Feb. 5, 1946. L. C. ROTTER ET AL 2,394,486

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Filed Oct. 5, 1942 2 Sheets-Sheet 1

FIG. 1.

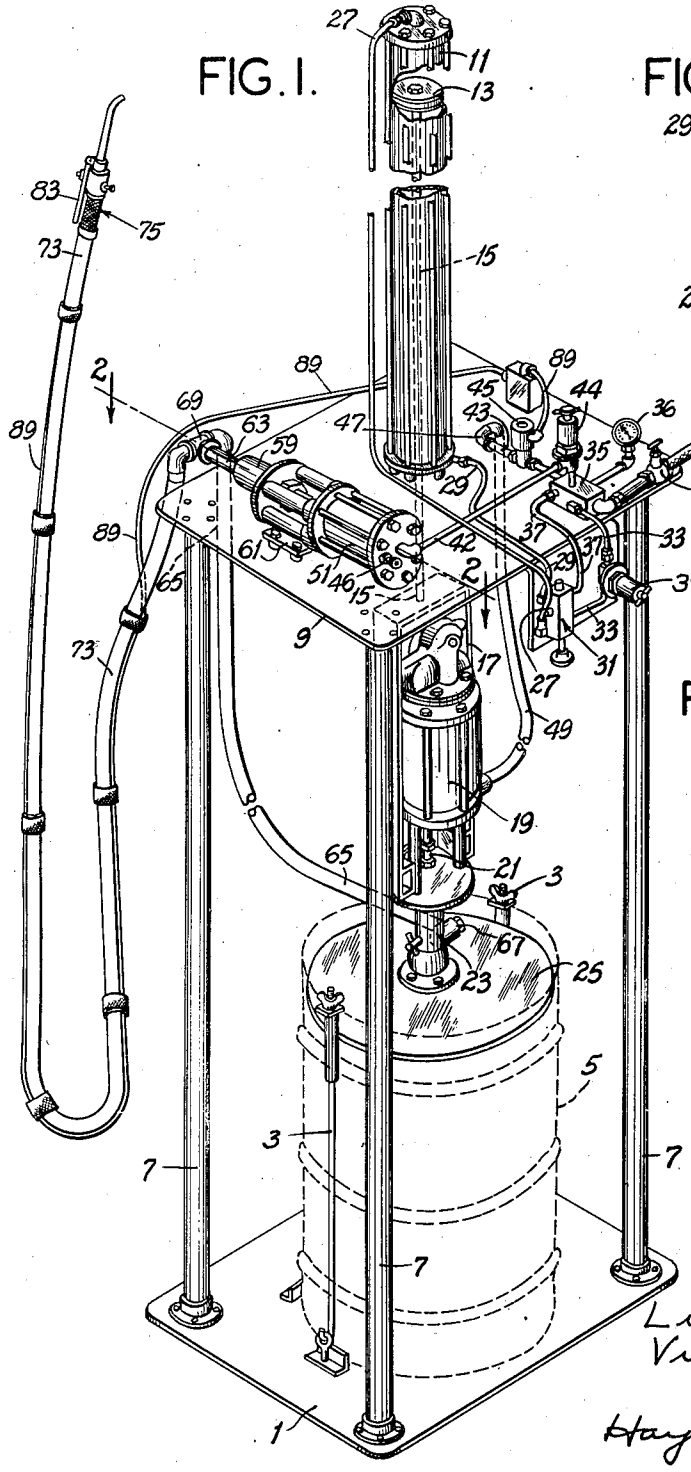


FIG. 4.

