(Model.) 2 Sheets—Sheet 1.

G. HOLLIDAY.

PISTON METER.

No. 307,464. Patented Nov. 4, 1884.

Fig. 1.

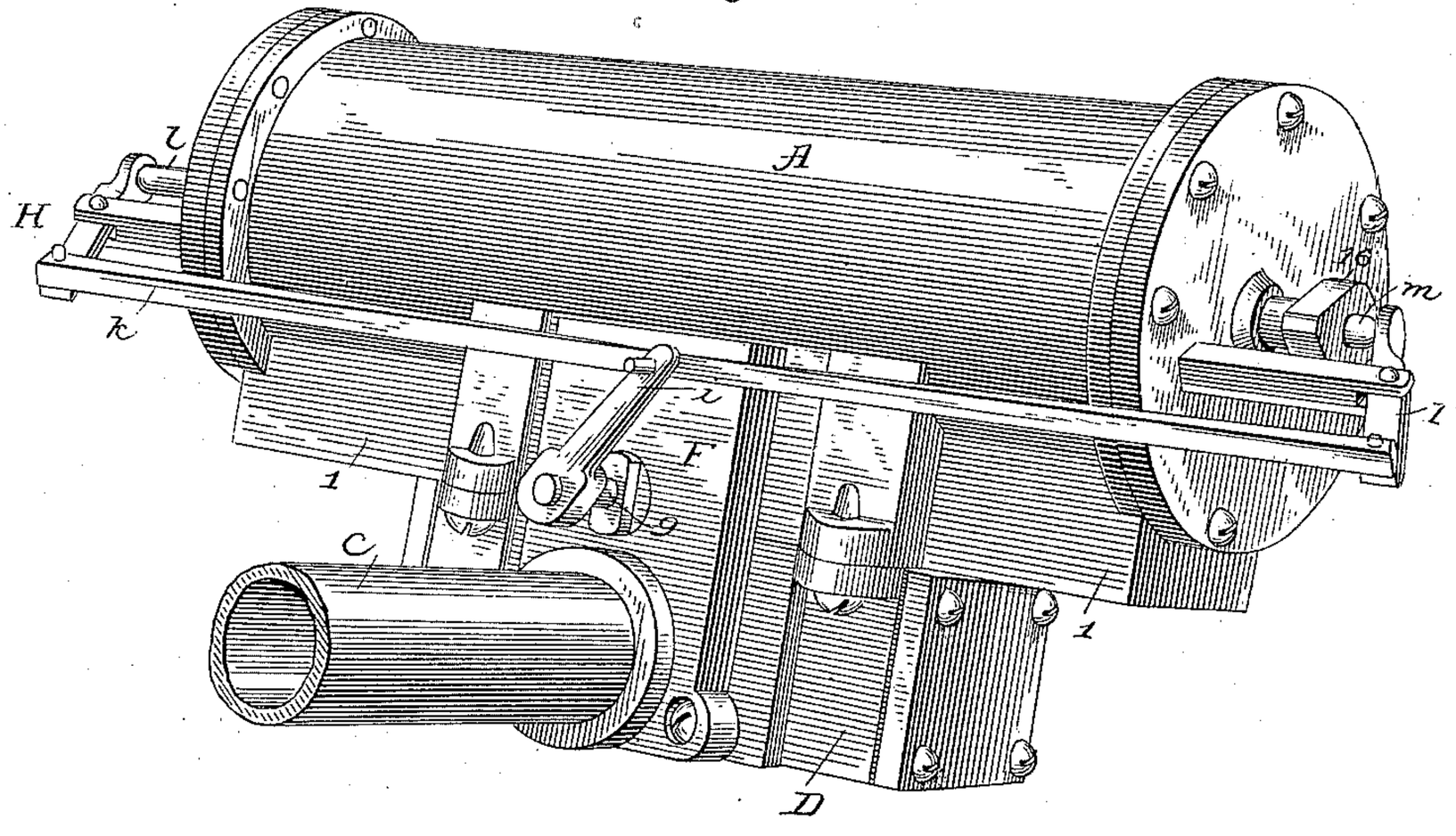


Fig. 2.

