TABULATED DATA: WITH EXPLANATORY NOTES RELATING TO FLOW OF WATER UNDER PRESSURE THROUGH CLEAN CLOSED PIPES

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UNDER PRESSURE

THROUGH

CLEAN CLOSED PIPES

BY

GEORGE T. PRINCE, C. E.

M. Am. Soc. C. E., M. Am. W. W. Assn.

M. N. E. W. W. Assn.

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PREFACE

SOME years ago, when the author was located at Denver, Colorado, in the capacity of Chief Engineer of The Denver Union Water Company, he collected a mass of data relating to the Construction and Maintenance of Continuous Wood-stave Pipe, with a view of getting the matter into tangible shape for publication.

It may be of interest to note that Denver was the home of this class of pipe and that the entire water supply for that city is obtained through more than one hundred miles of continuous wood-stave pipe, varying in size from 30 inches to 48 inches in diameter.

While engaged in the preparation of tables indicating the carrying capacities of continuous wood-stave pipe, the author was strongly impressed with the need of special investigation touching this most important factor of pipe design.

At that time the formula usually employed in designing pipe of this character was Kutter's with $n=0.010$, although other formulæ had also been used, among them being the expression $H_f=mV^{1.78}$.

It was deemed desirable as well as necessary and essential to a more complete understanding of the subject, to compare results of flow-data obtained by several well-established and accepted formulæ, upon a common basis, the same to apply to sizes of pipe and slopes usually involved in common practice.

Accordingly, five well-known formulæ were selected by means of which the following tabulated values were computed. Five-place logarithms were employed in these computations and as a ready means of comparing results derived from these formulæ, the value of c in the expression $v=c\sqrt{rs}$, has been determined for each size of pipe and for slopes as indicated in the extended tables.

It is believed that an inspection of these comparative values will assist in the proper dimensioning of pipe conduits to meet any desired service.

George T. Prince.

Omaha, Nebraska,
July, 1916.

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The flow of water in any channel is subject to the law governing falling bodies, commonly expressed $v=\sqrt{2gh}$; in which v equals the velocity in feet per second, g equals the "acceleration of gravity" and h equals the head of water in feet, producing the flow.

The value of g varies from about 32.0894 feet per second *per second*, at the equator sea-level, to 32.254 at the poles. Its value also varies slightly with elevation above sea-level. For all ordinary calculations applying to the United States, the value of g is generally assumed as 32.16 and $\sqrt{2g}$ as 8.02.

If the flow were not retarded by friction, the amount of discharge through a closed pipe would be expressed in cubic feet per second by the product of the following three factors: the internal cross-section of the pipe (expressed in square feet), the square root of $2g$ (equal to 8.02), and the square root of the head of water producing the flow, expressed in feet; that is the vertical distance of the source of supply above the axis of the pipe, measured at the point of discharge.

Because of the retarding influence of friction, the amount of flow is less than is indicated by the above expression and the amount of the frictional resistance can be expressed by the difference between the observed velocity in feet per second and that indicated by the expression $v=\sqrt{2gh}$ or $8.02\sqrt{h}$. In other words, the frictional resistance is equal to the accelerating force.

The discussions which have led up to our present knowledge of the laws governing the flow of water in channels have been most varied in their conclusions, and though many errors and false results appear, a study of them is of great interest to one who desires thoroughly to analyze the subject of hydraulics.