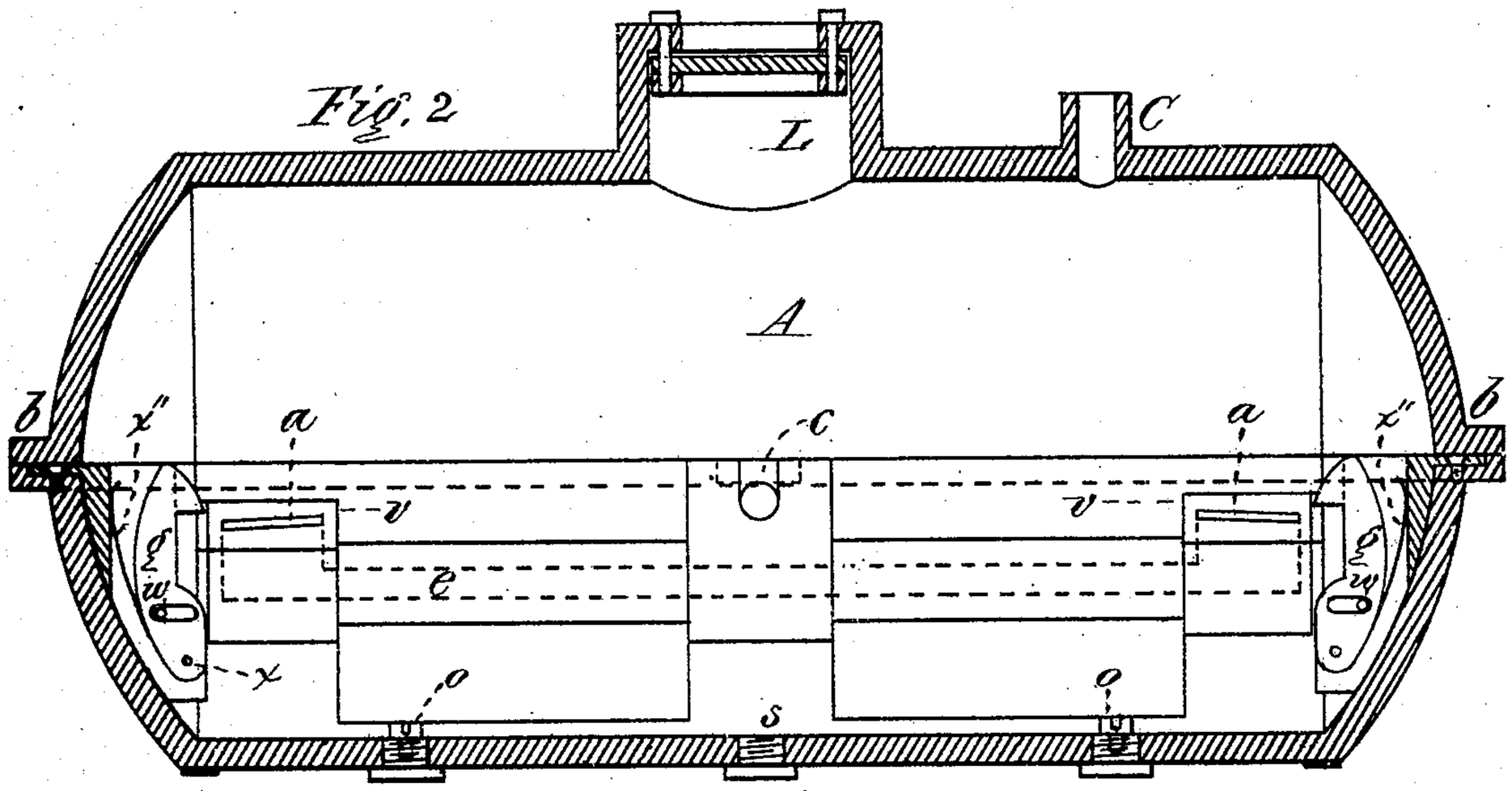
2 Sheets--Sheet 1.

T. A. & J. S. CURTIS.

Liquid-Meters.

No. 145,096. Patented Dec. 2, 1873.

