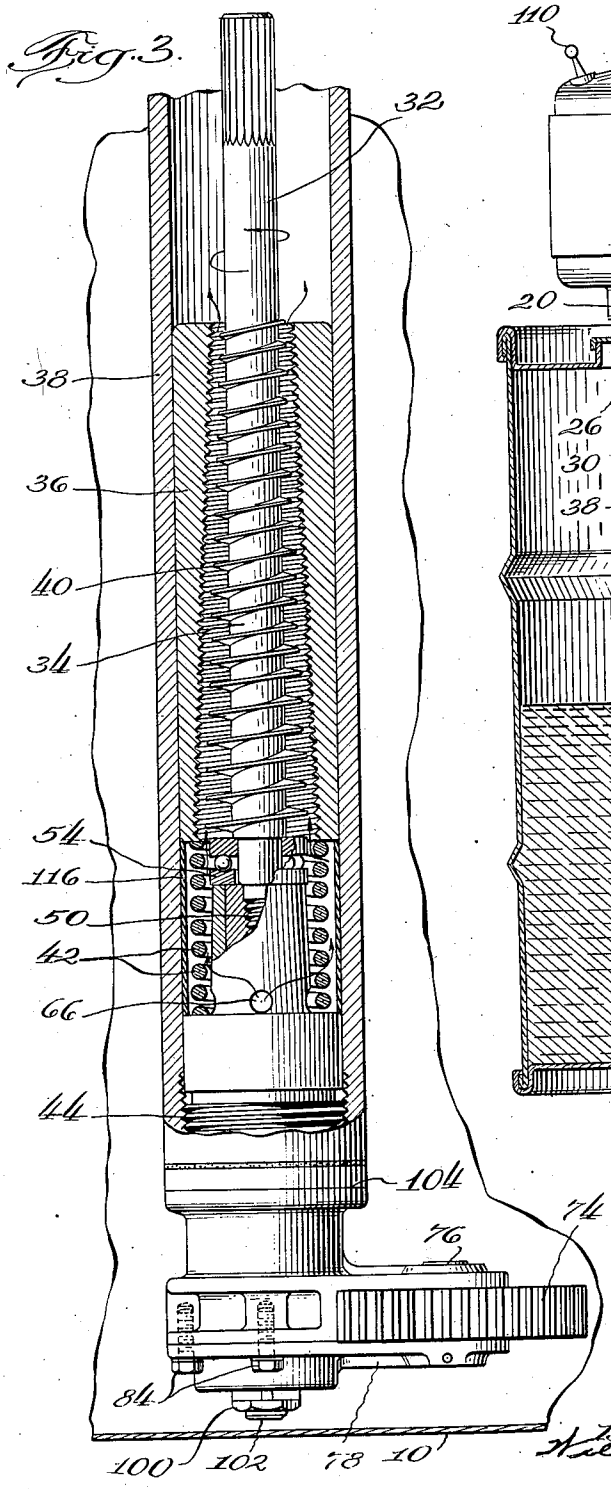
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ROTARY PUMP

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Fig. 3.



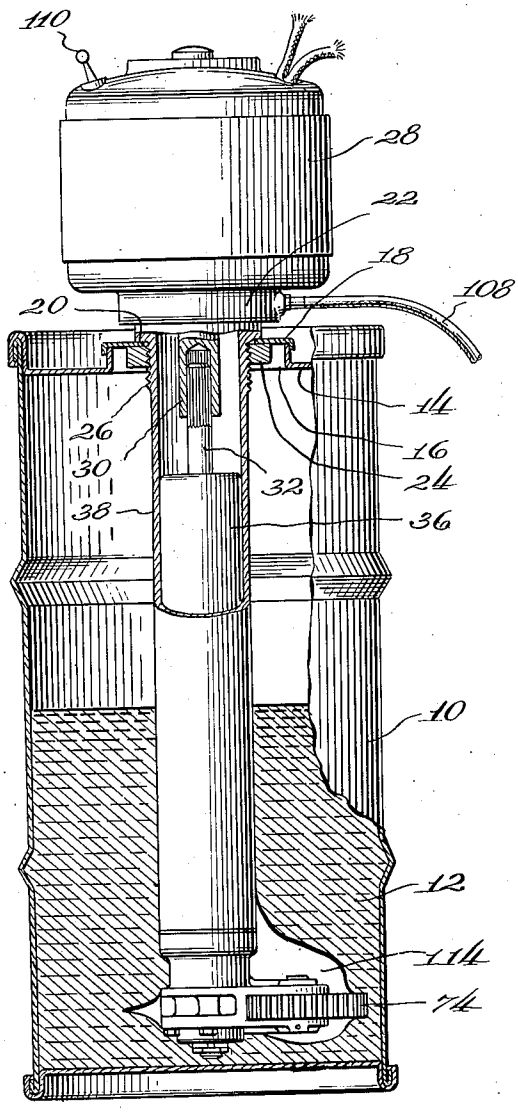


Fig. 1.

