4 Sheets—Sheet 1.

J. H. COOMBS.

Water-Meter.

No. 221,783. Patented Nov. 18, 1879.

Fig: 1

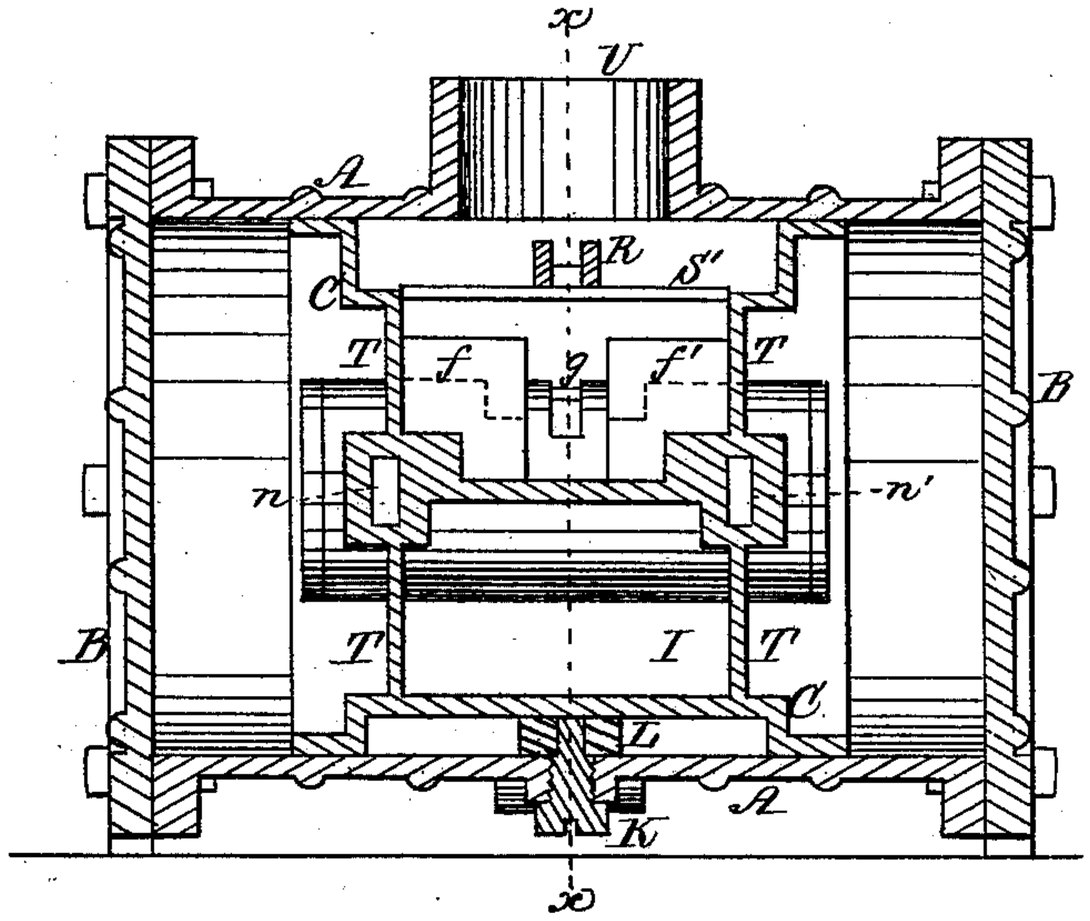


Fig: 2

