Dec. 8, 1925. 1,564,294

F. L. SWANBERG

LUBRICATOR

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Fig. 1.

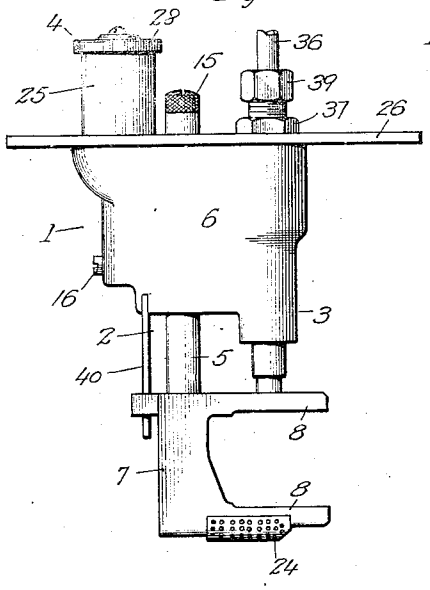


Fig. 4.

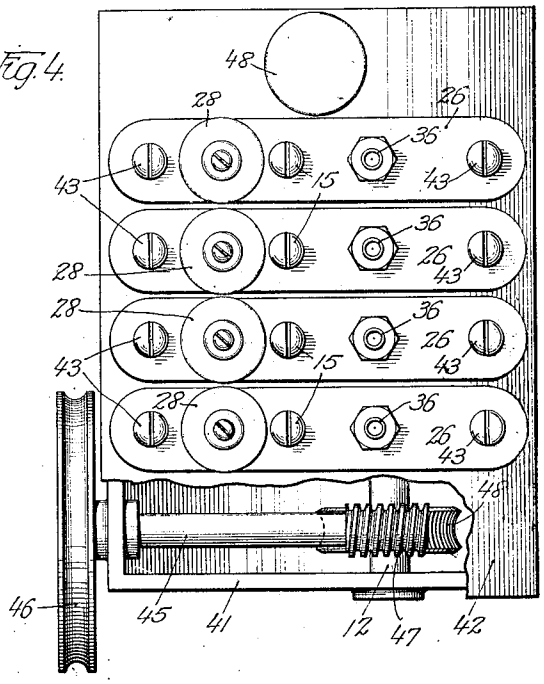
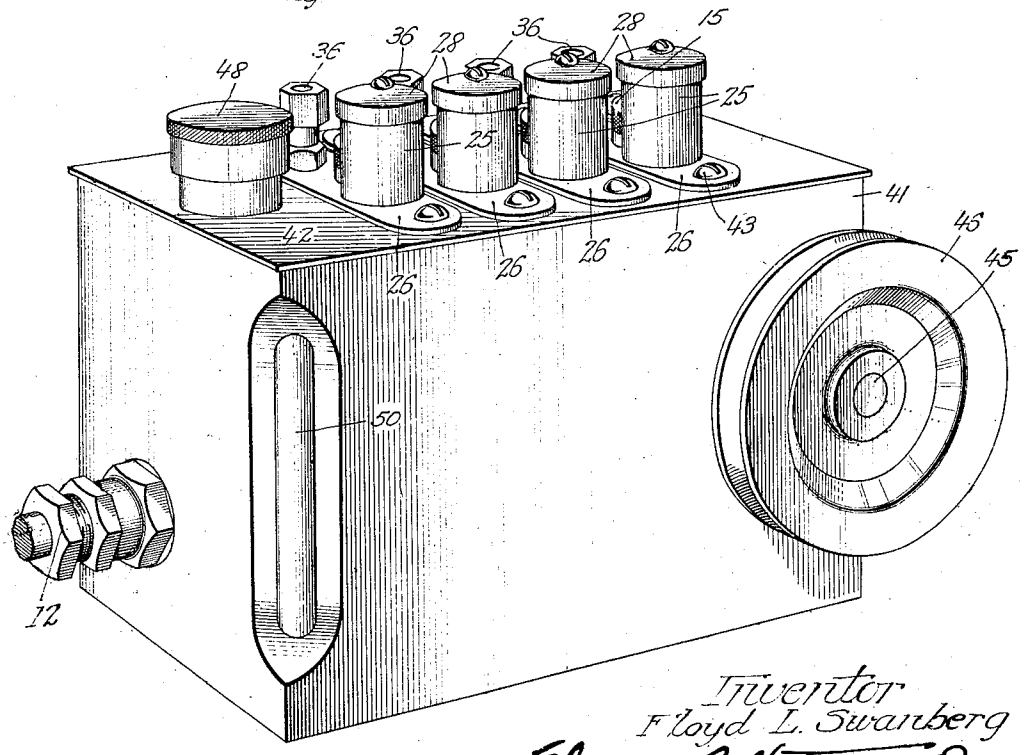


Fig. 5.



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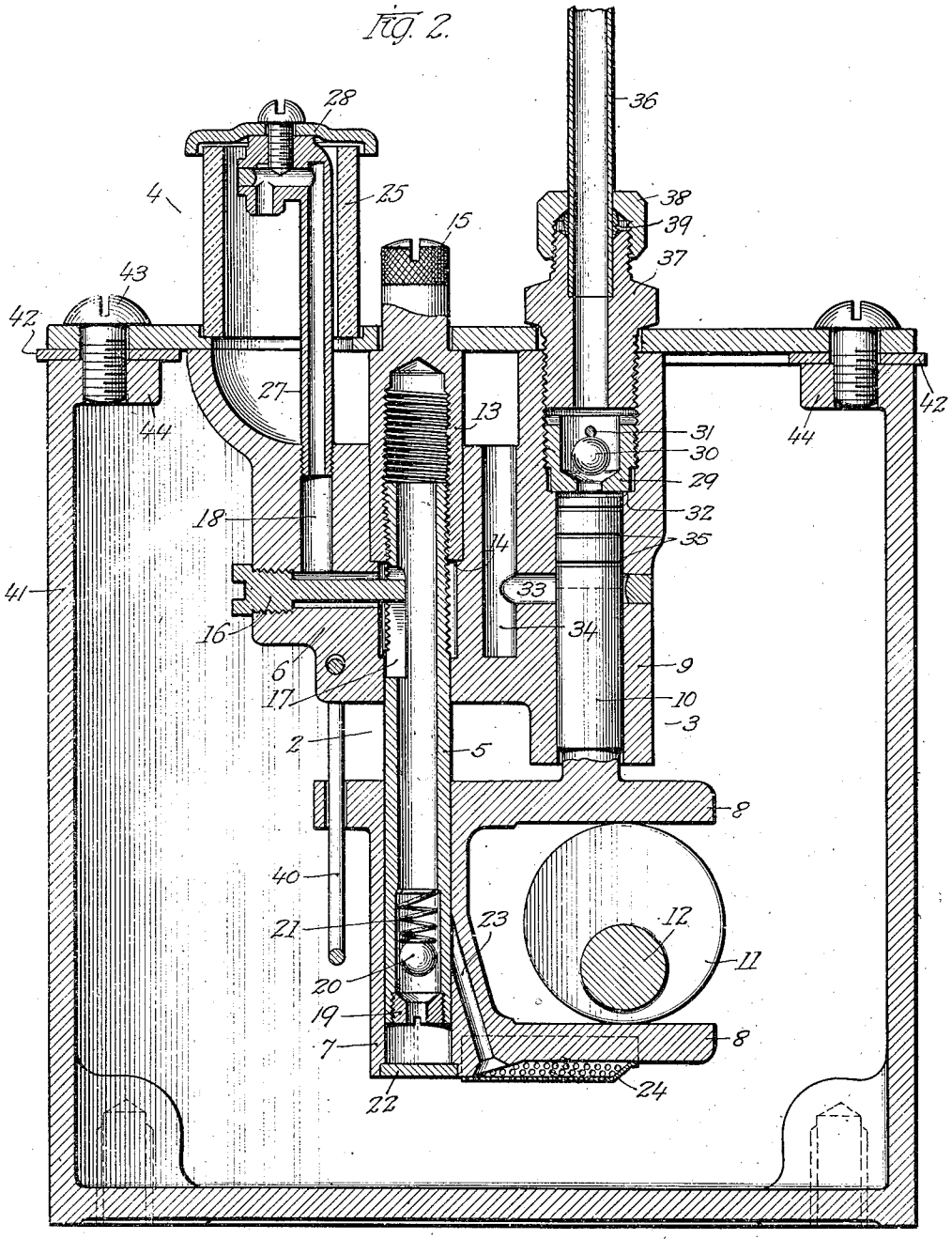
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LUBRICATOR

