tinuous circle. By bringing the bent portion in contact with a globule of mercury and some dilute sulphuric acid on a saucer, the wire loop becomes amalgamated or alloyed with mercury. Then, by sweeping it through mercury overlaid by water, with a quick skimming movement, a film can be picked up. Water will rest on its upper surface. This can be removed with blotting paper, leaving a pure mercury film. It must be held horizontal. It immediately breaks if an attempt is made to bring it into the vertical plane. The loop should not be much over a quarter of an inch in internal diameter.

FALL OF A GREAT WATER TOWER.

In various parts of the country it has become common, in connection with local water works, to erect slender towers or stand pipes for the purpose of maintaining the required head or hydrostatic pressure in the distributing pipes. The common method is to erect a simple iron cylinder or stack of, say, 16 ft. diameter and a hundred feet or more in height, into which the water is pumped and held like a cistern, the lower end of the cylinder being connected with one of the water distributing mains. In our paper for October 23, 1886, we gave an illustration of one of these stand pipes, as erected at Victoria, Texas, the upper end of which, not being at the time filled with water, had been damaged by a hurricane.

We now give illustrations of the far larger stand pipe of the Kings County Water Works, located at Sheepshead Bay, near Brooklyn, N. Y., which, at 1 P.M. on October 7, 1886, suddenly collapsed and fell, while being charged with water during a preliminary trial of its strength.

This stand pipe was 250 ft. high, 16 ft. in diameter at its base and for a height of 70 ft., then tapering upward for 25 ft., and then rising 8 ft. in diameter. A very strong and substantial foundation of concrete had been constructed, 33 ft. in depth below the surface of the ground. On this the stand pipe was built, the contractor being H. S. Robinson, of Boston, Mass.

In the construction of the work, the steel plates were hoisted to place by a derrick worked from within the tower, as indicated in the illustration at the left, which shows the structure partly completed.

As before stated, the explosion took place at 1 P.M., when the neighbors were startled by a rumbling noise followed by a crash like that of thunder. There was a slight vibration of the earth, but it was all over in less than thirty seconds. The people thought it was an earthquake, and rushed from their houses in terror. The shock was felt in all directions within a mile or two of Sheepshead Bay. A cloud of dust was seen rising from the locality, and when it had floated away the water tower was discovered lying on the ground, with tons of steel plates scattered in every direction. Great volumes of water rolled from and around the prostrate structure, and in a few moments nineteen acres of land was submerged.

Some water had been pumped into the tower a week previous to the explosion, but the real test was not made until the day of the explosion. It was supplied from drive wells in the immediate vicinity. The large engines were set in motion at the pumping station shortly after 11 o'clock. Two hours later the great tank was nearly filled, there being 227 feet of water in it, which would make about 400,000 gallons. The pressure was then 127 pounds to the square inch. It was noticed then that the tower leaked in some places, and Mr. Robinson prepared to mount the narrow iron ladder that led to the top of the structure, and make an examination. He approached within about five feet of the tower when he heard a rumbling noise like that of a rushing train, as he expressed it, and the plates for a distance of twenty feet from the ground parted and let loose the water. Others describe it as like the explosion of a steam boiler. The volume of liquid rushed with great force, and Mr. Robinson was caught in it. He was carried nearly fifty feet by the wave, and that saved his life. Almost in the same moment a large section of steel plate weighing a ton or more crashed down upon the spot where he had stood. Another section weighing five tons was thrown fifty feet in an opposite direction. Small pieces were tossed all around the base of the tower.

Meanwhile, the tower, supported by the wire cables alone, tottered for a moment and then fell with a crash and roar in a northeasterly direction. The heavy steel plate, bolts, and braces were broken, bent, and twisted like so much paper. The rush of the water had stirred up clouds of dust, and for a time the scene was concealed from view. People in the immediate vicinity thought that the dust was escaping steam. When Mr. Robinson recovered himself, he was floundering in three feet of muddy water. His hat, coat, pocket-book, and a number of papers were gone. He struggled to his feet and waded toward a dry spot a quarter of a mile away. Though considerably bruised, he was not seriously injured. His pocket-book and clothing were found some hours later near the wreck. The soil about the tower was of a sandy character, and the water quickly disappeared, except in places where the sand was mixed with clay. Several acres of rye that had been planted by Mr. Stephens disappeared after the explosion. No other damage was done.

The following from the contract gives the particulars of the structure. The general conclusion appears to be that bad work in putting up the great pipe and poor material were the causes of its failure.

