NEW METHOD OF MANUFACTURING HEAVY ORDNANCE.

Many efforts have been made from time to time to produce a gun of the larger calibers which could be "knocked down" for convenience of transportation in the field and readily put together by the artillerymen wherever it was desired to use it. Some very successful guns of this type have been constructed for mountain service. A common form is that in which the two halves have a screwed connection at the trunnions; but no attempt has hitherto been made to subdivide the gun proper into more than two parts, and for this reason the building of "knock down" guns has been restricted to the medium calibers. The weight of the individual parts in large guns and the difficulty of making a satisfactory screwed connection in them have apparently discouraged the inventor from any attempt in this direction.

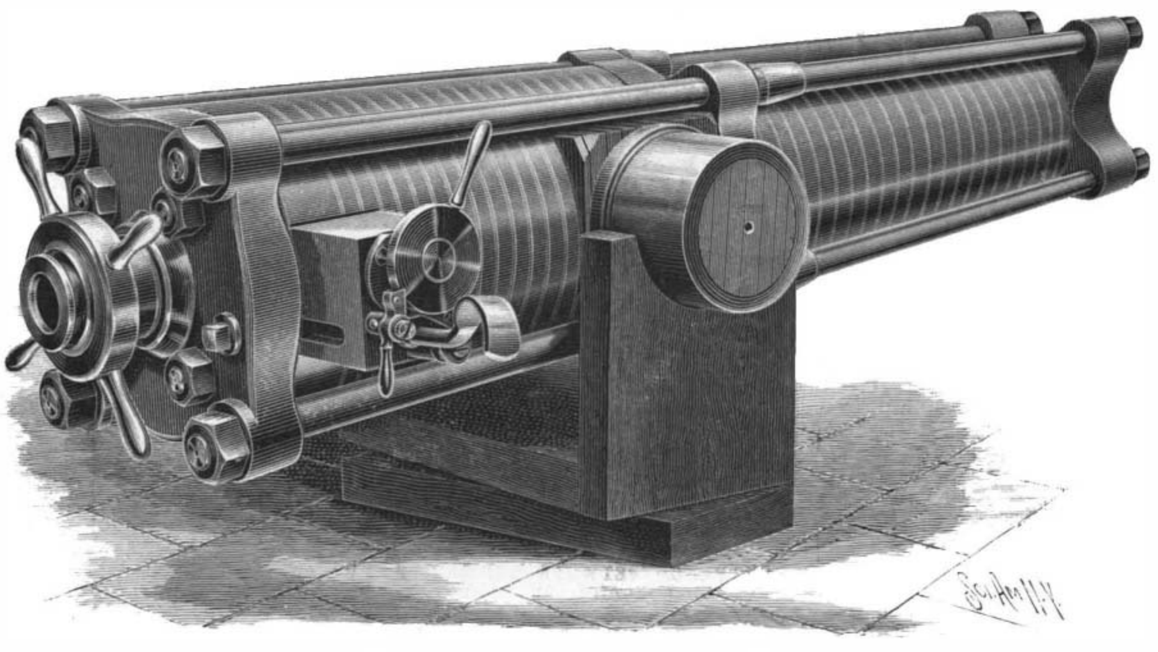


Fig. 1.—GUN CONSTRUCTED IN SECTIONS FOR READY TRANSPORTATION.

We have been favored by a correspondent with the accompanying illustrations of a system of "knock-down" construction which is intended to be applied to guns of any size and weight. Fig. 1 shows a view of the gun ready for firing, and Fig. 2 is a longitudinal section of the gun, from which it will be seen that it is built up in sections, each of which consists of rolled sheet-steel disks held between terminal crossheads by steel tie-rods. Longitudinal support is also afforded to the rear half of the gun by a number of internal tapered tie-rods which are drawn up by means of nuts at the breech. The rods are tapered in order to make it practical to knock that part of the gun down. After all the disks have been assembled and bolted up, they are bored centrally with a taper that fits the external diameter of the rifled steel liner or barrel, which is made in the usual manner, except that it is tapered and is lighter than the inner tube which is used as a nucleus upon which to build up heavy guns of the common type. The initial tension in the steel disks is secured by clamping a hydraulic jack to the breech crosshead and forcing the inner barrel into its tapering chamber. It is claimed that the enormous wedging effect due to the gradual taper of the tube, combined with the heavy pressure with which it is forced in, enables the desired initial tension to be secured in the body of the gun.

