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CONTENTS.

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CONTENTS

AN important decision in regard to mechanics' liens in New York has just been decided by the highest court. Mrs. Hannah Van Vechten, a resident of Staten Island, contracted with one Smalle to build her a house. The work went on under the contract until the plastering was done, and then stopped. The firm of Van Cleff & Sons, who furnished the lumber, then presented Smalle with a bill of about seventeen hundred dollars for lumber furnished for the building. He was unable to pay it, and they thereupon filed a lien against the property. The suit to enforce the lien was referred to an auditor, who dismissed the claim. Van Cleff & Sons then appealed to the General Term of the Supreme Court, which reversed the decision of the auditor. Mrs. Van Vechten then appealed to the highest court of the State, the Court of Appeals, which has now reversed the decision of the Supreme Court, on the ground that when a contractor has forfeited his contract, by ceasing work before its completion, the building or the owner cannot be held responsible for the debts of the contractor incurred in connection with the contract. This decision, while important in New York, should not be given too great weight as a precedent in other States. The mechanics' lien law of New York is a very peculiar one, and the interpretation of a statute by a court is a matter entirely independent of abstract justice, or of the laws of other States.

THE New York Board of Walking-Delegates has resumed business with vigor. A certain Mr. Downey was accused before this tribunal of having some cabinet-makers doing carpenters' work for a contract on which he was engaged. We should say that the line between cabinet-makers' and carpenters' work in buildings would be almost too fine for the unaided eye to distinguish; but the walking-delegates saw it clearly, and averred that excursions over it had been made by some of Mr. Downey's men. Mr. Downey, on the other hand, said that no violation of the frontier had been committed with his knowledge, and he did not believe that there had been any at all. The delegates thereupon pronounced Mr. Downey contumacious, and ordered one thousand men, including all the carpenters, derrick-men, tile-layers, steam-fitters, gas-fitters, tin and sheet-iron workers and laborers on all the buildings in which Mr. Downey had contracts, to drop their tools and remain idle until further notice. This astounding assault upon the rights of a thousand helpless workmen, on the pretext of a microscopic offence, which does not appear to have been committed at all, could hardly be explained even by the gigantic impudence of the Board of Walking-Delegates; and Mr. Downey is probably right in thinking that the real quarrel is between the leaders of the carpenters' and cabinet-makers' unions, as to what shall be considered the proper work of each. As Mr. Downey says, the contesting parties seem to have chosen to make his buildings the battle-ground of their struggle, without regard to his rights, or those of the owners for whom he works; but he is at their mercy, and there is every reason to believe that the fight may be a long one. It will be remembered that one of the longest and worst industrial struggles which ever took place in England was fought over the question whether terra-cotta should be laid by bricklayers or stone-masons. The latter insisted that terra-cotta was stone, while the former were positive that it was a sort of brick; and the settlement of the problem cost the poor working-people many thousands, perhaps millions, of dollars. After all, we believe that the war was only ended by a compromise, so that terra-cotta in England is partly brick and partly stone; and the final result in New York will probably be, in the same way, that certain shades of cabinet-work will be carpenter-work, and vice versa.

THE Columbus monument, which was recently presented to the city of New York, is to be placed in the circle formed at the intersection of Fifth Avenue and One Hundredth Street, opposite what is known as the "Pioneer's Gate." So far as names go, this is a very suitable position. It was proposed to put it near the "Stranger's Gate," but, as the New York *Tribune* points out, it seems hardly appropriate that the discoverer of a continent should be considered a stranger to it. It should be interesting to visitors to New York to know that the names originally adopted for the various gates of the park have been considered in placing the statues about them, although there are as yet no real gates and, unless the change has been made recently, no indication on the spot of the title belonging to each entrance. Thus, the statue of Professor Morse is placed near the "Inventor's Gate"; that of Commerce near the "Merchant's Gate"; that of Humboldt near the "Scholar's Gate," and so on. All this is obviously very pleasant, but before it is too late, it seems as if there were one omission which should be remedied. So far as we know, there is among the various park approaches no Briber's Gate, or Heeler's Entrance, or Saloon-keeper's Portal; and if monuments are to continue to be placed in the vicinity of a gate whose name recalls the character or occupation of their subject, there may be a difficulty, when future generations of New Yorkers desire to celebrate the memory of the "victorious" and "triumphant" rulers of their city and State, in finding an appropriate location, unless some such provision is made as we suggest.

THE stockholders of the Panama Canal Company will find some interesting reading in the notice issued by the New York Supreme Court, giving until May 23 for cause to be shown why the American Contracting and Dredging Company should not be dissolved. This company was organized in 1883, to fulfil a contract entered into with the Compagnie Universelle du Canal de Panama, for doing a part of the dredging for the Panama Canal. Its capital was two million dollars, but, of course, it is impossible to say how much of this was actually paid in. Within the eight years which have elapsed since its organization, it has paid to its stockholders eight million, two hundred and eighty-five thousand dollars in cash, as dividends, six hundred and seventy-five thousand of this being nominally dividends on stock of other companies, held by it. Of course, nearly all of this enormous return must have been made during the three or four years of active operations on the Isthmus, so that the profits of its work appear to have been about one hundred per cent a year on the nominal capital. The Panama contract is the only one that the Company ever entered into. It claims to have carried out its agreements to the letter, which it could certainly have afforded to do. Now, having no more business in which to employ its capital, and being out of debt,

it prays that the company may be dissolved, which, we suppose, means that two millions more are to be divided among the stockholders.

THE French Minister of the Interior has just submitted to the Legislature a draft of a law "for the organization of the service of public hygiene, and of the improvement of unwholesome houses and lodgings." This measure has been for some time expected, and the publication of the full text of the proposed law, which we find in *L'Architecture*, under date of February 6, has excited general interest. In regard to the mode of enforcing the regulations contained in it, the proposed law is very moderate. An appeal from the orders of the local Board of Health is allowed to all house-owners; and the acts of the local authorities, in all important cases, must be reviewed and approved by the General Government; while the latter, in its turn, has power over the individual towns, and can carry out sanitary reforms which the local authority neglects or refuses to provide for, and compel the towns benefited to pay the cost. The entire text of the measure is well worth reading by persons interested in the subject; but we can spare space only for a few quotations.

IN cases where it appears that works of sanitation are needed for the benefit of one or more towns, or where a town is not provided with a proper supply of water, it is made the duty of the prefect of the district in which the town is situated to request the advice of the Departmental Council of Hygiene upon the work necessary to be done. The prefect transmits the report of the Departmental Council to the Minister of the Interior, who, if he thinks best, submits it to the general Consulting Committee of Public Hygiene of France. If this committee agrees with the Departmental Council that certain works ought to be carried out, the prefect notifies the town to proceed with them; and if, within three months afterwards, the town council has taken no steps to comply with the order, and appears determined not to do so, the works are to be carried out by the General Government, and the entire cost may be laid on the town, or divided between the town and the Department, in such proportion as the General Council shall decide. In the case of a building, whether situated on a public street or not, which is found to be dangerous to the health of its occupants or their neighbors, the mayor is required to summon the district sanitary commission, which must consider what measures, if any, are necessary to put the house in proper condition. The report of this commission is to be submitted by the mayor to the prefect, who may refer it to the Departmental Council of Hygiene, and, if this shall confirm the opinion of the district commission as to the necessity of the works mentioned, the mayor, within one week after receiving notice of the decision, must summon the proprietor of the house to carry them into execution. Two months, at least, must be allowed the proprietor for commencing the work. During this time, the proprietor, who may be either the owner or "*usufruitier*" — that is, the person, other than the owner, who receives the rents — is entitled to appeal to the "*juge de paix*" of the district in which the house is situated. This appeal must be heard and decided within one month from the time of filing the application with the clerk of the court, and the delay of two months or longer, allowed by the mayor for beginning the work, ceases to run while the appeal is pending. If the judge before whom the appeal is heard decides that the work must be done, he assigns the period within which it must be commenced; and, if it is not begun within that time, an action is begun before the correctional tribunal which issues a warrant authorizing the mayor to carry out the necessary operations, at the expense of the proprietor, at the same time that the latter is held for punishment by imprisonment or fine. Where the building is rented, the rents are, by special preference, to be seized to pay the cost of the improvements. If the proprietor, at the end of the two months accorded him by the mayor in the original summons, has neither appealed to the judge nor commenced work, he is to be brought before the judge, who commits him for criminal proceedings at the same time that he authorizes the mayor, as before, to carry out the work at the proprietor's expense. In cases where the unwholesomeness of dwellings proceeds from external and permanent causes, or where these causes can be reached only by comprehensive operations, the town is authorzed to condemn and acquire all the property situated within the perimeter of the proposed works. After these have been carried out, whatever portions of the condemned property remain available may be sold at auction, the former proprietors having no more claim upon them than any other persons. In all towns, it is provided that no house shall be constructed until the mayor has examined the plans and has satisfied himself that the conditions of health prescribed by the law have been observed, and has issued a permit; and, after the house is finished, it cannot be occupied without a second permit from the mayor, who can issue this only after the building has been examined by the sanitary inspectors and pronounced to be in accordance with the sanitary regulation. The penalty for infraction of the provisions of the law may be fine or imprisonment, or both; but, for a second offence, the penalty is always to be imprisonment.

A FRENCH engineer, M. P. Germain, who has recently made a tour in the United States, writes to *Le Génie Civil* some observations on the great American fireproof buildings. To use his own words, "these buildings fulfil a new requirement, which the American architects have met boldly and frankly, and, in many cases, they have carried out their programme in the happiest manner. These constructions have a very great variety of aspect; many present defects of taste, but among the number are some extremely beautiful ones, the production of true artists. I am convinced that we are now witnessing the birth of a new style, which will characterize its age as our cathedrals and castles characterized the Gothic epoch. One cannot too earnestly advise architects and engineers to pay the closest attention to what is now going on in the United States." Like most foreigners, M. Germain finds himself much impressed by the ingenuity with which services of electricity, gas, hot and cold water, steam, and even refrigerating currents, are applied throughout our great buildings; but he finds our methods of construction the most interesting subjects of study, and particularly describes, as worthy of imitation in France, our common system of fireproofing iron columns and beams.

SPANISH architecture has met with a severe loss in the death of Don Demetrio de los Rios, who was, at the time of his death, in charge of the restoration of the Cathedral of Leon. His predecessor in this work was the distinguished Madrazo, who also died at his post. Demetrio de los Rios first became conspicuous as an architect at Seville, where he designed and carried out one of the fronts added to the Cathedral. Besides this, he was architect of the Ayuntamiento, or town-hall, and of the Murillo monument. Twelve years ago he was called to take charge of the works at Leon, and had nearly completed an admirable restoration. Apropos of this, it may be well to call attention to the fact that Spain, one of the most debt-ridden of European countries, one whose people are generally held to be perhaps the least progressive of nations, includes in her regular annual budget a large appropriation to provide for the preservation and repair of Spanish Monuments of Architecture, as the French would call their architectural masterpieces. Such a practice as this smacks of the liberalism which is giving to Spain a new birth, and though Spaniards may not relish an addition to their taxes, architects, artists and travellers, domestic as well as foreign, can but applaud the practice.

THE *Builder* mentions an interesting circumstance about the decoration of the new Hôtel de Ville. It is well known that this noble structure is a sort of museum of the works of modern decorative artists; and increased variety is to be given to the collection by hanging some of the rooms with tapestry, also designed by painters of note. The first artist to be selected for this service is M. Jules Cheret, a very clever man, well known in all the large towns in France as a designer of posters. It is not many years since American posters were the admiration of Europe; but the French have now taken up the idea of having such placards interesting, and, so far as may be, beautiful, and M. Cheret has carried the art of making them so to a high degree of excellence. It is quite possible that the study of effects to be produced on vertical wall-surfaces, with the simplest means, is a good preparation for designing tapestry, and the artistic community will watch for the results of M. Cheret's work with much curiosity.

CAPITALS.[1] — II.

HISTORICAL SKETCH.

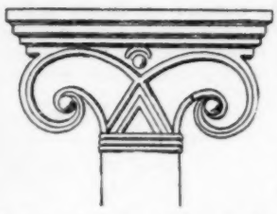

Fig. 15. Capital from Golgos, in the Louvre.

AT the beginning of this article the question was asked whether the capital had received at the outset the form most perfectly adapted to its constructional office. If a symmetrical disposition about a vertical axis is the best for carrying the summers of arches, had the capital of ancient architecture, which bore nothing but architraves, the form most suited to its rôle? The Ionic capital, with its powerful volutes, which have the appearance of prolonging it in the direction of the architrave, seems best constructed for this purpose. But, in fact, as the abacus is square, the support offered to the architrave lengthwise by the volutes is very largely in the appearance. Ionic capitals have been discovered at Delos with a rectangular abacus, and the question arises: Were Ionic volutes created for the purpose of extending the support of the architrave, and is the Ionic capital with a square abacus analogous to that of Delos? Or is the latter, as to support, merely an amplification of the first? Let it be remarked that the architrave at Delos was unquestionably of wood.

Fig. 16. Column from Persepolis.

These Delian capitals bear a resemblance to certain Asiatic forms in which there is clearly an attempt to relieve the architraves lengthwise. We reproduce in Figure 15 a capital from Golgos (Cyprus), which crowns a square pilaster; the volutes, springing from the gorge and developing in opposite directions, not like the Ionic volutes, but rather after the manner of the Composite, prolong both ways the support of the architrave.

Other Phœnician examples may also be seen in the Museum of the Louvre, complicated with other volutes, with their convex surface turned downward, and reproducing in *ensemble* and details an ornamental flower hallowed in Phœnicia. These capitals, which, like the first, were invented in order to prolong in a substantial fashion the support of the architrave, were not conceived for a single edifice; they must have been employed for a long time. We have seen in the small garden near the kiosk containing the Museum of Constantinople a similar capital, executed by a Greek hand; that is, all the details are in the Greek manner, without being altered in their general forms.

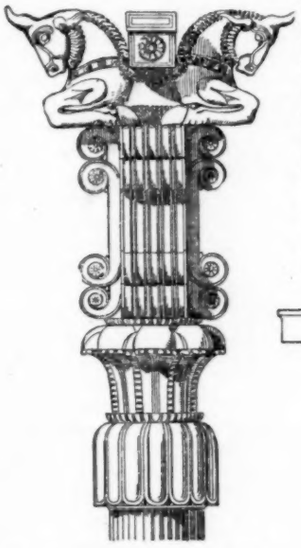

Fig. 17. Upper Part of a Column from Persepolis.

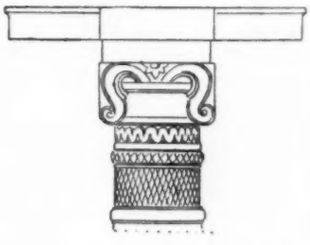

Fig. 18. Indian Capital.

Going still farther East, we encounter in Persia the tall, slender columns of the palaces of Persepolis (Fig. 16), surmounted by a complicated capital; this is crowned by an enormous course representing two bulls forced back against each other, and bearing on their haunches one of the large beams of the ceiling, while their heads approach nearly enough to the wooden architrave to appear to relieve its weight with their horned fronts (Fig. 17). The architects of the huge rock-cut Indian temples took pleasure in imitating constructional forms in the supports of the ceilings of their halls, which were often immense; they usually copied wooden constructions (Figure 18).

In all these capitals, coming from such different regions, a certain connection, or relationship, at least, is apparent in each instance, between the support and the object supported. One seems made for the other, and neither is complete by itself. It is a long way from these pillars to the columns of the Greek or Roman monuments, or even of the Egyptian. In these last the column always figures as a separate element, seemingly created outside of the edifice, and introduced into it afterward in order to obtain vertical support for the architraves, but without any existing connection between the two parts. The column has an individual existence, with independent forms; it is always disposed as a vertical monolith symmetrical about a central axis, as though it must find in itself its complete equilibrium. A column like that of Trajan, which serves merely as a support for a statue, is subjected to no changes, either in form or proportions, when used as the support of an edifice. And it is in this very fact that its beauty consists; it is one monument supporting another. As in the aulic constructions — that is, before the introduction of vaults and domes — they are invariably employed to withstand vertical pressure. From the practical standpoint of construction their use is entirely justified, but here, again, nothing points to a clear and well-defined relationship between the support and the object supported. Is this because the column, having received its forms and character independently, retained the same on being converted into a support in edifices, a character which it added also to that of the edifices themselves? It is this question that we would be glad to solve by studying the column wherever it is to be found; it should be remarked, however, that the column has not been universally employed, nor in all regions where monumental architecture has been developed. In the extreme East, in China or Japan, it does not exist so far as the capital is concerned; it appears to have been unknown in Egypt during the early dynasties. Assyria furnishes hardly any examples of columns, and such as are to be encountered there seem to have been merely introduced in imitation of the architecture of ancient Egypt. Round pillars are to be seen in the old Mexican edifices, but they have no capitals. This preliminary survey opens the way for a kind of review of the ancient edifices, and for the unfolding of the entire history of the capital.

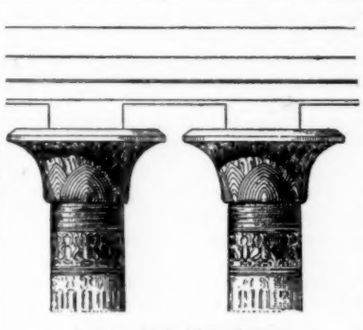

Fig. 19. Capital from Karnak.

It is ancient Egypt that must be interrogated first. As regards the capital, it is important to note one point at the outset. In the prefatory portion of this article, reviewing the capitals inspired by those of Roman Italy, it was shown that the capital of the monuments of that country always rests on the astragal at the top of the shaft, and that it is always crowned by an abacus, either moulded or without decoration, covering the entire capital and bearing the architrave directly.

In Egypt we shall find neither abacus covering the capital nor astragal terminating the shaft, making the shaft and the capital two wholly distinct elements of the column. Therefore the ornamentation of the capital never projects over the astragal and the capital, when finished, could always be placed on the shaft without anything being wanting to complete the column. The disposition of the Egyptian capital was unlike that which universally prevailed among the Greeks and the Romans, and it *never* carried the architrave directly; there was always an intermediary element a sort of square die; this was of varying height though it was generally higher than any abacus. The

[1] From the French of Adrien Joigny, in Planat's *Encyclopédie de l'Architecture et de la Construction.* Continued from No. 844, page 131.

distinction between the die and the abacus is all the more marked because the abacus *always* belongs to the capital, which it must cover completely, and *never* to the architrave, while the Egyptian die has *always*, on the contrary, been attached to the architrave, having the same thickness as the latter, and because, moreover, there is no moulding or decoration whatever to indicate to the eye a separation of the die from the architrave (Fig. 19). It seems — and this must have been the origin of the disposition in question — that the colonnade was long composed of simple square pillars of the same thickness as the architrave, as in the very old Temple of the Sphinx, and that at the period of the introduction of the column into edifices (of already ancient invention, as we shall see farther on) the pillars were cut off as it were, at some distance below the architrave in order to replace the portion removed by a column surmounted by its capital. The part of the pillar remaining became the die. From a constructional point of view, the form of the capital was a matter of indifference to architects, so long as it furnished a symmetrical base for the die. Aside from a few peculiar examples, the Egyptian capital has the form either of a truncated lotus, or of lotus flowers forming a circular sheaf and bound together by visible bands, in which case the die projects beyond the capital on all sides; or of a wide spreading bell or the bells of several flowers also fastened together in such fashion that the general form is circular; and with the capital projecting beyond the die on all sides.

A third form appeared at a period somewhat later perhaps than that which witnessed the introduction of the two forms just mentioned. This is the Hathor capital, representing the head of the goddess Hathor, dressed and bedecked and supporting a structure reproducing a house *à terrasse*, which furnishes the square foundation demanded by the die. A love for symmetry led to a modification of this capital whereby it was made up of four heads of Hathor, one on each side. The same evolution took place in the Ionic capital of the Greeks. We shall return to this subject.

The astragal does not exist in any of these columns, and the details of the shaft and of the capital blend with each other, with certainly no line of demarcation as distinct as that formed by the astragal of the Greek and Roman capitals. In a word, the Egyptian stone column has the form of a plant, or of a collection of plants, from the die downward; and we may already conclude that the Hellenic column cannot have been derived from the Egyptian; that in short, it had a genesis of its own and a special development.

Yet the Corinthian capital seems to have been created under an Egyptian influence. But this influence could not have been direct; here, as in many other cases, there must have been an intermediary; as Phœnician territory was especially an art laboratory for the countries of the East, the art of Ionia must have drawn from there more than one of its constituent elements.

We present here an enlarged reproduction of a Roman medal on which the artist has depicted the famous Temple of Paphos[1] (Fig. 20). In its architecture, this temple points to a curious transformation. It is noticeable that the architrave is constructed in the Egyptian style, that is, the capitals support it by the interposition of dies of the same thickness as itself; the capitals are covered with leaves similar to those in many Egyptian monuments, and the form of the leaves is also Egyptian, for they do not curl over at their extremities; but the imitation is confined to this arrangement of foliage, and the general disposition is Greek; the capital rests distinctly on the astragal at the top of the shaft; this column in its turn stands on a very characteristic circular base and the angle column is similar to the others.

