SPECIAL ISSUE
INDUSTRIAL BUILDINGS - - PRICE SEVENTY-FIVE CENTS

# THE AMERICAN ARCHITECT

ILLUSTRATIONS AND READING MATTER PERTAINING TO ARCHITECTURE AND ALLIED ARTS

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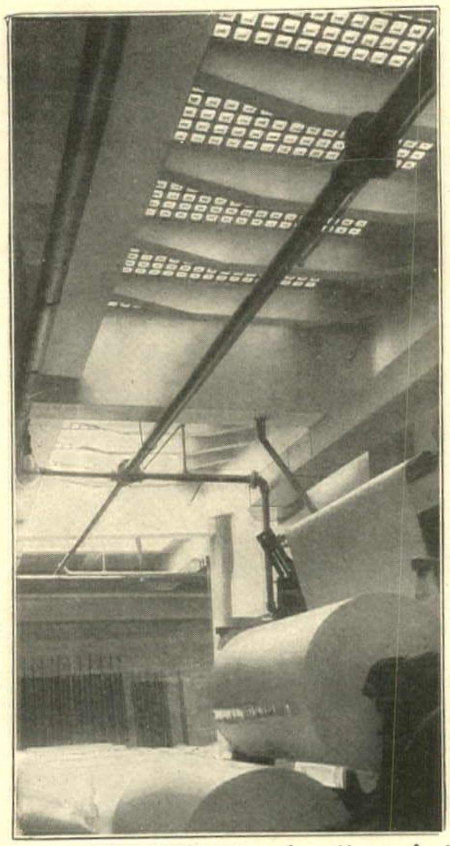
VOLUME CVII FEBRUARY 24, 1915 NUMBER 2044

W.W. BOSWORTH

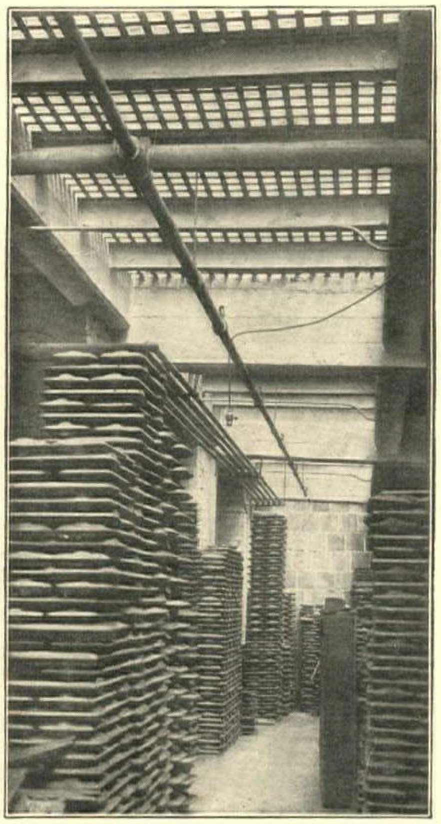
# Thousands of "Industrious Industries"—have Luxfer installations—office buildings, schools, libraries and



other places where Daylight plays an important part in the welfare of a business, the workmen, and the reduction of light bills—LUXFER is invariably used.

## Luxfer System of Scientific Daylighting

is as *important* as is Daylight itself—since it *delivers* the *Daylight* into dark places.



LUXFER increases the capacity of workmen by keeping them in better health—it improves their work because it relieves the "strain" always attending the use of artificial light.

It *cuts down* artificial light bills by flooding the Plant with *natural* Daylight. It makes for *economy, industry* and *cheerfulness,* and *pays* for itself again and again.

It's a case of *constant* Daylight *minus* the up-keep expense.

Whatever the industry, plant, or building of any kind, it needs LUXFER to accomplish the best results for the Owner, the Tenant, the Employee and the Architect as well.

Don't hesitate to tell us your daylighting problems. Our experts will analyze and prescribe for every specific condition to meet all your needs.

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Cleveland, 419-20 Citizens' Bldg.
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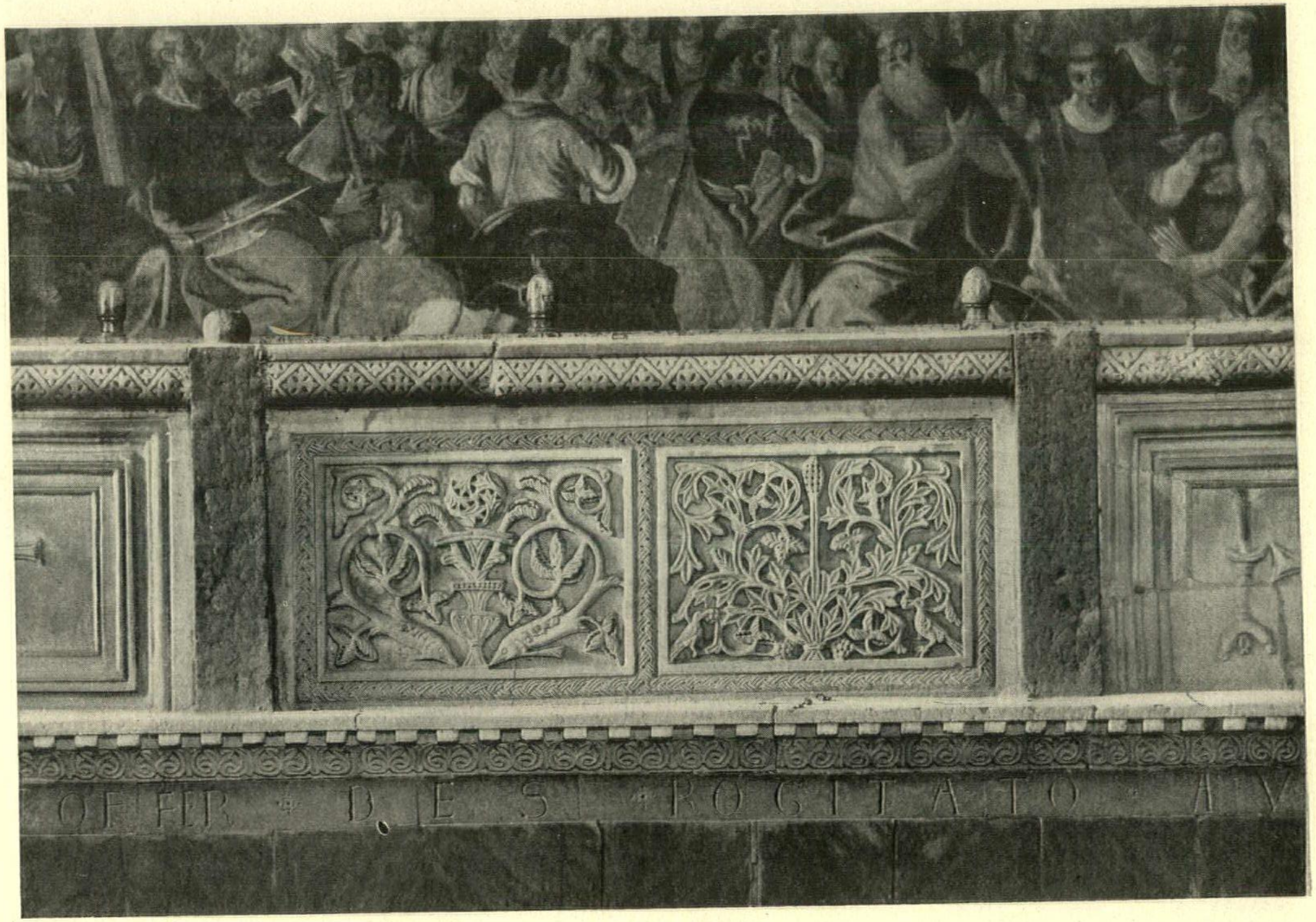
Kansas City, 909 N. Y. Life Bldg.
Milwaukee, Stroh Building
New York, 507 West Broadway
New Orleans, 904 Hennen Bldg.
Philadelphia, 411 Walnut Street
Rochester, 38 Exchange Street
Dallas, Builders' Exchange
San Francisco, 445-47 Turk St.
Los Angeles [illegible] S. Main Street
St. Paul, 365 University Ave.



PARAPET DETAIL

CHURCH OF ST. MARK, VENICE

# THE AMERICAN ARCHITECT

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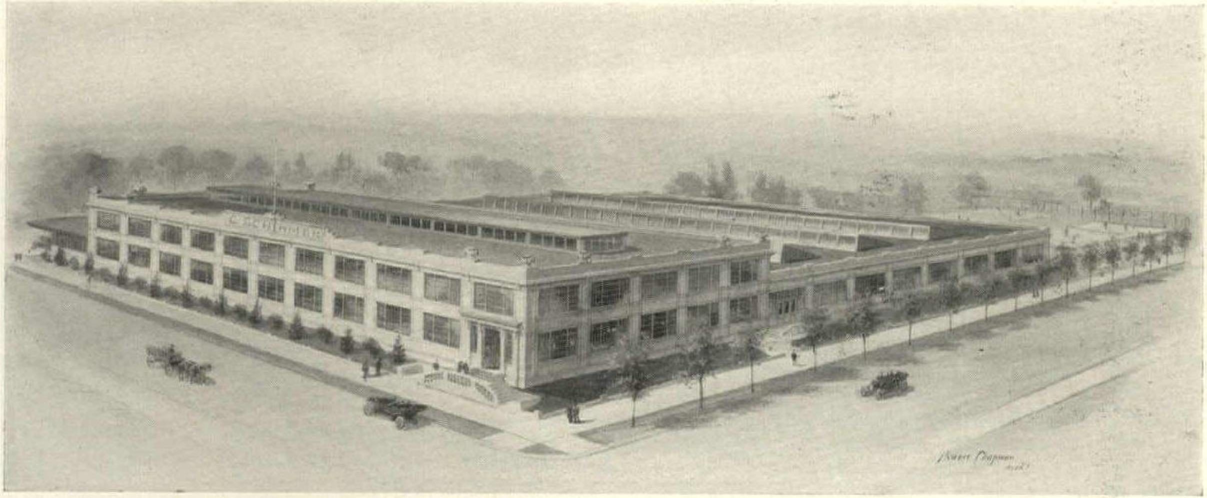

FACTORY BUILDINGS FOR G. SCHIRMER

MR. HOWARD CHAPMAN, *ARCHITECT*

## DESIGN OF INDUSTRIAL BUILDINGS

*By* HOWARD CHAPMAN.

IN the design of industrial buildings, the two most important factors, at least as viewed by the client, are utility and economy of construction. These should, however, be consistent with structural safety, durability and protection from fire.

Beauty and architectural effects, though desirable and important, are generally considered as secondary.

In considering utility, it is better to endeavor to use common sense and good judgment rather than follow rules, because the problems in industrial work are so varied.

Before commencing to lay out a plant, the architect should become familiar with the general method of carrying on the business. Though he is not supposed to know how to manufacture shoes or chewing gum better than the men who have spent their lives at it, he should be able to quickly see the general methods of doing business or process of manufacture, and by looking at the requirements in a broad sense should be better able to advise as to the design and construction of a building best adapted to the needs. The owner may be the best judge as to whether a building would fill the bill or not, after it were designed, but he has not had the training to scheme a plan and is often hampered by detail, which really should be taken up only after the general scheme is decided on.

The location, size of lot and required number of stories are generally and too often settled on before the architect is called in. This often imposes conditions which hamper the designing of the best building for the purpose.

Fire protection to buildings, stock and life must be given very careful consideration, but since so much literature is published on this matter, it seems best to here pass it over with but few remarks. Large

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MUSIC PUBLICATION BUILDING FOR G. SCHIRMER, NEW YORK

MR. HOWARD CHAPMAN, *ARCHITECT*

areas unbroken by fire walls and fire doors should be avoided; fireproof construction only should be used; vertical openings, such as elevator and stair shafts, should receive very careful attention, and sprinkler systems in almost every case should be installed. As the area protected by a single head is subject to rather rigid conditions by the underwriters, the sprinkler plans should receive some consideration in laying out the beam spacing if ribbed constructed floors are used, though it is possible to arrange the heads for any beam spacing. Some arrangements of beams would require the number of heads and tank supply to be unnecessarily large.

In planning for a warehouse, the shipping facilities and fire protection are usually of the most importance, especially where the storage is very active and goods do not stay stored long. Good light in this case, though perhaps desirable, is of secondary consideration. Large spans in column spacing also is often not necessary, though always desired by an owner until he is informed of the increased cost where the loads are great. The location of the building may demand that trucks be driven in, turned around and backed up to platforms within the building which would necessitate long spans. Where possible, for economy of construction, it is advisable to have shipping sheds outside and not under a tall building carrying heavy loads.

In factories, day light is generally a very important factor though not invariably so, as nowadays with the use of rolled steel sash windows it is sometimes possible to have too great an area of glass, causing a glare within and increasing the cost of heating.

An ideal width for a factory of several stories with wide, open space all around is from 50 to 60 feet, depending on the nature of the business. This would not apply, of course, to a one-story structure having saw-tooth roof, but such a building would not be economical where land is expensive. Often a building of several stories will bring a number of departments in more convenient touch with one another by the use of elevators and chutes than a one-story building with long horizontal communication.

On city property the depth of buildings from street to rear must generally be greater than 50 to 60 feet, but by carrying the windows to the ceiling, making the story heights from 11 to 12 feet in the clear, and being favored by wide streets and low surrounding buildings, good daylight may be had for 40 or more feet back from the windows.

The protection of life and health of the employees nowadays must receive more attention in the planning than formerly, as labor laws and public opinion have greatly improved such conditions.

Economy of construction influences the design as much if not more than anything else. The old style of mill construction with timber floors and brick walls, though still being built, is very rapidly being supplanted by reinforced concrete, with which a building can be constructed for a cost of about 5 to 10 per cent. greater than with non-fireproof material.

The use of brick for curtain walls will give a saving over concrete in some localities, but in the vicinity of New York there is little difference in cost.

Brick can be used in conjunction with concrete for architectural effect without materially affecting the cost one way or the other. A brick veneer, however, as shown by several of the illustrations, is an added cost purely for appearance sake.

The use of structural steel in buildings of the usual industrial type is almost always done at an increased cost over reinforced concrete, except where the steel is not fireproofed but left exposed.

The form of building affects the cost per square foot. All other conditions being equal, a long narrow or very low building costs more per cubic foot than one nearer to the shape of a cube, as the former has more outside wall area, more foundations and more roof area per cubic foot of area. In spite of this, however, the cube is not generally the best form except for a warehouse where day light is not needed.

For architectural effects in industrial work, one must usually confine himself to simple straight lines, variation in color by use of brick, terra cotta and cast concrete details, but usually the designer does not feel justified in letting his imagination run too free with decorations, and, moreover, an ornate factory does not seem in good taste.

Gravity tanks and pent houses are usually an eyesore on top of buildings. Often they can be arranged in pleasing-looking towers, but more often this is difficult and inadvisable as economy is too important and the question of utility requires the elevators to be located in such unfortunate locations from an architectural point of view. In a factory neighborhood there are usually so many chimneys, tanks, pent houses, etc., on nearby buildings that there is little incentive to strive for better things.

FACTORY BUILDING FOR MURPHY VARNISH CO., NEWARK, N. J.

MR. HOWARD CHAPMAN, *ARCHITECT*


# THE BALTIMORE AND OHIO RAILROAD COMPANY'S FREIGHT TERMINAL IN NEW YORK

MR. M. A. LONG, *Architect* MR. FRANCIS LEE STUART, *Engineer*

THIS building occupies the block bounded by Twenty-fifth and Twenty-sixth Streets and by Eleventh and Thirteenth Avenues, is 353 feet long by 68 feet wide and has eight stories for business purposes, with a mezzanine floor for offices, while there is an additional floor below the grade of the street.

The building is of the latest design in fireproof construction and is said to be the largest concrete building on Manhattan Island. A sprinkler system, having as its immediate supply a 50,000 gallon gravity tank located above the roof, and a 25,000 gallon supply in pressure tanks in a concrete house also located on the roof. There are five Siamese connections at the street level to which the city apparatus can be attached. In addition to the sprinkler system there are two hose risers with 75 feet of hose at each floor level.

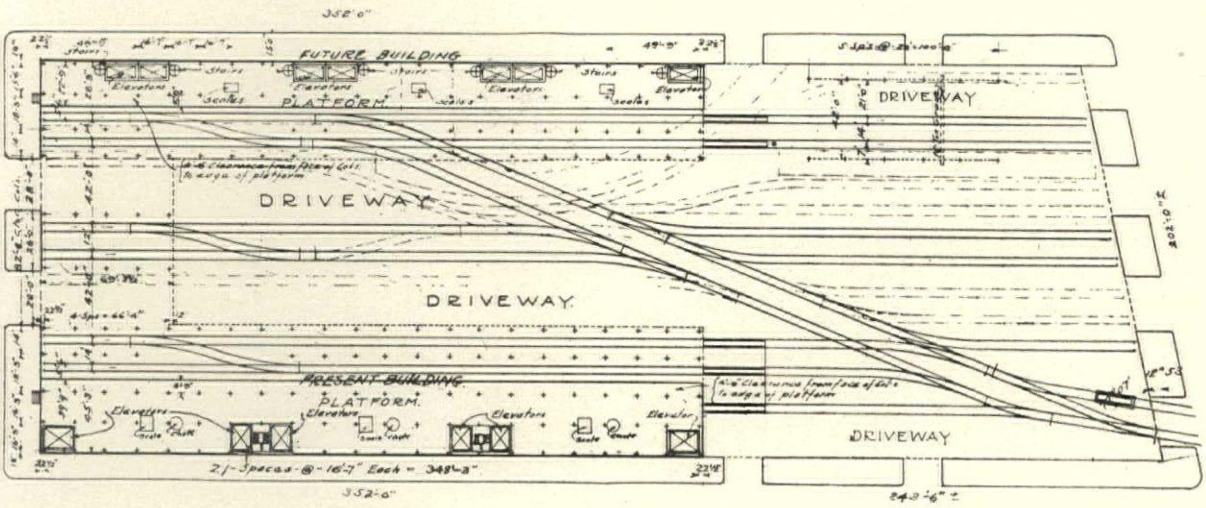
Two tracks, having a capacity of eighteen cars, enter the building. The tracks are so constructed that the floors of the cars are approximately level with the first floor of the building—this floor being the unloading and trucking platform. On the unloading floor are located automatic weighing scales. Six electric elevators, each with a capacity of 10,000 pounds, serve each floor, including the basement. These elevators are located on the street side, so that merchandise stored in the warehouse can be taken out without disturbing the freight handling on the first floor.

Large packages, especially automobiles,

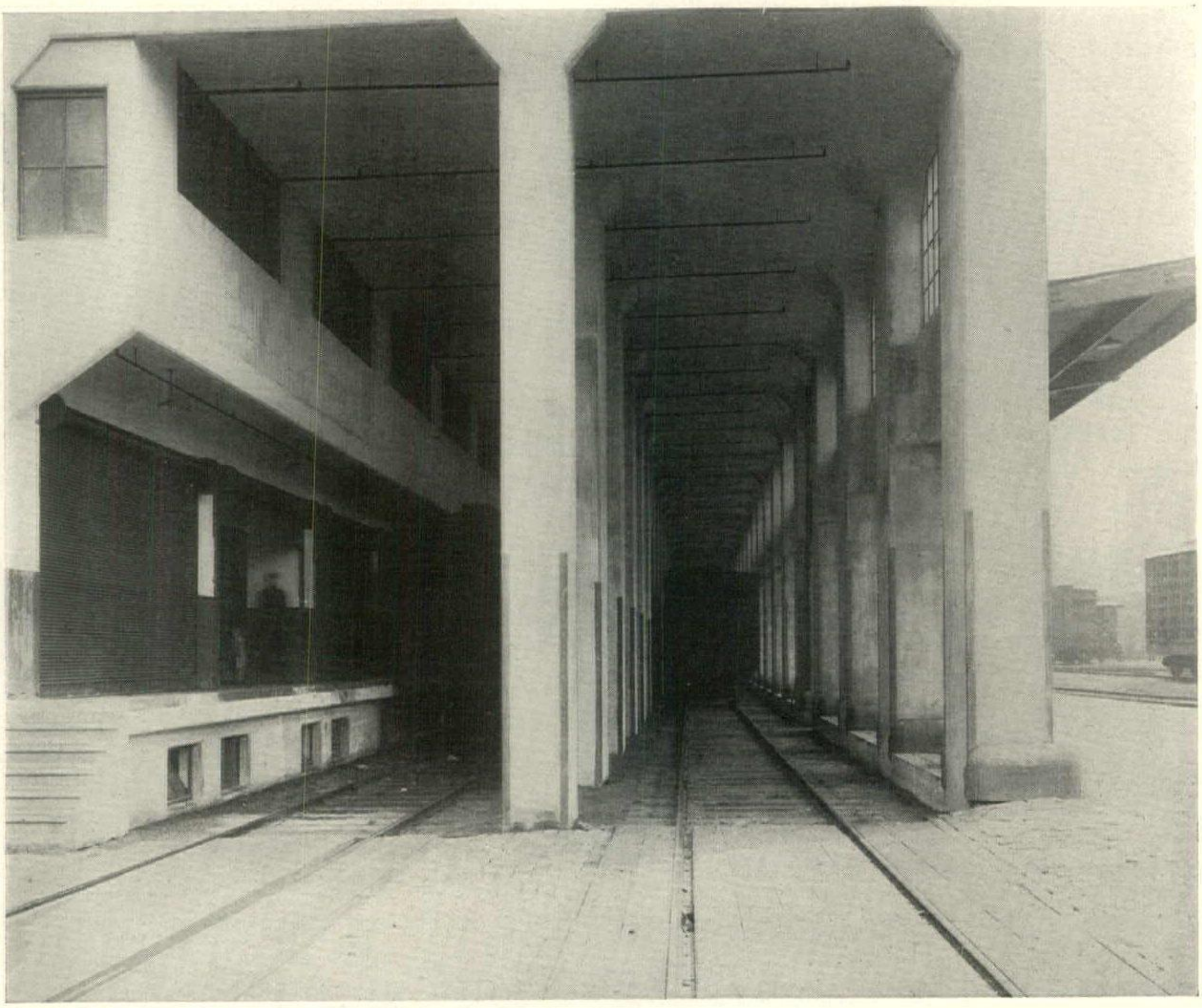
are handled in cars having end doors. To permit of such cars being unloaded directly into the warehouse, another track has been provided with its terminus just outside the end wall, where there is a door as large as the end of a car. Adjacent to this door is a large elevator to handle large packages or automobiles.

As the material stored varies considerably in weight, the floors were designed accordingly, the safe load varying from 500 pounds per square foot on the first floor to 150 pounds per square foot on the top floor. Above the first floor the building is divided into three sections by fire walls, making three separate compartments each served by two elevators, and an inclosed stairway which will also serve as a fire escape.

The structural features are especially interesting—the building being of the "flat




A TYPICAL FLOOR, AND GROUND FLOOR PLAN



RAILROAD TRACK ENTRANCE TO BUILDING

slab" type. It is the first building of this type approved by the building department of Manhattan. In this type the reinforcing rods radiate in all directions from the columns into the floor slabs, the loads being transmitted from the floor direct to the columns.

The curtain walls were carried up monolithic with the floors and the columns instead of being filled in after the column and floor skeleton was in place. This is somewhat unusual in concrete general practice.

Before work was started, test holes were sunk and it was found that the rock sloped very rapidly toward the river; the depth to rock below the street at Eleventh Avenue being approximately 55 feet and at the opposite end of the building approximately 90 feet. There were 3,590 wood piles driven, ranging from 45 to 85 feet. These piles were driven with great difficulty at certain points, as old piles were encountered, the remains of old piers, and at one point an old timber crib bulkhead approximately 35 feet deep and 18 feet wide, which was filled with one-man stone, and it was necessary to drive sheet piles and remove this stone one at a time. A number of old boats were also encountered; these had been filled with stone and sunk, and it was necessary to remove them in the same manner. These obstructions caused delay and added expense, and are noted to show the uncertainties and difficulties encountered in foundation work on Manhattan Island.

The first floor is finished with a rock mastic wearing surface. The office on the mezzanine floor have wood wearing surface, while all storage floors have a granolithic finish.

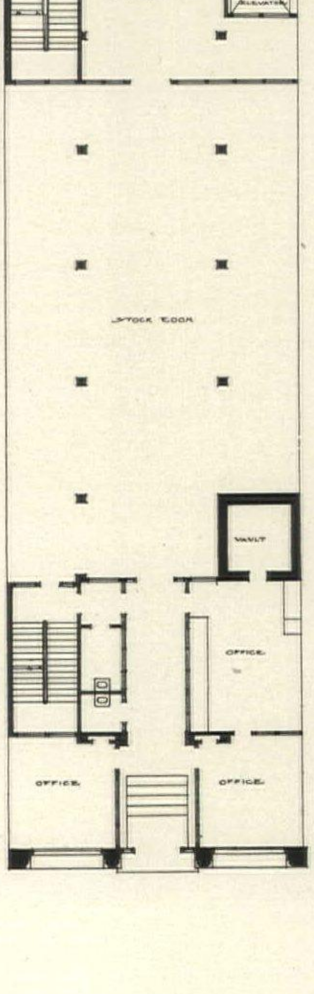
# J. E. FRIEND BUILDING, MILWAUKEE, WIS.