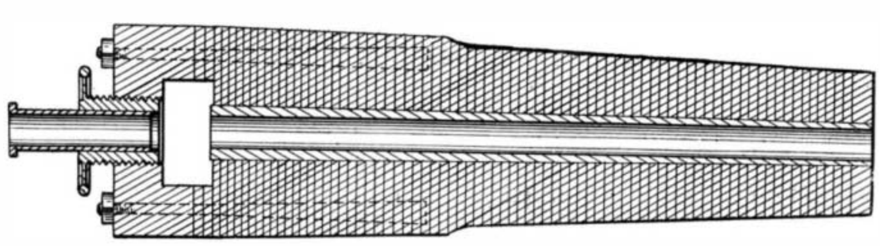


Fig. 2.—LONGITUDINAL SECTION THROUGH "KNOCK-DOWN" GUN.

The loading sleeve slides within a tubular steel screw, which serves to press the breech block so firmly in its place as to make a gas seal between it and the end of the inner barrel, at the same time holding the latter firmly in position while firing. The bolt in the breech crosshead enters a groove in the breech-block and prevents undue motion either way. One advantage of this construction is that the breech block may be taken out and carried away, thus rendering the gun useless should it be captured by the enemy, without rendering it unfit for use if recaptured. It is claimed that this system of construction insures thorough inspection and high quality in the material throughout every part of the gun and therefore removes the risk of faults or flaws, which is always more or less present in the large forgings of which the jacketed gun is built. It also largely reduces the time which is necessary for the construction of large guns, both because of the small size of the parts and the distribution of the work among several shops, where at present it must be confined to a few.

A further advantage is that the inner barrel may be readily removed and another one substituted, if it should become powder-burned or if the rifling should be cut, so that the life of the gun is thus prolonged indefinitely. A large gun can be constructed for less cost per pound than a small gun, whereas in the present system price increases in geometrical proportion to the size of the gun. Moreover, because this system of construction permits the building of a much larger gun than it would be practicable to use on shipboard, the coast defender is placed at a great advantage over an attacking fleet. But, perhaps, the most valuable feature of this system of construction is the great size of gun which could be transported by an army to a country which was not supplied with railway communication. The system is the invention of Mr. Edwin J. Blood, of Chicago, and a gun is now under contract for construction for English parties which it is expected will be tested by the Ordnance Department of our government at the proving grounds, Indian Head, Md. It is to be understood that the sectional view, Fig. 2, is not drawn strictly to scale, and is merely intended to show the general method of construction.

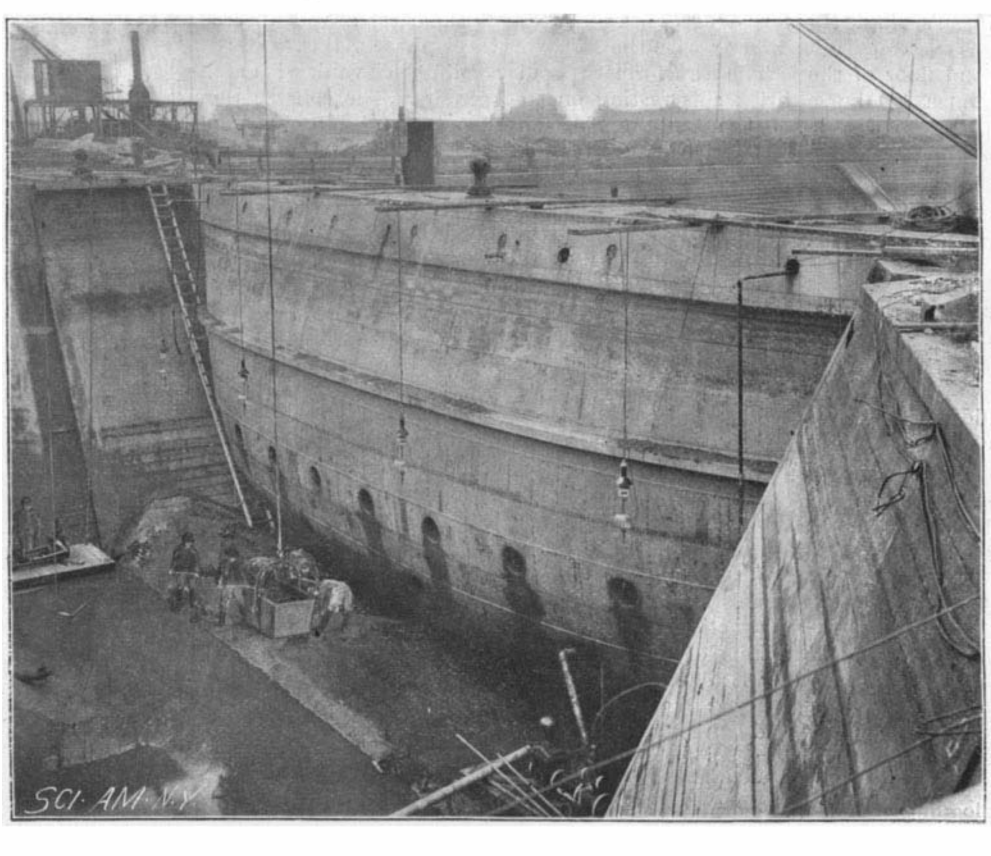
The design is certainly novel, and if it does not develop transverse weakness, the gun may mark a step in advance in the art of heavy gun construction. It will be remembered, however, that the 110-ton guns of the English navy failed for want of transverse strength and showed a tendency to droop at the muzzle after a few rounds had been fired. This weakness was attributed to the fact that the rings of which the gun is built up did not possess sufficient length to impart stiffness to the chase of the gun. The defect was remedied by making the outer rings at the weak point about three times as long as they were before. In view of these facts it will be interesting to see how far the heavy tie-bolts of this new gun combined with the firmly driven in center tube will give the necessary transverse strength.