We will not quit Egypt, however, without attempting some inquiry into the origin and development of the capital; it will be merely a preliminary survey of the manner in which the forms of art were evolved. In fact, it has never seemed to us that there has been a veritable creation in the case of any of these forms, as, for example, the capital; we do not believe, for instance, that an artist having to decorate a pillar to support an architrave, did, *without precedent*, create the Egyptian capital; or that the combination of the vegetable forms of

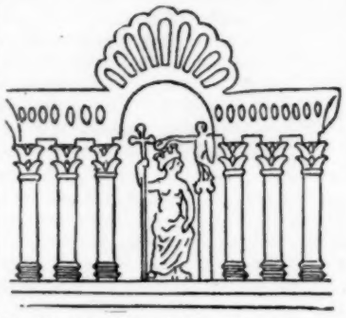

Fig. 20. Temple of Paphos (Roman Medal enlarged).

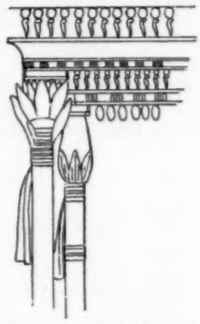

Fig. 21. Egyptian Bas-relief.

which it is composed came from his hands from the mere observation of the real plants. Such a translation is, we believe, never accomplished except by the different steps from which alone the complete and finished work can result. In this sense, architecture is an imitative art like every other, and it is so, as we are going to attempt to prove, even to the minutest details.

The stone column has not always existed in Egypt. It seems that centuries, even, of her history had elapsed before it made its appearance in monumental architecture. In any case the first existing examples carry us back only to the twelfth dynasty, to the dawn of the Theban period, when already the sun had risen for ages on the great pyramids and on the colossal sphinx which watches forever at their feet, and which, older still, had witnessed their construction.

Beside the square pillars, with cut or channelled sides, which are without capitals and are consequently not columns but simple pillars, we see, at Beni Hassan, the ceilings of the underground halls supported by columns cut to imitate wooden colonnettes; these last are pictured in mural decorations supporting the roof of the light structures which shelter sacred, divine, or funerary representations (Fig. 21). So, long before the stone pillar received its plant form and decoration, these were created; and because of their great age they must have become so familiar to the eye that the artist could not, without defying reason with the complicity, if we may so speak, of the beholder, clothe the stone column with plant forms, which, at a first glance, seem wholly out of keeping with it. Incongruities of the kind were unknown in the Greek column, whether Doric or Ionic, and, we must even add, in the Corinthian. The sources of the Egyptian column and the Greek are not the same.

We present two columns evidently of wood, taken from

Fig. 22.

Fig. 23.

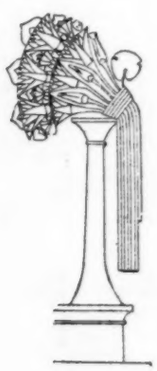

Fig. 24.

paintings (Fig. 22). The flower of the papyrus, the lotus in bud, the truncated lotus bud, and the bands holding them together are found in the stone capital. The essential as well as decorative elements of this column are here represented by the brush, a process which allowed the artist greater freedom. The superimposition of several capitals gives the *ensemble* a

[1] We should perhaps attempt here an explanation of this singular representation especially as the illustration by mistake found its way into the article "*Archæolte.*" Although in the periods of decadence this bastard disposition may have been sometimes adopted and carried out (medals similar to this were perhaps not then unknown), we cannot believe that the artist has reproduced the true aspect of the façade of the temple. Other representations do not give the addition of the circular part. The medal, which is of bronze, is Roman and of the first centuries of our era. Might it not have been struck by some one of benefactors of the temple, desiring to immortalize his work? The temple was often open to the sky, and that, in many cases, because it was impossible to cover such a large space; the dilapidation which must have resulted by this time may have induced the benefactor to have the space covered by means of a circular timber construction, which the Romans, and even the Etruscans before them, were so skilled in building. Consequently the engraver of the medal, having received orders to reproduce not only the exterior of the temple, *in order that it might be recognizable*, but at the same time the work done on the interior, an image similar to that given here would have been produced. Possibly also it represents merely a structure raised to protect the divinity like that in the Temple of Apollo at Didyma.

symbolic aspect (Fig. 23). One can even detect in it the semblance of a stem decorated with different elements, designed to be carried in the hand in processions and which, on account of its stiffness, was naturally adapted to play the part of a slight support. The forms of nature are copied here conventionally, and no realistic imitations are admitted. Yet the term *conventionally* is doubtless incorrect; it would be nearer the truth to say that these details are the reproduction of a primitive way of depicting natural objects which had become a fixed style. What difference is there between the flowers of the modelled or painted capital and the bouquet of flowers bound together and placed as an offering on the altar

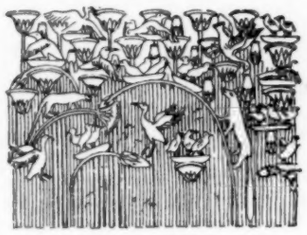

Fig. 25.

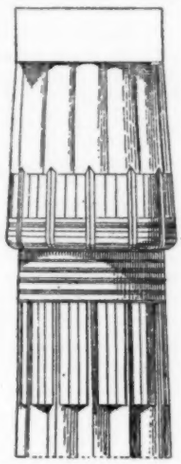

Fig. 26. Capital in an Edifice of Amenophis III, Thebes.

— flowers which the artist certainly attempted to render faithfully (Fig. 24).

If we go back still farther, and study the hunt in a marsh, copied from a painted bas-relief in the very ancient tomb of Ti — a scene from nature, a real landscape — we shall find our lotus once more, whether in full bloom, or in bud, under forms already consecrated by art (Fig. 25). The capital was not then modelled on nature. The sculptor converted compositions that had been created long before into those monumental forms which were to bring a genuine creation out of his work of simplifying, eliminating and balancing.

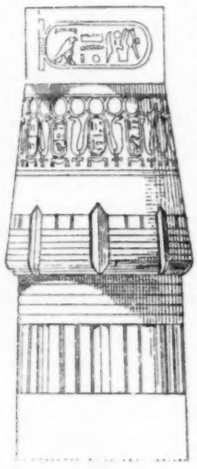

Fig. 27. Capital from the Menephteum of Goorneh.

Two examples of capitals from monuments of the eighteenth dynasty will show what the capital became under these conditions (Figs. 26, 27). The enrichment is managed with the greatest art; the parasitic symbolical forms seen in the paintings have all disappeared, or only such of their details have remained as were suited to monumental forms (Figs. 28, 29). A few examples selected out of the great number of capitals which have come down to the present time will suffice to exhibit the development of this important member of the column in Egypt. They are from the Temple of Esneh.

The origin of the Hathor capital, of which mention has already been made, can apparently be explained in the same way as that of the other Egyptian capitals, notwithstanding its peculiar character. Its name is derived from the heads of the goddess Hathor, of which it is composed (Fig. 30). The worship of Hathor is very ancient; it dates back to the first

Figs. 28 and 29. Capitals from the Portico of the Temple (Esneh).

dynasties. "She is," says M. Pierret, "*the personification, so to speak, of the space in which the sun moves, whose rising Horus symbolizes; the name, therefore, signifies literally the* ABODE OF HORUS (Hat-dwelling). *Hence her function as the mother of the sun symbolized by the cow, under the features of which she is represented suckling Horus. Kings, always likened to Horus, are sometimes depicted nursing the cow of Hathor. In her rôle of goddess-mother she is often confounded with Isis.*" (Fig. 31.)

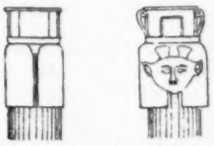

Fig. 30. Capital from the Temple of Sedeinga.

It is easy to see how much importance must have been attached to the office of the goddess, and kings must have looked favorably upon attempts at portraying her. But this would not of itself account for the adoption of the Hathor capital; among the various forms created with a religious aim, there are many that could not be adapted to such architectural requirements. That of Hathor was, however, especially suited to this purpose. The capital already figured as bearing a burden, a sort of doorway or cornice, emblem of the abode of the sun; if the capital possessed a kind of lateral volutes, it was because the head of Hathor, with cows' ears surmounted by the *hat*, had served as the handle of the sistrum. It was because of its natural fitness as a support that it was admitted without transition or modification into edifices. We give here a portion of the retinue of Ramses III, from a mural decoration at Medinet-Habou (Fig. 32). The priests are shown bearing the emblems of various divinities, a cow, birds, a jackal, the head of a greyhound, etc.; and the head of Hathor is seen under the same forms, as, later, in the Hathor column. The latter was then copied directly. It was in the period of the Lagides that the head of Hathor, which originally appeared on each of the principal faces of the capital, was repeated on all four faces for the sole purpose of making the capital perfectly symmetrical.

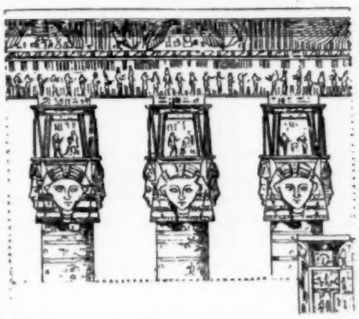

Fig. 31. Capital from the Temple of Denderah.

It is on similar principles that Greek columns were sometimes replaced by figures that seemed to be living. Nor was this transformation made by direct imitation of nature. Caryatides, like those of the Erechtheum, were reproductions of stone or marble statues originally isolated and consecrated to priestesses who were represented as bearers of sacred emblems; the architect introduced them into the temple without divesting them of their functions, but making them support the upper part of the temple besides.

Fig. 32. Cortège of Ramses III, Medinet-Habou.

Leaving Egypt, let us enter the territory of the Greek people, who succeeded in carrying their work to the highest degree of plastic perfection that man ever attained.

(To be continued.)

LABOR UNIONS OF THE UNITED STATES. — The hand-book of the Federation of Labor shows the strength of the seventy-four national trade unions of the United States to be 675,117. The Carpenters' Brotherhood leads with 65,000 members; Amalgamated Iron and Steel Workers', 60,000; Iron Moulders' Union of North America, 41,000; International Bricklayers' and Stone Masons' Union, 35,000; Brotherhood of Locomotive Engineers, 30,000; International Typographical Union, 28,000; Cigarmakers' International Union, 27,000; Brotherhood of Locomotive Firemen, 23,000; United Mine Workers', 20,000; Granite Cutters' National Union, 20,000; Journeymen Bakers' National Union, 17,500; Journeymen Tailors' Union, 17,000, and the Brotherhood of Railroad Trainmen and Brotherhood of Painters and Decorators, each with 16,000. — *Paper Mill.*

ARCHITECT, OWNER & BUILDER BEFORE THE LAW.[1] — XXI.

THE BUILDER AND THE OWNER. — THE CONTRACT. — RELATION BETWEEN OWNER AND BUILDER FIXED BY THE CONTRACT.

Romanesque Capital from the Cathedral at Autun. From *La Construction Moderne.*

THE relation between the builder and the owner is formed exclusively by the contract. This alone defines what the builder is to do for his employer, and how much, and in what manner, and at what time, he shall be paid for doing it.

A contract may be a very informal affair, and may even be implied from certain actions of one party or the other; but, without a contract of some kind, neither party is obliged to do anything for the other.

WRITTEN, ORAL AND IMPLIED CONTRACTS.

Contracts, in general, are of three sorts, written, oral or parol, as they are sometimes called, and implied. In the first sort, each party signs a writing, containing what both agree to do; in the second sort, the parties verbally agree what one shall do, and the other pay for the service; and in the third sort, one party asks the other to do something, or, after the thing has been done without his asking, accepts the benefit of it; and a promise to pay a reasonable price for what has been done is thereby implied.

Practically, most contracts combine the features of at least two of the sorts. Few written contracts, and still fewer oral ones, are so full as to describe everything that each party is to do, and some of the provisions which the parties really intended have to be implied from various circumstances, such as local custom, previous transactions between the parties, legal maxims laid down for the purpose of meeting such cases, or many other things.

WRITTEN CONTRACTS.

Of the three sorts, the written contract is commonly supposed to be the most binding. In reality, it is no more binding than any of the others, but as there can be no dispute about terms laid down in black and white, and signed by both parties, while two persons will rarely agree as to what was said in making an oral contract, it is usually the most easily enforced. Moreover, as there is a certain solemnity attached to the signing and delivery of a written contract, it is always presumed in law that the written document is the final quintessence and conclusion of all the oral negotiations which have preceded it, and expresses the matured agreement and understanding between the parties.

For this reason, as has been before mentioned (Page 10) testimony as to oral conversations and agreements, which contradict a subsequent written contract, or even a very informal written memorandum of a contract, is generally excluded by courts. Innumerable examples to illustrate this point can be found in the law reports, as nothing is more common than for people, when brought to account for not fulfilling their agreements, to endeavor, unsuccessfully, to introduce evidence to show that they did not really mean what they signed their names to, but something else.

CONTRACTS FOR EMPLOYMENT.

The contract between the builder and the owner may be, in some cases, a contract for employment simply, in which the mechanic works by the day or hour, and the owner either agrees to pay him certain wages, or promises, by implication, to pay him a reasonable compensation; or the agreement may be for the builder to furnish materials as they are wanted, and engage men, who work by the day at whatever the owner may wish them to do, and are paid for their time by the owner, although usually indirectly through the builder, who charges a profit on the wages actually paid, to compensate him for his trouble in hiring and supervising the men. A contract of this kind differs materially, in the method of enforcement, and the responsibility which it imposes on the parties, from one in which the builder agrees to do a certain work for a fixed sum; but details on this point will be given later.

IMPLIED CONTRACTS.

It was said above that if a person does a service for another, without being asked to do it, and the person for whom the thing was done accepts the benefit of it, a contract for doing the work is implied, under which the one who derives benefit is bound to pay a reasonable price for the work.

Such an implied contract would be subject to modification by any more definite agreement under which the work might have been done. For example, where a written contract provides that extra work shall not be paid for unless ordered in writing, the owner is not obliged to pay for extra work not so ordered, even though he may derive benefit from it; and there are various legal presumptions under which a person is considered as having intended to render services without expectation of being paid; as where children work for their parents; or a wife for her husband; or where persons employed work occasionally overtime.

Cases of this sort are often difficult to decide. On the one hand, is the maxim of law that no one can make another debtor to him against his will; and on the other, is the natural feeling that a person who innocently does another a service should receive what the service is worth to the one for whom it was done, even though he may not have asked for it. A good case[2] for illustration is that of a plumber in North Carolina, who made a sub-contract with a builder for the plumbing of a house. The owner discharged the builder for drunkenness, before the plumbing work was done. The plumber went on with his work, and, when it was done, sued the owner for the price. The owner was proved to have seen the work going on, and to have given some directions about it; and, although it seemed that money enough to pay the plumber, under his sub-contract, had been paid over to the builder, the Supreme Court held that the owner might, if the jury should think that the circumstances warranted it, be required to pay the plumber at least the value of the work done by him after the discharge of the builder, on the ground that "Where one stands by in silence, "and sees work done or materials furnished for work done "upon premises belonging to him, of which he accepts the "benefit, a promise to pay the value thereof may be inferred."

FORMAL CONTRACTS. — PROPOSAL AND ACCEPTANCE.

As distinguished from implied contracts, a formal contract may be defined as consisting of a proposal and acceptance.

The proposal may be made by one party, and accepted by the other, by separate acts, or the agreement as to what each is to do may be signed by both, this constituting virtually a simultaneous proposal on the one hand, and acceptance on the other, of all the conditions of the agreement.

Where it is desired to make a contract by means of a proposal and its acceptance, certain precautions must be observed by both parties. In all cases, the party making the proposal must be careful to have it include everything that he means to insist upon, for the reason that its acceptance by the other party binds both to its exact terms, without variation or reservation of any kind; and a person who, having received a proposal which seems to him favorable, desires to take advantage of it, must accept it at once, and unconditionally.

HOW SOON PROPOSAL MUST BE ACCEPTED.

Just how quickly the acceptance must follow the proposal, and how much opportunity shall be given to the one making the proposal to retract or modify it, are questions over which courts have spent much time. Something depends upon the circumstances attending the offer, and what would be a reasonable time in one case, might not be so in another. A man once wrote an offer to engage a person as trimmer in his millinery shop, asking for a prompt reply. The letter was received by the one to whom it was addressed, on March 22.

The next day, March 23, she answered by postal card, accepting the offer. She gave the postal card to a boy to mail, but he neglected to mail it until March 25. The place had then been given to some one else, and, on the suit of the one

[1] Continued from No. 843, page 117.

[2] Blount *vs.* Guthrie, 99 N. C. 93.

to whom the offer was first made, to enforce the agreement contained in the letter and its acceptance, it was held that the acceptance was sent too late, and that the milliner was not bound by his offer.

Where it is specified in the offer that it shall be open "until" a certain day, it has been held in New Jersey[1] that acceptance on that day was sufficient, unless the offer had been definitely withdrawn before acceptance.

ACCEPTANCE BY LETTER.

Where acceptance is made by letter, it is of importance to know whether the acceptance, and with it the contract, is complete on the mailing of the letter, or not until it has been received by the party making the proposal, but decisions in different States vary on this point. The English rule,[2] which is followed in New Jersey, and seems to be also adopted in New Hampshire, Illinois and Mississippi, is that "The acceptance of a proposal by letter is complete on the delivery of such acceptance to a messenger, to be carried to the proposer, and the contract is binding from that point of time; so that, if B. gives to a messenger, for the purpose of delivering to A., the acceptance of a proposition made by A., simultaneously with the time that A. dispatches a messenger to notify B. that the proposition is withdrawn, the acceptance is complete, and the contract binding."

Where the letter of acceptance is sent by mail, instead of being given to a messenger to carry, it seems to be the rule that the dropping of a letter in the post-office, or in a letter-box, is equivalent to giving it to a messenger, and that from that time, the contract is binding.

In New York, the law on the subject must be considered as doubtful. Some of the decisions appear to favor the English view, and others not. It was held by the Supreme Court in one case that an acceptance by letter was not complete on the mailing of the letter, when it was not shown that the postage on the letter was paid.

In Massachusetts,[3] it appears to be well settled that the contract is not complete until the letter of acceptance is received; and, in consequence, the person making the proposal is entitled to correct it, or withdraw it, until he receives the reply.

In the Federal courts,[4] the same doctrine is held, in respect to letters, as in Massachusetts.

ACCEPTANCE BY TELEGRAPH.

Where telegrams are sent, instead of letters, there are further variations in the decisions. In the Federal courts,[5] although and acceptance by letter is not binding until it is received by the person addressed, an acceptance by telegraph has been held to be complete as soon as the message was furnished to the telegraph office for transmission. In New York,[6] on the contrary, although acceptance by letter has been held to be complete on the mailing of the letter, it has been decided that acceptance by telegraph is not binding until the telegram is received.

WITHDRAWAL OF OFFER.

Whether the person making the proposal is always at liberty to withdraw it until it has been accepted appears to be somewhat doubtful.

The rule is that until the offer is accepted, it is an offer only, and may be withdrawn or modified by the party making it; but there would often be circumstances to indicate that a reasonable time was to be allowed for considering the offer. Where a proposal is made by letter, it is considered that it is, in any case, open until the letter is received; so that if a man receives a letter, making a certain proposition, and answers it at once, accepting the offer, the person who made it is bound by it, even though he may have sent off a second letter immediately after the first, withdrawing the offer. If, however, he should telegraph his withdrawal, so that it reached the proper person before the reply accepting the offer was sent, the proposition would be cancelled, and neither party would be bound.

[1] Haughwout *vs.* Boisaubin, 3 C. E. Gr. 315.
[2] Adams *vs.* Lindsell, 1 B. & Ald. 681. Dunlap *vs.* Higgins, 1 H. L. Cas. 381, 400. Newcomb *vs.* De Roos, 2 E. & E. 271. Harris Case, 7 L. R. Ch. 587. Bragdon *vs.* Metrop. R. R., 2 App. Cas. 691. Household Ins. Co. *vs.* Grant, 4 Ex. D. 216. Byrne *vs.* Van Tienhoven, 5 C. P. D. 344-8. Fox *vs.* Turner, 1 Bradw. 153. Mactier *vs.* Frith, 6 Wend. 103. Vassar *vs.* Camp, 1 Kernan, 441. Halleck *vs.* Com. Ins. Co., 2 Dutch. 268, 3 Dutch. 645. Taylor *vs.* Merchant's Ins. Co., 9 How. 390. Northampton *vs.* Tuttle, 11 Vt. 476. Britton *vs.* Philips, 24 N. Y. Sup. Ct. 111.
[3] Lewis *vs.* Browning, 130 Mass. 173. McCulloch *vs.* Eagle Iron Co., 1 Pick. 278.
[4] The Palo Alto, etc. 2 Ware, 343.
[5] Minn. Oil Co. *vs.* Collins Lead Co., 4 Dill, 431.
[6] Trevor *vs.* Wood, 36 N. Y. 307.

