No. 861,690. PATENTED JULY 30, 1907.

H. W. & J. E. YOST.

OSCILLATING MOTOR.

APPLICATION FILED APR. 30, 1906.

2 SHEETS—SHEET 1.

FIG. 2.

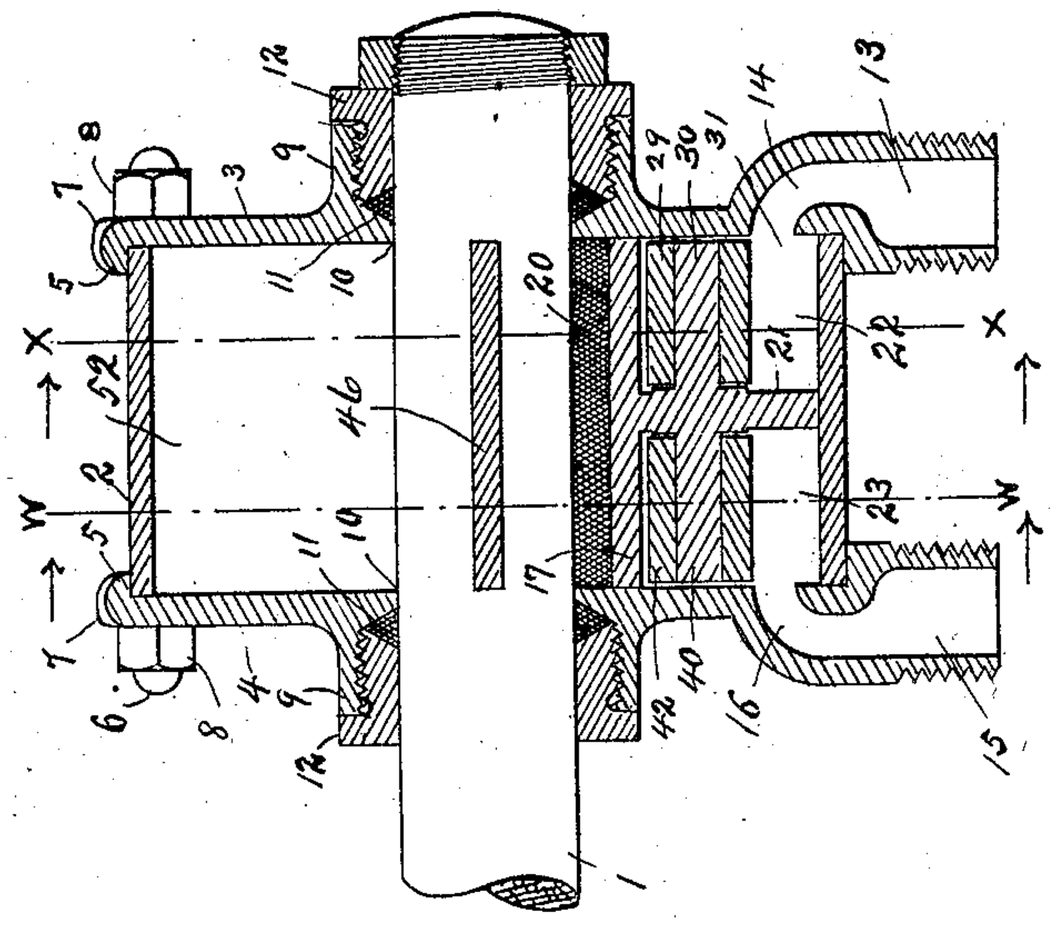
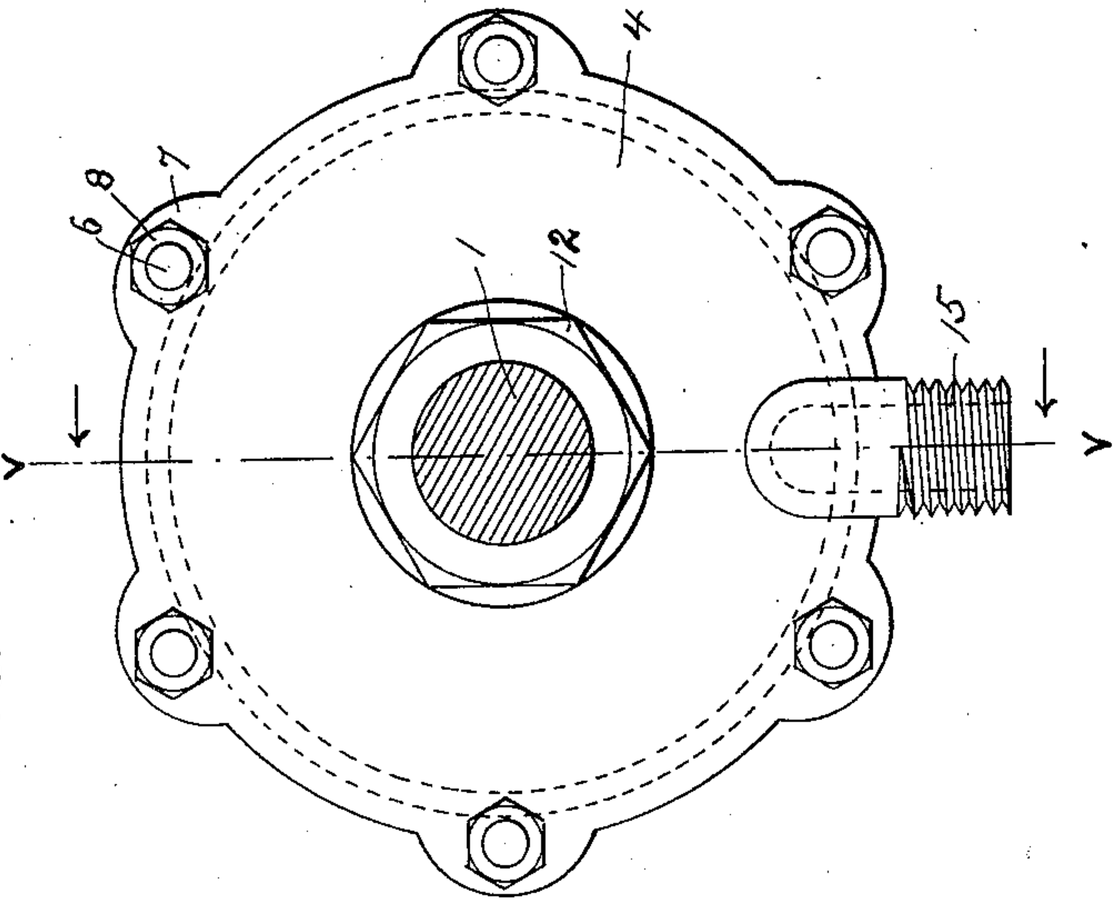


