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# CONTENTS.



## ILLUSTRATIONS.



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CONTENTS



THE story of the arrest, trial and conviction of what is known as the East Side incendiary gang, in New York, reads like one of Gaboriau's romances. This gang, seven members of which are already in custody, is said to be composed entirely of Russian Jews, who had organized their work into a regular business, soliciting custom, settling accounts promptly, and investing profits, just like ordinary bankers or merchants. The most active member of the partnership appears to have been one Schoenholz, who set the fires himself, and did most of the drumming for custom. His plan, as shown by the evidence at his trial, was to get an introduction to some small shopkeeper or manufacturer, whose affairs were known not to be very prosperous, and, after securing his confidence, to unfold to him a scheme by which he could sell his entire stock in trade, including a large amount of fictitious goods, to the insurance companies, and set himself up in business again in another place, with a stock of new goods, and a good balance in cash. In order to secure these advantages, it was not necessary to implicate himself at all; the only thing needed was to come to an understanding that the insurance money should be shared with persons designated by Schoenholz, and then go to the theatre, or to the synagogue, or any other place out of the way, leaving the door of his store unlocked, or, at least, putting the key where Schoenholz could get it. The latter's proceedings, after all had been arranged, were equally simple. After the unfortunate shopkeeper was out of the way, his benefactor would make his appearance with a small bundle under his arm, containing a bladder, with a string attached to it, and filled with benzine and alcohol, a candle and a match. Suspending the bladder by the string to any convenient gas-fixture or other attachment, he would set the candle under it, light it, and depart at his leisure. In course of time, the benzine and alcohol, heated by the flame of the candle, would boil, and when the tension of their vapor rose to a sufficient height, the bladder would burst, scattering the liquid, which would catch fire instantly, over the room. Nothing more was required to set the place in a blaze; and, by the time the engines arrived, there was practically no salvage on the goods in the room. An insurance adjuster, who was alleged to be in the secret, certified to the amount of the loss, the insurance money was collected, and divided as had been agreed upon. It ought to be remarked, in Schoenholz's favor, that he seems to have worked with an intelligent understanding of the circumstances, and to have tried to arrange his fires in such a way that they should not spread beyond the room containing the goods insured to the dwelling-rooms above. One of the witnesses against him, who lived in rooms over a store which was set on fire by Schoenholz, testified that Schoenholz assured him that the fire would not spread to his rooms. As it happened, however, some of his things were burned, and he, as he testified, was angry, and reproached Schoenholz for his want of skill; but fire is notoriously an unruly instrument, and perhaps Schoenholz, by the risk to which he exposed innocent people, deserved the forty years' imprisonment to which he has been sentenced.

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ONE of the curious things about the Schoenholz matter is that a large number of people seem to have known about the business that he carried on, but no one seems to have cared to inform the authorities. There is no doubt that he was protected by money and influence. One of the members of the band who is now in custody is said to have made seventy-five thousand dollars out of the business, and others are believed to have used Schoenholz as a cat's-paw for collecting fortunes for themselves. It was commonly believed, as the testimony showed, among the poorer and more ignorant people acquainted with the circumstances, that any one who revealed the secrets of the band would be killed; but the swindlers do not seem to have really slaughtered any one in pursuance of their purposes.

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UNDER a new law, all engineers in charge of power or heating plants in Massachusetts must be licensed, and, in order to be licensed, they must pass an examination, arranged by the State authorities. Although enacted last winter, the law only went into operation in August, and the examinations are now open to candidates, who, if the daily papers are to be believed, do not take much satisfaction in them. It will be remembered that the Supervising Architect of the Treasury Department once wanted some assistants, who, either under the civil-service laws, or some special provision, were to be selected by competitive examination. The examination was held, but, if we remember rightly, not one of the applicants could pass it, and it was necessary to fill the positions in another way. So with the Massachusetts engineers, as we are told. The examination is a long one, some fifty or sixty questions being proposed, to which written answers must be given; and it appears that the questions are mainly theoretical, involving principles which can be learned from books, but which working engineers have little occasion or opportunity for studying. The consequence is, as we are told, that the first-class licenses will go to youths fresh from the technical schools, who know all about heat-units and calorimeters, but would have considerable difficulty, on starting the engine under their care, in finding the valve for draining the water out of the cylinders, even if the propriety of this operation should occur to them; while the men who have handled engines intelligently and successfully for twenty or thirty years are, as we are informed, in danger of being deprived of their livelihood because they cannot solve a mathematical problem involving the solution of a quadratic equation. How much foundation there may be for these complaints, we cannot say, but it would certainly be a mistake to undervalue experience in such examinations. Of course, a man who has greased a locomotive successfully for twenty years might blow up a heating boiler at the first trial; but, on the other hand, algebraic formulas cannot teach the light hand and quick eye of a good mechanic; so that such examinations should be arranged to test both the theoretical knowledge and the practical intelligence of the candidate, and great skill on the part of the examiner is necessary for this.

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ONE of our readers calls attention to a letter written by Mr. E. C. Shankland, engineer in the office of Messrs. D. H. Burnham & Co., of Chicago, to the *Engineering Record*, in regard to the pile foundation under the Fisher, or Winnebago Building, giving a plan of the piling, and an explanation of the theory on which it was designed. According to this explanation, Mr. Shankland's idea was to compress the clay by means of the piles, rather than to drive these to a hard stratum. It is found that in Chicago, as in many other places with clay subsoil, a comparatively hard stratum, from six to ten feet thick, is found about fourteen feet below the street grade, and that under this stratum the clay is soft again to a great depth. When a heavy building is placed on piles driven to the first hard stratum, this is found to sink under the

weight, allowing the building to settle from six to twelve inches. The movement then ceases, and Mr. Shankland thinks that, when this occurs, the thickness of the firm stratum would be found, on investigation, to have been increased from six or eight feet to perhaps twenty-five, by the squeezing of the water out of the lower soft clay, and the addition of the compressed, and therefore hardened, clay to the original hard stratum. In his Fisher Building foundation, therefore, it occurred to him, instead of driving piles to the hard stratum, and depending on the weight of the building to harden the soft clay beneath, by squeezing the water out of it, to compress the soft clay in the first instance, by means of large clusters of piles, under the piers and columns, driven through the first hard stratum; so that the building erected on these piers and columns would have beneath it from the beginning masses of dense clay, similar to those which, if it stood on piles driven only to the first stratum, it would have only after settling enough to compress the lower clay.

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THIS idea is a valuable one, although we are not quite clear as to the action of the piles driven in Mr. Shankland's way. It is the common notion of builders, in clayey districts, near water, that the hard stratum, a few feet in thickness, which is usually found not far from the surface, resting on an indefinite depth of soft clay, originally formed the bottom of a body of water, and that its superior hardness is due to the action of the water, which, overflowing a soft clay formation, compressed by its weight the clay with which it came in contact, in such a way as to make it harder and more compact than the original material beneath. Whether the action of the water was quite so simple as this, is doubtful, but it seems to be evidently the case that the only difference between the hard, or bearing stratum, and the soft clay below, is in the consistency, the former having been compacted in some way out of the latter; and the possibility of forming an artificial bearing-stratum, by compacting certain portions of the clay, at a suitable depth, by means of piles, has often been discussed. Our correspondent argues that a cluster of piles, instead of squeezing the water out of the soft clay under and around them, would, unless the mass of clay were confined by sheet-piling, simply displace it, leaving what remained as soft as before. Mr. Shankland says, that, in practice, the driving of the clusters of piles, which were from twenty-five to twenty-seven feet long, driven three feet from centres, raised the surface of the clay around them from six to ten inches; and our correspondent thinks that this shows that the clay was merely displaced, and not compressed. To a certain extent, this criticism is justified. It is, however, to be considered that the resistance to lateral movement of the soil, which is due to friction, and increases with the depth, and consequent weight upon the surrounding soil, acts as a sort of sheet-piling, the effectiveness of which varies from zero, in pure water, whose particles move with perfect freedom in all directions, to a very considerable amount in soils of ordinary consistency. With this resistance to act against, the driving of a mass of piles ten or twelve feet square may be presumed to result in compressing the clay underneath them to a very appreciable extent, bringing the subsoil to a condition approaching that which it assumes after settlement under the weight of a building resting upon the first hard stratum. Whether further settlement will take place in a structure supported by clay compressed in this manner is a different question. Unless the compression extends to the underlying rock, which is unlikely, it seems as if the soft clay under the artificially-compacted mass would gradually flow out, allowing the mass itself to soften into its original condition; but this is something that only experience can determine.

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THE main building of the University of Virginia, erected from plans drawn by Thomas Jefferson, and the scene of much of his later work, was destroyed by fire a few days ago. The University buildings are situated in the village of Charlottesville, at some distance from any fire-department, and, the regular water-supply being inadequate for dealing with the flames, help had to be summoned from Staunton and Lynchburg; but, on the arrival of the engines, nothing could be done but to blow up the adjoining buildings, to prevent the spread of the fire. The work of the University will not be interrupted, but the place of the buildings destroyed must be filled as quickly as possible, and the alumni and the public will probably be asked to contribute money for that purpose.

AN ordinance has been passed in San Francisco, limiting the height of buildings to one hundred and thirty feet, where they front on streets one hundred feet or more in width, and to one hundred feet, where they front on streets less than one hundred feet wide, and requiring that all structures over eighty feet in height shall be of fireproof materials throughout. The San Francisco *Argonaut* wishes that the maximum height had been set at one hundred feet, instead of one hundred and thirty; but to Eastern people, accustomed to seeing buildings two hundred feet high, fronting on streets thirty or forty feet wide, a limitation of height to thirty per cent more than the width of the street does not seem severe, and in the business part of such a city as San Francisco will soon be, it is almost necessary to allow owners to build ten stories in height, to secure to them reasonable interest on the value of their land; and a hundred and thirty feet is not too much for ten stories.

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TO accuse one's neighbor is a bad way of defending one's-self, but we think that the public interest will be promoted by an occasional effort on our part to oppose the fashionable theory that, if an accident happens to any one during building operations, some one must be found guilty of manslaughter. The fact is that the construction of a building is, especially in cities, where it is seldom possible to get sufficient room for stagings and false-works, a difficult and dangerous operation for all concerned. Everybody understands this, and the people who consent to take part in such operations do so, knowing that they incur personal risks which they would not incur in most other sorts of business. Of course, we would not wish to excuse contractors or foremen who allow the necessary hazard of building operations to be increased by carelessness or neglect; but it is also very undesirable to encourage building workmen in the idea that they need not take reasonable care for their own safety. Of late, the practice of building in the United States has been compared, very much to its disadvantage, with that usual in Germany; and we have taken occasion to mention some falls of new buildings in Germany, to show that the idea that German work is better done, or better inspected, is quite unfounded. We have now another example to add to the list, in the fall of the spire of a church in process of construction in Berlin, the very focus of strict building-laws and still stricter police supervision. In this case, no one was injured, but the smash was a very complete one.

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M. EMILE TRÉLAT, at a recent meeting of the French Association for the Advancement of Science, over which he presided, delivered a very clever and interesting discourse on hygiene in general, presenting a picture of a village, Hygiæa, in which health and comfort reign, contrasted with a town, Noson, in which the average life is short, and is oppressed by ailments of all kinds. Although Noson, as he represents it, is a prosperous community, while Hygiæa is comparatively poor, the people of the latter enjoy the advantages of a sunny situation, on the southward slope of a gravelly hill, at the foot of which runs a river. The ocean is not more than two hundred miles away, and the sea-winds blow freely through the valley in which the river flows. The surrounding region is broken, with wooded hills and clear streams. The village itself is composed of one-story houses, with cellars under them, surrounded by gardens. The soil, being porous, does not produce very abundantly, but sunshine and careful cultivation make up for the want of natural fertility. The climate is favorably affected by the proximity of the sea, which, like a climatic fly-wheel, as M. Trélat calls it, tempers both heat and cold; and the unusual development of surface afforded by the broken character of the country gives, so to speak, increased storage capacity for the sunshine which is absorbed by the soil. The village is so high above the river as not to be affected by the mists of the valley, and drinking-water is obtained from the springs which flow from the forest above. Under these conditions, with pure air, pure water, a dry soil, plenty of sunshine and an equable climate, men can live as happily as physical conditions will enable them to do so, and as M. Trélat says, this is the ideal which modern sanitation keeps in view. All the world, it is true, cannot live in hygienic hamlets; but it is possible to do something every day to purify the air and water that we consume, and to drain the soil over which we live; and this work has already made good progress. The next thing will be, perhaps, to provide for increased sunshine in our great cities, and in this the advice of architects will be valuable, and will undoubtedly be sought.

