BLOWING UP FLOOD ROCK, HELL GATE.

The many large and small rocks which originally filled the bend made by the East River in rounding Astoria, were so located as to make all the deep channels extremely tortuous; a great part of these rocks was below

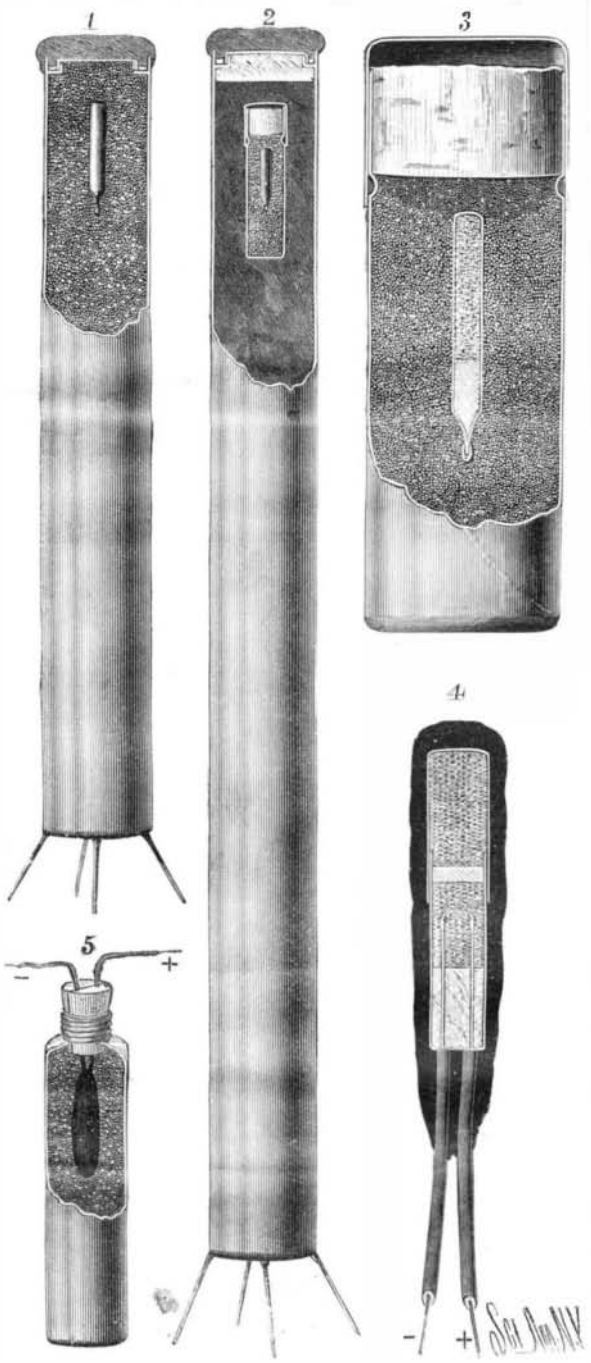


Fig. 7.—THE CARTRIDGES AND EXPLODERS.

the surface of the water even at low tide, and yet not sufficiently deep to be cleared by the keels of vessels; in addition, the current had a maximum velocity of 8½ miles an hour. These features combined to make the passage through Hell Gate extremely dangerous, as the boat had barely passed one obstruction before it met the next; and as there were many strong whirlpools, the prompt obedience of the vessel to the move-

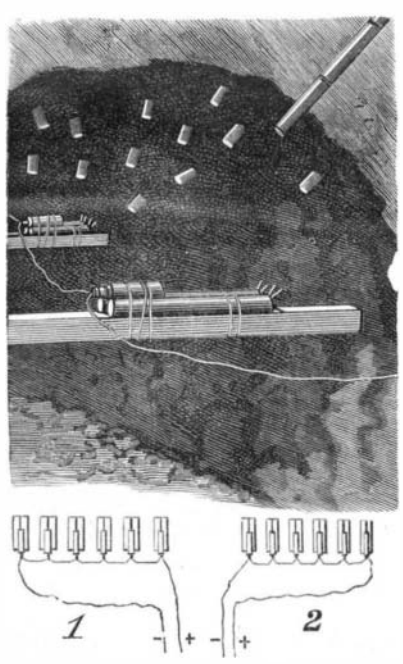


Fig. 9.—THE FUSES AND FIRING CARTRIDGES IN PLACE.

ments of her rudder was by no means assured. The magnitude of the obstacle thus placed in the path of all commerce between New York city and Long Island Sound can be imagined. Fig. 4 shows clearly the condition of Hell Gate about forty years ago, and gives the depth of water at various points, together with the three main courses.

Naturally, attempts were early made to clear the passage, but they were all confined to the removal of the smaller obstructions.

