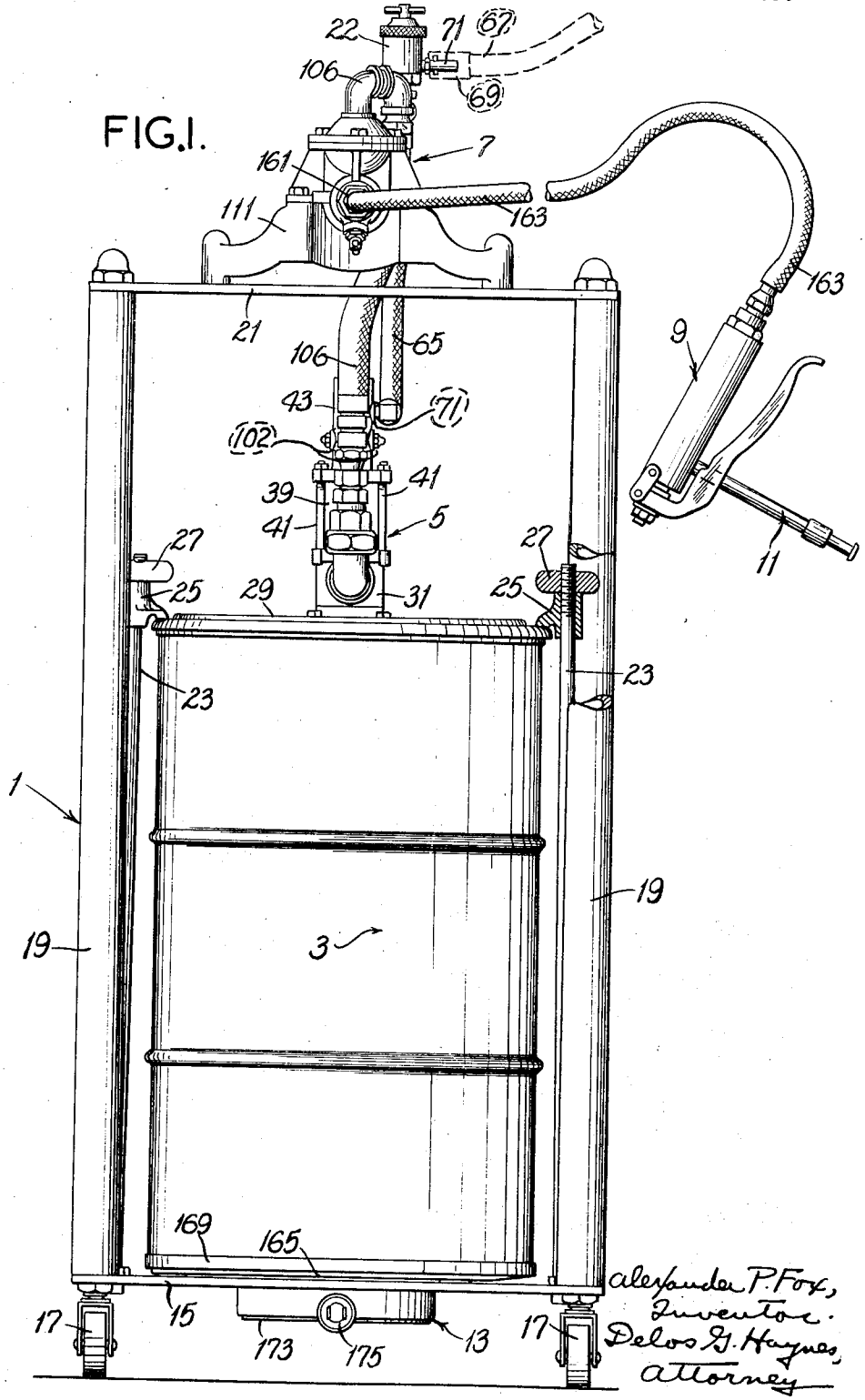
Sept. 5, 1933. A. P. FOX 1,925,832

LUBRICATING APPARATUS

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FIG. 1.



