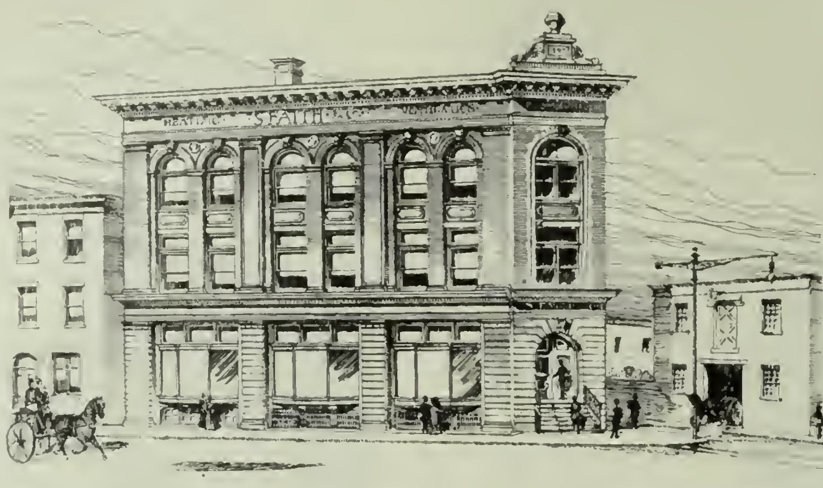
The prize has just been competed for by ten men, the program of competition proving of unusual interest. One has become so imbued with the understanding that scholarship competitions consist of designs for crematories, opera houses, custom houses, imperial villas, etc., of the most strictly *beaux arts* type that to break away at one step to "A Farm Steading," as was done this year, seemed quite to upset all axioms relating to this class of competitive work. The jury, Messrs. Sturgis and Andrews, having been taken, previous to the award, through Delaware County, where the farm was supposed to exist, had ample opportunity to grasp the nature of the problem, and were enthusiastic in their praise of the schemes submitted. The successful man is William C. Hays; first mention, Arthur H. Brockie; second mention, John Molitor; third mention, Alfred M. Githens, all of whom it appears are draughtsmen in the same office in this city.

Work on a large building for the Philadelphia *Press* is about to be commenced at 7th and Sansom Streets, from plans by T. P. Chandler. Mr. Chandler has designed many of the down-town office buildings, but it is some years since his work lay in that direction.

TERRA-COTTA CAP, STATE NORMAL SCHOOL, PROVIDENCE, R. I.
Executed by the Standard Terra-Cotta Company.
Martin & Hall, Architects.

This is to be an example of steel construction with facing entirely of terra-cotta, it being found more economical than brick.

Another large structure is in the office of Wilson Brothers, architects, to be put up for the newly founded gas company that has leased the city's gas works.



BUILDING FOR S. FAITH & CO., PENN AVENUE AND TAYLOR STREET, PHILADELPHIA.
Hales & Ballinger, Architects.

The old blue laws against Sunday work were invoked against the contractor for an office building at Broad and Chestnut Streets, the foundations for which are just being put in. It seems the necessary encroachment on the neighboring property for the purpose of underpinning the party wall was objected to by the tenant, so the wily contractor set to work after hours, on a Saturday afternoon, kept at it all night and all next day, and so had the thing completed by Monday morning, to the astonishment, if nothing worse, of the aforesaid tenant. The arrest for desecration of the Sabbath, which followed, had not much result,

TERRA-COTTA DETAIL, BLIND ASYLUM, OVERBROOK, PA.
Executed by the Burlington Architectural Terra-Cotta Company.
Cope & Stewardson, Architects.

as it was proved to the satisfaction of the court that the work was one of necessity.

ST. LOUIS.— Quite a little activity has been noticeable in building circles recently, and no small interest is felt in the prospects of some of the old landmarks recently destroyed by fire, to which reference was made in the February BRICKBUILDER, being replaced by modern fire-proof structures.

The G. A. Fuller Construction Company, of Chicago, have been awarded the contract for a twelve-story building on the site of the old Polytechnic Building, which they promise to have ready for occupancy by the first of the year. The contract is for $350,000, and the building is to be of brick and terra-cotta. Eames & Young are the architects.

Shepley, Rutan & Coolidge are preparing drawings for an eight-story fire-proof commercial building, on the corner of Broadway and Locust Street, to take the place of the old Mermod, Jaccard Building, and Isaac Taylor plans for a warehouse on 3d and Locust Streets.

There are a number of other buildings in contemplation, but the anticipated war has caused some uneasiness in the money world, and negotiations have been suspended in some instances.

The Board of Trustees of the Public Library recently purchased the entire block between 18th, 19th, Olive, and Locust Streets, which will eventually be the location of the library. The building will not be commenced for several years, a proposition to levy a tax for that purpose having failed to receive the requisite number of votes at the last election, and it will be impossible to resubmit the matter for more than a year.

The methods of our school board were so unsatisfactory that the legislature, last winter, was prevailed upon to pass a bill reorganizing the same. Later an election was held, which resulted in the election of a non-partisan board, and Mr. Wm. B. Ittner was appointed Commissioner of Buildings. Mr. Ittner has just awarded the contract for five school buildings that prove of especial interest, they being the first to be erected under the new building ordinance, which requires all school buildings to be fire-proof, and the cost is less than similar buildings of ordinary construction under the old régime.

The exodus of the city officials from the old City Hall, which had been promised to occur on the 11th of this month, will be equally gratifying to the public and officials, as some encouragement is offered that we may eventually have a new City Hall, even if it does become old before it is finished.

The building was commenced during the summer of 1890, after plans had been selected in a competition not devoid of criticism. After numerous delays incident to work of a public character, the north and south wings have been so far completed that they may be occupied; but the central portion, which includes the two chambers of the municipal assembly and rotunda, are still to be finished. The city has been handicapped by the meagerness of the building fund, and have been compelled to practise the strictest economy in finishing the building, which in many cases might be open to criticism. This is particularly noticeable in the corridors and stairs. The original scheme doubtless contemplated something elaborate, as the ceilings are coffered and richly ornamented, but the walls have been finished with plain plastering and Tennessee marble, without the suggestion of even a molding.

TERRA-COTTA DETAIL, NEW YORK & NEW JERSEY TELEPHONE BUILDING, BROOKLYN, N. Y.
Executed by the Perth Amboy Terra-Cotta Company.
R. L. Daus, Architect.

TERRA-COTTA LINTEL.
Executed by the New Jersey Terra-Cotta Company.

MEMPHIS. — Contrary to the prediction of calamity howlers and those who considered Memphis doomed after the yellow fever scare of last fall, the building outlook for spring and summer '98 is exceptionally good. Soon after what at first promised to be an epidemic an extra session of the legislature was called and the limits of the city extended, certain bills being passed to enable the authorities to sewer the annexed districts, also a certain portion of the old city where the fever wrought the greatest havoc.

As proof positive that confidence has been restored, it is only necessary to call attention to the clearing-house receipts for February, which aggregated nearly twelve millions of dollars, or more than the combined receipts of Nashville, Tenn., and Atlanta, Ga.; or more than Nashville, Knoxville, Chattanooga, Jacksonville, and Birmingham combined — an increase in Memphis receipts of more than 60 per cent. over February, 1897. Every precaution known to science in the way of sanitation is being taken to safeguard Memphis in the future, and, even if brought here, there will be no possible chance of the dreaded disease spreading.

Ground will be broken in May for St. Mary's Cathedral, to cost several hundred thousands of dollars. Work has already begun on the new Poplar Street School — contract $100,000 — and a syndicate has been formed to build a ten-story hotel. There is also a substantial rumor that in addition to the City Hospital buildings and Market House just completed, the new city administration will build a new City Hall.

Memphis architects are nearly all busy with Mississippi work, which is the most promising field in the South for architects. There is a vast improvement shown in the character of buildings under course of construction, and also some degree of attention is being paid to design, probably due to the influence of Eastern competition.

NEW TRADE PUBLICATIONS.

THE CLEVELAND HYDRAULIC-PRESS BRICK COMPANY has this season issued an elaborate copyrighted publication entitled "Early Religious Architecture of America," containing thirty plates 14 by 17 ins. in size, illustrating subjects especially selected by the company, of the ancient missions and churches of America. The work is a distinct departure in the line of advertisement. Indeed, except for the modest title page and the single advertising sheet at the end, the work would be taken to be a professional publication issued under the direction of an architect who was not only competent to make a wise selection, but was by training and experience enabled to know what to choose. The plates reveal a phase of American architecture which has been appreciated to a certain extent by some of our architects, and yet we imagine to many of them the quality of the work here shown will be a very considerable surprise. The best of the buildings are naturally from Mexico. Indeed, only a few are found within the borders of the United States. The cathedral at Chihuahua, and the work at Aguas Calientes are especially interesting for their architectural merit. The plates are accompanied by a very complete description of the several edifices together with a considerable amount of historical data relating to them. Altogether it forms a publication which will be welcomed by every architect and which ought to be eagerly sought for. This issue is by the Cleveland Company, and though all of the Hydraulic-Press Brick Companies are to a certain extent affiliated and will undoubtedly indirectly profit by whatever advertising would result from this publication, it is a distinctive product of the Cleveland Company, to whom great credit should be given for the excellent manner in which it has been gotten up and for the evident intent to not merely produce a good advertisement, but to publish a book which shall be of distinct worth and interest to every one who has in mind the value of American architecture.

THE ATWOOD FAIENCE COMPANY, of Hartford, Conn., has published an interesting portfolio illustrating a number of the mantels which the company is prepared to furnish in stock patterns in enameled terra-cotta. The plates form a collection which will be of value to those who contemplate the use of such product.

CURRENT ITEMS OF INTEREST.

A LARGE quantity of enameled tiling will be done in the new Town Hall at Revere, Mass., the Grueby Faience Company furnishing the tiles.

THE OHIO MINING AND MANUFACTURING COMPANY, makers of the Shawnee Brick, are represented in New York City by Meeker, Carter, Booraem & Co.

MR. F. P. PLUMRIDGE, formerly connected with the Hydraulic-Press Brick Company at St. Louis, has associated himself with the Evens & Howard Fire Brick Company of the same city.

DYCKERHOFF PORTLAND CEMENT is used in the new Union Station platforms at Providence, R. I., a job of considerable size, and also in the sidewalks around the State House, Boston.

THE C. P. MERWIN BRICK COMPANY, Berlin, Conn., are supplying the hollow bricks which are being used in Southern Terminal Station, Boston, also the new State Capitol building at Providence, R. I.

THE Celadon roofing tiles have been specified on the building for Mrs. Cole, Copley Square, Boston, of which Dwight & Chandler are the architects. The Celadon Company is represented in Boston by Charles Bacon.

THE PANCOAST VENTILATOR COMPANY are supplying their ventilators for a large government building at Fortress Monroe; Empire Building, New York City; and new round house for the Baltimore & Ohio Railway.

THE BRICK, TERRA-COTTA & SUPPLY COMPANY, Corning, N. Y., have the contract for furnishing the architectural terra-cotta required for the Kaufman building to be erected at Pittsburgh, Pa., Charles Bickel, architect.

THE GRUEBY FAIENCE COMPANY have been awarded the contract for furnishing the tiles for the walls of the restaurants in the new Southern Terminal Station, Boston. They are to be like those used in the Boston Subway stations.

THE EVENS & HOWARD FIRE BRICK COMPANY have closed contracts for supplying 200,000 face brick for the Chicago, Milwaukee & St. Paul Railway Passenger Station at Minneapolis, Minn., Charles S. Frost, of Chicago, architect.

THROUGH their Boston representative, Charles Bacon, the Excelsior Terra-Cotta Company will supply their terra-cotta for the new Mattapoisett School, Charles Brigham, architect, and for the new school at Malden, Mass.; Whitman & Hood, architects.

THE BERLIN IRON BRIDGE COMPANY designed and built the new buildings for the Morse Wool Treating Company at Norton, Mass., and have contracted for building a new power house, car barn, and steel bridges for the Port Jarvis Electric Railway Company, Port Jarvis, N. Y.

The Celadon Terra-Cotta Company's roofing tiles have been specified on the following new contracts: Residence for William Henderson, Chicago (8 in. Conosera); railway stations at Atlantic and Iowa City, R. I. & P. Ry. (10 in. Conosera and open shingle); school building at Niagara Falls (10 in. Conosera).

E. P. Lippincott & Co., Baltimore agents for the Excelsior Terra-Cotta Company, have closed contract for supplying the architectural terra-cotta to be used on the new Columbia Law Building at Washington, D. C., and, as agents for the Pittsburgh Terra-Cotta Lumber Company, will supply the fire-proofing for the same building.

The new Jordan Building, Boston, Winslow & Wetherell, architects, will be supplied with the Sayre & Fisher Company's bricks, through their Boston office. The same company will also supply the enameled bricks to be used in the new Masonic Building of which Loring & Phipps are the architects.

H. F. Mayland & Co., manufacturers' agents, New York City, are supplying the Roman buff and gray bricks for several apartment houses being erected in New York City and Brooklyn, for which W. B. Willis is the architect, and also the bricks that are being used in the residence of George Gould, Esq., at Lakewood, N. J., Bruce Price, architect.

The Columbus Brick & Terra-Cotta Company are supplying their bricks on the following new contracts: Public school building, New York City, C. B. J. Snyder, architect; store building, Cincinnati, Ohio, Ball & Taylor, architects; residence, Newport, Ky., Dittoe & Wisenall, architects; parish house, Pittston, Pa., E. F. Durang, architect; residence at Detroit, Mich., Baxter & Hill, architects; Phœnix Block, Knoxville, Tenn., Baumann Bros., architects; stable at Omaha, Neb., Henry Ives Cobb, architect.

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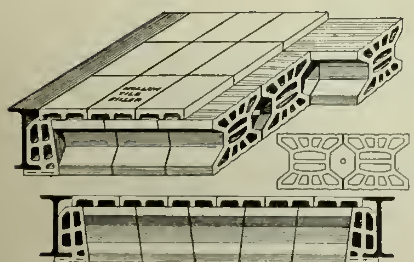

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JAMES BROWN LORD, ARCHITECT.

VOLVME VII MAY 1898 No. 5

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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MR. E. W. GODWIN, one of the brightest and most artistic of the English architects, founded some years ago, shortly before his death, the prize which bears the name of the Godwin Bursary, providing for a course of foreign travel and study on the part of a properly equipped architectural student. Several of the men who have held this prize have come to America and have made some very interesting and salutory comments upon our national architecture, particularly in its constructive manifestations. The latest holder of this prize, in his report to the Royal Institute, had occasion to consider the skeleton construction which has found so much favor in our larger cities. The apparent flimsiness of it, the seeming sham, impressed him quite strongly, and he made a number of comments upon it which are in a measure justified, though they are inspired very largely by his point of view. We are free to say that we do not unreservedly believe in the skeleton construction. It is in a way untried, it presents possibilities of failure which might be very serious, and it is a species of building construction which has been sadly misused. At the same time no intelligent observer can deny that as a system of erecting tall buildings it has come to stay, and that though we may not use it aright, though it has very decidedly objectionable features, at the same time it embodies possibilities which give promise of a healthy and an interesting development. We have learned a good many structural lessons from it, and we have been able to practically solve problems which would be impossible of solution with any of the older methods, and yet we can quite understand how strange, how contradictory, and how altogether bad such a system would seem to a foreigner trained in the conservative methods of the English school of architecture, and with also a very probable lack of appreciation of the practical necessities of which this system is an outgrowth.

In the editorial of last month we had occasion to call attention to the ephemeral character of much of our modern architecture and to express the hope that we were approaching an era wherein structural conditions more approximating those of the Romans might obtain. We cannot, however, believe that these solid Roman characteristics will ever be able to find an enduring place in our street architecture, which is necessarily forced into a thinness of construction, a minimizing of supporting members, which at once necessitates a certain change in the details of expression. It is the custom to characterize the architecture of this period as retrospective. We borrow nearly all of our architectural baggage, and it is not strange that when we attempt to apply historic forms to skeleton construction the result should seem to a stranger incongruous and often shoddy, especially if that stranger does not thoroughly understand the causes which have led up to the particular manifestations in design. Given the necessity for the least possible area of supporting members and the greatest amount of light in the wall surfaces, and we have a condition of affairs so different from anything which obtained during previous historic periods that, though we may use the forms of the Greeks and Romans or copy most directly many of the motives of the Renaissance period, the result is bound to be different, and in the process of assimilation we have very naturally not yet been able to thoroughly unite the details of expression to the general idea. But there is one thing which surely can be said with truth about the tall structures. They are not commonplace, and there is far more hope for a hopelessly bad design than there is for one which is hopelessly commonplace. Up to the time of the Centennial our architecture as a whole was both hopelessly bad and hopelessly commonplace. We have gotten bravely over the latter defect and it looks as if we were developing out of the former.

Theoretically there are two schools of designing a building, one which considers that all the ornamentation of the exterior, the disposition of the parts, should make manifest the constructive lines, while the other considers the ornamentation purely as a matter of decoration, not holding that it is necessarily a part of the construction. The former has a more logical sound; and yet with all the logic which has been expended upon this subject, including such poetic analysis as men like Ruskin have been able to bring to it, it is fair to say that there has yet to be designed a modern commercial building which really honestly shows its construction. Surely none of the skeleton constructions have in any way been able to show what they are built of, and however the theory may be, in fact we construct as best we may, and then proceed to apply ornamentation to the exterior. It goes without saying that as a young nation, as one that is only just beginning to feel its artistic possibilities, we use our ornament blindly, we copy our historical precedents often at random and without reason, and the baldness of our constructive decoration may appeal to a stranger as it evidently has to the Godwin Bursar. And yet this seeming inchoate condition is so essentially an element of development that it is not altogether to be deplored. The conditions of growth were the same during Romanesque development, and, for that matter, during the early Renaissance period. So long as our architecture is not commonplace we can afford to be incoherent, and by sticking to the main motives, by trying to improve along the lines of least resistance, a development is bound to come even if it is not already here: and though we may not appreciate it until it has arrived or even until after we have gone to the other extreme, we can at least take example from the past, and by keeping at one line of development can be pretty sure in the end to arrive at architecture which is both coherent, reminiscently correct, and is at the same time true to the essential conditions of construction. We shall not achieve development by startling manifestations in design or by endeavor to arbitrarily make our construction fit our ideas of decoration, but rather by working out our construction just as it naturally comes, and then trying to clothe that with forms which seem to produce beauty and fitness, keeping always within safe limits. A very successful architect used to tell his draughtsmen that the best advice he could give them in designing a building was to look through the files of the architectural papers until they had found about the kind of structure they wanted to make, and then go to work and do the same thing, only better. One of our prominent architectural clubs has made a practise in its monthly competitions, of re-designing public buildings, choosing some prominent structure, and asking its members to see wherein it could be improved. It is exactly along these lines that lies our greatest hope, and it does not make any difference if we do borrow our baggage from Rome or Greece, we have the bones. If we consistently and continuously try to improve on the expressions that have already found utterance, using, if we wish, the same forms, the same details of decoration, but striving to make them a little better, a little more fit, a little more approaching our ideas of beauty, the end cannot be in doubt; and though our skeleton constructions, carried out on these lines, may seem thin and unsatisfactory, though the reasons for what we do may appeal only to ourselves, and not be really clear to our own eyes, so long as we design with a definite purpose, and try honestly to cover our architectural forms with as much beauty as we know how to use, we are producing architecture which is certainly above the commonplace, and which is bound to take rank as development.

CLEANING OF OUTSIDE WINDOWS IN TALL BUILDINGS.

A FEATURE of modern commercial structures which has only within recent years received any attention is a proper provision for cleaning the glass in windows without endangering life or limb. There have been a number of patented devices put upon the market permitting both the appearance and the conveniences of the ordinary double-hung sash, but with the mechanism so arranged that the sash can either be reversed and washed from the inside or can be swung in like a casement. As far as we are aware, however, Chicago, which has been the pioneer in so many of the modern developments of commercial architecture, is the first to recognize the necessity for provision for safety in tall buildings. The following is an extract from the ordinance passed March 28, 1898: —

"SECTION 198.— In all buildings of Class I., II., IV., and V., the Windows above the second story shall be so constructed as to permit the cleaning of them from the interior of the Building, unless suitable stationary platforms, balconies, or porches admit safe access to the outside of such windows.

"SECTION 65.— As a means of reference in this ordinance, Buildings erected within the fire limits (sheds and shelter sheds as before described being excepted) shall be divided into classes as follows: —

"CLASS I.— In this class shall be included all buildings devoted to the sale, storage, or manufacture of merchandise, and all stables over 500 square feet area.

"CLASS II.— This class shall embrace all Buildings used as residences for three or more families, all hotels, all boarding or lodging houses occupied by twenty-five or more persons, and all office buildings.

"CLASS IV. and V.— These shall include all Buildings used as assembly halls for large gatherings of people, whether for purpose of worship, instruction, or amusement."

Such action as this is certainly to be commended on every ground, for while there are plenty of men who are willing to risk their lives by climbing out on a narrow ledge ten or fifteen stories above the sidewalk, to clean the outside of the glass windows, their willingness does not excuse the risk which they run, which risk, we imagine, the owners of property, no less than the building inspectors, would be glad to provide against.

ILLUSTRATED ADVERTISEMENTS.

NUMBER eleven of the series of brick and terra-cotta fireplace mantels, of which J. H. Ritchie is the designer, is illustrated in the advertisement of Fiske, Homes & Co., page vii.

The residence of Edmund Hayes, Esq., at Buffalo, N. Y., of which Green & Wicks were the architects, is illustrated in the advertisement of the Harbison & Walker Co., page xv.

A spiral staircase (Guastavino construction), extending through five stories of the Paterson Bank, at Paterson, N. J., Charles Edwards, architect, is shown in the advertisement of R. Guastavino, page xx.

PILASTER CAPITAL FOR BOTANICAL MUSEUM, BRONX PARK, NEW YORK.
Work executed by the New York Architectural Terra-Cotta Company.
R. W. Gibson, Architect.

The Boston Fire-proofing Company illustrate in their advertisement, on page xxii, the American Express Company's building at Boston, Winslow & Wetherell, architects.

A view of the skeleton construction of the new Westminster Chambers, Copley Square, Boston, of which Henry E. Cregier, Chicago, is architect, is shown in the advertisement of the Fawcett Ventilated Fire-proof Building Company, page xxiv.

PERSONAL AND CLUB NEWS.

E. G. W. DIETRICH, architect, has removed his office from 18 Broadway to 15 West 28th Street, New York City.

WOODRUFF LEEMING, architect, has removed his office from 726 Fulton Building to 617 Constable Building, New York City.

THE firm of George & J. P. Kingston, architects, Worcester, Mass., has been dissolved. John P. Kingston will continue the business at 518 Main Street.

EDGAR S. BELDEN and Augustus B. Higginson have dissolved the partnership under the firm name of Belden & Higginson and will henceforth practise the profession of architecture independently. Both have taken offices at 164 La Salle Street, Chicago.

THE third exhibition of the National Sculpture Society opened May 1, in building of the American Fine Arts Society, 215 West 57th Street, New York City.

ON Monday evening, May 2, Mr. Theodore M. Pietsch, lately returned from the Ecole de Beaux Arts, Paris, addressed the members of the Chicago Architectural Club on "Student Life in Paris," special reference being made to those studying architecture. Wednesday evening, May 4, was devoted by the club to Architecture, it being one of the series of lectures given under the auspices of the Central Art Association. At this meeting the following gentlemen spoke: Mr. George R. Dean, "Some Modern Ideas of Architecture"; Mr. Frank M. Handy, "A Plea for More Honest Living"; Mr. Robert C. Spencer, Jr., "Is there an American Style of Architecture"; Mr. Dwight H. Perkins, "Criticism of Architecture by the Public"; and an informal talk by Mr. Louis J. Millet. On the morning of May 5 Mr. Frank Wright delivered a lecture on "Art in the Home." At the same session Mr. William Ordway Partridge spoke on "The Relation of Art to Practical Life."

THE series of five discourses on "Architectural History" given by the Detroit Architectural Sketch Club at the Museum of Art has been a great success.

Norman and Gothic (illustrated), by Mr. J. E. Scripps, and Renaissance (illustrated), by Mr. A. Kahn, of Nettleton & Kahn, architects, completed the course. The large attendance showed the general appreciation and benefit of these papers. They will be repeated in a similar way next season. On March 28 M. B. Burrows was elected a director and J. A. Gillard, secretary, to succeed A. Blumberg.

OFFICE BUILDING FOR ALLIANCE ASSURANCE COMPANY, LONDON.
R. Norman Shaw, Architect, London.

THE T SQUARE CLUB, Philadelphia, held its regular meeting on Wednesday evening, April 20, at which the criticism and award of mentions on the drawings submitted in competition for the cover for the Club Syllabus for the coming season of 1898-99 was taken up. First mention was awarded to Nicola D'Ascenzo; second and third mentions, to Horace H. Burrell.

The annual meeting of the club was held on Wednesday evening, May 11, at which there were present forty-eight members. The treasurer's report showed the club to be on a secure financial footing.

The medals for the competitions held during the past year were awarded as follows: Gold medal, Nicola D'Ascenzo; silver medal, Horace H. Burrell; honorable mention, Charles Z. Klauder.

The following officers were elected for the ensuing year: President, Edgar V. Seeler; vice-president, Adin B. Lacey; secretary, Herbert C. Wise; treasurer, Horace H. Burrell; executive committee, David K. Boyd, Walter Cope, and James P. Jamieson; house committee, Nicola D'Ascenzo, George B. Page, and Frederick M. Mann.

CORNELL GRADUATES, ATTENTION!

ALL men who have studied architecture at Cornell University, no matter what their age may be, are requested to send their names and addresses to Prof. A. B. Trowbridge, Ithaca, N. Y., in order that they may receive data relative to the new Traveling Fellowship, the existing Graduate Fellowship, the new Two-Year Special Course in Architecture, the Illustrated Annual, which is soon to appear, and the competition for an Alumni Hall, which will probably be held in the near future.

The American Schoolhouse. VII.

BY EDMUND M. WHEELWRIGHT.

IN the Latin and English High School of Boston, begun in 1877, is found the first important application of sound principles of architectural planning to the school buildings of this country. The design of this building was in the main based upon that of the best Vienna schools, and while some of the features which here appeared are bettered in the later development of schoolhouse planning, it still remains an excellent building of its class, and in respect to the dimensions of its schoolrooms, 24 ft. in width and 14 ft. in height, it is superior to most schoolhouses since built. It will be seen from the plans that the lighting of its schoolrooms is almost wholly from one side, while light is also borrowed from the corridor windows. The provision made for hanging of pupils' clothing is not satisfactory, closets for this purpose being placed under the windows. Mr. E. P. Seaver, the Superintendent of Public Schools of Boston, writes: "These were not high enough to hang a coat in, and to fold a wet coat and stuff it into such a closet is bad for the coat. After a short experience with these cupboards, they were abandoned, except for caps, books, and other small articles. For overcoats, horses were provided, which stand in the corridor or in the schoolroom, as may be found more convenient." Separate wardrobes on the same floor with schoolrooms, or individual lockers in the basement, are, of course, preferable to this arrangement.

The heating and ventilating system is much less satisfactory in this building than in later schools of its class. In fact, it is absolutely the reverse of the system now adopted, by which the air is made to pass from the corridors to the rooms. In the Latin and English High School the passage of air is from the rooms to the corridors. The heating is by the indirect system alone, and not by direct radiation, while heated fresh air for ventilation is supplied by a plenum fan, the system now recommended by the highest authorities. In this building a supply of but 8 cu. ft. per minute for each pupil was contemplated, while to-day the laws of Massachusetts require at least 30 cu. ft. per minute for each pupil. This requirement of air delivery marks the notable progress made in the heating and ventilation of our schoolhouses in a generation, for it should be remembered that this building was generally considered, when built, to be the most perfect in all its features of any schoolhouse in the country. Judged by the criterions of its day, the only just criticism this building received was that in regard to the lack of proper provision for the storage of pupils' clothing.

CAMBRIDGE HIGH SCHOOL, CAMBRIDGE, MASS.
Chamberlin & Austin, Architects.

The Latin and English High School was designed by the then city architect, who worked in conjunction with Dr. John D. Philbrick, at that time superintendent of Boston public schools. In a description of this building Dr. Philbrick said: —

"The great fire, which came so near being disastrous to the project, turned out to be one of the causes of its ultimate success, by necessitating delay in building. Had the work gone forward with dispatch, as intended, the edifice erected would have been, without doubt, a substantial and costly one, and fully up to the standard of the best in the country; but it would not have been up to the standard of the best schoolhouses in the world, as this building is, for the simple reason that the knowledge requisite did not exist in this country. The most of the pupils in the public schools of Boston had better accommodations than those of any large city in the world; but we had no one schoolhouse equal to the best in the world. The characteristics of the best schoolhouses in this country were well known to me, and I had some knowledge of school architecture abroad; but it was not until I visited the Akademische Gymnasium, in Vienna, at the time of the Universal Exposition of 1873, that I was able to picture in my mind the image of such a building as we wanted in Boston for these two schools. The study there begun was followed up by visits to other first-class high-school buildings, not only in that city of wonderful schools, but in all the principal cities of Germany. In this way a valuable collection of views, plans, and descriptions of the best specimens was obtained.

"In respect to school architecture, while we made a better showing than any other American city, we were quite eclipsed by some of the European cities; that is, in some of the foreign cities schoolhouses have recently been erected which are architecturally and pedagogically superior to anything we have to show. The city of Vienna has individual school buildings vastly better than the best in Boston; but if you take all the school buildings in Vienna, the good and bad together, the average accommodations afforded to all the children of the city are perhaps not equal to the average of the accommodations provided for the children in Boston. What I mean to say is this: that Vienna knows how to build, and has built school edifices which are more durable, more safe, more convenient, more costly, and more beautiful, than any Boston has yet built, or is likely to build in the near future. The reason of this is, that in Vienna, when a schoolhouse is planned, it is done by the combined science and wisdom of the most accomplished architects and the most accomplished pedagogists. No mere whim of a schoolmaster, and no mere whim of an inexperienced and uneducated architect is allowed to control the design."

"In its general arrangements the block plan consists of a parallelogram 423 ft. long by 220 ft. wide, the longest sides, or main buildings, fronting on Warren Avenue and Montgomery Street, the Latin School occupying the former, and the English High School the latter.

"There are two courts within this block, of equal size, the division between the two being made by the location of a central building which is connected with the two main street fronts by means of a transverse corridor. These courts, as the plan shows, not only afford the most desirable advantages of light and air, but also serve the purpose of separate playgrounds for the pupils of each school.

"Across the easterly end of the block and connecting its two sides are located the drill hall and gymnasium; and across the westerly end, fronting on Dartmouth Street, a building, as shown on the plan, is proposed to be erected hereafter, as has been mentioned, for the accommodation of the school board and its officers.

Each of the street fronts of the main buildings is divided into three pavilions, — one central and two end pavilions, — the central pavilion being more pronounced in its proportions as to width and height. The main buildings have three stories and a basement, the latter being a clear story facing the courts.

"The arrangement of the plan is simple; longitudinal corridors extend the full length of the main buildings and parallel with the street fronts. In the central pavilions, opposite the ends of the transverse corridor, and at its intersections with the longitudinal corridors, are placed the two grand entrances, one from each street. These entrances are a feature in the design, both internally and externally, ample space being given at the intersections of the grand corridors where they are located for the placing of statuary. There are also four other entrances from the streets, two in each main building, at the terminations of the longitudinal corridor, one being in each end pavilion.

"There are eight staircases, one in each end pavilion, connecting with the entrances at the terminations of the longitudinal corridors, and two in each of the central pavilion, right and left of the grand entrances respectively.

"The drill hall, another feature in the design, is on the street level. It is 130 ft. long on the floor by 62 ft. wide and 30 ft. high; above the galleries, which are at the ends, it is 160 ft. long. The seating capacity of floor and galleries is sufficient for twenty-five hundred persons. It has four broad entrances: at the ends, from Warren Avenue and Montgomery Street; at the sides, from Clarendon Street and the eastern court. The floor is of thick maple plank, laid in a solid bed of concrete. It is finished in natural materials, and is so treated as to get a constructional effect of open timber work, the wood being of hard pine, shellacked and varnished, and the interior walls of Philadelphia face brick, laid in bright red mortar, and trimmed with buff sandstone.

