

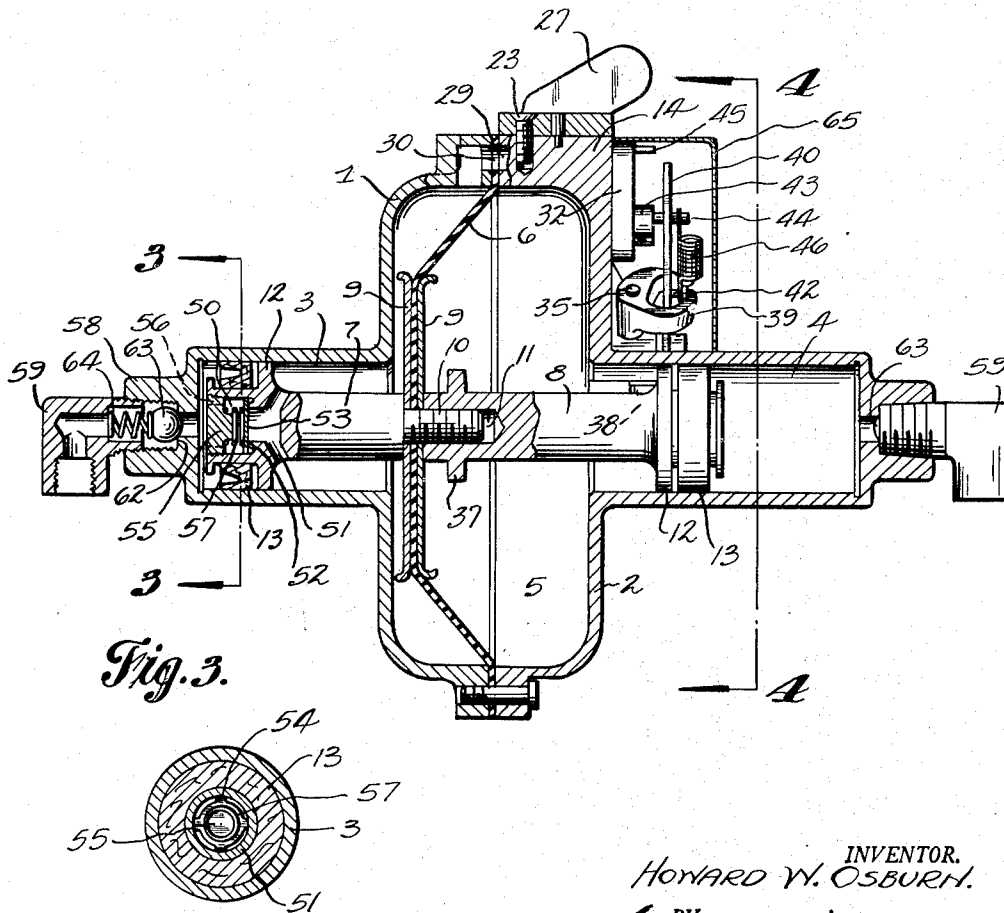
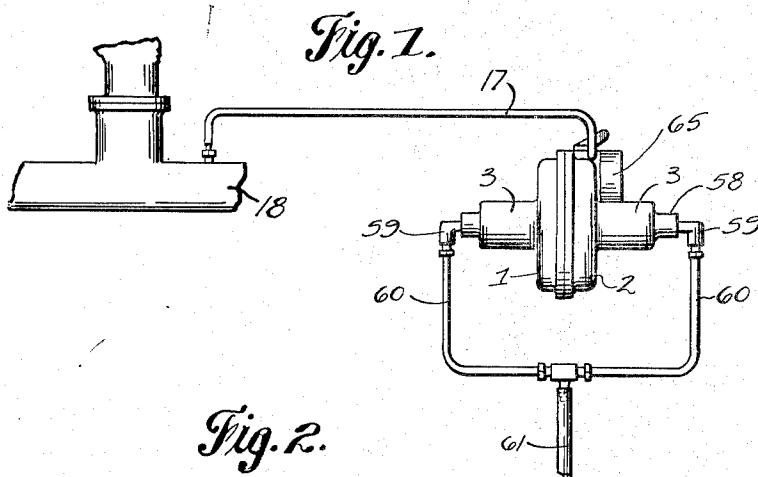
March 3, 1953

H. W. OSBURN
VACUUM OPERATED PUMP

2,630,102

Filed Feb. 28, 1947.

