F. E. ALLEN & J. M. LIEB.

WATER MOTOR.

APPLICATION FILED MAY 10, 1916.

1,254,644.

Patented Jan. 29, 1918.

2 SHEETS—SHEET 1.

Fig. 1

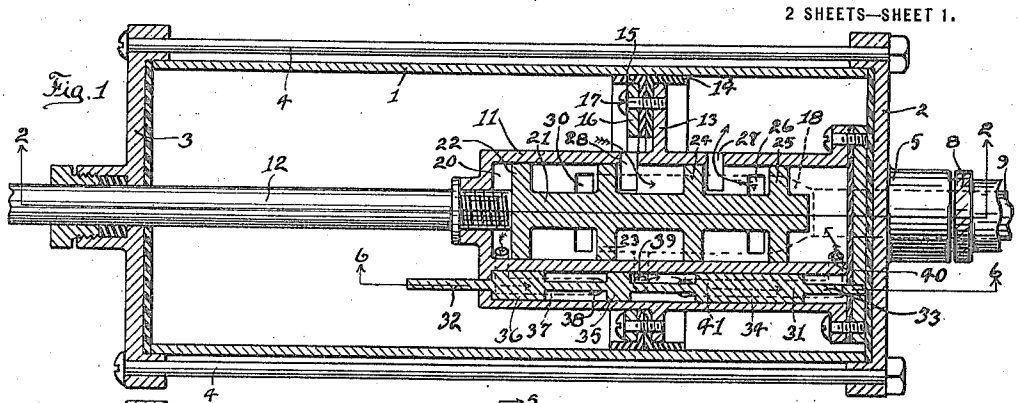


Fig. 2

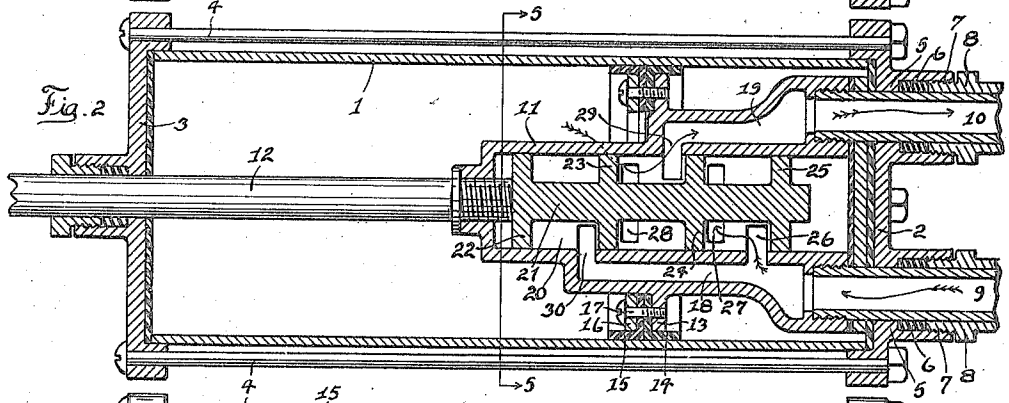


Fig. 3

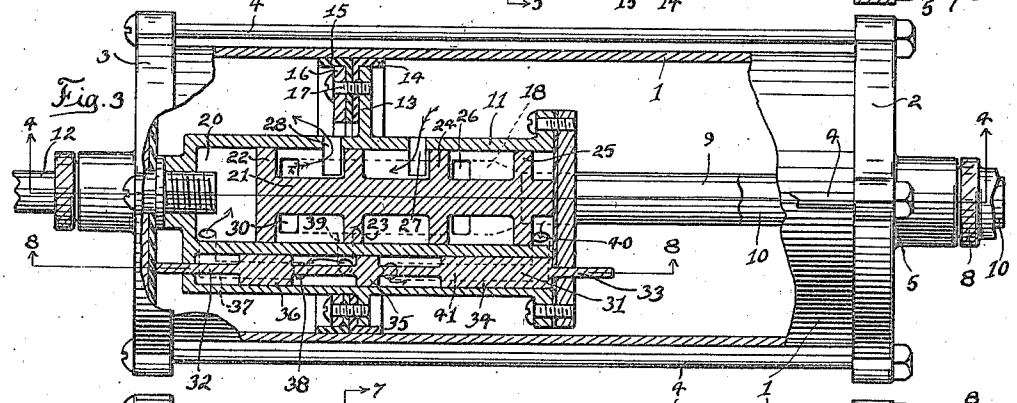
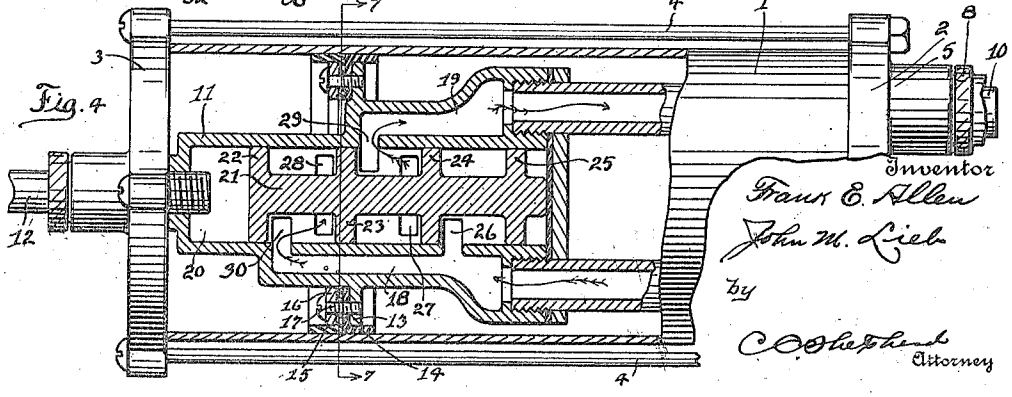


Fig. 4



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2 SHEETS—SHEET 2.

