2 Sheets--Sheet 1.

B. HUBER.

Fluid-Meters.

No. 154,486. Patented Aug. 25, 1874.

Fig. 6.

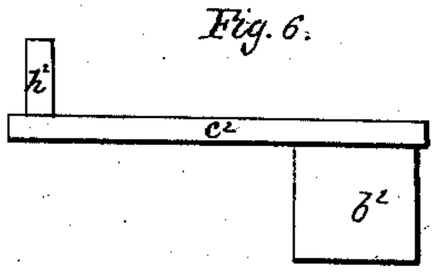


Fig. 5.

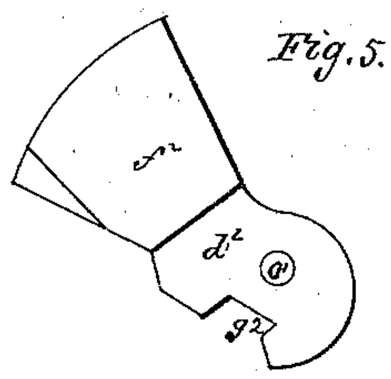


Fig. 2.

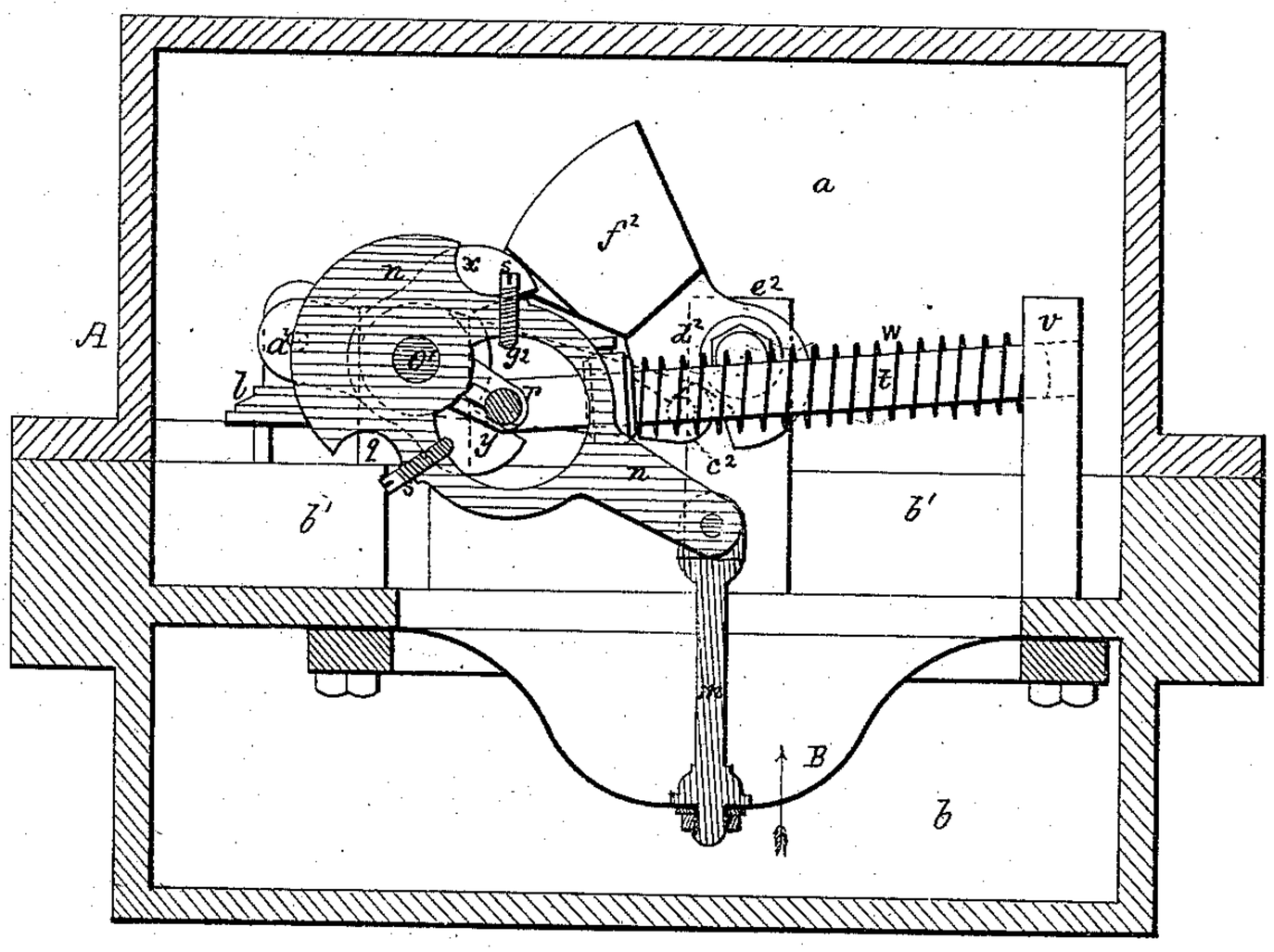
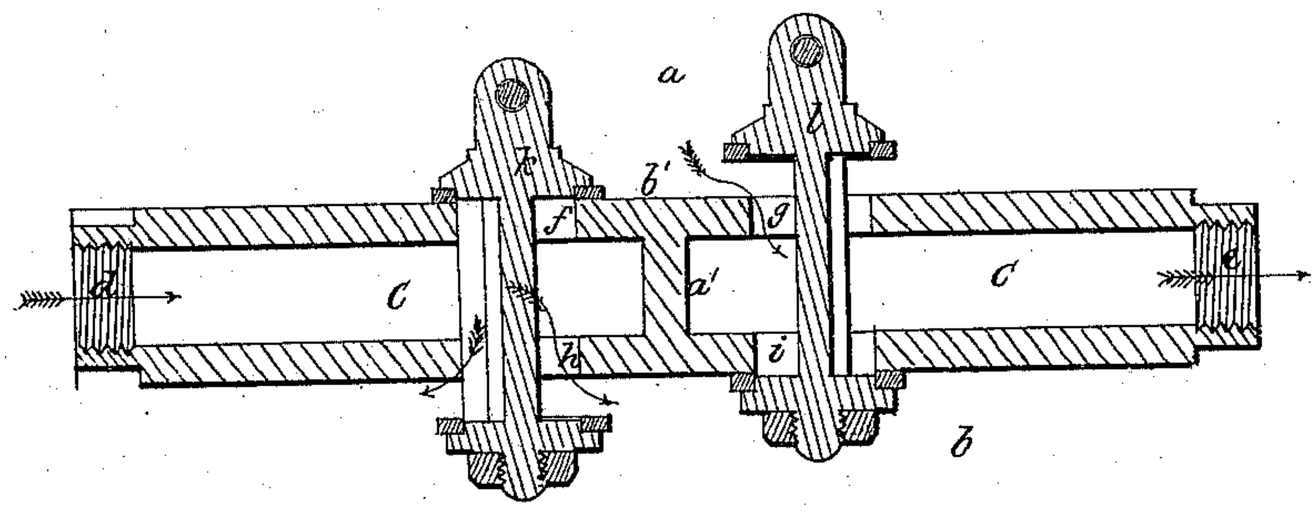


Fig. 3.



WITNESSES.

Francis E. Tatsin.

W. E. Boardman

Berthold Huber.

F. Curtis. Atty.

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

2 Sheets--Sheet 2.

B. HUBER.

Fluid-Meters.

No. 154,486. Patented Aug. 25, 1874.

Fig. 1.

