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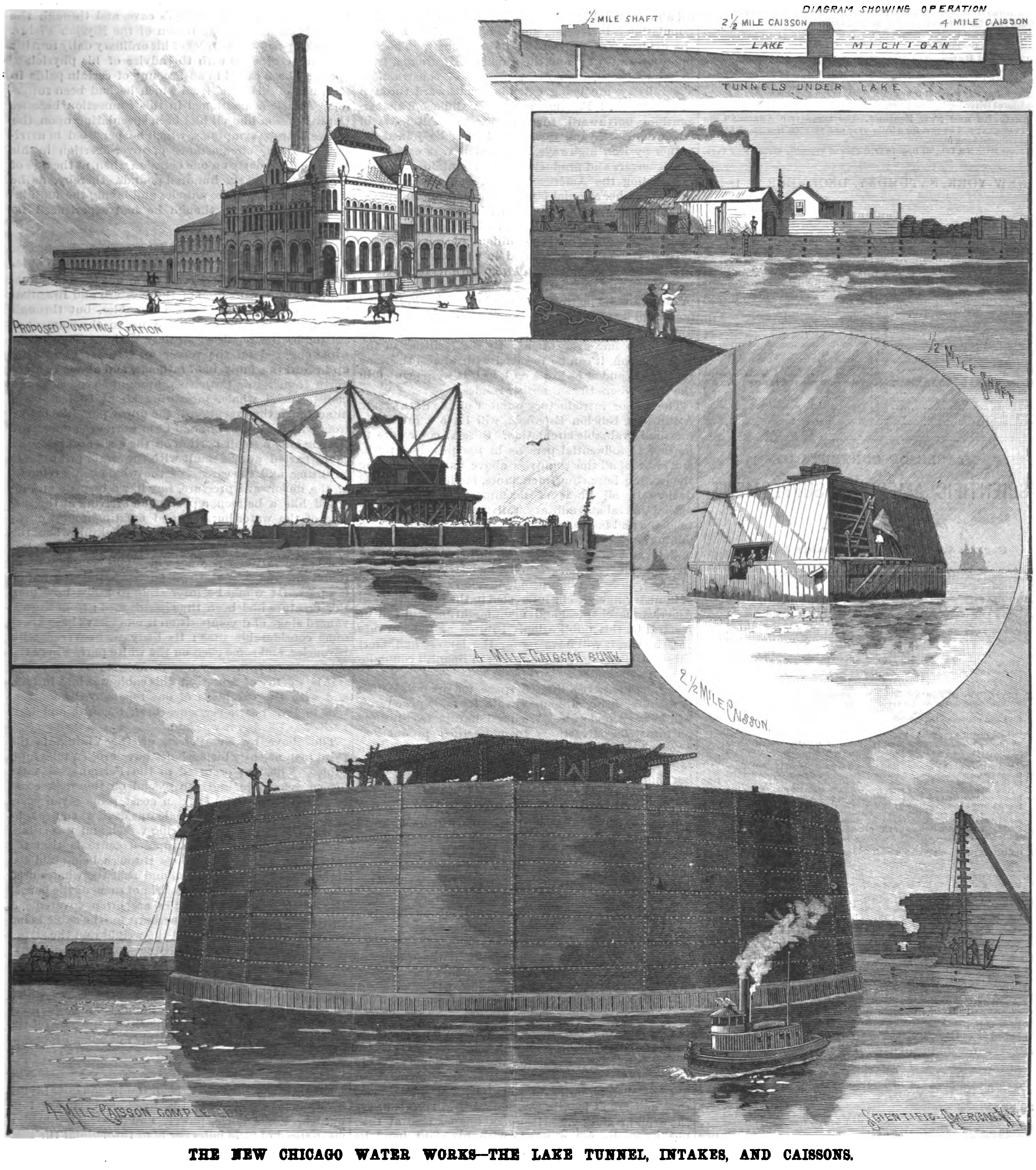
WEEKLY.

THE NEW CHICAGO WATER WORKS—THE LAKE TUNNEL, INTAKES, AND CAISSONS.

