

inside ring of bricks on the invert of the sewer and where the sewers are in rock excavation, the outside ring of bricks is omitted on the lower half of the sewer and concrete is substituted, being packed solid between the bottom of the trench and the sewer. In places on steep slopes the large sewers are built in steps to avoid excessive slopes. These steps are spaced 20 feet apart and are made by means of reversed vertical curves dropping two feet vertical in a horizontal length of 6 feet. The private drain connections are made with tile pipe and enter the sewers at the springing line. In deep trenches in rock cut these branches are carried up vertically several feet to the trench, quarter heads being used at both ends of the vertical portion, the lower one resting on concrete.

All of the work is now under contract. The third section includes a crossing under the Rideau canal, and because of the advisability of making this crossing in winter, when the water was out of the canal, this section was let first. It was let last February to Joseph Bourque, of Hull, for a lump sum tender of \$127,225, and at the present time is under construction. The first and second sections were let last April to O'Leary & Robillard of Ottawa, for a lump sum tender of \$226,119, and the work is progressing favorably. The fourth section was let last July to Stuart & O'Leary of Ottawa, for \$88,653, and a length of about 1,000 feet has been completed at the present time. The total length of the system is about 6½ miles, and has been let as above, for \$441,997. The great cost is on account of heavy rock cutting, which extends over nearly the entire system. On the first section a 34-foot cut is entirely through a refractory limestone rock, and in other places slate-shale is found. The estimated quantity of rock for the entire system is 81,200 cubic yards. The sewers are built in a most substantial manner of the best material, and under rigid inspection. Hard burned bricks are used and are laid in Portland cement mortar made of one part cement and three parts sand.

On sections one, two and three, travelling derricks with steam hoists are used, and on section four, two Moore hoists are in use. Six inch centrifugal pumps, operated by electricity, are used on all of the sections to remove water, and are giving good satisfaction. Pulsometers are in use ahead of the brickwork in rock formation, as they are easily taken out and replaced while blasting. The tributary systems are now being mapped out; the principal one is for a section called "The Glebe," located in the south-western part of the city. Construction work is to begin here next spring, and the estimated cost is about \$100,000.

IMPROVEMENTS AT VICTORIA, B.C.

Under the auspices of Mayor Redfern, who has guided the destinies of the city of Victoria for three years, there has been completed a permanent roadway pavement on Fort street in wooden blocks (fir and coal tar), from Government street to Douglas street, on the local improvement plan, the city and the proprietors on each side of the street paying equal portions,

that is, one third each. To do this the roadway was disturbed to a depth of 18 inches—the material removed making a good facing for a new street then forming. A solid concrete foundation of 8 inches was carefully laid down, rammed and graded; 6 in. fir blocks on edge were laid on this after being thoroughly dipped in boiling tar, cement and sand finish, extra care being taken with the rails and sleepers, as this thoroughfare is provided with tram car accommodation. At the conjunction with Government street and for many yards beyond, the car rails were very heavy, 6 in. deep, probably 75 lb. to the yard, laid on sleepers, in such form that an independent support of cement and gravel was provided and worked in under the rails, so that on the decay of the timber sleepers, the rails would still carry, bridge-like.

The permanent sidewalks for the same extent of street are composed of gravel, concrete or rammed earth or broken stone, and finishing with sand and inch cement, to a wood curb. Government street has also been provided with permanent sidewalks to the extent of nearly half its length and a portion with cement gutters. Part of the cost is met by the electric railway company.

To render the improvement more valuable, preparation had been made by

changing and improving water pipes, etc., and numerous brick wells provided to reach the stop cocks to mains. Everyone admires the neatness of appearance of the roadway, the discarding of crossings, the absence of gutters, and the facilities it offers for cleaning.

The street pavement cost in the neighborhood of \$2.75 per square yard, and the foot sidewalk about \$1.75 per foot run. The whole width of sidewalks is from 10 to 12 feet wide.

Victoria, B.C., a city of 25,000 inhabitants, expended \$40,000 on the fire department during the first nine months of this year. Headquarters fire hall contains six pieces of fire apparatus, valued at \$30,000, and eleven horses. It is the largest and best equipped fire hall on the Pacific coast.

Mr. Hugh Sparks, of Hintonburg, Ont., has invented a machine for distributing sand on sidewalks. It has been tested by the city engineer of Ottawa, who believes that it will result in a saving to the city. The machine consists of a hopper mounted on two wheels and drawn by a horse. The hopper is filled with running sand, which, by means of vibrating power, drops through a horizontal disc, which moves as the hopper is drawn along. The sand is sprinkled evenly or varied to suit the circumstances.



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