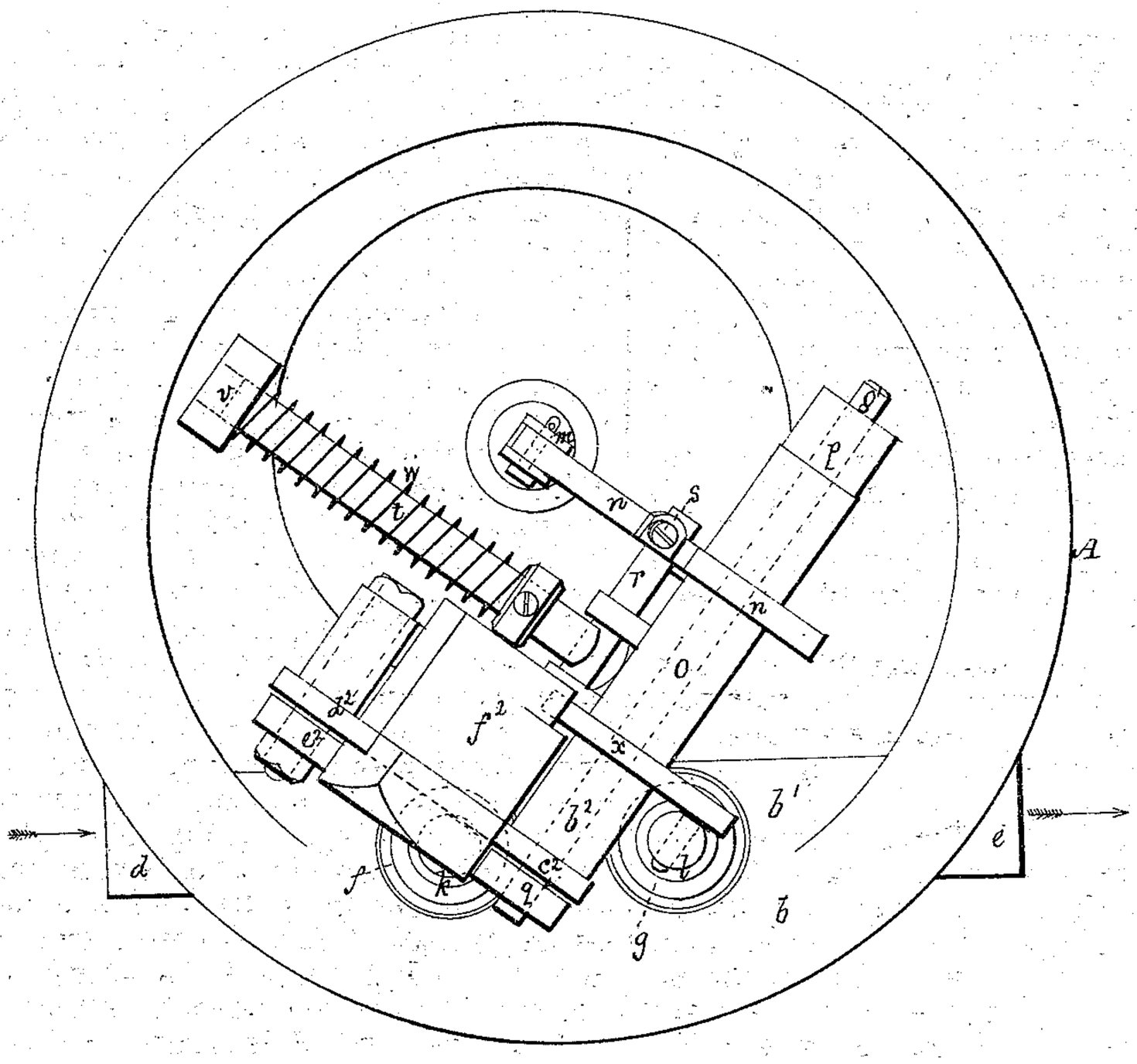
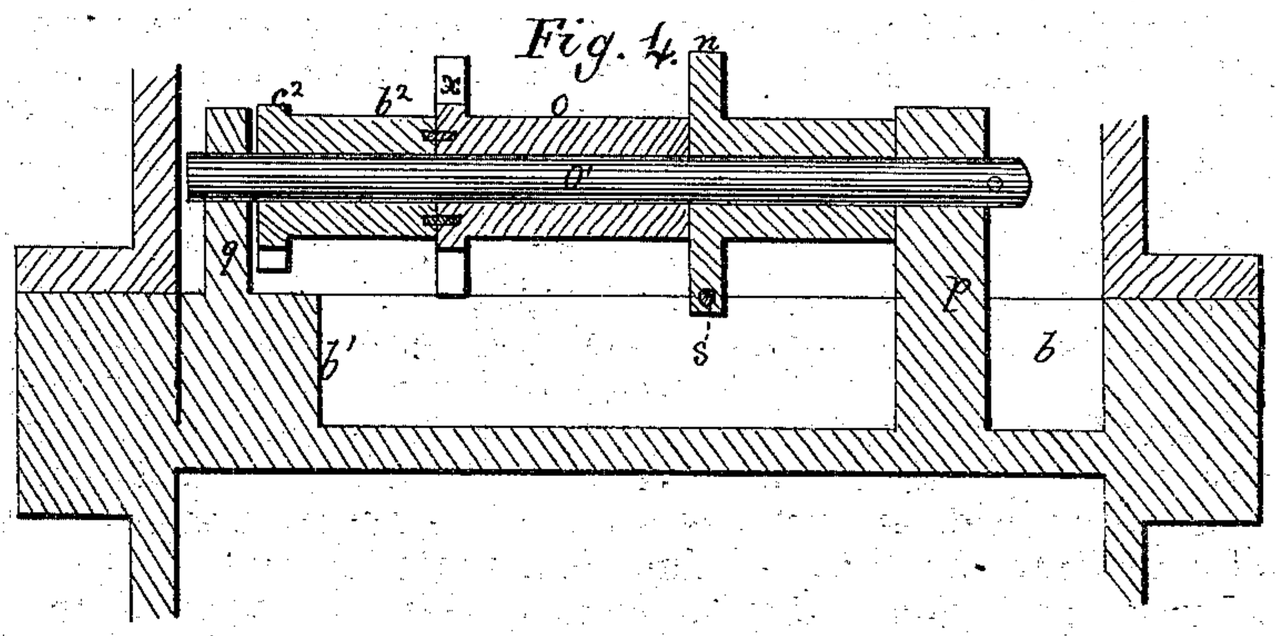


