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LUBRICANT PUMP

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FIG. 1.

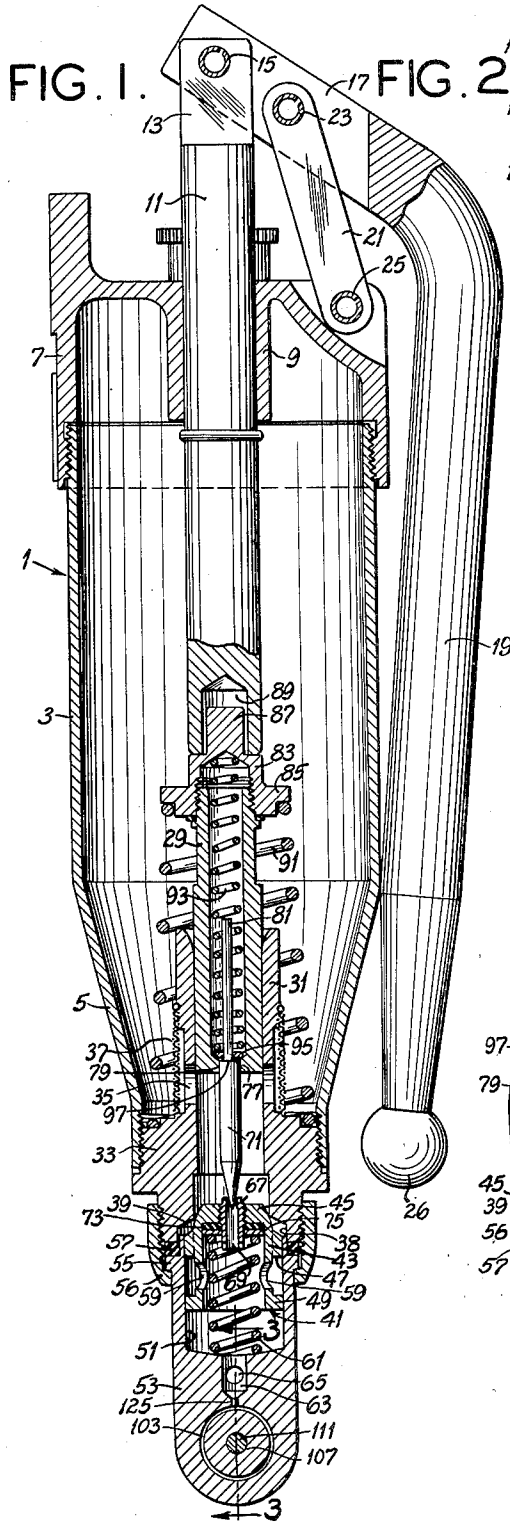
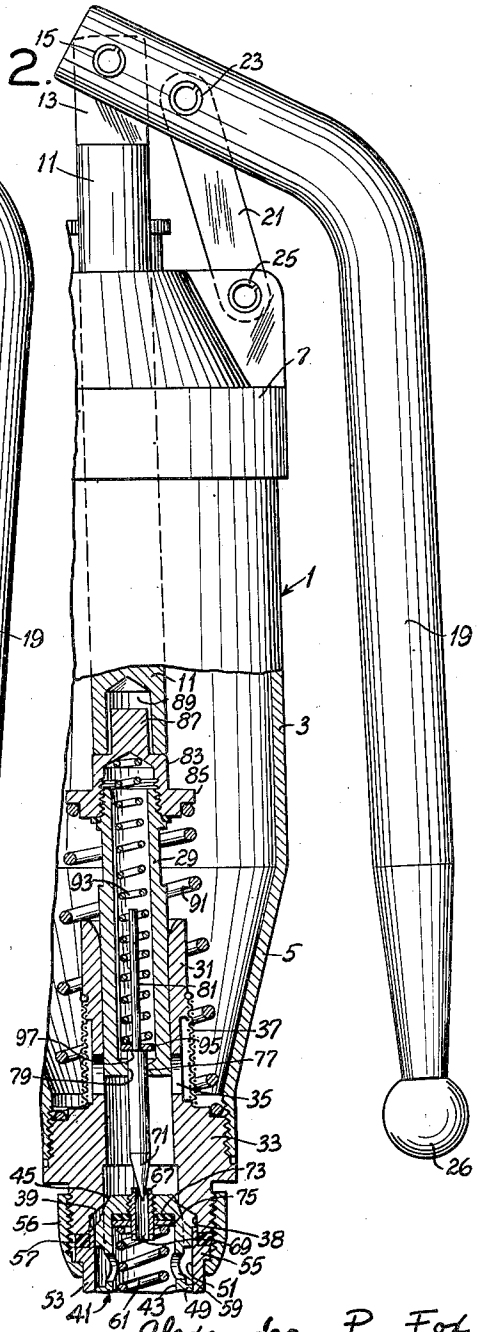


FIG. 2.



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FIG. 3.

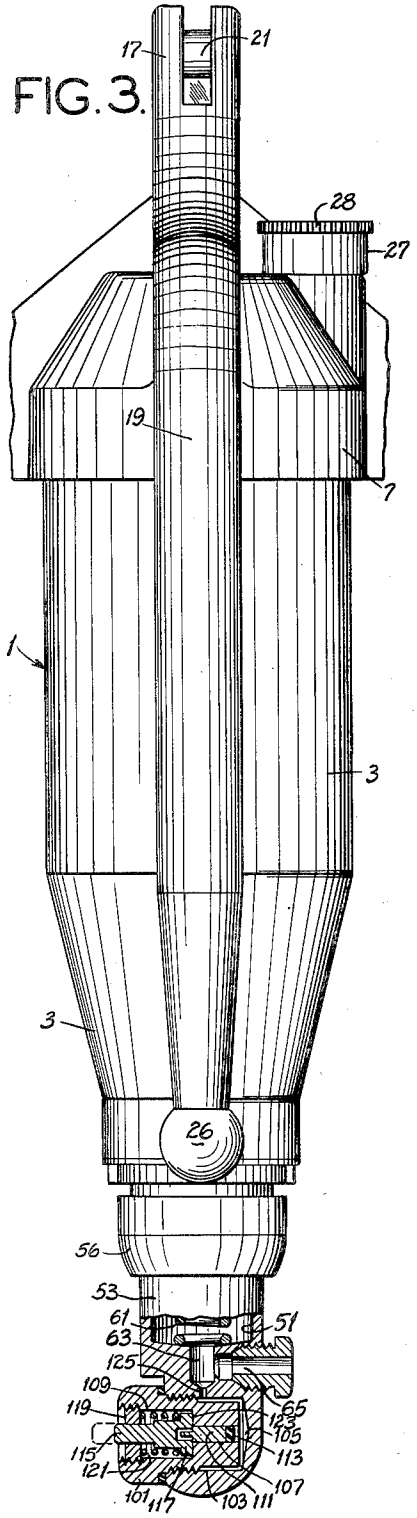


FIG. 4.

