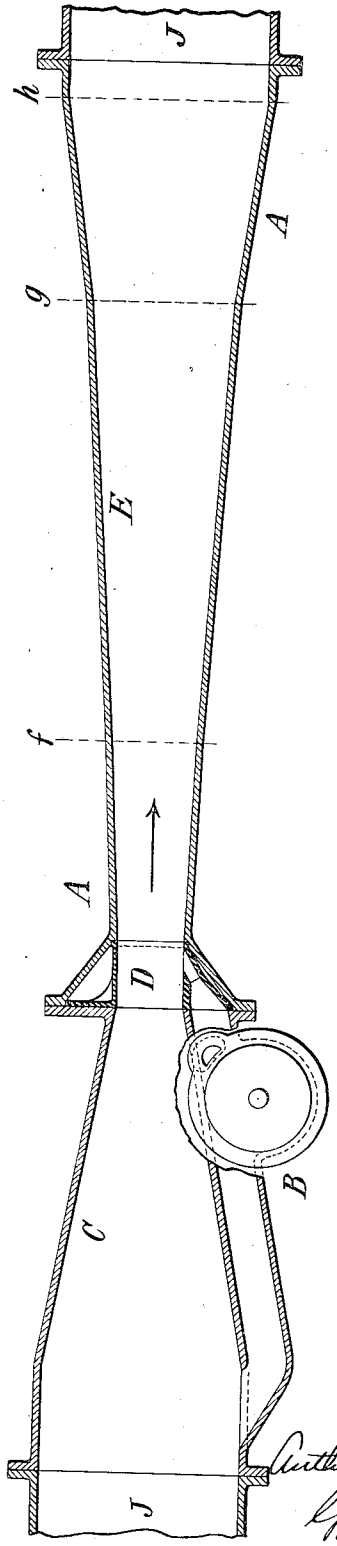
No. 816,280. PATENTED MAR. 27, 1906.

A. S. TUTTLE.

VENTURI TUBE.

APPLICATION FILED AUG. 2, 1904.



Witnesses:
Raphael Ritter
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UNITED STATES PATENT OFFICE.

ARTHUR S. TUTTLE, OF NEW YORK, N. Y.

VENTURI TUBE.

No. 816,280. Specification of Letters Patent. Patented March 27, 1906.

Application filed August 2, 1904. Serial No. 219,219.

To all whom it may concern:

Be it known that I, ARTHUR S. TUTTLE, a citizen of the United States, and a resident of New York city, borough of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Venturi Tubes, of which the following is such a full, clear, and exact description as will enable a person skilled in the art to embody my invention in the form at present preferred by me.

While I have shown my improvement in connection with a proportional meter, it is nevertheless in no way limited to this use, but may be applied whenever a Venturi tube is needed. For a detailed description of such a proportional meter reference may be had to the Letters Patent No. 58,045, granted to me April 29, 1901.

The accompanying drawing illustrates my invention applied in the form at present preferred by me; but it will be understood that various modifications and changes may be made without departing from the spirit of my invention and without exceeding the scope of the claims concluding the specification.

In the accompanying drawing I have denoted the Venturi tube which embodies my invention by the letter A.

The Venturi tube is now well known in the art. It takes the shape of two truncated cones joined at their smaller ends by a throat-piece D, one cone, C, being termed the "upstream" end and the other, E, the "downstream" end. The arrow indicates the direction of the flow of water. The downstream end E appears as one piece; but in practice it might be made of sections. The letters J J denote portions of the main between which the tube A is inserted. The water passing through the throat D has an increased velocity, with a corresponding loss in head, due to the contraction at that point. About the year 1791 Venturi, who first called attention to the relation between the velocities and pressures of fluids when flowing through converging and diverging tubes, after a series of experiments settled upon an angle of five degrees for the angle of divergence in the downstream cone as giving the least frictional loss. Since that date substantially this angle has been almost universally adopted. As can readily be seen, such a small angle of divergence necessitates a very long cone to connect the diameter of the throat with that of the main. This is objectionable, especially in large meters. It makes the meter more costly, more clumsy in shape, more inconvenient to test, and more difficult to ship, besides requiring the removal of a great length of pipe when it is placed on a main already in use.

I am able to materially shorten these tubes by taking a diverging tube or conduit made up of constantly or successively increasing angles of divergence—that is, I start at the throat D with the least angle of divergence and at a distance therefrom I increase the angle. At a further distance I again increase the angle, and so on, until finally the diameter of the main is reached.

I have experimented with tubes having various angles and combinations of angles, and up to the present date the combination giving the best results and which I have shown in the accompanying drawing and which I give merely as an illustration of one embodiment of my invention consists of a Venturi tube connected with a twelve-inch main and having a four-inch throat. The angle of the diverging cone next the throat for about twelve inches is about five degrees. At *f* the angle is increased to about seven degrees and thirty minutes, which is continued about twenty-six inches, when the angle is increased to about sixteen degrees and thirty minutes, which continues about twelve inches until it attains the diameter of the main.

The downstream end of the tube in the example above given is nearly one-half the length it would be had a constant angle of five degrees been employed. This saving in length is of great importance when the larger types of tubes are used.

I do not wish to limit myself to this number of angles nor to their size or positions, for by continued experiment it is possible that a better combination may be found.

To diminish materially the length of Venturi tubes is of great advantage from a practical and commercial standpoint, so long as the decrease in length does not result in a material loss of head in the water passed therethrough. Not only do I attain this advantageous result, but experiments with such a tube as I have described appear to show that in addition to the advantage of decreased length I have by the means described decreased the frictional losses in the

diverging end of the tube, and thus increased the head of water above what it would be were the constant angle of the prior art employed.

In this specification the angles are given in terms of the angle of divergence of the cone of which the section to which it relates is a frustum or, in other words, in terms of the angle included between two opposite elements of said cone.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a Venturi tube, an expanding outlet in which the angle near the throat is approximately five degrees and in which the angle is substantially greater than five degrees at a distance from said throat.

2. In a Venturi tube, an expanding outlet in which the angle near the throat is approximately five degrees and in which the angle increases progressively toward the outlet end.

3. In a Venturi tube, an expanding outlet made up of a series of cone frusta of progressively-increasing angles, starting with an angle of approximately five degrees.

4. In a Venturi tube, an expanding outlet in which the angle near the throat is approximately five degrees and which is succeeded by an angle of approximately eight degrees.

5. In a Venturi tube, an expanding outlet in which the angle near the throat is approximately five degrees and in which the angle increases continually toward the outlet end.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ARTHUR S. TUTTLE.

Witnesses:
E. F. PORTER,
S. C. YEATON, Jr.