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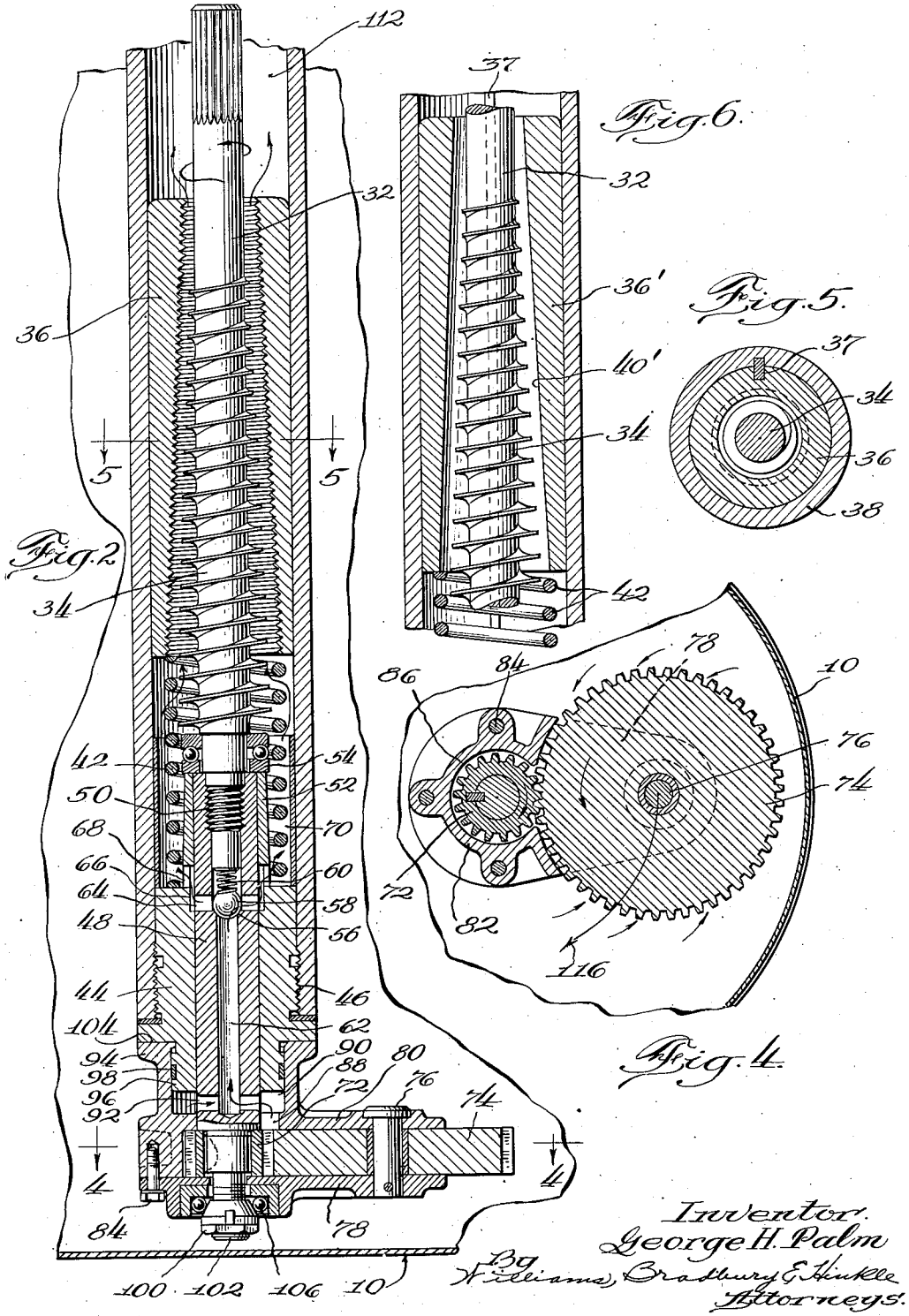


Fig. 2.

