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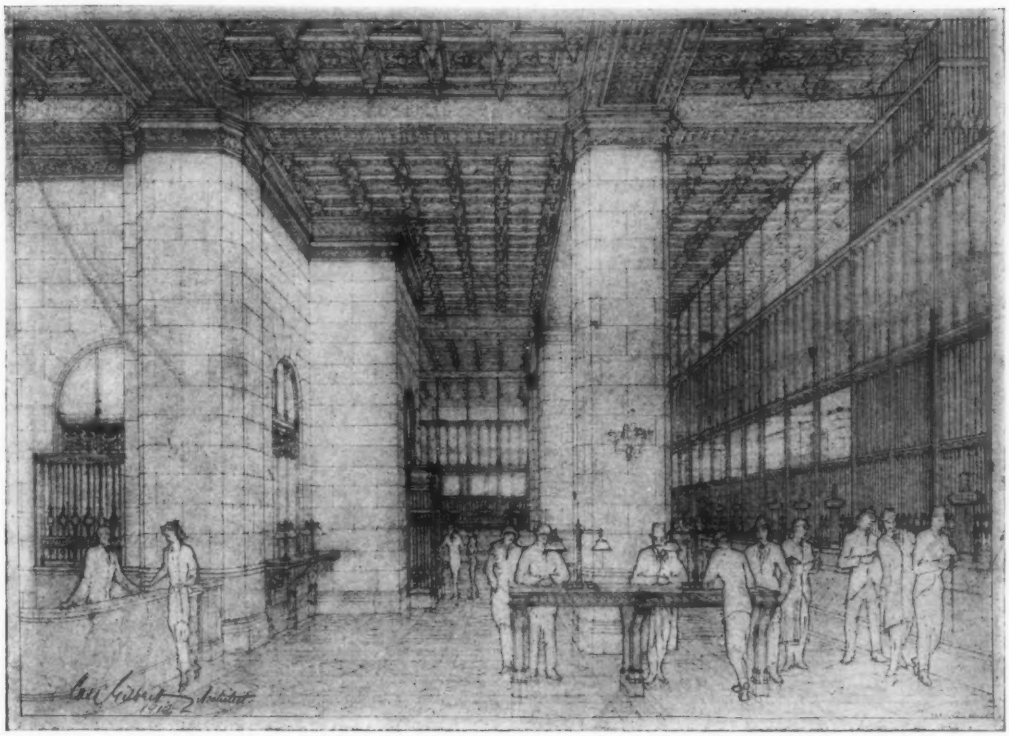


INTERIOR, IRVING NATIONAL BANK, WOOLWORTH BUILDING

ENGINEERING DESIGN OF THE WOOLWORTH BUILDING

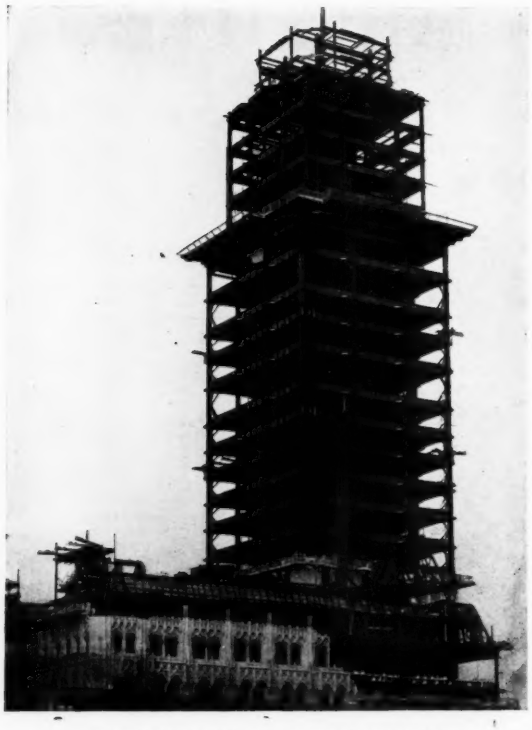
CASS GILBERT, F.A.I.A., *Architect*

WITH SOME GENERAL REMARKS ON ENGINEERING PROBLEMS AS AFFECTED BY THE NEW YORK BUILDING CODE. *By* GUNVALD AUS, M.AM.SOC.C.E.

BEFORE entering into a discussion of the engineering features in a structure like the Woolworth Building, I think it proper to discuss the different elements, which determine to a great extent the engineering design.

Of greatest importance is, in this instance the architectural requirements, but many other considerations, such as the character of the foundations, the size of the offices most easily rented in that part of the city where the building is located, the provisions of the Building Code, and sometimes the personal views of the owner, become very important elements in the finally adopted design.

It will readily be seen that where the foundations are very deep and must be carried to rock, it becomes comparatively cheaper to have a few and large foundations, rather than numerous smaller ones. The Live Load specified by the Building Code



TOWER DURING CONSTRUCTION

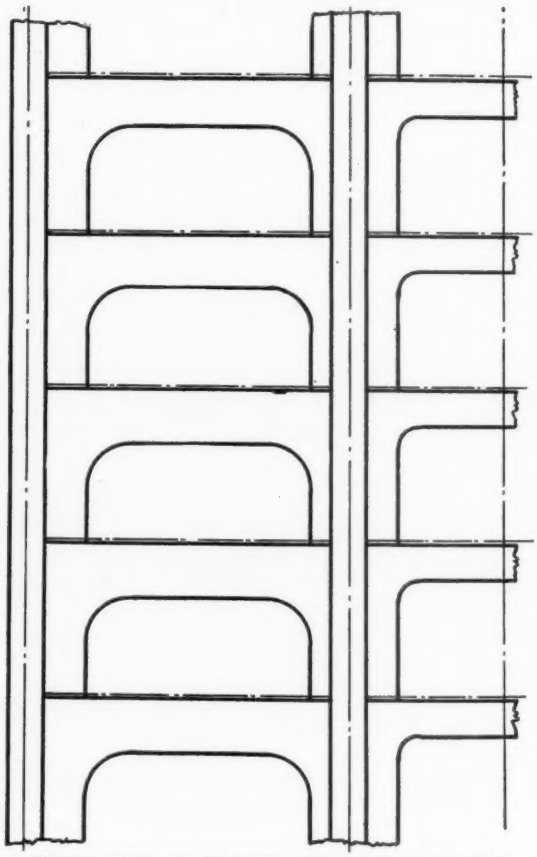
will also have some bearing in determining that spacing of the columns, which will insure the greatest economy of design.

The use of steel for the support of the walls of buildings permits constructions, that were never dreamed of by the architects of old, and unfortunately permits all kinds of freak designs. From an engineering point of view, no structure is beautiful where the lines of strength are not apparent, or in other words, where one cannot follow the distribution of the loads from the top of the structure to its foundations. There are many examples of architecture around New York which should hurt every trained eye because they look entirely unstable, and it is only the knowledge that steel members concealed behind the masonry prevent their collapse, which makes one pass without fear in front of such structures.

Fortunately architects are gradually recognizing that steel and stone should act together in such a way that one does not have to guess the support of an apparently unstable structure, although there are still a few who have the idea that the steel frame is merely a necessary evil, and that the structural elements should be as far as possible concealed, so that the building gives the impression of a masonry construction, whereas in reality the high modern buildings are essentially steel cages with the masonry forming only a veneer, or an enclosure, which serves the object of making the buildings habitable and beautiful, but where the walls have lost the function of supporting the floors and the roof, and are themselves supported at every floor by horizontal girders between the columns.

This should be acknowledged in the architecture, which obviously should be so designed as to clearly indicate the location of the supporting elements.

Mr. Cass Gilbert, the architect of the Woolworth Building, is strongly in favor of this latter method of designing the architectural features of a steel frame building. In fact, I think it is not too much to say that Mr. Gilbert is the leading exponent of modern steel frame architecture, in which the enclosing walls in a great measure serve to show the actual construc-



ELEVATION OF TOWER, BROADWAY FRONT

tion of the skeleton frame. There are probably no better examples of this form of architecture than the Woolworth Building and the West Street Building.

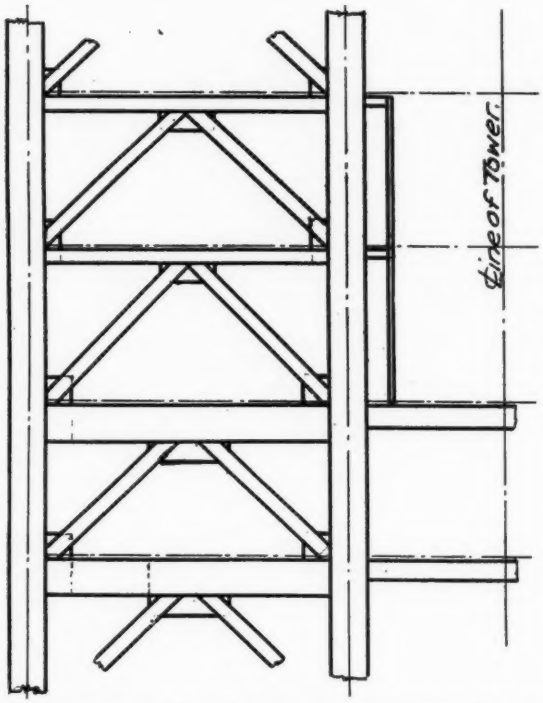
The location of the Woolworth Building is such that the renting agent insisted on a certain maximum and minimum size of office, and these requirements were practically responsible for the spacing of most of the columns in the wings of the building. In the tower proper, the column spacing was determined largely by the

VIEW LOOKING SOUTHWEST, CITY HALL IN FOREGROUND

WOOLWORTH BUILDING, NEW YORK, CASS GILBERT, F.A.I.A., *ARCHITECT*

architectural requirements, that is to say, the front elevation and the space required by the elevators.

Having determined the location of the columns, the next point that generally in a high building causes considerable debate is



WEST ELEVATION OF TOWER, BELOW FIFTH FLOOR

the wind bracing. The architect is very apt to think that the engineer requires too much space for the wind bracing, both in the interior of the building and in the walls. After considerable discussion it was determined that the most suitable bracing for the tower of the Woolworth Building was a system of portal braces, as these could be concealed in the piers of the exterior walls and in the partitions enclosing the elevators.

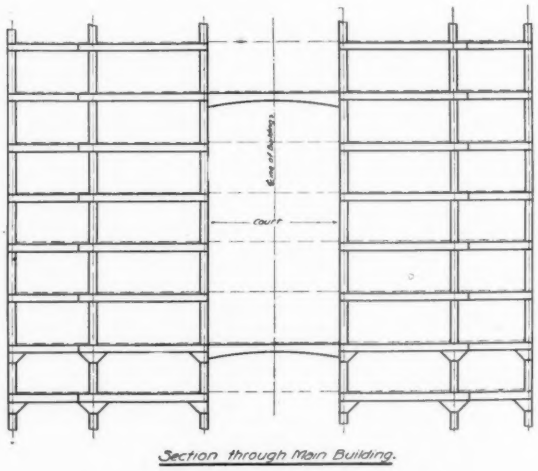
It was, however, found feasible to utilize full triangular bracing between certain of the interior columns in the tower, and as this form of bracing requires less steel than the portal braces, it was adopted in places where it could be used. For the two wings of the building a system of double plate girders, riveted with gussets to each side of the column, was adopted, and the gussets which projected below the bottom of these girders were omitted as soon as the bending stresses could be taken care of within the depth of the girders. This form of bracing is generally best adapted for interior transverse bracing, as it is not much in evidence in the finished building, whereas knee braces or gussets are very objectionable when exposed in the larger offices, which cover more than one bay of columns.

The three sketches shown here plainly indicate these various systems of bracing.

FOUNDATIONS

The subsoil under the Woolworth Building consists of a very fine sand to a depth of approximately 110 feet below grade. At this level hard rock is encountered. It became therefore in this case easy to decide that some method of foundation had to be adopted which would penetrate the sand and make the foundations rest directly on the hard rock, and under the given conditions pneumatic caissons were almost a necessity.