"There are forty-eight schoolrooms, twenty being on the first and second floors respectively, and eight on the third floor; twelve receive their light from the courts, the remaining thirty-six occupy the street fronts. The typical schoolroom of this building is intended for thirty-five pupils, but will accommodate forty or more, according to the mode of seating and the size of the pupils. It is 32 ft. long and 24 ft. wide and 14 ft. high. It is lighted by four windows, 9 ft. 6 ins. by 4 ft. 6 ins., placed on the longer side 6 ins. from the ceiling and 4 ft. from the floor, and equally spaced, with transom sashes hung, as shown in the cut, above the sliding sashes. It has, on the side opposite the windows, two doors opening from the corridor; over the doors are top lights for ventilation, and between them two high lights hung on hinges. The pupils face the platform at one end of the room, and receive the light on their left. Under the windows are cabinets for coats and caps, there being no separate rooms for this purpose. There is a closet sunk into the end wall, where the platform is, for a teacher's wardrobe. This description applies to most of the rooms, and where there is a variation from it the difference is not essential.

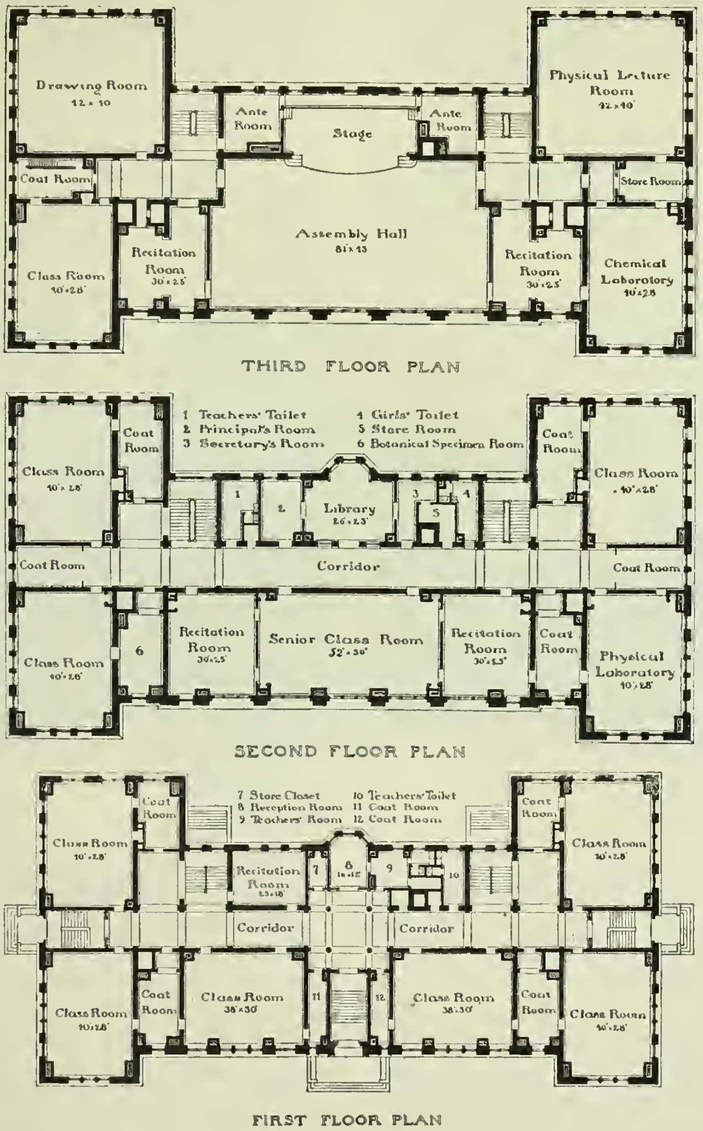
"The assembly halls are on the third floor, in the central pavilions, are 82 ft. long by 62 ft. wide, and 25 ft. high, each having a seating capacity for eight hundred and fifty pupils, with the amphitheater arrangement.

"The library rooms are on the first floor, on the right and left from the transverse corridor in the central building, each being 54 ft. long and 32 ft. wide, with octagon ends to catch the light at different angles. They are furnished with bookcases against the wall on all sides, excepting the door spaces, made of light oak, about 6 ft. high, with glass doors. The windows come down to the top of the bookcases.

"Over the libraries, and of the same size and shape, on the second floor, are the lecture halls for the natural sciences. Each of these has two conveniently connected rooms — one for physical apparatus and the other for specimens of natural history.

"Near the principal entrances, on the first floor in the central building, there are for each school a teacher's conference room, with an adjoining reception room, a head master's office, and a janitor's room; on the second floor adjacent to the transverse corridor are two suites of apartments, each having four rooms, for janitors' dwellings, each suite being connected with the basement by a separate staircase.

"In the central pavilions, at convenient locations on each floor, there are ample dressing rooms for the accommodations of the teachers. The water-closets and urinals for the pupils are located in four sections winged out from the principal staircases in the central pavilions, and are arranged in tiers, there being two stories of closets to each story of the building, one of which is entered at the corridor level, and the other from the half landing of the staircase above. There are six of these tiers in each section, which are connected by a spiral staircase in a round tower at the exterior angle running from the basement to the roof of the building, the top of which is surmounted by a large ventilator. By other means in addition to this the closets are completely ventilated. There are two spacious drawing rooms for each school on the third floor — one for model drawing and the other for copy drawing, both having side and skylights at either end; at either end is a room for the safe keeping of the models and copies.



CAMBRIDGE HIGH SCHOOL, CAMBRIDGE, MASS.

"In connection with the drill hall there are two rooms for the military officers, and an armorer's room, furnished with a work bench and the requisite tools.

"The extensive basement, besides the space necessary for the steam boilers and the storage of fuel, affords a covered playground for the pupils.

"A part of the English High School basement has been fitted with every desirable convenience for the occupancy of one of the branches of the Public Library. It is to be hoped that one or two of the basement rooms may be utilized as a refectory where the pupils may obtain a wholesome lunch at a moderate price.

"No chemical laboratory was supposed to be needed by the Latin School, and hence none has been provided; but the provisions for the instruction in chemistry on the English High School side are believed to be as near perfection as has yet been reached, having regard to the objects and grade of the institution. The portion of the block appropriated to this purpose is architecturally a detached building located at the east end of the high school building and facing Montgomery Street, and between it and the southerly end of the drill hall, being separated from the rest of the edifice by fire-proof walls, as far as convenience of access would allow.

"The lower floor is occupied by a lecture room 35 by 40 ft., and capable of seating about one hundred pupils. The room is constructed with rapidly rising tiers of benches and is fitted with a lecture desk and the ordinary appliances of a chemical lecture room.

"On the second floor are the laboratory and accessory rooms. The former is of a general rectangular shape 35 by 30 ft., with an alcove 27 by 7 ft., and is surmounted by a dome-like roof, from the center of which rises a short steeple or cupola. Of the interior arrangements the working benches of the pupils are the chief feature. These occupy the middle area of the room and will accommodate forty-four boys at any one time.

"Connecting with the laboratory are two small side rooms. One is for storage of apparatus, and can be darkened for spectroscopic experiments. The other is a preparing room, but is fitted with working desks and drawers, and is used also as a storeroom for chemicals.

"Practically the buildings are fire-proof throughout. The corridors are all constructed with iron beams and brick arches, and laid with a finished floor of black and white square Italian marble tiles. The under sides of the arches over the corridors are plastered upon the bricks, and the beams covered with a heavy coating of Keene's cement upon wire network, these corridors, in themselves, dividing the whole block into four fire-proof sections. The several apartments are separated by brick walls, and all the floors and the spaces between the furring upon the walls are filled with fire-proofing. The staircases are wrought or ornamental iron-work, built into the brick masonry.

"The floors and the platforms of the rooms, with the exceptions already mentioned, are of Southern hard pine, while the standing work is of the best white pine, grained and varnished, with the exception of the corridors, where it is painted in parti-color."

In a closing generalization Dr. Philbrick speaks of the leading characteristics of the building and notes features unique in American school architecture.

1. The arrangement of interior light courts.
2. The hall for military drill.
3. Toilet rooms on each floor.
4. Fire-proof construction.

Dr. Philbrick was inclined to the opinion that there could not be a first-class schoolhouse of any considerable size in which the interior court plan is not applied. This cannot be readily accepted, for while the court plan has many merits, it requires great depth of lot if any important rooms are to receive their light therefrom.

Other features are noted as unique at that time in the schoolhouses of this country.

1. The detached location of the chemical building.
2. Sufficient separate room set apart from gymnastic exercises.
3. The provision for conference rooms for teachers, and offices for head masters and janitors.
4. The iron staircases with rubber mats.

Dr. Philbrick's defense of the size of schoolroom adopted is as follows:—

"It remains now to specify with distinctness the leading characteristics of this edifice, which in their combination constitute its superiority over other school buildings heretofore erected in this country, and render it so interesting as a study both by school men and architects.

"1. A mere glance at the plans reveals at once to the eye of the expert the capital peculiarity of this block, which of itself renders it unique in American school architecture, namely, its arrangement around interior courts. This, I believe, is the first instance of the realization of this court plan or idea on a considerable scale in any school building in this country. The most serious defects in our large schoolhouses have resulted from the ignorance or disregard of this idea by our architects. This idea is distinctly foreign in its application to schoolhouses. It is Mr. Clough's great merit that he is the first to give it a practical application in this country. The principle may be thus stated: So plan the building that it shall be in no part wider than the width of a schoolroom with the width of the corridor added. We have college and other educational buildings with wings at right angles to each other, but not planned in accordance with this principle. The superiority of this court plan over what may be called the solid plan, which has hitherto prevailed, is found more especially in the advantages it affords for light and air. So important do I consider this idea in schoolhouse building that I doubt whether there can be a first-class schoolhouse of any considerable size in which it is not applied. The disadvantages of the solid plan may be appreciated by comparing our two most conspicuous examples of it, the Massachusetts Institute of Technology and our Girls' High School, with this block.

"2. The perfection of the schoolrooms is another of the more important characteristics. It has been said that the rooms are not large enough. One might as well say that a bushel measure is not as large as it should be. The rooms are as large as they need be for the objects in view in planning them; and, in fact, a margin was allowed for a change of views with a change of management.

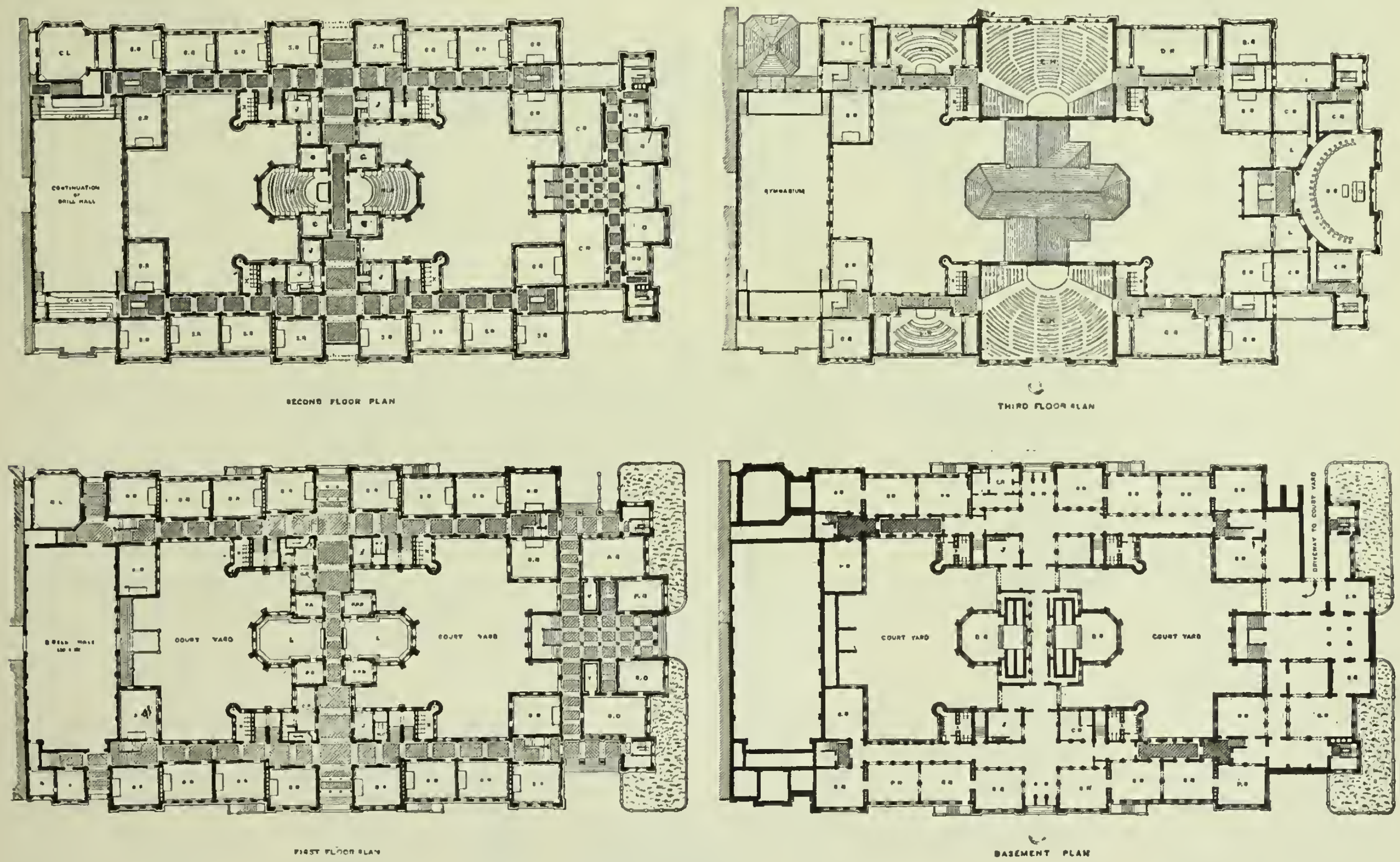
"My conclusion, then, is that the schoolrooms of this edifice, taken as a whole, considering their size, proportion, ventilation, and lighting, place it without rival in this respect among schoolhouses of its class."

ENGLISH HIGH SCHOOL, BOSTON, MASS.
George A. Clough, City Architect.

The foregoing description makes evident how important the building was in the history of American school architecture, and it will be recognized that many of the features developed in its construction have greatly influenced schoolhouses subsequently built.

It would have been well if the relatively narrow schoolrooms of high stud here built had been generally adopted in later schoolhouses. The schoolhouses recently built in New York City have these desirable characteristics.

We will consider again the Cambridge High School, in which is found a building preeminently distinguished not only for the beauty of its design, as previously noted, but for the excellence of its plan. The exterior walls of the basement of this building are of Milford granite, and the first story is of Amherst stone, the second and third stories are of light red Perth Amboy terra-cotta brick with trimmings and cornice of Amherst stone. The design and material used in this building are richer than is generally found or is generally advisable even in a high school house. This fine building was built by the city in recognition of the generous public gifts of a former citizen, among these gifts being the site for this school. A notable feature of the plan are the "emergency" or "hospital" rooms for use in case of sudden illness. These rooms are provided more especially for the girl pupils. The office of the head master, the library, and the office of the secretary of the board are placed in conjunction, and all these rooms are arranged for library purposes. The books are all placed on open shelves, so that the free use of the library by the pupils is encouraged. The library is not only used as a place for study, but it is sufficiently large to serve at the same time for a recitation room for advanced classes.



ENGLISH HIGH SCHOOL, BOSTON, MASS.

In his report the head master of the school gives the following description of the laboratory accommodations: —

"1. A physical laboratory, with a demonstration table for the teacher, chairs with writing-arm attachments for a class when seated, tables with supports for apparatus and lockers for storage, side tables with gas and water.

"2. A smaller connecting room, with shelves and cases for such physical apparatus as the pupils personally use, and a working table for the teacher and for advanced pupils or special students.

"3. A chemical laboratory with one hundred and twenty-eight lockers, so that each pupil may have his own equipment and be held responsible for its care. The room contains a chemical hood where a dozen pupils may work at once with noxious gases, also shelves for the storage of such supplies as are in daily or frequent use.

"4. A smaller connecting room with shelves and cases for supplies, books, balances, and the various materials used in chemical study. This room contains a table supplied with gas and water, and is intended for the use of the teacher or of special students under the teacher's immediate guidance.

"5. A small, dark room, with sink, shelves, gas, and electric lamps for photographic purposes.

"6. A large lecture room with a raised floor, and chairs for from one hundred to one hundred and fifty pupils, each chair having a shelf to facilitate the taking of notes. Here the teacher of physics or chemistry, or, in fact, of any subject, may assemble pupils in larger numbers than usual for talks, lectures, and such experiments as are better performed for the pupils than by them. This room contains closets for storage, cases for lecture table apparatus, a well-appointed demonstration table, a stereopticon screen, and a porte-lumiere. Its windows may be darkened at short notice. This room, as well as the five rooms just described, is provided with hot and cold water.

"In addition to the six rooms already described there is a botanical room, with drawers for the school herbarium, cases for botanical specimens, window shelves for plants and water; also a mineralogical room and a spacious drawing room, the latter to receive the tables, models, screens, and other equipment of the evening drawing school."

The school has a capacity of 692 desks.

COOPERATION BETWEEN ARCHITECT, ENGINEER, AND TERRA-COTTA MAKER.

THE CONSTRUCTION OF BALCONIES.

BY THOMAS CUSACK.

WE have taken it for granted that the architect and engineer — individually or jointly, directly, or through capable representatives — have studied the necessary points of contact between terra-cotta, steel, brick walling, and such other materials as chance to intervene. We shall further allow it to go unchallenged that they have agreed upon what appears to them a very satisfactory arrangement. It does not by any means follow that there is no room for improvement, or that it is not open to many, it may be, very serious objections when examined by the terra-cotta maker from a manufacturer's, or by a practical mechanic from a builder's point of view. We have good reason to know that the underlying facts do not furnish an adequate basis for such a hopeful assumption on their behalf. In fairness, however, to members of the professions referred to, let it be said that they do not all lay claim to a monopoly of the inventive faculty, or to an unerring judgment as to everything connected with building practise. The more distinguished of the number would, we suppose, be as ready to disavow any share in such pretensions as they are to acknowledge and act upon duly accredited suggestions. Speaking from an active experience of many years, we can say without hesitation that an architect's success is usually about equal to the use made of his unrivaled opportunities for obtaining the exact measure of things that may look well on paper, or sound plausible as an abstract theory. If he is true to himself and to his client, he will not allow such inestimable advantages to pass unimproved.

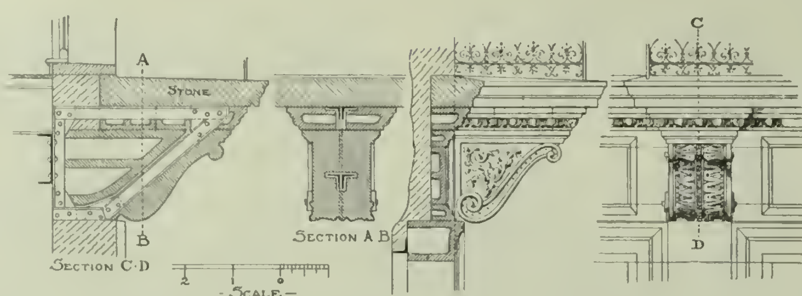


FIG. 53.

A noteworthy indorsement of all this was made a short time ago by the father of skeleton construction, Mr. W. L. B. Jenney, a man whose right to be heard on such a subject will not be disputed by either architect or engineer. One pregnant sentence will suffice: "It is desirable, whenever practicable, to consult with the terra-cotta company before the details are finally settled, as they must furnish and set the material, and sometimes very valuable suggestions can be obtained from them contributing to its stability and economy." Men of assured position can afford to do this, in the way indicated, without the least fear as to their professional dignity. The ablest and most successful among them gladly avail themselves of a privilege which, if enjoyed at all, is not shared to the same extent by the members of any other profession. It is the fledglings and failures that get hopelessly lost, while posing upon a pedestal of unapproachable superiority, making up in supercilious airs what they lack in solid acquirements. There can be no loss of dignity on the part of an architect in seeking to know as much as may be about the practical side of anything on which he is engaged, particularly so while he reserves to himself the undisputed prerogative of approval or disapproval. As applied to the recent development of steel and terra-cotta construction, these remarks have a special significance. It is a new problem, and one of unusual complexity, but the best solution will be found in an unbiased interchange of workable ideas.

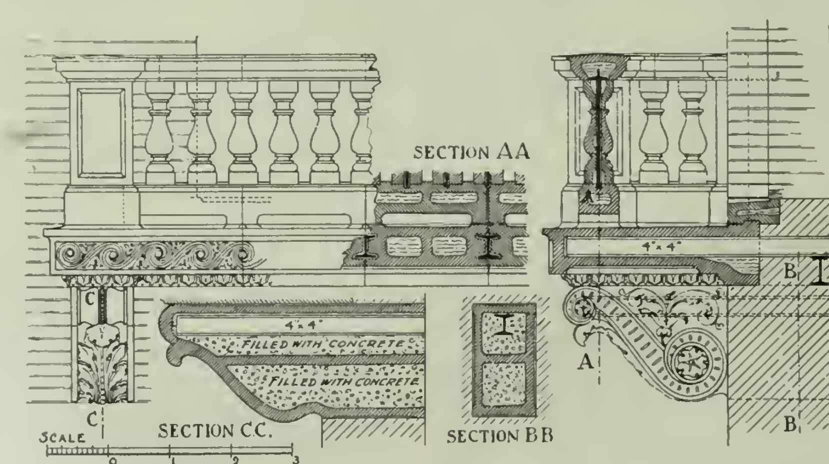


FIG. 54.

The manifold evils resulting from an opposite line of procedure are often costly, and nearly always vexatious. When, for example, an engineer has a balcony or other projecting member to support, he usually sets about it with the uncompromising directness to which he has been accustomed in work of a purely engineering character. The balcony in question, though not a strictly utilitarian adjunct to the building, may be prized by the architect as a somewhat desirable feature in his design; therefore craving a more ornate treatment than would be expected on a mere fire-escape. To that end the iron anatomy must be concealed — probably embellished — by the use of a material in which it is possible to obtain a higher degree of architectural form and finish. The engineer himself would, doubtless, concede as much (in theory) should the point be presented in that light, yet if called upon to modify a preconceived idea, or to depart from an established practise, his leanings would, we fear, be found strongly conservative. To make the use of iron or steel subordinate to that of any other material is to him a doctrine of doubtful validity and one which he is not inclined to encourage. His early training and subsequent associations run in an opposite direction, becoming, in time, a habit of thought not easily overcome. In his eyes the building itself takes the form of a huge cantilever set on end, from which these platform supports must be projected only on approved engineering principles. A certain priority as to the progress of execution enables the contracting engineer to forge ahead unmindful, it may be, of subsequent embarrassments from which he will not, in all probability, be called upon to suffer. Nor is this the only fortuitous advantage, on his side, of which he is naturally disposed to make the most. Fellow-contractors less favorably situated may have reason to complain of his lack of co-operation, in these respects, but as to them he calmly assumes that, "Where sits McGregor, there is the head of the table."

Left to himself, an engineer would provide for the needs of a terra-cotta balcony after the manner shown in Fig. 53. Not only would he frame his triangular support in that fashion; the chances are that, unless restrained by imperative orders, he would likewise make permanent riveted connections between it and the structural framing, thus manifesting an utter indifference to the claims or requirements of any other material. Indeed, we have known this to be done by an eminent member of the fraternity referred to, in the erection of a building on which a number of such balconies occurred, notwithstanding a warning to the contrary sent by way of anticipation. How this steel triangle was to be inserted in a terra-cotta bracket without first cutting away all the interior partitions and thereby reducing it to a mere shell was an important detail that did not seem to concern him. This was one of the things which he did not understand, and about which he would not take the trouble to inquire until his attention had been called to the oversight by a superintendent of unusual firmness and intelligence. He would not allow the terra-cotta bracket to be mutilated, or its strength in any way impaired, and so the trouble (in this case, at least) recoiled upon those who had caused it. In fact, the heads had to be cut off the rivets, and the steel bracket taken apart so far as to allow the diagonal strut to pass easily through the slot provided for it. The connections were then fastened again — this time with bolts instead of rivets — just as the terra-cotta maker had requested in the first instance.

One other notable circumstance may be mentioned in this connection. It was noticed that while two men were at work undoing a dozen or so prematurely fastened triangles, two other men working for the same firm were as persistently engaged (at another part of the same building) riveting similar brackets in position. They, too, were in turn taken apart for the same reason, to be reconstructed exactly as the first. The man in charge, when spoken to about this curious coincident, explained that they had been "got out that way at the works," and that he would keep on riveting until his present orders had been countermanded. It would seem that "some one had blundered," for though there were a score or more such balconies on the building, he stuck to his text, doing and undoing until the end of the chapter. This was a case of unmitigated red tape plus a predilection for rivets.

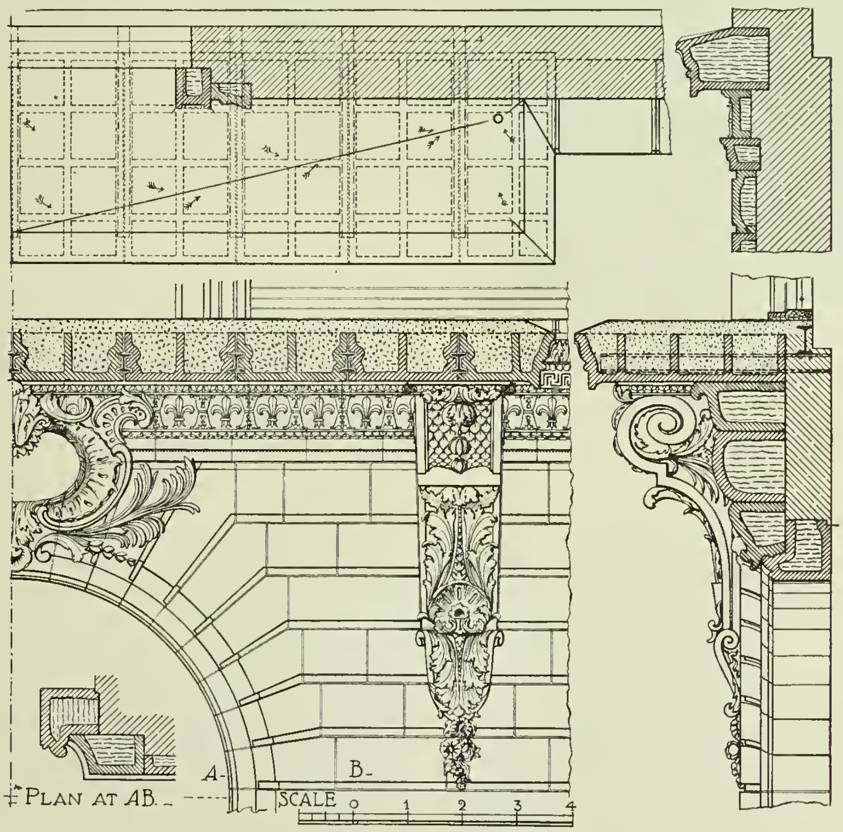


FIG. 55.

The construction of these balconies was in the main quite practicable, and had it been taken up in a spirit of mutual helpfulness neither side would have had any reason to complain. It but required reasonable forethought and intelligence to determine the readiest way in which the several parts of the two materials could be assembled so as to accomplish the final result aimed at by the architect. Work of this kind resolves itself into a well-considered compromise between different materials, each of which has some compensating advantage. To this end there must be mutual concessions, together with a total absence of prejudice on the part of those whose business it is to make the best possible disposition of available resources.

In the particular case under notice we think that these terra-cotta brackets could have been reenforced by a simpler and much less expensive method. Into the upper chamber of each we would have inserted a 3 by 5 in. I beam, the end of which could have extended to within 1½ ins. of the face of bracket. The remaining cavities having then been filled with concrete, the brackets would have been bonded into the 1 ft. 4 in. wall without further ado. The projection would, of course, be shored up until a sufficient countervailing weight of walling had been built on the other end. A balcony so formed would be capable of sustaining at least ten times the weight ever likely to be placed upon it.

In the last example a stone platform was used as a matter of choice, rather than one of necessity. At Fig. 54 we show a somewhat different arrangement, terra-cotta being the material used throughout. The brackets are strengthened in the manner described in last paragraph, not that they really needed any auxiliary support, but as an extra margin of safety. A 5 in. I beam is laid on the top bed, the ends of which extend a foot or so into each jamb of window above. To this is attached the 4 by 4 in. I beams inserted in joints of platform, the blocks themselves forming the fulcrum. These blocks are made with raised joints and a wash towards outlets in the base under balustrade. In each baluster there is a ½ in. rod which passes through a ¼ by 3 in. continuous bar, for which provision is made in bottom bed of capping. This bar enters the dies, returning at right angles into main wall, thus securing the whole balustrade against lateral deflection.

Turning to Fig. 55, we have a platform over an entrance, calling for another scheme of construction. It, like the preceding example, is one in which the terra-cotta manufacturer had something to say, and that at the invitation of an architect who believes in the principle of co-operation for which we have been contending. In this case it became necessary to provide for a cantilever at every joint, the blocks being molded to fit snugly on the flanges. Considerable leverage is obtained by placing a 5 in. I beam on top of the cantilevers, and across the window openings above, each end extending into wall far enough to receive all the cantilevers. The whole of the blocks having been adjusted to line, resting the while on a level staging, the cellular top bed was then filled solid with concrete graded towards outlets, and floated off in granolithic cement.

Terra-cotta being the material used above the granite base (Fig. 56), the architect, on that account, preferred using it for the platform also. This was quite apart from the question of cost, though the difference between it and stone would have amounted to a substantial item. These ten separate blocks, joined together in the manner indicated, became a monolith of considerable strength, which, being free from joints on the finished surface, could be made to shed water at will in any direction. The principle of composite construction embodied in this example, in which steel and cement are made to supplement the limitations of terra-cotta, is capable of the widest application in modern building practise. Where one is weak the other two are strong, and so the sources of strength outnumber the elements of weakness at the ratio of two to one. How to obtain the nearest approach to an equation of strength between the several components is an epitome of the whole question. It

FIG. 56.

will be answered best by those who study the physical properties of each, and who have also had a close practical acquaintance with the use of them under exacting diversified conditions.

A NEW TRAVELING SCHOLARSHIP.

CORNELL UNIVERSITY is offering a traveling scholarship to its graduates. "Since," as they say, "there are many objections to the prevailing method of conducting foreign scholarships, viz., that of traveling and making measured drawings, and since there is as much opposition to the idea that Americans must go to France for an architectural education, the Faculty of the College of Architecture has decided upon a course which is at the same time a departure from and a compromise between these two systems." The value of this scholarship will be $2,000. It will be awarded by competition to men under thirty years of age, and the winner will be required to spend two years in advanced studies at Cornell and in Europe under the direction of the faculty. The first of these prizes will be awarded this fall, and others, it is expected, will be awarded on alternate years thereafter. The course pursued differs somewhat from that usually taken in regard to these traveling scholarships. Instead of spending the time in traveling and making measured drawings, or going to France, entering the L'Ecole des Beaux Arts, the holder of the fellowship will spend the first eight months of each year at the university pursuing advanced studies, and four months on a European tour. For the award of this scholarship two competitions will be held. The first has for its purpose the selection of candidates for the second or final competition. The first problem will be one that can be executed at home in ten days, so restricted in size of sheet and elaboration of details that the average competitor can readily prepare his drawing in ten evenings. The second will be executed in four weeks at Cornell University in the College of Architecture. Seven will be selected from the first competition who may compete in the second, and here will be awarded the prize to the successful candidate, and a first and second mention to the two next best.

Brick and Marble in the Middle Ages.

BY G. EDMUND STREET.

CHAPTER IX.