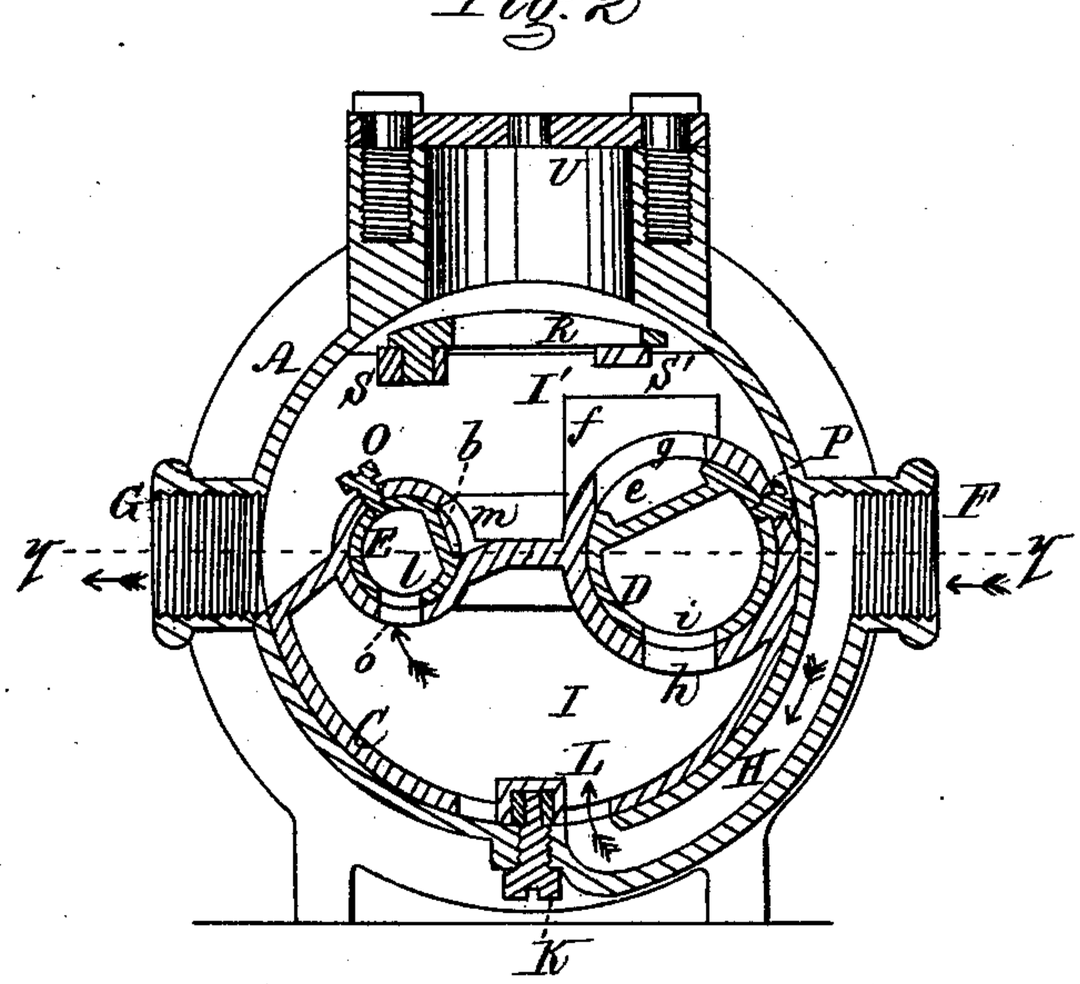
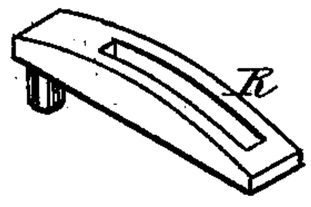


Fig: 7



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4 Sheets—Sheet 2.