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Fig. 2.



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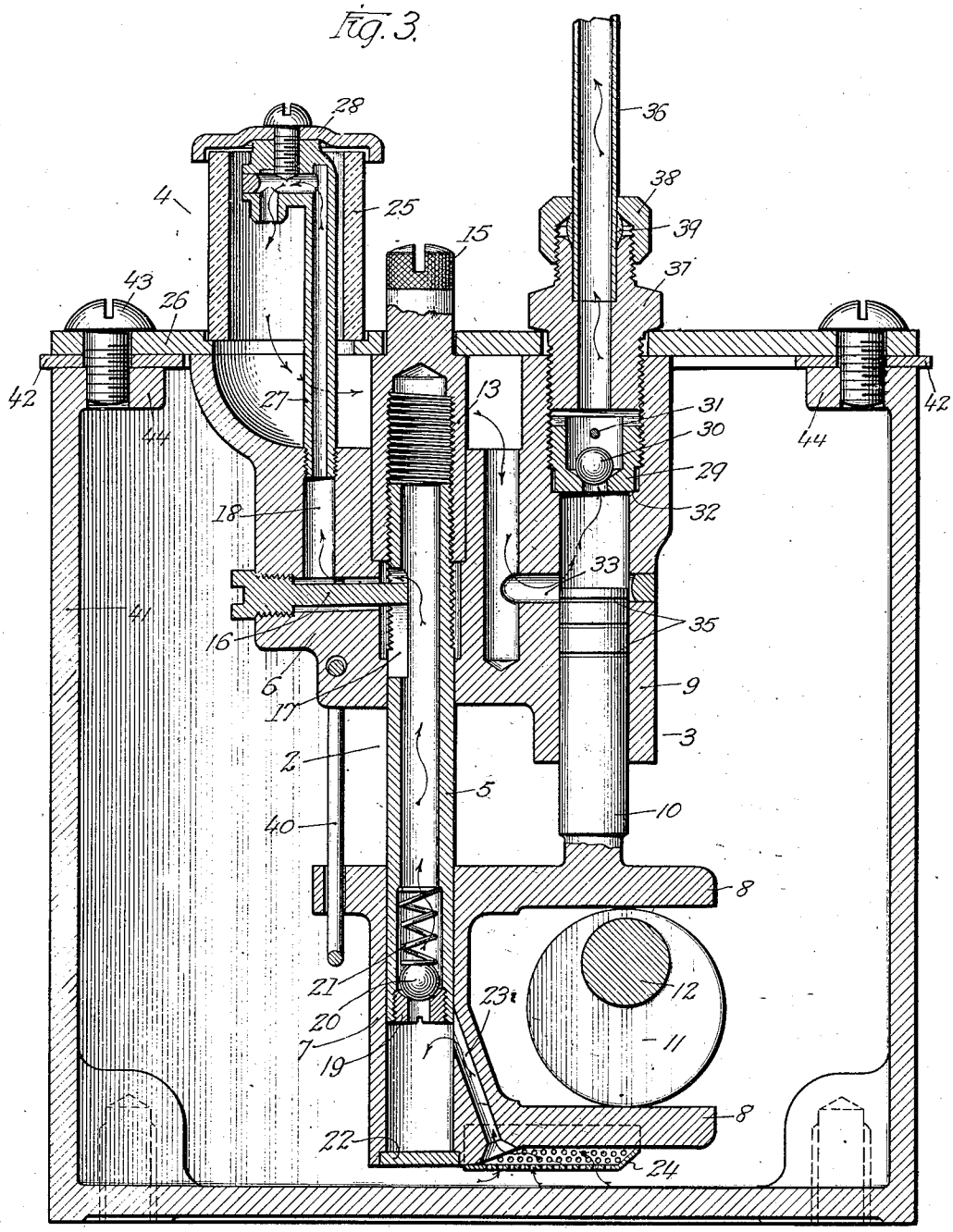
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Fig. 3.



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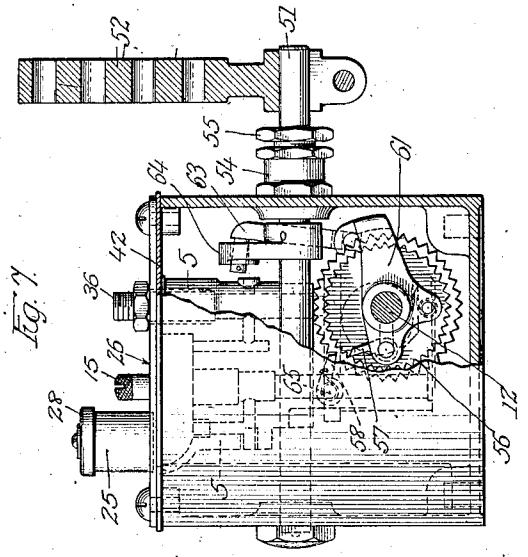


Fig. 7.