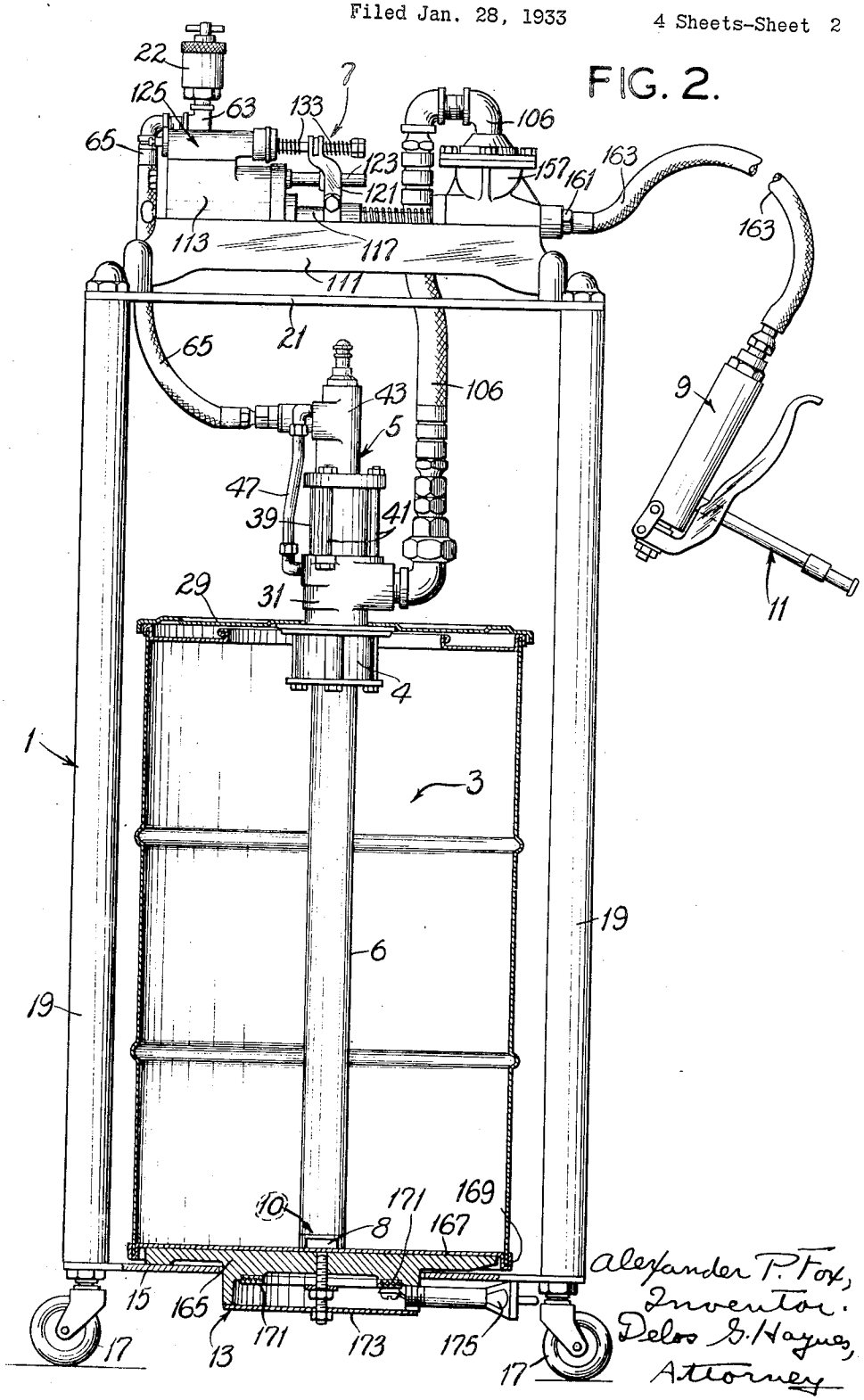
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LUBRICATING APPARATUS

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FIG. 2.



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LUBRICATING APPARATUS

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FIG. 5.

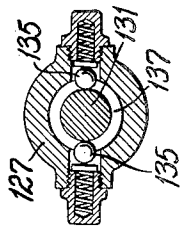


FIG. 6.

