

# *Otis & the Woolworth Building, New York*

*By EurIng Brian Roberts, CIBSE Heritage Group*



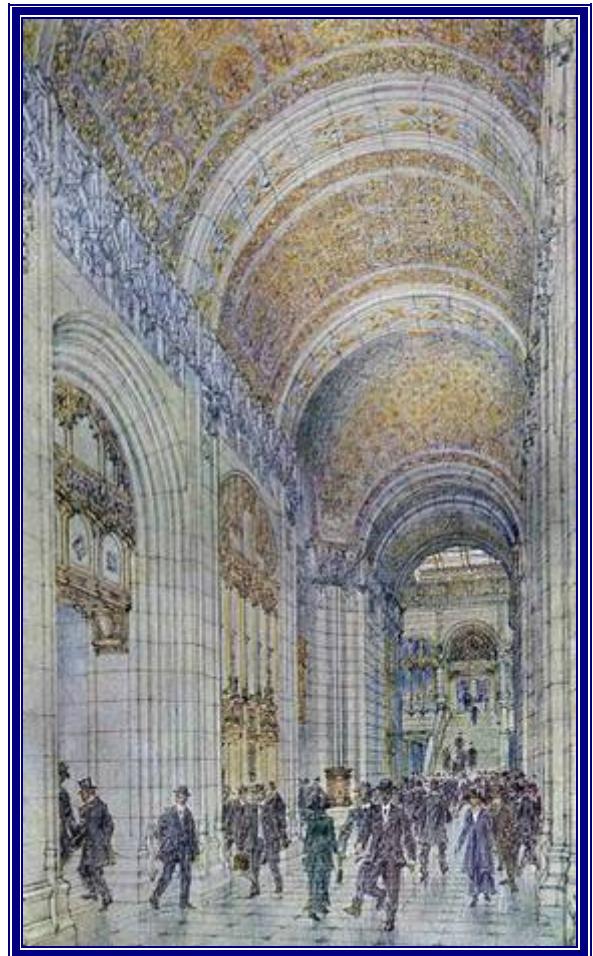
**Frank Winfield Woolworth 1852-1919**  
Company Founder



