No. 842,406. PATENTED JAN. 29, 1907.

L. C. LEWIS.

WATER MOTOR.

APPLICATION FILED OCT. 6, 1905.

2 SHEETS—SHEET 1.

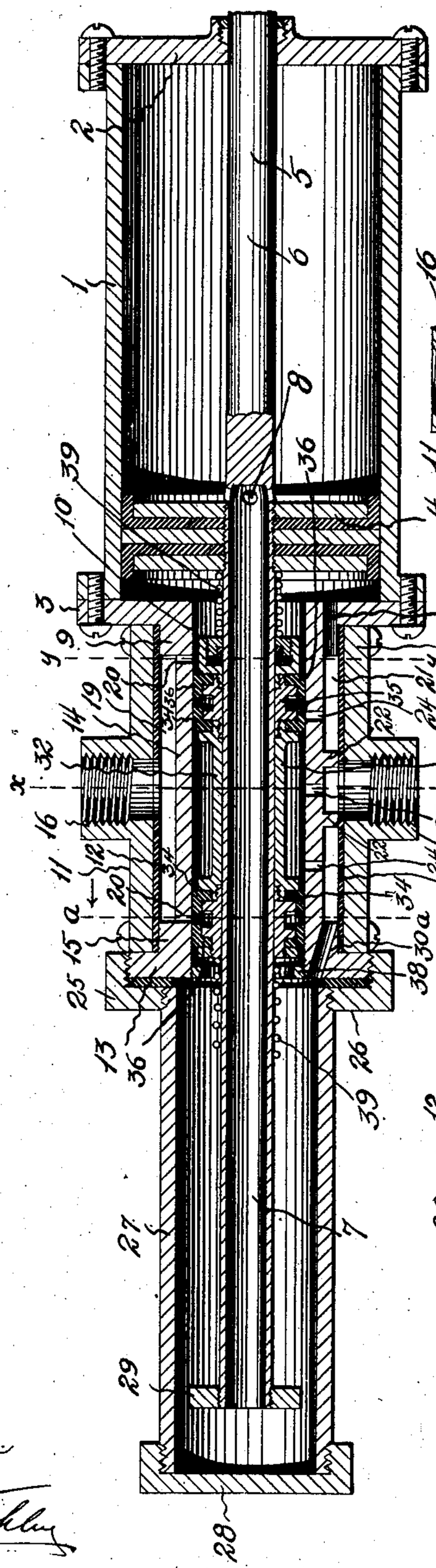

Fig. 5.

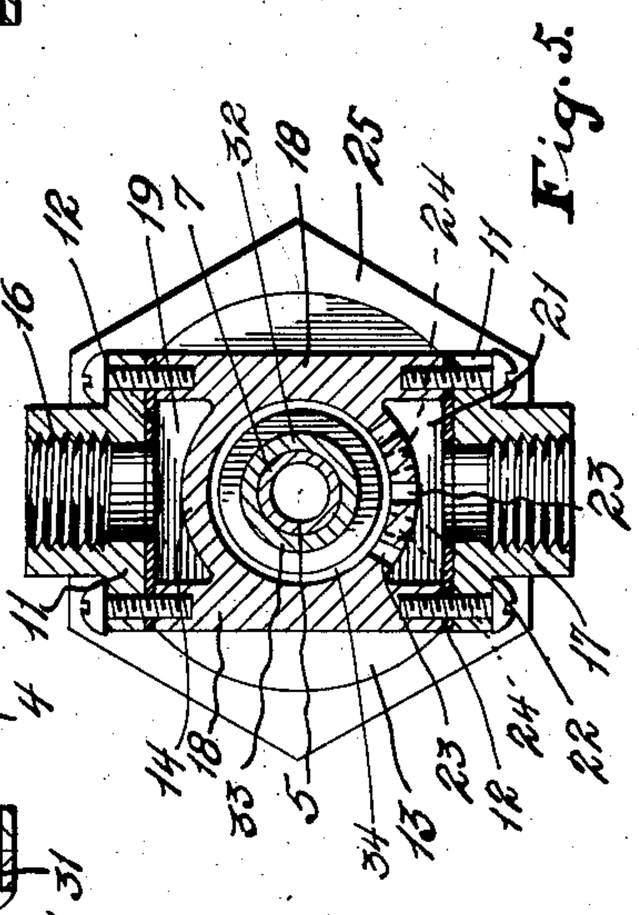

Fig. 1.