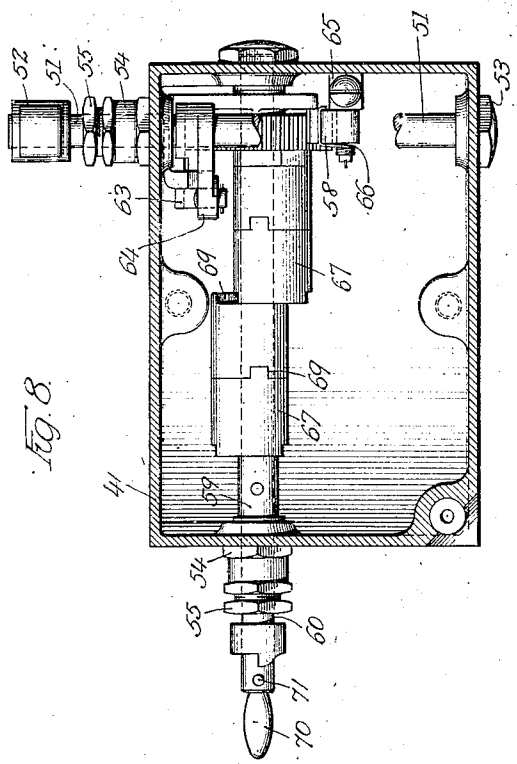


Fig. 8.

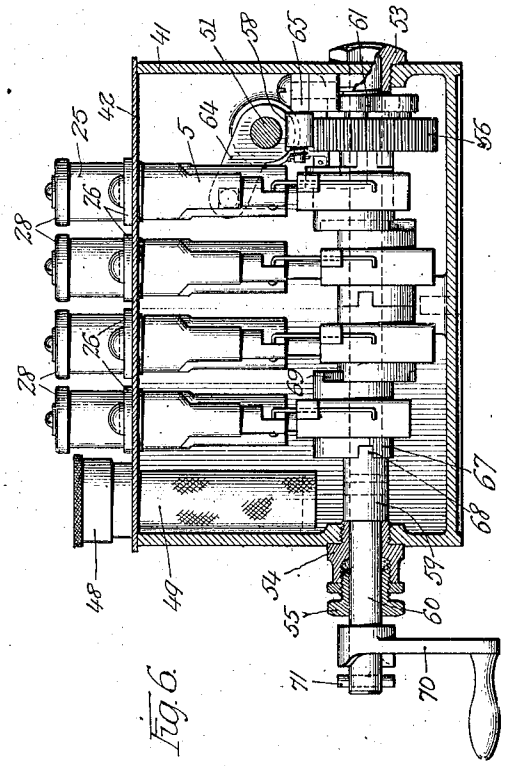


Fig. 6.

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LUBRICATOR

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Fig. 10.

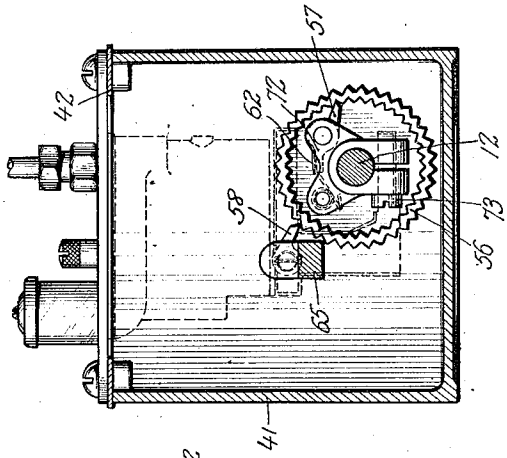
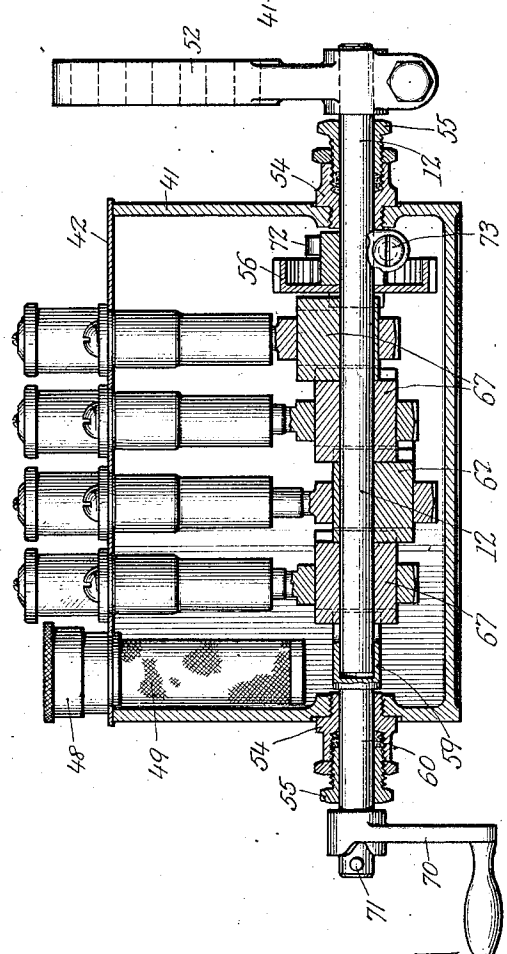


Fig. 9.



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LUBRICATOR

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Fig. 12.

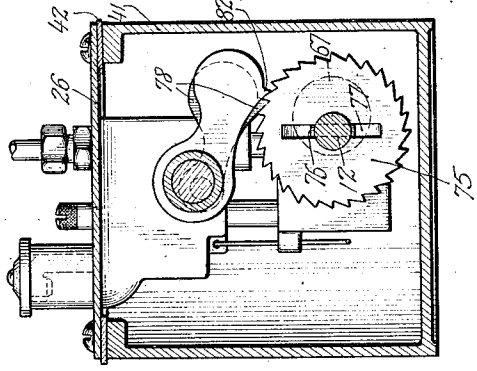
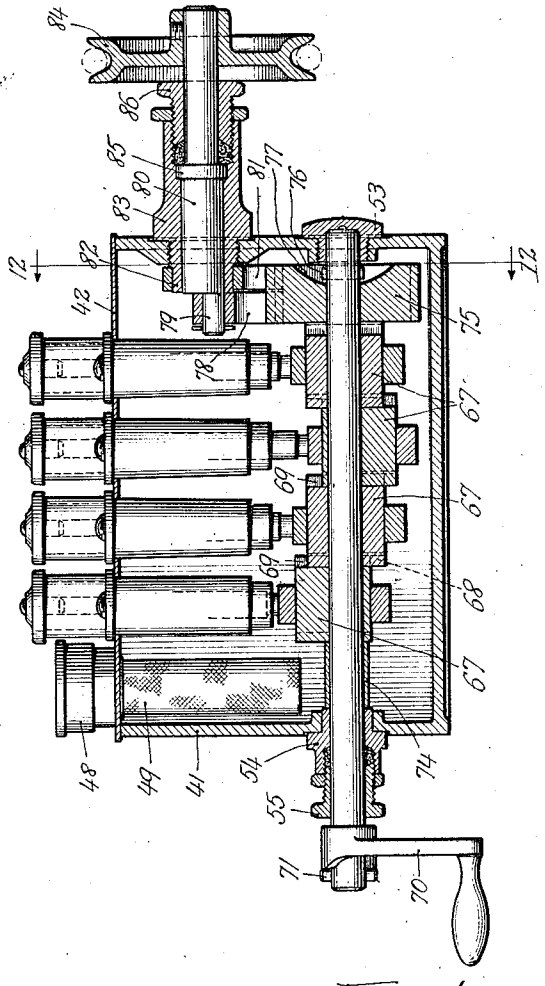


Fig. 11.