Chicago has long been noted for its water works, drawing their supply from the inexhaustible reservoir of Lake Michigan. They have been termed one of the wonders of the world. On March 17, 1864, the work began on a tunnel to be carried out two miles into the lake in order to secure a pure supply. On December 6, 1866, the tunnel was finished, and water was first furnished to the city through it on March 25, 1867. The original tunnel was in brick, 62 inches high and 60 inches wide, lying from 66 to 70 feet below the surface of the water. As Chicago lies nearly on a plain, all city levels are referred to this point, the surface of the lake. It forms a plane of reference, and is termed the city datum. At the end of the tunnel a grated cylinder of iron was established, through which the water enters the tunnel. This intake, for further protection, was surrounded by a crib and breakwater. Subsequently a second tunnel, 84 inches in diameter, carried out to the same crib, was extended under the city, so as to give an independent supply to the southwestern quarter. The original pumping engines had a daily capacity of 72,000,000 gallons. The original tunnel could deliver 57,000,000 gallons in the same time. In addition to the lake supply of water, a number of artesian wells have been sunk, at depths varying from 650 to nearly 2,000 feet. The water from these wells is not of the purest, containing 70 grains of solid matter to the gal-

(*Continued on page* 372.)



THE NEW CHICAGO WATER WORKS—THE LAKE TUNNEL, INTAKES, AND CAISSONS.

THE NEW CHICAGO WATER WORKS.

(Continued from first page.)

lon. The lake water, however, is remarkable for its good quality. It contains only 8 grains of total solids to the gallon, approximating in purity to distilled water.

Although this original water works had an excellent record, supplying water continuously for many years, under pressure limited by a stand pipe 130 feet high, being interrupted only for a few days during the great fire of 1871, the increase in population of the city has excited apprehensions as to its sufficiency, and new water works, on a greatly increased scale, are now in process of construction. We illustrate these operations, and the views show our readers what is really one of the great engineering works of the day.

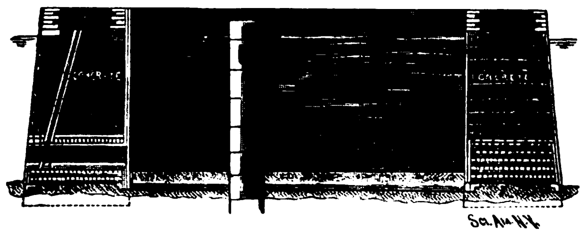
The general design of the new works provides for a tunnel which is to extend under the lake for four miles easterly from Park Row. This is to be about double the length of the old tunnel. Under the city proper two miles of tunnel are constructed, so as to connect two new pumping works, one for the south and the other for the west division of the city. The old system of tunnels and pumping works for the north division of the city will be brought into connection, by means of the tunnel under the city, with the new system, so that old and new tunnels and water works will all be connected and be susceptible of working together. The original intention was to have built a tunnel of 96 inches internal diameter. Upon investigation, it was found that the ground under the lake was not adapted for so large a structure. A stratum of bowlder clay, suitable for tunneling, was found beneath the lake, but was both overlaid and underlaid by strata of dangerous or unreliable character. The clay layer was too shallow to receive an 8 foot tunnel, so it was decided to construct two 72 inch tunnels parallel with each other, and situated about 50 feet apart.

The work within the city limits was constructed from three shafts, located at proper intervals, and these two miles are now complete. As regards the lake tunnel, about three-quarters of a mile are now finished, leaving a little over three miles still to be built.

The work under the lake is being constructed from four shafts, the first one being situated on the shore at the foot of Park Row. The depth at which the tunnels are built varies from 75 feet to 110 feet below the city datum. The lake shafts are three in number. The first is located one-half mile from shore. A pumping station was necessary at this point during the construction, in order to keep the works drained, owing to the grade. From the standpoint of the city's uses it is foreseen that this might be used for temporary supply if the completion of the terminal crib and connections was from any cause delayed. It is also possible that this shaft may ultimately be connected with the South Side water works by an independent tunnel, in order to be used as an intake for a high pressure water service to run elevators and machinery. The other lake shafts are two and a half miles and four miles from shore. The two and a half mile shaft is a structural one only. All the permanent shafts are heavy cast iron cylinders, built in sections, protected by hollow cribs or caissons.

The caissons for the first two shafts in the lake are built of 12 × 12 timbers, bolted together by 1¼ inch drift bolts. Taking as an example the two and a half mile caisson illustrated in one of our views, it represents two concentric pentagons, with their parallel walls twenty feet apart, providing an inner clear space of about 26 feet in diameter, the outer diameter being 72 feet 6 inches. The almost annular space between the two pentagons is filled with heavy rock, which rests upon the floor or bottom of the structure, which is made quite water tight. This floor extends over the area between the two pentagons, leaving the center well free. The pentagonal shape of the caisson affords a good place for vessels to lie at, each side being 47 feet 6 inches in length. The shaft descends through the center of this structure. The half mile shaft is of similar construction, and is the one which it is proposed to adopt as part of the water supply; it is further protected by a breakwater run out from shore. But the work of greatest magnitude is the four mile permanent caisson. It represents, in general terms, an annulus or ring of combined steel, timber, granite, and concrete, 125 feet in external diameter at the base, 118 at city datum when in position, 70 feet in internal diameter, and 53 feet in height. The bottom course is of timber. A grillage of solid white pine timbers, 12 by 12 inches each, was built up in the shape of a ring, 13 feet in depth, 125 feet in external diameter at the base, 123 feet at the top, and 70 feet in internal diameter.