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Fig. 3

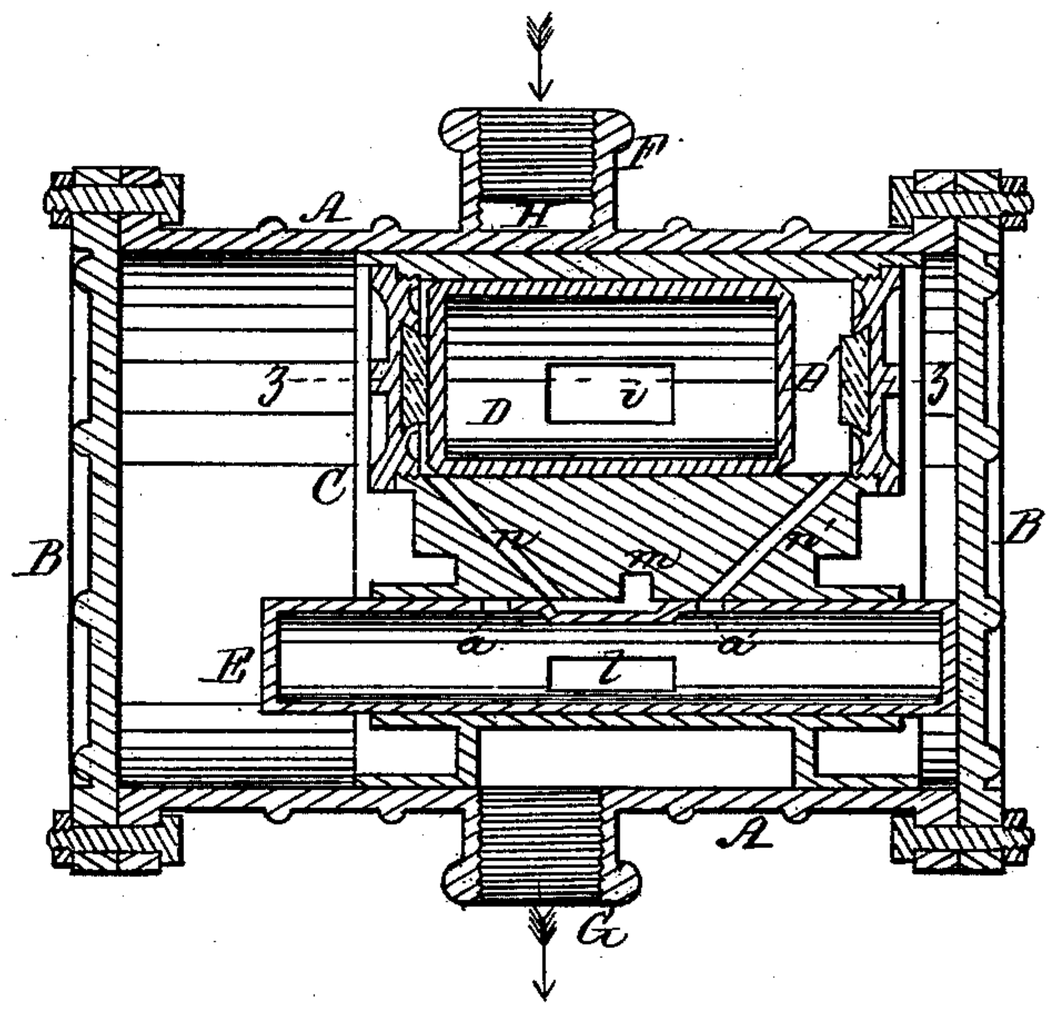

Fig. 4

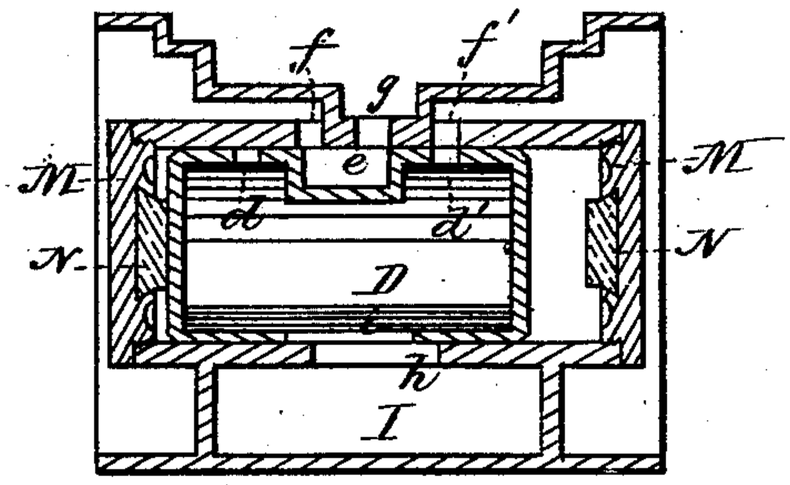

Fig. 5