I am of the opinion that wooden piles are not sufficiently used for the foundations

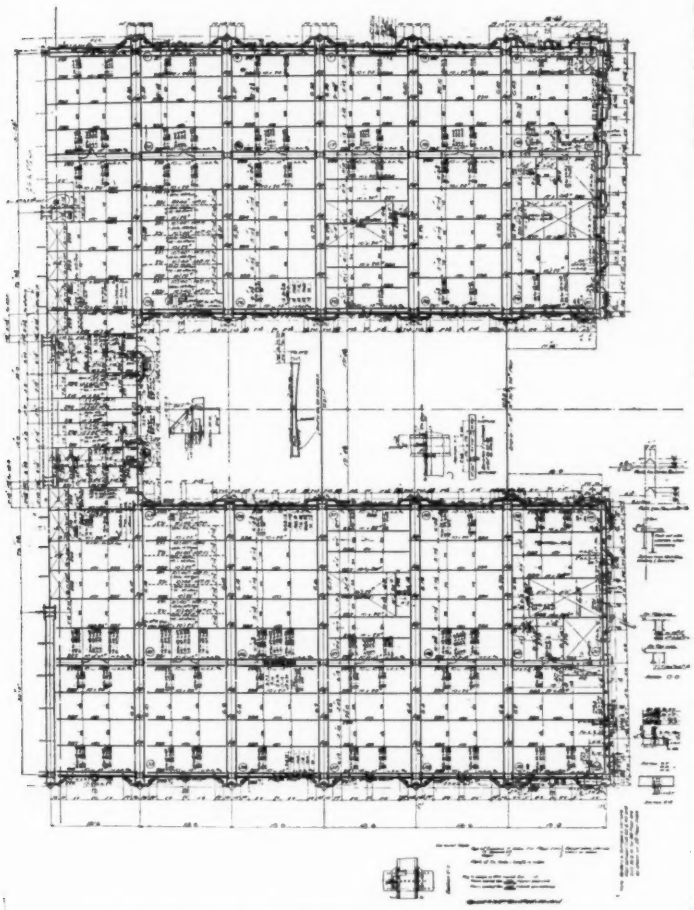


SECTION THROUGH MAIN BUILDING

of tall buildings, in many cases where conditions would warrant their use. Such cases would be where the strata, penetrated to hard pan or rock, consists of clay or a mixture of sand and clay. In other words, where the strata overlying rock or hardpan allow a fairly easy penetration, and at the same time offer a fair amount of lateral support to the piles, and where the perma-

nent ground water would not be too far below the level of the last cellar floor.

I know that there is a general feeling that wooden piles are not reliable for tall buildings, but this impression I consider very erroneous. The many important buildings in Europe, which are founded on wooden piles and which were built hundreds of years ago, give a good guarantee for the permanence of such construction, and, provided the load supported by each pile is well within the limit of the carrying capacity of the piles, it matters not whether the building, which causes this load, is high or low. The pile does not know the difference, and will perform its function of vertical support equally well, no matter what kind of structure induces that load.



SIXTH TO TWENTY-FIFTH FLOOR-FRAMING PLAN, WESTERLY HALF

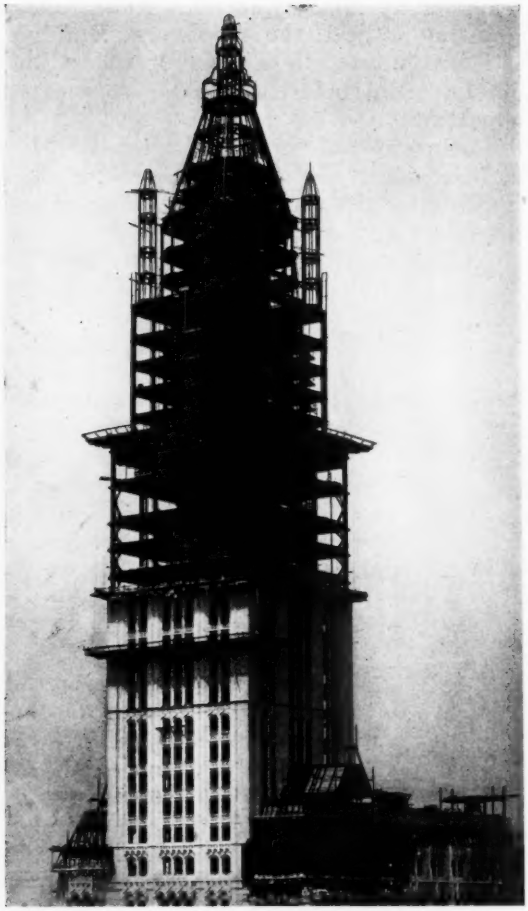
I offer no apology for this transgression from my subject, the Woolworth Building, as I have wanted to say this for a long time, but have not before found an appropriate opportunity.

The owner of the Woolworth Building had originally not secured the entire block fronting on Broadway between Park Place and Barclay Street, the corner on Barclay Street not being included in the original design, and the tower was therefore not placed in the center of the block, as it is today. The building was designed with the tower nearer to Park Place.

The contractor for the caissons had proceeded with the work, and had a number of caissons in place before Mr. Woolworth purchased the Barclay Street corner and ordered the redesign of the entire building.

How to utilize the tower foundations, which were already in place now became a very difficult problem, as these foundations did not come under the columns as located in the new design. After careful study it was decided that the new columns could always be on line with the columns in the original design, and that additional caissons could be put on these lines, so that the columns could be supported on plate girders between two adjacent caissons. This will be seen very plainly from the attached foundation plan. Wherever the caissons had not already been put in, they were shifted to the new position, so that they came directly under the columns.

It may be noted that the height of the tower was very materially increased in the new design, so that the old and new caissons combined in most cases were only large enough to support the load coming from the columns. It should also be noted that the additional caissons were, as far as possible, so spaced with reference to the column centers and the old caissons as to



distribute all that part of the load that could be carried by the old caisson, to it.

In other words, that the center of the column would be as far as possible in the center of gravity of the cross sections of the combined caissons.

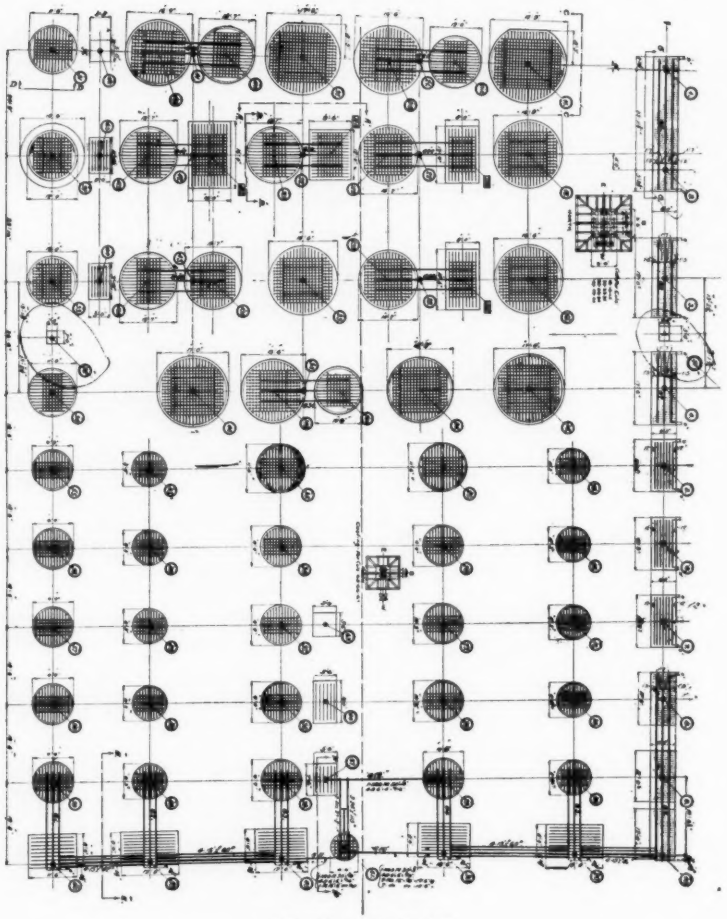
The very deep box girders which became necessary to bridge the opening between the two caissons were surrounded with a rich concrete twelve inches thick on the bottom of the girder and six inches thick over the extreme projections, and the space between the girders is carefully filled with the same concrete, so as to protect the steel thoroughly against corrosion. The concrete which surrounds and fills these girders, and in fact all other beams and girders in the foundation, adds enormously to the carrying capacity of such girders and beams; in many cases it fully doubles the bending strength of such girders and beams, but no account was taken of this in the design, as the New York Building Code unfortunately does not permit the designer to take this extra strength into account. It does not seem very clear why it should be permitted under the Building Code to construct a floor beam or girder consisting of a light steel beam buried in a concrete casing, in such a way that the steel takes all the tension, the concrete the compression, as is done in an approved system of reinforced concrete construction, and yet not allow any part of the compression to be carried by the concrete surrounding foundation beams or girders.

By looking at the foundation plan the serious effect of a recent ruling by the Borough President may be noticed, I refer to the ruling of the present Borough President, that no part of a foundation can extend beyond the building line.

As already stated above, the building was originally designed for only part of the area, which it now occupies, and the plans had been approved by the Building Department before the ruling above referred to had been made. Hence the foundations on Park Place and Broadway

MAIN ARCADE, WOOLWORTH BUILDING, NEW YORK

CASS GILBERT, F.A.I.A., *ARCHITECT*



GRILLAGE PLAN

extended beyond the building line, but when the area of the building was enlarged, the Department refused to permit the foundations to extend beyond the building line along Barclay Street, and would not permit any additional extension along Broadway beyond the lines occupied by the caissons already in place.

It will be noted that this made it necessary to cut a segment off from the one caisson on Broadway, whose diameter was so great as to make this caisson project beyond those already in place, and along Barclay Street it became necessary to use the narrowest caisson that can be constructed for such great depth, which is about six feet, and move the wall columns three feet back from the building line, or to the center of these caissons.

This construction adds very much to the expense of the caissons and necessitates the use of long and very heavy girders to distribute the load over these long and narrow caissons.

While I fully agree with the ruling of the Borough President which does not permit encroachment on the city's property beyond the building line, I nevertheless think that the ruling should be so modified, that a certain projection, say for instance one foot, should be permitted in case the owner pays for the space so occupied, somewhat in the same manner that vault privileges are now purchased, and I think the architects of New York should use their influence to have a city ordinance passed, permitting such projections. The possibility of a subway or other subterranean construction is so remote, that the city will lose nothing by permitting this projection of one foot, and the expense incurred by designing foundations without allowing any projection beyond the building line, amounts to a very great item every year. Every engineer has had many difficult problems to solve in the last two years on account of this ruling, and I do not believe that the owners of buildings realize what enormous expense they have been put to in the aggregate, or there certainly would be a very determined effort to modify the ruling and allow a reasonable projection, which in the average size building would be sufficient to utilize an ordinary spread foundation without cantilevers or combined foundations.