3 Sheets-Sheet 1



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Fig. 4.

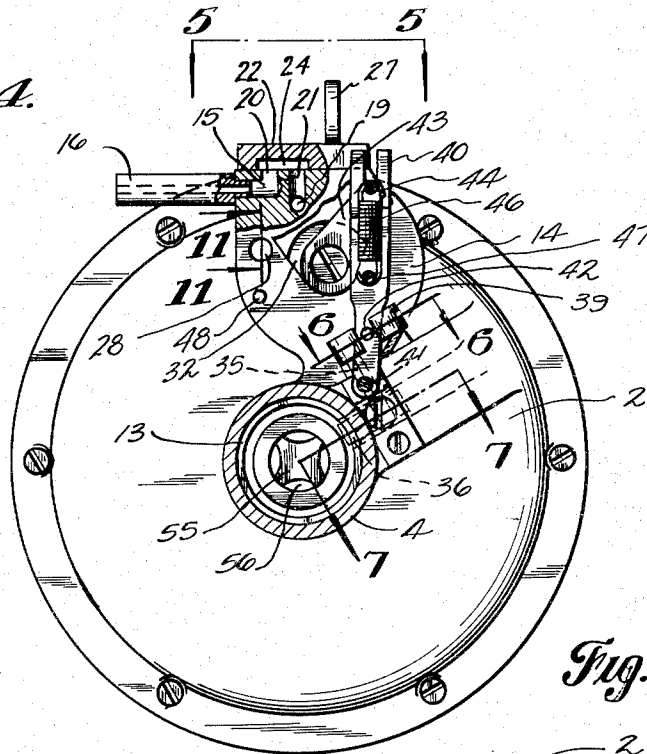


Fig. 6.

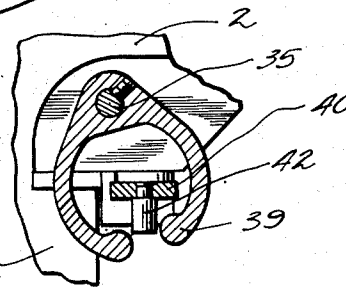
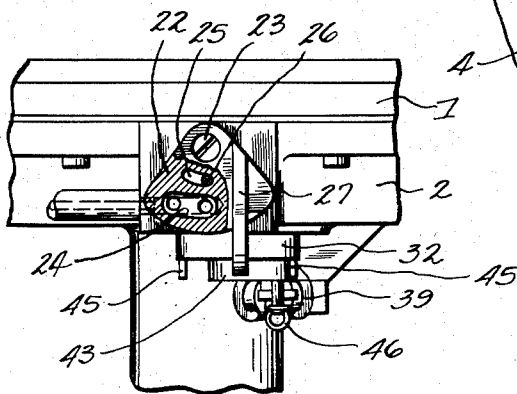


Fig. 5.



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Fig. 7.

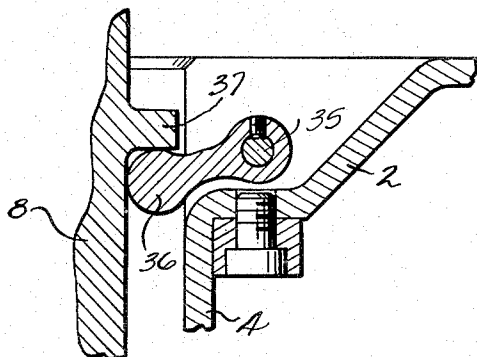


Fig. 11.

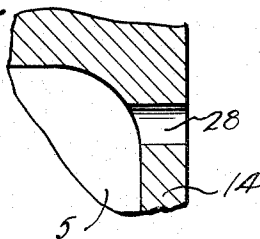


Fig. 10.

