Oct. 26, 1943. L. C. ROTTER ET AL 2,333,045

PUMP

Filed Aug. 24, 1942 3 Sheets-Sheet 1

FIG. 1.

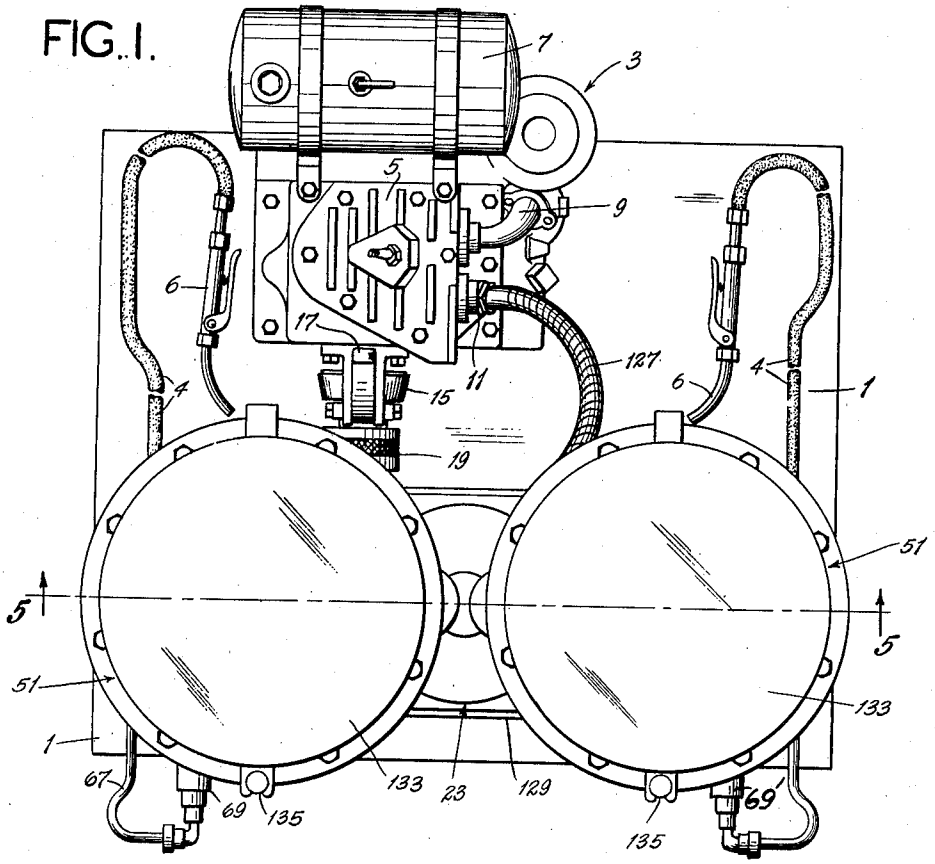
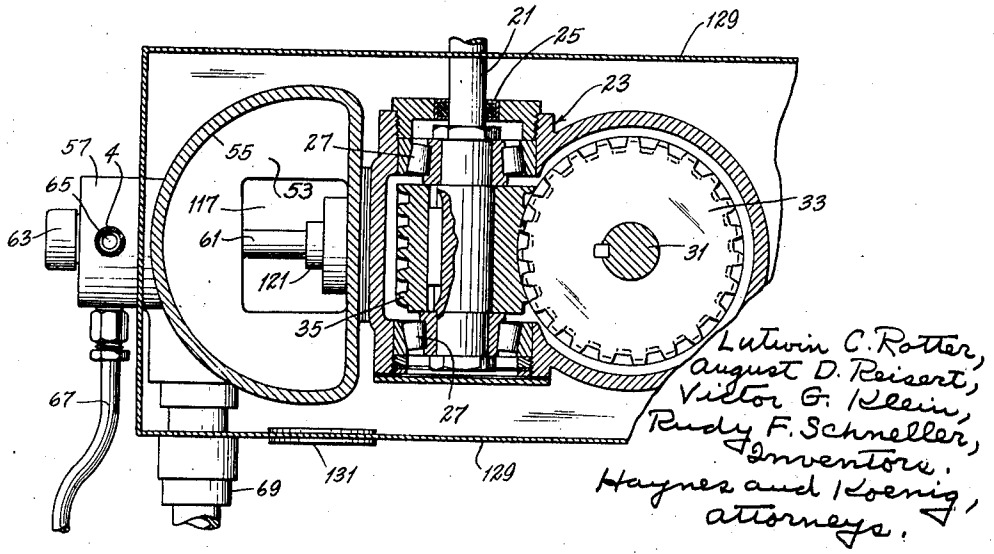


FIG. 6.