Before leaving the question of foundations I would like to say a few words about the very irrational designs, which we all have to make, due to the provisions of Building Codes, more particularly in such buildings as loft buildings or warehouses, where not even a reduction of the live load is allowed. The Building Code of New York and some

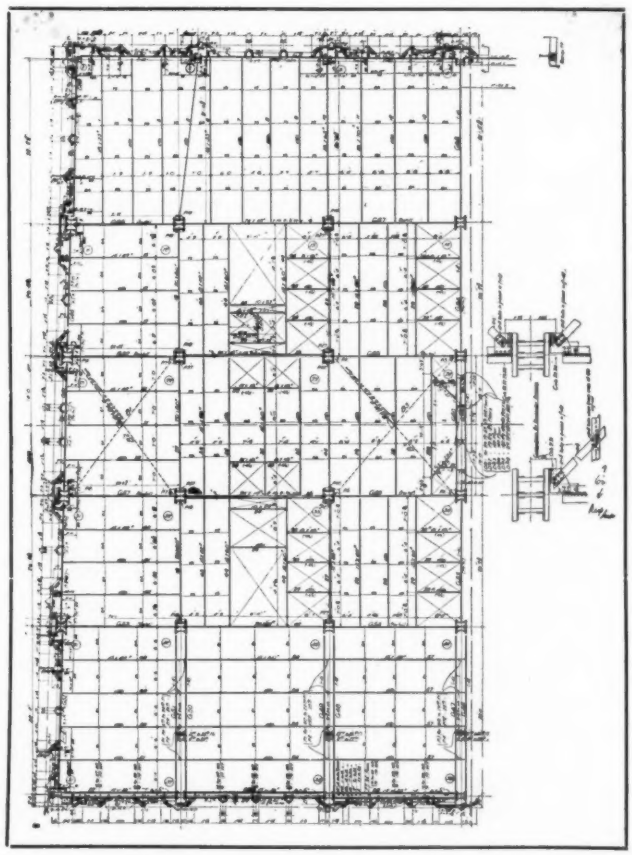
other cities require all foundations to be designed for either the full live load, or at least a very large part of it. The result is that wall columns, where the greater part of the total load is induced by the walls, receive practically all the load, for which they are figured, and transmit this load to the foundations. The interior columns carry only the weight of the floors and the movable live load, which will probably never be more than a fraction of the load, for which they are figured, and this movable load does not come on the column until long after they are erected. The result will be that the wall columns, if supported on a yielding foundation, will settle considerably, because they receive practically the full load, for which they are figured, whereas the interior columns together with their foundations will not compress the subsoil, and therefore they will not settle.

In an extreme case, the Post Office in Omaha, I have measured a variation of six and one-half inches of settlement between the interior and the wall columns, although they were designed for the same pressure on the subsoil, and rested on a very uniform clay bed, simply because the exterior columns got practically their full load several years before the interior columns carried even the dead weight of the floors, as the floor arches were not put in until after the building was under cover.

The Building Code ought to be revised, as to permit the design of the foundations for the full dead load and a very small live load, which should be made a percentage of that load, for which the beams are designed, and which should not be over ten pounds for an office building, and probably not over 100 pounds for a building designed for 250 pounds to 300 pounds per square foot on all floors carried, and the foundations should then be designed for a smaller pressure per square foot of subsoil, than is now permitted. The result would be that the footings under the wall columns would only carry somewhat more per square foot than the interior columns under normal conditions, and the latter columns somewhat more per square foot than the wall columns under maximum conditions of loading, but in no case would there be more than the permissible pressure per square foot of subsoil.

COLUMNS

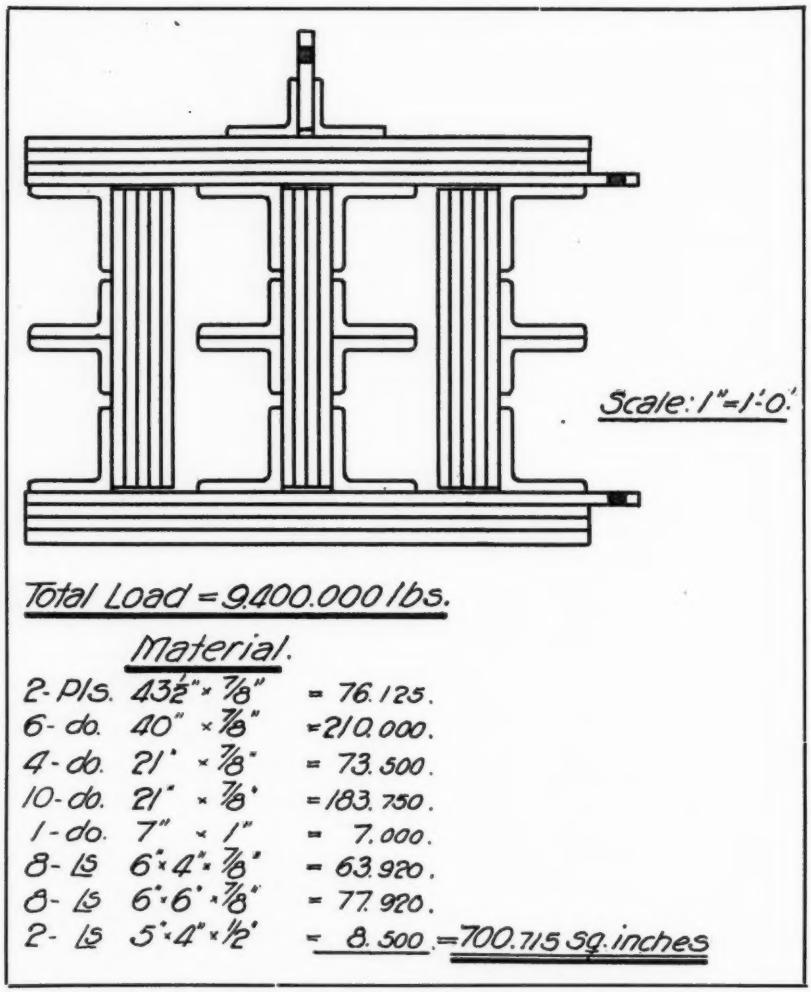
When a building is erected as high as the Woolworth Building, the loads on the columns including the wind load become so great as to approach the limit of practical construction. The columns are of necessity built up of plates and angles, and as the lateral dimensions must be limited, so as to occupy the least practical floor space, the thickness becomes very great. It was found impossible to design columns in this building with a dimension of about three feet by four feet without using rivets, which had as much as five



SIXTH TO TWENTY-FIFTH FLOOR FRAMING PLAN, EASTERN HALF

and one-quarter inches grip. The rivets were made one inch in diameter, in order to allow for this great length of rivets, but even then it is a question whether five inches is not about the permissible thickness of metal, and hence it would seem that it is not practical to design a building much over 800 feet high, unless the columns are spaced closer together, than they were in the Woolworth Building.

It may, of course, be possible to use a steel of greater resistance than the commercial steel, as for instance nickel steel, but so little data exists as to the strength of such enormous built up sections, that I do not believe it would be safe to use stresses much higher than those employed in the Woolworth Building, that is, about 14,000 pounds in compression on the lower tiers of columns. The actual stresses are, of course, very much smaller than those assumed, because the building law calls for a live load of seventy-five pounds per square foot, and a reduction of only five per cent. per floor down to a minimum live load of fifty per cent., or thirty-seven and one-half pounds for all the lower floors.



COLUMNS NO. 11 AND NO. 14, IN BASEMENT

Now, it is a well known fact that the actual live load in an office will not exceed ten pounds per square foot, and it would therefore seem rational to allow a very much greater reduction of the live load, for which columns are designed. I think it would be very safe to allow a five per cent. reduction until the live load should be reduced to ten pounds per square foot and use this live load for all the lower floors and for the foundations. If such a reduction was allowed, and if walls could be made only sixteen inches thick for three or four stories and twelve inches thick for the entire height of the building above, it would, of course, be possible to erect a building possibly not less than 1,200 feet high, and such buildings will probably be erected under special conditions in New York, if the Building Law can be so amended as to permit the construction of thinner walls and the consequent reduced live load that would be imposed.

WIND BRACING

Under the provisions of the New York Building Code the building must be designed to resist a lateral wind pressure of thirty pounds per square foot over the entire area of the building. This is a very excessive requirement, as all observations have shown that while the pressure of the wind over a very limited area may be fifty pounds per square foot or even more, it is only a very small part of a building, that is exposed to such great pressure, and that in other parts of the building the pressure may be zero, or in actual suction, that is negative pressure, so that the total resulting pressure will probably never be as much as ten pounds per square foot over the entire area. I think this assumption can be proved by the fact that there are many tall apartment houses existing in New York, which have no wind bracing whatever, except such stiffness as is given to the building by light terra cotta or plaster board partitions. If these buildings were really ever called upon to resist a pressure of anything approximating thirty pounds over their entire area, they would undoubtedly collapse like a structure of card boards, and the fact that they do not collapse, but on the contrary are perfectly safe for the conditions of wind prevailing in the eastern part of the United States, proves that it should not be necessary to design the tall structures for such excessive wind pressure.

However, the Woolworth Building was designed for the full load of thirty pounds per square foot, and the system employed was, as already stated, portal bracing in the tower of the building. This is a rather expensive form of wind bracing, as the material in the portals is not strained in direct tension and compression, as is the cause with diagonal bracing, but on the other hand, the portals can generally be arranged so as not to interfere with window openings, and the piers in the tower can be made very much lighter than would be possible with a system of diagonal braces.

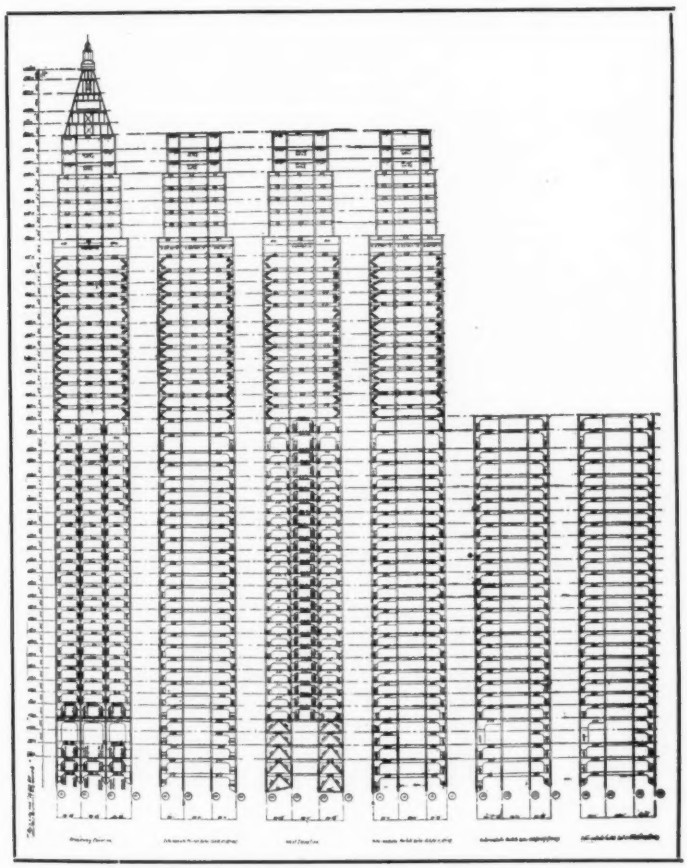
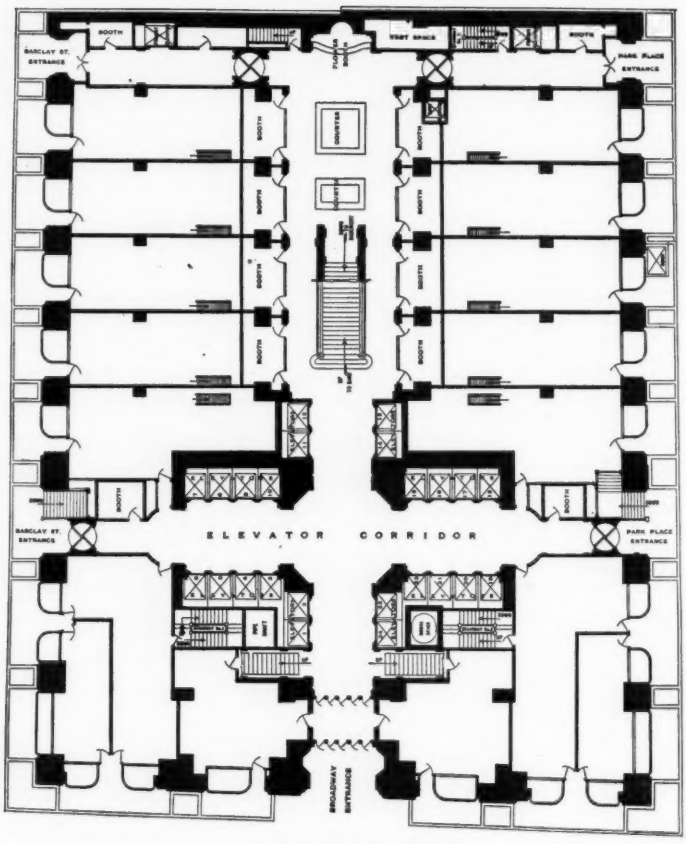


DIAGRAM OF TOWER WIND BRACING

For the upper part of the tower, that is to say above the twenty-eighth floor, it became possible to use a system of corner braces without interfering with the window openings, and it would undoubtedly have been possible to utilize this system in a number of places further down in the tower, but I believe that the great rigidity, which is found to exist in the tower, is due mostly to the system of portal braces, and that the money spent on this system of bracing is a very good investment, as not the slightest tremor can be observed on the top of the tower, even in a very heavy wind.