REPAIRING THE LEAK AT DRY DOCK NO. 3, BROOKLYN NAVY YARD.

The large wooden dry dock at the Brooklyn navy yard, officially known as No. 3, is just now the scene of a costly and difficult engineering work of a kind which has rarely been undertaken before. It will be remembered that this structure is the latest and largest wooden dock constructed in this country. It was built to accommodate the large battleships and cruisers which have recently been added to the navy, and it was more than anything else the necessity of having dry dock accommodation at the earliest possible moment which led to the dock being built of wood instead of the more lasting and reliable stone.

A detailed description of the dock was given in our issue of February 20 of this year, about the time of its opening. The length over all is 670 feet, breadth 151 feet, and the depth on sill 29 feet. The site consisted largely of made ground, and in preparing the designs special care was taken to prevent the seepage of water by providing several complete lines of sheet piling—continuous walls of heavy, square piles, which are tongued and grooved, and driven in close contact—which completely encircle the dock. There is one of these around the edge of the floor and another 26 feet back from the coping of the dock. They connect at the entrance of the dock with wing walls, of sheet piling, which are driven at right angles to the axis of the dock at each of the two sills and at the outer edge of the apron.

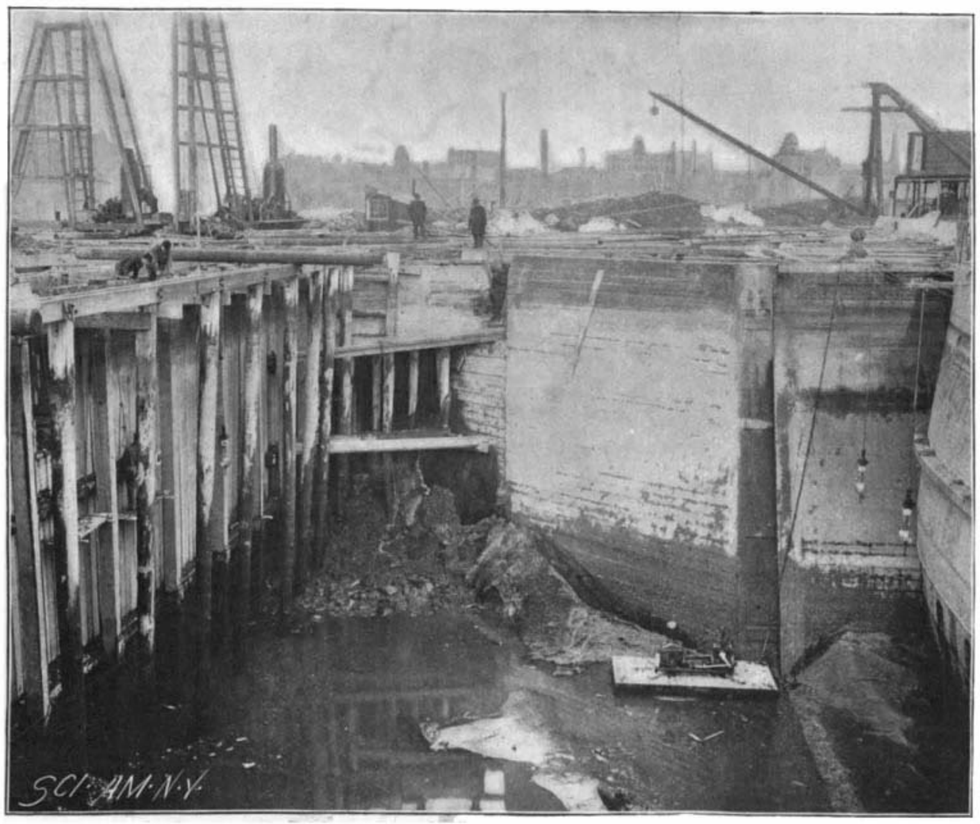
The new dock had not been many months in use before a serious leak developed, the water showing itself at the joints of the altar steps, near the caisson gate. It was at first supposed that water was making its way in by way of an old bulkhead which intersected the site of the dock on the north side. By sending a diver down on the outside of the caisson gate, however, and distributing coloring matter near the bed of the entrance channel, it was proved that the water was working its way in at that point, as the discoloration shortly appeared on the inside of the dock. This was rendered yet more probable by the discovery of a large hole which had been washed out just in front of the apron at the point marked A in the accompanying diagram, Fig. 3. The broken appearance of the sheet piling at the outer edge of the apron suggested that it had been accidentally torn up by the bucket of the dredge which had been used to cut out the channel from the river to the dock.



1.—REMOVING MUD FROM APRON IN FRONT OF CAISSON GATE.

