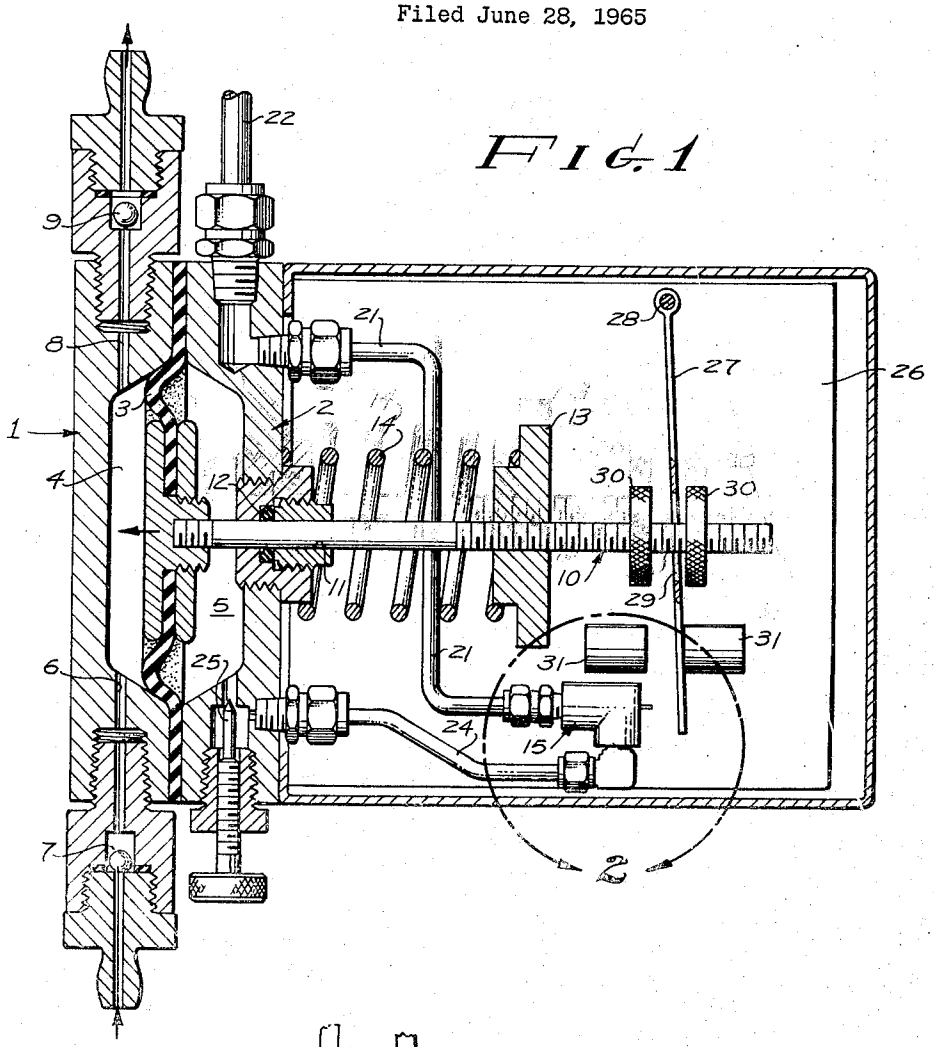
Jan. 24, 1967 J. F. WILLIAMS 3,299,826

DIAPHRAGM PUMP

Filed June 28, 1965

FIG. 1



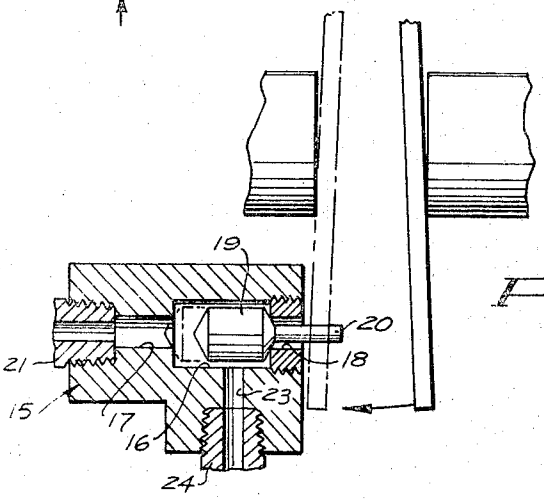


FIG. 2

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3,299,826

Patented Jan. 24, 1967

3,299,826

DIAPHRAGM PUMP

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Filed June 28, 1965, Ser. No. 467,498
4 Claims. (Cl. 103—152)

This invention relates to diaphragm pumps and included in the objects of this invention are:

First, to provide a diaphragm pump which is particularly adapted for supplying additives in small amounts to fluids flowing in pipe lines.