Fig. 2



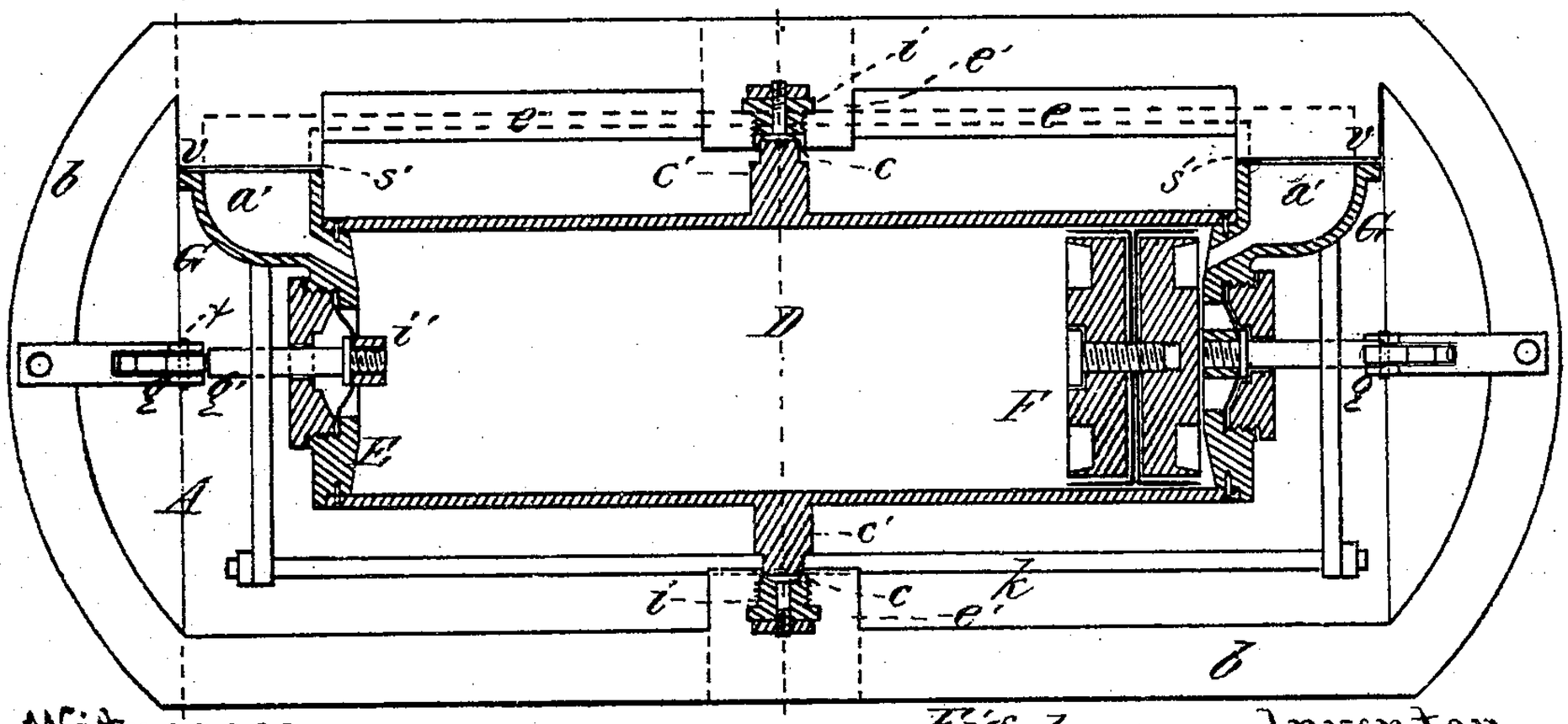


Fig. 1.

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2 Sheets--Sheet 2.