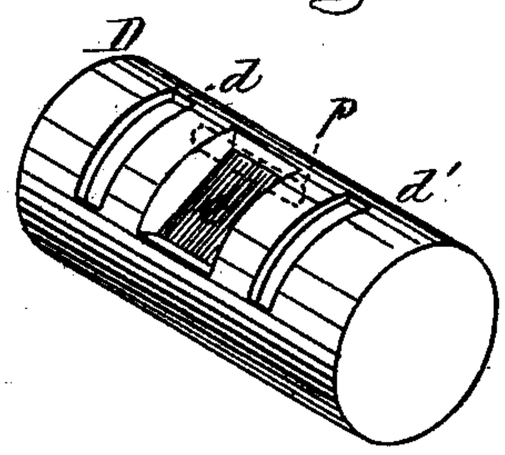

Fig. 6

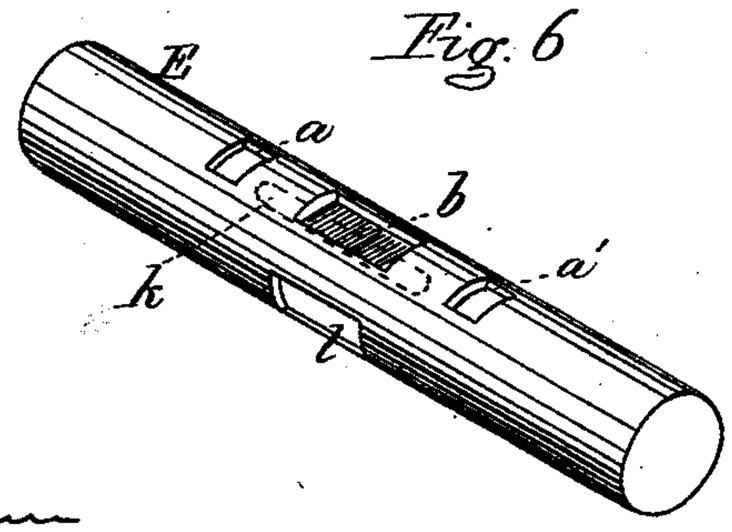

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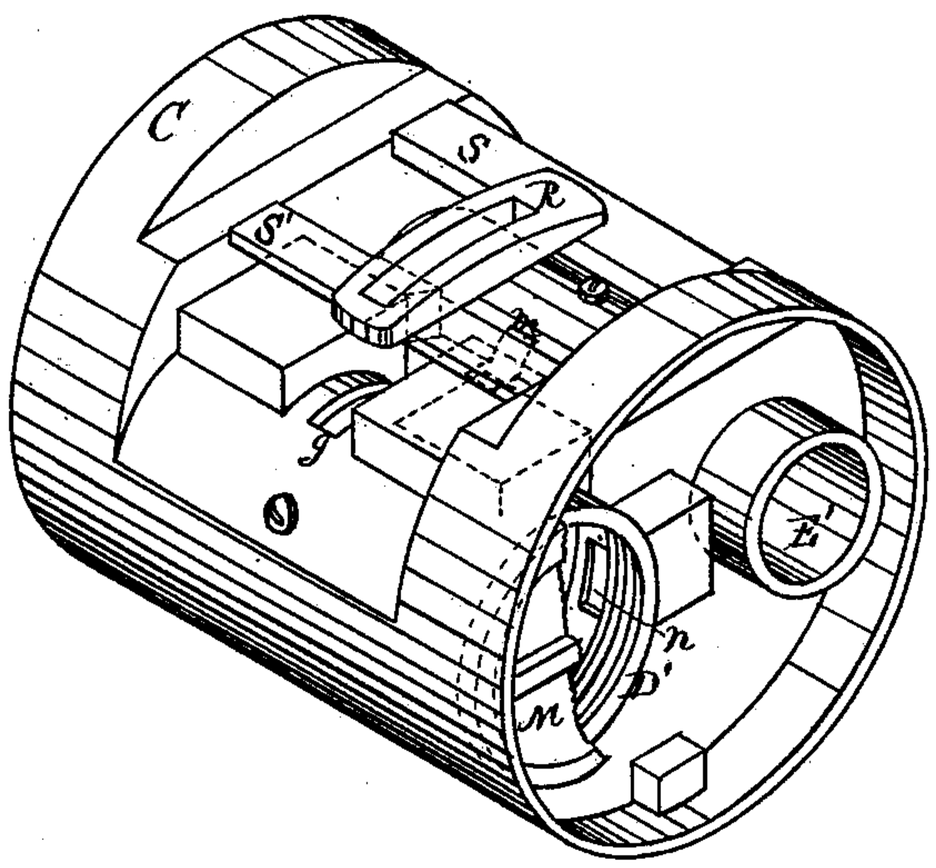
Fig. 8.