## ART IN THE MODERN CHURCH.[1] — VI.

Fig. 27.

COUNTRY churches, in truth, would seem to lead the architect farther astray from the Christian ideal than any other sort. They have been inspired by the same element that has been so largely, and, in many cases, so delightfully developed in our house architecture. And it has, therefore, been presumed that the same quality is equally desirable, if not absolutely necessary, in the country church. A singular instance of this tendency, and the results at which it ends, is shown in Figure 27, which is a design for a country church.

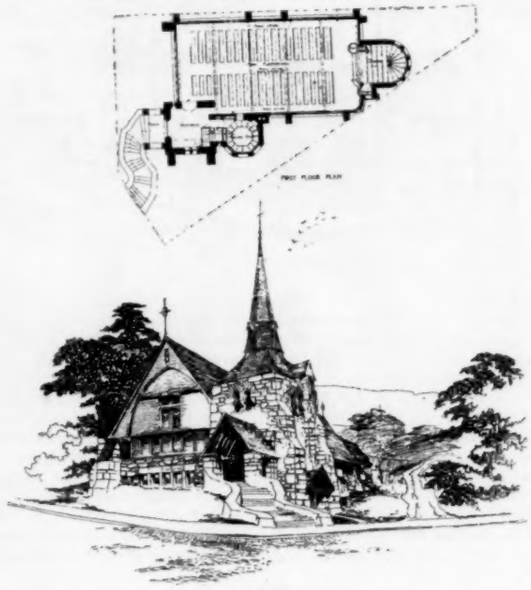

Fig. 28.

The end portion of this design, with the veranda and the tower, might better have served as the front of a casino or a club-house than a church dedicated to the Almighty. Perhaps the circumstance that this is the back of the church, and not the front of it, the choir being placed beneath the tower, has something to do with the producing of this effect. But, at any rate, we do not need on

Fig. 29.

our churches large towers with open balconies beneath their roofs, where he and she may view the landscape with that unanimity that comes from dual solitude in youth!

[1] Although the author of this paper has drawn the greater part of his illustrations from designs that have appeared in this journal, he and we are under obligations for the remainder to the *Inland Architect*, the *Northwestern Architect* and to *Architecture and Building*. Continued from No. 1037, page 66.

Nor can a vast veranda, with its suggestions of lounging-chairs and hammocks, of idle ladies and lazy men, seem a proper and holy adjunct to a church, even if spread across its rear, and looking out upon a landscape destitute of trees and beauty. These two strange features so entirely dominate this design, and both are so certainly

Fig. 30.

introduced because they produced a result of a certain picturesqueness, that nothing more need be said concerning it. Whatever faults as a design this may have, it was begun so far away from the true Christian spirit that it must be condemned at once. Neither godliness nor Christianity can be helped by such a structure as this.

Figure 28 is somewhat like a box of well-assorted confectionery. It contains a variety of mixtures, almost gay, and producing a result more complicated than any single one of them. It is an attractive little design, yet were it not for its spire, it would be hard to tell what manner of building it might be. It is, in brief, a picturesque design and a bad church.

Another design that may be studied in this connection is that of Figure 29. It is simple enough in idea, but the architects, while introducing no glaringly striking feature, and really keeping within sober limits, have, within the very simple range of their parts, introduced a good deal of variety for variety's sake. Here, as in many

Fig. 31.

other designs, a great deal of dependence is placed upon the roof for the church effect, though experience tells us no truer thing than that a roof may cover a multitude of sins.

In more pretentious designs the same rule holds, namely, that the picturesque should not be the leading *motif* in church architecture, and the more pretentious the design the more inexcusable the

picturesque element. For in a large church it is always possible to introduce sobriety, dignity, spaciousness and beauty, all of which do much to produce a pure Christian effect. Architectural beauty, it need scarcely be said, is not the same quality as architectural picturesqueness, but when the latter becomes rampant, as it often

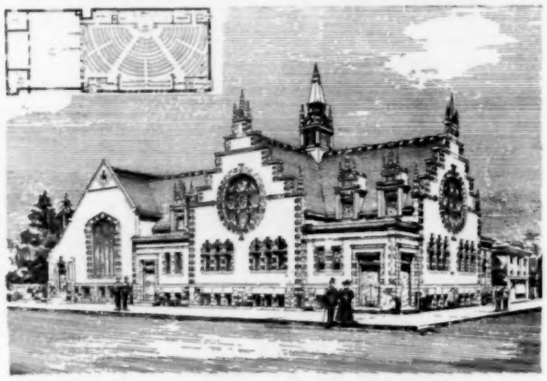

Fig. 32.

does, then beauty is retired, and a totally different character permeates the design. The picturesque, moreover, is more naturally a characteristic of small designs than of large ones, and a vast church, which is simply picturesque, is like some stately matron decked out with the furbelows and foolishness of extreme youth. The obnoxious element is, therefore, more obnoxious, if degrees of comparison are permissible, in a large design than in a small one, because so many of the elements of dignity and majesty, which help to make a Christian design, are deliberately ignored.

Some light is thrown on this point by a competitive design for a church (Fig. 30). There is a good deal that is excellent here, if such a modification of the Romanesque is a proper architectural language to be employed in a modern American church. Yet in its simplest form this design consists of a huge roof, supported by two gabled fronts, and surrounded with towers, turrets, dormers and pinnacles until the eye is bewildered by what the architect has so lavishly given us out of the abundance of his imagination. It should, however, be remembered, in studying this design, that it was destined for a non-liturgic worship. The central feature is a vast octagon that forms a not inappropriate auditory. But while this fact is expressed in the outline of the central mass, it is so surrounded by the lower parts, is so masked by fronts we naturally associate with liturgic churches, or with those in the traditional church form,

Fig. 33.

and the lecture-room in the back is so closely united with the main portions, that it is hard to tell just what sort of a building it may be. It does not, therefore, offer even so much as a non-liturgic effect.

We have not, heretofore, considered the relationship between the form of worship in a church and its expression in architecture. Considering the church solely from its fundamental standpoint as the house of God, the responsibility of the architect in expressing its specific destination beyond this has not been touched upon. But in the last design we have a structure that attempts to state that

Fig. 34.

the church is of the lecture-hall type; that the pulpit, not the altar, is the chief consideration. Why, then, it may be asked, is this fact masked behind an exterior that is neither the one nor the other? Why add parts, ornament, detail, enrichment of all sorts, to cover up the very thing it has been sought to build? If an auditory is desired, why not make one? Obviously the author of this design labored under a misapprehension of his duties. He planned a lecture-hall, of good form and convenient shape, and then surrounded it with parts that had no connection with his organic centre, because, in this way, he would obtain a picturesque attempt, which, doubtless, it was imagined, would have a traditional church effect. In other words, it was the picturesque that was sought, not a plain simple Christian expression of the uses to which the structure was to be put.

Much the same may be said of the design for the church in Figure 31, which, unlike the preceding design, has actually been built. Here the auditory has been more frankly expressed, there is less

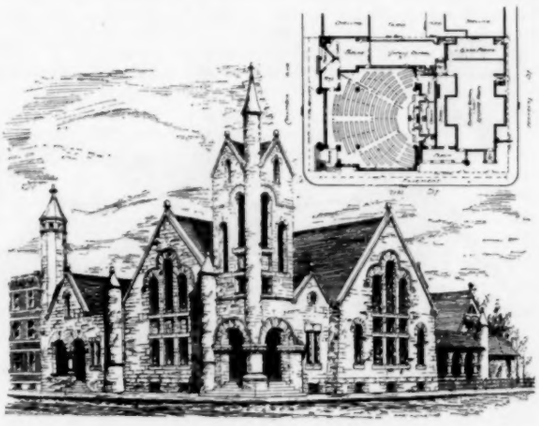

Fig. 35.

detail and fewer parts; the design is simpler, and yet, though the church auditorium may be regarded from certain standpoints as an entirely modern conception of a church building, the result is more strange and startling than churchly. The façade, with its two towers and connecting arcade, is simply a screen of traditionary

character, in which the picturesque has been sought, instead of an expression of Christian faith.

And so we might go on, examining church after church, finding perhaps much of the picturesque in them, certainly some attempts to obtain it, but nothing at all of Christianity or of true Christian feeling in architecture. The fancy of the architect, his imagination, his memory, perhaps, is the leading determinative element in our church architecture, if it does not dominate it. In the subjoined figures (Figs. 32, 33, 34, 35 and 36) are shown a series of churches, chosen almost at random from a very large number of examples, and representing churches of various grades of cost and pretentiousness, as well as those belonging to a considerable variety of religious bodies. It is not pretended that as designs, as mere architectural compositions, these churches have equal merit, nor, indeed, that they contain any merit of this sort. But they illustrate, in a very fair manner, just the sort of buildings our people are satisfied with in their churches.

Viewed from this standpoint, the lesson they teach is impressive in its dismalness. These buildings have naught to tell us of the heavenly life, scarce hint at the existence of God, certainly tell us no story of Christian love and reverence, and faith and fortitude. They are studies in brick and stone, in mortar and plaster; they are exercises in architectural composition, in the grouping of roofs, windows, towers and doors; they are essays in economy, in the arrangement of materials, in ambitious attempts with limited means; a few of them illustrate more or less novelty in departing from the model we call the accepted one. But this is all. Nor are they types of a small group. Church after church, in city after city, and from one State to another, tell the same lesson, teach the same forgetfulness of religion as expressed in architecture. Yet so far are we, as a people, from appreciating the true value of church architecture, that just such designs as these might be grouped together,

Fig. 36.

and learnedly discussed in an essay on church architecture. Types of architecture they may be, if you will, but types of church architecture, of religious architecture, of Christian architecture, they never have been, nor can they be, in such ungodly form.

BARR FERREE.

(To be continued.)

## PROTECTION FROM LIGHTNING.[1]

AT the Aberdeen meeting of the British Association for the Advancement of Science Sir William Thomson made the remark, "If I urge Glasgow manufacturers to put up lightning-rods they say it is cheaper to insure than to do so."

This was the answer given by practical business men, concerned only with questions of profit and loss, to the foremost physicist of our time; and their answer will serve as fairly representing views widely held, founded upon the double belief that the risk from lightning is not so very great and the protection afforded by the present methods not sufficiently certain to warrant implicit confidence and justify the necessary expense.

The recent remarkable experiments of Dr. Oliver Lodge, in his lectures before the Society of Arts, opposing and to some degree directly contradicting the empirical rules of the Lightning-rod Conference, have given support to the belief that the protection was uncertain. Indeed, realizing that his work might be misinterpreted, Lodge has stated, "an idea at one time got abroad that my experiments proved existing lightning-conductors to be useless or dangerous; this is an entire misrepresentation. Almost any conductor is probably better than none, but few or no conductors are absolute and complete safeguards. Certain habits of lightning-rod practice may be improved and the curious freaks or vagaries of lightning strokes in protected buildings are intelligible without any blame attaching to the conductor; but this is very different from the contention that lightning-rods are unnecessary and useless. They are essential to anything like security."[2]

What Lodge's brilliant experimental work does show is that the momentum of an electric current can not be overlooked in a lightning discharge. The old "drain-pipe" idea of conveying electricity gently from cloud to earth must give place to the new proposition, based upon recent discoveries, that even draining off must be done in an appropriate way to be effective. To illustrate, the rocks and trees upon a mountain side may influence and determine the course of a mountain stream, but even a good-sized channel would not suffice to carry off safely an avalanche, or control the path of a landslide; so with lightning. In the past four years we have learned, through the work of Hertz and others, that when an electric current flows steadily in one direction in a cylindrical wire its intensity is the same in all parts of the wire; but if the current be of an oscillatory character, *i. e.*, a current which rapidly reverses its direction, the condition no longer holds, and if the alternations are very rapid the interior of the wire may be almost free from current. If lightning, then, be a discharge of an oscillatory character, it may happen that the current down the lightning-rod would be only *skin* deep. The experiments of Tesla and Elihu Thomson with currents of great frequency of alternation and very high potentials open the door to systematic study of discharges such as the ordinary lightning-flash. In daily work currents of this type are coming more and more into prominence, and the time is not far distant when the lightning-flash will be studied as an electrical discharge of this character. Protection entirely adequate for such discharges will then be forthcoming. Indeed, the reasons why present methods occasionally fail are now understood, and the proper remedies apparent.

