March 19, 1935. J. BIJUR 1,994,460

LUBRICATING SYSTEM AND APPARATUS

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FIG. 1.

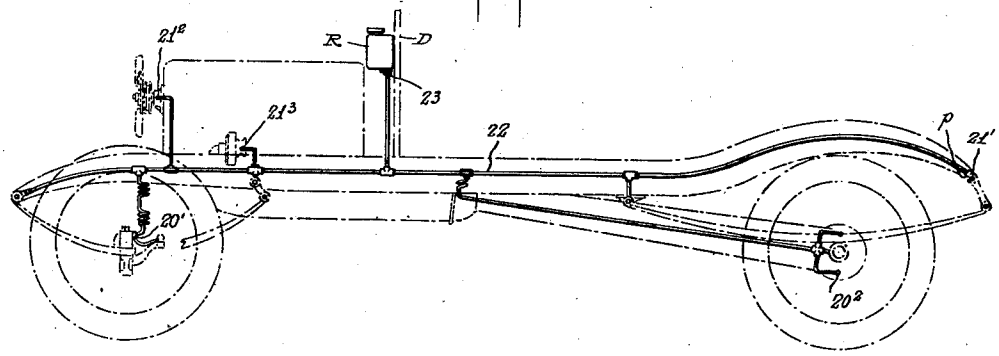


FIG. 2.

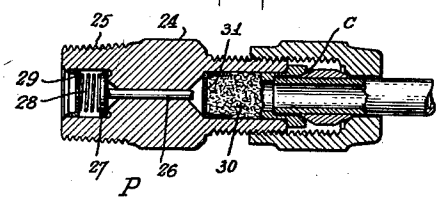


FIG. 6.

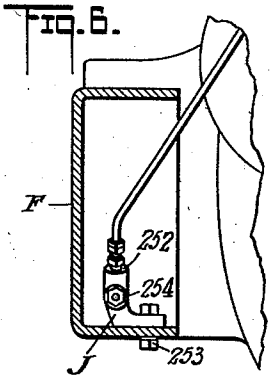


FIG. 3.

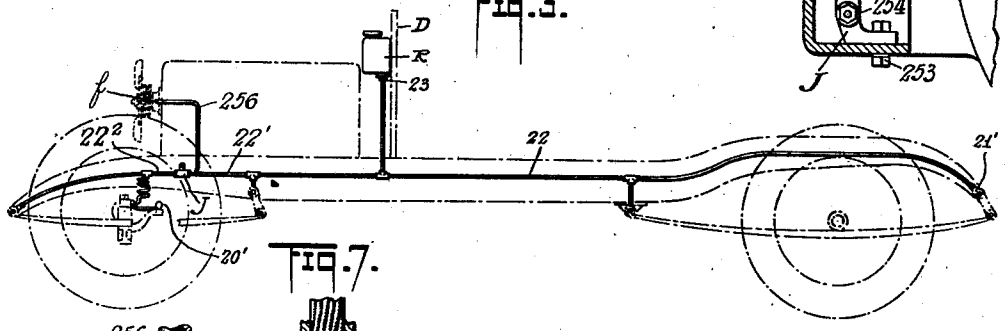


FIG. 7.

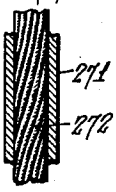


FIG. 5.

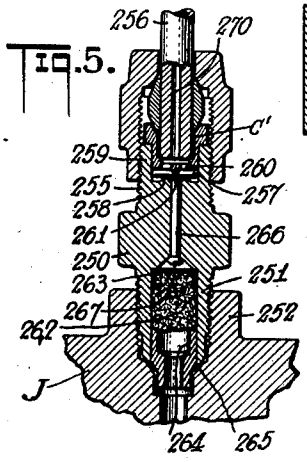
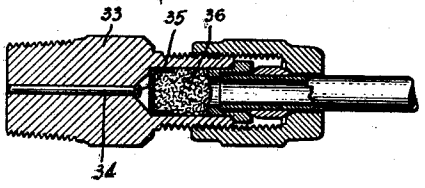


FIG. 4.



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LUBRICATING SYSTEM AND APPARATUS

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Fig. 8.

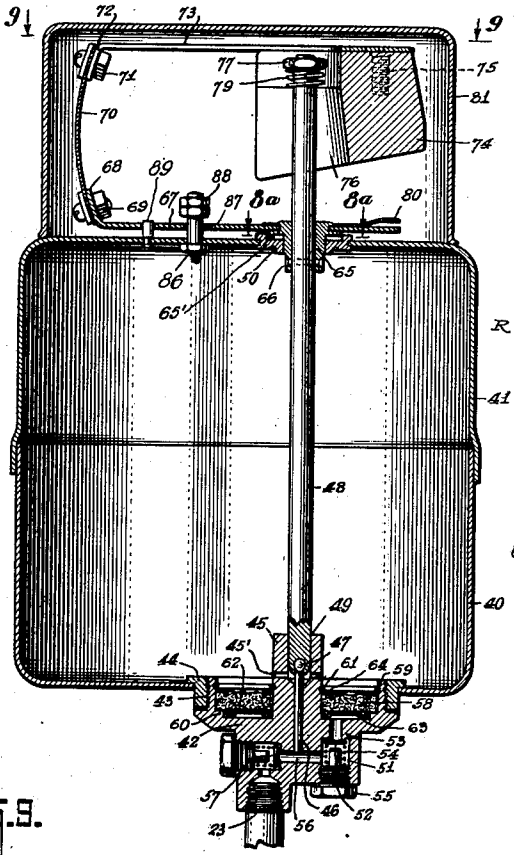


Fig. 8a.

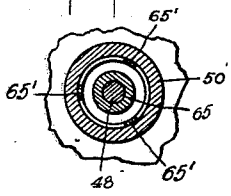


Fig. 9.

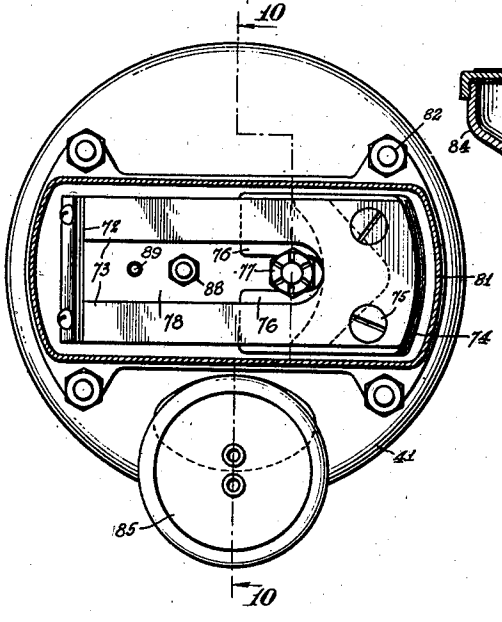
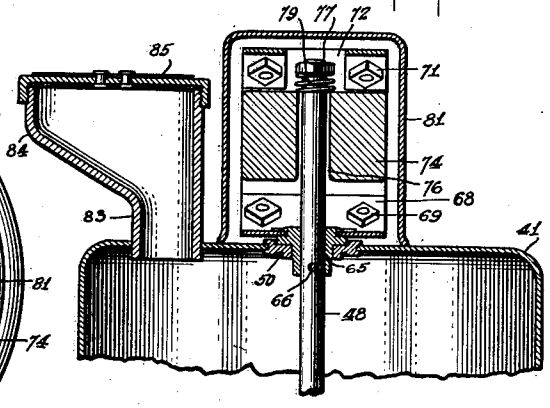


Fig. 10.



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LUBRICATING SYSTEM AND APPARATUS

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Fig. 11.

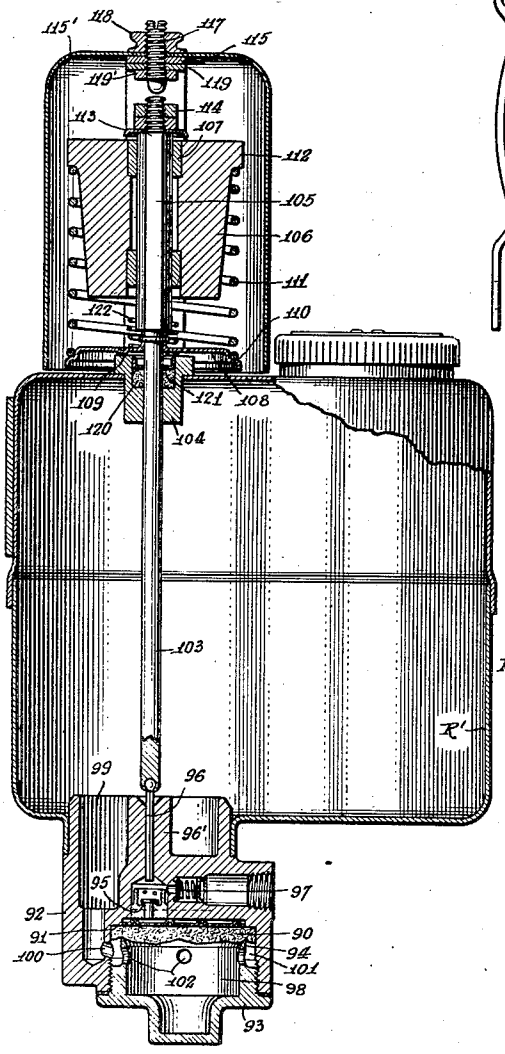


Fig. 12.

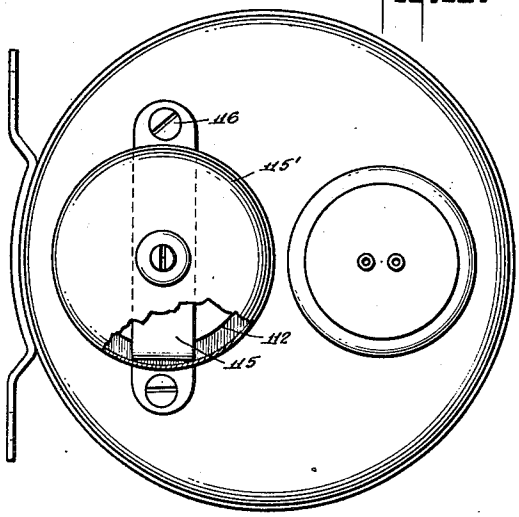
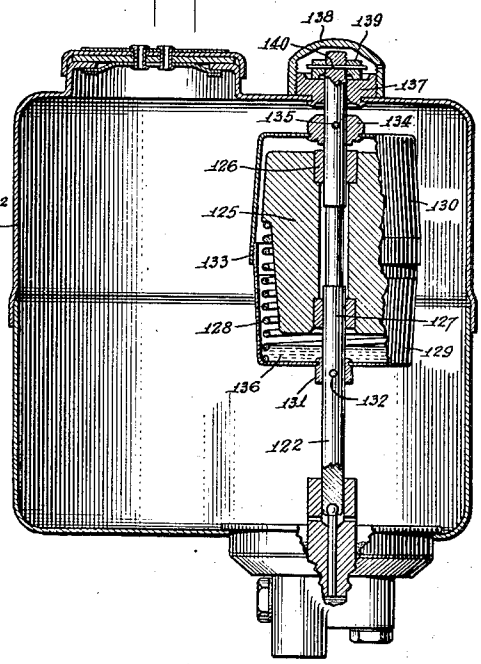


Fig. 13.



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LUBRICATING SYSTEM AND APPARATUS

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FIG. 14.