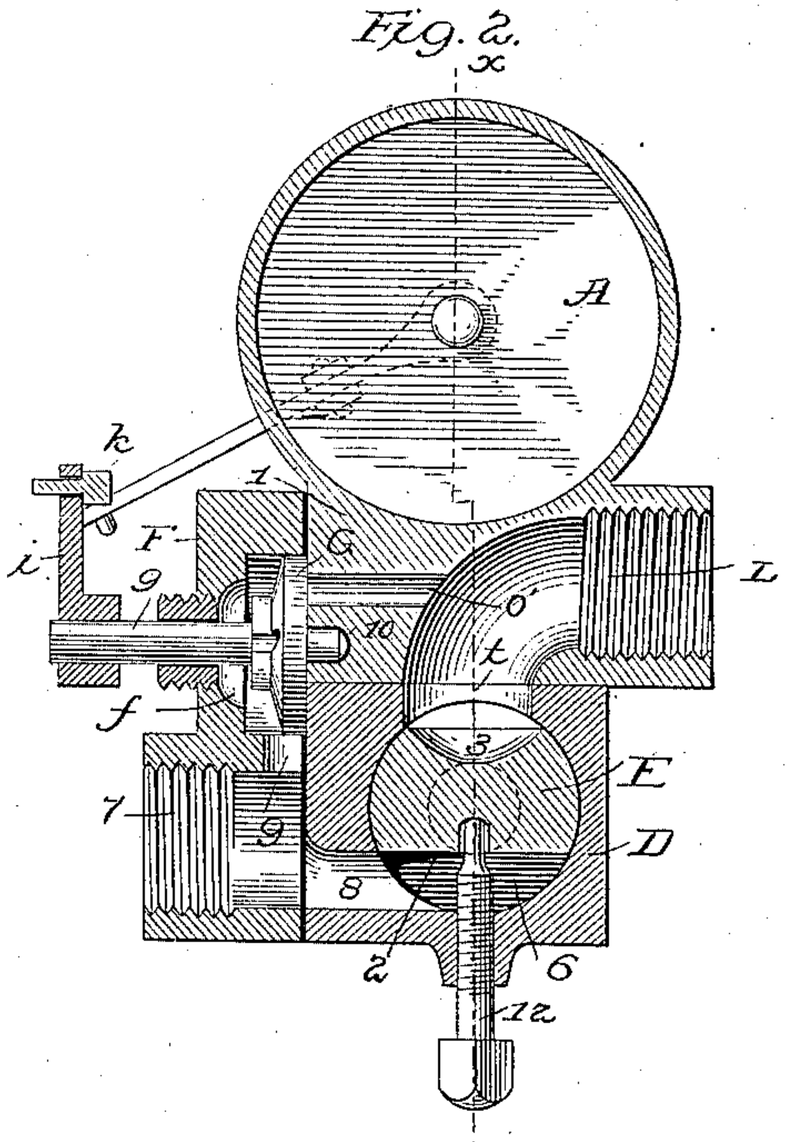


Fig. 3.

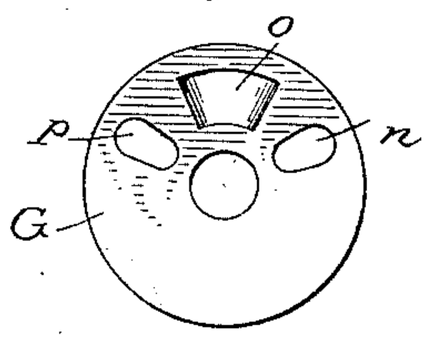
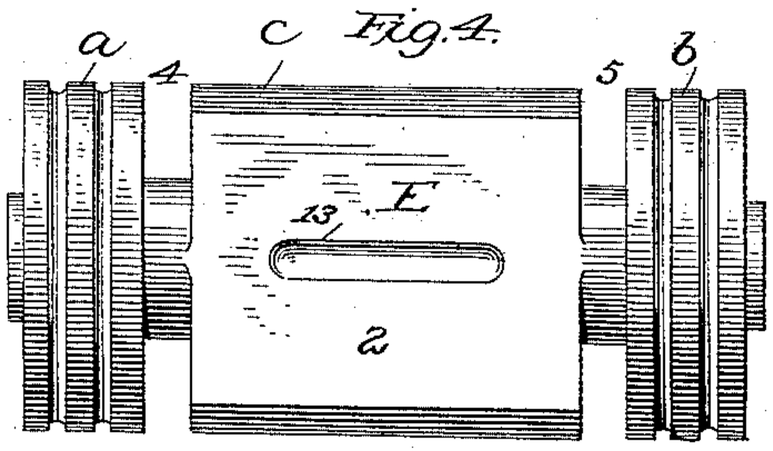


Fig. 4.