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Water-Meter.

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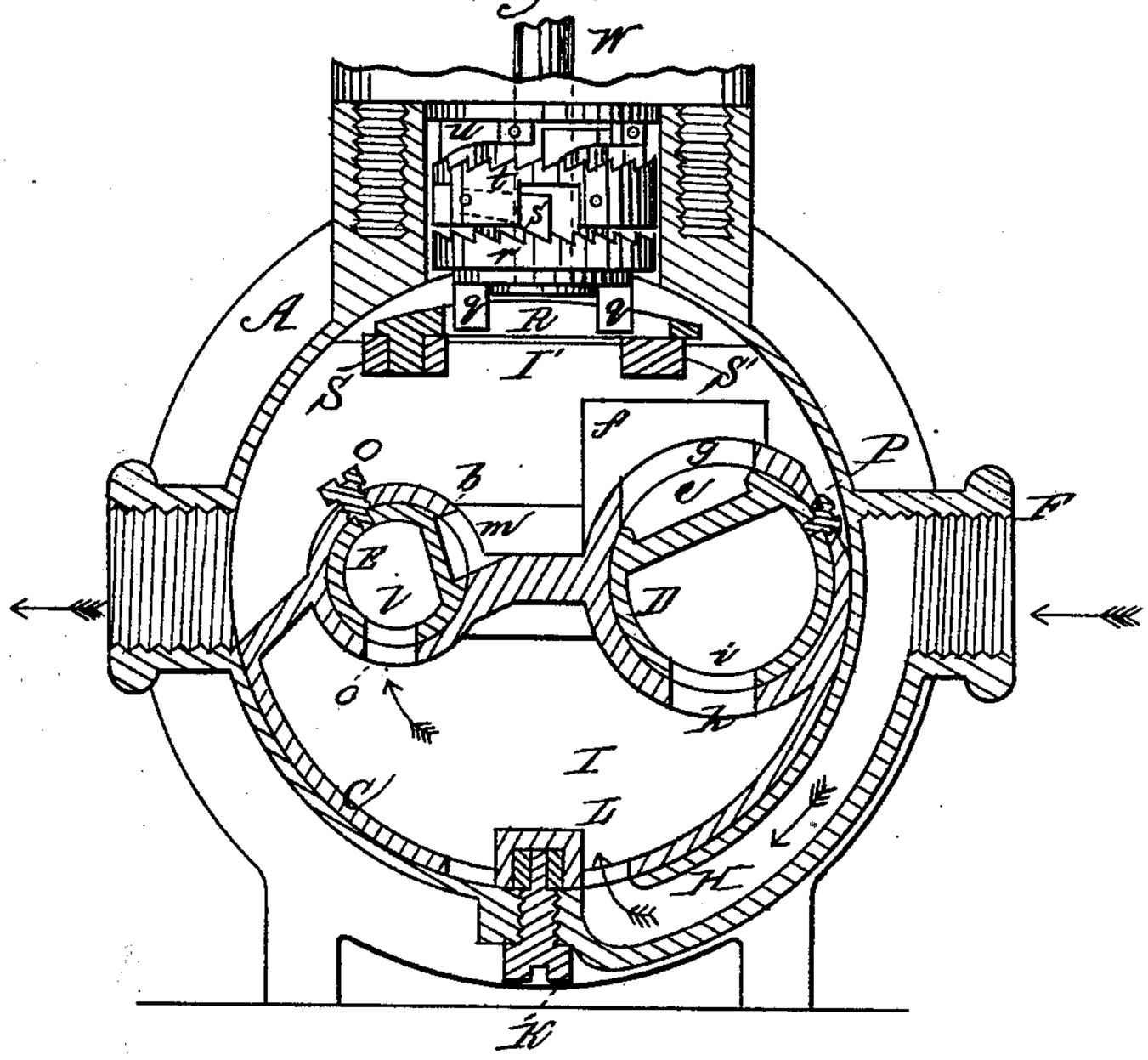
Fig. 9.



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UNITED STATES PATENT OFFICE.

JOHN H. COOMBS, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN WATER-METERS.