And first let us see whether it is cheaper to insure than to provide proper protection. Foreign countries, especially Germany, France and Great Britain, have recognized the importance of obtaining reliable data concerning the loss of life and damage to property through lightning. Perhaps the work of the Royal Prussian Bureau of Statistics[3] gives the fullest and most detailed accounts of the damage done by lightning in Germany, and the relative injury. Statistics are available for the number of houses struck, the number of fires, the character of the roofing, soil, etc.

In 1891 the Weather Bureau issued to its observers instructions to report at the end of every month the names, with corroborative dates and places, of all persons killed by violent wind-storms, tornadoes and lightning. During 1890 somewhat similar statistics had been gathered, but the returns were less systematically arranged. In preparing the Weather Bureau lists, observers were directed to examine all daily papers published in their respective cities, consult all local authorities and make inquiry if necessary. Naturally, where dependence was had upon newspaper items, there resulted much duplication, but in verifying names and dates the duplicates quickly appear and exaggerated reports are easily confined to proper limits.

From the Weather Bureau records which have been tabulated, it appears that in the United States, for the four years, 1890-'93, 784 lives were lost, an average of 196 lives per year.

It is also evident that these lives were practically all lost in five months — April to September — and that in June and July the maximum death rate occurs.

The Weather Bureau records, unfortunately, do not give information as to the extent of damage to property. To get at something like a fair commercial estimate of the destruction of property by lightning, I have made use of the "*Chronicle* Fire-Tables" for the eight years 1885-'92. It is hardly necessary to remark that these tables are compiled from the reports of the fire-departments, insurance companies and the reports of fires in the public press, and represent a high degree of accuracy.

From information contained in these volumes, the following tables have been compiled:

FIRES CAUSED BY LIGHTNING.

| Year. | Number of fires. | Loss on original risk. |
|---|---|---|
| 1885 to 1890, inclusive | 2,220 | $8,386,826 |
| 1891 | 457 | 1,355,525 |
| 1892 | 839 | 2,921,484 |

Or, in eight years, ending 1892, in the United States, and for the most part east of the Rocky Mountains, 3,516 fires, with a loss of $12,663,835.

It is very evident, therefore, that the damage done by lightning is no inconsiderable matter to be lightly passed over or turned off by replies such as the one given by the Glasgow manufacturers. It is certainly worth while to erect the proper protective apparatus.

The following table shows the number of barns, stables, granaries, churches and dwellings set on fire by lightning during the years 1890, 1891 and 1892:

| Year. | Barns, stables and granaries. | Churches. | Dwellings. |
|---|---|---|---|
| 1890 | 363 | 29 | 121 |
| 1891 | 290 | 11 | 78 |
| 1892 | 495 | 29 | 177 |

During nine years, ending 1892, 2,335 barns, 104 churches and 664 dwellings have been struck by lightning.

The question has often been raised whether there exists a periodicity in the number of lightning-strokes. Statistics must cover a

[1] A circular of information prepared by Alexander McAdie and issued by the Weather Bureau of the United States Department of Agriculture.

[2] Page vi. "*Lightning-conductors and Lightning-guards.*"

[3] *Beitrage zur Statistick der Blitzschlage in Deutschland*; von Dr. Hellman, Berlin, 1886.

period of, at least, twenty years before an answer to this question can be given, but it is interesting to compare the number and kind of buildings struck for the last two years of which we have record.

| | 1891. | 1892. |
|---|---|---|
| Barns, granaries and stables | 200 | 495 |
| Churches | 11 | 29 |
| Country and general merchandise stores | 5 | 6 |
| Dwellings and tenements | 78 | 177 |
| Electric-light stations | 1 | 2 |
| Grain elevators | 2 | 4 |
| Grain fields | 1 | ..... |
| Grain, hay and straw in stack | 10 | 12 |
| Ice-houses | 4 | 4 |
| Light-houses and life-saving stations (no other source of fire reported.) | 2 | ..... |
| Livery-stables | 4 | 4 |
| Lumber-yards | 2 | 1 |
| Oil-refineries | 2 | 2 |
| Oil-tanks | 2 | 22 |
| Railroad depots | 5 | 7 |
| Telegraph and telephone offices | 2 | 3 |

It is of particular interest to study the geographical distribution of the dwellings and barns struck in these two years. There are some notable increases in certain States, the reasons for which are not at present discernable. Attention is directed to the figures in bold-face type.

| State. | Barns. | | Dwellings. | |
|---|---|---|---|---|
| | 1891. | 1892. | 1891. | 1892. |
| Connecticut | 9 | **23** | 6 | **16** |
| Delaware | 4 | 5 | ..... | ..... |
| Illinois | 17 | 7 | 7 | **12** |
| Indiana | 31 | 38 | 7 | 9 |
| Iowa | 19 | 6 | ..... | ..... |
| Kansas | 1 | 2 | ..... | ..... |
| Kentucky | 3 | 4 | ..... | ..... |
| Maine | 21 | 23 | 7 | **16** |
| Maryland | 12 | 8 | ..... | **6** |
| Massachusetts | 12 | 15 | 8 | **12** |
| Michigan | 26 | **70** | ..... | **13** |
| Minnesota | 7 | 5 | 4 | 6 |
| Mississippi | 1 | ..... | ..... | ..... |
| Missouri | 2 | 1 | 2 | 3 |
| Nebraska | 1 | ..... | ..... | ..... |
| North Carolina | 2 | 3 | ..... | 2 |
| New Hampshire | 2 | 2 | ..... | ..... |
| New Jersey | 14 | **30** | 3 | 7 |
| New York | 30 | **117** | 5 | **23** |
| Ohio | 26 | 26 | 6 | 4 |
| Oregon | 2 | ..... | ..... | ..... |
| Pennsylvania | 29 | **73** | 3 | **23** |
| Rhode Island | 1 | 4 | ..... | 2 |
| South Carolina | 3 | ..... | ..... | ..... |
| South Dakota | 3 | 3 | ..... | ..... |
| Texas | 4 | 7 | ..... | ..... |
| Virginia | 4 | ..... | ..... | 2 |
| Wisconsin | 6 | **11** | 2 | 3 |

According to the statistics of the German Bureau, previously referred to, the frequency of lightning-stroke varies somewhat with the character of the land. Thus, in their investigations it was found that in flat lands 400 to 540 buildings were struck out of 1,000,000, the rate varying in different localities.

The nature of the material used for roofing has also been considered. Classifying the various materials under the general heads "hard" and "soft," the German investigators found for ten years (1873-'83) for Schleswig-Holstein, that of all the buildings struck, 9 per cent of those having *hard* roofs and 68 per cent of those having *soft* roofs were set on fire. The nature of the building and the purpose for which it is used will, as we readily see also in our own statistics, influence the liability to stroke and fire.

One interesting point which appears to be shown by statistical studies of lightning-stroke is the decreased liability to accident in *thickly settled* communities.

It may be said, in general, that the risk in the country is five times greater than in the city. For ordinary dwelling-houses, not unduly exposed in city blocks, lightning-rods are hardly necessary, a very considerable protection being afforded by the tin roofing, numerous cornices, gutters, etc. The geological, as well as the topographical conditions, may have some influence upon the frequency of lightning stroke. According to the authority already quoted, if 1 represents the frequency of lightning stroke in a chalk formation, 2 will represent the liability for marl, 7 for clay, 9 for sand and 22 for loam.

With regard to trees, the oak is most frequently, and the beech least frequently, struck. The values are something like, if 1 represents the frequency for the beech-tree, 15 for pines, other trees generally averaged at 40 and 54 for oaks. Trees struck are most generally those standing in the clear or on the edge of forests, and in height averaging from 16 to 20 metres (52 to 66 feet). The trunk appears to be struck about three times as often as the boughs, and generally the stroke seems to travel to the ground. Only in three out of a hundred cases did it jump to other trees.

Mr. Symons,[1] in his paper on thunder-storms, instances 16 trees struck. About one-third of these were elms, with the oak, ash, poplar, in order following, and one case each of crab-lime and willow.

It is interesting to recall at this point the record made by Hugh Maxwell as early as 1787, that the elm, chestnut, oak and pine were often struck, the ash rarely, and the beech, birch and maple never. This last, however, is not true. Indeed, it is not altogether plain just why some trees escape while others suffer. Capt. Maclear,[2] discussing the action of lightning during a thunder-storm on June 6 and 7, 1889, found a great number of trees struck within a radius of four miles, and set to work to discover, if possible, the cause of the selection of these particular trees. "For contrary to general expectations," he says "they were not the highest nor the most prominent in their immediate vicinity." A cottage, a haystack, two poplars, a spruce, fir and five oaks, in different places, were struck within this confined area.

The storm passed in a northwest direction with southeast wind, and it is apparent that the objects struck lie nearly in a line northwest and southeast, three miles in length. The spruce was very prominent on the southern brow of the hill, with two arms nearly in line with the stem; one arm was thrown to the ground and the other blown down. At the juncture of the arms there was a great deal of turpentine which was thoroughly "blackened." Hence, it is assumed that the prominence of the tree made it the best communication to earth, and that the collection of turpentine was raised to explosive temperature and split the tree, but a like good reason does not appear for the other objects struck. On the next day six oaks, a chestnut and an ash, in various positions within one-half mile of a pond, and on the slope of ground near the pond, a young fir and three young oaks; one-half mile south of Cranleigh, four oaks; on Cranleigh Common an oak, and one mile northwest, a chimney, a stable and an oak (struck also on the day before) and a single oak occupying a fairly prominent position on the slope of high hills, two and one-half miles northeast.

This last tree was struck just before the rain commenced and was split; the other trees struck during the rain were only scored. "Hence," concludes Maclear, "it is not easy to see the cause of selection, for these trees were not the most prominent, nor were they on the highest ground in the vicinity, *the only feature the groups possessed in common being that they were all either near ditches which were full of running water, or else near temporary courses taken by the deluge of water from the higher to the lower ground.*[3] The most puzzling case is that of the young fir-tree and three young oaks in the middle of the copse near the pond. They were not higher than other trees on the copse, but there certainly was a temporary watercourse close to them; other trees, however, stood equally close to water. . . . Another curious case is that of the stable struck, which was overshadowed by tall elms, where it might have been supposed that these would have taken the stroke."

Some statistics of the damage done by lightning stroke in Belgium[4] in 1889 may be appropriately inserted here: Of 324 lightning flashes, 2 struck lightning-rods; 123 struck buildings, setting 36 on fire; 16 struck persons; 96, trees; 81, telegraph and telephone lines; and others, miscellaneous. In other statistics we find that of eighteen deaths due to lightning, one occurred within a dwelling, eleven out of doors and six under trees. Contrasted with the cases of death resulting from lightning stroke, let us look at forty-three cases of persons struck, with results not necessarily fatal, and we find that twenty of these were indoors, twenty-three out of doors, including four under trees. No records sufficiently extended and authentic are available to ascertain what proportion of persons struck by lightning are killed outright. I know of but one record, and in that out of two hundred and twelve persons struck, seventy-four were killed. This question, which is of the greatest interest, is referred to again under the last of the rules given farther on for the protection of life.

One of the peculiar and most common characteristics of the action of lightning is the *tearing off* or *throwing* effect. This, as we shall see farther on, is just what might be expected from discharges of great frequency of alternation. Some interesting statistics are given by Parnell[5] on the mechanical tearing off and disruptive effects of lightning as distinguished even from the *heat* effects. He records 1,147 cases. Of these, 224 do not permit a determination of the character of the work done by the stroke of the remaining 923.

| | Mechanical work. | Heat. |
|---|---|---|
| Persons and animals | 52 | 79 |
| Cloths, carpets, canvas, woolen, linen and cotton goods | 88 | 79 |
| Masonry of all kinds | 416 | 2 |
| Glass, china, earthenware | 82 | 5 |
| Metal | 206 | 173 |
| Wood | 254 | 98 |
| Trees | 63 | 4 |
| Ground | 60 | ..... |
| Thatch, straw, etc. | ..... | 11 |
| Gunpowder | ..... | 15 |
| Gas | ..... | 19 |
| Total | 1,221 | 485 |

Colonel Parnell gives, furthermore, the details in 278 cases to show the existence of an *upward* direction in the force of the stroke.