Second, to provide a diaphragm pump which may be easily and accurately adjusted to vary its capacity over a wide range by varying the extent as well as the rate of travel of the diaphragm.

Third, to provide a diaphragm pump having a pumping chamber and motor chamber separated by a diaphragm and so arranged that the pump side of the diaphragm is free of any sliding or moving connection through which the fluid being pumped may escape, thus permitting its use to pump corrosive or toxic fluids.

Fourth, to provide a diaphragm pump which may be adjusted to move at an extremely slow rate, but employs snap-action or "over-center" means to effect reversal in such a manner that the pump valves move relatively quickly between their open and closed positions.

With the above and other objects in view as may appear hereinafter, reference is directed to the accompanying drawings in which

FIGURE 1 is a transverse sectional view of the diaphragm pump.

FIGURE 2 is a fragmentary sectional view taken within circle 2 of FIGURE 1.

The diaphragm pump includes a pump housing 1 and a motor housing 2. Interposed and clamped between the housings is a diaphragm 3. The pump housing is provided with a recess open at one side and covered by the diaphragm which forms a pump chamber 4. Similarly, the motor housing is provided with a recess closed by the diaphragm which forms a motor chamber 5, in coaxial relation to the pump chamber 4.

The pump housing is provided with an inlet port 6, controlled by an inlet valve 7 and an outlet port 8 controlled by an outlet valve 9.

Attached to the diaphragm 3 is a shaft 10 which projects through a guide 11 having a seal 12 therein. Mounted on the shaft 10 is a screw collar 13. A spring 14 is interposed between the screw collar and the motor chamber 5 so as to urge the diaphragm in one direction; that is, toward the right as viewed in FIGURE 1.

A control valve 15 is provided which includes a valve chamber 16 having an inlet port 17 and a coaxial vent port 18. Reciprocably mounted between the ports is a valve element 19 having valve seats at opposite axial ends so that the valve element may engage and seal either the inlet port 17 or the vent port 18. A pin 20 extends from the valve element through the vent port 18.

The inlet port 17 is connected to an inlet line 21 which is screw-threadedly connected to the motor housing 2 at one side of the motor chamber 5 and communicates with a motive fluid supply line 22 also secured to the motor housing. The control valve chamber 16 is also provided with a side port 23 which is connected by ingress-egress line 24 to the motor chamber 25. Mounted in the motor housing 2 near the terminal of the line 24 is a needle valve 25 which regulates the rate of flow in either direction through the line 24.

The inlet line 21 and the ingress-egress line 24 serve to support the control valve 15 at a point below and near the extended end of the shaft 10. In addition, the control valve may be secured to a mounting plate 26 extending outwardly from the motor housing 2. Also carried by the mounting plate 26 is a trip blade 27 pivotally connected to the mounting plate by a pin 28. The trip blade is provided intermediate at its end with an aperture 29 which receives the shaft 10. The extremity of the trip blade confronts the pin 20 extending from the valve element 19 and movable so as to engage the pin 20.

The shaft 10 is provided with a pair of adjustable nuts 30 positioned on opposite sides of the trip blade 27 so as to engage the blade and move it in one direction or the other depending upon the direction of travel of the diaphragm 3. Near the extended end of the trip blade 27 and on opposite sides thereof is a pair of spaced permanent magnets 31 supported from the mounting plate 26. The magnets tend to hold the trip blade in one extreme position or the other.

Operation of the diaphragm pump is as follows:

In a principal use of the diaphragm pump the pump chamber 4 and the valves 7 and 9 are interposed in an additive supply line originating at a reservoir, not shown, containing an additive and terminating at a pipe line, also not shown, into which the additive is to be introduced.

By way of example, the additive may be a liquid or gaseous such as chlorine or sulphuric acid intended for introduction into a water line or a body of water. However, the pump may handle any gaseous or liquid additive and introduce the additive into a gas or liquid.