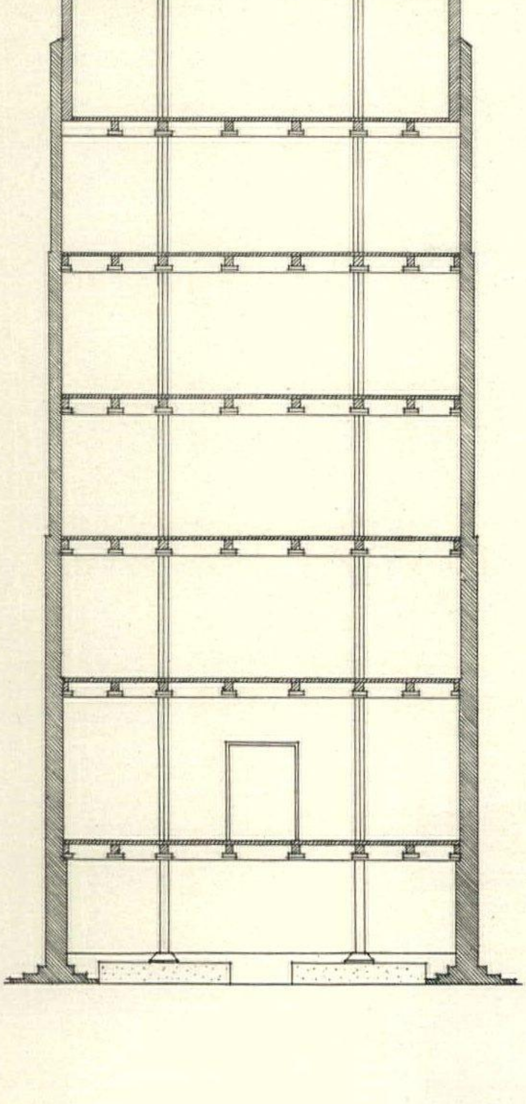
Mr. William H. Schuchardt, *Architect*

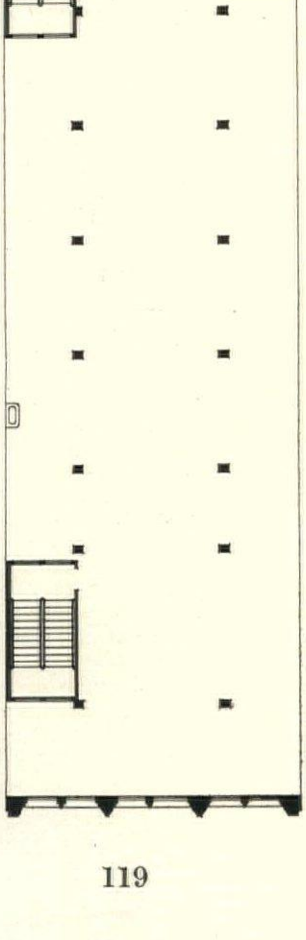
IN A communication received from Mr. Schuchardt, with reference to this building, he states:

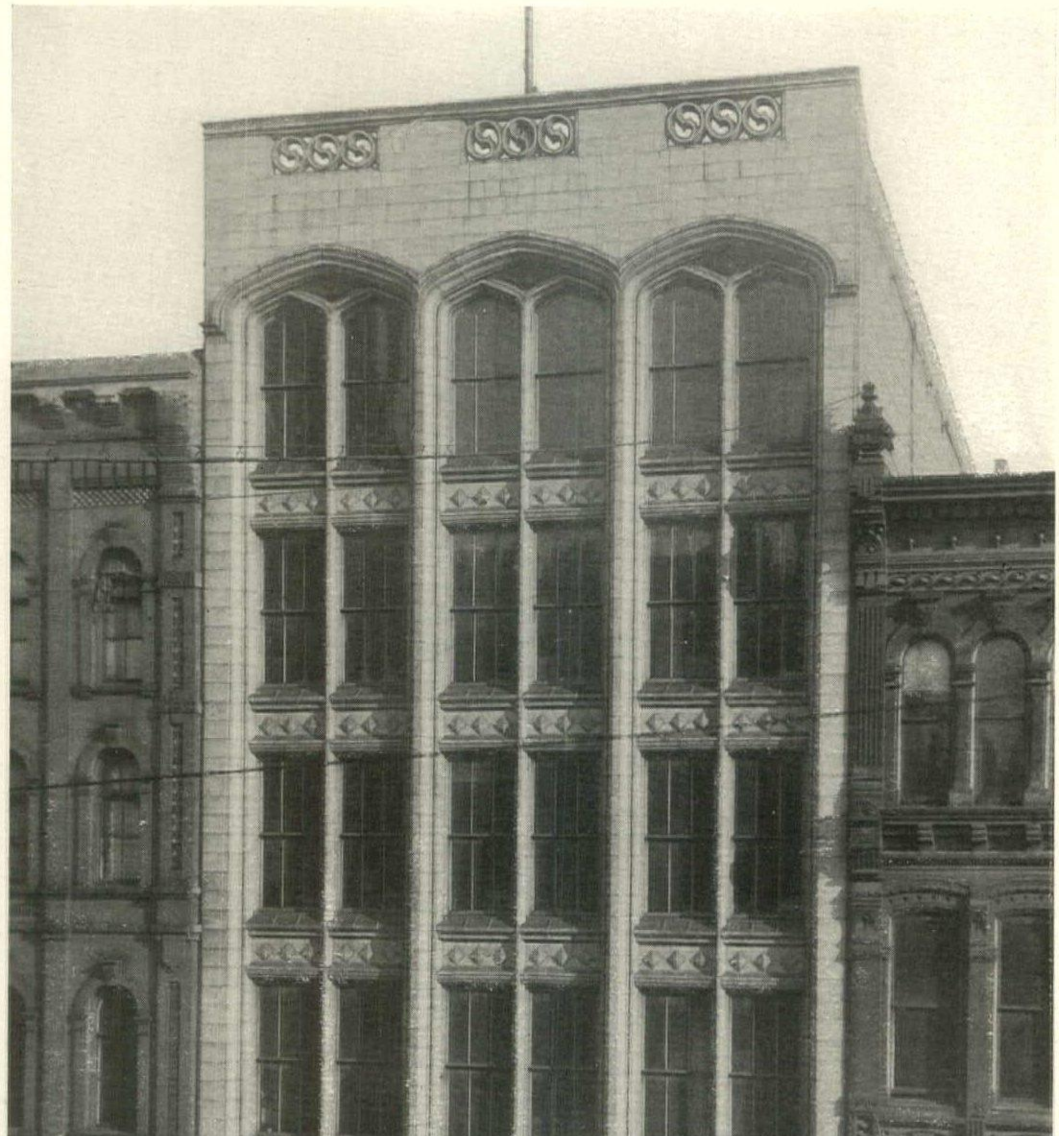
"There are one or two features which may be of interest.

"The old building, which this present structure replaces, was destroyed by fire, and because of poor construction all the floors and walls collapsed, carrying with them some fifteen or twenty firemen. After the debris was cleared, we found that the soil consisted of a layer of perhaps ten feet of sand resting on swamp muck. The old buildings to the north and to the south both rest on foundations of oak ties projecting some four feet into our property. Had we sawn these off on the lot line the old party walls would have collapsed, and had we attempted to drive piles the jarring would have also resulted in collapse. I therefore decided to place reinforced concrete floats (one-half ton per sq. foot) in the center on which we set the columns. These columns support on each floor continuous cantilever girders, running from party wall to party wall and carry all the floor loads. Even the additional walls on the upper floor are carried on these cantilevers as is shown in the section, and no additional weight whatsoever is placed on the old






UPPLIES
MIDDLETON
MORITZ

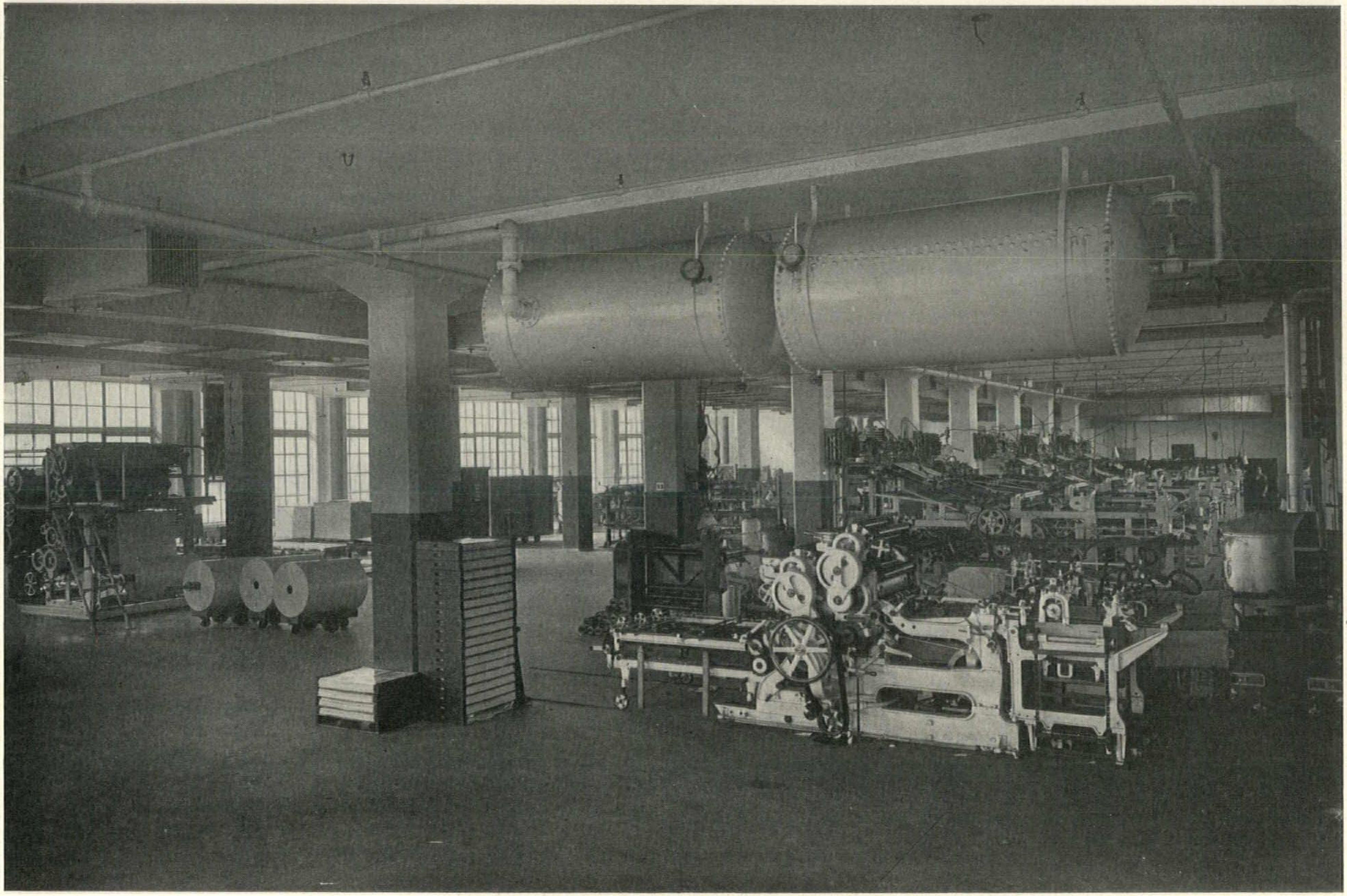
BUILDING FOR HILL PUBLISHING CO., TENTH AVENUE, NEW YORK

MESSRS. STARRETT & VAN VLECK, *ARCHITECTS*

AN OFFICE FLOOR

BUILDING FOR HILL PUBLISHING CO., TENTH AVENUE, NEW YORK

MESSRS. STARRETT & VAN VLECK, *ARCHITECTS*



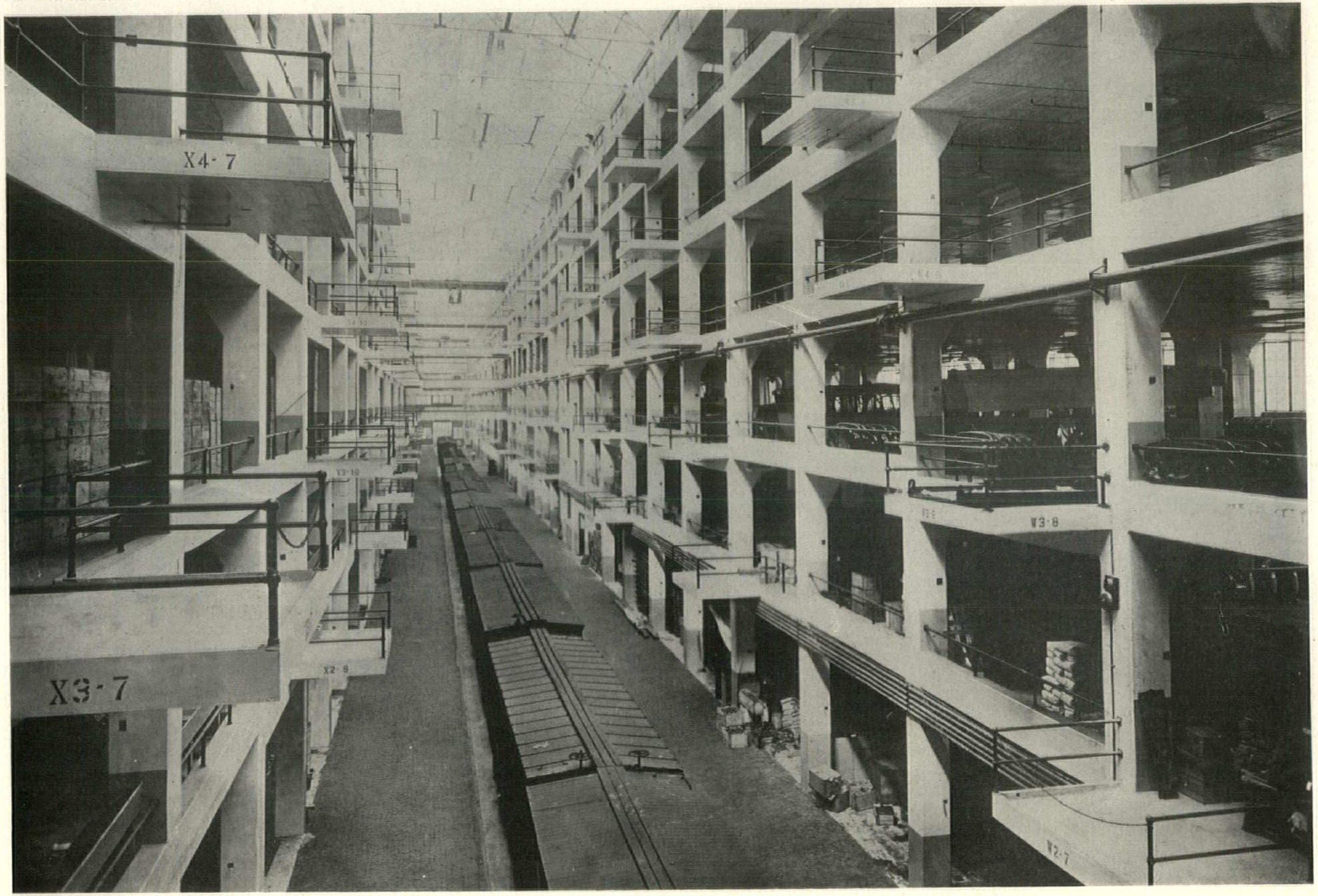
VIEW ON ONE OF THE PRESSROOM FLOORS

BUILDING FOR HILL PUBLISHING CO., TENTH AVENUE, NEW YORK

MESSRS. STARRETT & VAN VLECK, *ARCHITECTS*

BUILDING FOR FORD MOTOR CO., MANCHESTER AVE., DETROIT, MICH.

MR. ALBERT KAHN, *ARCHITECT*, MR. ERNEST WILBY, *ASSOCIATE*




INTERIOR, BUILDING FOR FORD MOTOR CO., MANCHESTER AVE., DETROIT, MICH.

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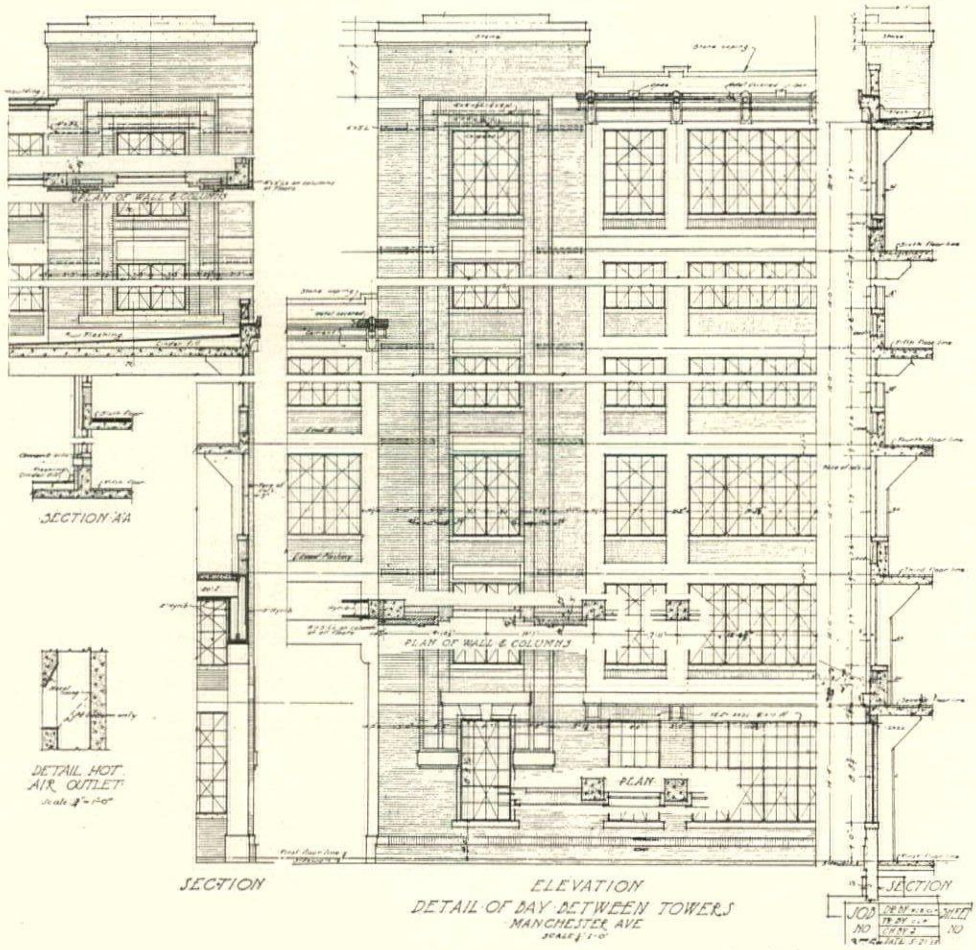


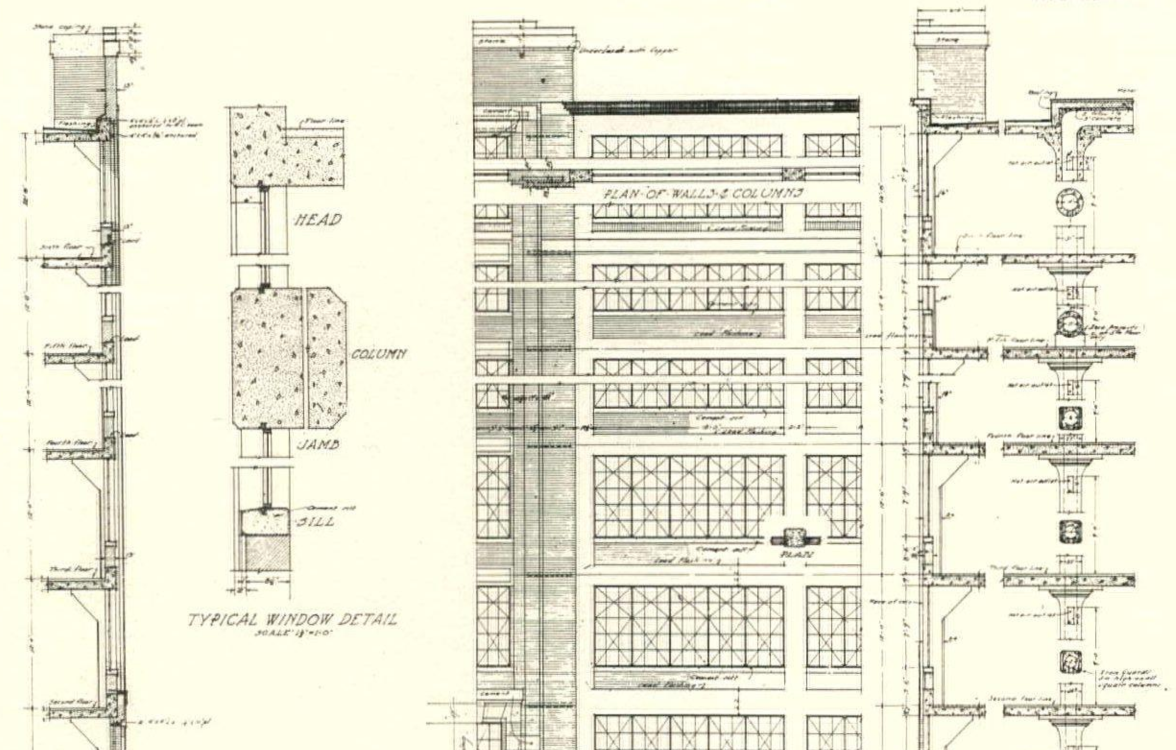


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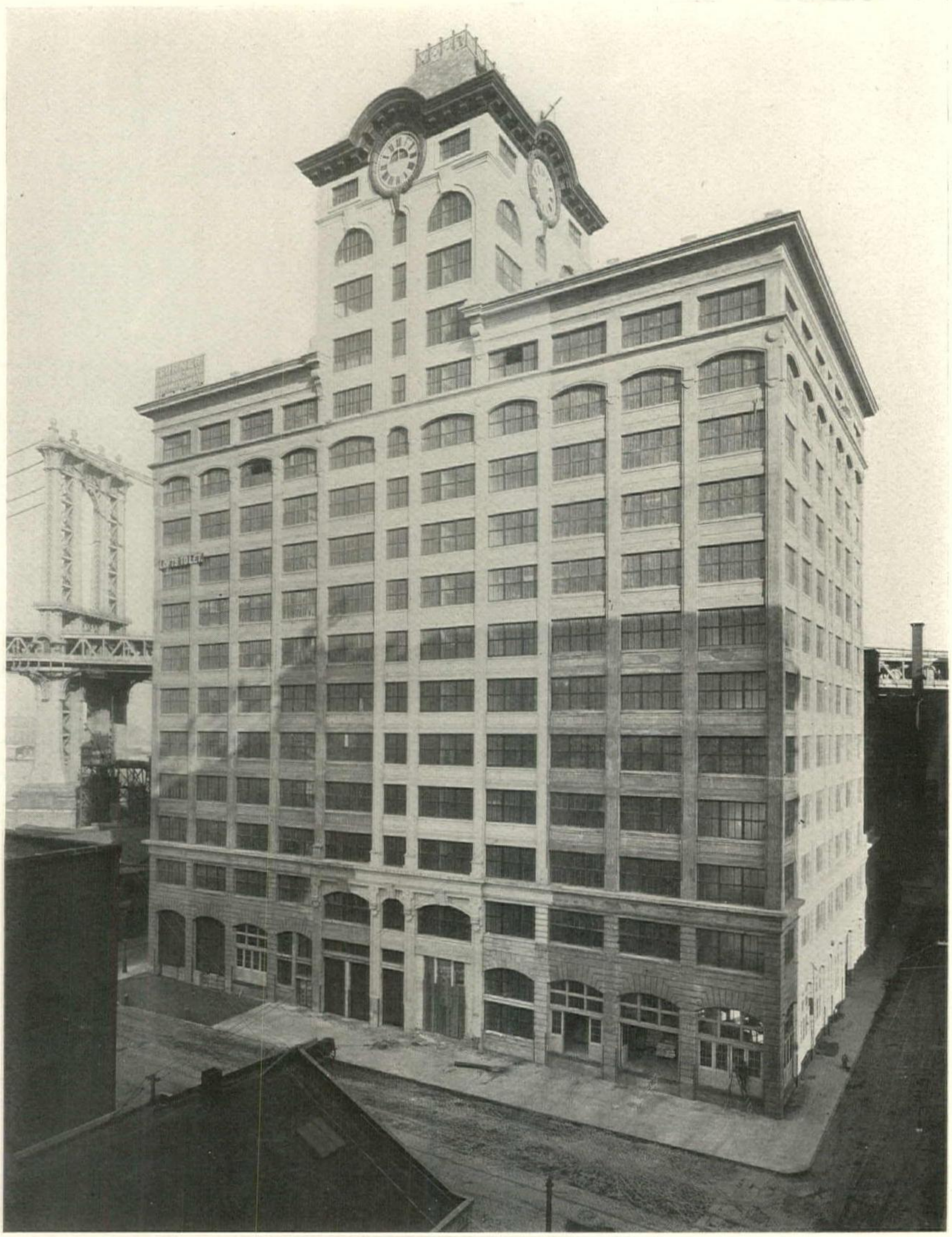