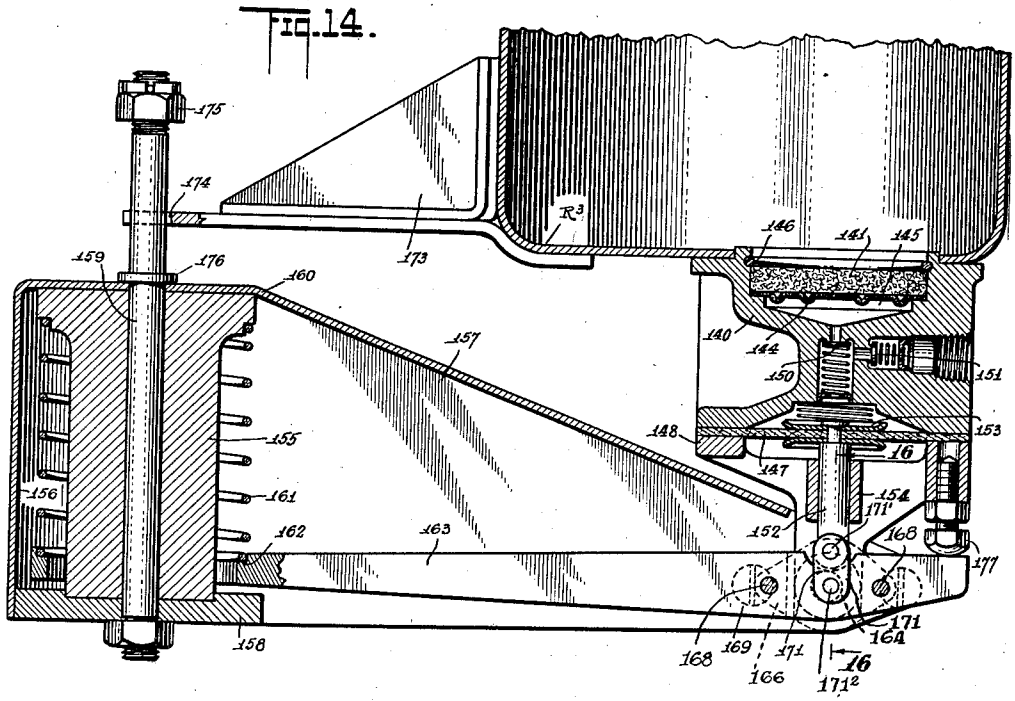


FIG. 15.

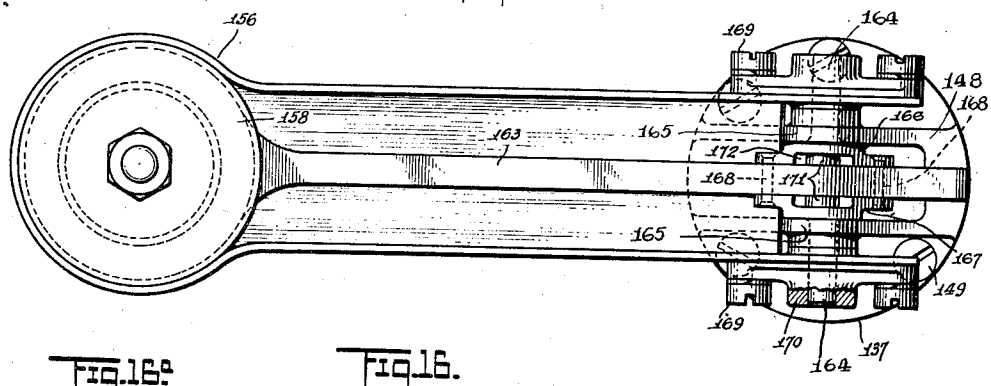


FIG. 16a.

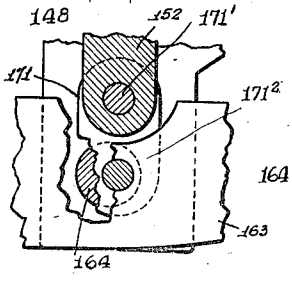
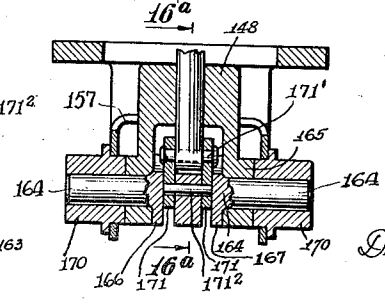


FIG. 16.



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LUBRICATING SYSTEM AND APPARATUS

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Fig. 17.

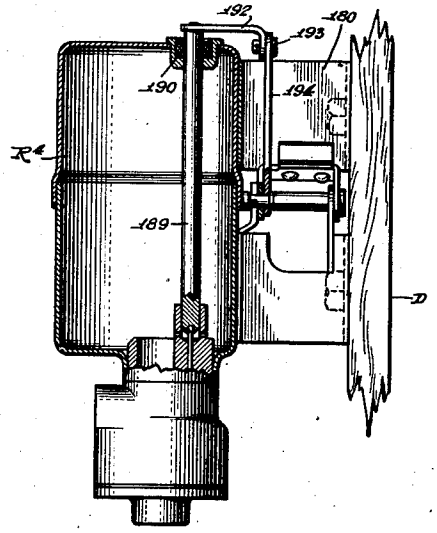


Fig. 18.

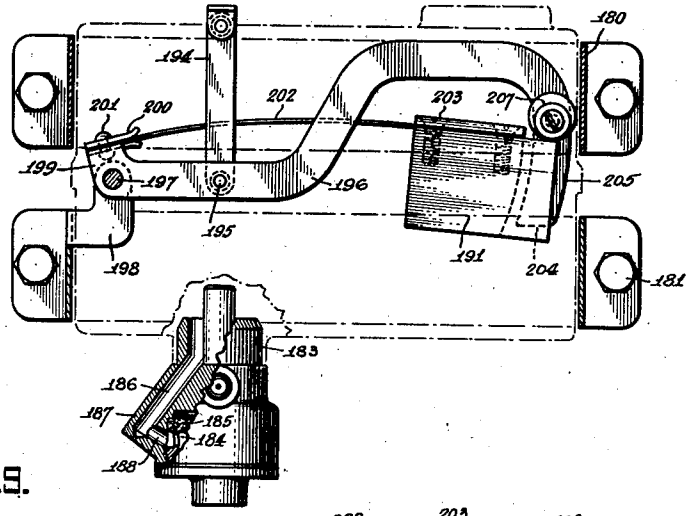
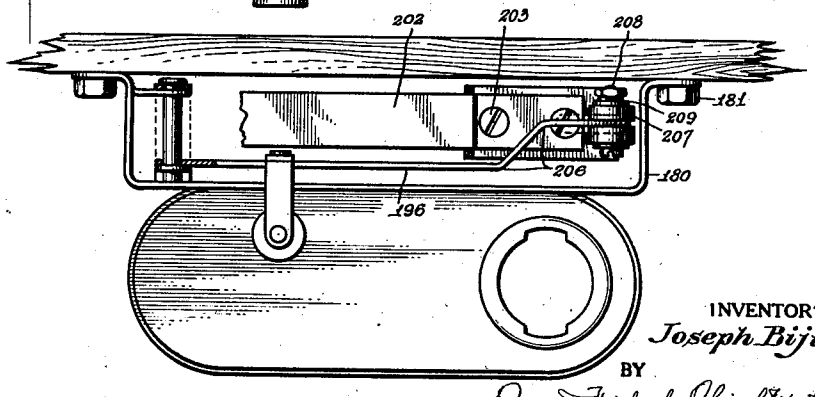


Fig. 19.



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LUBRICATING SYSTEM AND APPARATUS

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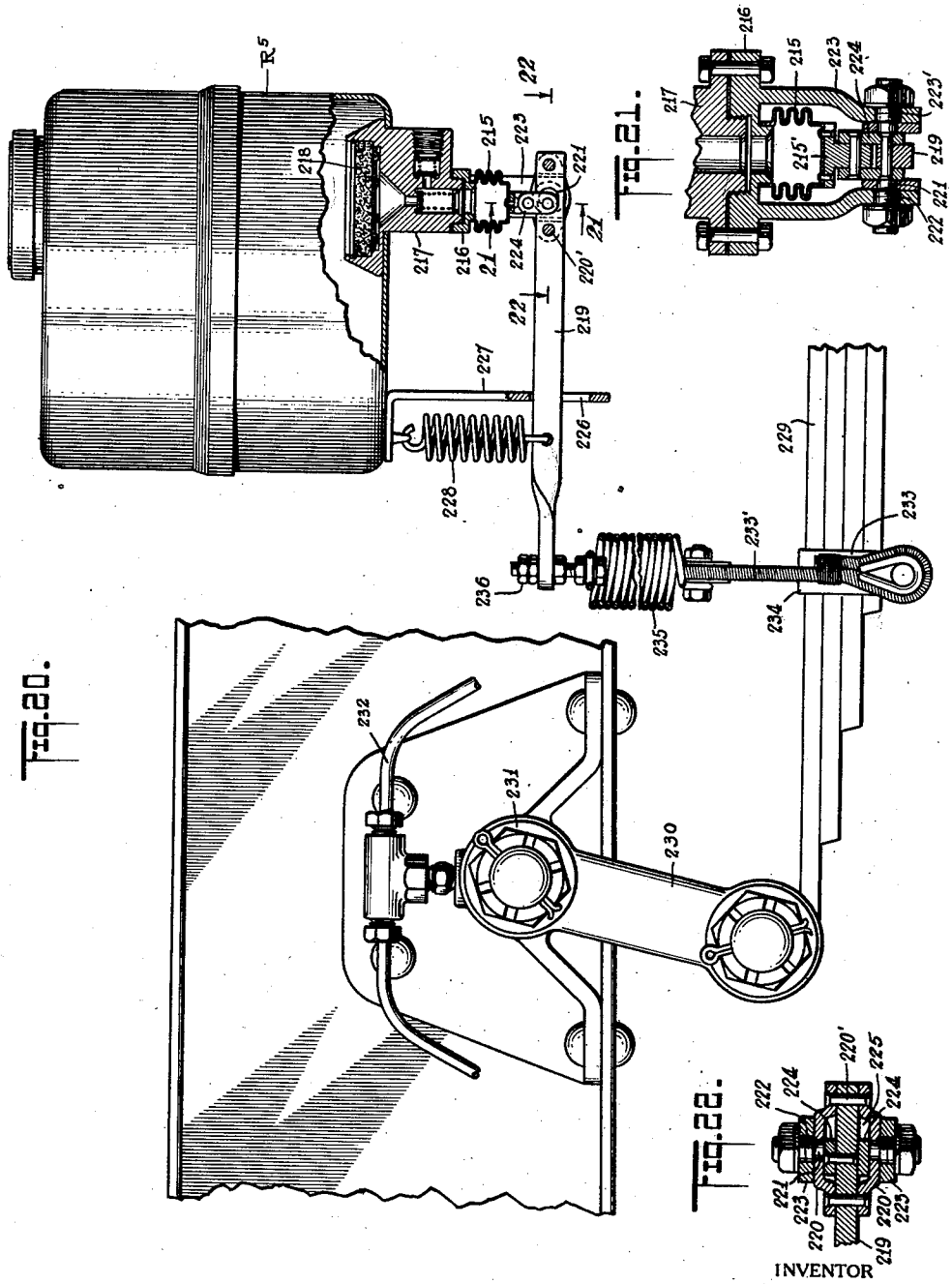

Fig. 20.

Fig. 21.

Fig. 22.

