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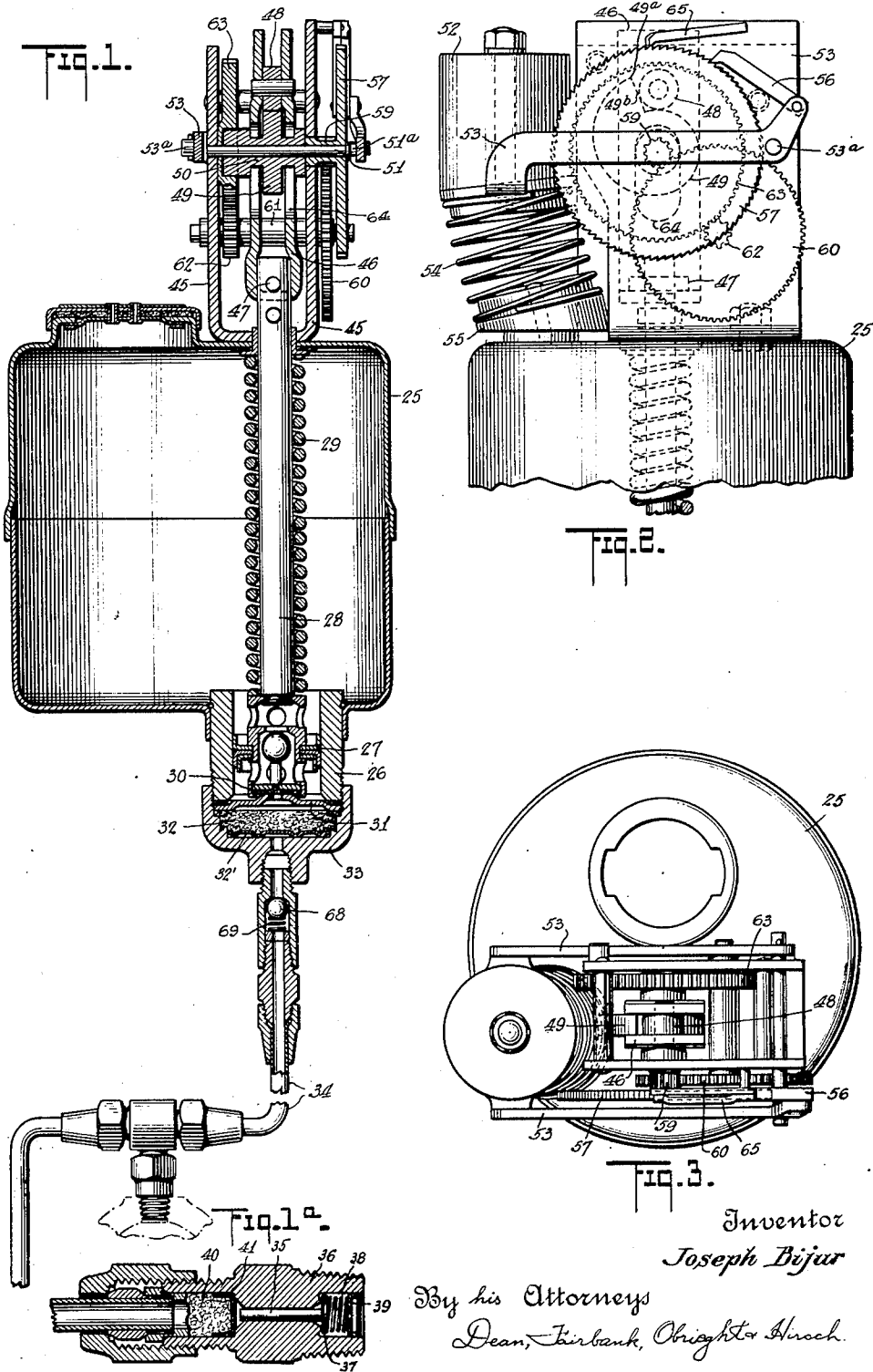
J. BIJUR

1,979,247

CENTRAL LUBRICATION

Filed March 28, 1928

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FIG. 4.

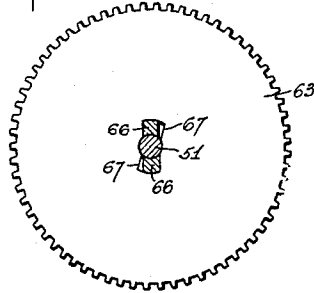


FIG. 5.

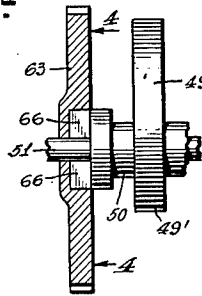


FIG. 6.

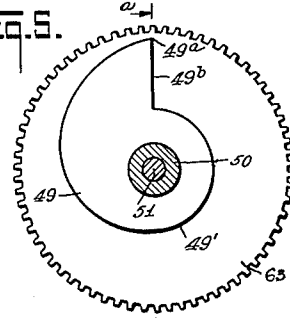


FIG. 8.

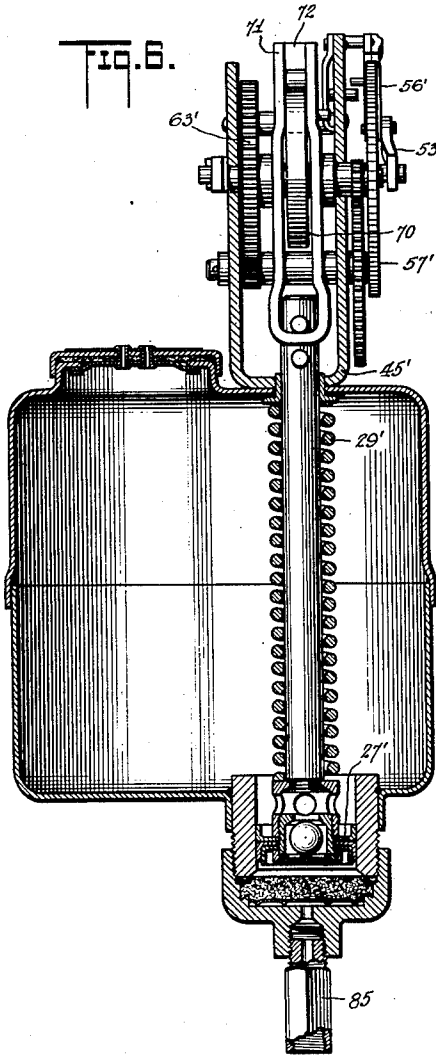


FIG. 7.

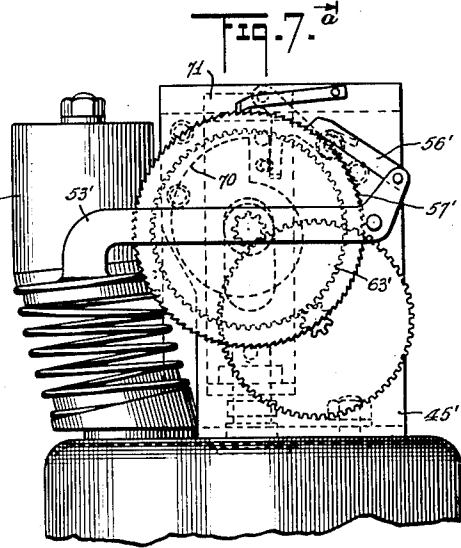
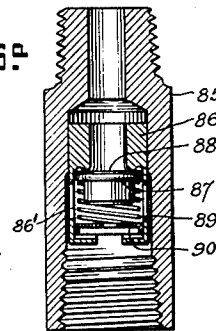


FIG. 6.