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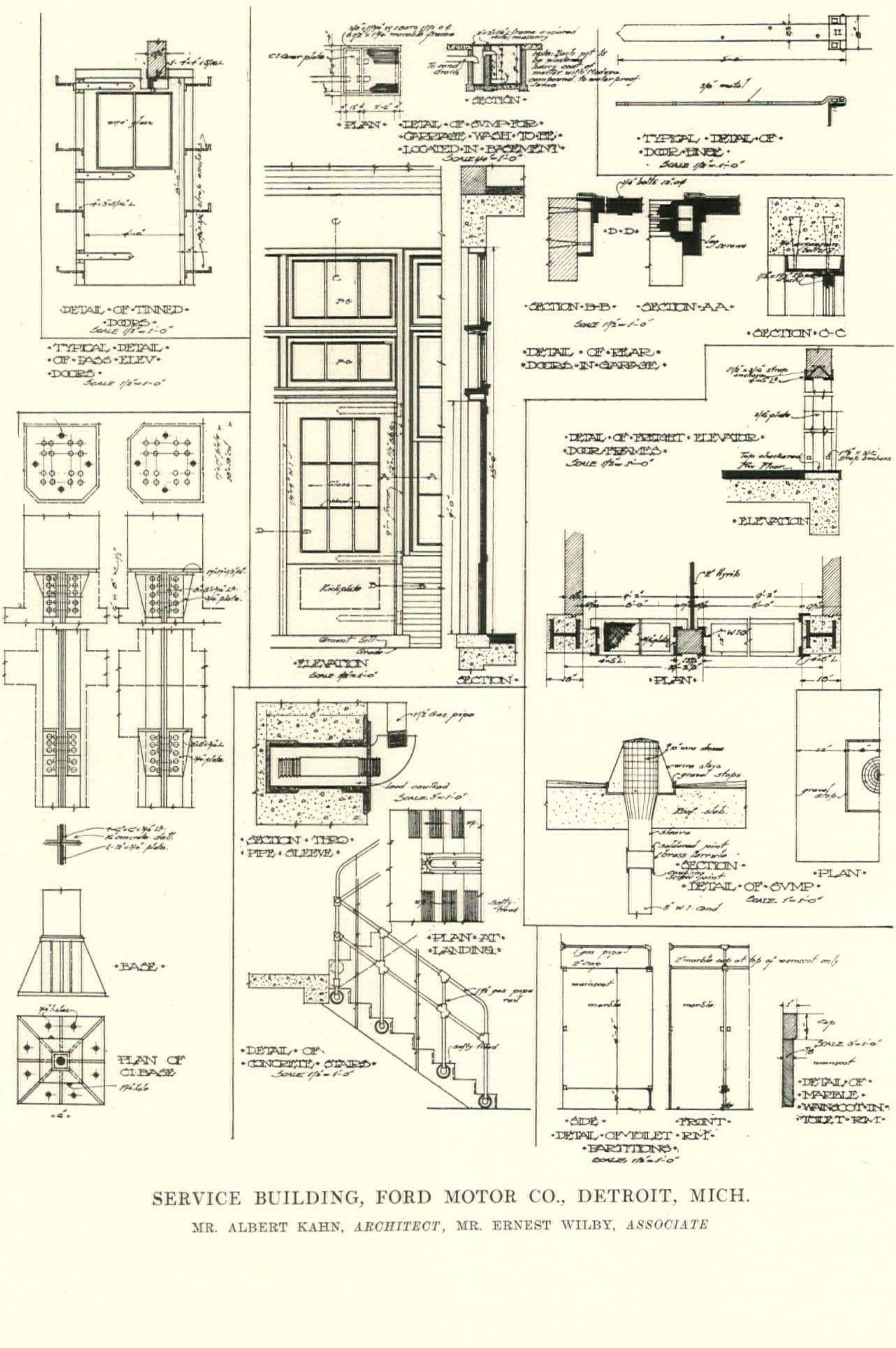


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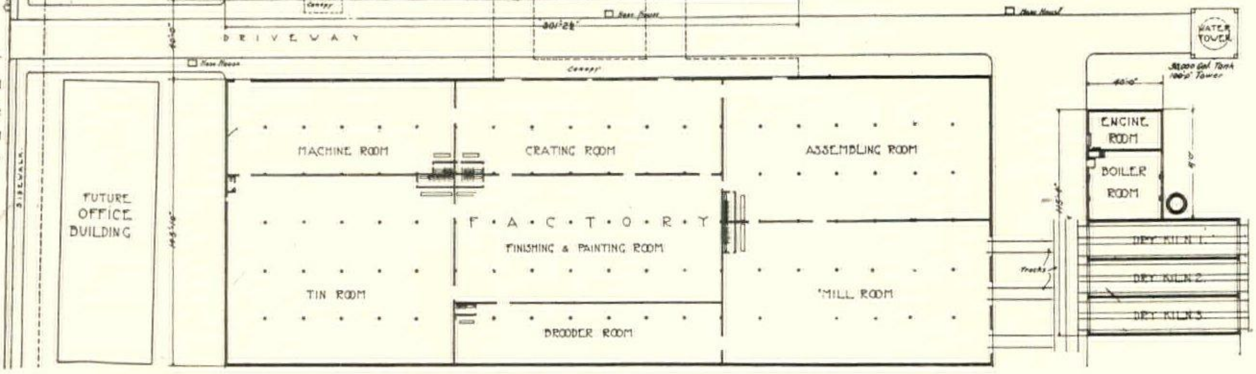


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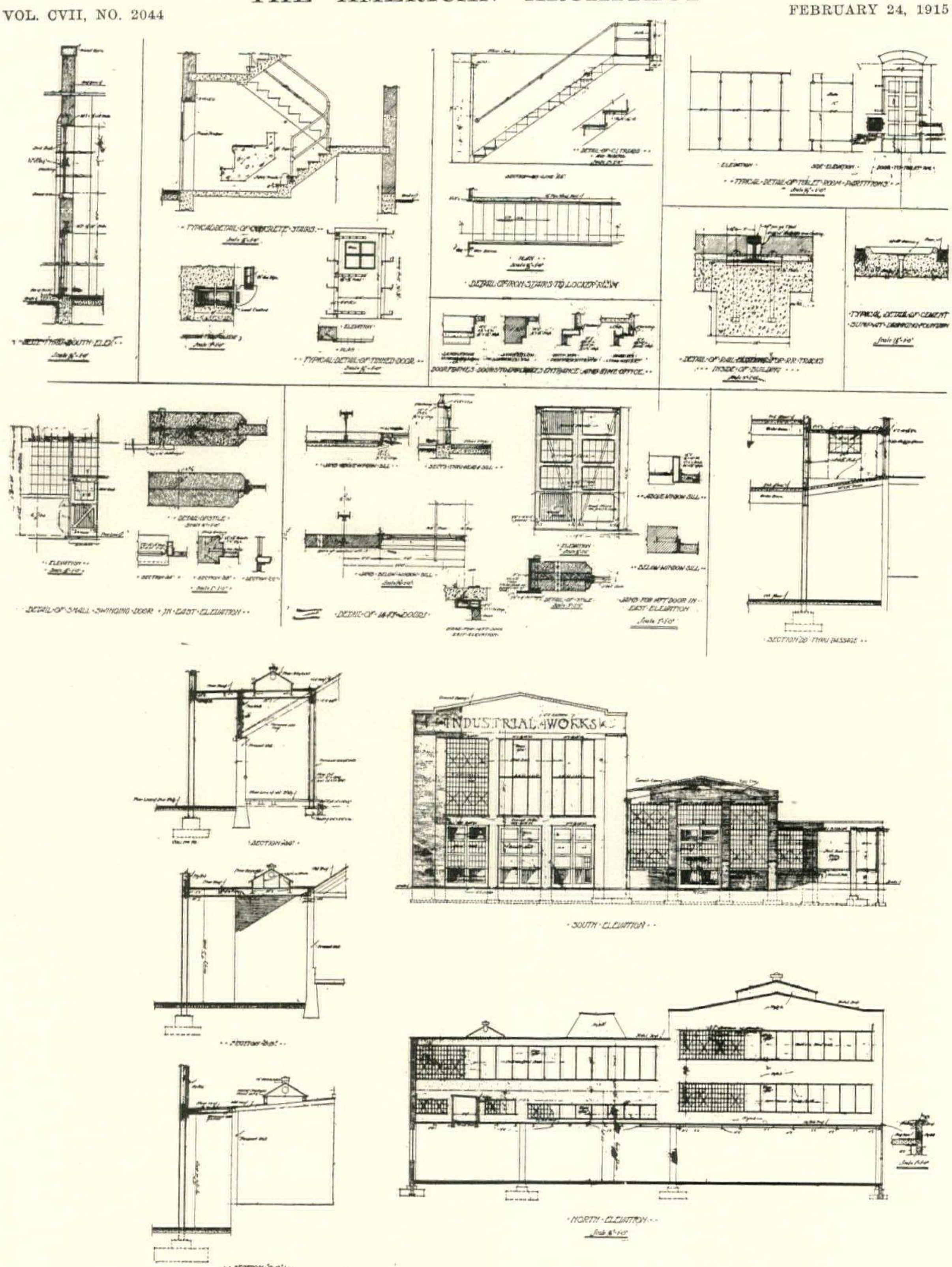


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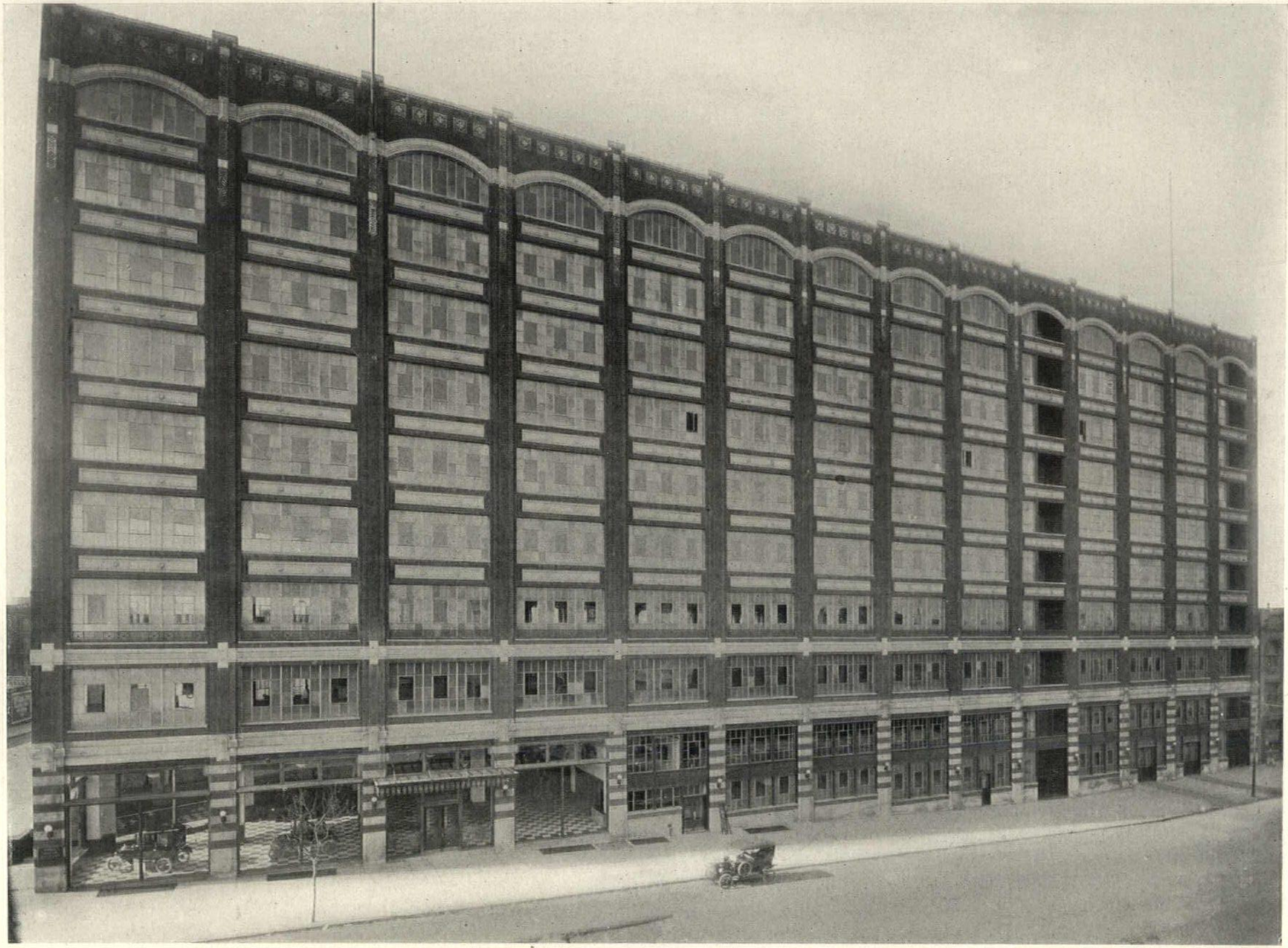

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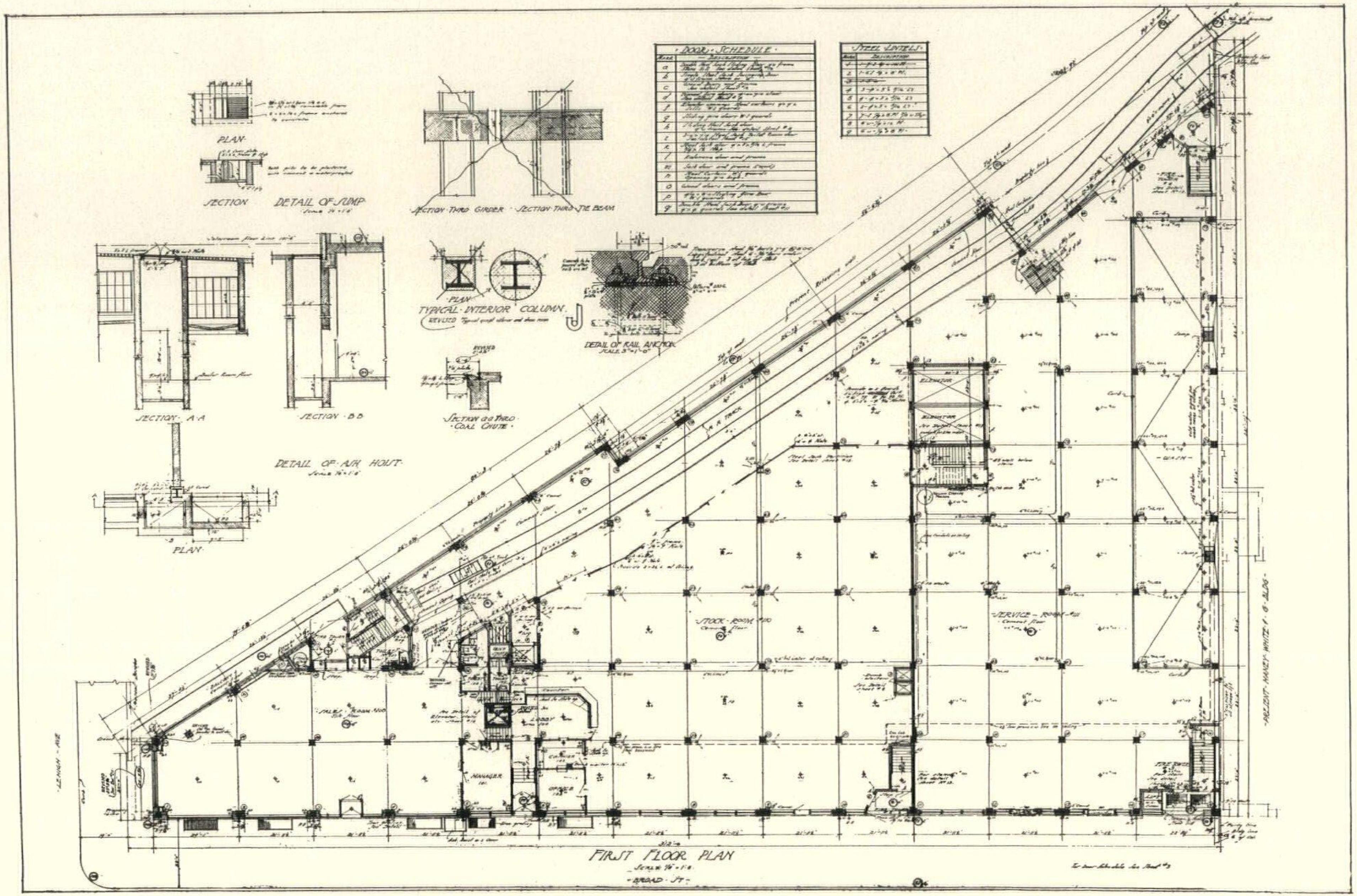


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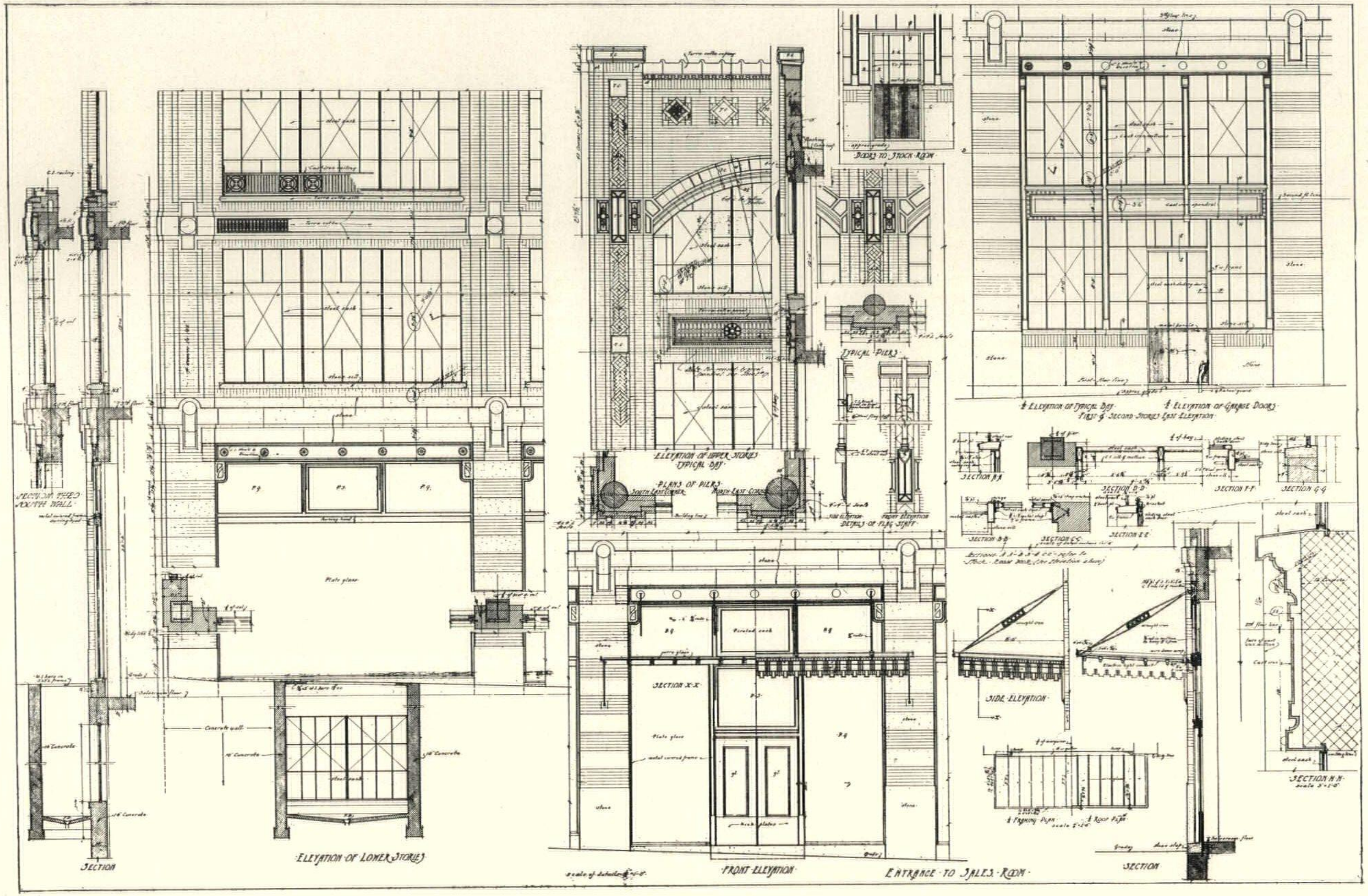


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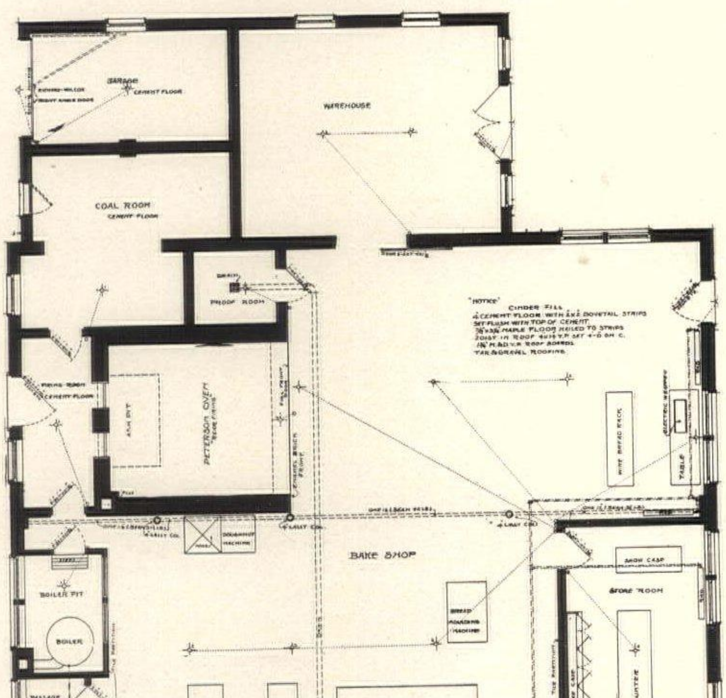


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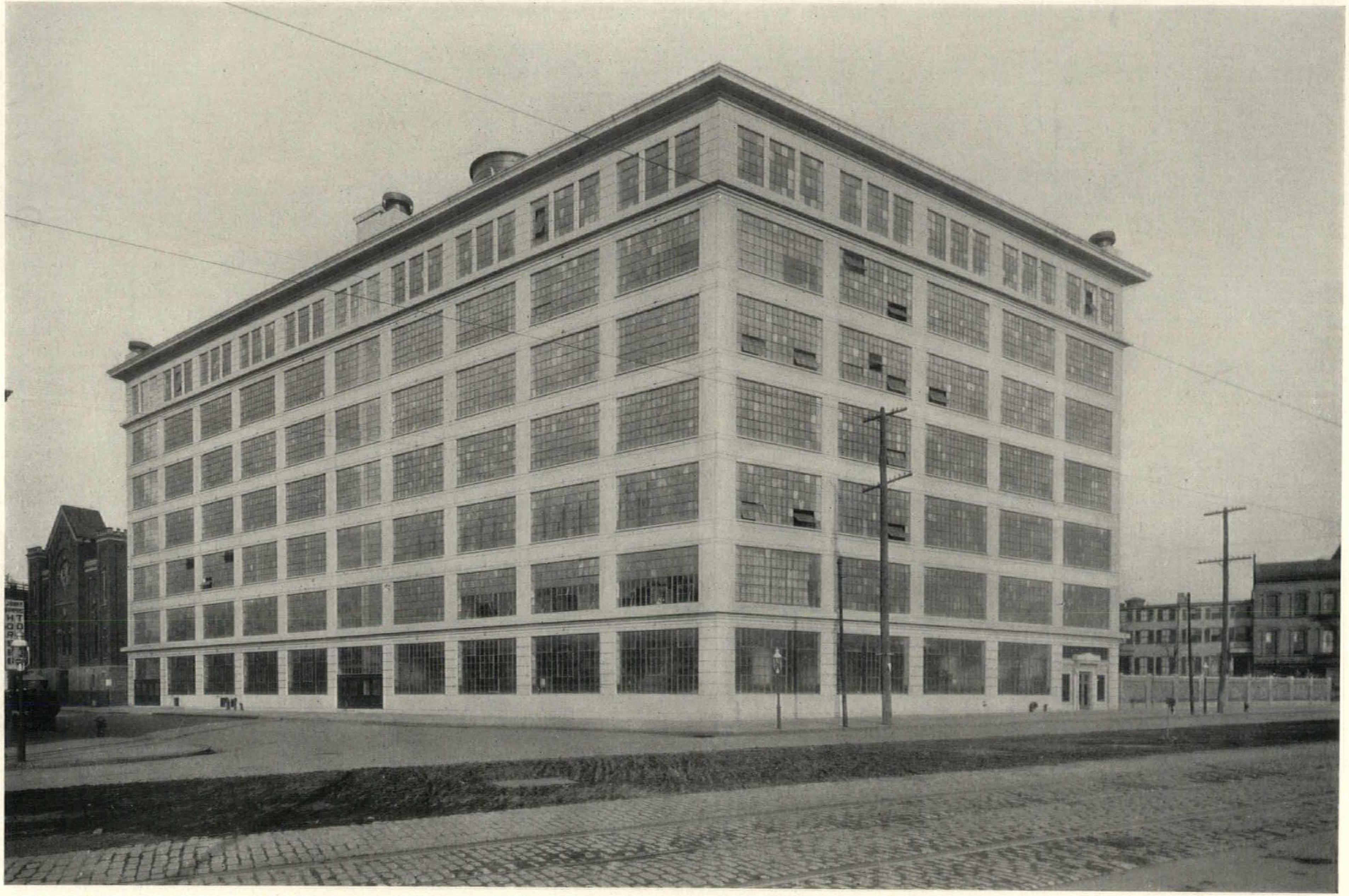

