No. 791,368. PATENTED MAY 30, 1905.

W. H. REYNOLDS.

FLUID MOTOR OR METER.

APPLICATION FILED AUG. 31, 1903. RENEWED NOV. 2, 1904.

2 SHEETS—SHEET 1.

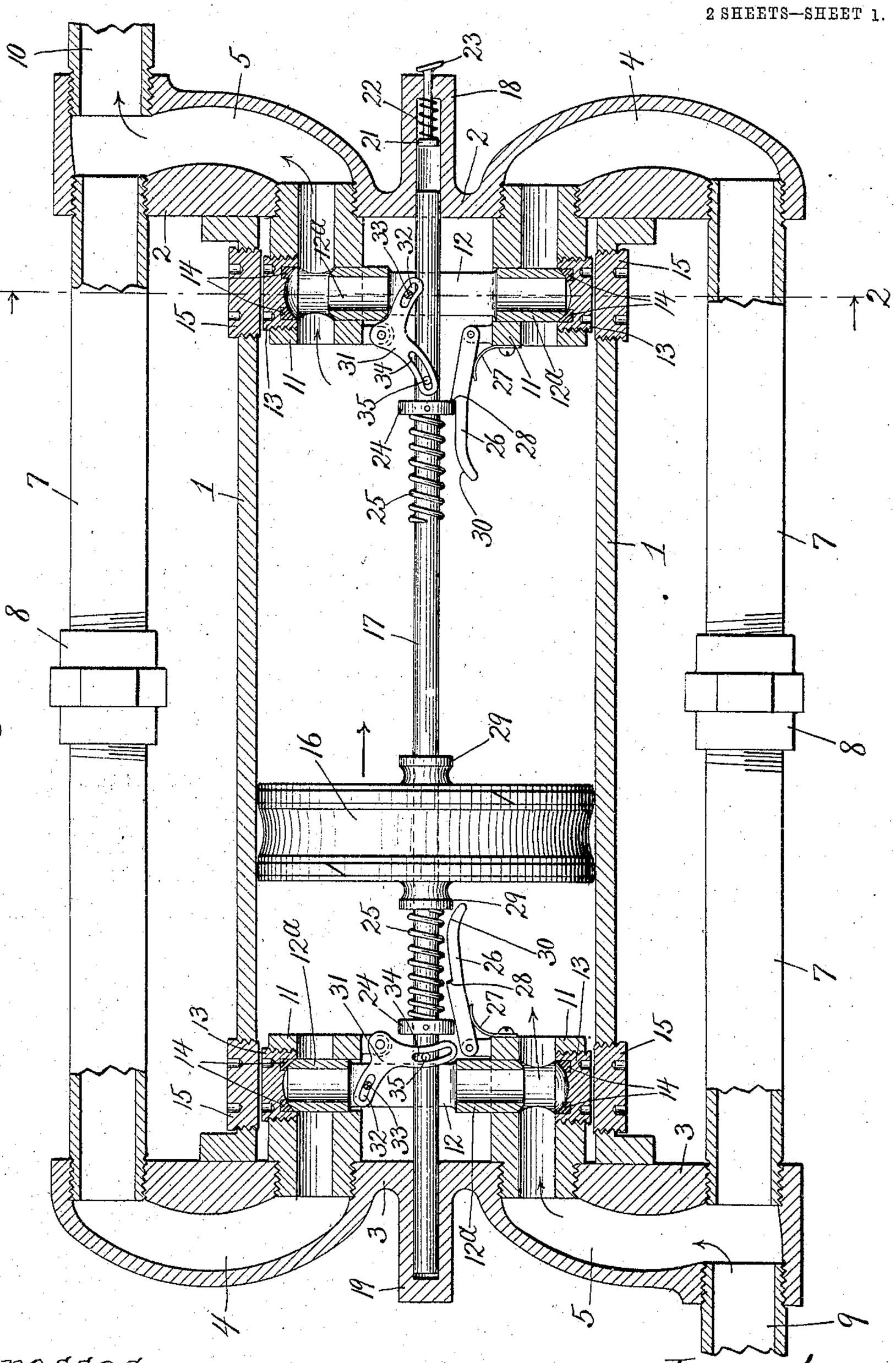

Fig. 1.