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Patented Dec. 8, 1925. 1,564,294

UNITED STATES PATENT OFFICE.

FLOYD L. SWANBERG, OF MILWAUKEE, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO S. F. BOWSER AND CO., INC., OF FORT WAYNE, INDIANA, A CORPORATION OF INDIANA.

LUBRICATOR.

Application filed September 27, 1920. Serial No. 412,920.

To all whom it may concern:

Be it known that I, FLOYD L. SWANBERG, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in a Lubricator, of which the following is a specification.

This invention relates to a lubricator.

The lubricator to which this invention particularly applies comprises in general a circulating pump for determining the quantity of lubricant delivered by the lubricator, a sight feed through which passes the lubricant from the circulating pump, and a force pump for forcing the lubricant under pressure to the machinery to be lubricated.

The objects of the invention are:

To provide a sight force feed lubricator having circulating and force feed pumps so arranged in an oil reservoir that the lubricator may be supported by and removable through the cover therefor;

To so mount a plurality of sight force feed lubricators in a reservoir and support the same from the cover thereof that each lubricator is separately and independently removable as a unit from the reservoir through the cover;

To provide a sight feed lubricator including a variable feed pump having a hollow adjustably mounted stationary piston, with which communication is maintained for different adjustments thereof;

To provide a variable feed lubricator having an adjustable stationary hollow piston wherein rotary movement thereof is prevented while the same is being adjusted longitudinally;

To provide a variable feed lubricator having an adjustable stationary hollow piston wherein rotary movement of the piston is prevented upon longitudinal movement thereof while maintaining the flow of the lubricant therethrough;

To provide a lubricator wherein improved means are employed for varying the quantity of lubricant delivered thereby;

To provide a lubricator wherein the feed thereof may be varied without varying its stroke or speed;

To provide a lubricator having a stationary piston and a reciprocating cylinder wherein the feed is varied by varying the cut-off point of the inlet port;

To provide a simple sight force feed lubricator of few parts;

To provide a sight force feed lubricator having circulating and force feed pumps employing a small number of valves;

To provide a lubricator of few parts which may be readily assembled;

To provide an improved drive for lubricators;

To provide a driving connection between a drive shaft and a plurality of lubricators wherein the assembling, adjusting and repairing thereof is facilitated; and

To provide a driving connection of few parts between a drive shaft and a plurality of lubricators.

Other objects and advantages will hereinafter appear.

According to the invention, a sight feed lubricator comprising a circulating and a force feed pump, one having a stationary cylinder and reciprocating piston, and the other a stationary piston and reciprocating cylinder, forms a unit. Several such lubricators are arranged in an oil reservoir and supported from the cover thereof so that each is separately and independently removable as a unit from the reservoir through the cover.

Common driving mechanism for the several lubricators is mounted within the reservoir and so constructed as to be readily removable therefrom for adjustment, cleaning and repairing. The feed of each lubricator is regulated by varying the position of the stationary piston without varying the stroke or speed of the pump.

The views of the drawings are—

Fig. 1 is a front elevation of the lubricator;

Fig. 2 is an enlarged vertical section of the lubricator and the reservoir, showing the pumps approaching the upper limit of their stroke;

Fig. 3 is an enlarged vertical section through the lubricator and the reservoir, showing the pumps approaching the lower limit of their stroke;

Fig. 4 is a plan of the reservoir with a plurality of lubricators arranged therein and with a portion of the cover broken away to show the driving connections for the lubricators;

Fig. 5 is a perspective of a reservoir with the lubricators mounted therein;

Fig. 6 is a side elevation of the side oscillating drive for a plurality of lubricators;

Fig. 7 is an end elevation thereof;

Fig. 8 is a bottom plan thereof;

Fig. 9 is a side elevation, partly in section, of the end oscillating drive for a plurality of lubricators;

Fig. 10 is an end elevation thereof;

Fig. 11 is a side elevation, partly in section, of the end rotary drive for a plurality of lubricators; and

Fig. 12 is a vertical section on line 12—12 of Fig. 11.

Figures 1 to 3 show the lubricator.

The lubricator 1 comprises a circulating pump 2 and a force feed pump 3, connected so that the lubricant passes from the circulating pump through a sight feed 4 to the force feed pump.

The circulating pump 2, which determines and measures the quantity of lubricant to be delivered by the lubricator, includes a stationary hollow piston 5, adjustably mounted in the pump casing 6, and a reciprocating cylinder 7 supported by and movable with a yoke 8.

The force feed pump 3, which forces the lubricant under pressure to the machinery to be lubricated, includes a stationary cylinder 9 formed in the pump casing 6 and a reciprocating piston 10 supported by and movable with the yoke 8.

The yoke 8, carrying the cylinder 7 and the piston 10, is reciprocated by a suitable cam or eccentric 11 mounted on a shaft 12.

The hollow piston 5 of the circulating pump is supported by a tubular sleeve 13, into which it is threaded. The lower end of the tubular sleeve 13 rests against a shoulder 14 in the pump casing 6 and is supported thereby.

The upper end of the sleeve 13 is provided with a nut 15, by which the position of the piston 5 with respect to the cylinder may be adjusted. To increase the quantity of lubricant delivered by the circulating pump 2 the hollow piston 5 is lowered, while elevating the hollow piston 5 decreases the quantity of lubricant delivered for each stroke of the pump.

A pin 16 threaded into an opening within the pump casing 6 and extending into a slotted opening 17 in the hollow piston 5, prevents rotary movement of the piston while the same is being adjusted longitudinally; it also limits the longitudinal movement of the piston.

The opening in the pump casing 6 through which the forward end of the pin 16 extends is larger than the pin and registers with the slotted opening 17, thus providing a passage from the hollow piston to the vertical passage 18 in the pump casing.