Specification forming part of Letters Patent No. **221,783,** dated November 18, 1879; application filed June 25, 1879.

To all whom it may concern:

Be it known that I, JOHN HENRY COOMBS, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Water-Meters, of which the following is a specification.

The object of my invention is to produce a water-meter in which the reciprocating piston and valves shall operate without any appreciable friction, thus obviating the liability to wear, and consequently avoiding leakage and insuring correct action.

The invention consists in so constructing and arranging the piston and valves that they shall be equilibriously balanced within their several shells or casings.

The invention also consists in the employment, within one and the same piston, of two separate and independent cylindrical hollow valves, provided with ports communicating with passages in the piston, in such a manner that the said valves shall reciprocate intermittingly in the same direction with each other, the one being moved by the pressure of the water acting alternately on its ends, and the other by impact of its ends against the heads of the meter.

The invention further consists of a slotted arm pivoted at one end to the piston on its upper side, so that as the latter reciprocates it will cause the said arm to operate the registering mechanism.

Referring to the drawings, Figure 1 represents a longitudinal vertical section of a water-meter embodying my invention. Fig. 2 is a transverse vertical section on the line *x x* of Fig. 1. Fig. 3 is a horizontal longitudinal section on the line *y y* of Fig. 2. Fig. 4 is a horizontal vertical section of the piston and main valve on line *z z* of Fig. 3. Fig. 5 is a perspective view of the main valve. Fig. 6 is a perspective view of the auxiliary valve. Fig. 7 is a view of the pivoted arm for operating the registering mechanism. Fig. 8 is a perspective view of the piston. Fig. 9 represents the device for actuating the registering mechanism.

Similar letters in the several figures indicate like parts.

A represents the outer shell or cylindrical casing of the meter, to which the heads B B are suitably connected by means of bolts and nuts, in the usual manner.

The shell A is to be made of iron or brass, or of iron covered with a coating of brass, the latter making a cheap and durable casing.

H is a channel or passage forming a part of and cast with the shell A, and leads from the inlet-opening F to the piston-chamber I, as shown in Fig. 2.

C is the piston, fitting within the shell A, so as to allow a free reciprocating movement in the same.

The piston is prevented from a rotary movement by means of a screw, K, the inner end of which is fitted in a block, L, that slides in a groove in the bottom of the piston.

The piston C, with its ports and passages, including the tubular casings for the main and auxiliary valves, is cast in one piece.

In the piston C are two separate chambers, the lower one, I, being the inlet and the upper, I′, the outlet chamber.

The area of the inlet-opening L in piston C is greater than the combined areas of the outlet-ports *g* and *m* in the valves E and F, through which the water passes into the chamber I, and consequently the excess of pressure of the water on the upper portion or partition of the chamber I serves to balance the piston and relieve it of friction on the bottom of the shell or casing in which it reciprocates.

Within the piston C, arranged to move longitudinally in suitable casings or chambers D′ E′, are two cylindrical hollow valves, D E. (Shown separately in Figs. 5 and 6.)

D is the main valve, and the casing or chamber D′, in which it moves, has a head, M, screwed to or secured at each end.

The two valves D E are prevented from turning in their casings or chambers by means of screws O P, passing through the said chambers and fitting in slots in the said valves.

The main valve D, as seen in Fig. 5, is provided with two transverse outlet-ports, *d d′*, and a central depression, *e*, which latter communicates with the exhaust-port *g* in piston C.

In the bottom of the main valve D is an opening constituting an inlet-port, *i*, communicating with the opening *h* in piston C, as shown in Figs. 2 and 4.

The chamber D′, in which the main valve D moves, is provided with heads M M, screwed to or secured at each end, and to the inner side of each head is attached a rubber cushion, N, as shown.

The auxiliary valve E in chamber E′, as seen in Fig. 6, is provided with two transverse outlet-ports, *a a′*, and an intermediate depression, *b*, communicating with the exhaust-port *m* in piston C, as shown in Fig. 2.

In the bottom of valve E is an inlet-port, *l*, communicating with an opening, *o*, in piston C, Fig. 2.

The auxiliary valve E is larger than the chamber in which it moves, and is closed at each end, so that as the piston reciprocates the ends of valve E will alternately strike on the heads B B of the shell.