Work upon Hallet's Point, which projected 325 ft. from Astoria shore, was begun in 1869, by the building of a heavy coffer dam of timber next to the shore. When this dam had been pumped out, a shaft was sunk to a depth of 33 feet, and from this ten radiating headings were started under the reef; these headings were united by numerous cross galleries. The total length of headings and galleries was 7,426 feet, and the roof was supported by 173 piers, each about 10 feet square. There were 47,461 cubic yards of rock removed by the excavation, and 3,676 drill holes, from 2 to 3 inches in diameter, were made in the roof and piers to an average depth of 9 feet. Into these holes was placed a charge of 47,781 pounds of dynamite; the separate charges were arranged in 184 battery groups of 20 charges each. The explosion took place September 24, 1876. This removed one of the most serious obstacles, since vessels coming to New York had no sooner rounded Hallet's Point than they were driven by the rapid current toward Flood Rock.

At the present time Diamond, Coenties, Way's Reef, Shelldrake, Heel Top, Frying Pan, Pot Rock, and Hallet's Point have been removed to a depth of 26 feet at mean low water; Bread and Cheese Reef has been inclosed, and a stone dike built from Great Mill to Little Mill Rock; in addition, many smaller rocks have been removed, and Flood Rock has been mined, charged with explosives, and only awaits the touch of a button to reduce it to a mass of small broken stone.

In the SCIENTIFIC AMERICAN of July 25, 1885, we described the method of mining and drilling Flood Rock; it is only necessary here to give a few points. The main shaft was sunk to a depth of 64 feet below mean low tide, and from the foot of this headings were extended parallel with and at right angles to the current; there are 24 of the former and 46 of the latter. The extreme length—parallel with the stream—is 1,200 feet, and the width 625. The roof of this chamber, which has an area of a little over 9 acres, averages about 15 feet in thickness, and is supported by 467 enormous piers. The total length of the galleries is 21,670 feet.

Into the roof and tops of the piers there have been drilled 13,286 holes, 3 inches in diameter and having an average depth of 9 feet; in other words, the rock has been pierced with holes having an aggregate length of over 22 miles. At the present writing these holes have been filled with rack-a-rock and dynamite, all the buildings and machinery have been removed from the small island, the electrical connections have been made, and a final survey is being made to make sure that no mistake will prevent the successful explosion of what is by far the largest blast ever attempted. The drawing, Fig. 6, is a longitudinal section through the galleries and shafts; it gives also a correct idea of the sloping character of the river bottom at this point.

Fig. 7 represents the cartridges and exploders. The dynamite cartridge No. 1 is 15 inches long by 2¼ inches in diameter; it is the last cartridge put in each drill hole, and it is so placed that its end projects about 6 inches beyond the face of the rock. In the forward or projecting end is placed an exploder, which consists of a thin, jumped-up copper shell filled with fulminate of mercury, the open end being pinched together and dipped in solder. No. 2 is the rack-a-rock cartridge with dynamite exploder, shown full size in No. 3. This cartridge is 24 inches long by 2¼ inches in diameter, and holds 6 pounds. Rack-a-rock is a mixture of chlorate of potash and dinitro-benzole; the ingredients are harmless until united. The mixing was done upon Great Mill Rock, in a lead-lined vat, the potash being made to pass through a fine sieve, and the benzole being then added in the requisite proportion. The explosive thus formed has 95 per cent the strength of No. 1 dynamite.

The cases are then filled with this substance, which looks like moist light brown sugar, a light wooden rammer forcing it gently into place. When filled, a cap is soldered upon each case. The alloy here used is very fusible, the soldering cap being only heated, by steam, to 112°. The filled shells are then placed in compartment boxes and carried to the galleries. At the bottom of each cartridge are four outwardly projecting wires, which serve to hold the cartridge in the drill hole The method of loading the holes was described and illustrated in our issue of July 25, 1885.

The dynamite exploder No. 3 (Fig. 7) consists of a copper tube filled with No. 1 dynamite, and provided with an exploder similar to that shown in No. 1. A cork stopper is placed in the open end of the tube, which is then dipped in glue and a copper cover put on. This exploder is pushed a short distance into the end of the rack-a-rock cartridge, as shown in No 2.