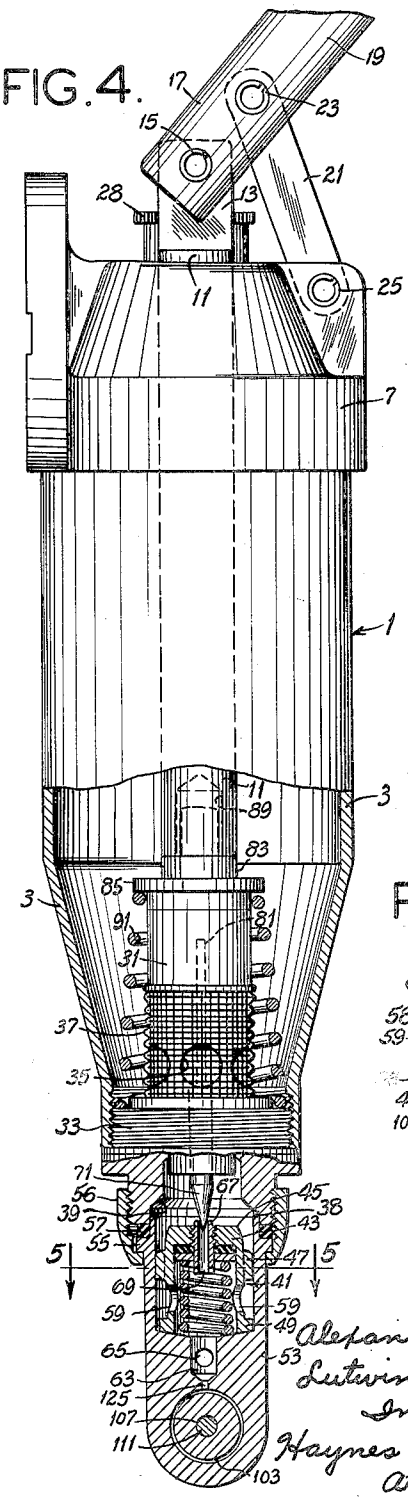
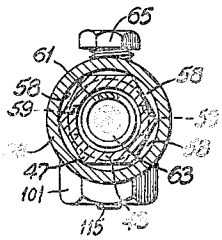


FIG. 5.



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FIG. 6.

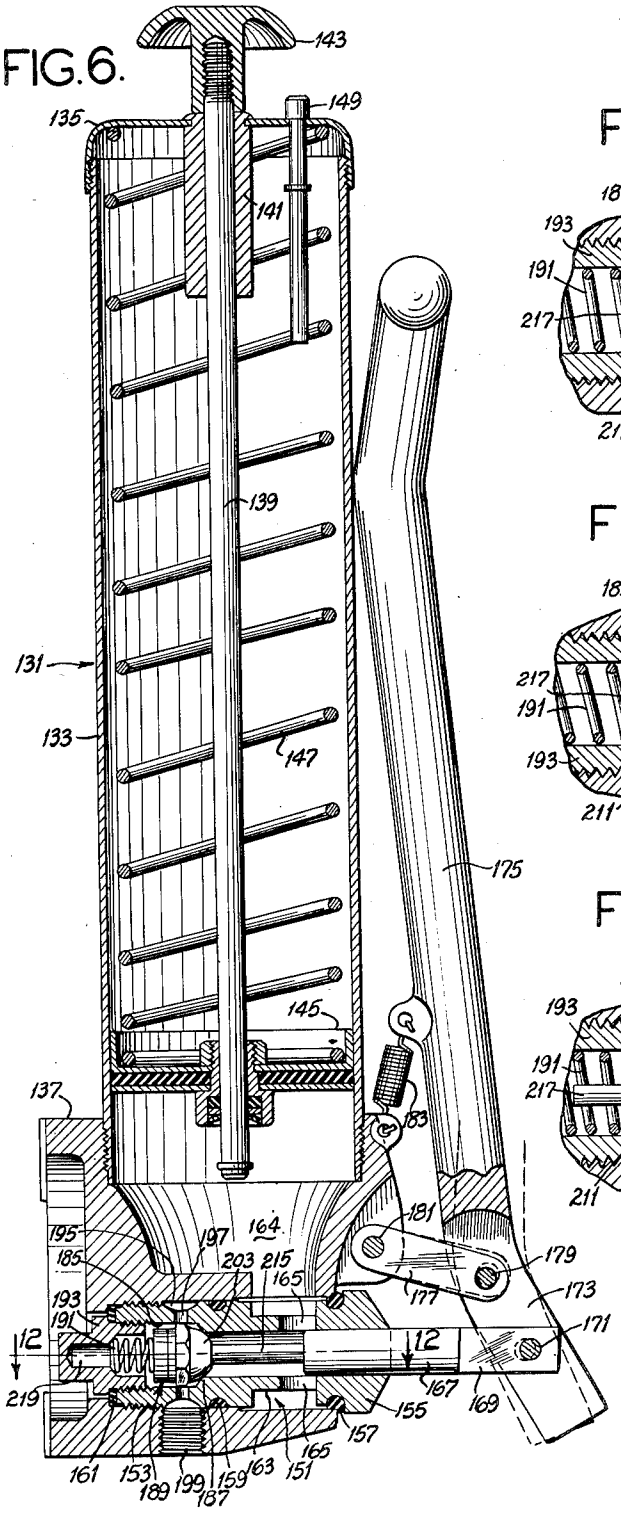


FIG. 7.

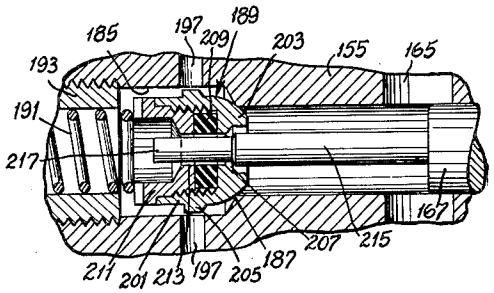


FIG. 8.

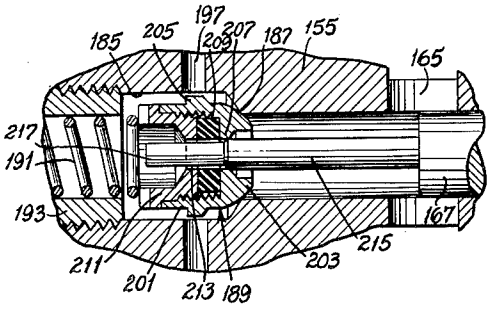
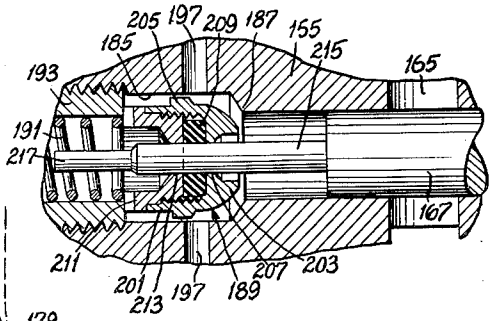


FIG. 9.



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FIG. 10.