Fig. 5

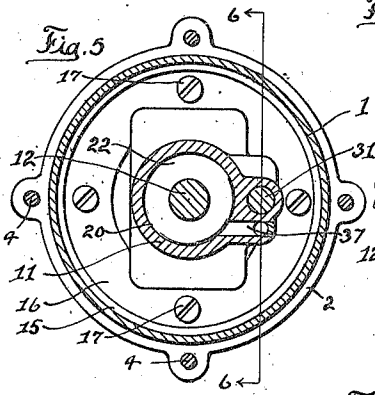


Fig. 6

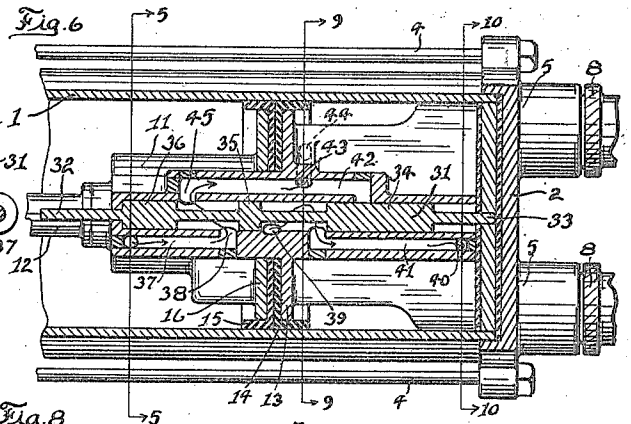


Fig. 7

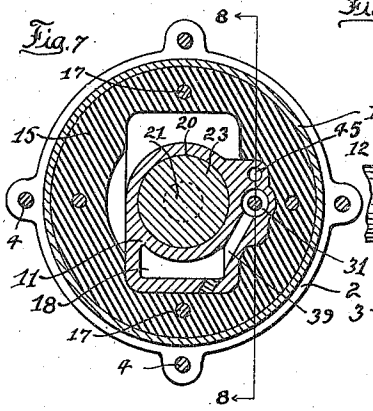


Fig. 8

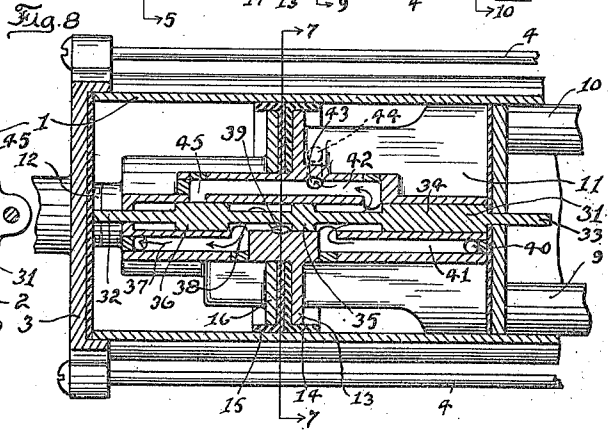


Fig. 9

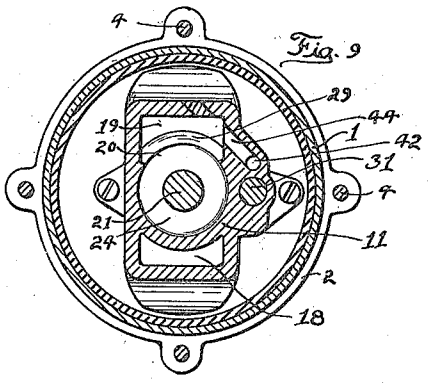
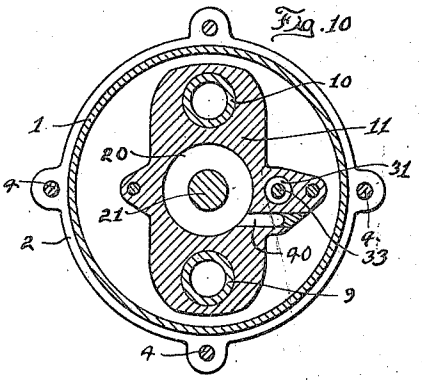


Fig. 10



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UNITED STATES PATENT OFFICE.

FRANK E. ALLEN AND JOHN M. LIEB, OF COLUMBUS, OHIO.

WATER-MOTOR.

1,254,644. Specification of Letters Patent. Patented Jan. 29, 1918.

Application filed May 10, 1916. Serial No. 96,487.

To all whom it may concern:

Be it known that we, FRANK E. ALLEN and JOHN M. LIEB, citizens 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.

This invention relates to water motors of the type that may be used as a driving motor for washing machines or as a water lift or the like. There is provided a double cylinder arrangement whereby water is fed into one end to force the piston to the opposite end at each time a valve is automatically rendered effective to permit the exhaust from that end to which water has just been fed and turn live water into the opposite end whereby the piston is returned.

In this connection, the main object of this invention resides in a peculiar type of piston provided with a valve structure which is automatically rendered effective to govern the driving water as has been related in the preceding paragraph, by impact with the cylinder ends. Thus, when the piston has moved to one end of its stroke, its engagement with the end of the cylinder wall causes a reversal of the entering water to automatically return the piston to the opposite end of its stroke.

