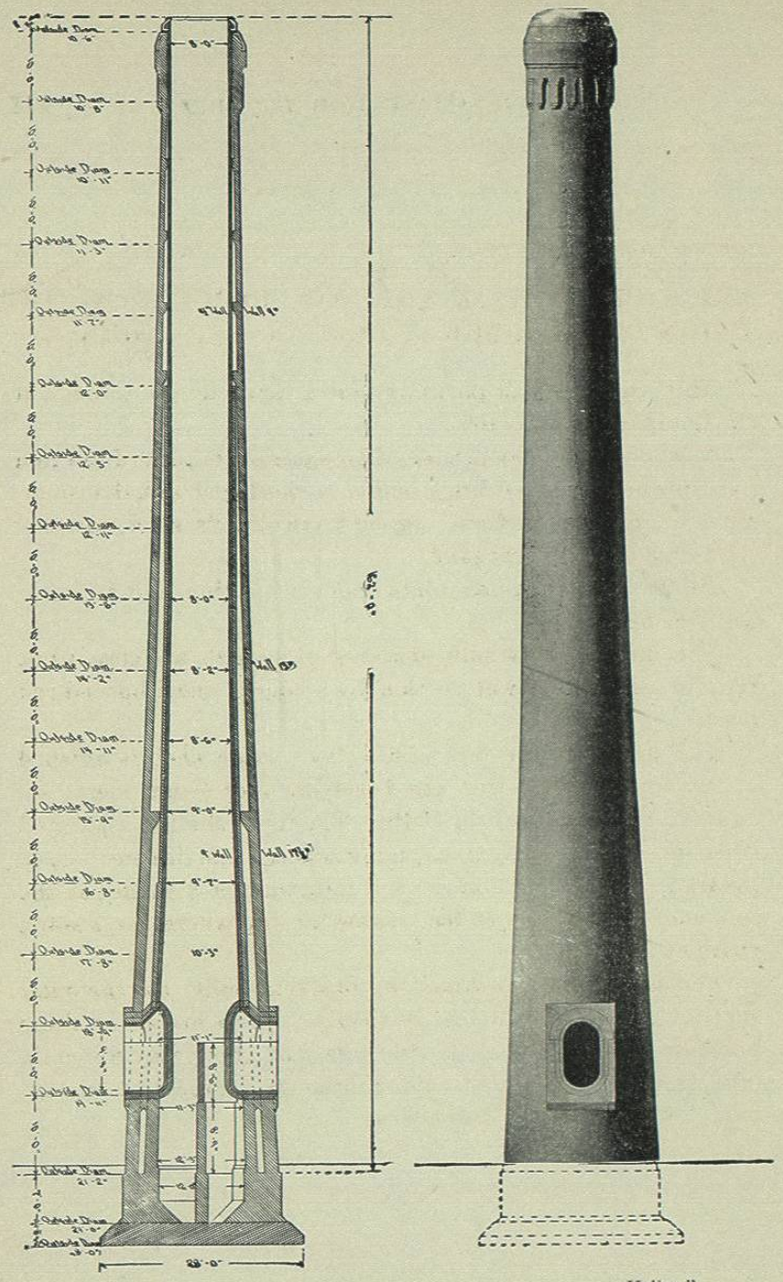


"Helios."

ILLUS. No. 28

BRICK CHIMNEY AT THE POWER HOUSE OF THE UNION DEPOT RAILWAY COMPANY, ST. LOUIS, MO.

BRICK CHIMNEY AT THE POWER HOUSE OF THE UNION DEPOT RAILWAY COMPANY, ST. LOUIS, MO.

This chimney was partially blown down by the tornado at St. Louis on May 27, 1896.

Construction.—It consisted of an outer shell built of selected hard-burned dark-red brick laid in a mortar of equal proportions of one part Portland cement to two parts sand, and one part lime to two parts sand.

Bricks laid with push-joints under inspection, and all joints are well filled.

The inner core is built of a ring of 4½-inch fire-clay brick, re-inforced in the lower section by a ring of hard-burned red brick.

The fire-brick are laid in fire-clay. Each shell is finished at the top by a cast-iron cap 2 feet deep, of ½-inch metal, secured to the brickwork by bolts. The inner shell is separated from the outer one by a varying distance; the dimensions, as planned, give this distance as a minimum of 2 inches at the top, and the same at 50 feet below the top where the section changes.