This, and the statement that "probably few persons are aware that lightning strokes are more apt to bend or break metal than to fuse it," are, in the light of the investigations of the past three years into the character of the lightning-flash, easily comprehensible. A lightning-flash being a break in the air (*i. e.*, the dielectric) when the

[1] Also Appendix E. "*Report of Lightning-rod Conference.*"

[2] *Quart. Journ. Met. Soc.*, 1890, p. 229.

[3] Italics mine.

[4] Evrard and Lambotte. *Ciel et Terre*, 1891; No. 7.

[5] *Quart. Journ. Met. Soc.*, vol. vi, 1895. See also Colonel Parnell's book.

electrical strain exceeds a certain value, determined by several variables, the strongest mechanical effect may be found in any direction, upward or downward. Speaking popularly, flashes may go from cloud to earth, earth to cloud, or from cloud to cloud to earth.

II.

Beyond doubt, Franklin proved his case that lightning-rods were efficacious in the protection of buildings. Buildings with conductors when struck by lightning suffered little damage compared with those without protectors.

The chief defects likely to occur are blunted points and breaks in the continuity of the connection. The function of a lightning-rod is twofold; first, that of conducting the charge to earth, and second, the prevention of a disruptive discharge by silent neutralization of the cloud electrification. The latter explains why a rod terminates in a point and likewise why points in good connection with the ground are always *desirable* upon buildings. Indeed, points are somewhat like small water-pipes connected with a large reservoir. If you have enough of them and a sufficient time you may drain the largest reservoir. Furthermore, when some sudden rise or flood occurs in the reservoir, these minute drains may be of service in keeping the height of the water down.

In the case of lightning the points are the small escape-pipes, the layer of air between cloud and earth the retaining-wall, and the cloud electrification — or charge — the overflowing and destructive element. A large conductor, be it rod or tape, on the other hand is more like a large main or water-way, which has its gate shut until the flood is imminent. Then the gate is suddenly opened and we try to compel the torrent to keep to the provided path. We trust in its ability to safely hold the flood. Generally it does. In perhaps nine cases out of ten, the lightning-conductor, if it be such a one as we will describe later, does carry the flash to earth; but there are cases where the discharges have been heavy and overflows have resulted. To carry the lightning-flash "the lightning-conductor should offer a line of discharge more nearly perfect and more accessible than any other offered by the materials or contents of the edifice we wish to protect." To prevent the discharge "the conductor should be surrounded by points." These quotations are from the Report of the Lightning-rod Conference.

The statement that lightning always follows the path of least resistance, as commonly understood and stated, needs modification. True it is, that when the air is strained by being subjected to the electrifications of cloud and earth, the weakest spot gives away first, and this is apt to be in line with some small elevated knob or surface; but it is equally true, and is perhaps the more general case, that when a really vigorous disruptive discharge does occur, it is somewhat, as Dr. Lodge aptly puts it, like an "avalanche." As a matter of fact, we find from the study of actual cases, where buildings have been struck, that lightning often disregards entirely metallic surfaces and points. What we should first know is, whether the condition is to be one of "steady strain,"[1] or "impulsive rush"[1] discharge. In the case of "steady strain," the metal is apt to influence the path of discharge; in the case of an "impulsive rush" discharge, even *points* seem to lose their efficiency and become of little use.

In a letter[2] of an old British admiral there occurs a description of his being called upon to approve some specifications for a lightning-conductor to be erected on a certain lighthouse. He was himself a believer in the "surface" theory of Harris; but thought that, to make sure, he would go and consult his friend Faraday. Faraday, who saw only the question of conductivity in the problem, said very positively that the solid rod was better than the tube (which gives greater surface with less copper), and that *solid volume was everything*, superficial area nothing. Moreover, if Harris says otherwise, "then, he knows nothing whatever about it." The admiral straightway approved the solid-rod conductor for the lighthouse. Within two or three days he met Harris, and bringing up the question was told by Harris "*surface* area is most important, and if Faraday says otherwise, then he knows nothing whatever about it!"

Up to a certain point Faraday was right; a copper rod an inch thick is capable of carrying almost any flash of lightning, and is undoubtedly a great protector, but if, as we have reason to believe, the core is seldom given a chance to carry the current, why have it? The views of Sir W. Snow Harris, based as they were upon close study of many thousand cases of lightning action, are finding in the experiments of to-day the confirmation so long needed.

While not going into details regarding this question of the shape of the rod, let us emphasize the fact, so recently brought out, that if an electric current flows steadily in one direction in a cylindrical wire, its intensity is the same in all portions of the wire, as shown by Hertz, but that with a current of an oscillatory character, *i. e.*, a current which rapidly reverses its direction, this condition no longer holds, and if the direction is altered very rapidly the interior of the wire, in our case the lightning-rod, may be almost free from current.

In 1882 appeared the report of the Lightning-rod Conference; in many respects the most important contribution to the literature of the subject yet made. While so many foreign governments, and in particular France, had by means of officially constituted boards taken a governmental interest in the protection of the people from the dangers of lightning, the English-speaking people of the world aside from the few directions officially issued for the protection of magazines and lighthouses, remained without any authoritative utterance upon the subject; and while this conference itself did not have strictly official sanction, it carries, from the character of its make-up, a weight certainly as great, if not greater, than an official board. It was simply a joint committee of representative members of the Institute of British Architects, the Physical Society, the Society of Telegraph Engineers and Electricians, the Meteorological Society, and two coöpted members. As might be anticipated from such auspices, the report is an excellent one, and must stand for years as the embodiment of the most widely-gathered information and well-considered decisions. The report is emphatically one based upon *experience*.

The famous free-for-all discussion which occurred at the British Association Meeting in 1888, so far as our judgment goes, simply proved that the decisions of the conference could not at present be disregarded. As the president of the meeting, Sir William Thomson said, "we have very strong reason to feel that there is a very comfortable degree of security, if not of absolute safety, given to us by lightning-conductors made according to the present and orthodox rules."

There are one or two further features to which attention may be called. There are some very prevalent misapprehensions with regard to lightning. For example: that it never strikes twice in the same place; that the most exposed place is always struck; that a few inches of glass or a few feet of air will serve as a competent insulator to bar the progress of a flash that has forced its way through a thousand feet of air, etc. These are alluded to in the following general directions:

III.

1. *Erection of rods.*— Few questions have been so thoroughly discussed from practical as well as theoretical standpoints as that of the certainty of the protection afforded by properly constructed lightning-rods. All barns and exposed buildings should have lightning-rods. Ordinary dwelling-houses in city blocks have not the need for rods that scattered houses in the country, and especially if on hillsides, have.

2. Use a good iron or copper conductor. If the latter, one weighing about 6 ounces to the foot, and preferably in the form of tape. If iron is used and it seems to be in every way as efficient as copper, have it in rod or tape form and weighing about 35 ounces to the foot. "A sheet of copper constitutes a conductive path for the discharge from a lightning-stroke much less impeded by self-induction than the same quantity of copper in a more condensed form, whether tabular or solid." [Sir William Thomson.]

3. The nature of the locality (See Chapter I) will determine to a great degree the need of a rod. Places apart but a few miles will differ greatly in the relative frequency of flashes. In some localities the erection of a rod is imperative; in others, hardly necessary.

4. The very best ground you can get is, after all, for some flashes but a very poor one; therefore, do not imagine that you can overdo the matter in the making of a good ground. For a great many flashes an ordinary ground suffices, but the small resistance of $\frac{1}{10}$ ohm for an intense oscillatory flash may be dangerous. Bury the earth-plates in damp earth or running water.

5. "If the conductor at any part of the course goes near water or gas mains, it is best to connect it to them. Wherever one metal ramification approaches another, it is best to connect them metallically. The neighborhood of small-bore fusible gas-pipes and indoor gas-pipes in general should be avoided." [Lodge.]

6. The top of the rod should be plated or in some way protected from corrosion and rest.

7. Independent grounds are preferable to water and gas mains.

8. Clusters of points or groups of two or three along the ridge rod are recommended.

9. Chain or link conductors are of little use.

10. *Area of protection.*— Very little faith is to be placed in the so-called "area of protection." The committee that first gave authority to this belief considered that the area protected by any one rod was one with a radius equal to twice the height of the conductor from the ground. Many lightning-rod manufacturers consider that the rod protects an area of radius equal to the height. The truth is that buildings are struck sometimes within this very area, and we now hold there is no such thing as a definite protected area.

11. *Return shock.*— Some uncertainty exists on this point. The so-called "return stroke" is caused by the inductive action of the charged cloud on bodies within its influence, and yet some distance away from the place of the direct discharge. As explained by Lord Mahon, who first called attention thereto, the sudden return of the body charged inductively to a neutral condition, following the equalization at some distant place, is the cause of the return shock. We are beginning, however, to see more clearly into the character of the stress in the dielectric, preceding and during flashes, and it is only a question of time before the use of this term, "return shock," will be abandoned. Of far greater import are the terms "recoil kick" and "alternative path," as shown experimentally by Lodge to exist.

12. *Upward motion of stroke.*— There is no reason to doubt that the discharge takes place sometimes from earth to cloud. That is to say, that while we now consider a lightning-flash as something like the discharge of a condenser through its own dielectric, made up of excessively frequent alternations, say something like 300,000 times per

[1] Terms used by Professor Lodge.
[2] See Report of Lightning-rod Conference.

second, the spark, or core of incandescent air, may seem to have had its beginning at the earth's surface. That is to say, the air gap breaks down first at a point near the earth.

13. *Indifference of lightning to the path of least resistance.*— Nearly all treatises upon lightning up to within very recent times, assumed that lightning always followed the path of least resistance. "It is simply hopeless to pretend to be able," says Lodge, "to make the lightning-conductor so much the easier path that all others are out of the question." The path will depend largely upon the character of the flash.

14. Any part of a building, if the flash be of a certain character, may be struck, whether there is a rod on the building or not. Fortunately, these are exceptional instances. The great majority of flashes in our latitudes are not so intense but that a good lightning-rod, well earthed, makes the most natural path for the flash. We have many instances, however (not to be confounded with cases of defective rods), where edifices, seemingly well protected, have been struck below the rods.

15. Parodox of parodoxes, a building may be seriously damaged by lightning *without having been struck at all.* Take the famous Hotel de Ville of Brussels. This building was so well protected that scientific men pronounced it the best protected building in the world against lightning. Yet is was damaged by fire caused by a small induced spark near escaping gas. During the thunderstorm, some one flash started "surgings" in a piece of metal not connected in any way with the protective train of metal. The building probably did not receive even a side flash. This is, therefore, a new source of danger from within, and but emphasizes the necessity of connecting metal with the rod system.

16. Lightning does sometimes strike twice in the same place. Whoever studies the effects of lightning's action, especially severe cases, is almost tempted to remark that there is often but little left for the lightning to strike again. No good reason is known why a place that has once been struck may not be struck again. There are many cases on record supporting the assertion.

17. As lightning often falls indiscriminately upon tree, rock or building, it will make but little difference sometimes whether trees are higher than adjoining buildings.

18. It is not judicious to stand under trees during thunderstorms, in the doorway of barns, close to cattle, or near chimneys and fireplaces. On the other hand, there is not much sense in going to bed or trying to insulate one's self in feather beds. Small articles of steel, also, do not have the power to *attract* lightning, as it is popularly put, to determine the path of discharge.

19. *Unnecessary alarm.*—Just in advance of thunderstorms, whether because of the varying electrical potential of the air, or of the changing conditions of temperature, humidity and pressure, and failure of the nervous organization to respond quickly, or to whatever cause it may be due, it cannot be denied that there is much suffering from depression, etc., at these times. It is, perhaps, possible that these sufferings may be alleviated. Apart from this, many people suffer greatly from *alarm* during the prevalence of thunderstorms, somewhat unnecessarily, we think. Grant even that the lightning is going to strike close in your vicinity. There are many flashes that are of less intensity than we imagine, discharges that the human body could withstand without permanent serious effects. Voltaire's caustic witticism, "that there are some great lords which it does not do to approach too closely, and lightning is one of these," needs a little revision in these days of high potential oscillatory currents. Indeed, the other saying, "Heaven has more thunders to alarm than thunderbolts to punish," has just so much more point to it, as it is nearer the truth. *One who lives to see the lightning flash* need not concern himself much about the possibility of personal injury from that flash.