FIG. 1.



WITNESSES:

William F. Bauer

Louis Miller

INVENTORS,

HENRY W. YOST,

JOSEPH E. YOST,

by H. A. Toulmin,

ATTORNEY.

No. 861,690. PATENTED JULY 30, 1907.

H. W. & J. E. YOST.

OSCILLATING MOTOR.

APPLICATION FILED APR. 30, 1906.

2 SHEETS—SHEET 2.

FIG. 3.

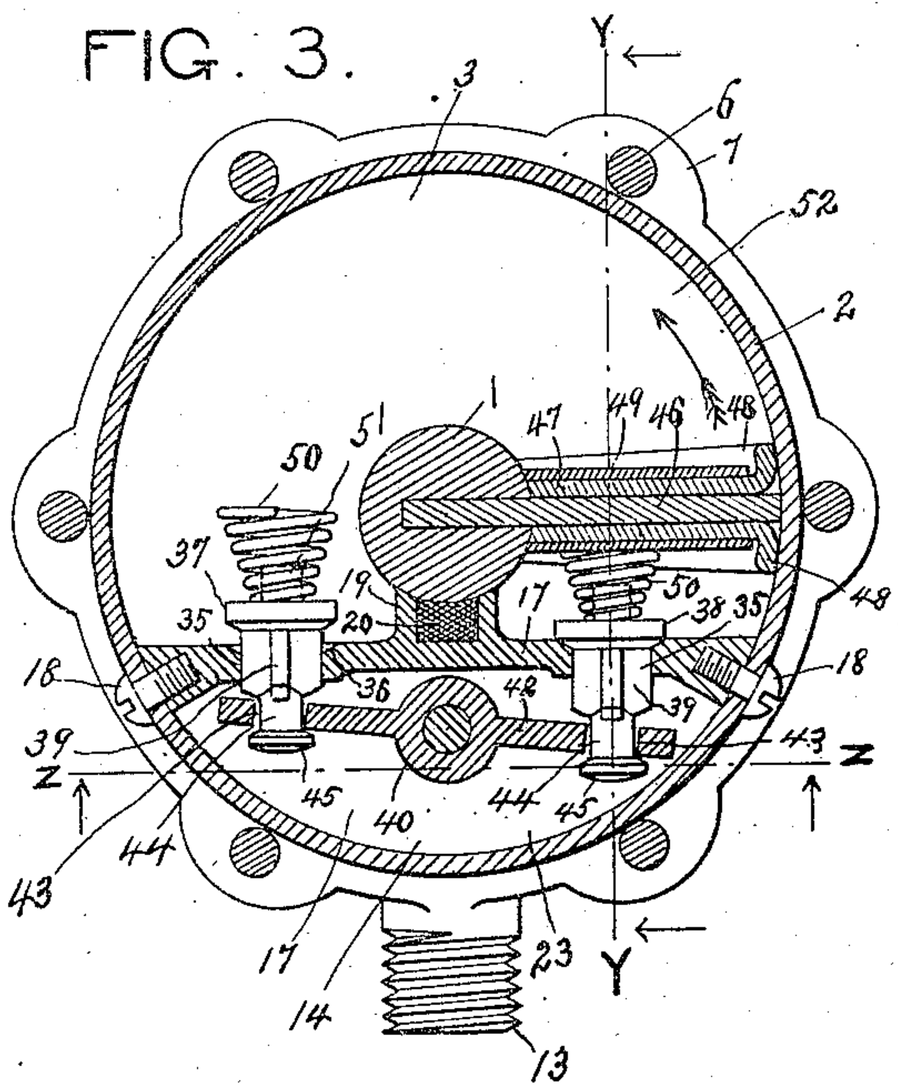


FIG. 5.