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Filed Aug. 24, 1942 3 Sheets-Sheet 2

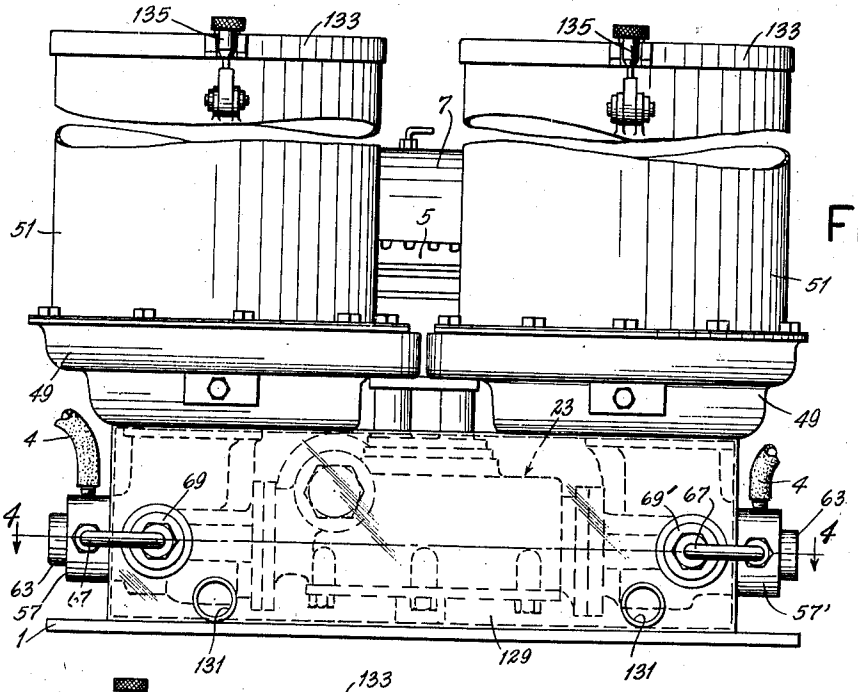


FIG. 2.