Attest:

Walter Donaldson

F. L. Middleton

Inventor:

Gavin Holliday

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Atty's.

(Model.) 2 Sheets—Sheet 2.

G. HOLLIDAY.

PISTON METER.

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Fig. 5.

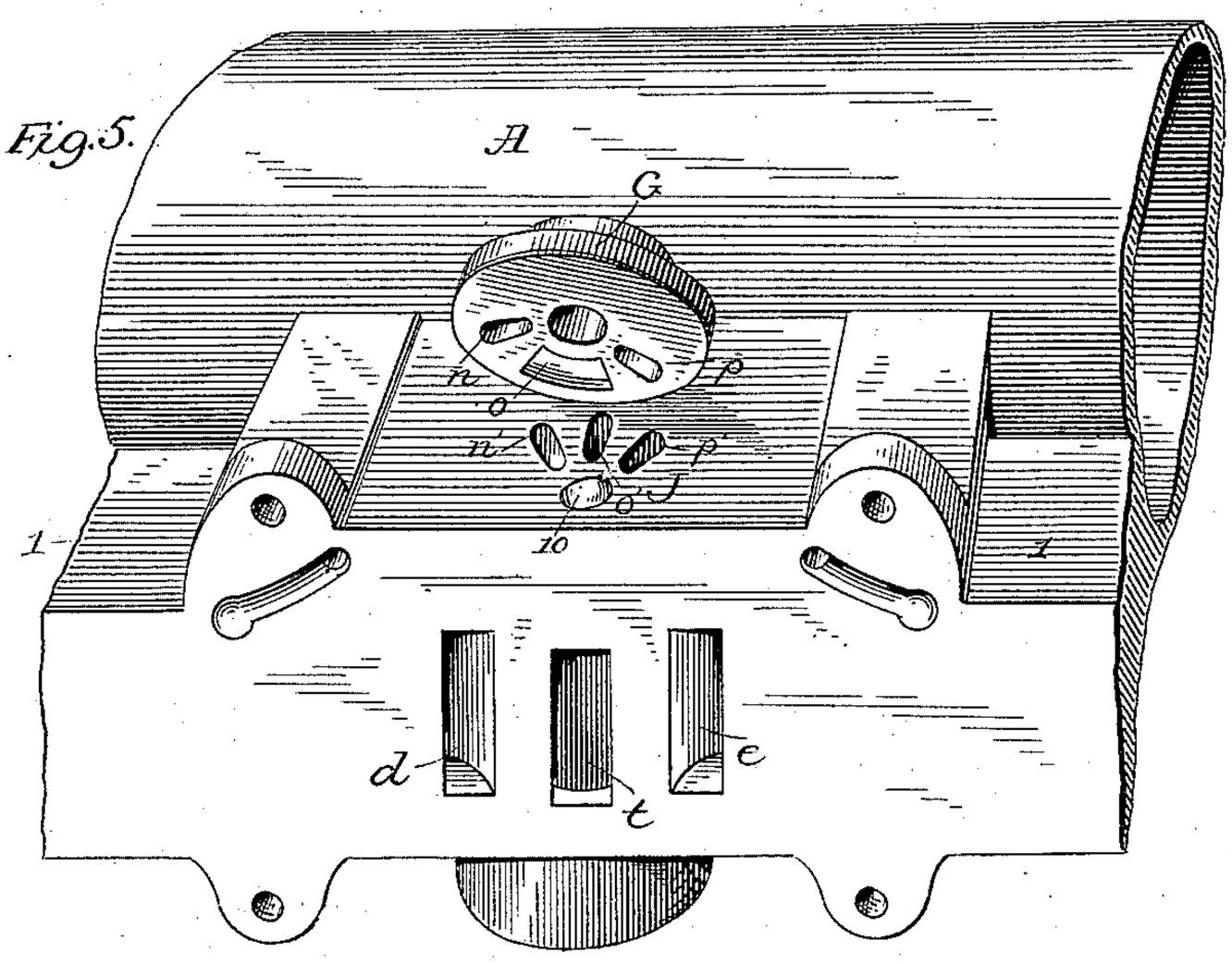

Fig. 6.