In order to examine the break and make the needed repairs it was necessary to build a huge cofferdam across the entrance channel and pump out the water. The magnitude of the task may be judged from the fact that the channel is 156 feet wide and the depth of the water is 34 feet, measured from mean high water mark. This gives a total hydrostatic pressure of 2,885 tons, which had to be withstood by the cofferdam. The construction of the dam is clearly shown in the accompanying photographs, and in the sectional diagram, for which we are indebted to Naval Constructor Bowles, of the Brooklyn navy yard. The dam consists of a central wall of clay puddle contained within three lines of sheet piling, backed up by two embankments of gravelly clay, the toe of the inner embankment being held by a fourth wall of sheet piling as shown. By reference to the large engraving, Fig. 4, it will be seen that the cofferdam is curved, presenting a convex face toward the river, or, to speak more strictly, it is built with five plane faces, those on the river side corresponding to the chords of a circle of 125 feet radius. This is done to secure an arch effect and cause the pressure of the water to be transferred to the walls of the channel, the latter acting as abutments. The lateral pressure thus set up is supposed to compress the lines of sheet piling and assist in keeping the joints watertight. Owing to the yielding nature of the sides of the channel, however, and the difficulty of driving the piles at the angles with a snug fit, it is a question whether a straight dam would not have been preferable. It would certainly have been cheaper, for it often took as long to fit and drive the angle piles as to drive the whole of one bent between them.

Soon after the commencement of operations, Naval Constructor Bowles was placed in absolute charge of the work, with instructions to push through the repairs with all possible speed. Contracts were at once let for the 600,000 feet of timber required; a temporary electric light plant was installed, and six pile drivers were put to work. Sticks of the size and quality required for the piling are not kept in stock, and when the contracts were let the 600,000 B. M. was yet standing in the Georgia pine forests. This had to be cut, dressed, hauled to a Southern port, and brought up to New York. Delays due to the non-delivery of the timber were frequent, and it was only by unflagging attention that the work has been brought to the present stage.



2.—BOTTOM OF DOCK ENTRANCE BETWEEN COFFERDAM AND CAISSON, SHOWING LOCATION OF LEAK.

The first operation was to drive eight lines of 14 by 14-inch guide piles, in pairs. Then the guide wales (horizontal lines of timbers to keep the sheet piles in line) were bolted in place. As three of these lines on each set were under water, they had to be adjusted by divers. This was slow and laborious work. Where the guide piles were out of line, blocking had to be inserted or notches cut in the guide wales and the piles drawn up to the wales by U-shaped yokes and bolted.

