2 Sheets—Sheet 1.

H. CHANDLER.

Piston Water-Meters.

No. 199,351. **Patented Jan. 22, 1878.**

Fig. 1.

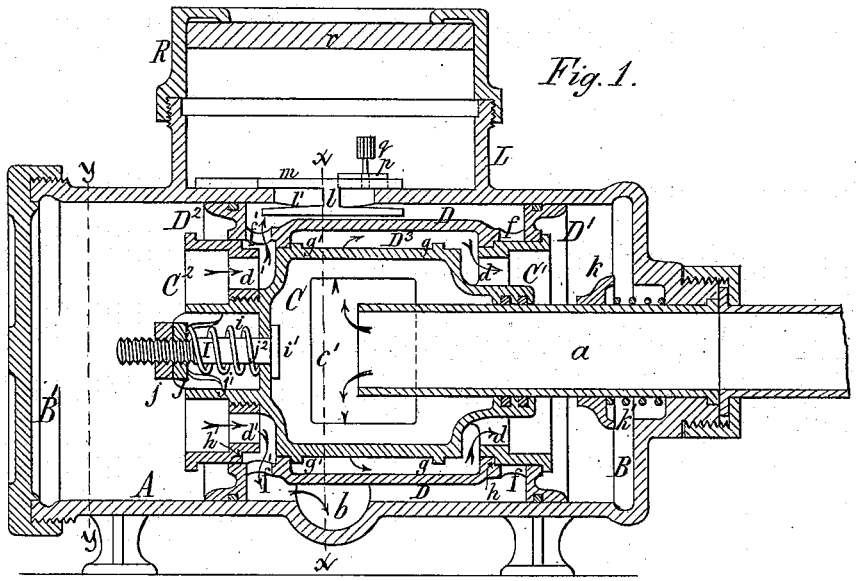


Fig. 2.

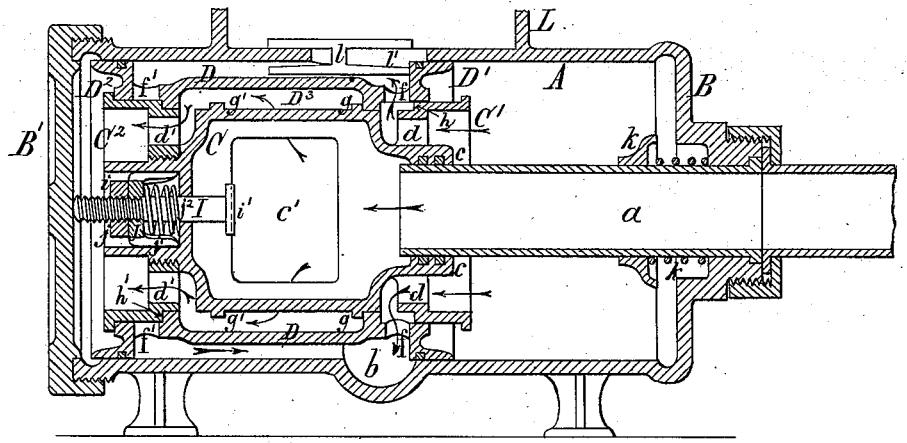
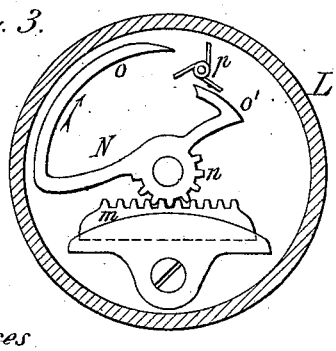


Fig. 3.



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2 Sheets—Sheet 2.

H. CHANDLER.

Piston Water-Meters.

No. 199,351. **Patented Jan. 22, 1878.**

Fig. 4.

