Nov. 18, 1958 A. L. HARDY ET AL 2,860,608

HYDRAULIC RECIPROCATING MOTION DEVICE

Filed Dec. 30, 1957

FIG. 1

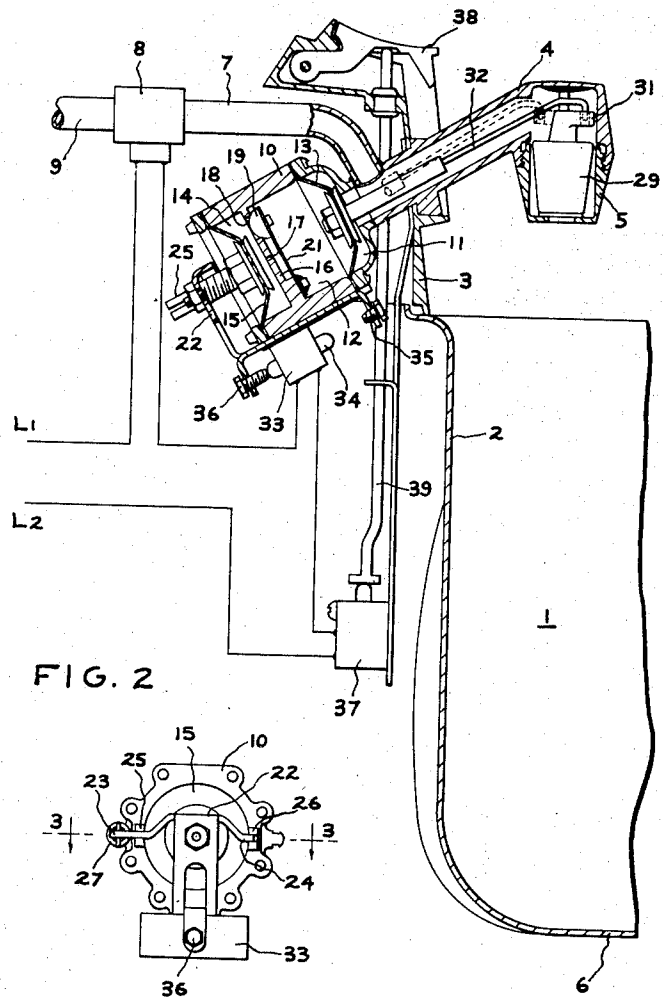


FIG. 2

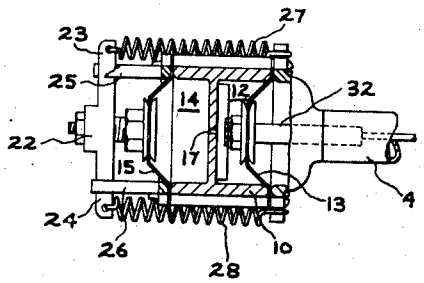


FIG. 3

FIG. 4

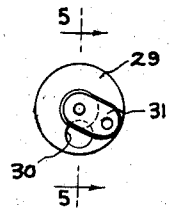
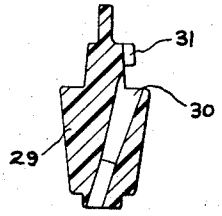


FIG. 5



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HYDRAULIC RECIPROCATING MOTION DEVICE

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Application December 30, 1957, Serial No. 705,956

3 Claims. (Cl. 121—48)

This invention relates to hydraulic reciprocating motion devices, and has as its principal object the provision of an improved device of this nature arranged to utilize the pressure in a water supply system to impart reciprocating motion to a movable member.

Further objects and advantages of the invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Briefly stated, in accordance with one aspect of this invention there is provided a pair of fluid chambers each having a movable wall portion or diaphragm, the fluid chambers being interconnected so that movement of one diaphragm causes similar movement of the other, a solenoid valve arranged to supply water under pressure to a water chamber formed in part by one of the diaphragms, and a switch arranged to be actuated by movement of the diaphragms and connected so as to control the opening and closing of the solenoid valve.

For a better understanding of this invention reference may be made to the following description and the accompanying drawing in which:

Fig. 1 is a fragmentary elevation view, in cross-section, of an embodiment of the invention applied to a sink rinsing spout.

Fig. 2 is an elevation view of one end of the reciprocating motion device shown in Fig. 1.

Fig. 3 is a cross sectional view taken along the lines 3—3 in Fig. 2.

Fig. 4 is a top plan view of one of the parts shown in Fig. 1.

Fig. 5 is a cross sectional view taken along the lines 5—5 in Fig. 4.

Referring to the drawing, and in particular Fig. 1 thereof, the numeral 1 designates a sink having a rear wall 2 and an upper wall 3 arranged to support a projecting water conduit 4 having a nozzle portion 5 located so as to direct a stream of water downwardly adjacent wall 2 of sink 1. In the illustrated embodiment of the invention it is utilized to provide a moving stream of water directed so as to flush the bottom wall 6 of sink 1. This sink flushing arrangement is the sole invention of Albert L. Hardy, and is disclosed and claimed in application Serial No. 706,011 filed December 30, 1957, and assigned to the assignee of the present application. However it will be understood that the reciprocating motion device of the present invention is of general application and may be utilized in other arrangements in which it is desired to impart reciprocating motion to a movable member.