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Patented Mar. 19, 1935 1,994,460

UNITED STATES PATENT OFFICE

1,994,460

LUBRICATING SYSTEM AND APPARATUS

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

Application June 15, 1928, Serial No. 285,526

63 Claims. (Cl. 184—7)

My present invention is concerned with central lubricating installations and parts thereof, of type useful for chassis lubrication.

It is among the objects of the invention to provide an installation of the above character, serving to supply clean lubricant to the chassis bearings substantially continuously and automatically and in accordance with requirements throughout the movement of the vehicle and by which the feed of lubricant to the bearings is arrested at other times and objectionable drainage or loss from the system is avoided.

Another object is to provide an installation of the above type in which, using the same grade of oil throughout the changing seasons and without the need for any special precautions or adjustments, approximately the same feed to the bearings is maintained without over-oiling in hot weather or underoiling in cold.

Another object is to provide an automatically operating lubricant supply device or installation, which lends itself readily for use with a branched distributing and outlet control system, of the general type disclosed and claimed in my prior Patent No. 1,632,771 of June 14, 1927.

Another object is to provide a supply installation for feeding lubricant under pressure at substantially uniform rate into the distributing piping, said installation being wholly apart from the revolving mechanism of the engine or vehicle, yet functioning in the course of normal vehicle operation by impulses automatically applied thereto without the exercise of conscious attention on the part of the operator.

Another object is to provide a supply installation of the above type, embodying a pump guarded by efficient filtering means and readily adjustable in effective volume and in which the full pump pressure is rendered available for application to the distributing system.

Another object is to provide a supply installation of the above type, wholly devoid of reduction gearing or other complicated mechanism, for efficiently utilizing energy derived by the usual vibration of the vehicle in normal operation thereof, to feed lubricant at the required rate under pressure, without objectionable increase of lubrication due to the greater vibration in operation on rough roads or at high speeds.

According to the invention, the supply device embodies a force pump by which successive small charges of lubricant are forced at short intervals, to a distributing piping system of the character referred to, having highly restricted calibrated outlets. The pipe line is thus maintained under pressure, by which the lubricant is forced through the restricted outlets in proportions determined by their ratings. In spite of the enormous change in the viscosity of the oil due to temperature changes, the feed to the bearings is maintained relatively constant and is determined by the volume delivered by the pump. In summer, the oil being fluid, escapes through the outlets without giving rise to much back pressure. As the viscosity of the oil increases, the escape through the outlets is accompanied by a rise in back pressure, until in cold weather, the maximum pressure attained in the pipe line might be 100 times as great as that prevailing in the line in summer.

The pump is preferably embodied in a unitary structure at the bottom of a lubricant reservoir and may be either of the plunger or of the diaphragm type.

In the former type of construction, a plunger of small diameter is used, so that by the application of a small operating force thereto, the pressure exerted in the piping system may be caused to rise to a hundred pounds or more per square inch, sufficient to maintain the constancy of emission when the oil has become quite viscous in cold weather. Where a pump of the diaphragm type is used of an area, say in the order of one square inch, equivalent high pressures are exerted by applying the small actuating force at the end of a lever having a long power arm and an extremely short work arm.

Among various sources of power for pump actuation, I have shown modes of utilizing vibratory energy developed in vehicle travel. The vibratory impulses may be applied to the pump from an associated oscillating or swinging mass set into motion under the vibration of the moving vehicle, or by direct mechanical connection of the pump to a vibrating part, such as the axle, vehicle spring or shackle. A pump of minute effective volume is employed to give the proper charge under the high periodic frequency imposed by the vibrating operating agency.

A feature of the invention is the oscillatory or jiggling operating mass mounted to strike a part connected with the pump for operating the latter in one stroke thereof, and to apply its weight for effecting the return stroke of the pump, through a resilient body, such as a coil spring, which preferably carries the mass. The jiggling mass has an amplitude of vibration considerably in excess of the stroke of the pump operating element actuated thereby. Appropriate, preferably adjustable stops are provided for the latter, so that the full stroke thereof is exercised even in

normal operation of the vehicle on smooth roads and no excessive lubrication occurs in propulsion over rough roads.

Preferably the pump discharge is effected by the weight stroke of the mass, and the charging stroke by the swing of said mass in opposite direction. Due to the use of a long tightly fitting pump piston, and the relative speed of the upstroke thereof, leakage past the piston is negligible in comparison to the suction applied, so that the use of an inlet check valve and a dense filter interposed in the course of oil-flow from the reservoir to the pump is feasible.

The operating mass may be mounted for reciprocation along the pump rod. The access of chassis lubricant to the bearing surface of the oscillating mass and subsequent drying of the oil or deposit of dust, tends to damp the free vibration of the mass. Even though mounted exteriorly of the reservoir, the mass is protected by appropriate barriers to prevent oil creeping thereto from the reservoir. Alternatively the mass may be completely enclosed in a larger lubricant tight casing, of length sufficient to permit the oscillating movement of the mass therewithin, said casing with its enclosed mass being mounted wherever convenient, preferably within the lubricant reservoir.

In another application, the operating mass may be affixed relative to a leaf spring, thereby swinging without the use of a sliding or rocking bearing. In the accompanying drawings in which are shown one or more of various possible embodiments of the several features of the invention:—

Fig. 1 is a side elevation of one form of automobile chassis installation, indicating diagrammatically the position of the reservoir and the outlets,

Fig. 2 is a cross-sectional view on a larger scale of a preferred form of drip plug or other controlling outlet,

Fig. 3 is a view similar to Fig. 1 showing another arrangement of chassis installation,

Fig. 4 is a cross-sectional view showing a desirable form of outlet or drip plug suitable for the embodiment of Fig. 3,

Fig. 5 is a view in longitudinal cross-section showing a reverse drip plug for the embodiment of Fig. 3,

Fig. 6 is a fragmentary detail showing a mount for a reverse drip plug,

Fig. 7 is a fragmentary detail section on a larger scale showing an alternative construction of restriction pipe,

Fig. 8 is a view in longitudinal cross-section of a preferred form of automatic lubricant reservoir,

Fig. 8*a* is a detail section on line 8*a*—8*a* of Fig. 8,

Fig. 9 is a view in transverse cross-section taken on line 9—9 of Fig. 8,

Fig. 10 is a fragmentary detail view in transverse cross-section taken on line 10—10 of Fig. 9,

Fig. 11 is a view similar to Fig. 8 of an alternative embodiment,

Fig. 12 is a top plan view of the embodiment of Fig. 11 with parts broken away and shown in section,

Fig. 13 is a view similar to Fig. 11 of another embodiment,

Fig. 14 is a fragmentary sectional view on a greatly enlarged scale of a further alternative embodiment,

Fig. 15 is a bottom plan view of the embodiment of Fig. 14,

Fig. 16 is a sectional view taken on line 16—16 of Fig. 14,

Fig. 16*a* is a detail section on a larger scale taken on line 16*a*—16*a* of Fig. 16,

Fig. 17 is a view in vertical section of another embodiment,

Fig. 18 is a rear elevation of the embodiment of Fig. 17 with parts broken away and in section,

Fig. 19 is a top plan of the embodiment of Figs. 17 and 18,

Fig. 20 is a view in longitudinal cross-section of a still further embodiment of the invention,

Fig. 21 is a sectional detail on line 21—21 of Fig. 20, and;

Fig. 22 is a detail section on line 22—22 of Fig. 20.

Referring now to the drawings, I have shown diagrammatically at Fig. 1, the elevation of a motor vehicle embodying chassis bearings at substantial differences of level, the knuckle bearing 20′ or rear torque arm bearing 20^2, for instance, being at lowest level and the shackle bearing 21′, the fan bearing 21^2 and the water pump bearing 21^3, for instance, being at various levels from 12 inches to 2 or 3 feet higher. The piping system 22 has an inlet 23 which may be at the dashboard D and leads along structure of the vehicle to various bearings thereof. To prevent the drainage of lubricant through a lower bearing while the vehicle is idle, with the concomitant entry of air at a higher bearing, relief or check valves are provided on the drip plug outlets P. While drip plugs, such as those of my prior Patent No. 1,632,772 are suitable, I have shown an improved drip plug construction, which will now be but briefly described, since it is not claimed herein.

The drip plug comprises a fitting 24 with a threaded end 25 for application at the bearing. High resistance to flow is determined by a pin 26 nearly filling a longitudinal bore in the fitting. A valve 27 preferably at the outlet is pressed against its seat by a spring 28 which reacts against a cup 29. A strainer plug 30 of wool felt at the inlet of the fitting, provided with a backing 31 of wire mesh, intercepts any solid particles that might otherwise become lodged at the valve seat or in the restriction crevice determined by the pin. A suitable compression coupling C serves for connection of the pipe end to the drip plug. The diameter of the pin determines the rating of the fitting, and in operation, the drip plugs, accordingly, proportion the distribution to the bearings under operating pressure.

At the inlet to the pipe system, I have diagrammatically indicated a source of lubricant and pressure R which may be of any of a wide variety of special constructions, illustrative examples of which are indicated in Figs. 8 to 22 of the drawings to be hereinafter described.

In Fig. 3 I have illustratively shown a type of chassis in which the difference in level between various bearings 20′, 21′, etc. is quite little, in the order of but a few inches. For the lubrication of such installation, using the heavy lubricating oil found most suitable for the purpose and with substantial restriction of the drip plugs, the leakage of those of the drip plugs at nearly a constant level is either entirely eliminated or reduced to negligible proportions, even though such drip plugs be devoid of check or relief valves. Accordingly, the drip plugs, one of which is illustratively shown in Fig. 4, may be and preferably are devoid of the valves shown in Fig. 2. The drip plug fitting 33 in this relation is provided with a metering pin 34 headed as at 35 to be maintained

in place within the bore therefor, through the entire length of which the pin preferably extends, as shown. A strainer plug 36 is provided as in the embodiment of Fig. 2. The strainer thus not only prevents the crevice determined by the pin from clogging, but keeps the pin in place.

This satisfactory operation would however be impaired by leading lubricant from the system to one or more special bearings at level materially different from that of the majority of the bearings.

If for instance the elevated fan bearing *f* is lubricated from the system, through a valveless drip plug as in Fig. 4, the head of lubricant in the riser leading thereto might be sufficient to cause slow leak or drainage through some or all of the lower bearings, with consequent loss of lubricant, and disturbance in flow division thereafter.

On the other hand, a system including a drip plug of the type shown in Fig. 2 at the one elevated bearing and drip plugs of the type of Fig. 4 at the various other bearings at lower level, would be apt to become deranged, since an imperfection in the elevated drip plug valve, might permit entry of air thereat, with resultant drainage, from therebelow. In such system, moreover, even though the special valve or valves thereof, be entirely operative, lubrication of the higher bearing would occur only if pressure first built up in the distributing system to a valve, at least sufficient to open said valve. This would result in unreliable lubrication of the elevated bearing unless pressure were applied, at least sufficient to open said valve and this is inconsistent with the use of low pressures in warm weather, as hereinafter described.

According to my invention, a check valve of the loose or floating type is preferably disposed at the vehicle frame in the line to the bearing at special level, so that before any air could pass said valve into the parts of the system therebelow, all of the column of lubricant beyond said valve would first have to be sucked therepast.

Specifically, I have shown a fitting 250 having a pipe-thread nipple 251 screwed into a socket 252 of a junction J which is bolted at 253 to the interior of the channel frame F, and has pipe terminal sockets 254 of smaller diameter, to which the respective pipe segments 22′ and 22³ of the main are connected. The fitting 250 has a cylindrical thread 255 at the outer end to which the lower extremity of the riser conduit 256 is coupled. This coupling connection may be of the same construction as that of Fig. 2, including the hardened steel sleeve C′ against which the coupling sleeve re-acts.