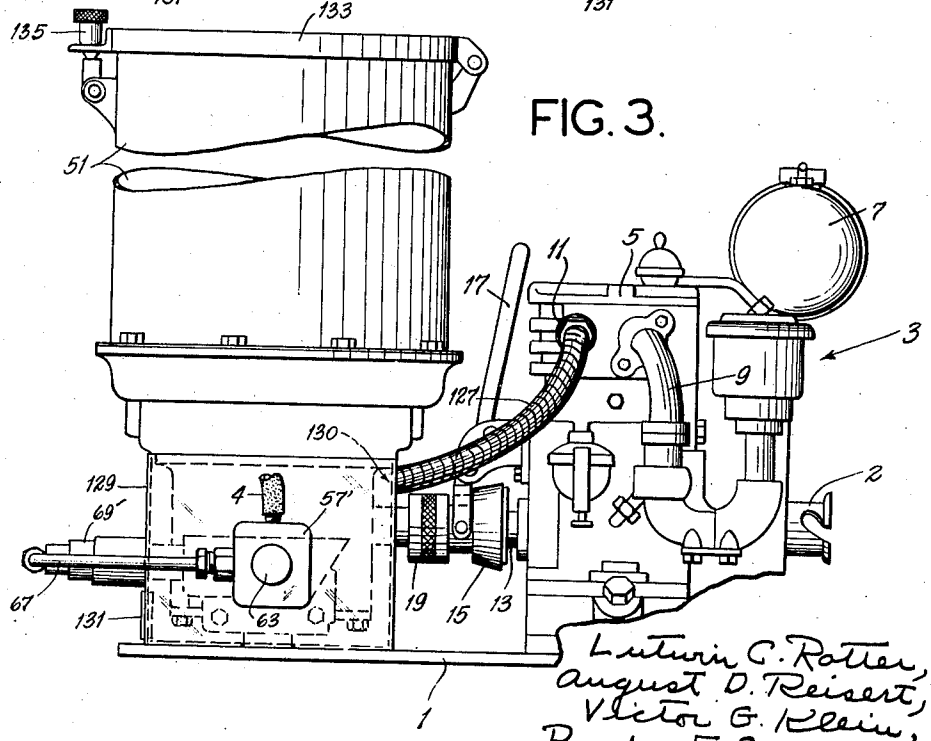


FIG. 3.

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Filed Aug. 24, 1942 3 Sheets-Sheet 3

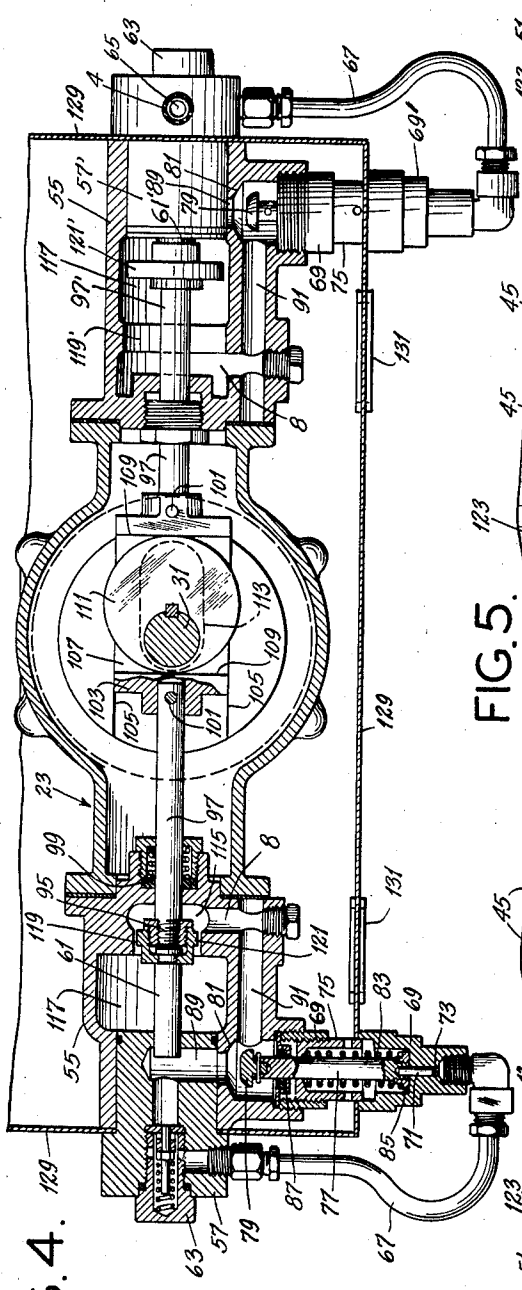


FIG. 4.