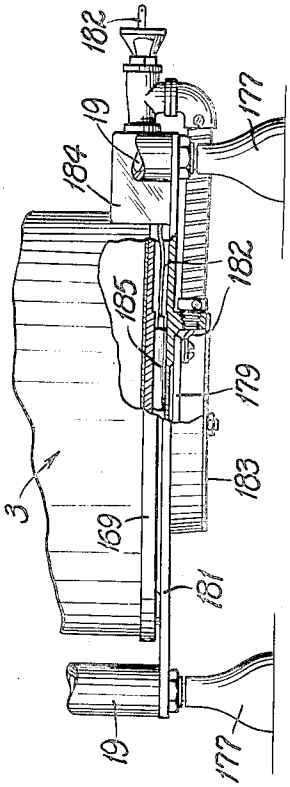
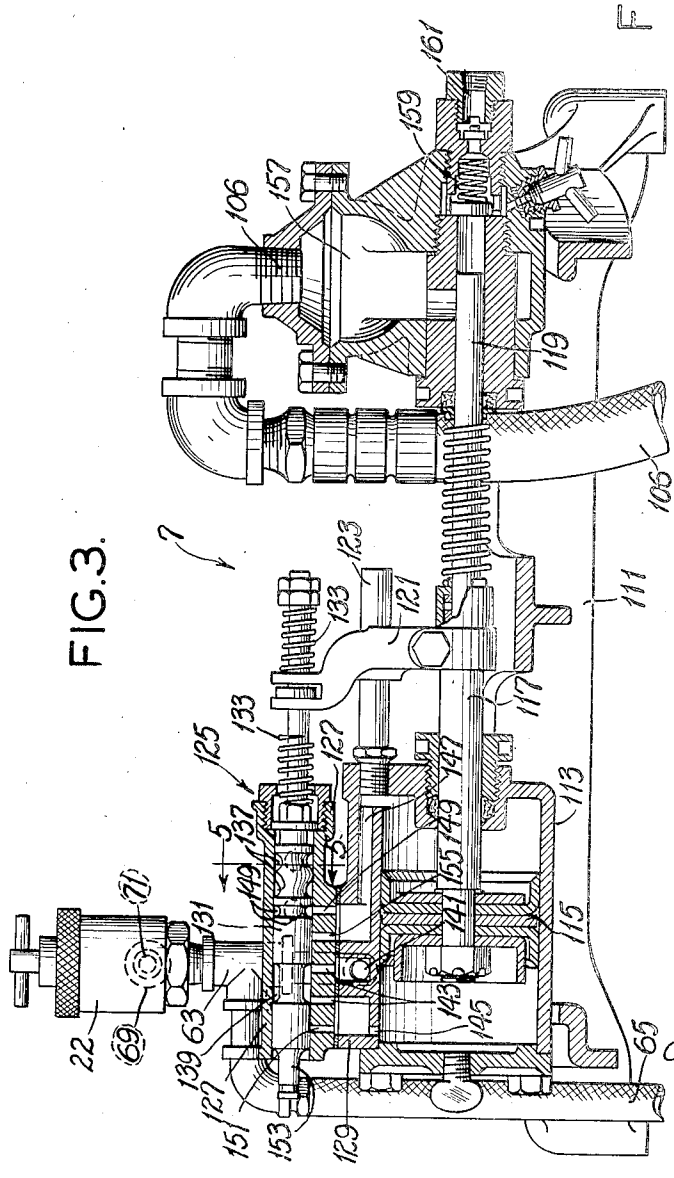


FIG. 3.