PROPOSAL MUST BE ACCEPTED AS MADE.

In any case, a proposition must be accepted as made. A conditional acceptance is no acceptance at all. It is very common for architects and other people, after receiving and considering bids for a building, to send word to the lowest bidder that his proposition is "accepted, on condition of signing a satisfactory contract." An acceptance of this sort does not bind the person who made the proposition, and if he chooses to reply that he will not sign any contract, or that he withdraws his bid, or if he makes no reply at all, he is no longer held to his offer, and a subsequent unconditional acceptance of it does not bind him.

To use the words of an Illinois Court;[7] "A proposal to "accept an offer, on terms varying from those proposed, "amounts to a rejection of the offer, and a substitution in its "place of a counter proposition, which cannot become a con- "tract until assented to by the first proposer. The original "offer thereby loses its vitality, and is no longer pending "between the parties, and it becomes an open proposition again "only when renewed by the party who first made it; hence, "the party who submitted the counter proposition cannot, "without the consent of the other, withdraw or abandon the "same, and then accept the original offer, which he has once "virtually rejected."

Even where a man, having received a verbal proposition, wrote a letter accepting it, and stating the terms as he understood them, and asking the party addressed to acknowledge his acceptance in writing, it was held[8] that this did not constitute a contract, but only a proposition for a contract.

In the same way, where the rather common trick is played of accepting a contractor's bid, for a few dollars less than his proposition, the contractor is in no way bound by the acceptance, but is, on the contrary, released by it from his original proposition.

Even an innocent mistake in the acceptance invalidates it. The Managers of the Corporation of the Maine Industrial School for Girls[9] once appointed a building-committee of five members, with instructions to advertise for proposals, and to take the necessary measures for the erection of a school-building. The building-committee did so, asking for proposals for labor and materials, according to plans and specifications. In answer to this advertisement, the following proposal was sent.

"HALLOWELL, September 26, 1884.

TO THE BUILDING COMMITTEE OF INDUSTRIAL SCHOOL:—

We propose to put up the superstructure of said building as per plans and specifications or instructions of your architect, E. E. Lewis, of Gardiner, Maine, for the sum of forty-five hundred and fifty dollars.

JOHN HALL, *Carpenter.*
HOWARD & CHURCH, *Masons.*"

On the same day the building-committee had a meeting, with three members present. They opened the bids, and found the one described above to be the lowest. The record of the meeting then proceeds as follows:

"And the contract was awarded to Hall, Howard and Church, for $4,525.

"Voted, that the committee require a bond from the contractors to the amount of the contract, for fulfilment; also forfeiture for delay in completing the work."

A controversy subsequently arose about the building, and the Supreme Court of Maine held that no contract existed between the parties.

Here, not only was there an error in the vote as to the amount of the bid accepted, but the action of the committee in requiring a bond from the contractor introduced a condition which was not, as the testimony showed, either suggested in the original bid, or subsequently accepted by the contractors.

The same rule holds good against the builder. The selectmen of a village once advertised for bids for building a town-hall, according to certain plans and specifications. One Hughes[10] sent in a bid, which was accepted. Hughes then drew up a contract, and the selectmen drew up another, but each party refused to sign the contract as drawn up by the other. The selectmen then indefinitely postponed the whole

[7] Fox *vs.* Turner, 1 Bradw. 153. Dwight *vs.* Ludlow, 128 Mass. 280. Eggleston *vs.* Wagner, 46 Mich. 610. Thomas *vs.* Greenwood, 69 Mich. 215. Falls Mfg. Co. *vs.* Broderick, 12 Mo. App. 378. Brecheisen *vs.* Coffey, 15 Mo. App. 30. Shickle *vs.* Chouteau, 84 Mo. 161. Hughes *vs.* Clyde, 41 U. S. 239.
[8] Hough *vs.* Brown, 19 N. Y. 111.
[9] Howard *vs.* Ind. Sch. 78 Me. 230.
[10] Hughes *vs.* Clyde, 41 U. S. 339.

matter, and Hughes sued the village for damages. It was not shown that Hughes ever offered to sign any contract limited to the terms expressed or implied in the advertisement, plans, specifications, bids and vote of acceptance, and the court held that the acceptance of a bid legally made, under the statute regulating the undertaking of public works by villages, only entitled the bidder to a contract according to those terms; and that, as Hughes never offered to execute such a contract, and the village did not waive its execution, he had no right of action.

Architects will perceive, from these examples, that it is very necessary, for their client's interest, as well as for their own, and that of the builders who bid on their work, to explain, as far as possible, in the specifications on which the builders base their estimates, all the conditions, as to time of completion, giving bonds, etc., upon which the owner wishes to insist.

If this is done, the bids will be made understandingly, and an acceptance of any one will bind the contractor making the offer to all the stipulations on which his bid was based.

GENERAL CONDITIONS.

In practice, this is usually effected by prefixing to the specifications for every part of the work which is intended to form the subject of a separate contract a printed sheet of General Conditions, which forms a part of the specification, and contains all the stipulations in regard to bonds, time of completion, payment for permits and water for building, compliance with building regulations, maintaining lights and guards, and so on, which the contractors will be expected to conform to.

As the bids are always based on the specification, which includes the general conditions, a simple acceptance of a bid establishes a valid contract with the bidder, by which he is held to all the terms of the general conditions, as well as to the other details of the specification.

To say nothing of the greater fairness of showing the contractors, before they make their bids, everything that will be required of them, it is often for the advantage of the owner to be able to accept promptly and definitely a particularly favorable bid without giving an opportunity for its withdrawal, such as would be afforded by any conditional acceptance; and, if the specifications on which the bid was based contained proper general conditions, there is no risk in doing so, as the contract thus made is perfectly binding, and the additional stipulations of a more formal document, such as those providing for insurance or regulating the times of payment, are usually more for the benefit of the builder than of the owner.

CONTRACT BY ACCEPTANCE.

Where, however, such general conditions have not been incorporated in the specification, the unconditional acceptance of a bid forms an equally valid agreement, to which the owner is bound, but which binds the contractor only to complete his work within what a jury may consider a reasonable time, without regard to the owner's wishes on the subject, and leaves uncertain various other matters of great importance to the owner.

ACCEPTANCE BY ARCHITECT FOR OWNER.

Whether the architect is entitled, by his relation to the owner, to accept bids for the work is very doubtful; and, although no case in which just this point is involved appears to have been decided in our courts, it seems quite probable, in the light of the decisions as to the architect's authority as agent for the owner in other respects, that an architect who, as not unfrequently happens, accepts unconditionally a favorable bid without consulting the owner, might find himself in an uncomfortable predicament if the latter should choose to repudiate the act of his too zealous adviser. At the same time, as it is often of great advantage to the owner to have propositions made to the architect accepted on the spot, it is desirable that the architect should be specially empowered by the owner to act for him in this way, either in general or for particular occasions, or under such limitations as may be agreed upon; and the architect should in such cases be careful to show that he is acting for the owner, and not for himself, by using some such form as "I am instructed by Mr. —— (the owner) to "accept your proposal"; or, "Under authority given me by "Mr. ——, I hereby accept for him your offer," etc.

For builders, also, an observance of this precaution is quite as necessary as for architects, inasmuch as a contract carelessly made might turn out to be only with an unauthorized architect, instead of with the owner of the estate; and it is safest for all parties, under such circumstances, to make sure at once either of the owner's previous instructions, or of his immediately subsequent ratification.

THE CONSIDERATION.

An important circumstance of every contract is the consideration; that is, the payment or service which is to be rendered by one party in return for the goods supplied him, or work done for him by the other. A promise without a consideration is void; so that if a man promises to build a house for another for nothing, even though he may make the promise in writing, and before witnesses, he cannot be compelled to fulfil it. In suits for the enforcement of contracts, it is very common for the claim to be raised that the agreement itself, or some subordinate or supplementary promise, was without consideration, that is, without promise or expectation of remuneration for the service; and that it was therefore a *nudum pactum*, or empty agreement, not enforceable in law.

Where the court can be induced to take this view of the contract, or of any part of it, the person who made the promise is released from obligation to perform such portion of it as may be held to be without consideration; and it is therefore important for persons who wish to be able to enforce upon the other party the agreements into which they enter to see that a consideration is clearly indicated for the promises that are made.

To make sure of excluding all misapprehension on the subject, it is well to begin contracts for work or materials, even though the value of the work to be done may be small, by saying that "For the consideration hereinafter mentioned, A. B. promises and agrees to deliver certain goods, or do certain work, for C. D.," leaving the details of the consideration to be described later. It is not necessary that the consideration mentioned should be *adequate* to the service rendered. If a man chooses to promise to build a house for another for one dollar, the law does not prevent him from doing so; and his promise will be enforced; and any proposed payment, or service, however small, will answer as consideration for a promise of any magnitude; but a consideration of some sort must be shown to bind the promiser.

SEALED CONTRACTS.

There is an exception to this rule in contracts under seal. Anciently, a seal was a mass of sealing-wax, on which the high-born party to a charter or treaty impressed an engraved stone, or, perhaps, his knightly thumb, in token of the solemnity with which he entered into the engagement. Now, in the case of private persons, a seal is commonly a bit of red paper, with mucilage on the back, which is moistened in the most convenient way, and stuck on the document to which it is supposed to add authority, near the signature of the party whose promise it strengthens. In many States, the seal may be even less formal an affair than this; and in some a blot of ink is held to be a good seal.

However the seal may be made, if it is affixed in the legal manner to the document, it has the effect of making any promise valid, whether a consideration for it is shown or not. In legal language, the seal "imports a consideration," and it is not necessary to show that any other was agreed upon for the promises contained in an instrument thus fortified.

For this reason, it is common, and usually advantageous to both parties, to have the signers of building-contracts affix seals to their signatures, thus mutually renouncing all opportunities which might be offered for escaping from any of the promises contained in the document, on the ground of want of consideration.

Illustrations of the importance of such a precaution, as well as observations on other properties of seals, will be found in the following chapters, where the various points of building-contracts are taken up in detail.

[To be continued.]

Non-freezing Dynamite.— Unfreezable dynamite has been brought out by the Unfreezable Dynamite Company of London, England, with a view of preventing the numerous accidents caused by carelessness of the men in thawing out the cartridges by baking, boiling or otherwise heating them. The unfreezable mixture was invented by Edward Liebert, of Berlin, percentage of isoamylic nitrate to the nitro-glycerine or to the dynamite itself. The dynamite is thus rendered uncongealable and somewhat less sensitive to concussion, while its explosive power is slightly increased. Dynamite is said to freeze at about 40° F., while isoamyl requires a temperature of more than 35° below zero to freeze it.— *Engineering News.*

The American Architect and Building News

ADVERTISERS' TRADE SUPPLEMENT.

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THE GRAPHITE INDUSTRY.

THE Graphite Industry is fittingly represented by the Company whose founder first gave it birth.

The Joseph Dixon Crucible Company, Jersey City, N. J., was founded by Joseph Dixon in 1827, who, at that time, began the manufacture of black-lead crucibles and completely revolutionized the crucible business. All crucibles used at the present day for melting brass, steel, copper, gold, silver, nickel, etc., are made of black-lead (the common name for graphite) and by the Dixon process.

The Dixon Company have not only been progressive, but they have been aggressive, and have pushed their goods into all parts of the civilized world. During the past year they made extensive changes in their factories, and we take pleasure in showing by the illustration below, the main works and offices located in Jersey City. Their graphite mines are at Ticonderoga, N. Y., and their cedar mills are at Crystal River, Fla.

The nature of graphite, sometimes called plumbago, or black-lead, is not generally understood; and therefore, its great value in the mechanical arts has not been fully appreciated. Graphite is one of the forms of carbon. It is not affected by heat, cold, acids, alkalies or any known chemical solvent. It is also the best solid lubricant known to science, a remarkable conductor of heat and electricity. The peculiar qualities of graphite have given it a wide range of usefulness. It is used in the manufacture of lubricants for all purposes, crucibles, stove-polish, lead-pencils, foundry-facings, electrotyping-graphite, graphite-paint, etc.

The Dixon Company are miners as well as importers of graphite in all its forms, and use no graphite that they do not mine or prepare. Their mines are located in Ticonderoga, N. Y., and they have every facility in the way of chemists and expensive machinery, etc., necessary for completely freeing the graphite from the silica, sulphur and other impurities which it contains when it comes from the mines.

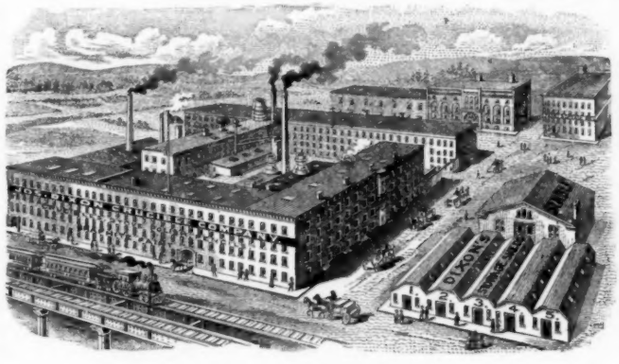
The company's illustrated catalogue of graphite productions is an interesting pamphlet and well worth reading. It is sent free on application.

JOSEPH DIXON CRUCIBLE CO.,
JERSEY CITY, N. J.

PHOTOGRAPHY AND THE MANUFACTURING ARTS.

TWELVE years ago photography was only practised by a chosen few who had gained their knowledge by the hard roads of study and experiment; to-day the photographic studios are more numerous than ever, and a hundred thousand amateur photographers are spending every leisure moment in "viewing" as it is now termed, while many large manufacturing concerns find it to their advantage to fit up their own studios and employ a regular operator, it being conceded that the most solid and impressive advertising is done by sending out to customers, present and prospective, photo-print views of their various manufactures, and especially of any new or novel works they may execute from time to time.

This wonderful advance in an art within so short a time is due solely to the substitution in place of the Collodion Bath, of the Dry Plate, which was introduced in this country by John Carbutt, of the Keystone Dry Plate Works, Philadelphia, about the time it was first manufactured in Great Britain, and in the short space of twelve years it has completely driven the old process into oblivion. The dry plate being made in the factory it is put on the market in dozen packages ready for use, rendering unnecessary all the preliminary work on the part of the photographer, which used to precede the taking of a picture. However, it is not our intention to tell the history of past achievements, but to draw attention to a new field of utility for the art, which is rendered possible since the introduction by Mr. Carbutt of his celluloid negative films, being the dry plate emulsion coated on thin sheets of celluloid, thus dispensing with the weight and liability of breakage incidental to glass, and rendering them particularly adapted for the use of supervising engineers, foremen, etc., in charge of works of construction at a distance from the main office, in making photographic records of progress and the different stages of the work. The negative films, being as light and flexible as a sheet of ordinary paper, can be carried in a hand-satchel without inconvenience, and after exposure is made, if there are no facilities handy for the development and printing, the film can be placed in an envelope and mailed to the home office for the necessary treatment. The record of time and place and notes, calling attention to details of construction, being made on the envelope. In this way the main office can have before them a pictorial record of all operations carried on at a distance, showing daily progress of the work, and enabling them to exercise thorough control over the matter, as was done by Mr. Claus Spreckels, the sugar king, when erecting his large refining-plant in Philadelphia, he having had photographs made daily, showing progress of the work, which were forwarded to him in San Francisco. Another important use of the photographic record is in sending from the scene of operations a picture of any error in manufacturing the various parts in the shop, or changes to be made, it being conceded that a picture will convey at a glance what it would require pages and a ready pen to describe. Nor is the photographing of works of construction confined to daylight exposures; machinery, etc., erected underground can, by the aid of the magnesium flash-light, be photographed with the same ease as when exposed to the sunlight.



The Joseph Dixon Crucible Works, Jersey City, N. J.

Notwithstanding the enormous extension of amateur photography in the last ten years, there still remains among many an erroneous idea that photography is a mysterious art, requiring study and skill before it can be mastered. This is in part true of the higher branches, but it may be safely laid down as an axiom that for the purposes above indicated, any man of average intelligence can learn from five minutes explanation how to put the plate in the camera and make the exposure; the further operations of developing and printing require some knowledge and skill to get proper results, but as we have

before shown with the Carbutt celluloid film, this can all be done at the home works, either by a young man in the office trained up for it or by the professional photographer, now so generally employed by all large manufacturing concerns.

For the purposes above described, none of the multitude of repeating detective cameras now in the market should be used. Many of them, we admit, are ingenious pieces of mechanism, and can be worked successfully by dilettante amateurs, with plenty of time, but are unfit for the practical use of a foreman of works. The camera should be of the pattern containing the bellows focusing arrangements and fitted with a good rectilinear lens. Thus equipped, and with a supply of Carbutt's celluloid films, your foreman is ready for anything in the photographic line that can reasonably be expected of him.

To those who think of carrying out our suggestion, we would give the advice to seek counsel with Mr. Carbutt before investing in an outfit, as not being a manufacturer of cameras, and solely interested in the successful working of his dry plate and celluloid films, his advice will be valuable as that of a disinterested expert, and we are assured that it will be cheerfully given.

JOHN CARBUTT,
PHILADELPHIA, PA.

THE MAIL CHUTE.

The Mail Chute has to be made in removable sections, and therefore requires a solid, continuous support. This is usually furnished by erecting a casing of wood, although marble and angle-iron supports are sometimes preferred. The openings in the floors, through which the Chute passes, are finished to iron floor-thimbles the exact shape and size required, which we furnish, free of charge. The furnishing and erecting of the casing or equivalent support and the setting of the floor-thimbles we call "preparatory work," and as it is done more cheaply by local mechanics, we do not include it in our contracts.

In the case of completed and occupied buildings, where elaborate finish and possibly expensive decorations have to be protected, and in other special cases, we are willing to do the preparatory work, but always make it the subject of a special agreement. Our printed contract stipulates that the preparatory work is to be done by the person accepting our proposal.

As our contract for installing the system with the U. S. collection-service has to be formally approved in writing by the local postmaster, in terms required by the Assistant Attorney-General of the Post-office Department, it must be on our own blank and executed by the owner or his authorized representative.

The Mail Chute is always made of the standard pattern, size and construction, with the front of heavy, polished plate-glass, the only variation being in finish. The usual finish, for which we estimate, unless otherwise requested, is black, with mouldings, collars and bases finished in polished brass. We also make the Chute bronze-plated or all brass, either finished antique or plain, of course at an extra charge. When we furnish a bronze-plated box, we always bronze-plate the chute-trimmings in the lower story to match.

The building being prepared to receive it and the stories not exceeding usual height, the minimum cost of the Mail Chute for a four-story building is five hundred dollars — including the No. 8 special box; additional stories one hundred dollars each. We do not take orders for less than the full number of stories, nor for the chute without the box. All our patented improvements to the date of filling the order are included without extra charge.

The other styles of boxes most commonly furnished are the following:

The No. 6, cold-rolled steel, bronze-plated, made especially narrow.

The No. 8, cold-rolled steel, bronze-plated, same as No. 6, except that it is wider.

The No. 8*b*, same as No. 8, but arranged for recessing. No extra charge for either of the above.

The No. 1 box, which is cast-iron finished black with brass mouldings, is furnished at a reduction of $50 from the above. It cannot be recessed.

The No. 7 and the No. 7*b* boxes, steel, covered with marble of any kind or finish, at special prices.

We make a large variety of mail-boxes from special designs, at various prices made known on receipt of inquiry. All mail-boxes conform to regulations as to inscriptions, height above floor, time-card and patent elastic bottom, are fitted to receive the U. S. mail-lock, etc., etc., and pass under the absolute control of the local postmaster.

In writing for an estimate, please give the name and location of the building, the number and heights of stories and thickness of floors, the style of box desired, and say whether the proposed location is on a solid wall or in front of an elevator-screen, or whether the chute is to be placed in an open channel in the wall. This enables us to send, with the contract, the full-size details and specifications covering the preparatory work, which should be arranged for as soon as the building is commenced, and which is conveniently and cheaply included in the builder's contracts.

In the case of new buildings, the best results are obtained where the Mail Chute is considered early enough to secure a good location and such arrangements for the preparatory work as will enable it to be done by the builder with other work of construction; the size and style of the mail-box determined upon in advance of the construction of the building, so that it may not be crowded to one side or the other by steam-pipes, radiators, or other incidents of the building. Experience with several hundred cases enables us in cases of difficulty sometimes to suggest a location, and plans sent to us for the purpose are always carefully and promptly returned. It is always a pleasure to furnish special drawings or to make suggestions, where we can be of service in this way.

THE CUTLER MANUFACTURING CO.,
ROCHESTER, N. Y.

THE STRENGH OF COLORS.