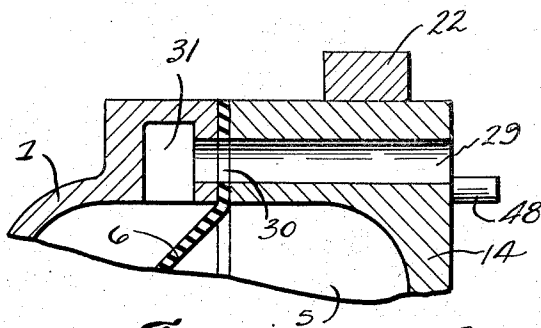


Fig. 8.

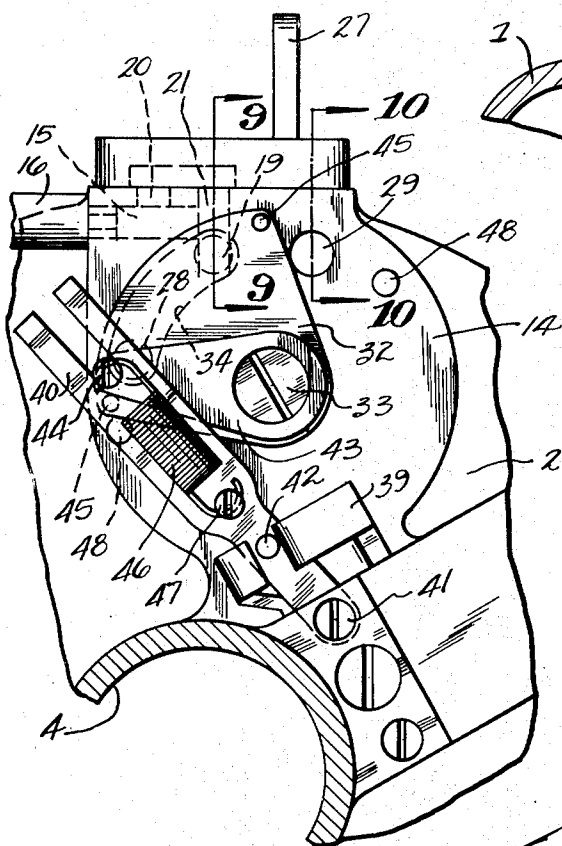
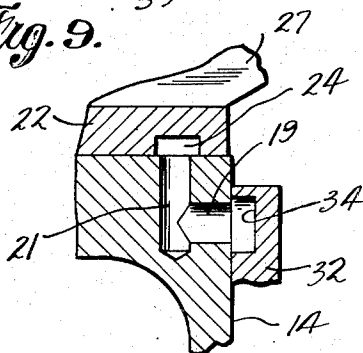


Fig. 9.



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UNITED STATES PATENT OFFICE

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VACUUM OPERATED PUMP

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Application February 28, 1947, Serial No. 731,545

4-Claims. (Cl. 121-164)

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The present invention pertains to a novel vacuum-operated pump designed particularly for use in connection with motor vehicles for inflating the tires.

The need for a portable tire inflating device has long been recognized, and some devices of this general character have been suggested. These devices, if motor driven, require belting or an equivalent driving connection to the motors. Since such a device is used only in those cases where access to a service station cannot readily be had, the user may have forgotten how to use the apparatus or how to connect it or may have misplaced a part of the driving connection to the motor. Motor driven pumps lose much of their utility for such reasons.

The principal object of the invention is to provide a motor operated pump but one that does not require a driving connection to the motor. In other words, the pump of this invention is driven by the reduced pressure in the intake line or manifold. The connection to the reduced pressure source, if not permanent, can readily be established when needed. For example, a simple fitting for making the connection may be provided.

Another object of the invention is to provide a pump that is double acting and which therefore furnishes a continuous flow of compressed air. Another object is to provide a device of this character that has a common port for supplying atmospheric air to operate against reduced pressure and for supplying the air that is compressed.

The pump itself is of the diaphragm type including opposed and alined cylinders at opposite sides of the diaphragm chamber. The chamber is divided into two compartments by means of a diaphragm which is secured to the piston rod. Each compartment is connected to atmosphere by a port, adjacent to which is a third port adapted for connection to the source of reduced pressure. An oscillating valve is adapted to connect the suction port to either of the atmosphere ports while leaving the remaining atmosphere port uncovered. Thus, one side of the diaphragm is under reduced pressure and the other side under atmospheric pressure to move the piston in one direction or the other. The position of the valve with respect to the atmosphere ports is alternately shifted by a connection to the piston rod.

