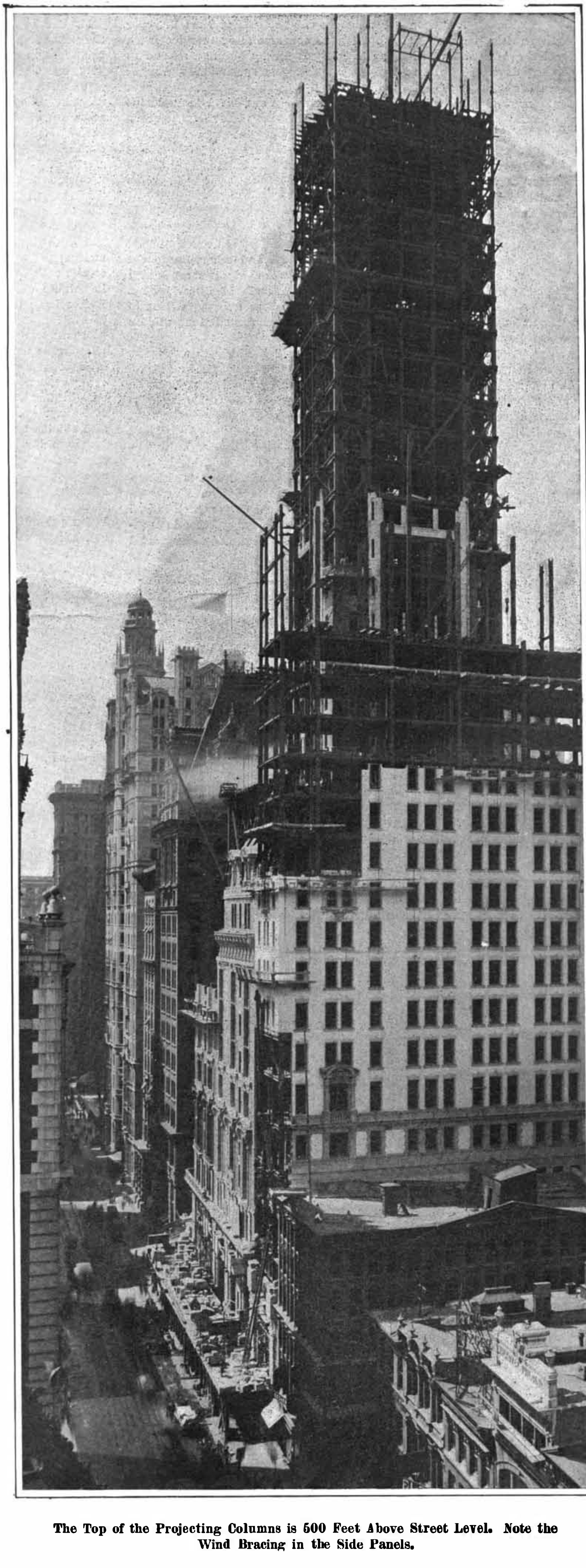
THE ERECTION OF THE 612-FOOT SINGER BUILDING.

Now that the Singer office building, or to speak more descriptively, the Singer tower, has been carried up beyond the 500-foot level, its really stupendous proportions assert themselves with far more dramatic effect than was possible in the many illustrations which have been made of the structure. It is at once a simple and a complicated task to erect on a foundation only 65 feet square, a building which shall lift its head more than 600 feet heavenward, and maintain itself, free from tremor and absolutely secure, against the fiercest hurricanes that can blow upon it. It is a simple matter so far as the erection of a 600-foot office tower consists merely in the addition of story to story; but it becomes complicated when we bear in mind that each successive story calls for a proportionate thickening and stiffening of the supporting columns below to support the ever-growing weight, and by adding to the enormous wind strains calls for yet more additional metal to resist them.

The tower itself forms the most striking feature of an elaborate reconstruction of the old Singer building, which is located at the corner of Liberty Street and Broadway. An addition, with a frontage of 76 feet on Broadway, has been built on the northern side of the old building, and the great tower rises above this addition, with its front standing about 15 feet back from the Broadway building line. The original building is being raised five stories, so as to match the fourteen-story height of the new addition. The completed tower will extend twenty-eight stories above this, and will contain forty-two stories in all.

Both the main building and the tower are finished in red brick with light buff stone facings, and it must be admitted that the treatment of this difficult architectural problem has been most successfully carried through by the architect, Mr. Ernest Flagg. The design of the structural steel work was worked out by Mr. O. F. Simsch as chief engineer, to whom we are indebted for courtesies in the preparation of the present article.