An attractive tint-card is issued by Harrison Bros. & Co., showing the tints produced by the mixture of certain of their high-grade colors with white lead, in the proportion of one pound of color to one ton of white lead. It would hardly seem possible that so small an amount of color would have any effect whatever on so large an amount of white lead; yet the tints shown are quite decided, and exhibit strikingly the marvellous excellence of colors, especially the fineness of grinding, which will produce such results. We understand that the other products of this firm have an equal reputation for purity and general care in manufacture. Indeed, the words "strictly pure" seem almost a watchword with them, so strongly do they insist in their general advertising that the labels on the packages should represent the true contents of the cans. The series of advertisements now running in the *American Architect* are practical in their character, and well worth the careful attention of every architect.

HARRISON BROS. & CO.,
PHILADELPHIA, PA.

STEEL LATHS.

The Bostwick Patent Fireproof Steel Lath is rapidly taking the place of the old-fashioned wood lath. Its benefits are apparent.

It is fireproof, and a large saving is realized on insurance where it is used.

It has already been demonstrated that a workman can put on about three times as much of this lath in a day as he can of wood lath;

That a plasterer can plaster more than double the number of square feet on this lath than he can on the wood in a given time;

That the Bostwick Patent Steel Lath will make a stronger wall than wood lath, and one which is less liable to crack from settling of walls;

That the plaster is much less liable to fall off from this lath than from wood, because it is so thoroughly keyed by loops;

That a given amount of plaster will cover nearly twice as much surface on this lath as it will on the wood lath, because the surface of the steel lath to be covered is even and unyielding, and the openings being uniform and sufficient to guarantee a stronger key, will not admit of waste mortar falling off from the back of the lath; and

That a finished wall with this steel lath will cost but little if any more than when wood lath is used, because of the great saving of material and labor.

The Bostwick Patent Steel Lath has been examined by the principal architects, builders, and insurance companies, and is pronounced by them to be the best steel lath yet produced.

AKRON, O., May 27, 1891.

BOSTWICK METAL LATH CO.:

Gentlemen, — Replying to your favor of 26th, will say that we have been very much pleased with the character of your metal lath, and trust that we will have frequent future occasions to adopt the use of same in fireproof buildings under our charge. We certainly consider it superior to any other style of fireproof lath which has come to our notice, or has been used by us in numerous buildings under our charge. Wishing you success in your new business undertaking at Niles, we remain.

Very truly yours,
WEARY & KRAMER, Architects.

No. 223 West 69th Street,
NEW YORK, November 14, 1890.

BOSTWICK METAL LATH CO.:

Dear Sirs, — We have used a large amount of your metal lath, and take pleasure in recommending it to all parties requiring a good and substantial job of plastering and a ceiling or wall that will not crack.

Your lath is also a great saver of mortar, and is readily and easily applied.

Respectfully yours,
COLLERAN BROS.

NEW YORK, November 11, 1890.

BOSTWICK METAL LATH CO.:

Dear Sirs. — It gives me pleasure to say that I have used upwards of five thousand feet of your metal lath in my building, corner of Eighty-third Street and Eighth Avenue,

where I put the same on wood studding, with the best of satisfaction.

My reasons for adopting this metal lath are that it makes a stronger and safer wall than wood lath.

Yours very truly,

H. B. HELMKE.

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242 Water Street, }
NEW YORK, July 1, 1890. }

BOSTWICK METAL LATH CO.:

Gentlemen, — The steel lath that we purchased of you is in every way satisfactory. Where protection is needed against fire your lath is especially desirable.

Very truly,

JANES & KIRTLAND.

This Patent Steel Lath is recommended by all architects, and is extensively used by builders as the best steel lath in the market, as it is much easier handled, more rapidly applied, takes less mortar and more thoroughly keys the plaster, and makes a stronger, safer, and more durable fireproof wall than any other wire or iron lath yet produced.

The mortar may be applied to either side of the lath with equal advantages.

The Bostwick Patent Steel Lath accomplishes all that is required of a metal fireproof lath, and we recommend it to the trade, knowing that it will give the best of satisfaction.

Our facilities for manufacturing this steel lath are ample, as each of our patented rotary lath machines has a capacity of forty thousand feet daily, which enables us to fill orders promptly. Trusting to be favored with your patronage, we remain,

BOSTWICK METAL LATH CO.,
38 PARK ROW, NEW YORK.

REMOVAL.

PURCHASERS of pulleys, hangers and shafting are reminded that Messrs. A. & F. Brown & Co., probably the largest manufacturers of these goods in the United States, will remove their office and sales-rooms from 44 Park Place to 17 Dey Street, New York, quarters formerly occupied by the Edison Machine Works, in the same line.

SPANISH TILES IN COPPER.

IN a recent article, public attention was called to the subject of clay tiles for roofing purposes. The statements made in that article having called forth some comment, a reporter of the Philadelphia *Times* was sent to examine a patent owned by Merchant & Co., 517 Arch Street, when opportunity was afforded him to view the new Spanish tiles, made of copper and tin, and manufactured by that firm under their patent.

These tiles are claimed to have superior merits over the clay tiles, for the reason that they are much lighter in weight, and, when made of copper, are practically indestructible, as a copper roof is known to be the most durable roof in the market. The copper itself, when removed from the roof, has a commercial value which is possessed by no other roofing material when taken off.

The great objection to the clay tiles is their excessive weight, as well as liability to breakage, and it is stated that it costs about one-third less to construct the supporting framework for the metal tiles than for those made of clay, which, of course, is an important item in itself.

Then, again, the vertical side-lock of the metal tiles renders them absolutely storm and weather proof, and the device is so simple that there is an immense saving in the time taken to lay them. Ample provision is made also in the construction of these tiles for any possible expansion and contraction of either copper or tin. — *Philadelphia Times.*

THE E. Stebbins Manufacturing Company of Brightwood has begun the new year with various improvements on its plant and additions which will increase its capacity a third. There has been an increased demand the past few years for the finer class of brass-work of which the company makes a specialty, so that last year especially it could not keep up with its orders and an increase became inevitable. The especial pinch came in the foundry, and consequently an addition 45 by 50 feet, was made at the end and at right angles to the former foundry building, which was 45 by 130 feet. This gave room for twenty-two moulders, and the company immediately increased its force from twelve to seventeen men; it also gave room for a new "core" oven and allowed the increase of the core-makers from nine to fourteen. This change allows an increase in the number of employés in the finishing-rooms, and altogether the force has received an addition of twenty-five men. This of course has necessitated the addition of much new machinery. The old room for the storage of patterns was much crowded, and so an addition of 30 feet has been made to this, which nearly doubles its capacity and allows a convenient arrangement. The company sold last fall 33 feet of land at the rear of the building to the Connecticut River Company, but it also bought 50 feet on the north and 35 feet on the south, which gives it a lot 240 feet wide and 207 feet deep. The change has made the whole arrangement of the yard more compact and convenient, the old storage shed which stood some distance behind the shop having been moved up even with the back of the foundry and a side-track run immediately behind it. — *Springfield Republican.*

BUILDING INTELLIGENCE.

Reported for the American Architect & Building News.

HOUSES.

Allegheny, Pa.—*North Ave.*, brick dwell., 75′ x 100′; owner, D. E. Park; contract to be let; architects, Longfellow, Alden & Harlow, Boston.

Ashmont, Mass.—Frame dwell., 30′ x 30′; owner, C. F. Kittridge; contract to be let; architects, Longfellow, Alden & Harlow, Boston.

Baltimore, Md. — Armiger & Flagg will build 10 two-st'y brick buildings, beg. cor. Kellow and Lennox Sts.

Boston, Mass. — *Garfield St.*, Ward 19, 4 three-st'y brick dwells., flat roofs, 20′ x 32′; owner and builder, Lomer Lahaise.

Lamartine Terrace, at 271 Lamartine St., Ward 23, three-st'y frame dwell., hip roof, 33.6′ x 34′; owner and builder, Frederick Schroater.

Bower St., near Humboldt Ave., Ward 21, three-st'y frame dwell., flat roof, 24′ x 58′; owner, Cordelia A. Vose; builder, Lorenzo Vose.

Dewey St., near Blue Hill Ave., Ward 21, three-st'y frame dwell., flat roof, 24′ x 60.6′; owner, John Suhl; builder, P. T. Hanlon.

Longwood Ave., rear No. 53, Ward 22, 2 three-st'y frame dwells., flat roofs, 23.5′ x 25.6′; owner, Hugh McGrady; builder, W. S. Cole.

Dewey St., near Dacia St., Ward 20, 2 three-st'y frame dwells., flat roofs, 22′ x 55.6′; owner, Annie M. Brummet, builder, Ernest G. Maskell.

Fuller St., near Dorchester Ave., Ward 24, frame dwell., 24′ x 36′; owner and builder, F. A. Perkins.

Dorchester Ave., cor. Fuller St. extension, Ward 24, three-st'y frame dwell., flat roof, 28′ x 63′; owner and builder, Alexander Gann.

Boylston St., cor. Bothnia St., Ward 11, 5 four-st'y brick dwells. and stores, flat roofs, 25′ x 50′; owner and builder, Albion Knowlton.

Warren St., No. 489, cor. Wyoming St., Ward 21, two-st'y frame dwell., hip roof, 45′ x 59.3′; owner, G. E. Leighton; builders, Woodbury & Leighton.

Mendum St., near Fairview St., Ward 23, frame dwell., 26′ x 28′; owner, Mrs. A. E. Corlson; builder, Wesley Young.

Ashmont St., near Dorchester Ave., Ward 24, three-st'y frame dwell. and store, flat roof, 29′ x 56′; owners, C. W. Campbell and G. W. Dinan; builder, H. M. Wallis.

Dean Ave., near Howard Ave., Ward 20, three-st'y frame dwell., flat roof, 29.6′ x 38′; owner, W. A. McConnell; builder, W. A. Pentz.

Jones St., near Fairview St., Ward 23, frame dwell., 26′ x 28′; owner, C. J. Westman; builder, Wesley Young.

Dorchester Ave., near Beale St., Ward 24, frame

dwell., 24′ x 28′; owner and builder, Isaac Schurman.

Nahant, Mass. — Frame dwell., 37′ x 50′; with L; owner, W. R. Richardson; builder, J. T. Wilson; architects, Longfellow, Alden & Harlow, Boston.

Seal Harbor, Me. — Frame dwell., 40′ x 50′; owner, W. M. Griswold; contract to be let; architects, Longfellow, Alden & Harlow, Boston.

Somerville, Mass. — *Broadway*, near Elm St., two frame dwells., 30.10′ x 31.4′, and 28′ x 50′; owner and builder, J. E. Herrick.

Myrtle St., No. 62, frame dwell.; owner, A. E. Hughes; builder, M. R. Sweatt.

Olive Ave., near Linden Ave., two frame dwells., 21′ x 28′; owner and builder, A. D. Rice.

Pearl St., cor. Walnut St., frame dwell., 23′ x 56′; owner and builder, Wilbur P. Rice.

Franklin St., near Pearl St., frame dwell., 22′ x 30′; owner, R. E. Nickerson; builder, Mark Leighton.

Meacham St., No. 52, frame dwell., 24′ x 28′; owner, Henry L. Glover; builder, Thomas Gordon.

Benton Ave., near Hudson St., frame dwell., 24′ x 28′; owner and builder, Arthur W. Berry.

Trull St., frame dwell., 22′ x 34′; owner, Mary Mullarky; builder, Michael Mullarky.

CONSTRUCTION.[1]—IV.

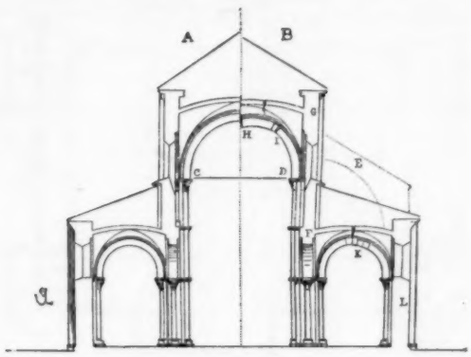


Fig. 15.

THE construction of vaults, then, was the great object of the architects of the Middle Ages; they had arrived, as we have shown, at combinations ingenious in themselves, although they had not yet found suitable means for firmly maintaining these vaults, and were reduced to expedients for them. Thus, for example, they filled-in these vaults with tufa, or with light materials, in order to diminish the effects of pressure; they reduced them in thickness as much as possible; they filled-in the masonry under the roof of the aisles to the height of the pressure, in the hope of preventing the deflection of the piers; they placed at the base of these buttresses transverse ties of wood, concealed by the slope of the roof, in order to unite the piers and the outer walls. These expedients sufficed in small constructions; in large ones they availed nothing but to mitigate the effects of the pressure, without completely destroying them.

We must take account of these effects in order to understand the series of reasonings and attempts by which the builders passed from ignorance to scientific knowledge.

Let (Fig. 15) be the cross-section of a Romanesque church at the end of the eleventh century, built, like that at Vezelay, with groined vaults over the aisles and over the central nave.

In *A*, the structure is represented as the architect had designed it; in *B*, as the pressure of the vaults had forced it out of shape. They had taken the precaution of leaving iron tie-bars *C D*, at the springing of the transverse arches; but these bars, probably poorly forged, had been broken. A century and a half after the construction of the nave, the effects produced had already caused the ruin of several vaults, and they had hastily built the exterior flying-buttresses *E*, indicated by dots upon our design.

These effects were: First, the bending of the piers and walls which bind them from *F* to *G*, the consequent sinking of the transverse arches at *H* at the key and the crushing of the beds of the voussoirs forming the haunches of these arches, at *I* in the intrados; Second, the dislocation of the transverse arches *K*, of the aisles as indicated in our figure; and hence, again the bending of the exterior walls *L*, of the aisles. These effects were produced everywhere in the same manner. In studying them the builders thought, not without reason, since the fact is constant, that the whole evil was produced by the pressure of the semicircular arches and of the vaults that they partly support; that the too flat concavity of these vaults had an oblique action, a pressure too considerable; that the pressure of a semicircular arch increases in direct ratio with its action; that the dislocation

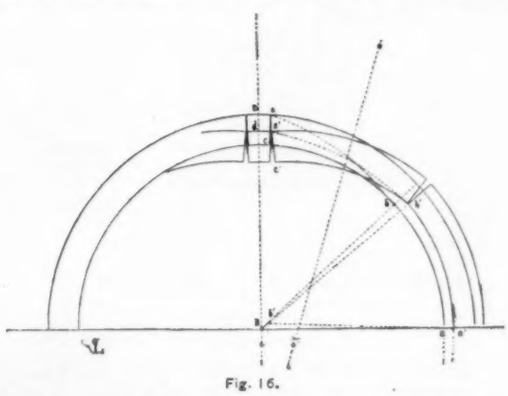


Fig. 16.

undergone by these arches shows their weak points, viz., the key and the haunches; that at all times when a semicircular arch is not perfectly buttressed, and when the piers that support it diverge, these arches are thrown out of shape, as indicated in Figure 16.

[1] From the "*Dictionnaire raisonée de l'Architecture Française*," by M. Viollet-le-Duc, Government Architect, Inspector-General of Diocesan Edifices, translated by George Martin Huss, Architect. Continued from No. 844, page 139.

Let this be a vault, the diameter of whose transverse arches is 7.00 metres, and the thickness of its voussoirs 0.60 c.; the walls have spread at the springing of the arches by 0.20 c. each; hence the diameter of the half-circle, whose centre is at *B*, has increased to 7.40 m., and the points *a* at the extremity of the transverse arches have receded to *a'*. The segment *ab*, which is a little less than a quarter of the half-circle takes the position *a' b'*; for, supposing that the pier breaks and turns upon a point placed at 3.00 m. below the spring of the arch, that extremity *a'* will descend below the level of the point *a*, and the centre *B* will rise to *b'*. The consequences of this first movement will be:

First, the fall of the key *D* to *d*, and the sinking of the segment *b c* to *b' c'*.

This effect will continue until the diagonal curve *b e* drawn from the intrados to the extrados of the segment, *b c*, shall be shorter than the distance between *b'* and *e'*. We should remark in passing, that the Romanesque vaults, which people suppose to have been built in elliptical form, have acquired that curve only through the divergence of the piers.

Forty centimetres of divergence between these piers, out of the vertical, give forty centimetres fall from the summit of the arch; and the difference between the radius of an arch, in this case, and the rise of the curve, is then 80 c.

The builders could not but notice these effects, and seek means to prevent them. The first means they seem to have used are these: having a nave whose transverse arches were 7.00 m. in diameter at the intrados, and 0.60 c. thick as to their voussoirs, and having observed (Fig. 16) that the segment *b' c'* in sinking pressed the lower segment *a' b'* on the intrados at *b'*, and the key at the extrados in *e'*, they concluded that the curvilinear triangle *b' e' c'* was useless, and that the diagonal *b' e'* alone offered any resistance; then, starting from this principle, they drew (Fig. 17) the two semicircles of the intrados and extrados *A, B, C*, and *D, E, F;* then upon the diameter

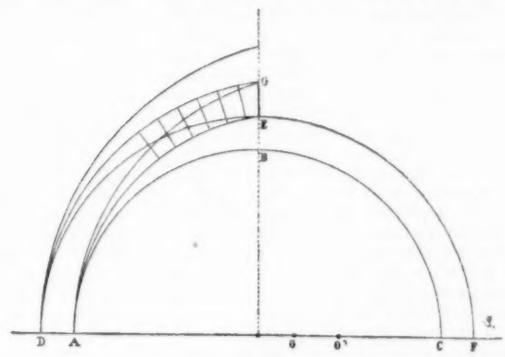


Fig. 17.

A C, they sought the centre *O*, of an arch joining the point *A* on the intrados to the point *E*, on the extrados of the semicircle.

Placing a joint at *E G*, instead of a keystone, in order to avoid the effect of equilibrium seen in Figure 16, they cut the voussoirs of this new arch *A E*, following the lines normal to the curve *A E*, that is to say, tending toward the centre *O*.

If fractures still occurred in these transverse arches, thus composed of two diagonal curves *A E*, the builders proceeded with that arch *A E* as with the semicircle — that is to say, they pushed the centre from *O* to *O'* upon the diameter in such a way as to obtain an arc joining the point *A* to *G*.

Thus, in the vaults of the twelfth century, we see little by little the transverse arches giving up the semicircular form to approach the pointed arch.

The best proof that we can give in support of our hypothesis, is the accurate list of a great number of these primitive, broken arches which have a rise longer than the radius, by exactly once, twice, or three times the thickness of their skewbacks. But this proof is evidence only to those who have been able to measure exactly a large number of transverse arches of that epoch. We give, then, a general observation which can be made by all the world, without recourse to measures difficult of access.

There are districts, like Ile-de-France, for example, where the Romanesque semicircular transverse arches have only a slight thickness of voussoirs. Now, here in the first vaults having pointed arches, the acuteness of these arches is scarcely perceptible, while in the provinces where the Romanesque semicircular transverse arches are very thick, as in Burgundy, the acuteness of the transverse arches, in the first vaults abandoning the semicircle, is much more marked.

The adoption of the pointed arch was so surely the result of the observations which the builders had made upon the dislocation of the semicircular arches, namely, the displacement of the haunches and the sinking of the key-stone, that there exists a large number of transverse arches of the twelfth century drawn as indicated in Figure 18; that is to say, having four centres: two centres, *A*, for the portion of arcs *B, C* and *D, E*, and two centres, *G*, for the portions of arcs *C D*, comprehending the haunches, this being done in

order to present from *C* to *D* a greater resistance to the effect of displacement felt between the points *C* and *D;* for the nearer the line *C D* comes to being a straight line, the less is it subject to breakage from within or without, and by this design the builders avoided giving the transverse arches an acuteness which could not fail to give a shock to those still accustomed to the semicircle.

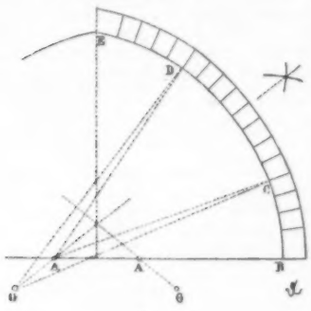


Fig. 18.

From the moment when the transverse arch formed by two circular arcs had replaced the semicircular, there flowed from this innovation a stream of consequences, which was to carry the builders very far beyond the goal which they expected to reach. The broken arch, or the pointed arch (since that is its true name), used as a means of construction, rendered necessary by the general structure of the large nave vaults, and obtained by observing the effects resulting from the pressure of semicircular arches, is a veritable revolution in the history of the art of building.

People say: "The builders of the Middle Ages, in adopting the pointed arch, have invented nothing; there are broken arches in the most ancient monuments of Greece and of Etruria. The section of the Treasury of Atreus at Mycenæ gives a pointed arch, etc." This is true, but they always omit one sufficiently important fact: that the stones composing these arches are set corbelwise, and that their beds are not normal to the curve, but horizontal. This is less than nothing to those who take account only of the outer form, but for us practitioners this detail, nevertheless, has its importance. And furthermore, if the Greeks and Romans had made vaults produced by broken arcs, what would that matter if the general principle of the construction be not derived from the combination of these curves and from the observation of their oblique effects?