20. Finally, if you should be in the vicinity of a person who has just been struck by lightning, no matter if the person struck appears to be dead, go to work at once and try to restore consciousness. There are many cases on record proving the wisdom of this course; and there is reason for believing that lightning often brings about suspended animation rather than somatic death. Try to stimulate the respiration and circulation. Do not cease in the effort to restore animation in less than one hour's time. For an excellent illustration of a case of severe lightning shock and recovery, due, it would seem, to prompt action by the medical gentlemen present, all who are interested may consult the *Medical News*, August 11, 1888. A number of cases corroborative of this view are on record in various medical journals.

## IV.

A practical application of the efficiency of lightning-conductors will now be considered. On June 5, 1885, the Washington Monument, at Washington, D. C., at that time the highest edifice in the world, was struck by lightning. The barograph curve shows the fluctuation in pressure about the time of the occurrence of the stroke, 3.15 P. M. The storm itself was, as usual, a secondary depression in the southeastern or southern quadrant of a "low" area, and at Washington resulted in a high forenoon temperature, with a maximum of 90° Fahrenheit about noon, with fresh southerly winds, veering to southwest at noon; to northwest at 1.23 P. M.; to northeast at 1.40 P. M.; and backing to northwest at 1.42 P. M.; to east at 2.20 P. M.; to northwest at 2.37 P. M., and veering to northeast at 2.40 P. M., from whence it shifted to southwest at 3.02 P. M.; to northwest at 3.10 P. M., and at 7 P. M. was blowing steadily from the north. The first thunder was heard at 1.07 P. M., and rain began at 1.23 P. M., ceasing at 2 P. M., commencing again at 2.20 P. M., and ending at 3.05 P. M. Thunder continued at frequent intervals at 3.50 P. M. The rain was at times heavy, and hail fell in the northern part of the city. Amount of rainfall at Signal Office, 0.61 inch.

Col. Casey, U. S. Army, the engineer in charge of the construction of the monument, requested Profs. Rowland, Newcomb and Mendenhall to examine the part struck and suggest what precautions should be taken to ensure the safety of the monument. It is proper to remark that the monument had been for all practical purposes finished and had already experienced storms of seemingly greater violence.

From the letter[1] of the commissioners charged with the completion of the monument, we find that "a considerable amount of unexpected work" was performed in the erection of rods and points to protect the obelisk from lightning. "The lightning protectors as established for the monument were commenced in January, 1880, and were finished in January, 1885," practically the date of completion of the monument. The elevation of the solid aluminium pyramid (which weighs 100 ounces and is 8.9 inches high and 5.6 inches square at base, with angle at the vertex of 34° 48′ is 555 feet (169.16 metres).

The conductors consist of the four hollow wrought-iron Phœnix columns, supporting the elevator machinery. "The bottoms of these four columns rest upon and are bolted to cast-iron shoes, standing upon the floor of the large drum pit, . . . . and the shoes are connected to ¾-inch soft copper rods, led to the bottom of a well in the centre of the foundation. This well is 32 feet 10 inches in depth below the bottom of the drum-pit and 15 feet 8 inches below the bottom of the masonry foundation, and the water stands in it permanently 2 feet 8 inches above its bottom. After the copper rods were inserted, the well was filled up with clean sharp sand for a depth of 15 feet 8 inches, or up to the level of the bottom of the old rubble-stone foundation of the monument. These four columns so arranged at their bases, *and always projecting above the top of the shaft, were continually lengthened as the building of the shaft progressed, and for the five summers during which the masonry was in progress acted as the lightning-conductors of the edifice.*[2] No disruptive discharge of electricity was experienced during those years." When the marble pyramidion was completed, December, 1884, these four columns were within this marble covering, and from the extremity of each column a copper rod ¾-inch in diameter was run to the top stone and there united in a copper rod 1½ inches in thickness, which passed vertically through the cap-stone and was screwed into the solid aluminium pyramid.

The conductors "when tested, gave an electrical resistance of .1 ohm from the tip of the terminal to the copper rods at the base, and 2.2 ohms for the ground connections, making a total resistance of 2.3 ohms for the conductor. The system was entirely completed and connected on January 20, 1885."

On April 5, 1885, during the passage of a heavy thundercloud over the monument, at least five immense sparks or bolts of electrical light were seen within a period of twenty minutes to flash between the terminals and the cloud without audible sound to the observers. A careful examination of the conductors and shaft after this phenomena failed to reveal any effects from these discharges.

On June 5, however, during the thunderstorm described above, a disruptive discharge was seen to pass between the summit of the pyramidion and the cloud. Upon examining the structure a crack was discovered in the stone in the north face of the pyramidion, just under the top stone, extending through the block in a line nearly parallel to the northeast corner and about 8½ inches from it. The fragment was pressed outward about ¾-inch at its bottom, chipping a small piece off the lower corner of the top stone into which it was locked, and was easily forced back to place and bolted to the solid stone from which it had been torn.

The recommendations of the gentlemen above named, who were asked to make a careful examination, were, in short, that the interior conductors should be connected "with a system of rods and a greater number of points, to be located upon the exterior of the pyramidion." Four one-half inch copper rods were fastened by a band to the aluminium terminal and led down the corners to the base of the pyramidion, and then through the masonry to the columns.

"As these exterior rods are each over sixty feet long, they are also connected at two intermediate points of their lengths with the iron columns by means of copper rods one-half and three-quarters inch in diameter, respectively, furnishing sixteen rods in all, connecting the exterior system of conductors with the interior conducting columns. Where the exterior rods upon the corners cross the eleven highest horizontal joints of the masonry of the pyramidion they are connected to each other all around by other copper rods sunk into those joints. All of these exterior rods, couplings and fittings are gold-plated, and are studded at every five feet of their lengths with copper points three inches in length, gold-plated and tipped with platinum. There are two hundred of these points in all."

Eight years have now passed since the alterations were made and the monument stands uninjured. Unquestionably, standing as it does, 555 feet high, in the centre of flat, well-watered ground, it constitutes a most dangerous *exposure* for lightning flashes. No better illustration of the value of lightning-conductors can be asked.

[1] Senate Ex. Doc. No. 6, 49th Congress, 1st Session.
[2] Italics mine.

## ST. PAUL AND ITS NEW STATE-HOUSE.


Door-head, *Life* Building, New York, N. Y. Carrere & Hastings, Architects.

YES, the public is really interested in architecture and is becoming more and more appreciative of it. Young men and old, and more particularly young women, know something about "the styles," something about the history of art and not a little about whether a building is good or not, and why it is so or is not so. At St. Louis, Professor Ives, the Director of the Museum of Art — who is doing some really good and interesting work in popularizing art and making the collections under his charge of real value to working people and artisans — declares he never has any but full houses when lectures on architecture — illustrated with stereopticon slides, of course — are to be given.

Up here in the Northwest, at St. Paul, popular interest has been manifested too, in rather an impressive way: the door-keeper says that while the competitive drawings for the new State-house were on exhibition, about twenty-five hundred visitors viewed the designs during a single day, while for the whole fortnight the drawings were open to the public the total tally ran to over twenty thousand. As this story was not verified by turn-stile count it needs to be taken with some allowance. But the fact remains that an unusually large number of laymen visited that generally supposed-to-be uninteresting thing, an exhibition of architectural drawings. Of course, this particular exhibition has been more attractive than architectural exhibitions ordinarily are. Not only has there been a prolonged and exciting struggle between St. Paul and Minneapolis as to whether the former should remain the capital city of the State and possess the new building as it has the old one, but there was much interest excited over, and much discussion in the newspapers evoked by, the first competition, which turned out such a fiasco.

However this second competition may result, it is evident that this exhibition of the drawings to the public, coming as it does between the making of the award by the expert adviser, Mr. E. M. Wheelwright, and the opening of his report by the Commissioners, is likely to be a benefit to the enterprise. It has given people a chance to compare the designs on their own account, to talk them over privately and in the public prints, and to realize that the local man with the "strong pull" has not beyond possibility of dispute presented the best solution.

What would be the result of a popular ballot I can't guess. Although I spent probably as much time in examining the drawings as any casual St. Paul layman did, I have not the least idea which design I should select as the best. I doubt if of the five I preferred more than two would be found in Mr. Wheelwright's list. One can but be bewildered by a short study of a number of designs, and if this is the case with one who understands drawings, how much more certain is the bewilderment in which laymen involve themselves when they sit down and try to exercise their untrained minds on such a problem. It is the usual result of competitions where an expert has not been employed that the award is made to a local architect, and this result is usually taken to be the result of collusion, bribery, "pull" and all kinds of unpleasant things.

For my own part, I incline to believe that the award is made to the local practitioner in sheer desperation. After a vain attempt to comprehend what the drawings really mean and how a section explains things which the plan cannot show, the committee-men begin to discuss and argue, and each finds he has understood the same things differently from his fellows and can neither convince them that they are wrong or be convinced by them that he is mistaken. Discussion makes the fog only thicker, till some brighter member says something like this: "Look here! we'd might as well agree that we don't understand these plaguy drawings and we may make the worst kind of a mistake if we go outside our own town. We all know the architects in this place and know what is their general reputation. Let's choose the man rather than the drawing." And so, *nem. con.*, the local designs are sorted out from the lot and the best of them — in the committee's judgment — is selected. It seems as if many a competition must be decided in this way, with a certain honesty of purpose, and without any underhandedness on the part of any one.

And the architects from other places, the outer barbarians, are they fairly treated? No, of course they are not; but did they deserve to be? In this particular competition the secretary of the Commissioners could not find words fitting to express his appreciation of the folly of architects in submitting to the "competition evil." If the beneficiaries of this evil system are willing to acknowledge the unfairness of it, what fools we all are to encourage its continuance by taking part in these scrambles which so often are decided in favor of home talent!

It is usually alleged that, however great the evils of the competition system may be, it has the advantage of giving a chance to men without social influence and to young and untried men. For this reason I looked with some care at the drawings to see what new men had been discovered. So far as my knowledge of names went, there were only three or four designs submitted by young architects who have just opened offices or by draughtsmen who styled themselves architects for this occasion only. Their work was distinctly that of beginners who had not yet got themselves out of the ruts of school training, but who showed distinctly that they had had training — good training, too. These designs formed a very acceptable transition between the designs of the men of some standing in the profession and the men who have standing only in their own communities. About half the designs were very unscholarly in their crudeness and I imagined that they must be the work of some of the elders of the profession who grew to be architects without the advantage of schooling or travel, men for whom and for whose efforts we all must have sincere respect — although we would much rather not have them take us to admire and criticise the buildings which they have erected.

It is to be hoped that St. Paul will eventually secure a state-house that is really a refined piece of design, for if it does not, then the new building will be quite at variance with the general character of the city itself. It is curious how distinctly different cities have an individual flavor that is perceptible to the traveller, quite as distinct in this new country as in Europe. In its more active and stirring way St. Paul impressed me with the same air of social refinement that still lingers about Portsmouth, N. H. Now, if the society in a place is refined, the chances are that the buildings in which its members house themselves will be refined also, and in this particular, at least, the buildings of St. Paul are unusually strong. It has been the good fortune of the city to have amongst its architects a few men of marked delicacy of feeling and as the town is not so very old the work of these men "tells" with great force, not by contrast, but as a leaven, for the public has not been slow to appreciate the value of such work and has sought to imitate the same spirit even when employing other designers.

St. Paul is not very old, hardly removed by more than seventy years from the condition of a primeval forest. It is this very youthfulness that makes a bit of Colonial architecture seem wholly out of place and a sheer anachronism when one comes upon a house cast in the prevailing fashion of the day, so far as wooden houses go. Colonists who imported workmen and material from the mother-country had nothing whatever to do with the founding of St. Paul, and a house that looks in place anywhere along the Atlantic seaboard seems singularly out of place in the Northwest. Other styles have no distinct habitat, but the Colonial work is fairly indigenous and though actually suitable to any part of the country looks in St. Paul a little as if it were taking part in a masquerade party.