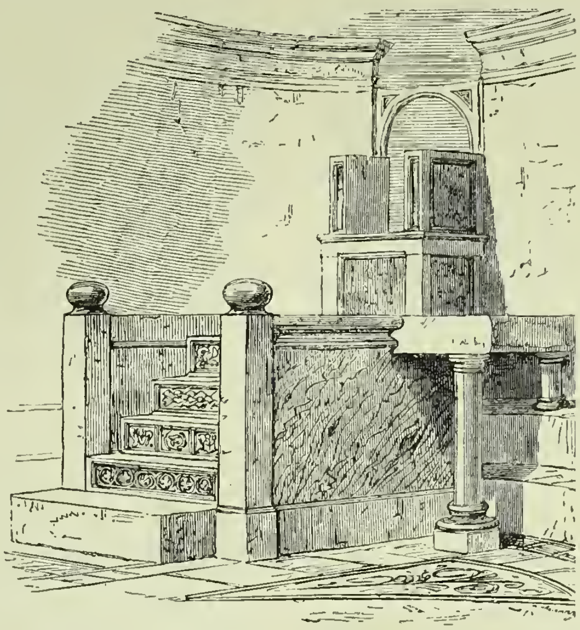
"A sea
Of glory streams along the Alpine height
Of blue Friuli's mountains." — *Childe Harold.*

New Roads to Venice — The Pusterthal — Innichen — Dolomite Mountains — Heiligenblut — Kötschach — Kirchbach — Gail Thal — Hermagor — Ober Tarvis — Predil Pass — Gorizia — Aquileja — Grado — Udine — Pordenone.

TO those who wish to find new roads to old haunts let me recommend the road to Venice described in this chapter. A more interesting way for any one who has already travelled through Lombardy to Venice cannot be desired. It affords a sight not only of charming scenery, primitive people, and churches of some interest, but gives an opportunity for a visit to Aquileja, Grado, and Udine, all of them places well worthy to be known by all lovers of architecture. Leaving the Brenner railway at Franzensfeste, we made our way first of all to Innichen. Here I found a very fine Romanesque church which, placed as it is not very far to the north of the distant mountains which one sees from Venice, and full as it is of Italian influence in its general design, may well be included in my notes. It is a cruciform church with a central raised lantern, three eastern apses, a lofty south-western tower, and a fifteenth-century narthex in front of the rest of the west end. The nave is divided from the aisles by columns which are, (1) ten-sided, (2) four half columns attached to a square, and (3) octagonal. The first and third are massive columns decreasing rapidly in size from the base to the capital. The central lantern has an octagonal vault upon very simple pendentives, and the apses have semi-dome roofs. A fine south doorway has the emblems of the four Evangelists, sculptured around Our Lord in the tympanum. Innichen is a small and unimportant village, but boasts, I think, of no less than five churches; and fine as is the mother-church, I suppose most travellers would agree with me in thinking the background of mountains to the south of it, the most delightful feature of the place. Truly I know few things more lovely than the evening view of the church and village, with the tall fantastic peaks of the Dolomite Drei Schuster behind, lighted up with the glowing brilliancy which is so characteristic a result of the Dolomite formation, by the last rays of the setting sun. Below all was gloomy, dark, and shaded; above the whole series of towering peaks seemed to be on fire, and most unearthly did they look. The attraction of such sights as I had seen before compelled me to give a day to an excursion southwards to the Kreuzberg pass, to have a glimpse, at any rate, of the Auronzo Dolomites, and I had no reason to repent the day so spent.

Leaving Innichen and going eastward, we went first to Lienz; then, after a *détour* to Heiligenblut, we crossed from the Pusterthal to the Gail Thal, and from thence across the Predil pass to the Adriatic at Gorizia. From Innichen till we reached the Italian seaboard, we saw and were much interested in a series of churches, generally of the fifteenth century, and all built apparently by the same school of German architects. They are small mountain churches, and are mainly remarkable for the complicated and ingenious character of their groined roofs. They have usually aisles, columns without capitals, and no distinct arches between them, but only vaulting-ribs. The panels between the ribs are often ornamented with slightly sunk quatrefoils, or in some cases regularly filled with tracery.

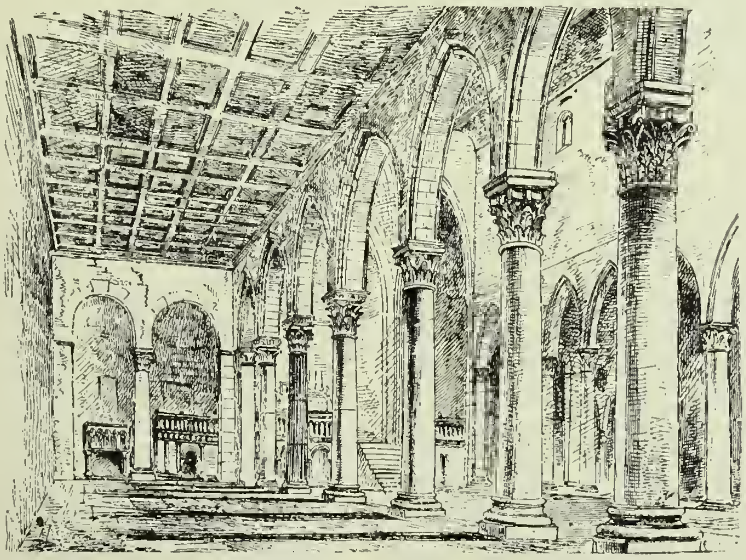
One of the best of these churches is that at Heiligenblut, in Carinthia. Here, where the main object of every one is the exploration of the mountains grouped around the beautiful snow-peak of the Gross-Glockner, it is not a little pleasant to find again, as at Innichen, a remarkable church just opposite the inn-door. This was built as a pilgrimage church to contain a phial of the sacred blood, and is extremely interesting architecturally as a church, built with a regular system of stone constructional galleries round the north, south, and west sides of the nave. The aisles are narrow and divided into two stages in height — both groined — and the upper no doubt intended for a throng of people to stand in, and see the functions below. Now, however, just as in most modern galleries, raised tiers of seats are formed in them, and their effect is destroyed. A pretty Retable at the end of the north gallery suggests that originally perhaps they were built in part to make room for side altars, but this was clearly not the primary object. The fronts of the galleries are covered with paintings of no merit, which illustrate the beautiful legend of S. Briccius, who is said to have brought the phial of blood from the East, and to have perished with it in the snow just above Heiligenblut. There is a crypt under the choir, entered by a flight of steps descending from the nave; a grand Sakramentshaus north of the chancel where the holy blood is kept (not over the altar); and there is a lofty gabled tower and spire on the north side of the chancel, whose pretty outline adds not a little to the picturesqueness of the village.



PATRIARCH'S THRONE, AQUILEJA.

From Heiligenblut, looking at churches by the same hands on the way at S. Martin Pockhorn and Winklern, we made our way back to Lienz, and thence, crossing the mountains, descended on Kötschach in the Gail Thal, passing a good church on the road at S. Daniel.

Kötschach is in one of the most charming situations for any one who can enjoy mountains of extreme beauty of outline, even though they are not covered with snow to their base, nor are more than some nine thousand feet in height. To me this pastoral Gail Thal, with its green fields, green mountain sides, wholesome air, and occasional grand views of Dolomite crags, among which the Polinik and Kollin Kofel are the finest peaks, is one of the most delightful bits of country I have ever seen. At Kötschach the architectural feature is a fine lofty gabled steeple with an octagonal spire. It is very remarkable how German these Germans are! Here, close to the Italian Alps, we have a design identical with those of the fine steeples of Lübeck, and as vigorously Teutonic and unlike Italian work as anything can possibly be.



DUOMO, AQUILEJA.

From Kötschach a pleasant road runs down the valley to Hermagor, another charming little town beautifully placed, and with — no small attraction — a capital hostelry. On the road, at Kirchbach, the drivers of the country waggons in which we were travelling pulled up their horses, to my no small delight, in front of a most interesting mediæval church yard-gate; this is a simple archway overshadowed by a shingled pent-house roof, to whose kindly guardianship we owe it that a fifteenth-century painting of S. Martin dividing his cloak with the beggar, and several saints under craftily-painted canopies, are still in fair preservation on the wayside gate, making one of the most lovely pictures possible on the road.

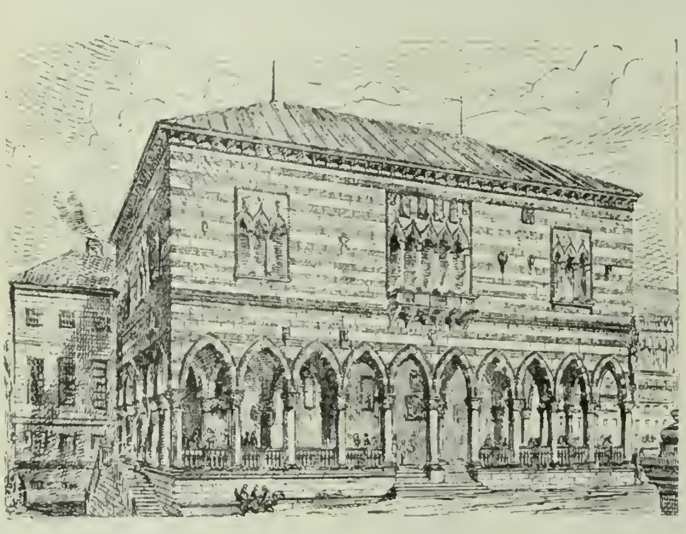
At Hermagor, where the grand and massive mountain range of the Dobratsch to the east, and the Gartner Kogel to the west, give never-failing pleasure to the eyes whichever way they turn, there is another fine church, very much of the same character as that at Heiligenblut, but without galleries.

Between Hermagor and Ober Tarvis the churches are not important, but one in the village of S. Paul has the unusual feature of a cornice under the external eaves effectively painted in the fifteenth century, with elaborate and very German traceries in red and buff, which are still fairly perfect.

At Ober Tarvis the Predil Pass is reached; and starting from thence in the morning, passing on the ascent the pretty Raibl See, and on the descent some of the most stupendous and aweful rocky precipices I have ever seen, we reached Flitsch to sleep, and on the following afternoon emerged from the mountains at Gorizia, not far from the head of the Adriatic, after a long and beautiful drive down the valley of the Isonzo.

It is a drive of about a couple of hours from Gorizia to Aquileja. The country is perfectly flat, but teeming with vegetation, and it is not until the end of the journey is reached that one realizes under what baleful conditions life or existence is endured here. A Roman capital and a fragment or two of Roman columns or mouldings are all that one sees at first to show that one is driving into one of the greatest of the old Roman seaports. Here, where before its destruction by Attila in A.D. 452 the population is said to have been about a hundred thousand in number, there are now only a few poor houses, and a sparse population, pauperized and invalided by fever and swamps on every side, whilst the sea has retreated some three miles, and left the place to its misery without any of the compensating gains of commerce. Certainly Torcello is a degree more wretched and deserted, but these two old cities have few compeers in misery, and I advise no one but an antiquary to make the pilgrimage to Aquileja, who is not quite prepared to tolerate dirt, misery, and wretchedness with nothing to redeem them.

The one great interest in the city now is the cathedral. This is a great cruciform basilica, with a central and two small apses east of the transept, and eleven arches between the nave and aisles. The arrangements of the apse are interesting; two flights of steps lead up to it from the nave, and in the centre of the east wall is the patriarch's throne of white marble, well raised on a platform above the seat which goes round the apse. The whole arrangement is singularly well preserved, and looks very well in spite of the destruction of most of the mosaic pavement with which originally no doubt the floor was laid, of which only a few tesseræ now remain, and in spite also of the modernization of the rest of the apse. This throne appeared to me to be not earlier than circa 1150, though the church is said to have been built between 1019 and 1042. These dates must, I think, be taken with large allowance for alterations. With the exception of the apse and the crypt under it, I believe the greater part of the church was rebuilt in the fourteenth century; for though the Roman capitals (which were everywhere ready to the hand) were used on the ancient columns, the arches carried by them are pointed, and the clerestory is evidently of the same age. This combination of Classic columns and sculpture with pointed arches is so very unusual, that it is quite worth while to give an illustration of the interior. The columns, capitals, and bases are of varied shapes and sizes, and evidently a mere collection of old materials which happened to be handy for the builder's use; the arches are rudely moulded, and the clerestory of cinquefoiled windows, each of a single light, is as insignificant as possible, and yet withal there is so grand an area inclosed that the effect is good and impressive. The nave is divided from its aisles by eleven arches on each side, and measures about one hundred and fifty feet in length, by one hundred and five in width. The aisle roofs are modern, but the nave still retains its old roof, a fine example of a cusped ceiling, boarded and panelled



PALAZZO PUBLICO, UDINE.

in small square panels. The whole of this ceiling is painted, and with extremely good effect, though the only colours used are black, white, and brownish yellow. Each panel is filled with a small painted hexagon filled with tracery painted in black and white, and all the ribs and leading lines are yellow and black. The purlines, which are arranged so as to form the points of the cusps, are very decidedly marked with black. Simple as the treatment is, the effect is admirable, and it appeared to me to be owing to the large amount of white in the panels. Near the west end of the north aisle is a singular circular erection, which is said by the cicerone to be the receptacle for the holy oil, but which without this information I should have taken for the baptistery. It is a perfectly plain circular mass of stonework about fifteen feet across, with a doorway on the west side, a moulded base and cornice, and above the latter a series of detached shafts carrying a second cornice of marble. A square projection on the north side abuts against the aisle wall, and seems to have been the special receptacle for the vessel which held the oil. At present it seems to be as little used and understood by the people of Aquileja as it would probably be if it were in some country beyond the Roman pale; a remark by the way on old church arrangements which one finds oneself making almost everywhere, when one contrasts the intentions of the old builders with the uses to which more modern ideas — reformed or deformed, whichever they may be — are in the habit of applying them.

ON THE EFFLORESCENCES ARISING, NOT FROM THE BRICK, BUT FROM THE SALINE SUBSTANCE OF THE ENVIRONMENT, SOIL, MORTAR, ETC.

BY OSCAR GERLACH (PH. D., BERLIN).

IN the preceding parts of this series I endeavored to give some explanation of the manner in which the white efflorescences on clay products are produced during manufacturing, and I found the main sources of the same to be contained in the iron pyrites resident in the clays and in the fuels used, but I considered only the case in which the bricks themselves contained the efflorescing salts. Experience, however, shows that even bricks that come from the kilns perfectly free from such salts subsequently exhibit efflorescence either in the finished building or even after long storage. Before proceeding to the remainder of my discussion, therefore, I will give a brief explanation of this phenomenon, and for the sake of clearness I will distinguish (1) efflorescences which appear during storage, and (2) efflorescences which make their first appearance in the building.

I.

In most brickworks the bricks are stacked in the open places round about the factory; and since these places are commonly very uneven, and often lie lower than the factory itself, they are usually filled in with ashes and broken bricks. But coal ashes contain large quantities of sulphurous materials, as even the uninitiated will understand from what has already been said, if he but reflect that coal ashes usually contain much lime, magnesia, and alkalies, which, on the combustion of the coal and of the sulphur in the pyrites, are converted into sulphuric or sulphurous salts. The fact is that magnesium and calcium sulphates are to be found in considerable quantities in coal ashes. When, therefore, perfect brick are stacked on places filled in with ashes, that part of the salts in the ashes which is dissolved by the rain or the moisture of the ground will penetrate into the lower layer of the porous bricks and will be carried thence gradually from brick to brick until the whole pile is thoroughly saturated with the salty solution. After the evaporation of the water the salts will be left upon the surface of the products.

II.

For the appearance of efflorescence on perfect brick in buildings we have to seek a different cause. Here the mortar is at fault. Many mortars contain alkalies; that is, carbonate of sodium or potassium in small quantities. These are dissolved by the rain, penetrate into the porous brick, and after the evaporation of the water are deposited on the surface, where the evaporation is most energetic. This is very frequently noticeable in buildings where colored mortars are used. The coloring matter oftenest used for the coloration of mortar is oxide of iron, which is mainly prepared by the roasting of iron pyrites. This oxide of iron always contains easily soluble salts of sulphur — principally ferrous sulphate. These sulphuric salts, on coming in contact with the above-mentioned alkalies in the mortar, are converted into sulphuric alkalies, and these in solution are absorbed by the porous bricks and precipitated on the surface. All these salts, which are very readily soluble in water, are easily washed off by the rain, and, on the bricks becoming dry again, are redeposited on the surface. Here a careful analysis of the mortar and coloring matter is necessary.

Frequently the salts contained in the soil on which the building stands are the cause of the efflorescence under consideration. These salts are most commonly produced by the putrefaction of organic, ammoniacal substances,— for example, the urine in cattle and horse stables,— and the efflorescences in question have actually been oftenest noticed in such buildings. By slow putrefaction nitric ammonium is first formed, which, on coming in contact with the lime in the mortar, is converted into nitric calcium, and so gives rise to the well-known "wall-saltpetre," a name by which many brickmakers still characterize all white efflorescences whatsoever on bricks. Also the environing atmosphere (for the air sometimes contains ammonium) may be the indirect cause of these efflorescences.

With the foregoing the sources of white efflorescences are practically exhausted. I will now speak of the modes of origin of the green and yellow colorations on buildings. These are almost exclusively found on light-colored bricks. They may be either organic or inorganic in character. When organic, they are caused by vegetable micro-organisms, microscopic Algæ, which find their nutriment in the water of the brick, and consequently grow and increase only where their natural element, water, is present, that is, on parts of buildings which are always more or less moist. They impart to the bricks a green or greenish-yellow appearance, similar to the moss-covered rocks of nature; but the Algæ excrescences are infrequent.

More commonly the green colorations are caused by mineral salts. Their characteristic tint renders them particularly noticeable in the case of buildings constructed of white or light-colored bricks. The coloring passes with time gradually from a yellowish green into a dark green, and finally into blue. It is a serious defacement of a structure, and impairs its appearance greatly.

These green efflorescences have been long known and various explanations of their origin have been given; but the interesting researches of Professor Seeger, of Berlin, first shed light upon what seemed to be an inexplicable mystery.[1] Seeger was the first who accurately determined the chemical nature of the green efflorescences caused by mineral salts. They had been thought to be soluble salts of iron, cobalt, and combinations of chromium, but the coloring element had never been determined definitely. In some cases combinations of chromium have really been discovered, and Seeger also found such. But Seeger first determined beyond a possibility of doubt that the majority of the green efflorescences in question were produced by the presence of vanadic acid salts, which are not decomposed by the heat ordinarily maintained in the kiln. Seeger procured large quantities of these saline efflorescences and carefully analyzed them. His analysis yielded the following results:—

Vanadiate of potassium	44.38
Potassium sulphate	9.01
Calcium sulphate	7.97
Magnesium sulphate	10.02
Molybdate of sodium	1.62
Chloride of sodium	4.47
Silicates	3.82
Water	18.25
Insoluble	0.46
	100.00

In addition to the small quantities of molybdate of sodium, it is principally the large quantities of vanadiate of potassium that produce the green efflorescences we are considering. Why this exceedingly rare element should just happen to occur in light-burning clays, and what its combination is in the unburnt clay, has not yet been ascertained. So much only can be said with certainty, that every bright-burning, fire-proof clay belonging to the carboniferous formation contains more or less vanadium. Noteworthy is it that in the green clay this vanadium is not found as a soluble salt. I lixiviated several pounds of green clay with water and diluted acid, and after evaporation sought to determine the vanadium in the solid residuum. I was unsuccessful. The vanadiates seem to be first formed during the burning of the brick. They may be present in the green clay as a metal or oxide.

Further discussion of these green efflorescences will be given later.

In conclusion I would state that the greenish vanadiates, owing to the minimal quantities in which they appear, have no disintegrating effect upon the brick, whereas the white efflorescences impair not only the appearance of the brick, but also injuriously affect their structure and strength, for their capacity for crystallization gradually induces disintegration.

[1] See Seeger: *Gesammelte Schriften*, "*Grüne und gelbe Ausschläge an Verblendsteinen*"; "*Vanadinverbindungen am Brennkohlenthone.*"

Fire-proofing.

SOME NOTES UPON THE STRUGGLE FOR SURVIVAL BETWEEN BURNT-CLAY FIRE-PROOFING AND ITS NEWLY ARISEN RIVALS.

BY DANKMAR ADLER.

IN the development of industrial, and even in scientific progress, men have always shown a tendency to make an occasional halt in their onward march, and at such times to treat partly developed theories as finalities, and to ignore propositions which, after but another forward step or another forward glance, would have been recognized as axioms. In the light of subsequent discoveries these halts seem to have been altogether unaccountable, while still greater marvel attaches to the tenacity with which otherwise enlightened and progressive men frequently adhere to the positions taken at these times of arrested development. After the forward movement has been again taken up it seems quite incredible that a fetish worship should have been accorded by enlightened beings to crude and half-developed theories, and to the still cruder incorporations of these crude theories into active practise; and it seems still more strange to note the mechanical paradox of an apparent increase of inertia which seems to be in direct proportion to the length of time consumed in any one of these halts. At such times the progressive energy which until then made for continuous movement toward betterment of practise seems to be converted into tenacious adhesiveness to the attained position, and all capacity for carrying out or even entertaining a forward impulse seems to be lost.

In the development of the science and art of fire-retardent construction we have successfully passed one such halting place only to have arrived at another, upon which the forces which originated and developed the known processes of burnt-clay fire-protective covering are resting in placid contentment with the progress attained, reluctant to attempt farther flights into the realm of attainable approach to perfection, and scornful of those who attempt such approach by the aid of other means than those which the tile-maker has already contributed.

For many years after the first appearance in building practise of iron pillars and beams it was believed that a building could be made really "fire-proof" by substituting iron pillars and beams and brick arches for wooden posts, girders, joists, and floors. Disastrous fires at London, Hamburg, Berlin, New York, and Chicago demonstrated the untenability of that assumption. Among the facts brought out by these fires were, first, that combustible chattels and furnishings placed within an incombustible structure still retain their combustibility, and may, if stored in sufficient quantities, be kindled and fanned into an exceedingly hot and fierce blaze; second, that iron, though incombustible, is not indestructible by fire, and that its deterioration under the effects of a hot fire causes results quite as disastrous as would be the burning of wooden structural members supporting the blazing combustible contents of the building of which they are part.

It seemed, then, in all cases where there were conditions which precluded the use of brick or stone piers and vaultings, to be Hobson's choice between the use of wooden structural members which add fuel to the flames of burning contents of buildings, and that of metallic structural members which expand, soften, and collapse under the effects of the heat of burning goods and chattels surrounding them; for in either case the destruction of a building appeared to be a foregone conclusion, if but a fire once obtained a good headway among its contents.

This led thinking and progressive constructors to conceive the idea of completely encasing the structural members of a building with substances at once slow to conduct heat and incapable of destruction or even serious injury by fire.

Almost from the very beginning burnt clay in various forms became the preferred encasing material. It was easy to mold it into the required shapes; it could be made light of weight in the course of its manufacture; it had been exposed to higher temperatures than those of a blazing building; it could be applied by ordinary building artisans at moderate cost and in all weathers. For these and other reasons it took and held possession of the field for many years with but little molestation.

It finally came to be believed that if only burnt clay were used to some extent as an essential part of a "system" of alleged "fire-proof" construction, building and contents were certainly secure against destruction and probably safe from serious injury by fire. But now this belief is assailed by reports of the damage suffered in the course of fierce and long-continued fires by buildings in which burnt clay had been used as fire-proofing material, and still more by fierce and persistent attacks upon burnt clay made by the advocates of other, more recently invented "systems" of "fire-proof" construction, which are so new as not to have had the opportunities of subjection to test in actual conflagrations which have fallen to the lot of older methods.

This tendency toward an anti-burnt-clay heresy may be fought in either of two manners. The first, peculiar to the state of halting and rest upon the road to perfection, is to fall back upon the incontrovertible statement that clay tiles of all kinds, having once been subjected to furnace heat, are indestructible by fire; that the present methods of manufacture and application of clay fire-proofing materials, being sanctioned by nearly a quarter century of practise and experience of manufacture and application, have achieved a status like that of the Thirty-nine Articles or Magna Charta or the Constitution, an attempt to alter which is synonymous with sacrilege, heresy, and treason; and that if there are observed facts which show that there may be buildings so constructed that the burnt clay used in them fails of making them fire-proof, why, then so much the worse for the facts. Fortify this position with a circumvallation built up of desires to save innumerable obsolete, rusty, rickety manufacturing plants, which have earned their first cost over and over again, but which are carried on manufacturers' inventories at their first cost together with all repairs and tinkerings since their first origin upon the plain of Shinar, and the champions of burnt-clay fire-proofing processes may make a defense as stubborn as that of Thermopylæ, but their cause will be lost and their territory overrun and despoiled by the enemy.

There is another, less sentimental and less romantic, way of facing the attack and of reestablishing and maintaining the claim that burnt clay is in most instances the most reliable material that can be used as a fire-protective covering of the structural members of buildings. In organizing and marshaling the forces of the burnt-clay industries in the offensive-defensive warfare which its friends must wage until their former position is reconquered, there is no room for maudlin, self-laudatory memories of the bloodless victories won in the past, of the hundreds of buildings, the square miles of floors, the hundred thousands of pillars and beams in and upon which burnt clay has been used as a fire-proofing material in the days when none other had been thought of; nor is it allowable to consider tenderly and reverentially the perpetuation of the plans and plants, the machines and dies, the processes and instruments by means of which the burnt-clay fire-proofing industry was established and maintained before its wicked and unscrupulous enemies had had the temerity of proposing the substitution of materials and processes wrongfully, of course, but yet plausibly, vigorously, and persistently vaunted as superior to burnt clay in its every shape. Nothing should be thought of but the aim to so profit by the lessons of the past as to eliminate from burnt-clay fire-proofing practise every imperfection developed by experience and incorporate in it every improvement suggested by thoughtful ingenuity and aggressive enterprise.

As the battle stands now, the age and general adoption and application of the various processes of burnt-clay fire-proof construction have become an element of weakness, while the apparent strength of other systems and processes appears to lie chiefly in their novelty and in the comparatively limited range of their practical application to actual building operations. The number of instances in which the former have been exposed to the destructive efforts of fire is necessarily much greater, and therefore, also, the number of opportunities for showing the existence of weakness and imperfection, than can in the nature of things be the case with the more recently developed systems, whose champions, however, are quick to observe and expose every tendency to failure under stress of actual use of the older material, the reputation of which they aim to destroy.

If those interested in the maintenance of the not yet altogether destroyed preference for burnt clay as a fire-proofing material will read and learn the lessons taught by the exposure of their material to fire under varying conditions and methods of attack, it will give them a great advantage over their newly arisen rivals, whose materials and processes will, ere long, begin to show in the light of subjection to actual conflagrations many shortcomings and failures to attain ideal perfection, as is the lot of all that is created by the spirit and the hand of man. By the time the conduct under fire of the newer materials and processes will have begun to amaze and horrify their friends, there will have been many corrections of defects which the experience of years will have shown, and which the criticism of rivals and enemies will have pointed out as latent in burnt-clay fire-proof construction, and this industry will have been established on a firmer footing than ever before.

But before the arrival of that day there will be many exasperating experiences. There are dozens of buildings, particularly in New York, in which hollow-tile arches have been used for floor construction, in which pillars, girders, and beams have been left exposed in whole or in part. There are scores of buildings throughout this country in which the burnt-clay coverings of bottom flanges of beams, or the enclosures of pillars are inadequate, and fully as many in which the integrity of the fire-protective covering of important structural members has been seriously impaired by the manner in which wooden grounds, and blocks, and conduits, and insulators made of highly inflammable materials have been applied and introduced. There are altogether too many instances of acres of floor space supported by burnt-clay protected pillars and beams, but covered by inflammable fixtures and chattels, and enclosed chiefly by sheets of glass in wooden frames, unprotected by shutters and exposed to attack by fire from without. There cannot help but be many more cases of serious injury to the fire-protective covering of such structures, and these will be considered as condemnatory of the material burnt clay and not of the manner in which it is applied, unless the friends of burnt clay begin to combat erroneous and injudicious use and application of their materials even more earnestly and vigorously than they may fight the efforts to substitute other materials and processes for their own.

It is, therefore, essential that thoroughgoing study be made of the damage which the ordeal of fire has inflicted upon clay fire-proofing materials, of the causes of such damage, and of the means by which it be prevented in the future. Of the injuries noted, some were due to the introduction, as in the building of the Chicago Athletic Association, of wooden strips between the individual blocks of hollow tile; others, to absence of protection upon important structural members, as was the case in the Western Union Building of New York; or, again, as in the Horne Building, at Pittsburg, the harm suffered seems to have been due to an effort apparently made to combine a maximum of exposure to attack of fire from without, with a maximum aggregation of combustible material within the building, and the opposition to this of a protective covering of burnt clay barely sufficient to meet the minimum of fire danger characteristic of the ordinary office building. That the Horne Building remained, for the most part, structurally intact is, therefore, in itself a victory for burnt clay, even if the general design of this building intended to be "fire-proof" was a disgrace to its author.

(*Continued.*)

The Masons' Department.

CERTAIN RIGHTS OF THE CONTRACTOR.

THE average building contractor is so accustomed to look out for himself, and, we must admit, is so perfectly able to do so, that we do not always bear in mind some of the rights which are undoubtedly his, but which are very often not insisted upon; and the scramble for work, especially in these dull times, is so pronounced that we imagine an architect can easily fail to appreciate how much it means for a contractor to be spending his time week after week figuring new work, none of which may come his way. There have been at different times a few spasmodic attempts to so alter the present system for making tenders for work that there would be an opportunity for some compensation to be awarded to unsuccessful bidders. At one time it was proposed that each of the contractors who were invited to figure should add a certain percentage to his bid, the one to whom the contract is awarded to divide this percentage among the unsuccessful contestants. One of the strongest of the trade associations in this city has, if we are rightly informed, carried such a scheme into practical effect for a number of years with eminently satisfactory results. But as this particular association limits its work to a technical portion of building operations and includes in its ranks practically all who follow this line in this city, it is easier to regulate such a practise than it would be in the case of the general contractors, who often have to compete with every one, and on all sorts of terms and conditions. It would really be fair that when a contractor is called upon to spend several days in carefully estimating the cost of a structure, the owner, who thereby gets the benefit of selection from several bidders, should be willing to pay a small compensation for the opportunity, though just how this can be brought about is a question which is not easily solved. There are a few considerations, however, that would certainly lighten the task of the unsuccessful bidder, without laying any serious burden upon either architects or owners.

It ought to be an inflexible rule with an architect that no contractor should ever be allowed to change his bid after it has once been submitted in writing. If the builder is to feel that the owner, by applying moral suasion, can expect him to cut off five, ten, or fifteen per cent., he will, if he is human, add that amount to his bid in the first place, and take his chances on being the lowest, and it is believed that by adhering strictly to a rule of this sort the architect would get lower bids in the first place, and would take a higher rank in the opinion of the competitors.

Another slight act of courtesy can make relations much more pleasant. Ordinarily when a builder submits a tender for work he thereupon goes his way and may not know for weeks, or even months, who is to do the work. Just as soon as any decision is reached, each one of the bidders ought to be notified that the contract has been awarded to so and so under certain conditions, and appreciation expressed of the services of the bidder in figuring. This is not money compensation for estimating, but it is a matter of courtesy between the architect and the builder, which one owes to the other. The architect cannot build a building without a builder, though the builder might put up a structure without an architect, but anything which brings the two more closely together is of unquestionable advantage. The line between architect and builder is at best a faint one, and the amenities of civilization can well be studied as a branch of architecture.

STRENGTH OF CONCRETE.

A SUBSCRIBER submits the following query to THE BRICKBUILDER for an answer: "Will you kindly inform me through your journal as to the bearing strength of concrete, or the proportionate thickness to the width?"

This query is somewhat indefinite in form, and it must be answered as two separate propositions, one as to the compressive strength of concrete, and the other as to the necessary proportion of width to thickness.

Some recent tests of the strength of concretes, prepared from different cements and aggregates, have been conducted by the Engineer Department of the District of Columbia, and the results are published in the Report of the Operations of this Department for the year ending June 30, 1897, and may be found in full on p. 165 of that report. A synopsis of these results is given in the following table: —

TABLE G.