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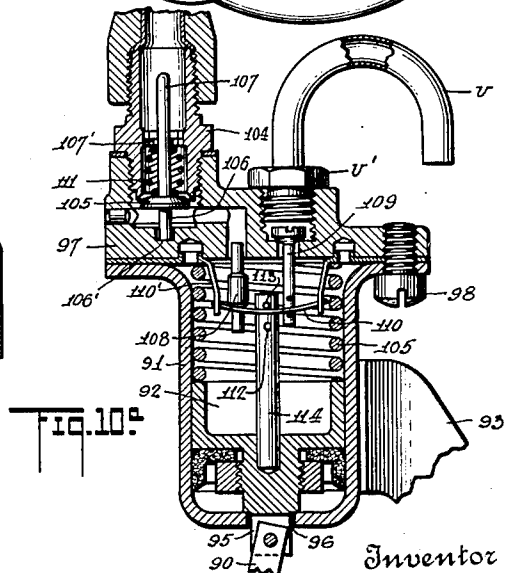
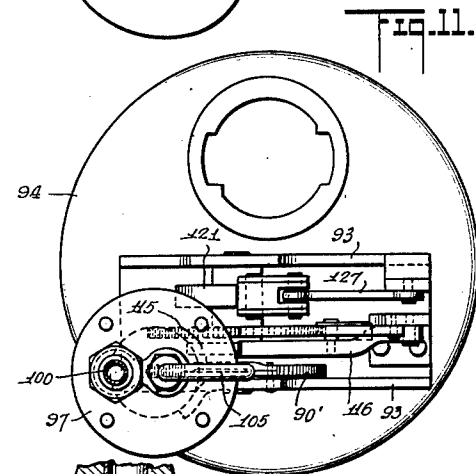
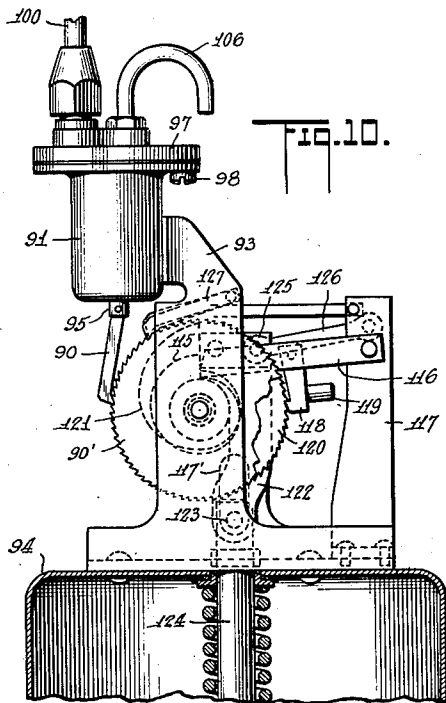
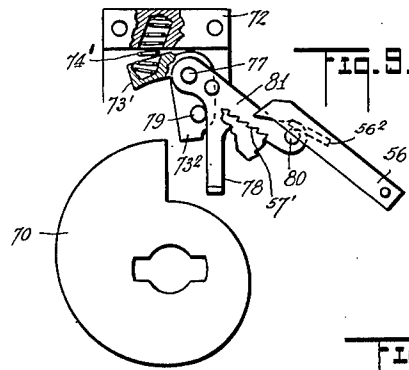
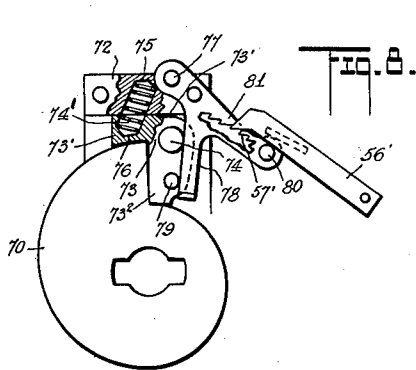
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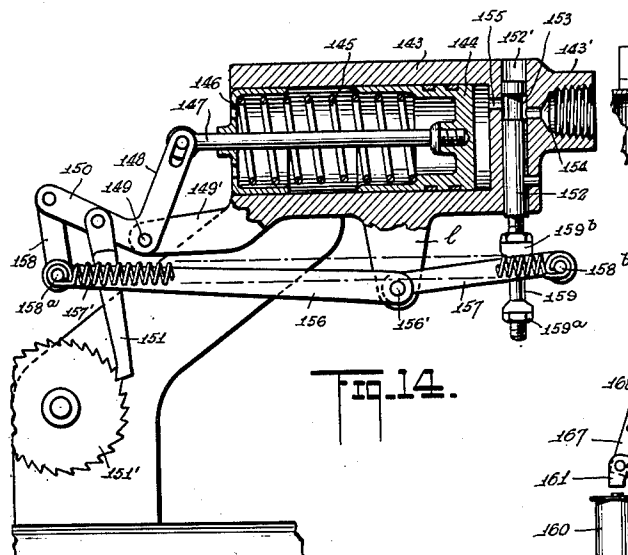
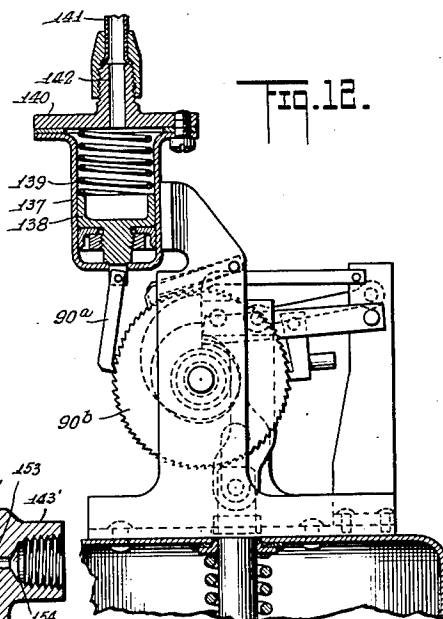
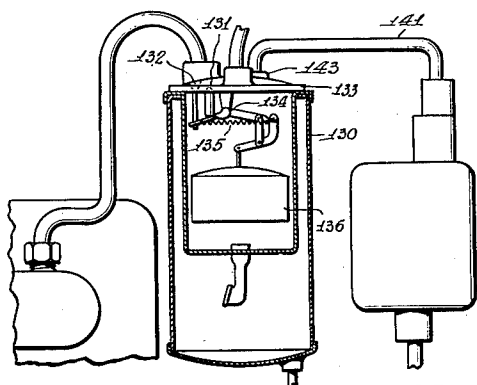
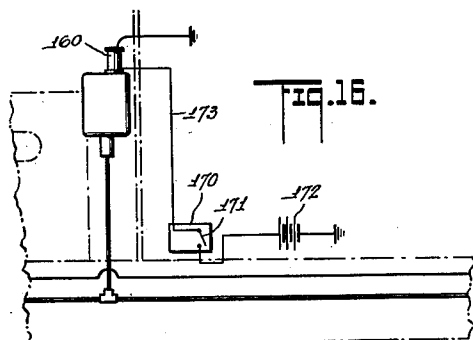
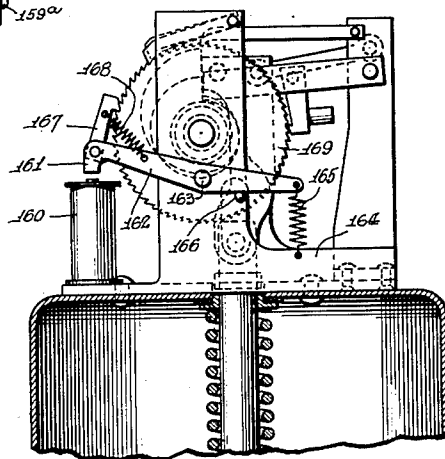


Fig. 15.



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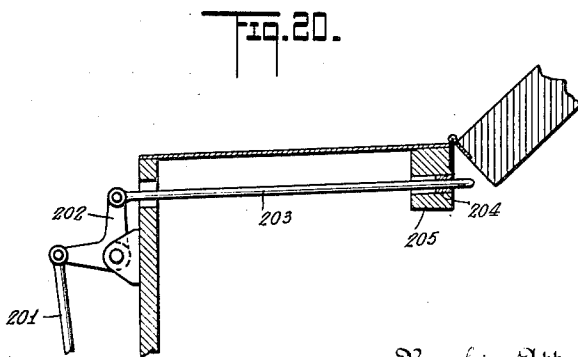
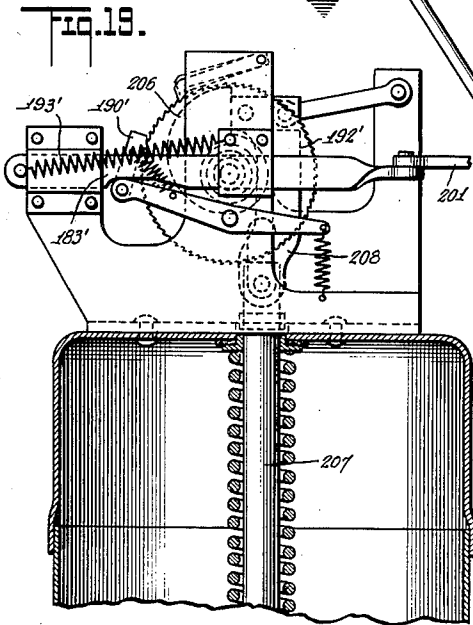
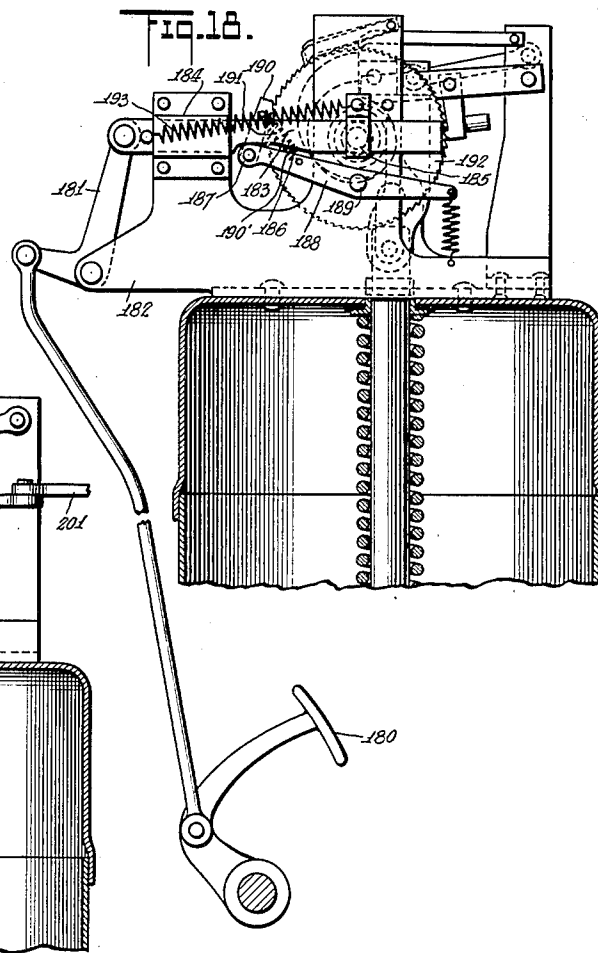
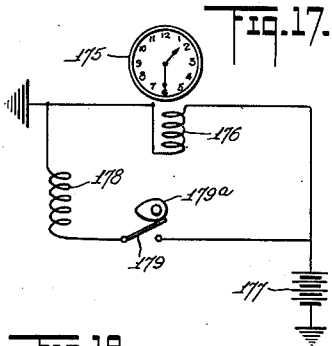
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Fig. 21.

