# EACH AGE BUILDS FOR ITS OWN NEEDS

### Evolution of the Modern Structure Is a Result of Our Demands.

### STEEL BROUGHT A NEW ERA

### Skeleton Construction Made Tall Buildings Possible—Details Figured Out Before Work Starts.

Each age finds a way to construct buildings suited to its own needs, and the process of building construction has been said to be merely a working out of the old law of demand and supply. The cliff dweller found his rudely constructed home suitable to his primitive needs and the cathedral builder of the Middle Ages sought the result he so perfectly accomplished, that of expressing a religious ideal in stone. The present day is one of intense business activity, and this activity is as much in need of housing as any of the past generations. So philosophers explain the tendency of modern architecture.

During the first part of the nineteenth century architects in the United States contented themselves with copying English designs, although the Colonial style, which is said to have grown out of the ability of builders to get shingles easier than any other material, preceded them. One of the first efforts of monumental building in this country was the beginning of the Capitol at Washington in 1793. It was finished seventy-two years later.

It was not until the advent of the steel method of building construction that the modern constructor had means at his disposal to cope with the demand existing. It allowed him to run his buildings high into the air and the introduction of elevator service made the highest floor almost as accessible as the ones nearer the ground. Steel construction of buildings attracted attention in New York about 1890, when some large buildings had been already completed, and investors who were cautious about a new type of structure could foresee the commercial possibilities in the venture. The idea behind the construction of tall business buildings made possible by the development of the steel skeleton method was to secure a higher rental from a given piece of ground. The crowded condition of the downtown business district caused the realty values to mount so high that a profitable return on an investment could not be made by employing the old type of brick and stone construction. Six or seven stories marked the limit for these buildings.

The first few of these tall buildings having been completed and office room in them having been offered for rent it was discovered that the additional floor space gained by the increase in height was not the only advantage gained. The offices rented quickly and the tenants who availed themselves of the opportunity were willing to pay a higher rental for the skyscraper office than for the one in the ordinary six or seven story structure. The tall buildings were attractive, an increase in light and air was obtainable and, perhaps as important as any of the other things involved, there was a general air of progressiveness about them that appealed to the active business man. In addition housing was provided under the same roof for other concerns in the same line of business; telegraph offices, public telephones, office supply shops, typewriting offices, a barber shop and no end of conveniences that the smaller structure did not have.

The construction of a tall office building is now systematized. The steel beams and other parts of the skeleton are rolled to measure at the mills. Each beam and part has its number, according to the plan furnished, and when the steel work has been finished at the mill it is shipped to the builder and put together with seldom an alteration in any part being necessary. What would appear to be as complicated a task as putting together a puzzle picture goes along as smoothly and as rapidly as trained workmen can drop the members of the skeleton into place.

Although the foundation for a tall building, as with any other building, must be built first, the engineer starts his work of designing at the top. This is necessary in order to distribute the weight. As each floor is finished the story under it is designed to be supplied with beams of sufficient strength to hold up the weight above it. Thus as the engineer goes down from floor to floor he is increasing the weight proportionately. A designer of a skyscraper could not begin at the bottom and work upward, it is explained, because he could only guess at the weight he was leaving behind him on the way up, and having got all the way up he might have to begin an "upward" revision of the weight of each floor on his way down again.

The foundations for a big building in New York can be carried down to bedrock and a base thus secured sufficient to bear up under the enormous weight of the structure. There is no danger under such circumstances of the foundations shifting or settling. But where there is no such solid bed of rock to rest the legs of the building on an artificial bed must be made. In Chicago, for instance, the soil is soft and sandy, and before work of laying the foundation can be started a heavy mass of steel rails must be buried in a concrete bed, the rails being laid criss cross. Another method is to build stone or brick piers close together and then to fill the spaces in with cement, so that what is practically one enormous block of stone is obtained for a foundation rest.

A feature of high building construction that has received considerable attention is the preventing of corrosion in the steel beams. The commonest protection is, of course, the coat of paint, usually red lead. But other materials are employed, patented compositions having graphite and rubber bases being among them. After the steel beams have been coated with a proper rust resisting material, the brick or stone walls which enclose them protect them from the weather and leave little opportunity for dampness to soak through.