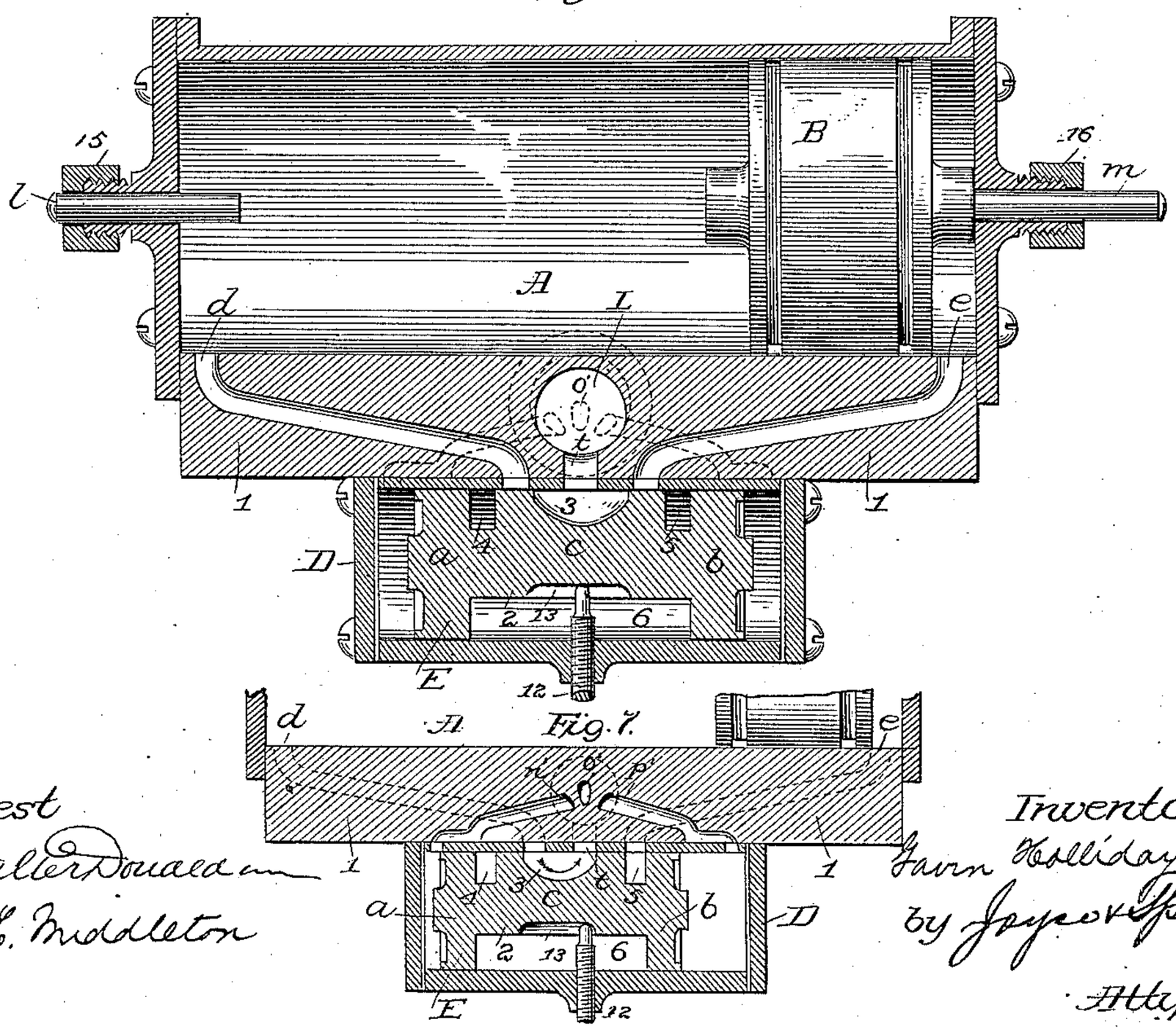

Fig. 7.

Attest
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UNITED STATES PATENT OFFICE.

GAVIN HOLLIDAY, OF SAUGUS, MASSACHUSETTS.

PISTON-METER.

SPECIFICATION forming part of Letters Patent No. 307,464, dated November 4, 1884.

Application filed October 11, 1883. (Model.)

To all whom it may concern:

Be it known that I, GAVIN HOLLIDAY, of Saugus, in the county of Essex and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Water-Meters, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention is an improvement in water-meters of that class in which the water is passed into a cylinder and caused to give a reciprocating motion to a piston contained therein, which motion may be registered by any suitable device designed for the purpose.