A further object of the invention resides in an auxiliary valve used to control the main valve. This auxiliary valve renders the main valve positively effective to accomplish the functions outlined for it and also permits the escape of all water which would create a back pressure to prevent its shifting from one position to the other.

The preferred embodiment of the invention is shown in the accompanying sheets of drawings, in which similar characters of reference designate corresponding parts, and in which:

Figure 1 is a longitudinal horizontal section taken through the water motor showing the piston in one end of the cylinder,

Fig. 2 is a longitudinal vertical section represented on line 2—2 of Fig. 1,

Fig. 3 is a view similar to that shown in Fig. 1, but showing the piston in the opposite end of the cylinder,

Fig. 4 is a longitudinal vertical section taken on line 4—4 of Fig. 3,

Fig. 5 is a transverse vertical section taken on line 5—5 of Fig. 2 and also represented by the line 5—5 of Fig. 6,

Fig. 6 is a longitudinal vertical section taken on line 6—6 of Fig. 5 and also represented by the line 6—6 of Fig. 1,

Fig. 7 is a transverse vertical section on line 7—7 of Fig. 4, and also represented by line 7—7 of Fig. 8,

Fig. 8 is a longitudinal vertical section taken on line 8—8 of Fig. 7 and also represented by the line 8—8 of Fig. 3,

Fig. 9 is a vertical transverse section on line 9—9 of Fig. 6, and,

Fig. 10 is a transverse vertical section taken on line 10—10 of Fig. 6.