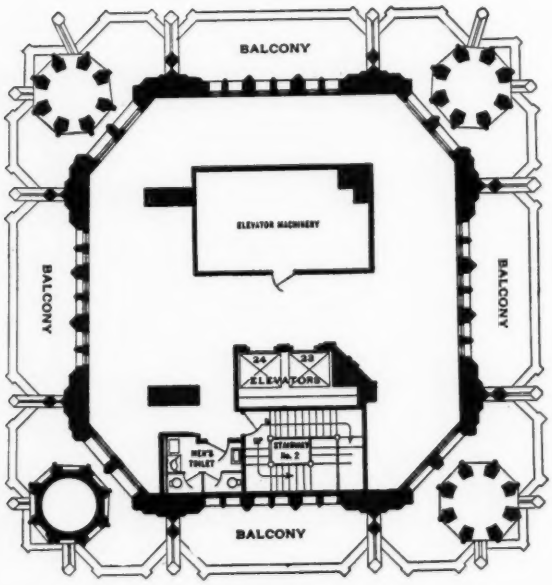
FLOOR CONSTRUCTION AND FIREPROOFING

The two lower floors were constructed of reinforced stone concrete, and the columns cased

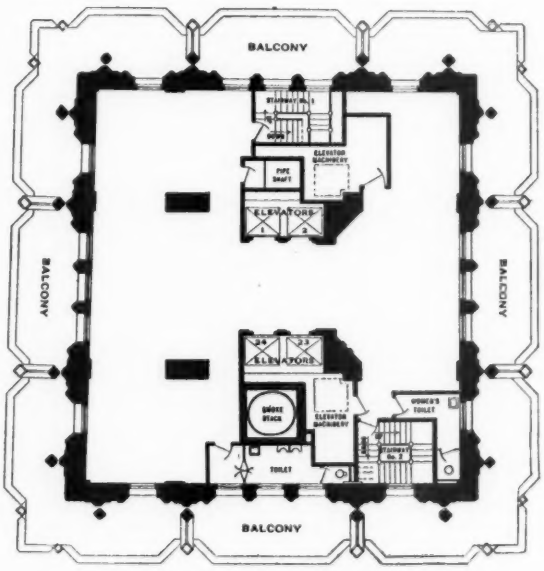


FIRST FLOOR PLAN

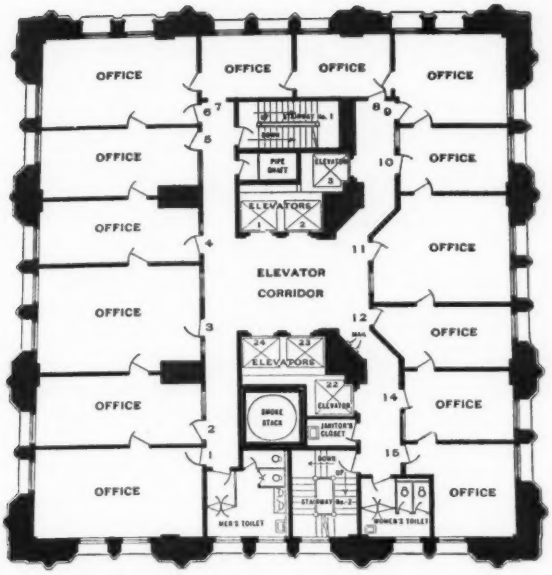
with concrete. This construction was adopted in order to have a continuous sheet of great strength which would transmit the wind loads into the retaining walls, which in turn are held by the surrounding subsoil. For all the upper floors terra cotta fireproofing was used for all the columns, and the floor arches were made of hollow blocks of end construction. I think it would have been very much better, structurally, if a system of reinforced concrete floor arches could have been used throughout the building, but the long time required in placing the reinforced concrete, and also the difficulty of working in freezing weather made it practically impossible to use such concrete for floor arches and fireproofing of columns, although the cost including suspended ceilings, which were required throughout all the offices, was somewhat less than the flat terra cotta arches. The great advantage of easy setting, and the absence of dirt and water incident to the placing of concrete arches, and the splendid plastering



FORTY-SEVENTH FLOOR PLAN



FORTY-SECOND FLOOR PLAN



THIRTIETH TO FORTIETH FLOOR PLAN

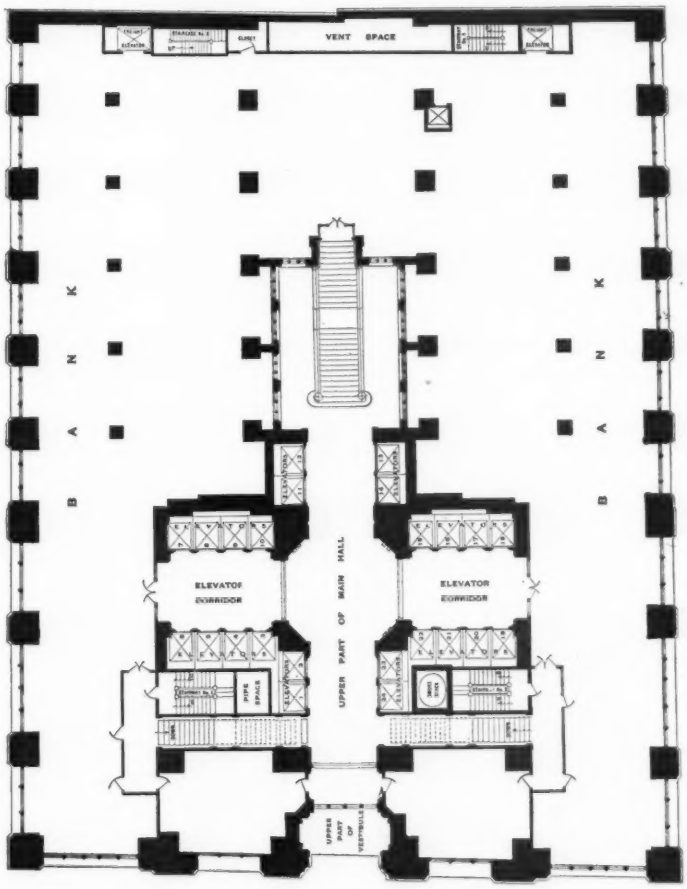
ground formed by the flat soffit of the terra cotta arches, decided in favor of this latter construction.

PAINTING

The question of painting the steel, so as to guard against possible corrosion, was given a great deal of study. There is probably no more important consideration in a steel skeleton building, than the proper protection of the steel against corrosion, which is not only caused by air and moisture, but also, and under special conditions to a much larger degree, by vagrant electric currents passing through the steel members and thus inducing what is popularly termed electrolysis. Whether it is possible to entirely protect steel against the effect of electricity by any form of painting is somewhat questionable but there can be little doubt that certain paints, containing various asphalts or tar products, do to a considerable extent insulate the steel.

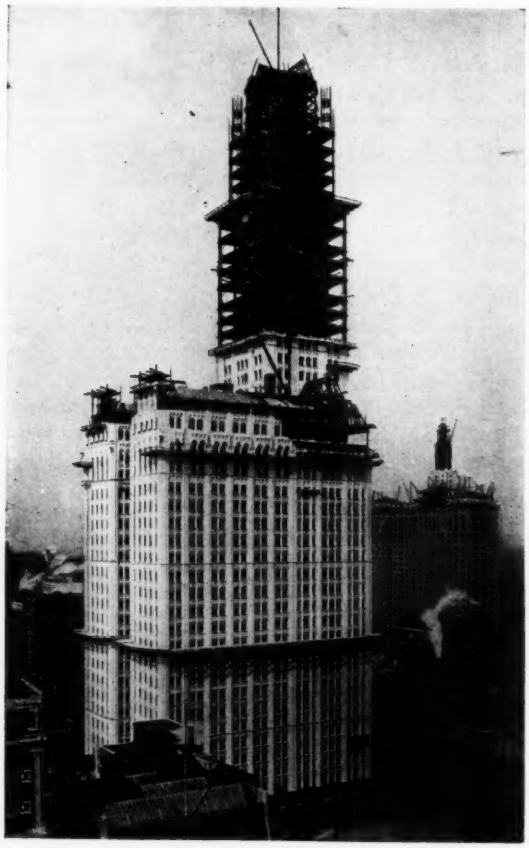
As a protection against ordinary rusting the ordinary red lead paint, consisting of pure linseed oil and about thirty pounds of red lead oxide to the gallon of oil is probably unexcelled, and it was therefore finally decided to paint the steel work in the Woolworth Building with two coats of such red lead paint, and a final coat of waterproof paint, which would protect the red lead against the attacks of the free lime in the cement, and to some extent insulate against vagrant electric currents. I feel confident that no better system of paint could have been adopted.

The drawings, which are reproduced for this article, show the construction so plainly, that it is hardly necessary to explain them in detail. They represent, of course, only a few of the typical floors, as so many different conditions were encountered, that a great many more floor



SECOND FLOOR PLAN

plans had to be made, but they will serve to give a very fair idea of the construction as actually carried out.



JEOPARDIZING THE STABILITY OF ST. PAUL'S, LONDON

THE stability and continued existence of St. Paul's Cathedral, London, will, it is believed, be seriously threatened if certain proposed plans for a subway are carried to completion. The history of St. Paul's in its conception and building, the traditions which surround it, have all served to invest this church with a reverence that is part of the nature of every Englishman and which is largely shared by every American who has visited London. Any imperilment of this building would be regarded not simply as sacrilege, but as almost approaching treason, and it is therefore easy to understand the solicitude that is felt in view of the fact that men whose opinions are to be taken with respectful consideration, regard the building of the proposed subway as a direct menace to the stability of this venerable and venerated structure.

It is the fabric below the surface that causes apprehension. Even if undisturbed, the immense weight placed on foundations whose footings were never too solidly set, would, and has, caused settlements that have from time to time given cause for alarm. St. Paul's does not stand on solid ground. Recent careful surveys show that the support is a cushion of soft material with a depth of less than six feet. The vibration of a largely augmented street traffic in the neighborhood has been shown to affect this cushion and to set up an oscillatory movement until, to quote *The Architect and Contract Reporter* of London, "St. Paul's is subject to daily recurrent earthquakes. It is probable that few of the seismic tremors noticed in England exceed in intensity the vibratory movements produced in St. Paul's by modern traffic conditions." All of the material employed in construction were not of the enduring character of present day material, and were such as could be most economically or readily procured. Some of the stone was utilized from old St. Paul's and shows evidence of its Norman workmanship. It was at the time of its utilization upwards of 600 years old and had been subject to the disintegrating influences of London's atmosphere. We are told that some of this ancient and imperfect masonry set in place by Wren is loaded with thirteen tons to the square foot. It is therefore easy to comprehend how precarious is the future of this structure unless it is safeguarded in every possible way. It has been stated on high authority that the building of the proposed subway would remove a considerable amount of pressure put upon the yielding materials by the superincumbent load and springs would almost certainly develop, causing inevitable movement, practically insuring the catastrophe of the collapse of the dome of St. Paul's.

