

1

2,901,977

WINDSHIELD WASHER PUMP

Robert P. Snyder, Saginaw, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application July 10, 1957, Serial No. 670,911

9 Claims. (Cl. 103—50)

This invention pertains to pumps, and particularly to an improved control arrangement for a windshield washer pump.

Heretofore, it has been the practice to incorporate a two-way valve for controlling the application and exhaust of pressure fluid to the motor for actuating a pump having fluid pressure effected delivery stroke and a spring effected intake stroke. The present invention relates to a control arrangement embodying separate motor inlet and outlet valves, the inlet valve being manually controlled and the outlet valve being automatically controlled in response to the position of the inlet valve whereby the possibility of leakage of the high pressure actuating fluid is minimized. Accordingly, among my objects are the provisions of an improved control valve arrangement for a fluid motor having a power stroke and a return stroke; the further provision of a control valve arrangement for a washer pump having a fluid pressure and spring actuated strokes including a manually operable inlet valve and an automatically operable outlet valve; and the still further provision of an improved windshield washer pump including simplified control means.

The aforementioned and other objects are accomplished in the present invention by utilizing a pair of spring biased ball valves, one of which can be manually unseated and the other of which is automatically actuated in response to the position of the manually operable ball valve. Specifically, the washer pump includes a two-part casing having a diaphragm therein that divides the casing into two chambers. One of the chambers constitutes the pumping chamber and communicates with an inlet conduit and an outlet conduit through suitable one-way check valves. The pumping chamber also has a spring disposed therein, one end of which engages the casing and the other end of which engages the diaphragm. The diaphragm constitutes a fluid displacing member having an intake stroke and a delivery stroke. The intake stroke of the fluid displacing member is effected by the spring.

The delivery stroke of the fluid displacing member is effected by a piston which is attached to the diaphragm, the piston being reciprocable in a cylinder bore formed in one part of the casing. The cylinder bore connects with a pressure chamber in the casing. The casing chamber communicates with an inlet nipple and an outlet nipple. The inlet nipple is connected to a source of hydraulic fluid under high pressure and connects with a passage in the casing having a ball valve therein which is spring urged into engagement with a valve seat. The inlet ball valve normally prevents communication between the inlet nipple and the pressure chamber in the casing.

The outlet nipple likewise includes a valve seat which can be engaged by a ball valve disposed within the pressure chamber. The latter ball valve constitutes an outlet valve and is spring biased away from its valve seat. The pump casing also has journaled therein a control shaft having a flat thereon engageable with the inlet ball valve. When the control shaft is rotated so that the arcuate periphery of the control shaft engages the inlet ball, this

2

ball valve will be unseated, thereby permitting the application of fluid under high pressure to flow through the inlet nipple into the pressure chamber. The pressure of the incoming fluid impinging against the outlet ball valve moves the outlet ball valve into engagement with its valve seat, whereupon the high pressure fluid will flow into the cylinder bore and effect the power stroke of the motor piston and the delivery stroke of the fluid displacing member attached thereto. As soon as the control shaft is returned to the position wherein the flat engages the inlet ball valve, the spring associated therewith will reseat the inlet ball valve and interrupt the application of pressure fluid to the pressure chamber. When this occurs the spring engaging the outlet ball valve will unseat the outlet ball valve due to equalization of hydraulic pressure on opposite sides of the outlet ball valve, and permit the spring acting on the diaphragm to effect the intake stroke of the pump and the return stroke of the motor piston thereby forcing the fluid from the cylinder bore to drain through the outlet nipple.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred embodiment of the present invention is clearly shown.

In the drawing:

Figure 1 is a longitudinal sectional view of a washer pump constructed according to this invention with the inlet valve closed and the outlet valve open.

Figure 2 is a view similar to Figure 1 with the inlet valve open and the outlet valve closed.

With particular reference to Figure 1, a windshield washer pump is shown including a two-part casing comprising an upper part 10 and a lower part 11. The two casing parts 10 and 11 are interconnected by a plurality of bolts 12, a diaphragm 13 of elastomeric material disposed therebetween and dividing the casing into an upper chamber 14 and a lower chamber 15. The diaphragm assembly includes upper and lower clamping plates 16 and 17 respectively, which are attached thereto by the rod end 18 of a piston 19. The rod end 18 extends through a central aperture in the diaphragm assembly and is thereafter upset as indicated by numeral 20. A suitable washer 21 is interposed between the upset end 20 and the rod portion 18 and the upper plate 16.

The upper part 10 of the casing connects with an inlet conduit 22 through a suitable one-way inlet check valve 23 and an outlet conduit 24 through an outlet one-way valve 25. In accordance with conventional practice the inlet conduit 22 connects with a suitable reservoir containing liquid solvent, not shown, and the outlet conduit 24 connects with washer spray nozzles, not shown, through which the liquid solvent is discharged onto the windshield of a motor vehicle.