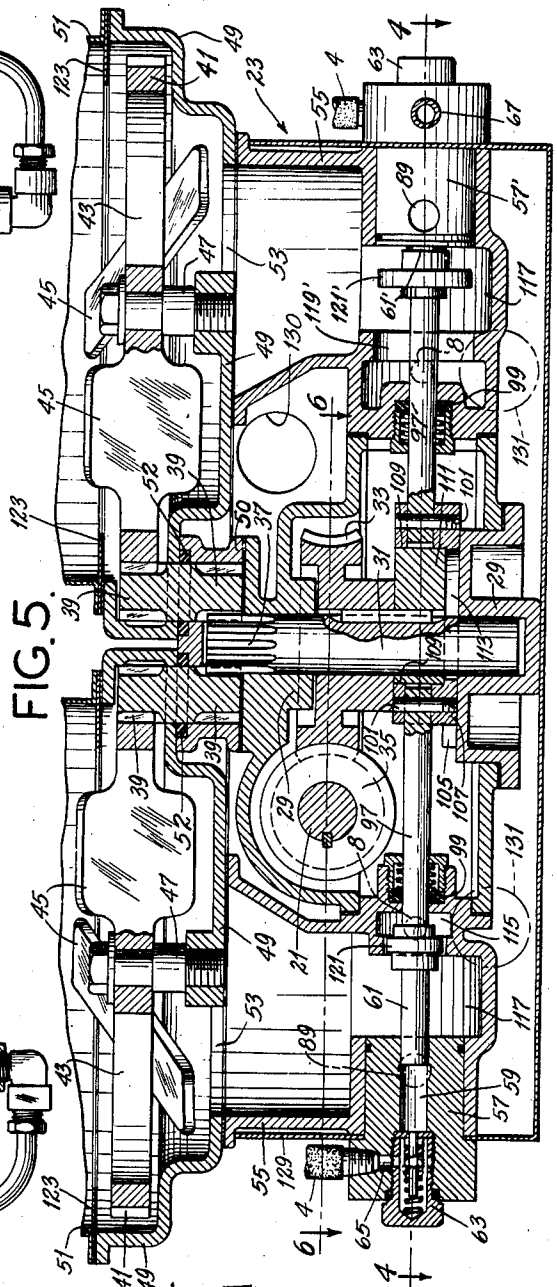


FIG. 5.

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UNITED STATES PATENT OFFICE

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PUMP

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Application August 24, 1942, Serial No. 455,852

11 Claims. (Cl. 221—47.1)

This invention relates to pumps, and with regard to certain more specific features, to lubricant pumps.

Among the several objects of the invention may be noted the provision of a lubricant pump driven by a continuously operating internal combustion engine without de-clutching the engine each time the lubricant flow is cut off; the provision of a pump of the class described in which positive priming of the pump is obtained without the use of check valves in the priming structure; the provision of apparatus of the class described in which lubricant may be maintained in a fluid condition at various temperatures, including the coldest; and the provision of apparatus of this class which is simple, compact and reliable. 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 plan view of the apparatus;

Fig. 2 is a front elevation of Fig. 1;

Fig. 3 is a side elevation of Fig. 2, taken from the right;

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

Fig. 5 is a vertical section taken on line 5—5 of Fig. 1; and,

Fig. 6 is a horizontal section taken on line 6—6 of Fig. 5.

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

United States Patent 2,221,585, dated November 12, 1940, shows a gasoline engine driven lubricant pump in which a mechanical driving connection is released at a predetermined lubricant pressure.

United States Patent 2,276,207, dated March 10, 1942, shows a gasoline driven lubricant pump in which an inlet port is covered by the operation of a mechanical linkage when a predetermined pressure is obtained, thereby unloading the prime mover without opening any mechanical connection.

In our United States patent application, Serial No. 441,620, dated May 4, 1942, for Pump, unloading operation is accomplished hydraulically. The present invention is an improvement upon said patents and application.

Referring now more particularly to Fig. 1, there is shown at numeral 1 a base for carrying the apparatus to be described. This base may be made portable by mounting it on a truck or the like with casters or wheels, or it may be bolted down, if desired.

Upon the base 1 is mounted an internal combustion engine unit 3 comprising in the present case a gasoline engine 5 including all of the accessories for independent operation, such as a fuel tank 7, carbureting system 9, starting pulley 2, exhaust port 11, etc. Associated with the drive shaft 13 of this engine is a clutch 15 manually operable to be opened and closed by a manual control handle 17. This is for permitting engine starting and warming prior to coupling it to its driven member. The driven side of the clutch 15 drives through a flexible coupling 19. The coupling 19 drives a shaft 21, and the latter enters through a packing gland 25 into housing 23. This housing is an assembly of castings, but one numeral is here used to designate it generically. The shaft is supported internally on bearings 27 (Fig. 6).

The housing 23 is supported upon the base 1 and includes central, vertical bearings 29 for a rotary shaft 31. To shaft 31 is keyed a worm wheel 33 meshing with a worm gear 35. The latter is keyed to shaft 21. Thus, when the clutch 15 is closed, the prime mover 3 may continuously drive the shaft 31 through gears 35 and 33.