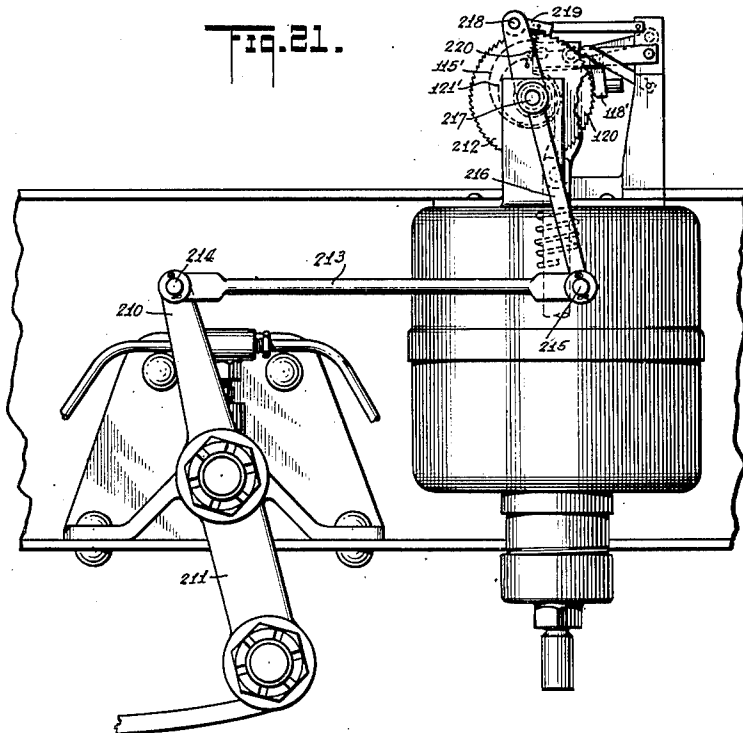
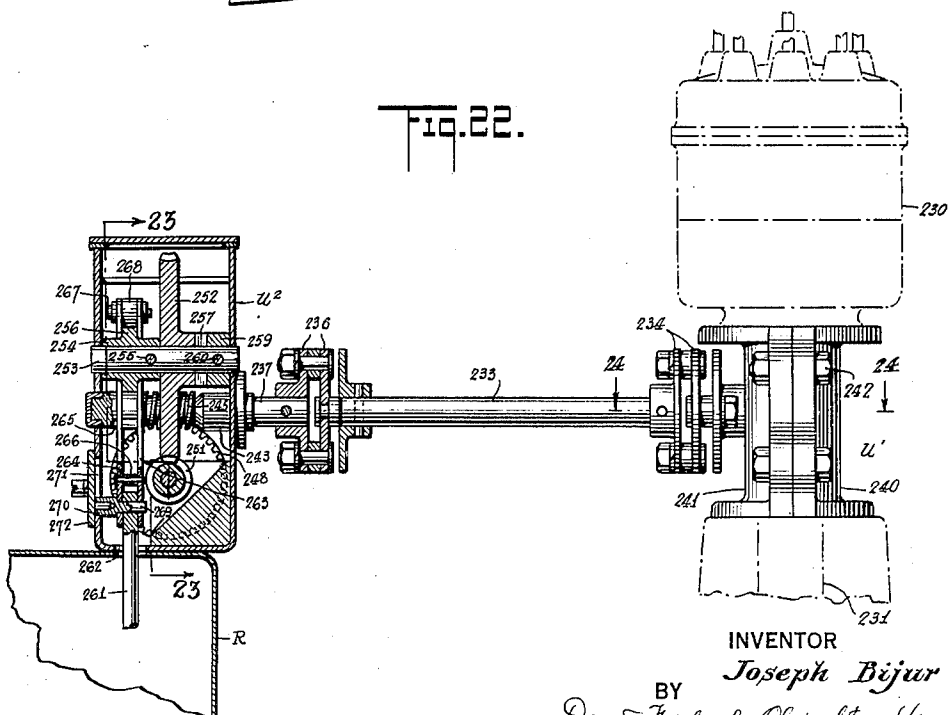


Fig. 22.



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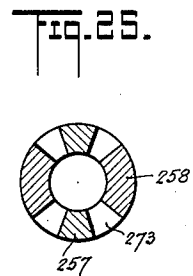
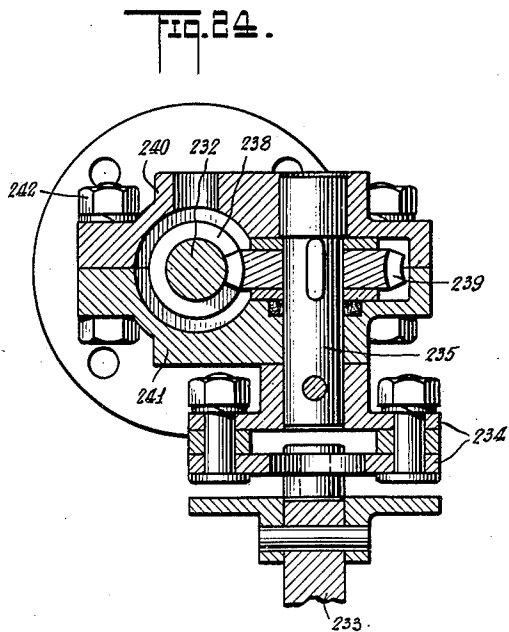
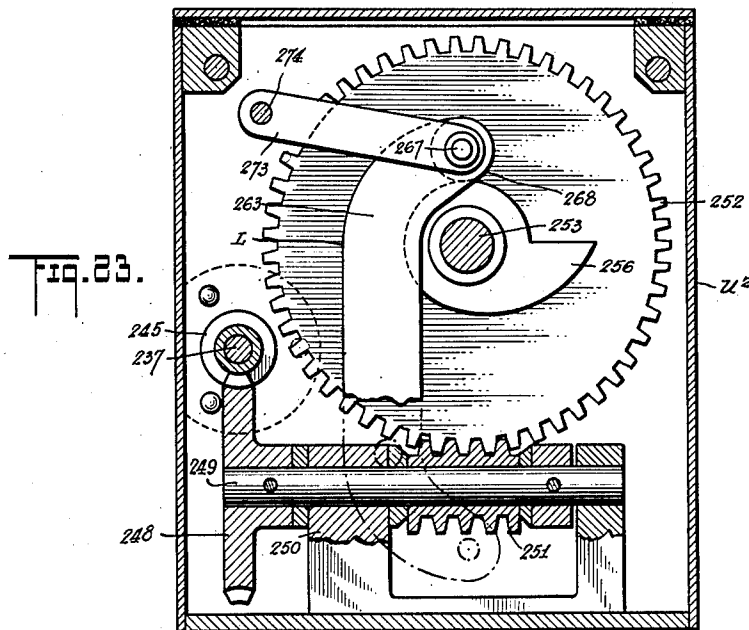
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CENTRAL LUBRICATION

Filed March 28, 1928

7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

1,979,247

CENTRAL LUBRICATION

Joseph Bijur, New York, N. Y., assignor to Auto Research Corporation, a corporation of Delaware

Application March 28, 1928, Serial No. 265,473

28 Claims. (Cl. 184—7)

My present invention is concerned primarily with central lubrication and has its preferred application to lubricating systems of the centralized pressure type.

5 It is among the objects of the invention to provide operating means for a distributing system of the type noted, which will function to deliver a sufficient, yet not an excessive supply of lubricant to the bearings, without the need for
10 any conscious operation whatsoever on the part of the operator other than to replenish the supply of lubricant from time to time, and which will supply lubricant in manner requisite for most effective operation of distributing systems of the types disclosed and claimed in my prior
15 Patents Nos. 1,632,771, 1,732,212 and 1,746,139.

The invention contemplates automatic actuation of the pressure source or pump, as for example in the case of chassis lubricating systems
20 from some source of energy associated with the operating vehicle. Energy from such sources is usually substantially continuously available and although it may be applied to creating substantially continuous lubricant pressure, it is an
25 object of this invention to accumulate such energy over a period of time and employ it to give rise to intermittent pressure impulses upon a lubricant distributing system.

Although the present invention is broadly
30 adapted to supply lubricant automatically to the various distributing systems, above referred to, it is particularly adapted for supplying a distributing system of the character shown and described in my prior Patent No. 1,632,771, particularly where the metering outlets of such a system
35 have check or non-return valves seated by springs of substantial strength. A system provided with valved outlets of this character should receive lubricant at a pressure substantially above the
40 seating pressure of the valves so that all valves shall be opened simultaneously upon said pressure application, as otherwise expansive flow would take place through those valves seated with slightly weaker springs to the deprivation of the
45 remaining outlets.

Another object is, therefore, to provide an arrangement which causes automatic actuation of a pressure source or pump in such a manner as to give rise to applications of lubricant pressure
50 which are of a predetermined value or of value substantially above a predetermined minimum.

A feature of the present invention consists in the provision of a reciprocating pump which is moved in a charging direction by actuation from
55 a part of the mechanism being lubricated and which is associated with a discharging agency, such as a spring, energized from said mechanism during the charging operation. Where the power is substantially continuously applied both
60 to charge the pump and to energize the resilient

means, an arrangement is provided whereby the continuous application of power will offer no opposition to pump discharge under the expansive power of its spring or other stored motor force.

In one specific embodiment, a pump lifting
65 cam is employed having a long initial dwell and performing its lifting action only during the final part of its movement, so that the discharge of the pump may be completed before the lifting action of the cam is resumed.
70

In another embodiment, the cam operates to lift the pump piston substantially throughout cam movement and automatic throw-out means is provided to disengage the mechanism which actuates the cam and to maintain said cam stationary as long as the pump is discharging.
75

Where it is desired to assure pump discharges to yield lubricant shots at intervals of sufficient length, I prefer to employ appropriate reduction mechanism for energizing the pump discharging agency and for charging the pump by a step by step action which may consist of suitable ratchet and/or gearing arrangements.
80

Among the various sources of power for actuating the stepping or other reduction mechanism, 85 I have shown embodiments deriving their power by inertia, electromagnetism, suction, pressure, by the actuation of some hand or foot operated element that serves primarily for another purpose in the operation of the vehicle and/or by
90 mechanical connection to some automatically moving part of the vehicle.

The inertia embodiment involves a jiggle weight. The solenoid embodiment may be controlled from any electric mechanism on the vehicle.
95 In the case of vehicles equipped with electric clocks, the solenoid operating the lubricant pump may be controlled from the clock winding circuit by connection in parallel therewith, but in circuit with a switch mechanically interlocked with the ignition switch, so that the charging operation can occur only while the vehicle is in operation. In the case of vehicles provided with electric fuel pumps, the solenoid may be connected in circuit with the electric motor operating such fuel pump. Where suction is employed as the motive force, this may be conveniently applied from the vacuum fuel tank, the intermittent suction of which actuates an appropriate piston, which in turn operates the pawl that
100 moves the reduction gearing. As an alternative, the suction may be applied direct from the intake manifold to a suction motor having automatic control valves.

Where pressure is employed, the same may be
115 applied either from the engine exhaust or where air brakes are used from the air line through which the brake operating tank is charged. The lubricant pump charging mechanism may be operated from the clutch pedal, or other hand or
120

foot controlled member, or by the closing of a door or other part not associated with the mechanism of the vehicle. Operation may be effected by mechanical connection with a spring shackle or other vibrating part, or with the ignition drive or other operating mechanism.

This application is a continuation in part of my copending application, Serial No. 580,668, filed August 9, 1922.

- 10 In my Patent No. 1,732,212, which is a division of my application Serial No. 580,668, filed August 9, 1922, I have disclosed a continuous lubricating system in which the pump is of minute capacity and discharges a small volume at frequent intervals into the line, which volume will be taken up by the resiliency of the piping or conduit system, with the result that a substantially continuous discharge will take place past the flow restricting or flow metering outlets.
- 15 In one preferred embodiment of the present invention, however, an automatic intermittent system is obtained by increasing the size of the pump and decreasing its frequency to supply substantially the same quantity to the line, which quantity however is intermittently fed past the outlets to the bearings substantially simultaneously with the pump discharge, which pump discharge now takes place at relatively infrequent intervals. The pump discharge capacity in this embodiment is many times the resilient capacity of the line so that the pump cannot complete its discharge until a substantially equivalent amount of lubricant has passed the flow controlling outlets. In utilizing a relatively large pump of this character it is desirable to use a packing material around the periphery of the correspondingly large diameter piston thereof, for otherwise there would be a liability of the lubricant escaping past the piston at a much greater rate than it escapes past the flow restricting outlets into the bearings.