The development of fire resisting materials for these office towers has, of course, received most careful attention. In some of our modern office buildings a claim is made that there is not enough wood in them to "make a lead pencil." But a problem is presented even if the floors of the building are fireproof by the possibility of a serious blaze that is confined to only one floor. Numerous devices are suggested to solve this. Some have considered the possibility of putting metal flaps on the ceilings of large rooms where the character of the work demands an extended floor space and so regulating these flaps that they would fall automatically when the least fire started.

After a recent New York fire in which a number of lives were lost experts consulted as to the best means of fire escape recommended enclosed staircases made fire tight as one way of protecting workers in the upper story lofts. To guard against the possibility of panic crazy office or factory employees jamming against a door, some firms have advocated a specially constructed door which will open outwardly when any pressure is exerted against it. A number of States and municipalities have made outward opening doors a legal requirement in the construction of large buildings.


## The P. J. Carlin Construction Company

is an outgrowth of P. J. Carlin & Company, which for many years had its main offices at No. 26 Court Street, Brooklyn, and which executed upwards of thirty million dollars of work in the thirty odd years of its existence. The corporation was organized in 1904, and the main office transferred to No. 16 East 23d St., New York City. The business has since materially expanded, the Company having contracts and estimating work all over the United States.

Among the buildings constructed by this Company may be mentioned the following:

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| Waterside Station, N. Y. Edison Co. | T. E. Murray, Consulting Engineer. |
| Sub-stations (4) N. Y. Edison Co. | T. E. Murray, Consulting Engineer. |
| Williamsburg Power Station, Brooklyn | T. E. Murray, Consulting Engineer. |
| 59th Street Power Station, Brooklyn | T. E. Murray, Consulting Engineer. |
| Power Station, Interborough R. R. Co. | W. S. Menden, Chief Engineer. |
| Car Barns, Maspeth, Long Island | W. S. Menden, Chief Engineer. |
| East New York Shops, Brooklyn, N. Y. | W. S. Menden, Chief Engineer. |
| Power Station, 38th Street, Brooklyn | W. S. Menden, Chief Engineer. |
| Power House, Boiler House & Coaling Station, Bellevue Hospital | McKim, Mead & White, Architects. |
| New York City Prison | Withers & Dickson. |
| Steel Cell Construction, City Prison | Horgan & Slattery. |
| Post Office, Brooklyn, N. Y. | Supervising Architect, Washington. |
| Hall of Records, Brooklyn | Wm. Mundell. |
| Group of Buildings, Kings Park, L. I. | L. G. Perry, State Architect. |
| Glackner Building, New York City | Dehll & Howard. |
| Wick Building, New York City | D. H. Burnham & Co., Chicago. |
| Armory & Boat House, Annapolis, Md. | Ernest Flagg, New York. |
| Sea Wall, Annapolis, Md. | Ernest Flagg, New York. |
| Brooklyn Institute of Arts & Sciences | McKim, Mead & White, Architects. |
| Warehouse for Arbuckle Bros. | Wm. Higginson, New York. |
| Four Central Stations, N. Y. & N. J. Tel. Co. | Ehlitz & McKenzie. |
| Fourteen Sub-stations, N. Y. & N. J. Tel. Co. | Ehlitz & McKenzie. |
| Boundary Wall & Medical Building, Navy Yard, Brooklyn | Supervising Architect, Washington. |
| Brooklyn Savings Bank | Frank Freeman. |
| Real Estate Exchange, Brooklyn | Geo. E. Edbrooke. |
| Fire Dept. Headquarters, Brooklyn | Frank Freeman. |
| Harlem Hospital, New York | Horgan & Slattery, New York. |
| Complete R. R. Shops, West Shore R. R. | Utica, N. Y. |
| Flatbush Terminal Station | Long Island R. R. Co. |
| Sub-stations, N. Y. C. & H. R. R. R. Co. | Geo. W. Kittredge, Ch. Eng. |
| Prison Ship Martyrs' Monument, Brooklyn | McKim, Mead & White. |
| Mortuary Chapel, Calvary Cemetery | R. P. Almirall, Architect. |
| Franklin Building, Brooklyn | J. G. Glover. |
| Germania Bank Building | C. Eisenach. |
| Carlin Building, West & Vestry Street | F. P. Dinkleberg, Chicago. |
| St. John's Hospital, L. I. City | Schickel & Ditmars. |
| Williamsburg Savings Bank, Brooklyn | Helmle & Huberty. |
| Home for the Aged Men | Lord & Hewlett. |
| Carnegie Library, Greenpoint, N. Y. | R. L. Davis. |
| Riding Club, New York | Bradford L. Gilbert. |
| St. Barbara's Church, Brooklyn | Helmle & Huberty. |
| St. Augustine's School, Brooklyn | Albert E. Parfitt. |
| St. Agnes' Parochial School, Brooklyn | T. F. Houghton. |
| Congregational Church, Williamsburg | John B. Snook & Sons. |
| St. Mark's Church, Brooklyn, N. Y. | H. M. Congdon. |
| MANY PRIVATE RESIDENCES. | |

