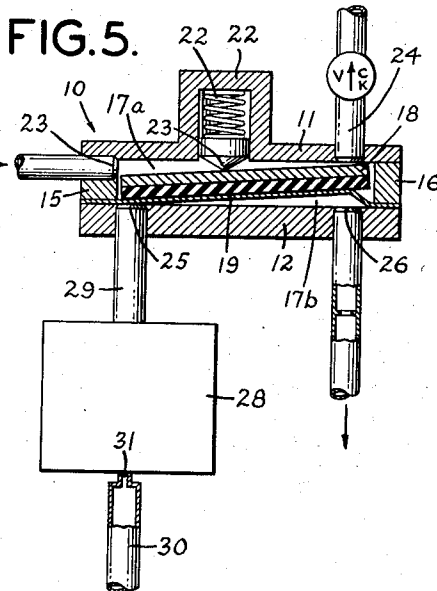
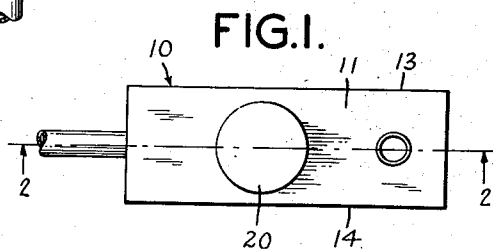
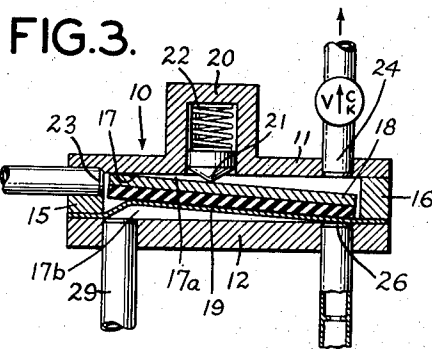


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OIL PUMP

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1

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OIL PUMP

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This invention relates to improvements in pumps and relates particularly to a gas-actuated pump for pumping oil and other liquids.

In some situations, it is impractical or inadvisable to provide mechanical or electrically driven motors for operating a pump to circulate or supply oil or other fluid under pressure. For example, in aircraft, insufficient space, considerations of weight, fire hazard or the like may render electrically or mechanically driven pumps unsuitable or unusable.

The present invention relates to a pump for supplying or circulating oil or other liquid, which is operable by means of compressed air or other gas under pressure and which is compact and simple in structure thereby facilitating installation of the pump in places where other types of pumps cannot be used.

More particularly, the present invention is a simplified form of oil pump formed of comparatively few parts and which is inherently automatic in operation and pumps at a rate dependent principally upon the rate of supply of air or other gas under pressure to the pump.

In general, pumps of the type embodying the present invention include a pump chamber having an inlet and an outlet and a free-floating piston in the chamber which is rocked and vibrated by means of gas pressure exerted against a diaphragm which forms a wall of an air chamber in the pump.

Vibration of the diaphragm causes movement of the piston to uncover the inlet port and draw liquid into the pump's chamber and then cover the inlet port and force the liquid out of the outlet port. The diaphragm also serves as a valve for controlling the flow of gas into and out of the air chamber.

The pump is compact and has a very small number of parts inasmuch as it does not include bearings or other elements which require lubrication or which might cause leakage in the pump or difficulties in maintaining it in service.

For a better understanding of the present invention, reference may be had to the accompanying drawing in which:

Figure 1 is a plan view of a typical pump embodying the present invention;

Figure 2 is a view in cross section taken on line 2—2 of Figure 1; and

Figures 3, 4 and 5 are schematic illustrations of the pump showing a pumping cycle thereof.

A typical form of pump embodying the present invention is illustrated in Figures 1 and 2. The pump includes a generally box-like casing 10, having spaced apart top and bottom walls 11 and 12, joined by the side walls 13 and 14 and the end walls 15 and 16 which define a chamber 17 in the casing. As shown in Figures 2 to 5, a generally rectangular piston 18 of plate-like form is mounted within the chamber 17 so that it can move up and down relative to the top and bottom walls 11 and 12 of the chamber and can also rock relative to

2

these walls. The piston rests upon a resilient diaphragm member 19 which has its periphery clamped between the bottom wall 12 of the casing 10 and the side and end walls 13 to 16 of the casing. The diaphragm separates the pumping chamber 17a above the diaphragm from the gas pressure chamber 17b below the diaphragm. It will be apparent that the bottom wall 12 may be detachably connected to the lower edges of the walls 13 to 16 of the casing by means of screws or in any other suitable way.

