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A. TYLOR.

WATER-METER.

No. 173,693. Patented Feb. 15, 1876.

Fig. 2.

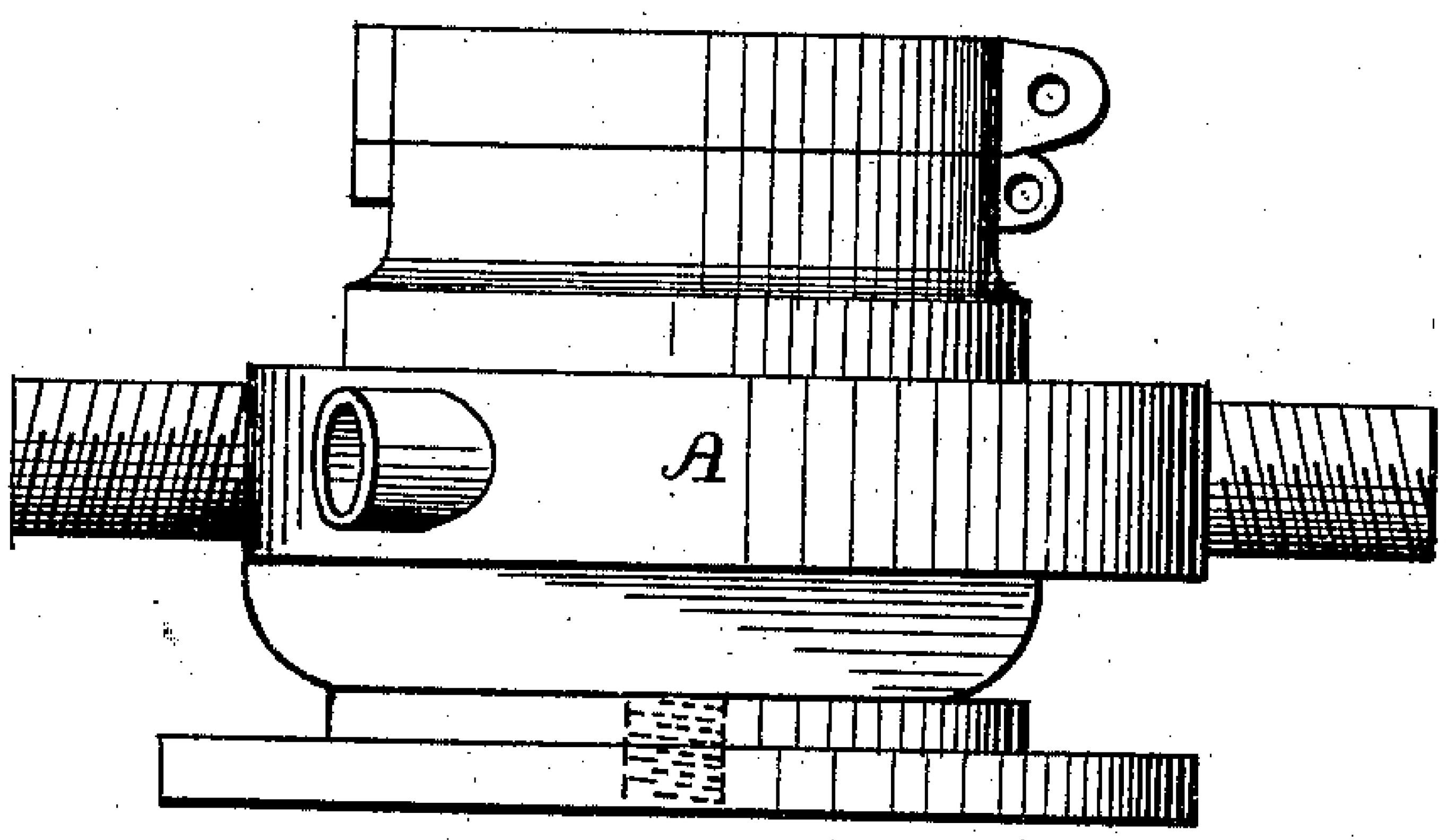

Fig. 1.