Witnesses.
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2 SHEETS—SHEET 2.

Fig. 2.

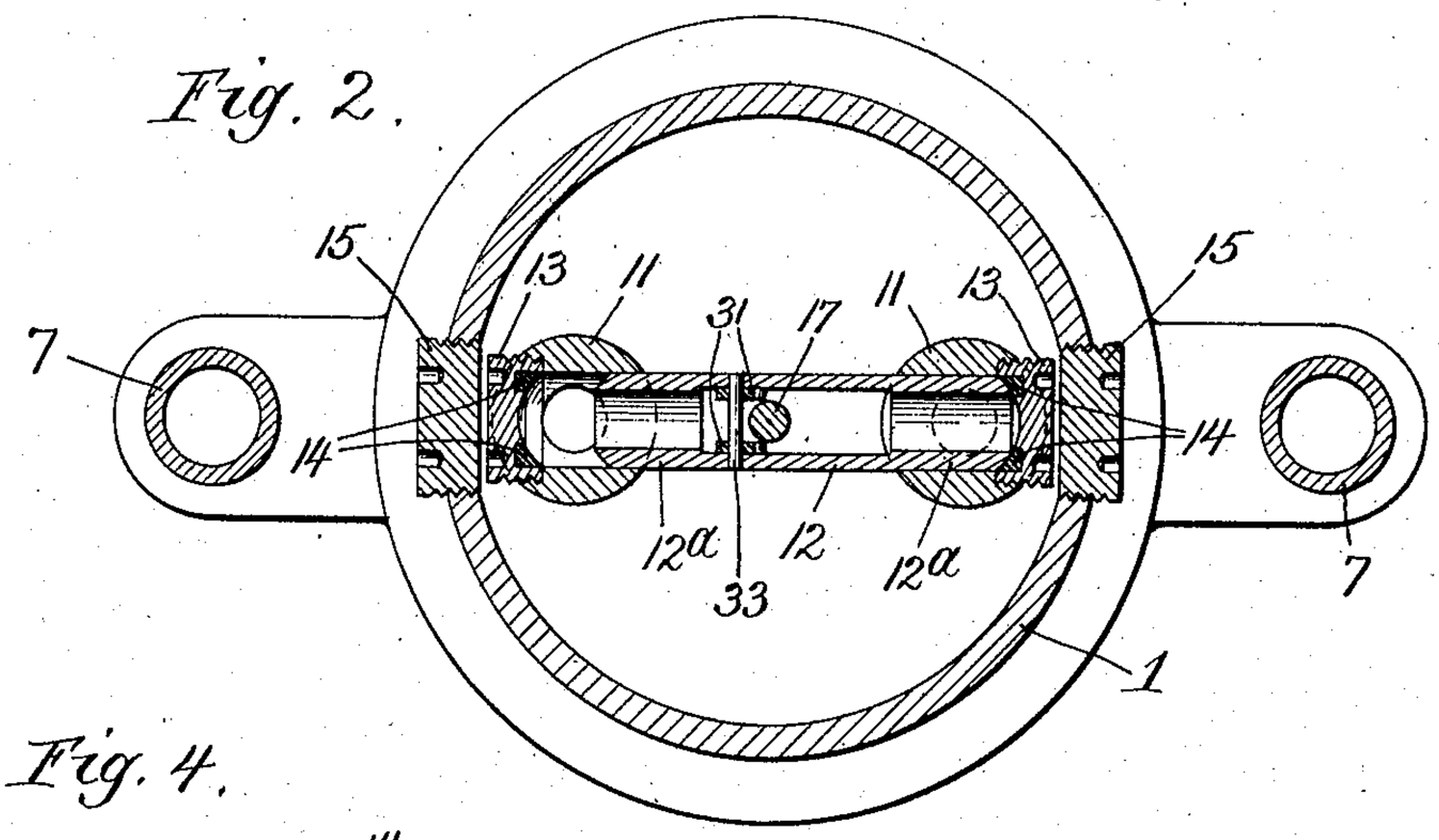


Fig. 4.