It is evident that, from the day when man invented the compass and the means of describing circles, he has discovered the broken arch; and of what consequence is it to us if he did not establish a complete system upon the observation of the properties of these arches? Some, on the other hand, have been pleased to see, in the use of the pointed arch for the construction of vaults, a symbolical or mystical idea; they have pretended to demonstrate that these arches had a deeper religious meaning than the semicircular arch. But men were quite as religious at the beginning of the twelfth century as at the end, if not more so, and the pointed arch appears at precisely the moment when the spirit of analysis, or the study of the exact sciences and of philosophy, began to spring up in the midst of a society up to that time almost theocratic.

The pointed arch and its widespread consequences in construction appear in our monuments when the art of architecture is practised by the laity, and comes out of the seclusion of the cloisters, where, until this time, it had been exclusively cultivated.

The last Romanesque builders, those who, after so many attempts, had finally dismissed the semicircle, are not visionaries; they do reason upon the mystical meaning of a curve; they do not know if the pointed arch is more *religious* than the semicircular arch; they build — a more difficult task than idle dreaming.

These constructors have to sustain large and high vaults upon isolated piers; they tremble whenever they strike a centre; from day to day they remedy defects as they appear. They observe with disquietude the divergence, the least effect produced, and this observation is a constant and fertile source of instruction. They have only vague, incomplete traditions, and obscurity about them, and the monuments that they build are their only model. It is upon these that they make experiments; they have recourse only to themselves, and refer only to their personal observations.

When we study carefully the constructions raised at the beginning of the twelfth century, when we come to classify them chronologically, and follow the progress of the principal schools of builders in France, Burgundy, Normandy and Champagne, we are still seized to-day by that species of fever that possessed these constructors; we share their anxiety, their haste, to arrive at a sure result; we recognize their advances from one structure to another; we applaud their perseverance, the justice of their reasoning, the evolution of their knowledge, so limited at first, so profound soon afterwards. In truth, such a study is useful to us, builders of the nineteenth century, who are disposed to take the appearance for the reality, and who often substitute vulgarity for good sense.

[To be continued.]

Percentage of Defective Lightning-rods. — A paper on "Protection against Lightning" has been read at St. James's Hall, before the Society of Architects, by Mr. A. Hands, F. R. Met. Soc. He stated that from April to October, 1891, inclusive, no fewer than 206 buildings had been struck by lightning, 18 persons, 94 cattle, 35 horses and 153 sheep being killed. Of the conductors which he had examined he found 70 per cent defective. — *Invention.*

BETTER WOOD CONSTRUCTION.[1] — II.

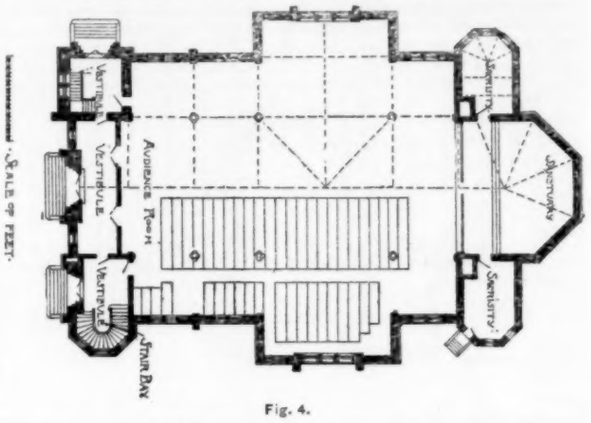


Fig. 4.

NOT long since while waiting in an office in a pretentious and comparatively new building, I noticed a row of holes along a partition at the height of the chair backs.

Examination showed stud-partitions wire-lathed with one of the best "stiffened" varieties. It was not so stiff, however, as to prevent the chair backs from breaking holes in the plaster through which the air rushed with enough force to blow out a match. This building was quite liberally supplied with iron floor-supports, but where was the return for this outlay in iron and wire-lathing, exposed to the draughts of air playing through these floors and partitions?

The wire-lathing alone of the partitions cost as much as the woodwork of the partition shown at Figure 3, *D.* Fire occurring in a room inclosed with this latter construction could not penetrate the walls for a long time, and at all events must always be in full view upon the arrival of the fire department.

As showing that the insurance companies are beginning to recognize the merit of the solid system, the pastor of a church in Minneapolis, the floors and roofs of which are of the solid construction (see plans and section — Figures 4 and 5) tells me the rate made by the "Board" companies on this building was but one-half that of any other church in the city.

The roof detail of this church was in constructive treatment somewhat like that shown in Figure 2, which is a detail of a school-house in which the roof-space was utilized, the lighting of second-story

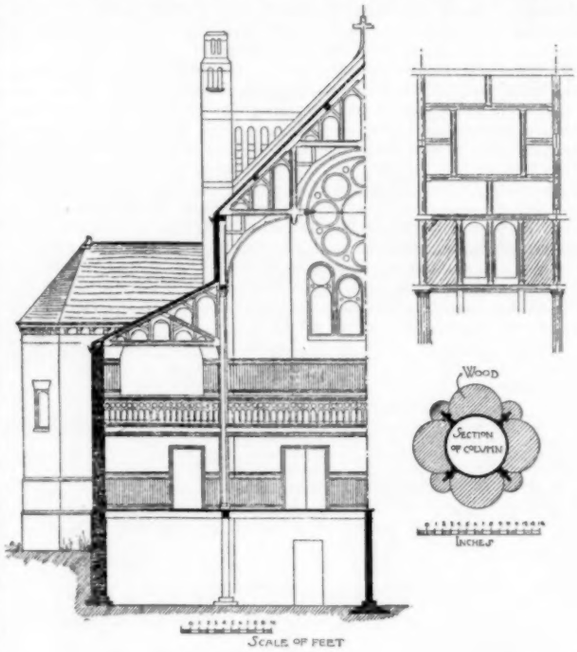


Fig. 5.

rooms being mainly from the gables. Some years since I made the drawing for a large wood-working factory and a warehouse of about the ordinary construction. Each building was of brick four stories in height. Not long after I was called upon to design another factory and warehouse and prevailed upon the owners to build in the improved way. These buildings were of brick, each four stories in height and not differing much in size from those first mentioned; the latter were also used for wood-working, but the risk was probably

[1] Continued from No. 842, page 107.

somewhat increased by the fact that finishing and varnishing were done in the upper stories. The average annual rate for the building and contents of the older plant is 4½ per cent and of those properly built is 1¼ per cent.

To be sure some of this difference is due to safer planning, to automatic sprinklers, etc., but to the solid-wood construction is due the principal saving. To get a true notion of what this saving of 3¼ per cent amounts to, we would have to ascertain the whole amount insured, and would quite likely find that the yearly difference in insurance premiums amounts to more than the interest on the cost of the better buildings.

SLOW TRANSMISSION OF HEAT.

It is fairly well understood that wood is a very slow conductor of heat, but this knowledge is not taken advantage of in building, as in some other arts.

The man who "jackets" a steam-cylinder with wood is much more appreciative of its merits as a heat-saver than is the average builder.

Arrangements of wood which prevent the passage of air-currents through the joints will give the maximum of warmth in winter and coolness in summer, with the minimum of material and cost under most conditions.

Among the building fraternity, the potency of confined air-spaces as an obstruction to the passage of heat is generally overrated. As a matter-of-fact, these confined spaces are always more or less indifferently constructed, so that they are open at points where intended to be otherwise. Even if closed in tightly at the ends, the circulation of the air within them carries heat readily from the warm to the cold sides, so that, unless this "convection" is interrupted by filling the spaces with porous materials, they rank very low as a heat-saving device.

Professor Ordway found that, by applying heat under certain conditions to the top of an air-space one foot square and one inch deep, double-plastered. The other is designed for a locality where cheap grades of lumber may be obtained at low prices, as where there is no great addition to the cost by heavy freight charges.

It will be noted that cheap lumber may be used for the planks and outer boards as well as a higher grade, and the grooved sheathing-lath is sold in short lengths very cheap. If heavily plastered and well dried between coats, a very poor grade will answer for this, but the estimate is made on the basis of what would grade, if longer, as "fencing." Below are estimates of cost of 100 square feet of each, the items of labor, of siding and of plastering being omitted, as about equal in either construction:

Cost of materials 100 sq. ft. "balloon-frame."

100 ft. b. m. 2″ x 4″	$1.20
120 " planed and matched sheathing	2.16
20 " 7-8″ x 2″ strips	.36
100 " (11 yds.) back plastering	1 32
100 " (11 yds.) lathing	.66
	$5.70

In solid work, we should require in place of the above, say:

105 sq. ft. building paper	.30
240 ft. b. m. planed and matched 2″	3.24
105 " " " outer sheathing	.95
124 " " "sheathing-laths," short	1.12
	$5 61

As we estimate at greater distances from lumber-manufacturing centres, the balance in favor of solid wood would be transferred to the other side, the "balloon-frame" becoming the cheaper as the element of freight charges increased. The solid construction would, of course, be very slow-burning, would exclude vermin, and would be immensely stronger. The "balloon frame" habit is so well established, however, with its attendant false view of the air-space as a heat-saver, that it will be hard to make the average builder or archi-

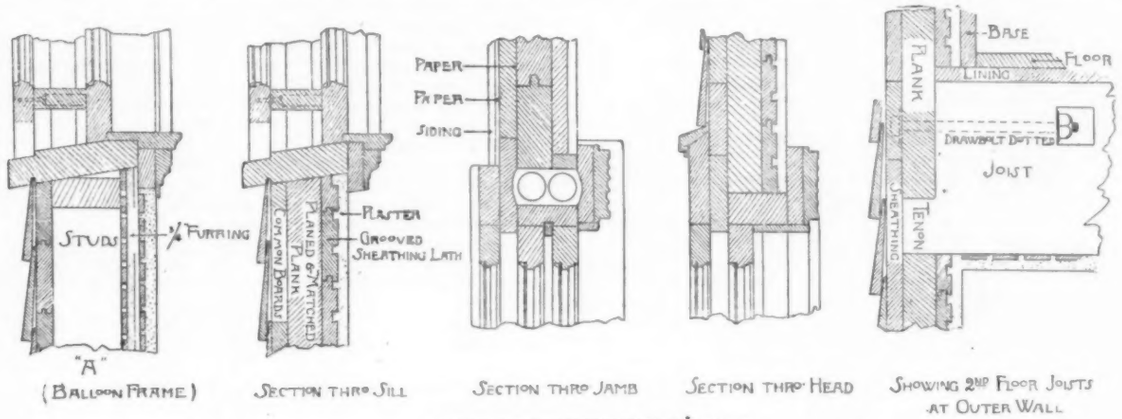


Fig. 6.

only 43 heat-units were absorbed by the side of the apparatus under the air; while, when the apparatus was arranged so that the radiating and absorbing surfaces stood vertical, 108 heat-units were absorbed under conditions otherwise similar to the first. In the first arrangement convection was absent, while in the second its presence raised the transmission of heat two and one-half times. It is hardly probable that in the second arrangement a moderate thickening of the air-space would have retarded the passage of heat in any great degree.

The convection of heat by air is found to be so potent that smooth, fibrous substances like asbestos, or smooth, granular substances like plumbago, transmit heat much faster under the arrangement in which the heat is applied at the side than when the radiating surface is above and the absorbing surface is below.

Filling the space with wool, the fibre of which is rough and scaly, reduces the transmission to 36 units, while dry, soft wood will transmit 75 heat-units under the same conditions. The lighter the wood the better, cork being a poorer conductor than soft wood — indeed, poorer than the best slag wool. Poplar sawdust transmits about the same as the wood itself.

Where practicable, by filling the air-spaces of our "balloon-frame" walls with loose granular or fibrous material, we not only effectually check the passage of fire or vermin, but we effect a wonderful saving of heat.

Wooden buildings are still common through the New England and other Eastern States built before the introduction of "balloon-frames." Many of these have outer walls, the beginning of which is planking, connecting the heavy timber sills and plates.

A return to this construction is advisable because of greater warmth, if for no other reason.

Figure 6 gives two arrangements of outer walls of frame dwellings. At *A* the usual balloon-frame is used, well and cheaply tect see the value of the plank as a heat-saver. This value should, we think, be stated about like this:

Relative transmission of heat by the two methods.

Let us offset the plastering on the grooved boards, with no movement of air behind it in the solid method against the two plasterings of the "balloon-frame." We then come to the air-space in one as against the 1¾ inch plank of the other, and here is where the heat-saving will be effected in the solid system.

In the "balloon-frame," five-sixths of the space (not occupied by studs) will be filled with air moving freely under the influence of heat in the vertical spaces.

Taking Professor Ordway's tests as data, I should say that the transmission of heat across this space could not be rated less than ⅘ of 102, or 85; while in the solid 1¾ inches of soft wood, rated as transmitting, say 77 to the inch in thickness, we should have a transmission represented by 45, or slightly more than one-half that of the air-space.

I think that a careful consideration of the conditions existing in the "balloon-frame," with the necessary imperfections of workmanship, will convince the intelligent architect or builder that I have not used the data unfairly. Probably it understates the value of soft wood as a heat-saver to say that an inch of it, with the joints properly closed, will intercept the passage of as much heat as the common air-space of the "balloon-frame."

Figure 7 shows a suggestion for a still heavier solid wooden outer wall for a frame building. Another thickness of boards is placed on the outside of the planks. The lumber is crossed for strength and arranged so that the shrinkage of the common boards will not split the siding.

But the worst waste of heat about whole classes of buildings occurs at the ceilings of the rooms. It is almost an unbroken custom in church building, for instance, to have only a coat of plaster

between the hottest part of the audience-room and an attic space averaging very near winter temperature. The waste of heat is more rapid here as the plastering is little more than a sieve, so far as retarding the actual escape of warm air, and what heat is transmitted to the upper surface of the coat of plaster is rapidly conveyed away by the air of the attic. But with a solid arrangement of wood and plastering as in the roof detail Figure 2, this loss is vastly reduced. This roof construction is practically the same as that of the church, Figure 4, in which ease of heating is very noticeable. The folly of expending all of our pains to prevent waste of heat at the walls and openings while covering with the ceilings common to our buildings, cannot be too strongly condemned.

The porosity of building materials is well nigh beyond belief. Plaster as ordinarily laid on laths, even if the last coat is trowelled,

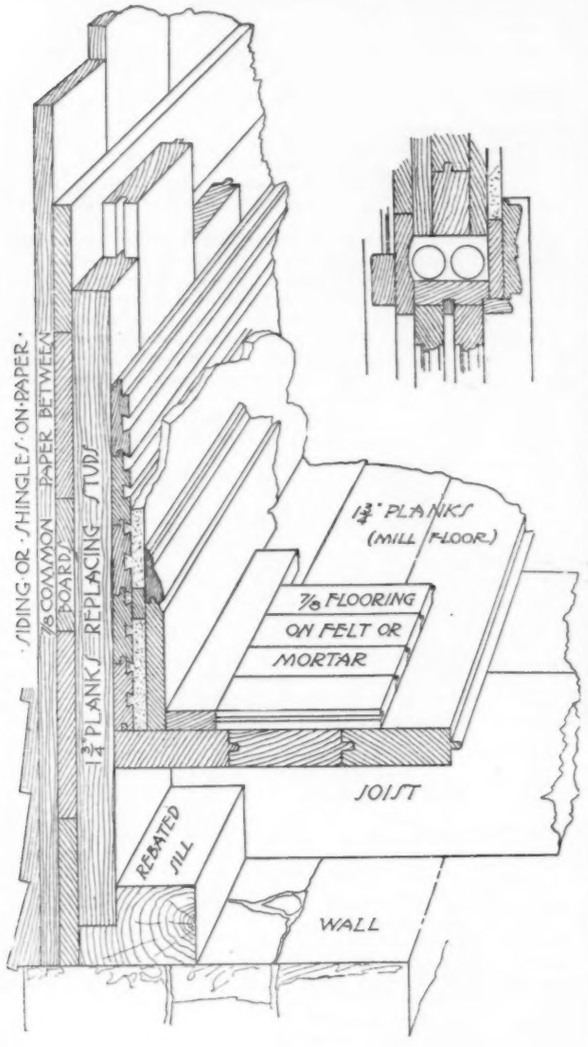


Fig. 7.

allows air to escape through the spaces between the laths almost as through a sieve.

One commonly finds in the northwest cheaply-built furnace-heated houses no higher than two stories, in which no provision is made for exhausting the air of second-story rooms. Of course a large volume of hot air must be passed into the room to warm it, but the air which it displaces is mainly forced out through the pores of the plaster. This loss is naturally greatest at the ceiling where the air is warmest and freshest.

The introduction of solider work would largely reduce this porosity and consequent loss of heat.

If we compare the weight of some of our soft woods with that of water, and if we recall that all varieties when "water-logged" will sink readily, we find that 60 per cent or more of the bulk of these woods consist of air-cells. Professor Ordway showed that one of these woods transmitted heat 86 per cent faster end-wise than across the grain. Here is the best of evidence that air must be prevented from moving about if we are to profit by its slow transmitting powers.

The poplar sawdust above alluded to contains more air than the wood of the same variety but in a form admitting of more ready convection. The loss of heat through the wood and its sawdust were about the same. The same authority found that in using cotton fibre for filling the space the transmitting power was diminished by compressing the fibre.

Finally, we rarely find conditions such that another building material of such heat-saving power can be substituted for wood at equal cost.

Note.—Prof. John M. Ordway published in *Popular Science* for March, 1891, a most instructive series of tests on non-conductors of heat. The following are portions of his tables, and are selected to indicate the activity with which air, more or less free to move in a given space, conveys heat through that space. The heating and absorbing surfaces were in each case one foot square, and the non-conductors tested were one inch thick. By placing the heating-surface level on top of the substance to be tested, he was able to prevent convection. All substances so tested are marked "still," while tests not so marked are made with the heating and absorbing surfaces vertical.

Non-Conductors of Heat one inch thick.	Net Cubic Inches solid matter in 100.	British Heat Units transmitted per square foot in one hour.
Still Air (Heat applied at top)	....	43
Confined Air (Heat applied at side)	....	108
Water, still		335
Cotton Seed Oil, still	....	124
Hair Felt	8.5	56
Cork		49
Yellow Poplar Sawdust	16.2	75
Yellow Poplar Board	36.4	76
Yellow Poplar Cross-section	30.4	141
Best Sing Wool	5.7	50
Asbestos in st ll air	3.1	56
Asbestos in movable air	3.6	99

STRUCTURAL NOTES.

Western lumber markets, while well stocked with all sorts of 2-inch planks, seldom afford other thicknesses except on special order. As in many classes of buildings a heavy construction is not needed either for strength or fire-resisting quality, it will be found advantageous to use the 2-inch planks.

Having occasion to use the solid method in audience-room floors and in roofs, I caused a platform to be built and tested with different loads on different spans with a view of getting the deflection under the conditions common to building.

The results are given below in the table. I believe them to be correct to the hundredth of an inch, except in the one instance marked with an interrogation point. My assistant who did most of the work was an exceptionally careful man, but we did not detect this evident error until too late to correct. This platform was of two inches by six inches white pine, planed and matched, 18 feet long, the joints alternating on supports.

The number of tests was not enough to give a mean result confirming or upsetting any theory, but they show pretty clearly for working purposes the effect of loads on these spans with and without the finished floor.

Other Conditions of tests. (All loads were evenly distributed.)	Loads in lbs. sq. ft.	Clear span.	No. spans loaded.	Hours after loading.	Deflection in inches.	Point measured.	Permanent set in inches.
Centre span loaded	100	5′ 8″	1		0.27	M	
					0.27	E	
Side span also	100	5′ 8″	3		0.13	M	
					0.13	E	
Loads remain	100	5′ 8″	3	70	0.15	M	
					0.16	E	
Loads removed		5′ 8″				M	0.03
						E	0.05
Platform furred and floored	100	5′ 8″	3		0.10	M	
					0.12	E	
Unloaded and reloaded to correct	100	5′ 8″	3		0.0?	M	
					0.09	E	
Two side spans unloaded	100	5′ 8″	1		0.21	M	
					0.21	E	
Further permanent set						M	
						E	
Central span loaded	60	5′ 8″	1		0.11	M	
					0.14	E	
Loads added to sides	60	5′ 8″	3		0.04 (?)	M	
					0.09 (?)	E	
Side spans unloaded—central spans increased	100	5′ 8″	1		0.21	M	
					0.24	E	
Three spans loaded	100	5′ 8″	3		0.06	M	
					0.07	E	
Platform relaid—no furring or flooring—spans increased	50	8′ 8″	1		0.69	M	
					0 65	E	
Loads added to side spans	50	8′ 8″	3		0.30	M	
					0 29	E	
Loads remain	50	8′ 8″	3	168	0.34	M	
					0 33	E	

In audience-rooms and dwelling-house floors as well as in many other situations it is in every way better to make three than two spans to 14-foot or 16-foot planks, and this table bears us out in the use of the 2-inch planks where reinforced by an upper flooring. As the table also indicates, we may use 2-inch plank up to 9-foot spans for certain classes of roofs.