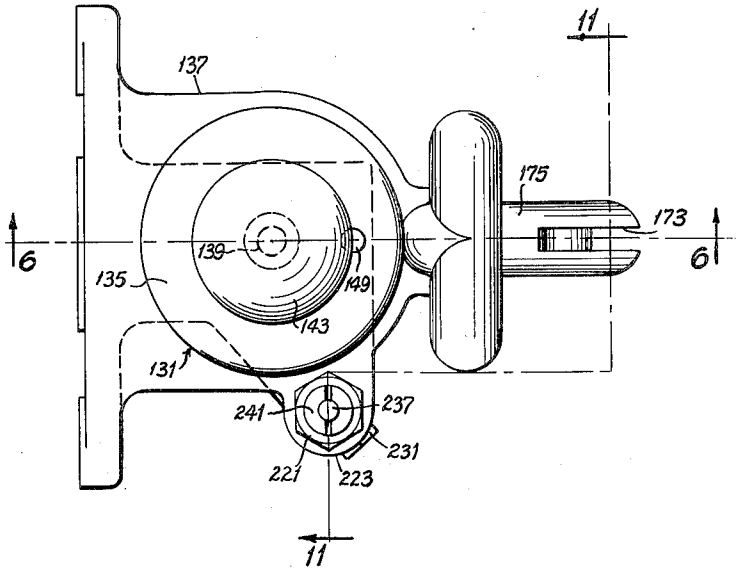


FIG. 11.

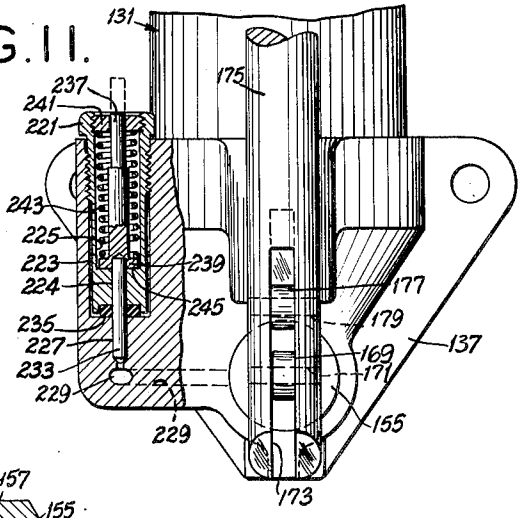
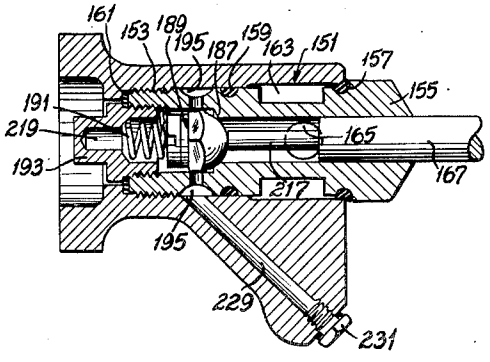


FIG. 12.



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Patented Nov. 4, 1952 2,616,524

UNITED STATES PATENT OFFICE

2,616,524

LUBRICANT PUMP

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Application April 22, 1950, Serial No. 157,561

20 Claims. (Cl. 184—28)

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This invention relates to lubricant pumps and, more particularly, to hand-operated pumps of this class for use in a lubrication system to supply lubricant to lubricant injectors.

The invention particularly pertains to hand-operated lubricating pumps for supplying lubricant through a supply line to a plurality of lubricant injectors of the type which act to inject a measured charge of lubricant into a bearing or other item to be lubricated upon development of injector-cycling pressure in the supply line, and which require venting of the supply line to reset and refill with lubricant from the supply line. Such injectors are shown, for example, in U. S. Patents 2,122,177, 2,141,022, 2,283,638 and 2,448,583. The object of the invention is the provision of an improved hand-operated pump for the purpose described which, with a simplified, compact and economical construction, provides positively and completely for venting of the lubricant line throughout the duration of periods of non-operation of the pump, whatever these periods may be, which assures that no venting of the supply line can occur during pumping, and which can supply as many injectors as desired, within certain practical limits, without being of particularly large size and without being difficult to operate.

In general, a pump of this invention comprises a pump cylinder having an inlet in communication with a lubricant supply, and an outlet. A plunger is reciprocable in the cylinder across the inlet from a retracted position through pressure and return strokes to pump lubricant from the supply and force it through the outlet. In the outlet is a check valve which is adapted to open during pressure strokes and to close during return strokes of the plunger. The check valve is provided with a vent, for venting the pump outlet to the cylinder and hence to the supply. Associated with the vent is a vent valve, which is controlled by the plunger in such manner as to vent the outlet to the cylinder only when the plunger is in retracted position and otherwise to maintain the vent closed. Other features will be in part apparent 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 several of various possible embodiments of the invention are illustrated,

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Fig. 1 is a full central vertical section of a pump of this invention, illustrating the pump plunger thereof in fully retracted position;

Fig. 2 is a partial elevation, with parts broken away and shown in section on the same plane as Fig. 1, illustrating a moved position of parts;

Fig. 3 is an elevation of Fig. 1 as viewed from the right, with parts broken away and shown in section on line 3—3 of Fig. 1;

Fig. 4 is an elevation like Fig. 2, with parts broken away and shown in section, illustrating parts in the position occupied at the end of a pressure stroke of the pump plunger;

Fig. 5 is a horizontal section taken on line 5—5 of Fig. 4;

Fig. 6 is a full central vertical section of another pump of this invention, taken on line 6—6 of Fig. 10, illustrating the pump plunger thereof in fully retracted position;

Fig. 7 is an enlarged fragment of Fig. 6;

Fig. 8 is a view like Fig. 7 illustrating a moved position of parts;

Fig. 9 is a view like Figs. 7 and 8 illustrating a further moved position of parts;

Fig. 10 is a plan view of Fig. 6;

Fig. 11 is a vertical section taken on line 11—11 of Fig. 10; and,

Fig. 12 is a vertical section taken on line 12—12 of Fig. 6.

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

Referring to the drawings, Figs. 1–5 illustrate a pump of this invention which is particularly suitable for pumping oil through a supply line to a plurality of injectors of the type above described. As shown, this pump comprises a lubricant container, generally designated 1, comprising a barrel 3 having a tapered lower end 5. Threaded on the upper end of the barrel is a head 7 formed for bracketing the pump in vertical position on or adjacent an apparatus equipped with injectors for lubricating various elements of the apparatus requiring lubrication, such as bearings. The head 7 is formed with a vertical guide bearing 9 for a piston rod 11 adapted to reciprocate vertically in the line of the axis of the barrel. The upper end of the rod above the head 7 is formed flat, as indicated at 13, and is pin-connected at 15 in a clevis 17 at the upper end of a curved operating lever or handle 19. A link 21 is pin-connected at one end to the handle in the clevis, as indicated at 23, and at its other end to the head 7, as indicated at 25, to constrain the handle to swing in

a vertical plane. The handle is curved to extend down alongside the container 1. By grasping the lower end of the handle and swinging it upward, the rod 11 may be driven downward. Engagement of the part of the handle grasped by the hand with the wall of the barrel 3 at about the upper end of the taper 5 determines a raised, retracted position of the rod, illustrated in Fig. 1. The handle has a knob 25 at its lower end. The arrangement is such that when the handle is grasped at its lower end in the normal way to reciprocate the rod 11, it is impossible to swing the handle into engagement with the barrel because the fingers come between the handle and the barrel. The head 7 is formed with a filling opening 27, closed by a spring cap 28.