The check valve is preferably a disk 257 of light flexible oil-resistant material, arranged to rest on a seat 258 formed in the base of the socket 259, which accommodates the coupling sleeve C′. The hardened sleeve C′ preferably has an open spider construction 260, at the inner end presenting a central protrusion 261 adjacent the valve seat and limiting the deflection of the valve from its seat. In a socket at the nipple extremity 251 of the drip plug, which in this case, is the inlet thereto, I provide a strainer, preferably a felt strainer wad 262 backed by a wire mesh cup 263 as in Fig. 2. The strainer is kept in position by a hollow end plug 264, lodged snugly in the strainer socket, engaging the end of the felt plug 262 at the periphery thereof and maintained in position by rolling the edge 265 of the fitting socket thereover.

While the flow restriction for the elevated bearing, may be in the length of the riser conduit, or at the bearing outlet thereof, I prefer to embody it in the same fitting as the valve just described. For this purpose, a calibrated restriction pin 266 as in Figs. 2 and 4, may be disposed in a longitudinal bore of the fitting, extending between the valve 257 and the strainer 262. The pin has a head 267 at its lower end to prevent it from sliding upward and possibly injuring the valve 257.

The drip plug described, thus feeds from the mount therefor, outward through a delivery pipe leading therefrom, a direction of feed the reverse of that of Fig. 2. Accordingly, I have designated the drip plug of Fig. 5 a reverse drip plug.

The riser conduit to the fan or other elevated bearing has a very fine bore 270 shown exaggerated in the drawings, thereby to reduce the volume of such pipe to the utmost. In a practical embodiment, it is a pipe with a bore of about 1.5 mm. diameter, and, therefore, an effective volume of .54 c. c. per foot of length, equal to about ten drops of the preferred chassis lubricant when at room temperature.

In practice, the pipe lines are all completely filled with lubricant before the vehicle leaves the factory. Should the riser pipe become injured and have to be replaced in vehicle use, such empty riser, by reason of its very small volume, would promptly fill with lubricant, which would then reach the bearing, following drip plug discharge, after but a short period of vehicle use. The small bore of pipe 256 in view of its substantial length, affords a considerable resistance to flow, and the flow retarding effect thereof can be readily compensated for by selection of a drip plug restriction of appropriate rating.

Instead of a pipe of small diameter, as shown in Fig. 5, equivalent small volume would be attained by the riser pipe 271 of larger diameter, filled with a snugly fitting core 272 of twisted strands of wire or cord as indicated for instance in Fig. 7, the effective volume being determined by the interstices between the wire filler and the pipe bore.

In operation, any tendency of the distributing system to leak through one or more of the outlets thereof, would result in corresponding tension on the light valve 257, which would thus be urged to its seat 258. The valve 257 is submerged in oil by the substantial length or column of lubricant thereabove, thereby providing not only an oil seal but a substantial head of oil resting upon and tending to seat the valve. Substantially, all of the lubricant within the length of the riser pipe would have to be drawn past the valve, by the suction engendered in an incipient leak, before air could enter and this is practically precluded, so that leak is inhibited. The oil, moreover, tends to stay in the riser pipe due to the capillarity of its small effective bore.

The principle of the system shown in Figs. 3 to 7 is, of course, applicable in relations in which more than one isolated bearing is at a level substantially different, either higher or lower, than that of the majority of the bearings, and in which some bearing is higher and another bearing is lower than the remainder of the bearings, the check valve being in each instance, preferably disposed at the inlet end of the conduit leading to the higher or to the lower bearing, as the case may be.

In Figs. 8, 9 and 10 of the drawings, is shown a lubricant supply installation, embodying a pump of the jiggle-mass operated type. The

reservoir R has base and cover sections 40 and 41 soldered together at their rims. In the bottom of the reservoir is mounted a lubricant pump unit comprising a casting, forging or machined piece 42 threaded at 43 into a collar 44 extending through and soldered into the base of the reservoir. A central upstanding boss 45 of said unit constitutes the cylinder of a small-diameter pump having a close fitting metal pin plunger 46 longitudinally therethrough, connected by a ball and socket joint 47 to a vertical pump operating rod 48 guided at its lower end in a corresponding bore 49 at the top of boss 45 and extending upward through a guide bushing 50 in the cover of the reservoir.

The pump rod has a collar 65 near its upper end riveted thereto as at 66 and this collar has a slide bearing in the bushing 50.

The unit has a cage 51 for an inlet check valve 52 retained against its seat 53 by a coil spring 54 which reacts against a closure plug 55. A transverse bore 56 near the lower end of the unit provides communication from the check valves to the lower end of the pump cylinder and also communicates with a check valve 57 similar to valve 52 but arranged to open under pump pressure, in order to establish communication with the outlet 23 which leads to a piping system which is shown in Figs. 1 to 4. Illustratively, the outlet valve 57 extends in a horizontal cage and the outlet 23 extends through the bottom of the unit.

The operating parts are protected from dirt or other solid particles in the oil by a filter ring 58 preferably of dense wool felt encircling the pump boss 45 and lodged within an annular basin in the unit and above the valves 52 and 57. The outer periphery of the felt ring is pressed by a split ring 59 against a unitary peripheral ledge 60 in the unit. The inner periphery of the felt ring is similarly pressed inward by a split ring 61 about the boss 45. The entire area of the felt is maintained effective for filtering purposes, by means of a backing sheet 62 of wire mesh, provided with appropriate spacing ridges 63. For effective application of the pressure, through the split rings 59 and 61, washers 64 of metal are pressed thereby into the upper face of the felt.

In the construction shown, the jiggling instrumentality comprises a metal plate 67 secured to collar 65 preferably by flanging over the upper edge of said collar thereagainst. To the upstanding outer edge 68 of plate 67 is bolted at 69 the lower end of an upstanding leaf spring 70, to the upper end of which is bolted at 71 the downturned edge 72 of a second horizontal metal plate 73. An inertia mass 74 is secured by screws 75 against the lower face of plate 73 and at the outer end thereof. This mass, as shown, comprises a metal block 74 having a pair of integral heel pieces 76 straddling the upper end of the rod 48 and adapted to engage at their upper faces, a nut adjustably threaded upon the extremity of the pump rod 48. Plate 73 is bifurcated to provide a slot 78 through which adjustment of the nut may be conveniently effected. A coil spring 79 encircling the rod 48 is preferably interposed between the mass and the nut to ease the shock in the upward stroke of the mass and an upturned leaf spring 80 in plate 67 similarly eases the shock of the downward stroke of the mass 74. The mass and the yielding mount therefor, preferably occupy a generally rectangular space and are enclosed in a corresponding rectangular box or cover 81 diametrically across the top of the reservoir and bolted thereto at 82.

The filling neck for the reservoir is disposed, as shown, laterally of the operating box 81, at an oval aperture in the cover 41. The neck comprises a specially shaped fitting 83 soldered into the aperture and widened at 84 to provide a circular filling opening which may be closed by a removable cover cap 85.

A bolt 86 through the casing top extends through a somewhat larger aperture 87 in the plate 67 and has a stop nut 88 thereover, for limiting the rise of the plate 67 preferably to a stroke in the order of $\frac{1}{16}$ inch. With a pump plunger of $\frac{3}{16}$ inch diameter, the effective pump charge would thus be in the order of about one drop. By adjustment of nuts 88, the length of the pump stroke may be adjusted. To prevent small pivotal displacement of the plate 87 and the jiggle mass assembly, about the rod 48, a stud 89 in the top of the case extends into a corresponding small hole in the plate 87 near one of the ends thereof, as shown.

In the operation of the vehicle over ordinary roads, smooth or otherwise, the mass 74 will oscillate continuously with the flexure of the leaf spring 70. In an upward stroke of sufficient amplitude, the heels 76 of the mass will lift the pump piston rod 48 through the nut 77 and the interposed spring 79. With the rod 48 will rise the collar 65 which is riveted thereto. The entire yoke made up of the plates 67 and 73 and the intervening leaf spring 79 is thus raised until it is arrested by the impact of plate 67 thereof against nut 88. The pump piston is thereby correspondingly raised and draws in a corresponding minute charge of lubricant past the filter 58 and the inlet valve 52.

The weight of the mass 74 and the inertia in its downward swing under the return of the stressed leaf spring 70 tend to propel the pump rod downward and to discharge the pump until the collar 65 has reseated on bushing 50, as shown in Fig. 8. Any lubricant within the upper part of the boss 45, will pass back into the reservoir through ports 45′ and only the lubricant in the small diameter bore for plunger 46 is forced into the pipe line.

To prevent sticking of collar 65 against bushing 50, the collar is undercut at its lower face, and the flange thus formed is interrupted to provide illustratively three lugs 65′ upon which the collar seats in the bushing.

The pump operating device has no bearings to wear or to require lubrication. Thus, the mass is so sensitively supported, that it will oscillate through a substantial stroke much greater than that to which the pump plunger is limited. In the up-stroke, momentum is, accordingly, accumulated in the mass, before the impulse thereof is applied to the plunger rod, and in the down stroke, the resilience of the spring assists the weight of the mass to similarly enhance the effectiveness of the pump discharge stroke.

In order to minimize variation in pumping effect due to road inequalities, I arrange that the small bumps occurring at frequent intervals on a good road should as nearly as possible be as effective to cause upstrokes of the piston as are the larger bumps of a bad road. By arranging that the mass 74 should be sensitive and by limiting the maximum stroke of the pump to a very small lift, such small lift will occur with considerable frequency even on smooth roads. Where the upward swing of the vehicle happens to coincide with the upward swing of the mass, the mo-

mentum imparted to the latter is sufficient to lift the piston.

The amplitude of vibration of the sensitive mass is considerable even when the vehicle is moving slowly along a smooth and level road, more than sufficient to cause the limited short stroke of the pump. On rough roads and at greater speeds, the mass may swing through a path of wider amplitude, but the pump stroke may be neither longer nor much more frequent. Only the cushioned impact of the mass against spring 79 and spring 80 will be increased.

Were the mass rigidly attached to the plunger rod, there would be little or no lubrication, as no effective oscillation would occur on smooth roads. On rougher roads, lubrication would be spasmodic and irregular and occur substantially only when the mass is jounced up, as a consequence of travel over a rut.

The pump plunger being of minute diameter, say $\frac{1}{8}$ inch, or of a cross-sectional area, roughly .004 square inches, a weight of only one pound will produce a pressure of 250 pounds per square inch upon the oil-filled pipe line, assuming that the substantially oil-filled pipe system and the drip plugs impose such high resistance to the lubricant flow as to permit that pressure to be developed.

Due to the use of a long tightly fitting pump piston and the relative speed of the up-stroke thereof, leakage past the piston is negligible, and the suction is effectively applied to open valve 52 and to flex the filter 58. The mass functions throughout in effecting pump discharge, except only for the relatively short intervals during which the quickly executed suction strokes occur.

