

Cleveland Water-Works, No 3—Objections to Cast-Iron Pipes.

Extracts from the report of E. S. Cheabrough, Civil Engineer of Boston, to the Cochituate Water Board in 1852, taken from the Report of Stuart and Marsh to Rochester Water Works Company.

"The rapidity with which the interior surfaces of some of the pipes have become covered with tubercles or rust, has excited a great deal of interest, and has become the subject of much observation; but the cause of such a wide difference in the growth of these tubercles in different pipes and in different places, does not appear to be clearly understood. All the large pipes that have been opened, have been partially or entirely covered on the inner surfaces, some with detached tubercles, varying from a half to two and a half base, with a depth or thickness in the middle of from one quarter to three quarters of an inch; and some entirely to an average depth of half an inch, with a rough coating, as if the bases of the tubercles had crowded together. The smaller pipes all exhibit some action of this kind, but generally to a less extent, as regards thickness, than the larger ones. In one case, however, a four inch pipe was found covered to a thickness of about one inch. This was in that part of Myrtle street which was formerly called Zone street, where the entrance to a service pipe was entirely stopped by rust. Wrought-iron pipes fill much more rapidly than cast-iron ones; and in several instances, service pipes made of that metal have, during the last year, become so obstructed as to be almost or quite useless.

"The Jamaica Aqueduct pipe, which was originally ten inches in diameter, has been in some cases, reduced to eight by tubercles, which, however, are different in form from those in the Cochituate pipes. They appear to lap over each other in the direction of the current; this is very strikingly the case at the commencement of the pipe, as if their form was owing in some measure to the mechanical action of the current.

"Knowing that this subject has occupied much of your attention, that you have consulted articles from various foreign journals that treat upon it, and that Prof. Horsford has it under consideration, no discussion upon the cause or causes of these tubercles will be attempted here."

The following extracts are taken from the last annual report of the "Cochituate Water Board to the City Council of Boston," to show the growing importance of this subject, copied also from the foregoing Report of Stuart and Marsh.

"Among the variety of topics noticed in the Report of the Engineer which are well deserving the consideration of the City Council, there is one in particular, to which we would now call its attention, which we consider to be eminently so. We allude to the effects which are found to be produced on the inner surface of all the iron mains and pipes, by the action of the water. The attention of the Water Board was attracted to the subject, soon after its appointment; for although the pipes had then been in use less than three years, those effects were already quite obvious and striking and had in fact been noticed some time previous.

"The effects to which we now allude, are the peculiar changes which have been produced on the iron itself; and they consist in

"1. The absorption of iron in certain places, and the formation in its stead of a substance resembling plumbago.

"2. The gradual development of local accretions or tubercles, in the interior of the pipes, by which the flow of water is impeded, and their capacity diminished, so that the object for which they were laid becomes imperfectly accomplished, and an apprehension is excited that they may be so far closed up as to be useless hereafter.

"This subject has received but little scientific investigation, till within a few years, notwithstanding its very obvious importance, and although the evil must have existed since cast iron has been used for such purposes. It is one, however, of no little importance to the City, as there is involved in it the question of the present and future capacity of all the iron pipes which have been, or are to be laid, at no small expense, and of their consequent adaptation to the purpose for which they are used, and also of their ultimate durability."

The first notice taken of this subject which we have seen, appears in the transactions of the French Academy of Sciences, in the year 1836. It is a note by Mr. Vicat, on the subject of a coating to prevent the development of tuberculous accretions in cast iron pipes for conducting water. He states that a report printed at Grenoble, November 22, 1853, by order of the Municipal Council, called the attention of the public to the rapid, as well as the unforeseen filling up of the large cast-iron main of the Chateau d'Eau, in that town: "The formation of numerous tubercles of hydroxide of iron, began to show itself shortly after the water was let on, by a perceptible though slight diminution of the discharge. The development of the accretions' however, as was proved by many accurate measurements, soon increased so much, that the supply of the Chateau, which had been in 1826 about 370 wine gallons a minute, was gradually reduced in 1833 to about 190 wine gallons, showing a loss of nearly one half. A good deal of alarm was excited by it, and an attempt was immediately made, by eminent chemists' to ascertain the cause, and reconcile the phenomenon with various theories. A commission, consisting of engineers and others, was also appointed. In the meantime new measurements indicated, that in less than five years the pipes would, probably, be so obstructed that the water would cease to flow through them. Two members of the commission, Messrs. Guemard and Vicat, Engineers in chief, being persuaded that the tubercles were formed at the expense of the castings, applied themselves to the discovery of some coating which would be, at the same time, cheap, indestructible, and capable of preventing oxydation. After two years of experiments, they considered it sufficiently proved, that hydraulic cement is, of all compositions combining facility of application and cheapness, that which adheres the best to the casting, is the most indestructible, and prevents most effectually all oxydation and consequent formation of tubercles."

The last information to which we shall refer on this subject, is contained in a paper on "Tubercles in Iron Pipes, by Mr. Gaudin, Engineer of Bridges and Roads," published in the Annales des Ponts et Chaussées, for November and December, 1851. He states that the iron conduit at Cherbourg, constructed between the years 1836 and 1838, of white castings, nearly 1 1/2 miles long, had become everywhere coated with tubercles, which in some places had an elevation of 1 5/75 to 1.968 inches, so that the orifice of the pipe, which was when laid about 7 inches in diameter, had been reduced to less than one third its original section. The consequence of the diminution of the orifice, joined to the enormous loss of head occasioned by the additional friction, had deprived many of the work shops at the end of the conduit of a supply; prevented the simultaneous playing of the fountains, and made the supply of the grand reservoir impossible, or very feeble.

"He considered it certain that the iron in the tubercles was to be attributed, exclusively, to an alteration which had taken place in the pipes themselves, no matter what the casting might be, whether white or gray."

He states "that chemists and engineers have recommended the forcing of linseed oil by great pressure into the metal, and also coatings of mortars and hydraulic cements, and bituminous coverings."

The Water Board close as follows:—

"But with regard to the accretions, their growth has been more rapid and important, so much so that our 36 and 30 inch mains have become already, in consequence of the actual diminution of their area, and also of the additional friction which has been occasioned, scarcely superior in capacity to those of 34 and 28 inches, having a clear surface; and we have had sufficient experience on the subject, to convince us of the impolicy of making use of wrought iron service pipes at all, or of cast-iron ones of less than four inches in diameter."