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NEW ART BUILDING IN NEW YORK

THE National Academy of Design has finally announced a plan that gives promise of ultimately resulting in a building that will provide adequate accommodations for the Academy's exhibitions and the purposes of the newly formed National Academy Association.

Apparently, attempts to secure a site for an art building on park property have been abandoned, and it is now believed that differences of opinion on the subject will be forgotten in an earnest endeavor on the part of everyone to hasten as much as possible a realization of the new plan. As announced, this will furnish a building on a site adjoining the present Fine Arts Building in West 57th Street, on the West and North. It will provide a frontage of 125 feet on 57th Street and 80 feet on 58th Street. It would seem to be entirely possible and feasible to construct on this site a building containing ample gallery space for the public exhibitions of the Academy and the other associations of artists and architects that will make use of it.

It is difficult to imagine a project more worthy of support than this of providing an art building for New York City. It is hoped that patrons of art, among whom there are many of large means, will furnish financial aid to the end that the undertaking is not long delayed in its fulfillment. New York City is rightfully entitled to be designated America's art center, but lack of proper facilities for holding exhibitions and carrying on the work of the various societies of artists, has rendered the retention of the above title extremely precarious at times. With the completion of the proposed building, the matter should be settled for all time.

THE HIGH BUILDING

A DISTINCTLY American product, the commercial building of great height, has furnished the text for scores of articles and discussions by foreign critics, and not a few by architects, sculptors and painters of this country. Time was, and scarcely more than a dozen years ago, when there was practical agreement that the skyscraper presented little of interest or merit architecturally, and simply expressed in concrete form the requirement of large floor area on limited ground space, or the exigencies of business which are thought to be served by bringing into close proximity the offices and business premises of a large number of persons engaged in similar lines of endeavor, be they professional or commercial. But during more recent years, the feeling toward this American creation has undergone considerable modification. There is no longer unanimity of opinion concerning its lack, or possession of artistic qualities and possibilities. Numerous authorities are now inclined to the belief that the skyscraper presents opportunities for the development of a distinctive type of American architecture that may even possess artistic merit comparable with that of a well designed residence or bank, on what have come to be considered conventional lines. In fact there is little doubt in the minds of many that certain buildings belonging to this class, already erected, compare favorably with any other buildings, of recent construction, of any type.

Probably no one has contributed more to this change of feeling than has Mr. Cass Gilbert, by the erection of the West Street Building, completed a few years ago, and the Woolworth Building, now practically complete and presented in this issue. These two examples furnish irre-

futable proof of the fact that the much maligned American skyscraper is not of necessity ugly; that if these structures have not always been pleasing to the eye, it is not altogether the type, but the handling of it to which many of the artistic shortcomings of tall buildings are properly chargeable. That there are many high buildings which do violence to every architectural principle and precedent, will not be denied, but the same might be said of every other type of building. When it is once conceded that it is possible to build to great height without entirely sacrificing architectural qualities, it would seem that architects might perhaps with profit devote less study to a plan by which tall buildings could be avoided or made to look like something else and address themselves to the problem of designing them, when occasion required, as nearly as possible in accordance with standards of excellence which have now been established.

Questions of light and air and the moral right of a property owner to build to immense height, dwarfing and overshadowing his neighbor, are other matters quite apart from the purely æsthetic aspect of the high building. In fact, whether a building above what might be considered a very moderate height should be permitted under any circumstances, may be questionable, but concerning the possibility of furnishing a satisfactory solution to the architectural difficulties of the tall building, there can be no further doubt.

RECENT LEGAL DECISIONS

LIABILITY FOR ACCIDENTS

Where a general contractor for the construction of a building undertakes the work of constructing the scaffolding, a subcontractor for the iron work, who comes upon the premises with his employees after the erection of the scaffolding, is not liable for an injury to one of his own employees from the falling of the scaffolding.

Bohnhoff *v.* Fischer, New York Appellate Division, 134 N. Y. Supp. 28.

TEMPORARY STRUCTURES—ASSUMPTION OF RISK

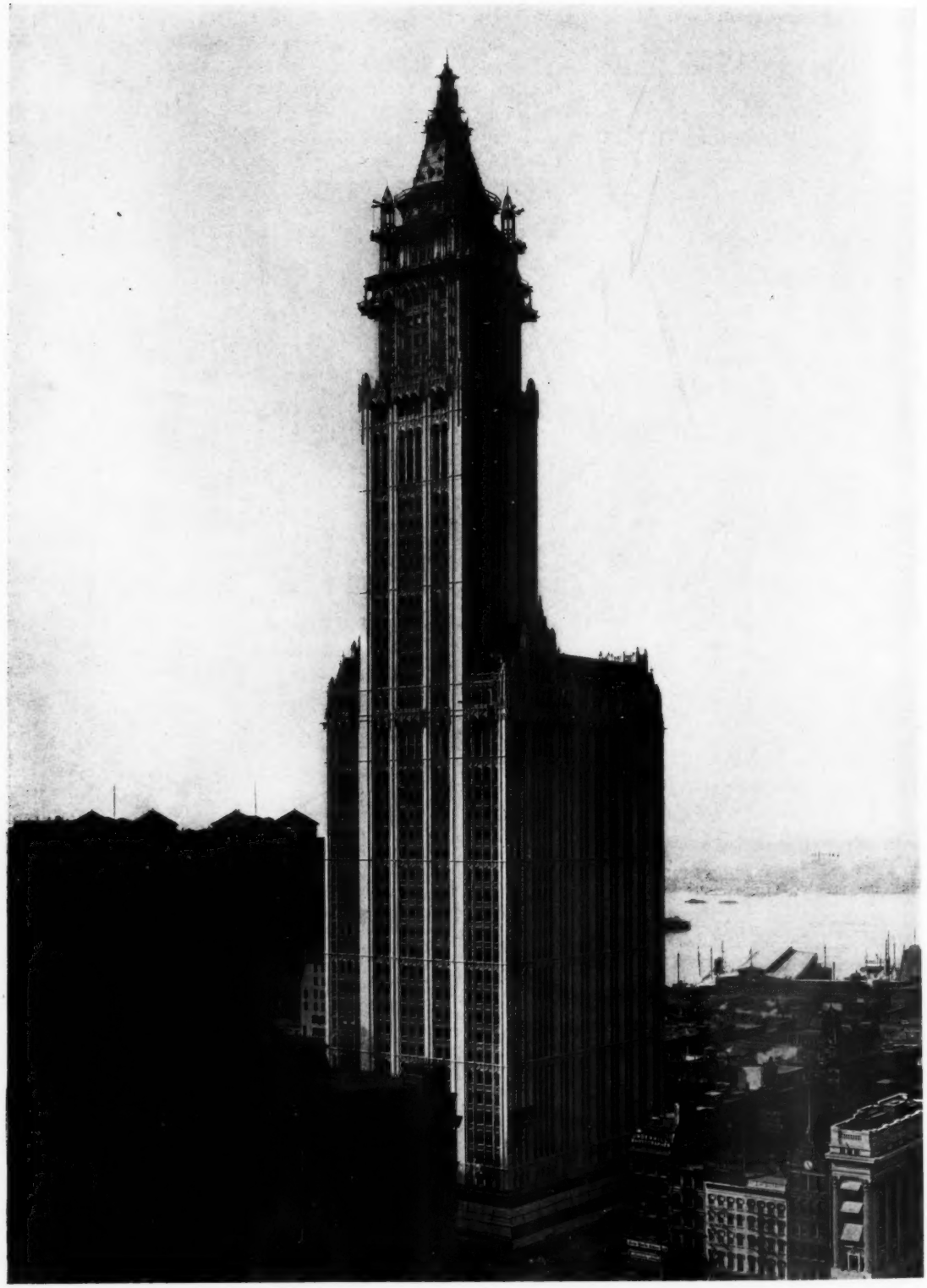
A master need only furnish suitable and proper materials for the construction of scaffolds, stagings and other structures of a temporary character. In undertaking the work the servant knows that the construction of these appliances is an incident to the performance of his duties. They are of such a temporary and ordinary character that their construction may properly be regarded as a detail of the work to be done, and the master does his duty when he supplies suitable materials. On the other hand, if the appliance be of an unusual character which the servant does not and cannot be presumed to know how to construct and which the foreman directs him to construct in a particular manner, the construction of the appliance is not a detail of the servant's work, and the master is liable for the foreman's negligence. In an action for personal injuries it was held that a breast derrick inside of a building in course of construction, for use in construction, was not, as a matter of law, an ordinary appliance which the servants should be expected to construct in the course of their work. It was for the jury to decide within which class it fell.

Sowles *v.* Norcross Bros. Co., C. C. A., 195 Fed. 889.

CONTRACTOR'S LIABILITY FOR DEFECTIVE WORK

Payment was made to a building contractor under an express agreement that he was to remedy defects in the building and complete it according to the specifications. Notwithstanding that the owner was at the time of the payment in possession and knew of the defects, it was held that he was entitled to compensation for the cost to him of remedying the defects and completing the building.

Hansen *v.* Walker, Iowa Supreme Court, 135 N. W. 653.



WOOLWORTH BUILDING, NEW YORK

CASS GILBERT, F.A.I.A., *ARCHITECT*

WOOLWORTH BUILDING, NEW YORK

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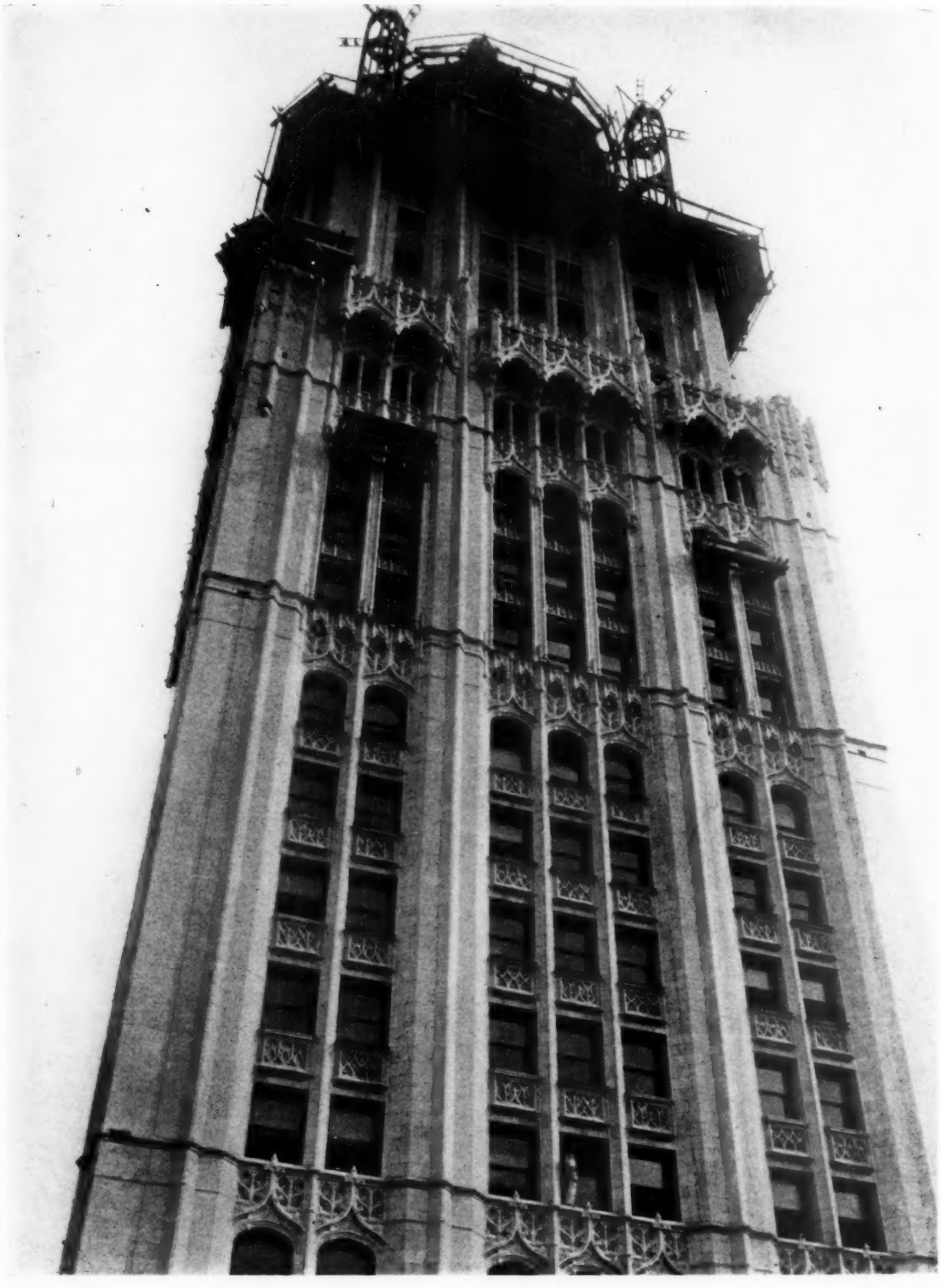