In accordance with the present invention, conduit 4 is connected to and receives water from a water supply line 7 which in turn is connected to the outlet side of a solenoid valve 8, the inlet side of valve 8 being arranged to be connected to water line 9 of a domestic water supply system. Conduit 4 is secured to a generally cylindrical housing 10 which includes a water chamber 11

communicating with the conduit, a fluid chamber 12 including a movable diaphragm 13 forming one wall thereof, and a fluid chamber 14 including a movable diaphragm 15 forming one of the walls thereof. It will be observed that diaphragm 13 also forms one wall of water chamber 11, and thus the volume of chamber 11 increases as the volume of chamber 12 decreases, and vice versa.

Fluid chambers 12 and 14 are separated by a common wall 16 having therein a passageway 17 of relatively small cross-sectional area and a relatively large passageway 18 provided with a check valve 19 mounted on the free end of a flexible arm 21. Check valve 19 is located in chamber 12, and thus prevents flow of fluid therethrough from chamber 12 to chamber 14 while freely permitting the flow of such fluid in the opposite direction.

Fixedly secured to the center portion of diaphragm 15 is a movable frame structure 22 including arms 23 and 24 arranged to ride in guide members 25 and 26 respectively. Frame structure 22, and hence the center portion of diaphragm 15, is biased to the right as viewed in Fig. 3 (i. e., toward a position in which the volume of fluid chamber 14 is at a minimum) by a pair of coiled spring members 27 and 28 which are secured at one end to frame structure 22 and at the other end to portions of housing member 10.

Nozzle 5 of conduit 4 encloses a plug member 29 which substantially obstructs the interior of the nozzle so that water flowing through conduit 4 must pass through a drilled opening 30 formed in plug 29 before passing out through the open end of nozzle 5. Plug member 29 is mounted within nozzle 5 so as to be partially rotatable about its vertical axis and includes an arm member 31 to which is connected an actuating member 32 fixedly secured at its opposite end to the central portion of diaphragm 13. Thus it will be seen that as rod member 32 is reciprocated by movement of diaphragm 13 it imparts a partially rotary motion to plug 29 so that plug 29 is pivoted first in a counterclockwise direction and then in a clockwise direction (as viewed from a point above the sink shown in Fig. 1) upon reciprocating movement of rod member 32. It will of course be understood that the flow restricting effect of passage 30 in plug 29 causes an appreciable build-up in the pressure of the water flowing through conduit 4 when valve 8 is open, and hence that the water pressure in water chamber 11 tends to move diaphragm 13 to the left (as viewed in Fig. 3) under these circumstances.

The biasing force of springs 27 and 28 is such that diaphragms 13 and 15 are shifted from the positions shown in Fig. 1 to the position shown in Fig. 3 whenever valve 8 is open, it being understood that the water pressure in water chamber 11 forces diaphragm 13 in the direction just mentioned so that fluid in chamber 12 is forced through passageway 17 into fluid chamber 14, the pressure therein being sufficient to overcome the biasing force of springs 27 and 28.

In order to permit diaphragms 13 and 15 to return to the position shown in Fig. 1, there is provided a switch 33 mounted on housing 10 and arranged to be actuated in response to movement of the diaphragms 13 and 15. Switch 33 includes a pushbutton actuator 34 extending therethrough and arranged to cooperate with a pair of switch actuators 35 and 36 which are carried by spaced ear portions of frame structure 22. For the purposes of calibration, actuators 35 and 36 are preferably threaded screws as illustrated in Fig. 1, and are arranged to shift pushbutton 34 to its opposite position each time frame structure 22 is moved to one extreme of its path of movement by the passage of fluid between fluid chambers 12 and 14. The contacts of switch 33 are arranged to open each time actuator 35 engages pushbutton 34 and to close

each time actuator **36** engages the pushbutton, so that solenoid valve **8** is open each time the parts move to the position shown in Fig. 1 and is closed each time the diaphragms move to the position shown in Fig. 3. A control switch **37** is also connected in circuit with switch **33** and solenoid **8** so as to provide manually actuatable means for connecting the solenoid to power supply lines **L1, L2**. Switch **37** may be provided with a pushbutton actuator **38** having a stop element (not shown) for resiliently retaining the pushbutton in its depressed position and associated with a push rod **39** in operative engagement with switch **37**.