Fig. 4.



WITNESSES.

Francis E. Stafford.
W. C. Boardman.

Berthold Huber.
F. Curtis. Atty.

UNITED STATES PATENT OFFICE.

BERTHOLD HUBER, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO HIMSELF AND FRANCIS MEISEL, OF SAME PLACE.

IMPROVEMENT IN FLUID-METERS.

Specification forming part of Letters Patent No. **154,486**, dated August 25, 1874; application filed July 6, 1874.

To all whom it may concern:

Be it known that I, BERTHOLD HUBER, of Boston, Suffolk county, Massachusetts, have invented an Instrument for Measuring Fluids, of which the following is a specification:

These improvements relate to diaphragm-meters, so called, or those in which a vessel or case is divided into two chambers by an elastic or flexible diaphragm, which latter is distended in alternating directions by the flow of water through the instrument, and serves to shift the valves and operate the indicator, the water displaced from one chamber by the advance of the diaphragm being replaced in the other to an equal extent, so that such diaphragm is at all times completely submerged in the water and subjected to like pressure upon both sides.

The drawings accompanying this specification represent, in Figure 1, a plan, with part of the case removed; in Fig. 2, a vertical section of the whole instrument; in Fig. 3, a section of the valves; in Fig. 4, a section of the actuating levers; and in Fig. 5, a view of the sectoral plate, to be hereinafter explained.