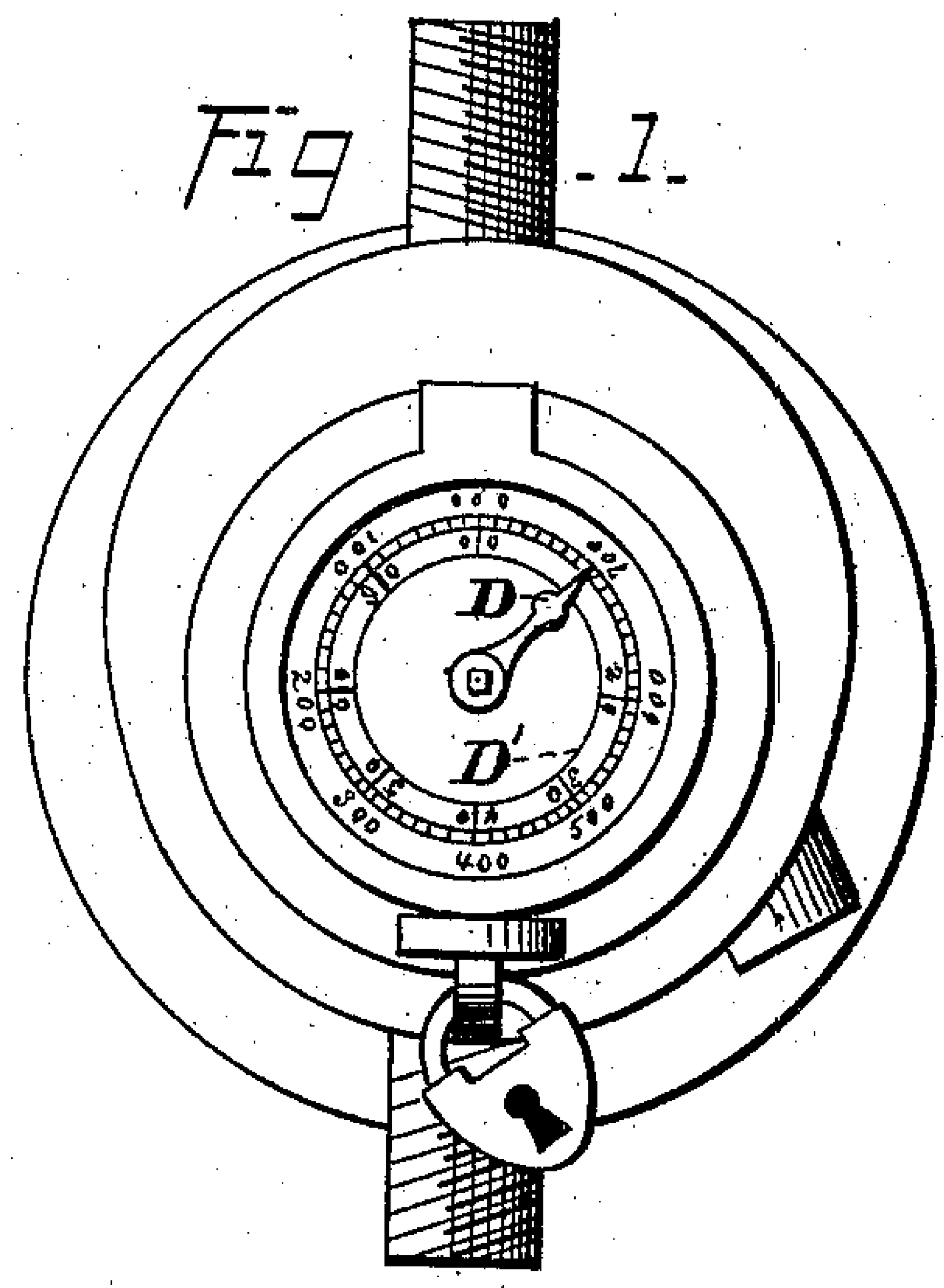

Fig. 3.