A passage is formed through each piston to transfer atmospheric air to the pressure face of the piston. These passages are controlled by

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check valves that open under atmospheric pressure and close under compression at the pressure face of the piston. The cylinders have outlets at the ends adjacent to the pressure faces of the pistons, to provide continuous flow of compressed air in a common line connected to both outlets. The outlets are also check-valve controlled to close off the suction stroke of the pistons.

The invention is fully disclosed by way of example in the following description and in the accompanying drawings in which:

Figure 1 is an elevation of the device installed;

Figure 2 is a longitudinal section of the device;

Figure 3 is a section on the line 3-3 of Figure 2;

Figure 4 is a section on the line 4-4 of Figure 2;

Figure 5 is an elevation on the line 5-5 of Figure 4, showing the parts broken away;

Figure 6 is a section on the line 6-6 of Figure 4;

Figure 7 is a section on the line 7-7 of Figure 4;

Figure 8 is a detail end elevation;

Figure 9 is a section on the line 9-9 of Figure 8;

Figure 10 is a section on the line 10-10 of Figure 8, and

Figure 11 is a section on the line 11-11 of Figure 4.

Reference to these views will now be made by use of like characters which are employed to designate corresponding parts throughout.

The body of the device comprises a pair of bell shaped sections 1 and 2, each formed with a reduced cylinder 3, 4, as shown more clearly in Figure 2. The members 1 and 2 are clamped together at their open ends to form a chamber 5, and in this position the cylinders 3, 4 are in axial alinement. A flexible diaphragm 6 is clamped between the sections 1 and 2, dividing the chamber 5, and also shown in Figure 2.

A piston rod comprising two sections 7 and 8 is mounted in the cylinders 3, 4 and is made in two parts for the purpose of binding a pair of clamp plates 9 against opposite surfaces of the diaphragm 6. The section 7 has a reduced and threaded end 10 screwed into a tapped hole 11 in the section 8, thereby clamping the plates between the meeting ends of the sections 7, 8. Each end of the piston rod is formed with a head 12 slidably engaging the inner wall of the adjacent cylinder, and next to each head 12 is a leather piston or cup washer 13 also engaging the adjacent cylinder wall.

On the section 2 is formed an enlargement 14 for the provision of several ports that will now be described. A transverse port 15 (transverse with respect to the piston rod) is adapted to receive a metal nipple 16 (Figure 4) which in turn is joined by a tube 17 (Figure 1) to a suitable low pressure source such as the intake manifold 18 of the engine of a motor vehicle. A longitudinal port 19 is formed through the block 14 and is spaced from the port 15. Ports 20 and 21 extend respectively from the ports 15, 19 through the top of the block 14 and are covered by a control plate or valve 22 pivotally mounted on a screw 23. The bottom surface of the valve 22 has a channel 24 adapted to connect the ports 20 and 21 as in Figure 5, or in another position to obstruct the port 20. Another slot 25 in the member 22 receives a pin 26 mounted in the top of the block 14, whereby to determine the two positions of the plate 22. A finger piece 27 is used for moving the plate.

Longitudinal ports 28 and 29 are formed from the outer face of the block 14 at opposite sides of the port 19, the port 29 being at a higher level than the port 28. The port 28 leads directly to the chamber 5 at the nearer side of the diaphragm 6, as shown in Figure 11. The higher port 29 extends along the outside of the chamber 5 through a port 30 in the diaphragm 6 and through suitable channeling 31 in the section 1 to the opposite side of the diaphragm 6, as shown in Figure 10.

A reversing valve in the form of a plate 32 is mounted against the outer face of the block 14 on a pivot pin 33 that is parallel to the piston rod. The inner face of the valve 32 is formed with a channel 34 adapted to connect the suction port 19 to either the port 28 or the port 29 while leaving the unconnected port exposed to atmosphere. In the position of the valve shown in Figure 8, the side of the diaphragm exposed to the port 28 is subject to sub-atmospheric pressure, while the opposite side of the diaphragm is exposed to atmospheric pressure through the ports 29 and 30 at the channel 31. This condition is reversed when the valve 32 is shifted to connect the port 29. Mechanism is provided for oscillating the reversing valve 32 and thus reciprocating the piston rod 7, 8 through the diaphragm 6. The piston rod is adapted to function as a double acting pump, as will be described hereinafter, and the mechanism for oscillating the valve 32 will now be described.