Just what it is about St. Paul that makes it seem more like a New England city than any place I have seen in the West is hard to determine. The hills and the somewhat crooked streets, entailed by the contour of the ground, suggest Boston, and the houses along Summit Avenue suggest certain parts of Brookline or Longwood, but after all it is more the air and bearing of the people themselves and the slightness of the Western accent in their speech that smack most of New England. It is a place a Bostonian would feel at home in and like to live in, if he could forego Boston's life-saving east winds in the hot season. It does not give one the impression of breathless energy, push and hurry that overpowers one in Chicago, although there is nothing that suggests sloth or lack of energy. Its local atmosphere suggests that its inhabitants have made their money and are enjoying it, rather than that they are straining every nerve and muscle and devoting every instant to its acquirement. It appears to be a distinctly different atmosphere from that which involves the neighboring city of Minneapolis, a dozen miles higher up the river. Here people seem to be still "on the make" and but few of them have had time to stop and consider whether life may not offer other pleasures than those of mere money-getting.

It is, perhaps, unfair, after going about one of the "Twin Cities" under guidance and then wandering around its fellow without the aid of a *cicerone*, to institute comparisons unfavorable to one place or the other. But the observations of most travellers are only skin-deep

at the best, and my impressions are hardly so deep as that; at the same time they are unquestionably more favorable to St. Paul than to Minneapolis. In the latter place the street architecture is distinctly eccentric, with the eccentricity of Chicago in its earlier Romanesque stage, and yet this phase does not overpower the results of the earlier fashion for "Eastlake" and Collings-decorated work that likewise smote both Boston and Chicago after their respective fires. St. Paul has not been unaffected by this sort of work, but the leaven of a more refined style has worked there with greater effectiveness and rapidity.

Since this was written the competition for the Minnesota Capitol has been decided and the award has been made to Mr. Cass Gilbert, of St. Paul, whose design was obviously one of those which was sure to be included amongst the five recommended by the expert to the attention of the Capitol Commissioners. The fact that Mr. Gilbert is a citizen of St. Paul affords an opportunity for the discontented to allege that the decision was the result of local influence and a strong and well-applied pull, and the fact that out of the five prize-winners three were St. Paul architects can be wrested to point in the same direction. Perhaps some competitors and some disappointed contractors and disgruntled political workers may voice a complaint of this sort. But what can they say to the fact that the Commissioners confined their selection substantially to the five designs that had been endorsed by the report of their adviser, Mr. Wheelwright, and that all designs were considered and judged by him without knowledge of their authorship?

No, the decision of this competition is simply another illustration of the fact that in all competitions the local practitioner, if of relatively equal capacity with the competing outsiders, always has a real advantage. This is partly due to his more perfect knowledge of the site, the local conditions of sentiment, the needs to be satisfied and the cost of labor and materials. Still more is it due to the fact that local practitioners enter such competitions with a greater personal interest in the solution of the problem and better heart and courage, more earnestness of purpose and a sensible feeling of self-respect — if not of vanity — which leads them to really do the best work that lies in them to do. The result is, in other cases as it has been in this, that the designs of local practitioners almost always are practical and practicable solutions of the problem, and generally some of them are so good that no fair-minded expert could fail to include them amongst the prize-winners, even if the actual work must be awarded to an outsider.

In this competition there is no questioning the fact that Mr. Gilbert's design carries off the chief prize on its merits. Of the prize designs of the two outsiders, Mr. Mann's was marked by the elegance of his distribution of light and the treatment of his interior as shown by his section, while Mr. Jones's was substituted seemingly for that of Messrs. Wendell & Humphreys, to whom the first place in the original competition was awarded and whose design in this second competition was amongst the five recommended by Mr. Wheelwright.

Of the two other St. Paul designs, that of Mr. Johnston had such merit that it was easy to see that in re-studying it for execution something of its rather ungrammatical expression could easily have been eliminated. As for the design of Messrs. Bassford and Traphagen & Fitzpatrick, I am free to say that I did not suppose it would be found amongst the five recommended by the expert, but doubtless it had excellences of arrangement in the plan that I did not have time to study. In its place I supposed would be found the design of Messrs. Eames & Young, of St. Louis, which was obviously one of the economical designs and was a carefully studied and refined piece of work: to be sure, it departed somewhat from the time-hallowed formula for the designing of state-houses, in that its low and modest interior dome over the rotunda was not disguised on the outside by a covering dome of different shape and treated with colonnade or ancillary features. In their plan they incorporated a rather obvious arrangement which none of their competitors, save their fellow-townsman, Mr. Mann, appears to have thought of. In arranging the seating for the Chamber of Representatives they placed the chairs in couples which, of course, increased the number of aisles and so facilitated ingress and intercommunication, while it afforded a greater degree of privacy to members while conversing with their fellows on matters political or private. This arrangement had another great advantage: when the Legislature meets as a committee of the whole it naturally gathers in the larger of the two chambers, and the provision of the greater number of aisles in the two St. Louis plans allowed better accommodation for such occasional assemblages than had been provided by any other designs.

Unless some one resorts to an application for an injunction and succeeds in getting one — and of late this device has been resorted to more than once — it is probable that this second competition will result in the erection of Mr. Gilbert's building, for Minnesota is one of those blessed States where the Legislature is not always in session, and the present Commissioners, who have full power to go ahead with the work, have plenty of time to get the building well above the ground before political machinations can interfere with them.

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Electricity in Westminster Abbey. — Advantage will be taken of the introduction of electricity into Westminster Abbey, in connection with the new echo organ, to place electric lamps in the choir. There is also some probability that this form of illumination will be extended to other parts of the building in the near future. — *New York Evening Post.*

## BOOKS AND PAPERS

If the time ever comes when, as prophesied by some architects, the steel-skeleton construction, to say nothing of the sky-scraper, will be a thing of the past, a recent work on "*Architectural Engineering*"[1] will afford very interesting reading to our successors, not so much as marking an epoch in building operations as by epitomizing and detailing the process of evolution by which human ingenuity has been able to pile up buildings twenty stories high with perfect theoretical safety. The science of skeleton construction is still too recent in its origin, however, for this work to be exhaustive in its character. It presents, rather, a summary of what might be called the best constructive practice in Chicago, and within such limitations it is well written, copiously illustrated, and in a general way covers all of the problems involved in Chicago tall-building construction, from the roof down to the foundations, the subject-matter being treated, quite properly, in the order in which the building calculations are made rather than in the order in which the building itself is constructed. It is not merely theoretical, however. Indeed, except for a somewhat extended analysis of the calculations involved in wind-bracing, the book contains very little mere theory. It is thoroughly up-to-date, and the clearness and thoroughness with which the subject is illustrated and the absence in the main of superfluous matter make the work exceedingly valuable. The chapter on floor-loads is especially good and contains a statement of all the different assumptions which are made by various engineers and architects as to what are the actual loads on floors. In regard to whether these loads should be assumed as being transmitted to the columns and then to the foundation, he states that "it is the judgment of the best engineers that the area of the foundations on the clay should be proportioned to the dead loads only and not to theoretical or occasional loads, so that it is good practice to neglect live loads on the clay for hotels, office-buildings or lightly loaded retail stores."

Mr. Freitag frankly admits that he writes from the standpoint of the engineer, incidentally mentioning that "the ignorance which the average architect displays in connection with structural ironwork is proverbial, and that contractors for steel work have long indulged in considerable sarcasm at the expense of the architect and his plans." It is to be hoped that such a statement is only partially true even in Chicago, and we are quite sure that there are architects in this country who are just as able to decide structural details as any engineer, and in some respects a great deal more so. The engineering bias of the book is clearly shown in the first chapter and part of the second, which as far as the essential character of the book is concerned are entirely superfluous, dealing with the general architectural problem of high buildings. A writer who speaks of the "massive" Parthenon and the "perfect structural beauty" of the Eiffel Tower is hardly a safe guide in matters of art and is entirely off his territory in everything except architectural engineering *per se*. This volume does for the Chicago practice what Birkmire's does for the New York practice, both having the effect of being purely local. They should be read together if one is to properly appreciate the manifestations of the skeleton construction east and west, for while this type of construction is largely credited to Chicago alone, there is relatively quite as much good work of its kind in New York as anywhere else in the country.

An interesting volume might be written on the mistakes which have been made in steel construction. Naturally the illustrations which Mr. Freitag offers are of the good types, and we hear nothing of the many failures. The writer states that two stories can generally be erected in six days of ten hours each. In the Unity Building of seventeen stories the metal work from the basement columns to the finished roof was accomplished in nine weeks. When we consider what such speed means, and also bear in mind that faulty details constitute even a greater part of the defects in the general run of buildings than arises from materials employed or imperfect general features of designs, the wonder is that there are so few absolute failures to record. Many and many are the architects who have used cast-iron columns piled story on story, with tile partitions only as a wind-resisting medium and their structures stand to become a source of wonder to the engineering profession. If some enterprising architectural engineer could gather together the examples of bad skeleton construction, possibly we might learn as much from them as we do from the very admirable illustrations which are gathered into this volume.

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One of the fortunate facts for a art student in these end-of-the-century days is, that for a few dollars, wisely expended, he can become the possessor of a collection of pictures — in the form of illustrated catalogues — which will comprise the most notable paintings in the public galleries of the Old World, and the treasures of the Pinacothek, the Louvre, the Luxembourg and the National Gallery are thus brought to his door.

He can now add to these a similar *brochure* on an American

[1] "*Architectural Engineering*," with special reference to High Building Construction, including many examples of Chicago Office-buildings. By Joseph Freitag, B. S., C. E. New York: John Wiley & Sons. London: Chapman & Hall, Limited. 1895. Price, $2.50.

gallery, for the Pennsylvania Academy of the Fine Arts has published an album [1] containing some thirty admirable reproductions of the most important pictures in its permanent collection.

The artists represented range from a fifteenth-century Italian — Benozzo Gozzoli — to an able military painter of our own day, William T. Trego — what miles of canvas have been covered with paint in the four hundred years that lie between these two! — and the pictures include such celebrated works as Vanderlyn's "Ariadne" and Allston's "Dead Man Restored to Life." Among the most satisfying of the excellent reproductions we must specify Van der Helst's "Violinist," the charming portrait of Miss Bordley, by Gilbert Stuart, Bridgman's "Roumanian Lady" in her rich, quaint costume, and Picknell's "Borders of the Marsh."

The book is handsomely gotten up and well-printed on good paper with generous margins, and is worthy of a place in the library of every lover of art.

Though the oldest of our public art institutions, the Pennsylvania Academy of Fine Arts is distinctly "up to date" in this enterprise and we hope that her example may be followed by other American art-galleries.

## SOCIETIES

### THE T-SQUARE CLUB OF PHILADELPHIA, PA.

THE T-Square Club of Philadelphia held its annual election in its Club-room in the School of Industrial Art on Wednesday, Nov. 6. An unusually large attendance was present to view the summer sketches and to participate in the election of officers. The result of the election was as follows :

Albert Kelsey, *President;* E. V. Seeler, *Vice-President;* Adin B. Lacey, *Secretary;* David K. Boyd, *Treasurer;* Walter Cope, Louis C. Hickman and Wm. L. Price, *Executive Committee.*

A House Committee was elected and the Chair appointed Horace Burrell, E. C. Schermerhorn and Frank A. Hays to act as an Entertaining Committee for the ensuing year. The event of the evening was the announcement of a liberal gift to the Club of one hundred dollars from an "unknown friend." A vote of thanks was taken, entered upon the minutes of the Club, and the treasurer was directed to personally thank the donor.

The summer sketches submitted at this meeting were evidence of a great amount of earnest work during the past summer. Mr. Walter Cope received First Mention; Mr. Wilson Eyre, Second Mention; Mr. Walter Price, Third Mention.

Among the other contributors were J. J. Bissegger, John Dull, Charles Klauder, Lloyd Titus, G. Basset, F. W. Bancroft and Edw. Gilbert.

The course of lectures for this year will soon be announced and will doubtless prove very instructive and interesting. Mr. Frank M. Day speaks first of his travels in Sicily. Mr. Cope, later on, will speak of his trip through Spain.

ADIN. B. LACEY, *Secretary.*

### SOCIETY OF BEAUX-ARTS.

THE Committee on Education, of the Beaux-Arts Society and the Jury of Award, beg to report that the following drawings submitted in the several competitions mentioned hereafter, have received the following awards:

COMPETITION FOR A CITY CHURCH, PROGRAMME CLASS A, JUNE, 1895.