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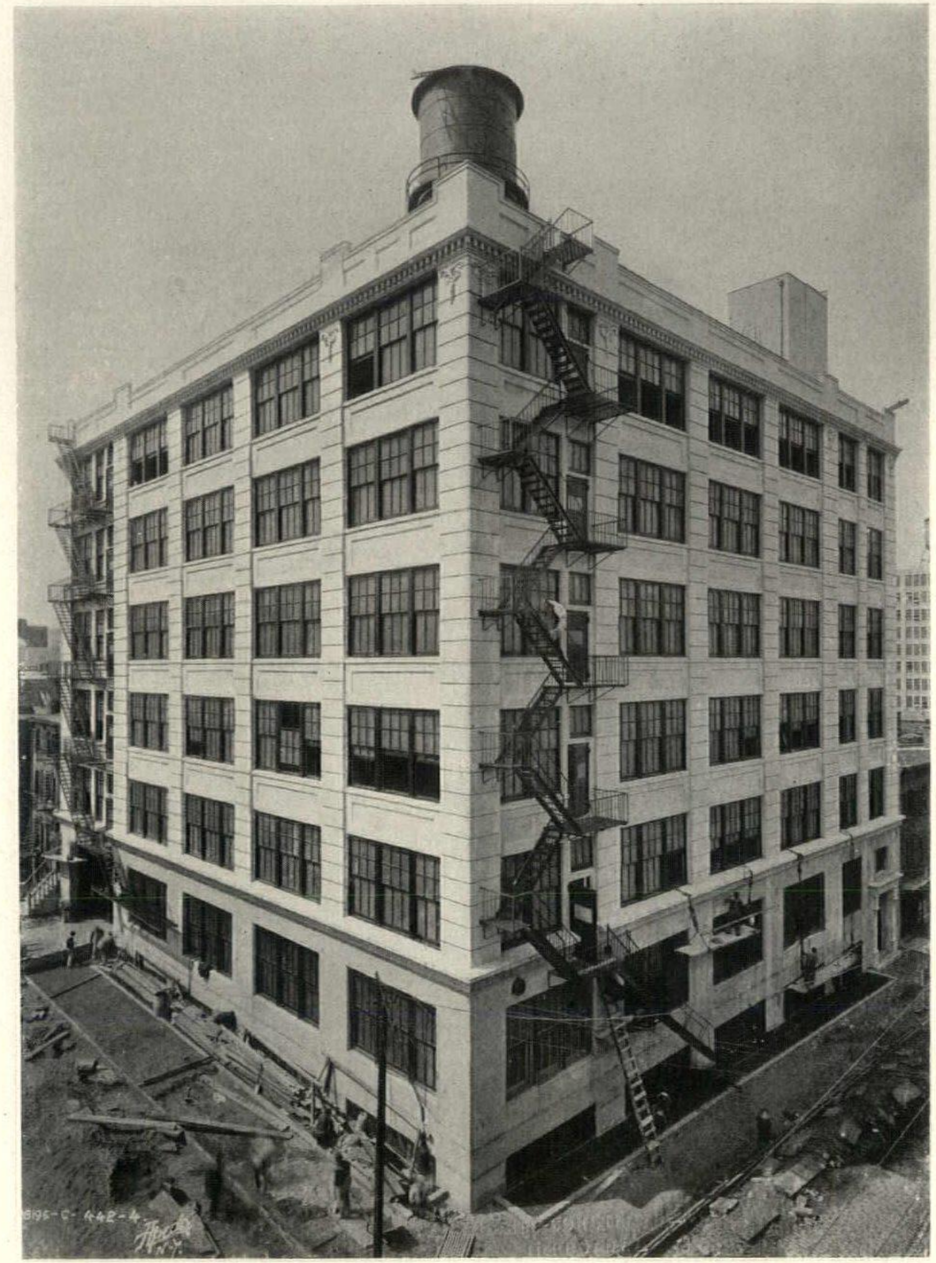

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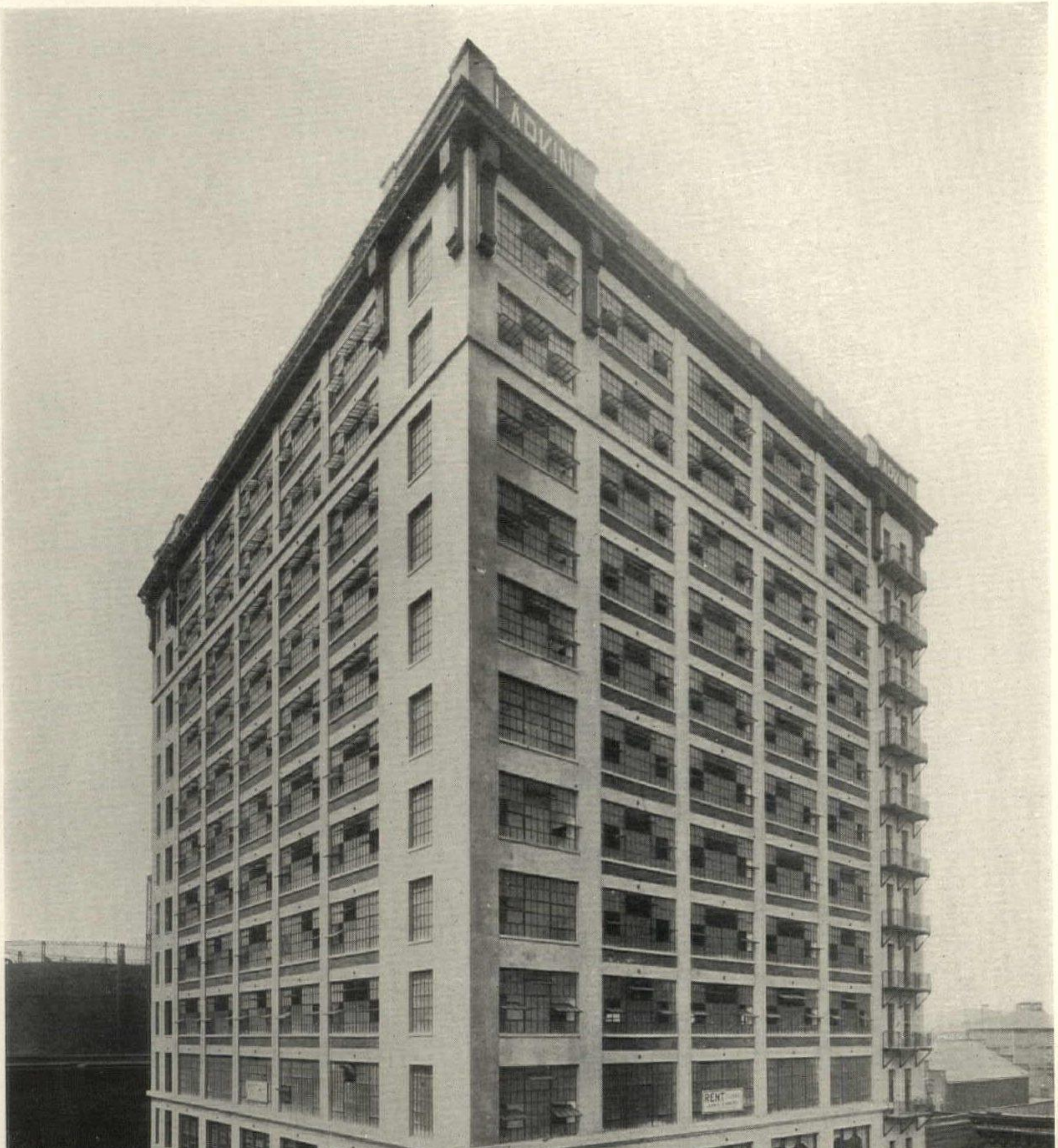


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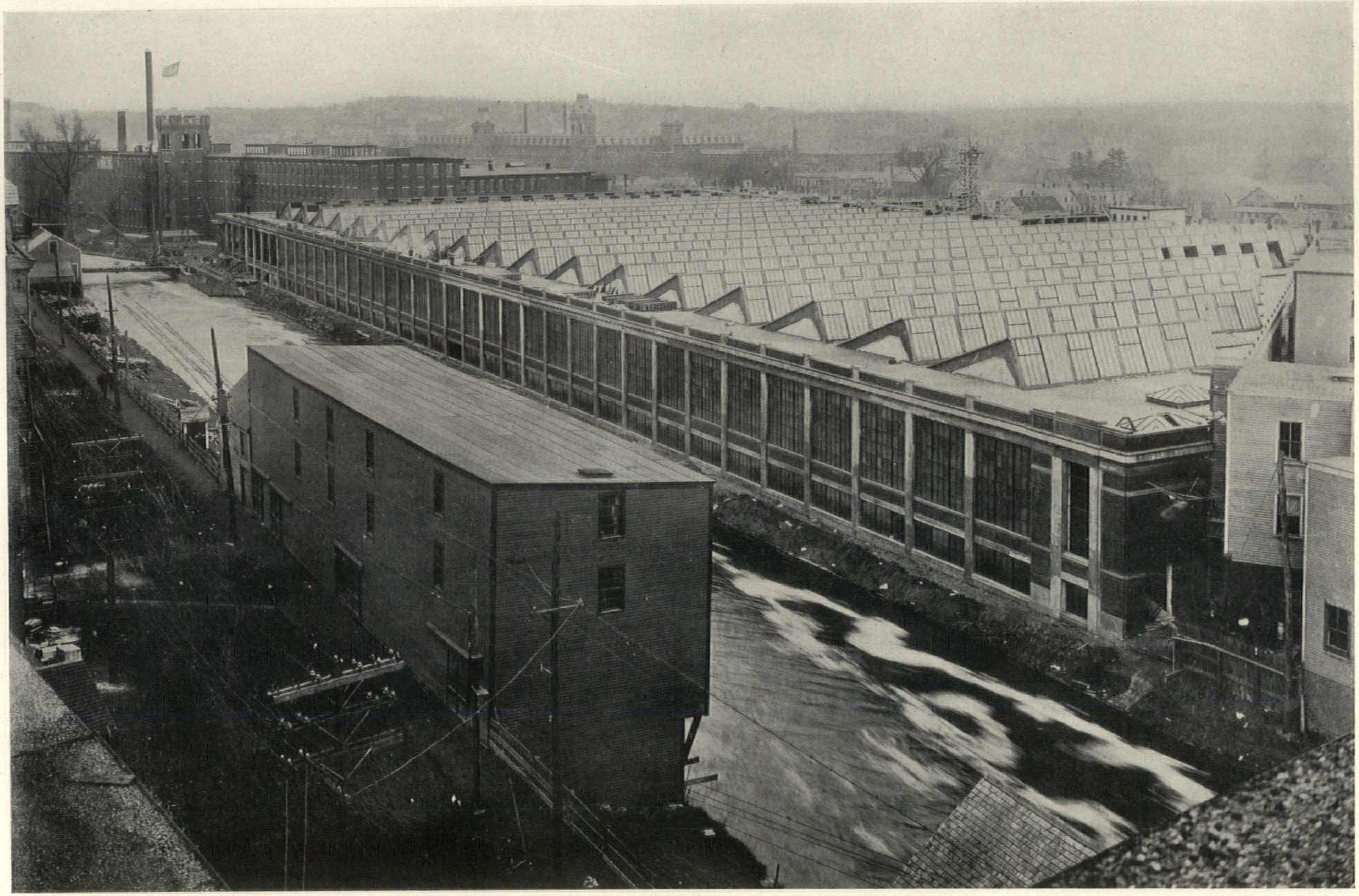

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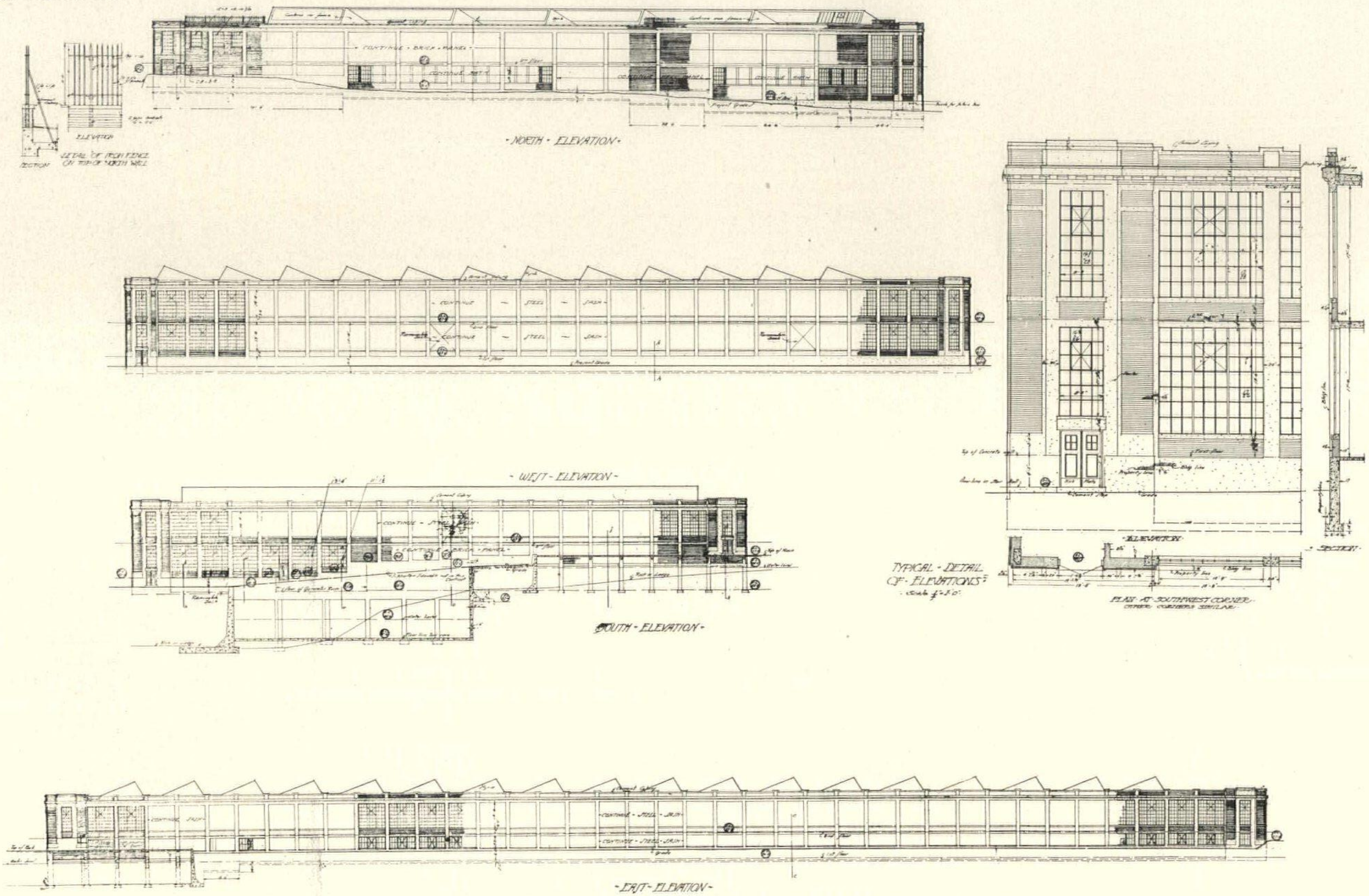


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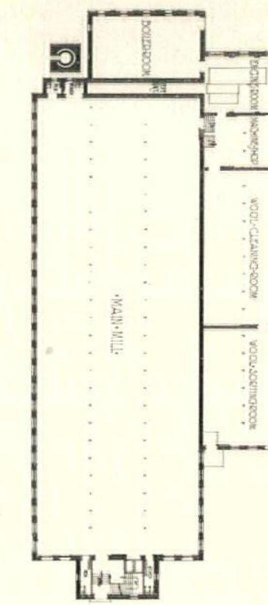


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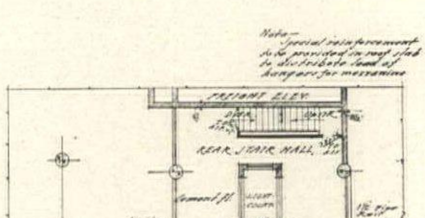
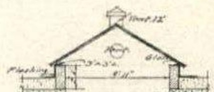



PLAN OF MEZZANINE FLOOR




SECTION · THRU · SKYLIGHT ·
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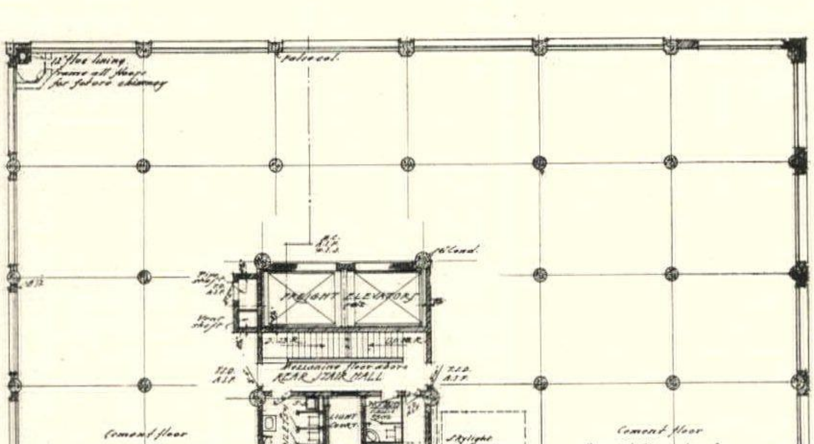


BUILDING FOR JOSEPH MACK PRINTING CO., DETROIT, MICH.

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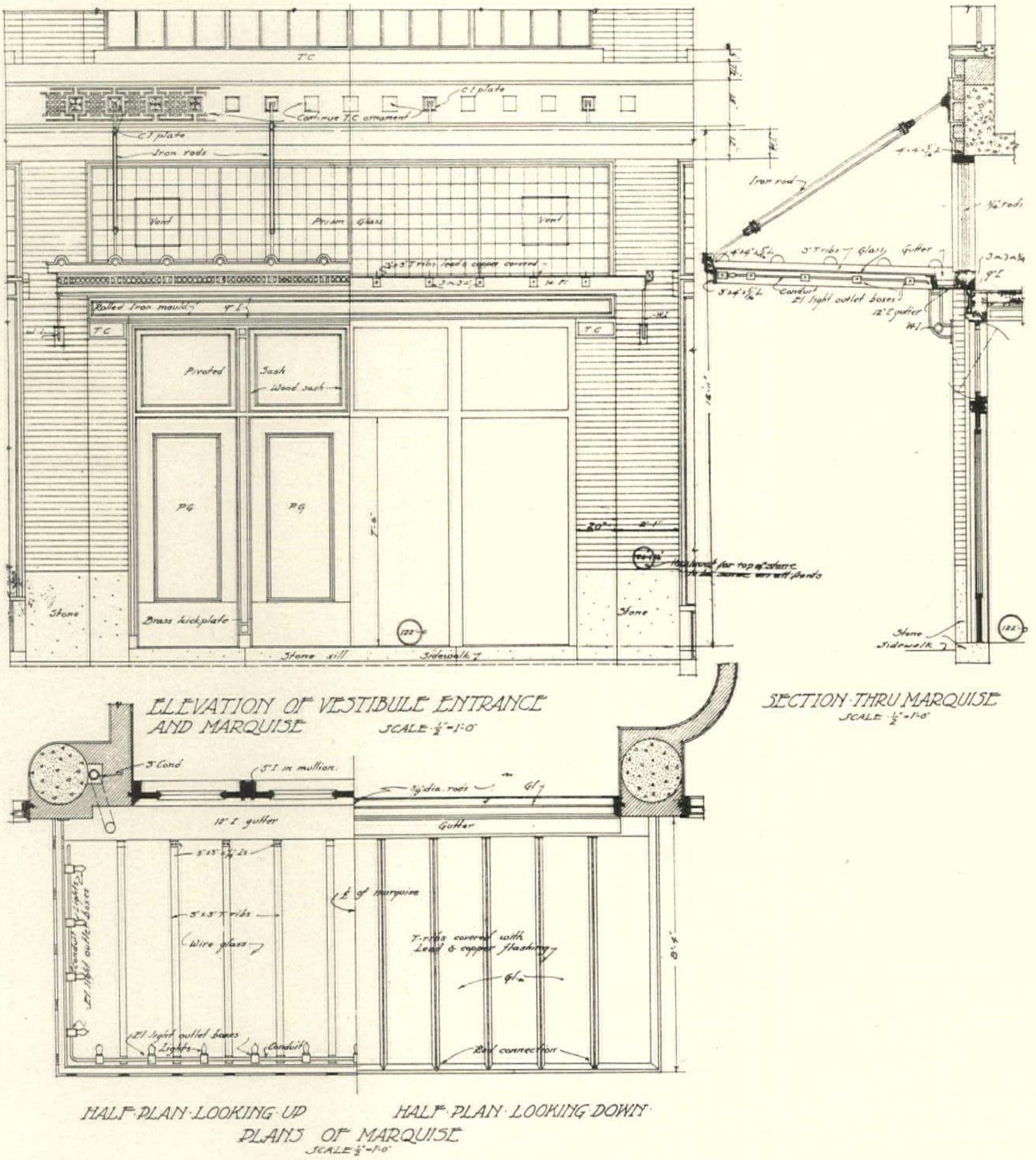
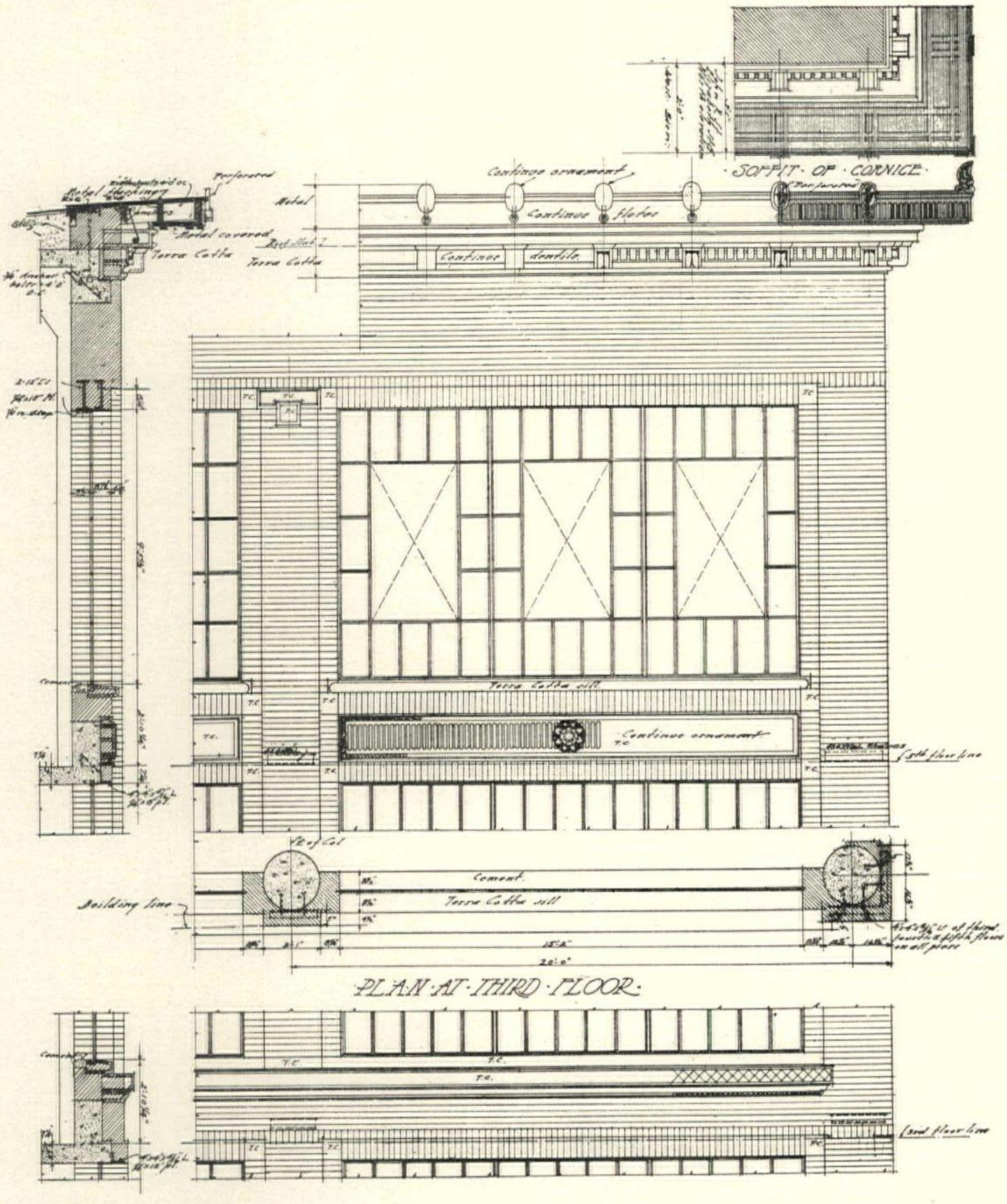



BUILDING FOR JOSEPH MACK PRINTING CO.