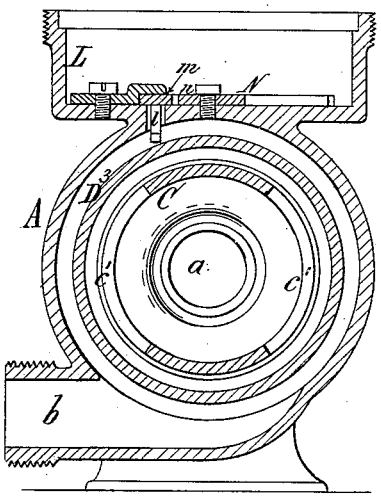


Fig. 5.

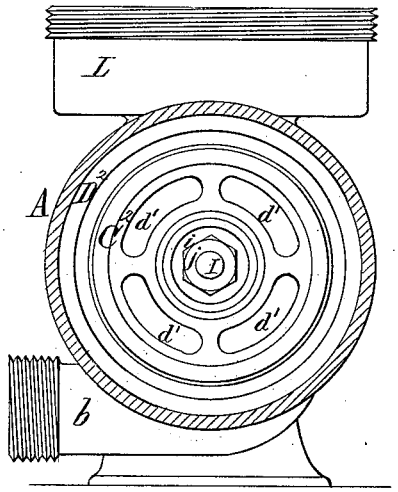
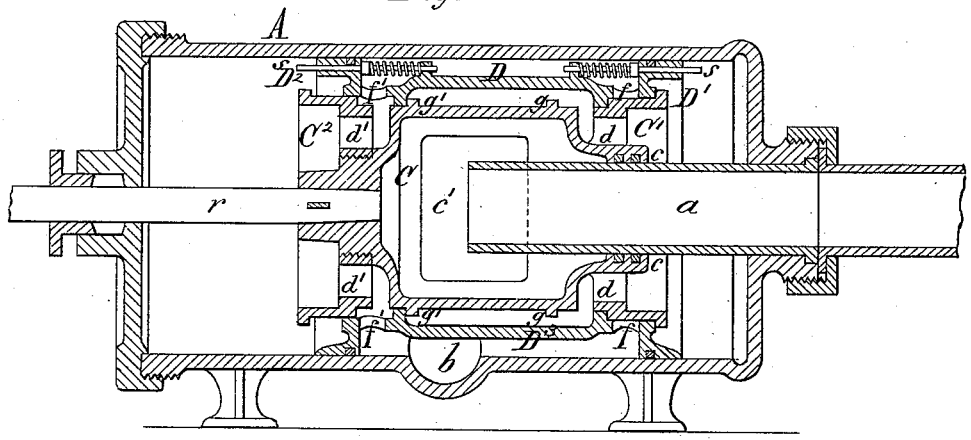


Fig. 6.



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UNITED STATES PATENT OFFICE.

HENRY CHANDLER, OF BUFFALO, NEW YORK, ASSIGNOR TO GEORGE C. STEARNS, OF SAME PLACE.

IMPROVEMENT IN PISTON WATER-METERS.

Specification forming part of Letters Patent No. **199,351**, dated January 22, 1878; application filed May 23, 1877.

To all whom it may concern:

Be it known that I, HENRY CHANDLER, of the city of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Liquid-Meters, which improvements are fully set forth in the following specification, reference being had to the accompanying drawings.

My invention relates more particularly to that class of liquid-meters in which the water enters the measuring-cylinder through an axial induction-pipe, and escapes therefrom through an eduction-spout in the side of the cylinder, and in which the passage of the water through the cylinder is regulated by a hollow piston provided with a hollow valve, the piston being connected with a suitable registering mechanism for recording the number of strokes of the piston.

Letters Patent of the United States dated, respectively, September 19, 1871, and May 14, 1872, and numbered, respectively, 119,076 and 126,623, were granted to me for improvements in meters of this class, and reference is here made to the said Letters Patent for a full description of said apparatus.

My present improvement relates, first, to the construction of the hollow piston and valve; second, to the means for reversing the valve; and, third, to the means for connecting the piston with the registering mechanism.

The nature of my invention will be fully understood from the following description.