No.	Composition of Concretes, by Volume	10 days.	45 days.	3 mos	6 mos.	1 year.
	1 PART NATURAL CEMENT, 2 PARTS SAND.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
1	6 parts average concrete stone	32,900	77,687	54,022	114,412	131,700
2	3 parts average concrete stone, 3 parts gravel	15,500	52,362	85,315	90,965	121,100
3	4 parts average concrete stone, 2 parts gravel					131,700
4	6 parts (¾ average concrete stone, ¼ granolithic)					115,200
5	6 parts average gravel	12,500	60,652	51,980	49,437	109,900
6	6 parts coarse concrete stone (no fine) .			85,880		119,300
	1 PART (ATLAS) PORTLAND CEMENT, 2 PARTS SAND.					
7	6 parts average concrete stone	130,750	[1]343,520 172,325	324,875	361,600	440,040
8	3 parts average concrete stone, 3 parts gravel	136,750	266,962		298,037	396,200
9	4 parts average concrete stone, 2 parts gravel					408,300
10	6 parts (¾ average concrete stone, ¼ granolithic)					388,700
11	6 parts average gravel	99,900	234,475	385,612	265,550	406,700
12	6 parts coarse concrete stone (no fine) .			234,475	220,350	266,300

Additional information is also contained in Baker's *Treatise on Masonry Construction*, p. 109, from which it appears that hydraulic concrete, made in various ways with natural cement, may have a compressive strength of from 65 to 85 tons per square foot in cubes at an age of six months, and with Portland cement a strength of from 144 to 219 tons, results which do not differ largely from those obtained in Washington.

The necessary relation of thickness to width of any concrete mass cannot be fixed by any general rule, but is dependent upon the particular conditions under which the concrete is used. If the concrete is to form the footing for the support of a wall or pier, the relation of thickness to width will depend upon the nature of the soil or foundation upon which the concrete is laid and the amount of load that it is to carry. Each particular case must, therefore, be considered by itself. For piers for the support of heavy machinery the concrete may be several times thicker than wide, whereas, as a base for pavements, it may be made many times wider than thick. For any particular case the relation can be determined from the strength of various concretes previously given.

LIMESTONE IN CONCRETE INJURIOUS TO IRON?

AT the last meeting of the American Society of Civil Engineers, Mr. L. L. Buck stated, as reported in our last issue, that limestone in concrete, applied to iron or steel surfaces, would certainly cause deep corrosion of the metal wherever the stone came in contact with the metal. In the anchorages of the Niagara railroad suspension bridge, the strands of the main cables were imbedded in a concrete made with limestone, and wherever the spalls touched the wires the latter were badly eaten and sometimes entirely severed.

This is a matter of such importance that it deserves careful attention, particularly in view of the use of limestone in concrete laid in connection with the structural metal work of large buildings, where corrosion can be detected only with much difficulty. There is a wide variation in limestones, and it may be that some grades will act corrosively and others not; it is desirable that this point should be borne in mind in discussing the subject. — *Eng. Record.*

[1] There being such a great difference in the crushing of the two cubes, the strength of each cube, and not the average, is given.

Brick and Terra-Cotta Work In American Cities, and Manufacturers' Department.

NEW YORK.— There seems to be an impression in all parts of the country that business in New York is entirely suspended and that the greatest uneasiness and excitement prevails. Such, however, is not the case, and it is really surprising, in view of existing circumstances, that everything is running along so smoothly. There is naturally some excitement and business is "quiet," but not suspended by any means. The exchanges are very active in buying and selling and a healthy tone prevails. Of course, most large building enterprises are being temporarily postponed, but owing to recent encouraging reports and the prospects of an early cessation of hostilities it cannot be for long. The work on smaller buildings and residences seems to be progressing favorably.

BRACKET IN MAIN CORNICE, CHAMBER OF COMMERCE BUILDING, CLEVELAND, OHIO.
Executed by the Northwestern Terra-Cotta Company.
Peabody & Stearns, Architects.

A great source of annoyance at the present time is a strike among the stone-cutters which has been in force for several weeks. It has almost caused a cessation of work on the great thirty-story Ivins Syndicate Building, on Park Row, which it is intended to have ready for occupancy in September.

The National Sculpture Society is now holding its third annual exhibition in the Fine Arts Society Building, 215 West 57th Street. This is by far the most ambitious exhibition which the society has yet attempted, and should be of great interest to the general public as well as to architects and sculptors. The growing friendliness and cooperation between architects and sculptors is very gratifying and gives promise of future works in which the two arts will be jointly represented, each enhancing the beauty of the other. Among the few important items of news among architects may be mentioned : —

Plans have been prepared by York & Sawyer, architects, for a new building for the Franklin Savings Bank to be erected at 658 Eighth Avenue. The building will be of brick and stone, and will cost $200,000.

Ludlow & Valentine, architects, have prepared plans for a five-story brick and stone store and office building to be erected on East Ninth Street ; cost, $200,000.

Edward H. Kendall, architect, has planned an eight-story brick and stone office and printing house for the Methodist Book Concern.

N. C. Mellen, architect, has planned a four-story brick and stone dwelling to be erected on Madison Avenue ; cost, $130,000.

Cleverdon & Putzel, architects, have prepared plans for four five-story brick dwellings to be erected on 76th Street, at a total cost of $160,000.

Carrere & Hastings, architects, have planned a five-story brick and stone dwelling to be erected on Fifth Avenue, near 72d Street.

DETAIL, NEW YORK AND NEW JERSEY TELEPHONE BUILDING, BROOKLYN, N. Y.
Executed by the Perth Amboy Terra-Cotta Company.
R. L. Daus, Architect.

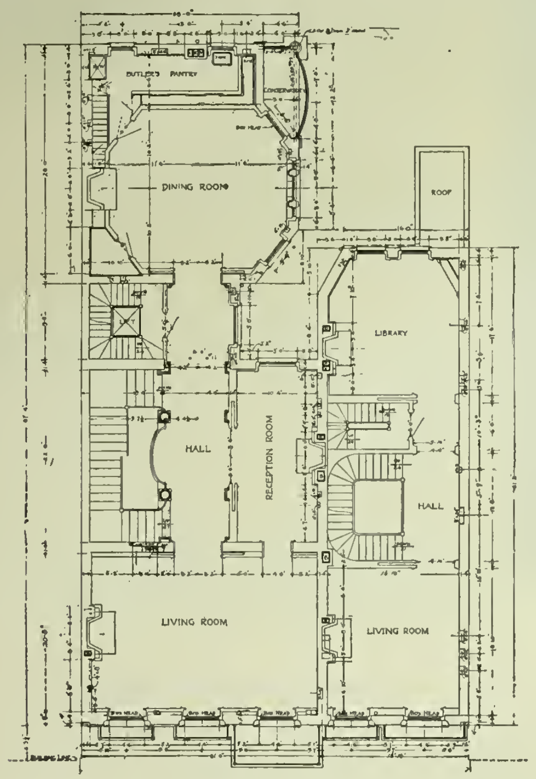
Dehli & Chamberlain, architects, have planned a new building for the Church of the Good Shepherd, Brooklyn. It will be a brick and stone structure and will cost about $40,000.

CHICAGO.— The writer knows of a building enterprise in New York which, a few months ago, could have obtained on its exceptional security a loan of $30,000 at 4½ per cent. Now, however, operations are suspended until the money market can determine its own emotions on the war with Spain. Similar conditions prevail in Chicago. Recently a loan at 4½ per cent. was announced on property located, it was noted, outside of the business center of the city. Not long afterward a better loan on property in the heart of the business district was held up at 6 per cent. As this indicates, many building projects are awaiting the outcome of the war.

About a year ago the Chicago Architectural Club gave up its club house and moved into the Art Institute Building. They and the Caxton Club (an organization of book cover connoisseurs) were the first to take advantage of the new policy of the Art Institute, to gather within its walls a group of clubs interested in art. Now the Illinois Chapter of the Institute of Architects has done likewise, and without any cost save the taking out of membership tickets in the

CAPITAL FOR OFFICE BUILDING, HOLYOKE, MASS.
Executed by the Standard Terra-Cotta Company.
Clough & Reid, Architects.

Art Institute for each member of the Chapter. It possesses headquarters in our temple of art, which, with its art school of twelve hundred, its fine galleries of painting and sculpture, its school of architecture, and close affiliation with the Armour Institute of Technology, and, finally, its group of art clubs, ought certainly to be the center of a strong art influence in the West.



FIRST FLOOR PLAN.

HOUSES FOR JAMES J. GOODWIN, ESQ., 54TH STREET, NEW YORK.
McKim, Mead & White, Architects.
Elevation shown on plate 34.

In the line of building news there is not much at present concerning tall office buildings. One fourteen-story building, 50 by 68, is to be erected on the site of a building recently burned.

Holabird & Roche have a business building 100 by 100, two stories high, "chiefly glass." Some important manufacturing plants are in the prospective stage. Wilson & Marshall have in hand extensive alterations to Hooley's Theatre. The question of a new court house is being agitated again. Some new public schools and city pumping stations are projected. The showing of the building operations for April is less, based on the permits, than for the previous month, or for the corresponding month last year.

Active measures are being taken by the Central Art Association, in behalf of the trans-Mississippi Exposition, "to erect, furnish, and decorate a modern $10,000 house containing ten rooms, wherein will be used the most approved building material of the present time. The following committee of architects, Geo. R. Dean, Frank L. Wright, and R. C. Spencer, Jr., has been selected by the Central Art Association to design a home which may be considered typical of American architecture." It is to be hoped that this project will be successful in every way, and that material dealers will contribute generously to make it so.

Apropos of a scandal referred to last month concerning an improperly constructed building which recently burned, it is interesting to note that the new city building ordinances hold architects responsible thus: "Any architect having charge of such building, who shall permit it to be constructed in violation of this ordinance, shall be liable to the penalties herein provided and imposed." However much architects may be overridden in matters of taste, they should be held fully responsible as professional men in matters of construction.

PITTSBURGH.— After the general complaint of the scarcity of work which has come from architects and contractors so far this year it is rather surprising to learn at the office of the building inspector that during February, March, and April three hundred and fifty-seven permits have been issued against three hundred and seventy-nine during the same period of last year, while the valuation of the work of this year has been nearly half again as much as that of the same period of 1897.

The first exhibition of the Pittsburgh Chapter of the American Institute of Architects was opened at the Carnegie Art Galleries on Saturday evening, April 30, by a reception to members and friends. The exhibit is a most excellent one and comprises most of the best drawings seen in New York, Philadelphia, and Chicago this year. Its general excellence is not due, however, as one of our daily papers would have us believe, to the large size of the drawings; this paper remarks that it is very impressive, "many of the drawings being quite large, many as large as 8 by 2 ft.!" Everything is being done to have the exhibition visited by the public, as it may be made an important factor in the education of the architectural taste and criticism of the community. Among some of the most attractive drawings may be mentioned Cope & Stewardson's drawings for the Pennsylvania Institute of the Blind; the designs for the National Academy of Design Buildings, by Babb, Cook & Willard; the drawings of the Mt. Aloysius Academy at Cusson, Pa., by Alden & Harlow; the interiors by Nicola d'Ascenzo; and the exhibits from the Massachusetts Institute of Technology and the University of Pennsylvania. There are also many attractive sketches, notably those of Frank A. Hays, the pencil sketches by H. A. Woodbury, a charming sketch of a suburban residence by Howard Shaw, and the pen and ink drawings of Joseph Pennell. There are also shown the drawings received in the competition lately given by the Pittsburgh Chapter for an entrance to Schenley Park. The prize, $500, to be expended in a year at some architectural school, was awarded to C. C. Mueller.

The opening exercises were also made the occasion of the unveiling of a life-sized bronze bust of the late J. D. Bernd, a prominent merchant of Pittsburgh, who left the Carnegie Library some $20,000 to be expended on architectural books.

CAPITAL SPINGLER BUILDING, NEW YORK CITY.
Executed in gray terra-cotta by the Excelsior Terra-Cotta Company.
W. H. Hume & Son, Architects.

Among buildings now in process of construction or soon to be commenced may be mentioned the new department store for Kaufmann Brothers, to be built of brick and terra-cotta, Charles Beckel,

MAIN ENTRANCE, CITY HALL, PATERSON, N. J.
Showing Guastavino system ceiling.
Carrere & Hastings, Architects.

architect; the First United Presbyterian Church, to be built in Oakland, Thomas Boyd, architect; the large new Mother House for the Sisters of the Third Order of St. Francis, of brick and stone,

TERRA-COTTA DETAIL, HARTFORD TIMES BUILDING, HARTFORD, CONN.
Executed by the Conkling, Armstrong Terra-Cotta Company.
A. W. Scoville, Architect.

S. F. Heckert, architect. Mowbray & Uffinger, of New York, have made plans for the new East End Bank, to be built of white marble, cost about $70,000. Alden & Harlow have recently let the contract for a Carnegie Branch Library and are at work on two more, one to be built on Wylie Avenue and the other on the South Side, estimated cost of each about $30,000.

D. H. Burnham, of Chicago, was awarded the first place in the competition for the Union Trust Company Building, and is at work on the drawings. The same architect is also preparing plans for a new Union Station for the Pennsylvania Railroad, to cost $500,000.

HAVING illustrated from time to time in our other pages various interesting problems in the Guastavino system of cohesive construction, large domes, floors for heavy loads, roofs, etc., it is a pleasure to note the increasing tendency in this strictly masonry system towards architectural and artistic effect in the construction itself. By means of improved material there has been a continuous advance along this line of making the masonry its own decoration, and we can see some of its capacities in the vestibule ceiling of the main entrance of Paterson City Hall, Carrere & Hastings, architects, illustrated herewith.

CURRENT ITEMS OF INTEREST.

St. Louis Sewer Pipe Manufacturers have been figuring on three hundred car loads of sewer pipe for Guadalajara, Mexico; also a large contract for city of Mexico.

Dyckerhoff Portland Cement was used to cover the Assabet Bridge, at Northboro, Mass., built by the Metropolitan Water Board. The bridge is 329 ft. long by 189 ft. wide.

The Burlington Architectural Terra-Cotta Company are supplying the terra-cotta for twelve houses for F. A. Potter & Son, at Philadelphia, H. E. Flower, architect.

The Berlin Iron Bridge Company have just completed for the Conway Electric Street Railway Company, at Conway, Mass., a steel bridge 300 ft. in length, to carry their electric line across the Deerfield River.

Waldo Brothers are furnishing the face bricks for a residence front at Worcester, Mass., L. E. Gironard, contractor. These bricks are manufactured by the Ohio Mining and Manufacturing Company, Shawnee, Ohio.

The Berlin Iron Bridge Company, of East Berlin, Conn., have just completed a fire-proof boiler house for the Hendey Machine Company, of Torrington, Conn.; also a new fire-proof casting shop for the Whitin Machine Company, of Whitinsville, Mass.

The contract for the Lincoln Trust Building, 7th and Chestnut Streets, St. Louis, has been let to McArthur Brothers, of Chicago, D. H. Burnham, Chicago, architect: cost about $400,000. Face bricks are called for.

Waldo Brothers report that they are supplying Atlas Portland cement for municipal work in the following cities: Boston, Providence, Worcester, Haverhill, Quincy, Somerville, Brookline, Everett, Melrose, Malden, and Medford.

The lining of the easterly walls of the Scollay Square station of the Boston Subway has been awarded to the Grueby Faience Company. This makes the fourth station of the Subway in which their goods have been used.

The American Enameled Brick and Tile Company will supply, through their New York agents, Meeker, Carter, Booraem & Co., the enameled brick and glazed terra-cotta in the new Post-Office building at Paterson, N. J., McIlvaine, Unkefer & Co., builders.

The Standard Terra-Cotta Company are supplying the architectural terra-cotta for the Press Building, Philadelphia, T. P. Chandler, architect; also for the new building for the Union Gas Company, at Point Breeze, Philadelphia, Wilson Brothers & Co., architects.

The Winkle Terra-Cotta Company is furnishing the terra-cotta work for interior and exterior of Ohio, Minneapolis & St. Paul Railway Station, Minneapolis, Minn., Charles S. Frost, architect. They are also making terra-cotta for Lincoln Trust Building, St. Louis, Eames & Young, architects; George A. Fuller Company, contractors.

Meiers Puzzolan Cement (Waldo Brothers, New England agents) is being used in the Somerset Hotel, Commonwealth Avenue, Boston, A. H. Bowditch, architect; and in the Westminster Hotel, Copley Square, Boston, Henry E. Cregier, architect. This cement is also specified for the light stone work on Back Bay Station of the N. Y., N. H. & H. R. R.

The Brick, Terra-Cotta, and Supply Company, M. E. Gregory, proprietor, Corning, N. Y., have closed contract for the brick and terra-cotta required for Mrs. S. L. Gillett's residence, Elmira, N. Y., Pierce & Bickford, architects. They also have contract for the terra-cotta required for Parochial School, Elmira, N. Y., J. H. Considine, architect.

The Boston Fire-proofing Company are fire-proofing the following new buildings in Boston: Store building, corner Bedford and Chauncy Streets, Winslow & Wetherell, architects; George A. Fuller Company, contractors; building for the Boston Electric Light Company, Whidden & Co., contractors; American Express Company's new building, Prescott & Sidebottom, architects; L. P. Soule & Son, builders.

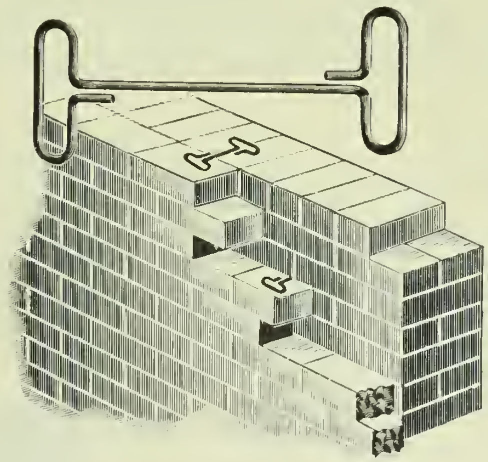
Among the new buildings recently supplied with brick by the Columbus Brick and Terra-Cotta Company are: Stores and apartment house for George H. Matchett, at Cleveland, Ohio, Robert Crabb, architect; theater and music hall at South Bend, Ind., Dirham & Schneider, architects; new high school building at Columbus, Ohio, D. Riebel, architect; and residence at Columbus, Ohio, for W. Y. Miles, J. E. Elliot, architect.

The following buildings have just been equipped with the "Bolles Revolving and Safety Sash": New York and New Jersey Telephone Building, Brooklyn, N. Y.; New York Telephone Building, 15 Dey Street, New York City; New York Telephone Building, 18 Cortlandt Street, New York City; Cushman Building, Broadway, New York City. The sash for the tallest office building in the world (Park Row Syndicate Building) is now being fitted with the Bolles fixtures.

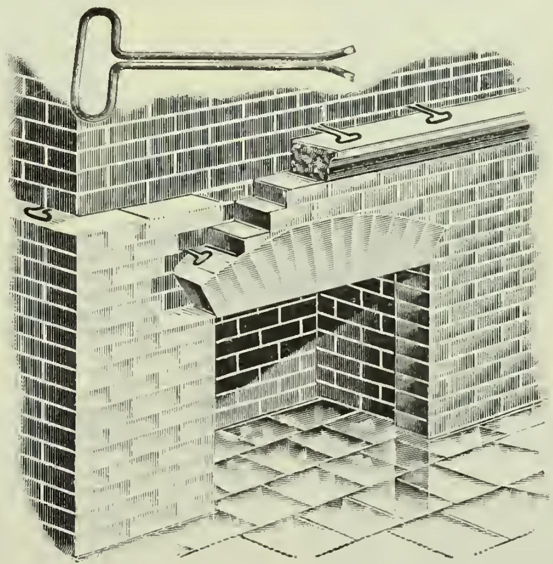
The Standard Terra-Cotta Company, through their New England agents, O. W. Peterson & Co., have recently secured contracts to furnish the terra-cotta for the following buildings: The Science Building, Springfield, Mass., Gardner, Pyne & Gardner, architects; a business block at Holyoke, Mass., Clough & Reid, architects; Taylor's Theater, Worcester, Mass., Fuller, Delano & Frost, architects; Thomas Barrett, builder; Wilder and Moore Halls, Dartmouth College, Lamb & Rich, architects.

The Queen Sash Balance Company, of 150 Nassau Street, New York City, whose overhead window pulleys have gained a world-wide reputation, are finding great success in placing on the market an improved window stop adjuster which they have just patented. The adjuster consists of a small bronze cup with a corrugated base having an oblong opening, and a corrugated washer to fit the corrugated base, which allows a screw to pass through it and thus holds the stop bead absolutely rigid. Samples and catalogue will be furnished upon application.

The Cleveland Wire Spring Company, of Cleveland, Ohio, are placing upon the market a line of patented steel wall ties



for bonding pressed or enameled brick facings, hollow walls, terra-cotta blocks, etc., which will, we believe, find favor among architects and builders as being practical and valuable. The claim is made that, being perfectly flat and the formation such, — without spring, — they form a direct lock that bonds perfectly. The accompanying illustrations give a good idea of the exact manner in



which these ties are used. The same company has also an improved wire snow guard for slate and shingle roofs. Catalogues which include price-list will be sent on application.

Vessels of the United States Navy are being equipped with the Mason Safety Tread, the Department having approved of this material as being well adapted to secure protection to the sailors under conditions where, to the ordinary danger of slippery treads, is added the instability caused by rough seas and constant motion. Among the vessels for which orders have been given for entire or partial equipment with Mason Treads are, the *Brooklyn*, *Iowa*, *Indiana*, *Minneapolis*, *Columbia*, *Kearsarge*, *Kentucky*, *Bancroft*, *Lancaster*, *Lebanon*, and *Southery*. Mason Treads prevent wear and slipping whether on land or sea.

The Dagus Clay Manufacturing Company shipped upwards of five hundred thousand bricks during the month of March. Among contracts recently closed is a residence for George B. Ensworth, Warren, Pa., C. M. Marston, architect; to be built of dark buff with dark pink trimmings; residences for William V. Eisenberger, Lancaster, Pa., and G. L. Lawrence, New York City, Dagus fire-flashed Pompeian tile; a building of light buff brick for John Westenberger, Lancaster, Pa. They are working upon an order of mottled pink for John W. Reith, Lancaster, Pa. They also furnished dark gray brick for a barn for Dr. John A. Ritchie, Oil City, Pa., and have delivered to the B. N. McCoy Glass Works one hundred and fifty thousand light buff brick for an addition to their factory building at Kane, Pa.; also forty-seven thousand dark red front brick for Thomas W. Poy, Kane, Pa. They report the season as having opened fairly well with prospects of continued trade excellent.

J. B. Colt & Co., who for many years were located on Nassau Street, near Ann Street, New York City, removed May 1 to Nos. 3, 5, and 7 West 29th Street, corner of Fifth Avenue, where they have considerably more room than heretofore, in a very much better neighborhood, and with very much better facilities of all kinds.

It is the leading firm of the United States engaged in the manufacture and sale, at wholesale and retail, of educational and scientific projection apparatus, electric focusing lamps, etc.

Since acetylene gas became a factor in illuminating work, Messrs. Colt & Co. have made a special feature of acetylene generators, and for such appliances they are now recognized as headquarters. They have very completely equipped acetylene gas show rooms at 125 West 37th Street, corner of Broadway, where the capabilities of the new illuminant are being fully set forth to a multitude of visitors every day.

The business of the house was originally founded in 1870 by Mr. James Bennett Colt, the present senior partner. In 1888 Mr. Charles Goodyear became a partner, and these two gentlemen constitute the present firm. The firm has branches in Chicago and San Francisco, and its business extends literally to all parts of the country.

NOTICE OF INJUNCTION.

The demand for our goods has induced certain parties to imitate our trade-marks for the purpose of fraudulently deceiving our customers and profiting by our reputation. We recently brought suit against the New York Metallic Paint Co., Fred. Lederer and Walter T. Klots, respectively, the President and Treasurer of said company, to restrain such fraudulent practises. This case was tried, and the following is a part of the findings which have just been signed by Judge Gaynor, viz.:—

"That the said defendants (the New York Metallic Paint Company) entered into the manufacture of said pigments and adopted the words 'Metallic Clinton Paint' printed upon the representation of a barrel head, for the *fraudulent purpose* of causing the customers of the plaintiff in particular, and all others, to confound the defendants' pigment with that of the plaintiff, and thereby enable the defendants to get the trade of the plaintiff."

A similar finding was also made with respect to "Clinton Hematite Red."

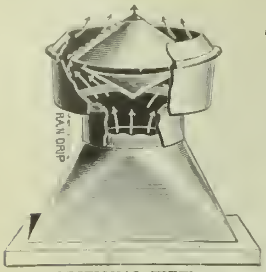
Judge Gaynor also decided that we were entitled to an injunction restraining the defendants from using the words "Clinton Hematite Red" and "Metallic Clinton Paint" printed upon the representation of the head of a barrel, or any colorable imitation thereof, as well as to all profits of the defendants upon goods sold by them, bearing imitations of our labels and trade-marks, and to such damages as we may have "suffered by reason of the defendants' unlawful use" of our labels and trade-marks. The public and the trade must decide for themselves whether it is desirable to purchase goods from manufacturers who, under the findings of the Court, *began business with the deliberate intention of fraudulently palming off their goods as those of a reputable manufacturer.*

In purchasing our goods, kindly see to it that they bear the words "Metallic Clinton Paint" or "Clinton Hematite Red" printed upon the picture of a barrel.

We will consider it a favor if our friends will notify us if any infringements of our rights come to their knowledge.

CLINTON METALLIC PAINT CO.,
Clinton, N. Y.

May 16, 1898.



SECTIONAL VIEW.

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To those who are tired of applying two or three coats of linseed oil to their brick walls every two or three years, and to those who would like to avoid the expense which this triennial application entails,

CABOT'S BRICK PRESERVATIVE

is recommended as an article that will waterproof brickwork thoroughly with one coat (or with the most porous bricks, two coats,) at a less cost per coat than oil, and which the test of time has proved to be permanent. It is an indestructible, insoluble compound which never requires renewal. A preventive of the white efflorescence.

SAMUEL CABOT, Sole Manufacturer,
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If You Ride a Bicycle — Ride the Best.

The Western Review of Commerce (one of the most reliable commercial papers in this country), after a thorough and complete examination of the 37 leading bicycles of the world, to determine **"Which is the best bicycle,"** said editorially: "The unanimous verdict was in favor of the Lovell 'Diamond,' manufactured by the John P. Lovell Arms Co. of Boston, Mass."

If You Ride a Lovell "Diamond" — You Ride the Best.

Lovell "Diamond" . . . . (Models 34, 35, 36.)	$50.00	Lovell Excel, 28-Inch . . . (Men's and Women's.)	$35.00
Lovell "Diamond" . . . . (Models 40, 41.)	$75.00	Lovell Excel, 26-Inch . . . (Youths' and Misses'.)	$28.50
Lovell Racers	$85.00	Lovell Excel, 24-Inch . . . (Boys' and Girls'.)	$23.50
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All Lovell "Diamond" Bicycles have been made in our own factory at South Portland, Me., since Jan. 1st, 1897.

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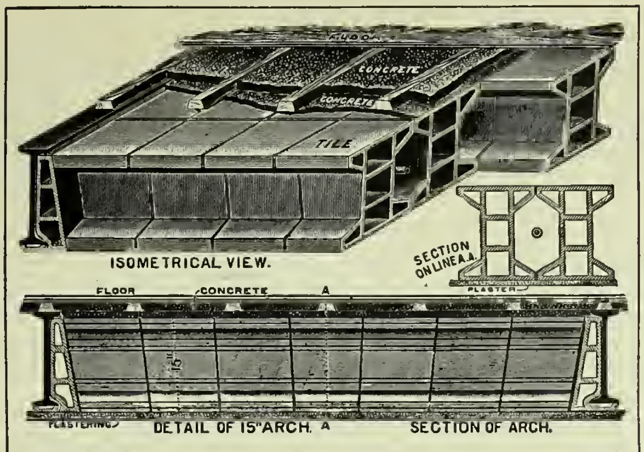

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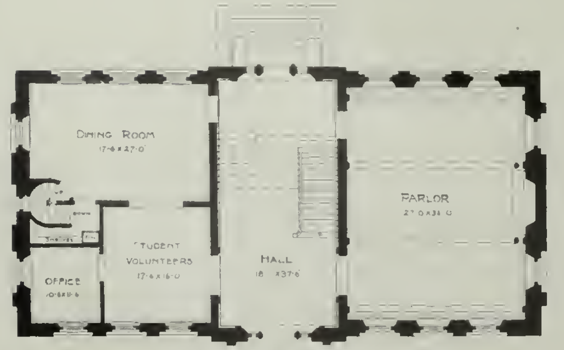

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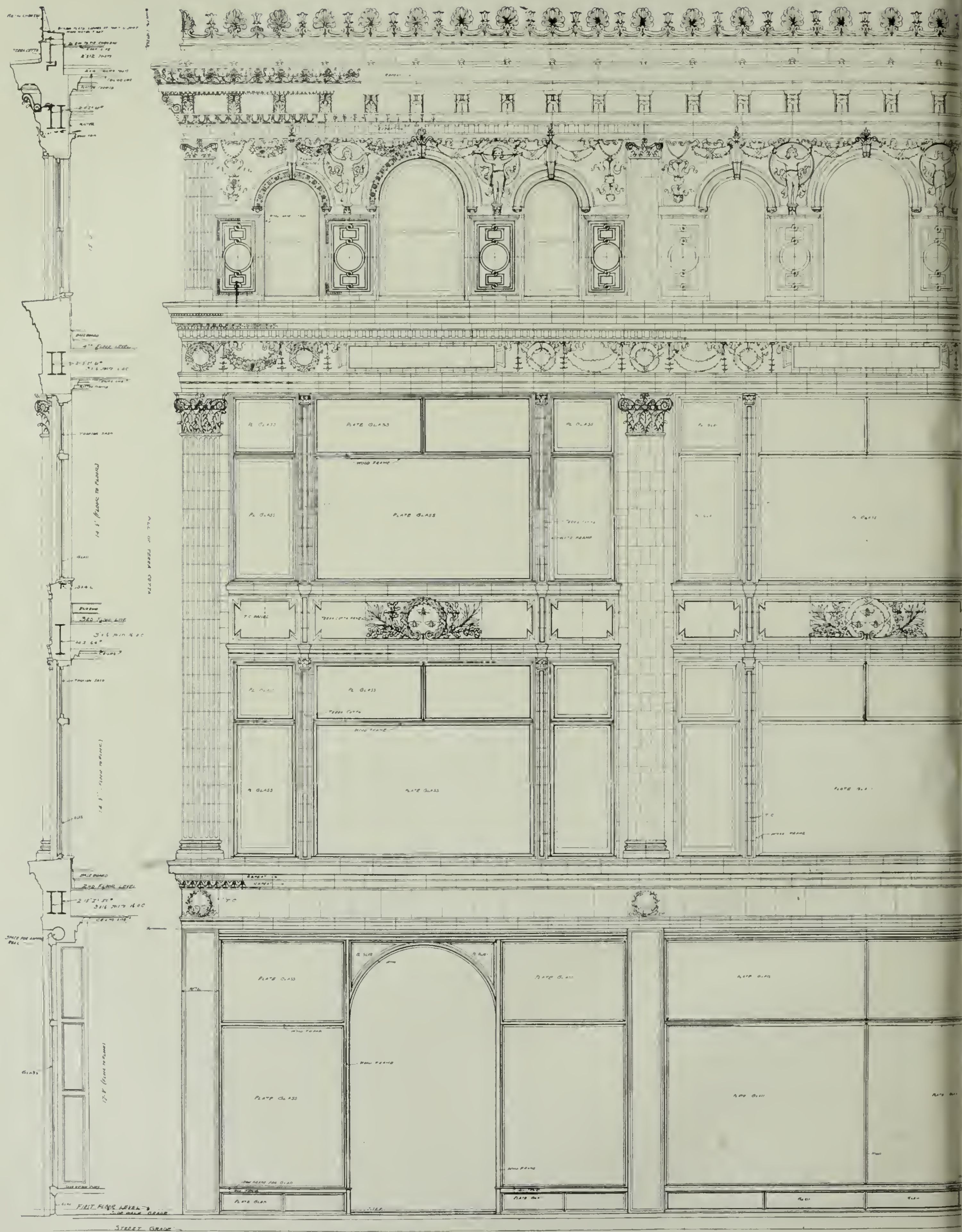
A. W. LONGFELLOW, Jr., Architect.