**Cass Gilbert 1859-1934**  
Architect

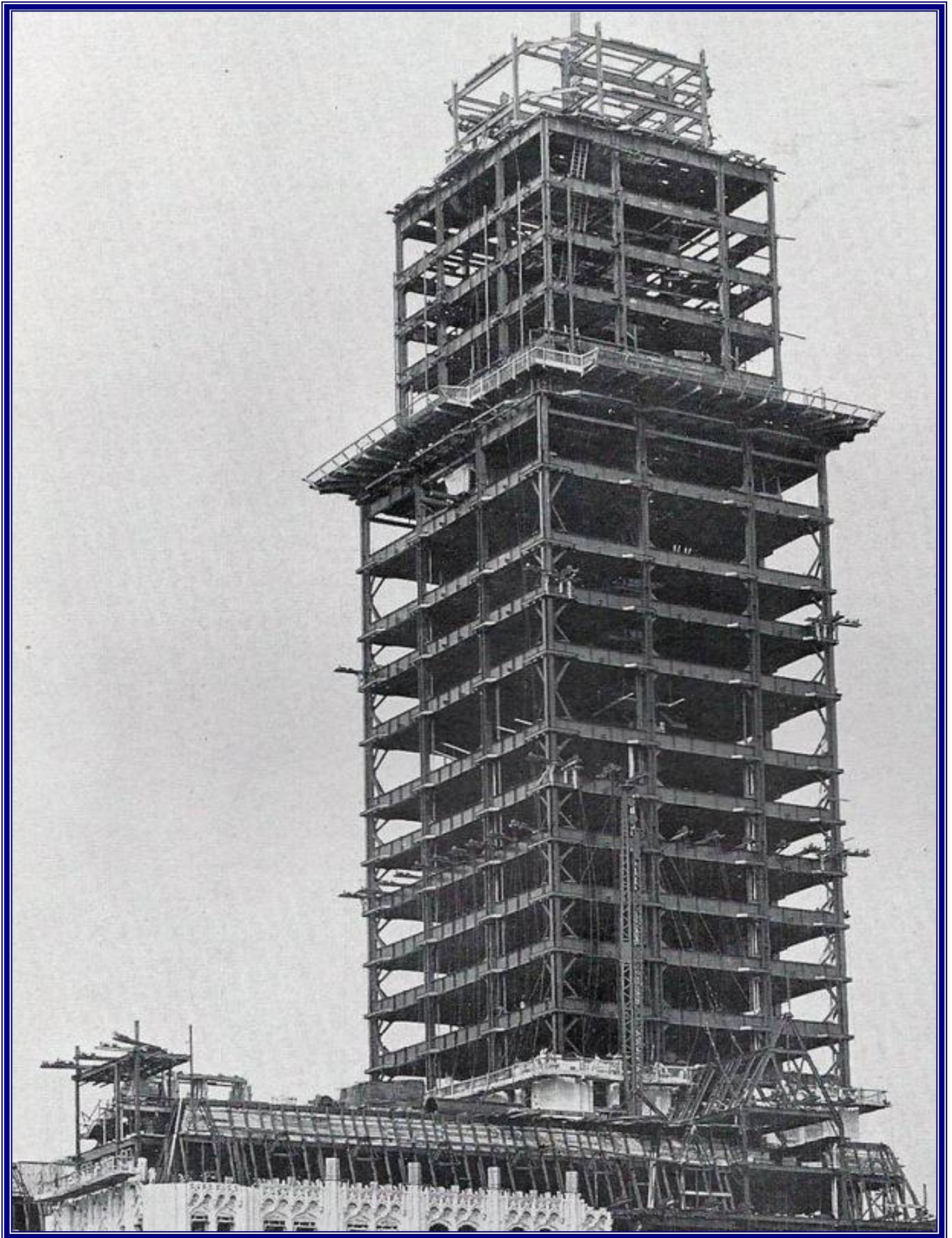


**Woolworth Building opened 24 April 1913**  
Height 792 feet (241 m), world's tallest until 1930



**Main Hallway (Lobby)**





The structural steel skeleton with the sixty main columns supporting a weight of 125,000 tons



Diagram showing the six main Otis tower elevators, each with a speed of 700 ft/minute when loaded to 2500 pounds, then the fastest electric passenger elevators in the world



## SELECTION OF THE ELEVATOR SYSTEM

It was considered fitting that a building of such architectural excellence and completeness as the Woolworth should be provided with the most modern transportation facilities. With a view to selecting the best, all the different elevator systems in use were carefully investigated and tested, having in mind the extraordinary height of this building, as well as the many floors to be served. As a result of this investigation, in which safety, reliability, speed and simplicity were paramount to every other consideration, the contract for the entire equipment was awarded to the Otis Elevator Company of New York.

"Safety first" was the motto of the builders of this great structure, and in particular did this apply to the elevators. During the last few years accidents resulting in personal injury, due to faulty elevator mechanism, have been very rare. Nevertheless, every precaution was taken to make the Woolworth elevators absolutely safe. They were equipped with the most improved mechanical safety devices. All the shafts, too, were equipped with air cushions, which have been proved time and time again to be absolutely reliable. Not long ago, when severe tests were made, a car was allowed to fall from the twentieth story of the Empire Building in New York, and a basket of eggs which it contained was entirely uninjured when the car was checked in its downward flight by the air cushions.

To a very large extent the success of the modern high office building as a paying investment must depend upon its elevator service. Every floor must be readily accessible and must be reached in the shortest possible time. During business hours time is too valuable to be wasted in waiting long for an elevator, or in spending ten, or even five, minutes in reaching a floor which should be reached in as many seconds. This problem of quick service was very carefully studied and the elevator installation planned to give the best results.

## INSTALLATION OF OTIS ELEVATORS

The elevator equipment, which is the most important part of the mechanical equipment of the building, consists of twenty-nine Otis Electric Elevators. Of these, twenty-seven are for the use of the public, seven serving the tower, and twenty the main building. In addition, there is an automatic push-button elevator for the private use of the Irving National Bank, and an ash lift which runs from the sub-basement to the sidewalk.



Of the seven elevators in the tower, two run to the fifty-third floor, two to the forty-seventh floor and two to the fortieth floor. These six elevators have a maximum capacity of 3000 pounds, and are designed to operate at a speed of 700 feet per minute with a load of 2500 pounds—the fastest service given by any electric passenger elevator in the world. One of the elevators which serves the fifty-fourth floor has an additional capacity of 6,000 pounds for lifting safes or other heavy loads. The seventh tower elevator is a shuttle elevator, which carries passengers from the fifty-third floor to the observation station of the tower and runs at a speed of 200 feet per minute with a load of 1500 pounds.

