(No Model.) 2 Sheets—Sheet 1.

F. W. HOOD.

PISTON METER.

No. 367,522. Patented Aug. 2, 1887.

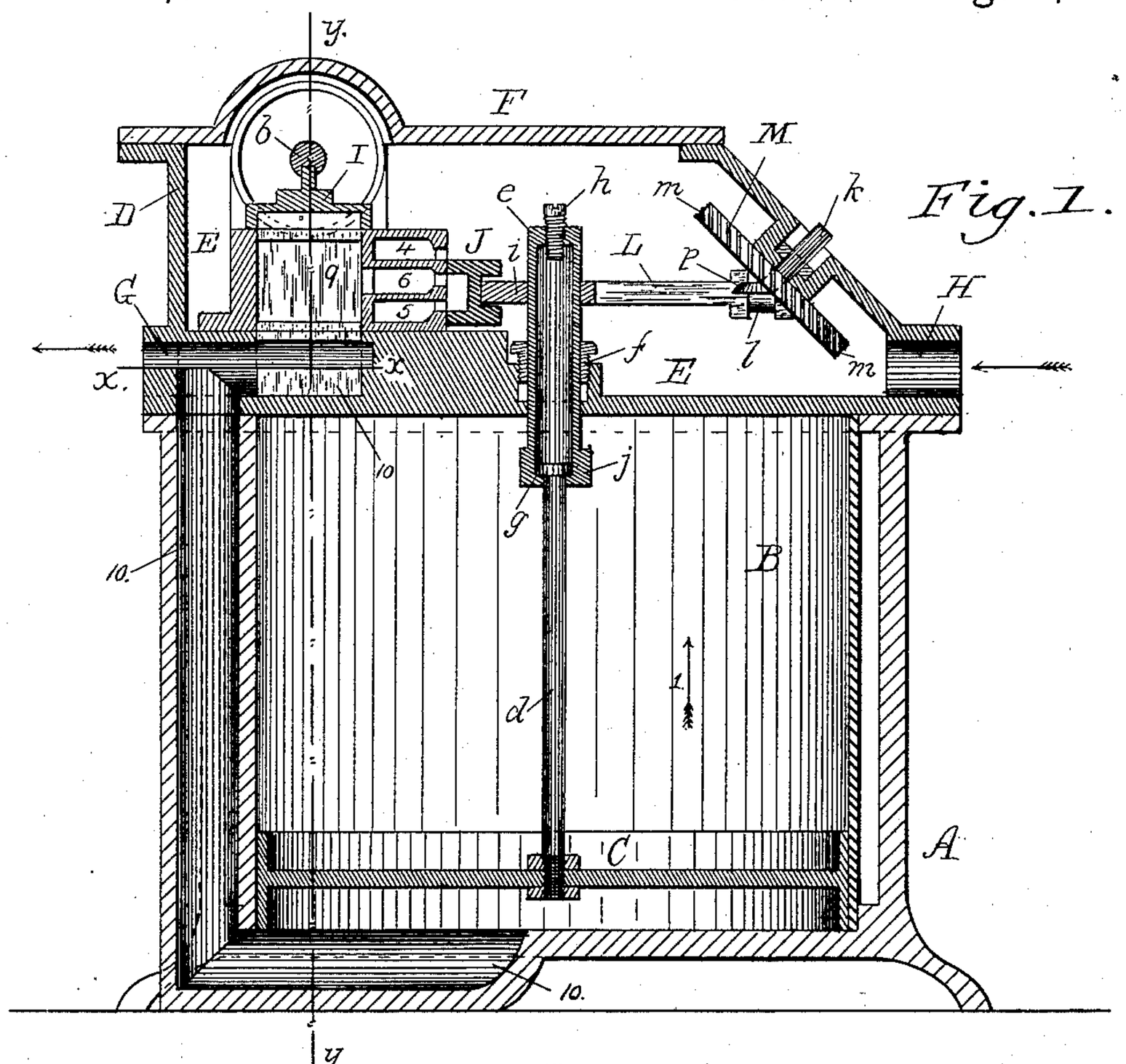

Fig. 1.

