As stated before, these were in commission from the main pumping station, three rising mains 30-in., 20-in. and 18-in. respectively being connected to the pumps in the usual haphazard way prevalent throughout many plants in this country. It was decided to build a fourth main 36 inches in diameter and about equal to the other three mains in discharging capacity. Although nearly two miles of this main had to be built to bring to the outskirts of the city along a pipe line already used by the other three mains, it was decided to take a slightly longer route away from this pipe line to avoid the danger of a bad blow-out, putting all the mains out of commission.

The connections from the pumps were carried to a header pipe 4 feet in diameter running at right angles and at a lower elevation than these connecting pipes.

Between each of the old pipes and the header a gate valve was placed and as the new 36-inch main went off from the end of the header the whole arrangement proved very flexible in operation. On each of the mains was the usual check and gate valve besides the Venturi tube for measuring the discharge. Before laying the large main to the city and other mains throughout the city, tests were made to ascertain the relative efficiency and speed in

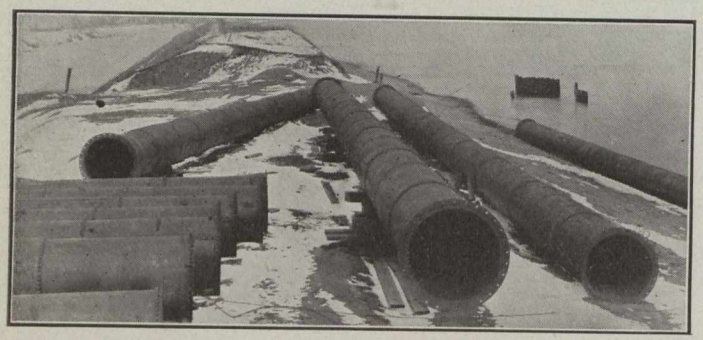

Fig. 6.—Sections of Beach Intake Pipe Before Placing.

making poured lead wool joints, also the relative efficiency of joints caulked by pneumatic hammers or by the usual hand method.

It was found that with the pneumatic hammers between four and five joints could be caulked with a poured lead joint to one by using lead wool. This was due generally to the hammers becoming wedged in driving. It was also found that the compression in the caulking went deeper in the poured than in the wool joint with the consequent greater density.

Several alternate joints were caulked by the pneumatic hammers and by hand, and this section gradually put under pressure. It was found that every joint caulked by hand commenced to leak slightly at 110 pounds pressure but that the pneumatic caulked joints remained tight.

To carry the construction of these mains through quickly and efficiently by the city forces an air compressor with pneumatic caulking tools was purchased.

The city had a small steam shovel with a ½-yard dipper which did the excavating and also the lifting of the pipe into the trench. A 12-ton dinky engine with cars and track was also purchased and with this equipment (which also did the back-filling) as high as fifteen 36-inch pipe were laid in a day in a trench which had a variable depth but always sufficient to give a top covering over the pipe of 5½ feet. This large main was laid to grade with blow-offs every ½ mile to the city and having the usual gate and relief valves.

To compare the relative speed of hand and pneumatic caulking tests were made with the results shown in the following table:—

Size	Class	Depth of lead joint	Weight of lead used	Depth of yarn	No. of hand caulkers	No. of joints per day	No. of machine caulkers	No. of joints per day
36″	C.	3½″	121 lb.	1″	2	4	2	12
30″	C.	3″	90 lb.	1″	2	6	2	15

From this it will be seen that in the 36-inch pipe the machine men caulked three times as many joints as the hand men and 2½ times as many in the 30-inch pipe. Through many attending local conditions, as, for instance, the filling-in of old wooden bridges and building of concrete culverts which were charged to the cost of the mains to the city, no cost data is given, but a length of 2,157 feet of 24-inch mains in the city under normal conditions is given for depth from 7 to 9 feet with conditions causing the variation in cost of laying indicated. The average cost per foot was $1.86 for this size of pipe.

The length in feet of new mains in this reconstruction comprised: 36-inch, 12,900 ft.; 30-inch, 13,800 ft.; 24-inch, 6,000 ft.; 20-inch, 4,600 ft.; 18-inch, 2,500 ft.; and the total cost of this work, including intake, conduit, pumping stations and mains, was $750,000.

MUNICIPAL STREET RAILWAYS IN SASKATCHEWAN.

The cities of Regina, Saskatoon and Moose Jaw are all served by systems of municipal railways. In Regina there are 30.53 miles in operation, the system having commenced service in July, 1911. The system comprises 34 passenger cars, 30 freight cars, 2 sweepers and 1 motor haulage car. The cost of construction per mile has been substantially as follows: Single track, 60-lb., gravel, $17,950; single track, 80-lb., gravel, $38,000; double track, 80-lb., concreted and paved, $83,000. The cost of the railway has been $1,375,251, of which amount roadbed and tracks have cost $1,216,000 and electric line construction, including poles and wiring, the balance. Cars and other rolling stock are valued at $184,940.

The Saskatoon system commenced operation on January 1st, 1913. It comprises 16.28 miles of track, the cost of construction per mile having been $49,509. It has 18 passenger cars, 4 freight cars, 1 snow sweeper and 1 tower wagon. The roadbed and tracks have cost $365,255, the electric line construction $62,314, and the rolling stock $78,245.

The Moose Jaw Electric Railway Company, started in September, 1911, has approximately 11½ miles in operation, the average cost of construction having been $22,000 per mile. It has 19 passenger cars, 1 work car and one snow plough. Its power equipment includes one 1,500-h.p. and one 2,250-h.p. Diesel oil engine with direct connected generators.

The cost of railway is stated to be $218,351 for roadbed and tracks, and $35,848 for electric line construction, including poles and wiring.

These data are from the recently issued report of the Government Department of Railways of the Province of Saskatchewan.

When grouting the joints of sewer pipe the grout should be poured from one side until it flows around and begins to fill the opposite side, when the pouring should be finished from that side. This causes a wave action that insures close filling at the bottom of the joint.