

# The Canadian Engineer

*A weekly paper for Canadian civil engineers and contractors*

## Troubles in Constructing a 48-inch Submerged Main

Cost Details of Shafts and Tunnels—Steel Riveted Pipe Sections each 30 feet long—Description of Plant Used for Pulling Sections Into Place—Paper Read Before American Waterworks Convention Last Month at Richmond, Va.

By F. W. CAPPELIN,  
City Engineer, Minneapolis, Minn.

THE distribution system required the crossing of the Mississippi River, just below the Falls of St. Anthony, with a 48-inch riveted steel pipe,  $\frac{1}{2}$ -inch thick. The river at this point passes through a gorge some 900 feet between bluffs, which on the east side of the river reaches a height of about 100 feet above low water, and on the west side, 72 feet. On the east side there is 39 feet of sand and gravel to the Trenton lime rock; on the west side, about 11 feet from top of ground to lime rock, which is of same elevation on both sides of the river. This rock is 25 feet thick; separated from the underlying St. Peter sandstone by 3 feet of shale. The St. Peter sand rock is some 800 feet thick. The river has cut through the rock, and the river bottom is filled with broken debris of lime rock and boulders at the deepest point (about 40 feet), then the sand rock.

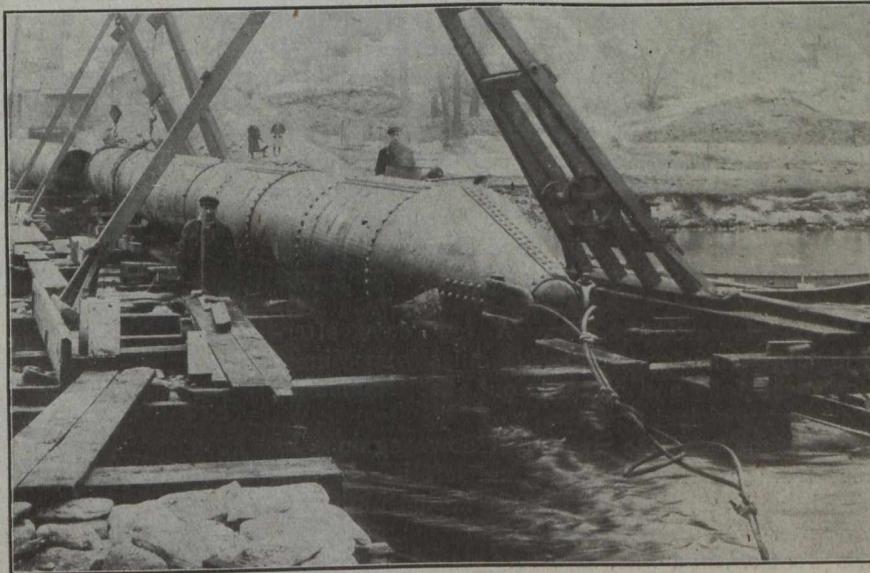
Eight-foot shafts were sunk on both sides of the river, and 8-foot by 7-foot tunnels extended from the shaft to the edges of the bluffs—340 feet long on the east side and 60 feet long on the west side—and trenches dug on shores as far as possible. This work was started January 3rd, 1916, and completed May 27th, 1916. As the current is very swift at all stages of water, it would be necessary to do the river work proper in extreme low water, which occurs from the end of December to the middle of March; mostly in below-zero weather. The problem was, how to excavate the trench in the material mentioned. Pile driving was impossible; water being too swift and shallow for a dredge (and no dredge to be had on the river here). It was then decided to build cribs 4 feet wide and 8 feet long, made of 10-inch by 12-inch timbers, with partly planked bottoms; each to be loaded with about two tons of rock. These cribs to be placed about 14 feet centres across the river, and 16 feet on centres up and down the stream. On these cribs across the river, 24-inch I-beams

28 feet long would be placed flatwise to form a running track for the excavator which consisted of an American stiff-leg derrick, with which we expected to handle one-half yard Howard orange peel. Before building the cribs we did some excavating with this rig on the low shore in land on the west side, and it looked as if we could handle the material that way all right, so we started the placing of the cribs with the derrick and run across the

river in a short time, completing the run-way from shore to shore.

The underframe of the derrick was fitted with grooved wheels which travelled on 40-lb. rails laid loose on the I-beams. The derrick was then sent back to the west end, and excavating operations continued with the orange peel, but as soon as we got into the river we found that the orange peel would not work satisfactorily at all and we changed the rig for excavating

by attaching to the boom of the derrick a dipper stick placed about 20 feet from the end of the boom with a  $\frac{3}{4}$ -yard steam shovel dipper; the whole apparatus working in a crawfish fashion. The excavation with this machine commenced February 18th, 1916, and the ditch was finished March 17th, 1916. It was a very hard job. The material was exceedingly bad to handle; big pieces of ledge from earlier erosions were often encountered, and they had to be simply dragged out. Some 2,500 yards of this material was excavated and dumped on the down-stream side. All small material was immediately washed away by the current, leaving the heavier stuff in place. As we excavated towards the east side the cribs were removed. As we went along, I-beams were placed on the spoil bank, which were used as a track to carry the cribs, timbers and I-beams back to the west shore. These beams also formed the pathway between the excavator and the west side.



Showing Torpedo Head Just About to be Launched.