The supply line 22 is connected to a source of motive fluid which may be a pressure tank containing inert gas or may be the gas supply line itself if the pump is arranged for use in connection with a gas supply line.

The spring 14 moves the diaphragm 3 in one direction preferably in a direction to accomplish the intake stroke of the pump. During the intake stroke of the pump, motive fluid bleeds from the motor chamber through the vent port 18. The trip blade is held against the pin 20 by one of the magnets so as to maintain the vent port open until the trip blade is engaged with sufficient force by one of the adjusting nuts 30 to overcome the force of the magnet whereupon the trip blade snaps into engagement with the other magnet closing the vent port. The motor chamber is then supplied with motive fluid causing the pump to move through its discharge stroke. At the end of the discharge stroke the other adjustable nuts 30 engages the trip blade causing the trip blade to snap to its original position opening the vent port so that the cycle may be repeated.

By reason of the adjustment supported by the nuts 30 the length of the pump stroke may be accurately adjusted so that the volume of fluid delivered with each stroke may be accurately predetermined.

The rate at which the pump reciprocates is determined by the needle valve 25 which regulates the flow into as well as out of the motor chamber.

It should be noted that the rate of movement may, if desired, be extremely slow. However, changeover from the discharge stroke to the intake stroke and vice versa is rapid so that the inlet and outlet valves 7 and 9 function properly.

Many other embodiments of the invention may be resorted to without departing from the spirit of the invention.

I claim:

1. A diaphragm pump comprisng:

(a) a diaphragm;

(b) a housing structure defining therewith a pump chamber at one side of said diaphragm and a motor chamber at the other side of said diaphragm;

(c) inlet and outlet valves for said pump chamber;

(d) a motive fluid ingress-egress line communicating with said motor chamber;
(e) a spring urging said diaphragm in one direction;
(f) a control valve in said line movable between a first position for supplying motive fluid to said motor chamber and a second position for venting said fluid therefrom;
(g) a blade engageable with said valve element to move said valve element to its venting positon;
(h) means on said shaft to reciprocate said blade into and out of engagement with said valve element;
(i) and opposed magnets tending to hold said blade in its valve engaged and non-engaged positions.

2. A diaphragm pump comprisng:
(a) a diaphragm;
(b) a housing structure defining therewith a pump chamber at one side of said diaphragm and a motor chamber at the other side of said diaphragm;
(c) inlet and outlet valves for said pump chamber;
(d) a single motive fluid ingress-egress line communicating with said motor chamber;
(e) a spring urging said diaphragm in one direction;
(f) a single control valve in said line movable between a first position for supplying motive fluid to said motor chamber and a second position for venting said fluid therefrom;
(g) a throttle valve in said line to control the rate of movement of said diaphragm;
(h) and means responsive to movement of said diaphragm for shifting said control valve between its positions.

3. A diaphragm pump comprising:
(a) a diaphragm;
(b) a housing structure defining therewith a pump chamber at one side of said diaphragm and a motor chamber at the other side of said diaphragm;
(c) inlet and outlet valves for said pump chamber;
(d) a single motive fluid ingress-egress line communicating with said motor chamber;
(e) a spring urging said diaphragm in one direction;
(f) a single control valve in said line movable between

a first position for supplying motive fluid to said motor chamber and a second position for venting said fluid therefrom;
(g) a throttle valve in said line to control the rate of movement of said diaphragm;
(h) a snap-acting means operable, as said diaphragm approaches predetermined extreme positions, for shifting control valve from one position to the other.

4. A diaphragm pump comprising:
(a) a diaphragm;
(b) a housing structure defining therewith a pump chamber at one side of said diaphragm and a motor chamber at the other side of said diaphragm;
(c) inlet and outlet valves for said pump chamber;
(d) a shaft attached to said diaphragm and extending from said motor chamber;
(e) a spring urging said shaft and diaphragm toward one extreme position;
(f) a motive fluid supply line;
(g) a control valve interposed between said supply line and motor chamber and including a valve element movable between a first position for supplying motive fluid to said motor chamber and a second position venting said fluid therefrom;
(h) a pivotable blade traversing said shaft and positioned for engagement with said valve element;
(i) adjustable nuts on said shaft engageable with said blade to pivot said blade into and out of engagement with said valve element;
(j) and opposed magnets tending to hold said blade in either of two selected positions.

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