A hollow boss 20 is formed substantially centrally of the top wall 11 of the chamber and receives slidably a plunger 21 having a pointed nose. A coil spring 22 normally forces the plunger against the upper surface of the piston 18, thereby urging it toward the bottom of the pumping chamber 17a and against the diaphragm 19.

An inlet port or slot 23 is formed in one end wall 15 of the pump chamber adjacent to the left-hand end of the piston 18. The port 23 is near the top of the end wall 15 and is uncovered by the piston 18 when the latter is in the retracted or repose position shown in Figure 2.

A discharge or outlet port 24 is formed in the upper wall 11 near the end wall 16. A check valve of any suitable type may be mounted in or adjacent to the outlet 24 to prevent back flow of liquid through the outlet 24 into the chamber 17a, although, in some usages, such a valve may not be required.

A gas inlet port 25 is formed near the left-hand end of the bottom wall 12 beneath the diaphragm 19 and a gas outlet port 26 is formed near the opposite end of the bottom wall 12. A source of air or other gas under pressure such as, for example, the chamber or reservoir 28 is connected by means of a tube or pipe 29 to the air inlet port 25. Air is admitted to the reservoir 28 through another conduit or pipe 30 which communicates with the source of gas under pressure such as a gas bottle or a compressor. A restriction 31 is formed in the conduit 30.

Assuming that the inlet 23 is connected with a reservoir or sump for liquid, such as oil, and that a pressure of 50 pounds per square inch is required to overcome the pressure of the spring 22 when air is supplied to the conduit 30, the pressure of the air in reservoir 28 increases at a rate depending upon the pressure of the air in the conduit 30 and the size of the restricted orifice 31. When the air pressure in the reservoir 28 increases to 50 p.s.i., it will lift the left-hand end of the diaphragm 19, as shown in Figure 3, and rock the piston 18 so that its left-hand end is forced against the top wall 11 and thereby closes the inlet port 23 and prevents reverse flow of liquid from the chamber 17a through inlet port 23. When this action takes place, a drop in pressure occurs, to perhaps as low as 40 p.s.i., but the increased area of the diaphragm exposed to the pressure will lift the right-hand end of the piston 18 to the position shown in Figure 4, and during movement to this position, liquid is forced from the pumping chamber 17a through outlet 24. Upon movement of the piston and the diaphragm to a position in which the air outlet port 26 is uncovered by the diaphragm, air can escape rapidly from the gas chamber 17a through the port 26, thereby reducing the pressure in the reservoir 28 and in the chamber 17b to a value too low to resist the pressure of the spring 22 thereby allowing the spring-pressed plunger 21 to force the piston 18 downwardly as shown in Figure 5 so that the inlet port 23 is uncovered. Continued escape of gas through the port 26 permits the plunger 21 to force the piston 18 and the diaphragm 19 to the position shown in Figure 2 in which the ports 25 and 26 are covered. The pump is then ready for another pumping cycle which

will occur when the pressure in the reservoir 28 again builds up to about 50 p.s.i.

By maintaining a relatively slower rate of flow of air into the chamber 28 than the rate at which air can be discharged through the port 26, alternate displacement and collapse of the diaphragm causes the above-described cycle of operation to take place. Gas cannot be admitted at a higher rate through the inlet port 25 than it can escape from the inlet passage 26, because under such conditions the gas pressure would hold the piston 18 against the top wall 11 and no pumping action would take place. It will be apparent that by suitably regulating the size of the restricted orifice 31 and the size of the discharge outlet 26, a fast or slow pumping action can be obtained.

The above-described pump can be made in almost any desired size. It can readily be connected with a hydraulic system and an air or gas pressure source. The pump can be placed in locations in which motor-driven pumps would not be suitable.

It will be understood further that the size and shape of the elements of the pump are susceptible to considerable modification and that the pump may be made from any material suitable for the service conditions under which it is used such as metals, plastic, glass and the like. Accordingly, the pump described above should be considered as illustrative and not as limiting the scope of the following claims.