In the main part of the building, two of the elevators rise from the sub-basement to the twenty-seventh floor, twelve from the basement to the twenty-seventh floor, and four from the first floor to the twelfth floor. All are passenger elevators, with a maximum capacity of 3000 pounds, and are designed to operate at a speed of 600 feet per minute with a load of 2500 pounds. The other two main building elevators are combined passenger and freight machines which rise from the basement to the twenty-eighth floor, operating at a speed of 550 feet per minute with a load of 3000 pounds, or at a speed of 350 feet per minute with a load of 4000 pounds. These also have an additional capacity of 6000 pounds for lifting safes and other loads.

The two elevators serving the fifty-third floor travel to a height of 679 feet 6 inches, which is the highest travel by any single passenger elevator in existence.

#### SAFETY DEVICES ON ELEVATORS

All the elevators are equipped with a complete system of safety devices, and including air cushions which will bring the cars gradually to rest at the bottom of the hatchways, in case of a drop even from the top of the shaft.

As this was the first time that air cushions were to be used on elevators travelling fifty or more stories, every precaution was naturally taken to make them perfect. The air cushion being approximately one-fifth of the height of the shaft, it meant that the enclosure doors on the lower eleven floors of the high rise elevators would have to be heavy enough to withstand the air pressure developed in case the car fell from the top. As manual operation of these doors was out of the question on account of the weight, the architect asked the Burdett-Rowntree Manufacturing Company to solve the problem, believing that their broad experience in equipping all types and weights of sliding and lifting elevator doors with pneumatic operating devices would guarantee the successful solution.

Tests were made and a special pneumatic device manufactured, and the satisfactory manner in which all the one hundred and twenty-four air cushion doors are operating is evidence of good reasoning in selecting the Burdett-Rowntree Manufacturing Company for this part of the work. To reduce the cost of maintenance of the operating devices so far as possible, this company installed an automatic lubricating system whereby all the devices are lubricated through the medium of the air from one point.





LOWER BROADWAY AND THE BAY, FROM THE WOOLWORTH TOWER

The Architect desired that the Burdett-Rowntree Manufacturing Company should assume the responsibility for as much as possible of the working of the air cushion doors, and therefore, in addition to the pneumatic door operating devices, they manufactured and installed the special door hangers and adjustable interlock switches and hung all of the air cushion doors.

A unique system has been designed for dispatching the elevators and regulating the schedule and general service. The dispatcher is located in an isolated room, and by means of a position indicator is able to follow the progress of each elevator in the building. These indicators consist of a series of miniature lamps corresponding to the different floors served by each elevator, and as a car reaches a floor the fact is known to the dispatcher by the lighting of the corresponding lamp.

Automatic starting signals are placed at the terminal landings and a buzzer signal is fixed in each car.

In order that the dispatcher may communicate with the operator, telephones have been provided. These are so arranged that they may be operated from either end of the line, or from the dispatching room only.

The telephone instrument in the car is provided with a loud-speaking transmitter which magnifies the voice tones and enables the operator to receive telephoned instruction while the car is in operation.

The public signals consist of the Armstrong Full Flash Type, having the up and down lamps at each floor. In addition to these, for each group of elevators, there is an electric sign to indicate the character of the service.



whether express or local, and the floors which are being served. These signs are operated electrically and can be controlled and changed from the dispatcher's station.

Nothing has been spared to make this the most complete elevator installation in the world, and to give to the public and the tenants of the building the best elevator service possible.

#### ELEVATOR SIGNALS AND AUXILIARY DEVICES

The large number of high-speed elevators in the Woolworth Building, while a fundamental necessity, by no means solve in themselves the problems involved; and they would fall far short of the duty demanded of them but for the elaborate system of elevator signals and auxiliary devices provided after careful study and experiment by the architect, consulting engineers and contractor.