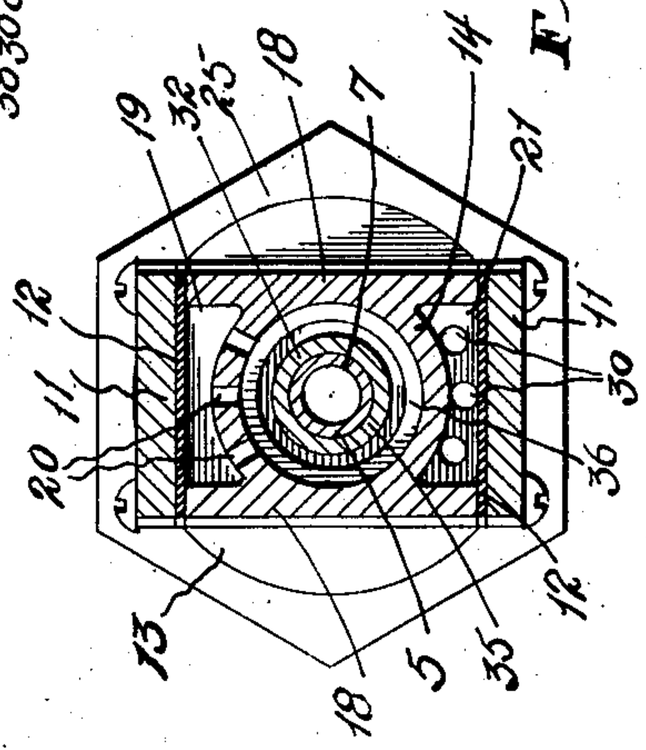

Fig. 4.

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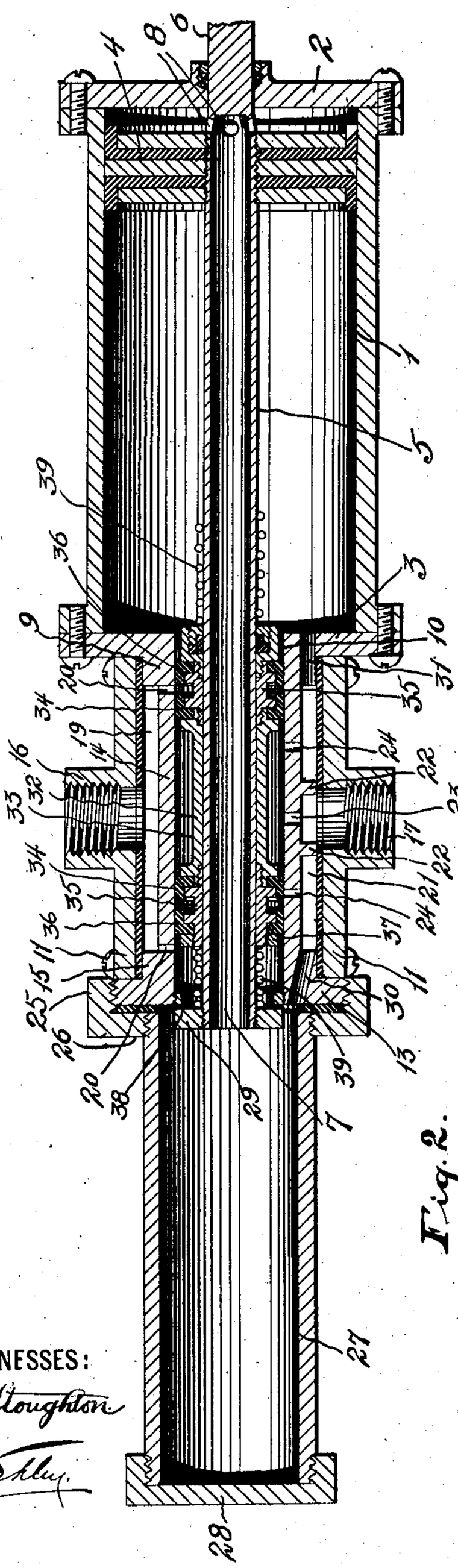

Fig. 2.