The leading particulars of the building are as follows: The tower is 65 feet square, and extends in height 612 feet from the sidewalk to the base of the flagstaff. The distance from the basement to the top of the flagstaff is 742 feet. There are forty-two office floors, and including the cupola and lookout there are forty-nine distinct stories. The weight of the tower alone is 18,365 tons. In the entire building there are 9½ acres of floor space, a large proportion of which is in the tower itself, which will contain sixteen offices on each floor, all of them lighted from the outside. It is estimated that when the building is fully occupied, it will accommodate about 6,000 people. For a structure of this size, it is necessary to provide quite an extensive engineering plant. In the present case this includes seven steam engines, five dynamos, thirty-three electric motors, twenty-eight steam pumps, besides air compressors, electric pumps, and other elements. The lighting of the building alone calls for 15,000 incandescent lamps. There will be sixteen elevators in the main building, and four in the tower.



The Top of the Projecting Columns is 500 Feet Above Street Level. Note the Wind Bracing in the Side Panels.

THE ERECTION OF A 612-FOOT BUILDING IN NEW YORK.

From the viewpoint of the engineer, the most interesting feature is the means adopted for resisting the great wind pressure. During the summer thunder storms which burst over Manhattan with cyclonic fury from New Jersey, and during the equinoctial and winter gales, the wind will sometimes reach a velocity of from 50 to 70 miles an hour; and, of course, it became necessary to give particular attention to the question of the stability of a tower over 600 feet in height when exposed to the shock and thrust of such winds. Not only does the wind pressure tend to overturn such a tower bodily upon its base, but it induces enormous bending stresses within the framing of the building. It was realized that the most desirable method of stiffening the tower was to run a continuous system of diagonal bracing from top to bottom, giving to it the true triangulated truss form. From an engineering standpoint, the best way to do this would have been to run the diagonal ties and struts continuously from side to side of the building; but this would have interfered seriously with the proper size and spacing of the windows. The problem was solved in a way which gives ample strength to the tower, and at the same time affords opportunity for excellent architectural treatment. As will be seen from our large photograph, in each side of the tower there are six lines of columns, forming five panels. It was decided to run continuous bracing throughout the whole height of the corner panels, and to extend this bracing inwardly at the corners for the depth of one panel. Also continuous bracing was run throughout the full height of the tower around the center elevator well. The whole tower, as far as its wind bracing is concerned, may be considered as made up of four corner towers, each 12 feet square in plan, and a central tower inclosing the elevator well. As will be seen by reference to our engravings, this arrangement provides an open space 36 feet in width down the center of each face of the building which is entirely free from diagonal bracing. These spaces are occupied by large bays filled in with glass, while the corner towers are lighted by single windows, which are so disposed that they are evenly spaced in a vertical direction, and are not in any way interfered with by the wind bracing.

Now, although this elaborate system of bracing, coupled with the resistance afforded by the masonry walls of the tower, is sufficient to resist all bending stresses, so great is the height and so large the area of the building, that precautions had to be taken to prevent the windward columns of the wind trusses from lifting from their foundations. The total uplift on certain columns amounts, under the most severe conditions, to as high as 470 tons. To provide against this, the columns are anchored down to the caissons, the margin of safety against lifting being never less than 50 tons on a column. The

© 1907 SCIENTIFIC AMERICAN, INC.

figures for the loading on a single one of the columns will be of decided interest. The total dead load at the foot, when the tower is fully occupied, will be 289.2 tons, this amount representing the weight of the steelwork and masonry. To this is added 60 per cent of the maximum live load, which reaches at the foot of the column in question a total of 131.6 tons, thus making a total dead and live load of 420.8 tons. The downward pressure on the foot of the leeward column due to the wind pressure is 758.8 tons, which added to 420.8 tons gives a total load on the column of 1,179.6 tons. In the whole tower the greatest combined load on a single column, when the building is completed and fully loaded and subject to heavy wind pressure, will be 1,585 tons.