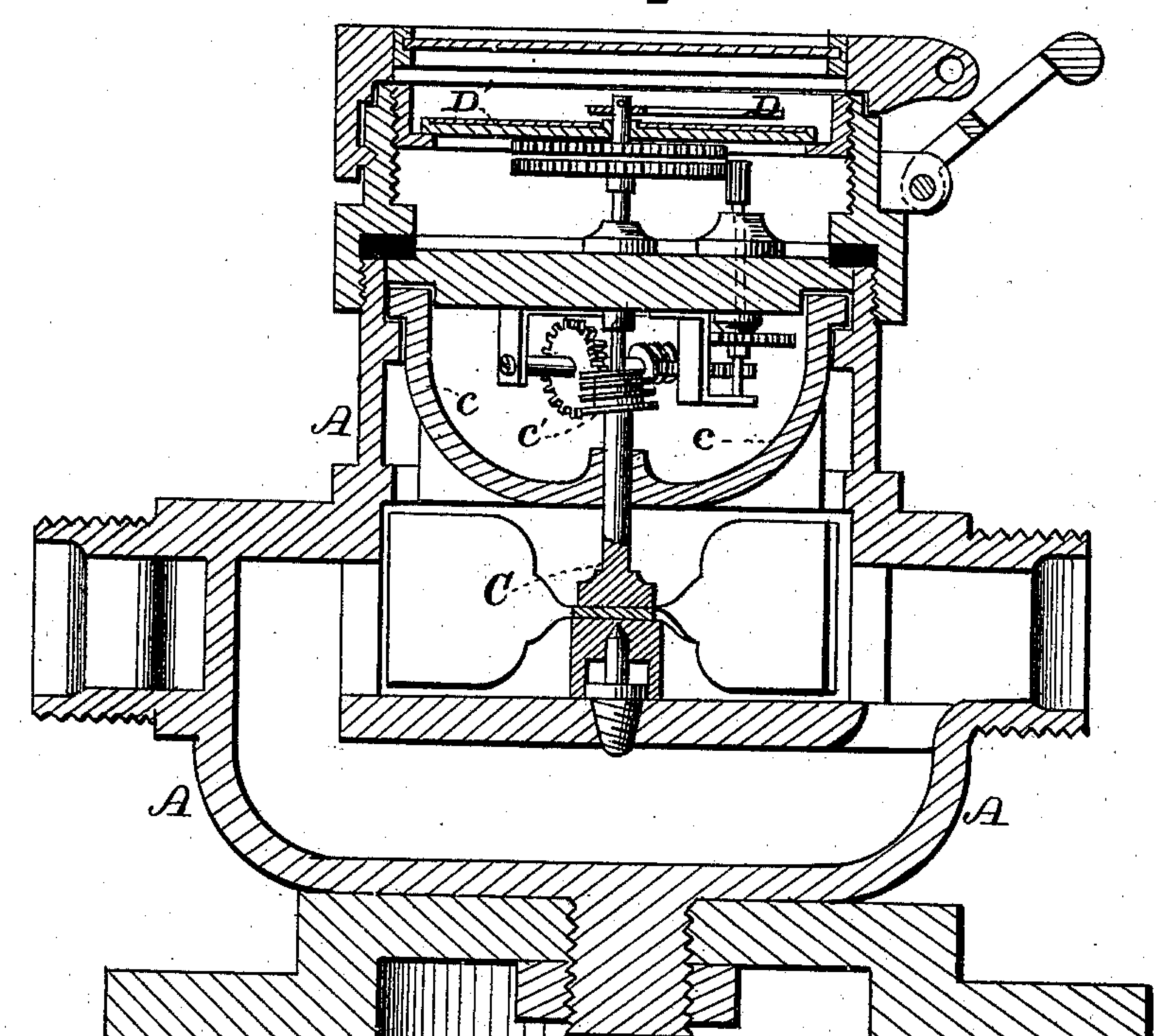

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Fig. 4.