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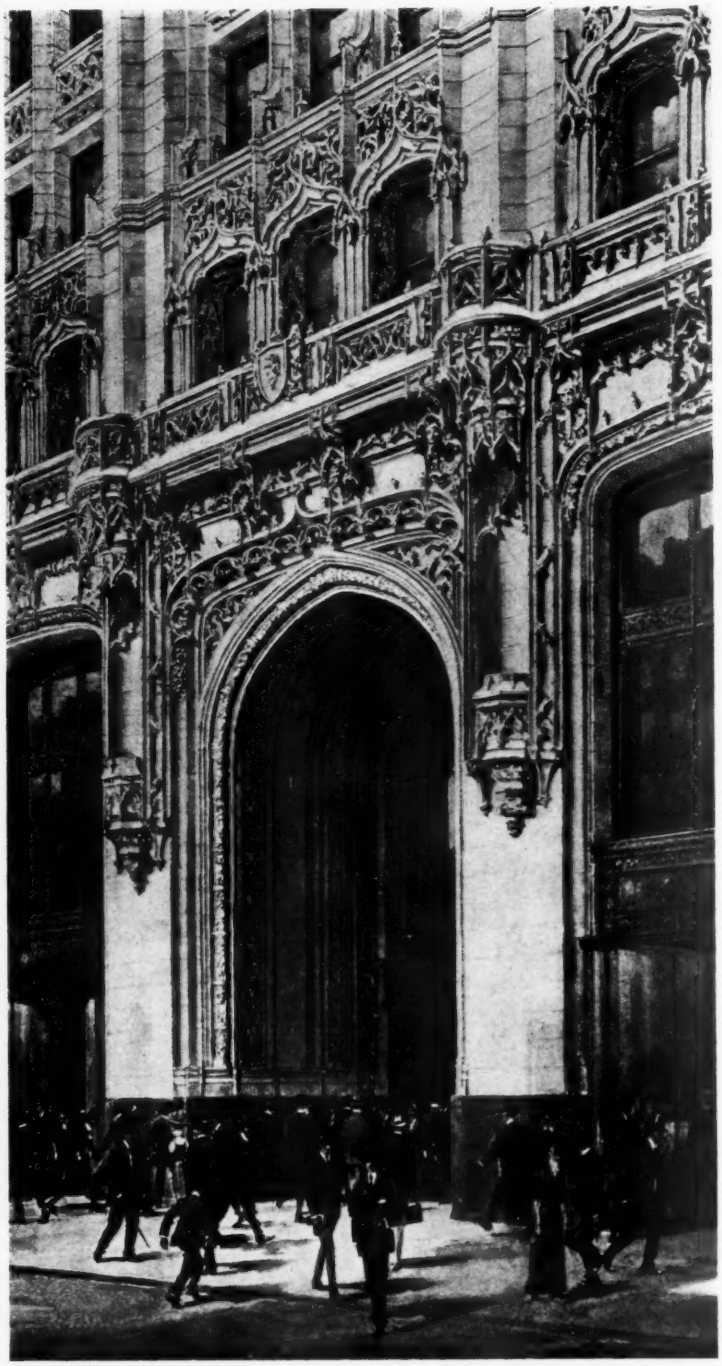

BROADWAY ENTRANCE

WOOLWORTH BUILDING, NEW YORK

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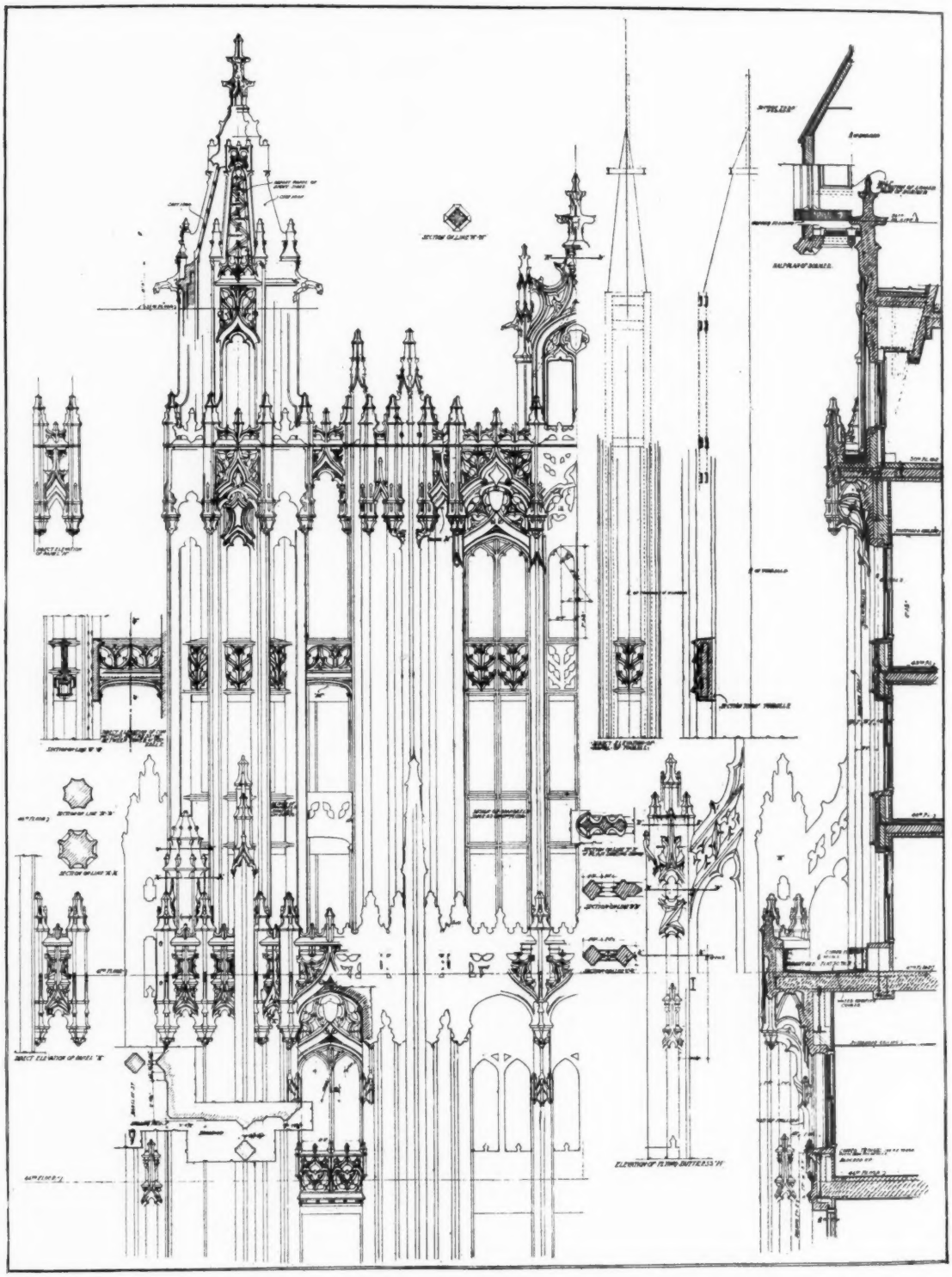
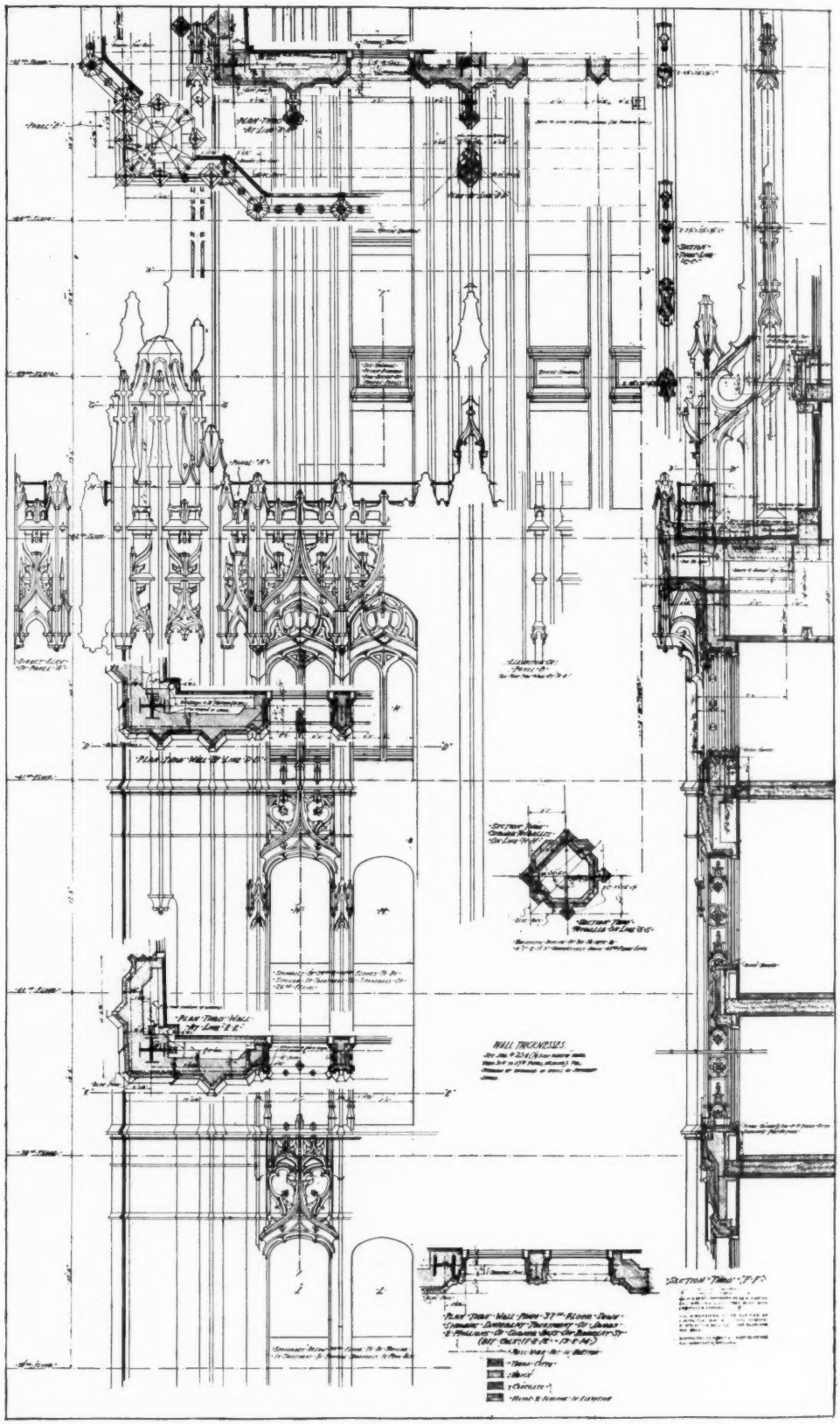