In the accompanying drawings, consisting of two sheets, Figure 1 is a longitudinal section of my improved liquid-meter. Fig. 2 is a similar view, showing the piston at the end of its stroke and the valve reversed. Fig. 3 is a top-plan view of the mechanism connecting the piston with the registering apparatus. Figs. 4 and 5 are cross-sections, respectively, in lines *x x* and *y y*, Fig. 1. Fig. 6 is a longitudinal section, showing my improved apparatus in a modified form, so as to serve as a motor.

Like letters of reference designate like parts in each of the figures.

A represents the measuring-cylinder, provided with two heads or bonnets, B B′, which latter are tightly secured to the ends of the cylinder in any suitable manner. *a* is the axial induction-pipe, and *b* the eduction-spout, arranged in the side of the cylinder centrally between the heads B B′. C is the hollow valve, provided at one end with a hub, *c*, sliding on the induction-pipe *a*, and D the hollow piston surrounding the valve C, and made capable of longitudinal movement thereon. The hollow valve C is provided in its side with one or more openings, *c′*, through which the water passes into the space between the valve and the piston. C^1 C^2 are two enlarged hubs, formed with or secured to the ends of the hollow valve C, and provided with openings or ports *d d′*, penetrating the hubs, and opening at the circumference of the valve. The piston D is composed of two annular heads, D^1 D^2, sliding upon the hubs C^1 C^2, and a connecting hollow shell, D^3, surrounding the body of the valve, and leaving an annular space between the hollow shell and the cylinder A. The piston D is provided with ports *f f′* arranged adjacent to the heads D^1 D^2, so as to coincide alternately with the ports *d d′* of the valve. The latter is provided with two rings or annular ribs, *g g′*, for limiting the inward movement of the valve, and the hubs C^1 C^2 are provided, respectively, with shoulders *h h′*, for arresting the outward movement of the valve. I is the reversing pin or bolt, arranged axially in the end of the valve opposite the induction-pipe, and *i* a cylindrical socket or recess surrounding the bolt I. The outer end of the latter is provided with a screw-thread and a nut, *j*, bearing against a washer, J, which has several arms or prongs, j^1, arranged within the socket *i*, so as to project inwardly, while the inner end of the bolt I is provided with a head, *i′*, bearing against the inner side of the valve.

j^2 is a spiral spring, arranged around the bolt I between the washer J and the end of the valve, as clearly shown in the drawings. *k* represents a collar sliding upon the induction-pipe *a*, and *k′* a spiral spring placed between the collar and the cylinder-head B. L is a casing, cast with the cylinder A, for the reception of the registering mechanism. *l* represents a flat I-shaped bar, arranged with its lower horizontal portion in the cylinder A be-

tween the heads D^1 D^2, while its vertical web extends through a longitudinal slot, *l'*, in the cylinder into the casing L, in which is arranged the upper horizontal portion of the I-bar, which is provided with a gear-rack, *m*, as shown in Figs. 3 and 4. N is a vibrating anchor, arranged on the bottom of the case L, and provided with a gear-segment, *n*, meshing with the rack *m*. The anchor N is provided with a long pallet, *o*, and a short pallet, *o'*, both arranged concentric with the fulcrum of the lever. *p* is the escape-wheel, provided with three teeth or arms, and arranged between the two pallets *o o'* of the anchor, so that the long pallet *o* vibrates outside of the spindle of the wheel *p*, while the short pallet vibrates inside thereof. *q* is a gear-wheel mounted on the spindle of the escape-wheel *p*, for transmitting the movement thereof to a suitable recording mechanism arranged in the case L. The latter is tightly closed by a glass plate, *r*, and cover R.