MR. ALBERT KAHN, *ARCHITECT*, MR. ERNEST WILBY, *ASSOCIATE*

THE AMERICAN ARCHITECT

VOL. CVII, NO. 2044 FEBRUARY 24, 1915

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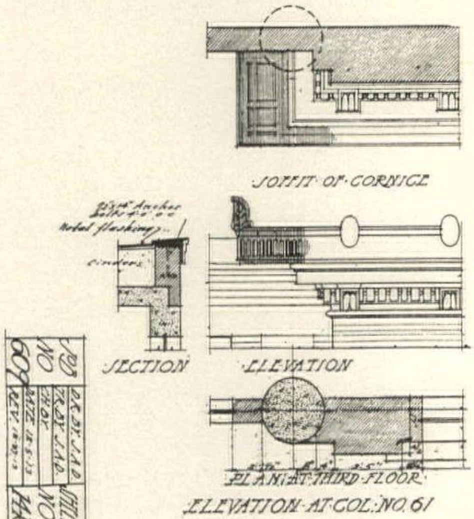


BUILDING FOR
JOSEPH MACK PRINTING CO.

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MR. ALBERT KAHN, *ARCHITECT*
MR. ERNEST WILBY, *ASSOCIATE*


GILBERT GARAGE, JACKSONVILLE, FLA.

MR. HOWARD CHAPMAN, *ARCHITECT*

WAREHOUSE FOR GREAT ATLANTIC & PACIFIC TEA CO.

MR. HOWARD CHAPMAN, *ARCHITECT*

party walls which now stand mainly through the force of habit. The building laws of Milwaukee require two staircases in a loft building, each of which must be completely enclosed in fireproof walls and roof. There is required in addition an approved (by the fire department) fire-escape.

"The exterior had to be very plain, of course, and as the building is long in proportion to its width (40x120) a large glass area was necessary.

"In the smoke-laden air of Milwaukee, white terra-cotta buildings have not been economically or aesthetically successful. Their original whiteness soon takes on an appearance of soiled linen, and as the expense of "washing down" or cleaning is considerable, buildings with white façades soon become extremely unsightly.

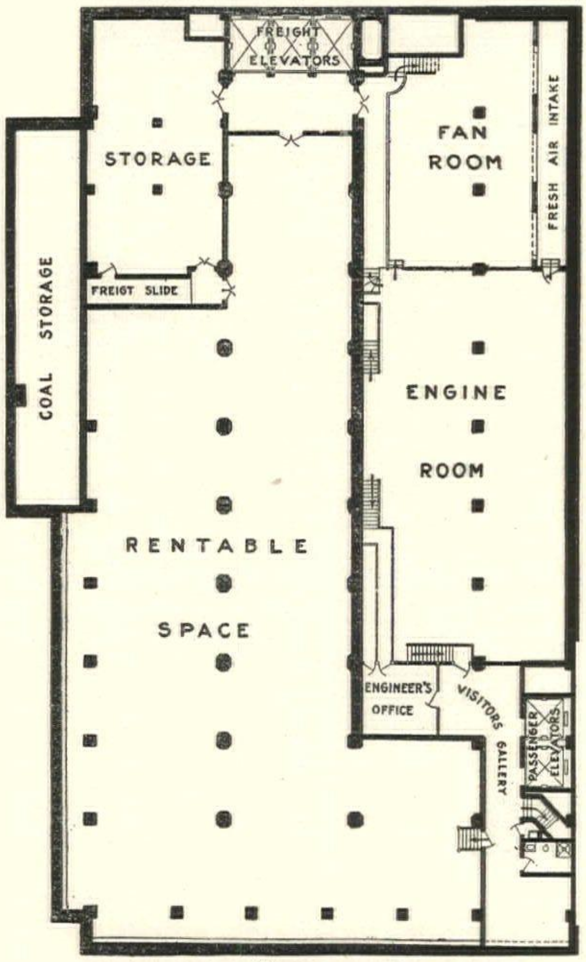
"In looking about for some form of terracotta that could be used and avoid these objections a sample that had just been experimented on was obtained. This sample was of a lot made to imitate granite, in connection with which it was to be used. The imitation was highly successful, and was selected and placed in this building. After wearing for three years the result as to effect and color has been found very satisfactory insofar that the action of smoke and soot appears to mellow the tone and not affect the good appearance of the building."

## Building for the Hill Publishing Company

STARRETT & VAN VLECK, *Architects*

IT IS probably not far from the truth to state that any building, unless especially planned for the purpose to which it is put, is little more than a makeshift. The ordinary loft building, with its floor area broken up by haphazard arrangement of supporting columns, its frequently inadequate systems of communication between floors and its lack of proper heating and ventilating equipment to provide for large numbers of employees, who often work in three shifts throughout the entire twenty-four hours, does not afford ideal accommodations for a large printing plant and the various adjuncts thereto of bindery, composing rooms, press rooms, etc. It is therefore easy to comprehend the reasons that lead the Hill Publishing Company to design and erect a structure that would meet the special requirements of its business, both present and future, so far as they could be anticipated.

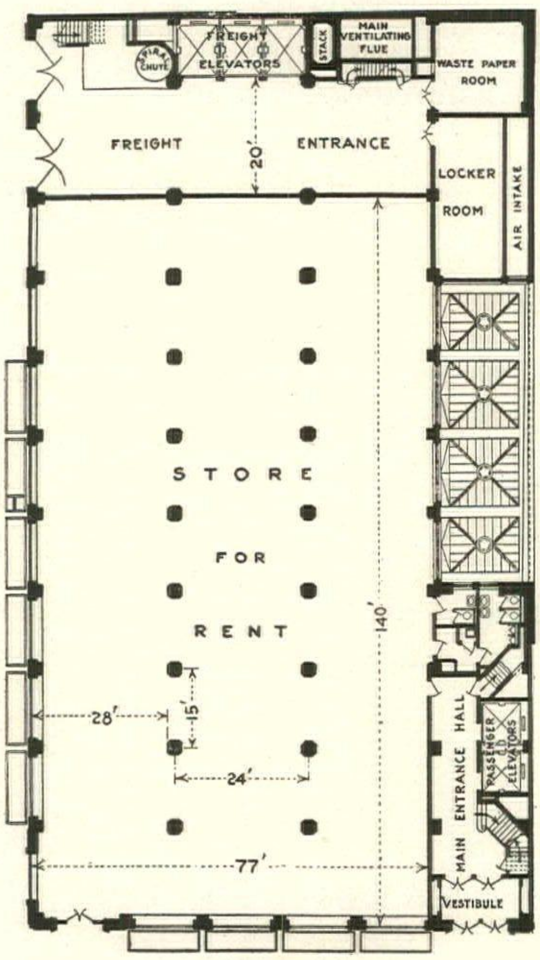
In a building of this character it is of interest to consider, in a general way, the various engineering problems involved and the manner in which the special requirements have been met. Designed primarily for the



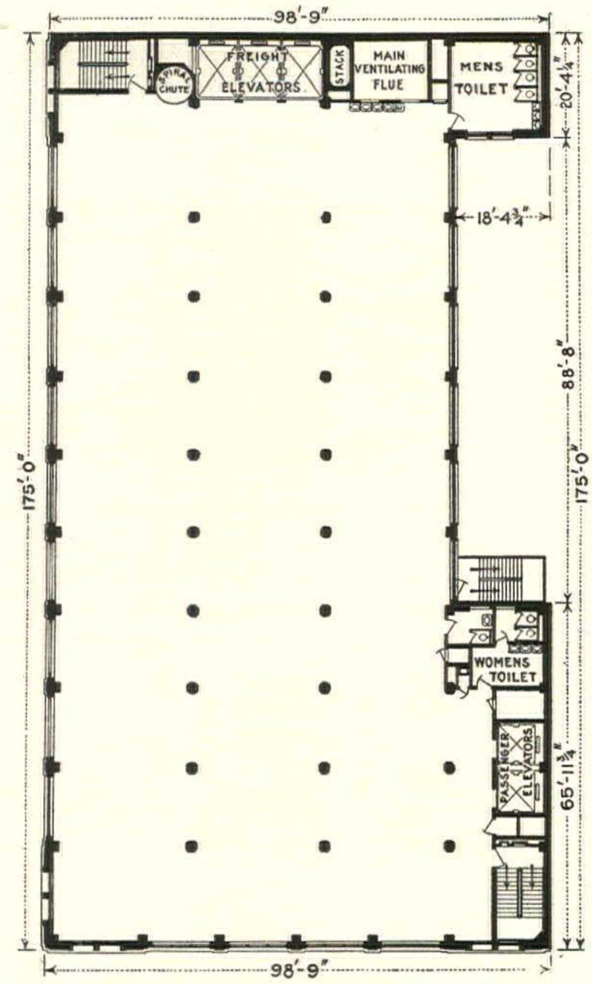

Basement

accommodation of the company whose name the building bears, it was thought wise for economic reasons, as well as to provide for future expansion, to carry the building to a greater height than was demanded by the present requirements of the business, letting to tenants engaged in similar or allied industries, space in excess of that required by the Hill Company.

Structurally the building has been made unusually strong and rigid in order to reduce to a minimum vibration caused by the




Street Floor




Typical Floor

great number of printing presses that run almost continuously. It is said that the Hill Building is the heaviest steel structure of its size in the city. It has been designed to carry 300 pounds per square foot of live load. While but twelve stories in height the building stands as high as the average sixteen-story structure. The story heights are approximately sixteen feet, affording unusual facilities for day-lighting and ventilation. Regard for both the comfort and health of employees is manifest throughout all stories. An ample supply of fresh air is assured as much perhaps by the unusual story height as by the mechanical blowers which are a feature of the building equipment. Combined with these essentials of proper lighting, heating and ventilating, none of which can be slighted without affecting the result of the whole, modern business realizes, as this building fully exemplifies, that good architecture is a valuable commercial asset. The theory that a building for purely utilitarian purposes need only be the plainest sort of a shelter has long since, and fortunately, been set aside. The result of modern ideas of business concerning buildings devoted to housing it is shown in the most insistent way in this new building for the Hill Publishing Company.

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# FACTORY CONSTRUCTION AND EQUIPMENT

*By* WALTER S. TIMMIS

THE problems involved in industrial buildings are probably as numerous and complex as any other type of construction; these problems involve a peculiar combination of architectural and engineering skill coupled with sound business judgment and a close study of manufacturing methods. As has many times been demonstrated, the time to call in the architect and engineer is before the site is purchased. The nature of the work or business to be carried on should be carefully considered and a location determined; the conditions governing location are briefly as follows:—

1. Proximity to good labor market.
2. Residence facilities for employees.
3. Shipping facilities.
4. Water supply and sewerage disposal.
5. Land value compared with building value.
6. Relation of business offices to factory.
7. Proximity to raw material.
8. Character of sub-surface conditions.

Of the many ramifications of the above points, it is not possible to speak here, but mention should be made of the fact that every one of these are cardinal points in the selection of a site for a manufacturing building.

The character of a building is largely determined by its character of occupancy as also is the height, but both character and type of construction and height are also governed largely by the cost of the land. There is a very definite relation of cost of improvement to the cost of land, a close study of which should be made before proceeding too far in any project. If a prospective owner would know whether his judgment as to location for a particular building on a particular spot is good, let him apply for a loan


MAIN ENTRANCE—OSGOOD-BRADLEY BUILDING, WORCESTER, MASS.

MR. WALTER S. TIMMIS, *ARCHITECT* AND *ENGINEER*

to a first-class banking institution. Lucky is the owner who can secure land, the land value appreciation of which will offset the building depreciation, but this can be done by proper forethought and careful planning.

It will be seen that the selection of a site determines to a great extent the character of the building to be erected upon that site, especially from an investment standpoint. This brings us to the consideration of the number of floors which can be most economically placed on any particular site. While the present practice of adding floor upon floor on one site can, by modern methods of construction, be extended to practically unlimited heights, the addition of such height beyond a certain point is accompanied by heavy increased costs, which requires a large increase of earning capacity and acts as an economic restriction. It is necessary, therefore, to determine the most economical height for a building for the particular plot

TABLES SHOWING COST OF BUILDING PER SQUARE FOOT OF PLOT

TABLE NO. 1. BUILDING 50 FEET HIGH

| Percentage of Plot Covered | 10c. | 12c. | 14c. | 16c. | 18c. | 20c. | 22c. | 24c. | 26c. | 28c. | 30c. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80% | $5.50 | $6.60 | $7.70 | $8.80 | $9.90 | $11.00 | $12.10 | $13.20 | 14.30 | $15.40 | $16.50 |
| 85% | 5.75 | 6.90 | 8.05 | 9.20 | 10.35 | 11.50 | 12.65 | 13.80 | 14.95 | 16.10 | 17.25 |
| 90% | 6.00 | 7.20 | 8.40 | 9.60 | 10.80 | 12.00 | 13.20 | 14.40 | 15.60 | 16.80 | 18.00 |

TABLE NO. 2. BUILDING 75 FEET HIGH

| Percentage of Plot Covered | 10c. | 12c. | 14c. | 16c. | 18c. | 20c. | 22c. | 24c. | 26c. | 28c. | 30c. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80% | $7.50 | $9.00 | $10.50 | $12.00 | $13.50 | $15.00 | $16.50 | $18.00 | $19.50 | $21.00 | $22.50 |
| 85% | 7.87 | 9.42 | 11.02 | 12.60 | 14.17 | 15.75 | 17.32 | 18.90 | 20.47 | 22.05 | 23.60 |
| 90% | 8.25 | 9.90 | 11.65 | 13.20 | 14.85 | 16.50 | 18.15 | 19.80 | 21.45 | 23.10 | 24.75 |

TABLE NO. 3. BUILDING 100 FEET HIGH

| Percentage of Plot Covered | 10c. | 12c. | 14c. | 16c. | 18c. | 20c. | 22c. | 24c. | 26c. | 28c. | 30c. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80% | $9.50 | $11.40 | $13.30 | $15.20 | $17.10 | $19.00 | $20.90 | $22.80 | $24.70 | $26.60 | $28.50 |
| 85% | 10.00 | 12.00 | 14.00 | 16.00 | 18.00 | 20.00 | 22.00 | 24.00 | 26.00 | 28.00 | 30.00 |
| 90% | 10.50 | 12.60 | 14.70 | 18.00 | 18.90 | 21.00 | 23.10 | 25.20 | 27.30 | 29.40 | 31.50 |

TABLE NO. 4. BUILDING 125 FEET HIGH

| Percentage of Plot Covered | 10c. | 12c. | 14c. | 16c. | 18c. | 20c. | 22c. | 24c. | 26c. | 28c. | 30c. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80% | $11.50 | $13.80 | $16.10 | $18.40 | $20.70 | $23.00 | $25.30 | $27.60 | $29.90 | $32.20 | $34.50 |
| 85% | 12.12 | 14.15 | 16.97 | 19.40 | 21.82 | 24.25 | 26.67 | 29.10 | 31.52 | 33.95 | 36.36 |
| 90% | 12.75 | 15.30 | 17.85 | 20.40 | 22.95 | 25.50 | 28.05 | 30.60 | 33.15 | 35.70 | 38.25 |

TABLE NO. 5. BUILDING 150 FEET HIGH

| Percentage of Plot Covered | 10c. | 12c. | 14c. | 16c. | 18c. | 20c. | 22c. | 24c. | 26c. | 28c. | 30c. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80% | $13.50 | $16.20 | $18.90 | $21.60 | $24.30 | $27.00 | $29.70 | $32.40 | $35.10 | $37.80 | $40.50 |
| 85% | 14.25 | 17.10 | 19.95 | 22.80 | 25.65 | 28.50 | 31.35 | 34.20 | 37.05 | 39.90 | 42.75 |
| 90% | 15.00 | 18.00 | 21.00 | 24.00 | 27.00 | 30.00 | 33.00 | 36.00 | 39.00 | 42.00 | 45.00 |

under consideration, bearing in mind that the higher the cost of land, the higher will be the building to bring down the cost of the occupied floor space; but beyond a certain point it is not possible to build on account of the increase in cost of construction and operation.

The tables on page 127 give the cost of buildings for the various heights as shown per square foot of plot determined for given rates for cubic foot and for percentage of plot area covered by building, it being assumed that the basement covers the entire plot. Tables 1, 2, 3, 4 and 5 (page 124) give the cost of buildings 50′, 75′, 100′, 125′ and 150′ high respectively, as measured from the sidewalk, each of them having a basement of twelve feet from the sidewalk level to the finished basement floor.

It is now possible to begin laying out the building, but before the actual plans can be prepared, it will be necessary to secure the area of every department in the old building, assuming we are erecting a new building to take the place of a building already existing. The aggregate area of the present departments, together with such additional area as may be required as a result of experience with the present building will guide one in the proper spacing of the area required in the new building. An analysis of the space occupied by the various departments will determine whether or not this space should be increased or diminished. The various manufacturing processes should be analyzed to determine what relation they bear to each other and a study made of the entire process of manufacturing from the receipt of the raw material to the delivery of the finished product. Having determined the layout of the departments, a determination of the number of floors required in the new building can then be made. After this, it is desirable to secure definite information in the form of outlined templets giving the shape and size of each of the large machines to-


OSGOOD-BRADLEY BUILDING, WORCESTER, MASS.

MR. WALTER S. TIMMIS, *ARCHITECT* AND *ENGINEER*

REAR VIEW—OSGOOD-BRADLEY BUILDING, WORCESTER, MASS.

gether with the necessary working space around them. This will enable one to determine the character and extent of the columns and the spacing of the same. After making a preliminary layout, it is advisable to make a preliminary drawing of each department with the space allowed to each piece of machinery together with the additional space required. This will very closely visualize the programme of manufacturing in the new building and will enable the architect to confer with the owner and the owner's representative, including the heads of all departments with the result of saving a considerable amount of time on finished drawings; in other words, all the preliminary drawings can be gotten out of the way before the finished drawings are made.

*Character of Construction.*

Character of construction of a factory building should only be determined when all the elements, sizes, heights, columns and spacing, character of the surroundings and floor loads have been determined. Generally speaking, it is not considered wise or profitable to carry reinforced concrete building above a height of ten stories. Steel buildings of more than ten stories can usually be erected at nearly the same cost as reinforced concrete buildings. For buildings of ten stories or less in height, in places where the allowable unit stress is not below the actual safe carrying capacity, reinforced concrete offers at once the most substantial and satisfactory form of construction both as to cost, durability and rigidity. Mill constructed buildings which have been quite common in the East have now close competitors in reinforced concrete, which is only slightly in excess of the cost of mill construction when all of the facts are taken into consideration. Reinforced concrete provides at once the most rigid form of building and as fireproof as any and has many other qualities to recommend it. There is no form of construction, however, which requires more skill in designing and closer supervision than reinforced concrete. On the other hand, there is probably no construction which will give more ultimate satisfaction.

*Floor Carrying Capacity*

It will be necessary, of course, to determine the floor carrying capacity, which can be done by taking the weight of the various machines and the weight of the material used in the process of manufacturing.

*Types of Construction*

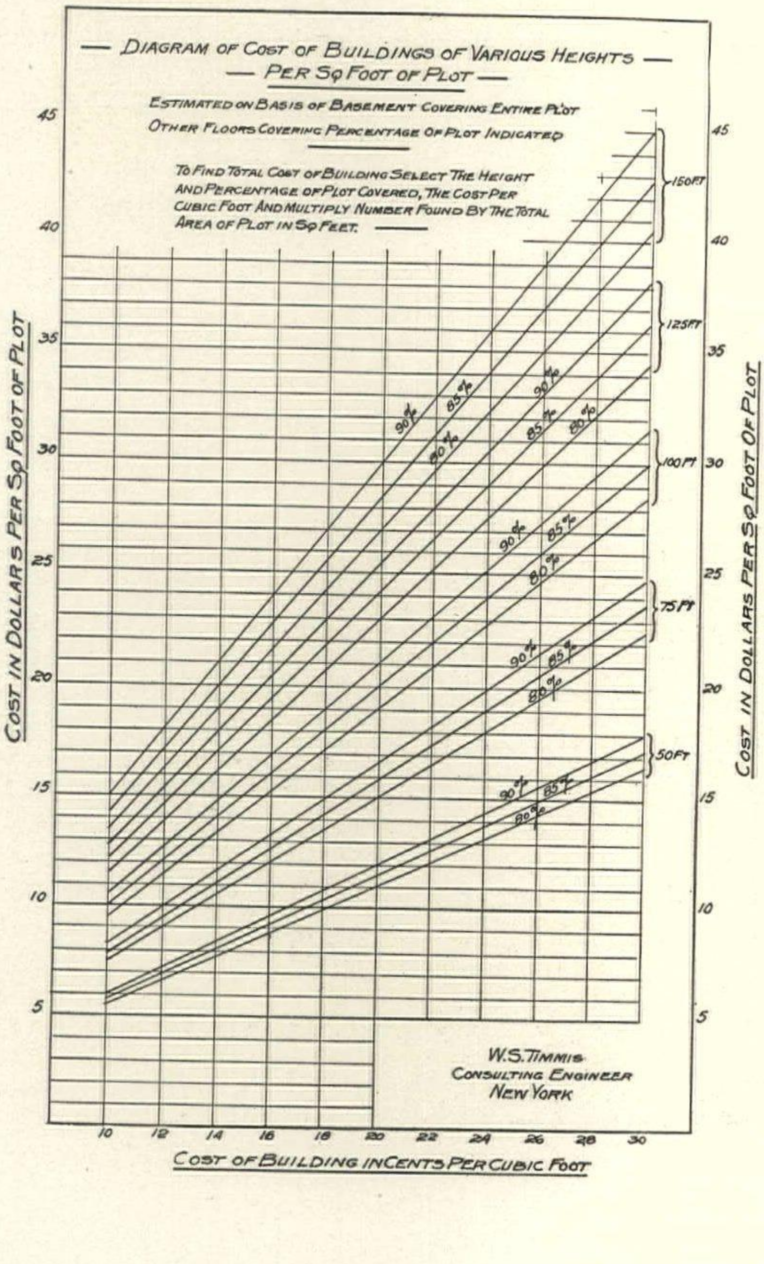
Beam and girder construction in concrete has given way in some instances to the flat slab system; only in suitable spans and with suitable floor loads is the flat slab construction more advantageous than beam and girder. Spirally wound reinforced octagonal or round columns can be used in buildings of ten stories, and with spans of 20′ x 20′ when live loads do not exceed 200 lbs. Buildings higher than ten stories and of similar spans and loads should have steel columns on the lower floors, if small columns are desirable.

*Fire Exits*

Consisting of externally enclosed fireproof stair shafts with stairs 4 ft. wide as a minimum in sufficient number should be provided. Generally, there should be one of these to each 5,000 sq. ft. in buildings of four stories or over. Access is had to these external stairs by means of balconies from the various floors: besides these fire exits, interior stairs are necessary.