DETAILS OF EXTERIOR TERRA COTTA FROM FORTY-SIXTH FLOOR UP TO ROOF OF TOWER

WOOLWORTH BUILDING, NEW YORK

CASS GILBERT, F.A.I.A., *ARCHITECT*



ELEVATION OF CORNER OF BROADWAY AND BARCLAY STREET

WOOLWORTH BUILDING, NEW YORK

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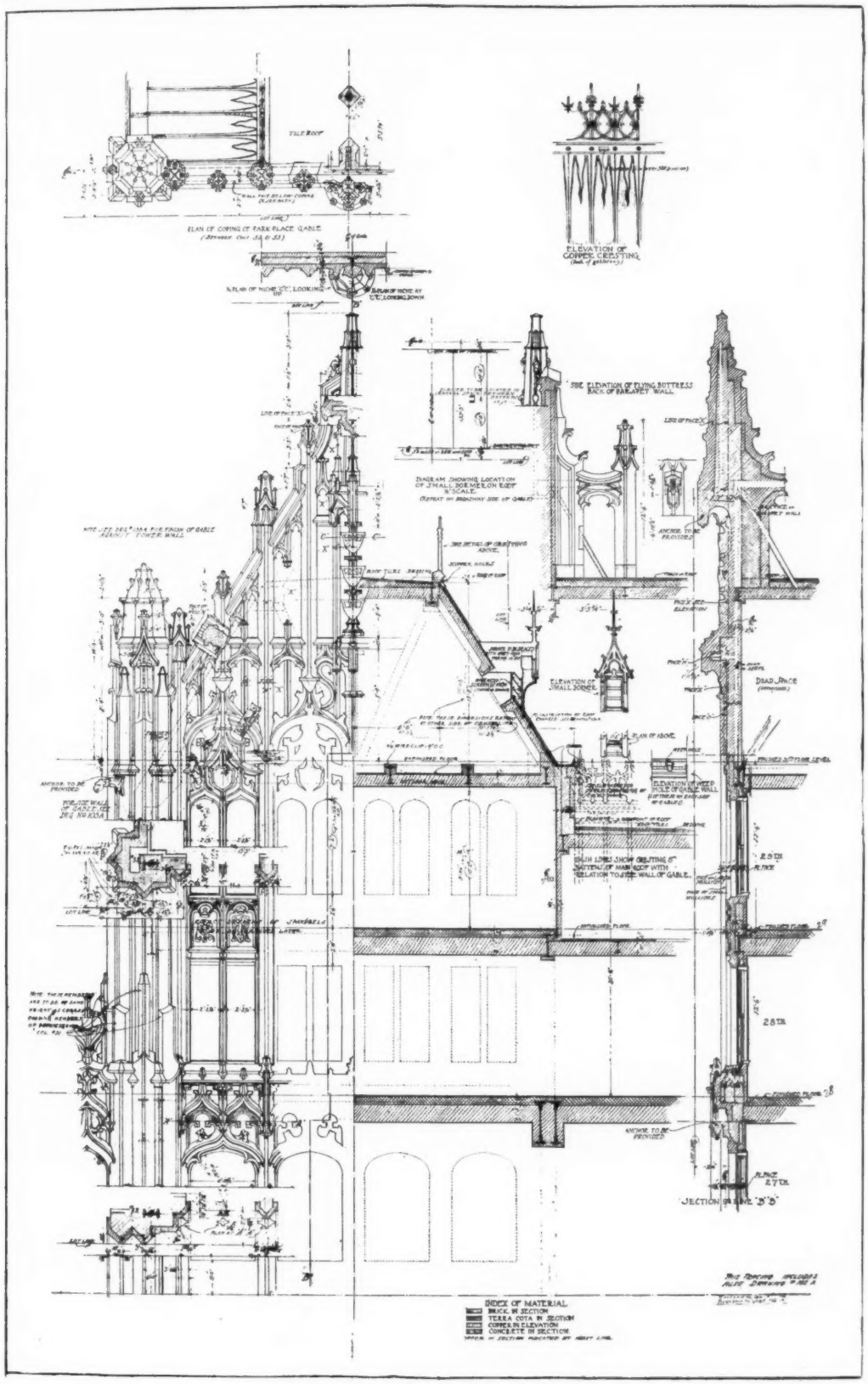

DETAILS OF GABLE ON PARK PLACE SIDE

WOOLWORTH BUILDING, NEW YORK

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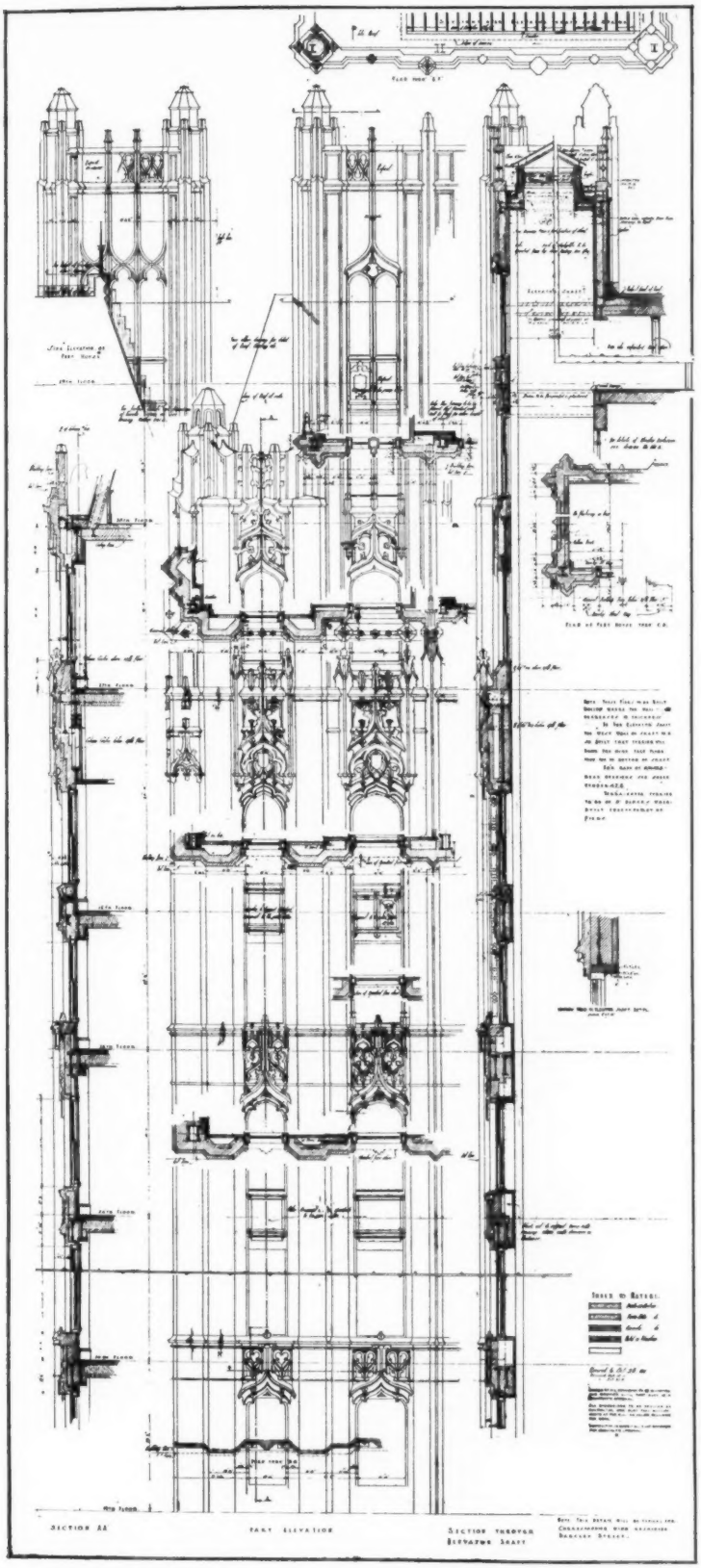

DETAILS OF WEST END OF WING ADJOINING PARK PLACE

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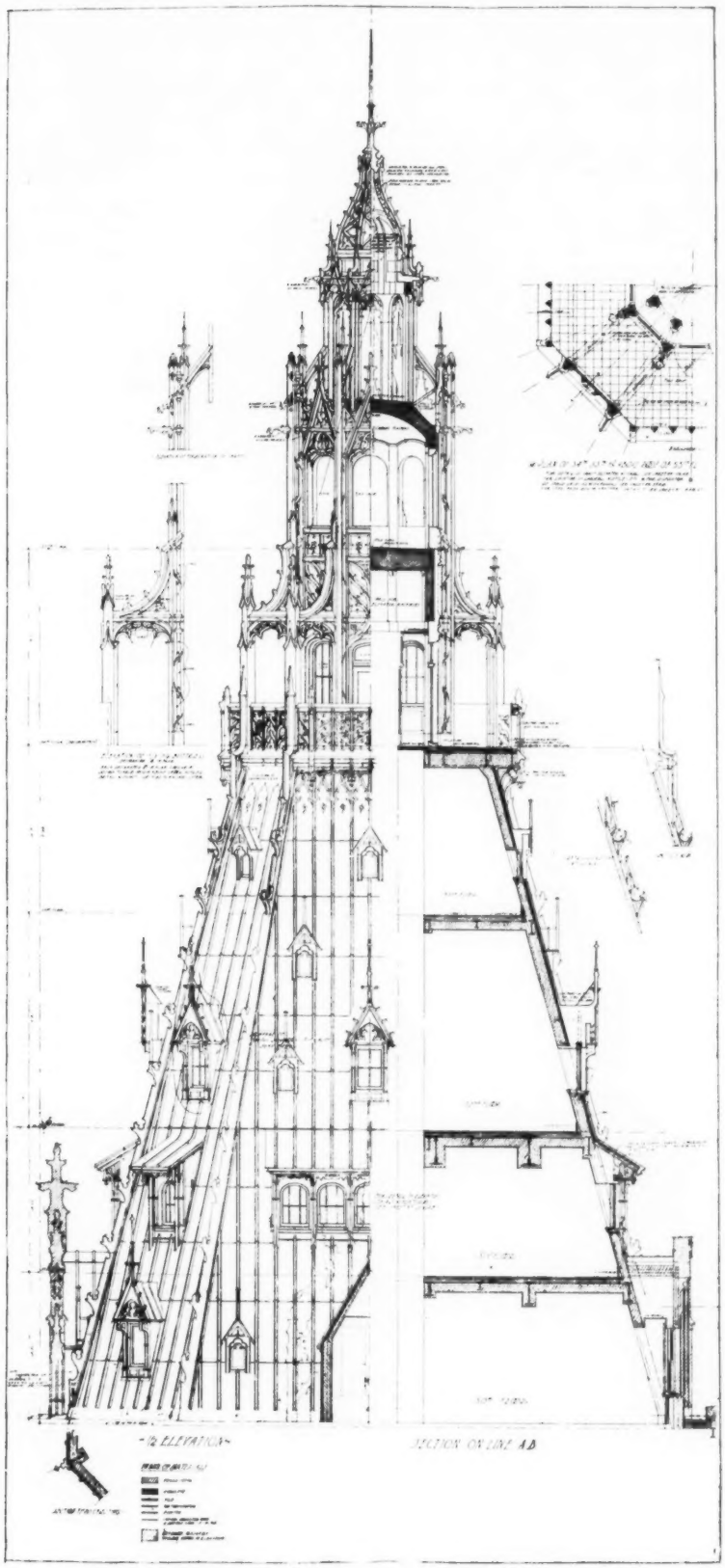