The operation of my improved apparatus is as follows: The water enters the measuring-cylinder through the pipe *a*, and passes into the interior of the valve C, whence it passes into the space between the valve and the piston through the openings *c'*. The piston being in the position shown in Fig. 1, the water passes through the ports *d*, and fills the space between the head B and the piston, forcing the latter and the valve toward the opposite end of the cylinder. The water contained in the space between the head B' and the piston is forced, through the ports *d'* of the valve and *f'* of the piston, into the space between the shell D^3 and the cylinder, whence it is discharged through the spout *b*. When the piston arrives near the head B', the end of the bolt I comes in contact with the latter, thereby stopping the further movement of the bolt I and washer J. As the piston and valve continue in their movement the spring j^2 is compressed until the end of the valve strikes the prongs j^1 of the washer J, when the movement of the valve is stopped, while the piston continues its movement toward the head B', sliding on the valve until the ports *f* of the piston are made to coincide with the ports *d* of the valve, and a communication is opened through the ports *d'* with the interior of the shell D^3, when the shell D^3 strikes against the rib *g* and shoulder *h'*, whereby the movement of the piston is arrested. The relative position of the valve and piston is now reversed, as shown in Fig. 2, and the water entering through the pipe *a* flows through the ports *d'* into the space between the head B' and the piston, while the water contained in the opposite portion of the cylinder escapes through the ports *d* to the discharge-pipe *b*, as indicated by arrows in Fig. 2.

By changing the position of the washer J on the bolt I, the stroke of the piston can be increased or lessened, as may be desired.

As the piston and valve approach the head B of the cylinder the hub *c* of the valve strikes the collar *k*, compressing the spring *k'* until the collar comes in contact with the head B, when the movement of the valve is arrested, while the piston moves on until the relative position of the valve and piston is reversed, when the movement of both in the opposite direction commences.

The springs j^2 and *k* render the reversing of the valve less abrupt or more gradual; but, if desired, the hubs of the valve may strike directly against the cylinder-heads for reversing the position of the parts.

As the hollow piston reciprocates the head D^1 thereof strikes the lower portion of the arm *l* and moves the same forward, which movement is transmitted by the rack *m* to the segment *n*, whereby the anchor N is swung in the direction of the arrow in Fig. 3, so as to strike with its long pallet *o* one of the teeth of the escape-wheel *p*, moving the same forward one space, the short pallet *o'* releasing the escape-wheel as soon as the long pallet engages therewith. During the return-stroke of the piston the rack *m* is moved in the opposite direction, whereby the anchor is returned to its former position, the long pallet locking the escape-wheel against retrograde movement during the first portion of the return movement of the anchor, and the short pallet locking the escape-wheel during the remainder of the movement.

In this manner the escape-wheel is moved forward one notch or space for every double stroke of the piston, and the number of strokes is readily recorded by any suitable registering mechanism connected with the escape-wheel.

By providing the hub C^2 of the valve with a piston-rod, *r*, and providing each of the piston-heads D^1 D^2 with a reversing-bolt, *s*, as shown in Fig. 6, the apparatus can be used as a motor, employing steam or water power.

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

1. The combination, with a cylinder, A, having an axial induction-pipe, *a*, and central discharge-pipe *b*, of the hollow valve C, sliding on the induction-pipe, and hollow piston D, surrounding the valve C, and made capable of longitudinal movement thereon, for reversing the parts, substantially as and for the purpose hereinbefore set forth.

2. The combination, with a cylinder, A, having an axial induction-pipe, *a*, and central discharge-pipe *b*, of the hollow valve C, provided with openings *c'* and ports *d d'*, and surrounding piston D^1 D^2 D^3, provided with ports *f f'*, substantially as and for the purpose hereinbefore set forth.

3. The combination, with the hollow piston D^1 D^2 D^3, of the hollow valve C, provided with rings *g g'* and shoulders *h h'*, for limiting the movement of the piston on the valve, substantially as hereinbefore set forth.

4. The combination, with the cylinder A, piston D, and hollow valve C, of the reversing-bolt I, provided with adjustable washer J

and spring j^2, all arranged as shown and described, for the purpose set forth.

5. The combination, with the cylinder A, induction-pipe *a*, hollow valve C, and piston D, of the collar *k*, sliding on the pipe *a*, and spring *k'*, interposed between the collar *k* and head B, substantially as and for the purpose hereinbefore set forth.

6. The combination, with a liquid-meter, of the bar *l* and anchor N, having a long pallet, *o*, and short pallet *o'*, for actuating the escape-wheel *p*, substantially as and for the purpose hereinbefore set forth.

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CHAS. J. BUCHHEIT.