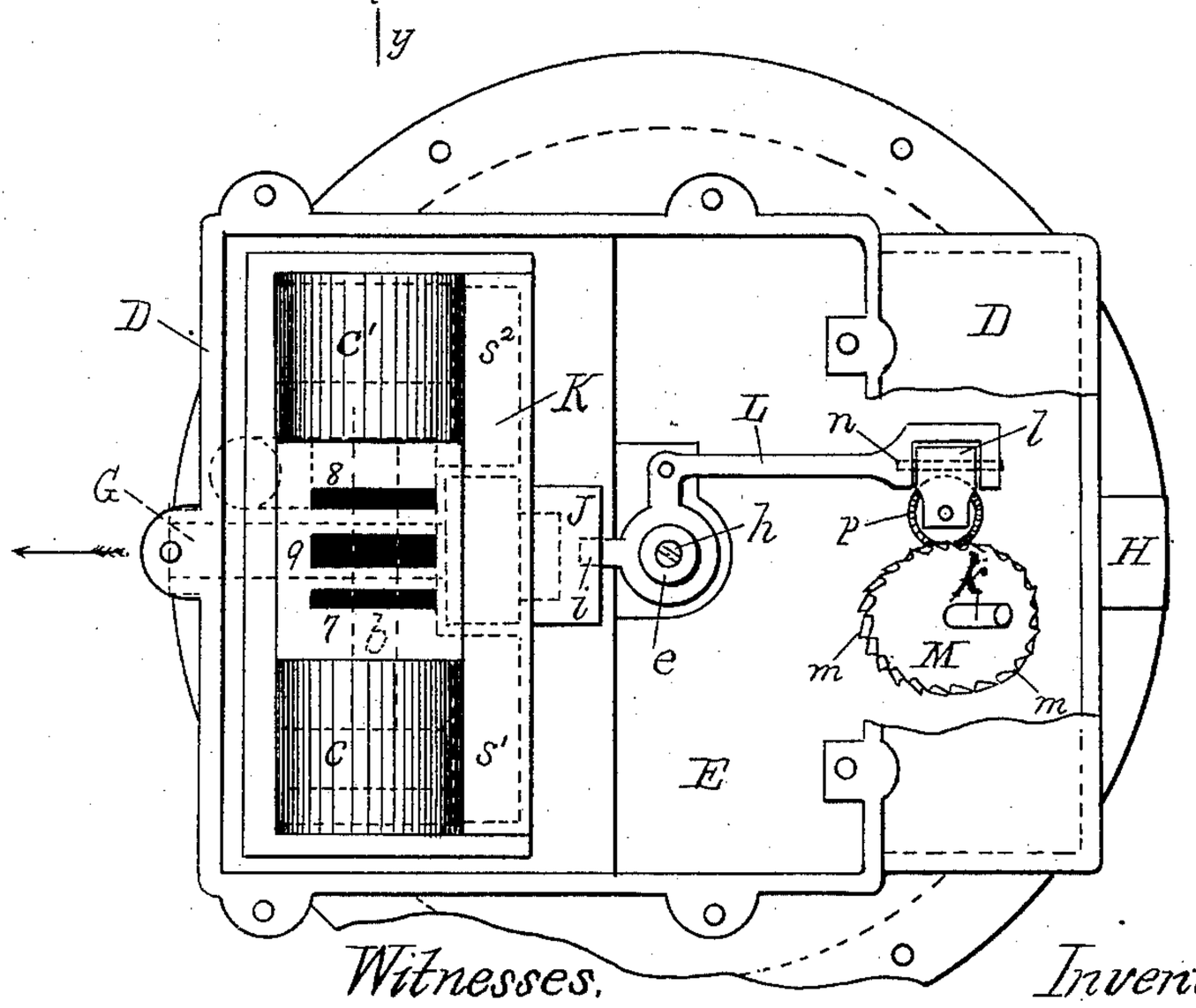

Fig. 3.