The piston rod 11, in moving downward, effects a pressure stroke of a piston or plunger 29 which reciprocates in a bushing 31 constituting a pump cylinder located in the lower end of the barrel 3. The cylinder 31 is formed adjacent its lower end with a head 33 which is threaded into the lower end of the barrel. Above the head, the cylinder is provided with radial inlet ports 35, surrounded by a strainer 37, for flow of lubricant from the container 1 into the cylinder 31 when the lower end of the plunger 29 is raised above the ports. The cylinder 31 is open at both ends and its lower end is counterbored to provide an enlarged axial outlet opening 38 with an outwardly facing annular valve seat 39 at the inner end of the opening for seating a special valve member 41.

The valve member 41 comprises a hollow cylindrical body 43 formed with a nose 45 at its upper end for sealing engagement with the valve seat 39. The body 43 is formed below the nose with two axially spaced heads, the upper head being designated 47 and the lower head being designated 49, which guide is for vertical sliding movement toward and away from the valve seat 39 in a vertical cylindrical valve passage 51 formed in a pump outlet body 53. The latter is of generally hollow cylindrical form in its upper portion and has an outwardly extending flange 55 at its upper end. It is held in assembly as an extension from the lower end of the pump cylinder 31 by a gland nut 56 which compresses a packing 57 between the flange 55 and the lower end of the pump cylinder. The upper head 47 on the valve 41 is hexagonal or the like to provide spaces 58 (Fig. 5) for flow of lubricant from above the nose 45 to the space between the heads 47 and 49, and the cylindrical body 43 is provided with radial ports 59 between the heads for flow of lubricant from the space between the heads 47 and 49 into the outlet passage 51 below the nose. The valve 41 is biased upward toward sealing engagement of its nose with the valve seat 39 by a spring 61 reacting from the lower end of the passage 51. The passage 51 opens at its lower end into a smaller vertical axial passage 63 in the body 53. The body 53 is formed with a transverse port 65 leading from passage 63 which constitutes the pump outlet and into which may be connected a supply line (not shown) leading to the injectors.

A short tube 67 is threaded in an aperture through the nose 45 of the valve 41, the bore of the tube providing a passage or vent 69 allowing for communication from below the nose to the pump cylinder 31. The upper end of the tube constitutes a valve seat for a needle valve 71. The tube extends below the nose and a packing 73 is compressed by the spring 61 between the

nose and a washer 75. The plunger 29 is of hollow cylindrical form and, at its lower end or pressure face, has an inwardly turned annular flange or shoulder 77 defining a central opening 79. The upper end of the needle valve has a close sliding fit in this opening. The lower end of the needle valve is tapered to seat in the upper end of the tube 67. The needle valve has a reduced-diameter extension or stem 81 extending axially upward from its upper end within the plunger 29. Threaded on the upper end of the plunger is a head 83 which has an outwardly directed flange 85 forming a spring abutment shoulder and an upwardly extending stud 87 which fits loosely in an opening 89 in the lower end of the piston rod 11. The plunger 29 is biased upward by a helical compression spring 91 surrounding the pump cylinder 31 and plunger 29 and reacting from the head 33 against the shoulder 85. A helical compression spring 93 located within the plunger is compressed between the head 83 and a collar 95 loosely slidable on the stem 81 within the plunger, the spring surrounding the stem.

The parts are so proportioned that when the handle 19 is in engagement with the barrel 3, and piston rod 11 is raised to the upper end of its stroke, as illustrated in Fig. 1, the spring 91 holds the plunger 29 in a fully retracted position at the upper limit of its stroke wherein its lower end is raised to unblock the ports 35. Under these circumstances oil flows from the supply in barrel 3 through the ports 35 into the pump cylinder 31 and fills the latter below the plunger and above the check valve 41. Also, the collar 95 is lifted at this time by the annular flange 77 at the lower end of the plunger above the shoulder 97 at the lower end of the valve stem 81, thereby relieving the needle valve 71 of the force of spring 93. Thus, with the parts in the position shown in Fig. 1, spring 93 does not exert its force on the needle valve at all, and the latter may move freely upward a small distance until its shoulder 97 engages the collar 95. Movement of the needle valve through this small distance is sufficient to unblock the vent 69. When the handle is grasped by the hand at its lower end in normal manner, the rod 11 is moved downward and moves the plunger 29 downward from its retracted position a distance such that the collar 95 engages the shoulder 97, whereupon spring 93 exerts its force on the needle valve 71 to bias it downward and thereby block the vent 69. Closing of the vent 69 occurs in an intermediate position of the plunger prior to closing of the cylinder inlet ports 35. As the handle is swung upward, the spring 93 is more heavily compressed and thus exerts increased force on the needle valve to hold it in closed position.

The pump is equipped with an indicator to afford a visible indication that sufficient pressure has been developed in the system supplied by the pump to cycle the injectors. As shown best in Fig. 3, this indicator comprises a fitting 101 threaded in a transverse socket 103 in the lower end of the body 53. The inner end of the fitting is smaller than the socket so that a pressure chamber 105 is provided at the inner end of the socket. The fitting has a bore 107 in its inner end open to the chamber 105 and its outer end is counterbored as indicated at 109. A plunger 111 is slidable in the bore, with a packing 113 at its inner end. A stem 115 having a head 117 at its inner end is slidable in the coun-

terbore 109, the outer end of the stem extending through a plug 119 threaded in the outer end of the counterbore. A compression spring 121 is located in the counterbore surrounding the stem and reacts from the plug against the head 117 to bias the stem to an innermost position wherein the head engages the shoulder 123 at the inner end of the counterbore. In this position, the outer end of the stem just protrudes from the plug. A narrow passage 125 in the body 53 connects the pump outlet passage 51 and the chamber 105. The arrangement is such that when the pressure in the pump outlet and chamber 105 reaches a predetermined injector-cycling value, the plunger 111 is driven to the left as viewed in Fig. 3 and drives the stem 115 to the outer position indicated in dotted lines in Fig. 3, to provide a visible indication that injector-cycling pressure has been attained. Upon relief of pressure, spring 121 biases the stem and plunger back to their initial position.

The above-described pump is mounted in vertical position on or adjacent apparatus equipped with lubricant injectors of the type above mentioned, with an injector supply line (not shown) connecting the pump outlet port 65 and the injectors. The container 1 is filled with oil through filling opening 27. Spring 91 normally holds the plunger 29 and the rod 11 in raised position at the upper limit of their stroke, with the lower end portion of the handle 19 engaging the wall of the container. With the plunger in retracted position at the upper limit of its stroke, the collar 95 is lifted by the flange 77 above the shoulder 97, and the valve 71 is entirely relieved of the force of the spring 93. Thus, if there is any pressure in the pump outlet below the valve 41, this will open the needle valve and be vented upward through the vent 69 into the pump cylinder.