Fig. 6.

Fig. 5.

Fig. 4.

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Patented Nov. 14, 1944 2,362,922

UNITED STATES PATENT OFFICE

2,362,922

ROTARY PUMP

George H. Palm, Chicago, Ill., assignor to Stewart-Warner Corporation, Chicago, Ill., a corporation of Virginia

Application October 16, 1942, Serial No. 462,223

6 Claims. (Cl. 103—5)

My invention relates to rotary pumps and is more particularly concerned with, but not limited to, pumps especially adapted for handling grease or similar lubricants.

It is customary for the grease manufacturer to ship grease in metal drums and the filling station or garage which produces such a drum of grease usually removes the cover from an opening in the top of the drum and inserts the inlet end of a pump through this opening to withdraw the grease from the drum and force it to bearings, differential housings, transmission housings and similar points of application. Where the grease has a high viscosity and the temperature is low, great difficultly is experienced in removing the grease from the drum by such pumps because the suction created at the pump inlet merely serves to form a cavity in the grease and does not produce proper priming of the pump. An object of my invention is to provide a new and improved pump which avoids this difficulty.

Another object of my invention is the provision of a new and improved pump which can be used with greases of different viscosities and which will be adequately primed under all temperature conditions.

Another object of my invention is to provide a new and improved pump wherein the volume of discharge varies inversely with the pressure.

Another object of my invention is to provide a new and improved pump wherein the clearance between pump elements is automatically varied to accommodate the pump to different discharge pressures.

Another object of my invention is to provide a new and improved pump which is of simple and sturdy construction and which can be economically manufactured.

Another object of my invention is to provide an improved pump which is lightweight and may be easily applied to, or removed from, a lubricant drum.

Another object of my invention is to provide an improved pump having a minimum number of operating parts of simple and sturdy construction and which will give long and trouble-free use.

Other objects and advantages will become apparent as the description proceeds.

In the drawings:

Fig. 1 is a plan view partly in section showing a preferred embodiment of my invention applied to a standard lubricant drum;

Fig. 2 is a view on an enlarged scale showing the pumping mechanism in vertical section;

Fig. 3 is a view showing the parts in a different position from that assumed in Fig. 2;

Fig. 4 is a view showing a horizontal section taken on the line 4—4 of Fig. 2;

Fig. 5 is a horizontal, sectional view taken on the line 5—5 of Fig. 2; and

Fig. 6 is a view showing a partial, vertical section through a modified form of my invention.

In Fig. 1, I have illustrated my novel pump as being applied to a shipping container 10 which is partially filled with lubricant 12. The upper end of the container has a top 14 provided with an opening 16 from which the cover has been removed. My new and improved pump is mounted on a plate 18 which is adapted to close the opening 16 when the pump is installed in the drum, as shown in Fig. 1.

The plate 18 is clamped between the shoulder 20 of a tubular housing 22 and a nut 24 which is attached to the threaded portion 26 of the housing 22. An electric motor 28 is mounted on the upper end of the tubular housing 22 and furnishes the power for operating the pumping mechanism. This motor has an armature 30 which is connected in driving relation to the upper end of a shaft 32 having a helicoid impeller 34 formed thereon.

The impeller 34 is located in a sleeve 36 which is slidably mounted in the lower portion 38 of the tubular member 22. A spline 37 (Fig. 5) holds the sleeve 36 against rotation. This sleeve has a tapered inner surface 40 which is illustrated as being provided with a spiral groove of opposite rotation to that of the helicoid impeller 34. The lower end of the sleeve 36 rests upon a coil spring 42 supported on the upper end of a bearing member 44 which is threadedly attached at 46 to the lower portion 38 of the tubular member 22.

The bearing member 44 provides a bearing for the hollow shaft 48 which is threadedly attached at 50 to the lower end of the shaft 32. The reduced upper end 52 of the bearing member 44 forms a supporting abutment for a thrust bearing 54 which is illustrated as being of the ball type. The hollow shaft 48 has an external shoulder 56 which forms the seat for a ball valve 58. This valve is urged against its seat by a spring 60 abutting the lower end of the shaft 32. The valve 58 controls communication between the passage 62 in the hollow shaft 48 and ports 64 provided in the walls of this shaft. These ports in turn communicate with an annular groove 66 formed in the bearing member 44. Ports 68 in bearing member 44 provide communication

between the annular groove 66 and a chamber 70 in communication with the lower end of the main or axial pumping means comprising the impeller 34 and sleeve 36.