The areas of the inlet-openings *i l*, respectively, in the bottoms of the valves D and E are greater than the combined areas of their respective outlet-ports *d d′* and *a a′*, so that, as in the case of the piston C, the excess of pressure of the water serves to balance the said valves, and thus relieve them of friction on the bottoms of their respective chambers.

In the center of the piston, and between the two valve-chambers of the valves D and E, are two passages, *n n′*, communicating from the auxiliary to the main valve chamber, as shown in Fig. 3.

Over the main-valve chamber D′, and forming a part of the same, are two passages, *f f*, having ports communicating with the outlet-ports *d* and *d′* of the main valve D, as shown in Fig. 4.

On the upper part of piston C are two longitudinal bars, S S′. (Shown in Figs. 2, 8, and 9.) To the center of one of these bars, S, is pivoted so as to vibrate freely a slotted arm, R, Figs. 7 and 8, the free end of the said arm resting on the opposite bar, S′.

Fitting in the slot in arm R, and so as to slide easily, are two lugs or projections, *q q*, Fig. 9. The said lugs are attached to a ratchet, *r*, fitted loosely on a spindle, W, extending upward to the registering mechanism, and communicating motion by means of dogs *s* to a ratchet-wheel, *t*, made fast to the spindle W, so that in connection with the dogs *u* motion will be communicated to the spindle from the piston C. As the piston reciprocates the arm R is caused to vibrate by means of the lugs *q q*, fitting loosely in the slot of arm R, which imparts a semi-rotary motion to the ratchets *r* and *t*, and to the spindle, and through the latter to the registering mechanism.

Operation: Water being admitted to the inlet-opening F passes down through the passage H into chamber I of the piston C. The pressure of the water against the upper portion of the chamber I, owing to the increase of the area of opening L over the escape-openings *h* and *o*, serves to hold the piston *in equilibrio*, and thus relieve the bearing upon the lower inner surface of the shell, and thereby prevents friction on the same, and the consequent wearing of their surfaces, the same being in effect a balanced piston. The water passes from chamber I into valves D and E through the ports *h i* and *o b*, respectively, as shown in Fig. 2. The force of the water entering the hollow valves D and E holds them *in equilibrio*, and, as in the case of the piston itself, friction is prevented, and the consequent wearing of their contiguous surfaces, and, as proved by practice, acting as balanced valves. The water then passes out of valve D through the outlet-port *d′* into the passage *f′*, as shown in Fig. 4, and into the space between the end of the piston and the head B of the shell. The pressure of the water then forces the piston to the opposite end of the shell, and the end of the auxiliary valve E, coming in contact with the opposite head of the shell, is forced in, causing port *a* to open into passage *n*, as shown in Fig. 3, and at the same time causing the passage *n′* to communicate with the depression *b* of auxiliary valve E, to open into exhaust-port *m* and conduct the water thence to outlet-chamber I′ to the exit G. The water passing through passage *n* then forces the valve D in the opposite direction, causing the port *d* to open passage *f*, at the same time opening passage *f′* to the depression *e*, communicating with exhaust-port *g* in the main-valve chamber, and thence to chamber I′ and out through exit G, causing the piston to reciprocate in the opposite direction again.

My invention may be used for the purpose of measuring the quantity or amount of steam when employed for heating purposes.

What I claim as my invention is—

1. The piston C, having the valve-chambers D′ and E′, the passages *n n′*, and exhaust-ports *g* and *m*, and ports *o* and *h*, substantially as shown and described.

2. The piston C, provided with the separate chambers I I′, and having the area of the inlet-opening L greater than that of the outlet-openings to chamber I′, substantially as and for the purpose set forth.

3. The combination, with the piston C, of the valve-chambers D′ and E′ and the chambers I I′, with their communicating passages and ports, substantially as set forth.

4. The slotted vibrating arm R, pivoted to the bar S of piston C, for the purpose of actuating the registering mechanism, substantially as specified.

5. In combination with the piston C, the independent cylindrical valves D and E, provided with corresponding passages and ports, substantially as specified.

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

J. H. COOMBS.

Witnesses:

J. H. ADAMS,

JOHN W. CARTWRIGHT.