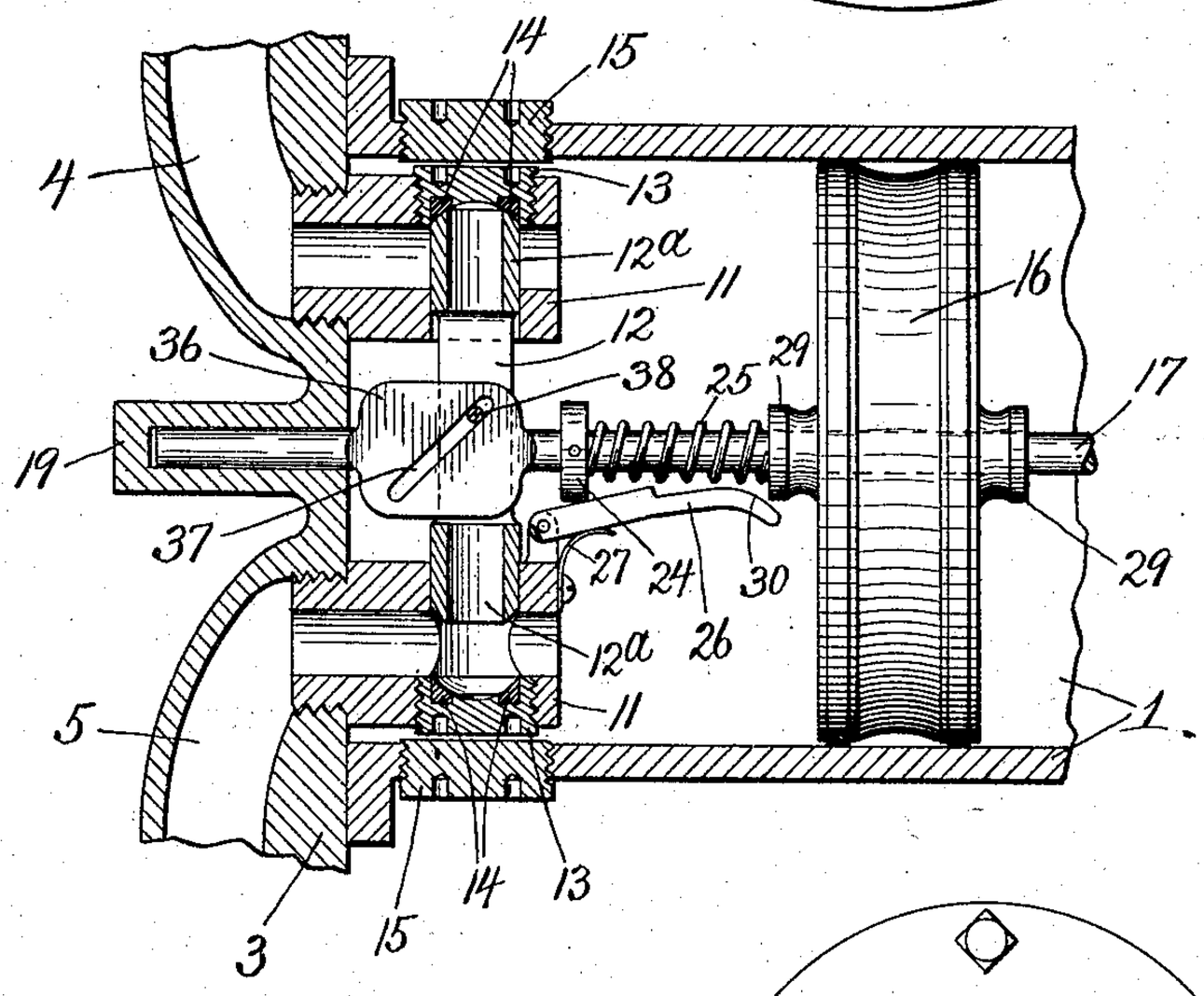
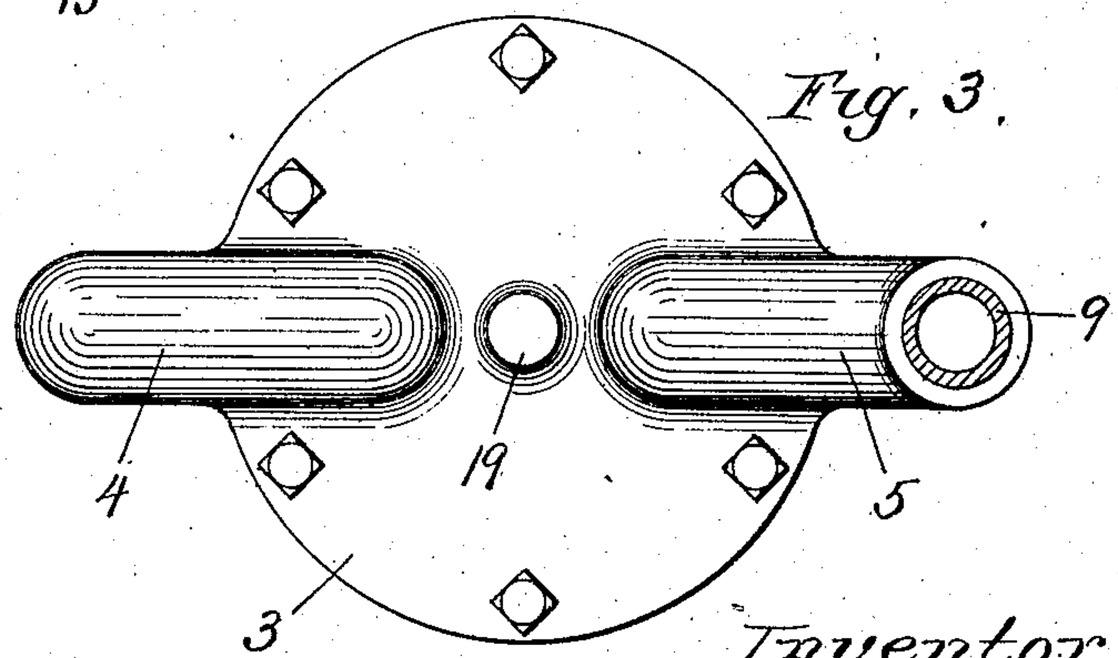