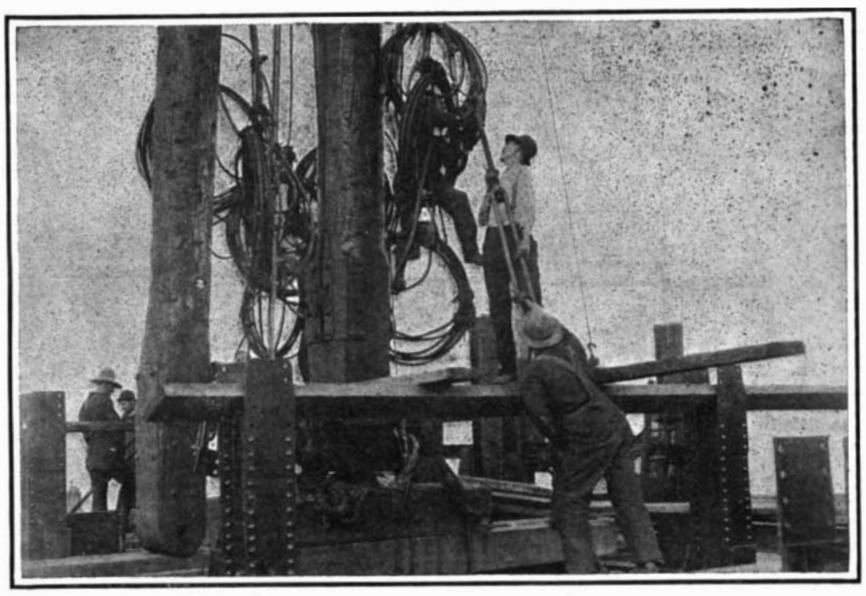
When once the steelwork of the tower was clear of the roof of the main building, the structure began to go up with great rapidity. The lifting of the steel columns and girders is done by means of a large derrick, the mast of which is placed centrally upon the topmost floor of the building, and guyed down with steel ropes to the tops of the outside posts. The swinging boom has sufficient reach to extend well clear of the sides of the tower and pick up the structural steel, either direct from the trucks on Broadway, 500 feet below, or from one of the intermediate platforms, to which it has already been lifted. After a sufficient amount of steel has been taken up for the erection of another two or three stories, the derrick picks up the various members, and swings them into position, where they are first bolted by the erection gangs, and then riveted by the riveting gangs. Our front-page engraving, taken at the 500-foot level, shows a couple of the erecting gang making preparations at the top of one of the columns to receive the next length above it, which will be lowered between the two cover plates and temporarily bolted to them. After the columns are erected the beams are swung into place and bolted up, and then the riveting gangs rapidly rivet up the work, being followed by other gangs, who put in the terra-cotta flooring. In the present case, one of the chief difficulties is to find storage room for the vast amount of material which must be on hand in order to keep the work steadily progressing. The material is stored on the various floors as fast as they have been filled in with terra cotta, and is subsequently built in position as required.

The view from the 500-foot level is superbly beautiful and full of varied interest. Certainly, it could not be matched in any city of the world. Lower New York, flanked by the East and Hudson Rivers, appears blocked out with the distinctness and regularity of a map, and the foreshortening of the nearer office buildings is so pronounced, that even the 300-foot structures look insignificant as viewed from a point 200 feet above their own roof line. The great altitude enables the eye to trace the outlying suburbs of New York in surprising detail.

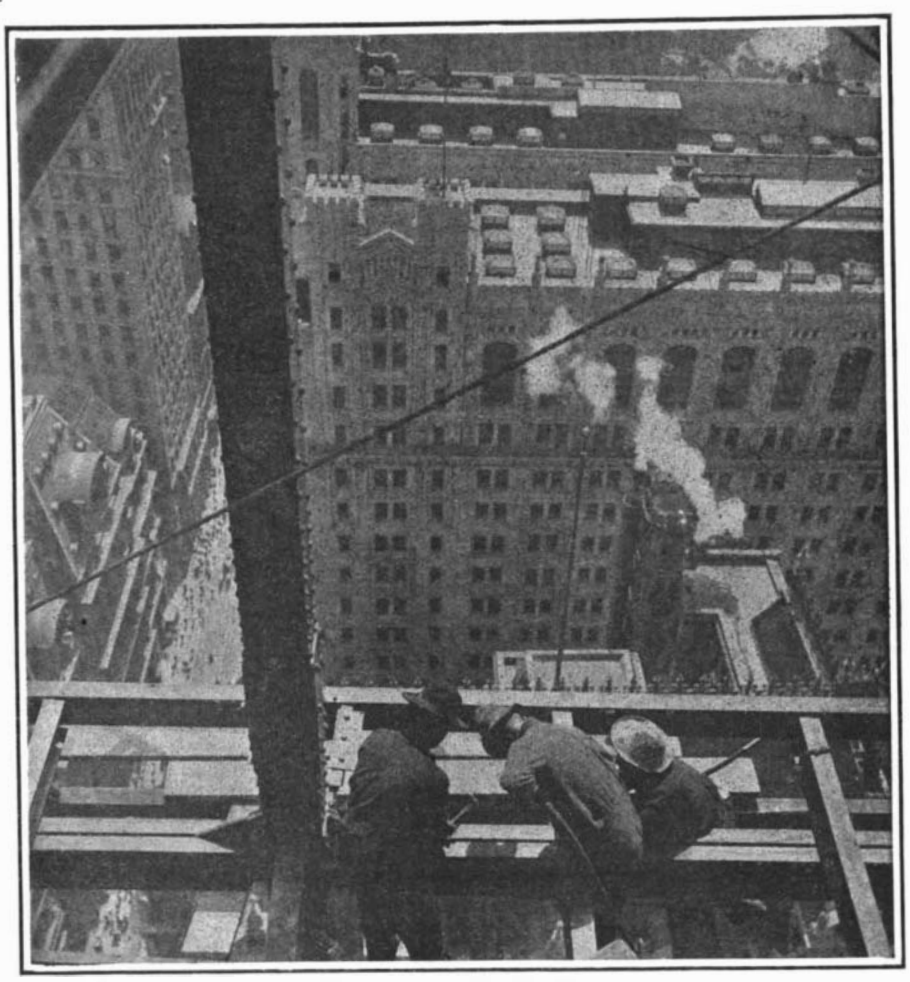
When the building has been carried to its full height, and the topmost observation platform is available, the horizon will be even more extended, and the map-like detail of New York, as spread out below, even more pronounced.