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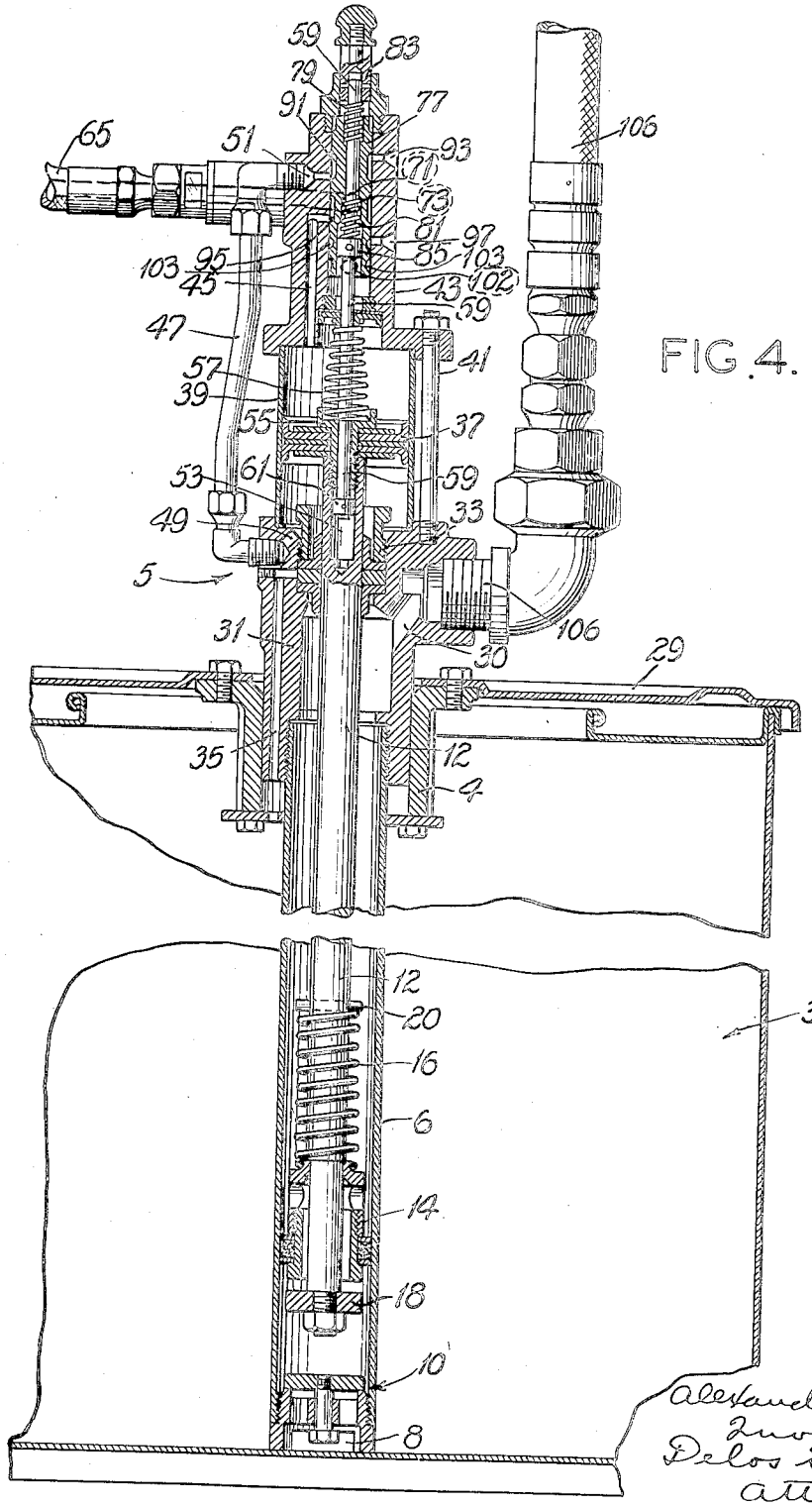


FIG. 4.

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1,925,832

UNITED STATES PATENT OFFICE

1,925,832

LUBRICATING APPARATUS

Alexander P. Fox, University City, Mo., assignor to Lincoln Engineering Company, St. Louis, Mo., a corporation of Missouri

Application January 28, 1933. Serial No. 653,982

7 Claims. (Cl. 221—47.1)

This invention relates to lubricating apparatus, and with regard to certain more specific features, to high-pressure lubricating pumps.

This invention is an improvement upon the invention set forth and described in my United States patent application, Serial Number 611,122, filed May 13, 1932, for Lubricating apparatus.

Among the several objects of the invention may be noted the provision of a lubricating pump adapted to pump directly from a commercial container or the like, said pump and container being organized as an improved form of portable unit; the provision of apparatus of the class described which may be properly heated for use with heavy and/or cold lubricants, without scorching the lubricants and with minimum waste of heat; the provision of apparatus of the class described which may have the said commercial container quickly dismounted and remounted thereon for the purpose of changing containers; and the provision of apparatus of the class described which may be made simple and rugged in design and which may be easily repaired. 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 front elevation;

Fig. 2 is a side elevation;

Fig. 3 is an enlarged, longitudinal section taken through a booster pumping unit;

Fig. 4 is an enlarged, fragmentary vertical section of a primary pumping unit;

Fig. 5 is a cross section taken on line 5—5 of Fig. 3; and,

Fig. 6 is a fragmentary detail showing the bottommost portion of a stationary form of apparatus, the same including a thermostatic heater cut-out.

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

Referring now more particularly to Fig. 1, there is shown in general at numeral 1 a portable carriage adapted to support a commercial container 3, the latter containing lubricant.

Mounted on and extending into the container 3 is a primary, air-driven pump 5 adapted to withdraw lubricant from the bottom of said container 3 and deliver the same to a high-pressure, air-driven, booster pump 7, the latter taking the lubricant from the primary pump 5 and boosting the pressure thereof and delivering said lubricant under high pressure to a normally closed valve 9. When the valve 9 is opened, lubricant is ejected from a nozzle 11. Fastened beneath the carriage 1 and below the container 3 is a heating element 13.

More specifically, the carriage 1 comprises a bed plate 15 supported on casters 17. The bed plate 15 carries four corner posts 19 the upper ends of which support a platform 21, the latter being fastened to the posts 19. The platform 21 carries said high-pressure booster pump 7.