To cycle the injectors so that each will deliver a charge of oil, the handle is grasped and pumped up and down until the pressure developed by the pump in the injector supply line reaches injector-cycling value (600 to 1000 p. s. i.. for example), as indicated by popping out of the indicator stem 115, which acts as a telltale. Each upstroke of the handle causes a downward pressure stroke of the pump plunger 29 and, upon each downstroke of the handle, spring 91 returns the plunger 29 through a return stroke, at the end of which the pump cylinder 31 is charged for the next pressure stroke. Immediately upon grasping the handle, the plunger is moved down a distance such that the force of spring 93 is brought to bear upon the needle valve 71, so that this valve closes (see Fig. 2). Upon each pressure stroke of the plunger, the force of the spring 93 on the needle valve decreases from the initial to the final end of the pressure stroke. Though the plunger 29 moves upward upon each return stroke, it cannot move upward far enough to relieve the force of spring 93 on the needle valve, because as long as the handle is being grasped, it is impossible for the handle to be moved into engagement with the container, and hence it is impossible for the plunger 29 to move upward far enough for its flange 77 to lift the collar 95. Thus, needle valve 71 remains closed throughout the operation of handle 19 to hold pressure in the pump outlet and the supply line. It will be understood that upon each downstroke of the plunger 29, the check valve 41 opens for flow of oil from the cylinder to the pump outlet.

As soon as the operator is apprised of the development of injector-cycling pressure in the pump outlet by the popping out of the telltale 115, he simply releases the handle 19. Spring 91 thereupon biases the plunger 29 and the rod upward to the upper limit of their stroke, the handle 19 returning to its rest position in engagement with the container 1 (Fig. 1). This frees the needle valve 71 of the force of spring 93, and the valve 71 opens under the pressure in the passage 51 and vents the injector supply line, oil returning to the container 1. Upon venting of the supply line, the injectors recharge, as will be understood. The valve 71 remains free to open as long as the handle is at rest, to insure venting of the injector supply line.

From the above, it will be seen that the valve 41 acts as a check valve in the pump outlet adapted to open during pressure strokes and to close during return strokes of the pump plunger 29. The needle valve 71 acts as a vent valve in association with the vent 69 in the check valve 41. The needle or vent valve 71 is mechanically controlled by the plunger in such manner as positively to close the vent 69 when the plunger, in being moved from its Fig. 1 retracted position, reaches an intermediate position prior to closing of the cylinder inlet ports 35, and positively to maintain the vent closed throughout the remainder of a pressure stroke and also during retraction of the plunger provided the plunger is not retracted past said intermediate position. Thus the valve 71 is controlled to vent the pump outlet to the pump cylinder 31 only when the plunger is in retracted position (Fig. 1) and otherwise closes the vent.

Figs. 6–12 illustrate a modified type of pump of this invention which is particularly suitable for pumping grease, as distinguished from oil, through a supply line to a plurality of injectors. As shown, this pump comprises a lubricant container, generally designated 131, comprising a container cylinder 133 having an upper head 135 and a lower head 137. The upper head is removably threaded on the upper end of the barrel. At 139 is shown a rod extending through the center of the head and slidable in a guide bearing 141 carried by the head. On the upper end of the rod above the head 135 is a knob 143. A piston 145 is slidable on the rod within the cylinder 133. The piston is biased downward toward the head 137 by a helical compression spring 147 in the cylinder surrounding the rod and reacting from the head 135. The arrangement is such that the head 135, rod 139, piston 145 and spring 147 may be removed from the cylinder as a unit, the cylinder filled with grease, and the head 135 and associated parts replaced, whereupon the expansion of the spring forces the grease toward and into the lower head 137. The cylinder may be loaded by pumping grease into it through a suitable port, if desired. At 149 is shown a telltale slidable in the upper head 135 for indicating when the cylinder is filled if loaded in this manner.

The lower head 137 is formed for bracketing the pump in vertical position on or adjacent an apparatus equipped with injectors for lubricating various elements of the apparatus requiring lubrication, such as bearings. It has a transverse stepped cylindrical opening 151, which extends through the head from one side to the other. Fixed in this passage as by threading at 153 is a bushing 155 constituting a pump cylinder. Packing for the cylinder 155 is shown at 157. 159 and 161. The cylinder is formed with an annular peripheral groove 163 adjacent one end of the

opening 151, this groove providing an annular chamber receiving grease from the container 131 through a passage 164 in the head. Grease may flow from this chamber into the cylinder through radial ports 165 in the wall of the cylinder.

A pump plunger 167 is reciprocable in the pump cylinder across the inlets 165 from the fully retracted position illustrated in Fig. 6 through pressure and return strokes. The plunger extends out of one end (the right end as viewed in Fig. 6) of the cylinder and its outer end is formed as a flat in a vertical plane, as indicated at 169, being pin-connected at 171 in a clevis 173 at the lower end of an operating lever or handle 175. A link 177 is pin-connected at one end to the handle in the clevis, as indicated at 179, and at its other end to the head 137, as indicated at 181, to constrain the handle to swing in a vertical plane, effecting a pressure stroke of the plunger when swung down, and a return stroke of the plunger when swung up. The handle extends upward alongside the container and its upward swing is limited by engagement of its upper end with the container 131. This engagement of the upper end of the handle with the container determines the fully retracted position of the plunger 167. When the upper end of the handle is grasped, it is of necessity moved away from the container, and it is impossible to swing the upper end of the handle into engagement with the container when grasped because the fingers come between the handle and the container. A tension spring 183 may be connected between the handle and the head 137 to keep the handle from rattling against the container if the pump is mounted where it is subjected to vibration.

The other end of the pump cylinder 155 (its left end as viewed in Fig. 6) is counterbored to provide an enlarged axial outlet opening or chamber 185 at the inner end of which is an annular shoulder 187 forming an annular outwardly facing valve seat. A check valve 189 located in chamber 185 is biased toward the valve seat 187 by a spring 191 reacting from a plug 193 threaded in the left end of the cylinder 155. The cylinder 155 is formed with an annular peripheral groove 195 around the chamber 185, communication between the chamber and the groove being provided by radial ports 197 in the wall of the cylinder 155. The groove is located between packings 159 and 161. At 199 is shown the pump outlet port, which is in communication with the groove and into which an injector supply line may be connected.

The check valve 189 comprises a hollow cylindrical body 201 formed with a nose 203 at its right end for sealing engagement with the valve seat 187. The body 201 is formed with a hexagonal head 205 or the like, which guides it for sliding movement in the chamber 185. In the nose 203 is an axial vent opening 207. An annular packing member or washer 209 having its central opening aligned with the vent opening 207 is compressed against the back of the nose within the body 201 by a gland nut 211 threaded in the body from its open left end. The opening 207 in the nose, the opening in the packing member 209 and the opening in the gland nut 211 constitute a vent port, designated 213.