ROBINSON BOILER WORKS, 28 STATE ST., BOSTON,
October 6, 1885.

BENJAMIN F. STEPHENS, ESQ., *President*:

I will make and erect on a foundation prepared by you near Coney Island, New York, a stand pipe 250 ft. high, as described below:

Pipe will be 16 ft. diameter up to 70 ft., then in the next 25 ft. taper in to 8 ft. diameter. Bottom of $\frac{7}{8}$ in. steel, 17 ft. diameter. Bottom course connected to bottom by $6 \times 6 \times \frac{7}{8}$ in. angle iron, flange turned out; 15 braces on the inside.

First 5 ft. of pipe of $\frac{7}{8}$ steel, with 3 rows of rivets in vertical seam; 30 ft. of pipe of $\frac{3}{4}$ steel, with 3 rows of rivets in vertical seam; 15 ft. of pipe of $\frac{5}{8}$ steel, with 3 rows of rivets in vertical seam; 20 ft. of pipe of $\frac{5}{8}$ steel, with 2 rows of rivets in vertical seam; 25 ft. of pipe of $\frac{5}{8}$ steel (taper), with 2 rows of rivets in vertical seam; 5 ft. of pipe of $\frac{5}{8}$ steel (1st course above taper); 30 ft. of pipe of $\frac{1}{2}$ steel; 35 ft. of pipe of $\frac{3}{8}$ steel; 30 ft. of pipe of $\frac{5}{16}$ steel; 30 ft. of pipe of $\frac{1}{4}$ steel; 25 ft. of pipe of $\frac{3}{16}$ steel.

For the first 75 ft. the course will be all inside, so at that height the diameter will be lessened by the thickness of the plates.

In the taper, the course will be all inside, and above that they will be large and small.

All of the plates will be steel stamped 60,000 lb. tensile strength. All of the vertical seams above the first 50 ft., and all of the horizontal seams, will be double riveted, with sufficient lap to make a good job.

I will rivet on to the outside of pipe a ladder running from top to bottom. Lower half of sides of 2 in. by $\frac{1}{2}$ in. iron, upper half of 2 in. by $\frac{3}{8}$ in. bar iron, and rounds of $\frac{3}{4}$ round iron 16 in. long and 12 in. apart.

I will rivet to pipe three manhole frames, position as shown on tracing, also two nozzles on bottom course.

I will rivet on to pipe two balconies (one under each of the upper manholes) with wrought iron brackets and floor as shown on tracing.

I will furnish and attach to the pipe twelve guys of 1 in. wire rope—six of them 100 ft. from the ground, and six 25 ft. from the top; the understanding being that you are to furnish and put down the anchors for same.

I will put around the top a 3 in. by 3 in. angle iron, and on the inside of the 25 ft. of $\frac{3}{16}$ iron I will rivet 4 in. by 4 in. T irons to stiffen the same. I will also rivet on 12 (twelve) 4 in. by 4 in. T irons to strengthen the joints where taper section of pipe joins the straight. Each piece to be 10 ft. long, and extend five feet above each joint and five feet below, eight of these T irons on lower joint, and four on the upper.

Price for the "stand pipe" completed as above, water-tight, and to your satisfaction, $16,625 (sixteen thousand six hundred and twenty-five dollars).

In the above price I have accepted your proposition to do the teaming from the dock at Bay Ridge or Long Island City to stand pipe site of all the material and tools used in the construction of said pipe for $350 (three hundred and fifty dollars).

Signed, H. S. ROBINSON,
By J. M. ROBINSON.

FALL OF A WATER TOWER AT KANKAKEE, ILL.

During a gale of wind on October 14, 1886, the water tower at Kankakee was overturned. The wind began blowing very strongly in the early morning, and reached an estimated velocity of sixty miles an hour. By 9 A. M. the tower was observed to be swaying slightly; the vibrations increased until the successive wind gusts raised it on one side or the other several inches at the foundation. An unsuccessful attempt was made to arrest this movement by tightening the nuts on the anchor rods, but the tower soon fell.

We quote the following particulars from the Kankakee *Gazette*:

"As the gale grew stronger, the tower with each vibration lifted itself further from its bed. Meantime, the top of the tower inflated and contracted like the sides of a panting horse. Then the windward side collapsed, forming a pocket extending downward from the top twenty-five or thirty feet, and the fall of the tower soon followed in a direction from the wind.