The inner shell is stayed by brackets built into the outer shell at intervals of 10 feet vertically. There are six of these brackets on a level, each having a face of about 8 by 8 inches. (See American Society of Civil Engineers. Proceedings, January, 1897. Baier on Tornadoes.)

Brick Chimney at the Omaha and Grant Smelting and Refining Works, Denver, Col.

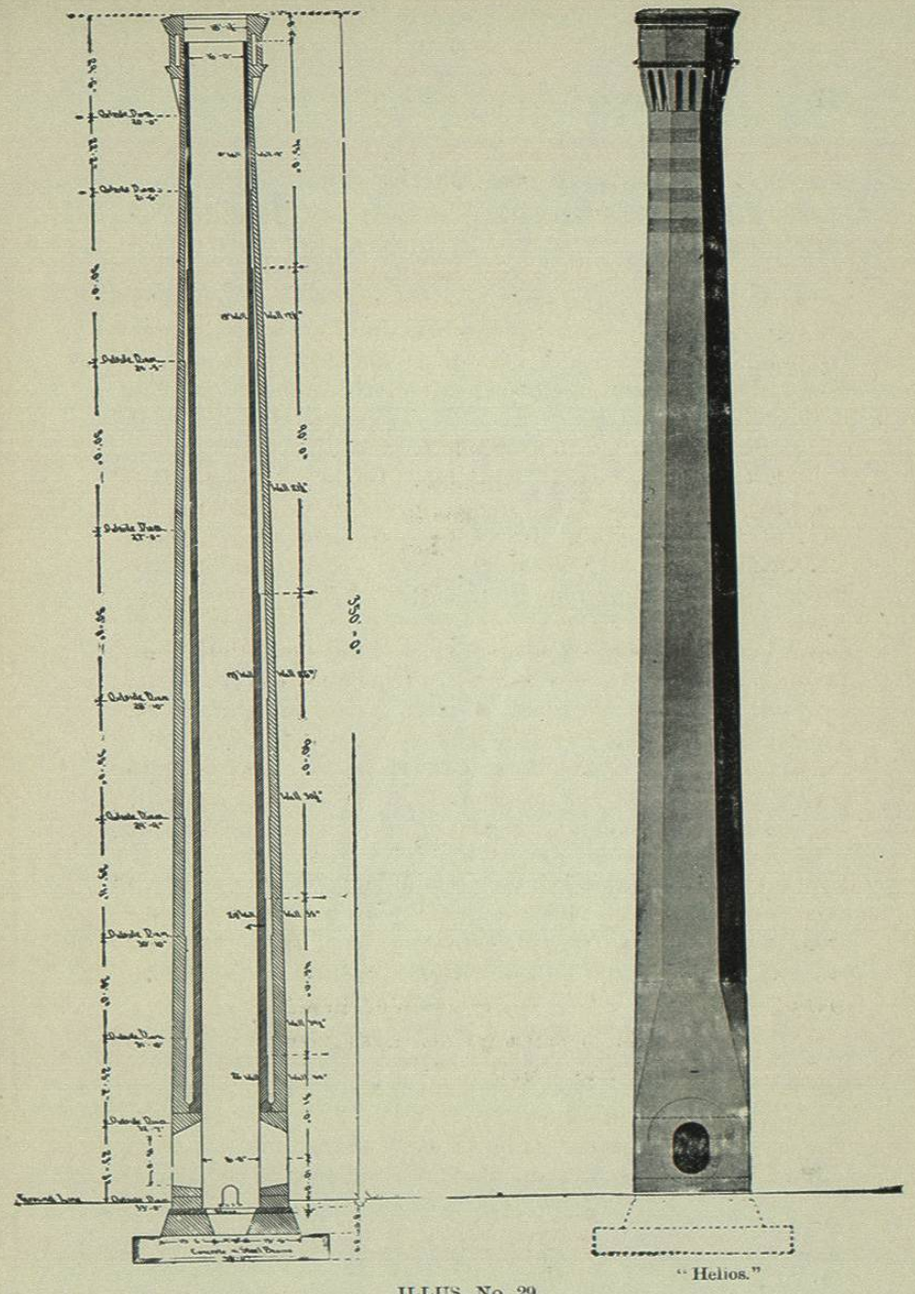
The *Denver Times* thus describes the Grant Smelting Company's chimney:

"The chimney of the Grant Smelting Company, designed by W. J. Scanlon, is the most marvellous construction of the kind in the world and the highest in the United States.* Its dimensions are as follows: It commences with a gravel foundation 8.4 feet high and 58 feet square, composed of Dikerhoff cement, containing from one to six parts of broken stone and sand. Barney Currigan had charge of the cement work.