Witnesses.
H. E. Lodge.
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Freeman W. Hood.
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(No Model.) 2 Sheets—Sheet 2.

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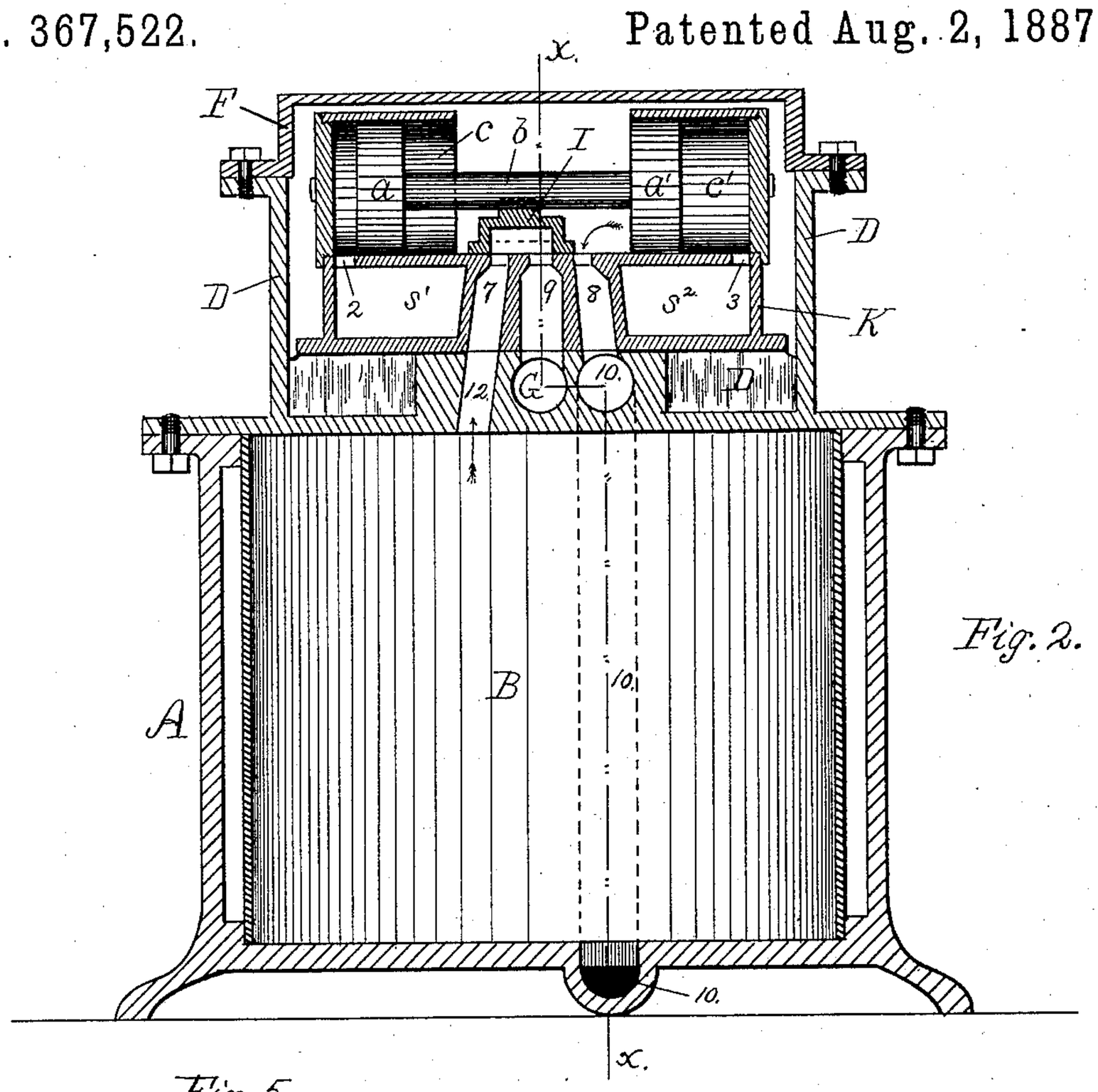


Fig. 2.