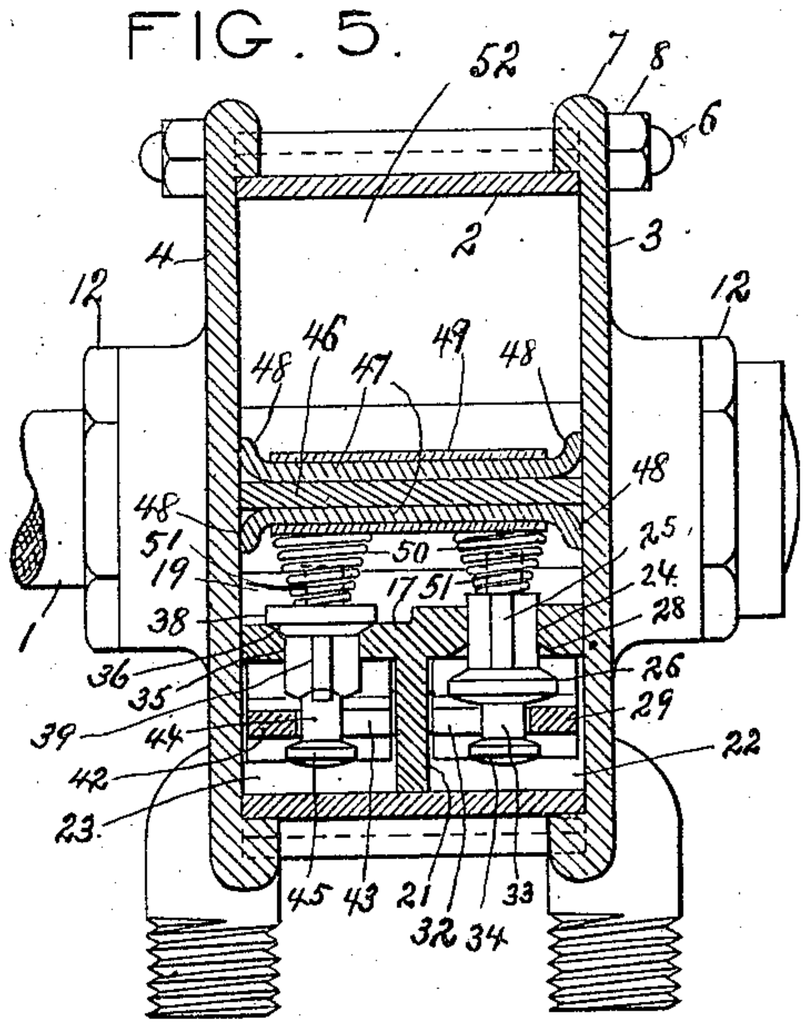


FIG. 4.