In operation, it will be seen that when pushbutton **38** is actuated so as to close the contacts of switch **37** (the parts being initially in the position shown in Fig. 1) valve **8** will immediately open inasmuch as contacts of switch **33** are closed and hence water will flow through conduit **7** to conduit **4** and out through nozzle **5**. The resulting pressure in conduit **4** will be transmitted to water chamber **11** and thus diaphragm **13** will be shifted from the position shown in Fig. 1 to the position shown in Fig. 3 at a rate determined by the cross sectional area of passage **17** through which fluid in fluid chamber **12** must pass to reach chamber **14**. Movement of diaphragm **13** will be accompanied by corresponding movement of diaphragm **15** and as the diaphragms reach the position shown in Fig. 3 switch **33** will be actuated by engagement of pushbutton **34** with actuator **35**, thus opening the contacts of switch **33** and deenergizing solenoid valve **8**. As a result, the pressure in conduit **4** and water chamber **11** will drop to atmospheric pressure and the diaphragm **15** will be returned to the position shown in Fig. 1 by the force exerted by springs **27** and **28** on frame structure **22**. The movement of diaphragm **15** in this direction will be relatively rapid inasmuch as check valve **19** opens under these circumstances to permit fluid in chamber **14** to rapidly pass to chamber **12** thus providing quick return movement of an actuator **32**. When the parts have returned to the position shown in Fig. 1 pushbutton **34** is again actuated by actuator **36**, solenoid valve **8** is again opened and the cycle described above is repeated. Thus it will be seen that a reciprocating motion is imparted to actuating member **32** and, as described above, this motion will be characterized by quick return motion of actuator **32** as it moves from the position shown in Fig. 3 to the position shown in Fig. 1.

While we have shown and described a particular embodiment of our invention, we do not desire the invention to be limited to the particular construction disclosed, and we intend by the appended claims to cover all modifications within the true spirit and scope of our invention.

What we claim is:

1. A hydraulic reciprocating motion device comprising a conduit, a solenoid valve connected to said conduit and arranged when energized to admit water thereto under pressure, a first fluid chamber including a first movable diaphragm forming one wall thereof, said first diaphragm also forming one wall of a water chamber communicating with said conduit, a second fluid chamber including a second movable diaphragm forming one wall thereof, means providing a fluid passageway between said first and second fluid chambers, a fluid sealed in said first and second fluid chambers, spring means biasing said second diaphragm from a first position in which the volume of said second fluid chamber is at its maximum value to a second position in which said volume is at its minimum value, the force exerted on said diaphragm by said spring being less than the force exerted thereon by the pressure within said second fluid chamber resulting from the pressure within said water chamber when said solenoid valve is open, a control switch connected in circuit with said solenoid valve so as to control the operation thereof, and means actuated by said second diaphragm to operate said control switch to its de-energizing position when said second diaphragm moves to said first position and to its energizing position when said second diaphragm moves to said second position.

2. A hydraulic reciprocating motion device comprising a conduit, a solenoid valve connected to said conduit and arranged when energized to admit water thereto under pressure, a first fluid chamber including a first movable diaphragm forming one wall thereof, said first diaphragm also forming one wall of a water chamber communicating with said conduit, a second fluid chamber including a second movable diaphragm forming one wall thereof, means providing first and second fluid passageways between said first and second fluid chambers, said first passageway being many times larger than said second passageway, a fluid sealed in said first and second fluid chambers, a check valve arranged to prevent flow of fluid through said first passageway from said first fluid chamber to said second fluid chamber, spring means biasing said second diaphragm from a first position in which the volume of said second fluid chamber is at its maximum value to a second position in which said volume is at its minimum value, the force exerted on said diaphragm by said spring means being less than the force exerted thereon by the pressure within said second chamber resulting from the pressure within said water chamber when said solenoid valve is open, a control switch connected in circuit with said solenoid valve so as to control the operation thereof, and means actuated by said second diaphragm to operate said control switch to its de-energizing position when said second diaphragm moves to said first position and to its energizing position when said second diaphragm moves to said second position.

3. A hydraulic reciprocating motion device comprising a conduit having a discharge opening therein, a solenoid valve connected to said conduit and arranged when energized to admit water thereto under pressure, a generally cylindrical body member enclosing a first fluid chamber, a first movable diaphragm forming one wall of said first fluid chamber, said first diaphragm also forming one wall of a water chamber communicating with said conduit, a second fluid chamber in said body member, a second movable diaphragm forming one wall of said second fluid chamber, a common wall member between said fluid chambers having therein first and second fluid passageways between said first and second fluid chambers, said first passageway being many times larger than said second passageway, a fluid sealed in said first and second fluid chambers, a check valve arranged to prevent flow of fluid through said first passageway from said first fluid chamber to said second fluid chamber, an arm member secured to said second diaphragm and said body member so as to bias said second diaphragm from a first position in which the volume of said second fluid chamber is at its maximum value to a second position in which said volume is at its minimum value, the force exerted on said diaphragm by said spring being less than the force exerted thereon by the pressure within said second chamber resulting from the pressure within said water chamber when said solenoid valve is open, a control switch connected in circuit with said solenoid valve so as to control the operation thereof, and switch actuating means secured to said second diaphragm to operate said control switch to its energizing position when said second diaphragm moves to said second position.

No references cited.