My invention consists in special devices whereby, when the water entering at either end of the cylinder has forced the piston to the opposite end, the said devices will be operated upon, actuating valves of peculiar and novel form, which change the course of the water, admitting it at that end of the cylinder to which the piston has been forced, and at the same time opening suitable ports for the egress of the exhaust-water that has been registered, which gives a reciprocating motion to the piston.

My invention further consists in the novel form and peculiar arrangement of the valves, and also in the various details of construction, more particularly referred to hereinafter, and specifically claimed.

In the accompanying drawings, Figure 1 is a perspective view of the device. Fig. 2 is a transverse section through the center of the cylinders and valve-chamber. Fig. 3 represents a plan view of the rear face of the disk-valve. Fig. 4 represents the sliding or piston valve in side elevation. Fig. 5 is a perspective view of the disk-valve and seat, the valve being represented as raised from its seat to better illustrate its form and relative position to its seat. Fig. 6 represents a longitudinal section through the cylinders on line *x x* of Fig. 2. Fig. 7 shows a section through the sliding valve, valve-chamber, and a portion of the cylinder.

In these drawings A represents the cylinder; B, the piston contained therein, and *c* the supply-pipe. The cylinder A is formed with a longitudinal projection, 1, to which is secured, by screws or bolts, the chamber D. (Shown in Fig. 1.) In this chamber works a sliding or piston valve, E, after the manner of the ordinary piston. Ports *d* and *e* are formed in the projecting portion 1 of the cylinder, leading from the valve-chamber D, near the center thereof, to the extreme ends of the cylinder A. The sliding valve E is a single casting of peculiar construction, consisting of cylindrical heads *a b* and a central portion, *c*, which is partially cylindrical in cross-section, having a flat side, as at 2, and a central depression, as at 3, as shown in Figs. 2 and 6. The heads of the valve are formed to fit accurately the bore of the chamber D, and are separated from the central portion, *c*, by spaces 4 and 5. These spaces 4 and 5 are adapted in size and position to register with the passages *d* and *e*, respectively, not, however, simultaneously. It will be seen from this construction of the valve that when it is in position within the chamber a space, 6, is formed between the heads and side 2 of the valve and the wall of the chamber. The movement of this valve is controlled by a supplemental valve, G, Figs. 2 and 6, which in turn is operated by the piston, as hereinafter described.

Secured in any suitable manner to both the valve-chamber D and the projection 1 of the cylinder, is a plate, F, in which is formed a chamber, *f*, Fig. 2, for a disk-valve, G, and an opening, 7, threaded to receive the supply-pipe C. The opening 7 has free communication with both the valve-chambers D and *f*, through passages or ports 8 and 9, as shown in Fig. 2, the passage 8 opening into the space 6 in the chamber D, before referred to. Supposing the valve E to be in the position shown in Fig. 6—that is, with the central portion, *c*, closing the passages *d* and *e*—water entering from the supply-pipe will first flow through the passage 8 and fill the space 6, but as the pressure exerted by the water is equal in all directions, the valve will not be moved from the position shown. The water unable to pass through the chamber will flow through the port 9 and fill the chamber *f*.

The action of the disk-valve G is now to be explained. It is fixed to a stem, *g*, which has a bearing at 10 in the projecting portion 1 of

the cylinder. Upon the outer end of the stem is secured an arm, *i*, which is connected by bar *k* to the ends of the levers H I, pivoted on studs on the cylinder-heads. The other ends of the levers are flattened and bear upon the sliding pins *l m*, passing through bosses formed on the heads of the cylinder, so as to be operated by projections on the faces of the piston, as shown in Fig. 6.

The valve G consists of a disk of metal or other material having ports *n p*, and an intermediate depression, *o*, Figs. 3 and 5. It is fitted to a seat, J, on the projection 1 of the cylinder, which has passages *n' p'*, communicating directly with the extreme ends of the valve-chamber D, and passage *o'*, communicating directly with the discharge-opening L. The ports *n p* and depression *o* of the valve are so positioned in relation to the passages *n' p' o'* of its seat that when either of the said ports *n* or *p* registers with its corresponding passage, the two remaining passages will be bridged by the depression *o*, the other port meanwhile being over the solid portion of the seat. As shown, the discharge-opening L has direct communication with valve-chamber D through the port *t*.