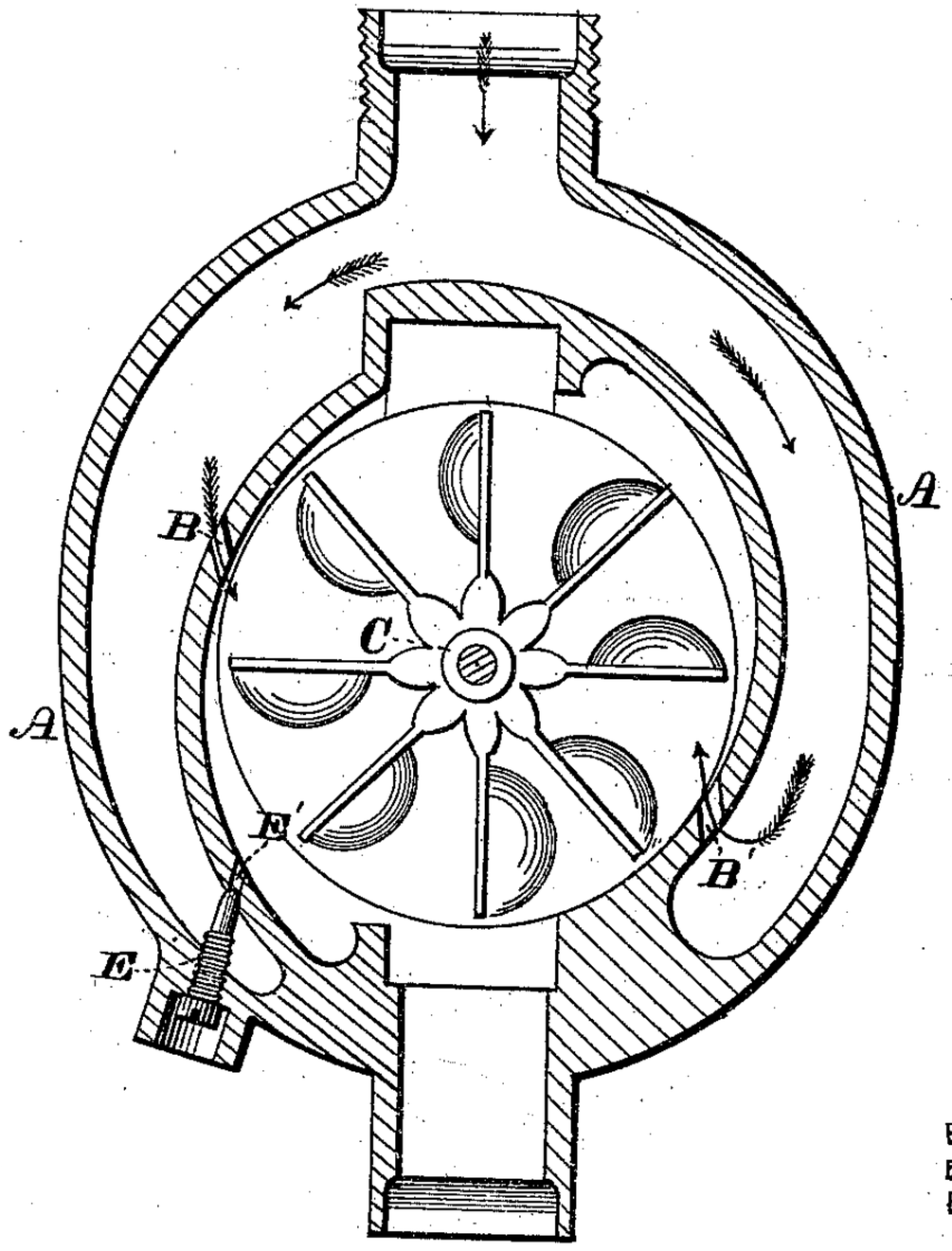


Fig. 5.

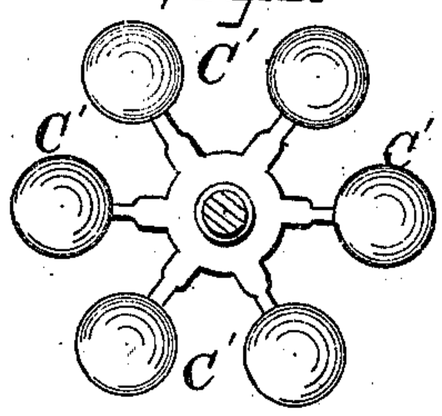
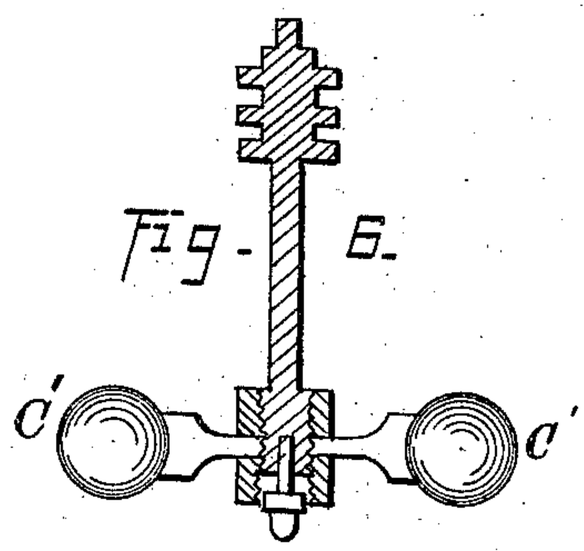


Fig. 7.

Fig. 6.



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4 Sheets—Sheet 3.

