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FOR THE CANADIAN ENGINEER.

HYDRAULIC APPARATUS.

BY WILLIAM PERRY, HYDRAULIC ENGINEER, MONTREAL.

THE SYPHON.

There is nothing in the way of hydraulic apparatus much more simple than the syphon, but strange mistakes are sometimes made about it and the causes which enable it to perform its work. Its action does not depend, as some old writers on natural philosophy supposed, upon any inequality of atmospheric pressure upon the liquid in the two arms. As a matter of fact, the pressure is slightly greater upon the orifice of the longer or discharging arm, because of the two it is nearer the earth, and therefore a higher and heavier column of air rests upon it. Nor does it depend upon the difference in the actual length of the two arms, or in their diameters, but the larger the tube the more water will be discharged. What causes the syphon to act is the destruction of hydrostatic equilibrium, by the discharging part having a greater perpendicular length than the receiving part; as the pressure of fluids depends upon the depth of the column only, that in the longer arm necessarily preponderates, so that when once a partial vacuum has been artificially formed within the syphon, the fluid in the deeper arm is forced to descend, leaving still a partial vacuum behind it, into which the liquid is forced by the atmospheric pressure on its surface. The property of cohesion which all fluids in a liquid state possess enables the particles to drag those in the shorter arm over the bend, and in this way a constant discharge is kept up.

Some twelve years ago I put in a 7-inch syphon for the Dominion Bridge Co., Lachine, 1,600 feet long. It

was then under the management of J. Abbott. Considerable experimenting was done and valuable information obtained. The earliest instance of the use of the syphon appears to have been its employment in Egypt for mixing wines. An inscription upon a tomb at Thebes, bearing date B.C. 1450, which tomb once contained the remains of Pharaoh Amunoph II., includes a delineation of three syphons, two of which are in operation, and the other is being charged by a man who has the long end in his mouth. The tomb of Rameses II., B.C. 1235, has an inscription showing a number of syphons. Among other utensils belonging to the kitchen, syphons were used by Italians. In the sixteenth century quite a number were used by the Germans, and with satisfactory results, in transferring large quantities of water over rising grounds. One of them was made of wooden planks, closely nailed and probably jointed with pitch, forming a square trough; in the top of the box a hole was left to charge it, both ends being plugged, and when filled the plugs from each end were withdrawn, when the syphon would, of course, get into action.

THE RAM.

It would be necessary to go a long way back to find the origin of the name which is applied to the water raising appliance universally known as the hydraulic ram. When the ancients first devised a machine for battering the walls of their foes, they called it a battering ram, in honor of the rather foolish animal of whose warlike action it was, in principle, a tolerably exact imitation. Ordinarily a beam of timber in length from thirty to sixty feet, suspended in the centre by chains to a tower, was impelled with great force against the wall or building by the united strength of a large number of men acting as one man. This kind of ram is well known; but it is, probably, not so generally understood that a column of water can act, and in some circumstances does act, in precisely the same manner. A long column of water, moving in one direction with velocity and encountering resistance, may have as destructive an effect as a beam of wood or iron, used after the manner of the old battering ram.

Probably most persons have noticed that if a compression cock on an ordinary supply pipe in our houses is suddenly closed, a blow is sometimes inflicted upon the pipe, which blow sounds almost as if it had been made with a hammer. It is caused by the water nearest the orifice which is being closed being forcibly driven against the moving mass of water in the pipe behind it. The force of the blow, as many people know, is often sufficient to burst a weak pipe. This is the real cause of large waterworks mains bursting, more especially near where elevators are running. It is on record that many years ago at a hospital in Bristol, England, a leaden pipe was carried from a cistern in one of the higher stories to the kitchen below; this pipe was frequently broken when one of the cocks was closed suddenly, and several attempts were made to remedy the defect in the system. They were not successful until a plan was hit upon by a local genius of attaching one end of a smaller pipe immediately behind the offending cock, and carrying the other end to the height of the