The parts are so arranged in relation to each other that the depression 3 of the valve D bridges the ports *d* and *t* when the space 5 registers with the passage *e*, this being done while the disk-valve is in the position shown in Fig. 5—that is, with the depression O bridging the passages *n'* and *o'*, and the port *p* registering with the passage *p'*. The valve being in this position, the water, having filled the chamber *f* as before described, will flow through the port *p* and passage *p'* into the right-hand end of the chamber D, forcing the valve from the position shown in Fig. 6 to the left-hand end of the chamber, the water or air in that end escaping through the passage *n*, depression *o*, and passage *o'* out through the discharge-opening. This movement brings the sliding valve into the position shown in Fig. 7, a direct passage being thereby formed for the admission of the water to the right-hand end of the cylinder A, through passage 8, space 5, and passage *e*, and a continuous channel being also formed for the egress of the exhaust water or air from the other end of the cylinder through passage *d*, depression 3, port *t*, and discharge-opening L. The piston, just before reaching the end of its leftward stroke, strikes the end of the pin *l*, pushing it out, which, through the lever H, connecting-bar *k*, and arm *i*, serves to reverse the position of the disk-valve, throwing the mechanism into the position shown in Fig. 1, thus changing the course of the water and allowing it to flow through the port *n* and passage *n'* into the left-hand end of the chamber D, and providing for the escape of the exhaust-water contained in the other end through the passage *p'* by bridging the opening of the said passage *p'* and the passage *o'*. This sends the valve E back to the right-hand end of its chamber, opening the passage *d* and *e* for the entrance and egress of the water to and from the cylinder, thus reversing the movement of the piston D, forcing it back to the right-hand end of its cylinder, with the effect already described of reversing the action of the entire device, thus giving a positive reciprocating motion to the piston. Suitable packing of rubber may be interposed between the joined portions of the device to make perfectly water-tight joints. The movement of the sliding valve E is limited by a set-screw, 12, the end of which enters a groove, 13, in the central portion of the valve. This prevents the passage *n'* and *p'* from being closed by the valve, and also serves to keep the valve in the position shown in Fig. 2, so that the water will flow unobstructed into the chamber D.

The bosses on the cylinder-heads, through which the pins *l* and *m* pass, are provided with adjusting-nuts 15 16, by which the movement of the levers H and I may be regulated to give the proper amount of movement to the disk-valve.

The registering device may be of any desired form, connected in any suitable way to the reciprocating bar *k*, the levers H I, or any of the moving parts of the device.

I claim as my invention—

1. In a water-meter, a cylinder containing a piston having entrance and exit passages for the water, a sliding valve adapted to open and close said passage, a supplemental valve and water-passages adapted to operate the sliding valve, and suitable devices at the ends of the cylinder, by which the supplemental valve is operated when the piston reaches either end of the cylinder, substantially as described.

2. In the described device, the cylinder having entrance and exit passages *d* and *e*, and discharge port and openings *t* and L, the chamber D, and valve E, consisting of heads *a b*, and central portion, *c*, the central portion having a depression, 3, and cut-away side 2, spaces 4 and 5 between the heads and the central portion, and the devices for operating the said valve, whereby when the water is admitted to either end of the cylinder the exit-passage is opened for the escape of the exhaust-water from the other end, substantially as described.

3. In the described device, and in combination with the chamber D and valve E, the supplemental valve G, for operating the same, consisting of the disk having ports *n* and *p*, and depression *o*, the valve-seat J, having passages *n'* and *p'* leading to the ends of the chamber, and the passage *o'* to the discharge-opening, all substantially as described, and for the purpose set forth.

4. In the described device, and in combination with the chamber D and its valve E, the valve-seat J, having passages leading to the ends of the chamber, a supplemental valve adapted to form a passage for the entrance of water to one end of the cylinder, and at the

same time form a discharge-passage for escape of the exhaust-water from the other end, substantially as described.

5. In combination with the valve E and supplemental valve, the means for operating the same, consisting of the arm *i*, secured to the stem of the valve, connecting-bar *k*, levers H I, bearing upon the pins *l* and *m*, which slide in the heads of the cylinder when acted upon by the piston, substantially as described.

6. In combination with the supplemental valve and its operating mechanism, the adjusting-nuts 15 and 16, substantially as described, and for the purpose set forth.

7. In combination with the valve-chamber D, having ports *n'*, *p'*, and 8, the valve E, having groove 13, and the set-screw 12, substantially as described.

In testimony whereof I have set my hand to this specification in the presence of two witnesses.

GAVIN HOLLIDAY.

Witnesses:
SEYMOUR RUTH,
C. B. TUTTLE.