The first railroad in Morocco was opened some months ago. It was built by a German company to haul stone from a quarry to tide water, and is only about one and one-quarter miles long.

Working on a Corner Post of the Tower at the 450-Foot Level.



Adjusting the Derrick at Topmost Floor for Hoisting New Steelwork.



View Looking Down Upon the Realty Building (380 Feet High) with Broadway Showing to the Left.

THE ERECTION OF A 612-FOOT BUILDING IN NEW YORK.

New Railway in Asia Minor.

A railroad project of great interest is the proposed Bagdad railway which Germany expects to carry out. The promoters of the scheme desire to give direct connection between Hamburg and Berlin, by way of Budapest and Constantinople, with Konieh, Bagdad, and Basra, thus reaching the western end of the Persian Gulf. The Kaiser is backing up the scheme, and the Sultan Abdul Hamid is warmly in favor of the new railroad, as naturally it will do much to develop the resources of Asia Minor. Germany has already secured a concession from the Turkish government which will secure her immense advantages, for the railroad running through Asia Minor is no less than 1,700 miles long, and the concession includes a tract of land twelve miles in width on each side of the railroad line, including mineral rights. The construction of the road has been already commenced, and the section from Konieh to Eregli in the Taurus region is now constructed. This section is 120 miles long, and it is proposed to build several other sections in the same region, probably three, of the same length. Where the line passes across the Taurus mountains it will be difficult to build, and will require a considerable amount of engineering work.

It is stated that the German engineer Siegesmund Schneider has worked out the plans for a bridge over the Bosphorus which have the Kaiser's approval. The Turkish government is doing everything possible to have the project carried out, and there will be practically an alliance between the two countries which may be far-reaching. Germany by this means will extend and confirm the commercial supremacy which she has been gradually acquiring in Turkey. What is desired especially is to develop the great mineral and agricultural resources of this wide region. Considering the future of the cotton supply of Mesopotamia alone, this would give Germany a vast advantage in securing an independent source and thus being free from the obligation to take supply from America. There are immense mineral riches to be developed, and one of the most important is the petroleum fields in the region of Babylon and the Tigris and Euphrates valley. It is said that their value is many times that of the Baku oil fields. As regards the raising of wheat, this can be carried out on a vast scale in Syria, Anatolia, and Mesopotamia, and in the future these regions can be counted on for a supply which may equal that of Russia. Experts are now investigating the coal seams at Eregli, the present limit of the road, and the results are encouraging. An important point is the rights which are given by the concession for making use of water power along the present tract, and electric plants can be operated in this way so as to provide current for different localities on the railroad line. Privileges are also granted for navigation on the Tigris and the Euphrates, and this may lead to the construction of quays at Bagdad and Basra and also at various points on the Persian Gulf. Germany will also be able to make connection with British India and establish commercial relations on a large scale with that country.

According to Power, gas generated in a producer, without the use of steam, has a thermal value of about 70 British thermal units per cubic foot. By using steam with the air admitted to the fire, the producer gas generated will have a thermal value of from 135 to 140 British thermal units per cubic foot.

© 1907 SCIENTIFIC AMERICAN, INC.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1907, by Munn & Co.]

Vol. XCVII.—No. 10.
ESTABLISHED 1845.

NEW YORK, SEPTEMBER 7, 1907.

10 CENTS A COPY
$3.00 A YEAR.

Preparing to Erect a Steel Column at the 500-Foot Level of the 612-Foot Singer Building, New York.

The building seen in the middle ground is over 300 feet in height. Beyond are the Hudson River and New Jersey.

THE SKYWARD GROWTH OF A MODERN CITY.—[See page 168.]

© 1907 SCIENTIFIC AMERICAN, INC.