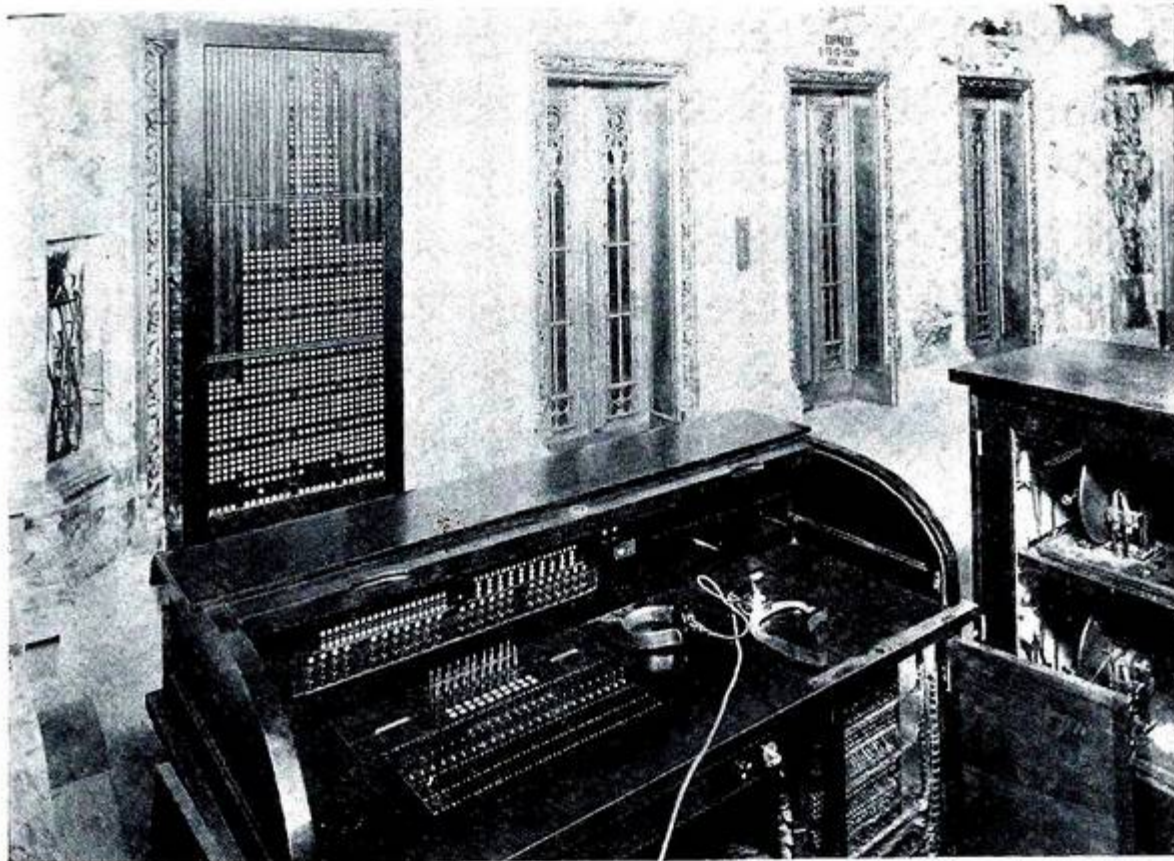
The results attained are perfect elevator service, controlled from one central station instead of through several starters stationed at different points on the ground floor; efficient and economical operation of the elevators through the system of signals and signs whereby false stops are eliminated and delay in waiting for passengers at the floors is avoided; absolute safety to passengers ensured, whether entering or leaving the elevators, through the installation of the Norton device, which automatically closes and locks the doors and prevents all movement of the car until the door is closed.

The signals and various devices through which these results are accomplished may be mentioned briefly, as follows:

The passenger elevators, twenty-four in number, are equipped throughout with the Armstrong Flashlight Signal System, embracing the usual "Up Down" lanterns at the floors, through which the waiting passenger is directed promptly to the first approaching car; "Up Down" push buttons at the floors, whereby the operator is given timely signal to stop, and which signal is automatically carried to the next car in the event of his inability to stop by reason of a "full car" or other cause. Signals of special design are provided for two high-rise cars for night service. Directional signs are also provided, designating the travel of the elevators and showing plainly to the public their travel in respect to express or local service. The elevators are also equipped with illuminated "thresholds," a valuable factor of safety, inasmuch as the passenger is enabled to see clearly where he is stepping when entering the car and is not liable to stumble.