The priming pump comprises a small gear or pinion 72 mounted on the lower end of the hollow shaft 48 for rotation therewith. This pinion 72 meshes with a large gear 74 rotatably mounted in arms 78 and 80, forming part of a housing 82. This housing is formed in two parts which are secured together by bolts 84, or in any other suitable manner. This housing has a cylindrical surface 86 which closely surrounds the pinion 72 and which cooperates with this pinion and the gear 74 to form a gear pump which functions as a priming means for the axial flow pump, comprising the impeller 34 and sleeve 36. The interior of the housing 82 is in communication with the passage 62 in the hollow shaft 48 by way of port 88, annular space 90 and ports 92.

The housing 82 has a cylindrical upper end 94 which is rotatably mounted on the reduced lower end 96 of the bearing member 44 and an annular gasket 98 is provided to prevent leakage of lubricant at this point. The housing 82 is clamped between a nut 100 threaded to the lower end 102 of the hollow shaft 48 and a shoulder 104 provided by the bearing member 44. A ball bearing 106 is interposed between the nut 100 and the lower portion of the housing 82.

The lubricant is discharged from the upper end of the tubular member 22 through a hose or discharge conduit 108. This discharge conduit may be provided with a tubular spout for insertion in the filling openings of differential and transmission housings, or may be provided with a nozzle or coupler for forming a sealed connection with a lubricant fitting attached to a bearing part. Operation of the motor 28 may be controlled by a manual switch 110. It is more common, however, to provide pumps of this general type with pressure operated switches which cut off the supply of current to the motor when the pressure in the discharge conduit reaches a predetermined value and to connect the motor with its source of current whenever the pressure in the discharge conduit falls appreciably below this predetermined value.

In such installations, the discharge conduit is commonly provided with a flow control valve like that disclosed in my co-pending application, Serial No. 454,667, filed August 13, 1942, and it is to be understood that the discharge conduit 108 may be provided with such a control valve and the motor 28 may be provided with a pressure operated switch in accordance with conventional practice.

When the motor 28 is operating, it rotates shaft 32 and impeller 34. Shaft 32 in turn rotates hollow shaft 48, which serves to drive pinion 72 and gear 74. As the gear 74 rotates, the spaces between its teeth become filled with lubricant which is expelled through port 86 where the teeth of this gear mesh with the teeth of pinion 72. This lubricant flows through annular space 90 and ports 92 into the vertical passage 62 in the hollow shaft 48. The upward flow of this lubricant raises ball valve 58 and this permits the lubricant to flow through ports 64, annular recesses 66 and ports 68 into chamber 70.

The upper end of chamber 70 is in communication with the axial flow or main pumping means comprising the impeller 34 and sleeve 36. Lubricant in the upper end of space 70 is engaged by the lower end of the impeller 34 and forced by this impeller through sleeve 36 to the discharge chamber 112 formed in the upper end of the tubular member 22. This chamber is in communication with the discharge conduit 108 through which the lubricant passes to the housing or bearing which is being supplied with lubricant.

As the priming pump operates to withdraw lubricant from the container 10 and force this lubricant to the impeller 34, there is a tendency to form a void in the lubricant. Such a void is indicated at 114 in Fig. 1. In my novel pump, however, the housing 82 is free to rotate about the axis of the shafts 32 and 48. The reaction created at the port 88 causes this housing 82 and gear 74 to move in the direction of the arrow 116 of Fig. 4 and the advancing edge of the gear 74 gnaws the lubricant away from the wall of the cavity 114 so that the spaces between the teeth of the gear 74 are always filled with lubricant in spite of any cavity which may be formed in this lubricant. Since the resistance of the lubricant itself is the only thing which prevents the gear 74 and housing 82 from rotating as a unit with the pinion 72, it will be apparent that the advancing edge of the gear 74 will always be in contact with the wall of lubricant which defines the leading extremity of the cavity 114.

When the resistance to flow of grease through the discharge conduit 108 is slight, the sleeve 36 remains in the upper position shown in Figs. 2 and 3. This provides a relatively large annular passage between the impeller 34 and tapered inner surface 40 of the sleeve 36 and the impeller forces large quantities of lubricant through this annular passage and thereby provides a maximum rate of lubricant discharge into the housing or bearing part being supplied with lubricant. Under these conditions of operation, there is little reactance at the port 88 and gear 74 and housing 82 move very slowly about the axis of the shafts 32 and 48. In other words, the gear pump supplies a maximum amount of priming material to the impeller 34.