- 20 In continuous systems of the character such as described in my Patent No. 1,732,212, the spring pressure or discharge pressure of the pump is not transmitted to the outlets, but such pressure is utilized for forcing the relatively minute charge of lubricant into the line within the resilient capacity thereof.

- 25 With large pumps of the character of the present invention on the other hand the spring pressure or direct pump pressure is transmitted through a substantially incompressible column of lubricant up to the outlets with the result that the piston functions to discharge lubricant directly through the outlets substantially in the same degree as it functions to discharge lubricant past the valved outlet of the pump.

In the accompanying drawings,

- 30 Fig. 1 is a longitudinal sectional view of one form of automatic tank, showing diagrammatically a fragment of the pipe system,

Fig. 1a shows a preferred outlet fitting,

Fig. 2 is a fragmentary elevation thereof,

Fig. 3 is a plan view thereof,

- 35 Fig. 4 is a fragmentary longitudinal section taken on line 4-4 of Fig. 5a,

Fig. 5 is a plan view showing the cam,

Fig. 5a is a sectional view on line a-a of Fig. 5,

- 40 Fig. 6 is a longitudinal section of an alternative embodiment of pump and tank,

Fig. 6a is a longitudinal section of the outlet fitting of Fig. 6 on a larger scale,

- 45 Fig. 7 is a fragmentary elevation of the embodiment of Fig. 6,

Fig. 8 is a detail showing one stage of the cam operation,

Fig. 9 is a detail showing another stage of the cam operation,

Fig. 10 is a fragmentary longitudinal section of a further embodiment of the invention,

Fig. 10a is a view in longitudinal section and on a larger scale of the suction motor of Fig. 10,

Fig. 11 is a plan view of the embodiment of Fig. 10,

Fig. 12 is a view similar to Fig. 10 showing an alternative embodiment,

Fig. 13 is a diagrammatic view illustrating the operation thereof,

Fig. 14 is a view partly in elevation and otherwise similar to Fig. 10, illustrating the operation from the engine exhaust,

Fig. 15 is a view similar to Fig. 10 showing a further alternative embodiment,

Fig. 16 is a fragmentary diagrammatic view of a chassis indicating the mode of connection for operation of the embodiment of Fig. 15,

Fig. 17 is a view similar to Fig. 16 illustrating an alternative circuit connection,

Fig. 18 is a fragmentary view of an automatic tank, illustrating in diagrammatic manner another mode of operation,

Fig. 19 is a view similar to Fig. 18 of another embodiment,

Fig. 20 is a fragmentary diagrammatic view illustrating the mode of operation of the latter embodiment,

Fig. 21 is a fragmentary view of a further embodiment,

Fig. 22 is a view partly in longitudinal section of another embodiment,

Fig. 23 is a sectional view on a larger scale taken on line 23-23 of Fig. 22,

Fig. 24 is a sectional view on a larger scale taken on line 24-24 of Fig. 22, and;

Fig. 25 is a sectional detail of the cam mount.

Referring now to Figs. 1 to 5 of the drawings, I have illustratively shown a supply installation more especially for a chassis lubricating system. The installation comprises a sheet metal tank 25, preferably supported in front of the dashboard (not shown) and having a short pump cylinder 26 of relatively large diameter in the bottom thereof, and a pump piston 27 fitting therein and operated by a vertical piston rod 28 encircled by a coil spring 29 reacting against the top of the container. The piston has a seating end 30 of soft material normally urged by the spring into contact with a metal seat 31 below which is a thick disk 32 of filter material backed by wire mesh disk 32' and maintained in position by a closure cap 33, to which is connected the head of the piping system 34. The detailed construction of the tank and pump need not be further set forth, since these elements are not by themselves claimed herein, but constitute the subject-matter, more particularly of my British Patent No. 261,967 and my copending applications Serial No. 580,688, filed August 9, 1922 and Serial No. 596,856, filed October 25, 1922.

In Fig. 1a I have indicated one of the preferred outlets. The outlets are of relatively high resistance determined by a pin 35 nearly filling a longitudinal bore in the fitting 36. A valve 37 preferably at the outlet is pressed against its seat by a spring 38 which reacts against a cap 39. At the inlet a strainer plug 40 of wool felt having a backing 41 of wire mesh intercepts any solid particles that might otherwise become lodged at the valve seat or in the restriction crevice de-

terminated by the pin. The diameter of the pin determines the rating of the fitting. The various outlet fittings in parallel determine a resistance to flow so high as to control the rate of discharge of the pump, permitting but slow expansion of the spring 29.

The present invention is more especially concerned with means for automatically operating, charging or energizing a lubricant pump, as distinguished from performing this operation by special manual or pedal impulses. While I have illustratively shown one desirable embodiment of pump and tank, which may be effectively operated by the automatic mechanism hereinafter described and claimed, it will be understood that said automatic mechanism may be employed for charging, energizing or actuating pumps of other constructions.

In Figs. 1 to 5 is shown step by step reduction mechanism, lifting the pump piston by an oscillating impulse, in this case illustratively, by the inertia of a jiggle weight. I have specifically shown a U-shaped supporting bracket 45 attached to the top of the container, with arms straddling a U-shaped operating yoke 46, through the base of which the pump piston extends, a pin 47 transversely through the piston constituting a coupling by which the piston may be lifted by means of the yoke. A cam follower roller 48 is carried between the upper ends of the yoke arm and rests on or is pressed by the pump spring 29 against a rotary cam 49 which extends with small clearance between the arms of the yoke 46. The cam is formed as an integral part of a collar 50 free to rotate upon a transverse stationary shaft 51 therethrough. The cam presents a high point or apex 49a. For actuating the cam, I provide preferably double reduction mechanism operated from the inertia or jiggle weight 52. For this purpose, a pair of levers 53 are pivoted at 53a to the exterior sides of the bracket 45. These arms sustain the jiggle weight 52 therebetween at their outer ends, said jiggle weight resting upon a coil spring 54 in turn supported upon an abutment 55 on the tank. The opposite end of one of the arms 53 carries a pivoted pawl 56 resting upon the periphery of a ratchet wheel 57 which is supported loosely upon the stationary shaft 51, the end of which is enlarged at 51a to maintain the ratchet from coming off. The ratchet wheel 57 has integral therewith a pinion 59 intervening between said wheel and the bracket 45, said pinion meshing with a gear 60 therebelow mounted on an axle 61 which bears in the arms of bracket 45 and extends laterally of the yoke 46 and thereby clears the same. The axle 61 has a pinion 62 adjacent the left end thereof, said pinion meshing with a gear 63 mounted on the stationary shaft 51. The collar 50 and shaft 51 extend through an elongated slot 64 in the yoke, to afford clearance for the rise and fall of the latter. Detent pawl 65 pivoted upon bracket 45 coacts with ratchet 57 to prevent retrograde movement thereof.

The gear 63 drives the cam 49 through a dog clutch connection (see Fig. 4). The clutch comprises a pair of teeth 66 protruding beyond the end of collar 50 and extending into corresponding keyways 67 in the gear 63. The key-ways 67 are considerably wider than the keys 66 to afford backlash for a purpose which will appear hereinafter.

The operation is as follows: During locomotion of the vehicle, the jiggle weight 52 will oscillate through a limited stroke, cushioned in its descent by the yielding spring 54. For each downward oscillation of the jiggle weight, the pawl 56 will

step the ratchet wheel 57 forward through one tooth or more, and on each spring return of the jiggle weight, said pawl will come into coaction with the following tooth of the ratchet wheel. The slow intermittent rotation of the ratchet wheel is transmitted to cam 49 through a double reduction by way of pinion 59, gear 60, axle 61, pinion 62, gear 63 and clutch 67—66 to the cam collar 50, thereby causing an extremely slow intermittent rotation of the cam 49. The cam thus gradually lifts the follower roller 48 and with it the yoke 46 which through pin 47 raises the piston 27 against the resistance of spring 29, until after the high point 49a of the cam is reached, the roller follower 48 is released from the cam, so that the spring 29 now expands and discharges the pump into the piping system 34, the discharge taking place at a rate determined by the resistance of the piping and of the outlet devices 36.

In order to accomplish this the pump is of such a size that its discharge will be substantially in excess of the resilient capacity of the line or piping so that before it may complete its discharge into the line a substantially equal discharge must take place past the outlet devices 36.

It will be seen that as soon as the cam follower rides off the high point 49a of the lifting surface, the drop off surface 49b of the cam will immediately recede by the reaction of the roller 48, due to the back-lash in the clutch 66—67, so that the descent stroke of the roller and the pump will occur without undue frictional resistance of the roller against any part of the cam. When the pump has been completely discharged, the roller 48 again rests on the surface of the cam to be again lifted in the continued rotation of the latter.

By reason of the slow discharge of the pump, the cam roller 48 is slowly returned to engagement with the curved surface of the cam, which will have been rotated through a substantial angle before contact occurs. If the cam had a continuous rise throughout its periphery, it will be apparent that in cold weather, when the oil becomes highly viscous and discharge correspondingly slow, complete discharge of the pump would not occur. I accordingly prefer to provide the cam with uniform radius as at 49' for approximately one-half of the periphery thereof, the entire rise or lift of the roller being effected by the second half of the cam periphery. In general, a complete discharge of the pump, even under low temperature conditions, will occur before the cam has completed a half turn, and complete discharge of the pump, accordingly, will occur in the intervals between successive lifting operations.

When the pump described is completely discharged, as shown in Fig. 1, its outlet 30—31 is sealed and drainage of the reservoir contents is prevented. Frequently, however, the vehicle will be stopped at a time when the piston has been lifted from seat 31 and before the lifting stroke has been completed. Under those circumstances, in the absence of other precautions, the tank might, before the vehicle is again started, become wholly or partly drained through a leak in the pipe. To avoid such occurrence, I have provided a relief valve 68 in the base of the pump. That valve is illustratively shown as a ball valve, urged against its seat by the spring 69. It is preferred, however, to employ a valve such as shown in the embodiment of Fig. 6 and Fig. 6a to be described below.