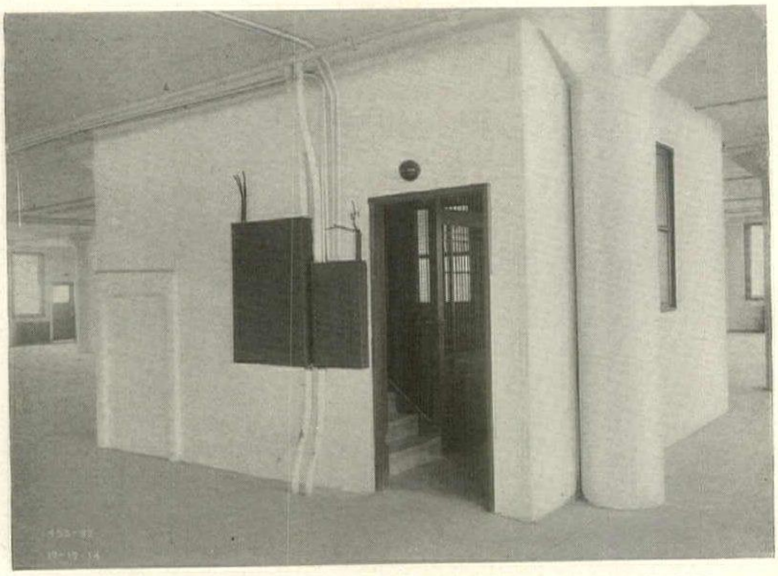
*Floor Finish*

In concrete buildings, granolithic floors are mostly used on account of low cost; when properly laid with suitable aggregate and proper top dressing and trowelled at the critical point, they are satisfactory and will not dust or abraid appreciably. Seldom, however, can this result be secured on large areas, and some form of surface treatment is resorted to.




*Heating*

Perhaps the best form of heating is a combination of direct steam heat and an indirect fan system for ventilation. In multiple story buildings separate small units for each floor can sometimes be used to advantage; these to be motor-driven fans with combination of vento or heating coils to supply the heat. This combined with sufficient direct radiation in toilet-rooms and in other places, to keep building from freezing during non-working hours. Direct steam radiation is used mostly on account of lower first cost; the combination above, however, furnishes ventilation and heating simultaneously and is usually justified. In direct steam-heating systems, double-pipe or return systems are best, with the returns run on a vacuum principle in-



INTERIOR DETAILS OSGOOD-BRADLEY BUILDING

suring freedom from noise and smell and giving perfect circulation. Forced hot water circulating systems are also used to great advantage in extended groups of buildings.

*Sprinkler Systems*

Sprinkler systems need no vindication; they furnish the best fire protection and pay for themselves in from two to five years by lowering insurance rates, and at once provide safety of life and property and, what is more, insure continuation of operation of plants. One head for every 100 sq. ft. is provided. The water supply depending on the maximum exposed single area, consists of either pressure or gravity tanks or both placed about 25 ft. above the highest sprinklers, with usually a secondary source of water supply, with independent pump and reservoir or other equally good supply.

*Elevators*

Generally, elevators are electrically operated. Usually carry 100 lbs. live load per sq. ft. Enclosures should be fireproof, preferably of 6″ concrete or 8″ brick. Doors of counterbalanced type vertically sliding, but fireproof, are finding favor. Electrically-operated door switches are required in some states to insure a closed shaft when car moves.

*Electric Lighting*

Outlets can readily be provided in concrete floor construction by running one or two outlets per circuit per bay of 600 sq. ft. or less. Light requirements being about one watt per sq. ft., there being allowed 660 watts per circuit. Push-button distributing panel boards for lighting spaced every 4,000 or 5,000 sq. ft. on each floor are desirable, each containing 8 or 10 circuit switches.

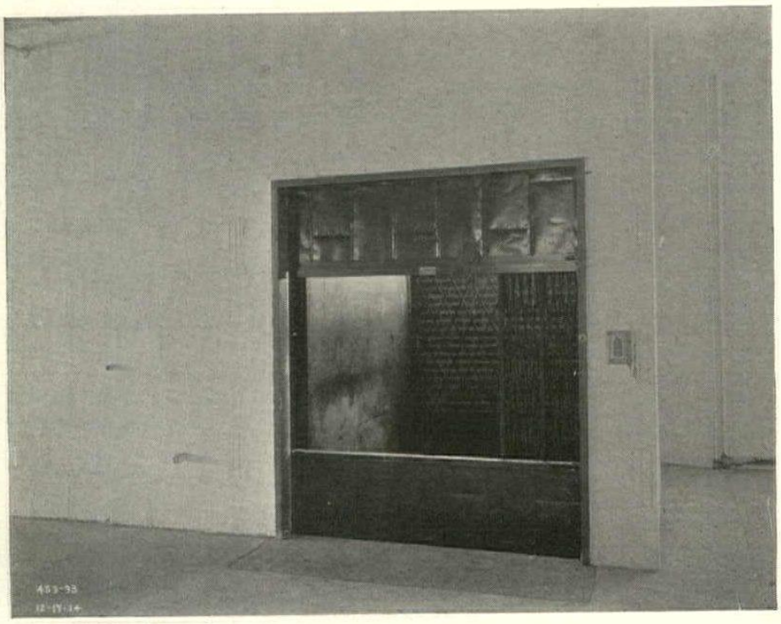
Power distributing panels should be provided for each 4,000 to 5,000 sq. ft., and floor outlets at the base of columns and in the side walls near floor can be provided in the construction. Telephone outlets should be provided in the offices under floor construction.

Fire alarm system wiring can also be provided for and put in during construction.

*Plumbing*

Stacks of plumbing every 5,000 sq. ft. are usual. Fixtures arranged on basis of one toilet to each group of fifteen employees. Wash basins and sinks in about same proportion as toilets. Dressing rooms, locker

(*Continued on page* 131)



INTERIOR DETAILS OSGOOD-BRADLEY BUILDING

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## THE RELATION OF ARCHITECTURE TO INDUSTRY

PROBABLY, all things considered, the easiest way to enlist the attention of the hard-headed business man in either a better plant or an improvement in his method of production is to demonstrate to him conclusively that improvement will unquestionably result in added profits. Now, some time during the latter years of the last century, the manufacturer began to realize that the efficiency and co-operation of his most important and necessary machine, the workman, depended not only upon the wage that he carried home Saturday night, but also upon a number of other and more indirect influences, such as well-lighted and ventilated workrooms, cheerful and attractive places for recreation, and snug and trim dwellings. A healthy mind in a healthy body is particularly necessary to those employed in industrial buildings as any other condition, aside from humanitarian considerations, affects the quality of the product. This is one of the things that the manufacturer has finally been obliged to admit, and the practical result of the admission is shown by the increasing facilities that are being afforded employees for recreation and amusement. In some instances roofs have been utilized as recreation places, and where manufacturing plants have been located in the suburbs, athletic fields, tennis courts and similar facilities for healthful recreation have been provided.

The manufacturer also made the interesting discovery that the consumers were becoming interested in the processes of production, and that their confidence was more easily won if they knew that these processes were carried on under conditions favorable to the workers. Up to this point, the connection between aesthetics and industry was perhaps slight, but when a manufacturer has reached the point where he builds with an eye for comfort and hygiene, he is very apt to build also with an eye for beauty. In fact, it is a traditionally short step from the form of duty to that of beauty, and it is probably by some such process as is here indicated that the modern development of industrial architecture has come about.

Because of the essential modernity of the problems involved, the architect of factory buildings finds himself freed from many of the traditions that limit or influence his work in other spheres of professional activity, and, in place of following precedents, he is called upon to make them. A study of recent achievements in this field shows how little the guidance of the past can be depended upon to assist him in his design and how much encouragement is given to the development of individual talent. If we may form an opinion from recent publications, German architects have been particularly keen in seizing the opportunities which this type of design affords and of utilizing its very restrictions to produce bold and picturesque effects. In our own country we have achieved many distinct advancements towards the time when all factory buildings will have the same thought given to their outward appearance as to their interior practical arrangement. The architects of some of our western cities in particular have been very successful in molding their industrial buildings into interesting architectural forms, while everywhere throughout the country one sees individual structures of great artistic merit. Generally speaking, however, American industrial buildings are conspicuously bare and ugly, furnishing little or no evidence of attention having been given either to their design or to their relation to their surroundings. It may almost be said that as they stand to-day, industrial buildings present a wide and practically undeveloped field for architectural study.

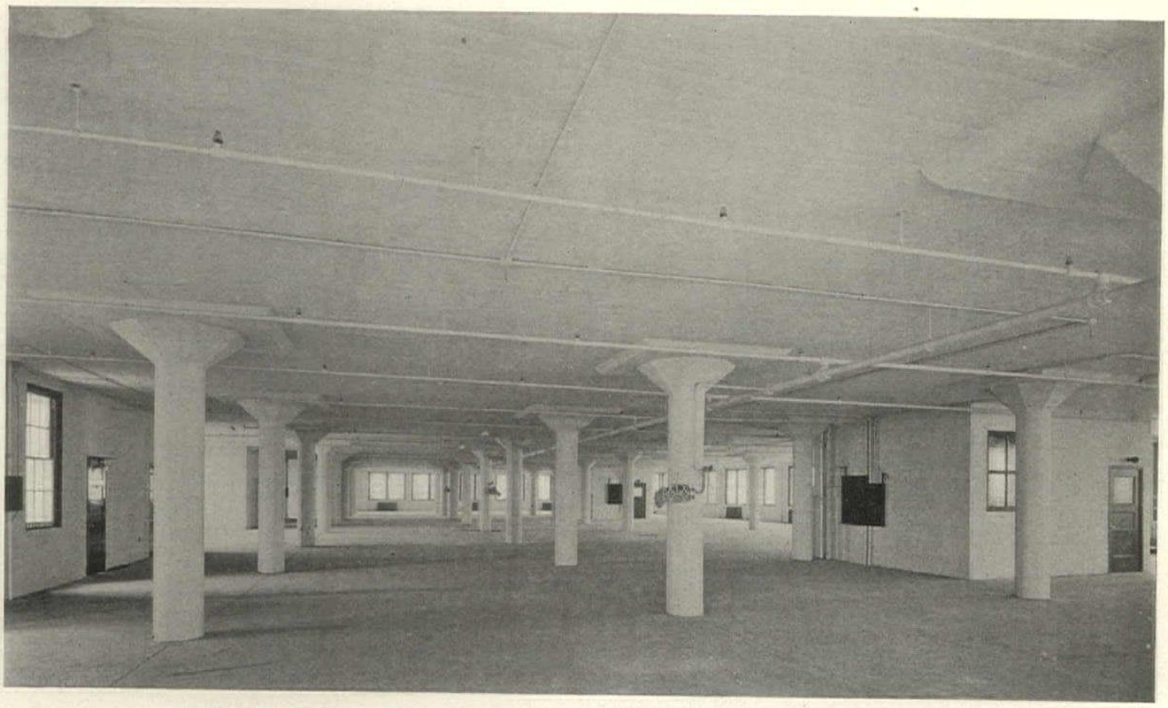
It is not intended that the importance of practical planning should be ignored or belittled, for in fitting the exacting arrangement of an industrial plant to an economical design, no small skill on the part of the architect is necessary. But it is in the shaping of the exterior that there is the most urgent need for architectural effort. The average architect is very apt to place the designing of industrial buildings upon a plane of inferiority and to value lightly the opportunities that accompany it. While it is true that practical limitations are often of the most irksome sort and require all the patience that an architect possesses to solve in any satisfactory degree, the freedom from tradition, together with the chances offered for striking and original effects with the simplest mediums, present especial attraction and interest. The limitations to economical materials and the absence of extraneous detail are in themselves influences for good, since they tend to stimulate the designer's dependence upon good proportion and arrangement of masses, or, in other words, upon the fundamental elements of design.

Not the least important element in the betterment of industrial design is its relation to that of civic improvement. Factories are frequently situated in neglected and unattractive localities, and in such instances not infrequently furnish the exception to our premise and harmonize with their surroundings, but the erection of well-designed buildings with some thought put upon the future or ultimate rather than present appearance of the environment, not only makes for better realty values but brings a direct influence for betterment into the whole locality.

In the instances where manufacturers have been led to appreciate the value of the architect's services in controlling the design and grouping of industrial building and plants the results are conspicuous and present obvious examples of the practical as well as architectural benefits derived from the course pursued. When manufacturers in general become thoroughly awakened to the fact that this is simply a corollary to their practical interest, already demonstrated, in the welfare of their workmen, industry and architecture will go hand in hand.

BUILDINGS FOR MILWAUKEE GAS LIGHT CO., MILWAUKEE, WIS.

MR. ALEXANDER C. ESCHWEILER, *ARCHITECT*



TYPICAL FLOOR OSGOOD-BRADLEY BUILDING, WORCESTER, MASS.

Factory Construction and Equipment

(*Continued from page 128*)

rooms and rest rooms to be provided, as they form part of any well digested plan.

*Refectory*

Many employers are now providing these as a part of the social service or welfare work incident to the operation of their buildings.

EXTERIOR DETAIL OSGOOD-BRADLEY BUILDING

## RECENT LEGAL DECISIONS

### Misrepresentations as to Cost Voiding Architect's Contract

An architect is bound to bring to the performance of his contract reasonable care, and intelligence befitting his profession and undertaking, and a proper investigation and knowledge of the business in hand, in all its details. The representations made to the owners should be true in fact, as to the general requisites of the contract, and substantially accurate in dealing with the amounts, quantities, and values involved. Those for whom an architect contracts to furnish plans for a building and to make contracts for materials have a right to believe that the cost of the building will be substantially as agreed upon. Where an architect knows the limit of cost of a building desired by those with whom he is dealing, his intentional concealment of the truth, or his material false statement as to cost, voids his contract with them.

Lane *v.* Town of Harmony, Maine Supreme Court, 90 Atl. 546.

# DIEHL MANUFACTURING CO.'S BUILDING, ELIZABETH, N. J.

MESSRS. DAY & ZIMMERMAN, *Architects*

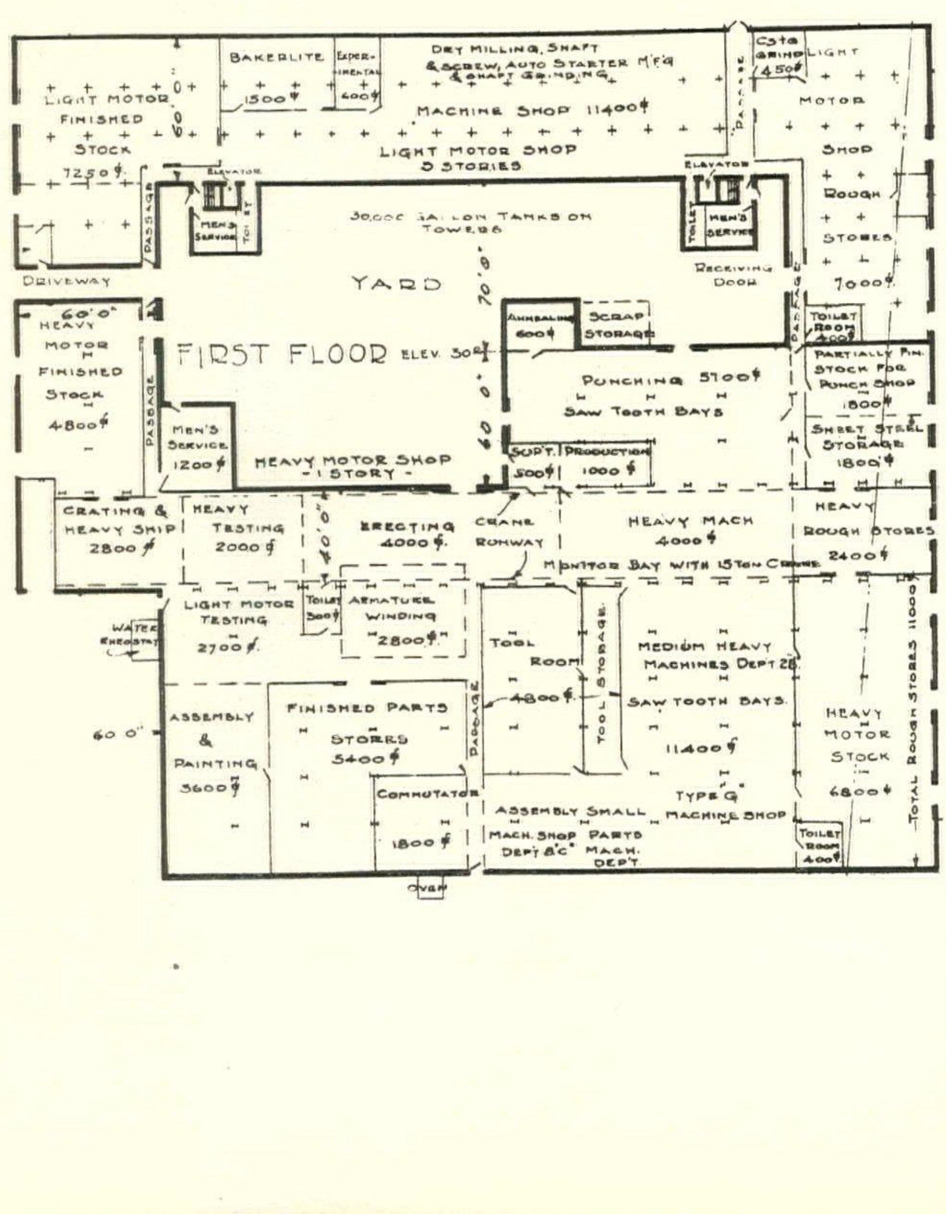
THE Diehl Manufacturing Company has recently built at Elizabeth, New Jersey, the first unit of their No. 2 plant. This will eventually be a complete plant for the manufacture of electric motors and generators, and electrical cranking devices for automobiles. The demand for these various products was such as to necessitate largely increased facilities, and as their old plant did not lend itself to expansion, an entire new one was decided on to be built in units as the growth of business demanded.

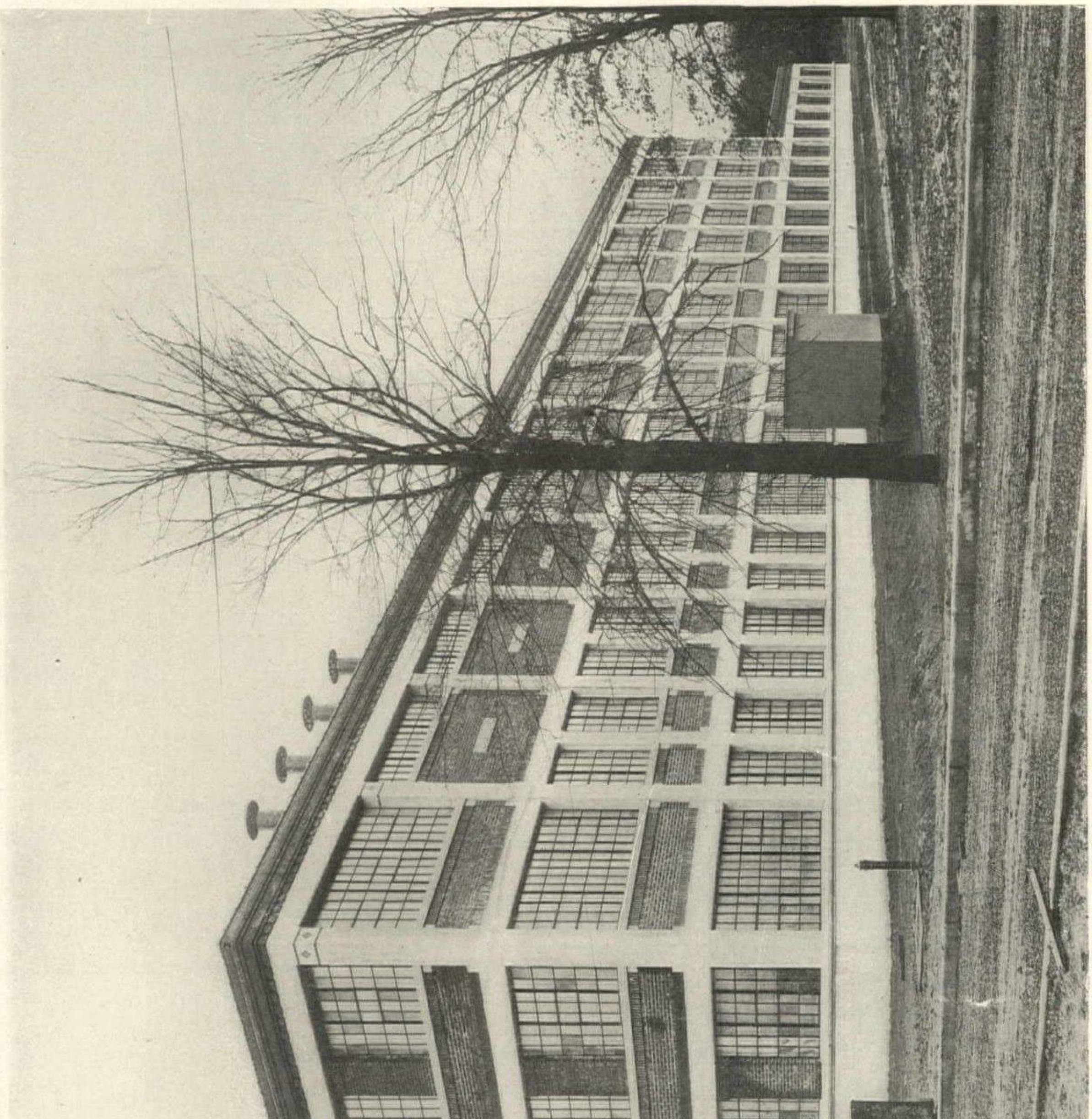
Before the detailed plans could be drawn up, it was necessary to make a careful study of their present manufacturing methods, in order to accurately determine the floor areas required in the new plant, as well as the correct inter-relation of departments. Future growth had to be allowed for in the various departments, and as the plant was to be built in units the various departments had to be so arranged that in any stage of completion of the finished plant, manufacturing could be economically carried on.

The main line of the Pennsylvania Railroad bounds one side of the property and two sidings are brought in, the northern being the receiving one for freight, and the southern one being the shipping siding. Both these sidings are depressed to the floor level of the buildings to facilitate trucking. A spur from the shipping siding provides a receiving track for the foundry and power plant.

The following departments are provided for in the layout; light motor shop, heavy motor shop, punch shop, pattern storage, foundry, finished stock room, service room and an administration building. There is a future light motor shop, indicated with a garage in one end for motor trucks, and a power plant.

The type of construction used for the light motor shop was a multiple story building of reinforced concrete with brick curtain walls. The heavy motor shop was provided with a monitor bay 30 ft. under the trusses for erecting the machines, while along one side a saw-tooth machine shop 14 ft. under trusses was provided. The





BUILDING FOR DIEHL MFG. CO., ELIZABETH, N. J.

MESSRS. DAY & ZIMMERMAN, *ARCHITECTS*

punch shop is an extension of the heavy machine shop housed under a saw-tooth roof. The heavy motor finished stock room is likewise an extension of the monitor bay of the heavy motor shop, and is also under a saw-tooth roof. The foundry is of the usual monitor type, while the pattern storage building is a fire-proof two-story building. The boiler and engine rooms are under one roof. An elevated siding is brought alongside the boiler room to secure a gravity discharge of coal to the firing floor level.

The several shop buildings are arranged around a central yard, access to which is by a driveway between the light and heavy finished stock rooms. The rough stores and stock room departments are all arranged along the north side of the buildings so that the freight cars can be unloaded directly into the stock rooms. The separation of the receiving and shipping tracks causes the material to move across the buildings, the various operations being performed on the way, and as the finished stores departments are along the south side of the buildings, the product is collected and stored adjacent to the shipping platforms. This arrangement avoids all unnecessary trucking of parts and finished machines through the various shops.

The manufacture of the light and heavy motors is in general kept entirely separate, the punch shop and testing department being the only place where parts of the light and heavy motors are together. This feature is essential, as light motors are all below one horsepower, a large proportion of which are for use on fans and sewing machines, and whose component parts are very much more fragile than the heavier motors, and the manufacturing operations are radically different.

The arrangement of the heavy machine shop with monitor bay, served by a fifteen-ton crane, and the saw-tooth machine shop alongside of it, makes a very desirable layout, as the parts are machined in the saw-tooth section under the most desirable conditions of grouping of classes of tools, and assembled in the monitor bay, where it interferes in no way with the machine work and where ample room and crane service are to be had.

It was decided to erect as a first unit 300 feet of the light motor shop, which will ultimately be 390 feet long. This provided the additional space immediately required by the light motor and automobile starter departments, as well as relieving the congestion at the No. 1 plant.