The upper end of the shaft 31 is cut as a pinion gear 37 which drives, on opposite sides, gear clusters 39. Each cluster 39 is in effect two coaxial gears of equal size cut into the ends of a short cylinder, one of which meshes with the pinion 37 (on shaft 31) and the other of which meshes with a ring gear 41 of a spider 43. Each spider 43 is formed with paddles 45. There are two oppositely located spiders 43, as shown, and these rotate in opposite directions. The paddles thereon are respectively arranged so that their front edges are high and their rear edges are low, referred to their respective directions of rotation. Thus these paddles 45 when they are rotated tend to force down any adjacent material. They skew down the lubricant.

The spiders 43 are centered for rotation upon studs 47 threaded into the bottoms 49 of tanks 51 which respectively carry different lubricants. An opening 53 is indicated in each bottom 49. These openings communicate with attached suction inlet manifolds 55 upon which the respec-

tive bottoms 49 rest. Each manifold 55 carries at its base a sump 117 and a reciprocating plunger mechanism. These mechanisms are similar in form and principle but different in size, since it is intended that each of the tanks 51 shall carry a different consistency of lubricant requiring a particular pressure for its transmission and therefore different size of pumping mechanism. We will therefore describe the left-hand pumping mechanism in detail, and it will be understood that the right-hand pumping mechanism responds to the same description, except that certain of its parts will be found to be larger.

Referring to the left-hand manifold 55, a bushing 57 forms a cylinder 59 for a plunger 61. An outlet check valve 63 for the cylinder communicates with an outlet 65. The outlet 65 is intended to receive the usual flexible hose 4 at the end of which hose is a control valve 6 for starting and shutting off the flow of lubricant.

Check valve 63 in a horizontal plane (Fig. 4) also communicates with a pipe 67 which leads to a body 69 in which is a sliding plunger 71. On the top of the plunger 71 is a sealing disc 73 movable with the plunger. The body 69 is organized with a member 75 which forms a compartment in which is a sliding stem 77. At the end of the stem is said plunger 71. On the other end of the stem is a valve head 79 which moves to and from a seat 81 in the side of the manifold 55. This seat forms part of an inlet 89 for the cylinder 59. A spring 83 acts against one end of the hollow in member 75 and reacts against a head 85 on the stem 77 so as normally to bias the stem into a position wherein the valve head 79 is open and away from the seat 81, as shown. Upon a predetermined pressure building up in pipe 67, the plunger 71 will be pushed in a direction to force the stem 77 against spring 83, until the head 79 contacts and closes the seat 81. As indicated, the stem 77 passes through a packing gland 87. Part 75 may be adjusted on its threads in body 69, thus changing the tension in spring 83 and the pressure at which the valve head 79 will function.

The port 89 is crossed by the front end of a reciprocating plunger or piston 61 which operates in the cylinder 59. This plunger 61 at 95 has a self-aligning attachment to a piston rod 97, the latter passing through a packing gland 99 and to a pin connection 101 with a crosshead organization 103. The latter slides between guides 105 formed in a central part of the main body 23. The part of the crosshead 103 which contacts the guides 105 is in the form of a bearing pad 107. A pin fastens the piston rod 97 to the crosshead 103.

The crosshead 103 is formed with an intermediate space between the endwise flats 109 which together with pad 107 form a follower yoke for a circular eccentric 111 keyed to the shaft 31. Thus the eccentric 111 forms a rotary positive-motion cam for the follower yoke flats 109, thereby reciprocating the rod 97 and plunger 61. A slot 113 is provided in the bearing pad 107 for permitting motion of the yoke with respect to shaft 31.

From the above it will be seen that the plunger 61 is reciprocated across the inlet port 89 so as to receive lubricant and compress it through the check valve 63. If the control valve 6 associated with the line from the check valve 63 is closed, pressure will build up until the inlet valve 79 closes, whereupon no more lubricant is available for building up pressure and therefore further building up of pressure is prevented. When this valve 6 is opened, the incipient reduction in pressure permits the valve 79 to be opened by spring 83, whereupon fluid is available at the inlet 89 for pumping at a pressure below that which will close the valve 79.