In the embodiment of Figs. 6 to 9, there is shown a jiggle weight 52' mounted on lever 53' and

operating through pawl 56' to step around a ratchet wheel 57' as in Figs. 1 to 5, corresponding reference numerals primed, being employed for corresponding parts. The cam 70 driven from the ratchet wheel 57' is in this case devoid of any dwell, but affords a continuous rise throughout the periphery thereof, pawl displacing means being provided to prevent further rotation of the cam when its high point reaches the vertical position shown in Fig. 9.

In a preferred embodiment, the yoke 71 has a cross block 72 (see Figs. 8 and 9) at the top thereof mounting a bell crank shaped cam follower 73 pivoted to one arm of the yoke at 74, which follower has one arm 73' against the block in one extreme setting of the cam and the other arm 73² against the drop-off of the cam 70, as best shown in Fig. 8. A coil spring 74' lodged in corresponding depressions 75 and 76 respectively in the cross block and the follower arm 73' tends to move the follower piece in counterclockwise direction. Pivoted at 77 to an arm of the bracket 45' is a bell crank lever having one arm 78 thereof in the path of movement of a stud 79 on the follower arm 73² and having a stud 80 on the other arm 81 thereof, in the path of a lug 56² on the pawl 56'.

In operation, the cam 70 is stepped around through the operation of the pawl and ratchet, from the position shown in Fig. 8. The bell crank follower is raised by the lift of the cam 70 and through the reaction of the follower against the cross block 72, the yoke 71 is raised and with it the piston 27' thereby compressing the pump spring 29'. The operation thus proceeds until the cam has made a complete revolution from the position shown in Fig. 8 at which time the high point of the cam rides off the end of the bell crank follower 73. The spring 74 is now free to expand as shown in Fig. 9, pivoting the bell crank follower 73 in counterclockwise direction and through its stop 79 similarly pivoting the bell crank lever 78 so that the stud 80 of the latter will through lug 56² elevate the pawl 56' about its pivot, free from contact with the ratchet wheel 57'.

In the continued operation of the vehicle, the jiggle action of the weight 52' will cause movement of the pawl, but since the latter is held out of engagement with the ratchet wheel, the cam will remain stationary and will not be stepped around until the spring 29' has expanded to complete the discharge of the pump, at which time the bell crank follower 73 has been brought into engagement with the high point of the cam 70 to the position shown in Fig. 8, thereby retracting the follower 73, overcoming spring 74 and allowing the bell crank lever 78 to return to the position shown in Fig. 8 and the pawl 56 to return into engagement with the ratchet wheel 57'. Thus the pump after completion of its charge is left free from the lifting impulse of the cam until complete discharge has occurred, and this regardless of the length of time required for the pump to discharge, or of the viscosity of the oil.

In the present embodiment, I have shown the pump piston 27' devoid of the seating end shown in Fig. 1, relying entirely on the valve in the outlet fitting 85 to close the pump against discharge during the intervals between downward strokes of the piston. I have illustratively shown the fitting 85 threaded into the base of the pump and housing a valve seat plug 86 in the bore therein and having a disk valve 87 provided with a seating facing 88 preferably of oil silk, re-

tained against its seat by a coil spring 89 in turn, held in position by a cup 90 in the slotted valve spring retainer 86' which is preferably integral with seat plug 86. This type of outlet affords a reliable seat with the use of a weak spring, so that little of the propulsive force of the pump discharge spring 29' is required to move the valve off its seat.

In Figs. 10 and 11 is shown an embodiment in which the propulsive force is derived from the course of flow of the combustible mixture, specifically from the intake manifold. For this purpose, the operating pawl 90 which coacts with ratchet 90' is actuated by a small suction motor 91. The suction motor casing may be affixed to a bracket 93 in turn secured to the top of the tank 94. The suction motor comprises a cylinder cup 91 with a piston 92 therein, having a stud 95 to protrude through an opening 96 and mounting the pawl 90. The head 97 of the cylinder which is bolted in place at 98 has an inlet opening through which the suction from the intake manifold (not shown) is applied through a connecting pipe 100. The cylinder is vented to atmosphere through a pipe *v* affixed in the cylinder head by means of a threaded bushing *v*'.

To govern the alternate application and relief of suction, in order to cause reciprocation of the motor, I have provided control valve mechanism comprising a valve 108 normally open, at the suction port, and a valve 109 normally closed or seated at the venting port. Both of these valves are loosely affixed with respect to a toggle leaf spring 110 mounted at its ends in supporting tongues 110' affixed at the cylinder head. The flexure of the toggle spring 110 is determined by cross pins 112 and 113 at opposite sides thereof and near the inner end of a rod 114 fixed axially of the piston 92.

The operation proceeds as follows: While the engine is operating and suction is applied at the intake manifold, air will be drawn out of the cylinder 91 past the open valve 108, thereby drawing the piston 92 upward against the resistance of a spring 105 until the cross-pin 112 thereon causes the toggle spring 110 to snap past dead center. By this operation, both the valves 108 and 109 are raised, the suction valve 108 being pressed upward against its seat to close the suction port and the venting valve 108 being lifted from its seat to open the venting port. Accordingly, no further suction from the manifold is applied to the cylinder 91, while the vacuum or partial vacuum within the cylinder is destroyed by the communication with atmosphere past the open valve 109. Accordingly, the spring 105 is free to expand and to return the piston to the lower extremity of its stroke, as shown in Fig. 10a, thereby, in that operation, causing the pawl to step the ratchet wheel forward through one tooth. When the extreme return position is reached, the toggle spring 110 is snapped to downwardly bowed position by the contact therewith of the upper cross pin 113, thereby again opening the suction valve and closing the venting valve, so that the operative or suction stroke will be repeated. Thus, throughout the operation of the engine, the suction motor will reciprocate and will cause the ratchet wheel 90' to be stepped forward.

In the absence of further precautions, the lubricator would feed more oil when the engine is idling or operating at slow speed than when the vehicle is moving at normal or high speeds. This is due to the fact that the suction upon the

intake manifold increases as the throttle valve is closed.

To obviate consequent over-lubrication, I provide a special valve in the suction line which automatically closes to prevent operation of the suction motor when the suction exceeds a predetermined maximum.

Illustratively, I have shown the motor head provided with a fitting 104 within which is a disk valve 105 having a stem 106 extending therebelow into a corresponding depression 106' in the motor head 97. The valve has also a stem 107 extending thereabove through a spider 107' in the fitting. A coil spring 111 encircling the stem 107 reacts against the spider and holds the valve 105 away from the end of the fitting 104, which latter serves as a valve seat therefor. The valve 105 is thus normally open but when the suction exceeds a predetermined maximum the expansive force of spring 111 is overcome and the valve closes so that effective application of suction to the motor ceases until the suction has again dropped below the maximum.

While the motor mechanism described may obviously operate upon the pump piston through a reduction mechanism, such as that shown in the embodiment of Figs. 1 to 5, or as that shown in the embodiment of Figs. 6 to 9, I have illustratively shown another desirable type of reduction mechanism, which latter might be employed in the embodiments of Figs. 1 to 9. Referring to Fig. 10, coaxially of and rigid with ratchet wheel 90' is a cam 115. The end of a lever 116 pivoted upon a bracket bar 117 rests upon cam 115, said lever having pivoted thereto intermediate the ends thereof, a pendent pawl 118 carrying a weight 119 and cooperating with a second ratchet wheel 120 concentric with the first ratchet wheel 90'. The second wheel 120 is in driving relation with a pump raising cam 121 concentric therewith, said cam preferably of the construction shown in Fig. 1. The cam 121 acts upon the pump piston through a link 122 pivoted upon a cross pin 123 in the upper end of the pump rod 124, for which an elongated slot 117' in the bracket, provides clearance. Link 122 has a rider piece 125 resting upon the cam 121 through which the cam transmits its lifting impulse. A link 126 pivoted at one end to the bracket and at the other end to the rider piece 125 prevents the latter from dropping free from engagement of the cam 121. Detent pawls 127 prevent retrograde movement of the ratchet wheel.

Thus, for each reciprocation of the suction motor, the primary ratchet wheel 90' is stepped forward one tooth. For each complete revolution of the primary ratchet wheel, the secondary ratchet wheel 120 is advanced one tooth, through the pawl 118 and for each complete revolution of the secondary ratchet wheel, the pump is lifted through a complete stroke. When the high point of cam 121 reaches the rider or follower piece 125, the latter is released. In the descent of the pump piston with the cam follower 125, friction against the cam is but slight since the latter would be readily pushed aside by the follower.

The embodiment of Figs. 12 and 13 is similar to that just described, but instead of controlling the suction through a special suction motor, the vacuum feed fuel tank mechanism serves as the control. The vacuum tank which is shown merely in diagrammatic form and being itself well known, need be described but briefly. The level of fuel in the chamber 130 determines the suction or venting respectively through the suction port

131 and the air vent port 132 in the tank head 133. This is accomplished through a toggle mechanism 134 including an actuating coil spring 135, the position of which is controlled by the level of the float 136. The toggle operates upon the stems respectively of the suction control valve at the port 131 and the vent control valve at the port 132. The suction valve is below its seat and is closed by an upward stroke. The venting valve has its head above the seat and is opened by upward movement of the toggle lever. With this construction, there is merely employed for operation of the lubricant pump, a simple cylinder 137 having a suction piston 138 therein urged forward by coil spring 139 and having a head 140 through which the suction is applied by way of a pipe 141 affixed to nipple 142, said pipe leading from a corresponding nipple 143 in the head 133 of the vacuum tank.

In operation, while the fuel system is drawing fuel into the float chamber thereof, suction is applied which will draw the piston 138 upward. When the fuel chamber is filled and the toggle 134 snaps over to vent the fuel tank, the suction cylinder of the lubricator is also vented and the expansion of the spring 139 steps the pawl 90a forward to advance the ratchet wheel 90b through one tooth.

Inasmuch as the fuel tank ordinarily operates once about every $\frac{1}{16}$ of a mile on good level roads, the pump will be discharged at intervals approximating definite mileage run and in this case at intervals of miles approximately $\frac{1}{8}$ of the product of the number of teeth on the two ratchet wheels of the specific transmission mechanism shown.

In the embodiment of Fig. 14, the tank, pump and reduction mechanism are similar to those of Fig. 12, but instead of the suction motor for operating the ratchet wheel, I have in this instance provided a pressure motor which may be illustratively connected to the exhaust manifold (not shown) or other source of fluid pressure in the engine.