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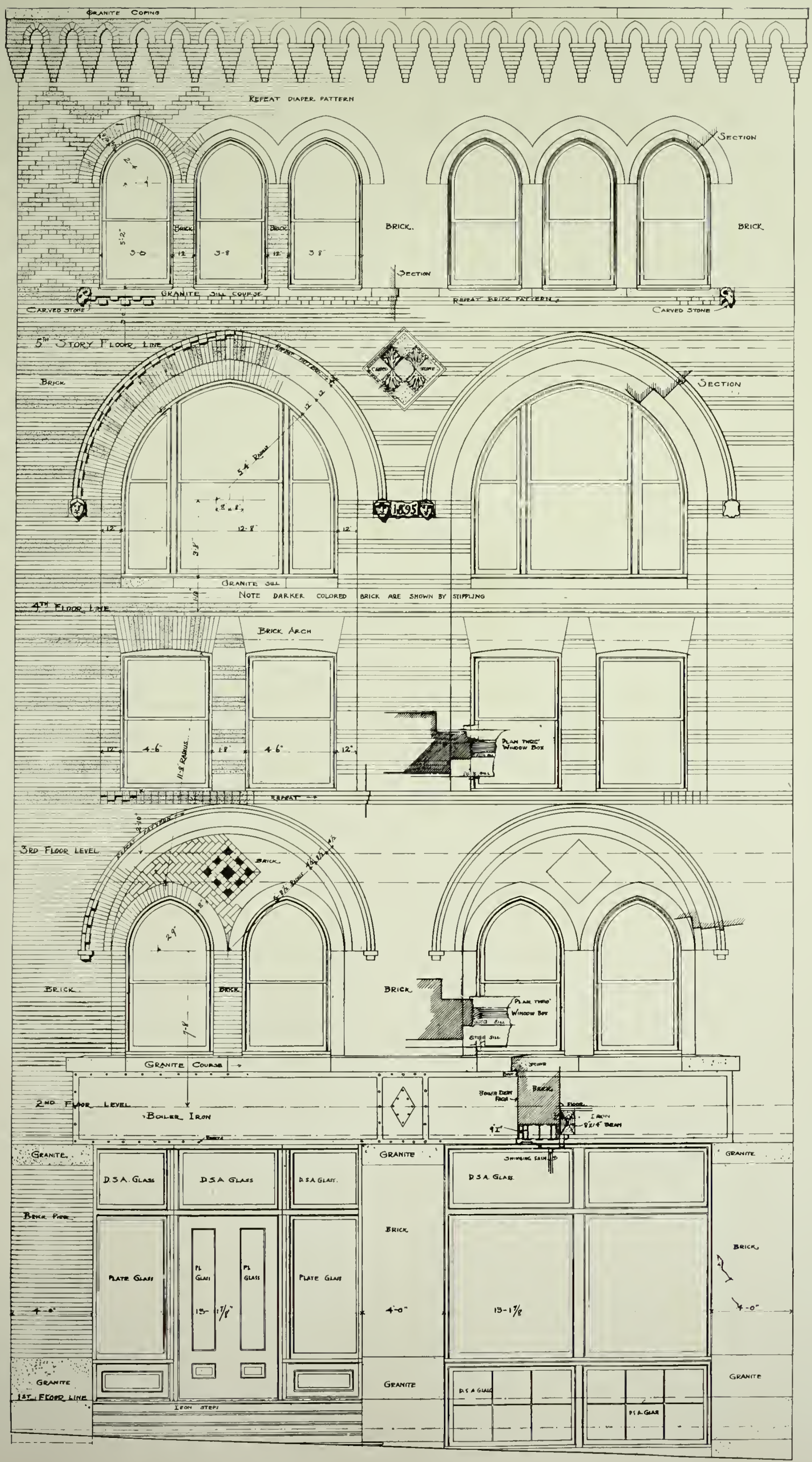
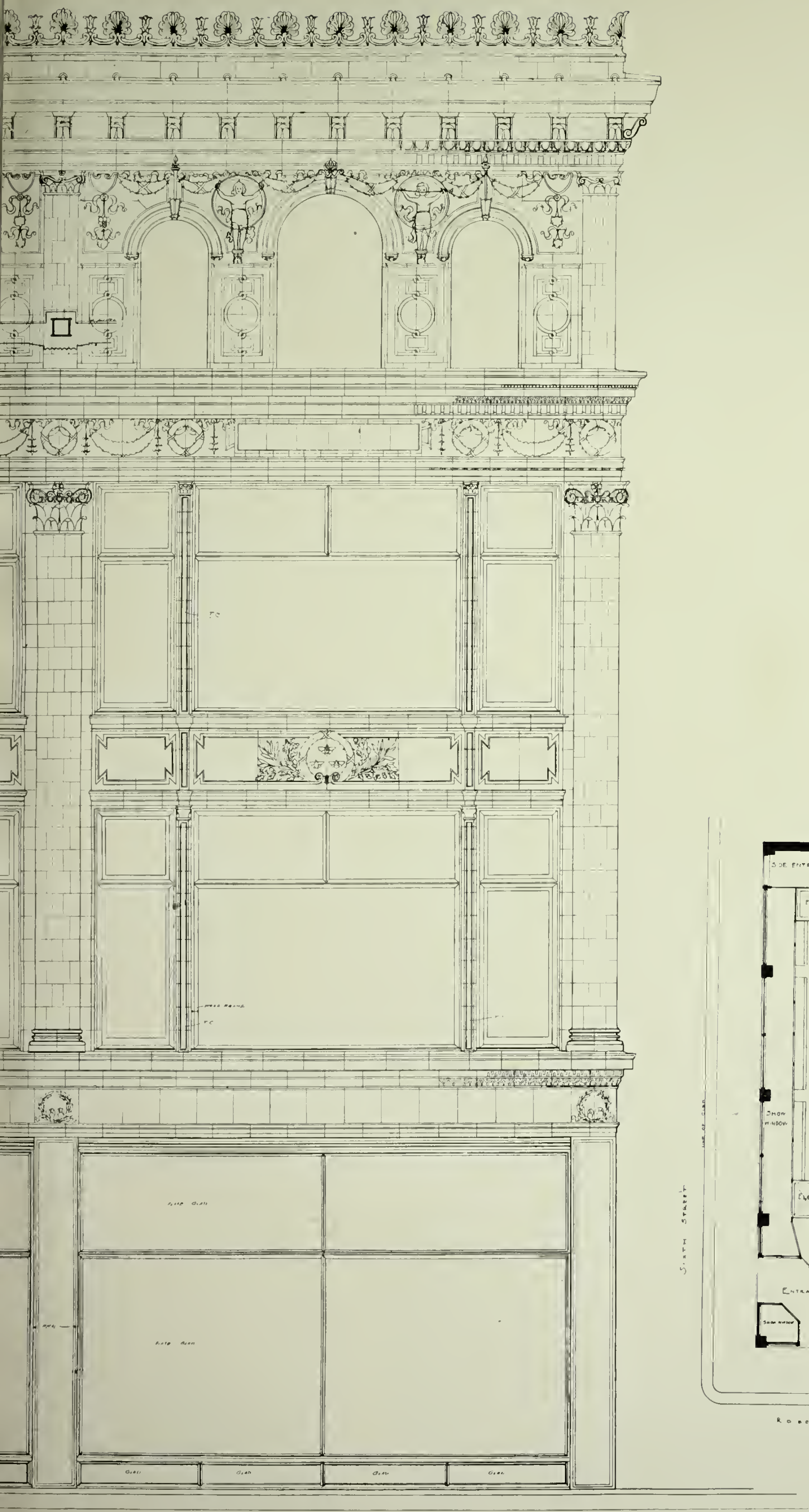


Front Elevation.

BUSINESS BLOCK, ST. PAUL, MINN.

CASS GILBERT, Architect.

PLATES 45 and 46.



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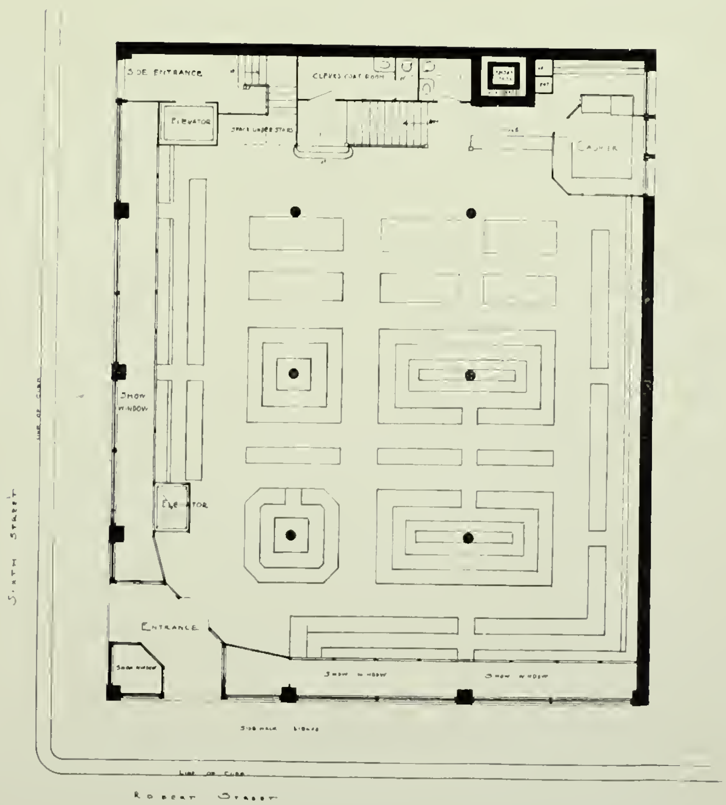
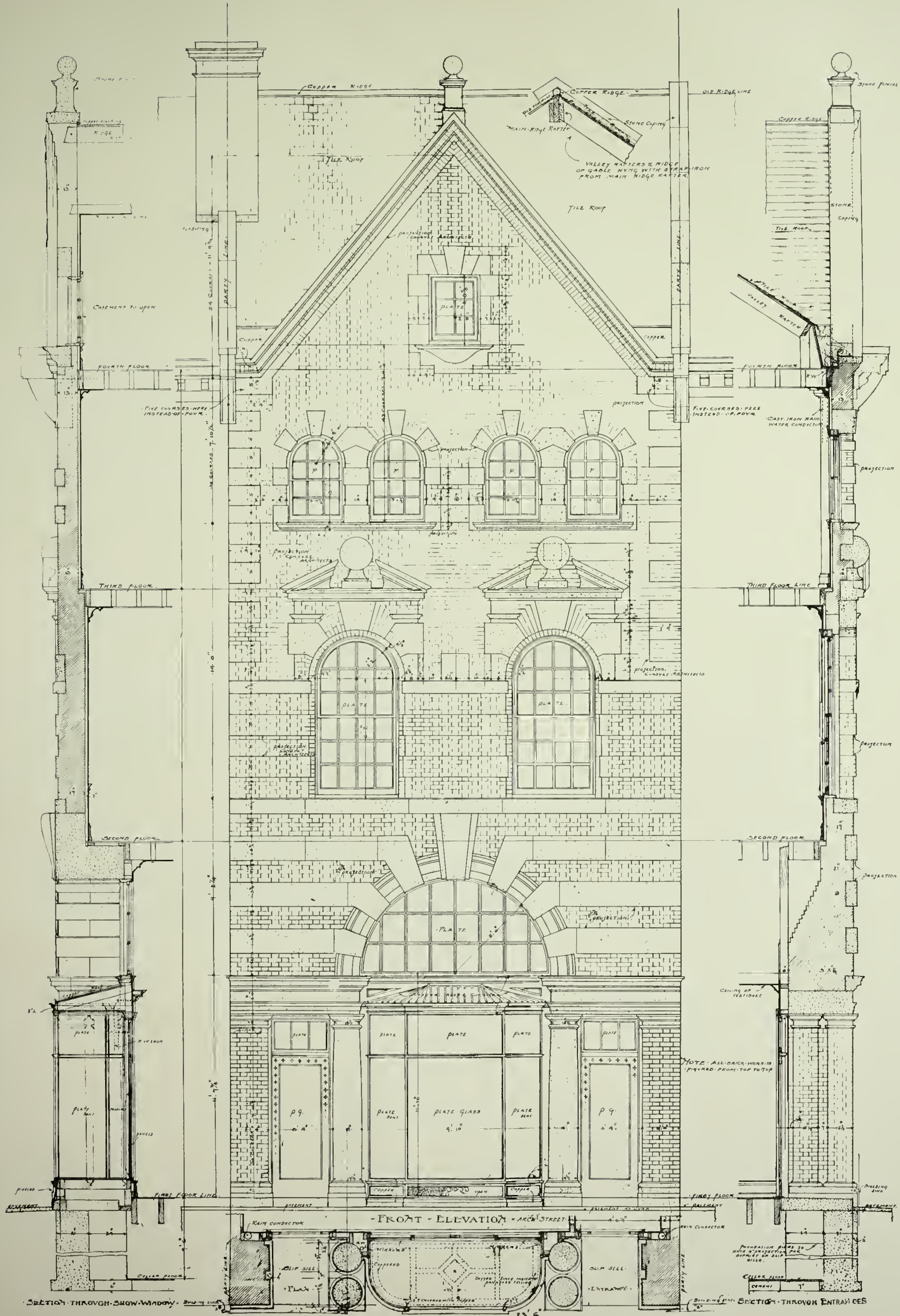


FIRST FLOOR PLAN

Scale ⅛ per Foot



BUILDING FOR THE LUTHERAN PUBLICATION SOCIETY, PHILADELPHIA, PA.

FRANK MILES DAY & BROTHER, Architects.

THE BRICKBVILDER

VOLVME VII JUNE 1898 No. 6

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

ROGERS & MANSON,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

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EXTENSION OF BOSTON FIRE LIMITS.

THE city of Boston has been on the whole quite fortunate in regard to its building ordinances; which, with very few exceptions have been drawn up under expert advice, and in some cases were directly prepared by some of the best architects and builders in the city. Alterations of these ordinances have in general been pretty carefully considered by experts before being presented to the legislature; but opposition which such well-considered improvements of existing laws invariably encounter at the hands of politicians and selfish property owners is of course not peculiar to Boston, but is a condition which our city shares with every large municipality, and the latest proposed change has come in for its full share of unreasoning, selfish opposition. As the laws at present stand, the so-called down-town district, including all of the business portion of the city, and a considerable portion of what is known as the Back Bay, which is now residential, but which is rapidly becoming a business section, is restricted so that no wooden structure except wharves, etc., can be built therein. It has now been proposed to extend the so-called fire limits so as to include a very considerable portion of Roxbury and Charlestown immediately adjoining on the south and north. The change in the law apparently comes at the suggestion of the underwriters, and of those who have the best interest of the city as a whole at heart; and it is an improvement which appears to be supported by the best architects and builders as well as by the majority of the building inspectors, but it seems to encounter a very unanimous opposition on the part of all real-estate owners and operators. The proposed changes, if put into effect, would, in general, prohibit the erection of wooden buildings of any description throughout the whole of the city proper, and a considerable portion of the suburbs, and it is this prohibition which seems to be viewed by the real-estate people as unnecessary, tending to reduce the valuation of the city of Boston, and as a usurpation of the people's rights.

It is taking long generations for this country to appreciate the innate wastefulness of cheap construction, and the traditions of wooden dwellings have been so rooted in our ideas of constructive possibilities that it requires a very determined effort to overcome the kind of arguments which are put forward against such a bill as has just been described. The dangers to a city from the closely contiguous suburban district built up of inflammable construction have been demonstrated so often, and the results of such conflagrations as will arise from time to time in a wooden district are so tremendous, that it would have seemed to be unnecessary to urge the adoption of more restrictive methods. Indeed, we believe that the principal remonstrants to this bill were actuated more by an unwillingness to add any restrictions whatever to their individual plots of land than by any conviction that the proposed law would not in the long run prove an advantage to the city as a whole. And however strongly opponents might argue against brick structures for other people, we have no doubt that if a personal matter were made of it, they would much prefer to live in a residential quarter built up of properly designed masonry houses than to live even upon the borders of a wooden house district. The argument that wooden houses are cheaper than brick ought not to count at all in the consideration of this proposed law. There are very few large cities that are not already possessed of far too many cheap houses, and if a low expense is to be considered, it can be shown by a very simple computation that, taken through a course of twenty-five or thirty years, a well-built brick house is cheaper, costs less money, and will rent for more than one built following the ordinary methods of wooden construction. If we are to have inexpensive residences, they can be built as a more permanent investment, will yield in the long run a better return on the capital, and can be made in every respect more habitable if properly constructed of brick than if of any other material, while the saving in insurance rates and the indirect saving in the exemption from large conflagrations, ought to be considered as of so much public value that private desire for exemption from restrictions would not weigh at all. There seems to be an unfortunate idea that a brick house can only be built as one of a block, that if we are not to build wooden houses we must perforce build long, dreary blocks of brick structures. If this were the inevitable consequence of the extension of this law it would certainly be deplorable; but we believe if such a law were to go into effect, we would see quite as many isolated houses, the city would have more real value, and so far from the houses being more congregated, we believe there would be quite as much isolated construction, and probably more, for in the same districts, given a necessity for a slightly more expensive construction in the first cost, the probabilities are that such structures as are put up would be owned by those who could afford more land around their houses. It seems to us there is every reason for, and no fair, valid reason against, the reasonable extension of the limits wherein nothing but masonry structures should be permitted, and this condition applies to every city in this country.

At one of the hearings on the opposed bill a suggestion was made by Mr. William Atkinson, an architect of this city, which as a compromise measure is certainly deserving of careful consideration. Recognizing the reluctance of property owners to yield to limitations upon their property, he suggests that the act be in such form that structures of wood must be separated from each other by a considerable distance, not less than twenty feet, so that the conflagration of large blocks of wooden structures can be avoided, and the fire loss correspondingly diminished. Mr. Atkinson expressed a belief that under such a law as this the property owners would find it cheaper to build of brick and cover more of their land, and that the final result of this law would be in time the same as if nothing but brick were to be allowed. This amendment is a good one, though we feel that the quicker a great city can arrive at a basis of reliable, fairly fire-retarding construction, the better it will be for both the individual property owner and the city at large.

A FIRE occurred at night, April 2, in the new building of the American Soda Fountain Company, 278 Congress Street, Boston. The night watchman, in going his rounds, noticed that a sprinkler had opened, and, being entirely ignorant of the fire, rushed to section valve on first floor and closed it. The sprinkler alarm was ringing but was unheard by the watchman, it being located in a closed room on the first floor. The floors were constructed of concrete, and supposed to be waterproof, but allowed the water to run through and caused damage to be done to four stories. The action of lime (in concrete) with water passing through caused silver-plated ware to be turned black, necessitating replating and polishing.

THE American Institute of Architects has leased the Octagon House, perhaps better known as the "Tayloe Mansion," Washington, D. C., as a permanent home for the Institute. The building is an interesting specimen of brick colonial architecture, both in its detail and well-studied plan. A committee has been appointed to put the building in thorough repair and make needed alterations. It will in the future serve as the regular gathering place for annual conventions.

THE New York chapter of the American Institute of Architects has submitted the following names to Mayor Van Wyck for appointment on the commission to formulate a new building code for Greater New York: George B. Post, Louis de Coppet Berg, Cyrus L. W. Eidlitz, L. F. J. Weir, R. W. Gibson, and George Keister.

THE Thirty-second Annual Convention of the American Institute of Architects is to be held in Washington, D. C., on Tuesday, Wednesday, and Thursday, November 1, 2, and 3. The local committee of arrangements consists of Messrs. Glenn Brown, Robert Stead, and Edward Donn, Jr., all of Washington.

THE Rotch Scholarship for 1898 has been awarded to Mr. L. C. Newhall, of Malden, Mass., a draughtsman in the office of Mr. Arthur H. Bowditch, of Boston. Mr. Newhall is the fifteenth holder of the scholarship.

NEW YORK insurance companies are willing to insure the new thirty-two story fire-proof syndicate building on Park Row, New York City, for $675,000, for five years, at a total premium of $675.

THE vacation traveling scholarship, instituted a year ago by the Boston Architectural Club, has been awarded for the present year to Mr. Albert C. Fernald.

THE new building ordinance of Chicago limits the heights of buildings to ten stories and 130 ft.

PERSONAL AND CLUB NEWS.

W. DOUGLAS HILL, architect, has removed from Pottsville, Pa., to Newport News, Va.

H. A. BETTS, architect, Milwaukee, Wis., has removed his office from the Goldsmith Building to the Colby & Abbott Building.

CHARLES E. DAWLEY, architect, has opened offices in the Bushnell Building, Springfield, Ohio.

THE Tenth Annual Exhibition of the work of the pupils of the Detroit Museum Art School was held in the east gallery of the Detroit Museum of Art from June 1 to 5.

THE WASHINGTON ARCHITECTURAL CLUB held its annual meeting Saturday, June 4, and elected the following officers for the ensuing year: President, Edward W. Donn; secretary, Arthur B. Heaton; treasurer, W. D. Windom; directors for two years, T. F. Laist and W. J. Marsh; for one year (to fill unexpired term) T. J. D. Fuller.

After the election, the constitution of the Fine Arts Society of the District of Columbia was accepted and the following delegates to that body were elected: T. F. Laist, W. D. Wood, T. J. D. Fuller; and as alternates, W. D. Windom, P. C. Adams, and E. R. Crane. Frank Upman and Harry Dodge Jenkins, of the Chicago Architectural Club, were admitted to membership.

ILLUSTRATED ADVERTISEMENTS.

THE accompanying illustration, representing the "Good Samaritan," is a panel in terra-cotta executed by the New York Architectural Terra-Cotta Company.

Number twelve of the series of "Brick and Terra-Cotta Fireplace Mantels," of which J. H. Ritchie is the designer, is illustrated in the advertisement of Fiske, Homes & Co., page vii.

The residence of James G. Pontefract, Esq., at Allegheny, Pa., of which Longfellow, Alden & Harlow were the architects, is illus-

trated in the advertisement of the Harbison & Walker Company, page xv.

A staircase (Guastavino construction) in the open shaft of an eight-story hotel is shown in the advertisement of R. Guastavino Company, page xx.

Two views of the plant of the Celadon Terra-Cotta Company, at Alfred, N. Y., one of the factory in 1888, and the other of the plant as it is to-day, are shown in the company's advertisement on page xxvii.

PLATE ILLUSTRATIONS.

PLATES 41 and 42. Phillips Brooks House, Harvard College, Cambridge, Mass., A. W. Longfellow, Jr., architect. After the death of Bishop Brooks his classmates decided to erect a building as a memorial to him and to his unlimited interest in the religious life of Harvard. It was decided to raise $300,000 and to call the building Phillips Brooks House. The endowment was to be applied under the direction of six trustees, of whom no more than two were to belong to the same religious denomination.

The committee raised much less than was expected (only about $50,000), and so the original broad plans of erecting a building "dedicated to the comfort and succor of all in the college world who were in trouble, sorrow, need, sickness," had to be given up, and only the chief purpose, affording a home and workshop for all forms of spiritual activity and benevolent action in the university, could be realized.

The building is to be on a line with Holworthy and behind Stoughton in such a way as to form, with Holden Chapel in the center, a pendant to Harvard Hall, and to give a generally symmetrical arrangement to that portion of the yard. Its position has been further emphasized by a colonial treatment of red brick with light stone trimmings in keeping with the design of Harvard Hall and the other old brick buildings. The same height of cornice has been followed, and the feeling of the old work has been preserved as far as possible.

OCTAGON HOUSE, WASHINGTON, D. C.
Recently leased by the American Institute of Architects for permanent headquarters.

It has been found necessary, from an architectural point of view, to reconcile the building to its position by a frank treatment of the triangular space in front. This has been made into a forecourt by means of a wall on the east running to the street, and by carrying along the front a fence of iron with brick posts and an ornamental gateway in keeping with the Harvard gates. This fence, if continued on either side in the future, will serve to reconcile the building still further to its position. The court in front is designed as a small, quiet garden to be laid out with vines and formal planting toward the street, and a stone seat against the wall at the widest part.

PARLOR MANTEL, OCTAGON HOUSE.

Plate 43. Detail of porch and front entrance, Phillips Brooks House, at Cambridge, Mass., of which A. W. Longfellow, Jr., is the architect.

Plate 44. Building for the Lutheran Publication Society, at Philadelphia, Pa., Frank Miles Day & Brother, architects.

Plates 45 and 46. The Bowlby Building at St. Paul, Minn., Cass Gilbert, architect. It is built of cream-white terra-cotta. The figures of the boys in frieze, and the circular panels back of them are done in color, and are finished in enamel in some parts, and glazed in others, the enamel being an opaque material, and the glaze being transparent, showing the terra-cotta through.

Plate 47. Warehouse building for T. Blood & Co., at St. Paul, Minn., of which Cass Gilbert is the architect. The Boston Northwest Real Estate Company are the owners.

Plate 48. Business block, St. Paul, Minn., Cass Gilbert, architect. The façade of this building is made particularly interesting by the color scheme introduced. It is built of a reddish-brown brick in two shades, the color being arranged in patterns, as indicated in the illustration.

HALL, OCTAGON HOUSE.

The American Schoolhouse. VIII.

BY EDMUND M. WHEELWRIGHT.

IN the sketch plans submitted in competition for the Providence High School, the central window generally placed in the wall opposite the teacher's desk is omitted. This is a method of fenestra-

HIGH SCHOOL, NEW BRITAIN, CONN.
William C. Brocklesby, Architect.

tion often found in French schoolhouses. In the Brookline High School (for plans see second paper of this series) there are no windows in the walls facing the teachers' desks, in that following the method generally found in German schoolhouses.

In the Brookline High School toilet rooms are arranged in mezzanines of the first story. These rooms are accessible from the staircase landing and give a compact and convenient arrangement. In this school appear also features which, I believe, were novel when the building was built, but which have since become well-nigh constant in large high schools, — a bicycle run to basement, and storage room for bicycles.

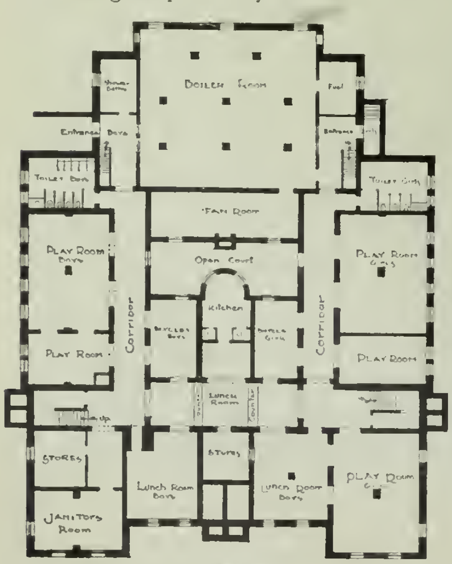
In our latest high schools we find the lunch room no longer a makeshift arrangement, but that it has become one of the customary and carefully considered requirements of such buildings. This feature was well provided for in the Cambridge High School, and again in the Brookline school, as it is in nearly all the large high schools built during the past few years.

It will be remembered that Dr. Philbrick speaks in his report of his desire that such a lunch room should be established in the Latin and English High School of Boston.

The Cambridge and Brookline schools have separate wardrobes adjoining each schoolroom. In the Brighton High School (see plans in second paper of this series) the pupils' clothing is kept in individual lockers in the basement. This later method of clothing disposal was, I believe, first introduced in the schools of Cleveland, Ohio, whence the idea came for its use in the Mechanic Arts High School in Boston. It was later used in the Brighton High School, and is that adopted in the designs of several new high school buildings which are about to be built in Boston. This method of disposing of the pupils' clothing permits more economical planning than the arrangement of separate wardrobes for each schoolroom. It is found to be entirely unobjectionable, and since it dispenses with the separate wardrobes, a feature developed from the necessities of discipline of the graded schools, it would appear to be the most desirable arrangement for high school pupils.

The lockers are made of ash with floors, and top and bottom panels of the doors of strong wire netting. If it is necessary to economize space, the floor area of each locker need not exceed 16 by 16 ins., and it would seem feasible, if closer arrangement were found to be necessary, to arrange the lockers in two tiers, with access given to the upper tier by a ladder running on a track, an expedient sometimes used to reach the upper shelves of a high bookcase. The lockers may be fitted with inexpensive combination locks, in which case the janitor keeps the record of the combinations, or each pupil may be provided with a key, the janitor having a master key. The rooms in which these lockers are placed should be sunny, if possible, and it should be strongly ventilated. It is better to have

SECOND FLOOR.



BASEMENT.

GROUND FLOOR.

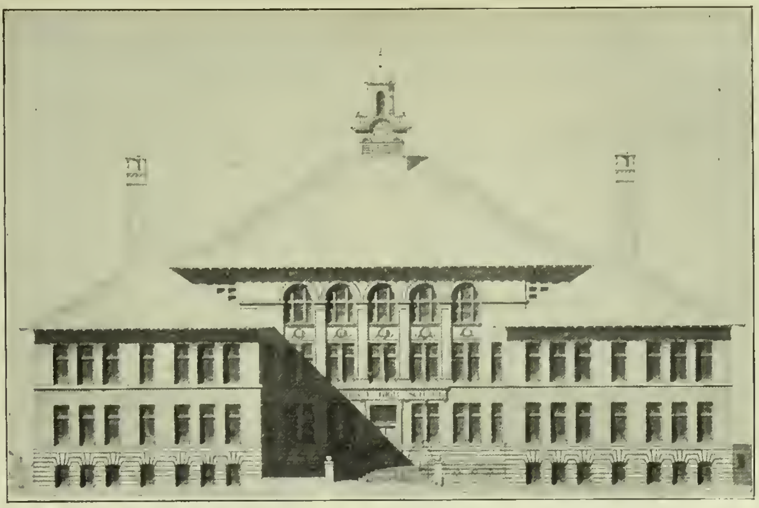
FIRST FLOOR.

HIGH SCHOOL, NEW BRITAIN, CONN.

the room ventilated through the lockers than to have the lockers ventilated through the rooms.

The "hospital" or "emergency" rooms were, I believe, a feature first introduced in the Cambridge High School. These rooms are provided in the Brighton High School and the New Britain school.

