anchor. Through this was run a ⅝-inch steel cable and both ends brought ashore.

The outlet end of this line was made up with a 45° L, looking upward, and a nipple leading into another 45° L reversed, allowing the open end when completed to be six feet from the bottom, thus being out of danger from filling with sand or becoming otherwise clogged.

A sea-anchor of the contractors' own design, and consisting of two castings and two clamps was fastened to the riser just described. One clamp was bolted over the nipple leading from the lower 45° L, and the other over the main pipe just in back of the same L, both clamps fitting close to the pipe. These were held by eight one-inch bolts. The sea-anchor weighed 2,200 lbs. in all, and was assembled on the beach just above high-water mark.

Starting at the lower L the pipes were joined together with the recessed couplings, the threads being painted with white lead to insure watertightness. Platforms were built at intervals of about 30 ft. from this

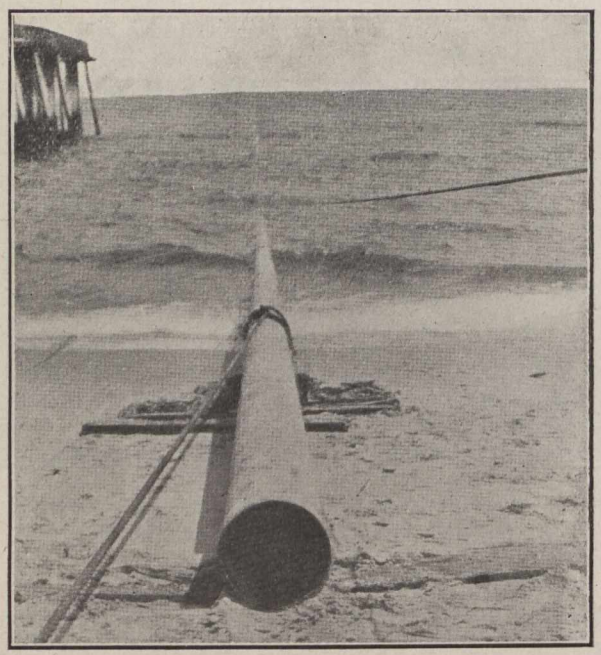

Fig. 2.—View of Pipe After Being Hauled Overboard.

point into the street. Rollers were set on these platforms at such elevations as would give an even fall from the street level and the pipe line was built up on these rollers.

A street leading from the ocean at this point formed a very convenient means to continue the work on the pipe line. The pipes were assembled on this street and raised on small wooden trucks, the latter being fastened at intervals equivalent to a length and a half of pipe, until the entire length from the river was sufficient to place it 1,200 ft. from the inlet point and have the last pipe above high-water mark on the beach. This much completed, there was 1,000 ft. of pipe intact, starting at high-water mark and extending in shore, all resting on either trucks or rollers.

The sea-anchor was carried on a big truck with two wheels six feet in diameter, made of two thicknesses of 2-in. plank and each having a rim of 2-in. by 8-in. plank to afford surface bearing.

A hook on the rear of the axle fitted into an eye on the rear of the coupling, thus supporting the sea-anchor and riser, and holding the same free from the ground. Extending out from the axle was a long tongue, at the end of which was a clevice. One end of the steel cable already running through the 18-in. sheave off shore was passed through this clevice and fastened firmly to the sea-anchor, with the other end on a drum of the hoisting engine.

The open end of the riser was next stopped up by means of a wooden plug inserted with white lead. So, with the outer end watertight and raised on a truck the entire line is ready and in a movable position.

The hoisting engine was then used to haul the entire length to sea (Fig. 1), the weight of the sea-anchor keeping the truck and outer end of the bottom, and the air in the pipe causing the balance of line to be bouyed up. A 3-in. pipe line extending through the entire length of large pipe acted as ballast and held the line partly submerged. This condition removed all of the unnecessary friction, and left only the resistance of the large truck holding the sea-anchor and the small trucks and rollers supporting the pipe. This diminished as the pipe went farther to sea. The small trucks were removed as they came up to the platform supporting the rollers.

The object of the sea-anchor being suspended by this hook and eye method, it will be noted, is to form a convenient means of depositing the pipe in its place when so desired. When the cable line is slackened the weight of the sea-anchor pulls the rear of the axle down, and the tongue up, and at the same time the hook releases the eye, and the sea-anchor is dropped in its permanent place.

The hauling finished, the five anchors off shore were raised singly, starting with the most distant anchor and coming in. This slackened the cable and dropped the sea-anchor. The cable was then cut as close as possible to the arm-anchor, releasing the truck, and with this the off-shore work was completed. Fig. 2 shows the pipe after being hauled overboard.

The open end in shore, at a point just above high-water mark was reduced to a 2-in. bushing, and water was pumped through this into the large pipe until a pressure of about 40 pounds was reached, thereby blowing the wooden plug out of the riser and sinking the remainder of the pipe in its place.

A block and fall was used in shore to relieve the strain on the five off-shore anchors, one end fastened to the 12-in. pipe and the other to a second drum on the hoisting engine. It was estimated that a force of about ten tons was required to haul the pipe overboard, this diminishing as the work progressed.

Next the in-shore end was lowered to its proper depth and the line continued to the manhole.

One of the largest factors to be contended with is the shore current, tending to bend the pipe out of line before it is lowered to the bottom. This makes it imperative that the temporary anchors and the engine base be absolutely secure before the hauling is underway. Another difficulty is the necessity of awaiting the proper weather conditions. While it took but 2½ weeks to put everything in readiness it was a considerably longer time before a combined light westerly wind and low tide made possible its completion.

The total, actual pulling time required was 39½ minutes in the intervals of about 5 minutes each, with lapses between to make sure every part was in proper working order. The total time from start of haul to finish was 2 hours and 15 minutes. At the start of the haul the pipe moved at a rate of 20 ft. in one minute while approaching the end it had increased to 20 ft. in 13 seconds. The average working force was six men, with about six added on the day of the haul overboard.