"On top of this cement foundation the brickwork starts, 40 feet square at the base, and tapers to 35 feet at a distance of 7 feet from the base. On the top of this level there are two courses of Fort Collins stone 9 feet thick, bedded in cement mortar, the stonework being the grade line from which the chimney proper starts. The base of the chimney from here is 33 feet square, and it continues to the height of 352 feet 3 inches, diminishing 13 feet from the bottom to the top. The octagonal corners are not built on an inclined plane as usual. They are curved, with a prominent outside curve of about three feet. This was so constructed in order to obviate an optical delusion through the use of a centre line, by plumbing down to the centre, which was established by bedding plate in the centre of the chimney. A 15-pound bob was used for this purpose, with as fine a line as would carry it. Plumb rules were changed every ten feet, with curve established on the rule to carry up from one measurement to the other and also measured out from centre line every ten feet and came out on top within a fraction of the size required.

"The chimney has a flue of 16 feet in the clear, and walls 8 feet 6 inches thick, which extend to the top of the racking. At this level start two walls with a space between of 2 feet; the outer wall is 4 feet thick, and the core wall 2 feet 6 inches thick. The space between these walls of 2 feet extends to the top of the chimney, to the open air, and the outer wall for the last 100 feet is reduced to a 13-inch wall. The core wall is reduced to a 9-inch

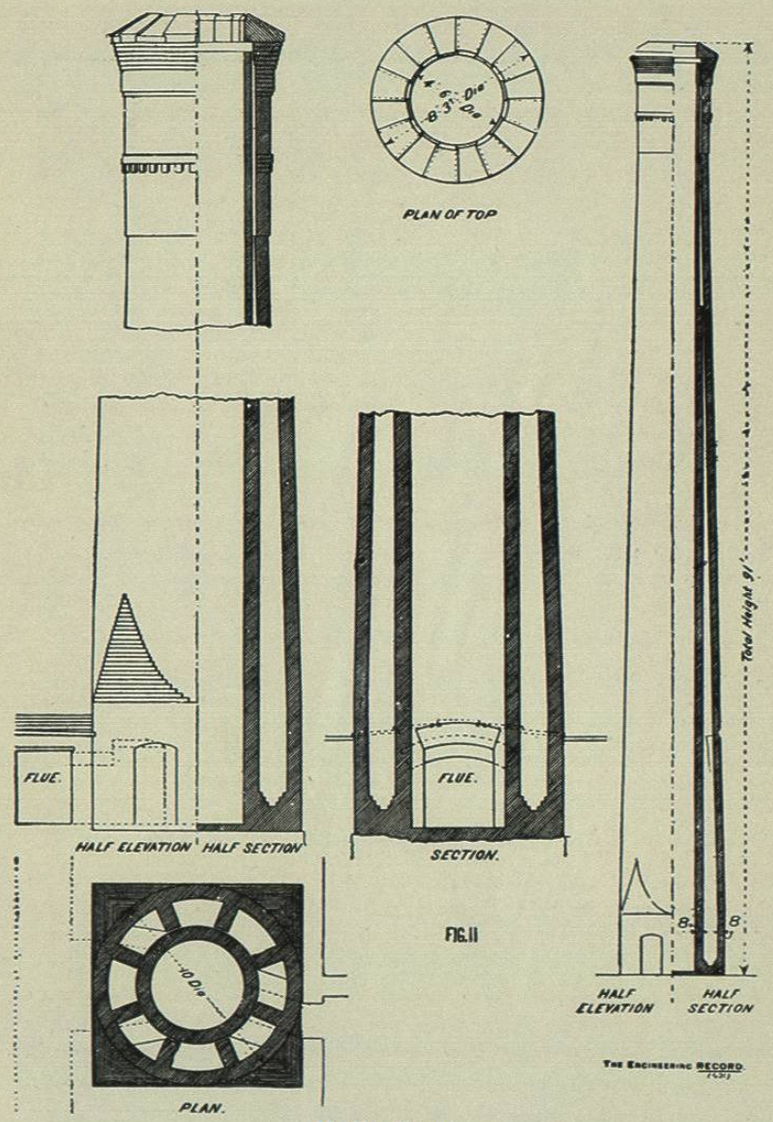
* In 1900 it was exceeded in diameter and height by the Metropolitan Traction Company's chimney, New York City, see p. 124 In 1901, in height by the Orford Copper Company's chimney, at Constable Hook, N. J., see p. 128.