Fig. 3.



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UNITED STATES PATENT OFFICE.

WILLIE H. REYNOLDS, OF AUSTIN, ILLINOIS, ASSIGNOR TO M. & P. CO. OF CHICAGO, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

FLUID MOTOR OR METER.

SPECIFICATION forming part of Letters Patent No. 791,368, dated May 30, 1905.

Application filed August 31, 1903. Renewed November 2, 1904. Serial No. 231,068.

To all whom it may concern:

Be it known that I, WILLIE H. REYNOLDS, a citizen of the United States, residing at Austin, Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Fluid Motors or Meters, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide improved means for deriving from the passage of water through a device movement of parts actuated by the movement of the water substantially proportionate to the quantity of the latter, so that by such derived movement power dependent upon the water-pressure may be transmitted or the quantity of water passing may be measured, or both, as may be desired, the device in question therefore being adapted to serve either as a meter or as a motor, according to the detail construction of the mechanism to which the movement is transmitted.

It consists in the features of construction of the mechanism for primarily converting the movement of the water into the movement of exteriorly-operating parts, as set out in the claims.

In the drawings, Figure 1 is a section made axially through the cylinder of the device constituting my invention. Fig. 2 is a transverse section at the line 2 2 on Fig. 1. Fig. 3 is an end view of the left-hand end of the motor. Fig. 4 is a detail view showing a modification of the means for operating the valves from the travel of the piston, the parts being represented as they would appear in a sectional view similar to Fig. 1.