The diaphragm 13 constitutes a fluid displacing member having an intake stroke and a delivery stroke. The diaphragm 13 is engaged by one end of a coil spring 26 disposed within the pumping chamber 14, the other end of which engages the upper part 10 of the casing. The spring 26 is utilized to effect the intake stroke of the diaphragm 13, as will be pointed out more specifically hereinafter.

The lower part 11 of the casing has a vent hole 27 therein which connects the chamber 15 to atmosphere. In addition, the casing part 11 has a cylinder bore 28 therein which receives the piston 19. The piston 19 carries a suitable packing as indicated by the numeral 29. The cylinder bore 28 communicates with a cylindrical pressure chamber 31 in the casing part 11 through a passage 30. The pressure chamber 31 has an outlet ball valve 32 disposed therein, the outlet ball valve 32 being engaged by one end of spring 33. The outlet ball valve

32 is snugly received in the cylindrical chamber 31. The other end of the spring 33 engages a shoulder 34 formed on an outlet nipple 35 threaded into the casing part 11. The outlet nipple 35 includes a valve seat as indicated by numeral 36, and the tubular portion of the nipple 35 between the shoulder 34 and the valve seat 36 constitutes a guide for the spring 33.

The pressure chamber 31 also connects with a passage 37 in the casing part 11 which terminates in a valve seat indicated by numeral 38. The valve seat 38 is engageable by an inlet ball valve 39 disposed within a bore 40 of the valve casing and urged into engagement with the valve seat by a spring 41. The spring 41 is disposed between the ball 39 and an inlet nipple 42 having threaded engagement with the casing part 11. The lower casing part 11 has a transverse bore 43 therein which receives a rotatable control shaft 44, the bore 43 intersecting the bore 40 adjacent the valve seat 38. The control shaft 44 has a flat 45 formed on a portion thereof engageable with the inlet ball valve 39. As long as the flat 45 on the control shaft 44 engages the ball valve 39, the spring 41 will maintain the inlet ball valve 39 in engagement with the seat 38. However, when the control shaft 44 is rotated so that the cylindrical peripheral portion thereof engages the ball valve 39, the inlet ball valve 39 will be unseated thereby permitting communication between bore 40 and the passage 37.

The inlet nipple 42 is connected by a suitable conduit, not shown, to a source of hydraulic fluid under high pressure, not shown. The outlet nipple 35 is connected by a conduit, not shown, to a sump, not shown, containing hydraulic fluid under atmospheric pressure. The control shaft 44 may be connected by any suitable means, not shown, to a manually operable control member, so that upon movement of the control member to the "on" position the shaft 44 will be rotated so as to unseat the inlet ball valve 39, whereas when the control member is moved to an "off" position the control shaft 44 will be returned to the position depicted in Figure 1 wherein the flat 45 engages the inlet ball valve 39.

Operation of the washer pump is as follows: When the control shaft 44 is rotated so as to unseat the inlet ball valve 39, high pressure actuating fluid flowing through the bore 40 and through the passage 37 will impinge the outlet ball valve 32. The force of this high pressure fluid acting on the outlet ball valve 32 will move the outlet ball valve 32 from the position of Figure 1 to the position of Figure 2 wherein the ball valve 32 engages the seat 36 so as to close the outlet nipple 35 from communication with the chamber 31. At the same time, the passage 37 will communicate with the passage 39 through chamber 31 whereupon high pressure fluid will be admitted to the cylinder bore 28. The pressure in cylinder bore 28 acting on the piston 19 will move the piston 19 upwardly to the position depicted in Figure 2 thereby effecting the delivery stroke of the washer pump. During the delivery stroke, the liquid solvent in the pump chamber 14 will be forced through outlet check valve 25 to the conduit 24 and thence to the washer spray nozzles, not shown.

When the control shaft 44 is returned to the position depicted in Figure 1 wherein the flat engages the inlet ball valve 39, the spring 41 will reposition the inlet ball valve 39 in engagement with the valve seat 38 thereby interrupting the communication between bore 40 and the passage 37. Accordingly, the hydraulic pressure on opposite sides of the ball 32 will be equalized and the spring 33 will move the outlet ball valve 32 from the position of Figure 2 to the position of Figure 1, thereby permitting the spring 26 to force the fluid from the cylinder bore 28 through outlet nipple 35 and effecting the intake stroke of the diaphragm 13 by drawing in liquid solvent from the conduit 33 through the inlet check valve 23.

From the foregoing it is apparent that the present invention provides a simplified washer pump and control

valve arrangement wherein separate inlet and outlet valves for controlling the application and exhaust of the actuating pressure fluid are incorporated. By utilizing the control valve arrangement of this invention the possibility of leakage of the high pressure actuating fluid is minimized, and the pumping cycle is effected automatically by opening and closing the pressure inlet valve.

While the embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A pump including, a casing having a fluid displacing member therein with an intake stroke and a delivery stroke, power means acting constantly on said fluid displacing member to effect one stroke thereof, fluid pressure actuated means operatively connected with said member for effecting the other stroke thereof, and a control valve arrangement in fluid circuit connection with said fluid pressure actuated means including an inlet valve having open and closed positions, manually operable mechanical means for controlling said inlet valve and an automatically operable outlet valve which is closed and opened in response to manual actuation of the inlet valve.