In these several views, the cylinder is represented by the reference numeral 1, the ends of this cylinder being closed by means of the cylinder heads 2 and 3, held in their applied position through the medium of the bolts 4. The cylinder head 2 is provided with a pair of bearings 5, the latter being counterbored to form a seat for the packing 6 and also threaded as is shown at 7 to accommodate the packing nut 8 through which nut and the bearing portion 5, the water pipes 9 and 10 slide. Both of these pipes are rigidly connected with one end of the piston which is designated in its entirety by the reference numeral 11 and to the opposite end of the piston there is attached an operating rod 12 which passes out through the cylinder head 3 by means of a packed joint similar to that described for the pipes 9 and 10. About midway of the piston, there is provided a circular flange 13 against which the leathers 14 and 15 are secured through the medium of the metallic washer 16 and the screws 17. By means of these leathers the cylinder is divided into two working chambers and the piston itself is provided with a series of ports and valves so arranged that when the piston is in the position shown in Fig. 1, water is supplied through the pipe 9 to force the piston toward the left during which movement the water pocketed in the left of the cylinder is permitted to exhaust through the pipe 10.

As has been stated, the supply and exhaust pipes 9 and 10 are connected with the piston 11, these pipes communicating with passageways 18 and 19 respectively. The piston itself is provided with a valve chamber designated 20 and this valve chamber is in turn provided with a plurality of ports

to coöperate with the valve 21, which valve is formed of a central stem and a plurality of annular collars 22, 23, 24 and 25. The arrangement of collars is such that when the piston 11 and valve 21 are in the positions shown in Figs. 1 and 2, water enters through the pipe 9 into the space 18 through the port 26 and out through the port 27 into the right hand end of the cylinder, these two ports 26 and 27 being then located between the two spaced collars 24 and 25. This flow of water will institute a movement of the piston toward the left and the water then in the left hand end of the cylinder will be permitted to exhaust through the exhaust pipe 10 by passage through the port 28, thence into the port 29 which leads to the exhaust channel 19; the two ports 28 and 29 being located between the two collars 23 and 24. The piston will then travel toward the left until it reaches the end of its stroke, at which time the action is such that the valve 21 will be shifted to the position shown in Figs. 3 and 4, at which time the water entering through the pipe 9 will pass through the channel 18, through the port 30 and out through the port 28 into the left hand end of the cylinder, thus causing a return movement of the piston, these two ports being now located between the two collars 22 and 23 of the valve 21. The water confined in the right hand end of the cylinder is then permitted to exhaust by passage into the port 27 and out through the port 29 into the channel 19 and pipe 10, the ports 27 and 29 being now located between the two collars 23 and 24. The space between the collars 24 and 25 in Figs. 3 and 4 may be filled with water by the entrance of this water through the port 26, but this portion of the valve chamber has no outlet and consequently this portion of the water is dead. A similar action occurs between the collars 22 and 23, when the valve is in the position shown in Figs. 1 and 2.

The mechanism for shifting the main valve 21 is found in the auxiliary valve 31 mounted in a suitable valve chamber also located in the piston. This auxiliary valve 31 is provided with end extensions 32 and 33 so arranged that the end extensions strike the cylinder ends when the piston approaches the end of its stroke and the ports operating in connection with the auxiliary valve are such that the main valve is shifted after the manner as has been related. This auxiliary valve is provided with three collars designated 34, 35 and 36 which coöperate with certain ports in the piston which will now be described. The space between the end of the main valve chamber and the collar 22 is provided with a port and passageway 37 which enters the auxiliary valve chamber at the point designated 38. Thus, when the piston has traveled toward the left a distance to cause the end projection 32 to engage the cylinder end to shift the auxiliary valve, the collars 36 and 35 will assume the position shown in Fig. 3, at which time the water entering through the pipe 9 passes through the passageway shown at 39 and enters the space between the collars 35 and 36 and flows through the passageway 37 into the space formed in back of the collar 22 of the main valve, which will then shift to the position shown in Fig. 3. During this shifting movement, the water pocketed in back of the collar 25 escapes by passing through the port 40 into the passageway 41 into the space formed between the collars 34 and 35, around the valve stem and out through the passageway 42, Fig. 8, through the port 43, and then through the passageway 44, Figs. 8 and 9, into the exhaust pipe 10. The piston will then start on its movement toward the right until the end projection 33 shall have come into engagement with the cylinder end to cause its shifting to assume the position shown in Fig. 1, at which time the water entering through the pipe 9 and passage 39 to the auxiliary valve will change its course to pass out through the passage 41 and enter the space to the rear of the collar 25 on the main valve through the port 40. This will then cause the shifting of the main valve to the position shown in Fig. 1 and the water pocketed to the rear of the main valve collar 22, will be permitted to exhaust by flow through the passageway 37 out through the port 38 between the auxiliary valve collars 35 and 36 around the auxiliary valve stem out through the passage 45, Fig. 6, which forms the left hand end of the passage 42 and out through the port 43, passage 44 and into the outlet pipe 10.