As the shaft 31 rotates, the paddles 45 also rotate and by a skew action tend to pack lubricant down toward the bottom 117 of the manifold 55. In order to perfect the priming action which these skew paddles 45 initiate, the inlet 91 is led into communication with a priming cup 115 (see numeral 8 in Fig. 4). This priming cup 115 communicates with the space 117 by means of a cylinder 119. Movable into and from this cylinder 119 is a freely fitting piston part 121 formed in association with the connection 95. This piston is rigid on the piston rod 97 and, during a compression stroke of the plunger 61, moves out into a free position in the space 117. At this time the paddles 45 (along with gravity and vacuum created by piston 121 in space 115) push lubricant into the priming cup 115. Upon a suction stroke of plunger 61, the piston 121 enters the cylinder 119 and forces lubricant from the cup 115 through passages 8 and 91 to the inlet 89, thus priming the charge ahead of the plunger 61 for compression upon the next stroke. Any excess amount of lubricant over that necessary for priming slips back past the free space around the piston 121 into chamber 117. This is the operation under open conditions of the valve 79.

On the other hand, when the valve 79 is closed and the piston 121 moves from the space 117 into the cylinder 119, the free space or clearance between parts 119 and 121 allows any charge trapped in the cup 115 to escape back to the space 117.

Thus there is obtained automatic priming of the pump under open conditions of the valve 79, and automatic relief of pressure from the priming cup 115 when the valve 79 is shut, without the use of any complicated check valve performing the operation.

It will be noted that the motion imparted to the plunger 61 by the circular cam 111 operating between the flat-faces 109 is not only positive during both the compression and suction strokes, but it consists of a simple harmonic motion, which is ideal for low deceleration and acceleration of the plunger 61 at the ends of its stroke, that is when the port 89 is uncovered. It is during this period that the auxiliary piston 121 is operative to prime. Thus the piston 121 primes under ideal conditions.

Also, the cooperation between the piston 121 and the cylinder 119 is during the slow part of the movement, that is, near the end of the reciprocation rearward. Hence, if the valve 79 is closed, there is plenty of time in which trapped fluid in the priming cup 115 may escape to the priming space 117 through the clearance between members 121 and 119.

Similar reference characters have been applied to the larger pump parts at the lower right of Figs. 4 and 5 respectively, except that these have been primed where they refer to parts of a different size but having the same functions. In order to obtain a concept of the relationship of parts when a piston 121 or 121' is in the space 117, the right-hand portions of these Figs. 4 and 5 may be examined. It will be understood that the plunger in 69' (corresponding to plunger 71 in 69) is made larger to operate correctly with

the larger plunger 61'. Or, if desired, a spring with a different force may be used.

The valve 79 closes on its seat 81 by moving downstream in the connection 91 between the priming cup 115 and cylinder 59, and this insures a positive closure action of the valve against pressure in the cup 115. This insures return of lubricant past the clearance betwen the piston 121 and the cylinder 119 under high-pressure conditions and one can be assured that there will be no improper loading of the plunger 61 due to any priming action at the time it is desired to limit pressure in the closed outlet line.

In order to guard the teeth of the gears 41, annular shields 123 are clamped between the containers 51 and the bottom castings 49. These shields 123 will prevent the fingers of an operator, who may reach into a container 51, from becoming caught in the gear teeth.

Since this apparatus is intended to have portable applications, it will occur that sometimes it may be in very cold locations, such as out-of-doors in winter. Under such conditions, many lubricants become stiff and difficult to pump, and in order to maintain them fluid at the proper point, we provide the exhaust port 11 of the engine 5 with a flexible metal exhaust pipe 127. This is made detachable at will from the exhaust port 11. When detached a muffler may be screwed into 11.

The other end of this exhaust line 127 is connected to a jacket 129 which surrounds the lower portions of the body 23 including the manifolds 55. Exhaust openings from the jacket 129 are indicated at 131. It will be seen that the rather flat shape of the manifolds 55 and connected parts is arranged transversely of flow between the inlet 130 and the outlet 131, thereby enhancing heat exchange and operating to a substantial extent as a muffler, due to the baffling and cooling action of the exhaust gases.