Where the same grade of oil is employed, throughout the year, its viscosity in severe winter weather is likely to be at least 100 times as great as in normal summer heat. With the use of a pump, such as that just described, which forces frequent small charges, in the order of a drop or less, of lubricant into the system, the pressure in the pipe line will vary in a direct ratio with increase in resistance to flow of the oil. With highly viscous oil, as in severe winter weather, the pressure will rise to a value in the order of 100 times as great as when the oil is of low viscosity. Accordingly, the range of pressure in the system may be from 0.5 to 3 pounds in warm summer weather to 50 to 500 pounds in winter. In the system of Figs. 3 and 4, where no relief valves are employed, the effective pressure at each outlet will depend closely on the resistance or viscosity of the oil. In the system of Figs. 1 and 2, embodying relief valves, the latter should seat under light pressure, sufficient both to prevent ingress of air and to prevent escape of lubricant under the relatively small differences of head usually found. With the pump capacity suitable to the bearings, the restriction of the drip plugs should be such that even with the thinnest oil provided, the pressure in the pipe line should materially exceed that seating the valves.

Even though the system be operated for prolonged periods, with an empty reservoir, the pump would not force air into the pipe system, since air would readily leak about the packingless pump plunger, back into the reservoir. Preferably, a visible or audible signal is provided to apprise the user of the need for refilling the reservoir.

In the modified form of Figs. 11 and 12 is shown a pump unit in which the lubricant is drawn upward past the filter disk 90. The latter is pressed against a shoulder 91 in the lower face of the pump unit 92, by means of the flange 94 of a closure cap 93, which compresses the rim of the felt 90. The intake valve 95 is arranged above the filter and immediately below the pump plunger 96 while the outlet valve extends laterally therefrom as at 97. The pump plunger 96 protrudes above the cylinder boss 96' therefor, so that no enlarged bore for the plunger rod 103 is required in said boss.

The lubricant is admitted from the reservoir R' to a cavity 98 within the closure plug and below the felt strainer, by way of a well or passage 99 communicating through ports 100 immediately below the felt, to an annular space 101 about the flange 94, which latter has a plurality of perforations 102 through which the lubricant enters the cavity 98. In the suction stroke of the pump, lubricant is, accordingly, drawn upward past the strainer 90 and the intake valve 95 into the pump cylinder. The arrangement of filter disclosed, has the advantage that dirt or sediment intercepted by the lower surface thereof, will drop therefrom into the bottom of the plug 93 without tending to clog the filter. The filter disk is conveniently removable and replaceable, as will be apparent.

In the present embodiment, I have illustrated another type of mass-actuating means for the pump. The pump piston rod 103 here extends through a bushing 104 in the cover of the reservoir and has mounted near the upper end thereof, a hexagonal sleeve 105 of hardened steel. Encircling said rod is a metal mass 106 having bushings 107 in the bore thereof, preferably also of hardened steel, with sliding fit on the rounded edges of the hexagonal sleeve. Rigidly crimped about the piston rod is a sheet metal ring 108, preferably provided with a few circularly arranged dents 109 normally resting on the upper flange of the bushing 104 and provided with a peripheral shoulder 110 for sustaining the lowermost turn of a coil spring 111 upon the upper turn of which rests the flange 112 of the mass 106, the length of which is tapered to avoid interference with the turns of the spring. A metal washer 113 encircling the threaded outer end of the rod 103 is pressed by means of nuts 114 against the upper end of the hardened hexagonal sleeve 105. A metal strap 115 is preferably secured by screws 116 to the top of the reservoir and has a central rounded screw stud 117, which serves as a stop for the upper end of the piston 103. Stud 117 may be screwed inward or outward by turning nut 119 to adjust the length of the pump stroke, and the lock nut 119' prevents the stop from shifting or loosening. Preferably a hood 115' held in place by nut 118 encloses the oscillating mass and the strap 115 to protect these parts from dirt and water.

The washer 108 serves not only as the support for the spring 111 and mass 106 and the means for transmitting the impulse of said mass to the pump, but performs the additional function of preventing the creepage of oil from the piston rod or from the interior of the reservoir to the surface of the hexagon rod bearing 105. Damping of the movement of the mass due to a dust film adhering to the oily hexagon bearing 105 is thus avoided. Preferably, the bushing 104 is provided with a gland 120 backed by means of a cap 121 for further security in preventing the escape of any lubricant to the hexagon sleeve.

A small coil spring 122 encircling the rod, above the washer 108, serves as a cushioning stop to prevent too vigorous impact of the mass thereagainst.

The operation is analogous to that of the embodiment of Figs. 2 to 10. The mass in its upstroke will gain momentum, and lift the washer 113 and with it, the piston rod 103 and the attached plunger 96, until the upper end of the rod becomes arrested at the lower rounded end of the screw stud 117. In the return stroke, the weight of the mass 106 is transmitted through the spring 111 and the washer 108 to cause the pump 96 to discharge.

In the present embodiment, as in that previously described, the excursions of the mass are of range considerably wider than the stroke of the piston, the latter being limited by the contact of the piston rod with the stop 117, at one end and by the contact of the washer 108 with the bushing 104 at the return.

In the embodiment of Fig. 13 is shown a modification in which a sliding mass 125 is also employed. The latter is completely enclosed to keep chassis oil from the sliding surface, for reasons pointed out in the description of the embodiment of Figs. 8 and 9. By enclosing the mass, the same may be disposed within the lubricant reservoir R^2, as shown. The pump unit may be like that of Fig. 8, or that of Fig. 11.

The mass 125 has bushings 126, which in this case, may encircle the ordinary pump rod 122. The mass rests on a coil spring 128 supported upon the lower cup 129 of the weight enclosing casing. Cup 129 has a bushing 131 crimped thereto, encircling the piston rod 127 and secured thereto by a rivet 132. The upper cup 130 of the enclosure is soldered at its rim 133 to the lower cup 129, and also has a bushing 134 crimped thereto and secured by a cross pin 135 to the rod 127 near the upper end thereof. Preferably, the lubricant tight enclosure has a small charge of a light lubricating oil 136, such as watch oil therein.

The upper end of the piston rod preferably extends through a bushing 137 crimped in place about the rim of a corresponding hole in the reservoir cover, and enclosed within a cap 138 screwed thereon. A nut 139 threaded upon the upper extremity of the piston rod 127 is locked in position by a cross pin 140 and normally rests upon the bushing 137.

The operation will be obvious, but it may be briefly noted that in its upstroke, the mass 125 will contact the bushing 134 and lift the piston rod 127 until the upper end of the latter strikes the cap 138. In the subsequent discharge stroke, the weight of the mass 125 reacts through the spring 128, cup 129, bushing 131 and piston rod 127 to depress the pump plunger, the latter stroke being limited by the engagement of the nut 139 with the upper surface of the bushing 137. The cap 138 is adjustable, as will be apparent to determine the length of the piston stroke.

In Figs. 14, 15 and 16 is shown another embodiment operating on the general principle of the embodiments above described, but utilizing a diaphragm instead of a plunger pump. The pump unit 140 is attached to the bottom of the oil reservoir R^3 and has a filter 141 with a backing 144 of wire mesh lodged in a corresponding basin 145 at the upper face of the unit and locked in place by a split ring 146. The periphery of a circular pump diaphragm 147 is clamped against the lower edge of the unit 140 by a clamp piece 148 attached to the unit by screws 149. The inlet valve 150 is lodged in a corresponding axial valve cage in the unit 140 between the filter 141 and the diaphragm 147, while the outlet valve 151 extends radially of the unit.

The diaphragm 147 is centrally riveted to a downwardly extending rod 152, the rivet reacting against a pair of metal plates 153 contacting opposite faces of the diaphragm to prevent excessive flexure of the central region thereof. The rod 152 is guided in a sleeve 154 cast as an integral part with the annular clamp construction.

The operating mass 155 is confined in the outer cylindrical conformation 156 of a sheet metal channel lever 157. A disk 158 is forced into the lower open end of the cylindrical conformation and a bolt 159 through the web 160 of the channel, the mass 155 and the disk 158 maintains these parts as a rigid unit. As shown, the web of the channel lever slopes so that the depth of the channel decreases toward the pivot end of the lever, the mount of which will be described below.

The mass is encircled by a coil spring 161, which rests in a corresponding socket 162 on the thrust transmission or operating lever 163. The transmission lever 163 has mounted at its inner end, a pair of gudgeon pins 164, which are supported in corresponding bearings 165 in the casting 148. The two gudgeon pins 164 are secured by anchor plates 166 and 167 respectively integral therewith, which are fastened to the operating lever 163 by rivets 168 extending transversely therethrough. The inner ends of the flank plates 157 of the mass carrying lever have screwed thereto as at 169 bearing plates 170 which are mounted upon the outer ends of the gudgeon pins 164.

The pump actuating impulse is transmitted from the operating lever 163 to the rod 152, through a pair of links 171 against the sides of the operating lever 163 and accommodated in the space 172 left by the corresponding curvature of the gudgeon anchor plates. The lower pivot of each of the links 171 at the pin 171^2 is but a small fraction of an inch (see the enlarged detail Fig. 16*a*), beyond and to the right of the center of the gudgeon pin 164 in order to provide a relatively enormous power multiplication say of 250 to 1, between the long work arm and the minute power arm of the operating lever 163.

Preferably a bracket 173 is secured to the reservoir R^3 and has a notch 174 through which the upper end of the mass mounting rod 159 extends, a nut 175 adjustably threaded at the extremity of the rod, limiting the downward stroke of the mass, while the shoulder 176 on the rod, by its engagement with the bracket arm, limits the upward stroke of the mass.

In operation, while the vehicle is running, the mass 155 will oscillate up and down, through a stroke limited by the engagement respectively of the flange 176 and the nut 175 with the bracket 173. On the up stroke of the weight 155 and downstroke of the pump, the disk 158 strikes the outer end of the operating lever 163 and carries the latter along with it until the shoulder 176 has struck the bracket 173. In this operation, as is apparent, the gudgeon pins 164 of the operating lever 163 pivot clockwise within bearings 165 in Fig. 16*a* and through the slightly eccentric mount of the links 171 move the pin 171^2 and the links 171 downwardly. Upon downstroke of the weight and upstroke of the pump, the left end of the lever 163 moves downwardly pivoting on the pins 164 and the pin 171^2 moves upwardly together with the links 171 until the right extremity of

lever 163 is arrested by contact with the head of the adjustable screw 177. The operating lever 163 having a ratio of say 250 to 1, the pressure exerted upon the diaphragm by a mass of one pound, will, if the drip plugs and pipe lines impose corresponding resistance, rise as high as 250 pounds. The deflection of the diaphragm by reason of the correspondingly great reduction in stroke, is, however, so minute that the discharge is in the order of only about one drop, as in the other embodiments.

In Figs. 17, 18 and 19 is shown another embodiment of lubricant supply construction, operating on the inertia or jiggle principle. In this embodiment, the operating mass construction is shown straddled by the reservoir mounting bracket 180, which may be secured by bolts 181 to the dashboard D or other convenient support.

The pump structure of the reservoir is substantially identical with that shown in Fig. 11. However, in this case I have illustratively shown a smaller neck 183 requiring a smaller opening in the reservoir bottom than in the case of Fig. 11, the inlet to the chamber 184 below the filter 185 being afforded by an outwardly diverging port 186 in a lateral plug 187 cast integral with the pump structure and communicating with said chamber 184 through an angular port 188 at the outermost part of bore 186.

In the present embodiment, the pump rod 189 extends upward through a gland 190 in the top of the reservoir R^4 and is caused to alternately rise and fall through impulse delivered by the mass 191 through an intervening transmission, which includes a horizontal bar 192 riveted to the upper end of the rod 189 to which is pivoted as at 193, a vertical pitman rod 194, the lower end of which is pivoted at 195 to an operating lever 196 which, in turn, is mounted on a pivot 197 near one end thereof in a lug 198 preferably blanked out from the bracket 180.