In my invention a cylinder 1 is supported, preferably in horizontal position, and is closed at its opposite ends by heads 2 and 3 of substantially similar construction, but different in a slight detail hereinafter pointed out. Each of the heads 2 and 3 has two cavities or ducts 4 and 5, respectively, each duct having one end opening into the cylinder and having at the other end, at the inner side of the head—that is, the side toward the opposite head—an opening in line with the corresponding opening of the opposite cavity of the opposite head, said openings in line being connected by pipes 7 7, respectively, which for convenience in assembling the parts are each made in two pieces joined by couplings 8 8. The cavities 5 in each of the heads have, beside the opening to which the pipe 7 is connected, an opening in line therewith at the outer side of the head for connection one with a water supply or inlet pipe 9 and the other with a service or outlet 10, and the openings connected with these pipes, respectively, may be named the "inlet" and "outlet" or "supply" and "service" openings. To the ends of the ducts 4 and 5 within the cylinder there are connected the tubular studs or posts 11 11 11 11, which are axially bored to afford continuous communication between the interior of the cylinder and the ducts 4 and 5, respectively. At the portion of said studs or posts within the cylinder they are provided at the outer side—that is, the side toward the cylinder-wall—with a seat for a valve 12, which has cylindrical heads or ends 12ª lodged in apertures bored transversely into said studs or posts 11 at points opposite the seats mentioned, respectively, so that said cylindrical valve-heads may be thrust across the inlet-ducts, which extend axially through the posts, to reach the seats at the opposite side. These seats are preferably formed in plugs 13 13, which are screwed into the sides of the posts 11, and because it is desirable to gain easy access to them for the purpose of renewing the annular seating-gaskets or cushions 14, with which they are provided, the cylinder has apertures in line with said plugs, respectively, which are closed by plugs 15 15, which may be withdrawn to insert and remove the seat-plugs 13. The length of each valve 12 is such that when seated at one end it is withdrawn substantially from across the axial duct of the posts 11 at the other end, opening free passage through said posts for the water in or out, as the case may be. The cylindrical heads of these valves are not designed to seat fluid-tight where they are thrust through the sides of the tubular posts 11, but are only fitted therein for the purpose of guidance,

their effective seating being obtained at the ends on the annular seating-gaskets 14 in the plugs 13. The heads of the valves 12 are hollow, being axially apertured from end to end.

A piston 16 plays within the cylinder 1 on an axially-situated rod or stem 17. This stem obtains guide-bearings at the centers of the heads 2 and 3, which have the cylindrically-protruding bosses 18 and 19, respectively, in which the guide-bearings of the rod are formed by boring from the inner face of the heads, respectively. In the head 3 this bearing is closed at the outer end; but in the head 2 the boss 18 is bored from the outer end axially with respect to the bearing of the rod in order that there may be extended through the end of the boss in said bearing a plunger having at its inner end a stop-nut 21, between which and the end of the bore made for the guide-bearing of the rod 17 there is coiled on the plunger a spring 22, tending to thrust the latter inward. At the outer end of the plunger it has a head 23, which stops against the outer end of the boss 18 and may serve as a means for actuating any suitable form of registering mechanism for recording the strokes of the piston which are communicated to the rod 17, as hereinafter explained, thereby adapting the device to operate as a meter. It will be manifest that devices for transmitting power proportionate to the water-pressure operating on the piston may be substituted for the devices shown for merely registering the movement. On the rod 17 at opposite sides of the piston and at positions suitably near to the valves 12 12 to perform the functions hereinafter indicated there are secured collars or flanges 24 24, and coiled about the rod on the side of said collars toward the piston are springs 25 25. Mounted on one of the posts 11 at each end there are latches 26 26, provided with springs 27 27, tending to hold them at their free ends inward toward the rod 17 and against the periphery of the collars 24. These latches have each a shoulder 28 in position to engage the collar 24 and stop the longitudinal movement of the rod 17 in the direction in which it would be thrust by the movement of the piston encountering the spring 25. The end of the latch toward the piston is sloped on the side toward the rod 17 to operate as a cam upon the encounter therewith of the hub or central boss 29 of the piston when the latter having first encountered the spring 25 has compressed said spring sufficiently to enable the boss or hub to reach the sloping cam-face 30 of the latch, and by such encounter the latch is crowded outward from the rod and its shoulder 28 disengaged from the collar 24, whereupon the spring 25, which has been compressed while the hub 29 of the piston was approaching and acting upon the cam-face 30 of the latch, reacting thrusts the rod onward in the direction in which the piston has been moving to compress the spring. Means are provided by which the rod in its longitudinal movement under the thrust of the spring operates the valve 12 at one end for seating it to close the duct in the post 11 connected with the inlet and the valve 12 at the other end to close the duct in the post 11 connected with the outlet and to open the ducts in the opposite posts connected, respectively, with the outlet and inlet. In the principal figures I have shown this means comprising a bell-crank lever 31, fulcrumed on one of the posts 11, having one arm provided with a slot 32, which is engaged by a stud 33 on the valve, while the other arm has a slot 34, engaged by a stud 35 on the rod 17. In each case the stud is conveniently in the form of a screw set through the slot into the part to which it pertains—valve or rod, as the case may be.