T. A. & J. S. CURTIS.

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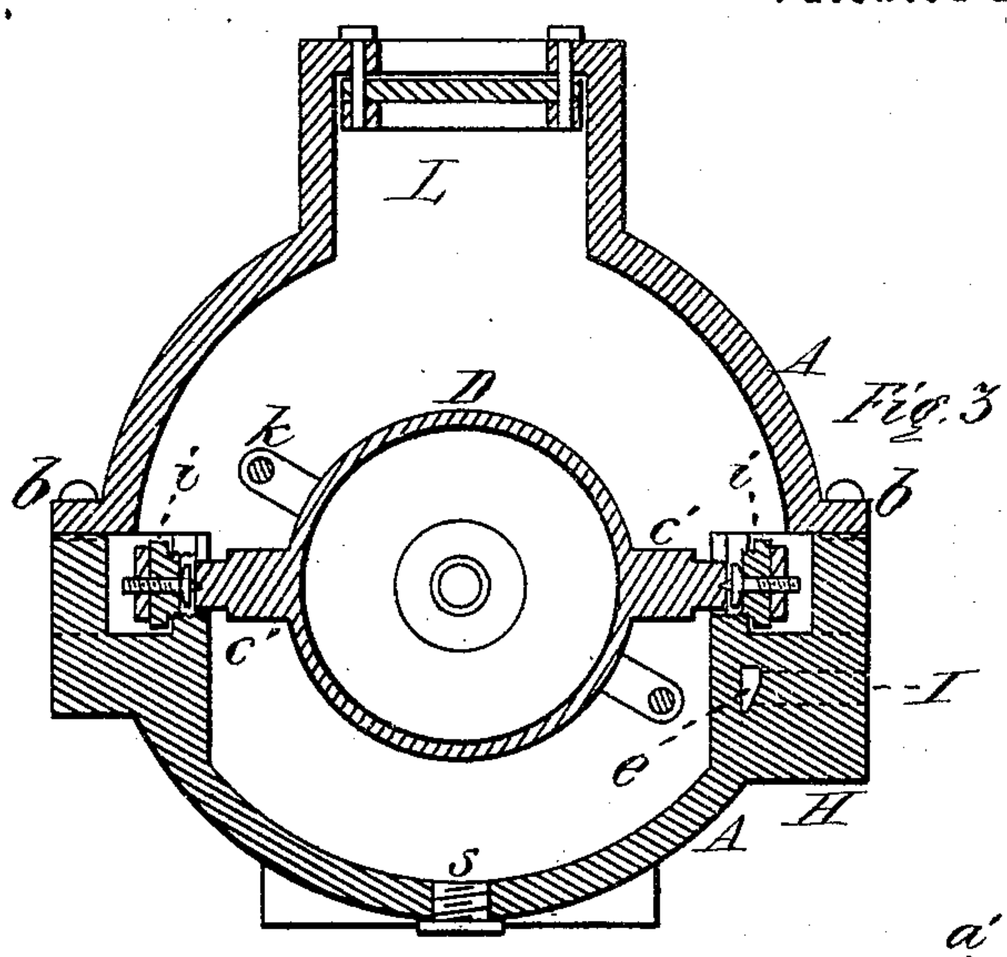