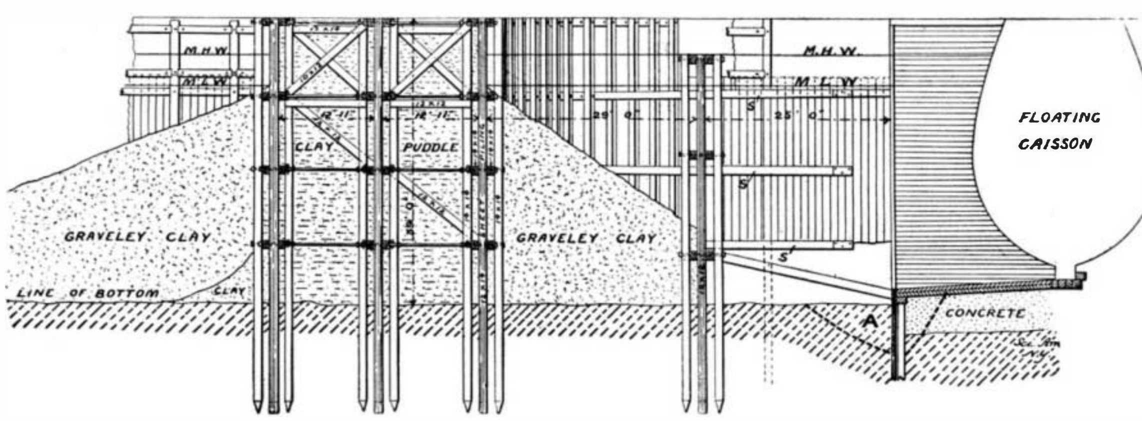
The sheet piling is 12 by 14 inches and tongued and grooved. It is driven 16 feet into the mud, and in the four walls there are 1,100 separate sticks 56 feet in length. The sheet piling was carried well into the banks of the channel, the concrete coping of the dock being blasted out for this purpose. The three walls of piling were then braced by a system of 1½-inch tie bolts and 12 by 12-inch braces, the latter being notched onto the guide wales and well spiked both to the wales and the guide piles. The structure was also braced at each end against the sides of the dock with heavy sticks of timber, S, S (Fig. 3), and ⅞-inch iron chains were carried back from the top of the cofferdam to the mooring-posts on the dock, and drawn taut by means of turnbuckles.

The cheapest bid that could be obtained for supplying the material for filling the cofferdam was $1.75 per cubic yard, and 80 cents per yard was asked for digging up the clayey soil in the neighborhood of the dock. Finally a lump contract at 40 cents per yard was closed for supplying the 18,000 yards required by using the mud excavated for the adjoining Wallabout dock extension. This was brought round in scows and unloaded by dredges at the dam. This mud has answered admirably for the purpose and proved quite impervious to water. The saving in this direction has fairly well offset the costly delays due to the failure of contractors to supply the timber.