Drift bolts, 1¼ inches in diameter, 2 feet long, and spaced not over 6 feet apart, are used to secure the members of this enormous mass of timber; inside and out it is planked with double vertical courses of 6 inch plank, the outer course being of white oak. Shoe courses of timber, 24 inches deep, run around its bottom, outside and inside, and two 12 inch courses of timber were specified to floor the bottom of th well. Upon the top of this ring-shaped structure are based two cylinders of steel plate ⅜ of an inch thick. The inner cylinder, 70 feet in diameter, rises vertically from around the inner wall of the grillage. The outer cylinder rises from the outside of the grillage with a slight batter inward; 24 radial bulkheads connect the two steel cylinders. The cylinders and bulkheads are bolted down to the timbers, some courses of bolts running through the entire 13 feet of timber and 2 feet of shoe courses. Through the timber six ports, 5 feet square, provided with gates and fish screens, are carried for the admission of water. The immense mass, owing to the timber and the air space, as it was built absolutely water tight, possessed considerable buoyancy, and floated on the water after launching and completion. The best quality of concrete, with large stones embedded in it, was then filled into the hollow annulus between the iron plates until it was sunk well down into the water, in order to do as much of the work as



CHICAGO WATER WORKS—CAISSON SECTION.

possible near the shore. It was then towed out to its place and more concrete added until it sank and rested upon the bottom of the lake, at this point 42 feet deep. The concrete was then filled up to the level of the top of the steel work. About 24,000 tons of concrete were used for this operation. This brought the upper line of steel within a few feet of the water or city datum plane. Two walls of granite, circular and concentric, were then carried up 8 feet above the iron plates, and the space between them is filled in solid. Upon this foundation a lighthouse is to be established to warn vessels of the proximity of the caisson.

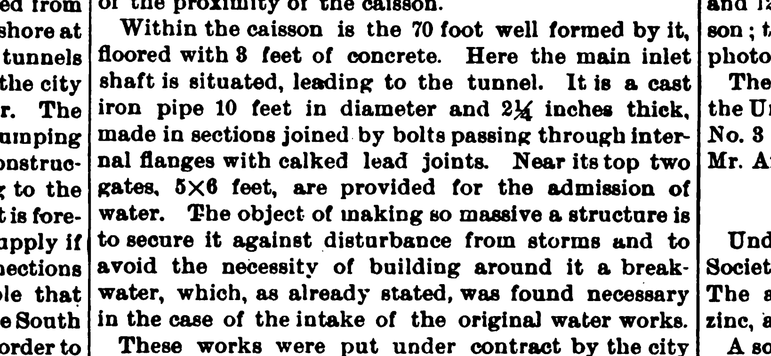
Within the caisson is the 70 foot well formed by it, floored with 3 feet of concrete. Here the main inlet shaft is situated, leading to the tunnel. It is a cast iron pipe 10 feet in diameter and 2¼ inches thick, made in sections joined by bolts passing through internal flanges with calked lead joints. Near its top two gates, 5×6 feet, are provided for the admission of water. The object of making so massive a structure is to secure it against disturbance from storms and to avoid the necessity of building around it a breakwater, which, as already stated, was found necessary in the case of the intake of the original water works.

These works were put under contract by the city of Chicago with Mr. Andrew Onderdonk, New York, about two years ago. Since that period the work has progressed night and day uninterruptedly, and in two years more it is believed the work will be completed. The end caisson was built under the direct charge of General Charles Fitzsimmons, of Chicago. In many respects the work is unequaled by anything of the kind ever undertaken. The new pumping stations will, of course, be constructed of the most advanced type, and we illustrate in elevation one of the buildings which it is proposed to erect for such use.

Whether the International Fair of 1892 be held in New York or Chicago, it is fair to assume that the new works here described will be one of the important objects for the inspection of visitors to America.

A FEAT IN PHOTOGRAPHY.