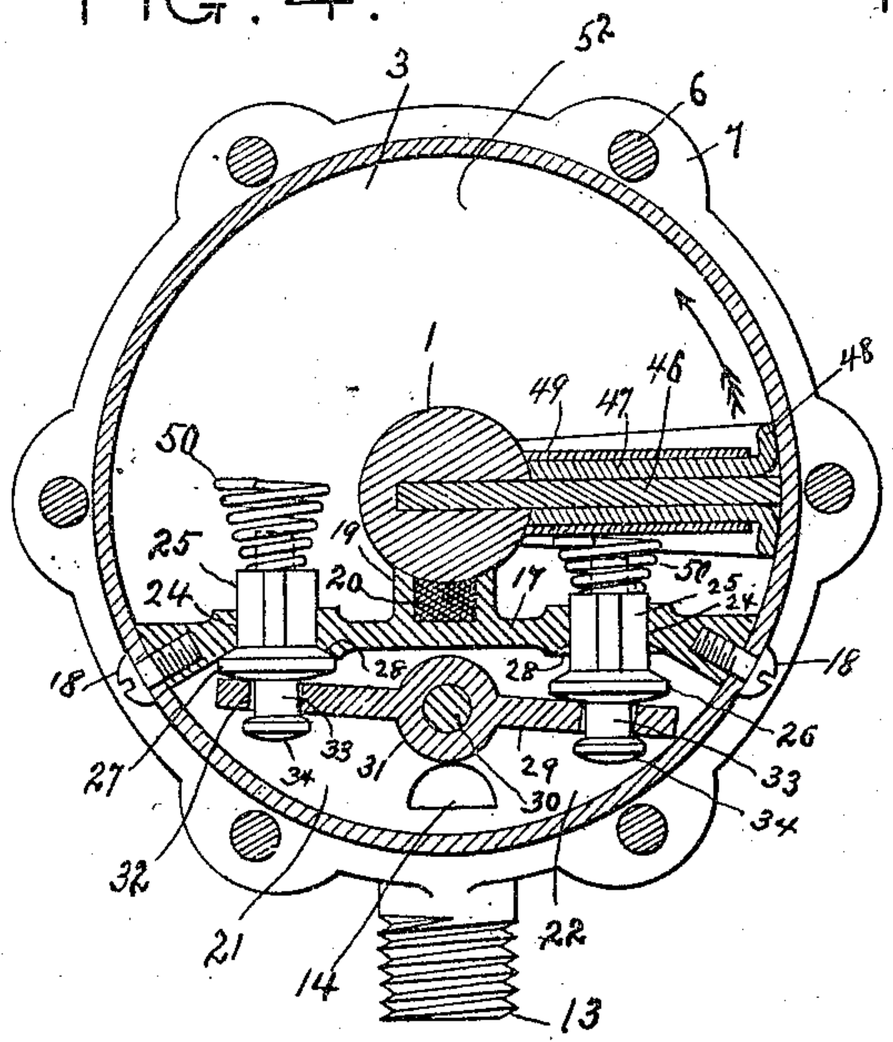
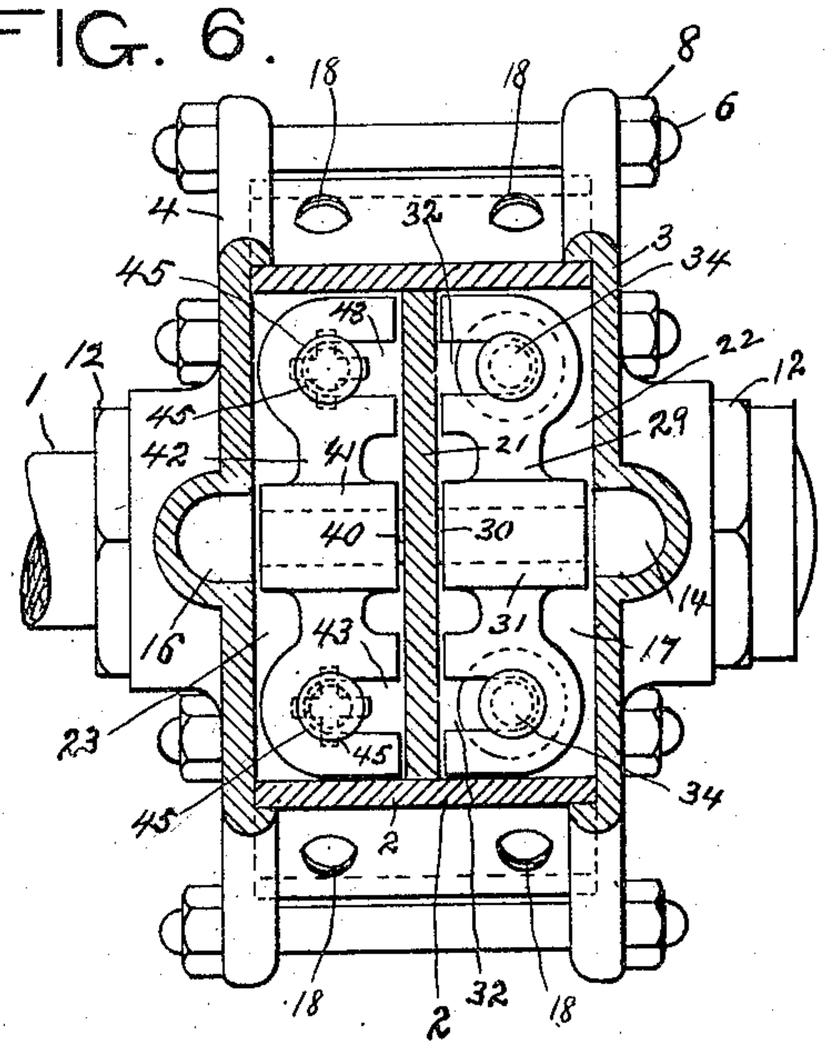