"Helios."

ILLUS. No. 29.

Brick Chimney at the Omaha and Grant Smelting and Refining Works, Denver, Col.



ILLUS. No. 30.

CHIMNEY DETAILS, CHENEY BROTHERS' SILK MILLS, SOUTH MANCHESTER, CONN.

wall for the same height. From the 28-foot level the outer or main wall is separate from the core, or practically one chimney within the other.

"At intervals of every ten feet in each octagonal section there are buttresses carried from both walls with plates between. There are six rollers between each plate, so that the core can rise when the heat is great enough to cause expansion. This idea was to prevent the pressure from being sidewise.

"The top or finish, which is 30 feet high, with a projection of 5 feet 2 inches, is the heaviest one ever made in brick. It is banded by large iron circlets passing around the structure. These bands are placed over the inner walls with bolts running out, which fasten to angle irons that form the octagon. These angle irons are placed on the outer course of brick and built in solid with the best cement mortar.

"While being built it was kept level and the weight equalized the pull or pressure of going out on these irons. There were several sets of these irons. A cast-iron plate covers the entire top, with a trap-door which connects with an iron ladder built in the main wall on the inside next to the core wall.

"The weight of the structure is 8,000 tons, and its cost was $55,000. Over 2,000,000 pressed bricks were used in its composition. The brickwork was done by John Cook in 199 days. Twelve bricklayers worked on the first 100 feet, eight bricklayers on the next 100 feet, and six workmen on the remainder. The laborers were paid $7 a day, and the foreman received $8."

A Tall Brick Chimney.*

The largest chimney on the Pacific coast, 1892, the third in point of size in the United States, and the fourth in the world, is being built in San Francisco. The broad column of bricks is seen high above the roofs of the houses in its vicinity, and towers above every factory chimney in the city. The structure was put up by the Edison Electric Light and Power Company on Jessie Street near Third, in connection with a new building 75 feet front, 165 feet deep, and 52 feet high. The chimney is 175 feet above the pavement, and will rest on foundations, below the street level, of solid concrete 9 feet 8 inches thick, and 28 feet square. The interior diameter for the entire height is to be 12 feet. At the base the chimney has an exterior diameter of 18 feet 6 inches, and the outside diameter of the cap will be 14 feet. Inside, for a height of 73 feet, there will be a detached fire-brick lining with air-space between it and the interior surface of the chimney. The object of this lining is to protect the chimney from the expansion and contraction incident to the varying degree of heat. As the base is of concrete so is the topmost ring of the chimney. Laid in the artificial stone of the cap and intended to bind it firmly together, are seven hoops of one-inch wire rope. Between base and cap machine-made brick is used entirely, it being estimated that 275,000 bricks will be required to complete it. The concrete ring will be 4 feet deep, and the ornamental brick and concrete capital of the chimney will be 16 feet high. The only vertical openings in the chimney will be one about the level of the roof of the building in order to repair the fire-brick lining and to clean it, and one at the base through which to remove soot and ashes. From the roof an iron ladder will rise outside the chimney to the very top, so as to afford a means to repair the exterior when necessary. This ladder would, if connected by copper wires to the earth, form a lightning conductor. The latter has not been provided, however, it being considered unnecessary, as there is no instance in the history of the city of a chimney or building of any kind having been struck by lightning. The sole duty required of this enormous chimney is to afford a natural draught to twenty-eight boilers, which will furnish the motive power to six engines of 1,200 horse-power each, or 7,200 joint. The cost of this chimney is estimated at $10,000.

* San Francisco *Chronicle*.