The dynamite cartridge is of the same size as the

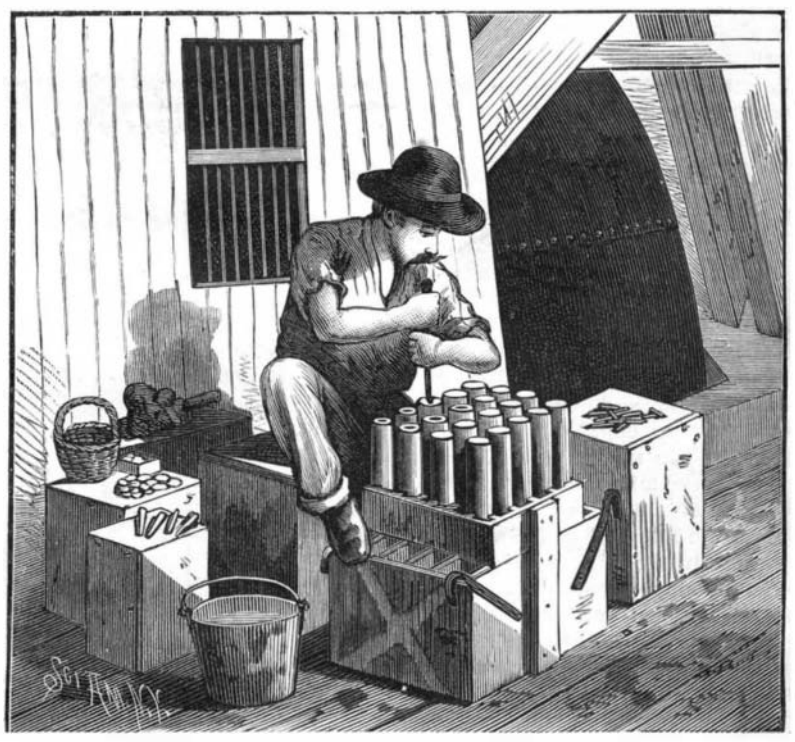


Fig. 8.—INSERTING EXPLODERS IN CARTRIDGES.

rack-a-rock, and is filled with No. 1 dynamite; it is furnished with a common fulminate exploder. The operation of forming a hole in the dynamite cartridge with a stick and inserting the exploder is shown in the engraving, Fig. 8. The cartridges are all dipped in oil and pitch and then rolled in sand, to protect them from corrosion.

No. 5 shows the mine exploder (shown in position in the mine in Fig. 9), which is a brass cylinder 7½ inches long by 1¾ inches in diameter, filled with dynamite. Inclosed within the dynamite is a fuse (No. 5), the wires from which pass through a divided cork in the mouth of the brass cylinder. The fuse—shown full size in No. 4—consists of a copper tube nearly filled with 30 grains fulminate of mercury. Fitting within the open end of this tube is a second one containing sulphur, through which pass the two conducting wires, which are held firmly in place by the sulphur. The inner ends of the wires are united by a small platinum wire or bridge. The ends of the wires are then surrounded with fulminate, and the two parts are put together, that containing the wires slipping within the other. The entire fuse is then covered with gutta-percha. The passage of an electric current through

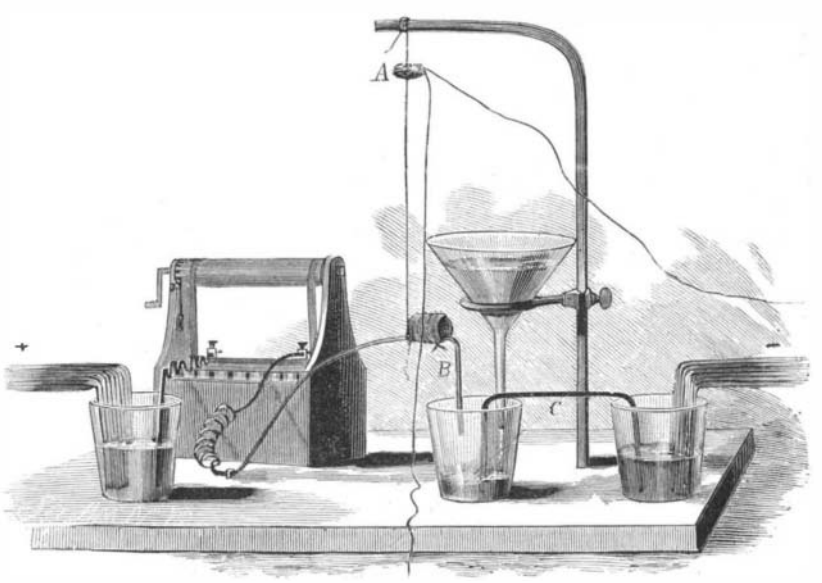


Fig. 10.—THE ELECTRICAL FIRING APPARATUS.

the wires heats the platinum bridge to redness, when the fulminate is exploded.

Each drill hole is nearly filled with rack-a-rock cartridges, space of course being left in the mouth to permit the entrance of the dynamite cartridge. We thus have each of the holes filled mainly with rack-a-rock, and from each projects a short length of tube having dynamite, and in every cartridge is an exploder.

Not one of the cartridges in the drill holes is connected with wires, nor is one to be exploded by electricity.

Extending from wall to wall in each of the galleries, and at intervals of about 25 feet, are timbers, 3 by 5 inches, as shown in Fig. 9. Tied side by side upon each one of these timbers are two dynamite cartridges like those already described as filling the mouths of the drill holes. Tied upon each pair of these cartridges is a mine exploder, represented in No. 5 (Fig. 7). The entire mine is divided into 24 independent circuits, each circuit representing or covering a certain section. Within each circuit are 25 fuses or mine exploders.