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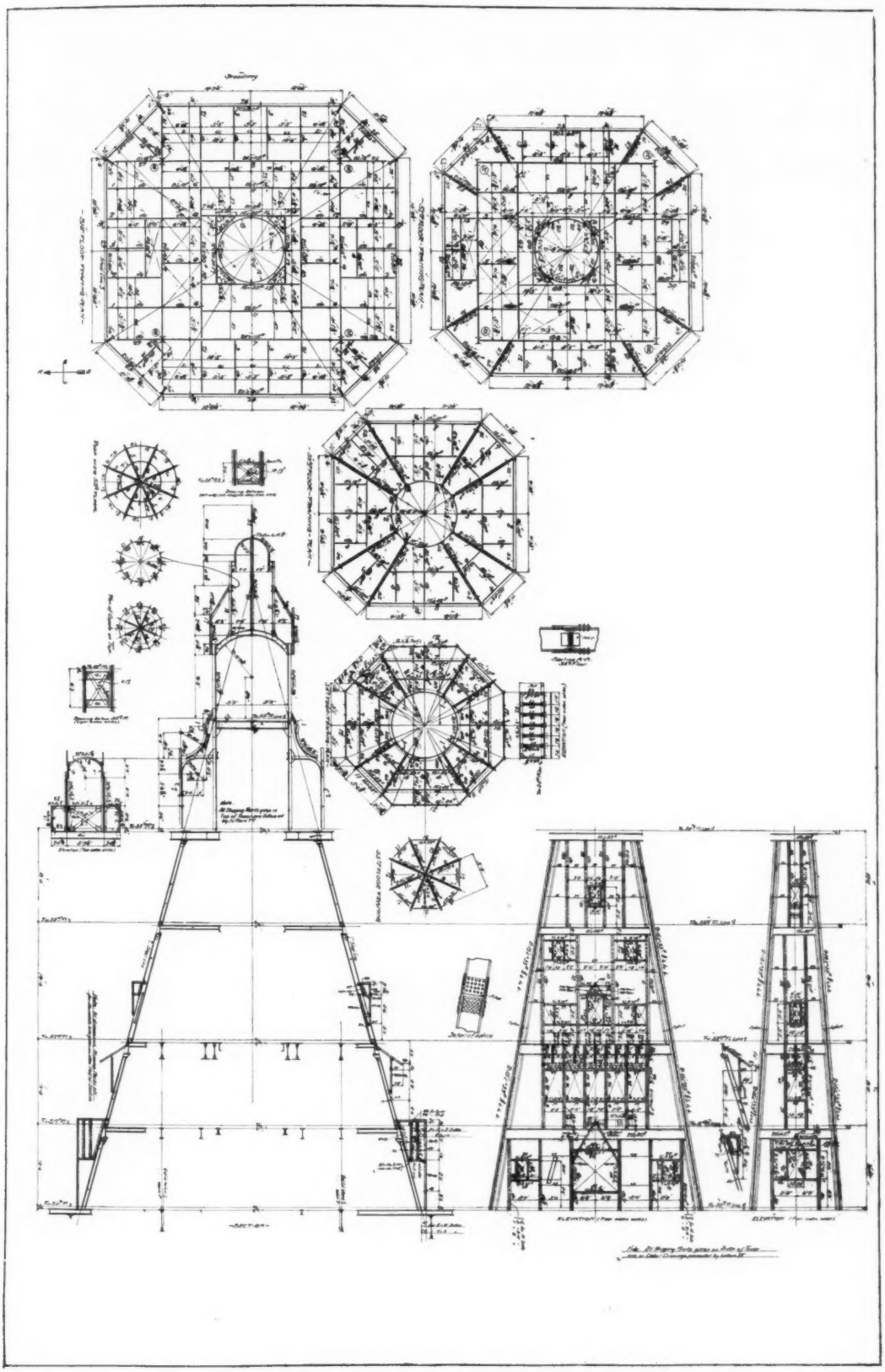
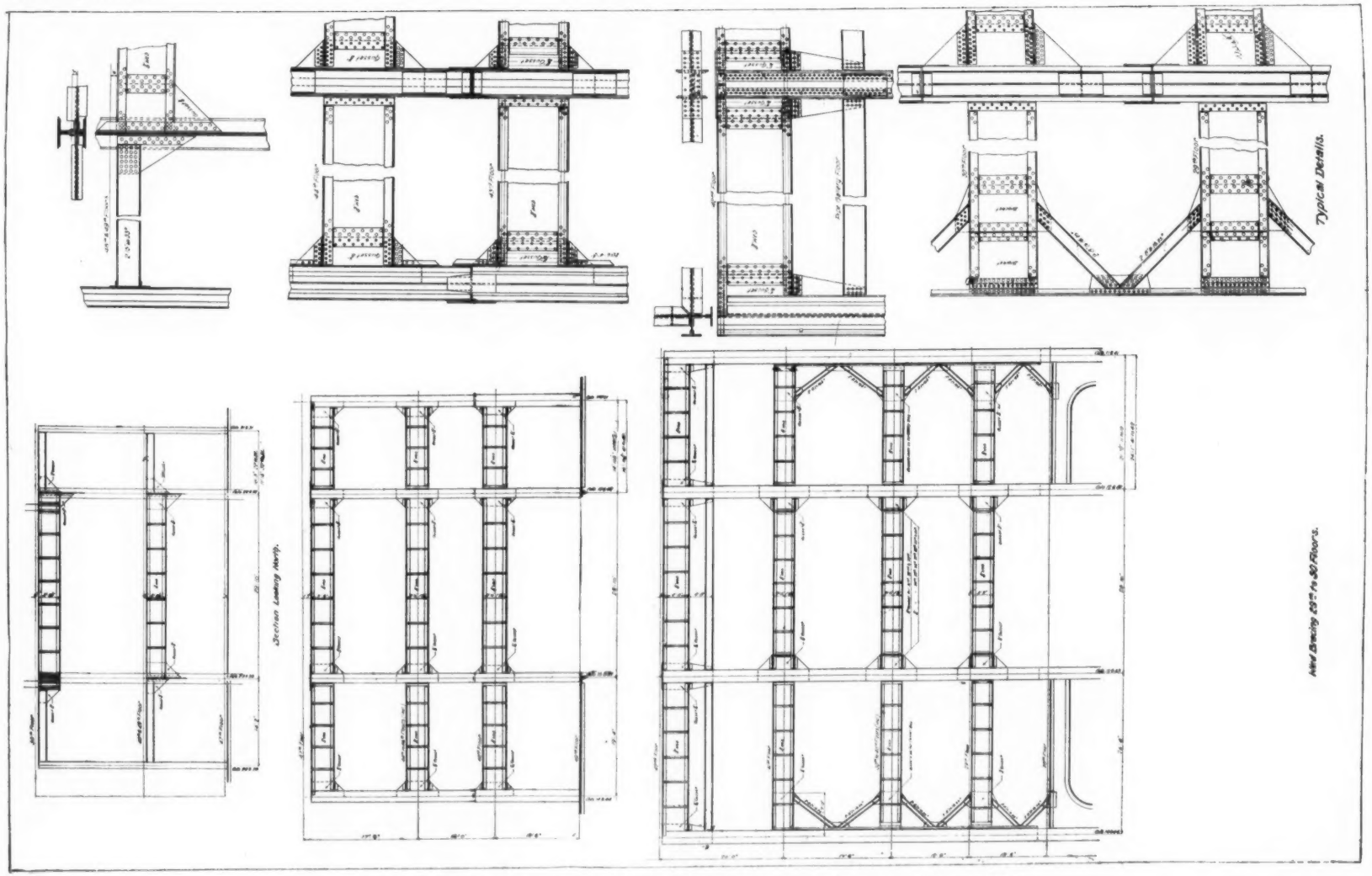


FRAMING OF TOWER ABOVE FIFTIETH FLOOR

WOOLWORTH BUILDING, NEW YORK

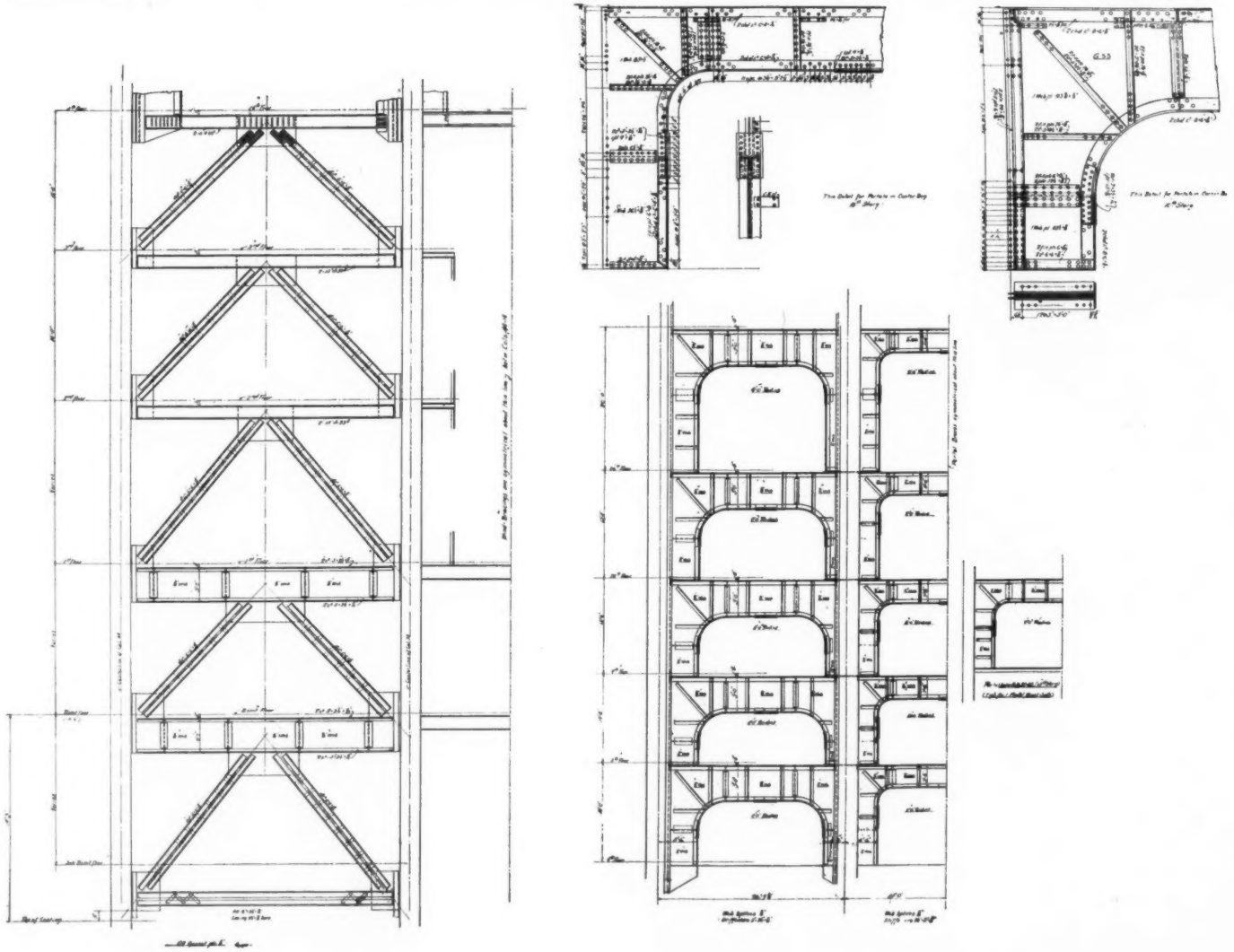
CASS GILBERT, F.A.I.A. *ARCHITECT*



TYPICAL DETAILS, WIND BRACING TWENTY-NINTH TO FIFTIETH FLOORS

WOOLWORTH BUILDING, NEW YORK

CASS GILBERT, F.A.I.A., *ARCHITECT*



PORTAL BRACES, WEST ELEVATION

WOOLWORTH BUILDING, NEW YORK

CASS GILBERT, F.A.I.A., *ARCHITECT*

ISAR TOR, A GATE DATING BACK TO 1314,
Arbitrarily restored 1833 with fresco representing Triumphal Entry of Emperor Lewis, the Bavarian, after the battle of Ampfing