

Open Cut Section.—Work was started on the open cut section by sinking a shaft at Sta. 16+35, which was at the end of the open cut and the commencing point of tunnel work. Contrary to expectations, the ground turned out to be a very hard clay in this portion of open cut, right down to sub-grade. This shaft was used afterwards for a working head in tunnel work. The excavation in the open cut proceeded from this point to Sta. 0+00, a stop being made for two months at Sta. 12+35 when the cold weather set in. The excavation was done by an Ohn bucket on a travelling derrick, which proved to be much more economical than hand work, the excavation being removed for 62 cents a cu. yd. throughout the open cut.

Before closing down for cold weather 400 ft. of sewer was constructed, wooden forms being used for the concrete work. The concrete in the invert and arch was first run, after which the brick invert was laid.

When the worst of the cold weather was over, operations were resumed on this portion of the work (the tunnel work having gone on without interruption).

work to be placed in the invert. After the invert forms were set the concrete was placed and after this had set sufficiently the turnbuckles were released and the 60 ft. of forms were drawn ahead by the engine of the excavating machine. The brick invert was next laid. Then, 6-in. x 6-in. timbers were placed on the brickwork just high enough to allow a 2-in. plank to be placed, to run the arch forms on when released, the arch forms being blocked to proper elevation off the 6-in. x 6-in. timbers. When the concrete had been poured and had set 48 hours the forms were released and drawn ahead as in the invert. These steel forms were certainly a big improvement on wooden forms as they could be set up in much less time and gave a much more superior finish, requiring very little, if any, pointing up.

The concrete in the first section of sewer completed was all mixed at Sta. 16+35, where a steam plant was installed to heat the material and run the mixer. The aggregate was placed on a knoll just above the mixer and the concrete dumped into cars below, which conveyed it

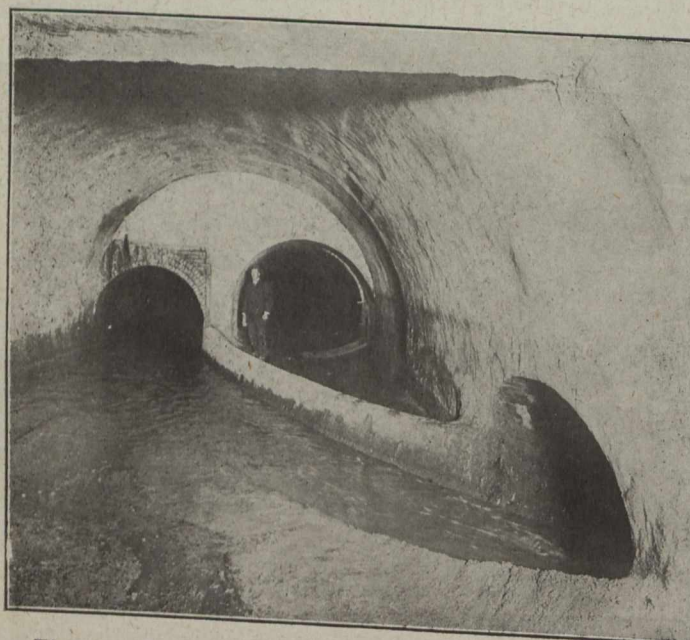


Fig. 6.—Junction Chamber, Viewed from Bellmouth of Section 4, Showing Section 3, Old 6 ft. 6 in. and Old 4 ft. 6 in. Garrison Creek Sewers on the Left and Right Respectively.



Fig. 7.—Outlet of Main Garrison Creek Storm Overflow Sewer at the Foot of Strachan Avenue.

In the balance of the open cut, 700 lin. ft. of it was in the ravine where the excavation was very shallow and the work went on very rapidly. Steel forms were used in place of the wooden ones and by so doing 240 ft. of invert and 180 ft. of arch could be finished in six days. These steel forms were manufactured by the Blaw Steel Form Co. They were made in 5-ft. sections and 12 complete sections (60 lin. ft.) were used. Each section was made in four pieces, two for arch and two for invert, the arch pieces being bolted together at the centre and separated by tie rods, which were operated with a turnbuckle, at spring line and half-way between spring line and centre of arch. The different sections were held together by U-s in one section passing through holes of the next and held flush with small oak wedges. Each section had four castors riveted to the angle plates at the spring line, to be used in pulling the forms ahead without being taken apart. The invert forms are practically the same, only they did not have the castors, and were 9 in. wider in diameter to allow for the one ring of brick-

along the line of work on tracks situated at the side of the trench. In the last section, two similar points were picked out for the mixer, but electricity was used for the motive power, proving much cheaper than either gasoline or coal.

The surplus excavation in the section from Sta. 16+35 to 12+35 was hauled to a nearby dump so the backfilling material for this section was obtained from the tunnel. This was brought to the surface on the elevator at the shaft, dumped into the concrete cars, and carried along to where it was needed. In the section between Sta. 12+35 and Sta. 5+00 there was no backfilling done as the arch of the sewer was above the ground elevation (Fig. 1) and as the city is filling in this ravine with ashes. But between Sta. 5+00 and 0+00 the excavation was piled up alongside the trench and after the sewer was completed it was replaced in the trench by the excavating machine.

Tunnel Section.—This is the portion of the contract where the contractors anticipated trouble owing to the