The lower end of the hollow piston 5 is provided with a check valve. This valve comprises a seat bushing 19 threaded into the piston, a valve ball 20 therefor, and a spring 21 for seating the ball.

The cylinder 7 of the circulating pump 2 is formed integrally with the yoke 8 and reciprocates therewith. The lower end of the cylinder is closed, as by plug 22.

An inlet port 23 for the cylinder 7 is provided in the yoke 8. The lower end of this port 23 is covered by a screen 24, which prevents the passage of dirt, grit, etc., from the oil in the reservoir through the port into the cylinder.

The sight feed comprises a tubular sleeve 25 of glass, seated upon the plate 26. The tube 27, threaded into the passage 18, extends into the glass sleeve 25. The tube 27 at its upper end is formed so that the extremity thereof is pointed downward, thus providing a nozzle from which the lubricant may drop through the glass sleeve. Consequently, the lubricant may be seen as it drops through the sight feed. A cover 28 for the sight feed is supported by the tube 27 in spaced relation to the upper end of the glass sleeve 25.

The sight feed 4 may be readily dismantled for cleaning and repairing merely by removing the cover 28 therefor. The glass sleeve 25 then may be removed from the opening in the plate 26.

The stationary cylinder 9 of the force feed pump 3 is formed in the pump casing 6. This cylinder is provided with a check valve which permits the lubricant to be forced therethrough from the cylinder but which prevents the flow of the lubricant back into the cylinder.

This check valve, which is removable as a unit, comprises a cage or valve seat 29 having an opening therethrough and a valve ball 30 for closing the opening. A pin 31, positioned in the cage above the ball, limits the upward movement of the ball.

The cage is threaded into the upper end of the cylinder and is seated against a shoulder 32 therein.

The cylinder 9 is provided with an inlet port 33 communicating with a well 34 in the pump casing.

The reciprocating piston 10 of the force feed pump 3 is carried by and reciprocates with the yoke 8.

The piston 10 near its upper end is provided with a plurality of peripheral grooves 35, which fill with the lubricant and thus serve as a packing to prevent the passage of the lubricant through the lower end of the cylinder 9 within which the piston 10 reciprocates.

The upper end of the cylinder 9 is connected with an outlet pipe 36 by means of a nipple 37 extending through the plate 26 and into the cylinder. The end of the out-

let pipe 36 is seated in the nipple 37 and is maintained in such position by means of a packing gland 38, cooperating with suitable metal packing 39 between the nipple and the gland.

The nipple 37 thereby cooperates with the outlet end of cylinder 9 to clamp plate 26 between itself and the cylinder. The pump casing 6 is thereby secured to the plate.

The pump casing 6 may be easily and quickly removed from the plate 26 for cleaning and repairing by simply removing the screw by which the cover 28 is fastened to the tube 27 and by loosening the packing gland 38 and removing the nipple 37 from the upper end of the cylinder 9.

A hook 40 fastened at its upper end to the pump casing 6 and extending through an opening in the yoke 8 and having its lower end bent to engage the yoke prevents the same from falling away from the pump casing 6 whenever the lubricator is out of operative relation to the cam 11.

The operation of the lubricator is as follows:

Assuming the pumps of the lubricator to be approaching the upper limit of their stroke as shown in Fig. 2, the check valves of both the circulating and the feed pumps are open.

As the yoke 8 moves down the check valve of the force pump closes due to the back pressure in the outlet pipe 36. As the downward movement continues the port 23 is opened allowing lubricant to flow into the lower end of the cylinder 7. The port 33 is also opened allowing lubricant to be drawn from the well 34 into the upper end of the cylinder 9.

During the upward movement of the yoke 8, the ports 23 and 33 are closed.

Upon the closure of the port 23, the valve ball 20 is elevated from its seat by the pressure of the lubricant in the cylinder 7 below the end of the piston 5. The lubricant is then forced up through the hollow piston 5, the slotted opening 17 therein, the passage around the pin 16, the vertical passage 18 and the tube 27. The lubricant then drops from the nozzle or open end of the tube 27 through the sight glass 25 into the groove in the upper end of the pump casing 6 and then into the well 34.

The ball 30 of the force pump check valve is elevated by the compression within the cylinder 9 after the closure of the port 33 and consequently the lubricant in this cylinder is forced through the check valve into the outlet pipe 36 leading to a bearing or other apparatus to be lubricated.

Figures 4 and 5 show a plurality of lubricators mounted in a reservoir 41 containing the lubricant. The reservoir has a cover 42 provided with a plurality of elongated openings, one for each lubricator. The lubricators extend through the elongated openings in the cover and the associated plates 26 close the openings. The plates 26 are secured to the cover 42 by screws 43, which engage inwardly extending projections 44 (see Figures 2 and 3) and thus secure the cover 42 to the reservoir 41.

The drive shaft 12, upon which are mounted the drive cams 11, one for each lubricator, is journalled in suitable bearings in the walls of the reservoir 41 and extends longitudinally thereof. A second shaft 45 carrying a drive pulley 46 extends through the reservoir 41 transversely to the shaft 12 with which it is operatively connected through a worm 47 and worm gear 48.

The shaft 12 may extend through one end of the reservoir so that the lubricators may be operated by hand, if desired.

An opening in the cover 42 through which the lubricant may be poured into the reservoir 41 is covered with a cap 48. A strainer 49 (see Figure 6) may be provided for straining the lubricant as it is poured into the reservoir.

A sight glass 50 may be provided in one corner of the reservoir 41 in order that the level of the lubricant therein may be readily ascertained.

Any of the lubricators may be readily removed from the reservoir for inspection, cleaning or repair, after the outlet tube or pipe 36 has been disconnected and the screws 43 therefor removed. The lubricators may then be removed from the reservoir through the cover thereof by first tilting the lubricator to disengage the yoke 8 from the associated cam 11 of the driving connection and then withdrawing the lubricator through the opening in the cover 42.

Various forms of drives for rotating the cams or eccentrics 11 and thus reciprocating the yokes 8 carrying the reciprocating pistons and cylinders of the lubricators may be adopted to meet the varying conditions of service.

Figures 6 to 8 show an oscillating drive for the lubricators which is to be operated from the side of the reservoir.

Oscillating movemtnt is communicated to a shaft 51 through a lever 52 mounted thereon. The shaft 51 extends through the reservoir and is journalled at one end in a blind bearing and near its other end in a bearing 54 provided with suitable packing and a packing gland 55 to prevent the lubricant from leaking from the reservoir.

A ratchet wheel 56 and an actuating or operating pawl 57 and a holding or retaining pawl 58 are provided for converting the oscillatory movement of the shaft 51 into rotary movement for rotating the cams which reciprocate the yokes 8 of the lubricators.