From which it can be seen that it has a wide and varied experience in all kinds of construction work. In recent years it has specialized in building construction involving engineering difficulties, as is evident from the work we now have, or had had in charge, for the New York Edison Company, the New York Telephone Company, the New York Central and the R. R. T.

The president of the concern, Mr. P. J. Carlin, has been identified with the building business for forty-five years, and organized the original Carlin Company in 1870.

# WRECKER OF BUILDINGS MUST BE RESOURCEFUL

### A Contractor Who Does This Work Should Be a Judge of Values.

### MANY STRUCTURES RAZED

### Seven Concerns for This Eight Years Ago—Now There Are 200 in New York.

It is quite probable that the average person has very little conception at the present day of the extent to which buildings in leading cities of the country, and more particularly perhaps in New York, are being and have recently been demolished in order to make room for more modern and commodious structures. An idea of this may be gathered from the statement that during the past ten years 8,000 buildings have been torn down on the Island of Manhattan alone for the purpose of making way for more modern improvements. Some of these have been single buildings, such for example as the twenty story Gillender building of steel skeleton frame construction at Wall and Nassau streets, which was demolished in order that its site with that of adjoining property might be utilized for the erection of a thirty-one story building. Again, there have been times when whole areas have been swept away, notable examples of which are the site of the present Hudson Terminal buildings, extending from Fulton to Cortlandt street on Church; the Grand Central Station site, covering almost half a square mile in the heart of the city; the two square blocks upon which the Pennsylvania Railroad Station and Terminal now stands; the site of the mammoth Woolworth Building and that of the Municipal building, not to mention the extensive demolition of buildings that necessarily occurred to make way for the approaches to the various new bridges completed within the last few years.

Eight years ago there were only seven house wrecking companies in the city, while to-day there are 200. Some idea of wrecking values may be gathered from the fact that the hospital building at Twenty-third street and Lexington avenue was sold to a wrecking company for $250, with the understanding that it would be removed from the site in twenty-one days. It proved to have a steel grillage foundation worth $1,500. The same company began on June 1 to tear down the Hospital for the Ruptured and Crippled, the Grand Central Palace and twenty other four and five story buildings in that vicinity, all representing a wreck value of about $10,000. The Gillender building already referred to was sold to wreckers for $50,000, although it cost $500,000 to build. One company tore down forty-two buildings in fifty-two days and among them was a massive brewery containing vast tonnages of machinery.

As to what becomes of the old material from the demolished buildings, Mr. Beals points out that common brick when cleaned of mortar will be sold to a second hand material dealer for $2 a thousand and they will eventually find their way into interior walls of many modern buildings at approximately $3 a thousand. Since so-called new light hard brick are no longer permitted to be used in new buildings the demand for second hand brick has continually increased. The only waste is the mortar between the joints, the plaster and the old bats that cannot be sold again as brick. While the Grand Central Station was being demolished the contractors are said to have shipped 100,000 old brick a day for almost a year to various points along the Hudson where the New York Central Railroad had some filling in to do. In this case no attempt was made to save the brick taken from these operations. The steel girders are also a source of barter. When they are standard shapes they are practically as good as new. A little emery wheel grinding and some waterproofing paint puts them in shape to go into suburban mills and factories and not infrequently into speculative apartments of the cheaper grade.

The wrecker of buildings must have great resourcefulness and a perfect organization in spite of the fact that his help is almost always of the unskilled labor class. He must be a keen judge of building material values to know whether there is any market to-day for black marble mantelpieces, iron, gas and water pipe, oak window sashes, mahogany stair railings and steps. He must know what the market is for brownstone, for old heating apparatus, elevators if the building contains such a device and other materials. If it is an office building that he is figuring on tearing down he must know whether there is at the time a good demand for second hand girders and cast iron columns, iron shutters, iron stairs and old vault lights. If he finds that the building which he is examining is of an irregular shape so that the crossbeams and girders are of different lengths, if the doors are of extra large size and the window frames smaller than those now used or even larger or the floor is badly cut up by partitions he will naturally make his bid for the wrecking contract correspondingly low.