Fig. 3

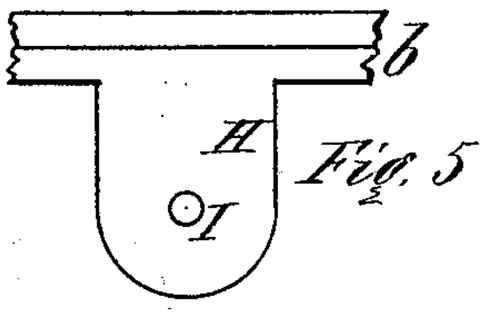

Fig. 5

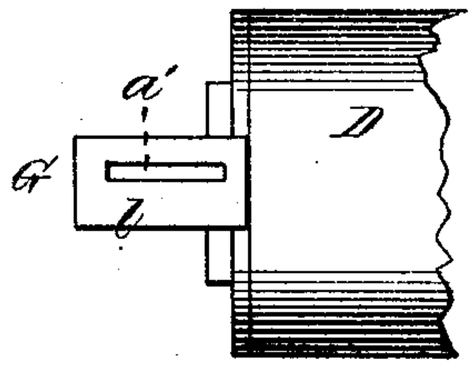

Fig. 6

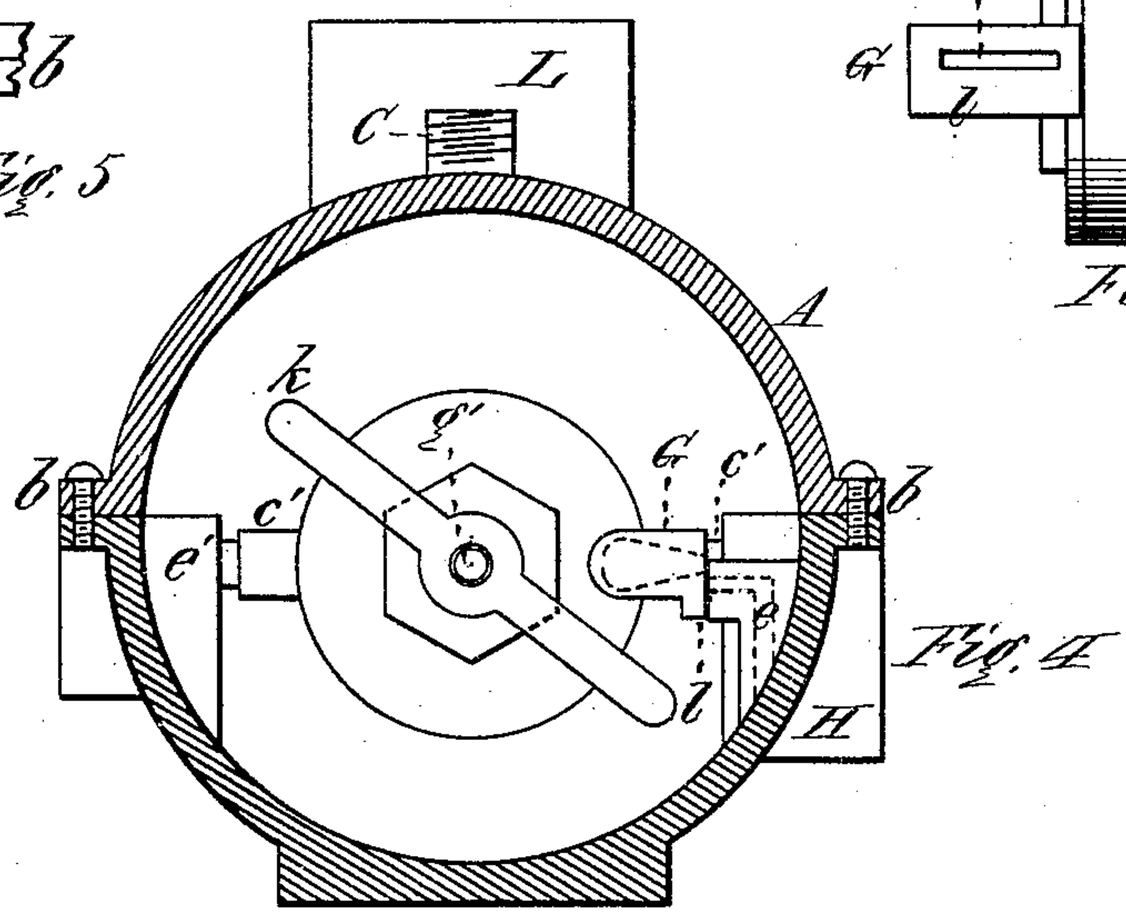

Fig. 4

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UNITED STATES PATENT OFFICE.

THEODORE A. CURTIS, OF SPRINGFIELD, MASSACHUSETTS, AND JONATHAN S. CURTIS, OF HARTFORD, CONNECTICUT.

IMPROVEMENT IN LIQUID-METERS.

Specification forming part of Letters Patent No. **145,096**, dated December 2, 1873; application filed September 25, 1873.

To all whom it may concern:

Be it known that we, THEODORE A. CURTIS, of Springfield, State of Massachusetts, and JONATHAN S. CURTIS, of Hartford, State of Connecticut, have invented an Improved Liquid-Meter, of which the following is a specification:

The object of our invention is to provide a machine for measuring liquid, in which a cylinder is used as the measuring-vessel, which oscillates or tilts upon trunnions, as a support, about midway its length, inside of a case, which, in its transverse section, is cylindrical, or of any form having a curved contour. The tilting cylinder is provided with a suitable valve at each end, having an orifice therein, and each valve fits against a corresponding seat on the inside of the case, also having an orifice therein, both faces of the valves and their seats being on a plane at right angles to the supports or trunnions upon which the tilting cylinder is suspended, and also parallel with the axis of said tilting cylinder; and a water-way extends along the case from the orifice in one valve-seat to the orifice in the other valve-seat. A short rod operates through each end of the tilting cylinder, projecting into the cylinder a short distance; and said rods are connected by means of a connecting-rod extending along the outside of the tilting cylinder, and retaining-latches are arranged at each end of the case inside, which catch over the ends of the projecting rods when either end of the cylinder tilts down, and the cylinder is held in that position until the piston, moving inside the tilting cylinder, strikes against the projecting end of the opposite rod, forcing it out, and, through the medium of the connecting-rod, draws the other rod from beneath the latch.