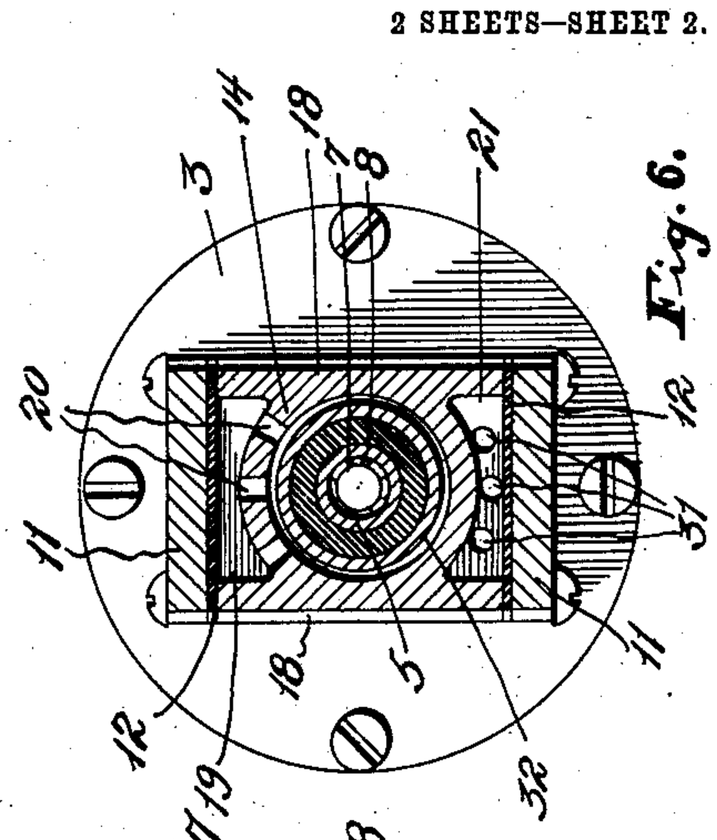

Fig. 6.