A wire from the surface of the rock at the mouth of the shaft leads from one fuse to the next until the 25 fuses are in the same electrical circuit, the other end of the wire, of course, returning to the surface. Each of the 24 circuits has its own wire. The wire circuit is shown at 1 and 2, Fig. 9. We now come to the electrical firing apparatus, shown in Fig. 10. We will suppose one end of each wire of each circuit to be + and the other —. All the + ends are dipped in mercury contained in a cup, and all the — ends in mercury in a second cup. It will be seen that if the mercury in these two cups be united by a wire, we shall have a complete electrical circuit embracing every fuse or mine exploder in the excavation.

Leading from the left hand or + cup is a wire secured to one pole of a battery; and leading from the opposite or — cup is a wire, C, which extends to the bottom of the middle cup, which contains only a little mercury. The wire, B, leads from the other pole of the battery, and is held suspended over the mercury in the center cup. It is evident that, when the wire, B, enters the mercury in the center cup, the circuits through the mine and battery will be completed, and the fuses discharged.

At A is a fuse held to the string carrying the wire, B, by a half hitch. One wire passing through this fuse is grounded, while the other leads to the shore, where it also is grounded; a battery on shore is placed in this circuit. The current through the shore wire explodes the fuse, A, which breaks the cord and allows the wire, B, to drop into the mercury in the cup; the mine is then exploded. It will be observed that the wire, B, enters the cup a short distance. This is in order that the mine may be exploded even if anything should happen to the shore wire or battery, or if the explosion of the fuse, A, should fail to break the string holding up the wire, B. The outlet of a vessel containing mercury is placed over the center cup. It has been ascertained by experiment just how long it will take the mercury running from this vessel to fill the cup up to the end of the wire, B. The flow has been so gauged that after all the apparatus has been arranged, there will be ample time for the boat to go from Flood Rock to the shore; then the current will be sent through the shore wire.

Should the shore wire fail, there will be nothing to do but wait until the mercury has filled the cup to the wire, B. The shore connection was devised mainly for the benefit of scientists, who will be located in the vicinity, and who wish to make observations of the vibrations of the earth caused by the explosion. The current will notify them of the exact instant of explosion. The failure of the shore wire would of course deprive them of this most important point, but would interfere in no way, as mentioned above, with the firing of the mine.

The electrical current will explode the 600 fuses or mine exploders (Fig. 9), when the dynamite cartridges projecting from the drill holes will "explode by sympathy," as it is termed, and these in turn will discharge the rack-a-rock placed behind them. Each cartridge is rendered more sensitive by the exploder embedded in it. The explosion of the 40,000 cartridges containing 75,000 pounds of No. 1 dynamite and 240,000 pounds of rack-a-rock will completely break up the 9 acres in which they are buried, so as to render easy the final operation of dredging the broken rock. The cost of the improvement is estimated at $1,000,000.

The Harlem River improvement contemplates the building of a deep water channel from the East River through the Harlem River and Spuyten Duyvil to the Hudson River, as shown in the map, Fig 11. Above the Third Avenue bridge to the entrance of Dyckman's Cut into the Harlem, the pier and bulkhead lines will be 400 feet apart. The line through rock at Dyckman's Meadows will be 350 feet wide, and from there to the Hudson 400 feet wide. From Third Avenue bridge to lower part of Randall's Island the width will be 500 feet, and from there to the East River 800 feet wide. Between Morrisania and Randall's Island the channel will be 350 feet wide.

All the work at Hell Gate was designed by Gen. Newton, to whose perseverance, industry, and skill we owe the successful opening of one of the most important entrances to New York; the last operation—blowing up Flood Rock—fittingly completes, by its great magnitude and the rare difficulties it presented, long years of well directed effort. During the past few years the work at Flood Rock has been under the supervision of Lieut. G. McC. Derby, who has without accident of any kind, or any delay, succeeded in performing one of the most arduous pieces of mining ever attempted. We wish