The bed plate 15 carries a heater plate 165 adapted to support a loaded, commercial grease container 3, and for holding said container 3 in position there are provided tension rods 23 attached to the bed plate 15 and having slidable finger catches 25 thereon adapted to be driven downwardly by hand wheels 27 threaded on said tension rods 23. Before the container 3 is placed on the bed plate 15 it has its commercial cover removed therefrom and a special, temporary cover 29 placed thereon. This temporary cover 29 is engageable by the fingers 25 so that said fingers may hold down the cover when the hand wheels 27 are threaded downwardly. The cover 29 and the parts directly associated therewith correspond essentially to similar parts shown in said patent application, Serial Number 611,122.

As stated in said application, I have found it desirable to pump lubricants under pressure by attaching to their original containers a pump such as 3, which shall withdraw the lubricant and directly deliver it to a line under pressure. I have also found that where a lighter lubricant is used, such as light grease and the like, a relatively high speed, small bore reciprocating unit may be used to provide high pressure in suitable quantity, the liquid friction being low.

However, in the case of the modern, heavy and viscous lubricants, especially when they are cold, the small bore, high speed equipment is not suitable. This is because the high speed causes the pump to lose its prime under the conditions of sluggish flow of the lubricant. The high speed is necessary with small-bore, high-pressure pumps in order that ample quantities may be obtained.

An alternative to the high speed operation, in obtaining ample quantities is to provide a larger bore of pump. This, however, introduces the

difficulty that high outlet pressures are not obtainable with economically sized apparatus. To overcome these difficulties, I provide a relatively large-bore, slow-acting, primary pump for withdrawing lubricant from the original container, and also a booster pump of smaller bore and operating at higher speeds in series therewith for maintaining a high outlet pressure. These units are all organized advantageously as will be hereinafter described.

The original closing cover having been removed from the container 3, an opening is left which is subsequently covered by the temporary cover 29. It will be understood that the cover 29 is of such a fit on the container 3 that it does not seal against entry of air. The temporary cover 29 has attached thereto a bushing 4 which has extending downwardly therethrough a pump cylinder 6 which is slidable in the bushing. The lower end of the cylinder 6 is castellated as shown at 8 to provide entry way for fluid from the container 3, even though the cylinder assembly is bottomed on the bottom of the container 3. A foot valve 10 is provided at the bottom of the cylinder 3 to permit ingress of fluid from the container into the cylinder 6 but to prevent reverse action.

Within the cylinder 6 is a reciprocating piston rod 12 which carries a hollow and slidable piston 14 hereon. By a spring 16, the piston 14 is normally caused to seat on a flange 18 carried at the lower end of the rod 12. The piston reacts in any downward movement against the spring 16. The spring 16 reacts against a pin 20 carried on the rod 12. It will be seen that any reciprocation of the rod 12 will result in drawing fluid through the castellated portion 8 and through the valve 10 into the cylinder 6, the piston 14 at this time seating on the flange or cap 18.

Upon downward movement the indrawn fluid is trapped in the cylinder 6 below the piston 14 and is placed under pressure. The pressure lifts the piston 14 from its seat 18, thereby causing fluid to change position from beneath the piston to the space above the piston. The change of position is effected through the piston itself which, as shown, is hollow.

Upon the next subsequent stroke, the fluid which is trapped above the piston is pushed out from the upper end of the cylinder 6 and out of a port 30 which is formed by a body casting 31 supported in said bushing 4.

There is advantage in having the plunger 14 reciprocate at or near the bottom of the container because this insures pressing the material upwardly rather than sucking it upwardly, thus avoiding loss of prime due to friction in the tube functioning against the applied air pressure of atmospheric degree. Also material is withdrawn from the lower heated region of the container.

At its upper end, the piston rod passes through a packing gland 33 carried in the body 31. A by-pass 35 from the gland 33, through the body 31 back to the container 3 serves to re-deliver any grease which may leak through the packing of the gland 33. This re-delivery is to the grease container; and diverts air leakage from the cylinder to atmosphere in the container and thereby prevents grease working up into the air cylinder, or vice versa, prevents air from working down into the grease chamber.

In order to reciprocate the piston rod 12, its upper end is provided with a piston 37 reciprocating in a cylinder 39, the latter being held to the casting 31 by means of studs 41. These studs 41 also hold down on the end of the cylinder 39 a cap 43 which encloses a valve.