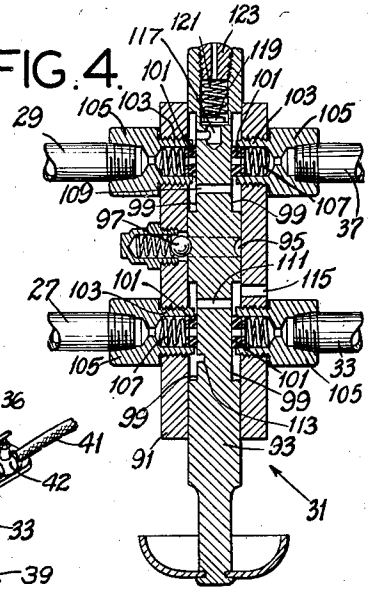
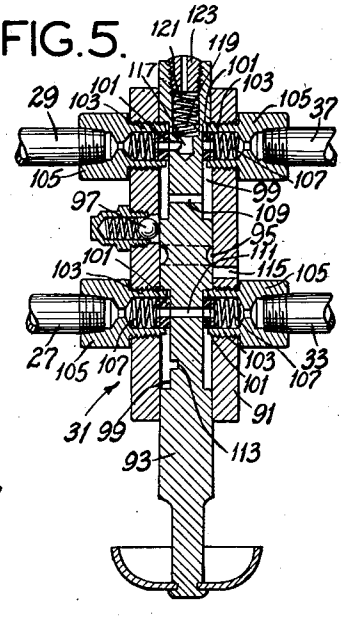


FIG. 5.



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FIG. 2.

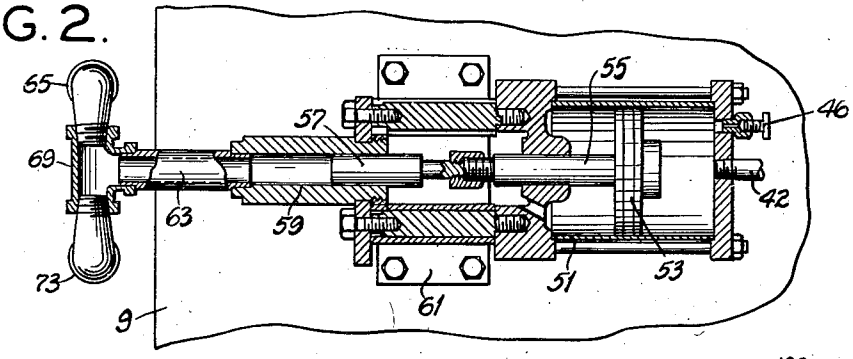


FIG. 3.

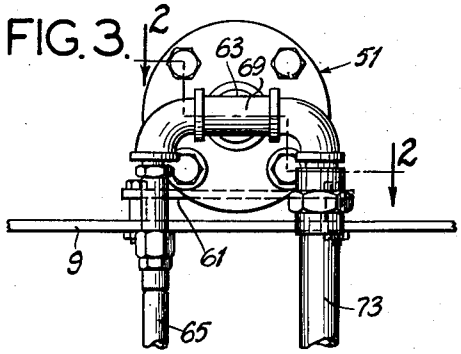


FIG. 6.

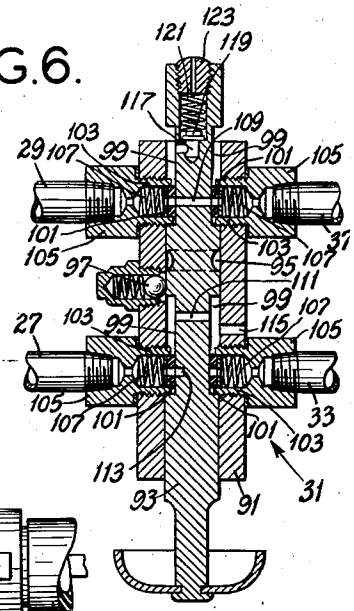


FIG. 7.

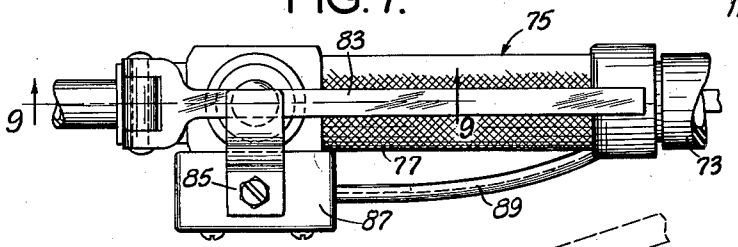


FIG. 8.