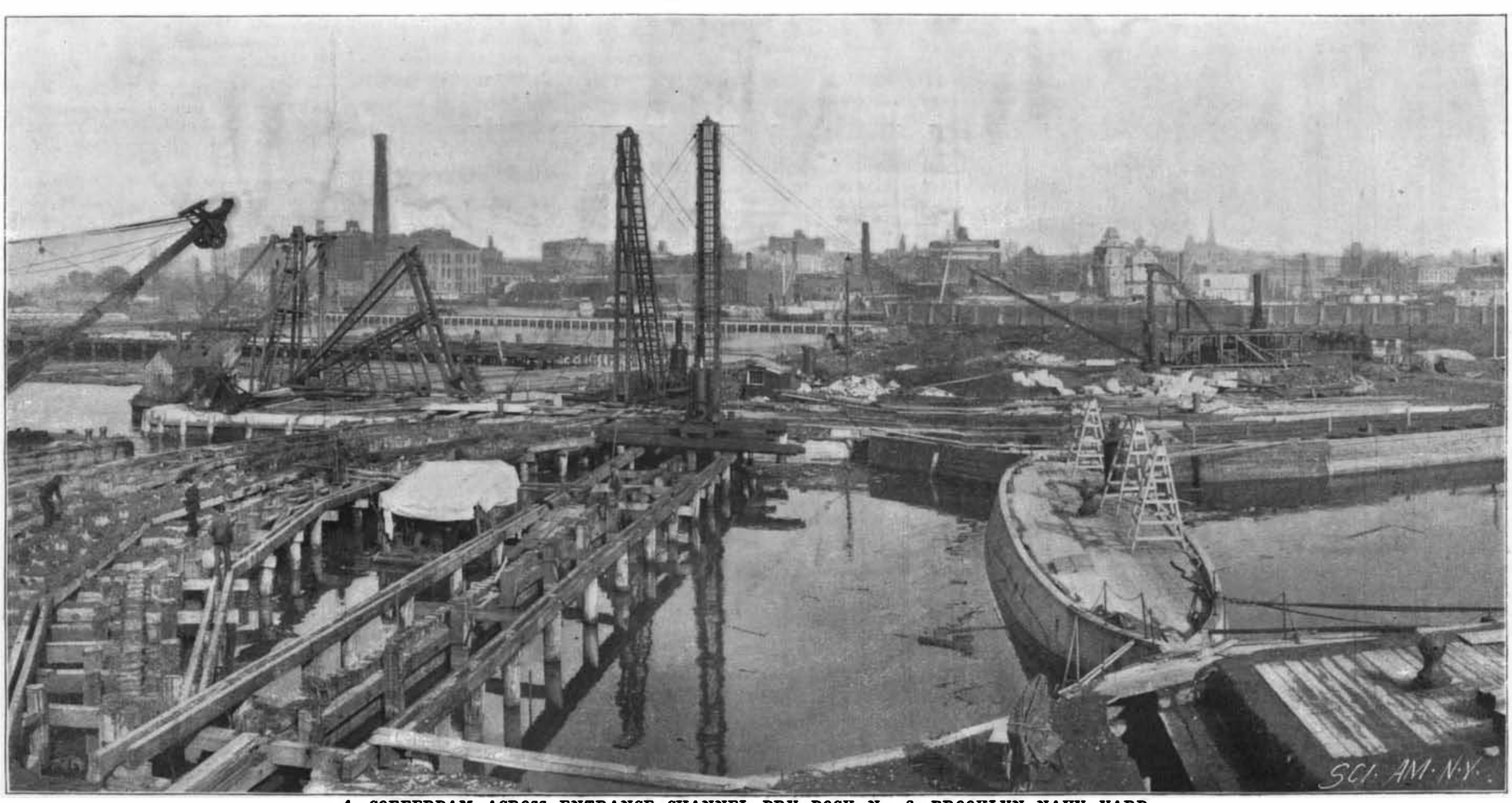
The dock was emptied by the regular dock pumps, and, as the water fell, the cofferdam proved to be a remarkably tight job, practically no watercoming through. Our illustrations, Figs. 1 and 2, show the pumped out space between the dam and the caisson gate. The gate is resting on the inner sill, and the line of the outer sill can be traced by the drop in the level of the mud. About twenty feet beyond this is the edge of the apron, where the sheet piling was torn up by the dredge, as already explained. The water is seen standing in the holes which have been washed out around the vicinity of the leak. A day or two after our photographs were taken, the lowering of the water showed that the whole line of piling had been more or less battered up and torn away by the dredge bucket. It is little to be wondered at that the dock was leaking.

To make the dock thoroughly secure against further trouble, two lines of sheet piling will be driven, one in front of the damaged piling and another at the outer sill, on which the caisson gate is shown in the accompanying diagram. The new piles will be heavier—12 by 12 inch, in place of 8 by 12—and they will be 35 feet in length and driven as deep as they will go in the mud. The new piling will be driven up the slopes at the sides of the entrance, and carried out to a junction with the outside wall of piling which surrounds the entire dock. The present floor of the apron will be ripped up, the three or four feet of concrete which underlies it taken out and fresh concrete filled in to as great a depth as can be conveniently excavated. The flooring will then be relaid in two courses with broken joints, with its outer edge finished off in snug contact with the new line of piling.

The fact that no water is now entering the dock proves that the leak must all have taken place at the damaged apron; and it is safe to say that when the present repairs are completed, Naval Constructor Bowles will place a perfectly sound dock at the service of the navy yard.



3.—CROSS SECTION THROUGH COFFERDAM.



4.—COFFERDAM ACROSS ENTRANCE CHANNEL—DRY DOCK No. 3, BROOKLYN NAVY YARD.