Fig. 5.

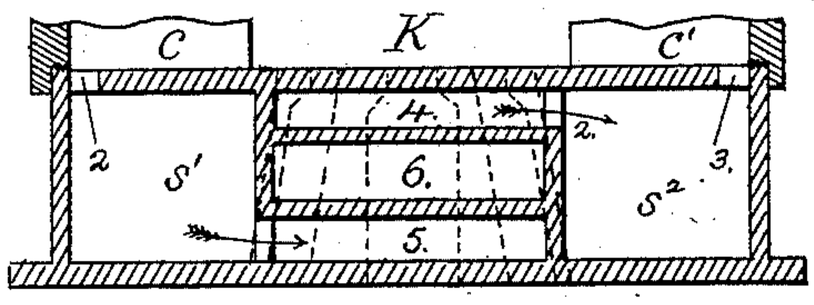
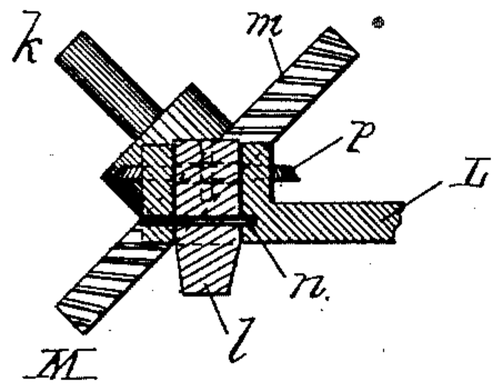


Fig. 6.



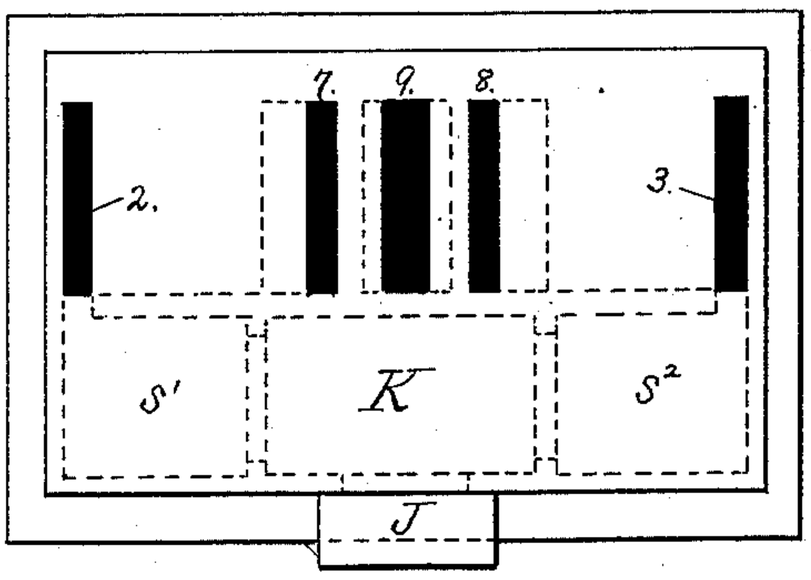


Fig. 4.

Witnesses.
H. E. Lodge.
E. K. Boynton

Inventor.
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UNITED STATES PATENT OFFICE.

FREEMAN WESTON HOOD, OF WELLESLEY, MASSACHUSETTS.

PISTON-METER.

SPECIFICATION forming part of Letters Patent No. 367,522, dated August 2, 1887.

Application filed March 5, 1887. Serial No. 229,824. (No model.)