The system of taking wrecking contracts is different in almost every locality. Here in New York the owner seldom has to pay for the removal of a building. In Baltimore the owners of the News Building paid $22,000 to a contractor to remove the building and sold the salvage rights to one man for $1,500. The destruction of a building requires more consideration than the mere matter of getting it down as quickly as possible. Dynamite could be used for that purpose provided the building was remote from other structures and pedestrians did not have to be protected.

The secret of the wrecker's success is in the organization he maintains. Most of the leading companies have a most perfect system, insuring economical demolition of buildings. They have several picked foremen who are expert appraisers of second hand material, and under these foremen from fifty to a hundred cheap laborers are employed. These are provided with crowbars, hammers or sledges, according to the type of work to be torn down and the proportion of that which is to be saved. There is usually to be found among them an expert ironworker who directs the careful removal of marketable steel girders and columns. Marble, granite and other building stone is also carefully taken out by these trained men.


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# PNEUMATIC CAISSON DAM FOUNDATIONS, UNITED FIRE COMPANIES BUILDING

Construction is about completed on the 25 story office building fronting on Maiden Lane and Cedar Street, New York, designated as No. 80 Maiden Lane, which is being built for the United Fire Companies. The cellar will have a floor about 26 ft. below the curb and will be enclosed in a water tight concrete dam carried down to solid rock at a maximum depth of over 60 ft. below the curb by pneumatic caissons united together to make a continuous construction similar to that of the Stock Exchange and later buildings which have from time to time been described in these columns. Concrete piers, also sunk to rock by pneumatic caissons, will support the interior columns and with a concrete cellar floor will comprise the substructure, which is the subject of this description.

The wall caissons are 9 in. from the lot line on the east and west sides of the building and are sunk through about 20 ft. of fine wet sand or hard clay, as the case may be, and below it through a stratum of hardpan from 3 to 4 ft. thick plentifully filled with green serpentine rock.

The hardpan corresponds to that found in all other neighboring excavations, but is here under unusual conditions in that while in the other cases the hardpan lies directly on the surface of the solid rock it is here separated from it by from 15 to 35 ft. of glacial drift, consisting of gravel, cemented clay and boulders in all sorts of irregular distribution, making a material of the most difficult character to penetrate. The underlying rock is here a compact gneiss, in some parts of which are found mica in quite large deposits, also garnets of the size of a pinhead sticking out of the broken quartz.

It was not unusual at times to find the entire bottom of the working chamber excavation covered with nigger head boulders, many of which were too large for removal without blasting, thus making the progress very slow until the cutting edge had sunk below them. Underneath the boulders fine sand was sometimes encountered, and in one instance there was met a remarkable stratum of black hard clay 1 ft. thick. As the adjacent tall and heavy office buildings had foundations on the upper stratum of sand or clay it was necessary to protect them from settlement due to possible undermining of their heavy walls from the caisson sinking and the inevitable disturbance and changes in underground pressure so close to them. Provision was therefore made for safeguarding a combined length of 256 ft. of the walls of three adjacent buildings before sinking any of the caissons close to them was commenced.

The three buildings were of different heights and different types, with different types of foundations, and were treated in entirely different manners. The 15-story office building No. 58 William Street has a wing 37½ ft. wide on the lot line with a brick wall carried by girders in each story on two columns which transmit their computed loads of nearly 400,000 lb. each to an I beam grillage on the sand about 15 ft. below street level.

Field-riveted connections were made to the columns for heavy adjustable spur bracing to supply any deficiency caused by the removal of the outer grillage beams which were cut out to clear a pair of cylindrical piers sunk by the Breuchaud process in the plane of the wall. These piers support a pair of plate girders riveted across the faces of the columns and wedged up to transfer a portion of the column load through the pier to solid rock, thus relieving a portion of its load and maintaining an always undiminished support for the columns in which the most accurate measurements have failed to detect any signs of settlement. The details of this underpinning were illustrated in the Engineering Record of Sept. 9, 1911.