The ratchet wheel 56 is carried by but is

free to rotate independently of the shaft 12 journalled at one end in a blind bearing 53 and at its other in a sleeve 59. The sleeve 59 is secured to a shaft 60 extending through the wall of the reservoir 41 and journalled in the bearing 54 provided with suitable packing and packing gland 55.

The actuating or operating pawl 57 is pivoted on one end of a ratchet lever 61 and is normally held in engagement with the teeth on the inner periphery of the ratchet wheel 56 by means of a spring.

The ratchet lever 61 is pivotally mounted on the shaft 12 and is operatively connected through a link 63 with a crank 64 fastened on the oscillating shaft 51.

The holding pawl 58 is pivotally mounted on a boss 65 and is pressed into engagement with the teeth on the outer periphery of the ratchet wheel 56 by a spring 66.

The conventional cams shown in Figures 2 and 3 now take the form of cams 67 having a groove 68 formed in one face thereof and a tongue 69 formed on the other face thereof.

The cams 67 are supported by the shaft 12 but rotate independently thereof. The tongue of one cam fits into the groove of the adjacent cam, while the tongue of the right end cam fits into a groove in the side of the ratchet wheel 56. Thus the ratchet wheel 56 drives the cam connected thereto and through it the next cam and on through the whole series of cams. The tongue and groove on each cam extend radially and at an angle to each other. Thus the cams are in different angular positions. Consequently the lubricators operated thereby are at any one instant in different cyclic positions.

The cams are interchangeable.

The lubricators may be operated by hand through a handle 70 adapted to engage a pin 71 in the shaft 60. The sleeve 59 fastened to the shaft 60 is provided with a tongue which engages the groove in the left end cam. Consequently by bringing the handle 70 into engagement with the pin 71 and turning the same causes the rotation of the cams 67 and the operation of the lubricators.

The shaft 12 and driving mechanism carried thereby may be readily dismantled for inspection, adjustment or repair. This may be accomplished after removal of the lubricators and cover of the reservoir, by unscrewing and removing the blind bearing 53, after which the shaft 12 may be withdrawn through the opening thus provided in the wall of the reservoir, or by unscrewing and removing the bearing 54, after which the shaft 12 may be slipped out of the blind bearing 53 and removed through the top of the reservoir.

Figures 9 and 10 show an oscillating drive for a plurality of lubricators mounted in a reservoir, which differs from the drive shown in Figures 6 to 8 merely in that it is operated from the end instead of the side of the reservoir.

The shaft 12 only is employed and extends through the right end wall of the reservoir. The lever 52 is mounted on and locked to the shaft 12.

The cams 67 are supported by and rotate in one direction with the shaft 12 but not in the other.

The actuating or operating pawl 57 is pivotally mounted on a rocker arm 72 locked to the shaft 12.

Thus the oscillatory movement of the lever 52 is communicated directly to the rocker arm 62. This oscillatory movement is converted into rotary movement by the ratchet wheel 56 and the pawls 57 and 58 whereby the cams 67 keyed to one another and to the ratchet wheel 56 are rotated. The rotation of the cams consequently effects the reciprocation of the yokes 8 and operates the lubricators.

After the removal of the lubricators and cover from the reservoir, the shaft 12 and driving mechanism may be readily dismantled for inspection, repair or adjustment by loosening the locking bolt or screw 73. The shaft 12 then may be withdrawn through the right end of the reservoir, thereby removing the cams 67, ratchet wheel 56 and rocker arm 72 therefrom.

Figures 11 and 12 show a rotary drive for a plurality of lubricators mounted in a reservoir, wherein the drive is operated from one end of the reservoir.

The shaft 12 at one end is journalled in a blind bearing 53 in the right end wall of the reservoir and extends through the left end wall and is therein journalled in a bearing 54.

Adjacent cams 67 are locked to each other through the tongues and grooves. A sleeve 74 surrounding the shaft 12 spaces the left end cam from the wall of the reservoir. The right end cam is locked to the ratchet wheel 75 through a tongue and groove connection.

The ratchet wheel 75 is mounted upon the shaft 12, and so far as the automatic operation of the drive is concerned, the ratchet wheel as well as the cams may rotate independently of the shaft. However, when hand operation of the lubricators is to be provided for, the ratchet wheel may be keyed to the shaft 12 by a pin 76 seated in a slot 77 in the face of the ratchet wheel and extending through an opening in the shaft 12. When the ratchet wheel 75 is thus locked to the shaft, the ratchet wheel and the cams rotate therewith. This however is not necessary for the successful operation of the drive.

Rotation of the ratchet wheel 75 is effected

through a gravity actuating pawl 78 pivoted on an eccentric pin 79 projecting from the end of the shaft 80. Backward rotation of the ratchet wheel 75 is prevented by a gravity retaining or holding pawl 81 pivoted on a bushed extension 82 of the bearing 83 in which the shaft 80 is journalled.

A drive pulley 84 secured to the free end of the shaft 80 effects rotation thereof.

Longitudinal displacement of the shaft 80 is prevented by a flange 85 thereon seated against a shoulder in the bearing 83 and so held by suitable packing and a packing gland 86.

As the shaft 80 is rotated, the actuating pawl 78, pivoted on the eccentric pin 79 thereof and resting against a tooth of the ratchet wheel 75, rotates the ratchet wheel a distance equivalent to one tooth during one half revolution of the shaft 80. During the other half revolution of the shaft 80 the actuating pawl 78 is drawn backward to engage the next succeeding tooth of the ratchet wheel, while the ratchet wheel is retained in advanced position by the engagement of the holding pawl with a tooth thereof.

The particular embodiments shown and described are for the purpose of illustration only and the drawings and description are to be considered therefore in an illustrative and not in a limiting sense, for it is obvious that many embodiments and adaptations will readily occur to and may be made by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. Lubricating means having in combination a reservoir; a plurality of lubricators therefor: each lubricator comprising a supporting plate removably fastened to the top of the reservoir, a pump casing fastened to the plate and depending therefrom into the reservoir, a circulating pump, a force feed pump, one pump having a stationary piston and a movable cylinder and the other a movable piston and a stationary cylinder, the stationary piston extending into an opening in the pump casing and the stationary cylinder being formed in the casing, and a member extending through the plate and adjustably supporting the stationary piston.

2. Lubricating means having in combination a reservoir; a plurality of lubricators therefor; each lubricator comprising a supporting plate removably fastened to the top of the reservoir, a pump casing fastened to the plate and depending therefrom into the reservoir, a circulating pump having an adjustable stationary hollow piston supported by the casing and a cylinder movable on the piston, a force feed pump having a cylinder formed in the casing and a piston movable therein, and an adjusting member for regulating the feed of the lubricator extending through the plate and engaging the hollow piston.