The lever 196 has a short heel 199 between jaws 200 on which is riveted as at 201, the end of a long leaf spring 202 to the outer end of which is screwed as at 203, the upper face of the mass 191 thereunder. The mass is bifurcated at its outer end 204 to straddle the outer downwardly directed extremity 205 of the lever 196, which is curved into a hook shape as shown to clear the mass 191. As best shown in Fig. 18, the lever 196 extends in front of the leaf spring 202 and is bent as at 206 to dispose the end thereof within the bifurcation of the operating mass. Preferably, the operative engagement between the mass and the lever is established through a pair of rollers 207 held by washers 209 in place upon the reduced ends of an eccentric pin 208, which passes through the lever 196. By rotary adjustment of the eccentric, the clearance between the weight and the rollers may in turn, be adjusted.

It may be briefly noted, that in operation of the vehicle, the mass 191 will oscillate up and down with flexure of the spring 202. In the up stroke, the mass will strike the rollers 207 and thereby raise the lever 196 about its pivot 197 and through the pitman link 194 and connector 192 will lift the pump piston rod 189. In the gravity return of the mass 191 aided by the return of the spring 202 under its resiliency, a clockwise impulse is applied at the heel 199 of the lever 196 to cause the latter to return and thereby depress the pump plunger through its operating stroke.

In Figs. 20, 21 and 22 shown another embodiment of the invention in which the operation of the pump depends on vibration of the vehicle in locomotion. In this instance, however, the operating mechanism is actuated from one of the vehicle springs in response to flexure of the latter. The pump and the operating construction are shown of the same type as those of Figs. 14, 15 and 16, although the details are illustratively modified, as shown, to provide a diaphragm 215 of the bellows type secured to a mounting cap 216 threaded upon the lower end of the pump unit 217, the upper end of which rises within the reservoir R^5 and has a depression mounting the filter 218. The operating lever 219 has bearing plates 220 riveted thereto at 220' at one extremity thereof into central bearing apertures in which extend the ends of bearing studs 221 threaded at 223' into the support structure 223 which is rigidly secured to the pump case unit. Transmitting links 224 are pivoted at one end to the head 215' of the bellows diaphragm and at the other closely adjacent the bearing studs 221 and to the left thereof in Fig. 20. The bearing plates 220 are deflected at 225 to afford clearance for the links 224.

The lever 219 extends, as shown, through a slot 226 in a bracket arm 227 affixed to the lower wall of the reservoir R^5. The ends of the slot determine the limits of the pump stroke, a coil spring 228 normally retaining the lever near the upper end of said slot.

Illustratively, I have shown a conventional vehicle spring 229 affixed to a spring shackle 230 mounted in a bearing 231 which may be lubricated from a piping system 232, a fragment of which is shown supplying the upper shackle bearing. Transmission between the spring and the outer end of the lever 219 is effected through a connection comprising a strap 233 securely lashed to one of the spring clips 234, a strong closely wound coil spring 235 being interposed between the upper end of the spring fastener and a mounting bolt 236 on the lever 219.

In operation, as the vehicle spring flexes downward, tension is transmitted through spring 235 to draw the lever 219 downward, stressing spring 228 and causing corresponding minute extension or charging of the bellows 215. In the subsequent upward flexure of the vehicle spring 229, the outer end of the lever 219 will be raised by the return of spring 228, thereby drawing up the links 224 to effect corresponding minute discharge into the distributing system.

The strap 233 is preferably flexible and affords sufficient slack in length 233' thereof, to permit the ordinary small vibrations of the vehicle spring without effect on the pump. Only when the flexure of the spring is somewhat greater, will the slack be taken up and the lever 219 pulled down, the strong spring 235 transmitting without appreciable flexure, the force required for pump operation. Spring 235 will, however, flex to permit further downward flexure of the vehicle spring after the lever 219 has reached the lower end of the slot 226, the latter limiting the stroke of the pump and preventing injury thereto due to great flexure of the vehicle spring.

While I have illustratively shown a pump with a diaphragm of the bellows type, it will be understood that the construction could be embodied in a construction of the plunger pump type such as disclosed in Figs. 8 to 13 and 17 to 19 or in a diaphragm of the type shown in Fig. 14.

I claim:—

1. A lubricant feeding installation for a central chassis lubricating system of a vehicle including a lubricant reservoir, a force plunger pump unit in the bottom thereof having a minute effective

volume, an inlet connection from the reservoir to the pump and a check valve controlling the outlet from the pump to the distributing system, and means for operating said pump, correlated with the vehicle to oscillate and to reciprocate said pump synchronously with the oscillation thereof during movement of the vehicle, said pump being constructed to minimize leak past the operating part thereof, the oscillating structure of said operating member being sufficiently rapid in the pump charging stroke to create an effective suction stroke for drawing lubricant in through said inlet connection, said pump including a pump block with a vertical cylindrical bore receiving said plunger located closely adjacent the bottom of said reservoir, said operating means and said plunger being directly operatively connected together so that said operating means will move said plunger both upwardly and downwardly to respectively take charging and discharging strokes, said cylindrical bore being provided with a lower portion into which lubricant is sucked from said reservoir upon upward motion of the plunger and from which it is discharged upon downward motion of the plunger and also being provided with an upper portion serving as a seal and guide for the plunger, said operating means when at rest floating in an elevated position, said plunger being located when at rest in said bore with its lower end adjacent said lower portion of said bore, said operating means in its reciprocation above and below said at rest floating position having a substantially greater movement than the effective movement and stroke of the plunger in charging and discharging, said plunger making one charging stroke for each complete upward stroke of the operating means and one discharging stroke for each complete downward stroke of the operating means, said plunger during its effective charging and discharging strokes moving upwardly and downwardly with the upward and downward movements of the operating means.

2. A feeding installation for a central chassis lubricating system of a vehicle including a lubricant reservoir, a force plunger pump having a minute effective volume supplied from said reservoir on the charging stroke and delivering into the distributing system on the discharge stroke, and operating means for said pump correlated with the vehicle to respond to the vibration of the latter in the movement thereof, for translating each substantial vibratory movement into a continuous rapidly executed full charging stroke of the pump, and means exerting a discharging impulse on the pump during the intervals between charging operation, said pump including a pump block with a vertical cylindrical bore receiving said plunger located closely adjacent the bottom of said reservoir, said operating means and said plunger being directly operatively connected together so that said operating means will move said plunger both upwardly and downwardly to respectively take charging and discharging strokes, said cylindrical bore being provided with a lower portion into which lubricant is sucked from said reservoir upon upward motion of the plunger and from which it is discharged upon downward motion of the plunger and also being provided with an upper portion serving as a seal and guide for the plunger, said operating means when at rest floating in an elevated position, said plunger being located when at rest in said bore with its lower end adjacent said lower portion of said bore, said operating means in its reciprocation above and below said at rest floating position having a substantially greater movement than the effective movement and stroke of the plunger in charging and discharging, said plunger making one charging stroke for each complete upward stroke of the operating means and one discharging stroke for each complete downward stroke of the operating means, said plunger during its effective charging and discharging strokes moving upwardly and downwardly with the upward and downward movements of the operating means.

3. An automatic force pump including a casing, and ejector therein, a moving operating member fixed to said ejector and protruding from said casing, a mass associated with said operating member and having a limited path of free movement relative thereto and a spring yieldingly supporting the weight of said mass upon said moving operating member.

4. An automatic reciprocating force pump including a moving operating member therefor, a mass associated with said operating member, and having a limited path of free movement relative thereto, and a spring yieldingly supporting the weight of said mass upon said moving pump operating member.

5. An automatic supply installation including a pump having a plunger, operating means therefor moving with said plunger, stop means for limiting the stroke of said pump to a definite short length, and an inertia mass spring-sustained upon said moving operating means and having a stroke with a component of length materialily greater than that of said pump.

6. An automatic pump installation having a reciprocating member, and operating means therefor comprising a mass subject to reciprocation under vibration of the vehicle, said mass having a lost motion connection with respect to the pump to acquire momentum prior to actuating the pump and continuously exerting pressure upon said reciprocating member to move said member to the end of its discharge stroke in the intervals between momentum operations.

7. An automatic pressure pump for a chassis lubricating system comprising an ejector member, a mass bearing on said member to urge it to one end of its stroke, and mounted to have a path of reciprocating movement under vibration of the vehicle, means to cause a preliminarily lost motion movement by said mass before effecting discharge by said ejector member in each discharge stroke and means stressed by the discharge stroke of said mass and actuated by the charge stroke of said mass for effecting the return stroke of said ejector.

8. In an automatic chassis lubricating system, the combination of a pressure pump of minute volume including a plunger and an elongated cylinder member continuously enclosing said plunger, operating means therefor comprising a mass, the weight of which urges said pump toward one end of its stroke, a spring sustaining said mass, a stop connected to said pump and interposed in the path of movement of said mass under vibration of the moving vehicle preventing said plunger from leaving said member, for operation of said pump through a limited stroke, said spring transmitting the force imposed by the weight of said mass in effecting the return stroke of the pump.

9. In a chassis lubricating system, the combination of an oil reservoir, a pump therein of small

volume, a mass for actuating said pump by a jiggle action, said mass being connected to furnish the operative impulse for reciprocating the operating pump member, in both directions and a spring associated with said mass to permit movement of the latter relative to the operating part of the pump, said spring transmitting the operating impulse of the mass in one direction of the movement thereof and assisting the effect of the mass in its movement to produce the opposite stroke of the pump.

10. In a chassis lubricating system, the combination of an oil reservoir, a plunger pump therein of small volume, an operating mass for said plunger and a spring supporting said weight and transmitting the impulse due to the weight of said mass, to said plunger for operating the latter through one of the strokes thereof.

11. In a chassis lubricating system, the combination of an oil container, a pump near the lower end thereof, having a small bore and a plunger having a substantial length thereof tightly fitting therein, an upstanding rod on said plunger, a resiliently sustained mass through which said rod extends and stop means on said rod in the path of oscillation of said mass.

12. In a chassis lubricating system, the combination of an oil reservoir, a pump associated therewith and operating means therefor including a mass, a supporting spring for said mass rigidly secured with respect thereto at one end thereof, said pump having a part interposed in the path of oscillation of said mass in both directions thereof, thereby to cause said pump to reciprocate.

13. In a chassis lubricating system, the combination of a lubricant reservoir, a pump of small volume at the bottom thereof, a pump operating rod extending upward therefrom, operating means for said rod comprising a generally horizontal plate secured to said rod, an upstanding leaf spring secured to said plate, a second plate secured to the upper end of said spring, a mass rigid with the outer end of said second plate and a stop upon said rod in the path of the oscillatory movement of said mass and positioned to permit a range of free movement of said mass.

14. In a chassis lubricating system, the combination of an oil reservoir, a small volume pump in said reservoir, an operating rod for said pump, means for operating said rod, said means including an inertia operator, a bushing about said rod rigidly secured thereto, said inertia operator comprising a yoke having the free end of one of the arms thereof secured to said bushing and having a mass rigidly secured at the free end of the other arm thereof, the cross-arm of said yoke being a leaf spring.

15. In a chassis lubricating system, the combination of an oil reservoir, a pump having an operating rod extending into the reservoir, means for reciprocating said rod, said means comprising a mass, a leaf spring yieldingly sustaining said mass, said leaf spring rigidly secured at one end thereof relative to said mass, said piston rod having a stop rigid therewith at one side of said mass and another stop rigid therewith at the other side of said mass, said stops being spaced to permit a range of free movement of said mass therebetween, but arranged in the path of oscillation of said mass, thereby to cause operation of the pump.