Extending through the pump cylinder 155 from the inner end of the plunger 167 is a vent valve 215. This consists of a rod of such diameter as to be capable of a sliding sealing fit in the vent port 213 having a reduced-diameter end extension 217. The length of the valve 215 is such that when the plunger 167 is in its fully retracted position (Figs. 6 and 7), the valve is withdrawn from the vent port 213. Under these circumstances, the vent valve extension 217 extends through the vent port, but the chamber 185 is in communication with the portion of the pump cylinder 155 to the right of the check valve 189 through the vent port around the extension. When the handle 175 is grasped, the plunger 167 moves from its retracted position to the left a distance such that valve 215 enters and blocks the vent port (Fig. 8). Closing of the vent 213 occurs in an intermediate position of the plunger prior to closing of the cylinder inlet ports 165. The vent valve then maintains the vent port blocked throughout the remainder of a pressure stroke of the plunger and also maintains the vent port blocked as the plunger returns toward retracted position until it reaches its fully retracted position (Fig. 7). However, as long as the handle is being grasped, the plunger cannot be returned all the way to fully retracted position and hence under these circumstances, the vent valve keeps the vent port blocked. When the plunger 167 is moved through a pressure stroke, the extension moves through the spring 191 and enters a bore 219 in the plug 193.

The pump of Figs. 6–12, like that of Figs. 1–5, is equipped with an indicator to afford a visible indication that sufficient pressure has been developed in the system supplied by the pump to cycle the injectors. As shown best in Fig. 11, this indicator comprises a fitting 221 threaded in a vertical socket 223 in the head 137. The fitting has a bore 224 through its inner end and its outer end is counterbored as indicated at 225. The bore 224 is in line with a vertical bore 227 in the head 137 below the socket 223. A bore 229 (Figs. 11 and 12) in the head connects the pump outlet groove 195 and the lower end of the bore 227. The outer end of the bore 229 is plugged as indicated at 231 (Fig. 12).

A plunger 233 is slidable in the bores 224 and 227 and through a packing 235 compressed between the inner end of the fitting 221 and the inner end of the socket 223. A stem 237 having a head 239 at its inner end is slidable in the counterbore 225, the outer end of the stem extending through a plug 241 threaded in the outer end of the counterbore. A compression spring 243 is located in the counterbore surrounding the stem and reacts from the plug against the head 239 to bias the stem to an innermost position wherein the head engages the shoulder 245 at the inner end of the counterbore. In this position, the outer end of the stem just protrudes from the plug. The arrangement is such that when the pressure in the pump outlet reaches a predetermined injector-cycling value, the plunger 233 is driven upward as viewed in Fig. 11 and drives the stem 237 to the outer position indicated in dotted lines in Fig. 11, to provide a visible indication that injector-cycling pressure has been attained. Upon relief of pressure, spring 243 biases the stem and plunger back to their initial position.

The pump of Figs. 6–12 is mounted in vertical position on or adjacent apparatus equipped with lubricant injectors of the type above mentioned, with an injector supply line (not shown) connecting the pump outlet port 199 and the injectors. The container 131 is filled below the piston 145 with grease, which is forced by the piston toward and into the annular pump inlet cham-

ber 163. The handle 175 and the plunger 167 normally occupy the fully retracted position shown in Fig. 6, with the upper end of the handle engaging the container and the plunger retracted to clear the inlet ports 165, so that grease may flow into the pump cylinder. In the fully retracted position of the plunger, the vent valve 215 is withdrawn from the vent port 213 (Fig. 7), so that the pump outlet port 199 is in communication back to the container 131 through groove 195, ports 197, chamber 185, vent port 213, the pump cylinder 155, ports 165, chamber 163 and passage 164, thereby to vent the injector supply line.

To cycle the injectors so that each will deliver a charge of grease, the handle 175 is grasped and pumped up and down until the pressure developed by the pump in the injector supply line reaches injector-cycling value, as indicated by the popping out of the telltale indicator stem 237. Each downstroke of the handle causes a pressure stroke of the pump plunger 167 and each upstroke of the handle returns the plunger toward, but not all the way to its fully retracted position of Figs. 6 and 7. Immediately upon grasping the handle, the plunger of necessity is moved far enough to move the vent valve 215 to closed position blocking the vent port 213 (Fig. 8). While pumping, the vent valve does not open, because as long as the handle is grasped it is impossible to retract the plunger far enough to move the vent valve to open position. Thus, the vent port 213 remains closed throughout the operation of the pump handle. It will be understood that upon each pressure stroke of the plunger, the check valve 189 opens (Fig. 9) for flow of grease from the pump cylinder to the pump outlet.

As soon as the operator is apprised of the development of injector-cycling pressure in the pump outlet by the popping out of the telltale 237, he simply releases the handle 175. The pressure in the pump outlet chamber 185, acting on the end of vent valve extension 217, thereupon drives the vent valve 215 and the plunger 167 to their fully retracted position of Figs. 6 and 7, whereupon the pump outlet (and the injector supply line) is vented back to the container 131. It will be understood that the pressure developed by the spring 147 is considerably less than the pressure developed in the pump outlet and the injector supply line. This returns the handle 175 to its fully retracted position determined by engagement of its hand-grasp portion with the container. While the spring 183 assists in this return, the primary purpose of this spring is to prevent rattling, and it could be omitted. Upon venting of the supply line, the injectors re-charge, as will be understood. The vent valve 215 remains open as long as the handle is at rest, to insure venting of the injector supply line.

From the above, it will be seen that the valve 189 acts as a check valve in the pump outlet adapted to open during pressure strokes and to close during return strokes of the pump plunger 167. The valve 215 acts as a vent valve in association with the vent 213 in the check valve 189, and is mechanically controlled by the plunger in such manner as positively to close the vent 213 when the plunger, in being moved from its Fig. 6 and Fig. 7 retracted position, reaches an intermediate position prior to closing of the cylinder inlet ports 165, and positively to maintain the vent closed throughout the remainder of a pressure stroke and also during retraction of the plunger provided the plunger is not retracted past said intermediate position. Thus the valve 215 is controlled to vent the pump outlet to the pump cylinder 155 only when the plunger is in fully retracted position (Figs. 6 and 7) and otherwise keeps the vent closed.

It will be seen that as to both the Fig. 1 and Fig. 6 pumps, whenever the pump is not being operated, the pump handle occupies its position of rest in engagement with the lubricant container of the pump, which serves as a stop for the handle. With the handle in rest position, the pump outlet is vented back to the container through the pump cylinder, thus providing positively and completely for venting the lubricant line supplied by the pump throughout the duration of periods of non-operation of the pump, whatever these periods may be. As soon as the operator grasps the handle, however, the vent is closed, to hold pressure in the lubricant line. During pumping, the vent cannot be opened because the handle cannot be returned to its rest position as long as it is being grasped by the hand. The pump may be stroked as many times as necessary to build up injector-cycling pressure in the pump outlet and lubricant line. Thus, a large number of injectors may be serviced by one pump, which need not be of particularly large size nor difficult manually to operate.

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. A lubricant pump comprising a pump cylinder having an inlet and an outlet, a plunger reciprocable in the cylinder and movable across the inlet from a retracted position through a pressure stroke and back to retracted position through a return stroke, a check valve in the outlet adapted to open during pressure strokes and to close during return strokes of the plunger, said check valve having a vent therein, and a vent valve in association with the vent in the check valve mechanically controlled by the plunger to vent the pump outlet to the cylinder when the plunger is in retracted position and positively to close the vent when the plunger, in being moved from its retracted position, reaches an intermediate position prior to closing of the cylinder inlet, the vent valve maintaining the vent positively closed throughout the remainder of a pressure stroke and also during retraction of the plunger provided the plunger is not retracted past said intermediate position.