At Paterson, N. J., a great many of the old mill chimneys are built as follows: with square flue or core about 3 feet 4 inches square inside, and 75 feet high.

A chimney of the above dimensions has been built as follows:

Foundation of concrete, 9 feet by 9 feet by 4 feet deep; base of chimney, 7 feet 9 inches square; 12-inch wall tapering up 25 feet 6 inches; the next 19 feet 6 inches is 8-inch wall.

The core is 3 feet 4 inches square inside, with 8-inch wall running up and meeting the outer wall at 45 feet above the foundation, where the chimney is 6 feet square, above this the flue continues straight up, and the outside is drawn in to about 8 inches thickness of wall at the top.

A square cap of cast iron in four pieces is put on top, and bolted by inside flanges.

About 45,000 brick and 36 cubic yards of concrete entered into its construction.

The weight per square foot on foundation is 2.20 tons.

The weight per square foot on soil is 1.82 tons.

Air vents are placed in outside wall to let out the heated air from cavity between walls.

Some of these chimneys have had their top part lifted off by reason of the heat of the flue, and the flue and outer shell being run together, others have stood very well, probably because the fires have not been forced.

BRICK CHIMNEY AT THE PLANT OF THE STEINWAY ELECTRIC COMPANY, ASTORIA, L. I.

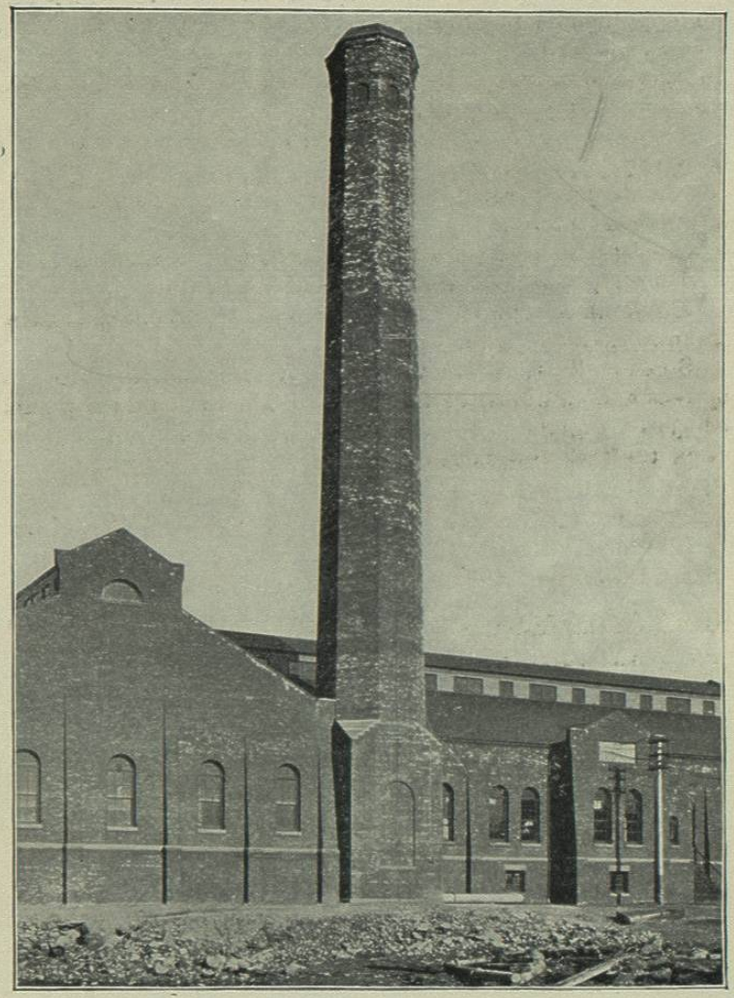
Flue, 8 feet in diameter.

Height, 140 feet above the ground.

Fire-brick lining, 45 feet up from the bottom, 5 inches thick.