A general view of the light motor shop is shown. The building is three stories high of reinforced concrete, using the flat slab type of construction. Brick curtain walls are employed, together with steel sash of the ventilating type. The floors are of maple, with the exception of the japanning room floor, which is wood block laid on sand. This type of floor is used on account of the heavy trucking between the dipping tubs and drying ovens. The building is sprinkled throughout, and two outside fire escapes are provided. The roof is of slag laid on concrete. A 30,000-gallon water tank is on the roof, and eventually there will be a 100,000-gallon surface tank and fire pump to afford adequate protection to the entire plant.

A temporary power plant of corrugated iron construction is situated at one end of the building, and supplies electric power and light as well as steam for process work. The units in this power plant are of such size that when the additional units of Plant No. 2 are built they will fit into the permanent equipment of the ultimate power plant.

The preliminary work of layout and the plans and specifications were drawn by Day & Zimmerman, of Philadelphia, while the concrete work was carried out by the Turner Construction Company, under the supervision of the engineers. The building was ready for occupancy four months after the contracts were let.

## In Acknowledgment

Acknowledgment is hereby made and our thanks are due to the Aberthaw Construction Company, Boston, Mass., and to the Turner Construction Co., of New York, for much valuable information, and the permission to reproduce the large number of photographs placed by them at our disposal.

# FACTORY ILLUMINATION

*By* F. A. Patterson

A FACTORY is a building, or group of buildings, appropriated to the making of goods. There are three subdivisions of such an institution, viz.: (1) Materials; (2) Tools; (3) Operators. The last of these, after centuries of neglect, is finally beginning to be acknowledged as of great importance. The awakening of the world to the realization of the fact that the human being is the most precious of all gifts, is shown by the numberless movements for "Welfare," "Safety First," "Living Wage," "Minimum Hours," etc. Ever since the making of things was moved indoors, and the buildings crowded together into towns, it has been necessary to pay attention to the natural and artificial illumination of factories. A consideration of both was necessary because no one has yet been able to design and construct a building every part of which has sufficient natural light, and no manufacturer has yet been able at all times of year to so operate his factory that no artificial light will be needed.

In order to utilize natural light to the fullest extent, the modern factory is designed and built with high ceilings, light finished interiors, largest possible window areas, skylights, saw-toothed roofs, and advantage is taken of the use of reflecting and diffusing glasses. Most all of these improvements have produced problems in heating and ven-


INTERIOR OF BUILDING FOR DIEHL MFG. CO., ELIZABETH, N. J.

MESSRS. DAY & ZIMMERMAN, *ARCHITECTS*

tilation, but this has not retarded the progress along these lines, because there is an appreciation of the absolute necessity of proper illumination.

It is very fortunate that in the use of natural light it is seldom necessary to use any devices for moderating. If a building is so located that the direct rays of the sun pour into the windows at certain times of the day, it is necessary to use awnings, shades, screens, or diffusing glass. But unfortunately natural light is not always at its best and so we have to turn to the artificial.

In the artificial illumination of factories, we have a number of considerations that make up the total of safety and economy. Electric light is the safest and most economical of all sources of illumination for this purpose. In a factory we must have sufficient light to enable the operator to work with ease, every point of danger must be plainly visible, and the worker must be able to look up from his work without meeting with glare. In operations requiring exactness and precision in measurements, or setting of machines or tools, ample concentrated light must be provided to render this possible without eye strain. None of these results can be accomplished by using unshielded lamps. Therefore every lamp used should be provided with a proper shade, reflector, or diffusing globe, according to its position relative to the operators and the lighting function it has to fulfill.

There are three systems of lighting in modern factories, viz.: localized light, general light and localized general light. The localized light includes all lamps placed to concentrate its light on a definite limited space on a tool, bench, desk, or wall. No matter how the room is illuminated, there are nearly always some of these lamps required. The second system consists of lighting the space throughout and spacing the units so as to have an even illumination. The third system is that of placing units to illuminate certain operations, or groups, and allowing the lighting to be what it will in between these groups. It would seem that although all of these schemes have their merits, better results can be obtained by a combination of all, rather than attempting to force the use of any one system throughout any given installation.

The lighting sources are of three kinds, viz.: direct, where the units are so distributed as to have the light pass from the source direct to the plane where needed; indirect, where the units are arranged and the ceiling so prepared that the light is thrown, by means of reflectors, upon the ceiling, and the diffused light gives a pleasant illumination; direct-indirect, which is the same as the indirect except that the reflectors are made translucent so that a small amount of light passes through. The direct is the most used method, and in fact it is rarely possible to have the ceilings proper for either of the other two methods, and the operations of such a nature as to be correctly lighted by them.

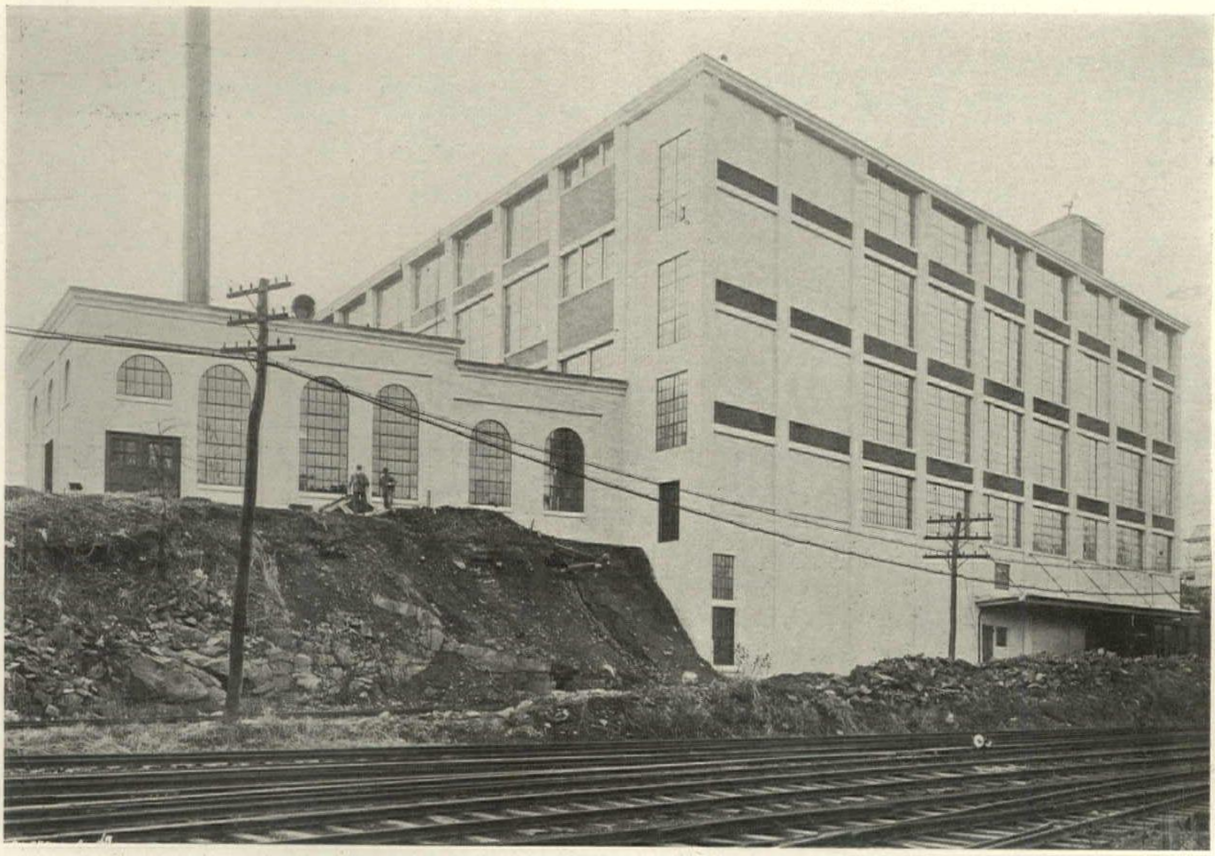
What then is the best way to light a factory? There is no one and only best way. Each one must be studied by itself as no two will be found to be exactly alike.

To properly plan a lighting scheme for a factory, one must know the plans of the building, the raw materials, the routing of the product, the function of each machine, the location of operators when working, the location of each machine, or tool, method of conveying product throughout, method of packing, storage and shipping. In other words, to be able to properly illuminate any given operation, or group of operations, one must be familiar with all the details. With the exception of such plants as steel mills and similar equipments, the best results can be obtained by distributing high efficiency units, hung close to the ceiling and equipped with deep diffusing reflectors, so as to give an even general illumination, and placing lamps with concentrating shades for tools and operations requiring precision. By this means you have produced an illumination that will make for an efficient operator, and when this is accomplished you also have proper light to insure safety. Not only does humanity demand it, but manufacturers are at last beginning to realize that it pays to properly light a factory. Not only should the parts of the building where the work is done be well lighted, but fire exits should be plainly marked by red lights, and stairways should be illuminated so as to clearly light the way and have no glare in the eyes. This is so much recognized as a necessity that in many States the law compels it.

# BUILDING FOR C. F. MUELLER CO., JERSEY CITY

MESSRS. F. P. SHELDON & SON, *Architects*

THE foundations, walls, inside and outside columns, and floors are of reinforced concrete. The floors are of flat slab construction without the use of floor beams or girders. This construction was adopted in order to give a perfectly exposed exterior surface of concrete was given a special treatment at completion, and the panels underneath the windows are of brick, as will be noticed from the photographs. These panels are made of Harvard brick with raked-out joints.

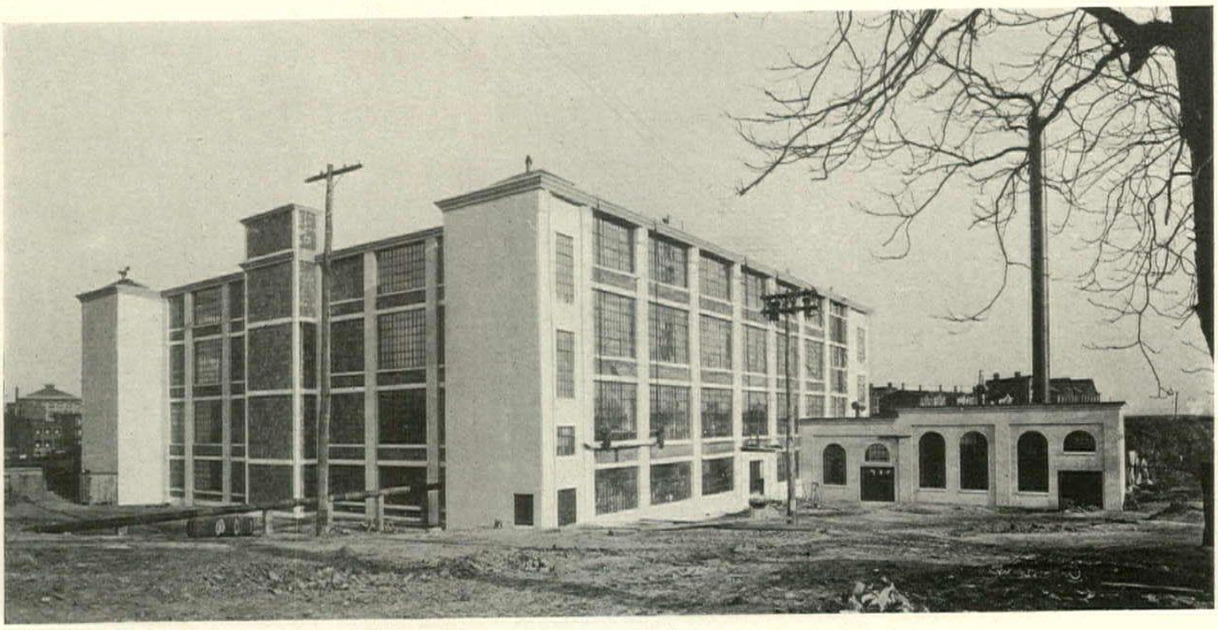


BUILDING FOR C. F. MUELLER CO., JERSEY CITY, N. J.

MESSRS. F. P. SHELDON & SON, *ARCHITECTS*

flat ceiling which would be free from pockets for the collection of dirt and dust. Two of the floors have a granolithic finish, while the remaining two floors are finished with "Tilene." The windows are rolled steel sash, double glazed. The roof is covered with the usual 6-ply roofing felt, protected with slag with the addition of an insulating material betweeen the roof slab and the roofing paper to prevent heat loss through the roof and condensation on the ceiling. The

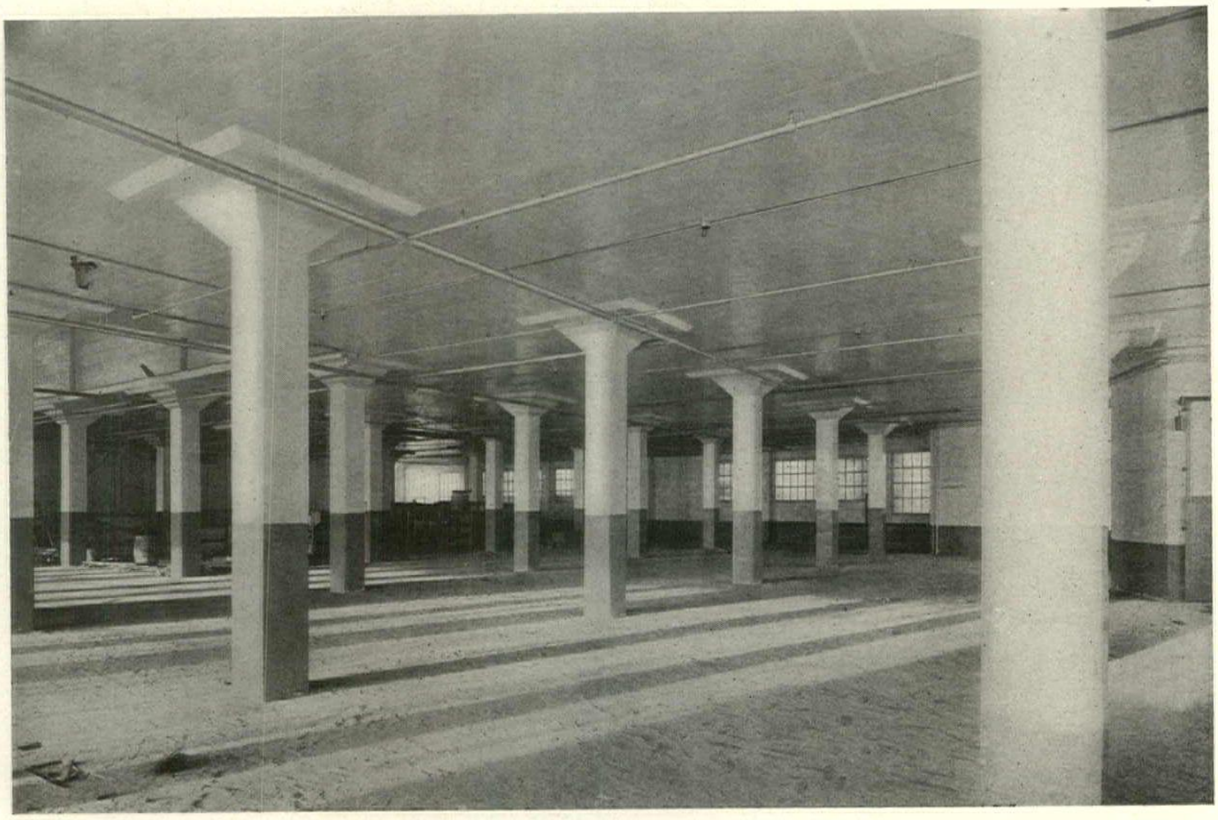
The building is therefore thoroughly fireproof construction, and in addition is equipped with an automatic sprinkler system to extinguish incipient fires within the building. The building is equipped with a forced circulation hot water heating system, with radiating coils on each floor around the walls just below the window stools. No special method of ventilating is provided except the ordinary ventilation through the windows and the provision of a ventilating chimney



BUILDING FOR C. F. MUELLER CO., JERSEY CITY, N. J.

MESSRS. F. P. SHELDON & SON, *ARCHITECTS*

on one side of the building. This chimney is connected with each floor by means of registers, which may be opened and closed as desired to regulate the change of air wanted. The building is equipped with two elevators and has three large stair towers at three corners of the building to facilitate the rapid exit of the occupants at times of necessity.



INTERIOR—BUILDING FOR C. F. MUELLER CO., JERSEY CITY, N. J.

MESSRS. F. P. SHELDON & SON, *ARCHITECTS*

# The Problems of the Contractor

*Being Extracts from an Address by Mr. Leonard C. Wason, President of The Aberthaw Construction Co., Before the Boston Society of Civil Engineers*

IT IS of prime importance to study the engineer or architect and consider his method of handling and supervising work. The methods of some engineers are radically different from those of others; this has a marked bearing upon the cost of the work and sometimes on its desirability to the contractor. The contractor must determine what sort of treatment he will receive. Nothing adds to the price of a bid like uncertainty, whether it be in the temperament of engineer and owner or in unknown construction problems.

In one case where a number of local firms were invited to bid on a certain large building for an architect who was well known always to rule in favor of his client, irrespective of the merits of the case, the successful bidder, after figuring full measure on all quantities, added this item—"Humor architect"; the item was 10 per cent. of the contract. It is safe to presume that all other competitors placed this contingency at a higher figure. Such a man could not get a reasonable bid from any one who knew him, and he certainly could not expect to let work advantageously to guileless strangers. An engineer in a distant city whose reputation has reached beyond the limits of his activities has a personal equation of 25 per cent. plus. The best information available indicates that these men do not personally profit in any way improperly in this excess cost. Instead of being wise and just judges between the two contracting parties, they are simply over-zealous partisans. Fortunately this class of architect and enginer is very small and their influence on industry still smaller.

The largest class is that in which the engineer or architect intends always to be just, but on rare occasions allows his judgment to be influenced by the attitude of the owner; or, where two different solutions may be possible, for policy's sake or for hope of personal advancement, makes the second best decision. This increased expense which is entailed can never be foreseen, although it certainly exists and has to be paid for as a contingent item of cost. The reputation of

DENNISON MFG. CO.'S BUILDING, SOUTH FRAMINGHAM, MASS.

MESSRS. MONKS & JOHNSON, *ARCHITECTS*

INTERIOR, BUILDING FOR DENNISON MFG. CO., SOUTH FRAMINGHAM, MASS.
MESSRS. MONKS & JOHNSON, *ARCHITECTS*

the engineer who is always fair spreads far and wide, and he is sought out by many responsible contractors who desire to do his work. This results in work being done at the lowest legitimate cost by competent firms; the owner gets a square deal, continues himself, and also recommends his friends, to employ this engineer, who in the long run prospers more than he could by other methods. Meanwhile, he maintains his self-respect and is justly proud of work well done.

Contractors talk rather freely among themselves about their experiences and their opinion of those for whom they have worked, and perhaps oftener than is imagined are asked by owners whom they would recommend to design new work. They certainly exert an influence on the reputation and also on the business of the engineer and architect.

*Minor Features.*—This term is applied to those parts of the designing which are not vital to the construction, and, therefore, frequently are not shown on plans, being left either to be settled in advance by the builder or during construction by himself and the engineer. Some of these points are learned only by experience in actual construction, and may not have occurred to the engineer until called to his attention.

Chief among these minor features to receive attention are the means to be provided to prevent cracks, which mar the appearance and are often a source of annoyance though seldom a cause of structural weakness. There are, sometimes, cracks caused by unequal settlement of foundation. Sometimes a part of a building is on piles and part on earth. Where they join it is hard to foresee and provide such an amount of bearing that the whole will settle evenly. It is usually best to provide a broader bearing on the less rigid material than theory dictates, then unsightly cracks may be avoided by very rigid tying of the building together with reinforcement, against pulling apart longitudinally or shearing. This requires both horizontal and diagonal reinforcement with a minimum quantity, equal to at least one-half of one per cent. of area of concrete. A somewhat larger amount is preferred.

Another way to overcome the same difficulty is by building a joint vertically clear through the structure at this point and designing the members of the structure on either side so that, if settlement does occur, they will not crack. This was done with satisfactory results in a recent building where one end rested upon sand, the center on ledge and the other end on clay.

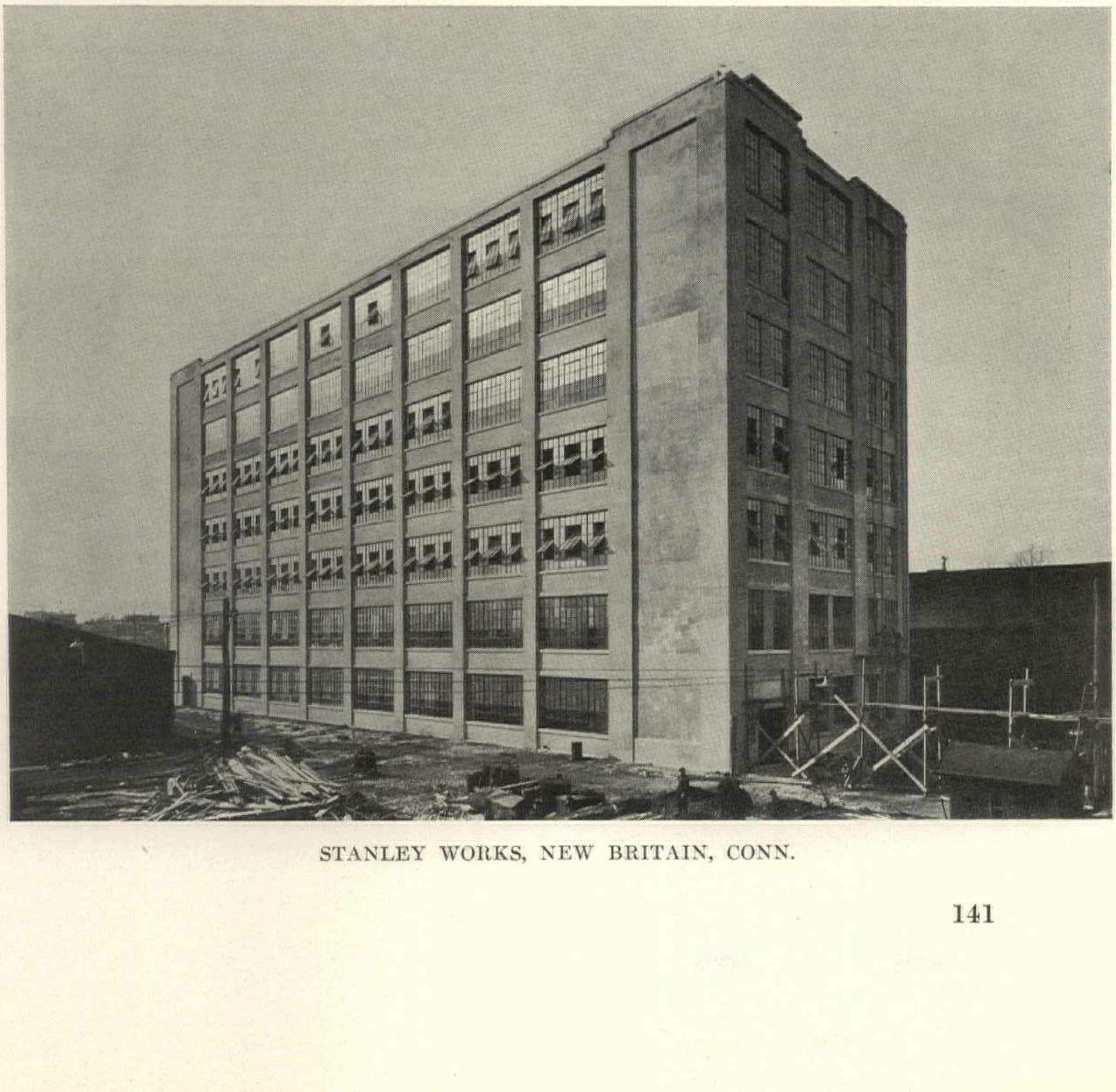
Large wall surfaces without joints are very liable to crack vertically, due to the shrinkage stresses of the concrete. Experience has shown that thin walls with insufficient reinforcement will crack about every twenty-five feet of their length where exposed to the air on both sides. Thick walls will crack about every fifty feet. Where the wall is exposed to the air on one side only, and kept at a fairly uniform temperature, either by water or earth on the other side, there is very much less danger of cracks in any length.

Temperature stresses do not have to be considered by themselves. The writer has not met a case where the structure could change its temperature so rapidly as to crack from this cause. If properly reinforced against shrinkage cracks, the temperature stresses will be sufficiently provided for.

Walls of buildings 400 feet in length, which have been built without joints, have not developed cracks. However, the amount of steel used, in the writer's opinion, was not justified on the grounds of economy or in comparison with the result obtained. In such a wall internal stresses are very likely to open diagonal cracks, radiating from corners of windows and doors; therefore, diagonal reinforcement is necessary at such points. This is seldom shown on plans when received.

On the ground of cheapness of construction it is almost always better to put curtain walls in after the frame is up; the work then goes ahead much faster. Weather-tight joints can readily be made, and the joints between the frame, that is, the columns and floor, can be concealed so that no unsightly crack is visible.