2. A pump including, a casing having a fluid displacing member therein with an intake stroke and a delivery stroke, energy storing means acting constantly upon said member for effecting one stroke, fluid pressure actuated means for effecting the other stroke of said member, and control means in fluid circuit connection with said fluid pressure actuated means comprising an inlet valve having open and closed positions, manually operable mechanical means for controlling said inlet valve and an outlet valve actuated by fluid pressure to a closed position and spring biased to an open position in response to manual actuation of the inlet valve.

3. A pump including, a casing having a fluid displacing member therein with an intake stroke and a delivery stroke, a spring biasing said fluid displacing member to move it throughout one stroke, a fluid pressure actuated power member connected to the fluid displacing member for moving it throughout its other stroke against the urge of said spring, and control means in fluid circuit connection with said power member comprising an inlet valve having open and closed positions, manually operable mechanical means for controlling said inlet valve and an outlet valve actuated by fluid pressure to a closed position upon movement of the inlet valve to the open position and spring biased to an open position upon movement of the inlet valve to the closed position.

4. A pump including, a casing having a fluid displacing member therein with an intake stroke and a delivery stroke, a spring biasing the fluid displacing member to move it throughout one stroke, a fluid pressure actuated power piston connected with the fluid displacing member for moving it through the other stroke against the urge of said spring, and control means in fluid circuit connection with said power piston including an inlet valve having open and closed positions, manually operable mechanical means for controlling the open and closed positions of said inlet valve and an outlet valve actuated by fluid pressure to a closed position and spring biased to open position in response to manual actuation of the inlet valve between the open and closed positions.

5. A pump including, a casing having a fluid displacing member therein with an intake stroke and a delivery stroke, resilient means biasing said fluid displacing member to move it throughout one stroke, said casing having a cylinder bore therein, a fluid pressure actuated power piston reciprocable in said cylinder bore and connected to said fluid displacing member for moving it throughout its other stroke, and means for controlling the application of fluid pressure to and drain from said cylinder bore comprising an inlet valve having open and closed positions, a spring engaging the inlet valve for normally

5

maintaining it in the closed position, manually operable means engageable with the inlet valve for moving it to the open position and disengageable therewith for permitting the spring to move it to the closed position, and an outlet valve actuated by fluid pressure to a closed position when the inlet valve is open and spring biased to an open position when the inlet valve is closed.

6. Control means for a fluid motor having a cylinder with a reciprocable piston therein having a fluid pressure actuated power stroke and a spring actuated return stroke, including, an inlet valve for controlling the application of pressure fluid to said cylinder having open and closed positions, manually operable mechanical means engageable with the inlet valve for controlling the open and closed positions thereof, and an outlet valve connected with said cylinder so as to be actuated by fluid pressure to a closed position and a spring biased to an open position in response to manual control of said inlet valve between the open and closed positions.

7. Control means for a fluid motor having a cylinder with a reciprocable piston therein having a fluid pressure actuated power stroke and a spring actuated return stroke, including, an inlet valve having open and closed positions, resilient means engaging said inlet valve for moving it to the closed position, manually operable mechanical means engageable with the inlet valve for moving it to an open position to apply fluid under pressure to said cylinder and disengageable therewith for permitting said spring to move the inlet valve to the closed position and interrupt the application of pressure fluid to said cylinder, and an outlet valve connected with the cylinder actuated by fluid under pressure to a closed position when the inlet valve is open and spring biased to an open position when the inlet valve is closed.

8. Control means for a fluid motor having a cylinder

6

with a reciprocable piston therein having a fluid pressure actuated power stroke and a spring actuated return stroke, including, a chamber connected with said cylinder having an outlet ball valve therein, a seat for said outlet ball valve, a spring engaging said outlet ball valve for moving it to an open position, a pressure inlet passage, an inlet ball valve disposed in the pressure inlet passage, resilient means engaging the inlet ball valve for normally preventing communication between the inlet pressure passage and the pressure chamber, and manually operable means engageable with the inlet ball for moving it to an open position whereby the pressure fluid acting on the outlet ball will move the outlet ball valve to a closed position to effect the power stroke of said piston, said manually operable means being disengageable with the inlet ball valve to permit said resilient means to move the inlet ball valve to the closed position whereupon the resilient means engaging the outlet ball valve will move the outlet ball valve to the open position to facilitate the spring actuated return stroke of said piston.

9. The combination set forth in claim 8 wherein said manually operable means engageable with said inlet ball valve comprises a shaft arranged transversely of the inlet pressure passage having a flat thereon permitting said resilient means to close the inlet ball valve, said shaft being rotatable so as to move said inlet ball valve to an open position when the cylindrical periphery thereof engages the inlet ball valve.

References Cited in the file of this patent

UNITED STATES PATENTS

2,004,146	Wineman	June 11, 1935
2,451,013	Ziskal et al.	Oct. 12, 1948
2,722,455	Oishei	Nov. 1, 1955