All the elevators are controlled, as has been mentioned, from one central station. This dispatcher's station is located on the main floor balcony and is provided with a Position Indicator Lamp Board, showing by miniature lamps the exact position of all the cars; a telephone system extending to all the cars and establishing communication between the dispatcher and operators at all times and regardless of the position of the car; motor-driven Automatic Timing Devices, ringing bells and buzzers at the top and bottom





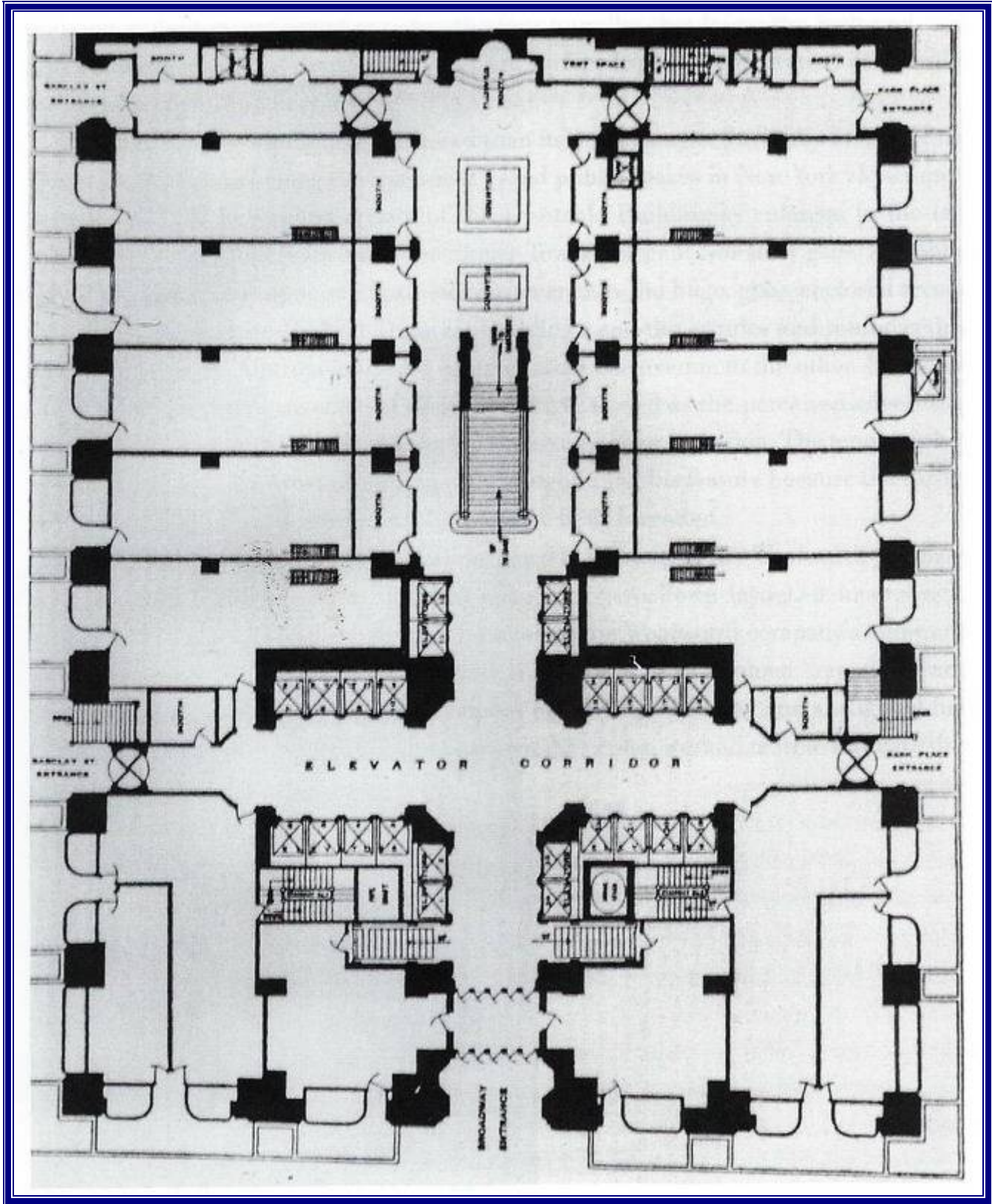
DISPATCHER SYSTEM—ELEVATOR SUPPLY AND REPAIR CO.

of the elevator hatchways for starting the cars at predetermined intervals; motor generators, storage batteries, and equipment complete in every detail for the control of all the cars by one dispatcher.

In providing means for automatically starting the cars from either terminus and of transferring the signal to the next approaching car when the car originally signalled does not stop, and means whereby the dispatcher and his operators are in full communication at all times, the greatest source of delay in elevator service has been overcome.