Operation is as follows:

The clutch 15 is manually opened and the engine 3 started, which immediately sends exhaust gas into exhaust pipe 127 (if connected) and through the jacket 129, thus warming the lubricant around the manifolds 55. Then the clutch 15 may be closed. At this time, if there is no pressure in the lines connected with the outlet 65, the valves 79 will be opened. Thus, lubricant is available at the inlets 89 for priming and pumping to build up the pressure upon pumping. Pressure will build up in a given outlet line if the outlet valve is closed. After building up to a predetermined point as determined by the tension in the respective spring 83, the respective valve 79 will close, thus cutting off the supply of lubricant in the respective inlet 89. The engine continues to operate to reciprocate the pump plungers without further building up pressure. Then when an outlet line valve is opened, pressure is incipiently reduced in the respective line, causing opening of the respective inlet valve 79 and positive priming and pumping of lubricant. The non-positive skew primers 45 act at all times that the engine is operating and the clutch closed, but the positive primers 121 are effective to prime only when the respective valves 79 are open. At other times lubricant squeezes by the clearances between 119 and 121.

It will be understood that all necessary or desirable auxiliary accessories are used, such as lids 133 and closing locks 135 on the containers 51.

Also, both reciprocating plunger elements 61, 61' may be made of equal size if it is desired to pump the same weight of lubricant on either side of the apparatus; or the apparatus may be built as a single tank and single plunger unit. This obviously would be done simply by eliminating one side of the construction, so far as the tank and plunger elements are concerned.

Each cluster 39 is made simply by machining teeth into opposite ends of a cylinder, so that the central portion of the cylinder and the addenda of the teeth act as bearings in suitable coaxial openings in the bottoms 49 and in an intermediate member 50. Packings 52 are used between the intermediate member 50 and the bottoms 49, around the middle portions of the cluster 39. This makes a simple arrangement for mounting these rotary clusters.

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 pump comprising a lubricant manifold, a pumping cylinder having an outlet and an inlet, a plunger passing through said manifold and having a portion reciprocating in said cylinder and traversing said inlet, a piston on said plunger outside of said cylinder and reciprocating in said manifold, and a part forming a priming cup connected with said manifold by a cylindric portion cooperating freely with the piston and into which the piston moves during a suction stroke of the plunger in the pumping cylinder, said priming cup being connected with said inlet for compression of lubricant thereto during a suction stroke of the plunger and while the piston moves from the manifold through said cylindric portion and toward said priming cup.

2. A pump comprising a lubricant manifold, a pump cylinder having an outlet and an inlet, a plunger passing through said manifold and having a portion reciprocating in said cylinder and traversing said inlet, a piston on said plunger outside of said cylinder and reciprocating in said manifold, a part forming a priming cup connected with said chamber by a portion cooperating freely with the piston and into which the piston moves, said priming cup being connected with said inlet for compression of lubricant thereto during a suction stroke of the plunger and while the piston moves from the manifold toward said priming cup, a valve seat associated with said inlet, a valve movable to and from said seat, means normally biasing the valve from the seat, and means for transmitting fluid pressure from the outlet of the pump cylinder to apply pressure against said bias and to the valve to seat the latter at a predetermined outlet pressure.

3. A pump comprising a suction manifold for lubricant, a pump cylinder having an outlet and an inlet, a plunger passing through said manifold and having a portion reciprocating in said cylinder and traversing said inlet, an enlarged piston on said plunger outside of said cylinder and reciprocating in said suction manifold, a part forming a priming chamber connected with said manifold by a cylindric portion cooperating freely with the piston and into which the piston moves during a suction stroke of the plunger, said priming cup being connected with said inlet for compression of lubricant thereto during a

suction stroke of the plunger in the pump cylinder and while the piston moves from the manifold toward said priming cup, a valve seat associated with said inlet, a valve movable to and from said seat, means normally biasing the valve from the seat, and means for transmitting fluid pressure from the outlet of the pump cylinder to apply pressure against said bias and to the valve to seat the latter at a predetermined outlet pressure, said free fit between said piston and the cylindric portion allowing return of fluid from the priming cup to the manifold upon reciprocation when said valve is closed.

