flange 113.1 pounds would be wasted if the American Standard flange were used; besides the poor casting that might result from casting such a heavy flange on a light pipe.

If a flange 1.67 ins. thick were used on a 30-in. class B pipe, taking the outside diameter of the pipe as the inside diameter of the flange, it would weigh 169.38 pounds. The American standard flange on this pipe, would weigh 215.5 pounds, showing a saving of 46.12 pounds per flange.

Would it not be a good idea for the committee of this association which has this matter in charge to endeavor to take it up with like committees from the New England Water Works Association, the American Society of Mechanical Engineers, the American Gas Institute, the Cast-Iron Pipe Manufacturers, the Committee of Manufacturers on Standardization of Fittings and Valves, and such other organizations as might wish to be represented?

BUFFALO WATER SUPPLY, WITH SPECIAL REFERENCE TO THE FILTRATION PROBLEM

(Continued from page 552)

elevation anywhere near sufficient for the purpose it would be necessary to go out at least fifteen miles into the country. The enormous expense that would be incurred in securing the right-of-way and in constructing a dual pipe line of the size which would be sufficient for the purpose would place too heavy a burden upon the resources of a city the size of Buffalo.

I believe, however, that a solution to this problem will eventually be found, as I have here very briefly outlined. Directly to the south of the Porter Avenue pumping station, the grounds being separated by Jersey Street only, is a large tract of waterfront land which is at present used for a dumping grounds. Part of these lands are covered by the harbor waters, but can be easily reclaimed by a retaining wall and subsequent filling in. I believe that this would make the best location, and, in fact, all that could be desired for a rapid sand filtration plant. The water could be diverted to the filters by short extensions to the existing canals and raised to the required height by low-duty pumps. After passing through the filters the water would be permitted to return to the original suction wells by gravity and distributed through the present system.

ECONOMICAL SECTION OF WATER CONDUIT FOR POWER DEVELOPMENT

(Continued from page 554)

Fig. 2 is the logarithmic graph of Equation (18) for values of Q from 100 to 10,000, in four parts; for the line BC the ordinates are to be multiplied by 10 and the abscissae by 100; for CD, by 100 and 100; for DE, by 100 and 1,000; for EF by 1,000 and 1,000—all as indicated by the figure. From this figure, Table II. is readily computed.

TABLE II.—VALUES COMPUTED FROM FIG. 2

Q.	A.	V.	r.	s. (Ft. per 1,000.)
100	23	4.35	1.60	0.830
500	100	5.00	3.34	0.520
1,000	191	5.22	10.50	0.180
2,500	450	5.56	16.70	0.128
10,000	1,650	6.08	33.30	0.077

Two special cases are of particular interest: First, when $n=0.5$ and the increment cost is proportional to the surface; this would approximate the case of a flume or a concrete-lined canal in earth. Here

$$A^3=NQ^2$$

and, since $v=Q/A$,

$$v^3 \frac{1}{N} \quad \ldots\ldots\ldots\ldots (19)$$

or there is one best speed of flow independent of the size of conduit. This is a somewhat surprising result.

The second case is when the increment cost is proportional to the amount of excavation, as for costly rock cut; here $n=1.0$, and

$$A^{3.5}=NQ^3 \quad \ldots\ldots\ldots\ldots (20)$$

This can be solved either by plotting, as in Fig. 2, or as follows:—

$$A^{0.5}=Nv^3 \quad \ldots\ldots\ldots\ldots (21)$$

$$Q=Av$$

Calculate $A^{0.5}$ and A from (21), assuming values for v; then find Q, which can be plotted to A.

Variations in A resulting from other values of the unit costs than those used in plotting Fig. 2 can be easily taken into account without replotting these curves. Put

$$N'=fN$$

then

$$\log N'=\log f+\log N$$

and a length equal to $\log f/(n+2.5)$ added to the ordinate of the curve at any point will give the value of Y for $N'=fN$. If f is less than unity the length is to be subtracted. For example, for the point P of Fig. 2, $Q=2{,}500$, $A=450$, $v=5.56$.

If $f=1.5$, then P is the point where $PP_1=\dfrac{\log 1.5}{n+2.5}=\dfrac{\log 1.5}{3.25}$

If $f=1/1.5$, P_2 is the point. These values are given in Table III.

TABLE III.

N.	Q.	A.	V.
$10^2\times4.00$	2,500	510	4.90
$10^2\times2.67$	2,500	450	5.56
$10^2\times1.78$	2,500	395	6.32

The usefulness of this analysis is limited by the accuracy of the determination of n, and this in turn depends upon the definite knowledge of construction costs.

CUTTING PAVEMENT SAMPLES

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GROWING demands for better roads have made it necessary for engineers and road commissioners to examine the existing roadbeds and to study the composition and character of the material used. It is also desirable to take and preserve samples of new roads as constructed, so that the wearing quality can be compared from time to time.

To cut a block out of any road with a pick or chisel is not satisfactory. It is almost impossible to get a solid piece representing the complete thickness of the material. The samples are large, of irregular shape, and, therefore, difficult to store, and besides, the place where the samples have been taken is a rough hole, inconvenient to repair.

It is important to take as small a sample through the bed as conditions warrant, and not destroy or fracture the surrounding pavement, as well as to produce this sample quickly with a minimum of failure and without using a large amount of labor; also to leave a hole that can be easily repaired. These samples should also be of a standard size, easily preserved and tagged for reference.

The core drill will do this work rapidly, and meet all requirements. By using a 5½-in. shot bit, it will cut a hole not exceeding 5¾ in. diameter and produce a core 4½ in. diameter in all material, such as concrete, tar macadam or similar substances. In loose material without binder, cores cannot be extracted, but generally the sides of the hole can be examined.

The power-driven (gasoline or electric) core drill has proved most satisfactory for this class of work. The hand-operated drill can be used, but four men are required as compared to two men with the power-operated drill. The machine should be mounted on wheels for the purpose of moving to different locations. On city work, connection can be made with the water mains; in the country, a hand-pump is carried. In no case should the motor be of less than 5 h.p.