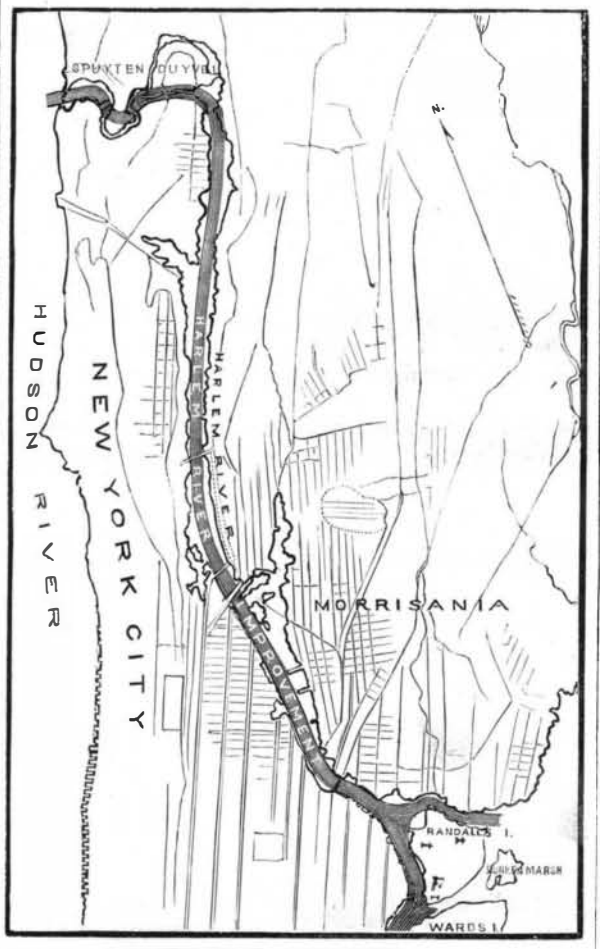
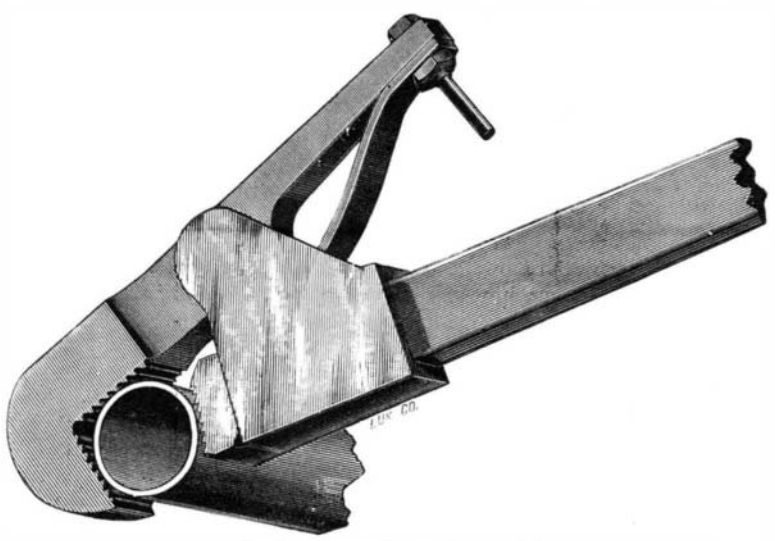


Fig. 11.—MAP SHOWING HARLEM RIVER IMPROVEMENT.

to acknowledge the kindness of Gen. Newton and Lieut. Derby, who furnished us data.

AN IMPROVED WRENCH.

The wrench shown in the accompanying cut has many admirable features—it adjusts itself to either pipe, nut, or stud; owing to the form of the forward or movable jaw, it can be used to fit corners about machinery that cannot be reached with other forms of wrenches; and owing to the fact that it has three bearings on the pipe, the latter is not liable to be crushed. The serrated or holding surfaces of the movable jaw are at right angles to each other; this jaw is pivoted in a fork projecting from the side of a fixed sleeve on the end of the handle, and a spring presses the holding portion of the jaw toward the end of the handles, which is also serrated. By pressing upon the rear end of the movable jaw bar, the jaws may be opened to their widest extent. The metal (best steel) is so distributed as to make those parts which are subjected to the severest strain exceedingly strong. The wrench is easy to handle, exerts a powerful grip, and may be instantly freed from the pipe. It is manufactured in sizes, taking pipe from one-eighth inch to five inches, the smallest size being provided with a screwdriver handle.



PORTER'S IMPROVED WRENCH.

This wrench is manufactured by the Porter Manufacturing Company, of Revere, Mass.; The Eaton, Cole & Burnham Company, of 82 and 84 Fulton Street, New York city, are sole agents.

An Electric Railway in Toronto.

The Vandepoele electric railway was recently put in operation in Toronto, in order to carry passengers from the horse cars to the fair grounds, a distance of one mile. Trips were made in two and a half minutes, and large numbers of passengers were carried over the road daily.

Rapid Steaming by the Etruria.

The Cunard steamship Etruria arrived at New York August 22, from Liverpool, having made the fastest trip in the record of Atlantic traveling. Time from Queenstown to Sandy Hook, 6 days 5 hours and 31 minutes. The fastest previous passages were made by the Oregon of the same line, and were: Westward, 6 days 10 hours and 10 minutes, just a year ago, and eastward, 6 days 6 hours 41 minutes, in December, 1884. The Etruria's previous trip eastward, reckoning to Fastnet only, was made in 6 days 5 hours and 35 minutes.

Following is a table of the runs made on the different days during the Etruria's last voyage:

Run.	Miles.
Liverpool to Queenstown	240
From leaving Queenstown to noon August 17	424
24 hours to noon August 18	464
24 hours to noon August 19	450
24 hours to noon August 20	465
24 hours to noon August 21	464
24 hours to noon August 22	465
From noon to 3:35 P. M. August 22	71
Total	3,043

The Etruria is built of steel, has a gross tonnage of 8,000 tons, and upward of 14,000 horse power; her length over all is 520 feet, and extreme breadth 57 feet 3 inches.