To all whom it may concern:

Be it known that I, FREEMAN WESTON HOOD, a citizen of the United States, residing at Wellesley, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Fluid-Meters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to fluid-measuring apparatus termed "meters," particularly that class known as "piston-meters."

My invention pertains to improvements in the form and construction of certain parts, as well as their relation with respect to each other, by means of which a meter is produced which shall contain the fewest possible number of parts and yet be compact and efficient when operating.

The especial features of my invention consist, primarily, in the disposition and form of the tubular stem *e*, which is hollow and extends into the main measuring-chamber. Thus the main piston-stem can be reduced in length and the meter rendered more compact in shape; secondly, in having said tubular stem adjustable in length and capable of endwise motion, this latter motion being effected by means of main piston-stem, which is solid and reciprocates within it, and, furthermore, is axially aligned therewith; thirdly, in the peculiar structural arrangement of the dial-operating mechanism by which reciprocating right-line movement is converted into intermittent rotary motion.

The drawings accompanying this specification represent, in Figure 1, a central vertical section of a fluid-meter embodying my invention, on line *x x* in Fig. 2. Fig. 2 is a vertical section on line *y y* in Fig. 1. Fig. 3 is a plan of the meter with the top cap removed. Fig. 4 is a plan, and Fig. 5 is a vertical section, of the valve-chest. Fig. 6 is a sectional elevation of the operating-dial mechanism hereinafter described.

Since my present improvements relate to a class of piston-meters the construction and operation of which are well known, I shall proceed to describe the operation and relation of the several component parts as briefly as possible.

In the drawings, A represents a metallic shell or casing open at the top and which contains the measuring-cylinder B, provided with a reciprocating main piston, C. This casing A is closed by and surmounted with a flanged head, D, so called, bolted to it, and within the chamber E of which are located the several operative parts, whereby said piston is controlled and the fluid which actuates the latter is measured and registered. A cap, F, completes and closes the exterior casing of the meter and compels the fluid passing through the apparatus to enter and discharge solely through the passages G H, respectively.

The operative parts contained within the valve-chamber E of the head D consist, primarily, of the main valve I, which controls the flow of the main column of fluid to be measured, and which latter actuates the main piston, an auxiliary valve, J, impelled by the said piston and which in its turn governs the movement of the main valve, and likewise the operative mechanism by which the registering-dial is actively induced.

The main valve I, located in the top of the valve-chamber E, is operated by two pistons, *a a'*, mounted on a common rod, *b*. Said pistons play in and close the open ends of two cylinders, *c c'*, which form part of the auxiliary valve-chest K, divided into the chambers s' s^2, and communicate with the latter by the ports 2 3. Said valve-chest in the present instance is cast separate from the metal composing the head D, which is cored to form the discharge-passage G, and is further provided with the inlet-ports 4 5 and common discharge-port 6. The two former lead to the fluid-supply valve-chamber E and are controlled by the auxiliary valve J, which in the present instance has vertical movement. The port 4 communicates with the chamber s^2 and the port 5 with the chamber s' in the valve-chest.

The main valve is horizontally disposed, and co-operates with the ports 7 8, which lead, by ducts 10 12, to opposite sides of the main piston C and serve as ingress and egress passages

for the fluid, the common discharge-port 9 uniting them alternately with the discharge-orifice G as the general discharge.

Having thus briefly described the well-known arrangement of meters of the class before premised, as regards their valves, ports, and the devious passages controlled by them, I will now proceed to describe the especial features in which is embodied my invention.