In these drawings, A represents a hollow closed cylinder, of equal diameter throughout, which constitutes the case or shell of the instrument, and which serves to contain the valve mechanism, and forms the measuring-chamber. The case A is divided centrally, or nearly so, by an elastic or flexible pulsating diaphragm, B, which is inclosed or clamped between the two halves *a b* of the case, this diaphragm serving at once to seal the joint between the two, and to impart to the valves the motion of the water escaping from such case alternately upon opposite sides of such diaphragm. Upon one side or half, *b*, of the case A I cast a boss, b^1, and through this boss I create a passage or conduit, C, divided by a central partition, a^1, whose two ends are outside of such case, and constitute one—viz., *d* the water-inlet or induction-port, and *e* the water-outlet or eduction-port—while midway of such boss I create four orifices, *f g h i*, two of which—viz., *f g*—communicate freely with the chambers *a* of the instrument, and the other two—viz., *h i*—with the chamber *b*. Upon the outer surface of the boss b^1, and about each orifice, I create a valve-seat; and to each pair *f h* and *g i* of ports I apply a double puppet-valve, *k* or *l*, each valve closing alternately the two ports with which it operates, it being observed that, while the port *f* is closed and the port *h* open, the port *g* is open and port *i* closed, and vice versa. In the present instance the valve-operating mechanism is located in the chamber *a*, and consists as follows: To one side of the diaphragm B, and centrally thereof, I attach one end of a rod, *m*, the opposite end of which is pivoted to the inner end of a lever, *n*, which, in turn, is pivoted at its opposite end upon a horizontal rod, *o'*, supported within standards *p p* erected within the chamber, the lever *n* straddling a radial arm, *r*, making part of a tubular rock-shaft, *o*, mounted upon the said rod *o'*, and being provided with set-screws *s s* to operate with this arm, in such manner as to adjust the relative positions of the lever and shaft and of the diaphragm with respect to the valves *k* and *l*. Immediately alongside of the rod *m* I dispose a bar, *t*, one end of which slides freely within a bearing, *v*, and the other end is connected, in a suitable manner, with the arm *r*, a spring, *w*, being coiled about the bar, and serving to force it toward and actuate the arm and rock the shaft *o*, as hereinafter explained. I furthermore mount loosely upon the rod or support *o'* a second lever, *x*, one end, *y*, of which bears upon the arm *r*, and the other end, a^2, is pivoted to the stem of the valve *l*, while to the hub b^2 of such lever *x* I secure an arm or second lever, c^2, the free end of which operates in connection with a sectoral plate, d^2, placed near it, and pivoted upon a post, e^2, erected within the chamber *a* and near to the valve *k*, as shown in Fig. 1 of the drawing. The plate d^2 is overweighted by a weight, f^2, applied to its upper end, and is formed with a notch, g^2, of a width somewhat greater than the diameter of the stud h^2 of the lever c^2, with which it operates, the two sides of this notch serving, at alternating periods of time, to actuate the said lever, as hereinafter explained, while the stem of the valve *k* is pivoted to the lever c^2 at about the center of the latter.

The two chambers *a b* are at all times full of water, such water entering the port *d*, and being finally discharged at the educt *e*. Each pulsation of the diaphragm displaces a given amount of water, which escapes by the said educt *e;* and a suitable register is to be added to the meter, and connected in a proper

manner with the rock-shaft, to indicate the number of pulsations of the diaphragm B, and, consequently, of the quantity of water discharged at each pulsation.