The specific pressure motor shown, illustratively comprises a pump cylinder 143 having therein a piston 144 urged toward the right by means of a coil compression spring 145, which reacts against a cylinder head 146, friction-fitted into the body of the cylinder and through which the piston rod 147 extends. Pivoted to rod 147 is the arm 148 of a bell crank lever, which is pivotally mounted at 149 to an ear 149' on the motor frame. The other arm 150 of the bell crank lever has a pawl 151 pivoted thereto, and coacting with the ratchet wheel 151' through which the pump transmission reduction gearing (not shown) is operated. Pressure is applied to the inner end of the piston through a socket 143' to which is connected the end of the pneumatic pipe (not shown).

A control valve rod 152 extending transversely across the base of the pump cylinder 143 through a corresponding bore 152' has a short portion 153 of reduced diameter which when in registry with the ports 154 and 155 through the cylinder base, as shown, permits communication from the inlet 143' to the piston head in order to force the latter outward against the resistance of spring 145 under the influence of the exhaust pressure.

Means is provided to automatically shut off the valve 152 after the pump has completed its stroke, so as to permit the spring 145 to return the piston to the right. For this purpose, a toggle is provided, comprising a long arm 156 and a short

arm 157, pivoted at 156' at their adjacent ends to a lug 1 integral with the cylinder. The end of arm 156 may be pivoted to a link 158 on the bell crank lever 150. The shorter arm 157 is formed with a yoke (not shown) on its end which straddles a threaded shank 159 integral with the valve 152. Nuts 159a and 159b adjustably mounted on the threaded shank are alternately engaged by toggle arm 157 to govern the reciprocation of the motor. A coil spring 157' connects the opposite extremities of the toggle arms and is affixed at corresponding cross pins 158a and 158b. In the position shown, the spring toggle presses against nut 159b and forces the valve to the position shown, in which the engine exhaust communicates with the interior of the cylinder. When in operation, the piston has reached the opposite end of its stroke, during which, as previously noted, the ratchet wheel 151' is stepped forward, the toggle arm 156 has thereby been pushed downward about its pivot 156' to draw the length of spring 157' past the pivot 156', that is, past dead center, in which operation, as is apparent, the arm 157 will be snapped downward to strike the nut 159a, a sharp blow, shifting the valve 152 downward to shut off the entrance to port 154 while opening free communication from port 155 through the upper extremity of bore 152', thereby venting the pump cylinder. As is obvious, the spring 145 is now free to expand and to return the piston to its inner position, causing the pawl 151 to pass over to the next tooth of the ratchet wheel 151' and pulling the end of arm 156 upward again, so as to cause the toggle to again snap the valve to the position shown. Thus, throughout the operation of the engine, the pressure motor will reciprocate and the reduction gearing will be slowly stepped forward.

In certain of the claims, I have used the term combustible mixture circuit as dominating the intake, the exhaust, the compression chamber or any other part of the engine or vehicle through which the combustible mixture passes from the air intake to the outlet at the muffler and from which power is derived in the embodiments of Figs. 10 to 14 previously described, to operate the lubricant tank.

In the embodiment of Figs. 15 and 16, I have shown an electromotive means for operating the step by step charging transmission for the pump. Illustratively, I have here also shown transmission mechanism corresponding to that of Fig. 10. In this case, an operating solenoid 160 is shown mounted directly upon the tank and operating upon an armature 161 thereabove at the outer end of a lever 162 pivoted at 163 between its ends upon the supporting bracket 164 for the reduction gearing and retracted by a coil spring 165 against a stop pin 166. The operating pawl 167 is pivoted to the lever adjacent the armature 161 from which it extends upwardly and is retained by means of a coil spring 168 in coaction with the ratchet wheel 169. Otherwise the structure of the reduction mechanism is identical with that shown in Fig. 10 and previously described.

Thus, each time the solenoid 160 is energized, it will pull the armature 161 downward and thereby cause the pawl 167 to step the primary ratchet wheel 169 forward through one tooth and to retain the same in that position until the solenoid is de-energized, whereupon the spring 165 will cause the pawl and armature to return preparatory to the next advance, upon the succeeding energization of the solenoid.

Automatic means is shown to control the inter-

mittent energization of the solenoid. Illustratively, I have indicated in purely diagrammatic manner, an electric fuel pump 170, the alternative operative and idle periods of which are automatically controlled in accordance with the fuel requirements, preferably by automatically opening and closing a contact 171, energizing the motor of the pump from the storage battery 172. I have connected the solenoid 160 by means of a conductor 173 in series with the fuel pump contacts and in parallel with the solenoid, so that every time the fuel pump is operated, the solenoid actuates the mechanism of the lubricator tank.

In Fig. 17, I have shown another automatic control means for determining the intermittent energization of the solenoid shown in Fig. 15. In this embodiment shown but diagrammatically, the control is effected through the electric clock 175 used as standard equipment on some embodiments of automobile. The electric clock is spring-operated, but automatically wound by an electric motor 176 driven from the battery 177. In practice, the motor rewinds the spring approximately every two minutes. In the present embodiment, I have connected the solenoid 178 in parallel with the clock operating motor 176 and in series with a switch 179 mechanically interlocked as by cam 179a with the ignition switch (not shown). Accordingly, as long as the ignition switch is open and the engine, accordingly, not operating, switch 179 is open and no charge of the pump will take place although the clock is running at all times. While the ignition switch and, accordingly, switch 179 is closed, that is, during the running of the engine or vehicle, the solenoid 178 will, accordingly, be energized for each winding operation of the clock, that is, at intervals of approximately every two minutes of running of the vehicle or engine.

Preferably the solenoid circuit is so arranged as to have much greater electric resistance than the circuit of the clock motor, so that the effectiveness of the latter is not hampered, and no alteration in the clock circuit is required.

In Fig. 18 I have shown an embodiment operated directly by manual or pedal power which, however, requires no distinct conscious manipulation, but is accomplished as an incident to the operation of one of the regular parts or controls of the vehicle. I have by way of example shown the clutch pedal 180 connected through linkage to operate the pump actuating reduction gearing. Illustratively, the linkage includes a bell crank lever 181 mounted upon the support bracket 182 on the tank, which bracket carries the reduction gearing. The bell crank lever has pivoted at the outer end thereof, a slide cam 183 mounted in bearing blocks 184 and 185, and urged toward the right by coil spring 193, anchored at one end to the cam and at the other to the bracket. This slide cam has an oblique camming surface 186 coacting with the roller end 187 of a lever 188 pivoted at 189 to the support bracket 182, and mounting at the outer end thereof a pawl 190 retained by a coil spring 190' in engagement with the primary ratchet wheel 192. In operation of the pedal, the bell crank lever 181 is moved in counterclockwise direction, tensioning spring 193, which returns said cam when the pedal is released. Except as just described, the reduction mechanism is in this case identical with that in Fig. 10 and need not be more fully set forth. With the double reduction mechanism employed, very little energy is required for each step, so that oscillating such mechanism with the clutch pedal or other control

does not impose upon the operator any appreciable added load.

In the embodiment of Figs. 19 and 20, the control is shown effected by the opening or closing of a vehicle door, although it may also be done by the raising and lowering of an extra seat or by other operations or adjustments effected from time to time and not concerned with the operating or running mechanism of the vehicle. Inasmuch as considerable force is applied in the closing of a vehicle door, I have found that the refinement of double reduction mechanism is not required, and, accordingly, have shown but a single reduction mechanism through which the pump charging impulse is transmitted. In the present embodiment, a slide cam 183' is employed substantially identical with that of Fig. 18, but instead of operating through a bell crank lever at the left end, I have shown a push link 201 pivoted to the right hand end thereof, said push link connected to the outer end of a bell crank lever 202 in the body of the vehicle. The bell crank lever 202 has a rod 203 pivoted to the end thereof with its extremity protruding through an aperture 204 in the door jamb 205, when the door is open, at which time the tank control parts are in the position shown in Fig. 19. When the door is now closed, the extremity of lever 203 is pushed inward moving bell crank lever 202 in counterclockwise direction, transmitting a push thrust through the lever 201 to push the slide cam 183' toward the left and thereby cause the pawl 190' to step the ratchet wheel 192' forward through one tooth. In the advance of the slide cam 183', the spring 193' is, of course, tensioned and remains tensioned while the door is shut. When next the door is opened, the spring returns the slide cam to the position shown in Fig. 19 preparatory for the succeeding operation of the ratchet wheel when the door is again closed. The pawl 190' operates on the ratchet wheel 192' which as indicated, has rigid therewith, the rotary cam 206 that operates directly upon the pump piston rod 207 through the pivoted link 208, which latter is of construction identical with the corresponding parts in Fig. 10.

If desired, all reduction mechanism may be omitted in the latter embodiment, the pump being charged completely by the substantial effort of closing the door. Preferably, the pump is in this case made of smaller volume or the resistance of the drip plugs is made higher, or both of these changes are introduced, to avoid over-lubrication.

The three types of reduction mechanism shown respectively in Figs. 1 and 2, in Figs. 6 and 7 and in Fig. 10 are interchangeable, any one of them being suitable for operation by any of the propulsive agencies in the various embodiments set forth.

The operation of each of the embodiments of tank disclosed, is entirely automatic, not only in the lubricant propulsive action thereof, but also in the control. No attention is required other than from time to time to charge the tank with lubricant. Notwithstanding the irregularity with which the actuating impulses are applied from the various operating agencies disclosed in the several embodiments, the lubricant discharge in each instance is effected by the propulsive force of the stressed pump spring, the rate of discharge being controlled by the fixed drip plug or other flow governing outlets. The volume of the pump is sufficiently large to cause the pressure to build up promptly throughout the pipe line, so that emission through all the drip plugs will occur, and the slow discharge will be

governed by the rated restrictions of the outlets, substantially regardless of variations in the outlet valves.

The pump volume is sufficient to supply the lubricant needs for many miles and the operation of the pump occurs at corresponding intervals. The time intervals of operation are and need be only very roughly proportional to distance run.

In the jiggle weight embodiments of Figs. 1 to 9, for instance, the intervals are governed by the frequency of jiggle, which is more or less a function, not only of distance run but of speed of propulsion and roughness or smoothness of the road, so that in these embodiments the frequency of lubrication is substantially governed by the actual requirements of the chassis.

In the embodiments of Figs. 10 to 16, the rate of flow of mixture, in the intake or exhaust, governs the lubrication and this, in turn, is a function of speed or load, so that the frequency of operation is determined roughly by the requirements of the vehicle.