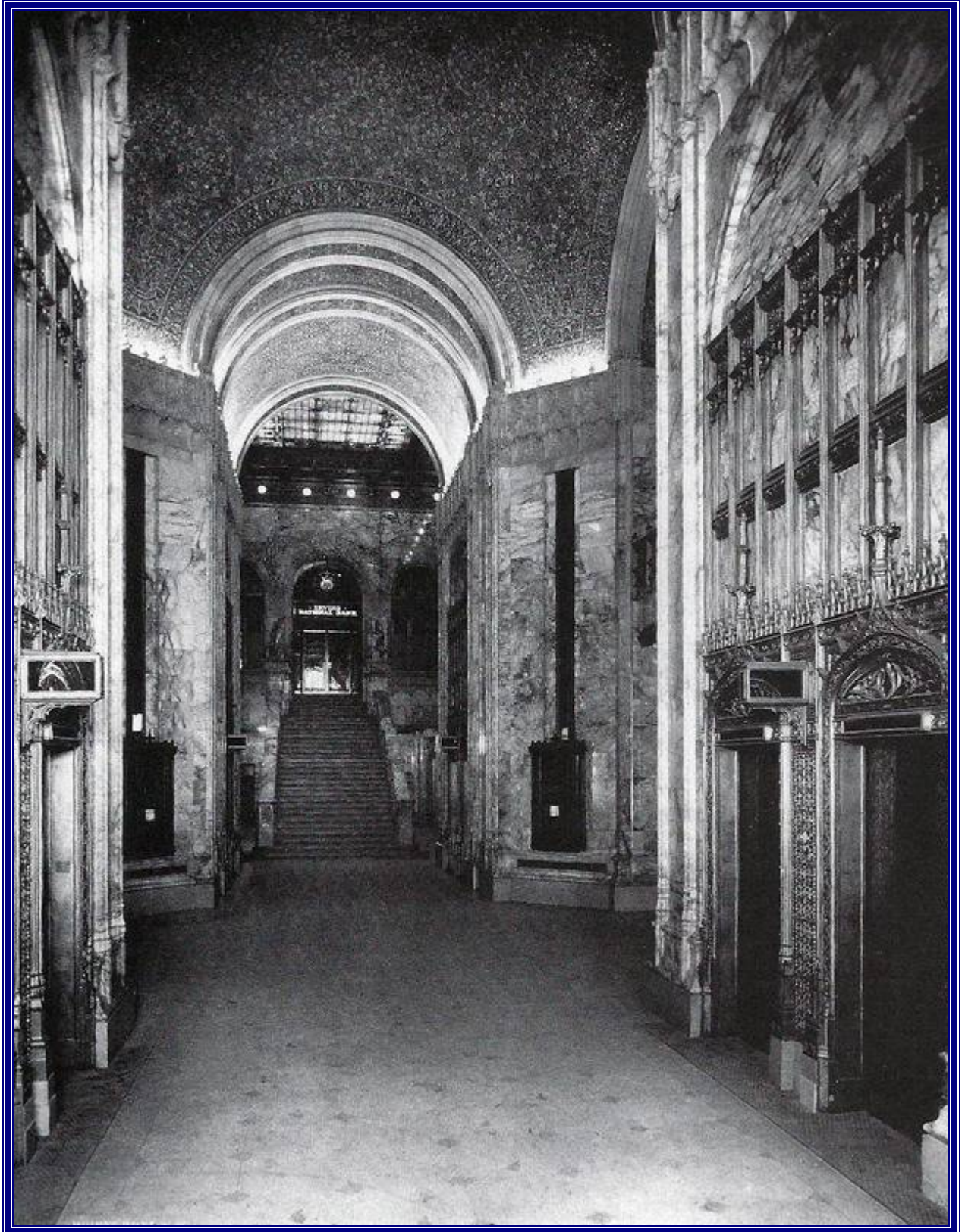
The records of the liability companies show that eighty-five per cent. of all accidents to the public in connection with elevator service are what they classify as "door accidents," or those due to unlocked doors or which occur while the passengers are attempting to board or leave the elevators. The elevators in the Woolworth Building are equipped with the Norton Elevator Door Closer, a device that absolutely prevents the possibility of accidents of the class cited. With this device the door is opened manually by the operator in the usual manner; when released, it closes automatically, without noise, and locks. By an electric switch arrangement the controlling circuit of the elevator is broken while the door is open, and all motion of the car is automatically and positively prevented until the door is closed. Carelessness or confusion on the operator's part is thus rendered harmless to the safety of the passenger. The elevator signals and auxiliary devices herein described were furnished and installed by the Elevator Supply & Repair Company, of New York and Chicago.