FIG. 6.



WITNESSES:

William F. Bauer.

Louise Miller

INVENTORS.

HENRY W. YOST.

JOSEPH E. YOST.

by H. A. Faibisoff

ATTORNEY

UNITED STATES PATENT OFFICE.

HENRY W. YOST AND JOSEPH E. YOST, OF SPRINGFIELD, OHIO, ASSIGNORS TO YOST GEARLESS MOTOR COMPANY, OF SPRINGFIELD, OHIO, A COPARTNERSHIP.

OSCILLATING MOTOR.

No. 861,690. Specification of Letters Patent. Patented July 30, 1907.

Application filed April 30, 1906. Serial No. 314,385.

To all whom it may concern:

Be it known that we, HENRY W. YOST and JOSEPH E. YOST, citizens of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Oscillating Motors, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to oscillating motors, and more particularly to oscillating motors such as water motors, adapted for use with a practically inelastic motor fluid.

Our invention has for its object to provide a simple, durable, inexpensive and efficient structure of this class, which will be compact and self contained.

To these ends our invention consists in certain novel features which we will now proceed to describe and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is an elevation of a motor embodying our invention in one form; Fig. 2 is a sectional view of the same, taken on the line *v v* of Fig. 1 and looking in the direction of the arrows; Fig. 3 is a sectional view, taken on a plane corresponding with the line *w w* of Fig. 2 and looking in the direction of the arrows; Fig. 4 is a similar view, taken on a plane corresponding with the line *x x* of Fig. 2 and looking in the direction of the arrows; Fig. 5 is a sectional view, taken on the line *y y* of Fig. 3 and looking in the direction of the arrows; and Fig. 6 is a sectional view, taken on the line *z z* of Fig. 3 and looking in the direction of the arrows.

In the said drawings, 1 represents an oscillating shaft, which may be the shaft of a washing machine, for use in connection with which our improved motor is especially adapted. This shaft passes through the motor cylinder, which comprises a cylinder body portion 2 and heads 3 and 4. The cylinder body 2 is in the form of a plain annulus, and therefore may be readily constructed from a section of pipe or tubing. The heads 3 and 4 are provided with marginal flanges 5, which fit around the edges of the body 2 so as to center the heads and body, and the heads are connected by bolts 6, passing through lugs 7 on the heads and provided with nuts 8, by means of which the heads may be drawn towards each other and held firmly against the ends of the cylinder body 2. Each head has a stuffing box for the passage of the shaft 1, the same comprising an internally threaded sleeve or collar 9, formed integrally with the head and surrounding a central aperture 10 in the head, through which aperture the shaft passes. This sleeve or collar forms a chamber to receive a packing 11, which is held in place and tightened upon the shaft by the usual gland 12. The head 3 has formed integrally therewith an inlet nozzle 13, threaded or otherwise adapted for connection with a source of supply of water under pressure, a passage or port 14 conducting the water to the interior of the cylinder. A similar exhaust nozzle 15 is formed in one piece with the head 4, and communicates with the interior of the cylinder through a port or passage 16.

A portion of the interior of the cylinder is divided off to form a valve chest comprising an inlet chamber communicating with the port 14 and an outlet chamber communicating with the port 16. To provide a simple and effective construction for this portion of the motor, we employ a casting comprising a diaphragm 17 which extends across the cylinder in the plane of a chord of the circle of the cylinder section at right angles to its bisecting radius. This diaphragm is secured at its ends to the cylinder body 2 by means of screws 18, as shown in Figs. 3 and 4, its lateral margins fitting against the heads, while its central portion is provided with an inwardly extending abutment 19, which fits against the shaft 1 and is provided with a recess containing a packing 20 to make a water-tight joint between said abutment and the shaft.

The diaphragm or partition 17 is provided on its other or outer side with an integral flange 21, arranged at right angles to the body of said diaphragm, extending thence outward so as to fit against the cylinder body 2, and dividing the space between the diaphragm 17 and said cylinder body into an inlet or pressure chamber 22 and an outlet or exhaust chamber 23. The portion of the diaphragm 17 which lies inward from the inlet chamber 22 is provided with two ports or openings 24, arranged on opposite sides of the abutment 19, and in these ports fit and slide the stems 25, cruciform in cross section, of the inlet valves 26 and 27, the outer face of the diaphragm 17 being provided with valve seats 28 to receive said valves. The valves 26 and 27 are connected to the ends of a rocker arm or vibrating lever 29, which lever is centrally pivoted to a bearing stud 30 projecting outward from the flange or partition 21, and preferably formed in one piece therewith, the lever 29 being provided with a central sleeve 31 which slips over the bearing stud 30, so as to be readily removable therefrom when the head 3 is removed to give access to the interior of the inlet chamber 22. The connection between the valves 26 and 27 and the ends of the lever 29 is effected by providing the lever with an inwardly directed open-mouth slot 32 at each end, each valve being provided wth a shank or extension 33 to fit said slot, and a head or enlargement 34 to engage the lever, which is thus engaged on one side by the valve proper and on the other side by the head 34, so as to cause the lever and valves to move in unison while permitting the lever to rock relatively to the valves, the fit between the shanks 33 and slots 32 being a sufficiently loose one to permit this rocking. It will

be seen that when the head 3 is taken off the lever 29 can be readily removed by merely pulling it outward in the direction of the axis of the shaft 1, the sleeve 31 slipping off of the bearing stud 30, while the open-mouth slots 32 permit the ends of the lever to be disengaged from the valves.