The cap-and-valve casting 43 is in communication with the upper end of the cylinder 39 by way of a port 45 and in communication with the lower end of said cylinder by way of a pipe 47 and ports 49 and 51 at opposite ends of said pipe 47. The details of the valve carried in the casting 43 and the actuating mechanism therefor are as follows (Fig. 4):

The upper end of the piston rod 12 is made hollow as shown at numeral 53. Threaded into the hollow portion is a cap 55 which also holds in place the piston 37. It also functions as a socket for a spring 57.

A reciprocating valve stem 59 passes through the guide in cap 55 and is provided in the hollow portion 53 with a head 61. The hollow portion or socket 53 is of such length that a predetermined amount of lost motion is provided between the stem 59 and the piston rod 12.

Leading from an air inlet manifold 63 (Fig. 2) is a flexible inlet air pipe 65 which may be manually attached and detached from the valve body 43. The inlet air manifold 63 carries a lubricator 22. The inlet manifold 63 receives air from an air hose (see dotted lines 67, Fig. 1) attached by means of a detachable coupling 69 to an inlet air fitting 71. The air pipe 65 leads to an inlet port 73 in the casting 43.

The interior of the body 43 is provided with a valve 77. The valve fits slidably on the valve stem 59 and is endwise engaged by springs 79 and 81, said springs reacting against collars 83 and 85 respectively held to said stem 59.

The valve 77 is provided with a peripheral recess 91 for providing communication between the passage 51 and an exhaust passage 93 when the valve is in its upper position. When the valve is in its lower position this groove 91 cuts off the said communication and causes a communication between said port 51 and the air inlet 73 thus to deliver air beneath the piston 37.

The valve 77 is also provided with a second peripheral groove 95 which, when the valve is in its uppermost position, connects the inlet port 73 with the port 45 to lead air above the piston 37; and when the valve is in its lowermost position cuts off this connection and causes a communication between said port 45 and a second exhaust port 97.

The valve 77 is also provided with a pair of spaced grooves 103 in one or the other of which rests a pair of detent balls (indicated at numeral 102) normally spring-pressed inwardly. These have been particularized at greater length in said application, and in view of said particularization, and in view of the fact that they comprise known devices for effecting a detent action, they will not be further described. For an analogous detent construction shown herein, see the device of Fig. 5, used in connection with the engine 7.

In view of the above, the operation of the primary engine 5 is as follows:

Air enters the pipe 65 and the port 73, from whence it passes through the groove 95 to the port 45 and thence into the upper end of the cylinder 39, thus pressing downwardly the piston 37. This causes the downward stroke of the lower piston 14 so as to bring fluid to the upper side thereof.

The downward stroke continues until the cap 55 strikes the collar 61 to cause movement of the stem 59. The movement of the stem 59 continues beyond the time that the upper collar 83 strikes the spring 79. After the collar 83 strikes the spring 79, the spring 79 is compressed but does not move the valve 77, because of the detent action. The collar 83 continues its downward movement until it contacts the valve 77 thus moving it. Thus, the valve 77 is given a full-stroke action by the energy released from the upper spring 79. This results in the grooved ports 91 and 95 being reset, so that the port 91, which previously permitted exhaust from below the piston now cuts off the exhaust. Instead, the port 91 permits air under pressure to flow from the inlet 73 to the port 51, down the pipe 47 and to the port 49, thus pushing upwardly the piston 37 after the same has reached the lower end of its stroke. The full-stroke action of the valve 77 does not take place until the piston 37 has almost reached the end of its stroke.

The resetting of the valve also results in the inlet port 73 being cut off from the port 45, the groove 95 in its lower position causing communication between the port 45 and the lower exhaust port 97.

The upward stroke continues as long as air flows in under the piston 37. The lower end of the socket strikes said collar 61 to move the same until the lower collar 85 strikes the spring 81. The spring 81 is stressed but does not overcome the detent reaction until the piston nears the end of its stroke, at which time the collar 85 contacts the valve 77 moving it slightly to permit spring 81 to throw the valve 77 to its original position, thus again starting the cycle of action.

The above action forces material under pressure into the outlet line 106 and, if it were desired, the grease could be used at this pressure. However, it is my desire to increase the pressure of the grease beyond that provided for by the above described priming engine 5 and to do this I provide a booster pump 7 which, instead of being integrally organized with the primer pump 5 is separate therefrom and stands upon the upper plate 21 from which it is readily removable. The line 106 is readily detachable, as is the air line 65 so that the drum 3 and the engine 5 thereon may be removed from the platform 15 when the container 3 is empty. Thus removed, the container 3 may have the pump 5 removed therefrom with the lid 29, these parts 5 and 29 being applied to another filled container which, with the pump 5 may be replaced on the platform 15 and the lines 65 and 106 again connected.