16. In a chassis lubricating system, the combination of an oil reservoir, a reciprocating pump therein of small volume, an operating rod for said pump, operating means for oscillating said rod, said means comprising a swinging mass, a spring rigidly secured with respect to said mass at one end and with respect to said rod at the other end thereof, and stops on said rod at opposite sides of said mass and in the path of swinging movement of the latter, said stops affording a path of swinging movement therebetween for said mass.

17. A lubricating supply installation including a reservoir, a plunger pump of small effective volume, inertia operating means for automatically reciprocating said pump including a resiliently supported reciprocating weight and means for causing rapid charge strokes, and an inlet port permitting admission from the reservoir to the pump, under the substantial suction generated by the quick charging strokes, said pump including a pump block with a vertical cylindrical bore receiving said plunger located closely adjacent the bottom of said reservoir, said operating means and said plunger being directly operatively connected together so that said operating means will move said plunger both upwardly and downwardly to respectively take charging and discharging strokes, said cylindrical bore being provided with a lower portion into which lubricant is sucked from said reservoir upon upward motion of the plunger and from which it is discharged upon downward motion of the plunger and also being provided with an upper portion serving as a seal and guide for the plunger, said operating means when at rest floating in an elevated position, said plunger being located when at rest in said bore with its lower end adjacent said lower portion of said bore, said operating means in its reciprocation above and below said at rest floating position having a substantially greater movement than the effective movement and stroke of the plunger in charging and discharging, said plunger making one charging stroke for each complete upward stroke of the operating means and one discharging stroke for each complete downward stroke of the operating means, said plunger during its effective charging and discharging strokes moving upwardly and downwardly with the upward and downward movements of the operating means.

18. A lubricant supply installation comprising a reservoir, a small volume plunger pump near the bottom thereof, tight to minimize leak, a filter in the path of admission from the reservoir to the pump, an inlet port connection between the pump and the filter, and inertia means for operating said pump including a resiliently supported reciprocating weight and means for causing the charging stroke to take place in a single sharp movement, thereby to exert sufficient suction and to draw lubricant in through said inlet connection which has passed through the filter, said pump including a pump block with a vertical cylindrical bore receiving said plunger located closely adjacent the bottom of said reservoir, said operating means and said plunger being directly operatively connected together so that said operating means will move said plunger both upwardly and downwardly to respectively take charging and discharging strokes, said cylindrical bore being provided with a lower portion into which lubricant is sucked from said reservoir upon upward motion of the plunger and from which it is discharged upon downward motion of the plunger and also being provided with an upper portion serving as a seal and guide for the plunger, said operating means when at rest floating in an ele-

vated position, said plunger being located when at rest in said bore with its lower end adjacent said lower portion of said bore, said operating means in its reciprocation above and below said at rest floating position having a substantially greater movement than the effective movement and stroke of the plunger in charging and discharging, said plunger making one charging stroke for each complete upward stroke of the operating means and one discharging stroke for each complete downward stroke of the operating means, said plunger during its effective charging and discharging strokes moving upwardly and downwardly with the upward and downward movements of the operating means.

19. A lubricant supply installation for a central distributing system comprising a reservoir, a force pump in the bottom thereof, including an ejector of small effective charge, a jiggle mass device for operating said pump, said mass having a path of free movement with respect to said pump unit, to lift the ejector in a rapidly executed stroke and to exert its weight for thereupon depressing the same, a filter adjacent the pump, a check valve between the filter and the pump, the suction generated in the rapid suction stroke of the pump being sufficient to draw the corresponding charge passed through the filter and to open the check valve.

20. A lubricant supply installation comprising a reservoir, a pump unit in the bottom thereof, a pump plunger comprising a pin fitting snugly in a corresponding bore in said unit, a dense filter controlling the inlet from said reservoir to the pump bore, a check valve interposed between the filter and the pump inlet, means for reciprocating said plunger, said means comprising a spring-supported jiggle mass having movement relative to the pump operator, said pump operator presenting stops at opposite sides of the path of movement of the jiggle mass.

21. An automatic force pump including a casing, an ejector therein, a moving operating member fixed to said ejector and protruding from said casing, a mass associated with said operating member and having a limited path of free movement relative thereto and a spring yieldingly supporting said mass.

22. An automatic chassis lubricating pump installation comprising a plunger pump of small diameter and short stroke including a plunger and an elongated cylinder member continuously enclosing said plunger, said pump plunger having an upstanding rod extension, a mass enclosing said extension, a spring sustaining said mass to bear upon said rod and a stop to limit the upward movement of said plunger preventing said plunger from leaving said member.

23. A feeding installation for a central chassis lubricating system, including a reservoir, a diaphragm pump of small volume substantially at the bottom thereof, means for operating said pump including a fulcrumed lever the lever being connected to the diaphragm closely adjacent its fulcrum and means applying an oscillating impulse responsive to the vibration of the vehicle in locomotion thereof connected to said lever relatively distant from said fulcrum.

24. A feeding installation for a central chassis lubricating system, including an oil reservoir, a diaphragm pump, a check valve controlling the inlet from the reservoir to the pump and a check valve controlling the outlet from said pump, and operating means for said pump including a pressure multiplying transmitting lever, having a short lever arm connected to the diaphragm and a long lever arm correlated with the vehicle for periodic oscillation thereof during vehicle operation, said long lever arm being associated with a resiliently connected weight for reciprocation upon operation of the vehicle.

25. A supply installation for a chassis lubricating system including a reservoir, a pump unit in the bottom thereof including a diaphragm operating element, an outlet for said pump above said diaphragm element and inertia operating means for said pump extending under said diaphragm element including a weighted extension automatically actuated upon movement of said chassis.

26. A feeding installation for a central chassis lubricating system, including an oil reservoir, a diaphragm pump at the bottom thereof having a minute effective volume, spring-seated valves controlling the inlet from the reservoir to the pump and the outlet from the pump to the distributing system, and inertia means including a weighted extension automatically actuated upon movement of said chassis correlated with the vehicle to cause reciprocation of said diaphragm at short intervals for successively forcing small charges of oil into the distributing system during operation of the vehicle.

27. A feeding installation for a central chassis lubricating system, including an oil reservoir, a pump at the bottom thereof having a minute effective volume, spring-seated valves controlling the inlet from the reservoir to the pump and the outlet from the pump to the distributing system, and inertia means including a weighted extension automatically actuated upon movement of said chassis correlated with the vehicle to cause reciprocation of said pump at short intervals for successively forcing small charges of oil into the distributing system during operation of the vehicle.

28. A supply installation for a chassis lubricating system including a reservoir, a pump unit in the bottom thereof including a diaphragm operating element, an outlet for said pump above said diaphragm element, operating means for said pump extending under said diaphragm element, means for oscillating said diaphragm, said means including a lever below said diaphragm having a relatively long work arm and a very short power arm connected to said diaphragm and means operating on the outer end of said lever and responding to movement of the vehicle to oscillate said lever and operate said pump.

29. A supply installation for a chassis lubricating system including a reservoir, a pump unit at the bottom thereof including a reciprocating element, an outlet for said pump above said element, operating means for said pump for oscillating said element extending across said element, said means including a lever having a relatively long work arm and a relatively short power arm connected to said element and means operating on the outer end of said lever and responding to movement of the vehicle to oscillate said lever and operate said pump.

30. In a chassis lubricating system, the combination of an oil reservoir, a reciprocating pump therein of small volume, an operating rod for said pump, operating means for oscillating said rod, said means comprising a swinging mass, a spring rigidly secured with respect to said mass at one end and with respect to said rod at the other end thereof, stops on said rod at opposite sides of said mass and in the path of swinging movement of the latter, and a yielding cushion for

one of said stops, said stops affording a limited path of swinging movement therebetween for said mass.

31. In a chassis lubricating system, the combination of an oil reservoir, a reciprocating pump therein of small volume, an operating rod for said pump, operating means for oscillating said rod, said means comprising a vibrating mass, a spring rigidly secured with respect to said mass at one end, stops at opposite sides of said mass and in the path of movement of the latter, and yielding cushions for said stops, said stops affording a limited path of movement therebetween for said mass.

32. In a chassis lubricating system, the combination of an oil reservoir, a reciprocating pump therein of small volume, an operating rod for said pump, operating means for oscillating said rod, said means comprising a vibrating mass, a spring rigidly secured with respect to said mass at one end and with respect to said rod at the other end thereof, stops rigid with said rod and in the path of movement of the latter, said stops affording a path of vibrating movement therebetween for said mass.

33. A supply installation for a chassis lubricating system including a reservoir, a force pump in the bottom thereof having an operating diaphragm, a stem protruding downward therefrom, an operating lever having a fulcrum closely adjacent to said stem, a jiggle mass at the other end of said lever and a spring sustaining said mass upon said lever end.

34. A supply installation for a central chassis lubricating system including a reservoir, a pump unit therebelow, of minute effective volume, having an operating diaphragm, means for oscillating said diaphragm for emission at high pressure of minute charges, said means comprising a power multiplying lever, means to operate said lever, said means comprising a jiggling lever having a mass sustained thereon at the free end thereof, and a spring interposed between said mass and said operating lever.

35. A supply installation for a chassis lubricating system including an oil reservoir, a pump unit in the bottom of said reservoir, said unit including an operating diaphragm, a pump head clamping the periphery of said diaphragm in place, an axial rod on said diaphragm, having a bearing in said head, an operating lever extending below said rod and connected thereto, pivot pins in said head supporting said lever, the centers of said pivot pins closely adjacent the center of said connection, and a jiggle mass cooperating with the free end of said lever.

36. A supply installation for a central chassis lubricating system including a reservoir, a force pump unit of minute effective volume in the bottom of said reservoir, and having an operating diaphragm, pivot pins in the bottom of said unit, a pair of levers mounted on said pivot pins, one of said levers having an operating connection to said diaphragm, slightly displaced from said pivot, a mass securely retained at the outer end of the other of said levers, and a spring interposed between said mass and the outer end of said first lever.

37. A supply installation for a chassis lubricating system including a lubricant reservoir, a pump unit in the bottom thereof having an operating diaphragm, a pair of levers pivoted to said pump unit near the lower part thereof, a jiggle mass firmly supported at the outer end of one of said levers, the other said lever having an annular outer end encircling said mass, a spring sustaining said mass upon said annular lever and a transmission connection from said second lever to said diaphragm, said connection being slightly offset from the common pivot of said levers for great multiplication of pressure and reduction of stroke.

38. The combination set forth in claim 37 in which stop means is provided to limit the oscillatory stroke of said jiggle mass.

39. A supply installation for a chassis lubricating system including a lubricant reservoir, a diaphragm force pump unit in the bottom thereof, means for operating said pump to cause a succession of small discharges thereof, said means including an outlet for said pump above said diaphragm element, operating means for said pump extending under said diaphragm element, means for oscillating said diaphragm, said means including a lever below said diaphragm having a relatively long work arm and a very short power arm connected to said diaphragm and means operating on the outer end of said lever and responding to movement of the vehicle to oscillate said lever and operate said pump.

40. The combination of an oil reservoir, a pump substantially at the bottom thereof, a pump rod extending through the top thereof, operating means for said pump in back of said reservoir, said means including an oscillatory mass, a lever in the path of operation of said mass, to be oscillated thereby, and means rigidly connecting said lever to the upper end of the pump rod.