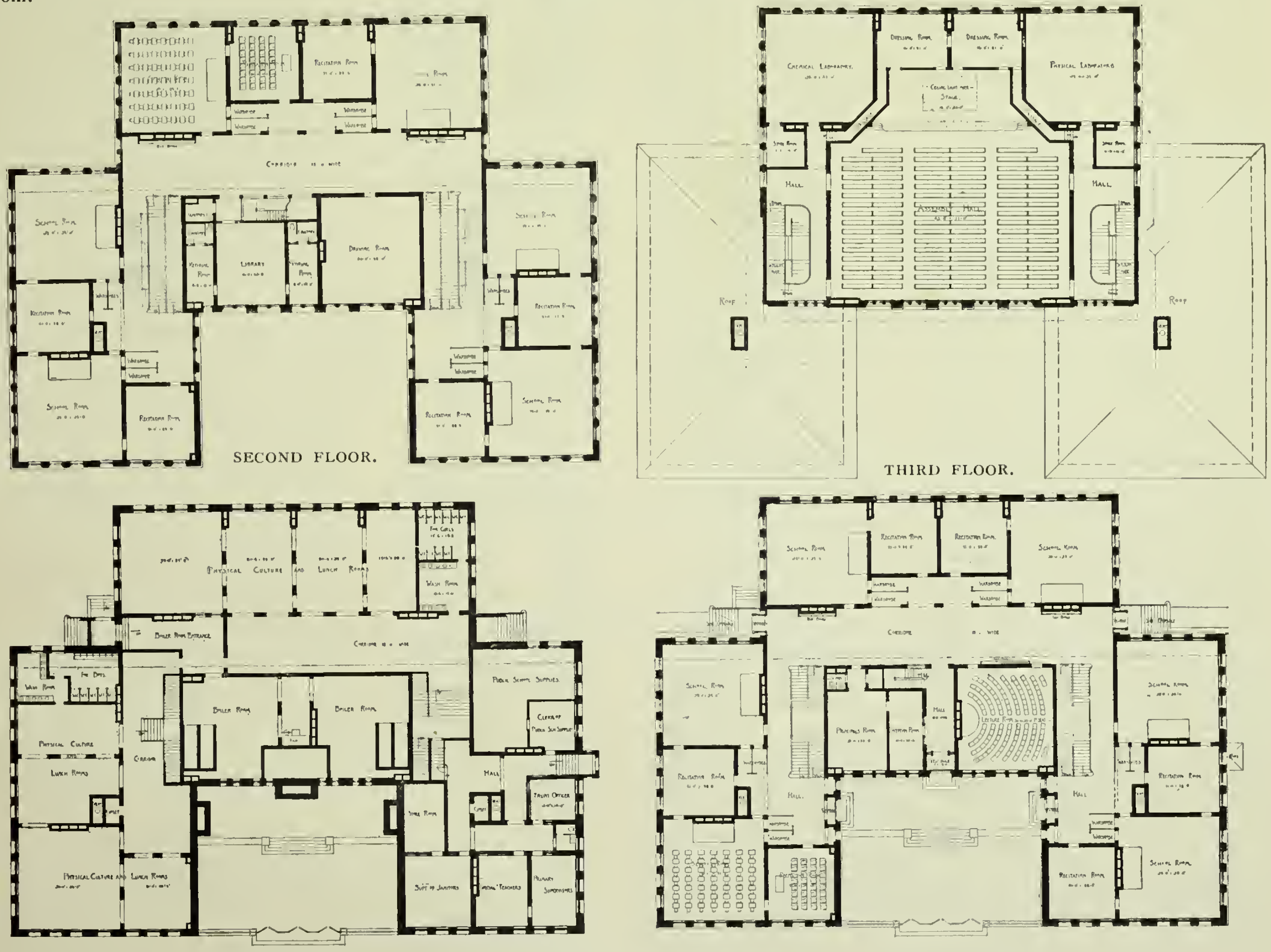
This last-mentioned school is a remarkably compact and well-planned building. It has all the essential requirements of the very latest high schools. The rooms for pupils' clothing are placed upon each story, and does not follow the grammar grade method of separate wardrobes adjoining each schoolroom.



DESIGN SUBMITTED FOR HIGH SCHOOL, PROVIDENCE, R. I.
Stone, Carpenter & Willson, Architects.

The library is becoming a more important feature in high schools and in grammar schools also. This room may be given a northerly exposure. This exposure is that most desirable for drawing rooms. It is requisite that physical laboratories should have one wall with exposure to the sunlight. The room for storage of physical apparatus should be made as secure from the admission of dust as is possible.

As the methods of instruction in high school houses approximate more closely to that pursued in our colleges, it would be possible to effect considerable economy in the con-



SECOND FLOOR. THIRD FLOOR.

BASEMENT. HIGH SCHOOL, PROVIDENCE, R. I. FIRST FLOOR.

The only later-day feature which appears to be lacking in the New Britain school is a bicycle run to basement. The central light shaft is designated upon the plan as a "courtyard." This is a misnomer, as the dimensions of this feature do not warrant such a title; indeed, the space here assigned would appear to be even too scant to light satisfactorily those rooms on the first floor which gain their light from this source. The gymnasium has a running track in the gallery which is served by two staircases. Lockers for both sexes adjoin the gymnasium, receiving light from the central light shaft.

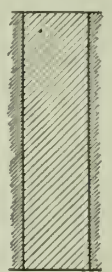
struction of high schools if, instead of providing schoolrooms to accommodate between forty and sixty pupils, large rooms for one hundred pupils were given. Such rooms are generally provided in English and French schoolhouses. This arrangement would make a large number of recitation rooms desirable. Recitations of small classes may, however, be conducted in these large rooms without disturbance to those who are at their studies. Such a method would appear to tend towards the goal of the most enlightened educators and the development of increased self-reliance at least among pupils of the high school.

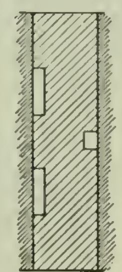
Architecture of Apartment Buildings.

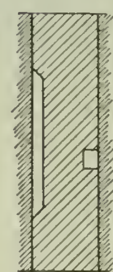
I.

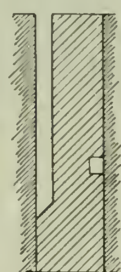
BY IRVING K. POND.

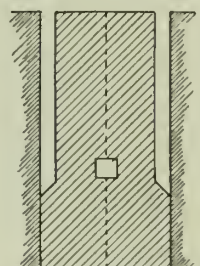
APARTMENT buildings offer about as great variety in plan as do the ordinary city residences, up to and including even the more expensive detached houses. It is due in great measure to structural necessity that the various stories of an apartment building repeat, with slight variation, the chord (or discord) struck in the principal story. It is through no such necessity that house after house, in block upon block, drums monotonously on one note. This is due in part to lack of imagination in the designer, — which is a misfortune; but in greater part it is due to the general desire of speculative builders to give little and receive much, — which is a fault. This misfortune has led in apartment buildings to a deal of trivial and inconsequential planning, and the fault has so overcrowded the ground, to the exclusion of light and air, as to bring it under the ban of State and municipal authority and make the tenement house and the apartment building in crowded centers of population subjects for serious consideration to the philanthropist and social reformer.

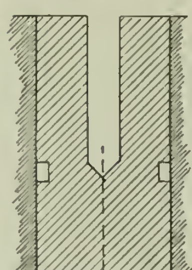

FIGVRE 1

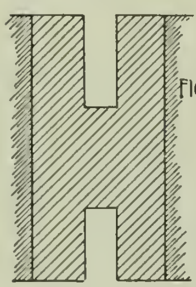

FIGVRE 2

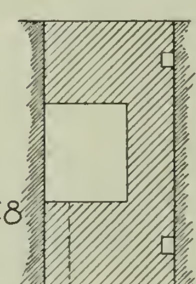

FIGVRE 3


FIGVRE 4


FIGVRE 5


FIGVRE 6


FIGVRE 7


FIGVRE 8

If lack of imagination, with its resultant dreary commonplaceness, is indeed a misfortune, no less so is untamed imagination, with its equally trivial and perhaps more harmful emanations. Generally, however, where a too vivid imagination seeks to play about a problem affecting returns from financial investment it will meet restraint in the conservatism of the investor, voicing what he believes to be public opinion.

Unfortunately, this conservatism makes against innovation wrought out by trained skill acting under guidance of cultivated imagination almost as effectually as it curbs the playful antics of the untutored mind. It is this conservatism which makes difficult the first step beyond the bounds of what is (and being *is*, supposedly, is right). The reformer moves, and laws embodying sanitary measures appear; he may move again, and laws are enforced. The philanthropist takes up the work, and sanitary tenements arise amid wholesome conditions; but real estate investors as a body are neither reformers nor philanthropists, and do not move except as public opinion impels. One, adventuresome, takes a step in advance, or the step may be taken in meeting a certain contingency; should the result prove popular, others follow. This statement is in no way made to hold the investor up to blame either because of his seeming timidity or because of what really may be a reasonable conservatism, but it is made simply as a statement of fact which in itself explains the apparent slowness in the development of the medium type of real estate and apartment house, and shows sufficient reason why the many radical ideas in which their authors see naught but good (and which indeed they may contain) are not on the instant realized in permanent building materials.

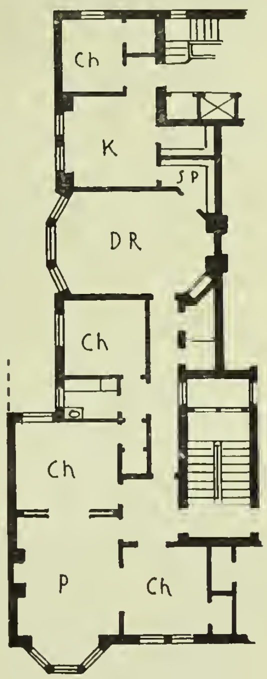
Yet none the less, in spite of conservatism and ingenuity lacking in real vitality, the apartment building has developed in plan till now numerous and distinct types exist side by side. It is the purpose of this article to present for comparison and for contrast various of these types.

The relative importance of apartment buildings and single or private houses in modern social and domestic economy needs not to be discussed here. The apartment is here and will develop as long as men crowd into the existing centers of population or create new centers. The apartment is very much in evidence in modern domestic economy, for it was the necessity for economy which first suggested it; and the idea of economy will not separate itself from the idea of the apartment for some time to come. The economical housing of the multitude within the gates must be as thoroughly and as scientifically studied as is the economical transportation of this same multitude. Economical, safe, and rapid transit to economical, safe, and quiet domicils is the ideal to be sought in the great cities. It may be too much to expect that rapid transit ever shall become so much of a pleasure that people shall find luxury in the personal employment of its means; but it is not too much to expect that the apartment shall be as convenient in its arrangement and as complete as any house, and while being economical in maintenance, present at the same time high possibilities of taste in its plan and general decorative treatment, so that the ideals of economy, privacy, convenience, and beauty shall be realized.

In even a superficial study of the development of the apartment building its lower form, the tenement house, must be noted; for here the struggle for decency and hygienic conditions began and was fought bitterly, to the outcome that many of the tenements of to-day are better planned as to light, air, and privacy than many of the more recent medium-priced apartments in highly respectable neighborhoods. The first move in tenement-house reform was to bore wells down through the roof and various stories, and so relieve the dark inner chambers which had been utterly devoid of fresh air and daylight. In many tenement houses chambers were in series four or more deep, the second borrowing its light and air from the first, the third from the second, the fourth from the third, and so on. Not infrequently was entrance to the farther compartment to be effected only through the nearer. The "toilet room," to use so unoffensive a name for so hideously offensive a thing, was but a black stench hole, and running water was to be drawn on but one floor. Municipal regulation framed and enforced by philanthropists and reformers mitigated much of all this evil.

That which, next to greed and carelessness, most contributed to this state and still makes the problem of light, and air, and economy of construction a serious one even in the better class of apartments, is the form of the city lot with its long, narrow proportions. The problem of the tenement house was not solved until two or more adjacent lots, even to the extent of a city block, had been utilized for one scheme of building, and, by means of the court-yard, sometimes amounting almost to a park, all light wells had been banished, and all rooms, for what purpose soever, furnished with light and air direct. It is probable that the highest type of apartment building is to develop along this line, that is, about a court-yard or garden. This is the continental idea even where the comparatively narrow lot is to be contended with.

The process of development as regards utilization of ground area may be seen at a glance by referring to Figs. 1 to 4 for the single narrow lot, and to Figs. 5 to 8 for double lots. Fig. 1 shows how absolutely light and air were excluded from the interior portions of the building in many metropolitan tenement houses not many years ago and previous to enforced use of wells, which were sunk as in Fig. 2. The scheme presented in Fig. 2 and its modification, as in Fig. 3, are in use to-day in apartments commanding fair rents, in comparatively respectable neighborhoods of our greater cities, and in many instances without the individual shaft for bath and toilet rooms which is indicated in Figs. 2, 3, and 4. It would be unprofitable to argue with a sane man for a hygienic principle in these enclosed areas for light and air, and all well-wishers of the multitudes who are forced to dwell in apartments look forward hopefully to the day when it will be equally futile to argue their financial benefit to an owner. In many cases this area, where it occurs in the center of a double building, is covered with a skylight at the roof and inadequately ventilated, which indeed would be the case were the skylight removed entirely. The roofing by skylight of shafts which give light and air to chambers or living rooms is barred by law now in every city which has a building code, and the practise must soon become a thing of the past.



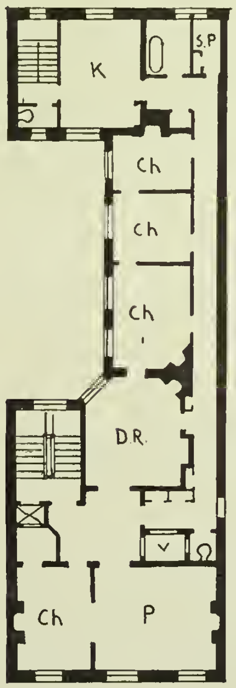
FIGVRE 9

The great step toward agreeable and sanitary conditions was made when the scheme suggested in Fig. 4 was adopted, and this scheme is now at the base of the plan of the great majority of better class apartment buildings in our city blocks. Of course the ideal sanitary condition is far away, while the bath rooms of more than one apartment give upon the same enclosed shaft, and is not reached until bath rooms open to the free air; but the court, unenclosed at one end and free from ground up, is a great advance, and depends only on its width and direction toward the sun to be ideal, from the sanitarian's point of view. Figs. 5 and 6 show possible combinations of the scheme in Fig. 4 on a double lot. The combination shown in Fig. 5 on a double inner lot is to be employed in general only under the necessities of strictest economy, for unless additional light from neighboring lots is assured, or the double lot itself is more than customarily wide, the divided court is insufficient for first-class apartments. In the scheme in Fig. 5 there is a great economy in walls and foundations, and if the bath rooms are placed on the inner shaft, cost of plumbing and sewers is reduced; but this latter saving is not commensurate with the advantage in sanitation and privacy which is gained by placing the bath rooms on the open court.

Figs. 7 and 8 present other schemes for the introduction of light and air into buildings on double lots. The idea in Fig. 7 is to shorten the narrow light courts and more effectually cheer the inner portions of the structure. To make an effective façade, the courts in this scheme should be wide enough to form a terrace or garden. Fig. 8 presents a continental scheme with apartments fore and aft, and a court sufficiently extensive to be capable of an attractive treatment in its gardening, and effective in architectural surroundings.

In discussing in detail the possibilities of arrangement within various outlines, any scheme possible within the outlines laid down in Figs. 1, 2, and 3 may be ignored as unworthy of further study, for no plan can be considered seriously in which living rooms give upon an enclosed shaft, or even upon an enclosed court, unless that court be more than ordinarily ample, so ample indeed as to amount to a free air space. One can conceive of a court entirely hemmed in, which by its size and condition shall be open to the rays of the sun, and so be more sanitary than some long, narrow, open courts into which the sun hardly can penetrate; but however courts may be employed, shafts on which open other than stairways or subordinate toilet rooms are to be shunned.

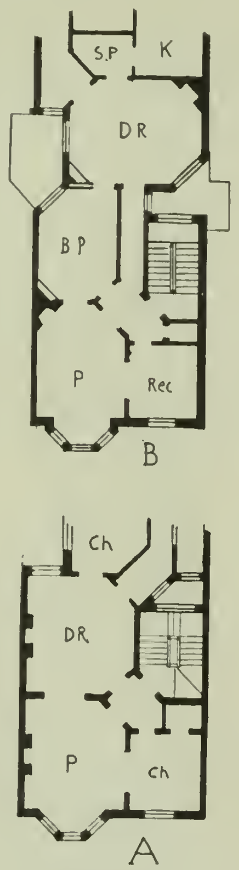
Also to be set aside as unworthy of consideration are all types of plans in which chambers, or living rooms, or general toilet rooms are to be reached only by passing through other rooms. To maintain the dignity and at the same time preserve the privacy of the family life has been the study of the best designers of apartment buildings in recent years. It is a comparatively modern and altogether American idea that the chambers and toilet rooms of an apartment should be as isolated as are the same rooms in a private house. The seemingly necessary position of the kitchen in the rear of the apartment has hampered the development of this idea. Because the kitchen was at the rear of the house seemed, probably, sufficient reason for placing it at the rear of the "flat," and besides, that is the position always given to the kitchen in the apartments of the French who, at least until recently, had been considered masters in the art of apartment planning. The American idea, which finds no prototype in the French or English, is that the dining room, serving pantry, and kitchen shall be *en suite*. This has led to the development of a type shown in Fig. 9, a type which, in greater or lesser degree of perfection, rules in our cities to-day. The long intervening corridor between dining room and living room or parlor, as it generally is called, which necessitates passing all chambers in the tour from one of these rooms to the other, is held to be the objectionable feature of this arrangement, and objectionable it is if chambers open directly from it on one side, and toilet room directly from it on the other, as is too often the case; but the majority of owners and designers balance over against this objectionable quality the great economy in space which is effected by this plan, and economy seems the more to be desired, and this type prevails. When the building lot is small and is completely utilized from front to rear, and rooms are curtailed in number and are of the least allowable dimensions, one need not argue against this plan; but when there is offered an opportunity to expand, then the belief grows that economy may overreach itself, and that added convenience and desirability will force a more than proportionate return on the small added investment. This added convenience and desirability is coming to be considered a necessity, and consists partly in having the dining room and parlor *en suite*, or, at least, separated by no more than the reception hall, as in the smaller city house. This has been the commonplace in European apartments, and seemingly no other scheme has been thought of. But Americans demand also, as has been noted, that the kitchen shall be very convenient to the dining room, and this, which American designers have accepted as part of the great necessity, and a large part at that, appears never to have occurred to their continental brethren, at least never to have troubled them. The Frenchman has dealt and continues to deal with the problem as indicated in Fig. 10, only that in the vast majority of instances the dining room lies across the antechamber or reception hall from the entrance to the long corridor; and it appears to present no drawback to a French apartment that servants, in preparing and clearing the board, are compelled to traverse the reception hall and the long corridor to the kitchen and serving room beyond the region of the less



FIGVRE 10

important chambers (for the principal chambers are grouped about the parlor or salon, generally). Without doubt it is fine in imagination to behold the great retinue of servants and retainers bearing the steaming meat and the viands in procession along the corridors and through the halls of state, as in good old baronial England; but what food for imagination is there in a lorn maid bearing across the reception hall the lone codfish ball and the belated breakfast tea? However it may be with republican (?) France, it would seem that democratic (?) America demanded that the commonplaces of service be as little as possible in evidence in the home life. That misguided sentiment which made every man's house, not in real spirit, but only in seeming reality, his castle was responsible for much vulgar display of shingled towers, and tin turrets, and brutal, rock-faced walls in the domestic architecture of this country, and a fevered imagination feeding on the life in the medieval castle may well tend, if not restrained, to vulgarize the life of to-day. In the American apartment no deep-seated precedent hampers, and there it is possible to make the setting of a family life which shall be direct and simple, and free from vulgar display and ostentation.

The grouping together of the parlor (and library), reception hall, dining room, and kitchen is purposely to, and does, make possible the isolation of the chambers and toilet rooms from the remaining portion of the apartment. That this separation is absolutely essential to the perfect enjoyment of life in an apartment need not be argued; but when it is achieved at the expense indicated in Fig. 11 (A and B) the plan is worthless and lacking in desirability as compared with the earlier plan developed along the lines indicated in Fig. 9. Fig. 12 shows a development of the newer type, which has been found to be highly attractive. The one point, or rather line in all plans of this general type is the long corridor, which, from an esthetic point of view, is not so attractive as is the stairway of the house, but this must be offset against the convenience of the general plan. And the long corridor of course is necessary only in buildings on the long narrow lot, and it is away from this that designers are striving to get, by various ingenious combinations.



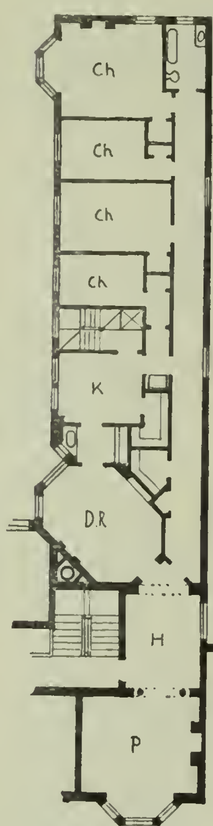
FIGVRE 11

CLIPPINGS.

GREAT importance attaches to the statement made by Mr. L. L. Buck at the last meeting of the A. S. C. E., that deep corrosion results from the contact of limestone in concrete with metal. This fact is said to have become apparent in the anchorage of the suspension bridge at Niagara, the main cables of which are imbedded in a concrete made of limestone. The discovery was recently made that at the points of contact between the spalls and the wires, the latter were badly corroded and in some instances entirely severed. — *Architecture and Building.*

IT is reported that one feature of the new building law for Chicago will be the architects' responsibility for their specifications and the strains and weights in building. In the matter of permits these will not be passed upon unless architects figure out their own weights. This regulation seems naturally to follow in the wake of the new law for licensing architects. They should welcome the responsibility proposed to be thrown on them by the new law. It is one that men skilled in their art can readily meet, and will do more to raise the standard of their profession than the lax, haphazard regulations that have prevailed so largely in the past. Such a regulation will do much to prevent flimsy building. When the highest standard aimed at was to build just good enough to pass the building department frequent accidents were inevitable. No architect will be likely to risk this responsibility, and the result will be that a large class of builders who have heretofore depended upon incompetent draughtsmen for their designs will feel compelled to seek the aid of the architect. — *Architecture and Building.*

ARCHITECTS and owners of real estate should take to heart the discussions which have been going on for some days past among the officers of insurance companies, in relation to the proper rates of insurance for fire-proof buildings of the modern kind. It will be remembered that, a few months ago, reductions were made in the rates of premium on certain classes of buildings in New York. This reduction led to a demand for reductions on other classes of buildings, and to a certain demoralization in rates generally, which, as usual in such cases, resulted in competition among the companies for policies on the best sort of risks. Such risks, apparently, they consider to be presented by the great fire-proof office buildings, and premium rates on these have fallen to a point almost unheard of in this country. One company is said to have offered to write a policy for a million dollars on the Clearing-House Building for five years, for five hundred dollars. This is one cent per year on each one hundred dollars of insurance, and the Clearing House is situated in the middle of a block, on a narrow street, and surrounded by old buildings, so that it is by no means the best risk of its kind. The manager of another insurance company is reported to have said that, "If we wrote fire-proof buildings for nothing we should lose but little. Total destruction of the steel-constructed office buildings of this city is practically an impossibility." Considering how short a time has elapsed since the insurance companies found little or nothing to commend in steel-constructed office buildings, professing to regard them as exposed to frightful but mysterious hazards, from which ordinary structures were exempt, it is with a certain astonishment that we read these new deliverances; but the fact appears to remain that steel-constructed buildings of the sort that American architects have learned to design and carry out can now be insured, with their contents, at a rate which makes it for the interest of owners to erect them. The tendency in all our cities is toward the concentration of masses of goods in warehouses, so that a building costing a hundred thousand dollars may contain a million dollars' worth of merchandise. Supposing the insurance on the merchandise, if stored in an ordinary building, to be 1 per cent. a year, and if stored in a fire-proof building, to be one tenth of 1 per cent., which would still be ten times as great as the clearing-house rate, the saving to the owner of the goods, by having them placed in the fire-proof building, would be nine thousand dollars a year. If the owner of the goods were also the owner of the building, this saving, added to that on the insurance on the building itself, would pay the interest on the extra cost of fire-proof construction over that of the ordinary kind about ten times over; while, even if the owner of the building had no interest in the goods, the owner of the latter would be glad to pay a part of the saving in his insurance in the shape of an extra rent, which would abundantly compensate the proprietor of the building for his extra outlay. — *American Architect.*



FIGVRE 12

Notes on Terra-Cotta for Exterior Polychrome Decoration.

BY ELMER ELLSWORTH GARNSEY.

THE practise of modern architecture involves the solving of the most complicated problems of design and construction; and one has but to visit any large American city to be impressed by the masterly way in which our engineers, architects, and builders have met and battled with these intricate questions.

There is an inspiration in the sight of the huge buildings which tower a score of stories along either side these cañons we call our city streets, and the imagination is stimulated when we contemplate the possibilities of urban architecture in the years which are to come.

It is a new method of construction, rather than a new school of architecture, which has so rapidly developed at our end of the nineteenth century, and it may be said that more triumphs of construction and engineering than of pure architecture have been achieved. But as the utilitarian has always preceded the esthetic, it cannot be doubted that the genius which has already conquered the laws of matter will, in time, bring under equal subjection the more pliant sympathies of art.

No Greek or Renaissance architect was ever confronted with such recurring problems of space and utility, of cost and time; and some of our critics apparently lose sight of this fact; and it may be held a truism in these days that great works of art require both deliberation in conception and despatch in execution, and that these are not to be had at slight expense.

The modern tall building has come to stay, and it must be accepted henceforth as a ruling factor in city architecture.

The area of its base is fairly fixed by the comparative smallness of city plots, and its skyward tendency is scaled by the value of the land in which its foundations are planted. Structural steel and express elevators, those swift *fin-de-siècle* mercuries, make possible the heights attained, and the question of a beautiful city has been reduced in great measure to the solving of the problem of the exterior design and enrichment of these great structures, the clothing of gaunt steel skeletons with coverings of beautiful texture and color.

The ancients had no constructions of steel demanding marble, terra-cotta, stucco, or other veneers, but they applied these incrustations to structures of brick and stone with marvelous effect and durability.

At Girgenti, in Sicily, the stucco still remains on many drums and capitals of columns which have been thrown about by earthquakes and received the buffeting of storms for more than twenty centuries.

In the museum at Palermo are terra-cotta friezes and cornices from Selinunto and other Greek ruins in Sicily, retaining their colors and patterns, which have withstood the ravages of time and the elements for even a longer period; and at Pompeii are found great quantities of terra-cotta antefixes, cornices, water-spouts, and almost every sort of architectonic enrichment, which have undergone the trial by fire as well.

Marbles have crumbled and bronzes have lost their original perfection of surface, while the baser clay still shows the touch of hand and tool impressed in its yielding surface before the dawn of the Christian era.

From the practical point of view, therefore, burnt clay may well be classed among the most valuable materials for exterior veneer, while it is not to be despised as the vehicle for more refined treatment for interior work, and even figure sculpture.

It retains the personal touch of the artist or artisan, and is not a translation by the chisel from an original model in a different material.

But above all other considerations, the value of terra-cotta as an exterior covering or enrichment on modern large buildings lies in its adaptability for color treatment, the absence of which is no less remarkable than regrettable in contemporaneous architecture.

The artistic eye does not seriously resent the typical red brick front with white marble trimmings along the streets of Philadelphia, because the houses are small and do not insist on occupying the entire field of vision; but multiply such planes by ten, placing them one above the other, and what a monstrosity we should behold!

The paler, almost colorless brick, which has had such vogue in recent years, is hardly more agreeable when used in huge unbroken masses, save in a negative way; and architectural color blindness, as exemplified in exterior construction, seems to consist of an absolute inability to conceive of other color harmonies than those of similarity.

To no other source can be traced the conception of these great façades of pallid gray or opaque yellowish white, without a trace of color from the topmost cyma down to the lowest base course, while even the window frames, sash moldings, and often iron grilles as well, are painted "to match."

It would seem reasonable that while the mass of the building might be best expressed in one general solid color, that the decorations of surface and details of ornament would be much more effective, especially at considerable heights, if rendered in contrasting and more positive colors, whether these details are rendered in relief or not.

The diffusion of light and reflections thrown up from below rob shadows and moldings of their true value and reason for being, and the loftier stories of tall buildings seldom appear to have due definition; therefore, if the grounds of entablatures, friezes, capitals, and possibly flutings of columns, decorated moldings, dentil courses, etc., were treated in polychrome, these would all gain in definition as well as in effect, without losing an iota of their intimate relation to the whole structure, while they would bring into the scheme a charming play and sparkle of color.

It would be most interesting to introduce more richly colored terra-cotta in the façades of our large buildings, and the time seems to have arrived when our architects themselves should show a livelier interest in the matter.

Most of these men have always studied architectural problems in black and white, save when perspective drawings were demanded, and they seem to dread to risk their "splendidly null" line or wash drawings to too close acquaintance with the color-box.

In view of this tendency, would it not be worth while to insist that students of architecture should be obliged to study at least a large proportion of their drawings in color? for in no other way is it possible for them to understand the value of color, or to grow into the habit of thinking in color, which must be acquired before its perfect fruits may be brought forth.

The employment of incrustations and insertions of colored marbles in Venetian palaces are too well known to be described here; and the splendid façades of Italian churches, enriched by color in stone and marble, in mosaic, graffito, fresco, majolica, and terra-cotta, are known and admired by all our students and architects who travel abroad; yet when we look about our American cities, where these gentlemen have designed miles of buildings, costing enormous sums of money, how often do we look in vain for the evidences of the influence of that color sense which imparts so much beauty and character to architecture, especially in the classic and Italian Renaissance styles!

It has often been said that the climatic and atmospheric conditions of the north temperate zone are unfavorable for the employment of exterior color, and that while Greek polychrome may have been effective and harmonious beneath the skies of Attica, the same sort of thing would be quite out of place along our northern Atlantic coast.

It is true that our climate differs from that of Greece, but the difference is greater in degree than in kind; for snow is not at all unknown in Greece, neither is our summer sunlight less brilliant than that which gilds the shores of the Mediterranean; and for a large portion of the year our climate may be fairly compared with that of Naples during early summer and late autumn.

Besides, what could be more grateful to our Northern eyes than the warmth and richness of real color on our buildings during that season when leaden skies and snow-covered streets bound our vision, and make us long for sunnier climes and cheerier prospects?

Difficulties in the way shrink into insignificance beside the inviting possibilities of success; and it seems to have been rather a question of willingness on the part of architects, than the public, that has thus far deferred an intelligent consideration of this subject.

Our manufacturers of burnt clay are more competent to produce beautiful effects in form and color than any of their predecessors; for, heirs of the ages which have gone before, they have profited by the experience of fellow-craftsmen of the Middle Ages, as well as by the scientific skill which is at their service to-day.

These men are constantly experimenting with new clays, new furnaces, new colors and processes; and nothing short of a personal visit to the kilns themselves will give one any just appreciation of their achievements and the inherent possibilities of a lump of clay.

For exterior work the colors should naturally be fired in the glaze, as applied pigment of any sort is bound to deteriorate in the course of time: and the range of colors for terra-cotta glazes, already known and proven, is astonishingly wide, and embraces practically all those which would be desirable for either interior or exterior work. Reds, ranging from the palest pinks to the deepest madder tints; blues, from faint cerulean to dark indigo; greens, from delicate malachite to olive; yellows, from primrose to stone ochre; exquisite pale mauves, royal purple and velvety black, — a palette fit for a Titian.

Then, as to quality of color, the American terra-cotta maker does not confine his color effects to highly glazed surfaces, for, while these are useful in many cases, they are not always desirable; so, by certain processes, the brilliancy of the glaze may be reduced to a perfectly matt surface, which in texture is more like the patina of fine old bronze than anything else; and when the color also is bronze-like, the effect is very charming.

It is on molded or modeled surfaces, such as capitals, cartouches, friezes, etc., that this treatment is seen at its best, for in the process of reducing the glaze a slight modification of the relief occurs, so that instead of a sort of wire edge being left on the burnt clay, it is softened in a very subtle manner, appearing to have received the faintest "touch of time"; and as the glaze color is practically left untouched in the depressed portions of the work, a charming gradation of tone results, and a texture as of satin renders such a piece as unique as a piece of old Chinese porcelain.

Thus terra-cotta seems to possess more artistic possibilities, and to admit of more variations of form, color, and texture, than any other equally appropriate exterior veneer; and once it is brought into general and rational use, these possibilities will be increased and multiplied through experience and invention.

As to the planning of an exterior color scheme which shall be satisfactory when executed in polychrome terra-cotta, and built up against the sky, much depends upon the architectural character of the building and its environment.

Anything in the way of exuberant color spread over a great surface would hardly be desirable or admissible: and, on the contrary, very diluted tones would be inefficient at a little distance.

It would seem that as horizontal lines are so valuable in a tall façade, that these might best be emphasized by rich colors; and, to carry this point still farther, why should not an entire story or stories be made of a different color or shade of a color from those above or below? Watch a tall gray or white building or tower at sunset, and note how exquisite are the gradations of tint from the rich, rosy glow at the top to the pearly tones at the base; and why is this not a suggestion for possible color treatment?

The walls of certain northern Italian cathedrals and churches are laid up in alternating courses of black and white, or red and white marble and stone; but as this arrangement lacks variety and gives a distinctly "stripy" effect, it has little to commend it to our use.

The Doge's Palace at Venice has a very beautiful checker pattern in pearl and rose carried over its exterior color walls, which has been imitated at various times with conspicuous failure to reproduce the effect of the original; and taking into consideration the probable softening and improvement of the original through atmospheric exposure for centuries, it is not altogether remarkable that the experiments have not been successful.