When the resistance to flow of lubricant through the discharge conduit 108 is high, pressure builds up in the discharge chamber 112 and this pressure acts on the upper end of the sleeve 36 to move this sleeve downwardly against the resistance of its spring 42. As this sleeve moves downwardly, the tapered inner surface of the sleeve approaches more closely the correspondingly tapered helicoid blade of the impeller. This reduces the size of the passage available for the flow of grease, but permits the impeller to exert a greater discharge force and deliver the grease at higher pressure to the discharge chamber 112. Downward movement of the sleeve 36 is limited by engagement of the lower end of this sleeve with a cylindrical stop 116.

When the main pump is discharging smaller quantities of lubricant under higher pressure, it requires less priming material from the gear pump. This produces a greater reactance at the port 88 and under these conditions the gear 74 and housing 72 rotate more rapidly about the axis of the shafts 32 and 48. This results in a decreased supply of lubricant to the main pumping means.

In the modification of Figs. 1 to 5, inclusive, the tapered sleeve 36 is provided with an internal thread. Such a thread, while desirable, is not essential and in Fig. 6 I have illustrated a modi-

fied form of my invention wherein the sleeve 36' is provided with a smooth tapered surface 40'. In all other respects the embodiment of Fig. 6 is like that of Figs. 1 to 5, inclusive.

From the foregoing description, it will be apparent that I have provided a new and improved rotary pump in which the primary pumping means is effective to prime the main pumping means regardless of the viscosity of the lubricant or the particular temperature conditions to which the lubricant is exposed. Furthermore this priming mechanism automatically adjusts itself to the requirements of the main pumping mechanism without any attention on the part of the operator. The main pumping mechanism is particularly adapted for supplying lubricant under varying pressure conditions, since the maximum quantity of lubricant is supplied at low pressure and the maximum quantity is supplied for any given pressure condition throughout the entire pressure range of operation of the pump.

While my novel pump is particularly adapted for pumping lubricants of varying viscosities, it is not limited to such use, but may be advantageously used for pumping other viscous or semi-solid materials. My invention is not limited to the particular details shown and described, but may assume numerous other forms and is to be considered as including all modifications and variations falling within the scope of the appended claims.

I claim:

1. In a pump of the class described, the combination of a motor, a helicoid impeller driven thereby, a sleeve enclosing said impeller, a first gear driven by said impeller, a second gear meshing with said first gear and cooperating therewith to form priming means for said impeller, and supporting means for said second gear, said supporting means permitting said second gear to rotate about the axis of said first gear.

2. A pump of the class described, comprising a motor, an impeller driven by said motor, a tubular member cooperating with said impeller to form pumping means, a hollow shaft connected to said impeller and providing a passage for supplying material thereto, a first gear rotatable with said shaft, and a planetary gear engaging said first gear and driven thereby, said gears cooperating to supply material to said shaft.

3. A pump of the class described, comprising a plate adapted to be supported on the open upper end of a lubricant drum, a motor carried by said plate, a tubular member extending through said plate and having one end extending into the lubricant in said drum, a tapered sleeve slidable in said tubular member, means for preventing rotation of said sleeve relative to said member, a screw located in said sleeve and driven by said motor, a housing rotatably mounted on the lower end of said tubular member, a pair of intermeshing gears in said housing, and means for driving one of said gears from said screw.

4. A pump of the class described, comprising a tubular member, a sleeve slidably mounted therein, means for preventing rotation between said sleeve and tubular member, an impeller in said sleeve and cooperating therewith to form pumping means, said sleeve having a tapered inner surface, said impeller having a tapered blade, and a spring for urging said sleeve in one direction, said sleeve having a part exposed to pressure created by said pump to vary the quantity of material discharged by said pump inversely with variations in said pressure.

5. In pumping apparatus of the class described, the combination of a sleeve, a tubular support for said sleeve in which said sleeve is slidably mounted, said sleeve having a tapered inner surface, an impeller having a tapered helical blade for forcing material through said sleeve, means for driving said impeller, and yieldable means for resisting movement of said sleeve over said impeller and in a direction opposite to the flow of material under the impetus of said impeller.

6. In apparatus of the class described, the combination of a sleeve having a tapered inner surface provided with a screw thread, an impeller located in said sleeve and having a helical blade for forcing material through said sleeve, the spiral of said thread being opposite to the spiral of said blade, and means for rotating said impeller.

GEORGE H. PALM.