2. A lubricant pump comprising a pump cylinder having an inlet and an outlet, a plunger reciprocable in the cylinder, a handle connected to the plunger for manually moving it across the inlet from a retracted position through a pressure stroke, the retracted position of the plunger being determined by engagement of the handle with a stop, the stop being engaged by the part of the handle grasped by the hand so that in grasping the handle it is necessarily moved away from the stop, and so that while the handle is grasped it cannot be moved against the stop, a check valve in the outlet adapted to open during pressure strokes and to close during return strokes of the plunger, said check valve having a vent therein, and a vent valve in association

with the vent mechanically controlled by the plunger to vent the pump outlet to the cylinder when the plunger is in retracted position and positively to close the vent when the plunger, in being moved from its retracted position, reaches an intermediate position prior to closing of the cylinder inlet, the vent valve maintaining the vent positively closed throughout the remainder of a pressure stroke and also during retraction of the plunger provided the plunger is not retracted past said intermediate position.

3. A lubricant pump comprising a lubricant container, a pump cylinder associated with the container having an inlet in communication with the container and an outlet, a plunger reciprocable in the cylinder, a handle mounted for swinging movement toward and away from the container connected to the plunger for manually moving it across the inlet from a retracted position through a pressure stroke when the handle is swung away from the container, the retracted position of the plunger being determined by engagement of the handle with the container, the container being engaged by the part of the handle grasped by the hand so that in grasping the handle it is necessarily moved away from the container, and so that while the handle is grasped it cannot be moved into engagement with the container, a check valve in the outlet adapted to open during pressure strokes and to close during return strokes of the plunger, said check valve having a vent therein, and a vent valve in association with the vent mechanically controlled by the plunger to vent the pump outlet to the cylinder and through the cylinder inlet to the container when the plunger is in retracted position and positively to close the vent when the plunger, in being moved from its retracted position, reaches an intermediate position prior to closing of the cylinder inlet, the vent valve maintaining the vent positively closed throughout the remainder of a pressure stroke and also during retraction of the plunger provided the plunger is not retracted past said intermediate position.

4. A lubricant pump as set forth in claim 1, further comprising a pressure indicator associated with the pump cylinder having a port in communication with the pump outlet and adapted to indicate development of a predetermined pressure by the pump.

5. A lubricant pump as set forth in claim 2, further comprising a pressure indicator associated with the pump cylinder comprising a telltale biased in one direction to a retracted position by a spring and in the opposite direction by pressure in the pump outlet and adapted to move away from retracted position against the spring bias when the pressure in the pump outlet reaches a predetermined value.

6. A lubricant pump as set forth in claim 3, further comprising a pressure indicator associated with the pump cylinder comprising a stem axially movable in a chamber and spring-biased in one direction to a retracted position in the chamber, said stem being biased in the opposite direction by the pressure in the pump outlet and adapted to move away from its retracted position against its spring bias to a position protruding from the chamber when the pressure in the pump outlet exceeds a predetermined value.

7. A lubricant pump comprising a pump cylinder having a radial inlet and an enlarged axial outlet opening at one end providing an annular outwardly facing valve seat at the inner end of the opening, a plunger reciprocable in the cylinder and movable across the inlet from a retracted position toward the outlet opening through a pressure stroke and back to retracted position through a return stroke, a check valve in the outlet opening, a spring biasing the check valve toward the valve seat, the check valve having an axial vent therethrough, and a vent vale working in the pump cylinder in association with the vent controlled by the plunger mechanically to vent the outlet opening to the cylinder when the plunger is in retracted position and positively to close the vent when the plunger, in being moved from its retracted position, reaches an intermediate position prior to closing of the cylinder inlet, the vent valve maintaining the vent positively closed throughout the remainder of a pressure stroke and also during retraction of the plunger provided the plunger is not retracted past said intermediate position.

8. A lubricant pump comprising a pump cylinder having a radial inlet and an enlarged axial outlet opening at one end providing an annular outwardly facing valve seat at the inner end of the opening, a plunger reciprocable in the cylinder, a handle connected to the plunger for manually moving it across the inlet from a retracted position toward the outlet opening through a pressure stroke, the retracted position of the plunger being determined by engagement of the handle with a stop, the stop being engaged by the part of the handle grasped by the hand so that in grasping the handle it is necessarily moved away from the stop, and so that while the handle is grasped it cannot be moved against the stop, a check valve in the outlet opening, a spring biasing the check valve toward the valve seat, the check valve having an axial vent therethrough, and a vent valve working in the pump cylinder in association with the vent mechanically controlled by the plunger to vent the outlet opening to the cylinder when the plunger is in retracted position and positively to close the vent when the plunger, in being moved from its retracted position, reaches an intermediate position prior to closing of the cylinder inlet, the vent valve maintaining the vent positively closed throughout the remainder of a pressure stroke and also during retraction of the plunger provided the plunger is not retracted past said intermediate position.

9. A lubricant pump comprising a lubricant container, a pump cylinder associated with the container having a radial inlet in communication with the container and an enlarged axial outlet opening at one end providing an annular outwardly facing valve seat at the inner end of the opening, a handle mounted for swinging movement toward and away from the container connected to the plunger for manually moving it across the inlet from a retracted position through a pressure stroke when the handle is swung away from the container, the retracted position of the plunger being determined by engagement of the handle with the container, the container being engaged by the part of the handle grasped by the hand so that in grasping the handle it is necessarily moved away from the container, and so that while the handle is grasped it cannot be moved into engagement with the container, a spring biasing the check valve toward the valve seat, the check valve having an axial vent therethrough, and a vent valve working in the pump cylinder in association with

the vent mechanically controlled by the plunger to vent the outlet opening to the cylinder when the plunger is in retracted position and positively to close the vent when the plunger, in being moved from its retracted position, reaches an intermediate position prior to closing of the cylinder inlet, the vent valve maintaining the vent positively closed throughout the remainder of a pressure stroke and also during retraction of the plunger provided the plunger is not retracted past said intermediate position.

10. A lubricant pump as set forth in claim 7, further comprising a pressure indicator associated with the pump cylinder having a port in communication with the pump outlet and adapted to indicate development of a predetermined pressure by the pump.

11. A lubricant pump as set forth in claim 8, further comprising a pressure indicator associated with the pump cylinder comprising a telltale biased in one direction to a retracted position by a spring and in the opposite direction by pressure in the pump outlet and adapted to move away from retracted position against the spring bias when the pressure in the pump outlet reaches a predetermined value.

12. A lubricant pump as set forth in claim 9, further comprising a pressure indicator associated with the pump cylinder comprising a stem axially movable in a chamber and spring-biased in one direction to a retracted position in the chamber, said stem being biased in the opposite direction by the pressure in the pump outlet and adapted to move away from its retracted position against its spring bias to a position protruding from the chamber when the pressure in the pump outlet exceeds a predetermined valve.