An English architect, Mr. Butterfield, tried a checker in red and yellowish brick some years ago, at Keble College, Oxford, in a well-meant endeavor to gain richness of exterior color, but the result was anything but happy, as it is entirely out of keeping with its surroundings,— a sufficient reason for its failure; moreover, the colors employed were too strong, and their contrast with each other is too great for harmony.

The Albert Memorial and Natural History Museum at South Kensington, London, are conspicuous British examples of the use of terra-cotta as a constructive material, but may hardly be considered successful from the point of view of color; and in many cities, both at home and abroad, may be seen other examples of the utilitarian value of this material; but its possibilities as a vehicle of architectural and artistic expression, in form and color, have neither been exemplified nor appreciated.

As tall buildings are more often seen in contrast with the sky than with their immediate neighbors, their relation to the sky color is to be considered rather than to that of adjoining and lower structures; and as to what colors shall look best against the sky, we are not without precedent in the successful coloring of certain domes and spires for suggestions.

The green with which old copper roofs so often clothe themselves is always agreeable against the blue sky, and the color of the light yellowish-red Spanish tiles, quite on the opposite side of the color scale, seems to have been invented especially for its value as a foil to the unclouded heavens.

Again, the colors used by the Della Robbias — deep blues, a sort of emerald green, tawny yellow, and a brownish purple with a paler golden yellow — seem to form a complete scale for architectural color composition. In fact all colors may be used in association, provided their values as lights and darks, and the relative surface which they cover, be taken into consideration.

Given the desire for exterior color, or polychrome decoration of large buildings, which undoubtedly exists to-day, there are but two questions to be argued; namely, how much and what colors, and the vehicle or material which is to be colored.

The answer to the first is to be found in the artistic perceptions of those who ask it: as much color and as many colors as may be required to produce a rich and dignified effect.

A description of the walls of the ancient city of Ecbatana, in Persia (from *Enc. Brit.*, 9th Ed., Vol. II., p. 399), which deserve particular mention on account of their being among the earliest examples of constructive coloring on a grand scale, does not seem out of place here, although we are hardly ready for such a gorgeous scheme in America.

"The walls are said to have been 75 ft. broad and 105 ft. high. They were seven in number, one above the other, on the sides of a conical hill, and colored in succession, white, black, scarlet, blue, orange, silver, and the innermost gilt."

Restorations of the great Hall of Xerxes, by Chipiez, show a high cornice with many decorated members, the grounds of these colored in pale yellow, mauve, and blue, with the reliefs accented by touches of stronger value, vermilion, yellow, and rich blue, the whole effect resembling the bloom of an old rug. The frieze of arches from Susa, a full-size reproduction of which may be seen in the Louvre in Paris, shows the figures of men modeled in relief, on a large scale, with the costumes in different tones of yellow, blue, and mauve against a background of broken blues, the whole having been modeled in clay, colored, and then cut into bricks before firing, after which they were laid up into the wall in accordance with their original positions.

These examples show that the palette is practically unlimited, and that almost any scheme of richness or simplicity may be executed in permanent form.

For interior or protected work the colors need not be "fired in"; but tempera, water-colors, or oil-colors, with gilding, may be used, and thus terra-cotta may receive as elaborate and finished decoration as any other substance.

As to what material is best adapted for polychrome architectural decoration, either external or internal, terra-cotta possesses so many obvious advantages, both utilitarian and artistic, that no other may be favorably compared with it.

One way to go about the study of exterior color is first to visit the kilns where terra-cotta is made, there to study the material itself in its various forms and developments, that its possibilities or restrictions may be properly understood; for there is no more potent influence than that of material on art expression. Observe what has been done, and then make suggestions as to what is desirable in a particular instance.

ON THE SALINE EFFLORESCENCE OF BRICKS.

THE MEANS OF AVOIDANCE.

BY DR. OSCAR GERLACH (PH. D., BERLIN).

I NOW pass to the part of my subject which is concerned with the avoidance of efflorescences, and for the sake of clearness I shall briefly recapitulate the modes of origin, taking up the means of avoidance in connection with each separately.

WHITE EFFLORESCENCES.

Sources.—I. *The Green Clay.*

1. Caused by the antecedent presence of sulphates in the clay.
2. Caused by the formation of sulphates during the storage of the clay.

Sources.—II. *The Manufacturing.*

1. During molding.
   - *a.* Caused by the presence of sulphates in the water or coloring matter.
   - *b.* Caused by the formation of sulphates during drying.
2. During burning.
   - *a.* Caused by the water-smoking.
   - *b.* Caused during burning.

Sources.—III. *Environment of the Bricks and Buildings.*

1. Caused by the absorption of saline solutions from the soil of the place of storage.
2. Caused by the absorption of soluble salts from the soil on which the building stands.

YELLOW AND GREEN EFFLORESCENCES.

1. Organic in character — caused by the action of vegetable micro-organisms.
2. Inorganic in character — caused by soluble vanadiate salts.

Source I. *The Green Clay.* The quantity of sulphates antecedently present in the clay is usually not very large, but 0.1 to 0.05 per cent. is quite sufficient to impart to the product an annoying white incrustation. To prevent this efflorescence, the soluble salts must be converted into insoluble by the addition of appropriate chemicals. The most effective and the most economical are the barium compounds, and particularly carbonate of barium and chloride of barium. Barium salts possess a strong affinity for sulphuric acid. When barium salts come into contact with sulphates, an immediate transformation takes place, the sulphuric acid combining with the barytes to form sulphate of barium — a combination absolutely insoluble in water. Expressed in chemical formulæ, the transformation of the calcium sulphate with the barium compound above mentioned is as follows: —

Sulphate of Calcium		Carbonate of Barium		Carbonate of Calcium		Sulphate of Barium
$CaSO_4$	+	$BaCO_3$	=	$CaCO_3$	+	$BaSO_4$
Sulphate of Calcium		Chloride of Barium		Chloride of Calcium		Sulphate of Barium
$CaSO_4$	+	$BaCl_2$	=	$CaCl_2$	+	$BaSO_4$

In both cases the sulphuric acid is transferred to compounds that are insoluble in water, and so is absolutely incapacitated from producing the injurious incrustations. If these salts are easily and cheaply had, it is indifferent which of them the manufacturer employs; but if they have to be brought from a distance, it is more economical to employ the chloride of barium. The reason of this is plain, from the chemical nature of the salts.

MODE OF EMPLOYING CARBONATE OF BARIUM.

We shall first take up the carbonate. Carbonate of barium is insoluble in water. To procure a uniform effect, therefore, the salt must be mixed with the clay very thoroughly and in as finely powdered a form as possible, because the transformation of the soluble sulphates takes place only where the two salts come into immediate contact with each other. The amount required is relatively very small. But since it is difficult to mix small quantities with the requisite thoroughness, a large excess of carbonate of barium should be employed, say from ten to twenty times the amount which is theoretically sufficient, in order to ensure the conversion of all the soluble sulphates into insoluble salts of barium. The excess of carbonate of barium is not injurious, since it is absolutely insoluble in water.

I will now give examples of how the matter is to be carried out in practice.

First, the clay must be analyzed and the amount of sulphates in it determined. Analyses of the kind in question are best made in a special laboratory. Let us suppose the clay contains 0.1 per cent. of calcium sulphate ($CaSO_4$). One kilogram of dry clay contains 1 gram of calcium sulphate. One English pound contains 0.455 gram. One gram calcium sulphate requires, according to the formula, for perfect conversion into barium sulphate, 1.45 grams of carbonate of barium. Hence, theoretically, for 1 kilogram of clay, 1.45 grams of barium carbonate, or for one English pound of clay, 0.66 gram of barium carbonate, must be used. Since, now, for the reasons stated above, ten times the amount theoretically required must be employed, therefore 6.6 grams barium carbonate must be used for every pound of clay. Supposing the green brick weighs 7 lbs., then for one brick 46.2 grams, or for a thousand bricks 46.2 kilograms, or 101.6 English pounds, would be required. A pound of barium carbonate costs 2½ cents. Therefore, for a thousand bricks an extra outlay of $2.50 would be necessary.

Much cheaper is the process if chloride of barium be employed, for here the transformation takes place instantly and more energetically. This salt is readily soluble in water, and in its dissolved condition is uniformly absorbed by the clay particles, so producing an immediate transformation of the soluble sulphates into insoluble. Whilst the carbonate of barium must be used in considerable excess, in employing the chloride of barium it is advisable to keep as closely as possible to the theoretical limit, because too great an excess is quite apt to cause a re-crystallization of the chloride of barium on the surface of the brick, and so to give rise to other incrustations.

THE EMPLOYMENT OF CHLORIDE OF BARIUM.

We use the same clay as before; namely, a clay containing 0.1 per cent. sulphate of calcium. One gram of calcium sulphate requires theoretically 1.8 grams of crystallized chloride of barium ($BaCl_2 + 2\ H_2O$). One kilogram of clay containing 0.1 per cent. sulphate of calcium requires, therefore, 1.8 grams chloride of barium, one English pound requires 0.82 gram chloride of barium.

Supposing, now, the green brick weighs seven English pounds, then one brick would take 5.74 grams, and a thousand bricks would take 5.74 kilograms barium chloride. If barium chloride costs 2½ cents a pound, a thousand bricks, therefore, would require an extra outlay of only 32 cents.

In using barium chloride, chloride of calcium is produced as a collateral product; but this has no injurious effect, since it is readily decomposed at red heat into oxide of calcium, and as such acts as a flux.

In like manner, the coloring matter and the water used should be analyzed for their sulphur, and treated accordingly with barium chloride.

Source II. Manufacturing. If the clay, treated as above indicated with chloride of barium, be used at once, no coloring will be noticeable either on the surface of the unburnt or on the surface of the burnt brick: but if the clay as thus treated be allowed to lie for any length of time, new quantities of iron pyrites will be converted under the influences of weathering into sulphates, and so fresh additions of the chloride will be necessary. If the clay has been made into green brick, the process of drying should be accomplished as quickly as possible, to prevent the subsequent accumulation of sulphates on the surface. On the other hand, quick drying prevents the deposition of possible other salts which are present, on the surface of the products. In general the deposition takes place here preferably in the interior.

It has often been observed that bricks manufactured from sulphurous clays, which come absolutely uncolored from the kiln, afterwards show distinct colorations. This is largely due to the drying. The evaporation of the water takes place in most part on the surface, and most energetically at the places which are most exposed to the draught. And so the incrustations are first and most commonly found on the edges of the product, whilst the spots where the bricks rest upon one another, and where, consequently, no evaporation can take place outwardly, are quite free from colorings. The more quickly the evaporation of the water is effected the less will be the quantity of salts visible on the surface. This is explainable from the following consideration.

The water in the interior of the bricks must ascend through the fine pores to the outer surfaces. If the water ascends slowly through the pores, occasion is given for its saturating itself thoroughly with the soluble salts and so carrying them to the surface.

The phenomenon admits also of another explanation. As stated above, and owing to capillarity, — that property in virtue of which fluids rise by attraction on the walls of minute tubes, — the evaporation of the water takes place mostly on the outer surfaces of the bricks, which constitute a system of fine tubes. Now it is a familiar fact of physical chemistry that very many saline solutions do not rise uniformly and unaltered through such systems, but that they are separated in such a process into pure water and a concentrated solution of the salt. The water hastens in advance of the salt,— and the more quickly, according as the ascent is rapid, or according as the brick is more porous, or according as the evaporation of the water is accelerated at the surface. The pure water will thus first reach the surface and be evaporated there, while the saline solution will be kept back in the interior of the brick, where it will gradually be deposited if no more water is present to dissolve it; but if the progress of the water be slow, the saline solution will reach the surface with it and be deposited there.

The incrustations, therefore, which appear during drying are found more frequently on bricks which are made from oily (plastic) clays than on bricks made from relatively non-plastic or sandy clays. In the former the porous system is considerably restricted, the orifices are smaller, and the water has more obstacles to encounter in reaching the surface. In the latter, — in bricks made from sandy clays, — owing to the greater porosity, the evaporation takes place more energetically, and not only at the surface, but also partly in the interior: first, because the interstices are here much larger; and secondly, because the sand prevents the perfect closure of the pores. This is why the smooth surfaces of pressed brick show the saline efflorescences more than the rough surfaces. By the action of the press the lateral surfaces of the brick acquire a denser structure than the upper and under surfaces. And also in ejection from the press, owing to the friction between the plastic brick and the sides of the form, these same lateral surfaces are still more densely compressed. By this compression the escape of the water is obstructed; consequently, because of its evaporating slowly and gradually, the water carries all the dissolved saline components to the smooth surface, where they are more readily rendered visible than on the rough surface, where, owing to the magnitude of the porous orifices, a partial evaporation of the water, and therefore also a deposition of the salts, occur in the interior.

There is a kindred annoying phenomenon which makes its appearance principally on the rough surfaces of the bricks, when the impressions of the workingmen's hands become visible. Frequently, after burning, certain spots are found colored white, while the remainder of the brick exhibits the normal, desired color. These are the spots at which the brick has been subjected to the pressure of the workingman's hand.

From what has gone before, an explanation for this readily suggests itself. By the pressure of the workman's hand, which is always more or less moist, the pores of the brick are closed at these spots, and the spots themselves made smooth. In consequence of the slower evaporation of the water here, the salts will be deposited at these places first, and the deposition will be rapidly augmented by the constant crystallization at these points of the saline water of the environment.

Another explanation is the following: During drying, salts come to the rough surface of the brick, but owing to the roughness of the same are not visible to the eye. If, now, by the pressure of the workingman's hand these places are flattened, and the minute saline particles crushed, the white coloration will be much more noticeable at these spots than at the remainder of the surface. An illustration will explain my meaning.

Imagine a very large number of minute particles of chalk on a slate or blackboard, and about a millimeter apart from one another. The original color of the board will not be destroyed by the particles. A short distance away, the dark coloring of the board alone will be noticeable; but if we stroke the board lightly with our moist finger, the soft particles of chalk will be crushed and pressed into the granular surface, so obliterating the dark coloring, and rendering the white path of the finger distinctly visible.

ETERNAL vigilance is the price of safety. Wherever a building, or any part thereof, has once come to grief under stress of attack by fire and water, there is proof of the existence of something which demands remedy at the hands of those interested in the development of fire-resisting construction, whose constant aim should be to increase protection and to diminish exposure. The latter is as important as the former. There are too many whose professions of confidence in the efficiency of protective appliances are such as to lead to contempt of danger, and therefore to neglect of such simple measures as guarding against exposures from without by the application of shutters, as the subdivision of space by fire walls, as the use of automatic sprinklers, and whose confidence in the value of fire-protective coverings is so great as to encourage carelessness in their design and application.

That branch of the fire-proofing industries will achieve the greatest success which is most suspicious of the efficiency of its own products, and, therefore, takes greatest pains to bring about improvement in their design, manufacture, and application. Whatever is pronounced by its makers to be "good enough" is sure to be crowded out of the market by those makers who never consider anything which they have done "good enough." If those interested in the manufacture and application of burnt-clay fire-proofing materials will work in this spirit their position will become impregnable.

Fire-proofing.

SOME NOTES UPON THE STRUGGLE FOR SURVIVAL BETWEEN BURNT-CLAY FIRE-PROOFING AND ITS NEWLY ARISEN RIVALS.

(*Concluded.*)

BY DANKMAR ADLER.

SUPPOSE that the architect of the Club House of the Chicago Athletic Association had given more thought to the fire protection of its pillars and less to their ornate wooden enclosures; suppose that the pillars, the girders, and the bottom flanges of the floor beams in the Western Union Building had had protective covering; or suppose that the enormous glass exposures of the Horne Building had had the protection of iron shutters; suppose its floor acreage had been divided by a good fire wall; suppose that a very little attention had been given to the support of its water tanks and to the fire-proofing of the supports. Even if all these things had been attended to as they should have been, even then there would have remained a certain defect inherent to the present methods of manufacture and application of clay fire-proofing material.

I refer to a tendency to break, under stress of exposure to alternations of intense heat with the cooling effect of the application of water, which has been observed at the lines of intersection of face and return members of hollow-tile blocks. This tendency has shown its greatest development at exposed corners, such as are formed by the coverings of beams projecting below the general ceiling surfaces of hollow-tile floor arches, or by the angles of pilasters formed where column coverings project from the faces of hollow-tile partitions and walls, also at the jambs of doors and windows, and still more so at the corners of rectangular coverings of free-standing pillars, even where such corners are rounded. Then there is the tendency of the bottom flange of hollow-tile arches, under stress of alternating heating and cooling, to crack away from the web members, which, if the arches are of the side-web type, cause their destruction; while in the case of end-web arches, while the arch generally maintains its integrity, the ceiling is apt to be lost.

The writer has enjoyed opportunities, in buildings erected under his professional charge, for noting the behavior of burnt-clay fire-proofing materials. These observations have demonstrated quite clearly the great value of burnt clay as a fire-protection covering for the structural members of buildings, but also call attention to the necessity for eliminating the danger which lies in the existence of an inelastic and brittle connection between face and return members of hollow-tile blocks. There is enough difference in the behavior of the protective material, under exposure to fire and water under different conditions of varying methods of application, to point the way to the corrective and remedial measures, which, however, are not stated as being finalities. Further study of the subject may develop other and more valuable suggestions. It is hoped that every one who has made or applied burnt-clay fire-proofing material, or who is in any manner interested in any building in which the same has been used, will make a study of this subject and observe and report upon occurrences like the following at every possible occasion.

Among the buildings under my observation, the Auditorium at Chicago is foremost. Its fire-proofing material is hollow tile made of porous terra-cotta, the webs being quite thick, to the best of my recollection fully 1 in. if not more. Ordinary brick clay was used, and the tiles were not burnt very hard. I remember five different fires in the building. The first, during construction, in a large unfinished room used for storing empty glass boxes, which, being filled with straw, made an exceedingly hot blaze, but caused no damage to the building other than breaking glass and burning window frames and sashes. In the completed building there were two similar fires, each of which burned up the combustible contents of a room, but caused no further damage. There were also two fires in the basement kitchen, where the accidental spilling of grease upon hot ranges set fire to the insulating covering of electric cables carried on the ceiling near by, and these in their turn caused ignition of wooden shelves, cupboards, etc. But no damage was done in either case to the structural members of the building. The writer ascribes the excellent behavior of the fire-proofing in this building to the fact that in the places where the fires occurred there were no angles exposed to irregular expansive and contractive action. The pillars were round and the coverings followed the curves of the metal; the ceilings were flush, and, above all things, the tile was thick. It had been made before the day of the theory that good building is synonymous with approximation to the condition of the captive balloon.

In the Schiller Building, at Chicago, there were two fires originating in the restaurant kitchen, as in the Auditorium, from hot grease spilled into range fires, but which also, like the corresponding fires in the Auditorium, left the structural framework and its coverings uninjured; and there was another fire which attacked the Schiller Building from without, beating upon the enclosing walls of the large court, which were formed of two thicknesses of 4 in. hollow burnt-clay tile blocks. A very fierce fire having arisen in a building about thirty feet away, the intensity of the heat was such as to break all the glass and burn the frames and sashes in the exposed court wall of the Schiller Building, and also to break the glass and burn the paint off the doors and windows in corridors and rooms inside of the building, and from sixteen to twenty-two feet distant from the exposed court wall. The floor and partition construction of the Schiller Building escaped injury, but the enclosing walls of the court were seriously damaged. The outer webs of most of the tiles fell off, particularly at the jambs of the windows, but enough remained intact that the structural steel members of the building escaped injury. The effect of the fire was the same as that observed at the Athletic Association Building, and was quite a vivid illustration of the chief, if not the only weakness of the hollow-clay tile as a fire-protective covering. There were breaks at the lines of junction with return webs in almost every hollow-tile surface exposed to the joint action of hot fire and cold water.

A reasonable inference to be drawn from these observations is, that it is necessary to so form and apply the burnt-clay tiles as to allow for free movement in sympathy with the changes of dimension caused by the action of fire and water, and yet exclude the fire from access to pillars and beams.

I shall cite two instances where this has apparently been accomplished. Both the buildings referred to have wooden joists resting on steel girders, which in turn are supported by round, cast-iron pillars.

In case of one of these, built for Mr. Martin Ryerson, at the northeast corner of Wabash Avenue and Adams Street, at Chicago, the protective material used consisted of solid blocks of porous (fire clay) terra-cotta applied to the pillars and girders and to the under side of joists, while the tops of the joists were protected by a mortar deafening 2 ins. thick. The upper story of this building was used as a manufactory of straw hats, and was filled over its entire surface and almost to its entire height with shelves and racks containing straw braid, and straw hats in various stages of manufacture. The dimensions of the place were 110 by 170 by 16 ft. The building was struck by lightning, and the shelving, racks, straw braid, and hats in the top story consumed by fire. The damage done the building consisted of breakage of glass, burning of window frames and sashes, the burning of a considerable area of floor boards, the partial burning of the 2 by 4 in. strips to which the floor boards had been nailed, the strips having been imbedded in mortar. The plastering was but slightly damaged, as its hold upon the porous terra-cotta was such as to prevent its falling off. This seems to me one of the most severe tests to which fire-proofing material was ever subjected in a building.

It is my belief that the changes of dimension induced by the action of fire and water were taken up in the small air cells of the porous terra-cotta. It is also to be noted that the column covering was circular, and therefore did not prevent any angles for breakage by reason of expansion and contraction.

In another building of Mr. Ryerson's, in which also there were wooden joists, steel beams, and cast-iron columns, the fire-proofing for the joists was made of hard tile, "book tiles" split in half. There was quite a hot fire in this building, then used for storage of wall paper, which fire was also confined to the story in which it had originated, and which also did not feaze either the fire-proofing material or the structural members protected by it. Here the ceiling tiles, which were split book tiles, and practically without return webs, had been so applied as to allow a little lateral motion; and although the fire was quite hot and the water was freely used, the tiles passed through the fire intact and free from cracks. Here, also, the column coverings were circular in plan.

Summarizing the results of these observations of the action of fire upon various forms of fire-proofing material, and noting, also, the published accounts of the conduct of such materials in fires in other buildings, and giving due heed to the published reports of various special tests, I cannot escape the conclusion that the side-web tile arch should not be used at all, even if there is a special protection for its soffit. Such protective covering should, however, always be used, and may be designed upon lines similar to those adopted for the ceiling construction under concrete arches, as, for instance, used by me in the Wainwright Building, of St. Louis, where there is a suspended ceiling of burnt tile (book tile) below a system of concrete arches of large span. While where the end-pressure arch is used protection for the soffit may not be essential to the safety of the arch, yet if it has an independently suspended ceiling that will not come to grief, but will yield to expansion and contraction, as was the case in the Ryerson Buildings quoted above, and therefore its use is advisable. Column coverings should always be made circular in plan. Jambs should be formed of solid blocks of porous terra-cotta, and not of hollow tile.

These changes in current methods suggest themselves to me. Many others, perhaps more valuable, will occur to those more conversant than I with processes of manufacture. Still, when all has been considered, it seems strange how little may have to be done to enable the burnt-clay tile to maintain the claim of its makers, that it is the best fire-proofing material available for ordinary building construction. The modifications of current practise need not be many, but whenever found necessary they must be made. Therefore, I repeat that the side-pressure arch must go, as must also the rectangular column covering with and without rounded corners, unless it be made of solid blocks of porous terra-cotta. The hollow-tile jamb block must be abandoned and solid porous terra-cotta blocks used in its place. While some modification of the form of wall and partition tiles is necessary in order to avoid the cracking away of face from return members, I am not sufficiently familiar with the processes and possibilities of tile manufacture to feel qualified to make any suggestion, but I hope that tile makers may find a simple and effective solution. In making these, as well as all other forms of tiles used in fire retardent construction, strength must be sought for in preference to lightness.

Those interested in the manufacture of clay fire-proofing materials owe it to themselves and to the community which they serve, that they abandon the claim that there is any protective covering which can make a building really fire-proof, or even reasonably fire retardent, unless it is used and applied with ordinary good judgment. It must always be remembered that the hollow-tile arch and the clay column and beam covering will not increase the fire-resisting qualities of glass, and that to leave a single heavily loaded beam or pillar unprotected or inadequately protected may cause the collapse, not merely of this particular unprotected member, but also of large areas of floor and wall resting upon beams connected with it by means of bolts and rivets.

Mortar and Concrete.

HYDRAULIC CEMENTS.

BY CLIFFORD RICHARDSON.

FINISHED CEMENT.

THE best Portland cement is a light gray or neutral tint, with a tinge of yellow and green, and a specific gravity of about 3.15. If the color approaches too nearly white, or is too dark, or has too yellowish a tinge, the burning or composition is at fault. The best Portlands vary somewhat in shade, depending on the amount of iron oxide present, but all have a similar color and one which is characteristic of good cements, and not at all like that of slag or hard-burned natural cement.

If the burning is not satisfactorily carried out the specific gravity of the cement will vary from the normal, as will the volume weight or density, although the latter is also affected by the degree of fineness to which grinding has been carried and the length of time the cement has been stored. The most thoroughly burned Portland cement has a specific gravity of about 3.15, never below 3.10, and rarely above 3.18, at 60 degs. Fahr. At higher temperatures it is relatively less, and for a number of brands recently examined the following results were obtained : —

Brand.	Specific Gravity at 78 degs. Fahr.	Specific Gravity at 60 degs. Fahr.
Germania	3.078	3.175
Alsen	3.079	
Vulcanite	3.036	
Black Eagle	3.075	
Belgians	2.924–3.013	
Sand Cement	2.757	

The best Portland cement should be so fine that not more than 25 per cent. will fail to pass a two hundred mesh sieve, 10 per cent. a hundred mesh, and none a fifty mesh sieve. Coarser cement should command a smaller price, as the amount of sand that can be safely mixed with it is largely dependent on its fineness. It has been found by Le Chatelier that particles larger than those which will pass an ordinary sieve of one hundred and twenty meshes to the linear inch are of little hydraulic value, being slowly decomposed and hydrated, and then not entirely even after a long time. Cement having a specific gravity of less than 3.10 should be looked upon with suspicion. When of normal character of fineness and gravity the volume weight per cubic foot is between 100 and 108 lbs., as packed in barrels commercially, as compared to the 65 to 80 lbs. which natural cement weighs.

SETTING.

Portland cement, and in a similar way natural cement, when mixed with water to a paste, in the form of mortar, becomes hard on standing, or sets. This is the result of a chemical reaction in which water takes an essential part, as it will be found that cements will not harden or set with any liquid which does not contain it. According to the most reasonable theory water plays two parts in the process: in one decomposing the original compounds of the cement and acting as a solvent for the products of their decomposition; in the other combining with these products to form new hydrated crystalline solids which, in their formation and crystallization from the watery solution, bind themselves and the mass together, bringing about the result called setting. The original substances of which cements are composed are, in Portland cements, very basic compounds of lime, with silica and alumina, or iron, which are easily decomposed by water with the liberation of lime and the formation of the hydrated compounds. On the decomposition of the aluminates of lime, when Portland cements are mixed with water, free lime is liberated, and, if the cement is not immersed in water, soon begins to crystallize out in the mass in the form of plates of calcium hydrate, which can be observed under the microscope. If the cement is then, or later, immersed in water, this free lime is gradually dissolved out, and may be detected by the soapy or alkaline feeling which a limited volume has in which the cement is placed. It is also noticed, where cement concrete is placed in water, the volume of which is limited, as a pellicle of calcium carbonate which forms on the surface under these conditions.

This solvent action might go on indefinitely were it not for the density of Portland cement mortar, and unless, as is claimed, the action of carbonic acid of the air or water put an end to it and exercised an important influence in the hardening of cement. At the same time, if there are salts in the water which attack carbonates, no protection can be gained in this way. It is unlikely that there is any lime actually free in a high-grade Portland cement, this being distinctly characteristic of the natural cements, but rather that, in those containing a high percentage of lime, it is in such a state of combination with alumina as to be more rapidly liberated with the evolution of heat in the presence of water than would be the case if there were less of it, or if it were stably combined with silica by harder burning. In fact, it is found that the larger the percentage of lime a cement has the more care must be given to the burning, and the higher and longer the temperature must be in order to bring about the entire combination of the lime in forms which shall not be too rapidly hydrated by water. The calcium aluminate, which has been decomposed by the water with liberation of lime, is the cause of the first or initial set of Portland cement, the less basic aluminate becoming hydrated and crystalline. The nature of the set, whether quick or slow, depends on the amount and basicity of the aluminates; and, as has been shown, when there is too large a portion of aluminates, or too basic ones, the set is fiery. The basic silicates of lime are decomposed more slowly than the aluminates, and contribute chiefly to the hardening of the cement or mortar, as shown by the Newberrys. Portland cement forcibly burned and ground usually sets very rapidly and often becomes heated on mixing with water. For example, 10 ozs. of new cememt mixed with 20 per cent. of water at ordinary room temperature, balled up very much, heated, and on immersion of a thermometer in the mortar an elevation of 23 degs. Fahr. was observed. Such cement is, of course, unsuitable for ordinary use, as it cannot be well mixed and put in place before setting.

If the cement is left exposed to the air and in storage for some weeks it will be found to set slowly, having in the meantime become, to a certain degree, hydrated. It is customary, therefore, to store cement for some time before putting it on the market, but where this is not convenient, a similar result can be brought about in another way. It has been found that burned gypsum or plaster, when added in small amount to very rapid setting cement, has the effect of reducing the set to normal. No more than 1 or 2 per cent. is required for this purpose. Its use is not considered out of the way, and it is a common practise with most manufacturers both abroad and at home. Its action is supposed to be due to the fact that it combines with the basic aluminate of lime and prevents its too rapid decomposition and hydration. If plaster is used in excess, however, it is claimed that it has an injurious effect, especially in the presence of sea water. Portland cement should not set, at ordinary temperatures, in less than an hour, except in particular cases where it may be necessary to use it in presence of water. This slow set is one of the features which distinguishes it from the quick-setting natural cements.

When subjected to cold it will be found that the setting of both kinds of cements is much delayed, and at a freezing temperature will be prevented under any conditions, whereas heat may be made to produce as much effect in a short time as would require weeks at ordinary temperatures. Portland cement will, however, act much more satisfactorily in cold weather than natural, and will eventually attain a satisfactory strength very often where the latter crumbles, especially if once it has attained its natural strength.

Hardening of Cement. Beyond the mere preliminary act of setting or becoming firm there is a change in cement which goes on for a long time, accompanied usually by a continued increase of strength. It may be described as hardening. It involves chemical changes and the rearrangement of the elements of the cement, depending on the action of water and carbonic acid on its constituents. Much water and some carbonic acid enter into combination with the silicates and aluminates. For example, at different ages after being made up and kept in water neat briquettes of an American Portland cement, after being taken from the water and dried at 212 degs. Fahr., contained the following amounts of water and carbonic acid: —

	H_2O	CO_2	H_2O Free.
1 day test	5.06%	1.92%	2.02%
7 „ „	6.47	2.79	2.88
28 „ „	7.94	2.36	2.56

It appears that with Portland cement a relatively small amount of water is present and necessary for the set of the cement, but that with age water plays a prominent part in the real hardening process, while carbonic acid is of minor importance.

SETTING OF NATURAL CEMENTS.

The process of setting with natural cements is somewhat different from the comparatively simple one with Portland cements because of the presence of the caustic alkaline earths, lime and magnesia, their carbonates and undecomposed silicates, all of which enter more or less into the reaction. The aluminates, here as with Portland cements, probably produce the principal phenomena connected with the initial set, but the presence of free lime has generally a tendency to make all natural cements heat on mixing with water. Few natural cements are burned to such a degree as to remove all carbonates, and what are left seem to be capable of developing some very decided hydraulic properties with the free alkaline earths. Utica and Akron cements, which are but lightly burned, illustrate this fact.

In the final hardening, also, the undecomposed silicates very likely play the part of a puzzolana, while it is questionable whether any tricalcic silicates exist in natural cements, although a large portion of the silicates have been decomposed in burning with the formation of aluminates. We are, unfortunately, not in a position to explain the setting of natural cement as well as that of Portlands.

Further Comparison of Portland and Natural Cements. The relative proportions of water and carbonic acid present in Portland cement mortar of different ages when immersed in water has been commented on.