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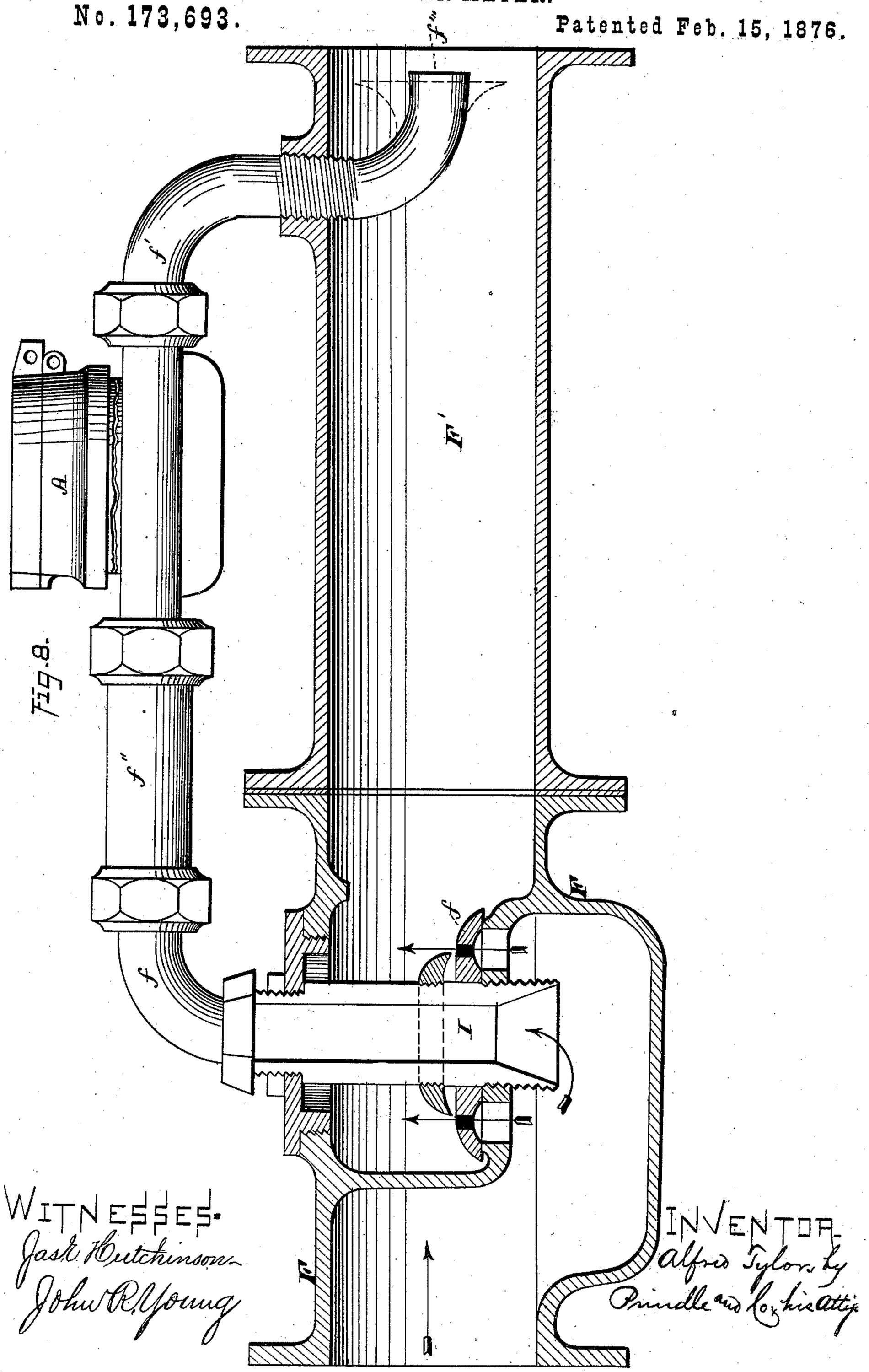

Fig. 8.

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4 Sheets—Sheet 4.