Referring to the booster pump 7, it will be seen to comprise a base 111 carrying a cylinder 113 having a reciprocating, double-acting piston 115 therein, with a piston rod 117 reaching therefrom. The piston rod 117 drives a plunger 119. An arm 121 which rides upon a guide 123 operates a full-stroke valve gear 125.

The valve gear 125 comprises a manifold 127 associated with a ported chest 129 on a cylinder 113. A valve stem 131 is operated by said arm 121 which is forked thereover and, with lost motion, engages springs 133 which springs absorb energy until the spring-pressed detent balls 135 (Fig. 5) are pushed from one or the other of the grooves 137 in the valve stem 131 to spring into the adjacent groove to effect a full valve stroke at or near the end of the full stroke of the piston 115, thus to reset the valve only after substantially full stroke of the piston 115. In the position shown, a recess 139 is carrying air from an inlet port 141 in communication with said manifold 63 into the left end of the cylinder 113 by way of ports 143 and 145. At this time air is exhausting from the other end of the cylinder 113 by way of ports 147 and 149.

When the valve becomes reset, the left end of the cylinder 113 may exhaust through ports 145 and 151, the reduced end portion 153 of the valve stem 131 permitting this. At the same time the recess 139 connects an inlet port 143 with an inlet port 155 which carries air to the opposite end of the cylinder 113 by way of port 147. By this means the same air pressure which operates the engine 5 is caused to operate the engine 7.

The reason for the pressure at the outlet of engine 7 being higher than at the outlet of engine 5 is that the area ratio of the piston diameter of engine 7 to the plunger diameter is greater than the ratio of areas of the corresponding parts in engine 5. Thus the engine 7 receives lubricant under pressure from line 106, said line 106 being attached to a manifold 157 from which the plunger 119 takes its charge and ejects the same through a check valve 159 to an outlet 161, the latter being connected to a flexible line 163 which passes to said gun or valve 9.

From the above it will be seen that whenever the valve 9 is closed, the air pressure in manifold 63 causes both the low and high pressure pumps 5 and 7 to operate. The pump 7 will operate until the pressure in the line 163 is built up so that the total load impressed upon the end area of the plunger 119 equalizes the total air load on the piston 115 (Fig. 3). Said pressure in the manifold 157 depends upon the pump 5 which will start to operate whenever the pump 7 has decreased the pressure in the manifold 157 to a point where it no longer, when impressed on piston 14, balances the air pressure on piston 37. That is to say, when the unit pressure of grease in the manifold 157 multiplied by the projected area of the piston 14 is equal to the unit pressure of the air multiplied by the projected area of piston 37, then the pump 5 will cease operation; otherwise it will be operated until this balance is established. The volume displaced per stroke by plunger 119 is considerably less than that displaced by piston 14 per stroke; consequently the speed at which piston 14 travels is governed by the volume displaced by plunger 119 per stroke. The displacement values can be varied to insure a movement of the primer pump 5 at a rate best suited to effectively prime, depending upon the consistency or viscosity of the fluid being pumped. Thus the advantages of a slow-operating, low-pressure pump handling large volumes are obtained for boosting pressure from atmospheric to the intermediate value. Thereafter the high pressure booster 7 is used which, although it must operate at higher speeds for a given volume, is nevertheless capable of doing so maintaining a full prime because of the superatmospheric pressure in its intake manifold 157 caused by pump 5.

It is pointed out that among the advantages of the invention is the fact that should either of the pumps 5 or 7 become out of repair, either one may be readily removed and replaced. All that is necessary is to uncouple the air and grease lines and make the replacement. All of

these lines are flexible and require no expert mechanics to make the changes. They are all provided with quick-detachable couplings.

Another feature of the invention is the provision of improved means for heating the fluid in the container 3. Referring to Figs. 1 and 2, one form of heater is shown to comprise the plate 165 resting on the lower support 15 and adapted to engage the bottom 167 of the drum 3 within a flange 169 thereof. An electrical heating element 171 is mounted within the plate 165 and provided with a cover 173 and an energizing line and plug 175 adapted to be connected with a suitable outside electrical circuit.

The heating value of the electrical resistance 171 is made such that in view of the size of the drum 3 carried on the plate 165, the heat input will be balanced by the radiation from the drum, at a temperature which is less than the point at which the lubricant is scorched. Reference here is made to cold weather conditions. Variations in cold weather temperature have the effect of causing a greater or less depth of lubricant in the bottom of the container 3 to be heated.