A Great Cargo of Lumber.

Mr. J. K. Ward, the well known Montreal lumberman, gives the following in the *Gazette* of that city:

Probably the largest cargo of sawed lumber that has ever been shipped from Canada left this port to-day per steamship Regius, Capt. Kayll, on account of Bryant, Powis & Bryant, of London, Eng. It consisted of 1,272 St. Petersburg standard three inch deals, or 2,518,560 feet board measure, equal to ten large barge loads of 250,000 feet each. If it were in one inch boards it would cover a farm of 60 acres, and require the pine product of say 1,000 acres of ordinary forest land, such as we have to depend on for our future supply. This shipment may suggest to the minds of many the great importance of the future of our leading industry. There is no questioning the fact that our country is fast being depleted of one of its most important elements of prosperity, and that it behooves not only the lumbermen and the government, who are directly interested, but also every member of the community, to do what they can by expression of opinion or otherwise to protect that that cannot be reproduced in our day.

Texas Copper Deposits.

According to a Texas newspaper, the copper region of that State is of great extent, running westward from Red River, from the line of the Indian Territory, through several counties, prominent among which are Archer, Baylor, Knox, Hardeman, and Cottle. The district is approximately in latitude 32 degrees north, with Red River to the north as well as the east, and the Brazos River to the south. The copper deposits were discovered by General George B. McClellan, in 1852. In that year, McClellan, then a lieutenant in the army, was detailed by Jefferson Davis, Secretary of War, to accompany an expedition up Red River into Texas and Indian Territory. While on this duty Lieutenant McClellan found important deposits of rich copper ore near the point where Cache Creek empties into the river, and some miles above it was discovered that Red River flowed through apparently solid beds of the valuable mineral. In the same locality rich gold bearing quartz veins and placers were found, and all the conditions pointed to the existence of a mining district of great possibilities. To complete the romantic history of the discovery of copper in Texas, it is only necessary to add that General McClellan is now, after the lapse of a third of a century, the leading spirit engaged in the development of the deposits. The Grand Belt mines, in which he is largely interested, are fifty miles from Harrold, in Wilbarger county, from which latter point forty wagons are at present engaged in hauling coke to the smelter. The smelter is an experiment, but has a capacity of forty tons per day, and is suitably provided with engine, blower, pumps, etc. All told, the McClellan company's patented claims embrace some 36,000 acres, stretching sixty-five miles along the ore belt. Upon this vast property they have made probably sixty shallow openings of an average depth of seven or eight feet. The ore is found principally in shallow pockets, and at the main point of taking out is said to average about 54 or 55 per cent metallic copper. Some of it is supposed to be very rich in silver. The most promising opening at present being worked by the company is at Kiowa Peak, the center of Motley County, some sixty miles west of Margaret, the county seat of Hardeman County.

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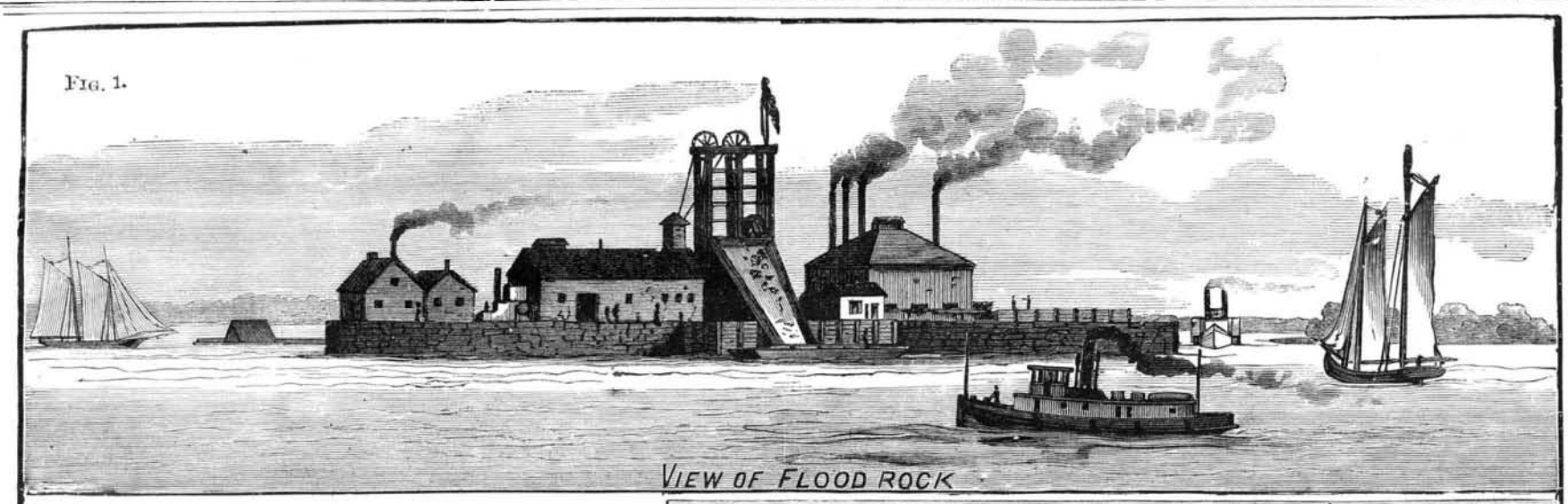
FIG. 1.