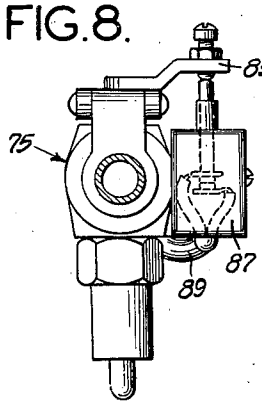
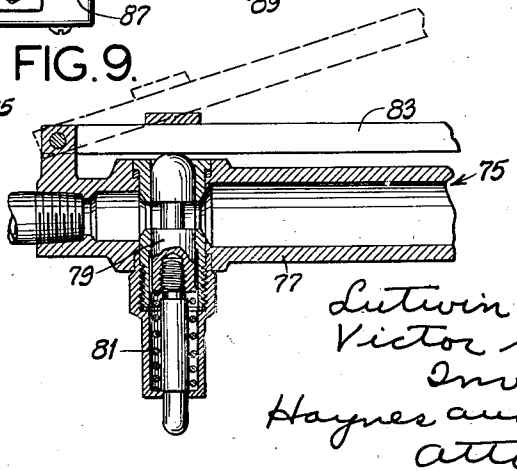


FIG. 9.



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UNITED STATES PATENT OFFICE

2,394,486

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Application October 5, 1942, Serial No. 460,790

2 Claims. (Cl. 222—261)

This invention relates to pumps, and with regard to certain more specific features, to improvements upon the United States patent of Victor G. Klein and Jonathan Kludt, No. 2,280,708, dated April 21, 1942, for Pump; and upon the pump disclosed in the United States patent application of the inventors herein, Serial No. 395,136, filed May 26, 1941, eventuated as Patent No. 2,348,151, dated May 2, 1944.

Among the several objects of the invention may be noted the provision of an improved pump for pumping a wide range of materials from containers to applicator nozzles and the like, in which a load-carrying grease follower is pneumatically pressed for pump priming, and in which the weight effect of said load is neutralized; the provision of a device of the class described which avoids sinking of the follower into lubricant, regardless of lubricant consistency; the provision of a device of the class described which obtains even flow of lubricant; and the provision of simplified valve means for carrying out said neutralization. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is illustrated one of various possible embodiments of the invention,

Fig. 1 is a perspective view of the invention;

Fig. 2 is a horizontal section taken on lines 2—2 of Figs. 1 and 3;

Fig. 3 is an end view of the parts shown in Fig. 2, viewed from the left;

Fig. 4 is a vertical section of a control valve shown in midposition;

Fig. 5 is a view similar to Fig. 4, but showing said valve in a position to admit pressure for forcing down a follower;

Fig. 6 is a view similar to Fig. 5, showing the valve in a position to raise the follower;

Fig. 7 is an enlarged fragmentary plan view of a control nozzle;

Fig. 8 is a vertical section taken on line 8—8 of Fig. 7; and,

Fig. 9 is a left-end view of Fig. 8.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Fig. 1, there is shown at numeral 1 a base which carries fasteners 3 for holding down a commercial drum 5 of lubricant, caulking compound or the like. Standards 7 on the base 1 support a raised platform 9. Supported on top of the platform 9 is a vertical cylinder 11, within which operates a piston 13 on a piston rod 15. The rod 15 at the bottom passes out through a suitable packing and is joined with a frame 17. This frame 17 supports a reciprocating air engine 19. Engine 19 operates the piston rod 21 of a pump unit 23, the latter being bolted to a lubricant follower plate 25. The plate 25 contacts the surface of lubricant or the like in any open container 5 placed upon the base 1, and contacts loosely with its inside periphery. It prevents cratering of lubricant.

Thus it will be seen that the members 13, 15, 17, 19, 23 and 25 constitute a movable unit which may be lifted up or pressed down by air below or above the piston 13. Air for forcing this assembly downward is brought to the upper end of the cylinder 11 by a pipe connection 27. A connection 29 leads air to the bottom of said cylinder 11. Connections 27 and 29 lead to a hand control valve 31 which is shown in Fig. 1 and detailed in Figs. 4, 5 and 6.

