

suction pipe from the fore-bay to the pipe vault under machinery floor is 20 inches in diameter. A 16-inch branch is led up from suction pipe to each pump cylinder, and provided with a gate valve 16 inches diameter to each branch, to permit of pumps being entirely shut off from suction.

The suction pipe is laid out to the intake house, situated 200 feet above the pumping station in the river, and ends in a well in the river crib; where suction pipe enters vault a 20-inch gate valve is placed so that suction may entirely be shut off from river crib if so desired. The end of suction pipe in pipe vault is turned down at right angles into the tail-race provided for the wheels, as the illustrations clearly show, and can be utilized to supply the pumps in the event of a heavy demand for fire or other purposes, or in the event of accident to the crib from ice or other cause; a 20-inch gate valve is also placed in pipe vault to close off this end of suction when not in use. The pumps have a lift of four feet, and from indicator cards already taken of them by the writer, the action of the suction is all that could be desired. The delivery main in vault is 16 inches in diameter, provided with a 16-inch check valve and bye-pass just inside the pipe vault. From the delivery pipe of each set of pumps are two 6 inch branches, just below machinery floor line, on which are placed six inch relief valves discharging into an 8-inch pipe leading through floor of vault into tail race.

The pipe vault is worthy of comment; there is over 9 feet of head room, and ample room around the pipes and valves, and is well lighted and easy access to the roadway. The pipes are laid close to the floor upon cast iron crutches laid upon hardwood blocks, and all pipes were tested by hydrostatic pressure before being put into place.

The machinery floor supporting frame and lying shafts is formed of rubble masonry, resting upon the rock which formed the bed of the river. The holding-down bolts of the frame of pumps are encased in pipe or tubing, which was built into the foundations when they were building; the bolts can be taken out at any time, they not being run up with cement.

The penstock for the wheels is practically an extension of the fore-bay through the dam and wall of pump house; the openings to penstock are 9 feet square in the clear; the admission of water to the penstock is regulated by means of stop logs placed in front of opening in building and also in front of dam. The penstock is decked over with steel plating having cast iron girders 10 inches deep of I section, the ends of which are built into the walls; provision is made so that they can be removed at any time, if desired, without damaging the walls in any way, and permit the removal of the entire deck. The deck plating around walls is securely held to L pieces of cast iron checked into walls, and held in place by bolts let into the masonry and run up in lead. The L pieces on wall are run up with lead between casting and wall, and when cold were carefully caulked, thus ensuring a tight joint between wall and casting.

A stuffing box for water wheel shaft is formed in two halves around the water wheel shaft, and made very strong to successfully resist the greatest pressure due head. Water tight joints between plates and castings are formed by means of rubber, the plates being securely bolted to girders, stuffing box and L pieces, thus making a thoroughly water tight deck. A man-hole is provided upon the deck to give access to the penstock and wheel when water is drawn off.

A 4-inch drain pipe from the deck, extending down through penstock floor, is also provided to drain off any leakage and sweating that may take place. A 2-inch pipe is tapped into the deck plating, and is formed goose-neck, led into drain pipe, and by means of globe valve on this pipe the air in penstock can be drawn off.

The water wheels are of the well-known make of the Wm. Hamilton Co., "Boss" turbines of 68 inches in diameter, having a vent of 1,300 square inches, and discharging, under a calculated head of 12 feet, 15,000 cubic feet per minute, developing 270 h.p., making 55 revolutions per minute. The depth of the pit under the wheels is 8 feet, and allows a perfectly free discharge of the water.

The wheel shaft is 7 inches in diameter, of forged steel, with an enlargement through the stuffing box and where it passes through the hub of cast iron pinion. This shaft is over 15 feet long; the entire weight of water wheel, runner, shaft and pinion rests upon the step carried upon bridge-tree in draft tube of wheel. The upper end of shaft runs in a bearing of liberal dimensions, placed upon side of bridge-tree placed above penstock deck.

The penstock timbers are of oak securely built into the masonry, and are sheathed over with planking 3 inches thick, and perfectly watertight; hard-wood skirting is placed between wheel case and deck.

The wheels are operated from the machinery floor with large hand wheels and suitable gearing; a neat cast iron column fastened to the floor carries the gate stem shaft, upon which is placed the hand wheel; there is also upon the stand an indicating device, by means of which the position or opening of the wheel gate may be known.

The cast iron girder carrying tail end of lying shaft and upper end of water wheel shaft, is of massive design, of inverted U section, resting upon plates built into the walls, and is securely held to the masonry by strong bolts. Provision has been made to enable aligning the girders at any time, if required. The pressure gauges and revolution counters are placed upon the wall above hand wheels, and can be readily seen from any part of the building.

The entire weight of the pumps and piping is over 160,000 pounds, and was placed in position by the William Hamilton Company, under the superintendence of Mr. Wm. Kennedy, jr., C.E., of Montreal, who had entire charge of the works.

The illustrations are copied from the designs of the plant, prepared by the writer.

The present distribution system comprises about fifteen and one-half miles of mains, varying in size from 5 to 16 inches, there being one mile of 16-inch, one and one-half miles of 12-inch, four miles of 8 and 10-inch; the balance of distribution is practically 5 inches.

There are placed 115 stop valves on the system. The mains supply 114 fire hydrants. The total cost of the works is over \$200,000. They are owned and controlled entirely by the Peterborough Water Company, composed of local gentlemen: John Burnham, Esq., M.P., president; G. W. Hatton, Esq., sec.-treas., and Wilson Henderson, superintendent.

MINING ASSOCIATION OF QUEBEC.—The annual convention of the association took place in Montreal on the 9th, 10th and 11th of January. A paper by T. J. Drummond, read on that occasion, appears in this issue. A general report of what took place is unavoidably held over.