VIEW OF FLOOD ROCK.

Fig. 2.—FORMER APPEARANCE OF FLOOD ROCK.

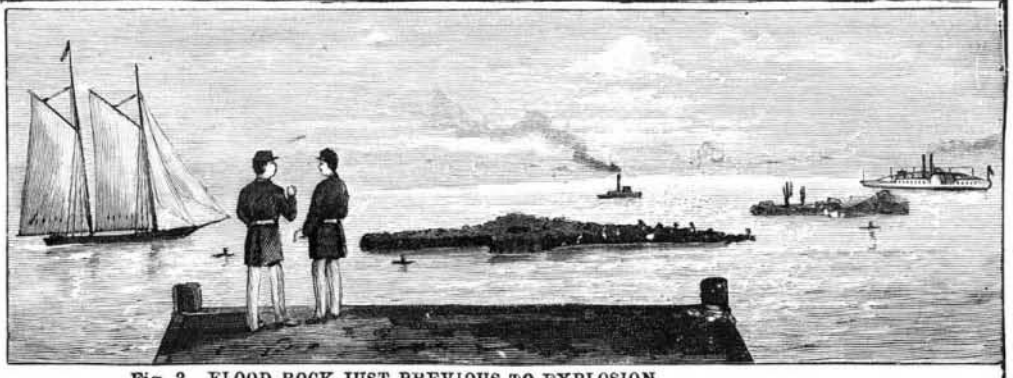


Fig. 3. FLOOD ROCK JUST PREVIOUS TO EXPLOSION.

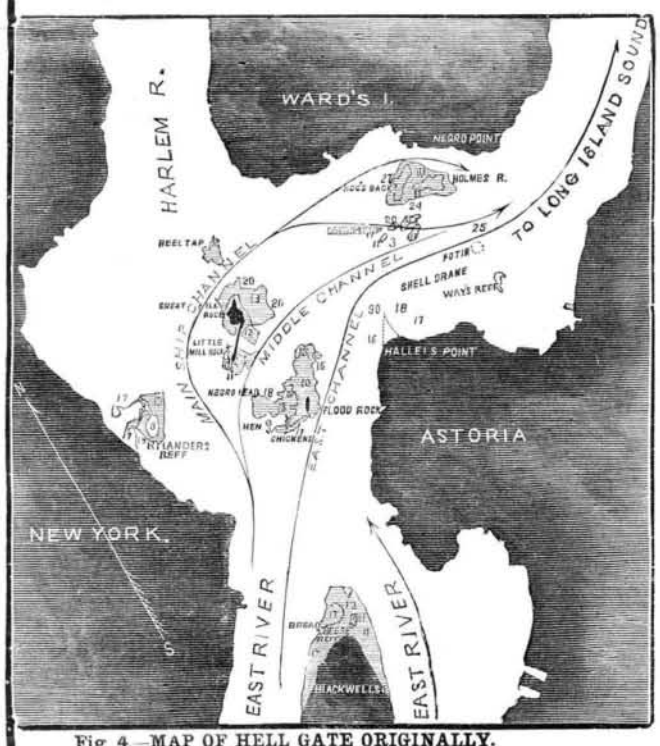


Fig. 4.—MAP OF HELL GATE ORIGINALLY.