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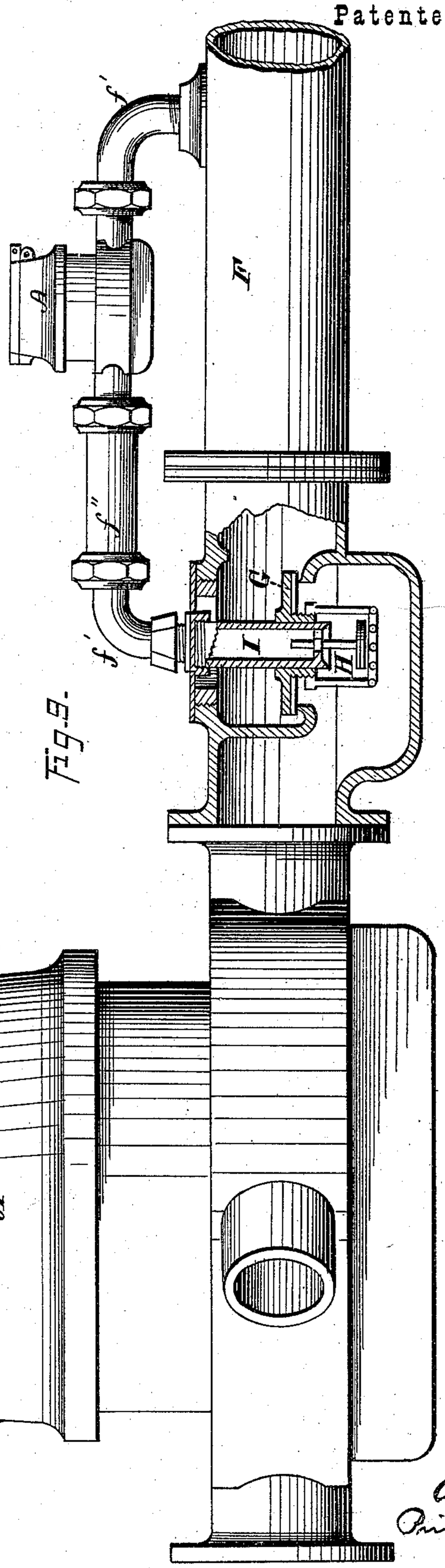

Fig. 3.

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UNITED STATES PATENT OFFICE.

ALFRED TYLOR, OF LONDON, ENGLAND.

IMPROVEMENT IN WATER-METERS.

Specification forming part of Letters Patent No. **173,693**, dated February 15, 1876; application filed January 12, 1876.

To all whom it may concern:

Be it known that I, ALFRED TYLOR, of London, in the county of Middlesex, England, have invented certain new and useful Improvements in Water-Meters; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 represents a plan view of the case, upon the top side, of my improved machine for measuring the speed of currents. Fig. 2 is a side elevation of the same. Fig. 3 is a vertical central section, showing some of the water-passages, the semi-spherical oil-cup, and the moving parts, in position. Fig. 4 is a horizontal central section, showing water-passages, position of turbine, and the regulating or adjusting brake. Figs. 5 and 6 are a plan and elevation of one form of turbine, in which hollow balls, or those made of vulcanite or any other suitable material, are used, the object being to enable them to float, and thereby diminish the friction upon the shaft of the turbine. Fig. 7 is a side elevation of a turbine-blade, of which, in the construction of the machine, I preferably use six. Fig. 8 is partly a longitudinal vertical section and partly an elevation, showing the application of one of my improved machines to a smaller pipe or passage, in conjunction with a self-adjusted valve; and Fig. 9 is another modification, where, by the combination of a large and a small machine, and the addition of one or more valves, the speed or velocity of the current in a large pipe or passage may be more accurately measured and recorded than can with certainty be done by the use of one large machine.

Letters of like name and kind refer to like parts in each of the figures.

The object of my invention is the production of a machine or instrument, by means of which the speed or velocity of water or other liquid currents, in pipes or passages, may be accurately measured, and from the speed thus measured the entire volume of water or other liquid flowing through a pipe or passage may be readily computed and ascertained; and it consists, principally, in providing a case, within which passages are so formed as to produce a circular current, substantially as and for the purpose hereinafter shown and set forth. It consists, further, in the means provided within the case for producing counter-currents, substantially as and for the purpose hereinafter shown and set forth. It consists, further, in the modes of adjusting the currents from the outside, substantially as and for the purpose hereinafter shown and described. It consists, further, in the means provided for self-adjustment and regulating water area, substantially as and for the purpose hereinafter shown and described. It consists, further, in the combination of a small measuring machine or instrument with a by-pass and a large pipe or passage, in such a manner as that the speed or velocity of the water or other liquid shall be measured and recorded by the measuring machine or instrument, and from the speed or velocity so measured and recorded the volume of water or other liquid passing through the large pipe may be computed, substantially as and for the purpose hereinafter shown and described. It consists, finally, in the combination of a large and a small speed-measuring machine and a by-pass, in such a manner as that, in case the speed or velocity of the water or other liquid should be insufficient to operate the movable parts of the large machine, as might sometimes be the case, on account of heavy machinery and consequent friction, the small machine would invariably measure and record the speed which the large machine had failed to do, substantially as and for the purpose hereinafter shown and described.