In the embodiment of Fig. 17, the operation occurs at definite time intervals during the running of the vehicle or motor which corresponds with sufficient accuracy to actual requirements.

In the manually controlled embodiments of Figs. 18 to 20, the reduction mechanism is so proportioned as to assure a sufficiency of lubricant under average conditions of use.

In Fig. 21 is shown another embodiment of automatic lubricating apparatus, in which the vibration of the moving vehicle effects the operation. In this specific application, the spring shackle is connected to the pump, so that the oscillation of said shackle in use of the vehicle will furnish the motive power for charging the pump. For this purpose, an upward extension 210 is provided on one of the shackle links 211. This extension is connected to the ratchet mechanism 212 by means of connecting linkage comprising a pitman 213 pivoted at one end as at 214 to the upwardly extended arm of the shackle and pivoted at 215 at its opposite end to an arm 216 mounted coaxially as at 217 upon the ratchet mechanism. To the upper extremity of arm 216 is pivoted at 218 the primary pawl 219 which is held in engagement with the teeth of ratchet wheel 212 by means of the coil spring 220. The details of the ratchet operating mechanism and of the pump need not be more fully described, as this construction may be identical with that of Fig. 10.

In operation, the oscillation of the spring shackles is translated through the linkage 210, 213 and 216 to effect slow advance of the ratchet wheel 212 which correspondingly steps forward the cam 121' to operate the secondary pawl 118' which actuates the secondary ratchet wheel 120' to slowly rotate the cam 115' until the pump (not shown) has been completely charged, and, when the apex of the cam 115' has reached uppermost position, the pump is released and automatic discharge of the pump contents takes place in the manner previously described.

In Figs. 22, 23 and 24 is shown an arrangement for the automatic operation of a lubricant pump by power connection with a part of the automobile or engine mechanism.

In a preferred embodiment the pump is operated from the ignition drive shaft. For this purpose, the ignition head 230 instead of being coupled direct to its drive shaft 231 is connected to the top of an interposed reduction gear unit

U', the main drive shaft 232 of which serves as the transmission from the drive shaft 231 to the ignition head 230. The reduction gear unit U', the details of which will be described below, is connected by means of a transmission shaft 233, with a reduction gear and pump lifting mechanism enclosed in a casing U², which casing is mounted on top of the combined pump and reservoir R, the latter similar to those shown in the other embodiments. Preferably, a flexible coupling 234 of familiar construction connects the transmission shaft 233 to the end of the shaft 235 of unit U' and a similar coupling 236 connects the opposite end of said transmission shaft to the driving shaft 237 of unit U².

The unit U' comprises preferably a worm 238 on vertical shaft 232 meshing with a worm wheel 239 keyed to shaft 235. Shaft 235 revolves in bearings formed in the split casing of unit U, the segments 240 and 241 of which are held together by screws 242.

The shaft 237 is mounted in the bushing 243 in the wall of casing U². A worm 245 on shaft 237 meshes with a worm wheel 248 affixed upon the end of a horizontal shaft 249 bearing in a standard 250 on the bottom of casing U². A worm 251 on shaft 249 meshes with a worm wheel 252 of larger diameter upon a transverse shaft 253 upon which is pinned at 255 the hub 254 of cam 256. The hub of worm wheel 252 is coupled to shaft 253 by means of dog clutch teeth 257 co-acting with similar teeth 258 on a clutch collar 259 which is pinned at 260 to the shaft 253. The cam 256 is connected by means of a link with the upper end of the pump piston rod 261 which protrudes through a corresponding aperture 262 in the base of the casing U².

The connecting link L is preferably composed of a pair of metal stampings 263, curved to clear the cam hub 254 and extending along opposite faces of the cam. The stampings are connected into a unitary assembly by rivets 264 and 265 encircled by collars 266 which maintain said stampings in parallelism. A cross-bolt 267 connected between the upper ends of the stampings 263 mounts the cam roller 268. Near the lower extremity of the composite link L is a cross pin 269, which extends through a corresponding aperture in the upper end of the piston rod. The cross pin 269 has a head 270 sliding in a vertical slot 271 in the wall of casing U², which slot is closed by a cover plate 272. The space between the stampings 263 composing the link L is sufficient to permit unimpeded rotation of the cam 256 therebetween. The upper end of the link L is guided by pivotal connection to a lever 273 having a fixed pivot 274 at its opposite end in the wall of the casing U².

Power is transmitted from the ignition drive shaft 232, worm 238, worm wheel 239, shaft 235, transmission shaft 233, shaft 237, worm 245, worm wheel 248, shaft 249, worm 251 and worm wheel 252, to clutch 257-8 and shaft 253 to revolve the cam 256. The triple reduction illustratively shown, may be in the order of 40,000 to 1, so that after 40,000 revolutions of the ignition shaft the cam 256 has lifted the roller 268 and with it the link L and the connecting piston rod 261 through the full length of the pump stroke. Thereupon, the roller drops off the apex of the cam and the coil spring (not shown) of the pump causes the latter to discharge. The cam is illustratively similar to that of Figs. 1 and 5, so that the pump has had ample time to discharge before recharg-

ing is resumed in the slow rotation of the cam, during engine operation.

As in Fig. 1, the dog clutch connection 257-8 has lost motion as at 273, so that after the roller 268 has passed off the apex of the cam, the latter will recede out of engagement with the cam roller, to avoid undue friction against the cam during pump discharge.

As already stated in the specification it is readily apparent that the pumps and actuating mechanisms of the present invention may be associated with other machines to be lubricated than an automobile chassis, and that the actuating mechanisms shown may be utilized with a wide variety of pumps, or that the pumps may be utilized in connection with other actuating mechanisms. Although the preferred outlets are of the type shown in Fig. 1a other outlets may be employed of the type shown in my copending applications above referred to.

The present application relates to similar subject matter as copending applications Serial No. 33,387, filed May 28, 1925 and Serial No. 566,705, filed October 3, 1931, said copending applications disclosing a reciprocating pump actuated by movement of one of the movable parts of the mechanism to be lubricated, which pump includes means for accumulating energy for over a period of time and then expending said accumulated energy for forcing lubricant from said pump into a distributing system with outlets metering fittings, the discharge capacity of the pump being in excess of the resilient capacity of the line so that the pump cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, and subject matter disclosed in the present application but not claimed herein is covered in said copending applications.

I claim:—

1. An operating mechanism provided with a central fluid distributing system comprising a lubricant supply, piping, a pump with a valved inlet and a valved outlet communicating respectively with the supply and with the piping, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, a propulsive agency for discharging said pump under pressure, said piping having pressure resistant outlets so correlated with the propulsive agency of the pump as substantially to retard free pump discharge and to cause said discharge to occur slowly, and means operated by the fluctuating power generated in the varying normal use of the mechanism, for intermittently setting said pump preparatory to effective application of said propulsive agency.

2. An operating mechanism provided with a central distributing system comprising piping, a pump with a packed piston emitting into the piping and of volume sufficient to supply the requirements of the system during intervals of long duration, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, said piping having pressure resistant outlets so correlated with the propulsive agency of the pump as substantially to retard free pump discharge and to cause said discharge to occur slowly, and means operated by the fluctuating power generated in the varying normal use of the mechanism for intermittently setting said pump preparatory to self-discharge thereof.

3. A chassis lubricating system comprising a pump having a cylinder, a tight-fitting piston therein substantially preventing leakage, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, means automatically controlled from the vehicle for initiating discharge of said pump at intervals corresponding approximately to the requirements of the bearings during many miles of operation, said pump having an associated propulsive agency of substantially predetermined power, a piping system supplied from said pump and leading to the bearings to be lubricated, said system having flow rate metering obstructions near the outlets, so correlated with the propulsive agency of said pump as substantially to retard free pump discharge and to cause said discharge to occur slowly, and means automatically operated by power derived from the vehicle in the normal operation thereof to restore the pump piston from completely discharged to completely charged position.

4. A central chassis lubricating system comprising piping, a lubricant pump emitting into the piping and of volume sufficient to supply the requirements of the chassis during intervals corresponding to many miles of operation, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, said piping having pressure resistant flow-rate metering outlets so correlated with the propulsive agency of the pump as substantially to retard free pump discharge, reduction mechanism operable to charge said pump, motive means for actuating said reduction mechanism and energized by the fluctuating power generated in the varying normal use of the vehicle, and means disconnecting said reduction mechanism from said pump during discharge of the pump.

5. A chassis lubricating system comprising a pump having a tight fitting piston, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, means automatically controlled from the vehicle for initiating discharge of said pump at intervals corresponding approximately to the requirements of the bearings during many miles of operation, a propulsive agency associated with said pump exerting substantially predetermined force, a piping system supplied from said pump and leading to the bearings to be lubricated, flow controlling obstructions near the outlets of said system, so correlated with the propulsive agency of said pump as to substantially retard free pump discharge and to cause said discharge to occur slowly, and pressure opened valve means near the inlet to the piping system normally closed to prevent leak from the system during the intervals between successive pump discharges.

6. A chassis lubricating system comprising a spring discharged pump, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, a piping system communicating therewith, having flow rate controlling obstructed outlets so correlated with the pump as substantially to retard the free discharge thereof, valve means at the head of the piping line closed during the intervals between

pump discharge and cooperating with said obstructions to maintain the pipe system at all times completely filled with oil, means actuated by power derived in the normal operation of the vehicle to stress the pump spring and to slowly charge said pump preparatory to the slow discharge of the pump, and means whereby the application of pump charging power is rendered ineffective throughout the discharge of the pump.

7. A supply installation for a chassis lubricating system comprising a lubricant tank, a spring discharged pump communicating therewith and having a tight-fitting piston therein, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, operating mechanism for intermittently energizing said pump, said mechanism including a rotary cam co-acting with the pump piston to displace the same, and a reduction transmission through which the cam is revolved, flow controlling outlets of high resistance sustaining the pressure of the pump spring throughout pump discharge, said operating mechanism including means serving to permit complete discharge of the pump prior to resumption of the operative functioning of said operating mechanism, and valve means to prevent drainage from said supply installation during the intervals between pump discharge.

8. A supply installation for a central chassis lubricating system comprising a lubricant tank, a spring discharged pump communicating therewith and having a piston therein, means for intermittently energizing the pump, said means including a rotary cam coacting with the pump piston to displace the same and a pawl and ratchet mechanism for intermittently revolving said cam, means controlled by the position of the parts for setting the step by step mechanism out of operation at the end of the pump charge stroke and setting it into operation at the end of the pump discharge stroke, and valve means to prevent drainage from said supply installation during the intervals between pump discharge.