3. A lubricator comprising a casing having a force feed pump cylinder formed therein, a piston movable in the cylinder, a circulating pump provided with a stationary hollow piston and a cylinder movable thereon, a member mounted on the casing and adjustably supporting the hollow piston, and means integrally connecting the movable piston and cylinder.

4. A force feed lubricator having in combination a circulating pump comprising a stationary piston having a passage therein, a spring operated check valve for the passage, and a movable cylinder having an inlet port in one side thereof opened and closed directly by the piston.

5. The combination, in a force feed lubricator, of a circulating pump comprising a stationary piston having a passage therein, a valve therefor, a cylinder cooperating with the piston, a pump casing, and means for adjusting the position of the piston relative to the cylinder to vary the feed of the circulating pump, said means being rotatably supported in said casing and engaging said piston.

6. In a force feed lubricator, the combination of a circulating pump comprising a stationary piston and a reciprocating cylinder, and means for varying the feed of the pump including an adjusting rod engaging the piston so as to vary the position thereof relative to the cylinder.

7. In a force feed lubricator the combination of a circulating pump comprising an axially adjustable stationary tubular piston having a lateral outlet near one end and an inlet at the other end thereof, a valve for the inlet, a cylinder reciprocating on the piston, and means co-operating with the lateral outlet to prevent rotary movement of the piston while being adjusted axially.

8. A lubricator having in combination a circulating pump comprising a stationary tubular piston having a lateral outlet and an inlet at opposite ends thereof, a valve for the inlet, a reciprocating cylinder cooperating with the piston, means for adjusting the piston axially with respect to the cylinder, and a sight feed communicating with the lateral outlet.

9. In a lubricator the combination of a circulating pump comprising a stationary tubular piston having a lateral outlet and an axial inlet at opposite ends thereof, a valve for the inlet, a reciprocating cylinder cooperating with the piston, a sight feed communicating with the lateral outlet, and means for varying the feed of the pump without changing the travel of the cylinder.

10. In a lubricator the combination of a circulating pump comprising a stationary

hollow piston having a lateral outlet and an axial inlet, a valve for the inlet, a reciprocating cylinder for the piston, and means for varying the feed of the pump without changing the stroke thereof.

11. In a lubricator the combination of a circulating pump comprising a stationary tubular piston having a lateral outlet and an axial inlet, a valve for the inlet, a reciprocating cylinder cooperating with the piston, a sight feed communicating with the lateral outlet, and means for varying the feed of the pump without changing the stroke thereof, said means including an adjustable support for the piston.

12. In a lubricator the combination of a pump comprising a stationary piston and reciprocating cylinder, and means for varying the feed of the pump without changing the stroke of the cylinder.

13. In a lubricator the combination of a pump comprising a stationary piston and reciprocating cylinder, and means for varying the feed of the pump without changing the stroke of the cylinder, said means including an adjustable support for the stationary piston.

14. In a lubricator comprising a pump with a stationary tubular piston, longitudinal feed adjusting means cooperating with the piston, and means associated with the piston to prevent rotation thereof while being adjusted longitudinally.

15. In a lubricator the combination of a circulating pump including a stationary tubular piston and a cylinder reciprocating thereon, a sight feed having a passage communicating with the tubular piston, and means within the passage preventing rotation of the piston and permitting longitudinal movement thereof whereby the feed of the pump may be varied without obstructing the flow of lubricant through the tubular piston and communicating passage to the sight feed.

16. A lubricator having in combination a pump comprising a stationary tubular piston and a cylinder reciprocating thereon, means for adjusting the relative positions of the piston and cylinder longitudinally, and means preventing rotary movement of the adjusted member while the same is being adjusted longitudinally.

17. A lubricator including a pump having a stationary hollow piston, a valve seated in the inlet end thereof, a cylinder reciprocating on the piston and having an inlet port, and means for adjusting the position of the piston to vary the point of cut off with respect to the inlet port of the cylinder whereby variable feed is obtained without altering the stroke of the pump.

18. A lubricator comprising a circulating pump, an adjustable hollow piston therefor, a cylinder movable on the piston and adapted to move a lubricant therethrough, a force feed pump having a movable piston, and operating means for the lubricator including a transverse arm projecting from the upper end of the movable cylinder and connected to the movable piston, and a transverse arm projecting from the lower end of the movable cylinder and co-operating therewith and with the other arm to form a yoke.

19. A force feed lubricator having in combination a circulating pump comprising a stationary hollow piston, a check valve within the hollow piston, a movable cylinder for the piston having a pair of spaced arms projecting therefrom to form a part of the lubricator operating mechanism, and an inlet for the cylinder extending through one of the arms and the cylinder wall.

20. In a lubricator, a circulating pump having a support and a stationary hollow piston fitting in an opening thereof, a cylindrical tubular sleeve seated in said opening and adjustably engaging the hollow piston so as to vary the axial position thereof in the opening, and means for limiting the axial movement of the piston and for preventing rotary movement thereof during axial adjustment.

21. In a lubricator, a circulating pump having a support and a stationary hollow piston fitting in an opening thereof, a cylindrical tubular sleeve seated in said opening and adjustably engaging the hollow piston so as to vary the axial position thereof in the opening, and means for limiting the axial movement of the piston and for preventing rotary movement thereof during axial adjustment, said means including a longitudinal slot in the piston and a pin located in the slot.

22. A lubricator comprising a circulating pump having an adjustably mounted stationary hollow piston, a sight feed, means associated with the piston and maintaining a communicating passage between the sight feed and the interior of the piston, said means including an elongated opening in the side of the piston communicating with the interior thereof, and means extending through the passage and into the opening and preventing rotation of the piston and limiting the longitudinal movement thereof.

23. A sight force feed lubricator comprising a circulating pump having an adjustable stationary hollow piston and a reciprocating cylinder therefor, a force pump having a stationary cylinder and a reciprocating piston therefor, a support common to the stationary cylinder and piston, and a yoke for reciprocating the movable piston and cylinder formed integrally therewith.

24. A sight force feed lubricator comprising a force feed pump, a stationary cylinder

therefor having a valveless inlet port in the wall thereof, a plunger cooperating with the cylinder, and a removable valve cage having an outlet valve therein.

25. A force feed pump for a lubricator comprising a cylinder having an inlet port, a plunger therefor, and a removable valve cage arranged in one end of the cylinder and having an outlet valve therein.

26. A force feed pump for a lubricator comprising a pump casing, a plate for supporting the same, a pump cylinder in the casing, a removable valve cage in one end of the pump cylinder having an outlet valve therein, and means directly engaging said cylinder outlet and the supporting plate for securing the pump casing to the plate, said means forming an outlet for the lubricator.

27. A force feed pump for a lubricator comprising a pump casing, a plate for supporting the same, a pump cylinder within the casing, a removable valve cage in one end of the cylinder having an outlet valve therein, and means for detachably securing the pump casing to the plate and permitting the removal of the valve cage from the outside of the casing.