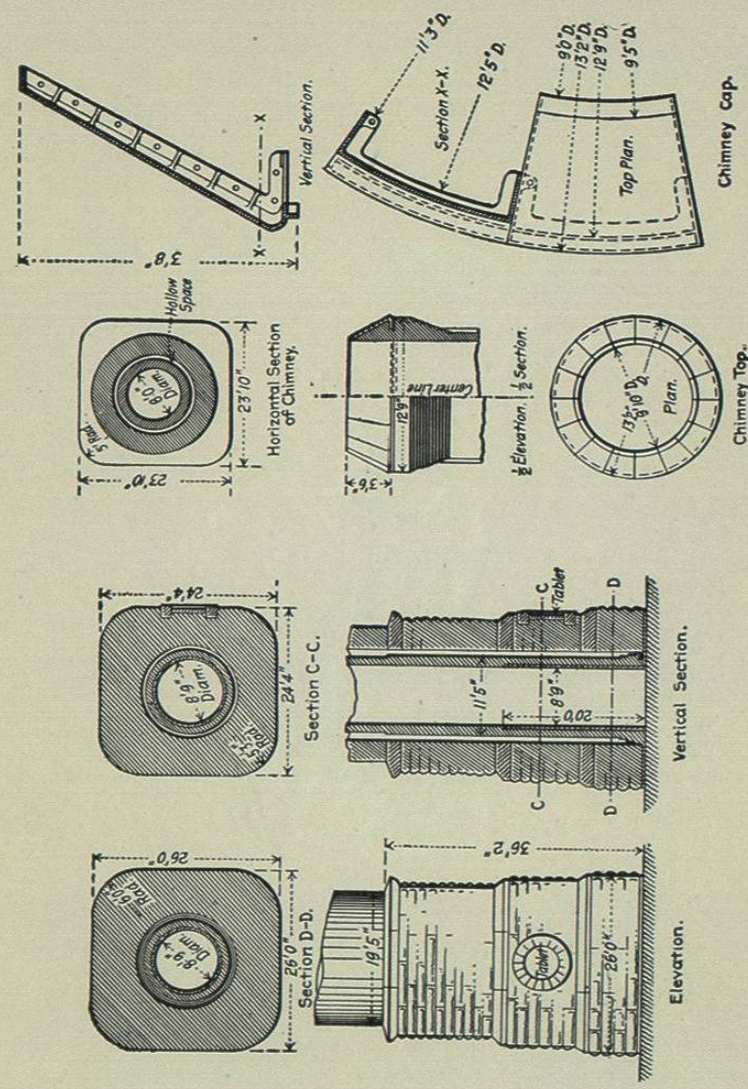
Core of chimney, 13 and 8 inches thick to within 50 feet of the top.

Outer shell, 32 inches thick at the bottom, reduced to 12 inches thick at the top.



ILLUS. No. 31.

STEINWAY ELECTRIC COMPANY, ASTORIA, L. I.



ILLUS. No. 32.
DETAILS OF BRICK CHIMNEY, IVORYDALE, O.

BRICK CHIMNEYS.

The Cambria Iron Company, Johnstown, Pa., in 1881 built two sizes of chimneys, which from the peculiar design were termed "Crinoline" chimneys.

One was 140 feet 6 inches high above base-plate, with a flue 7 feet 11 inches in diameter.

The other, 200 feet high above base-plate, with a flue 10 feet in diameter.

The prominent features of their design are:

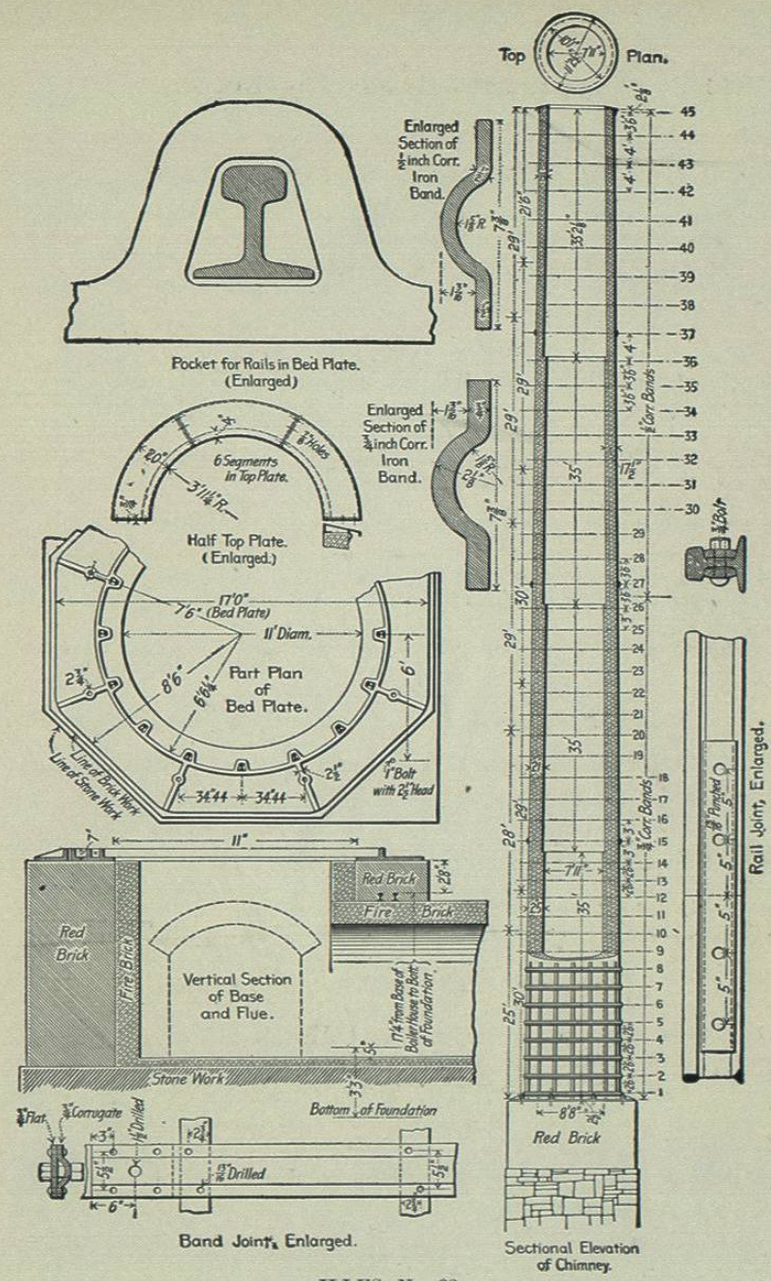
First.—Single-brick tube.

Second.—Cast-iron base-plate.

Third.—Steel rails set vertically in outer walls, with wrought-iron binders or hoops.

They have been in constant use up to the present time, and have proved themselves well fitted to the work for which they were designed.

Through the courtesy of Mr. Jos. Morgan, Chief Engineer of the works, the 140-foot chimney is pictured in detail on the opposite page.



ILLUS. No. 33.

THE CAMBRIA IRON COMPANY, JOHNSTOWN, PA.

Robert Kuntsman* gives the data for material for a brick chimney of 2,000 horse-power capacity, as follows:

Working capacity of chimney	2,000	horse-power.
Depth of foundation	12	feet.
Height of chimney inclusive of foundation	205	feet.
Height of chimney from base line to top of cap	193	feet.
Height of cap from neck of shaft to top	14	feet 9 inches.
Effective height from inlet of boiler-flues	178	feet 3 inches.
Batter per foot on side walls $\frac{2}{100}$ inch outside, and	$\frac{3}{100}$	inside.
External diameter of chimney at base line	17	feet.
Internal diameter of flue at base line	8	feet.
External diameter at neck under cap	10	feet 6 inches.
Interior diameter at extreme top	7	feet.
Thickness of outer wall under the cap	$1\frac{1}{2}$	brick, 12 inches.
Thickness of outer wall at section *CD*	2	brick, 16 inches.
Thickness of outer wall at section *EF*	$2\frac{1}{2}$	brick, $20\frac{1}{2}$ inches.
Thickness of outer wall at section *GH*	3	brick, $24\frac{1}{2}$ inches.
Thickness of outer wall at section (with inlet flue) *IK*	3	brick, $24\frac{1}{2}$ inches.

Size of inlet flue from boilers, 9 feet by 4 feet 6 inches, with an area of 32 feet square.

Area of outlet on top of chimney	38.5 square feet.
Total weight of chimney, including foundation	$1,588\frac{1}{2}$ tons.
Total weight of brickwork, from base line upward	$1,016\frac{1}{2}$ tons.