In the case of natural cements at early stages the amount of carbonic acid, derived largely from that not driven out of the original carbonates in burning, may exceed that of the combined water, a Cumberland briquette at the age of seven days having 9.23 Co_2–6.07 H_2O, but the relative changes with age and the acquisition of water of hydration is much more rapid than that of carbonic acid. After very long periods of time, and especially with exposure to the air, the amount of carbonic acid may increase relatively, although the increase is slow, as in the case of ordinary lime mortar. The importance of any carbonic acid found in a natural cement some time after use is, therefore, to be attributed quite as much to its original origin in the carbonates of the cement stone as to its gain in setting.

(*Continued.*)

IN the United States there are now thirty factories making cement, the output being 2,250,000 barrels annually. This industry has been almost entirely developed within the last ten years, and the greatest development has been in Pennsylvania, where the limestone is almost free from magnesia and makes a cement equal in every respect to the imported article. The country is now producing nearly as many barrels of cement a year as were imported in 1895. While the imports have not greatly increased, the home product of Portland cement has steadily grown from 454,813 barrels in 1891, 547,440 barrels in 1892, 590,652 barrels in 1893, 798,757 barrels in 1894, to 990,324 barrels in 1895, and of this quantity Pennsylvania produced more than one half. — *Philadelphia Enquirer.*

Masons' Department.

REGULATING COMPETITION — METHODS OF ESTIMATING.

BY F. E. KIDDER.

ONE of the great problems, if not the greatest problem that confronts brick contractors in many localities to-day, is to provide some lawful means of regulating competition so that there shall not be such a variation in the "brick bids" as now prevails, and so that when bids are opened one or more shall seldom be found to be so low as to preclude any possibility of a fair profit, or of doing the work as it should be done, without the contractor "going into his pocket" to pay for a part of it.

In some of the older and larger cities contractors have arrived at an understanding or agreement whereby work that is let from architects' offices goes at a figure that will give some profit if the job is wisely managed; but in many cities no such agreement exists, or if there is one, it is not kept, and the large number of would-be contractors constantly importuning architects and owners for an opportunity to figure, to say nothing of the peddling of bids by general contractors, makes the difficulty of getting a fair price still greater.

In Denver, and probably in many other Western cities, competition has been so close during the last five years that nine tenths of the building contracts have been made at figures which, after all bills were paid, barely left journeyman's wages for the contractor, and too often nothing at all. If low bidding only injured the party directly involved, it would not be a matter of general interest; but so long as it is a common custom to let the work to the lowest responsible bidder, this evil prevents those who make fair and reasonable bids from securing a contract. If a contractor wished to do good, honest work, and make, say, 5 per cent. on the contract, it has been in many cases hardly worth while to put in a bid.

Now, how can this bidding below a living profit be prevented?

One method is by means of a close association having an arrangement with the material dealers by which "outsiders" cannot procure material, and an understanding amongst its members that work shall be figured on a certain basis. This method has been made to work fairly well in some localities, but it involves some injustice, and has the nature of a "combine" which prejudices the building public against it.

The brick contractors of Denver undertook, at the beginning of the present year, to have all brick bids opened in the rooms of their association before they were handed to the architect. Extreme low or high bids were thrown out, and an average taken of the others, and 3 per cent. added to defray the association expenses. This final sum was then to be the lowest bid submitted, and the party whose original bid was nearest to this average bid was chosen to put in the low bid fixed upon. Those whose bids were above the average handed to the architect their original bid, while those whose bids were below made out new ones, so that when the bids were opened by the architect, they had all of the appearance of an open competition. A method of taking the average of the bids within certain limits would perhaps not be unjust, as the average bid is probably, in most cases, about what should be received for the work; but the particular method pursued in Denver seemed to the architects there false and unfair, and they denounced it publicly, so that it has been abolished, after having been in force for about three months.

There are other methods, looking to limiting the number of competitors, which have been tried and advocated with more or less success, but so long as there are more contractors than there are contracts to be let, it will always be more or less difficult for contractors to get a fair price for their work. The writer believes that one reason why bids are often much too low is, that the contractor does not take off the quantities correctly, or does not know, within reasonable limits, what the work will cost him. An honest contractor is not very likely to put in a bid that he knows will allow him no profit, and bids from dishonest contractors should not be accepted. In the opinion of the writer, therefore, a correct system of taking off the quantities whereby the exact cost of the labor and materials can be very closely computed is of the first importance, and if such a system were generally followed, the bids would run very close wherever a fixed standard of wages prevails.

Another advantage of a general system of estimating is that the architect can also easily take off the quantities, and figure the cost with reasonable accuracy, thus enabling him to determine beforehand about what the cost will be and what the work is worth.

After all of these years of intelligent building, contractors' associations, conventions, etc., it would seem that so simple a matter as estimating plain brickwork would have been reduced to a fixed and accurate system, or rule, long ago, but it has not, and perhaps may never be.

It is true that individual contractors can and do estimate very closely the probable cost of labor and materials, but a great many follow a very simple rule which gives neither the exact quantity of brick nor takes into account the character of the building, so that the price based upon it is largely, after all, a matter of guess work, and it is not to be wondered at that some needy contractors guess as low as they dare. In a succeeding paper a comparison will be made of different systems of estimating, with a view of showing the most accurate.

LAYING BRICKS IN COLD WEATHER.

THE composition of mortar which can be used to lay bricks in freezing weather without risk of destruction of the set of the mortar is a subject which affords a fertile opportunity for space fillers and technical journals,—we know, for we have tried it ourselves,—and yet there is a common-sense view of looking at it which ought to settle it at once, namely, that if first-class work is expected, we ought no more to expect to be able to lay bricks in freezing weather than we would to wear pajamas at Christmas. One of the curses of modern construction is the assumed necessity for haste. Our architects and constructors ought to be willing to look at it in the light of common sense, and admit that it is impossible to successfully lay any kind of masonry in freezing weather without running so great a risk of a poor resulting construction that they had a great deal better wait until the mercury goes up. This would solve once and for all the question of how the mortar should be composed. If we want first-class work we must have first-class conditions, and these simply do not exist when the thermometer is below 32 degs.

ENAMELED BRICK.

THE economic advantages of using enameled brick for elevator wells, engine and boiler rooms, and cellars is thoroughly appreciated by all who have had the management and care of a large commercial building, but is not always patent to those who are having their first experience with such investments. The extra cost of enameled brick is considerable, if good brick is used, and we should be sorry to recommend anything but the best. The advantages, however, more than offset the extra cost in the long run. Enameled brick is a non-conductor of heat and moisture, the surface is not easily abraded, and consequently preserves its appearance intact indefinitely, it is a light reflector, and all these qualities combine to discourage dirt, which is the most expensive and troublesome factor of a large building. If the byways of a big office building can be kept immaculate, the machinery will last longer, the character of the building be higher, it will be easier to rent rooms, and the temper of the attendants will be much more livable. Now, enameled brick does not directly do all this; but on the same principle that an electric arc light on the street is the best kind of policeman, so the bright, light appearance of an enameled surface is a discourager of shiftlessness, carelessness, and dirt, and to that extent warrants all the extra cost of even the best manufacture.

Brick and Terra-Cotta Work In American Cities, and Manufacturers' Department.

NEW YORK.— No doubt readers of THE BRICKBUILDER who follow closely the reports of building operations in New York will be interested in comparing the report of this month's doings with that of the corresponding month of 1897. The greatest and most noticeable difference is in the falling off of the number of projected new office buildings in the business section of the city; and as these buildings are of great importance, involving a great expenditure of money, and affecting largely brick and terra-cotta interests, an inquiry into the cause of this falling will be of interest.

First, the continuance of our war with Spain is partly responsible, but not as largely as might be imagined, as reports from Wall Street show a healthy and confident condition, and money to loan on easy terms.

Last year at this time lower New York looked as though it had suffered from the effects of a bombardment (not from a Spanish source, however, for they would not have struck anything), and to visitors must have presented an odd appearance. This was on account of the unusually large number of buildings on prominent corners that were being torn down to make room for new and more ambitious structures. In place of these old buildings we now have the new Empire Building, Exchange Court, Hudson Building, Washington Life, Singer Building, and the still unfinished Park Row Building, the tallest office building in the world. The only large office building in process of construction on Broadway now is the Cheseborough Building, Clinton & Russell, architects.

BAYARD BUILDING, BLEECKER STREET, NEW YORK CITY.

Louis H. Sullivan, Lyndon P. Smith, Associated Architects.

The front of building is of terra-cotta, executed by the Perth Amboy Terra-Cotta Company.

Investors have continually been warned by conservative people that they were supplying offices far in excess of the demand, but few thought that the excess would be great enough to make any serious break in rentals. The craze for sky-scrapers has been at its height for the past three years, gradually diminishing as the truth was enforced that, under modern methods of construction and with the enormous capital available for the purpose, offices could be created, and were created, at twice the speed that the need of them actually grew, even in good times.

SOFFIT PANEL, MAIN CORNICE, BAYARD BUILDING.

Speculators are realizing that sky-scrapers are not the good speculative operations of which they had dreamed. It may be expected, therefore, that the sky-scrapers of the future will be those that are erected not merely for profit, but from some other reasons; that they may be built by strong estates or by great corporations, the former looking for very small interest upon a moderate value for their land, and the latter seeking that unnamed but substantial advantage which is derived from having an imposing home; and thus, in course of time, will rentals right themselves as the business of the city grows up to the offices now at its disposal.

The next monthly meeting and dinner of the Architectural League will be unusually interesting, as it will be held in Havemeyer Hall, Columbia University, and, through the courtesy of Professor Ware, the members will have an opportunity to inspect the new and interesting group of buildings designed by Messrs. McKim, Mead & White.

Some of the more important items of new work are: —

Jeremiah O'Rourke & Son, architects, of Newark, have planned a thirteen-story brick and limestone apartment hotel, to be erected at Fifth Avenue and 45th Street; cost, $750,000.

McKim, Mead & White, architects, are at work on plans for a residence to be built on the corner of Fifth Avenue and 72d Street, for Mr. James Stillmann.

Messrs. Cable & Lucas are preparing plans for a store and apartment house to be erected on the north side of 42d Street, from Broadway to Seventh Avenue, for Mr. Charles Thorley.

C. L. W. Eidlitz, architect, has filed plans for two three-story brick telephone exchanges, to be built on 79th and 89th Streets; cost, $50,000.

Clarence True, architect, has planned eight six-story brick dwellings, to be built on Riverside Drive, at a total cost of $266,000.

De Lemos & Cordes, architects, have planned a four-story brick office building to be erected on the corner of Second Avenue and 21st Street; cost, $150,000.

M. W. Morris, architect, has planned a brick and stone fireproof extension to the Hotel St. George, Brooklyn, to cost $200,000.

Herts & Tallant, architects, have won the competition for the Aguilar Free Library's new building. It will be a two-and-one-half story building and cost $35,000.

Schickel & Ditmars, architects, have planned a four-story brick

WINGED FIGURE, TWELFTH-STORY SPANDRELS, BAYARD BUILDING.

dwelling, to be erected on Riverside Drive, for Mr. William Baumgarten; cost, $25,000.

McKim, Mead & White have planned a six-story brick and stone fire-proof store and loft building, to be erected on Broadway, for J. C. Hoe's Sons.

The Knickerbocker Realty Improvement Company will erect a new hotel on the site of the old Fourth Presbyterian Church, 34th Street, near Sixth Avenue. It will be twelve stories in height, having a frontage of 80 ft., and is estimated to cost about $500,000.

Charles C. Haight, architect, has prepared plans for a brick and stone warehouse eight stories in height, to occupy the block fronting on Hudson Street, from Vandam to Spring Streets, to be erected for the corporation of Trinity Church, at a cost of $450,000.

ST. LOUIS.— The war has very materially affected the building interests here. Nearly all prospective schemes have been abandoned for the present, and in some instances operations have been suspended upon work under headway.

DETAIL ABOVE MAIN CORNICE, BAYARD BUILDING.

A good season's business had been expected, and even now, should there be indications of a cessation of hostilities soon, considerable work of importance may be undertaken.

The trustees of the Barnes Hospital Fund are considering plans for a hospital which will cost over a million dollars. The money was left by the late Dr. Barnes for this purpose some years ago.

The patriotism of our citizens has aroused sufficient interest in our citizen soldiery to start a movement which may eventually give the militia much-needed homes. L. C. and W. M. Bulkley, architects, have prepared plans for an armory for Light Battery A, to be built on Grand Avenue and Rutger Street. The building will be 190 x 212 ft., the front being three stories high. The drill hall, which will be in the rear, will be 179 x 180 ft. Red brick and stone will be the materials used in the fronts.

The proposition to build the armory for the First Regiment has not assumed definite shape, although prominent citizens made an offer to build the same if the city would donate the site of the old City Hall. As the charter of the city will not permit this some other locations are being considered.

Another old landmark is about to disappear. The Dorris Block, on the northwest corner of Olive and 11th Streets, extending nearly to 12th Street, is to be replaced by a six-story commercial building, for which Shepley, Rutan & Coolidge have prepared plans.

The same architects have prepared plans for a six-story warehouse for the Ely, Walker Dry Goods Company, which will cost $100,000.

The committee in charge of the publishing of the new building ordinance report that the book will be out of press in a few days.

The St. Louis Architectural Club held its regular monthly meeting on Saturday Evening, June 4. A large number were present, and were well entertained by the hosts, Messrs. Stock Dwyer,

CAPITAL TO FIRST-STORY COLUMNS, BAYARD BUILDING.

Stiff, Draper, and Schmidt, who provided not only the customary refreshments, but good music, sketches, a lantern-slide talk, etc.

A committee was appointed at the last meeting to inquire into the advisability of holding an exhibition some time during the fall or winter. The committee recommend the same and suggested that it be an inter-club exhibition, and that an effort be made to procure drawings from all the clubs, and that an illustrated catalogue be issued.

The report of the building commissioner for the month of May shows permits issued for buildings amounting to nearly double that for the previous month, but nearly all are for small residences, or unimportant improvements, which would suggest that people are taking advantage of the extremely low prices of building materials and labor to build themselves homes.

CHICAGO.—Building reports do not seem to be any better than a month ago, when the figures showed a decrease of nearly 20 per cent. as compared with the work done in the corresponding month of the previous year. One of the most important announcements chronicled this month is that of a twelve-story commercial building for Schlesinger & Mayer, to cost $1,000,000, which is being designed by Louis H. Sullivan. The interior is described as "finish of mahogany and bronze," and the exterior "Georgia marble." It would not be surprising, however, to see the building executed in terra-cotta. That material has been largely the medium of Mr. Sullivan's designs, and with such appropriateness that the additional reason for such a guess is hardly needed, that an existing stone-cutters' strike may lead to the substitution of terra-cotta. Chicago cut stone contractors say that the competition of terra-cotta has brought them to such low prices that they cannot accept the rule of the stone cutters that there must be eight men employed for every planing machine in operation. If they do accept the rule the stone cutters must accept the alternative of a reduction in wages from $4 to $3 per day. The workmen are not far sighted enough to see beyond the temporary injury done by the use of labor-saving machinery, and they have contributed at this writing some six continuous valuable weeks toward strengthening terra-cotta as a competitor of stone.

DETAIL, STORE BUILDING, PHILADELPHIA.
Executed by the Conkling, Armstrong Terra-Cotta Company.
Frank R. Watson, Architect.

PANEL, SPINGLER BUILDING, NEW YORK CITY.
Executed in gray terra-cotta by the Excelsior Terra-Cotta Company.
W. H. Hume & Son, Architects.

In this connection it is of interest to note that School Architect Patton has made encouraging progress in inducing the board to adopt fire-proof construction. The contract for one school building just let is reported to have cost 13¼ per cent. more than the wood construction previously used. The fact that Chicago spends about a million dollars annually for new school buildings shows the importance of this departure if it proves to be an indication of future policy.

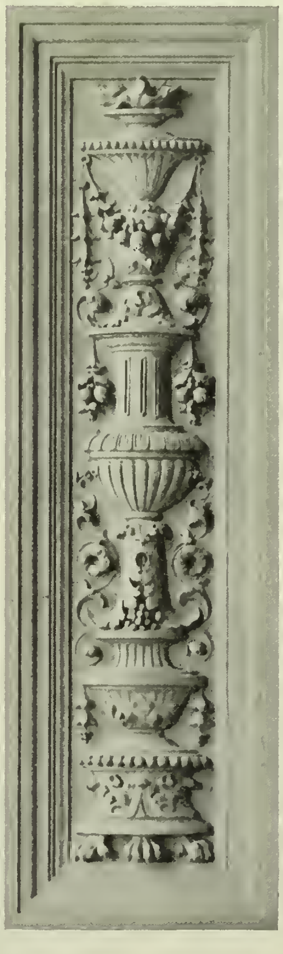
The license system for contractors has gone into effect. As the ordinance reads: ". . . Each and every person, agent, firm, company, or corporation engaged within the limits of the city of Chicago in the construction or repairing of the whole or any part of buildings and appurtenances, shall be and he or it is hereby required to obtain a license from the city of Chicago . " which license costs $2 per annum, and is obtained without examination.

Among the most important building items may be noted: A warehouse 170 by 120 ft., seven stories, by John M. Van Osdel; apartment buildings by architects Handy & Cady, Sidney Lovell, and H. C. Hoffman; a manufacturing building eight stories, 50 by 160 ft., by John H. Wagner; a ten-story fire-proof commercial building by Holabird & Roche; alterations of Marshall Field retail store by D. H. Burnham & Co.; and a fire-proof manufacturing building by S. A. Treat.

CORBEL.
Executed in terra-cotta by the Northwestern Terra-Cotta Company.
Walker & Kimball, Architects.

The Stock Exchange Office Building, which is 100 by 180 ft. and thirteen stories, was sold recently. The exterior is all terra-cotta, and one of the best of Adler & Sullivan's designs. The consideration for the building with the ground was placed at $2,530,000. Another announcement of importance to Chicago real estate interests is a purchase of three hundred acres on the shore of Lake Michigan, seventeen miles from the City Hall. On this site, it is said that Mr. Frick, of Carnegie Steel Works, and associates, will establish one of the largest steel plants in the world, including in its equipment blast furnaces and steel rail and structural steel rolling mills.

The previously mentioned Ayer Building, designed by Holabird & Roche, which is to cost $200,000, will have a front entirely of plate glass and terra-cotta.



TERRA-COTTA PANEL, INTERIOR BAPTIST PUBLICATION SOCIETY BUILDING, PHILADELPHIA.
Executed by the Conkling, Armstrong Terra-Cotta Company.
Frank Miles Day & Brother, Architects.

A BRIGHT, CLEAN, AND BRILLIANT CITY.

IMAGINE, if you can, a row of business structures with fronts made entirely of enameled bricks. What a contrast to the ordinary dull and uninteresting city block! The first feature to attract the attention would be the variety of design and of coloring, for each separate building would have been the object of a distinct color scheme, according to the idea of the architect who planned it. But all would be alike in one important particular — the harmony of color. Instead of the glaring contrast which is now observable where pressed brick and the various dull stones are the only available materials, there would be a careful selection of such tints as, taken together, would create a beautiful and harmonious effect. The architect could give free rein to his

DETAIL OF ENTRANCE, LAWRENCEVILLE BRANCH OF CARNEGIE LIBRARY.

ideas in devising ornamental color schemes suited to the particular construction in hand.

This desirable condition is now quite possible by the use of enameled brick. These brick, the best of which are of American manufacture, were originally made in a brilliant glazed white for use in alleys and light courts, but are now made also in any color desired, and either glazed or unglazed. The latter, known as the dull finish, are particularly desirable for fronts, because they preserve, under all conditions of light, the beautiful color effects which the glaze (the glare from which is so objectionable to architects) not infrequently would hide or detract from. At the same time, the unglazed brick are just as impervious to moisture and dirt and as readily cleaned. The durability of both the glazed and unglazed brick has been so well demonstrated to architects as to need no extended comment in this connection. They have been repeatedly frozen and boiled alternately — also heated to a red heat and then plunged into cold water, without injury, the important point being that the enamel has been demonstrated by these tests to be part of the brick itself and not a mere cleavage. Thus they are seen to be not only fire-proof, but absolutely indestructible by any combined force of fire and water.

As to the comparative cost. Enameled brick laid in the wall cost less than 60 cents per superficial foot, being a little cheaper than good Bedford stone, while their advantage over this material is that they are fire-proof and can be easily and cheaply cleaned. Where it may be desired to put an addition either on top of a building or adjacent to it, any colors can be duplicated, and after the entire wall is washed down, the building will be uniform in appearance, the new and the old alike, which would be impossible with materials which absorb dirt or have to be painted. The advantages of cleanliness are not of least consideration in alleys, light courts, and basements, where they are especially valuable for sanitary reasons. They can be washed down as frequently as desired, and dark places made light and healthful. In England, the home of the enameled brick industry, the municipal laws require their use in alleys and courts on account of their sanitary qualities.

The foregoing statements as to the perfection arrived at in the production of American enameled brick, including their durability, beauty, and variety of color and shape, their bright and dull finish, as well as the severe tests mentioned, are based on facts obtained from an investigation of the attainments of the Tiffany Enameled Brick Company, of this city. Their brick are made in all sizes and shapes usually desired by architects, and may be ground perfectly for high-grade archwork. English, American, and Roman sizes are made in stretchers, quoins, octagon, round end, etc., and can be enameled on both faces, when required, for thin partition walls. Any color can be produced to order, with certainty as to uniformity of shade.—*Inland Architect.*

CURRENT ITEMS OF INTEREST.

At St. Louis the price of common brick dropped during the month of May from $5.50 to $4.25 per thousand.

Atlas Portland Cement is being used in erection of Garbage Plant at Boston.

The Union Akron Cement Company are supplying their cement for a large sewer now being constructed at Cleveland, Ohio.

Meier's Puzzolan Cement is being used by Norcross Brothers on a church at Whitinsville, Mass., Shepley, Rutan & Coolidge, architects.

Waldo Brothers have sold a considerable quantity of Hoffman and Atlas Cement for use on Metropolitan Water Board Work at Malden, Mass.

D. D. Cassidy, Jr., architect, Amsterdam, N. Y., is making plans for a four-story store and flat building, which will be constructed of brick and terra-cotta.

Several thousand barrels of Atlas Portland and Hoffman

LAWRENCEVILLE BRANCH CARNEGIE LIBRARY, PITTSBURGH, PA.
Alden & Harlow, Architects.

Rosendale Cement will be used on three sewer contracts at Somerville, Mass.

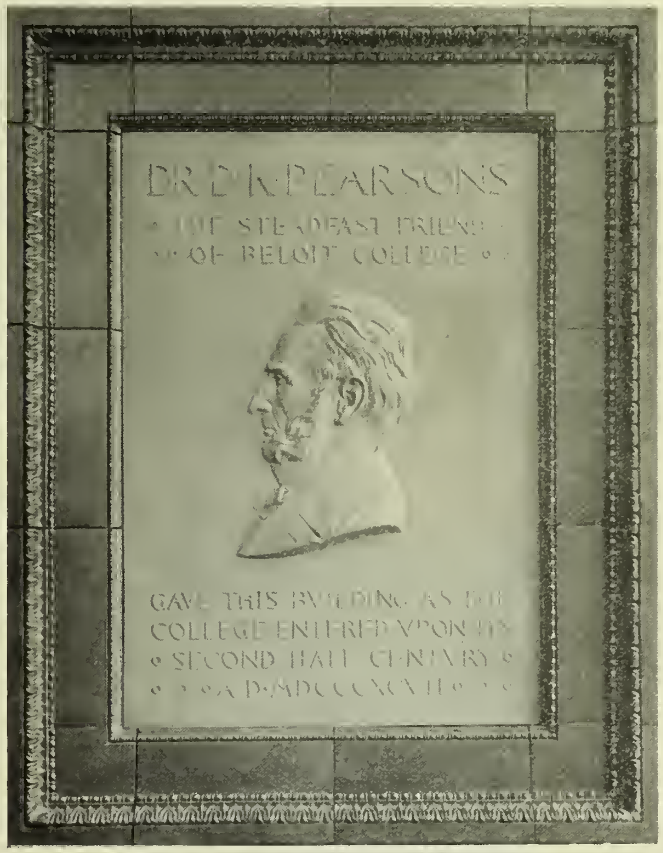
THE BOLLES REVOLVING SASH COMPANY has arranged for the exclusive manufacture and sale of the Queen Overhead Pulley and Window Stop Adjuster. These devices were formerly manufactured and sold by the Queen Sash Balance Company.

W. L. MILLER has bought Atlas Portland Cement of Waldo Brothers for contract for piers on Summer Street, South Boston. Atlas Cement is to be used on all the masonry connected with this new street and bridge.

THE EXCELSIOR TERRA-COTTA COMPANY, through their Boston agent, Charles Bacon, has secured the contract to furnish the terra-cotta for a new hotel at Albany, N. Y., H. Neil Wilson, Pittsfield, Mass., architect; J. Clark & Co., Chicago, Ill., contractors.

WALDO BROTHERS have closed with Horton & Hemenway for the supply of Hoffman Cement for the new Back Bay Station, Boston. Hoffman Cement will also be used on approaches and track-widening changes connected with the new stations of New York, New Haven and Hartford Railway.

THE BOLLES REVOLVING SASH COMPANY have had their sash specified in the following projected buildings: Public schools, Rivington and Eldredge Streets, Houston and Essex Streets, Rivington and Forsyth Streets, New York City; also for the New York Hospital, Cady, Berg & See, architects; and the Hebrew Charities Building, New York City, De Lemos & Cordes, architects.



COMMEMORATIVE PANEL, BELOIT COLLEGE, BELOIT, WIS.
Executed in terra-cotta by the American Terra-Cotta & Ceramic Company.
Patton & Fisher, Architects.

THE plant of the Illinois Supply and Construction Company, at Collinsville, Ill., suffered loss by fire, May 29, amounting to $25,000. The plant will be immediately rebuilt, but no loss will be occasioned by the delay, owing to the fact that they had a large stock of brick on hand.

THE BRICK, TERRA-COTTA AND SUPPLY COMPANY, M. E. Gregory, proprietor, Corning, N. Y., has contracted to furnish the following buildings with terra-cotta: Masonic Temple, Geneva, N. Y., A. B. Camp, architect; Masonic Temple, Monticello, N. Y.; Wilmerding School, Wilmerding, Pa., C. H. Bartelberger, architect; Farrell Building, Buffalo, N. Y., E. R. Williams, architect.

THE DAGUS CLAY MANUFACTURING COMPANY, Daguscahonda, Pa., are supplying through their Philadelphia agent, O. W. Ketcham, 150,000 flashed Roman brick for a new factory at Kane, Pa.; 30,000 pink brick for a new building in New York City, of which D. A. Callahan is the owner; also 30,000 gray brick for the new City Hotel at St. Mary's, Pa.

THE BURLINGTON ARCHITECTURAL TERRA-COTTA COMPANY, through their New York agents, H. F. Mayland & Co., are supplying the terra-cotta for the new buildings 155, 157, 159 West 34th Street, New York City, George H. Van Auken, architect; also the new building at 80 and 82 Fourth Avenue, William J. Dilthy, architect.

CHARLES E. WILLARD, Boston, removed his office on June 1 from 171 Devonshire Street to a more convenient location on the street floor, at 192 Devonshire Street. Mr. Willard will continue to handle a full line of clay products, and invites inspection of his new exhibit of a large variety of sample brick, of both mud and dry pressed process.

JAMES A. DAVIS & CO., Boston, are furnishing Alpha Portland Cement in the construction of the new Southern Terminal Station, Boston; also for the Back Bay Station sea-wall and bridge foundations. The United States Government is using large quantities of Alpha Portland Cement in their engineering works along the Atlantic coast.

THE UNION AKRON CEMENT COMPANY, Buffalo, N. Y., have closed a contract for 3,000 barrels of Akron Cement with the Alcatraz Paving Co., Philadelphia; and also for 15,000 barrels with E. D. Smith & Co. for the Philadelphia and Reading Subway tunnels which are to be built in the city of Philadelphia.

THE BERLIN IRON BRIDGE COMPANY, Berlin, Conn., are supplying the steel framework on the following new buildings: New station and car house for the Spencer, Warren, and Brookfield Street Railway Company, at Brookfield, Mass.; new building for the Waterville Cutlery Company, at Waterville, Conn.; new power house for the Bryant Electric Company, at Bridgeport, Conn.; addition to the Wilmot & Hobbs Manufacturing Company's plant, at Bridgeport, Conn.; and new power house for the Port Chester Railway Company, at Port Chester, N. Y.

SAYRE & FISHER COMPANY, through their Boston agent, Charles Bacon, are supplying the gray brick being used in a mercantile building now under process of construction at the corner of Beach and Utica Streets, Boston, Winslow & Wetherell, architects; C. Everett Clark, contractor.

The same company has recently taken their third order for enameled brick for the new Terminal Station, Boston, Shepley, Rutan & Coolidge, architects; Norcross Brothers, contractors. They have also secured a large order for enameled brick for the Back Bay Station of the New York, New Haven & Hartford Railway, at Boston, Shepley, Rutan & Coolidge, architects; Horton & Heminway, contractors.

THE MASON SAFETY TREAD is growing in favor with conservative architects and real-estate owners as a protective appliance for stairways. Among work recently specified are the following-named buildings: Cambridge City Hospital and Randall Dining Hall, Cambridge, Wheelwright & Haven, architects; New England Telephone & Telegraph Company's building, Oxford Street, Clarence A. Perkins, chief engineer for the company; Subway station at Haymarket Square, Howard Carson, chief engineer; Subway stations at Scollay and Adams Squares, and office building of Transit Commission at Brattle and Court Streets, Charles Brigham, architect; First Corps Cadets Armory, Columbus Avenue, William Gibbons Preston, architect; Dorchester schoolhouse, Hartwell, Richardson & Driver, architects; South Boston schoolhouse, Herbert D. Hale, architect; fire-engine house, Haymarket Square, Perkins and Betton, architects; ferry house, South Ferry, city of Boston, Maginnis, Walsh & Sullivan, architects; Worcester County Court House, Andrews, Jaques & Rantoul, architects; State Hospital for the Insane, Westboro, Kendall, Taylor & Stevens, architects; Cambridge Savings Bank, C. H. Blackall, architect; Brookline Savings Bank, F. Joseph Untersee, architect; town hall, Revere, Greenleaf & Cobb, architects; police headquarters and court house, Newton, Lewis H. Bacon, architect; Union Station, Omaha, Walker & Kimball, architects; Alice Building, Providence, R. I., Martin & Hall, architects; Besse Building, Springfield, Mass., B. H. Seabury, architect; Meier & Frank Building, Portland, Ore., Whidden & Lewis, architects.

Draughtsman Wanted.

FIRST-CLASS DRAUGHTSMAN WANTED IN ARCHITECTURAL TERRA-COTTA WORKS. TO A THOROUGHLY COMPETENT MAN A PERMANENT POSITION IS ASSURED. ADDRESS, STATING FULL PARTICULARS, "ARCHITECTURAL TERRA-COTTA," CARE OF THE BRICKBUILDER.

For Sale—By Order of Court.

COMPLETE BRICKMAKING PLANT OF W. C. HILL ESTATE, NOW RUNNING AT GOOD PROFIT, NINETEEN ACRES OF LAND ONE MILE FROM POST OFFICE, SEATTLE, WASHINGTON. PRICE, $30,000. WILLIAM H. LEWIS, ADMINISTRATOR, P. O. BOX 52, SEATTLE, WASHINGTON.

FOR SALE.

Fine Clay Property and Factory Sites.

Twenty-five hundred acres, within six miles of Baltimore, Md. A large part is underlaid with clays of fine quality and great variety, suitable for making red, buff, and other kinds of Bricks, Tiles, and Terra-Cotta. A railroad, running through the property, connects it with Baltimore and Washington. Water connection with Baltimore and Chesapeake Bay by channel fifteen feet deep. Good water power on property. Fine sites for Factories. Parts of property are suited for suburban development and parts for truck farming. For sale, as a whole or in lots to suit, on reasonable terms.

Also a small FACTORY, equipped for making roofing tiles and bricks.

Apply to Curtis Creek M. F. & M. Co., 12 St. Paul Street, Baltimore, Md.