The office building adjacent to No. 58 has a self-supporting brick wall about 76 ft. long and 60 ft. high which, with its floor load, weighs about 10,000 lb. per linear foot, and has concrete footings about 9 ft. below the curb on a pile foundation. As the footing was in good condition it was decided to retain it, and plans were made to maintain the wall and compensate any settlement in the foundations without shoring or underpinning.

To this end the wall was braced from first and second floor levels by six spur shores with jackscrew adjustments on their crib footings, and holes about 8 ft. apart were cut through the walls just above the footings. In them were inserted nine pairs of 40-ton jack screws set up to positive bearing before excavation was commenced alongside.

As the excavation progressed accurate levels were taken at least twice a day and as fast as they showed the slightest settlement the jack screws were operated to maintain the wall at the original elevation. This method limited all displacement to the footings and piles, which were thus driven down to solid bearing as fast as they needed it, and eventually were displaced 4 or 5 in. vertically without injury or distortion to the wall or the rest of the building or any material injury to the foundations themselves. After the caisson sinking was completed wedging stones between the jacks were adjusted to relieve the latter and the jacks were removed and the wall made good. As there was no apparent tendency for the building to diverge from the vertical the spur shores could be shifted as required and some of them were entirely removed to clear the adjacent caissons.

Competitive bids were received for the construction of the substructure for which the greatest expedition was demanded and enforced by unusually severe conditions. A large penalty per day was imposed for each of the first 20 days' delay in finishing the contract at the specified time, besides an additional penalty of a large lump sum for any further delay. No corresponding bonus was provided for completing the work in advance of contract time, but payments were made on a basis of 100 per cent. monthly estimates.

The contract was awarded to the O'Rourke Engineering Construction Company, who offered to complete the caisson work Aug. 15, six weeks sooner than their principal competitor, who, in addition, required certain changes to be made in the construction. The owners, architects and general contractors considered the time absurdly short and only awarded the contract after considerable discussion and a careful examination of the time schedule submitted. Work was commenced April 15 and the caisson sinking was completed about Aug. 11, thus permitting the entire contract to be finished in time as agreed to by the contract and establishing a remarkable speed record.

Before the site was more than half cleared by the wrecking contractor who razed the old building two air compressors were installed and a derrick set up for the erection of the four-boom traveller which handled the caisson, plant and materials. The first caissons were delivered and their sinking commenced as quickly as possible, while the remainder of the site was cleared and the general excavation and sheeting was carried on, the rest of the plant installed, the material received and the work pushed day and night as fast as space limits permitted.

The old sidewalk vault was utilized where available for storing and working purposes, and the vault walls were maintained in some places for retaining walls and in other cases the sides of the excavation were retained by vertical jacks driven with mauls as the digging advanced and secured by four lines of 12 x 12-in. rangers which, as the earth stood well, did not develop any pressure and in some cases served temporarily without bracing until the caissons could be sunk to clear inclined braces to them.

There are 21 exterior or wall caissons forming the dam enclosing the site and 31 interior caissons, all of which were made complete at the contractor's yard, delivered by trucks and swung to position by the derrick booms. The interior caissons average about 7 ft. square and are made entirely of wood with horizontal interior frames to which are spiked the vertical 3-in. tongue and groove calked sheeting planks. The rectangular wall caissons have a uniform exterior width of 6 ft. 6 in. and are from 26 to 35½ ft. long. They have permanent interior angle iron horizontal frames covered with 3-in. vertical sheathing and have permanent steel plate and angle decks proportioned to support the wet concrete and permit the concreting to proceed continuously with its greatest rapidity instead of having to wait for the lower portion to harden and support the rest, as is the case when the caissons are designed to have the decks formed by a concrete slab cast on temporary centering.

This method of constructing continuous concrete caisson masonry was invented by Mr. John F. O'Rourke, to whom patents for it were granted in 1901, when he at first applied it to the construction of the foundations of the New York Stock Exchange building. This building has interior caissons forming a dam with an immersion of 40 ft. above the sub-cellar floor. The same construction has been used in the Hudson Terminal, the Whitehall, the Bankers' Trust and many other buildings. For this reason it was considered unnecessary to provide a pressure resisting floor for the United Fire Companies Building, where the exclusion of the water is expected to prevent upward pressure. Such water as will seep through during the first few months will be pumped out. Experience indicates that concrete placed under water is traversed to some extent by small openings formed by the compressed air escaping from the working chambers before the concrete was set. These openings are, however, very small and soon