Air for the pipe 27 is brought to the valve 31 by a pipe 33 leading from a manifold block 35. In pipe 33 is a regulating pressure-reducer 39, which is manually adjustable. Air for the pipe 29 is brought to the valve 31 by a pipe 37. At 41 is shown the main air supply line for the manifold 35, in which is a shut-off valve 42.

A pressure pipe 43 leads from the manifold 35 and in it is a solenoid control valve 45. At 47 is a take-off for a flexible air supply hose 49 supplying air to the engine 19. The manifold is connected with an air cylinder 51 (shown more particularly in Figs. 2 and 3) by a pipe 42. This cylinder 51 is carried on the platform 9. It carries a piston 53 on a piston rod 55 which passes from the cylinder 51 into connection with a plunger 57 in a surge cylinder 59, the cylinder 59 being carried on the same frame 61 as is carried the cylinder 51. The cylinder 59 is connected with a pipe 63. A flexible hose 65 is connected to the outlet 67 of the pump 23 and receives pumped lubricant and delivers to a flexible hose 73 via a connection 69, with which pipe 63 communicates. Thus plunger 57 is exposed to fluid pressure from the pump 23.

The lubricant hose 73 leads to a control valve 75 shown in Figs. 1 and 7–9. It consists in a manifold body 77 traversed by a slide valve 79 normally biased shut by a spring 81. The valve is

under control of a handle 83 which upon pressure opens the valve 79. The handle 83 has an adjustable extension 85 for cooperating with a switch 87, the arrangement being such that the switch 87 is closed when the valve 75 is opened, and vice-versa. Thus an electric line 89 organized with the hose 73 and leading to the solenoid valve 45 is closed. This opens the valve 45 to admit air from the line 41 for operating the engine 19. Thus the pump 23 is operated to compress lubricant over the lines 69 and 73 and out through the then open valve 79. Any pump surges are compensated for by movement of the plunger 57 against the charge of air behind the piston 53 (Fig. 2).

In the line 42 leading from the manifold 35 is a pressure regulator 44. The pressure regulator 44 allows for regulating the pressure upon the compensator piston 53 so that the surges of pressure against the plunger 57 may move the plunger back, thereby tending to dissipate said surges. For example, if the air pressure were too high on the piston 53, it might maintain the plunger 57 in a fixed position, substantially immovable (or at least with not enough movement) against the surges. With the regulator this contingency is avoided by proper adjustments.

A manually-operable relief valve 46 is used in the head of the cylinder 51 to relieve pressure when desired. For example, if the regulator 44 has been providing a relatively high pressure and it is desired to regulate it to provide a relatively lower pressure, it will be necessary to open the vent 46 temporarily to relieve said relatively high pressure, because the ordinary pressure regulator does not have facilities for releasing a pressure higher than that for which it is regulated at a given time. Thus it will be seen that the construction of Figs. 2 and 3 is a very simple one for obtaining an effective reduction in surge due to reciprocating action of the pump 23, and this under various field conditions met with.

The valve 31 (Figs. 4, 5 and 6) consists in a body portion 91 bored out to receive a slide valve 93, the latter being grooved as shown at 95 for detent cooperation with a spring-biased ball 97. When the ball 97 is in the groove as indicated at Fig. 4, the valve is in mid position.

The stem 93 is cylindric except where flat as indicated at 99 for cooperation with sealing washers 101 in cups 103 forming parts of nipples 105. Springs 107 in the cups 105 normally bias the washers 101 into sealing engagement with the flats 99 respectively. The lengths of the flats 99 are such as to permit desired movement of the valve on both sides of mid position.

Stem 93 is ported as indicated at 109 and 111, so that when the stem is in mid position (Fig. 4) neither port transmits air. When the stem 93 is down, Fig. 5, the port 111 admits air between pipes 33 and 27, thereby supplying the top of the piston 13.

When the stem 93 is up (Fig. 6), the port 109 connects pipes 37 and 29. Also, when one set of pipes 33, 27 or 37, 29 is connected the other is disconnected from the air pressure supply.