A rock shaft 35 (Figures 2 and 7) is rotatably mounted in the section 2 adjacent to the cylinder 4 and perpendicular to the axis of the cylinder. On the shaft 35 is secured a finger 36 extending into the chamber 5 where it joins the cylinder 4. As the piston rod 7, 8 is reciprocated, the finger 36 is struck on one side by a collar 37 near the center of the rod and on the other side by a lug or abutment 38 at the head 12 in the cylinder 4, thereby rocking the shaft 35. This motion of the shaft 35 is utilized to oscillate the reversing valve 32. To the shaft 35 is fastened a yoke 39 externally of the section 2 and cylinder 4, as shown in Figure 2. A fork 40 is pivotally mounted at 41 on the section 2 and extends through the yoke 39 where it carries a lateral pin 42 extending between the ends of the yoke to be engaged alternately thereby in the rocking movement of the yoke with the shaft 35. The shaft 33 loosely carries an arm 43 from which a pin 44 extends into the fork 40. The valve 32 is also loose on the pin 33, and it is evident that

the oscillation of the fork swings the arm 43. As the arm 43 reaches the ends of its stroke, its movement is delivered to the valve 32 by engagement with pins 45 mounted on the ends of the valve.

A compressed coil spring 46 is extended along the fork 40, from the pin 44 to another pin 47 on the fork at a point nearer the yoke 39. In either position of the valve 32, this spring is distended in an over-center position with respect to the shaft 33, so that the fork is thrown with a snap action as it passes the center of the shaft 33 in either direction, thereby shifting the valve 32 with a quick movement. The movement of the valve itself is arrested by stop pins 48 at opposite sides thereof on the block 14.

For the pumping action by the pistons on the ends of the piston rod, each end is formed with a chamber 50 and is ported at 51 from the chamber into the cylinder 3 or 4 at the inner side of the piston. A valve seat 52 is formed between each chamber 50 and port 51 and is covered by a loose disk valve 53 having guiding lugs 54 engaging the wall of the chamber 50. Into the outer end of the chamber is screwed a plug 55 having passages 56 therethrough and serving as a retainer for a coil spring 57 that holds the valve 53 seated.

The outer end of each cylinder 3, 4 is formed as a reduced nipple 58 that receives a pipe fitting 59. The two fittings are joined to each other by a line 60 and thence by a line or hose 61 to a vessel for receiving the compressed air, such as the inner tube of a tire. Each nipple 58 is formed with a valve seat 62 adapted to be closed by a ball valve 63 backed by a spring 64 seated in the adjacent fitting 59 and closing the valve in the direction toward the adjacent end of the piston.

In the operation of the device, the low pressure in the line 17 is alternately transferred from one side of the diaphragm 6 to the other by the means already described, while the remaining side of the diaphragm is exposed to atmospheric pressure. The resulting oscillation of the diaphragm reciprocates the piston rod 7, 8. Atmospheric pressure in one side of the chamber 5 opens the valve 53 in the piston at the same side, and atmospheric air is communicated to the expanding cylinder 3 or 4 between the piston and the adjacent ball valve 63 which, however, remains seated at this time. As the direction of the piston rod is reversed by the means already described, the aforementioned valve 53 closes, and the air in the contracting cylinder is compressed and expelled through the now opened valve 63. At the other end of the piston rod, where the cylinder is expanding, atmospheric air is drawn into the expanding cylinder in the manner already described and is compressed and expelled on the next reversal of the piston rod. Thus, the device functions as a double acting pump and furnishes a substantially constant stream of compressed fluid in the hose 61.