Thus, it will appear that all of the movements of the main valve 21 are accomplished by a shifting of the auxiliary valve by its positive engagement with the cylinder ends. This auxiliary valve control is desirable, in that the main valve is not forced to operate against the exhaust pressure in the end of the cylinder in the direction in which the piston is traveling, since the live water is caused to enter to the rear of either end of this main valve to cause its shifting and at the same time exhaust the pocketed water on the opposite end of the main valve. Also, the shifting of the auxiliary valve is positive by its engagement with the cylinder ends and then begins to assume a proper position to cause the shifting of the main valve slightly before the time that the piston has reached the end of either stroke.

It will be understood that where the various passageways and ports leading to and from the auxiliary valve chamber have been described, the same are preferably formed by drilling through the metallic body por-

tion of the piston and then plugging the open portions in the manner shown in the drawings. This manner of construction is far better than coring of the various small passageways although, should it be found desirable, this latter course may be resorted to.

What is claimed, is:

1. A water motor comprising a cylinder, a piston movable within said cylinder, a valve and valve chamber within said piston for controlling the admission and exhaust of both ends of the cylinder, exhaust and intake pipe conduits attached to said piston to communicate with said valve chamber, said pipes slidably passing through said cylinder, and means for changing the position of said valve to govern the direction of movement of the piston, said means being operated by engagement with the cylinder ends when the piston has reached either end of its stroke.

2. A water motor comprising a cylinder, a piston having a valve chamber therein movable within said cylinder, exhaust and intake pipe conduits attached to said piston to communicate with the valve chamber, said pipes slidably passing through said cylinder, a valve within said chamber, said piston having ports arranged so that water flows from the intake conduit through said valve and into one end of the cylinder while the water in the other end of the cylinder passes through the valve into the outlet conduit when the valve is in one position and vice versa when the valve is in the other position, an auxiliary valve for controlling the proper positioning of said first named valve, and means whereby said auxiliary valve is automatically shifted by engagement with the cylinder ends when the piston reaches either end of its stroke.

3. A water motor comprising a cylinder, a piston having a valve chamber therein movable within said cylinder, exhaust and intake pipe conduits attached to said piston to communicate with said valve chamber, said pipes slidably passing through said cylinder, said chamber having a single centrally arranged exhaust port leading into the exhaust conduit, and a pair of spaced intake ports leading into the intake, said chamber having a second pair of spaced ports leading into the cylinder, a valve within said chamber arranged to let water enter one end of the cylinder and exhaust from the other end, an auxiliary valve for controlling the proper positioning of said first named valve, and means whereby said auxiliary valve is automatically shifted by engagement with the cylinder ends when the piston reaches either end of its stroke.

4. A water motor comprising a cylinder, a piston having a pair of valve chambers therein movable within said cylinder, exhaust and intake pipe conduits attached to said piston to communicate with the valve chamber, said pipes slidably passing through said cylinder, a main valve within one of said chambers for governing the admission and exhaust of both ends of the cylinder, an auxiliary valve for controlling the proper positioning of said main valve, and end projections on said auxiliary valve for shifting it by engagement with the cylinder ends when the piston reaches either end of its stroke.

5. A water motor comprising a cylinder, a piston having a pair of valve chambers therein movable within said cylinder, exhaust and intake pipe conduits attached to said piston to communicate with the valve chamber, said pipes slidably passing through said cylinder, both of said conduits being in communication with both of said chambers, a main valve in one of said chambers controlling the admission and exhaust of water to and from both ends of said cylinder, an auxiliary valve in the other of said chambers for admitting live water to one end or the other of said main valve to govern the direction of movement of the piston, said piston being also provided with ports leading to said auxiliary valve from points in the rear of either end of said main valve to permit the exhaust of the pocketed water when the main valve is shifted, and end projections on said auxiliary valve for shifting it by engagement with the cylinder ends when the piston reaches either end of its stroke.

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

FRANK E. ALLEN.
JOHN M. LIEB.

Witnesses:
WALTER E. L. BOCK,
A. L. PHELPS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."