It will be seen that by arranging a hot plate upon which the commercial drum stands and applying a pump which draws in lubricant from the bottom of the container, the pump draws lubricant from the region at which it is heated. As lubricant is pumped, the cold lubricant is drawn down against the hot plate prior to being pumped. The position of the mass of lubricant above the heater is conducive to economy, because the heat has a tendency to rise. Furthermore, it is the commercial container for the lubricant which is heated and thus the lubricant needs at no time be pumped or transferred from container to container while cold.

In Fig. 6 is shown another form of heater applied to a stationary form of the apparatus wherein the fixed supports 177 are substituted therefor for casters. This heater has an electrical heating element 179 fastened to the plate 181, covered as at 183. The electrical leads 182 pass through a thermostatic switch 184 before passing to the heating element 179, the switch 184 being adapted to open and close the circuit in response to low and high temperatures applied to a sensitive, thermostatic element 185 which is in heat-conducting relationship with and above the heating element 179. The switch 184 has the known adjusting means whereby a predetermined temperature may be carried in that which is heated by the electrical heating element 179 (here the lubricant). The advantages above set forth in connection with the non-thermostatic form of the heater apply to the thermostatic form. Furthermore, with the thermostatic form it is possible to maintain a given temperature of lubricant under more widely varying exterior conditions.

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 carrying out 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.

I claim:

1. In lubricating apparatus, a portable carriage adapted to removably support a lubricant container having an opening, a relatively low-pressure pump adapted to be inserted into and removed from said container independently of the carriage, a relatively high-pressure boosting pump supported by the carriage, and lubricant and energizing lines connecting said pumps, said low-pressure pump being adapted to be passed through the upper opening of said container and to withdraw lubricant from the lower end thereof, and a heater associated with said carriage located beneath the container adjacent to said point of withdrawal.

2. In lubricating apparatus, a portable carriage adapted to removably support a lubricant container having an opening, a relatively low-pressure pump adapted to be inserted into and removed from said container independently of the carriage but having exterior parts, a relatively high-pressure boosting pump supported by the carriage, and lubricant and energizing lines connecting said pumps when on the carriage, said low-pressure pump being adapted to be passed through the upper opening of said container and to withdraw lubricant from the lower end thereof, and a heater associated with said carriage located beneath the container adjacent to said point of withdrawal, said low-pressure pump having its exterior parts located adjacent to said booster pump.

3. In lubricating apparatus, a portable carriage comprising a lower platform, a plurality of posts thereon, an upper platform supported by the posts, said lower platform being adapted to support a lubricant container, a booster pump on said upper platform, and a relatively low-pressure pump attached to the container and removable from the carriage with said container, the outlet of said low-pressure pump feeding the inlet of said high-pressure pump.

4. In lubricating apparatus, a portable carriage comprising a lower platform, a plurality of posts thereon, an upper platform supported by the posts, said lower platform being adapted to support a lubricant container, a booster pump on said upper platform, a relatively low-pressure pump attached to the container and removable from the carriage with said container, the outlet of said low-pressure pump feeding the inlet of said high-pressure pump, and heating means located on said lower platform beneath the container.

5. In lubricating apparatus, a portable carriage adapted to support a lubricant container having a mouth, a low-pressure pump applicable into the interior of said container through the upper mouth thereof, said pump reaching to and withdrawing material from the bottom of the container, a heating element on the carriage beneath the container and adjacent to said point of withdrawal, a booster pump mounted on said carriage, and quick-detachable connections between the low-pressure pump and the booster pump.

6. In lubricating apparatus, a portable carriage adapted to support a lubricant container having a mouth, a low-pressure pump applicable into the interior of said container through the upper mouth thereof, said pump reaching to and withdrawing material from the bottom of the container, a heating element on the carriage beneath the container and adjacent to said point of withdrawal, a booster pump mounted on said carriage, air-operated means for operating both pumps, and flexible material and air lines connecting said pumps, including quick-detachable

connections whereby the container and associated low-pressure pump may be removed from the carriage after detachment of said lines.

7. In lubricating apparatus, upwardly extending supports, a platform for a container at the lower ends of said supports, an upper platform on the supports, said lower platform being adapted to support a lubricant container, a booster pump on said upper platform, and a relatively low-pressure pump attached to the container and removable from the container, the outlet of said low-pressure pump feeding the inlet of said high-pressure pump.

ALEXANDER P. FOX.