In said class of meters the travel of the main piston is large, while that of the auxiliary valve, which controls it indirectly by means of the main valve, is very small; hence to render the meter compact and at the same time operate said auxiliary valve directly from the main piston-rod, I have adopted the following mechanism—that is, I employ a solid piston-rod, *d*, and have located the auxiliary tubular stem *e* in axial alignment therewith. This latter is a hollow movable rod, which is independent of and unattached to the valve J, which it operates. Moreover, this tubular stem *e*, so called, extends into the main measuring-cylinder B and is provided with a stuffing-gland, *f*, which prevents flow of liquid between the chamber E and measuring-cylinder B, and yet permits free play of the said tubular stem. By this disposition of the hollow independent tubular stem *e* within the measuring-cylinder B it is very evident that I am enabled to shorten the main piston-rod *d* very materially and yet permit the piston itself to travel the requisite distance. Moreover, its piston-rod, moving within the tubular stem *e*, serves to move the latter endwise and shift the auxiliary valve J. Thus the objection caused hitherto by the travel of the piston-rod *d* is overcome by permitting it to telescope within the hollow tubular stem *e*, while the slight movement endwise of the latter enables it to be readily accommodated in the valve-chamber E, and without enlarging or extending the meter-casing especially for the purpose. Upward end thrust of the main piston C is limited by the length of the bore of the tubular stem *e*, which is free to play between the division-wall of the valve-chamber E and measuring-cylinder B. Thus, by withdrawing or advancing the adjusting-screw *h* in said tubular stem, the length of the latter is regulated, and likewise the travel of the piston C, since the head *g* of the piston-rod *d*, meeting either end thereof, causes the valve J to shift and changes the motion of the piston.

The actuating-dial mechanism, in which, also, are embodied certain features of my improvements, consists of the obliquely-disposed shaft *k*, to the outer end of which is secured the dial. (Not shown.) Its lower end is furnished with a ratchet, M, the teeth *m m* of which are angularly disposed upon its periphery. To simplify the number of parts as much as possible, and to actuate said ratchet M intermittently but successively at each reciprocation of the main piston, I have furnished the long end of the actuating-arm L, affixed upon the hollow tubular stem *e*, with a finger, *l*. The latter is loosely pivoted at right angles to said arm upon the pin *n*.

In the operation of the meter, and the consequent right-line vertical reciprocations of the finger to produce rotary movement of the ratchet M, it is evident that the teeth *m m* of the latter must slip along the finger as said teeth advance, due to their oblique position with respect to their axis of rotation. To obviate the friction resultant therefrom I have armed the extremity of said finger with a conical roll, *p*, which projects beyond said finger and engages with the teeth of the ratchet. Thus when the finger has engaged a tooth, *m*, vertical movement of said finger compels lateral advance motion of the tooth; and, since the roll *p* is the active agent and is axially aligned with the face of the teeth *m m*, it revolves upon them, and a rotary motion is easily effected and produced as the resultant of the right-line travel of the piston.

The operation of this apparatus is as follows: Presuming that the parts are in their respective positions, as shown in the several drawings, and that the piston C in the measuring-cylinder B is about to move upward, as indicated by arrow 1, the main supply-fluid enters by way of passage H and fills the valve-chamber E in the flanged head. When the piston C is at its extreme of travel, as shown, the auxiliary valve J has opened the port 4, through which the fluid escapes (see arrow 2, Fig. 5) into the chamber s^2 of the valve-chest K, and thence by way of port 3 into cylinder *c'*, and drives the pistons *a a'* to the position shown. Such movement of these pistons actuates the main valve I and opens the port 8 and duct 10, the supply-fluid passing directly from the chamber E by said duct to the under side of the piston. Simultaneously with the ingress of fluid by way of ports 3 4, chamber s^2, to piston *a'*, egress of fluid occurs through ports 2 5 and chamber *s'*, thence to discharge-port 6, which opens into passage 9 and orifice G. Moreover, while supply-fluid is entering duct 10 to move the main piston, the fluid already measured, and which now fills the cylinder B, is allowed to escape through duct 12 and ports 7 and 9 to discharge-orifice G. As the piston is actuated, the piston-rod *d* advances within the hollow tubular stem *e*, which remains stationary and inactive until the piston C has almost reached its extreme limit of travel in direction of arrow 1, when the head *g* contacts with the adjusting-screw *h* and the tubular stem *e* is moved downward together with the lug *i*. In this way the auxiliary valve J is shifted, the port 5 opened to the supply-fluid, while port 4 is closed and egress of fluid occurs into port 6. The fluid which has just escaped from chamber *s'* is now replaced by an equal amount, and the pistons *a a'* reverse their motion and shift the main valve I. The port 7 now opens to admit supply-fluid to impel the piston downward on its return-stroke, and the ports