Where a floor is built around machinery foundations, frequently a long span and a short span beam come close together. Un-



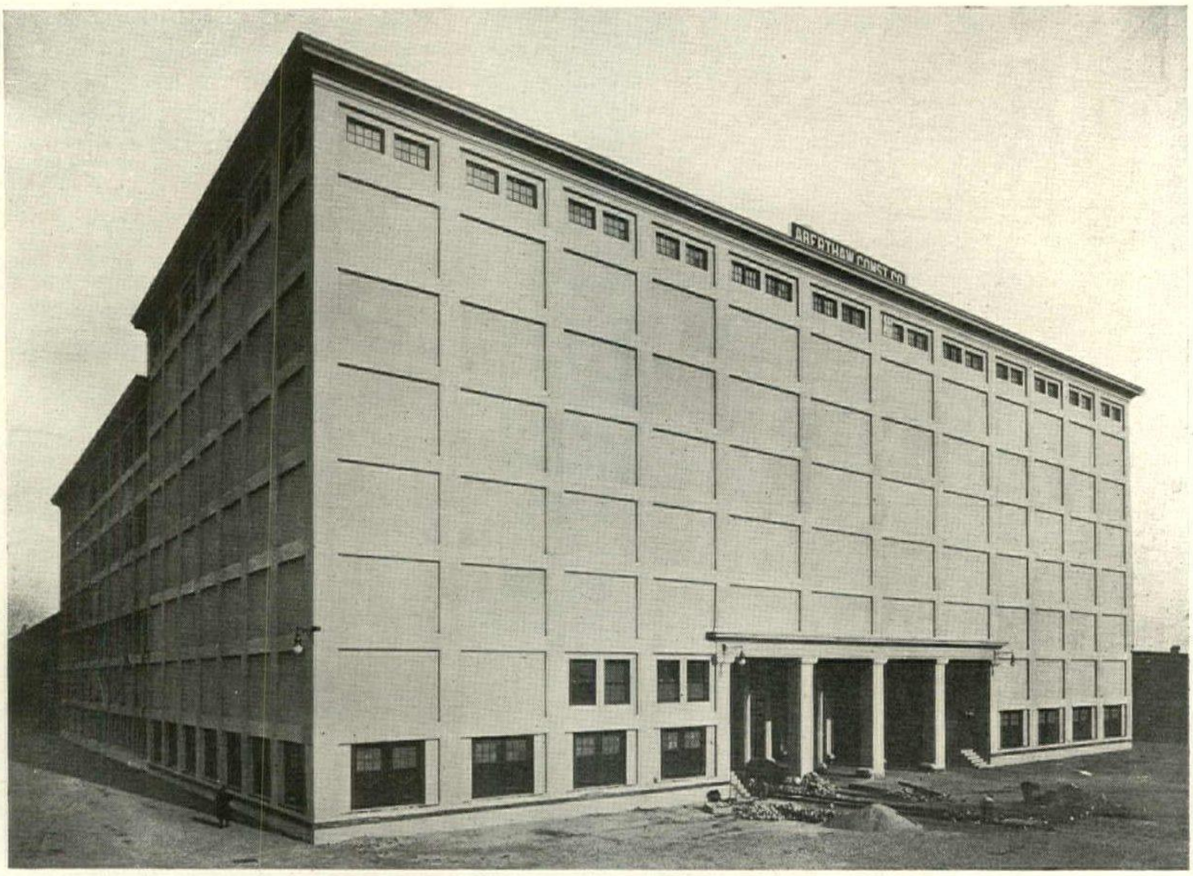
STANLEY WORKS, NEW BRITAIN, CONN.

less provision is made for a joint between them, there is certain to be an unsightly crack, due to the difference of deflection of the two under the same load.

Another point of design which may sometimes be advantageously discussed by the engineer is that of roof construction, whether the structural part shall be flat and covered with cinders, to give a proper pitch for drainage, or whether the ceiling shall be pitched and the fill avoided.

In construction the most serious objection to the first method is that so much time of five months, due to the collection of water on the slab in the cinder fill. In another case there was some dripping even after two years. This is a matter entirely beyond the control of the contractor, as it is solely a question of weather conditions, and can be avoided only in the engineer's design.

There is a question as to whether stairs shall be cast integrally with the floors or whether rods shall be left projecting from floor to bond in stairs, which are cast later. The latter method is much preferred by the writer.



BUILDING FOR COMMONWEALTH ICE AND COLD STORAGE CO., BOSTON, MASS.

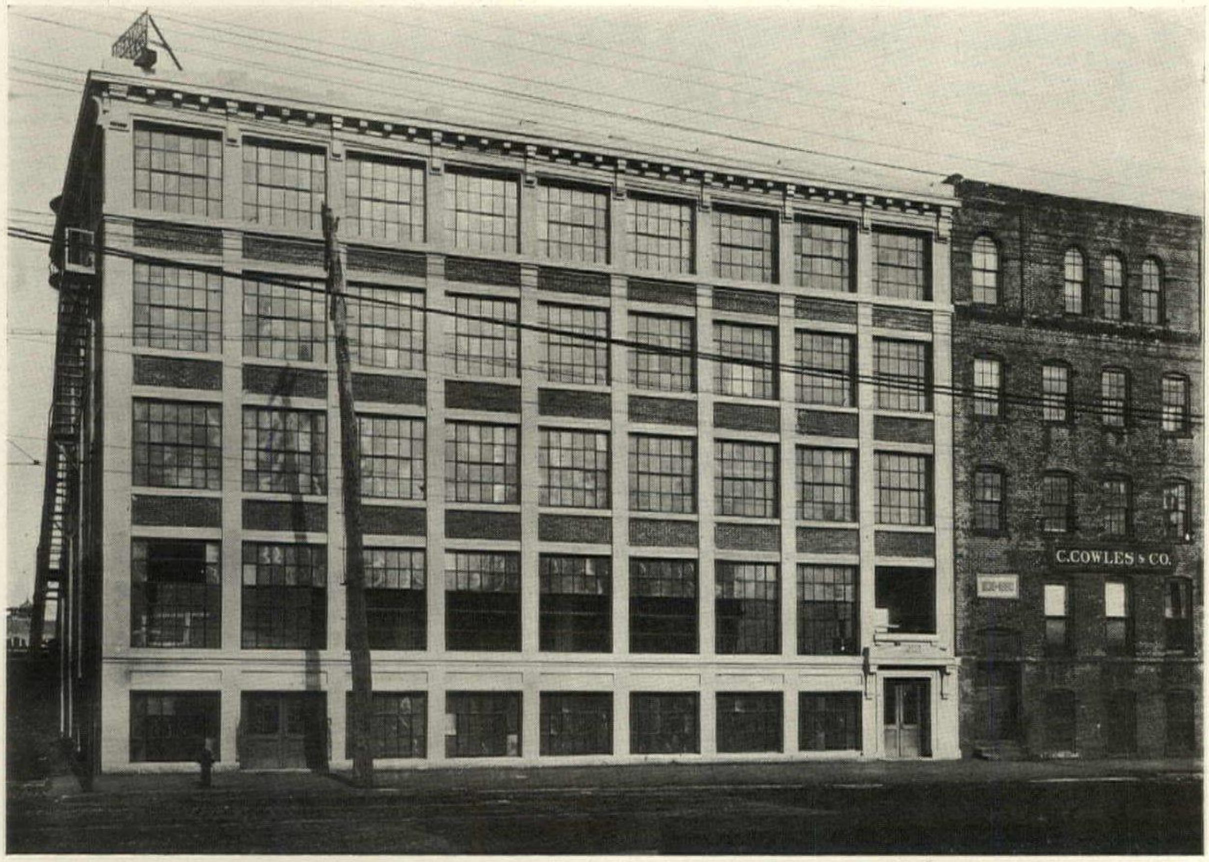
MESSRS. STERRETT & BENNERS, *ARCHITECTS*

elapses between the casting of the roof and the waterproof cover of tar and felt over the cinder fill that a considerable quantity of rain collects on top of the roof slab. These slabs, while not absolutely watertight, are tight enough to hold a considerable quantity of water. On some jobs holes had to be drilled from ceiling to drain roof slab. In one building water dripped from the ceiling after it had been waterproof for a period

Another important question which must be taken into consideration in the designing is whether a granolithic floor is put on as an integral part of the construction, or as a second operation, and if a second operation, what its thickness shall be. For economy's sake, both in materials and in labor, it is cheaper to put on the finish with the construction. Under these conditions it is frequently impossible to keep off the floor long enough for it to harden sufficiently to prevent its being somewhat marred. If this is a serious objection, the finish must be put on as a second operation. As this does not bond sufficiently with the floor to be considered a unit, the construction should be thick enough to carry the load without any assistance from the finish.

If the finish be one inch thick it is almost safe for the contractor to guarantee that it will be loose in spots, whereas if two inches thick it is pretty safe to guarantee it as solid and satisfactory. This adds to the dead weight and the expense. It is necessary to settle these points before construction begins in order to get the minimum of cost and the maximum of efficiency, as the amount of forms bought and the conduct of work are influenced by it.

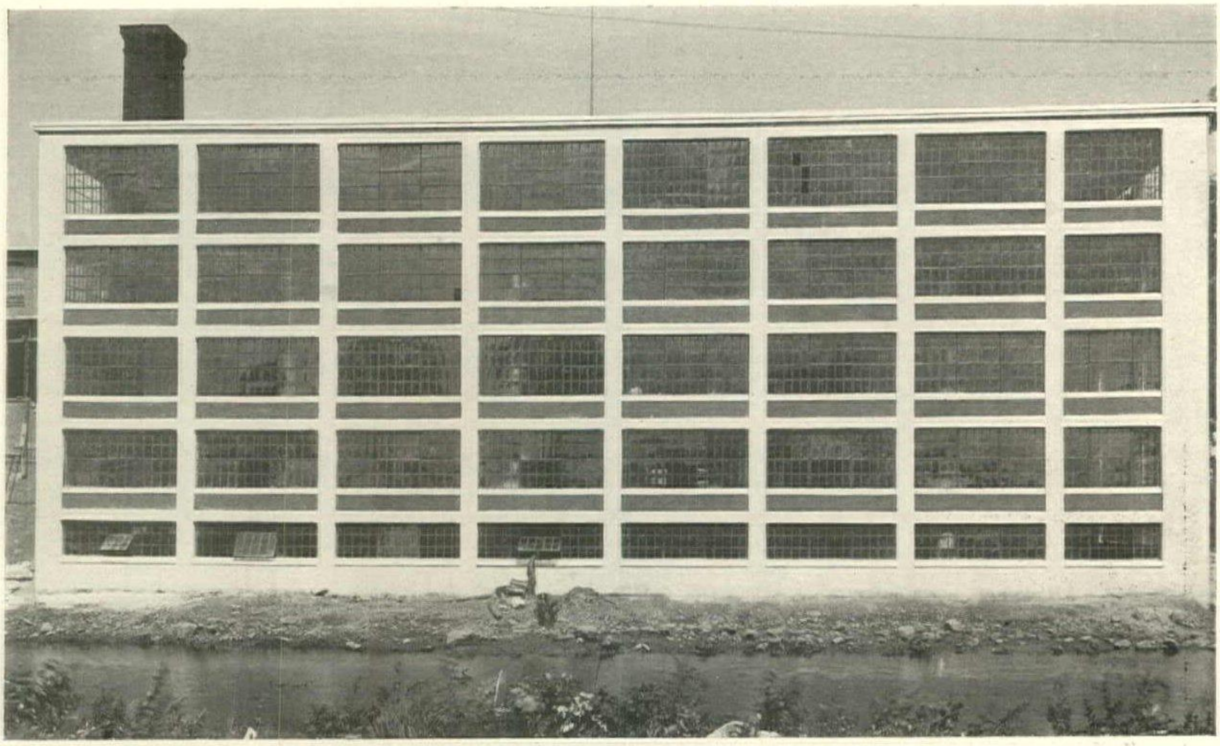
Frequently, the location of construction joints between days' work is an item of importance, but these are almost never indicated on plans, and must be discussed and settled. Some of the points which influence fixing their location are the capacity of the mixing plant, sufficient supply of materials and the weather. Sometimes the latter causes several days' delay where continuous work is desired. There is a question as to whether the construction joint shall go in the middle of the span of a floor, or be made in line with the columns. The treatment in the two cases is somewhat different. If in line with the columns, these must be thoroughly reinforced above and below the floor, and steel plates used, otherwise they are certain to be split when the floor shrinks at the construction joint. If the building is to have contraction joints, the construction joints should be made so as to coincide with them.




BUILDING FOR C. COWLES & CO., NEW HAVEN, CONN.

MR. L. W. ROBINSON, *ARCHITECT*

Because concrete is a plastic material cast in place, and because the molds can be made of any design, engineers seem to feel that there is no necessity for holding to any standard sizes for the members of a concrete structure, as they do when designing in steel. An engineer can, however, use quite an amount of thought to good advantage in



BUILDING FOR FLORENCE MFG. CO., FLORENCE, MASS.
MR. SAMUEL M. GREEN, *ARCHITECT*

the selection of sizes, as the particular dimensions which best satisfy his designs will quite often not be the most economical. In one building of large size, in a single floor there were in the original design received 455 different sizes and styles of beams. Upon studying it was found possible, without impairing the result to be accomplished, to reduce these to less than a sixth of the original number, and by co-operation with the engineers the number was reduced to 52.

Where extremely heavy loads are to be carried on columns, sometimes so much steel reinforcement is shown that it is impossible to use stone concrete, as the bars are so close together that the column really has to be filled with mortar. This is doubtless an oversight on the part of the drafting room of the designer, and makes a problem for the contractor to adjust before work can progress. Similarly, heavy girders have had such an amount of reinforcement that there was not enough concrete in the width of the girders shown to imbed the reinforcement, as shown on plans.

An unusual problem put up to the writer's company to solve in execution was a very high tower which had two floors near its top, one 160 feet and the other 180 feet from the ground, each of which carried a load of 400 tons on an area of 28 by 30 feet. This floor was supported on a central girder, running the short way, with beams running from it to the opposite walls. The requirement of the engineer was that the walls and floors be cast as a monolith and be watertight as a tank, as moisture penetrating from driving storms would be a serious handicap to the operation of the plant. This unusual feature, high in the air, required absolute prevention of all cracks from any cause, impermeable concrete and as near continuous work as possible. Under ordinary conditions there would be frequent joints between days' work of reasonable size which might allow the penetration of the weather.

This problem was solved by a little lower working stress in materials than is common by a rich mixture carefully proportioned for maximum of density, by designing forms for casting a large amount of concrete at one time, and by continuous work with different shifts of men, combined with very close supervision by more than the usual number of bosses, besides the inspetcor. The result proved satisfactory in every way.

WAREHOUSE OF AUSTIN NICHOLS COMPANY, BROOKLYN, N. Y.

MR. CASS GILBERT, *ARCHITECT*

# CURRENT NEWS AND COMMENT

## To Make Use of Incombustible Roof Materials Mandatory

A special committee, appointed by the State Fire Prevention Commissioner, of which Mayor George H. Newhall, of Lynn, Mass., is chairman, has issued an announcement of its conclusions, as follows:

Voted, that this committee recommend to the fire prevention commissioner that the cities and towns of the metropolitan fire prevention district should by ordinances, by-law or otherwise, put in force the following regulation:

"The roof of every building hereafter erected or recovered, in whole or in part, and the top of every dormer window thereon, shall be covered and roofed with brick, tile, slate, tin, copper or iron, or such other incombustible or fire-retarding roofing as the commissioner by his certificate in writing may authorize; but this section shall not be construed to prohibit the patching of minor repairs of shingled roofs."

It is said that it is the intention of the fire prevention commissioner to communicate this recommendation to every city and town in the district, and to do all that he can to secure its adoption by cities and towns not having such an ordinance at the present time.

## A Bill to Create a California State Art Commission

A bill, recently introduced in the California State Legislature, provides for the creation of a State Art Commission.

The bill calls for a commission to consist of the Governor and one architect, artist painter and sculptor.

The provisions as to the acceptance of works of art and the designs of State buildings are similar to like enactments in other States.

## South Carolina Association of Architects

At the annual meeting of the South Carolina Assocaition of Architects, held in Columbia, January 20th, the following officers were elected:

A. W. Todd, Charleston, President; J. D. Urquhart, Columbia, Vice-President; J. H. Sams, Columbia, Secretary and Treasurer. The Association endorsed the proposed State Licensing Act.

The summer meeting will be held in July, 1915, at Wrightsville, N. C.

## T Square Club, Philadelphia

The announcement by the Executive Committee of the T Square Club of Philadelphia, of the program for the spring of 1915, indicates a wide range of activities contemplated by this progressive organization.

A course of lectures, including one on March 30th, on Architectural Asymmetries, by Professor William H. Goodyear, special exhibitions, intimate talks by both club members and non-members and other features will undoubtedly make the new clubhouse the scene of many interesting activities.

Competitions are announced: The facade of a small city house, with four prizes aggregating $500, and the Walter Cope Memorial Prize Competition, 1st prize $100, second $25, the money to be spent for books under the supervision of the Executive Committee.

## MacMonnies Bacchante Returns to Boston

The Robert Dawson Evans memorial galleries for paintings, an extension of the Museum for Fine Arts, were formally opened in Boston on February 2. At the axial focus of the new wing of the marble group in the Fenway may now be seen the famous MacMonnies Bacchante, banished, some years ago, by reason of the protest of some purists in art, from exhibition in the Boston Public Library.

## National Academy of Design Spring Exhibition

The ninetieth annual exhibition of the National Academy of Design will be held in the galleries of the American Fine Arts Society, March 20th to April 25th, both inclusive.

## Personals

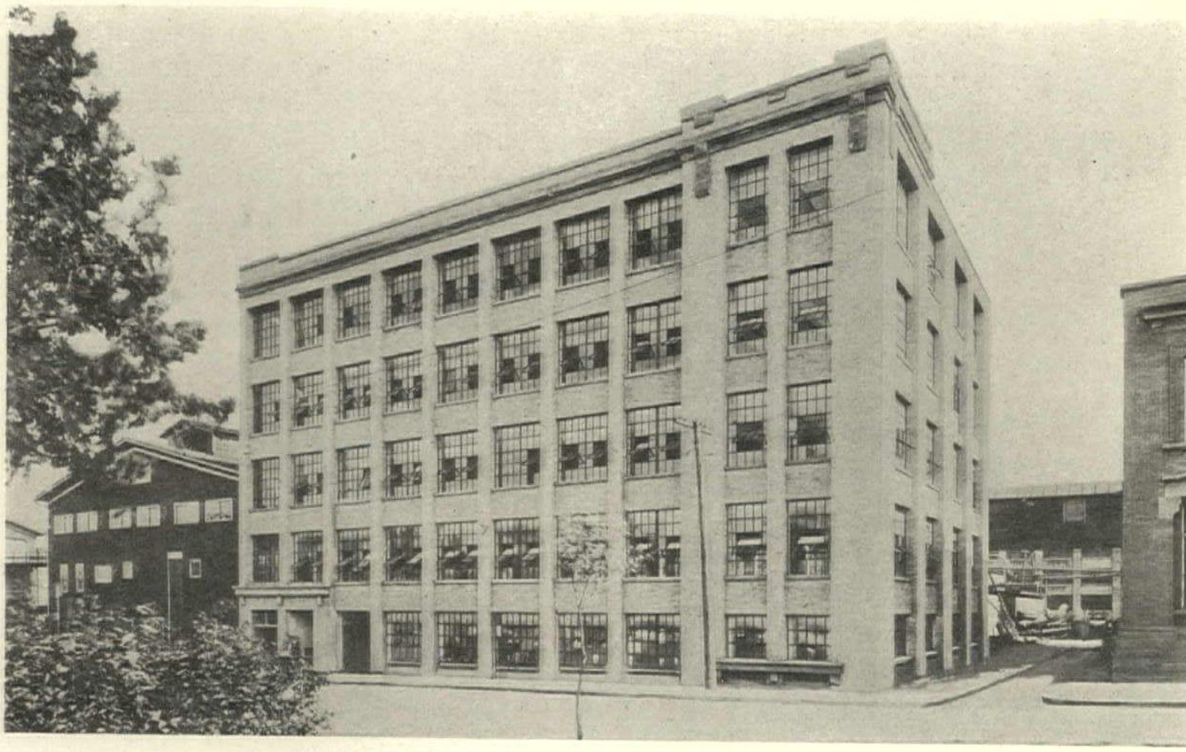
Mr. Wm. Newton Diehl, Architect, Norfolk, Va., has moved his offices to 46 Chamberlaine Building. He desires to receive manufacturers' samples and catalogues.

Mr. Samuel E. Perry, Architect, Rocky Mount, N. C., announces that he has opened offices where he will practice his profession. Samples and catalogues are desired.

Mr. Charles C. Rich, Architect, Portland, Oregon, has secured offices in the Corbett Building, where he will continue the practice of architecture.

Wm. A. Otis & Edwin H. Clark, architects, announce the removal of their offices to the eighteenth floor of the Tower Building, No. 6, N. Michigan Avenue, Chicago, Ill. The firm name will be Otis & Clark.

Mr. William L. Althouse and Mr. Herbert S. Jones, architects, Mansfield, O., announce that they have formed a partnership for the practice of their profession, under the firm name of Althouse & Jones. Their offices will be in the Citizens Building.



WOODWORKING BUILDING, HAMILTON MFG. CO., TWO RIVERS, WIS.
MESSRS. LOCKWOOD, GREENE & CO., *ARCHITECTS*

# INDUSTRIAL INFORMATION

## Twentieth Century Screens

The Watson Mfg. Co., Jamestown, N. Y., manufactures and markets a type of insect screen which is termed "The Twentieth Century Screen," and is described at some length in a booklet of thirty-five pages, printed in colors and profusely illustrated.

These screens are made with wood frames of any variety selected, or with frames of bronze, brass or galvanized steel. Roll screens are also made in brass, bronze or galvanized steel, and are finished in any color desired. The principle of the screen employed is indicated in the name, and when not in use the screen cloth is entirely out of sight. It is stated that the roll screen is the only practical form for use in casement windows opening out.

The claims for these screens are: superiority in manufacture, light weight, neatness of appearance, safety devices which prevent removal, by extended corner construction of great strength, renewal of wire cloth made possible without special tools, and hardware built into frames.

Any further detailed information desired, or the booklet referred to will be sent upon request.

## Sanitary Flooring

The Imperial Floor Company, Inc., Rochester, N. Y., has recently issued a descriptive booklet and a sheet of instructions for mixing and applying their product, which is designated as Imperial Sanitary Flooring. This material is a composition which is applied in plastic form over old or new wood floors, iron or concrete to a depth of from three-eighths to one-half inch. It is said to harden quickly, and become a solid sheet, resembling a seamless tile. It is claimed that a surface is presented which is smooth, never becomes slippery, offers neither crack nor crevice for the accumulation of grease, dirt or moisture, and does not give off dust as a result of use.

Further advantages claimed are elasticity, noiselessness, durability, fireproofness and economy. It is designed for public dining-rooms, kitchens, bathrooms, police stations, hospitals, schools, churches, auditoriums, amusement houses, stores, etc. It is made in gray, red, buff, brown and white.

The booklet referred to and a sample of the flooring will be furnished to architects upon request.

## The Lynn Drain Trap

The Central Foundry Company, 90 West Street, New York City, manufactures a drain trap which has been designated as the "Lynn," and is intended for automobile wash-stands, stables, breweries, factories and hotels.

The claims for this trap are, safe and perfect drainage, positive separation of sediment and ease and rapidity in cleaning.

A folder recently issued illustrates the trap and its operation, and shows the dimensions of the various sizes in detail. A price-list of the various types and sizes is also printed. From the illustrations it would appear that there are many features of this trap well worth consideration of architects and sanitary engineers.

Folder referred to will be mailed upon application.

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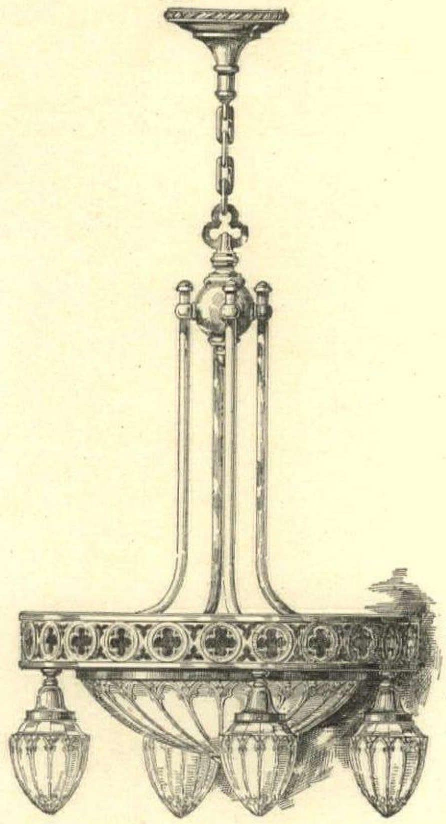

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