CEMENT JOINTS FOR CAST-IRON WATER MAINS.

IN *The Canadian Engineer* for May 24th an abstract of Clark H. Shaw's paper on "Cement Joints for Cast-iron Water Mains" appeared. The following discussion of this paper, which is taken from the Proceedings of the American Society of Civil Engineers, will be of interest:—

Harry Y. Carson, Jun.Am.Soc.C.E. (by letter).—It would be a valuable addition to engineering literature if some one were to compile a comprehensive and authoritative paper or thesis on joints for cast-iron pipe. Much has appeared in the technical press, as well as before technical societies, with reference to the leakage of water and gas from underground mains, but, obviously, not enough has yet been done to bring about a general improvement in the prevention of these large percentages of wasted water and gas. This paper is a valuable contribution to such literature as now exists.

The causes for the normal leakage at joints in mains may be classified as follows: (1) Contraction and expansion; (2) unequal settlement; (3) vibration and shock.

A fourth cause may be corrosion, but a very able paper entitled "External Corrosion of Cast-Iron Pipe," by Marshall R. Pugh, M.Am.Soc.C.E., points out that deterioration in cast-iron pipe, as compared to other materials, is practically nil; that the oldest cast-iron pipe, flanged, and in 1-m. lengths, put into service more than 250 years ago has shown no appreciable loss in wall thickness or strength, and that: "experience has not been sufficiently long to establish just what its life is." The chief consideration for cast-iron pipe, therefore, may be said to centre about the type of joint best suited to prevent waste through leakage.

Contraction and expansion exist in all mains, and vary in direct proportion to changes in the temperature of the pipe line. The movement caused thereby, though slight, and scarcely ever exceeding 2 ins. per 1,000 ft., is absolutely irresistible, and its effect must be taken care of properly, or disaster is sure to result. No material is of sufficient strength to resist its power if rigidly maintained against it. Contraction and expansion produce by far the greatest proportion of normal leakage in mains. Because of its inelasticity and fragility, cement, as a material for jointing cast-iron pipe, has always been questioned. This in spite of the fact that it is very cheap.

The author makes the following statement: "Long Beach now has 60 miles of cast-iron water mains, * * * laid with joints of this (cement) type. All these pipes are under pressures ranging from 40 to 80 lbs. per square inch, and are giving perfect satisfaction."

He presents no data, however, by which the satisfactory performance of the line may be measured, as he has not submitted any information as to tests made for leakage or figures as to its quantity. Manifestly, without this information it is difficult to see how the line can be stated to be perfectly satisfactory.

The principal advantage of bell and spigot pipe when packed with lead lies in its ability to take care of the always existent contraction and expansion at its joints, without fracture. Cement joints may reduce the number of joints actually leaking, but rigidity is increased to such an extent that there may result an increasing number of fractures at those points. The net leakage with cement joints, however, is probably not materially different from lead.

Flanged jointed pipe, in order to withstand expansion and contraction, must have expansion joints at very frequent intervals.

Regardless of the kind of jointing material used, the unequal settlement of a pipe line may cause normal leakage as well as breakage, with extraordinary leakage. Damage ensues from settlement almost in direct proportion to the relative rigidity of the joint. Flanged pipe is particularly unsuited to conditions where unequal settlement prevails as is the case in the down-town or business districts of cities, where the streets are so frequently torn up.

Vibration and shock are exceedingly deleterious to joints which are rigid, and here again the pipe line suffers in direct proportion to its rigidity. The general results are similar to those caused by unequal settlement. Moreover, main leakage will increase as the system gets older, on account of the loosening of the joints, through contraction and expansion, settlement, and vibration.

A pipe joint in which packing materials of every character are entirely eliminated, so as to have a ground metal-to-metal connection, should give the most desirable results of all. Joints of this construction have now been in successful service for more than 15 years; and their more general adoption will proceed from the excellent results which have been obtained from their use for cast-iron mains. In joints of this type the bell and spigot ends of the pipe are machined at slightly different tapers, so that, when entered in a tight manner, the line may settle without leakage. Such a pipe line is capable of taking a rough contour over the trench bottom, or of assuming a comparatively small radius on any change of alignment.

Without the slightest leak whatever, pipe and fittings made with the machine flexible joints have been used successfully to convey hot water and fluids, such as steam, where the maximum expansion and contraction would be expected.

Furthermore, cast-iron pipe in which all jointing material is eliminated gives an ideal line. It cannot fail by subsequent deterioration of the joining material. For instance, there are many alkaline soils where cement is quickly attacked by chemical action, which, however, does not corrode the pipe itself. Moreover, such materials as lead, oakum, and cement, by virtue of their resistance to stray electric currents, are known to increase the damage to cast-iron mains, that sometimes follows the improper return of electric currents from trolley car systems.

In so far as settlement and vibration or shock become effective factors in causing leakage from cement and lead joints, or from flanged joints due to breakage in the latter, no leakage has resulted from proper metal-to-metal joints, and records have repeatedly shown that such joints have withstood successfully and without failure the most severe conditions known in practice.

F. M. Randlett, Assoc.M.Am.Soc.C.E. (by letter).—This paper is of added interest to the writer as the Water Department of Portland, Ore., has been experimenting with cement joints for the past year.

During 1916, there were laid 1,910 ft. of 8-in. and 362 ft. of 12-in. cast-iron pipe with cement joints, with the most satisfactory results.

For the purpose of investigation, and to illustrate the manner of using the materials, three lines of 8-in. cast-iron pipe were laid, according to the specifications of the New England Water Works Association, as follows:—

Line No. 1. Neat cement joints; 3.5 lbs. per joint; some waste; cement joint about 3 ins. deep.

Line No. 2. Leadite joints; 4 lbs. per joint; 2 ins. of leadite.

Line No. 3. Pig lead joints, caulked; 13.11 lbs. per joint; 2 ins. of lead.