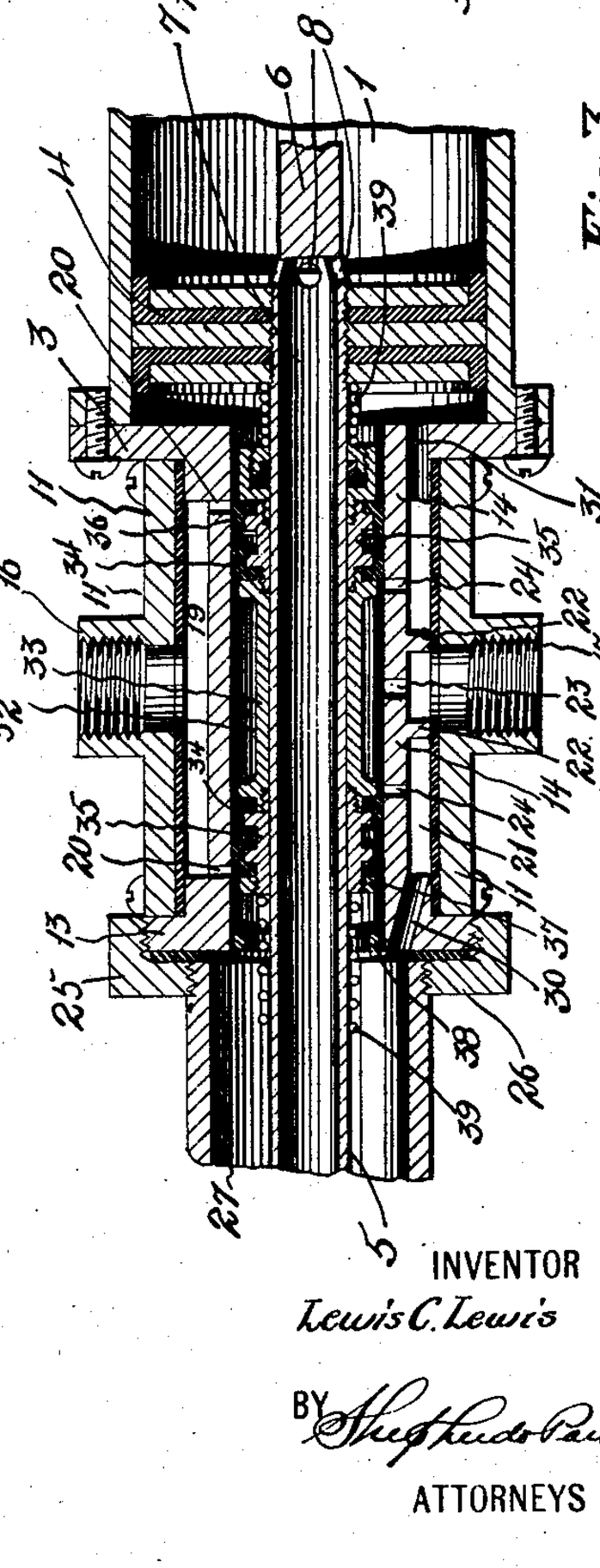

Fig. 3.

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UNITED STATES PATENT OFFICE.

LEWIS C. LEWIS, OF COLUMBUS, OHIO, ASSIGNOR TO THE MONARCH MANUFACTURING COMPANY, OF COLUMBUS, OHIO, A CORPORATION OF OHIO.

WATER-MOTOR.

No. 842,406. Specification of Letters Patent. Patented Jan. 29, 1907.

Application filed October 6, 1905. Serial No. 281,579.

To all whom it may concern.

Be it known that I, LEWIS C. LEWIS, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Water-Motors, of which the following is a specification.

My invention relates to new and useful improvements in water-motors.

The object of the invention is to produce a simple motor of superior construction in which a comparatively few number of parts are employed, thus reducing the wear and lengthening the intervals when repairs become necessary.

It is also an object to so construct and arrange the parts that access thereto may be easily and readily had.

Still another feature resides in the provision of a main valve which is shifted by the action of the piston-head and the pressure of the fluid without the use of auxiliary valves or tappets.

Among other objects is the provision whereby a steady and continuous movement of the piston-head is had and the liability of "pounding" reduced to a minimum.

Finally the object of the invention is to produce a motor which will be strong, durable, and efficient and one in which the several parts will not be liable to get out of working order.

With the above and other objects in view the invention consists of the novel details of construction and operation, a preferable embodiment of which is described in the specification and illustrated in the accompanying drawings, wherein—

Figure 1 is a longitudinal sectional view of the motor, the piston being at one end of its stroke and the main valve shifted. Fig. 2 is a like view with the piston at the opposite end of its stroke and the valve shifted in the opposite direction. Fig. 3 is a partial longitudinal sectional view showing the piston-head near the end of its stroke, the spring compressed and about to complete the shifting of the valve, also showing the exhaust-ports open to relieve the pressure. Fig. 4 is a transverse sectional view taken on the line *a a* of Fig. 1 looking in the direction of the arrow. Fig. 5 is a transverse sectional view taken on the line *x x* of Fig. 1, and Fig. 6 is a transverse sectional view taken on the line *y y* of Fig. 1 looking in the direction of the arrow.

