

room, boiler-room and coal shed. The smoke stack is of brick, 73 feet high, 8 feet square at the base, with a flue 30 inches square. Near the pump-house a two story brick house for the engineer was built.

From the pump-house to the town limits of Petrolea, the conduit line is of cast iron pipes 12 inches in diameter. The length of the line is 57,943 feet, but the 12-inch main continues 3,705 feet to the water tower, and 4,502 feet to Petrolea street, the whole distance being nearly 12 miles. All the pipes are laid to grade, most of the line having an inclination of one in 1,000 only. On the line are seven gate valves, four automatic air valves, and four blow-off valves.

The pipe was supplied by the Gartshore-Thompson Pipe Foundry Co., Hamilton, except about 15,300 feet, which was supplied by the St. Lawrence Foundry Co., of Toronto. Several weights of pipes were used, the heaviest being at the north end. The conduit line was tested by maintaining the pressure of 200 lbs. to the square inch at the pump-house, for six consecutive hours. Very few leaks were discovered, and only three pipes failed in the preliminary tests made by the contractor. This pressure of 200 lbs. at the pumping station gives 147 lbs. at the height of land, and from 160 to 180 lbs. in the town. This is the longest waterworks conduit in Ontario, working under pressure.

The distribution pipes were laid with four feet six inches of covering, and generally in stiff, blue clay. The valves were manufactured by the Doherty Manufacturing Co., of Sarnia, and the hydrants by the Kerr Engine Co., of Walkerville. The hydrants have five-inch barrels, and are provided with a four-inch steamer nozzle, in addition to the two ordinary hose nozzles. The valve chambers are of hard brick laid in cement with heavy cast-iron manhole covers.

All valves are provided with extension spindles. Gate valves with valve boxes were placed on all the hydrant branches on the 12-inch mains, in order to permit the repairing of these hydrants without closing the valves on the 12-inch main. Two three-inch relief valves were placed on the system at a very low point where the pressure is greatest, also two of the same size under the water tower. These valves are set to relieve the mains when the pressure exceeds 120 lbs. The total length of pipe in conduit and distribution system is nearly 22 miles.

The water tower is of steel, 25 feet in diameter and 85 feet high. It rests upon a foundation of very heavy stone masonry laid in Portland cement mortar. The cylinder is well anchored to the masonry and has an ornamental balcony at the top, reached by a ladder. The tower contains about 257,700 Imperial gallons, or approximately 3,000 gallons per foot in height of the tower; when full it will give a pressure at the fire hydrants varying from 25 lbs. to 50 lbs., the average being about 30 lbs. To give domestic pressure in town, it will be necessary to keep the tower half filled at all times. The water in the lower half will be available for fire supply, but not for domestic purposes. By cutting off the tower, a good fire pressure can be given direct by pumping from the lake.

There are two pumping engines, one a compound "Duplex," and the other a compound "High Duty Fly Wheel." The first was manufactured by the Hughes Steam Pump Co., the second by the London Machine Tool Co., of London, Ontario. The duplex has steam cylinders, 14 inches and 26 inches in diameter, plungers 10 inches diameter, all with 18-inch stroke. The high duty engine has steam cylinders 13 inches and 26 inches diameter, water plungers 6½ inches diameter, with 32-inch stroke.

It is speeded to make about 50 revolutions per minute. This engine is a very compact machine, the fly-wheel revolving on a shaft placed near the steam end. Each of these pumps has an easy capacity of 700 Imperial gallons per minute, or one million gallons per twenty-four hours, against a head of 200 lbs. to the square inch. One independent fly-wheel air pump, with feed pump attached, is operated in conjunction with a surface condenser, placed on the discharge main. A duplex feed pump supplies the water to the boilers. This pump can be used to empty the well, to pump into the conduit, or for hose service at the pumping station. Three 3-inch relief valves are placed in the engine room, with ample discharge pipes. Steam is supplied by two return tubular boilers 16 feet long, 62 inches in diameter each, with 68 tubes 3½ inches in diameter. These boilers were made and set by the Stevenson Boiler Works of Petrolea. Although both engines were in running order on January 1st, 1897, the contractors for machinery were not ready to test the pumping engines until February. The first test was made on February 4th and 5th, J. H. Killey, Esq., of Hamilton, representing the pump manufacturers. The fly-wheel pump was run ten consecutive hours under 200 lbs. water pressure, at the rate of 1,000,000 gallons per 24 hours, the coal consumption being 2,300 lbs. The duplex, in 10 hours, under the same pressure, and pumping at the same rate, consumed 4,400 lbs. This test gave a duty considerably below that guaranteed for the fly-wheel pump, but the duplex exceeded the guaranteed duty. On March 18th and 19th a second duty test was made of the fly-wheel engine in the presence of the manufacturers. During ten hours the coal consumed was 2,430 lbs.; ashes removed, 121 lbs.; water pumped, 462,338 imperial gallons; water pressure, 200 lbs.; suction lift, 14 feet; temperature of feed water, 109 F. The duty determined from the above is 98,570,000 foot lbs. per 100 lbs. of coal. The duty of the duplex engine was found to be 55,000,000 foot lbs.

The only defect in the Petrolea water supply system is that the pressure is not sufficient for fire protection. The town has, however, two fire engines, and all hydrants are provided with steamer nozzles. The engineer recommends that when the amount to be pumped daily increases to over 500,000 gallons, a pumping station should be erected near the water-tower, to be provided with two underwriter fire pumps of the same capacity as those at the lake pumping station. In this way water could be pumped out of the tower or the conduit line, and forced into the system under any pressure desired.

The quantity of water available is about 1,000,000 gallons per twenty-four hours. This quantity of water would supply a population of 10,000 people, allowing 100 gallons per day for each person. This is the quantity pumped in London, Brockville and Toronto, but less than that pumped in Sarnia, Port Huron, Windsor, Detroit, Cleveland, Buffalo and other lake cities and towns.

In spite of the recommendations of the engineer, that meters should be placed on all the services, they were only placed upon the services of the large consumers. As the original plans of the system were prepared with the idea of using meters all round, it will probably not be found adequate if the small consumers are allowed to waste the water. This matter, however, can probably be adjusted when the difficulty arises.

THE Farmers' Hedge and Wire Fence Company of Ottawa, Limited, has received an Ontario charter. Capital, \$25,000. The incorporators are: J. Bright, Myrtle, Ont.; J. Vipond, Brooklin, Ont.; R. R. Mowbray, Kinsale, Ont.; E. E. Cooper, East Whitby, Ont.; J. D. Howden, Whitby, Ont.