"The tower was 124 feet high and 20 feet in diameter. It was constructed of plates of $\frac{5}{8}$ inch boiler iron, four feet wide and ten feet long, diminishing in thickness to No. 9 iron (one-eighth of an inch thick) at the top. It was intended to have iron rods across the top to act as braces and prevent a collapse. These were put on, it is said, but taken off for some reason. The tower was erected by the Sharon Boiler Works, of Sharon, Pa., under the direction of William Jones. The foundation was of stone and concrete, seven feet deep, about twenty-one feet in diameter, and rose about eight inches above the surface of the ground except on the side toward which the tower fell, where an excavation left the wall exposed for about a yard. Mr. Shannon, superintendent of the Water Works Company, computed the resisting or supporting capacity of the foundation at 160,000,000 pounds, while the tower when filled with water would have weighed only 22,000,000 pounds. Six anchor rods, two inches in diameter, extended from about six feet above the foundation into the foundation a distance of two feet, where they turned at right angles and ran laterally into the stone about two feet. One-third of the foundation, on the side toward which the tower fell, is broken down and sloughed off to a depth of three feet. Whether this crumbling began before the fall of the tower, or was caused by the weight of the tower as it leaned far over, we cannot say. On the windward side the rods were broken off."

John C. Hoadley.

On the 21st of October, 1886, death brought to a close the career of John Chipman Hoadley, of Boston, U. S., an American engineer whose breadth of attainments rendered him one of the leading men in the profession, especially in steam engineering, in which he was an authority equaled by few.

He was born in the State of New York in 1818, and his first engineering experience was in connection with the system of State canals, which was founded by the Dutch settlers in the seventeenth century, and increased from time to time as the needs of the day demanded. Leaving the State engineers' corps at the age of twenty-six, he became engineer for the construction and equipment of a number of mills at Clinton, Mass., devoting himself to the wide range of work necessary to build up a variety of industries, a task which could not be accomplished except by one possessed of unusual force, skill, and versatility.

Later, he became manager of a large machine shop in Lawrence, and for a number of years was engaged in the manufacture of locomotives and textile machinery. His experience with locomotives led him into an analysis of the dynamical relations which speed bore to the operation of engines; and the result of his investigations, partly mathematical and partly experimental, resulted in the invention of the Hoadley portable engine, which was probably the first application of scientific principles to the design of high-speed engines. These engines contained numerous radical features, since appropriated by others, notably the application of an automatic variable cut-off to a single slide valve, operated by a governor attached to the side of the driving pulley of the engine. We do not speak by the letter as to the exact limitations of Mr. Hoadley's inventions in this respect, as measured by the patents issued to him, but the fact remains that he was the pioneer in the successful application of the methods of construction of the Hoadley engine, which was manufactured in great numbers for many years.

During the later years of his life he separated from commercial and manufacturing affairs, and confined his attention to the practice of his profession in consulting engineering and as an expert in patent causes. In this latter capacity his services were held in highest repute, his retentive memory rendering an extended reading and wide experience tributary to a power of keen analysis which would set forth the measure of each patent's merits or the worth of the mechanical features of an invention.

His acquirements were not limited to technical matters, but extended through a wide range of general culture. The transactions of the American engineering and scientific societies contain frequent contributions from his pen; the members of the British Association may recall among these his paper on "American Steam Engine Practice in 1884," read at the Montreal meeting, and which was the first step in the recent polemical engineering papers respecting English and American railway practice.

Mr. Hoadley was always interested in public affairs, but he held few offices. He was, however, the engineer member of the Board of Health of the State of Massachusetts. He also visited England and the Continent in 1862, on the part of the State Government, making an examination of fortifications for the purpose of devising a system for American sea coast defences.

The professional work of Mr. Hoadley is shown by its influence over a wide range of engineering practice in mill work, applications of steam, sanitary engineering, and methods of expert evidence, rather than in any massive structures which bear his name as builder. In his personal address he was especially genial, and endeared himself to a large number of friends.—*London Engineering.*

Improved Lock for Firearms.

In our issue of December 11 we described and illustrated an improved lock for firearms, invented by Mr. Charles E. Goodwin, of Saybrook, O. We omitted one important feature: A single pull of the trigger will fire both barrels consecutively. By properly adjusting the arms of the sears, both barrels can be cocked at the same time and fired simultaneously or consecutively, as may be desired; or, when both are cocked, one can be fired and the other not.

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