In addition, when the stem 93 is up (Fig. 6), the pipe 27 may exhaust via a groove 113, port 111 and an exhaust 115. When the valve is down (Fig. 5), the pipe 29 may exhaust through a port 117 and a throttle valve 119 which is held to a seat in the port 117 by a spring 121, reacting from a hollow plug 123. Under these conditions, any exhaust from the pipe 29 (from the bottom of the piston 13) must be at a pressure determined by the spring 121. The amount of this pressure is predetermined by the weight of the organized parts 13, 15, 17, 19, 23 and 25. The purpose of this is to prevent the weight of said parts from exerting a downward bias on the lubricant follower 25.

Operation is as follows:

Valve 31 is pushed down as in Fig. 5. Desired air pressure is supplied to the line 41 as determined by a gauge 36 on manifold 35. Regulator 44 reduces this pressure in line 42 and consequently on compensator piston 53. Regulator 39 reduces the line pressure in pipes 33, 27 and consequently on the top of the piston 13. When the hand valve 75 is opened, the switch 87 closes and energizes the electric line 89. This opens the solenoid valve 45 to admit full air line pressure to the flexible engine-supply hose 49. This starts the engine 19 into operation, and biases the piston 53 and the plunger 57. The follower 25 is pushed down because of air flowing over pipe 27 to the top of piston 13. Air exhausts over line 29 from beneath piston 13 and releases at a predetermined pressure because of throttle valve 119. The predetermined pressure at which the throttle valve 119 releases has a value which will be discussed further in the next paragraph. Lubricant is pumped out from under follower 25 by pump 23 over the lines 65, 73 to the open valve, and the pressure of any surges are compensated for by the resiliency of the air at adjusted pressure behind the piston 53 and plunger 57.

When enough lubricant has been obtained, the valve 75 is cut off. This also opens the switch 87 and closes the solenoid valve 45. Thus the engine 19 stops and this prevents building up of unnecessary pressure in the lines 65 and 73. At this time, valve 31 may be set at its upper position (Fig. 4) and hence the pipe 29 is cut off from the inlet and from exhaust in valve 31. This also cuts off supply air from pipe 27 and therefore from the top of piston 13. The air trapped under the piston 13 is at the said predetermined throttle pressure, determined by the valve 119 while the valve was exhausting. This pressure is predetermined by the spring 121 at a unit value such that the total pressure force pushing up on the piston 13 is equal to the weight of the parts 13, 15, 17, 19, 23 and 25. Thus said parts (when equilibrium is reached on piston 13), although they contact the surface of the material in the drum 5, do not sink into the material for any substantial distance, and consequently no hydraulic floating arrangement is required, regardless of the consistency of the material. The predetermined air pressure under piston 13 prevents sinking. At the same time no counterweights are needed, which leads to a considerable weight reduction and enhances portability.

It will be seen that for thinner fluids carried in the container 5 the regulator 39 may be adjusted for lower pressures above the piston 13; and for heavier fluids it is adjusted for higher pressures. The total weight of the parts 13, 15, 17, 19, 23, 25 is always kept from coming into action on the material in the container 5 because of the pressure under the piston 13. The entire pressure on the fluid for priming the pump 23 is thus always equal to the total load brought about by the unit air pressure on the top of the piston 13, which may be closely controlled from the regulator 39. Without balancing pressure under the piston 13, it would not be

possible to obtain a range of pressure adjustments on the fluid in the container 5 below values predetermined by the weight of parts 13, 15, 17, 19, 23 and 25. By means of this invention, it is possible to take advantage of this range.

When the valve 93 is pushed up above the mid position (Fig. 6), the port 109 connects the pipes 37 and 29, which has the effect of placing line pressure under the piston 13 while air from the top may exhaust, as already made clear. Since the solenoid valve 45 is beyond the manifold 35, it is seen that the pipes 29 and 37 are always supplied with air at line pressure. This forcibly lifts the assembly 15, 17, 19, 21, 23 and 25 against any suction on 25 in container 5. The empty drum 5 may then be removed and a full one inserted.