41. A reservoir-pump combination adapted to serve as a source of lubricant pressure to a lubricating installation comprising a motor mechanism, two enclosures side by side, one of which is liquid tight and serves as a reservoir and the other of which serves to enclose the motor mechanism, a pump adjacent the bottom of the reservoir enclosure, actuating connections extending upwardly from the pump and from the motor to adjacent the top of each enclosure and connecting means between said actuating connections for transmitting movement of the motor to the pump.

42. In a chassis lubricating system, the combination of an oil reservoir, having an associated pump, a U-shaped bracket secured to the rear wall thereof, and having means at the ends thereof for mounting the reservoir upon a vehicle, and pump operating means extending within the space defined by said bracket, said operating means including a pivoted lever, means rigidly connecting said lever to said pump, and a spring-sustained mass having the lever in the path of movement thereof for operating the pump.

43. In a chassis lubricating system, the combination of a reservoir having a pump associated therewith, automatic operating means for said pump, comprising a jiggle mass laterally of said reservoir and below the top thereof, and linkage extending upward from said mass to the top of said reservoir and connected to the upper end of the pump rod, the mass having a lost motion connection with respect to the linkage.

44. Operating means for the pump of a central chassis lubricating system comprising a pivoted lever, a structure fixed thereto, adapted to transmit oscillatory impulse from said lever to a pump, a spring leaf mounted on said lever, a mass carried by said spring leaf, said lever having an abutment member in the path of oscillation of the mass.

45. In a chassis lubricating system, the com-

bination of an oil reservoir, a pump associated therewith, an operating rod for said pump, an inertia mass for causing reciprocation of said rod, a spring supporting the weight of said mass upon said rod, and adjustable fixed stop means for limiting the stroke of said rod in a pump charging direction under the impulse of said mass, thereby to regulate the discharge volume of said pump.

46. An automatic pump installation for a central lubricating installation applicable to a motor vehicle, said installation having a reciprocating pump member, a body automatically subject to reciprocation upon operation of the vehicle, actuating connections between said body and said reciprocating member to cause the member to move with the body, said actuating connections permitting disconnection of said body from said pump member during such reciprocation.

47. An automatic pump installation for a central lubricating installation applicable to a motor vehicle, said installation having a reciprocating pumping member, a body automatically subject to reciprocation, upon operation of the vehicle, actuating connections between said body and said reciprocating member to move the member with the body, and said actuating connections including means for causing the reciprocating pumping element to move with but at a slower rate than the body.

48. The automatic pumping installation of claim 47 in which said last mentioned means consists of a resilient connection between the body and the actuating connections.

49. An automatic pump installation for a central lubricating installation applicable to a motor vehicle, said installation having a reciprocating pumping member, a body automatically subject to reciprocation upon operation of the vehicle, actuating connections between said body and said reciprocating member so constructed and arranged that the member will always move with the body, and means associated with said actuating connections for causing the reciprocating pumping element to move with but at a faster rate than the body.

50. The automatic pump installation of claim 49 in which said last mentioned means consists of a resilient connection between the body and the actuating connections.

51. An automatic pump installation for a central lubricating installation applicable to a motor vehicle, said installation having a reciprocating pumping member, a body automatically subject to reciprocation upon operation of the vehicle, actuating connections between said body and said reciprocating member so constructed and arranged that the member will always move with the body, and means associated with said actuating connections for resisting movement of the element with the body in one direction and assisting it in a reverse direction.

52. The automatic pump installation of claim 51 in which said means consists of a spring associated with a connecting rod attached to the reciprocating element, said spring acting to assist charge of the pump and to resist discharge.

53. In a central lubricating system for application to an automotive vehicle, the combination of an oil reservoir fixed to said vehicle, a pump rigid with said reservoir receiving its lubricant supply from said reservoir with a reciprocating ejecting element substantially movable in respect to said reservoir, a reciprocating motor element for said pump substantially movable both in respect to the reciprocating pump element and the reservoir, an actuating connection between said reciprocating motor and pump elements so constructed and arranged that substantial movement of the motor and pump elements toward each other will result in a discharge into the central lubricating system, while substantial movement away from each other will result in charging of the pump from the reservoir.

54. A lubricant supply and pressure installation adapted to be utilized with a central lubricating installation comprising a reservoir with an opening in the bottom thereof, a plunger pump arrangement attached to and depending below said opening with a pump chamber, said pump being provided with reciprocating operating means, and with inlet and outlet passages included therein below said reservoir bottom and a filter in said opening at said reservoir bottom in the path of lubricant flow from the reservoir to the inlet passage, said pump including a pump block with a vertical cylindrical bore receiving said plunger located closely adjacent the bottom of said reservoir, said operating means and said plunger being directly operatively connected together so that said operating means will move said plunger both upwardly and downwardly to respectively take charging and discharging strokes, said cylindrical bore being provided with a lower portion into which lubricant is sucked from said reservoir upon upward motion of the plunger and from which it is discharged upon downward motion of the plunger and also being provided with an upper portion serving as a seal and guide for the plunger, said operating means when at rest floating in an elevated position, said plunger being located when at rest in said bore with its lower end adjacent said lower portion of said bore, said operating means in its reciprocation above and below said at rest floating position having a substantially greater movement than the effective movement and stroke of the plunger in charging and discharging, said plunger making one charging stroke for each complete upward stroke of the operating means and one discharging stroke for each complete downward stroke of the operating means said plunger during its effective charging and discharging strokes moving upwardly and downwardly with the upward and downward movements of the operating means.

55. A lubricant supply and pressure installation adapted for association with a central lubricating installation comprising a reservoir and a plunger pump arrangement positioned adjacent the bottom of said reservoir, said pump arrangement including at the top thereof a strainer and in the body thereof below said strainer a pump chamber and inlet and outlet passages leading, respectively, thereto and therefrom and reciprocating operating means for said pump supported upon said reservoir, said pump including a pump block with a vertical cylindrical bore receiving said plunger located closely adjacent the bottom of said reservoir, said operating means and said plunger being directly operatively connected together so that said operating means will move said plunger both upwardly and downwardly to respectively take charging and discharging strokes, said cylindrical bore being provided with a lower portion into which lubricant is sucked from said reservoir upon upward motion of the plunger and from which it is discharged upon downward motion of the plunger

and also being provided with an upper portion serving as a seal and guide for the plunger, said operating means when at rest floating in an elevated position, said plunger being located when at rest in said bore with its lower end adjacent said lower portion of said bore, said operating means in its reciprocation above and below said at rest floating position having a substantially greater movement than the effective movement and stroke of the plunger in charging and discharging, said plunger making one charging stroke for each complete upward stroke of the operating means and one discharging stroke for each complete downward stroke of the operating means, said plunger during its effective charging and discharging strokes moving upwardly and downwardly with the upward and downward movements of the operating means.

56. The lubricant supply and pressure installation of claim 55 in which the pump is actuated from above and a central opening is provided in said strainer.

57. A lubricant supply and pressure installation adapted for association with a central lubricating installation comprising a reservoir and a pump arrangement positioned adjacent the bottom of said reservoir, said pump arrangement including a pump body with a central passageway receiving a piston and forming a pump chamber, with a socket of greater diameter than said pump chamber receiving the end of a connecting rod actuating said piston and with passageways from the bottom of said socket to the reservoir to permit free flow of lubricant thereinto and therefrom, the reciprocation of the end of said connecting rod in said socket serving to damp the movement of said piston.

58. A lubricant supply and pressure installation adapted for association with a central lubricating installation comprising a reservoir and a pump arrangement positioned adjacent the bottom of said reservoir, said pump arrangement including a pump construction with two aligned cylindrical pump compartments of diverse diameters, each receiving a plunger, one of which has inlet and outlet passages originating and terminating within the reservoir and the other of which has an inlet passage originating within the reservoir and an outlet passage terminating outside of said reservoir, the reciprocation of the respective plunger in the first mentioned compartment serving to damp the motion of the plunger in the second mentioned compartment.

59. A lubricant supply and pressure installation adapted for association with a central lubricating installation comprising a reservoir and a pump arrangement positioned adjacent the bottom of said reservoir, said pump arrangement including a pump arrangement having an inlet chamber at the top thereof, a pump chamber at the bottom thereof, an inlet passageway through the arrangement connecting said chambers, said inlet chamber, said pump chamber and said inlet passageway being all aligned and an outlet passageway transverse to said inlet passageway.

60. An automatic pump including a moving ejector, a mass associated therewith and having a limited path of free movement relative thereto and a spring yieldingly sustaining the weight of said mass, said spring being stressed upon downward movement of the weight and being subsequently released upon upward movement of the weight, said spring when stressed serving as a transmitting member between said mass and said ejector.

61. In a chassis lubricating system, the combination of an oil reservoir, a plunger pump associated therewith and operating means therefor including a mass, a supporting spring for said mass extending from said mass to the reservoir, said pump including a pump block with a vertical cylindrical bore receiving said plunger located closely adjacent the bottom of said reservoir, said operating means and said plunger being directly operatively connected together so that said operating means will move said plunger both upwardly and downwardly to respectively take charging and discharging strokes, said cylindrical bore being provided with a lower portion into which lubricant is sucked from said reservoir upon upward motion of the plunger and from which it is discharged upon downward motion of the plunger and also being provided with an upper portion serving as a seal and guide for the plunger, said operating means when at rest floating in an elevated position, said plunger being located when at rest in said bore with its lower end adjacent said lower portion of said bore, said operating means in its reciprocation above and below said at rest floating position having a substantially greater movement than the effective movement and stroke of the plunger in charging and discharging, said plunger making one charging stroke for each complete upward stroke of the operating means and one discharging stroke for each complete downward stroke of the operating means, said plunger during its effective charging and discharging strokes moving upwardly and downwardly with the upward and downward movements of the operating means.

62. A lubricant supply and pressure installation adapted for association with a central lubricating installation comprising a reservoir and pump arrangement positioned adjacent the bottom of said reservoir, said pump arrangement including at the top thereof a flat horizontal strainer and in the body thereof below said strainer, a pump chamber and inlet and outlet passages leading, respectively, thereto and therefrom, operating means for said pump positioned below said pump arrangements and operating connections between said operating means and said pump supported upon said reservoir and extending upwardly from said operating means to said pump.

63. A supply installation for a lubricating system comprising a reservoir, a pump unit in the bottom of said reservoir, said unit including a pump plunger pin of small diameter, inertia operating means including a resiliently supported reciprocating weight to cause said plunger to take rapid charging strokes, a filter interposed between the reservoir and the pump, and an inlet port between the filter and the pump, the suction generated by the rapid charging movement of the piston being sufficient to draw the corresponding charge of oil past the filter and the inlet port, said pump including a pump block with a vertical cylindrical bore receiving said plunger located closely adjacent the bottom of said reservoir, said operating means and said plunger being directly operatively connected together so that said operating means will move said plunger both upwardly and downwardly to respectively take charging and discharging strokes, said cylindrical bore being provided with a lower portion

into which lubricant is sucked from said reservoir upon upward motion of the plunger and from which it is discharged upon downward motion of the plunger and also being provided with an upper portion serving as a seal and guide for the plunger, said operating means when at rest floating in an elevated position, said plunger being located when at rest in said bore with its lower end adjacent said lower portion of said bore, said operating means in its reciprocation above and below said at rest floating position having a substantially greater movement than the effective movement and stroke of the plunger in charging and discharging, said plunger making one charging stroke for each complete upward stroke of the operating means and one discharging stroke for each complete downward stroke of the operating means, said plunger during its effective charging and discharging strokes moving upwardly and downwardly with the upward and downward movements of the operating means.

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