In the drawings the numeral 1 designates the main or piston cylinder of the motor, which is provided at its ends with heads 2 and 3. A suitably-constructed piston-head 4 is arranged in the cylinder and is carried on the piston-rod 5, having a solid portion 6 and a hollow portion 7, the solid portion terminating short of the piston-head and passing through the cylinder-head 2, so as to be connected with the pump or other device which it is desired to operate. The hollow portion 7 of the piston extends through the piston-head 4 and is provided with a plurality of ports 8, which communicate with the cylinder 1 between the piston-head and the cylinder-head 2. The cylinder-head 3 is provided with an outwardly-directed angular boss 9, preferably four-sided. A cylindrical valve-sleeve 14, having a diameter less than that of the boss 9, is extended therefrom. The valve-sleeve is provided at its outer end with an annular screw-threaded flange 13, having an annular boss or shoulder portion 15, corresponding to the boss 9.

Two packing-strips 12 are supported at each end on the bosses 9 and 15 and receive plates 11, which are suitably secured in place. Side plate 18 are formed integral with the valve-sleeve 14 and the bosses 9 and 15, so that interspaces are provided between the plates 11 and the valve-sleeve. One of the plates 11 is provided with a nipple 16, through which the fluid under pressure is supplied, while the plate opposite is provided with a nipple 17, through which the exhaust is conducted. The interspace between one of the plates, which I will call the "upper" plate, provides a supply-chamber 19 between the said plate and the valve-sleeve. Adjacent the bosses 9 and 15 the valve-sleeve is provided with ports 20, which establish communication between the extreme ends of the chamber 19 and the interior of the valve-sleeve, so that the fluid introduced into the chamber may be conveyed into the sleeve when the parts are opened, as hereinafter described. The interspace between the other plate 11, which I will call the "lower" plate, and the valve-sleeve provides an exhaust-chamber 21. Transverse ribs 22, extending between the valve-sleeve and the packing 12

on each side of the opening of the nipple, divide the exhaust-chamber into compartments or sections. One or more ports 23, extending through the valve-sleeve, establish communication between the interior of the sleeve and the exhaust-nipple, the said ports being located between the ribs. Exhaust-ports 24 are also provided in the valve-sleeve, establishing communication between the same and the opposite sections of the exhaust-chamber 21. In this manner the exhaust fluid passing into the chamber 21 must first pass through one of the ports 24 into the valve-sleeve and out through the port 23 before passing through the exhaust-nipple 17.

An internally-screw-threaded collar 25 is engaged about the annular screw-threaded flange 13 and is provided with an inwardly-extending annular screw-threaded flange 26, into which the end of an extension-sleeve 27 is screwed. The extension-sleeve 27 has a diameter slighter larger than that of the valve-sleeve 14 and is closed at its outer end by a screw-threaded cap 28. The hollow portion 7 of the piston-rod extends through the valve-sleeve 14 and well into the casing 27, carrying on its end a threaded washer 29. One or more inclined ports 30 extend through the flange 13 and boss 15, establishing communication between the interior of the sleeve 27 and the exhaust-passage 21, while one or more ports 31 extend through the cylinder-head 3 and the angular boss 9, establishing communication between the opposite end of the exhaust-chamber 21 and the cylinder 1.

Within the valve-sleeve 14 I arrange a double-headed slide-valve 32. The valve 32 comprises a central tubular portion 33, provided at each end with internally-threaded flanged portions and fitting snugly about the hollow portion 7 of the piston-rod 5. About each of the flanged portions of the tubular member 33 oppositely-directed annular cup-leathers 34 are arranged, the said leathers having their peripheries fitting snugly within the sleeve 14. The leathers are held in place by flanged thimbles 35, each of which supports an annular cup-leather 36, similar to the cup-leather 34 and directed toward the same. The last-named cup-leathers are securely held in place on the thimbles by rings 37, threaded on the extreme ends of the thimbles, and thus the valve. The cup-leathers at each end of the valve are separated so that the valve may be positioned to cause them to stand on each side of one of the sets of ports 20 of the supply-chamber 19, but when so positioned acting to confine the fluid therebetween and prevent the same from passing into the bore of the sleeve. In the outer end of the sleeve 14 and within the flange 13 a guard-ring 38 is threaded, said ring being provided to prevent the valve from being moved out of the sleeve when shifted, as hereinafter described. About the piston-rod and at each end of the valve I loosely mount suitable coiled springs 39, the said springs being only of sufficient length to properly shift the valve when compressed.