4. A pump comprising a suction manifold for lubricant, a cylinder having an outlet and an inlet, a plunger passing through said manifold and having a portion reciprocating in said cylinder and traversing said inlet, a piston on said plunger outside of said cylinder and reciprocating in said manifold, a part forming a priming chamber connected with said manifold by a cylindric portion cooperating freely with the piston and into which the piston moves during a suction stroke of the plunger, said priming cup being connected with said inlet for compression of lubricant thereto during a suction stroke of the plunger and while the piston moves from the manifold toward said priming cup, driving means for reciprocating the plunger, and non-positive means operated from said driving means for advancing lubricant into said manifold and the priming cup.

5. A pump comprising a lubricant container, suction manifold connected thereto, a cylinder having an outlet and an inlet, a plunger passing through said manifold and having a portion reciprocating in said cylinder and traversing said inlet, a piston on said plunger outside of said cylinder and reciprocating in said manifold, a part forming a priming chamber connected with said chamber by a portion cooperating freely with the piston and into which the piston moves during a suction stroke of the plunger, said priming cup being connected with said inlet for compression of lubricant thereto during a suction stroke of the plunger while the piston moves from the manifold toward said priming cup, driving means for reciprocating the plunger, and rotary skew paddle means in the container and operated from said driving means for advancing lubricant from the container, through said manifold and to the priming cup.

6. A lubricant pump comprising a suction manifold for lubricant, a cylinder having an outlet and an inlet, a plunger passing through said manifold and having a portion reciprocating in said cylinder and traversing said inlet, a piston on said plunger outside of said cylinder and reciprocating in said manifold, a part forming a priming chamber connected with said chamber by a cylindric portion cooperating freely with the piston and into which the piston moves during a suction stroke of the plunger, said priming cup being connected with said inlet for compression of lubricant thereto during a suction stroke of the plunger while the piston moves from the manifold toward said priming cup, a valve seat associated with said inlet, a valve movable to and from said seat, means normally biasing the valve from the seat, and means for transmitting fluid pressure from the outlet of the pump cylinder to apply pressure against said bias and to the valve to seat the latter at a predetermined outlet pressure, said free fit between said piston and the cylinder allowing return of fluid from the priming cup to the manifold upon reciprocation when said valve is closed, said valve closing downstream in the connection between the priming cup and the cylinder.

7. A lubricant pump comprising a pair of adjacently located vertical lubricant containers, oppositely located and spaced manifolds below said containers, a vertically located shaft between said manifolds, opposite coaxial pump cylinders connected with said manifolds, opposite coaxial reciprocating plunger means for said cylinders, a yoke connecting said plunger means and surrounding said shaft, eccentric means driven by the shaft and connected with said yoke for reciprocating said plunger means, and means for driving the shaft.

8. A lubricant pump comprising a pair of adjacently located vertical lubricant containers, oppositely located and spaced manifolds below said containers, a vertically located shaft between said manifolds, opposite horizontal coaxial pump cylinders connected with said manifolds, opposite coaxial reciprocating plunger means for said cylinders, a yoke connecting said plunger means and surrounding said shaft, eccentric means driven by the shaft and connected with said yoke for reciprocating said plunger means, means for driving the shaft, horizontally located spider gears respectively at the bases of the container and rotatable therein, lubricant driving skew means on said gears, and gear driving means between the upper end of said shaft and said spider gears respectively.

9. A lubricant pump comprising a vertical lubricant container, a manifold below said container, a vertically located shaft, a horizontal pump cylinder connected with said manifold, a coaxial reciprocating plunger means for said cylinder, means for driving the plunger from said shaft, means for driving the shaft, a horizontally located spider gear at the base of the container and rotatable therein, a lubricant driving skew means on said gear, and gear driving means between the upper end of said shaft and said spider gear.

10. A lubricant pump comprising a vertical container having an outlet opening at the bottom, bearing means attached to the bottom adjacent said opening, an open spider gear rotary on said bearing means and horizontally rotary at the base of the container, the teeth of the gear being adjacent to the outer walls of the container, and paddle means arranged radially in the open portion of said spider gear.

11. A lubricant pump comprising a vertical container having an outlet opening at the bottom, bearing means attached to the bottom adjacent said opening, an open spider gear rotary on said bearing means and horizontally rotary at the base of the container, the teeth of the gear being adjacent to the outer walls of the container, an inwardly directed guard flange from the walls of the container directly above the teeth of said gear, and paddle means arranged radially in the open portion of said spider gear.

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