On the opposite side of the flange or partition 21, the diaphragm 17 is provided with exhaust ports 35, having valve seats 36 at their inner ends to receive the exhaust valves 37 and 38, which lie on the inner side of said diaphragm, and which have stems 39, cruciform in cross section, which fit and slide in the ports 35. The partition 21 is provided on this side also with a central bearing stud 40, on which fits a central bearing sleeve 41 on a rocker arm or vibrating lever 42, the ends of which are connected to the exhaust valves 37 and 38 in a manner similar to the connection of the lever 29 with the inlet valves 26 and 27. In other words, the lever 42 is provided at its ends with inwardly directed open mouth slots 43, and the valve stems 39 are provided with reduced shanks 44, loosely fitting said slots, and heads or enlargements 45 to engage the lever. In this case also it will be seen that the mouths of the slots 43 are inwardly directed, so that, by removing the cylinder head 4, the lever 42 may be drawn out by simply moving it in a direction parallel with the axis of the shaft 1, without displacing the valves.

The shaft 1 is provided with an oscillating piston 46, in the form of a radial blade secured to the shaft at its inner end and fitting between the cylinder heads, shaft and cylinder body 2. In order to make water-tight joints between the piston and cylinder, there is secured to each side of said piston a packing sheet 47, preferably constructed of leather and of an area somewhat greater than that of the piston, so that its margin 48 is free and bent outward so as to be held against the cylinder walls by the pressure of the water. These packing sheets are held in position by clamping plates 49, suitably secured to the body of the piston on each side thereof and clamping the packing sheets against said body.

Each valve has that end thereof which lies in the path of the piston 46 provided with a coiled spring 50, secured to said valve and so arranged as to be squarely struck by the piston and compressed thereby before the shifting of the valves finally occurs. These springs are preferably secured to studs 51, projecting inward from the valves or their stems, and the springs are preferably conical in form or of increasing radius toward their free ends.

The operation of the motor will be readily understood from the preceding description. Assuming that the parts are in the position shown, the water under pressure, entering the inlet chamber 22 through the inlet nozzle 13 and port 14, is admitted to the interior of the working portion 52 of the cylinder through the port 24 of the inlet valve 26, the other inlet valve 27 being held to its seat by the pressure of the water against it so as to close the inlet port which it controls. The pressure thus exerted on one side of the piston 46 moves the same in the direction of the arrows in Figs. 3 and 4, the water on the other side of the piston escaping through the port controlled by the open exhaust valve 37, the other exhaust valve 38 being held closed by the water pressure. Movement of the piston in this direction continues until it comes into contact with the springs 50 of the inlet valve 27 and exhaust valve 37. Movement of the former valve is resisted by the water pressure on its other side and movement of the latter valve is resisted by the water pressure on the other exhaust valve 38, which, being connected with the valve 37 through the lever 42, resists the closing of the valve 37. The springs 50 are therefore compressed, while the valves 27 and 37 remain stationary and the piston completes its stroke. The compression of the springs continues until the piston comes into contact with the studs 51, and, by its engagement with them, will start the valves upon their shifting movement, positively lifting from their seats the valves which are held there by the water pressure. As soon as these valves have been thus started and relieved of the water pressure resistance, the springs act to shift the valves the remainder of the way, the inlet valve 27 opening and the exhaust valve 37 closing, while the inlet valve 26 is closed and the exhaust valve 38 is opened through the medium of the connecting levers 29 and 42. Water under pressure is thus admitted to the other side of the piston, which thereupon reverses its direction of travel and moves back to the position shown in the drawings, thereby again opening the inlet valve 26 and exhaust valve 37 and closing the inlet valve 27 and exhaust valve 38, whereupon the same cycle of operation is continued. It will be understood in this connection that the springs are always compressed to the same extent, to wit, to an extent just sufficient to enable the piston to come into contact with the studs 51. This prevents excessive compression of the springs, which would occur when the motor is carrying a heavy load if the springs were compressed sufficiently to overcome the pressure of the water against the valves. Such excessive compression tends to rapidly crystallize the springs and correspondingly shorten their lives. The construction which we have devised makes the compression of the springs uniform under all loads and avoids excessive compression, thereby increasing the life of the springs.