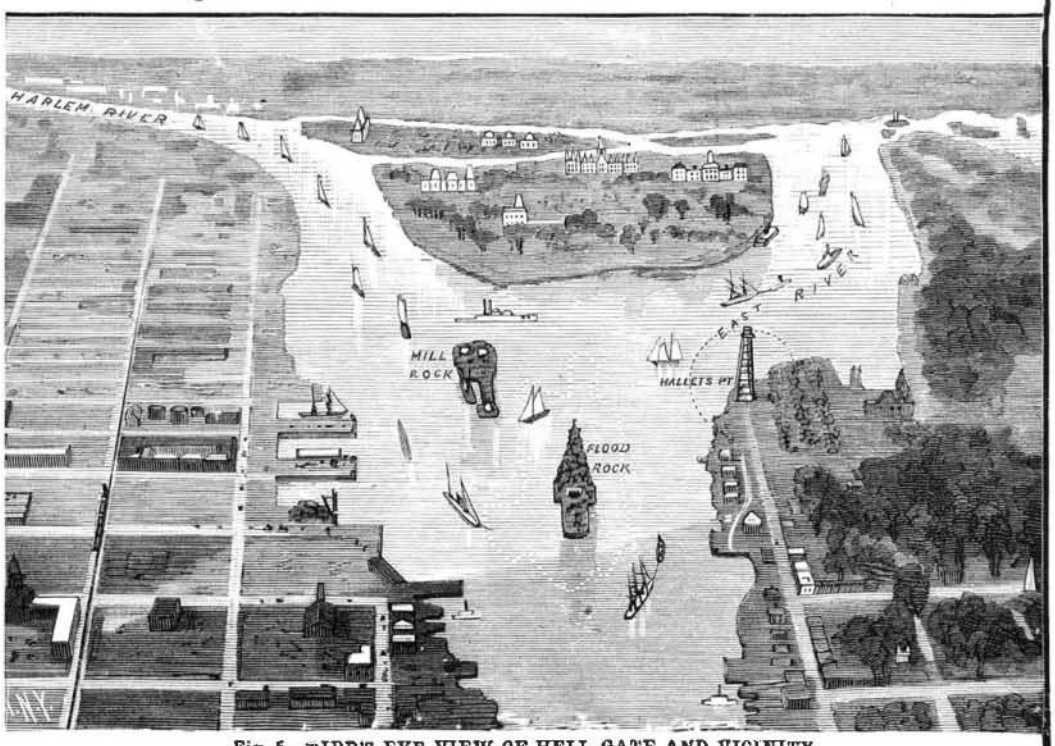
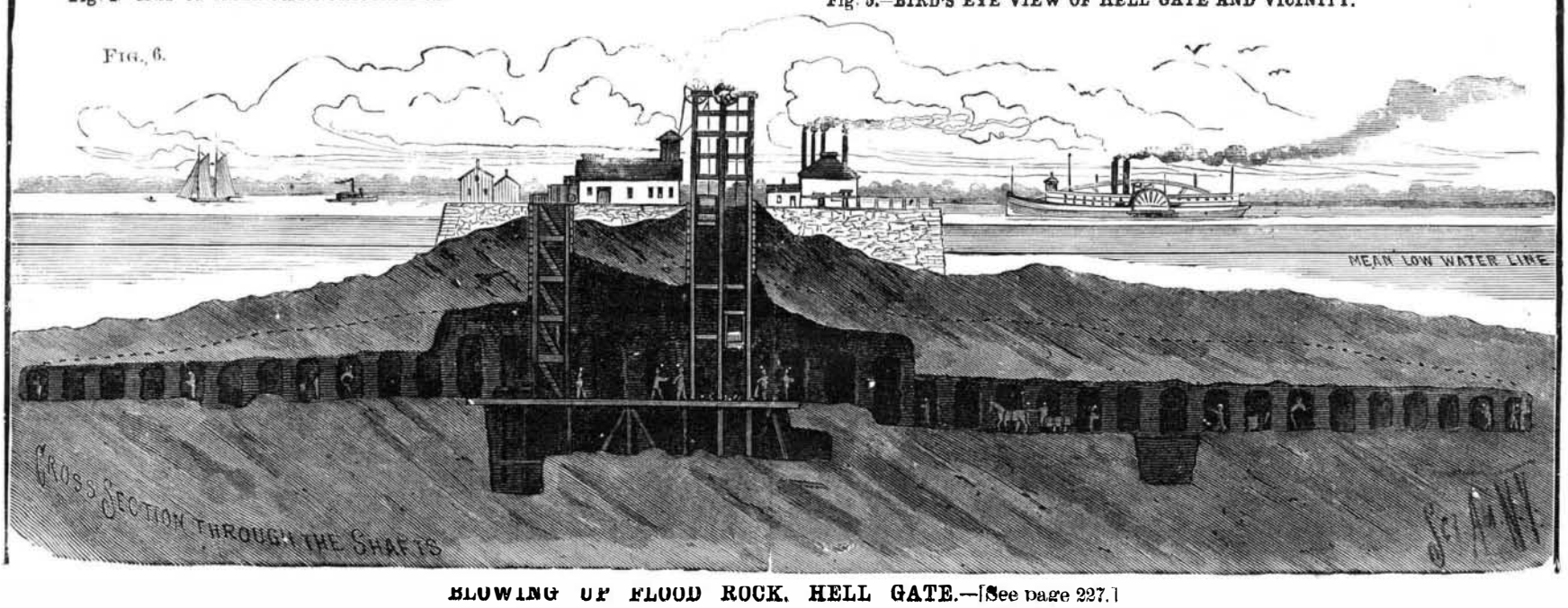


Fig. 5.—BIRD'S EYE VIEW OF HELL GATE AND VICINITY.

FIG. 6.



BLOWING UP FLOOD ROCK, HELL GATE.—[See page 227.]