Mr. Mortimer Foster (pupil of Masqueray & Chambers), *First Mention.*

Messrs. Berger & Debus were placed "*Hors de Concours.*"

COMPETITION FOR A RESTAURANT IN A PARK, PROGRAMME CLASS B, JUNE, 1895.

Mr. P. Reginald Allen (pupil of Masqueray & Chambers), *First Mention.*

Mr. John S. Gibbs (pupil of Masqueray & Chambers), *First Mention.*

Mr. Arthur Shrigley (pupil of University of Pennsylvania, Department of Architecture), *First Mention.*

Mr. John A. Holly (pupil of Masqueray & Chambers), *Second Mention.*

Mr. George Baum (pupil of University of Pennsylvania, Department of Architecture), *Second Mention.*

Mr. Alfred Morton Githens (pupil of University of Pennsylvania, Department of Architecture), *Second Mention.*

Mr. Joseph L. Chesebro (pupil of Joseph McGuire), *Second Mention.*

Mr. E. J. Willingale (pupil of Masqueray & Chambers), *Second Mention.*

Mr. Francis W. Bancroft (pupil of University of Pennsylvania, Department of Architecture), *Third Mention.*

COMPETITION FOR A DEPARTMENT STORE, PROGRAMME CLASS A, SEPTEMBER, 1895.

Miss M. L. MacNaughton (pupil of Carrère & Hastings), *First Mention.*

[1] Pennsylvania Academy of the Fine Arts : "*Album of Reproductions of Selected Works in the Permanent Collections.*" Philadelphia ; Published by the Academy. Price, $1.

Mr. E. J. Willingale (pupil of Masqueray & Chambers), *First Mention.*

COMPETITION FOR A LIBRARY IN A SMALL TOWN, PROGRAMME CLASS B' SEPTEMBER, 1895.

Mr. Edwin S. Morton, *Second Mention.*

Mr. Francis S. Swales, *Third Mention.*

The Committee wish to make the following comments :

*Competition for a City Church.* — Messrs. Berger & Debus were placed "*hors de concours*" for not conforming with the conditions of the programme, which required a Classical composition. The Committee regretted not being able to offer more encouragement to these competitors, as their drawings showed a good deal of work, though the Committee believed entirely in the wrong direction, and they hope that Messrs. Berger & Debus will enter some of the coming competitions more successfully; the general feeling of the Committee being that their work deserved encouragement.

Mr. Mortimer Foster was awarded a First Mention for the excellency of his plan, which shows a good deal of study from the artistic standpoint. The Committee regretted that the elevation and sections did not show the same degree of ability, and hesitated upon giving a First Mention on this account. The award was made, however, on the plan, which deserved recognition.

*Competition for a Restaurant in a Park.* — The number of drawings submitted for this competition was very large, and the general character of the work was exceedingly interesting and in the spirit of the programme, both as to scheme and character of elevations and rendering. With one or two exceptions, all of the drawings submitted were deserving of recognition.

In the case of the drawings which did not receive any award, the lack of study in the plans (which were confused and which did not provide for proper circulation and light) had the most influence with the Jury.

The entire scheme, plan, section, elevations and rendering of Mr. P. Reginald Allen, was especially interesting and deserving of attention, and the drawings submitted by Mr. John S. Gibbs and Mr. Arthur Shrigley, though not as well studied throughout, showed considerable ability, and were awarded the First Mentions without hesitation on the part of the Jury.

*Competition for a Department Store.* — Both drawings receiving awards were interesting, both in conception and study. The Jury considered that Mr. E. J. Willingale's design was especially successful — the plan being well-studied and a fairly typical plan for the programme, and the elevation and section (especially the section) being exceedingly interesting. This design, in the judgment of the Jury, was capable of study and development, and was thoroughly satisfactory.

Miss MacNaughton's elevation was very highly commended by the Jury, though not quite as much in keeping with the programme as Mr. Willingale's. The scheme was frank and well-handled — the plan was less successful, the arrangement of points of support being weak, and the arrangement of the staircases and circulation being less direct than in Mr. Willingale's plan; the whole scheme being capable of study and development.

*Competition for a Library in a Small Town.* — The Jury was particularly interested in the two premiated drawings for this programme, as they understood that the authors had not received the advice or assistance of a professor.

The scheme submitted by Mr. Edwin S. Morton was most interesting, though lacking in study. The scheme submitted by Mr. Francis S. Swales, though less original and less well-presented, was also interesting.

The Committee wish to thank the students for their interest in the work so far, and to request that all of the students should feel at liberty to write and ask for further criticisms of their work.

The Committee propose to arrange for a meeting, after the judgment of the next competition, to which all of the students will be invited, to listen to criticisms by the different members of the Society, for the special benefit of the students.

## THE ILLUSTRATIONS

[*Contributors of drawings are requested to send also plans and a full and adequate description of the buildings, including a statement of cost.*]

THE ENTRANCE GATEWAY: "AULDWOOD," ESTATE OF J. C. HOAGLAND, ESQ, SEABRIGHT, N. J. MESSRS. SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS, BOSTON, MASS.

[Heliochrome issued with the International and Imperial Editions only.]

DESIGN FOR FREE PUBLIC LIBRARY AND MANUAL AND INDUSTRIAL TRAINING SCHOOL, HOBOKEN, N. J. MR. JAMES ROSS, ARCHITECT, YONKERS, N. Y.

THE perspective of this design has been accidentally omitted from this issue, but will be published next week.

HOUSE FOR MR. NEWBOLD, LAVEROCK, PA. MR. G. T. PEARSON, ARCHITECT, PHILADELPHIA, PA.

FIELDSTONE TERRACE FOR DANA ESTES, ESQ., BROOKLINE, MASS. MESSRS. CABOT, EVERETT & MEAD, ARCHITECTS, BOSTON, MASS.

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**[Additional Illustrations in the International Edition.]**

LIBRARY CHIMNEYPIECE: "AULDWOOD," HOUSE OF J. C. HOAGLAND, ESQ., SEABRIGHT, N. J. MESSRS. SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS, BOSTON, MASS.

[Gelatine Print.]

DINING-ROOM CHIMNEYPIECE IN THE SAME HOUSE.

[Gelatine Print.]

SECOND PREMIATED DESIGN FOR TECHNICAL INSTITUTE AND PUBLIC LIBRARY, WEST HAM, ENG. MESSRS. CLARK & HUTCHINSON, ARCHITECTS.

PLANS OF THE SAME.

THIRD PREMIATED DESIGN FOR THE TECHNICAL INSTITUTE AND PUBLIC LIBRARY, WEST HAM, ENG. MR. THOMAS DAVISON, ARCHITECT.

PLANS OF THE SAME.

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## 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.*]

### "HEAVY FOUNDATIONS ON THE LOT LINE."

NEW YORK, November 11, 1895.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

*Dear Sirs,* — Permit me to make one slight correction to my letter in your paper of the 9th instant. The minimum pressure is *minus* 6,160 pounds. In other words a pressure ranging from 6,160 pounds per square foot at the edge to 0 pounds at the zero point would have to be exerted in order to prevent this edge from lifting off the ground. This shows the uselessness of any footing beyond that point.

There are several solutions to the problem, the one you gave being theoretically the best. The following has been used in one case: the batter carried up above the first tier of beams, tie-rods with large stars on outside of walls were placed across the building and brought to their proper tension. The battered wall on the inside was considered as an inclined strut, the horizontal component of its strain being taken up by the tie-rod on top and friction and side pressure against the earth below.

I have been asked if the fact that a wall next door would or might be erected would not balance this equality. It would hardly do so, because the walls being independent, both they and the footings have independent settlements, and not being held together by the tenacity of the latter at its point of greater strain, the footings must act independently. It is only after the soil has yielded so as to bulge the walls that these then may act together, which, however, will not relieve the pressure on the soil.

Very truly yours, OSCAR LOWINSON.

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## EXHIBITIONS

ATLANTA, GA. — *Cotton States and International Exposition:* September 18 to December 31.

BOSTON, MASS. — *Loan Exhibition; Gobelin Tapestries; Japanese Paintings; Line Engravings, Mezzotints and Etchings by Rembrandt:* at the Museum of Fine Arts.

*Triennial Exhibition of the Massachusetts Charitable Mechanic Association, including Art Exhibition and Special Poster Show:* October 2 to November 30.

*Paintings from the Paris Salons of* 1895: at the Jordan Art Gallery, 450 Washington St., opened October 14.

*Exhibition of Water-colors:* at the St. Botolph Club, October 28 to November 16.

*Photographs of the Work of Burne-Jones:* at Walter Kimball & Co.'s Gallery, 9 Park St.

*Illustrations of Shakespeare's Comedies by Edwin A. Abbey:* at J. Eastman Chase's Gallery, 346 Boylston St.

*Drawings made for the "Ladies Home Journal":* at the Boston Art Club, opens November 16.

*Vinton's Portrait of Archbishop Williams:* at Williams and Everett's Gallery, 190 Boylston St.

BRIDGEPORT, CONN. — *Exhibition of Artistic Posters:* at the Public Library, November 9 to 30.

CHICAGO, ILL. — *Eighth Annual Exhibition of Oil-paintings and Sculpture:* at the Art Institute, October 22 to December 8.

NEW YORK, N. Y. — *Twenty-ninth Semi-annual Exhibition, including Loan Exhibition of Early American Paintings, Old English Paintings, and the Cullum Collection of Classic Sculptures:* at the Metropolitan Museum of Art.

*Turner's "St. Mark's Place, Venice," also, Paintings by other English Artists:* at the Avery Galleries, 368 Fifth Ave.

*Loan Exhibition of Portraits:* at the National Academy of Design, October 30 to December 4.

*Sixth Annual Exhibition of the New York Water-color Club:* at the Galleries of the American Fine-Arts Society, 215 West 57th St., November 11 to 23.

*Illustrations of Shakespeare's Comedies by Edwin A. Abbey:* at H Wunderlich & Co.'s Gallery, 868 Broadway.

*Works by Gerke Henkes:* at the Holland Art Galleries, 329 Fifth Ave.

*Sir Joshua Reynolds's "Death of Dido":* at the Blakeslee Galleries, 353 Fifth Ave.

*Drawings by A. B. Frost, illustrating "Uncle Remus":* at the Gallery of F. Keppel & Co., 20 East 16th St., November 11 to 21.

*Sir Joshua Reynolds's "Shepherd Boy," Courbet's "Woman with a Parrot," etc., etc.:* at the Durand-Ruel Gallery, 389 Fifth Ave.

*Works of Frederic Remington, the Smith Jewels, and Chinese Porcelains:* at the American Art Galleries, Madison Square South.

PHILADELPHIA, PA. — *Autumn Exhibition of the Philadelphia Art Club:* opens November 18.

PITTSBURGH, PA. — *Loan Collection of Paintings:* at the Carnegie Library, during November.