In the operation of the structure as thus far described, assuming the position of the parts at any starting-point as that shown in Fig. 1, the fluid will be entering through the inlet-passage 5 at the left-hand end and passing through the post 11 whose axial duct is open, forcing the piston 16 toward the right-hand end, at which the axial duct is open through the post 11 connected with the outlet-pipe 10. As the piston moves under the pressure of the water and as water is drawn from the service system connected with the outlet its hub 29 at the right-hand side will encounter the cam-slope 30 of the latch 26 and will disengage the shoulder 28 from the collar 24 after the spring 25 has been sufficiently compressed to permit said hub to reach said cam-slope and traverse it far enough to effect such disengagement. The reaction of the spring will thereupon thrust the rod 17 toward the right-hand head, and the collar 24, operating upon the arm of the bell-crank lever having the slot 34, which is engaged with the rod, will by means of the other arm of the bell-crank lever, having the slot 32, thrust the valve 12 across the open duct in the post 11 leading to the outlet and seat it at the outer side thereof, closing said outlet and opening the duct through the post 11 at the other side, which is connected by the pipe 7 with the inlet 9. The same movement of the rod 17 will by means of the stud 35, connecting the other bell-crank lever through the slot 34 in one arm, rock said lever about its fulcrum, causing the other arm having the slot 32, engaging the stud 33 of the opposite valve, thrust that valve across the duct in the post 11 leading from the inlet and seat it, closing said duct and opening the duct in the opposite post 11, which is connected, by the other pipe, 7, with the outlet 10. This change in positions of the valves will reverse the water connection, admitting it at the side of the piston from which it was before the change being forced by the movement of the piston

and permitting it to escape from the side at which it was before admitted. The water entering through the inlet 9 and discharged through the outlet 10 will continue its entrance and discharge by said passages, respectively, without interruption except for the unobservably short time occupied by the thrust of the rod under the action of the spring when released from the latch, as described, and no observable interruption of the flow of the water will thereby be caused and no change in the pressure incident to such flow except to the extent of the resistance which the spring 25 opposes to the movement of the piston while it is compressing said spring in order to reach the camface 30 of the latch. The tension of this spring, which is to be produced by its compression to the extent which will occur before the latch is disengaged, need only be sufficient to cause it to react to thrust the valves 12 12 to their opposite seats, respectively, and as there is no necessity for these valves having other than a mere guide-seating in the posts 11, where they penetrate them at the inner sides, and since the pressure of the water on these valves is nearly balanced the resistance of the spring to the movement of the piston may be so slight as to have no perceivable effect upon the flow of the water. This effect is further diminished by making the valves 12 12 hollow—that is, axially apertured from end to end—so that the volume of water which they displace in moving across the current which is passing through the posts 11 is reduced to minimum and is permitted to pass through the valve itself during the movement of the latter until it reaches its seat.

It is not necessary to be limited to a lever connection between the rod 17 and the valves 12 12. A cam connection between said moving parts is easily provided, and such connection is shown is detail in Fig. 4. In this modification of the structure the rod 17 is expanded and slotted, forming at each end a blade 36 passing through the valves 12 12 between the heads, and these blades are provided with oblique slots 37 37, which are engaged by pins 38 38, extending across the slots in the valves, through which the blades play. With this construction it will be seen that the rod in moving in one direction will by the engagement of the oblique slots in the yoke carry the valves transversely to one end of their path and by the movement in the opposite direction will thrust the valves back transversely to the other end, operating, therefore, with the same effect as the bell-crank levers above described. It will be understood that the camslots in the yokes at the opposite ends of the cylinder are oppositely disposed, so that the movement of the rod in either direction thrusts the valves at opposite ends in opposite directions, as in the case of the bell-crank levers, their arms which engage the valves extend from the respective fulcrums in opposite directions for such engagement.