From an examination of Fig. 5 of the drawings, it will be seen that the relative position of the inlet and outlet valves is such that the former will be struck and unseated by the piston before the latter is struck and its shifting movement started. In said figure of the drawings the difference has been slightly exaggerated to make it apparent on the small scale necessarily employed, and it will be seen that the stud 51 of the inlet valve 26 extends somewhat further inward than the stud 51 of the exhaust valve 38. The same is true of the valves 27 and 37, the inlet valve stud extending somewhat in advance of the exhaust valve stud. It follows from this construction that the inlet valve starts to shift somewhat before the exhaust valve, the inlet valve leading somewhat in this movement. This allows water under pressure to enter through the opening inlet valve somewhat before the exhaust valve starts, admitting water under pressure on that side of the piston, so that it will assist the spring on the outlet valve in moving the outlet valve quickly to its seat. This arrangement also avoids the possibility of the outlet valve leading in the shifting movement, which leading might result from some variation in the resistance of the springs and would be objectionable.

It will be seen that the structure is very compact, simple and inexpensive, that the parts are readily assembled and wholly or partially disconnected for inspection or repair, and that the motor is durable in construction and efficient in operation.

We wish it to be understood that we do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. An oscillating motor comprising a cylinder, an oscillating shaft provided with a piston traveling therein, a valve casting located within the cylinder and forming inlet and exhaust chambers, each chamber having ports opening into the main cylinder on opposite sides of the piston, valves controlling said ports and provided with springs arranged in the path of the piston, and rocker arms centrally pivoted in the respective valve chambers and connected to the corresponding valves to move them in opposite directions, substantially as described.

2. An oscillating motor comprising a shaft provided with an oscillating piston, a cylinder in which said piston operates, a diaphragm extending chordwise across said cylinder and provided with valve openings and valves, a partition flange extending at right angles to said diaphragm and dividing the space between it and the cylinder body into inlet and exhaust chambers, bearing studs supported within said chambers, rocker arms pivotally mounted on said studs and provided at their inner ends with open mouth slots to engage the valves.

3. An oscillating motor comprising a shaft provided with an oscillating piston, a cylinder in which said piston operates, said cylinder having an annular body and removable heads, a diaphragm extending chordwise across the cylinder body and provided with valve openings and valves, a partition flange extending at right angles to said diaphragm and dividing the space between it and the cylinder body into inlet and exhaust chambers, bearing studs extending outward from said partition flange into the chamber, and rocker arms constructed to removably slip over said bearing studs and provided at their ends with open-mouthed slots to engage the valves, substantially as described.

4. An oscillating motor comprising a shaft having an oscillating piston, a cylinder having an annular or tubular body and removable heads, an integral valve chamber casting comprising a diaphragm extending chordwise across the cylinder, an abutment extending transversely of said diaphragm on one side thereof and fitting against the shaft, a partition flange at right angles to said diaphragm and abutment on the other side of said diaphragm, said partition flange extending to the body and forming inlet and exhaust chambers on opposite sides thereof, and bearing studs extending outward from said partition flange across the valve chambers, said diaphragm being provided with valve openings between the main body of the cylinder and each valve chamber on opposite sides of the abutment, valves controlling said valve openings and provided with springs arranged in the path of the piston, and rocker arms having central sleeves to slip over the bearing studs and open-mouthed slots at their ends to engage the valves, substantially as described.

5. In an oscillating motor of the character described, a valve chamber, one side whereof is removable, in combination with two valves, each comprising a valve proper, a stem cruciform in cross section, a reduced shank, and an enlarged head, and a rocker arm removably pivoted between the valves and having open-mouthed slots at its ends to loosely engage the shanks of the valves, substantially as described.

In testimony whereof, we affix our signatures in presence of two witnesses.

HENRY W. YOST.
JOSEPH E. YOST.

Witnesses:
IRVINE MILLER,
E. O. HAGAN.