Trotting horses, leaping acrobats, running hounds, even a locomotive at full speed, have proved comparatively easy subjects for instantaneous photography,



PHOTOGRAPH OF FLYING PROJECTILE.

but certain other moving objects have severely tested the skill of the photographer as well as the capacity of the apparatus employed.

Perhaps the most difficult feat yet attempted in the line of photography is that of catching an impression of a bullet or cannon ball as it flies across the field of the camera. This has been accomplished with varying degrees of success, but most of the specimens of this class of work hitherto produced have been at the best mere streaks, not in any way resembling the projectile. This failure to procure a sharp impression is shown by the photograph itself to be due to lack of shutter speed.

A recent invention, to which we alluded a short time since in an article on "The Tachyscope," has apparently obviated this difficulty, so that it can no longer be said to be impossible to secure a recognizable picture of a flying projectile.

Last year Mr. Ottamar Anschuetz, of Lissa, Prussia, tried some very interesting experiments at Gruson, near Magdeburg in Germany, which demonstrate the practicability of photographing a flying bullet by daylight. Mr. Anschuetz constructed a small camera of great strength, in which he arranged a shutter of his own invention, which in this case was operated by an eight hundred pound weight. The shutter is arranged immediately in front of the sensitive plate, and consists simply of a curtain having a narrow slit as long as the plate, the width of the slit being variable. This slitted curtain passes over the entire face of the sensitive plate, exposing successive portions thereof to the action of the light. This arrangement insures a brief exposure of all portions of the image of the moving figure, thereby producing an extremely sharp negative. The slit in the shutter during this experiment was adjusted to a width of 0·002 of an inch.

Fig. 1 of our engraving represents the photograph in its actual size. Fig. 2 shows the photograph enlarged. In the field of the camera, which covered a space of 46 feet, Mr. Anschuetz drew a canvas curtain, and at every 13⅛ feet suspended a projectile 12 inches long, for comparison with a projectile of the same kind to be fired from a cannon. At a distance of 200 feet a wire netting was placed, which was connected electrically with Anschuetz's drop shutter. The projectile passed through the wire netting at a velocity of 1,312 feet per second, and its image was caught on the sensitve plate after having sped along the canvas curtain a distance of 42 feet. The shutter passed over the plate in the short space of 75-1,000,000 of a second. The numbers marked on the canvas indicate the distance in meters. The projectile shown below the space between the 10th and 12th meters is one of those suspended for comparison; the other shown above the 13th meter is the one photographed in its flight.

The photograph we reproduce was furnished us by the United States Photograph Supply Company, of No. 3 East 14th Street, New York City, who represent Mr. Anschuetz in this country.

A New Antiseptic.

Under this title a paper was read before the Medical Society of London, on November 4, by Sir Joseph Lister. The antiseptic is the double cyanide of mercury and zinc, and is prepared as follows:

A soluble double cyanide of mercury and potassium is dissolved, and to it a soluble salt of zinc is added; the precipitate formed is the double cyanide, which should be well washed with water to free it from any soluble cyanides, as they cause irritation and suppuration if placed on a wound in the shape of gauze.

One in 2,000 of double cyanide keeps blood serum and corpuscles from putrefaction, but if the wound has developed bacteria a much stronger solution or powder or gauze must be used. In other words, the double cyanide has a strong inhibitory but a weak germicidal power. Gauze is prepared in the following way: The double cyanide is triturated with starch, and water is added to this, the result being a somewhat leather-like mass. The water is strained off, and to the mixture of double cyanide and starch sulphate of potassium is added. This enables the mixture to be easily powdered, and, when it is dry, it is a fine white powder. In order to fix this powder on gauze, 3 per cent or 5 per cent of it is suspended in a 1 in 4,000 solution of mercuric chloride, when, by the agency of the starch, it sticks so firmly that it cannot be washed off except with difficulty.

Sir Joseph Lister said that the dressings should be used moist, and he had a little contrivance which he employed to show the surgeons present how they might prepare the gauze themselves, as he had made it a point that the gauze should be made as required. The exact composition of the double cyanide is uncertain, and is being investigated in the Pharmaceutical Research Laboratory.

The Tallest Chimney Yet.

The Clark Thread Company's chimney, at East Newark, N. J., which was illustrated in these columns not long ago, and claimed to be the tallest chimney in this country, has been supplanted by a smokestack just finished at Fall River, Mass., which is 340 feet high above the granite base and 30 feet square at the bottom. The shaft was built on the grounds of the Fall River Iron Works, and is, without doubt, the tallest smokestack in America.

The tallest finished chimney in the world is at Paisley, Scotland, and is over 500 feet high. Fall River's new chimney will furnish draught for four new factories.