NEW AQUEDUCT BRIDGE AT WASHINGTON, D.C.

Among the public works now in course of completion at Washington, is the Aqueduct Bridge over Red Creek, at the western end of Pennsylvania avenue. This bridge is a cast iron arch of 20 feet rise and 200 feet clear span between the abutments. The arch consists of two ribs, each of which is composed of 17 cast iron pipes of 48 inches internal diameter, and 12 feet 3 inches in length. They have flanged ends pierced with holes for screw bolts, by which the pipes are firmly connected together. After being cast, they were placed in a lathe, and the ends and flanges were accurately turned or faced off. They are put together in the form of a circular arc, the faced ends abutting against each other, and 40 screw-bolts firmly secure each joint. Such is the accuracy obtained by the present use of machinery in engineering, that these joints are water-tight, under the aqueduct pressure of 120 feet head, by mere application of the dressed surfaces of cast iron, no packing or cement being used in the joints.

Upon these two arched ribs, which are firmly connected with each other by cast iron tubular crossbraces and heavy wrought diagonal ties, is erected a framework of heavy rolled iron "H" beams (from the works of the Phœnix Iron Company of Philadelphia), supporting two continuous horizontal iron girders, 204 feet 6 inches in length. Upon these girders rest crossbeams of timbers, supporting the roadway of the bridge, which embraces two city railroad and carriage tracks, and two paths for foot passengers.

The cornice of the bridge is decorated with modillions of cast iron, and a light wrought iron railing surmounts the whole.

The abutments, founded upon solid rock, are built in the most substantial and durable manner, of a fine gray sandstone, obtained in large blocks from the government quarries at Seneca, upon the Chesapeake and Ohio Canal, 24 miles from the city of Washington. The strength of the stone is 17,000 pounds per square inch.

This bridge is particularly remarkable for the double duty which the arch performs. While it supports a roadway, forming a beautiful and much-needed communication, by which the traffic between the cities of Washington and Georgetown is carried over, the water of the Washington Aqueduct is carried into the city of Washington through the pipes of which the arch is composed. To guard against all danger of freezing, the pipes are lined with staves and resinous pine timber, three inches in thickness, leaving a clear water-way in each rib of three and a half feet in diameter.

The flanges and bolts by which the pipes are connected at the joints are covered with decorative mouldings, encircled with foliage of cast iron. The arch ribs spring from ornamental bases, which distribute the pressure over huge blocks of granite set in the skew back of the abutments. The intersections of the beams in the framework of the spandrils are covered with ornamental bosses, also of cast iron. The whole is a model of lightness and elegance, being 200 feet in clear span, and 45 feet in hight from the water to the top of the parapet.

The abutments contain vaults, in which are the connecting pipes and stop-cocks for regulating the flow and discharge of water; and in the western abutments on the Georgetown side, one of the vaults serves as an engine-room and contains a water-pressure engine—the first, it is believed, erected in this country.

The engine, drawing its supply from the cast iron street mains of the Washington Aqueduct, pumps 10,000 gallons of water per hour into a reservoir on the hights of Georgetown, a mile distant, and 204 feet above the machine. This reservoir supplies that portion of Georgetown which is above the level of the great store and distributing reservoirs of the Washington Aqueduct. In a recent experiment, the engine, using 10,862.2 gallons of water per hour, under the effective pressure of 99.86 feet as power, pumped 10,410.4 gallons of water against an effective head or resistance of 90.245 feet. This gave an useful effect of .866 of the power employed; the loss being absorbed in friction, in producing motion of the parts of the engine and of the water and in leakage, the latter alone being about 2½ per cent. of the water used. By the formula given by Weisbach for the efficiency of

the engine alone, the efficiency of the engine and pump being considered equal, 12½ of the total loss of effect being due to the motor, the efficiency of the motor here used is 933, a very high result. The engine and pumps were built by H. B. Worthington, of New York city, under his patent of 1855.

The Washington Aqueduct has other works not less remarkable than the one described; among them, the great granite arch, by which the masonry aqueduct, nine feet in diameter, crosses the Cabin John Creek, at a hight of 101 feet above the bed of the stream. The arch is built of huge granite, is 20 feet wide, 57 feet 3 inches rise, and, being 250 feet in clear span, is the largest stone arch in the world.