In the annexed drawings, A represents the case which contains the moving parts, and is partly circular and partly elliptical, and within which are provided apertures B and B′, preferably of unequal dimensions, so that the greater area of the indirect aperture B′ may neutralize the greater velocity at the direct aperture B, and when the water or other liquids to be measured enters at the oblique inlet-apertures B and B′, a current is generated within the circular portion of the case A of a rotary character, and stronger at the circumference of said circular portion than at the center of the same. The moving or registering parts of the machine are actuated and

kept in motion by means of a turbine-wheel, C, which consists of a vertical shaft, to and upon which are secured a series of radial blades, balls, cups, or floats, as may be most desirable. A semi-spherical oil-cup, *c*, is provided and placed in the upper part of the circular portion of the case A, for the purpose of forming a chamber for the greater portion of the gearing or moving parts of the machine, in order that the same may be protected from sediment and dirt. The upper portion of said oil-cup *c* is provided with a flange, by means of which a tight joint is formed, and the oil-cup secured firmly in position. The vertical shaft of the turbine C is caused to project upward through the bottom of said oil-cup, and in the center of the same, and said shaft is held in position and permitted to rotate by means of pivotal bearings at the upper and lower ends of the same.

A worm, *c'*, is provided, and secured upon, and fastened to, the shaft of the turbine C near its upper end, and within the chamber formed by the oil-cup *c*, the office of which is, in connection with other moving parts or gearing, to transmit motion from the turbine C to a hand, D, and dial, D', by which indications of speed or velocity are shown.

A regulating or adjusting brake, E, is provided for the purpose of regulating and adjusting the current flowing from the direct aperture B. It will be seen that the moving parts are surrounded with, and inclosed in, a partly elliptical and partly circular case, provided with apertures—preferably of unequal dimensions—so that the greater area of the indirect aperture may neutralize the greater velocity at the direct aperture, and, when the water or other liquid to be measured enters at the oblique inlet-apertures, a current of a rotary character is at once generated within the circular portion of the case A, which, acting upon the blades of the turbine C, causes the latter to rotate, thereby imparting motion to the hands D and dial D'. The semi-spherical oil-cup *c* should contain a sufficient quantity of oil to thoroughly lubricate the moving parts or gearing contained within the chamber formed by the same; and, as the oil will float upon water, whatever of the latter passes through the hole provided for the shaft at the bottom of the cup will serve to bring the oil more thoroughly in contact with the gearing.

The current formed within the case may be modified by the counter-current entering through the aperture E' in the opposite direction; and said counter-current may also be modified, by means of the regulating or adjusting brake E, so as to cause the currents formed by the water or other liquid entering at apertures B and B' to produce circular or rotary motion alone, until a current is produced which tends to produce circular or rotary motion alone, and which will not tend to move the turbine C upward, downward, or sidewise, so that the friction upon the pivotal bearings of the same will be reduced to a minimum. It will also be seen that, until the velocities communicated to the turbine C are directly proportional to the quantities of water or other liquid passed through the machine, whatever velocity the same is moving at; and also that the current may be so localized at that part of the same nearest the outside of the case that when small quantities are passing through the machine the turbine C may move with the same speed or velocity as the current, it is necessary that all the moving parts should be constructed with direct reference to reducing the friction of the same to a minimum.

In order to enable a small machine to be used for measuring and recording the velocity of water or other liquid passing through a large pipe, a small pipe is attached to, and connected at both ends with, the large pipe, and between the two ends so attached and connected the small machine is placed in such a manner as that the water or other liquid can obtain a ready access to the same. Fig. 8 shows this arrangement, a part of which is a longitudinal vertical section, and part an elevation, in which the measuring and recording machine is placed upon, and connected with, a small pipe, in conjunction with a self-adjusting valve.

The chamber F is connected with the main pipe F'—preferably by means of a flange-joint—within which the valve *f*, opening upward, and the small pipe which forms the inlet to the by-pass *f''*, are placed. The dirt-box or strainer *f'''* is attached to, and connected with, the by-pass *f'* and the case A of the speed-measuring machine, and from the outlet of the latter the by-pass *f'* is continued in the direction of the flowing current to a point where it is again attached to, and connected with, the main pipe F', and, by means of an elbow, is farther extended in the direction of the flowing current until it finally terminates in the center of the bore of the main pipe F'.