The operation of this instrument or meter is as follows: Taking as a starting-point the position of parts shown in the drawings, in which the diagonally-disposed ports *f* and *i* are closed and *g* and *h* open, the lever c^2 depressed and the weight f^2 bearing upon it, while the diaphragm is distended within the chamber *b*, and the arm *r* of the rock-shaft *o* at its lowest point and at some distance from the upper set-screw *s;* water begins to flow under a suitable head from chamber *a*, through the port *g*, into the conduit C, and escape from the latter by the educt *e*, while simultaneously with such flow water enters the chamber *b* through the port *h*. This circulation or flow of water of necessity drives the diaphragm toward the chamber *a*, and continues until such diaphragm is distended, and passes into such chamber to its extreme limit, the lever *n* being elevated by the diaphragm, and serving, by means of the arm *r*, to rock the shaft *o*, and, consequently, elevate the idle end of the bar *t*, and compress the spring *w*. This movement of the diaphragm B, lever *n*, and rock-shaft *o* continues, with the movement of the other parts of the mechanism, until the extreme limit of such diaphragm in this direction is reached, and the arm *r* passes beyond a mean line drawn through the centers of the rod *o'*, arm *r*, and bar *t*, when the pressure of the spring suddenly throws the said arm *r* upward, and completes the partial rotation of such shaft, and by means of the lever elevates the free end of the lever c^2 and raises the valve *k*, and at the same time tilts the sectoral plate d^2, and throws the weight from off such lever, the lower side of the notch g^2 of such plate d^2 bearing against the stud of the lever. By the sudden throw of the bar *t*, and the consequent elevation of the arm *r* and partial rotation of the shaft *o*, the said arm *r* depresses the outer end of the lever *x*, and lowers the valve *l*. The ports *f* and *i* are now open, and ports *g* and *h* closed; consequently water begins to flow from chamber *b* into conduit C through port *i*, and to enter chamber *a* through port *f*, while the diaphragm retraces its movement, and by the flow of water is forced toward and into the chamber *b* until its extreme limit in this direction is reached, when, by the action of the bar *t* and spring *w*, the shaft *o* is rocked in an opposite direction, the levers *x* and c^2 tilted until the valve *k* is lowered, and the valve *l* raised, the weight f^2 shifted and allowed to bear upon the said lever c^2, and the parts returned to the position assumed at the start.

As each distension of the diaphragm displaces an equal quantity of water, and as every distension is registered by the indicator, the amount of water passing through the instrument is accurately noted.

The meter may be adapted with equal facility to register by feet and inches, or by gallons and fractions of gallons, and operates with equal accuracy and certainty under any pressure or any volume of water. I have striven in devising this meter to avoid the objectionable feature of a dead-center in the shifting of the valves, and careful reference to the accompanying drawings will show that I attain my object, as it will be seen that owing to the arrangement of the rocker arm or lever *n* and rock-shaft *o*, in connection with the diaphragm B, that the movement of the latter is not confined to any specific point, but is free to travel, after the spring has effected the shifting of the valves, according to the position of the screws *s s*, or at least would do so did the valves permit it, and it will be seen that by this arrangement the diaphragm must move until the valves are reversed.

The only power to be overcome, and, consequently, the only pressure taken from the water, is what is requisite to compress the spring *w*, and shift the position of the weight, and to overcome the friction upon the bearings.

The spring may be quite light, and, as the weight is not acted upon until the lever c^2 has acquired considerable momentum, the loss of pressure is small.

The purpose of the weight is to maintain the valves in their proper positions during the transit of the diaphragm and the rocking of the lever *n* and shaft *o*, as, but for such weight or its equivalent, the valves at such times would be without control, and inoperative to a certain extent.

By the employment of puppet-valves, which I provide with elastic faces, I avoid the very serious objections existing in the use of slides valves, such as rapid wear and breakage from the presence of sand or abrading substances in the water, friction between the valve and its seat, &c.

My meter may be made neat in appearance, and compact in form, and produced at small expense, as it is mostly cast directly into the shaft, and requires but little fitting.

I claim—

1. The lever *n*, in combination with the arm *m*, and levers *x* and c^2, and the diaphragm and valves, substantially as herein described, whereby a dead center or point is avoided, essentially as and for purposes stated.

2. In combination with the pulsating diaphragm, lever *n*, arm *m*, and levers *x* and c^2, the arm *r*, and rod and spring *t w*, as and for the purposes set forth.

3. The weighted plate d^2 and rod and spring *t w*, in combination with the diaphragm-valves and system of levers *m n x* c^2, as and for the purposes shown and set forth.

BERTHOLD HUBER.

Witnesses:

F. CURTIS,

W. E. BOARDMAN.