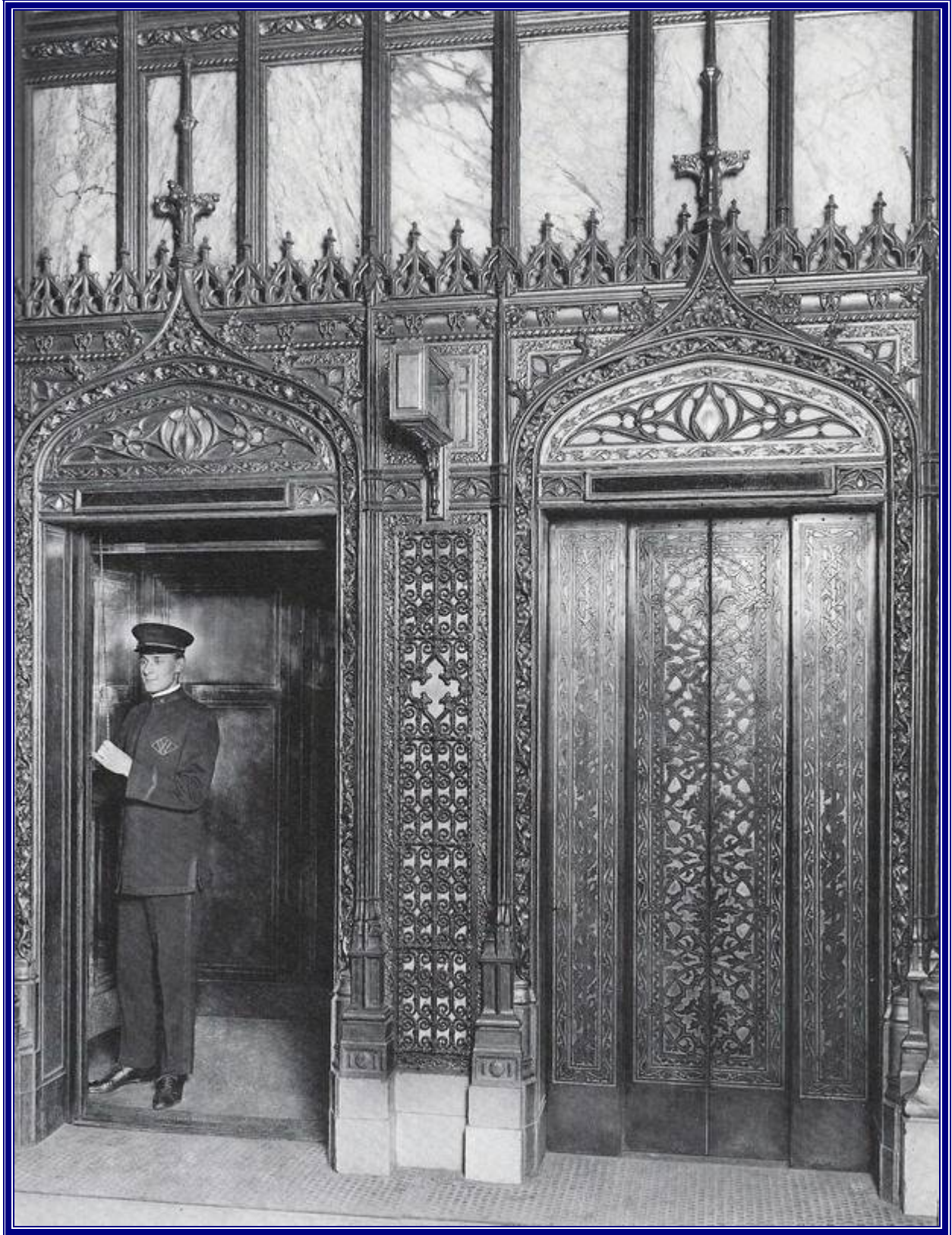
Plan of lobby showing elevator positions at this level