In the drawings, Figure 1 is a plan view of one part of the cylindrical case, showing a horizontal sectional view of the tilting cylinder arranged to operate within. Fig. 2 is a longitudinal vertical section of the cylindrical case, showing the position of the valve-seats and the ports therein, and the position of the latches. Fig. 3 is a transverse section through the middle of the case and tilting cylinder at line B′. Fig. 4 is a transverse section of the same at line C′, showing an end view of the tilting cylinder. Fig. 5 is a front view of that part of the case in which the tilting cylinder is suspended; and Fig. 6 is a front view of one of the valves, showing the position of the port or orifice.

The tilting cylinder D is substantially similar, so far as relates to its operative mechanism, to that shown in Letters Patent No. 122,759, granted to us January 16, 1872, except that the tube or cylinder, instead of being made of cast-iron, may be made of any suitable sheet non-corrosive metal, with no separate water-way therein, is suspended upon two ordinary journals, *c′*, and the heads may be of cast metal, secured properly to the tube. Each end of the said tilting cylinder is provided with a projection, G, or valve, which, in this case, is cast in the head E, and in this projection is made an orifice or port, *a′*, communicating with the interior of the cylinder; and the faces *s′* of the projections G are planed off parallel with each other and parallel with the axis of the cylinder D, and at right angles with the axes of the trunnions or journals *c′*, or the line of suspension of said cylinder. The ports *a′*, one in each valve G, are made narrow, and somewhat elongated, in order to get the desired water-passage with as little movement of said cylinder D as possible, the form and location of the port in the valve being shown in Fig. 6, which is a front view of the valve.

The case A is preferably of cylindrical form, but may be of any desirable form which, in its transverse section, is of a curved contour, as thereby the two opposite sides of the case are prevented from being forced apart in the least by the great pressure of water within the case when in use, as, the valve being made upon the tilting cylinder, and its corresponding seat or counterpart being made upon the inside of the case, the machine would be practically inoperative and worthless as a correct measuring-machine if the face of the valve G and its seat should move away from each other in the least.

The case A is provided upon the inside with a seat, *v*, at each end opposite the valves G on the cylinder, and each seat is planed off perfectly true and vertical, to fit well the faces of

the valves G; and an orifice, *a*, is made in each valve-seat, as shown in Fig. 2, corresponding in general form and size with the orifices *a'* in the valves G. A water-way is made in the case A, (shown in dotted lines at *e*,) extending from one orifice, *a*, to the other, and an inlet-orifice, I, is made at any convenient point about midway the length of the case, communicating with the water-way *e;* and the latter may be cast in a ledge or projection upon either the inside or outside of the case. The ports *a'* in the valves G, and the ports *a* in the valve-seats *v*, are so arranged that, when one end of the cylinder D is tilted down, the port *a'* in that end of the cylinder is opposite and coincides with the port *a* in its corresponding valve-seat, and the port *a'* in the other end of the cylinder D, which is up, is above its valve-seat, and opens directly into the case, while the lower part, *l*, of the face of the valve G covers the orifice or port *a* in its corresponding seat, and stops the ingress of water through that orifice or port *a*.

A latch, *g*, is secured to the case A inside, which may consist of the piece *g*, pivoted at *x*, with a spring, *x''*, behind it to force it out quickly, and a check-pin, *w*, to limit the outward movement of the piece *g*, and prevent it from moving with the projecting rod *g'*, when drawn from under said piece *g* or the projection thereon; but any convenient arrangement of latch will answer the purpose equally well, as a common ordinary small spring-bolt made to move easily, and secured in place so that the end of the projecting rod *g'* may strike it when moving down, and force it back and be held under the said bolt until drawn out again. The trunnions *c'* are supported in suitable bearings in a piece, *e'*, secured to the inside of the case A, as shown in Fig. 1, and the tilting cylinder D is adjusted to its place, with the faces of the valves G just in contact with the valve-seats *v*, by means of set-screws *i*, one on each side. The cylindrical case A is provided with an egress-orifice, C; and the cylinder D may be adjusted to its proper tilting movement to cause the orifices *a'* and *a* to coincide by means of nuts *o*, upon which the ends of the tilting cylinder strike, which nuts may be turned either in or out; or the said movements may be adjusted or regulated by any other suitable and convenient means.