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## NOTES AND CLIPPINGS

THE TOMB OF RENE OF ANJOU. — King Rene's body was recently exposed by an accident in the cathedral at Angers. In repairing the choir, workmen broke through the roof of a vault in which were two coffins. The wooden cases had rotted away, and the leaden cover of the one containing the old king of Naples and Duke of Lorraine and Anjou had been torn off. The skeleton had a crown of thin gold about its head, and in its hands the sceptre and globe, which, being of bronze, had turned green. The other coffin, containing his wife, Queen Isabella, of Lorraine, was intact and was not disturbed. After the inspection the vault was sealed up again. Over it there was formerly a splendid tomb, destroyed in 1794, but the vault escaped injury, in consequence of the woodwork and stalls concealing it. — *Exchange.*

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HOUSE-BUILDING IN SIAM. — A curious method of house-building is practised in Siam. When the soothsayer has found a suitable spot for the site of a house, and declared it in every way felicitous, the family who wish to build the house gather together the necessary materials, then invite all their relatives and friends. On the day fixed, all these arrive in a crowd, armed with picks, bill-hooks, knives, hatchets and saws. Some dig the holes in which to place the supports, others cleave the bamboo or prepare the woodwork. Before night the light habitation is completed, but everything is uneven, notably the steps, the windows and the doors. The columns are ornamented with red and white rags, which are supposed to bring happiness; the unevenness of doors and windows is supposed to avert the coming of evil spirits. — *Illustrated Carpenter and Builder.*

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ASPHALT DEPOSITS IN THE UNITED STATES. — The growing use of asphalt for street pavements has stimulated inquiry as to the possible deposits of the material in this country so situated as to make its mining profitable. To-day almost all that is used comes from abroad, much of it from Trinidad, and some of it from the mainland of South America, from Syria, Germany, Switzerland and France. Yet it is claimed by experts in the service of the Geological Survey that the United States has the best quality and the largest quantity of asphalt to be found in any country. The problem is how to get it as cheaply, and this economic side of the question is to be investigated by agents of the Geological Survey. Asphalt deposits have been discovered in West Virginia, Ohio, Kentucky, California, Utah, Oklahoma, Montana, Texas, Arizona, Idaho, New Mexico, Nevada, Wyoming, Oregon and Washington. Only four States make commercial use of their deposits — California, Kentucky, Texas and Utah — and yet during the past year these four States mined over half as many tons of asphalt as were imported. The native asphalt is claimed by E. W. Parker, of the Geological Survey, to be superior for paving to the imported article, as it contains more gritty matter, and will, therefore, wear longer, and not be as slippery. — *N. Y. Evening Post.*

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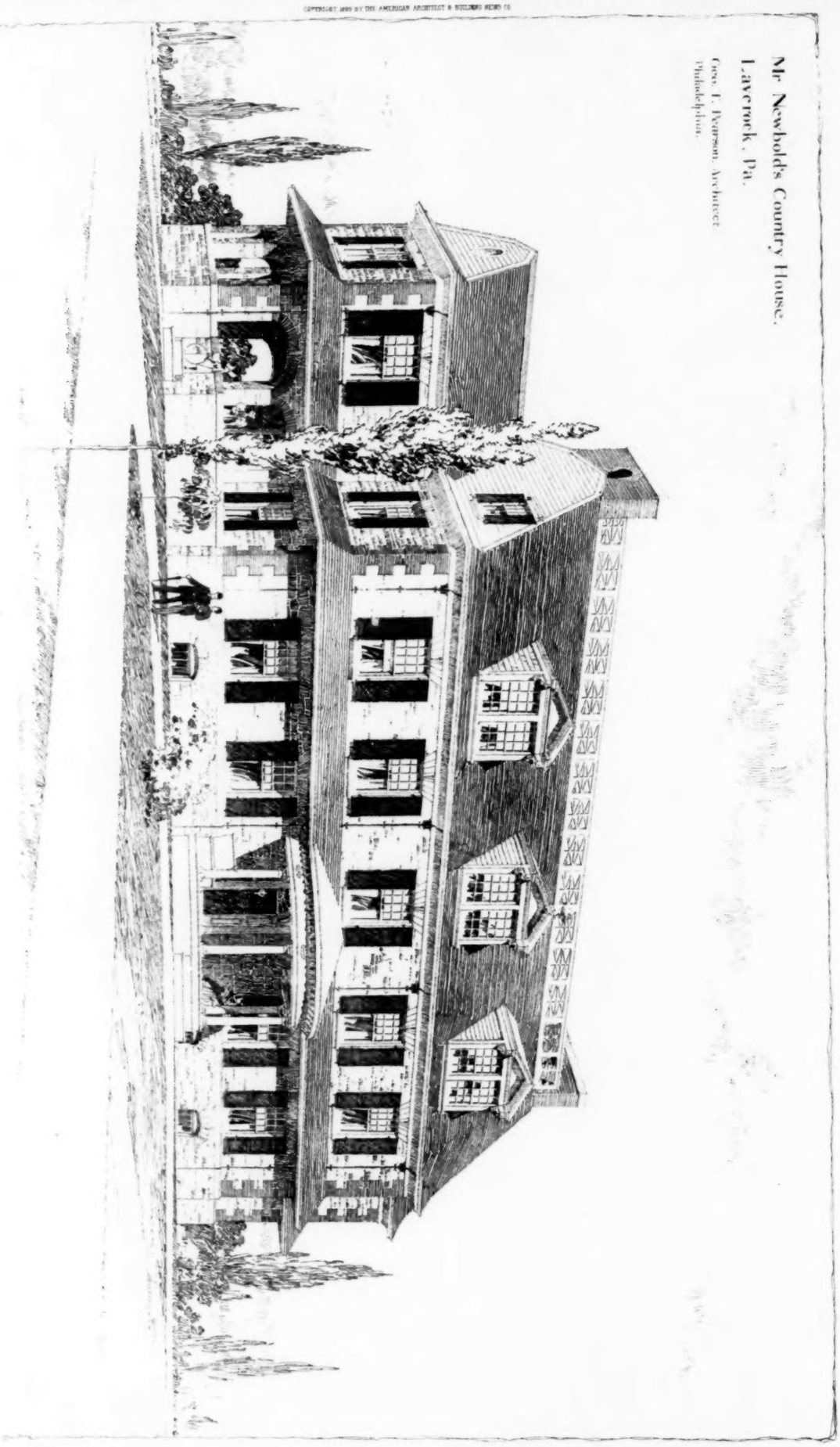

Mr Newbold's Country House.
Lavcrock, Pa.
Geo. L. Pearson, Architect
Philadelphia.

American Architect and Building News, Nov. 16, 1895. No. 1038.



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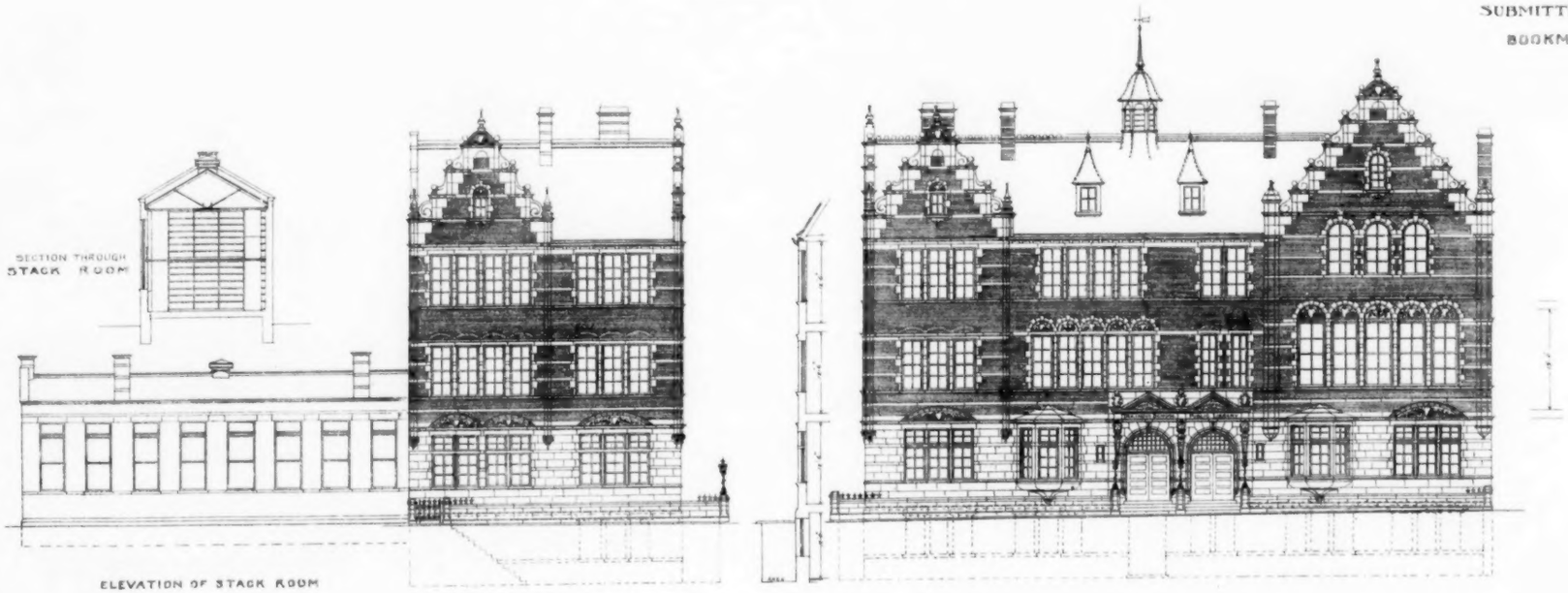


ELEVATION OF STACK ROOM

ELEVATION ON FIFTH STREET

ELEVATION ON PARK AVENUE

SCALE 1/8 INCH = ONE FOOT

James Ross
Architect
Yonkers, N.Y.

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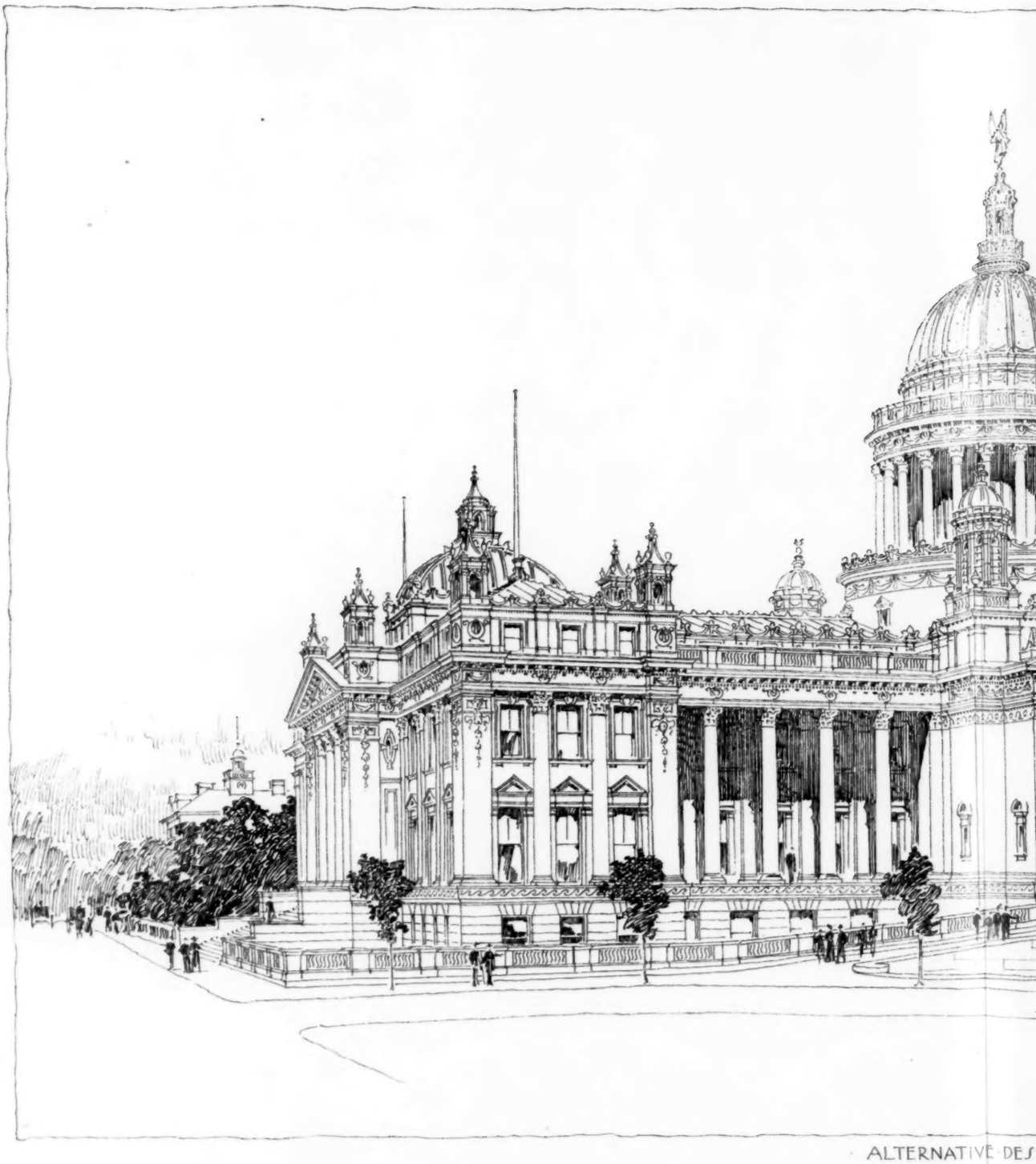

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