I will now proceed to give a complete description of the operation of my pump.

Referring to Fig. 2, the piston-head 4 is shown at the end of its outer stroke and about to commence its inward stroke and the valve 32 having been shifted. Fluid introduced through the nipple 16 fills the chamber 19 and passes through the ports 20. That portion passing through the ports 20 at the right hand of the chamber is confined between the leathers 34 and 36 of the valve-head at the right hand, as clearly shown in Fig. 2, while the remainder of the fluid is free to pass through the ports 20 at the left-hand end of the sleeve into the bore of the sleeve 14 and through the ring 38 into the sleeve extension 27. Fluid introduced into the sleeve extension 27 under pressure enters the hollow portion 7 of the piston-rod 5 and passes therethrough to the ports 8, out through which it passes into the cylinder 1 behind the piston-head 4, thus acting to drive the same inward and cause the inward stroke of the piston-head. With the valve in this position and still referring to Fig. 2 the ports 24 at the left-hand end of the sleeve 14 are closed by the cup-leather 34, while the exhaust-ports 24 at the other end are uncovered and opened, so that the exhaust fluid in the cylinder 1 is free to pass through the ports 31 into the exhaust-chamber 21 at the right-hand end. From this point it is free to pass through the uncovered ports 24 into the valve-sleeve 14 and out through the ports 23 to the exhaust-nipple 17. As the fluid is supplied and the piston-head driven inward the valve remains in the same position until the piston-head 4 nears the end of its stroke. As the said piston-head approaches the end of its inward stroke it encounters the coiled spring 39, mounted on the piston-rod and bearing against the right-hand end of the valve. The spring is compressed as the piston-head continues to move, and as the spring is compressed the valve 32 is moved or shifted to the left until it reaches the position shown in Fig. 3. By observing Fig. 3 it will be seen that the valve is so positioned that the supply or inlet ports 20 at each end of the valve-sleeve are closed by the cup-leathers 36, while the exhaust-ports 24 at each end are open, so that pressure of the fluid is relieved on both sides of the valve. It is also to be noted that the cup-leathers 34 and 36 at the right-hand end are just about to open and close the inlet-ports 20 and the exhaust-ports 24, respectively. The valve on reaching this position, as shown in Fig. 3, and the pressure being relieved by the opening of both the exhaust-ports, the spring 39, which has been compressed, is free to expand,

which it does, completing the movement of the valve to the left, so that it arrives at the position shown in Fig. 1, the piston-head thus having completed its inward stroke and ready to begin its outward stroke. When the valve is shifted to the position shown in Fig. 1, the supply-ports 20 are opened, fluid entering through those at the left being confined between the leathers of the valve at that end, while the fluid under pressure, passing through the ports 20 at the right, enters through the opening 10 of the head 3 into the cylinder 1 against the piston-head 4, thus forcing the same outward. The exhaust-ports 24 at the right-hand end of the sleeve are closed by the leather 34, while the opposite ports 24 are open. The exhaust fluid in the cylinder 1 as the piston-head moves outward passes through the ports 8 into the hollow portion 7 of the piston-rod 5. Passing through the said hollow portion the exhaust fluid enters the sleeve extension 27, from which it passes, by way of the ports 30, chamber 21, ports 24 and 23, to the exhaust-nipple 17. The valve remains in this position, as shown in Fig. 1, until the piston approaches the end of its outward stroke, when the spring 39 at the left hand of the valve is compressed by the washer 29 and the valve shifted in the same manner as before described, so that it is moved to the position shown in Fig. 2. The inward and outward strokes of the piston and the shifting of the valve is carried on in the manner described as the motor continues to operate.