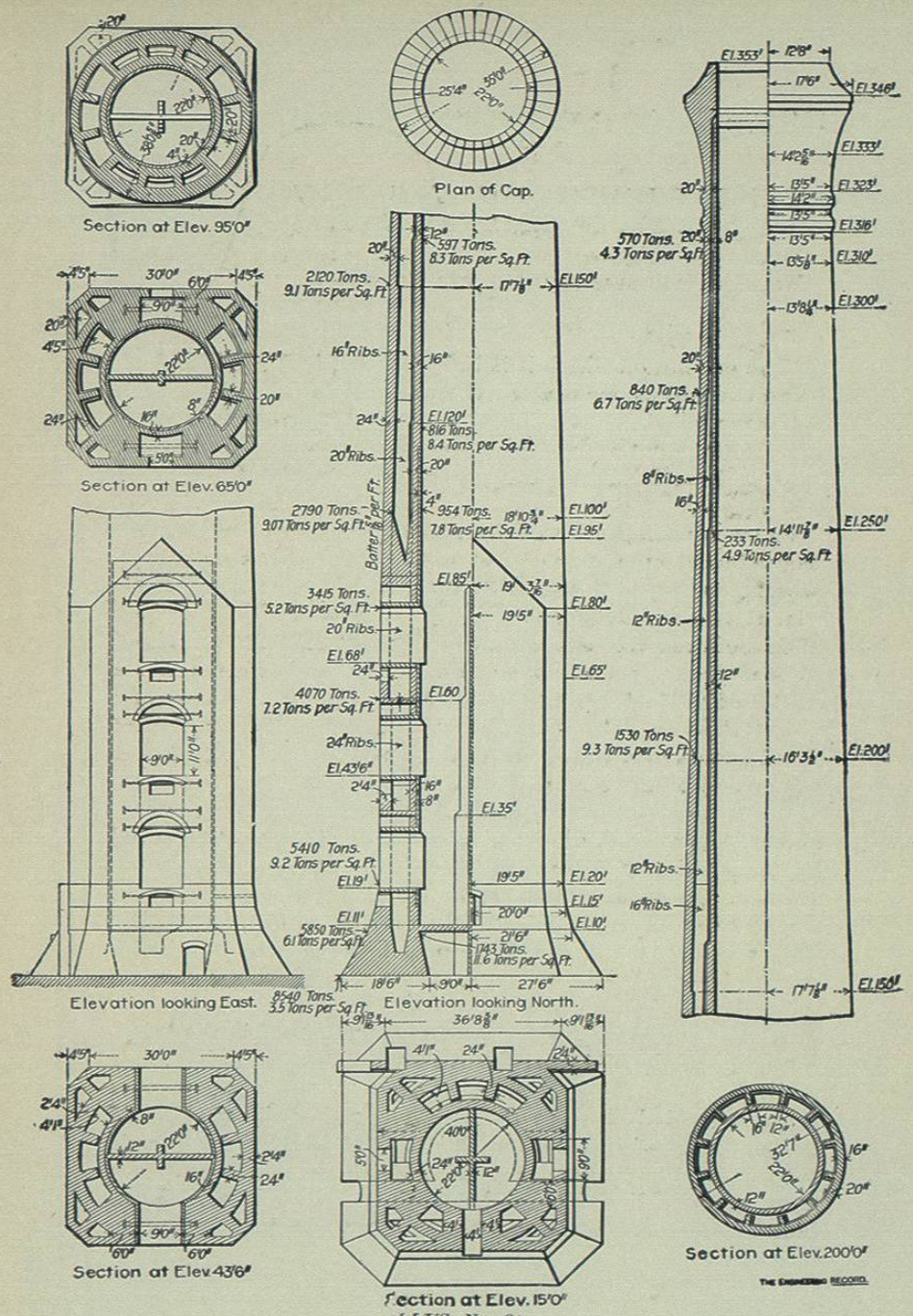
Load on concrete foundation 2.9 tons, or nearly 3 tons per square foot.

The load on the ground and distributed over an area of 1,370 square feet is therefore 0.86 ton per square foot.

It should not be difficult to arrive at the cost of this chimney at any locality if, according to local conditions, price of materials and labor are estimated from the quantities we have given.

It will require 390,000 brick.

* Brick, April, 1897.



ILLUS. No. 34.

CHIMNEY METROPOLITAN STREET RAILWAY POWER HOUSE, NEW YORK CITY.