A hole, *s*, may be provided, if desirable, into which a nut may be turned, or a valve arranged, which may be opened from time to time, as occasion requires, to permit the sediment to be blown out; and the entrance of larger foreign substances or animals, which would interfere with the operation of the machine, may be prevented by a strainer placed over the inlet-orifice I, to which the water-supply pipe is attached.

A pipe is attached at the outlet-orifice C; and one end of the tilting cylinder D being down, and water being admitted at the inlet I, the water passes along the water-way *e*, and through the orifices or ports *a* and *a'*, which coincide, into the lower end of the cylinder, and moves the piston F toward the upper end of said cylinder, and forces the water with which the cylinder may be filled out through the port or orifice *a'* in the valve G, at the other end of the cylinder, into the case A, the lower part *l* of the face covering the port *a*, and preventing the water from entering that end of the case. As the piston reaches the highest end of the cylinder D, it strikes the inner end of the rod *g'*, moving it out, and, by means of the connecting-rod *k*, drawing the outer end of the rod *g'*, at the other end of the cylinder, out from beneath the latch *g*. That end of the cylinder D into which the piston has moved then tilts down quickly by the weight of the piston within, and the water enters that end of the cylinder D through the ports *a* and *a'*, moving the piston F back again, and the water which entered before, out through the same port *a'* at which it entered, into the case A. The case being filled, the water therein and in front of the piston is of the same pressure as that in the supply-pipes, or in the cylinder behind the piston, and any leakage between the faces of the valves G and their seats is prevented.

The valves G may be adjusted up at their seats (both at the same time) by the movement of one set-screw, at one side of the case, while too great friction between the valve-faces and their seats is prevented by the set-screw at the valve side of the case, and the operative parts of the machine, as well as the valve-seats, being made of non-corrosive metal, are always kept lubricated by working in water.

As the valve-seats are made upon the inside of the case, and the valves are made upon the tilting cylinder, it is evident that, to be practical and correct as a measuring-machine, the valve-seats must not move away from the faces of the valves G, but both must always retain the same relative position one with the other. In order to obtain this result, we make the case A of a form the cross-section of which is of a curved contour, such as an ellipse, ove, cylinder, or of a figure composed of a series of compound curves; but we prefer a cylindrical form, as being the simplest and easiest of construction. When the case A is of this shape in its cross-section, the pressure of water upon the inside—often from one hundred and forty to one hundred and fifty pounds per square inch—is the same upon all parts of the surface inside, and the sides of the case are not pressed or forced apart, but every portion of the same keeps its place.

For convenience of construction, the case A is made in two parts, being divided at the horizontal line *m*, and each part provided with a flange, B, through which holes are made and bolts inserted, and both parts bolted together after the tilting cylinder has been put in place; but the case may be divided at any other point equally well without changing the principle of its construction and operation.

Any desirable and convenient arrangement of index may be used, and moved by an arm

attached to any part of the cylinder, or to the latch.

We are aware that a tilting cylinder has been used in a rectangular-shaped case; and we do not claim the same, nor any arrangement of case having a rectangular form; but,

Having described our invention, what we do claim as new is—

1. An oscillating cylinder, D, which operates as the measuring-vessel, and provided with valves G having a port, *a'*, therein, (one at each end,) the faces of which valves are parallel with the axis of the cylinder, and at right angles to the axis of its support, operating in connection with the valve-seats *v*, provided with an orifice or port, *a*, all substantially as described.

2. The tilting cylinder D, supported on trunnions *c'*, and provided with valves G, (one at each end,) both the faces of which are adjusted to their proper bearing against the valve-seats *v*, at the same time, by a set-screw, *i*, substantially as described.

3. An oscillating cylinder, which serves as the measuring-vessel, operating within and in combination with a case or inclosing-vessel of a curved or cylindrical form in its cross-section, substantially as described.

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