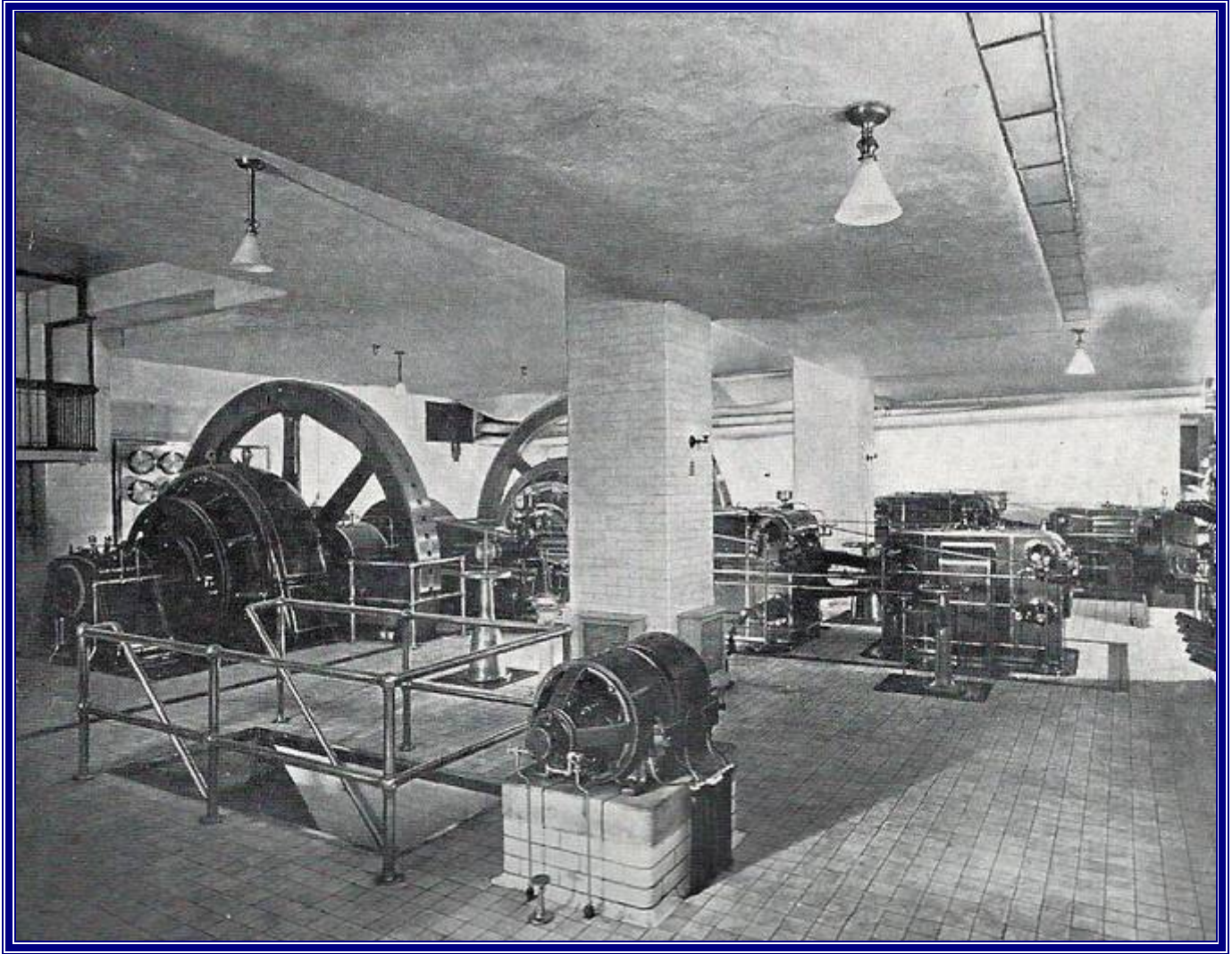
The elevator lobby





Decorative elevator doors and attendant





**Electricity generating room**

Steam-driven generators provided direct-current electricity for lights, elevators and various motors. There were 2 x 500 kW, 1 x 300 kW & 1 x 200 kW machines connected to four Rice & Sargent horizontal, tandem compound, non-condensing engines built by the Providence Engineering Works. The exhaust steam was used to heat the building during the heating season.

### **Building Engineering Services**

The consulting engineers for the heating and ventilation were Nygren, Tenny & Ohmes.

The heating contractor was Thompson-Starrett Company, their work including the installation of a Dunham system of vacuum steam heating.

The ventilation contractor was the Kauffman Heating & Engineering Company employing a series of *Kinealy* air washers.

Plumbing work, water supply and drainage systems were installed by the W G Cornell Company.

In addition, the tower was served by the central vacuum cleaning system of the Spencer Turbine Cleaner Company and also incorporated a series of vertical post collection chutes by the Cutler Mailing System.