9. An automatic pump for a chassis lubricating system comprising a reciprocating structure including a piston, a cam coacting with said structure, stepping mechanism for slowly rotating said cam, said stepping mechanism including a pawl and ratchet, and means carried by said structure and coacting with said pawl to displace the latter out of engagement with the ratchet at the charging end of the piston stroke, said means actuated by said structure upon complete discharge of the pump to re-set the pawl into coaction with the ratchet.

10. An automatically charged spring-discharged pump comprising a piston, a yoke for operating the latter, an operating cam coacting with said yoke, means for rotating said cam by a step by step action including a pawl and ratchet, and pawl controlling linkage coacting with said yoke and with said cam, said linkage being released by said cam at the end of the charging operation thereof to disengage the pawl from the ratchet, and operated by the yoke at the completion of pump discharge to effect re-setting of the pawl into coaction with the ratchet.

11. In a pump operating mechanism, the combination of a pump piston, a yoke through which the piston is operated, a cam coacting with the yoke, stepping mechanism for operating the cam including a pawl and ratchet, pawl controlling linkage coacting with the yoke and with the cam

cooperating with the cam during the rotation of the latter to maintain the pawl in operative position, a spring unstressed automatically to shift the linkage when the cam reaches the end of its lifting course, thereby effecting displacement of the pawl from operative position with respect to the ratchet, and stressed again by coaction of the yoke with the cam at the end of the descending stroke of the piston, thereby permitting the pawl to re-engage the ratchet for a subsequent operation.

12. In a mechanism for automatically charging a pump, the combination of a fixed bracket at an end of the pump, a pump piston extending through the base of said bracket, a yoke at the upper end of said pump piston, a rotary cam rotatably mounted between the arms of said yoke, a cam follower carried between the arms of said yoke and contacting said cam and means for intermittently driving said cam, said means comprising a ratchet wheel rotatably mounted near one of the arms of said bracket, a pinion rotatable with said ratchet wheel, a gear meshing with said pinion, an axle therefor extending transversely between the arms of said bracket, a pinion on said axle near the arm of said bracket opposite said gear and a gear meshing with said pinion, said cam mounted coaxially of and rotatable with said latter gear.

13. A transmission for charging a chassis lubricating pump by a step by step action, said transmission including a rotary cam connected to the pump piston for moving the same in a charging direction, a ratchet wheel concentric with said cam, a pawl for stepping said ratchet, a rotary cam for operating said pawl once for each revolution thereof, a second ratchet wheel for operating said latter cam, a pawl for operating said latter ratchet wheel, and means for intermittently operating said pawl.

14. In a chassis lubricating pump, the combination of a tank, a spring-discharged pump communicating therewith, means for intermittently applying energy to charge said pump by a step by step action, transmission means through which the energy is applied to the pump piston, said transmission means including a rotary pump-piston lifting cam, reduction mechanism through which said cam is operated, a cam follower connected to the piston and supporting means for the cam to permit rotary back lash thereof, thereby to permit said cam to recede free from frictional engagement with the follower at the end of the charging stroke.

15. In a central chassis lubricating system actuated by a spring shackle, the combination of a spring discharged pump, distributing piping supplied therefrom, reduction mechanism through which said pump is charged by an intermittent step by step action and linkage connecting a moving part of said spring shackle with said reduction mechanism to operate the latter.

16. In a chassis lubricating system actuated from the spring shackle, the combination of a spring discharged pump, a distributing piping supplied therefrom and step by step reduction mechanism for charging said pump including a depending operating link, a link on said spring shackle with an upstanding arm and a substantially horizontal pitman pivotally connecting the end of said upstanding arm to the end of said link.

17. A pump charging mechanism comprising a rotary cam, stepping mechanism for intermittently rotating the same to displace a pump pis-

ton to charged position, means movable by the piston for automatically disabling the stepping mechanism at the end of the charging stroke and means coacting with the piston member for automatically re-setting the stepping mechanism to operative relation upon complete discharge of the pump.

18. A combined tank and pump, said pump comprising a cylinder element, a piston therein, a piston rod protruding from the top of the tank, means for intermittently raising said piston including a cam, a pawl and ratchet mechanism for intermittently rotating said cam, a yoke at the upper end of said piston and a cam follower carried by said yoke interconnected with said pawl, said follower normally resting on said cam, and released by the cam upon completion of the pump lifting stroke thereof to displace the pawl from the ratchet and thereby to prevent operation of the cam, and said cam serving as a stop for the follower to limit the discharge movement of the piston and to effect return of the pawl for re-engagement with the ratchet.

19. An automatic pump for a central chassis lubricating system comprising a piston rod, a U-shaped supporting bracket extending thereabove, reduction gearing and a cam driven therefrom coacting with said rod to operate said pump, both mounted between and along the sides of said bracket, a ratchet wheel for driving said reduction gearing and disposed at one side of the bracket, a pawl for operating said ratchet wheel, a pair of arms pivoted at the exterior of said bracket, one of said arms mounting said pawl, a weight mounted between the free ends of said arms and a coil spring sustaining said weight.

20. The combination with a mechanism comprising movable parts and bearings to be lubricated, of means for lubricating said bearings comprising a fitting secured to each bearing and having a passageway therethrough, the resistance of which is large as compared with the resistance of one of said bearings, a single conduit for supplying lubricant to said fittings, said conduit having a branch leading to each of said fittings, means for supplying lubricant to said conduit comprising a reciprocating pump actuated by the movement of one of said movable parts, said pump including means for accumulating energy over a period of time and then expending said accumulated energy for forcing lubricant from said pump, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, and means for preventing return flow of lubricant through said conduit, the capacity of the pump and the frequency of its charges being proportioned to cause intermittent pressures substantially spaced in time to be transmitted to said fittings.

21. The combination with a mechanism comprising movable parts and bearings to be lubricated, of means for lubricating said bearings comprising a fitting secured to each bearing and having a passageway therethrough, the resistance of which is large as compared with the resistance of one of said bearings, a single conduit for supplying lubricant to said fittings, said conduit having a branch leading to each of said fittings, means for supplying lubricant to said conduit comprising a reciprocating pump actuated by the movement of one of said movable parts, said pump including a plunger and

means for driving said plunger with a slow intake stroke and a quick discharge stroke and means for preventing return flow of lubricant through said conduit, the capacity of the pump and the frequency of its charges being proportioned to cause intermittent pressures substantially spaced in time to be transmitted to said fittings said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets.

22. In combination with an automotive vehicle, a chassis lubricating system comprising a spring discharged pump, a piping system communicating therewith having flow controlling outlets so correlated with the pump as to substantially retard free discharge thereof, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, and means actuated by the power derived in the normal operation of the vehicle to stress the pump spring and charge the pump preparatory to the retarded discharge thereof said last mentioned means comprising a lifting cam with a long dwell whereby application of the pump charging and spring energizing power is rendered ineffective during said retarded discharge.

23. In combination with an automotive vehicle, a chassis lubricating system comprising a spring discharged pump, a piping system communicating therewith having flow controlling outlets so correlated with the pump as to substantially retard free discharge thereof, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, and means actuated by power derived in the normal operation of the vehicle to stress the pump spring and charge the pump preparatory to the retarded discharge thereof, said last mentioned means comprising a lifting cam with a drop, a follower coacting with said cam and means permitting a slight reverse movement of said cam during movement of said follower over said drop.

24. In combination with an automotive vehicle, a chassis lubricating system comprising a spring discharged pump, a piping system communicating therewith having flow controlling outlets so correlated with the pump as to substantially retard free discharge thereof, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, and means actuated by said power derived in the normal operation of the vehicle to stress the pump spring and charge the pump preparatory to the retarded discharge thereof, said last mentioned means comprising a lifting cam and means for disengaging the power from said lifting cam during the retarded discharge.

25. In combination with an automotive vehicle, a chassis lubricating system comprising a spring discharged pump, a piping system communicating therewith having flow controlling outlets so correlated with the pump as to substantially re-

tard free discharge thereof, said pump being of discharge capacity in excess of the resilient capacity of the line so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets, and means actuated by said power derived in the normal operation of the vehicle to stress the pump spring and charge the pump preparatory to the retarded discharge thereof, said last mentioned means comprising a ratchet and means for disengaging said ratchet from said power source during said retarded discharge.

26. A chassis lubricating system for a vehicle with spring shackles including a pump with a piston, and means for intermittently energizing said pump by a step by step action from said vehicle, said pump energizing mechanism including a rotary cam operatively connected to the pump piston, a pawl and ratchet mechanism for actuating the cam and linkage connecting said ratchet mechanism with said spring shackles, said system including a branched piping arrangement with a plurality of drip plug outlets to the chassis bearings to be lubricated and said pump being of discharge capacity in excess of the resilient capacity of the piping arrangement so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets.

27. In a lubricating system for the chassis of the vehicle, the combination of a source of pressure comprising a reciprocating spring-retained piston pump for feeding lubricant into said system and means controlled from a part of the vehicle performing an oscillating movement in the normal operation of the vehicle, and reciprocating actuating means actuated by a direct mechanical connection with said oscillating means to effect successive charging strokes of said piston, simultaneously stressing said spring and then at the end of said charging stroke effecting release of said spring, whereby a discharging stroke is caused, said discharging resulting in a periodical emission of a definite charge of lubricant, said system including a branched piping arrangement with a plurality of drip plug outlets to the chassis bearings to be lubricated and said pump being of discharge capacity in excess of the resilient capacity of the piping arrangement so that it cannot complete discharge until a substantially equivalent quantity of lubricant passes the outlets.

28. An automatic pump arrangement for a central chassis lubricating system, comprising a reservoir, a cover for the reservoir, a pump, a piston rod, a supporting bracket with spaced arms extending above said cover, a cam carried in said bracket and coacting with said rod to operate said pump, and a reduction mechanism including reducing gear wheels, a ratchet wheel, a pawl for operating said ratchet wheel and a jiggle weight mechanism for operating said pawl, said mechanism comprising a pair of arms pivoted at the sides of said bracket, a weight mounted upon the free end of said arms and beyond said bracket and a compressed coil spring between said weight and said cover sustaining said weight, said ratchet wheel and said gear wheels being supported in said bracket and being positioned on opposite sides of said cam.

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