I claim:

1. A pump comprising a pump casing having a pumping chamber and a gas chamber therein, each provided with an inlet and an outlet, a resilient diaphragm separating said pumping chamber from said gas chamber, means urging said diaphragm to a position covering said inlet and outlet of said gas chamber, said diaphragm being displaceable by gas pressure at the inlet of said gas chamber to decrease the capacity of said pumping chamber and force liquid therefrom, and upon continued displacement thereof to uncover said gas outlet to vent said gas from said gas chamber, said means simultaneously urging said diaphragm to cover said gas chamber inlet and outlet and increasing the capacity of said pumping chamber thereby drawing liquid into said pumping chamber through the inlet thereof, means for introducing gas through the inlet to the gas chamber at a restricted rate and means for discharging gas from the gas chamber through its outlet at a greater rate.

2. A pump comprising a pump casing having a pumping chamber and a gas chamber therein, each provided with an inlet and an outlet, a resilient diaphragm separating said pumping chamber from said gas chamber, biasing means urging said diaphragm to a position covering said inlet and said outlet of said gas chamber, said diaphragm being displaceable by gas pressure to uncover said inlet and upon continued displacement by said gas pressure to uncover said outlet and vent gas from said gas chamber, means for supplying gas under pressure to said inlet of said gas chamber to displace said diaphragm in opposition to said biasing means to decrease the capacity of said pumping chamber, force liquid therefrom through its outlet and uncover the outlet of said gas chamber to vent said gas from said gas chamber, said biasing means returning said diaphragm to said position covering said gas chamber inlet and outlet while said gas is being vented from said gas chamber, and increasing the capacity of the pumping chamber to draw liquid into said pumping chamber through the inlet thereof.

3. The pump set forth in claim 2 comprising a piston in said pumping chamber movable by said diaphragm to positions closing and opening said inlet to said pumping chamber as the capacity of the latter is decreased and increased.

4. The pump set forth in claim 2 comprising a check valve in said outlet from said pumping chamber enabling liquid to be discharged, only, through said outlet.

5. A pump comprising a pump casing having a pumping chamber and a gas chamber thereon, each provided with an inlet and an outlet, a resilient diaphragm separating said pumping chamber from said gas chamber, means urging said diaphragm to a position covering said inlet and outlet of said gas chamber, said diaphragm being displaceable by gas pressure at the inlet of said gas chamber to decrease the capacity of said pumping chamber and force liquid therefrom, and upon continued displacement thereof to uncover said gas outlet to vent said gas from said gas chamber, said means simultaneously urging said diaphragm to cover said gas chamber inlet and outlet and increasing the capacity of said pumping chamber thereby drawing liquid into said pumping chamber through the inlet thereof, a piston in said pumping chamber movable by said diaphragm to positions closing and opening said inlet to said pumping chamber as the capacity of the latter is decreased and increased, means for introducing gas through the inlet to the gas chamber at a restricted rate and means for discharging gas from the gas chamber through its outlet at a greater rate.

6. A pump comprising a pump casing, a resilient diaphragm in said casing forming a pumping chamber and a gas chamber in opposite sides thereof, said casing having a liquid inlet port and a liquid outlet port connected with said pumping chamber and a gas inlet port and a gas outlet port communicating with said gas chamber, said diaphragm overlying and normally covering said gas inlet and outlet ports, means for supplying gas under pressure to said gas inlet port to displace said diaphragm and decrease the capacity of said pumping chamber, means responsive to displacement of said diaphragm for closing the inlet port of said pumping chamber, said outlet port of said gas chamber being uncovered by further displacement of said diaphragm to discharge gas from said gas chamber and restore said diaphragm to a position closing the inlet and discharge ports of said gas chamber.

7. A pump comprising a pump casing, a resilient diaphragm dividing said casing into a pumping chamber and a gas chamber, said casing having a liquid inlet port and a liquid outlet port communicating with said pumping chamber, said casing also having an inlet opening and an outlet opening in a wall thereof communicating with said gas chamber, said diaphragm being disposed adjacent said wall and flexibly urged to close said inlet and outlet openings, a piston in said pumping chamber movable between a first position covering said pumping chamber inlet port and decreasing the capacity of said pumping chamber, and a second position uncovering said pump chamber inlet port and increasing the capacity of said pumping chamber, means normally urging said piston to said second position and against said diaphragm, means for admitting gas under pressure into said gas chamber through the inlet opening at a controlled rate less than the gas discharge rate through said outlet opening to urge said piston toward said first position and uncover said gas outlet opening to discharge gas from said gas chamber at a higher rate than said controlled rate, thereby to return said piston to said second position.

References Cited in the file of this patent

UNITED STATES PATENTS

1,067,613	Lane	July 15, 1913
2,419,993	Green	May 6, 1947
2,711,134	Hughes	June 21, 1955