8 9 are in communication to permit the fluid just measured to escape from the cylinder B and discharge through the orifice G. The finger *l* is pivoted to the arm L, with the preponderance of weight of said finger on the end which carries the roll *p*. When the tubular stem *e* and arm L move upward, this finger *l* bends downward by reason of the attraction of gravity and the frictional resistance of ratchet M operating in the same direction, and the periphery of the roll *p* slips over the teeth *m* of said wheel. When the tubular stem *e* and arm L move downward, the frictional resistance of the wheel M is in the reverse direction to the attraction of gravity, and the roll *p* will be held against said wheel and will cause the latter to turn. The rotary motion of said wheel M is communicated through its shaft *k* to dial-hands carried by the latter. These register the fluid measured at each stroke of the main piston.

I claim—

1. In a fluid-meter, the combination, with a valve-chamber, a main and auxiliary valve located therein, and a measuring-cylinder which contains a piston and piston-rod, of a movable tubular stem, *e*, located transversely in the division-wall of said chamber and cylinder and adapted to be thrust endwise through said wall by means of the solid piston-rod which reciprocates within it, substantially as and for purposes stated.

2. In fluid-measuring apparatus, the combination, with the main valve and a main piston controlled thereby and provided with a solid piston-rod, of the tubular stem *e*, extending into the measuring-cylinder and actuated by thrusts of the piston-rod sliding within it, and an auxiliary valve which controls the main valve and is operated by the tubular stem *e*, substantially as herein described.

3. In combination with the main valve I, its operating-pistons *a a'*, the valve-chest K, its chambers *s' s²*, and ports 4 5 6, the auxiliary valve J, its actuating-lug *i*, and the adjustable tubular stem *e*, common to and movable in the chamber E and cylinder B by means of the piston-rod and main piston, substantially as herein set forth.

4. The combination, with the measuring-cylinder B, the piston C, its piston-rod *d*, headed at *g*, and the auxiliary valve J controlled thereby, of the movable tubular stem *e*, its screw *h*, head *j*, and lug *i*, said tubular stem interconnecting the piston and auxiliary valve and actuating the latter by movement of the piston-rod within it, substantially as herein specified.

5. In a fluid-meter, a measuring-cylinder, a valve-chamber communicating therewith by passages 10 12, the main valve I, which controls the ports 7 8 9, its actuating-pistons *a a'*, combined with the auxiliary valve J, its ports, the main piston C, solid piston-rod *d*, and the movable tubular stem *e*, located as described and operated by the piston-rod which moves within it, for purposes specified.

6. In fluid-measuring apparatus, the combination, with the reciprocating measuring-piston and the operating-arm L, of the finger pivoted thereon, a roll carried by said finger, and a ratchet-wheel which is actuated by said roll and which operates the dial-register, the axis of rotation of said wheel being disposed obliquely to the path of travel of the finger and roll, substantially as herein set forth.

7. In combination with an operating-arm, L, its pivoted finger *l*, and the roll *p*, the shaft *k* and its ratchet-wheel obliquely disposed with respect to the movement of the arm L and furnished with the teeth *m m*, the faces of the latter being parallel with the axis of rotation of the roll *p*, with which they engage, substantially for purposes herein stated.

In testimony whereof I affix my signature in presence of two witnesses.

FREEMAN WESTON HOOD.

Witnesses:

H. E. LODGE,

A. G. MEAD.