The end of the by-pass *f'* may be formed as shown, or may be formed as indicated by the dotted lines *f''''*, so as to induce a greater or less current through the speed or velocity measuring machine or instrument; or, if necessary, by the regulating or adjusting brake E. The action of this arrangement is as follows:

The valve *f* rises or falls to its seat in accordance with the pressure or velocity of flow of water or other liquid through the same and the outlet or passage which it controls, the valve being solid, or having one or more apertures in it, as shown, the object of the valve being that the quantity of water or other liquid which passes the small speed or velocity measuring machine or instrument upon the by-pass *f'* shall bear a constant relation to the quantity passing through the large or main pipe F', so that the indications upon the dial D' of the small speed measuring and recording instrument or machine may always give, by inference, a correct record of the quantity of water or other liquid passing through the main pipe F'. This constant proportion or relation between the flow in the two pipes is

obtained by increasing or decreasing the areas of the main pipe F′ or by-pass *f′*, or by the use of one or more cocks or valves, whereby the current in the smaller pipe or by-pass *f′* is induced to flow more rapidly, or the speed of the current in the larger or main pipe F′ increased or decreased at any particular point, as may be found necessary.

Fig. 9 shows an arrangement designed, by the combination of a large and a small speed measuring and recording machine or instrument, to measure the speed or velocity with more certainty of water or other liquids flowing through a large pipe than can be done with a single large machine or instrument, it having been found that large machines for measuring the speed or velocity of water or liquids in its flow through large pipes or passages require a considerable quantity of water or other liquid to set them in motion. Consequently all quantities less than the amount required to accomplish this purpose pass through unrecorded, the speed or velocity of the current not being sufficient to operate the machine.

By the application of a small speed or velocity measuring machine or instrument, (which is more easily set in motion by a smaller quantity of water or other liquid,) in addition to the larger one, the quantities which would otherwise pass the larger one and be unrecorded will be shown; and, by the addition of a valve or valves, a small and a large machine are arranged to act so that the speed or velocity which the large machine will not measure and record is measured and recorded by the small machine.

The action of this arrangement is as follows: The large machine or instrument A is attached to and connected with the main pipe F′, through which the water or other liquid flows, the velocity of which is to be measured and recorded. The small machine or instrument A is connected with said main pipe F′ by means of the by-pass *f′*, within which is included the dirt-box or strainer *f″*. The valve G, which the smaller quantity of water or other liquid is not sufficient to open, allows the current to pass up the passage I, through the by-pass *f′*, to the small machine or instrument, and the speed of the current thus be recorded. When the quantity of water or other liquid which the large machine A can measure and record the speed of is reached, the valves G and H are arranged so that the water or other liquid opens the valve G and closes the valve H, so that either the large or the small machine, or both, are always measuring the speed or velocity of water or other liquid when the same is flowing through the main pipe F′ and by-pass *f′*.

Having thus described the nature and merits of my invention for measuring and recording the speed or velocity of water or other liquids flowing through pipes or other passages, and the manner in which the same may be put into practical effect, I wish it to be understood that I do not confine or limit myself to the exact details and modifications shown in the accompanying drawings and described in this specification, as the same may be modified or varied without in any manner departing from the nature of the invention; but

What I claim as new is—

1. The case A of the speed-measuring machine, provided with apertures B and B′ in such a manner as that water or other liquid flowing through said apertures shall produce a circular current, substantially as and for the purpose shown and set forth.

2. In combination with the case A and apertures B and B′, the aperture E′, arranged for the purpose of producing a counter current, in the manner and for the purpose substantially as shown and described.

3. In combination with the case A and apertures B, B′, and E′, the regulating or adjusting brake E, by means of which the currents are adjusted and regulated from the outside of the case, in the manner and for the purpose substantially as shown and described.

4. In combination with the case A, the chamber F, main pipe F′, and the self adjusting and regulating valve *f*, substantially as and for the purpose shown and described.

5. In combination with the case A, chamber F, main pipe F′, and self adjusting and regulating valve *f*, the inlet-pipe I and elbow-pipes *f′ f′* and *f‴*, constructed and arranged in the manner and for the purpose substantially as shown and described.

In testimony that I claim the foregoing I have hereunto set my hand this 20th day of December, 1875.

ALFRED TYLOR.

Witnesses:

T. M. FRIGORT,

J. A. MACKINTOSH.