However, we should have the heading joints alternate to get the full stiffness of the planking.

The matching will usually be found much cheaper for 2-inch planks than splining.

Timbers of large section are, of course, more difficult to obtain dry, and are at best, certain to suffer great disfigurement and some loss of strength by "season-checks." To obviate this the timber is sometimes bored through from end to end. This takes out the part which always shrinks last and usually least, and also admits of some drying from the inside.

Where practicable a hole of considerable size can be made through the centre of a timber sustaining a transverse strain without diminishing its strength.

It is usual to allow of an air passage through these holes by means of a small transverse hole tapping the larger one near either end.

Posts suffer some loss of strength theoretically by being bored, but no doubt the "season-checks" in a post not bored often weaken it more than would the boring.

It is, however, seldom possible to get long timbers bored. In such event we may sometimes have those subject to transverse strain grooved from the upper side as in Figure 3, *B*, with rather better results as to preventing the "checking," than if bored. As the tensile fibres remain undisturbed a thin groove of this sort does not take appreciably from the strength of the timber.

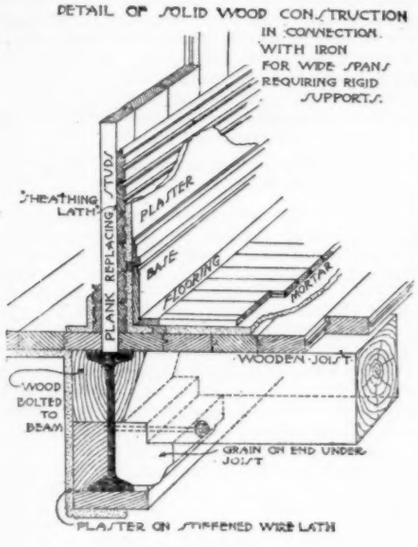


Fig. 8.

A timber in two parts bolted at intervals, see *C*, Figure 3, would be less liable to "season-checks," and if the outer growth were placed inside and blocks of end-wood inserted at the bolts, the middle joint would not open so as to admit of more rapid burning in case of fire than if solid. Unless, however, the sides placed together were coated at the time with some antiseptic, the conditions would favor the development of "dry-rot."

Timbers made up in this way, if continuous over several supports, are much stiffer than if in single spans.

Often so much less timber will be required in this arrangement, as to compensate for the greater cost per foot, board-measure, of the longer stuff.

Several thicknesses of ordinary joists are used at times and are quite commonly supposed to be even stronger than the same amount of solid timber, but where the markets are such as to afford the larger timber, it is rarely advisible to make up our beams of a greater number than two parts and they should be bolted as shown in Figure 3, *C*, all parts excluded from the air being treated for the prevention of "dry-rot" as will appear further on.

For posts the proportions of the two parts might be so changed, that by adding slightly to the cross-section required for a solid timber (in a direction transverse to the joint, see Figure 8) and by bolting as shown, we might avoid most of the unsightly cracks due to drying.

There are often places where a wide span requires in the ordinary construction very deep joists, making quite an expense in timber and adding measurably to the height of the wall.

Let us take for instance a school-room twenty-five by thirty-one feet in the clear. If we were to substitute for the usual joists of the second floor, an iron beam to which is bolted common lumber, Figure 3, *D*, into which we frame a few large joists covered by planks, an inch of mortar, and a hardwood floor, the underside being properly plastered, we shall have for the purpose of a school-building a fire-proof floor. Among the savings will be, say one foot in the height of the walls necessary to support the second floor and give the same number of cubic feet to the first story.

This construction of iron and wood is especially valuable where offices, hotels, etc., are built over stores of considerable width. The Figures 3 and 8 show a detail which I have used when wanting rigid supports for partitions above.

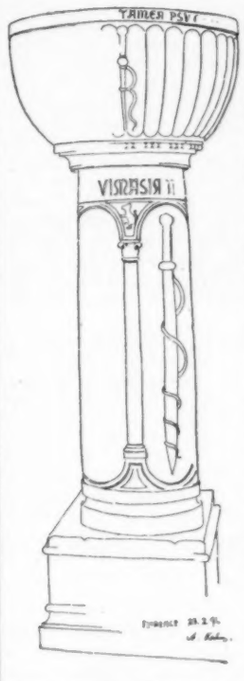
In heavy floors the practice is pretty well established, of using iron caps at the posts. I submit that there are many cases where a dry oak cap may be substituted with saving of money and advantage to the construction. By computing the strains we will find that but little thickness will be required (so little in fact that it will be advisable to cover the exposed part in some cases with bright tin to resist a quick fire) not enough to count as inducing settlement by shrinkage.

The oak will yield and conform to the curve of a loaded girder so that a shearing strain is about all we have to take into account, while the curve assumed by a loaded girder transfers the load to the farthest extremity of the unyielding iron cap. The flaws in the oak are easily seen and rejected at the time of building, while there is always some uncertainty about the soundness of cast-iron.

F. G. CORSER.

(To be continued.)

DUST AND FRESH AIR: HOW TO KEEP OUT THE ONE AND LET IN THE OTHER.[1]



EXCEPT in the case of museums, few serious attempts have been made to exclude dust from rooms, closets, cupboards, and drawers, to the contents of which, not unfrequently, dust is simply ruinous. We allow dust to run riot amongst our things of value, and then go to considerable expense to render them clean again, only to start them on a fresh career of defilement.

Looked at in the abstract, is not our passive capitulation to dust incomprehensible? When I enter an office in a town and see the window-sills and papers dotted with soot, or go into a bedroom and see the toilet-table defaced with blacks, and know that the soot and the blacks need not be there, I cannot refrain from asking how comes it to pass that we so patiently submit to such perpetual discomforts. You will doubtless reply, "We agree with you as to the existence of the evil, but how is it to be remedied?" The object of my appearance here to-night is to offer some practical suggestions whereby you may so far mitigate and reduce the evils of soot and dust as to make them tolerable, perhaps, even to lay down principles by which the evils can be annihilated in those instances in which the result to be obtained is worth the cost of achievement. For the practical purposes of everyday life it may turn out that we had better be content with approximate perfection, a condition of existence which compels us to be content with approximately pure water from a filter, and approximately pure air in our living rooms.

If dust is to be kept out of any cavity, we must first find out why the dust gets in, in spite of good workmanship and accurate fitting. The reason is simple, ridiculously simple when stated, but, curiously, it has been little, if at all, thought of, and certainly hardly ever acted upon in practice. And the reason is this. Closets, cupboards, drawers, and boxes contain air; if the air were inelastic and never altered in volume there would practically be no entrance of dust into these closed cavities. Unfortunately for our cleanliness, air is changing in volume incessantly. We are all familiar with the barometer, and most of us no doubt understand why the quicksilver rises and falls in the glass tube, or why, in the aneroid barometer, the index moves to right or left. Let us consider what these changes mean, and what they record.

When the air around us becomes condensed — shrinks into a smaller volume — it becomes heavier, puts greater pressure on the surface of the mercury, and makes it ascend in the tube; then the mercury is said to rise. When the air expands — swells into a larger volume — it becomes lighter, the pressure on the mercury is less, the mercury sinks in the tube, and the barometer is said to fall. Therefore, every change of height of the quicksilver which we observe is a sign and measure of a change in the volume of air around us. Further, this change in volume tells no less upon the air inside our cases and cupboards. When the barometer falls, the air around expands into a larger volume, and the air inside the cupboard also expands and forces itself out at every minute crevice. When the barometer rises again, the air inside the cupboard, as well as outside, condenses and shrinks, and air is forced back into the cupboard to equalize the pressure; and, along with the air, in goes the dust. The smaller the crevice, the stronger the jet of air, the farther goes the dirt. Witness the dirt-tracks so often seen in imperfectly-framed engravings or photographs. Remember, ladies and gentlemen, whenever you see the barometer rising, that an additional charge of dust is entering your cupboards and drawers. So much for the barometer, which is a very restless creature, rarely stationary for many hours together. But this is not all. We also have the thermometer. The temperature of our rooms varies daily — often considerably — between mid-day and midnight, and greatly between summer and winter. What does the thermometer tell us? Not less than the barometer does it tell of change of volume of the air, though it is probably not so rapid in its effect upon the air in

[1] A paper read February 3, 1892, by T. Pridgin Teale, M. A. Oxon., F. R. S. before the Society of Arts and printed in the *Journal of the Society of Arts*.

enclosed spaces as is the change of volume indicated by the barometer. Many of you have seen a fire-balloon. The heated air, filling the balloon, expands, and becomes lighter than the surrounding air, and up goes the balloon, until, the source of heat having become exhausted, the contained air cools, contracts, becomes as heavy as the surrounding air, and down comes the balloon again. So, also, as temperature rises outside our cases, the increased warmth is slowly conducted to the air inside the case, which expands and escapes through the crevices. Then, when the time for cooling comes, the air inside slowly contracts, and back rushes the air through the crevices, and again in goes the dust. Thus, we see we have two factors constantly acting, one or other tending to produce daily, nay, hourly, changes in volume of our dirt-carrying air.

In order to inform myself of the amount of change of volume that could, under extreme conditions, possibly take place, I asked Professor Rücker to kindly calculate for me the change of volume that would take place in 100 cubic feet of air, between a temperature of 30 degrees, *i. e.*, just above freezing point, in combination with the barometer standing at 30 inches, or about "fair," and a temperature of 60 degrees, combined with the barometer standing at 29 inches, or "stormy." He told me that the difference would be about 10 cubic feet, or one-tenth; in other words, that a closed case of 100 cubic feet, if hermetically sealed at a temperature of 30 degrees, with the barometer standing at 30 inches, would have to resist the pressure equivalent to the addition of 10 cubic feet, when temperature rose to 60 degrees, and the barometer fell to 29 inches. Have we not now discovered the reason why dirt enters closed spaces? What shall be the remedy?

Seeing, then, that air will find an entrance, and in the nature of things must get in — well, we must let it in, not at innumerable uncovenanted small crevices, but at our own selected opening, specially provided. Then we are in a position to strain off the dust by providing the selected opening with a screen, which acts as a filter. These, then, are the general principles on which we must act. The rest is a question of detail. The details range themselves under three heads: 1. What is the most effective, or the most generally applicable filtering material? 2. Given the filtering material, what ought to be the proportion between the area of the screened opening and the cubic contents of the case to which it has to be fitted? 3. What, in any particular instance, is the best situation for the filter?

A. — FILTERING MATERIAL.

What is needed in our filtering material is that it shall readily allow air to pass through, and shall also possess the quality of arresting in its meshes fine particles of dust. For some purposes it may suffice to use a coarse canvas, the threads of which are not too closely twisted, and have an abundance of fine fibres projecting from them, thereby reducing the small squares of the woven texture to a still finer mesh. The material I have used most frequently is "bunting," but it has disappointed me. When examined by the microscope, many of the small squares of mesh are seen to be deficient in delicate fibres standing out from the threads, which would enhance the filtering power of the texture. Lately, I have tried other materials, domette, flannel and cotton-wool between layers of muslin, such as is used for dressing wounds under the name of Gamgee tissue. Cotton-wool is probably the most perfect filter. Indeed, so perfect is it, that in the new science of bacteriology it is used as an effective means of excluding dust and germs from flasks in which experiments are to be carried on. In order to put various textures to an exact comparative test, an experiment was tried. Having selected six quart bottles with wide mouths, I tied over the mouth of each a piece of the filtering tissue which I wished to test. The bottles are not liable to crack, as wooden boxes are; the only access for the interchange of air in the interior was through the filtering texture. I thus had a means of testing the comparative value as strainers of the various materials. Within the bottles were placed glass slides, on which any dust that was carried in might settle. The experiments were begun on May 5, 1891, and the slides were taken out on January 6, 1892, and most carefully photographed by Mr. Lafayette and made into lantern-slides.

The bottles were placed near a window in a room in the building of the Leeds Philosophical Society; *i. e.*, quite in the centre of Leeds. The materials tested were: canvas, bunting, ordinary flannel; domette flannel, rough side in; domette flannel, rough side out; cotton-wool, one inch thick.

The results of the experiments are now shown you by the lantern. It will be seen that, as a consequence of the eight months' exposure, including a week of the worst fog I ever knew in Leeds, three of the filtering tissues admitted a very appreciable amount of dust, viz: coarse canvas the most, bunting coming second, ordinary flannel admitting less than either. The other three bottles were screened, one with thick domette rough side in, one with domette rough side out, and one with cotton-wool about an inch in thickness. The three last show hardly a trace of dust. Curiously, the cotton-wool shows a trace more than the domette flannel. The explanation of this I suspect to be that the cotton-wool was not tied firmly enough round the neck of the bottle, which had no rim, and that some air passed between the bottle and the wool, instead of through the wool.

Another experiment which I tried was to fit up a cupboard with panels of double domette flannel. After the fog, to my surprise, the inner screen had become more or less black, showing that black particles had passed into the cupboard, but with this remarkable difference; whereas the outer flannel was almost uniformly black from top to bottom, the inner flannel was divided into four squares of different shades of blackness, corresponding to four spaces between shelves. Of these four, the lowermost was almost as black as the outside, and the uppermost was almost clean. I just mention this as a fact which needs an explanation, but without suggesting one.

There is one error which I think has been committed in the screens made for me, and it was pointed out by my friend Mr. White, the architect of Wimpole Street. The filtering material is likely to act more effectively if left loose, and not stretched tight, as when tense the interstices are stretched and made larger, and when out of sight it might be very loose, almost baggy, with advantage.

Hoping to get some hints as to the comparative value of the various textures under trial, I placed specimens of each under the microscope. It is obvious that both canvas and bunting are of too open a texture, having numerous small holes unguarded by delicate fibres. Judging by the microscope, one would conclude that of woven textures, probably flannel, and still more, domette flannel, are the best, and this judgment seems to be borne out by the experiments with the bottles.

B. — THE PROPORTION BETWEEN THE FILTERING OPENING AND THE CUBIC CONTENTS.

This is a question which experience alone can decide. Doubtless the larger the area of screened opening, the more effective the filtration. For a bookcase with glazed front, probably the whole of the back might be made of flannel loosely fixed over the necessary skeleton framework. For a cupboard or closet, every panel should be replaced by a screen. If the closet have a window, all crevices and joints in the window should be pasted up to exclude the soot, otherwise the wind from the outside, or the fires of the house from the inside, will force the air soot through. On the other hand, it is probably true that, given very perfect fitting and workmanship, aided by the interposition of velvet, as hereafter described, where the edges of the doors come into contact with their frame, a much smaller area of filter, perhaps even a simple tube, filled with cotton-wool, may prove to be efficient. These, however, are points on which further experience is needed, and which may, ere long, be settled by experiment.

C. — THE SITUATION OF THE SCREENED OPENING.

Where shall we place our screen? This is a question which admits of a variety of answers, and gives scope for endless ingenuity. In anything which is being newly made, such as the cupboards and closets of a new house, or in new furniture, we are masters of the situation. In many of them we may substitute at the back our filtering texture for wooden boards, and perhaps even save expense thereby. In closets we may replace the panels of the door by filtering texture, guarding the closets, if necessary, against thieves by wire netting or iron bars fixed on the inner side. As a rule, chests of drawers may have the filter over the whole surface at the back, care being taken that the back of each drawer falls half an inch short of the top of the drawer, to allow free entrance of air from the screen. In one set of drawers so placed that I could not get at the back, the difficulty was got over in this way: In the front of each drawer a series of twenty holes, of an inch diameter, was made for admission of air. The filter, on a frame, was fixed on the inner surface of the front of the drawer, so that the material should stand half an inch away from the holes. A somewhat similar plan was adopted in a bureau. About twenty large holes, two inches in diameter, were cut in the woodwork at the back, some of the holes being opposite pigeon holes. Then the whole was covered with bunting, on a frame so arranged that the bunting was fully half or two-thirds of an inch away from the wood. Another method has been adopted at the Yorkshire College for some of the cases. The filter was applied at the roof, somewhat after the fashion of a weaving-shed roof, the vertical face being filled-in by the screen. Again, Mr. Branson has provided a roof filter for a case of scientific instruments, by placing the screen in the roof of the case, and protecting it by a false roof two inches above it, to prevent its being choked by falling dust.

HOW TO DEAL WITH CREVICES.

What shall we do with crevices and cracks? At first, I hoped that narrow chinks might be ignored, on the principle that easy passages of air through an ample screen would virtually stop off currents through narrow spaces. In this I have been disappointed, as, in some cases, a chink, though apparently narrow, has proved too accommodating to the passage of air, and a more ready channel than the interstices of flannel. My rule now would be to close or guard with filtering material every place where the door comes into contact with its frame.

The plan I have adopted with the doors of several cupboards and closets is this — to put strips of cotton velvet wherever the door comes into contact with its framework. On the side where the hinges are, the velvet is glued and sprigged to the edge of the door; on the other side and the top the velvet is fixed to the rebate against which the door presses. If the door belong to a closet, and the

bottom is not in close contact with the floor, a small piece of flannel or cloth may be fixed along the inner side of the bottom of the door, so as to form a curtain which closes the gap, and filters any air that passes through.

Such, then, are the principles which may guide us to a victory over dust, and such are some of the details whereby we may work out a method by which the victory is to be won. Do not suppose that I claim to have completely conquered the enemy; but a beginning has been made, a beginning definite enough and assured enough to encourage others, and especially architects, to study the question and to make trials. If they will but work with a determination to conquer, they may confer upon the community a most welcome amelioration of some of the smaller miseries we have to submit to.

A MODEL ROOM.

And now let me venture to tell you what I should do were I to construct an office in the centre of a town. I should begin with the fireplace. Let it be constructed on the principles I have been teaching for the last ten years, and which were brought to a focus in my lecture at the Royal Institution in 1886; principles which are at last influencing the construction of fire-grates throughout the kingdom. Shortly stated, they are:

1. The back and sides of the fireplace to be firebrick, built solid.
2. The depth of grate from front to back never to be less than nine inches.
3. The back to lean over the fire, not to lean away from it.
4. The front bars to be vertical and thin, not horizontal and thick.
5. The ash-place under the grid to be made into a closed hot chamber by a moveable shield, named an "Economizer."

The effects of this construction are:

(*a*) Great diminution of dust, since the ashes fall into a closed ash-chamber.

(*b*) Better warming of the room, with a diminution of about one-fourth in the quantity of coal used.

(*c*) Diminished draught across the floor from diminished roar up the chimney when the fire is burning briskly.

(*d*) Diminished production of soot.

These are the principles which I have urged, and they are open to every one to adopt. I do not speak of a further improvement, as it is the subject of a patent, and is not open to every one to copy.

Having made sure of my fire, the next step would be to secure admission of air to supply the fire, without making a draught or introducing dirt. As far as I know this is best done by the "Harding diffuser," which admits air directly from the outside and delivers it through a series of small jets near the ceiling. To shut out the smuts the air passes through a canvas screen placed diagonally in a flat tube, which leads up to the "diffuser" and gives a filtering area about six times the sectional area of the tube. This air is admitted into the room by a legitimate channel, and is filtered. The "Harding diffuser" was once patented, but the patent has lapsed.

Having thus secured a supply of air for the chimney, we can afford to deal with the windows, and make them air-tight, without fear of the chimney smoking. Now I should like to see a revolution in windows, at any rate, wherever we can be content with panes of moderate size, and can have the heart to surrender plate-glass.

Three things are required of a good window:

1. That the outside of the window may be cleaned by a servant standing inside the room, whereby the risk and expense of cleaning from without is avoided.
2. That it shall exclude wind and dirt, even under the stress of a gale.
3. That the air of the room, especially in frosty weather, shall not be itself so chilled by contact with the large surface of glass as to cause induced cold currents, which have not even the merit of being air freshly introduced.

To attain these points, the sash-window must be abandoned. The window must be so divided that one-half vertically, or, in a large window, one-third, may open inward on hinges, the other half or two-thirds being fixed, and, therefore, wind-tight; the breadth of each division to be such that a servant's arm can reach out and clean the outer side of the fixed window as she stands inside the room. In the case of three divisions, the fixed windows would be to the right and left of the hinged window. The hinged window should be in two or three divisions, according to the height, not in one large casement from top to bottom. Thus have we provided for my first requirement, the cleaning of the window. The hinged window must be so constructed that, when closed, the framework of the window locks into a double rebated fast frame, after the manner of a jeweller's show-case. Then, if well made, it would fit tight, and keep out wind and dust. This provides for my second requirement.