I wish to call attention to the fact that by simply unscrewing and removing the sleeve extension 27 and the guard-ring 38 the slide-valve may be readily exposed to view and by removing the washer 29 the spring 39 and the valve may be entirely removed, for whatever purposes desired, and access to the valve-sleeve 14 had. On the other hand, access is readily had to either the supply or exhaust chambers 19 and 21 by simply removing the plates 11 and to the cylinder and the right-hand end of the valve-sleeve by simply disconnecting the cylinder from the head 3. Another point of advantage and novelty to which attention is invited is the fact that only four cup-leathers are employed, which greatly reduces the intervals between, as well as the cost of repairs, which, it is obvious, are often necessary and depend in proportion to the number of cup-leathers or packings employed.

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

1. In a fluid-motor, a cylinder, a piston-head working in the cylinder, an extension-sleeve, a hollow piston-rod carrying the piston-head and arranged to establish communication between the cylinder and the sleeve, provision for supplying and exhausting fluid to and from the cylinder and sleeve, and a valve interposed between the cylinder and sleeve extension having movable engagement with the piston-rod adapted to control the supply and exhaust of fluid to and from the cylinder and the sleeve.

2. A sleeve provided with suitable inlet and exhaust ports and provision for supplying and exhausting fluid to and from said sleeve, in combination with a piston and a valve having a plurality of leathers snugly fitting within the sleeve, and provision for moving said valve to cause its leathers to alternately cover and uncover the ports in the sleeve and during certain periods to cover both the supply-ports and uncover both of the exhaust-ports.

3. In a fluid-motor, a cylinder, a piston-head working in the cylinder, a valve-casing associated with one end of the cylinder, a sleeve extension associated with the valve-casing, a hollow piston-rod carrying the piston-head extending through the valve-casing into the sleeve and arranged to establish communication between the cylinder beyond the piston-head and the sleeve, and a valve having movable engagement with the piston-rod arranged in the valve-casing.

4. In a fluid-motor, the combination with a cylinder, an extension-sleeve, a piston and a piston-rod working in the cylinder and the sleeve and establishing communication therebetween, of a valve-casing provided with a supply and an exhaust chamber and disposed between the cylinder and the extension-sleeve, the said casing having ports establishing communication between the sleeve and one end of the exhaust-chamber and the cylinder and the opposite end of the exhaust-chamber, a valve-sleeve arranged in the casing having supply-ports communicating with the supply-chamber and exhaust-ports communicating with the exhaust-chamber, and a free sliding valve arranged on the piston-rod in the valve-sleeve and adapted to alternately cover and uncover the ports leading to the supply-chamber and the exhaust-chamber.

5. In a water-motor, the combination with a cylinder, of a piston mounted for reciprocatory motion in said cylinder, a valve-casing, a valve slidably disposed in said valve-casing, an extension-sleeve extending beyond the end of the valve-casing, a hollow piston-rod to which the piston is secured, said piston-rod being arranged to establish communication between the sleeve extension and the interior of the cylinder beyond the piston, said piston-rod extending through the valve and having a member arranged upon its outer end adapted to shift said valve at the limit of movement of the piston away from the sleeve extension.

6. In a device of the character described, the combination with a cylinder, of a piston

mounted for reciprocatory movement in said cylinder, a valve-casing located adjacent said cylinder, a sleeve extending from said valve-casing and closed at its outer end, means for admitting fluid under pressure to the valve-casing, means for conducting said fluid from said valve-casing, a hollow piston-rod secured to the piston and extending through the valve-casing and into the sleeve, said piston-rod being adapted to establish communication between said sleeve and the interior of the cylinder beyond the piston, and a valve located in the valve-casing and adapted to be shifted when the piston reaches its limit of movement in either direction.

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

LEWIS C. LEWIS.

Witnesses:
A. L. PHELPS,
M. B. SCHLEY.