13. A lubricant pump comprising a pump cylinder having a radial inlet and an enlarged axial outlet opening at one end providing an annular outwardly facing valve seat at the inner end of the opening, a plunger reciprocable in the cylinder and movable across the inlet from a retracted position toward the outlet opening through a pressure stroke and back to retracted position through a return stroke, a check valve in the outlet opening, a spring biasing the check valve toward the valve seat, the check valve having an axial vent therethrough, a vent valve in the pump cylinder for closing the vent, a spring for biasing the vent valve to closed position, and means carried by the plunger cooperable with said vent valve biasing spring for relieving the vent valve of the bias of said vent valve biasing spring when the plunger is in retracted position, the vent valve otherwise being biased closed.

14. A lubricant pump comprising a pump cylinder having a radial inlet and an enlarged axial outlet opening at one end providing an annular outwardly facing valve seat at the inner end of the opening, a plunger reciprocable in the cylinder and movable across the inlet from a retracted position toward the outlet opening through a pressure stroke and back to retracted position through a return stroke, a check valve in the outlet opening, a spring biasing the check valve toward the valve seat, the check valve having an axial vent therethrough, the plunger being hollow and provided with an inwardly directed flange at its working end defining a central opening, a needle valve adapted to close the vent axially slidable in said central opening, a compression spring in the plunger reacting from a seat at the other end of the plunger against a member slidable in the plunger, said member being engaged by said flange only when the plunger is in retracted position and thereby being moved away from the end of the needle valve in the plunger to relieve the needle valve of the force of said compression spring, the needle valve being subjected to the force of said compression spring in all other positions of the plunger.

15. A lubricant pump comprising a lubricant-containing barrel, a pump cylinder fitted in one end of the barrel extending axially of the barrel, the cylinder having a radial inlet port spaced from its inner end in communication with the interior of the barrel and having an enlarged axial outlet opening at its outer end providing an annular outwardly facing valve seat, a plunger reciprocable in the cylinder and movable across the inlet port from a retracted position toward the outlet opening through a pressure stroke, a head on the other end of the barrel, a rod slidable in the head aligned with the plunger, a plunger return spring in the barrel biasing the plunger into engagement with the inner end of the rod within the barrel, a handle connected to the outer end of the rod and linked to the head for swinging movement toward and away from the barrel to drive the plunger through a pressure stroke when swung away from the barrel, the retracted position of the plunger being determined by engagement of the handle with the barrel, the barrel being engaged by the part of the handle grasped by the hand, a check valve in the outlet opening, a spring biasing the check valve toward the valve seat, the check valve having an axial vent therethrough, the plunger being hollow, closed at its end engaged with the rod and having an inwardly directed flange at its other end defining a central opening, a needle valve adapted to close the vent extending axially in the pump cylinder and slidable in said central opening, a valve stem extending from an annular shoulder at the end of the needle valve in the plunger, a collar slidable on the valve stem, a compression spring in the plunger reacting from the closed end of the plunger against the collar, the arrangement being such that when the plunger is in retracted position, the flange at the lower end of the plunger engages the collar and holds it away from the shoulder to relieve the vent valve of the force of the spring in the plunger, the needle valve being subjected to spring force in all other positions of the plunger.

16. A lubricant pump comprising a pump cylinder having a radial inlet and an enlarged axial outlet opening at one end providing an annular outwardly facing valve seat at the inner end of the opening, a plunger reciprocable in the cylinder and movable across the inlet from a retracted position toward the outlet opening through a pressure stroke and back to retracted position through a return stroke, a check valve in the outlet opening, a spring biasing the check valve toward the valve seat, the check valve having an axial vent therethrough, and a vent valve extending from the plunger comprising a rod sized for a sliding sealing fit in the vent, said rod being of such length that when the plunger is in retracted position, the rod is withdrawn from the vent, and in all other positions of the plunger is entered in and seals the vent.

17. A lubricant pump comprising a pump cylinder having a radial inlet and an enlarged axial outlet opening at one end providing an annular outwardly facing valve seat at the inner end of the opening, a plunger reciprocable in the cylinder and movable across the inlet from a retracted

position toward the outlet opening through a pressure stroke and back to retracted position through a return stroke, a check valve in the outlet opening, a spring biasing the check valve toward the valve seat, the check valve having an axial vent therethrough, said check valve comprising a hollow cylindrical body formed at one end with a nose for sealing engagement with the valve seat and open at its other end, and having an axial vent opening through the nose, an annular packing in the body compressed against the nose by a gland fitted in the open end of the body, the openings in the nose and packing defining a vent, and a vent valve extending from the plunger comprising a rod sized for a sliding sealing fit in the vent, said rod being of such length that when the plunger is in retracted position, the rod is withdrawn from the vent, and in all other positions of the plunger is entered in and seals the vent.

18. A lubricant pump comprising a container, a head at one end of the container containing a pump cylinder extending transverse to the container, the cylinder having a radial inlet port in communication with the container through a passage in the head, the cylinder having an enlarged axial outlet opening in one end providing an annular outwardly facing valve seat, the head having a pump outlet port in communication with the outlet opening of the cylinder, a plunger reciprocable in the cylinder and movable across the inlet port from a retracted position toward the outlet opening through a pressure stroke, a handle connected to the plunger and linked to the head for swinging movement toward and away from the container to drive the plunger through a pressure stroke when swung away from the container, the retracted position of the plunger being determined by engagement of the handle with the container, the container being engaged by the part of the handle grasped by the hand, a check valve in the outlet opening, a spring biasing the check valve toward the valve seat, the check valve having an axial vent therethrough, and a vent valve extending from the plunger comprising a rod sized for a sliding sealing fit in the vent, the rod being of such length that when the plunger is in retracted position, the rod is withdrawn from the vent, and in all other positions of the plunger is entered in and seals the vent.

19. A lubricant pump for injectors, comprising a pump cylinder having an inlet and an outlet, a plunger reciprocable in the cylinder from a retracted position through a pressure stroke and back to retracted position through a return stroke, the cylinder inlet being open when the plunger is in retracted position and closing upon movement of the plunger from retracted position, a check valve in the cylinder outlet opening upon pressure strokes and closing upon return strokes, a vent passage by-passing the check valve, a vent valve mechanically associated with and controlled by the plunger for opening and closing the vent passage upon movement of the plunger, the mechanical correlation between the plunger and the vent valve being such that the vent passage is opened only when the plunger is in a retracted position, the cylinder inlet being opened during return strokes of the plunger before it reaches its retracted position, and means for operating the plunger through pressure and return strokes without full return of the plunger to retracted position.

20. A lubricant pump as set forth in claim 19 wherein the operating means for the plunger comprises a handle for manually operating the plunger through pressure and return strokes, the pump further including stop means adapted when the handle is grasped to prevent return of the plunger to its retracted position, and means biasing the plunger to its retracted position when the handle is released.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,761,127	Jacques	June 3, 1930
1,909,348	Hallerberg	May 16, 1933
1,915,443	Pelouch	June 27, 1933
1,947,088	Johnson	Feb. 13, 1934