The pumping unit is relatively small and can easily be mounted on the dashboard or another part of a motor vehicle. The manner of connection to the manifold 18 is also relatively simple. The pumping unit may, if desired, be unmounted and held in the hand while in use. In such case a convenient means of connection to the intake manifold is furnished. In either case the connection to the intake manifold as a source of motive power is considerably simpler than adapting the motor for the belt or chain

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drive for a rotary pump. A cover 65 may enclose the valve 32 and its operating mechanism and would have an opening of sufficient size to supply atmospheric air at the required rate.

Although a specific embodiment of the invention has been illustrated and described, it will be understood that various alterations in the details of construction may be made without departing from the scope of the invention as indicated by the appended claims.

What I claim is:

1. In a pump, in combination, a housing formed with two compartments, a reciprocable piston rod in said compartments, said housing being formed with a pair of ports for establishing communication between the compartments and the atmosphere, said housing having a third port adapted for connection to a reduced pressure source; a relatively movable valve mounted on said housing and arranged to selectively establish communication of the third port with either of the other ports while uncovering the remaining port to the atmosphere; a rock shaft journaled on the housing; a finger on the rock shaft disposed interiorly of the housing; means on the piston rod arranged for alternate engagement with the finger to oscillate the rock shaft at each reciprocation of the piston rod; an arm pivotally mounted on the housing; a lever pivotally mounted on the housing for movement about a different axis; an operative connection between the lever and the rock shaft; a lost motion connection between the arm and the valve, and means including a snap action spring connected to said arm whereby movement of the rock shaft is transmitted by said lever and arm to said valve through the lost motion connection.

2. In a pump, in combination, a housing formed with two compartments, a reciprocable piston rod in said compartments, said housing being formed with a pair of ports for establishing communication between the compartments and the atmosphere, said housing having a third port adapted for connection to a reduced pressure source; a relatively movable valve mounted on said housing and arranged to selectively establish communication of the third port with either of the other ports while uncovering the remaining port to the atmosphere; a rock shaft journaled on the housing; a finger on the rock shaft disposed interiorly of the housing; means on the piston rod arranged for alternate engagement with the finger to oscillate the rock shaft at each reciprocation of the piston rod; an arm supported for pivotal movement about the pivotal axis of the valve and independently thereof; a lever pivotally mounted on the housing for movement about an axis spaced from the axis of said valve and arm; spaced abutments on said valve; arranged to be successively engaged by the arm to move the valve; an operative connection between said rock shaft and lever, and a spring connected to said arm and arranged to bias the arm to valve shifting position when said arm is moved by said lever at each reciprocation of the piston rod.

3. In a pump, a housing forming a chamber

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divided into two compartments, a piston rod in said compartments, said housing having a pair of ports connecting said compartments to atmosphere and a third port adapted for connection to a reduced pressure source, a valve plate pivotally mounted on said housing and having a channel formed therein adapted to connect said third port to either of the other ports while leaving the remaining port exposed to atmospheric pressure, a rock shaft journaled in said housing and extending from the exterior to the interior thereof, a finger of said shaft within said housing, means on said piston rod at opposite sides of said finger for engaging said finger in either direction of movement of said rod, an arm pivotally mounted on said housing co-axially with said valve for restricted movement independently thereof, stops on the ends of said valve and engageable by said arm to move the valve, and a fork having slidable connection with said arm and pivotally mounted on said housing and adapted to be swung by movement of said rock shaft.

4. In a pump, a housing forming a chamber, divided into two compartments, a piston rod in said compartments, said housing having a pair of ports connecting said compartments to atmosphere and a third port adapted for connection to a reduced pressure source, a valve pivotally mounted on said housing and adapted to connect said third port to either of the other ports while leaving the remaining port exposed to atmospheric pressure, a rock shaft journaled in said housing and extending from the exterior to the interior thereof, a finger of said shaft within said housing, means on said piston rod at opposite sides of said finger for engaging said finger in either direction of movement of said rod, an arm pivotally mounted on said housing co-axially with said valve for restricted movement independently of the valve, stops on the ends of said valve and successively engageable by said arm for moving the valve to alternate positions, a fork pivotally mounted on said housing on an axis displaced from the axis of movement of the valve and adapted to be swung by movement of said rock shaft, and a snap action spring connecting said fork to said arm and adapted to throw said arm as the spring crosses the common axis of said valve and arm to move the valve.

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