It will be seen that the dead weight of the assembly on the piston rod 15 is supported by air trapped beneath the piston 13, thus preventing the follower 25 from gradually sinking into such lubricant as may not have a consistency adapted to support said weight. Also the range of pressure control on follower 25 is considerably extended into the smaller values. Also the air trapped under piston 13 at the pressure allowed by the valve 119 prevents the necessity of designing the follower 25 so as to float any weight upon it, because that weight is balanced by said air pressure under said piston 13. At the same time, the valve 119 releases air from under the piston 13 under influence of air pressure from the line 41 brought to the top of the piston 13 via lines 33 and 27. Thus at any position in its stroke, the piston 13 is supported by the trapped air under it with a force counterbalancing the weight of the assembly supported from the rod 15.

It will be noted that the valve 119 is effective as a pressure limiting device only when the stem 93 of valve 31 is entirely down, that is, when the latter is admitting pressure to the top of the piston 13. When the valve is in neutral position, such as shown in Fig. 4, which is its normal position when the device is idle, this valve is cut off from communication with the underside of the piston 13, but it will be clear that the air pressure retained under the piston 13 is that which will counterbalance the gravity load, thus relieving the follower 25 of any function of floating on the lubricant the gravity weight of connected parts.

Also, priming of the pump 23 is effected only by the degree of air pressure on the top of piston 13, and not by the gravity weight of parts on the follower 25. Thus, the priming pressure may be controlled at will to the smallest values, and is not dependent in any way upon said weight. This makes the device effective on a wide range of materials of various consistencies.

It is to be understood that the regulator 44 is adjusted to a pressure in the cylinder 51 which is low enough to prevent the piston 53 from being pushed to the outermost end of its stroke (to the left in Fig. 2), but high enough that the piston is not pushed to the innermost end of its stroke (to the right in Fig. 2). This allows for a range of movement which will allow for volume changes which compensate surge pressures.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. Apparatus for pumping, and applying controlled priming pressure to liquid and semi-liquid materials of various consistencies carried in containers, comprising a movable follower located above the material in a container and contacting with the material surface at various levels assumed by its surface, a pump assembled with and carried by the follower and pumping material from under it, a cylinder above the follower, a movable piston in said cylinder, said piston being connected with the pump and follower assembly and adapted to lift or depress it, separate fluid supply connections from a fluid supply line to points in said cylinder above and below said piston respectively, exhaust connections from the cylinder above and below the piston respectively, control means for said supply and exhaust connections, said control means being adapted to transmit fluid from said supply line to one end of the cylinder while venting its other end to its exhaust and vice versa, and pressure resistance means associated with that exhaust connection which is below the piston, said resistance means being adapted at all times to maintain exhaust pressure below the piston at a predetermined value substantially to counterbalance the weight of the pump and follower assembly so as to prevent it from sinking of its own weights into the material, regardless of the consistency of the material.

2. Apparatus for pumping, and applying controlled priming pressure to liquid and semi-liquid materials of various consistencies carried in containers, comprising a movable follower located above the material in a container and contacting with the material surface at various levels assumed by its surface, a pump assembled with and carried by the follower and pumping material from under it, a cylinder above the follower, a movable piston in said cylinder, said piston being connected with the pump and follower assembly and adapted to lift or depress it, separate fluid supply connections from a fluid supply line to points in said cylinder above and below said piston respectively, exhaust connections from the cylinder above and below the piston respectively, control means for said supply and exhaust connections, said control means being adapted to transmit fluid from said supply line to one end of the cylinder while venting its other end to its exhaust and vice versa, and pressure resistance means associated with that exhaust connection which is below the piston, said resistance means being adapted at all times to maintain exhaust pressure below the piston at a predetermined value substantially to counterbalance the weight of the pump and follower assembly so as to prevent it from sinking of its own weight into the material, regardless of the consistency of the material, and adjustable pressure-reducing and regulating means in said supply line connection above the piston, whereby a full range of priming pressures may be applied to a material from low values to the highest of which the apparatus is capable.

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