Lastly, the panes should be doubled; that is, a second pane must be placed inside the ordinary pane at a distance of about five-eighths of an inch. The outer pane is fixed by putty in the usual way. The fixing of the inner pane is peculiar and all-important. The inside of the frame is cut to receive the glass exactly in the same manner as the outer side for the outer pane, but the inside pane must not be fixed by putty, but is held in place, "sprigged" firmly against its rim, "the rebate," by small nails, two in each side, very carefully put in. Why do I insist upon this mode of fixing the inner pane? For two reasons: one, to make it easy to remove the inner pane if ever it should be necessary to clean the inside of the two panes; the other reason is, to enable me to render cleaning of the inside unnecessary. How is this achieved? By facing the flange, against which the pane is pressed, with cotton velvet. The air that must perforce pass in and out of the space between the panes must pass the velvet and be filtered. Two windows of my bedroom thus treated five years ago have never needed to be cleaned, and a pane which was removed at the end of four years for inspection was absolutely clean. Another advantage of the double panes is this: When my other windows with single panes are steamed all over, and even glazed by the frost, the outer panes of the double window show hardly a trace of unfrozen steam; the inner panes are never steamed. Again, a thermometer placed between the panes has never been below 30° all this severe weather, even though a thermometer outside the window has been several times below 20°.

Lastly, I would treat the cupboards and drawers after the manner already described. The result would be, not absolute freedom from dirt nor absolute protection from London fog, but such a departure from what is commonly experienced as to make the experiment well worth all the trouble it costs.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE ON WALNUT ST., PHILADELPHIA, PA. MR. WILSON EYRE, JR., ARCHITECT, PHILADELPHIA, PA.

[Gelatine Print issued with the International and Imperial Editions only.]

COMPETITIVE DESIGN FOR THE CARNEGIE LIBRARY, PITTSBURGH, PA. MESSRS. F. I. COOPER AND W. W. BOSWORTH, ARCHITECTS, BOSTON, MASS.

THIS design received the second prize.

COMPETITIVE DESIGN FOR THE CARGEGIE LIBRARY, PITTSBURGH, PA. MESSRS. ARNE DEHLI AND J. H. CHAMBERLIN, ARCHITECTS, NEW YORK, N. Y.

COMPETITIVE DESIGN FOR THE CARNEGIE LIBRARY, PITTSBURGH, PA. MESSRS. J. A. & W. T. WILSON, ARCHITECTS, BALTIMORE, MD.

[Additional Illustrations in the International Edition.]

CARVED WOODEN DOORS FROM A HOUSE AT ABBEVILLE, FRANCE.

[Photogravure.]

HOTEL DE VILLE, SCHAERBEEK, BELGIUM.

[Gelatine Print.]

DETAIL OF THE BANQUE NATIONALE, BRUSSELS, BELGIUM. MM. BEYAERT & JANSSENS, ARCHITECTS.

[Gelatine Print.]

A GENERAL view of this building was published in the *American Architect* for January 23, 1892.

NEW HOSPITAL FOR WOMEN, EUSTON ROAD, LONDON, N. W., ENG. MR. J. M. BRYDON, ARCHITECT.

DETAILS OF THE SAME.

OLD HOUSES, SION.

SION is out of the beaten track of tourists in Switzerland; but it has a history which dates from the time of the Romans, and it will be seen that Prout found at least one picturesque corner in it.

DESIGN FOR MUNICIPAL BUILDINGS, OXFORD, ENG. MESSRS. MOORE & WHITE, ARCHITECTS.

THE DIAMOND DRILL USED BY THE EGYPTIANS. — Mr. Flinders Petrie has, says the *Indian Engineer*, originated the theory that the ancient Egyptians were familiar with the diamond-drilling device. In his "*Pyramids and Temples of Gizeh*" illustrations are given of samples of work which apparently show the use of jewel points in drilling and sawing. Various samples of this work are in his possession. He cites six examples in the Bulak Museum and at Gizeh. In a temple at Gizeh there is found in one of the lintels of a door a drill-hole with the core still sticking in it. A base of a tube drill-hole is also found between the feet of a statue of Chefren now preserved in the Bulak Museum. — *Invention.*

COMMUNICATIONS

[The editors cannot pay attention to demands of correspondents who forget to give their names and addresses as guaranty of good faith; nor do they hold themselves responsible for opinions expressed by their correspondents.]

A NEW ORDER OF ARCHITECTURE.

Macon, Ga., February 18, 1892.

To the Editors of the American Architect: —

Dear Sirs, — Will you kindly advise me through your valued paper if it is true that there is a standing reward offered to any man who will invent or design a new order of architecture? Give particulars of said offer, and by whom made.

Yours truly, PROGRESS.

[We do not know that any person is so dissatisfied with the existing elements of architectural design that he has offered a prize for a "new order of architecture." Philibert Delorme, we believe, carried off such a prize for the order used by him in the Tuileries. But there are no kings in this country to offer such prizes, and moreover, Delorme's effort did not have the revolutionary effect that was anticipated. — Eds. American Architect.]

BOOKS.

Brooklyn, N. Y., February 24, 1892.

To the Editors of the American Architect: —

Dear Sirs, — Will you kindly let me know, through the columns of your valuable paper, the names and prices of the best books on architecture and construction (printed in English), as I am an architect's student. I will be thankful to you for your favor. Also, kindly let me know where I can obtain them. I remain,

Yours truly, C. C. Wagines.

[Our correspondent will find a number of useful books advertised on page vi. — Eds. American Architect.]

NOTES AND CLIPPINGS

Compressed Air for Motive Power in Philadelphia.—The application recently made to Councils by the Pneumatic Power Company, of Philadelphia, for permission to lay pipes on Ridge Ave. and other streets will result, if granted, in ushering into the city a new competitor to rival steam in the supply of power. The new force may be used, it is claimed, not only for street railways, but for the running of stationary engines, elevators, and everything else requiring power. The Pneumatic Power Company and the Philadelphia Rapid Transit Company, which has recently secured control of the Ridge Ave. passenger railway, are allied corporations, controlled by the same people and their interests are identical. The one is incorporated for the purpose of supplying power in the form of compressed air, the other for rapid transit on Ridge Ave. The system has been in successful operation in the city of Paris for a period of four years, and in that time the capacity has increased from 120 horse-power to 16,200 horse-power. While compressed air has been used in mining and tunnelling for many years, its commercial value for use in cities had not been recognized until the establishment and successful operation of the enormous plants in Paris and Birmingham, England. Compressed air, it is claimed, beats all its competitors in general power distribution, not only by its economy and convenience, but by the extent and variety of uses to which the laid-on power may be applied, such as driving ordinary rotative steam-engines, steam-hammers, pile-drivers and other direct-acting engines, domestic motors, elevators, ventilating or exhausting, supplying air to furnaces, improving draught of chimneys, refrigerating by expansion of compressed air after performance of work, elevation and transport of grain, etc., working warehouse hoists, ejecting water for extinguishing fires by direct pressure, all without the intervening of machinery and many other uses. With the great range and variety of applications, the compressed-air system, its projectors claim, holds out a far better prospect of success than any of the other systems. Among some of the advantages which it affords to power-users is that their existing engines can be used, their boilers, ash-pits and coal-stoves can be dispensed with, new works are spared the cost of boilers, flues, chimneys, etc., freedom from smoke nuisances, and the risks of boiler explosions. Power is had at any moment by simply turning a tap and the exhaust from the engines would supply pure cold air to ventilate the workshops. — *Philadelphia Record.*

Ocean Lumber Rafts on the Pacific. — As has been before mentioned in these columns, the Joggins raft scheme is being introduced on the Pacific coast. H. H. Robertson, of St. John, N. B., who is said to be the inventor of the Joggins system, is constructing for the Fort Bragg Redwood Company, at Fort Bragg, a large raft of timber for transportation to San Francisco. In making up the float a wide departure is being taken from the method pursued at Joggins. The raft will be equipped with a rudder and steering gear, and will carry a crew, with a full equipment of signals for day and night use, anchors and chains, so that the raft can be navigated in case of accident to the tugs that are to do the towing. The raft will be in the shape of a cigar, will be 360 feet long, 36 feet wide in the centre, 21 feet deep, and will contain 3,000 piling sticks. It will be bound together by chains 12 feet apart, having a core or centre chain of solid stud-link cable running from end to end, by which it will be towed. From the centre chain lateral ones will be run out, which will shackle to the encircling chains. It is claimed that this system of floatage will save 80 per cent in cost by the ordinary way, and there will be no wastage. It is thought that the saving of waste will pay the cost of transportation. Since there is less liability of gales on the Pacific Ocean, it may be that the Joggins raft system will solve the problem of log and timber carriage on the western coast, and that before long cigar-shaped rafts will be as thickly scattered on the sea off Washington, Oregon and California as whales in Baffin's Bay.—*Northwestern Lumberman.*

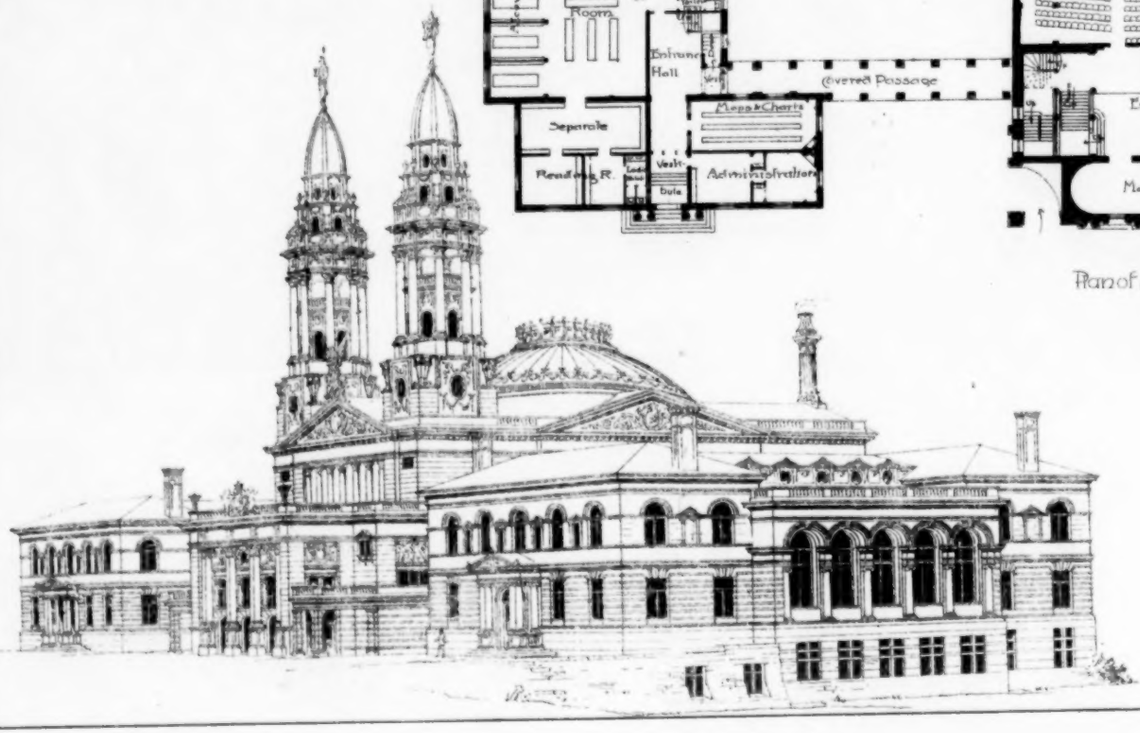
The Designs for the New British Coins. — New designs being wanted for British coins, namely for the sovereign, half-sovereign, crown, half-crown, florin and shilling, a number of artists of note were selected. Of these, the following sent in designs: Armistead, Birch, Brock, Thornycroft, Poynter and Ford. Designs by several hands were accepted. The intelligence shown by the British authorities puts our own mint-masters and legislators to shame. Our new silver pieces have heads on them which are of indeterminate sex, neither male nor female, and these heads are so small in brain space that the contour of the cranium may well have been studied in Washington from those who had most to do with the matter. The new American eagle on these coins is no improvement on the old one, but the reverse. — *New York Times.*

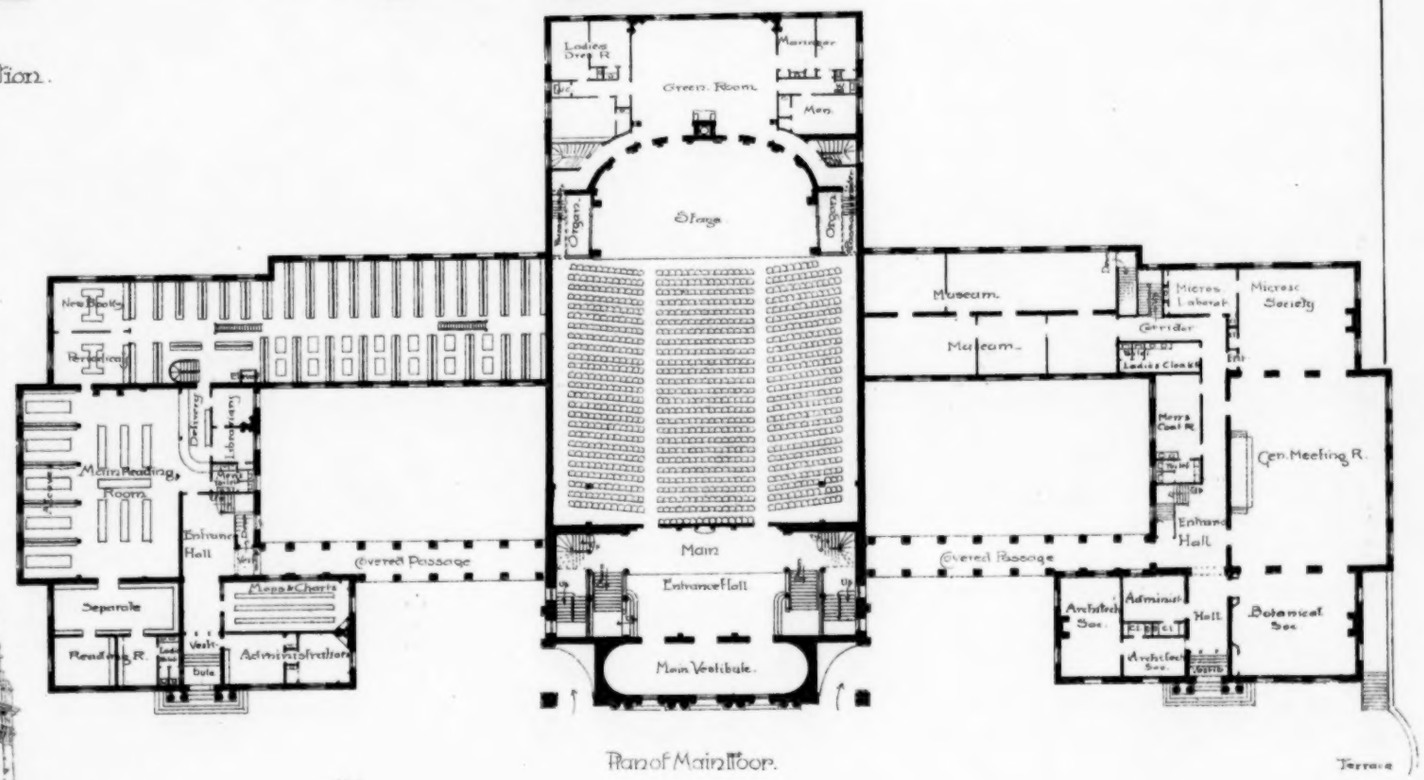
TRADE SURVEYS

An increase of thirty-three per cent in the volume of business last week throughout the country is the first reliable symptom of the general improvement that has been awaited with anxiety so long. The improvement that has been made is simply in distribution channels. In manufacturing, no improvement has taken place. In financial circles, outside of the demand caused by the increased activity in distribution, no improvement has manifested itself. In the promotion of new enterprises there is no change. A great deal of work is being held back. It is, therefore, extremely difficult to correctly forecast even the next ninety days, and it is almost as difficult to draw correct conclusions as to actual existing conditions. There are several contradictory conditions and tendencies apparent; hence the only thing to be done at this time is to state the facts upon the surface. Loans are steadily expanding. Eastern financial centres are finding a demand for about all the money they care to part with. The surplus reserve at New York is about $27,000,000; this would disappear if the actual demand which could be made were represented. About three million dollars in gold have been exported since the present movement began, and this movement is likely to continue, despite the fact that the balance of trade for the past seven months is in our favor to the extent of $158,000,000. Extraordinary shipments of cereals are being made to Europe. In railroad circles, reports continue encouraging. Reports from 135,000 miles of road, out of a total mileage of 170,000 miles, show an increase in gross earnings for last year of $47,000,000, and of net earnings of $22,566,424. The present situation on the railroads is gratifying to stockholders and to managers. The gross and net earnings continue to increase steadily throughout the year; percentage of increase is about seven per cent in net earnings. Financiers are somewhat concerned over the course pursued by the financial managers abroad. While they have no immediate fears as to stringency, they would much prefer to see the scramble for gold in Europe supplanted by a wiser and farther-reaching policy. While our financiers respect gold, and appreciate the importance of it as a basis, they do not like to see such a struggle for it, and the strong evidences of such a reliance upon it as is being furnished by the managers of financial affairs abroad. One reason for this feeling is the growing doubt as to the possibility of maintaining an exclusively gold basis throughout the world very much longer. They are watching with interest the expressions of European and British statesmen on the silver question. While our financiers do not express any pronounced views as to what ought to be or likely will be done, they evidently feel that some sort of a departure from past policy will be forced upon the United States and the world at large. In business circles, there is a great deal of disappointment felt over the slow opening of spring trade. In several branches prices are declining; margins are extremely narrow; production is being maintained at the highest point compatible with safety. Managers of some of the great industries have recently declared that there will be a restriction of production unless an improvement should set in by April 1st. It is rather curious that, accompanying such statements as this, from reputable industrial managers, are other statements to the effect that possibly and probably there will be a very heavy demand for manufactured products of all kinds, necessitating full time and full work in all of the great industries. This opinion is not mere idle anticipation or a mere sentiment, but it seems to be based upon pretty solid grounds. The very fact that the industries have been running in a very conservative way for a year past is evidence of a reviving demand in the near future. The managers of nearly all of the industries are keeping this possibility in sight, and firmly believe that there will be a market for about all the existing capacity, and that before many months. This optimistic view is not quite so assailable as surface indications seem to warrant. The smaller industries are suffering with the larger from a moderate demand. Jobbers who are accustomed to look six or twelve months ahead rather confirm the anticipations of manufacturing interest regarding the probable course of trade. Makers of machinery have had very little encouragement for several months past, but in comparatively few instances has there been any disemployed labor. The mining interests show a heavier production, the iron interests a lighter. Textile manufacturers hold their own, except in hosiery, and boot and shoe making interests report a steady increase. Building-material men are all crowding work at present, and architects speak confidently of booming demands ahead. Western bankers are loudly calling for more money, and real-estate dealers throughout the West feel that their opportunity for better business is close at hand. Cotton continues low, and will not likely improve for months to come. Ship-buildings, both on coast and lake, are thriving. Rumors are afloat of probable large railroad combinations of a transcontinental character, but the time for apprehending danger from such combinations is past. In railroad circles, it is generally understood that there will be considerable new building inaugurated this year, but not vigorously prosecuted.

S. J. Parkhill & Co., Printers, Boston, Mass.

Transverse Section.