I claim—

1. In a fluid motor or meter comprising a cylinder, longitudinal inlet and outlet passages at both ends thereof; a valve at each end mounted so as to be thrust endwise across said passages to close the same, and adapted, in respect to its dimensions, at one limit of its endwise thrust to close one passage, and at the opposite limit to open said passage and close the other; a piston in said cylinder and an axial rod extending therein and penetrating the piston; means by which the rod when moved longitudinally thrusts the valves endwise in the transverse direction; latches mounted within the cylinder for locking the rod and for holding the valve at either position; stops on the rod at opposite sides of the piston; springs interposed between the piston and said stops respectively, the piston having means for compressing the springs as it moves toward the valves, and for afterward in the same movement disengaging the locking devices.

2. A fluid motor or meter comprising a cylinder having at each end two longitudinal passages; a valve at each end mounted so as to be thrust across said passages for controlling the same; means by which the movement of the piston toward either end operates the valve at that end for reversing its control of the passages, the cylinder having apertures at opposite ends of the transversely-thrust valves and plugs closing said apertures removable for access to the valves.

3. A fluid motor or meter comprising a cylinder; caps for the same at both ends, provided each with an inlet and an outlet passage; posts extending inward from said passages respectively, longitudinally apertured for continuation of the passages; a valve at each end mounted on the two posts at that end and adapted to be thrust endwise across the passages in the post to close the same; means by which the piston operates both valves in each of its strokes for reversing their control of the passages respectively, the posts having plugs closing the outer end of the seats for the valves therein, and the cylinders having apertures and plugs closing the same in line with the valves at both ends of the latter.

4. A fluid motor or meter comprising a cylinder having at each end two longitudinal water-passages; a valve at each end mounted for thrusting transversely of the two passages at that end, and adapted as to dimensions to close one passage at one limit of its endwise thrust and at the opposite limit to open said passages and close the other; means by which the piston at each stroke in either direction operates the valves for reversing their control of the passages respectively; plugs against

which the valves are thrust endwise for seating, the valves being tubular for the free passage of water through them longitudinally.

5. A fluid motor or meter comprising a cylinder; caps for the same at both ends, provided each with an inlet and an outlet passage; posts extending inward from said passages respectively, apertured for continuation of the passages; a valve at each end of the cylinder mounted on the two posts at that end for endwise thrust across the passages therein to close the same, and adapted, in respect to dimensions, to close one passage at one limit of the endwise thrust and at the opposite limit to open said passage and close the other, such valves being tubular for the free passage of water longitudinally through them; plugs screwed in the outer sides of the posts respectively, having at their inner ends packed seats to receive the end thrusts of the valves, the cylinder having apertures and plugs closing the same in line with the valves at both ends of the latter, the plugs in the cylinder being larger than the plugs in the posts, so that the latter may be operated and removed through the apertures in the cylinders.

6. A fluid motor or meter comprising a cylinder; caps for the same at both ends, provided each with an inlet and an outlet passage; posts extending inward from said passages respectively, apertured for continuation of the passages; a valve at each end mounted on the two posts at that end and adapted to be thrust endwise across the passages in said posts to close the same, and adapted in respect to dimensions at one limit of its endwise thrust to close one passage and at the other opposite limit to open said passage and close the other; a piston in said cylinder and an axial rod extending therein and penetrating the piston; a cam at each end of the rod and abutments on the valves for coöperation with the cam to cause the endwise thrust of the rod to operate the valves; latches mounted within the cylinder for locking the rod to hold the valves at either position; stops on the rod at opposite sides of the piston; springs interposed between the piston and said stops respectively, the piston having means for compressing the springs as it moves toward the valves respectively, and for afterward, in the same movement, disengaging the locking devices whereby the reaction of the springs gives the rod its valve-actuating thrust.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 25th day of August, A. D. 1903.

WILLIE H. REYNOLDS.

In presence of—

FREDK. G. FISCHER,

M. GERTRUDE ADY.