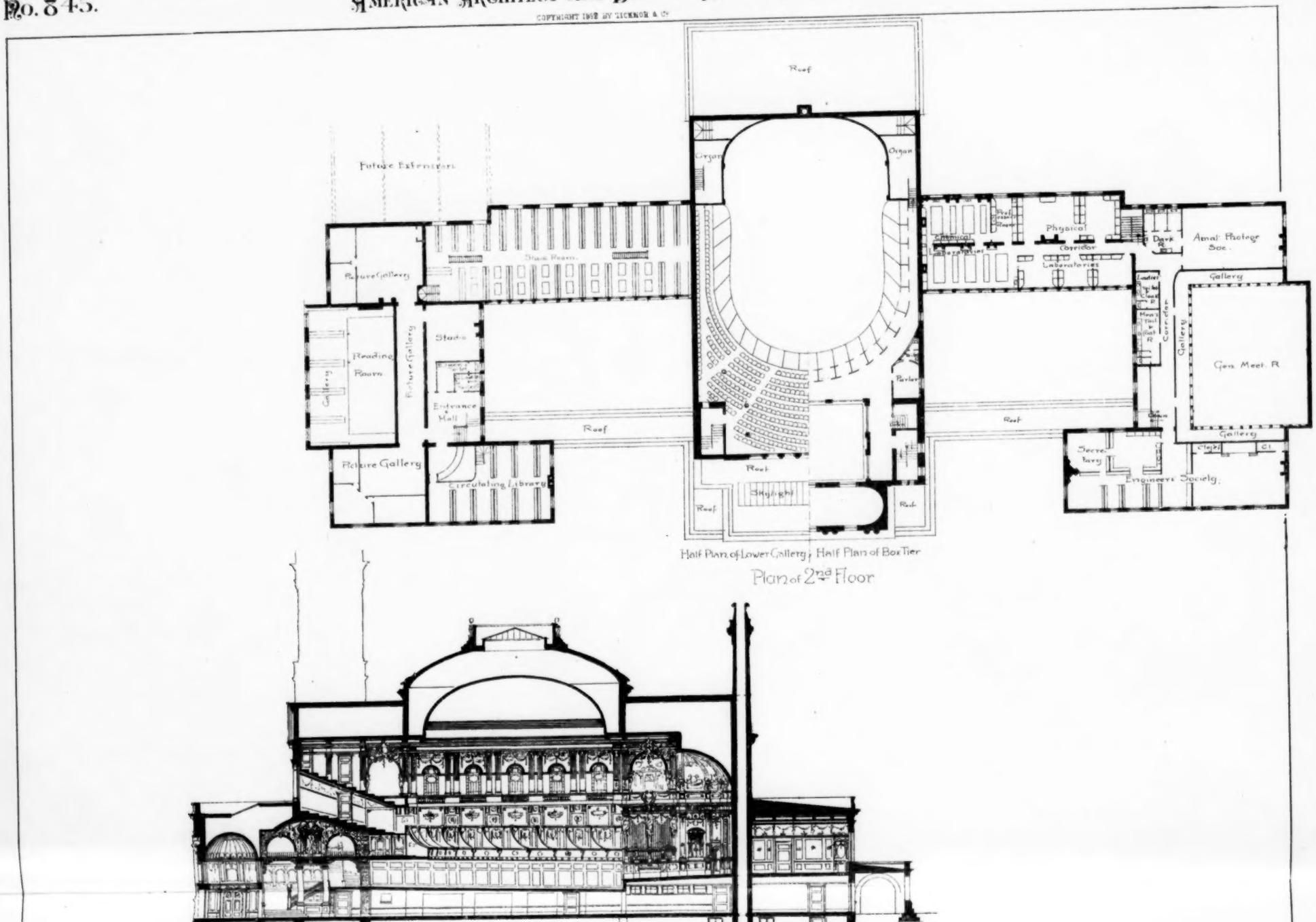


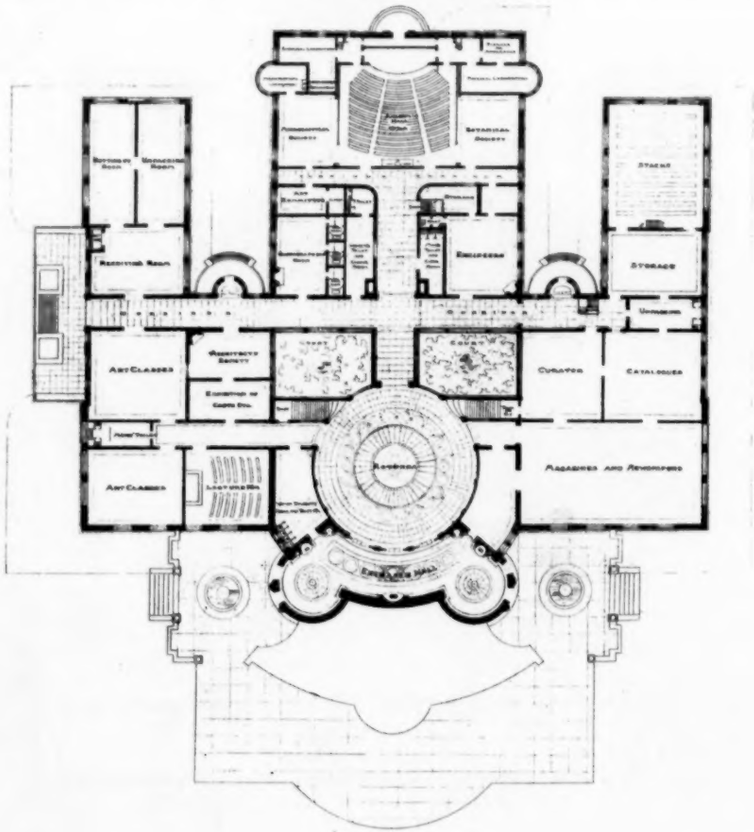
Plan of Main Floor.

COMPETITIVE DESIGN
FOR PROPOSED
CARNEGIE LIBRARY
AT PITTSBURGH, PA.

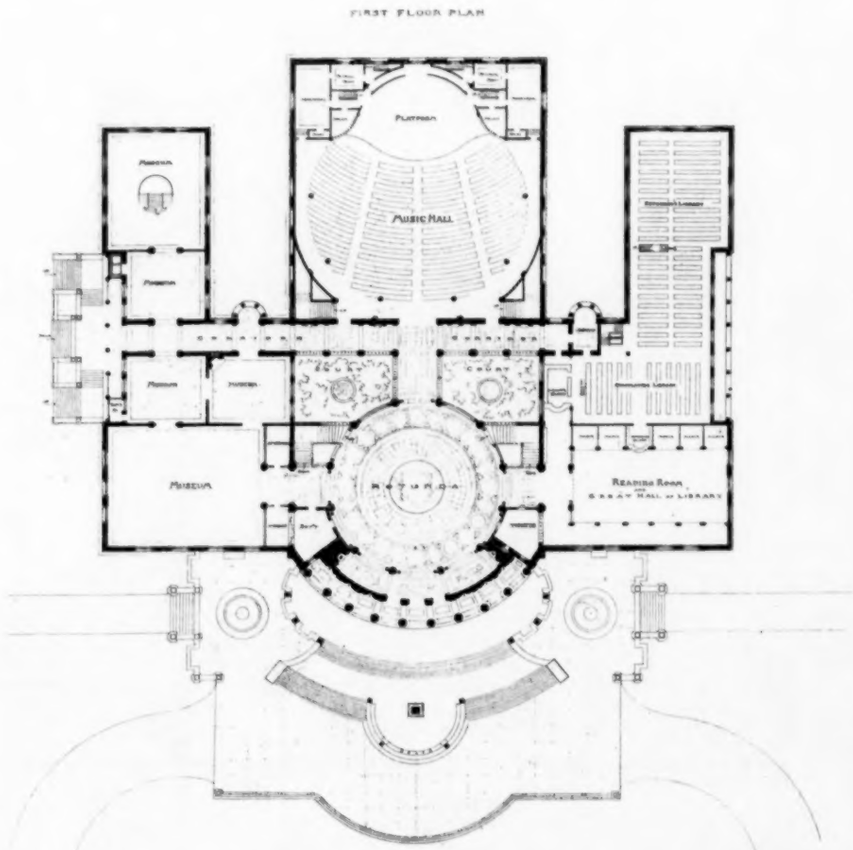
ARNE DEHLI & J. HOWARD CHAMBERLAIN
ARCHITECTS
874 B'WAY, NEW YORK.

HELIOTYPE PRINTING CO. BOSTON.





BASEMENT PLAN



FIRST FLOOR PLAN

THE CARNEGIE LIBRARY

AND MUSEUM OF FINE ARTS

PITTSBURGH

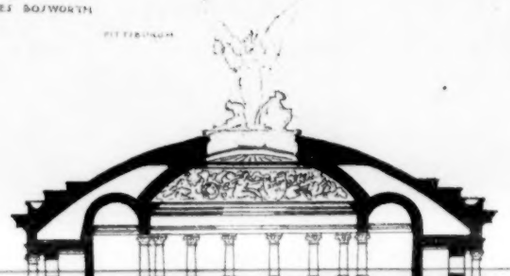
PENN

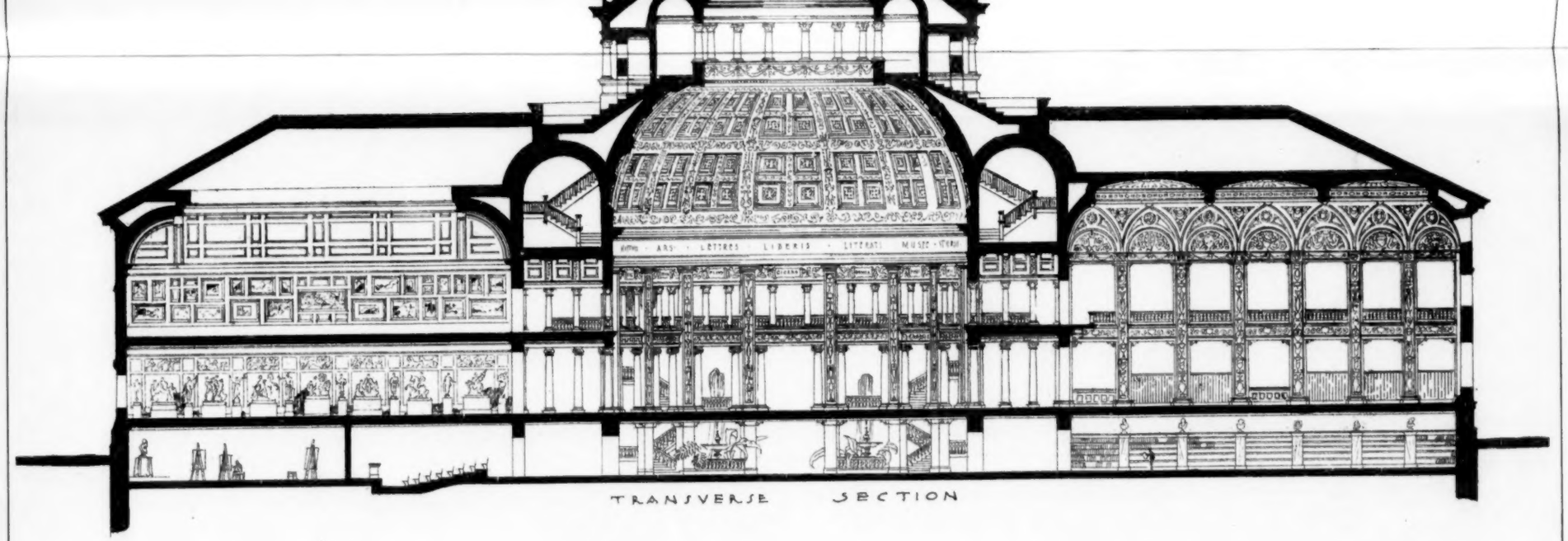
FRANK IRVING COOPER

&

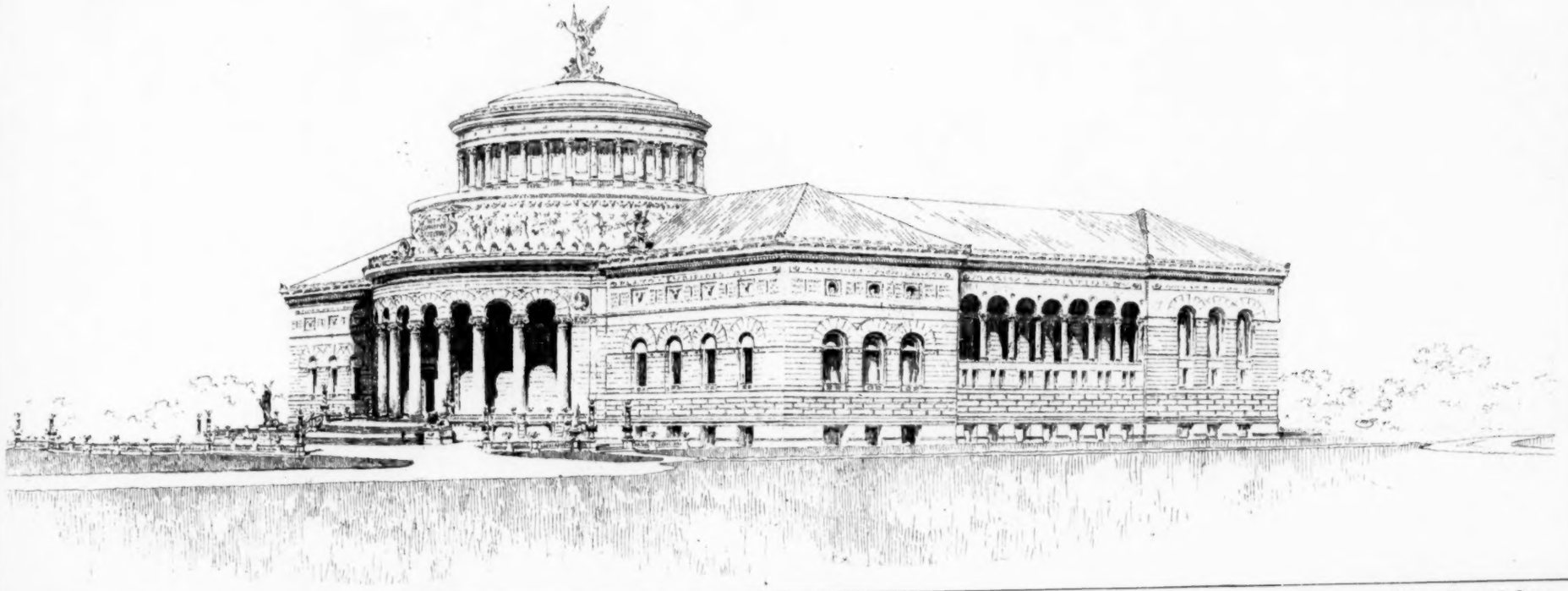
WILLIAM WELLES BOSWORTH

ARCHITECTS PITTSBURGH

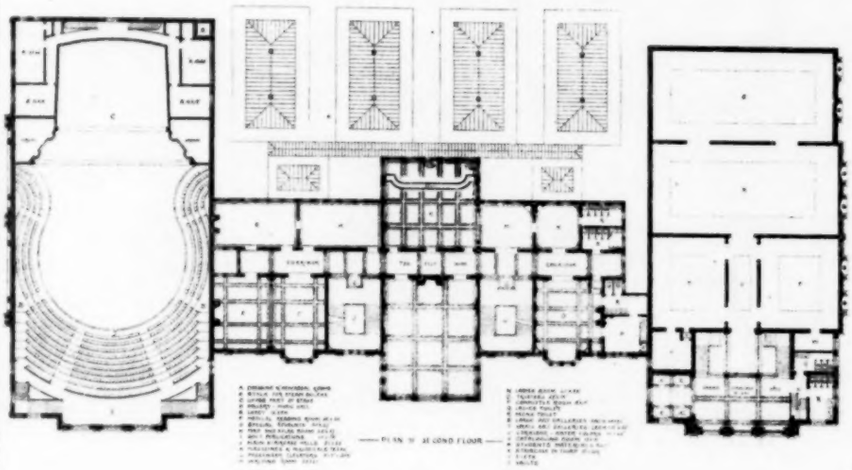




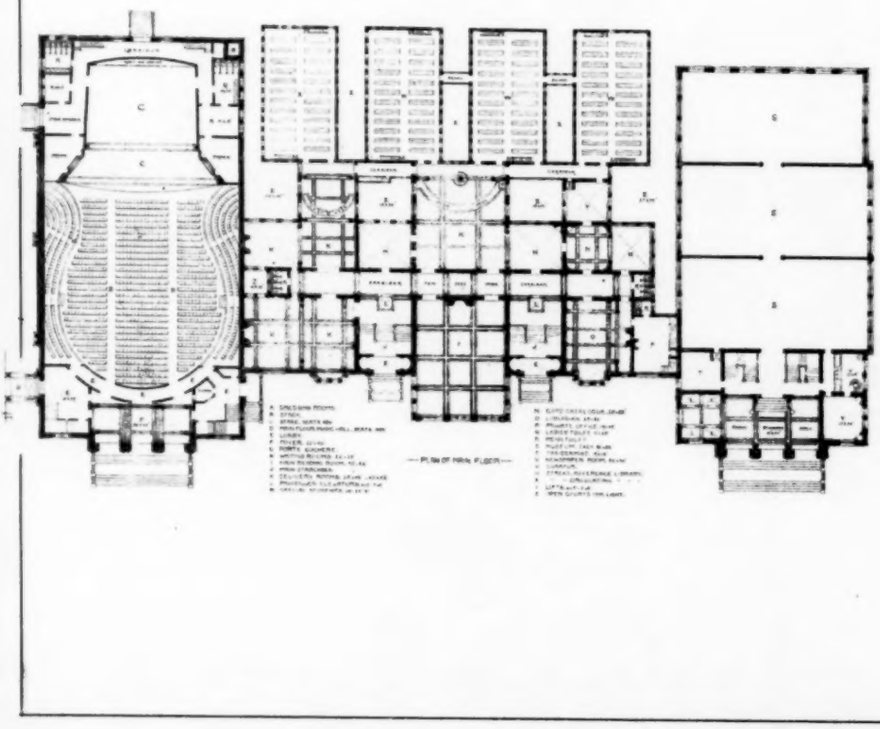
TRANSVERSE SECTION

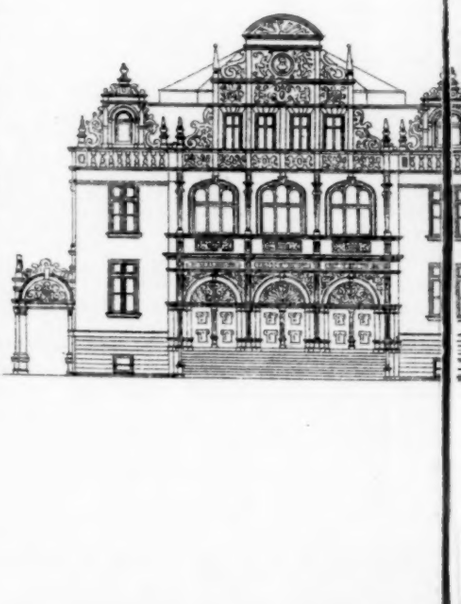


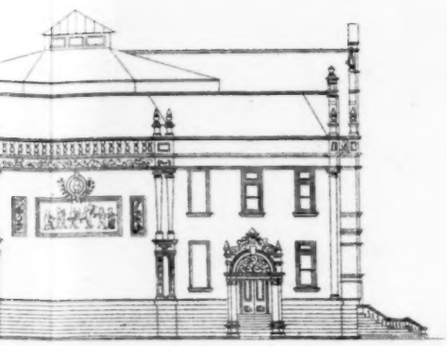
HELIOTYPE PRINTING CO. BOSTON



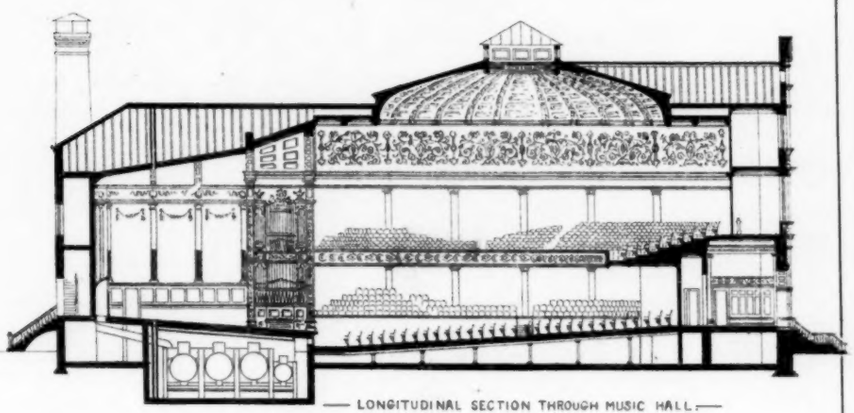
EAST ELEVATION, MUSIC HA





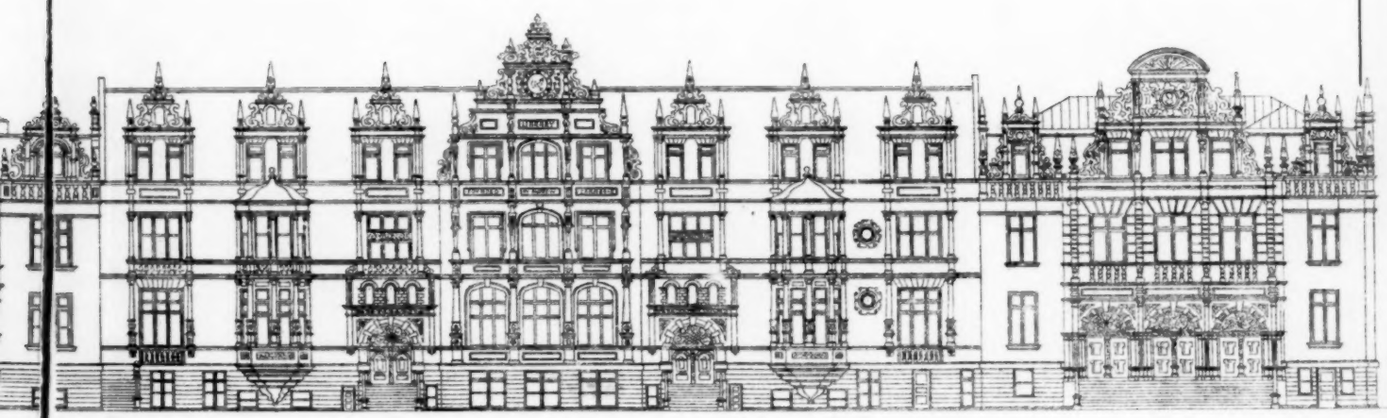


MUSIC HALL.



LONGITUDINAL SECTION THROUGH MUSIC HALL.

CARNEGIE LIBRARY PITTSBURGH PA.
JOHN APPLETON WILSON ARCHT.
BALTIMORE.



NORTH FRONT ELEVATION