28. A sight force feed lubricator comprising a casing, a circulating pump having a stationary piston adjustable from without the casing supported thereby, a reciprocating cylinder, a force feed pump having a stationary cylinder formed in the casing, a reciprocating piston for the stationary cylinder, a yoke carrying the reciprocating piston and cylinder and open at one side so as to embrace driving means for the lubricator.

29. A sight force feed lubricator comprising a circulating pump having a stationary piston and a reciprocating cylinder, a force feed pump having a stationary cylinder and a reciprocating piston, a casing supporting the stationary piston and cylinder and having communicating passages therebetween, and a driven member rigidly connected to the reciprocating cylinder and piston and forming part of a driving connection for the lubricator, said driven member being so supported as to have only a movement parallel to the piston and cylinder connected thereto.

30. A sight force feed lubricator comprising a pump casing, a stationary hollow piston mounted in the casing, a cylinder formed in the casing which has connecting passages formed therein and affording communication between the hollow piston and the cylinder, a reciprocating yoke, and a cylinder and a piston rigidly connected thereto and cooperating respectively with the piston and the cylinder of the pump casing.

31. A lubricator having in combination a supporting plate, a pump casing located on one side of the plate and removably fastened thereto, a circulating pump, a force feed pump, one pump having a movable cylinder and a stationary piston and the other a stationary cylinder and a movable piston, the stationary cylinder being formed in the pump casing and the stationary piston being supported thereby, and a member extending through the plate and adjustably supporting the stationary piston.

32. A lubricator having in combination a supporting plate, a pump casing located on one side of the plate and removably fastened thereto, a circulating pump, a force feed pump, one pump having a movable cylinder and a stationary piston and the other a stationary cylinder and a movable piston, the stationary cylinder being formed in the pump casing and the stationary piston being supported thereby, a member extending through the plate and adjustably supporting the stationary piston, and lubricator operating means including a driven member integrally connected to the movable piston and cylinder.

33. A lubricator having in combination a supporting plate, a pump casing located on one side of the plate and removably fastened thereto, a circulating pump, a force feed pump, one pump having a movable cylinder and a stationary piston and the other a stationary cylinder and a movable piston, the stationary cylinder being formed in the pump casing and the stationary piston being supported thereby, a member extending through the plate and adjustably supporting the stationary piston, and lubricator operating means including a pair of spaced arms integrally connected to the movable cylinder, the movable piston being integrally connected to one of said arms.

34. A lubricator having in combination a supporting plate, a pump casing located on one side of the plate and fastened thereto, a circulating pump having a stationary hollow piston adjustably supported in the casing and a cylinder movable on the piston, a force feed pump having a cylinder formed in the casing and a piston movable in the cylinder, and a member for axially adjusting the hollow piston, said member being supported by the casing and extending through the plate.

35. A lubricator having in combination a supporting plate, a pump casing located on one side of the plate and fastened thereto, a circulating pump, a force feed pump, one pump having a movable cylinder and a stationary piston and the other a stationary cylinder and a movable piston, the stationary cylinder being formed in the pump casing and the stationary piston being supported thereby, a member extending through the plate and adjustably engaging the station-

ary piston to vary the feed of the lubricator, and means carried by the casing and co-operating with the stationary piston to prevent rotary movement thereof during the adjustment thereof.

36. A unitary force feed lubricator comprising circulating and force feed pumps, a single piece pump casing, one pump having a stationary tubular piston and a movable cylinder and the other pump having a stationary cylinder and a movable piston, the stationary piston being mounted in the casing and the cylinder being formed therein, a supporting plate to which the pump casing is attached, and a member extending through the plate and having threaded engagement with the stationary piston to allow the feed of the lubricator to be varied without changing the stroke of the movable cylinder.

37. A unitary force feed lubricator comprising circulating and force feed pumps, a single piece pump casing, one pump having a stationary tubular piston and a movable cylinder and the other having a stationary cylinder and movable piston, the stationary piston being mounted in the casing and the cylinder being formed therein, a supporting plate to which the pump casing is attached, and a sleeve seated on a shoulder in the pump casing and enclosing one end of the stationary piston and having screw threaded engagement therewith, the other end of the sleeve being closed and so shaped as to be readily rotated to vary the feed of the lubricator without changing the stroke of the movable cylinder.

38. A sight force feed lubricator including a supporting plate, a pump casing to which are secured a circulating and a force feed pump removable as a unit from the plate, a stationary piston for one pump, a movable piston for the other, a member extending through the plate and adjustably engaging and supporting the stationary piston, and means for fastening the pump casing to the plate and serving as an outlet for the lubricator.

39. A sight force feed lubricator including a supporting plate, a pump casing to which are secured a circulating and a force feed pump removable as a unit from the plate, means serving as an outlet for the lubricator, a sight feed tube arranged above and supported by the plate, a feed tube connected to the circulating pump and extending into the sight tube, and a cap for the sight tube secured to the feed tube, said cap and the means serving as the outlet for the lubricator comprising the only means for fastening the pump casing to the plate.

40. A sight force feed lubricator comprising a circulating and a force feed pump, a supporting plate therefor forming therewith a unit, a pump casing having the force feed pump cylinder formed therein, a stationary piston for the circulating pump arranged in the casing, an adjusting supporting member for the hollow piston mounted on the pump casing, a reciprocating yoke, and a cylinder and piston movable with the yoke and cooperating with the stationary piston and cylinder respectively.

41. A sight force feed lubricator comprising a pump casing having a piston and a cylinder therein, a reciprocatory yoke having a cylinder and piston rigidly fastened thereto and adapted to cooperate with the piston and the cylinder of the casing, means for reciprocating the yoke, and a link cooperating with the yoke and casing and preventing separation thereof after the yoke has been disengaged from the reciprocating means.

42. In a force feed lubricator, a circulating pump having a stationary tubular piston, a movable cylinder therefor having a constant travel, and means for adjusting the piston axially to vary the feed of the pump.

43. In a force feed lubricator, the combination of circulating and force feed pumps, one having a stationary hollow piston and a movable cylinder having a constant travel and the other having a stationary cylinder and movable piston, a pump body in which the stationary hollow piston is mounted and in which the stationary cylinder is formed and having communicating passages therebetween, a member connecting the movable cylinder and piston so they will move together, and means for adjusting the hollow piston axially to vary the feed of the lubricator.

44. In a force feed lubricator, a circulating pump having a stationary piston, a movable cylinder therefor having a constant travel, and means engaging the piston so as to adjust the same to vary the feed of the pump.

45. In a force feed lubricator, a circulating pump having a stationary hollow piston, a movable cylinder therefor having a constant travel, and a rotatable member engaging and supporting the piston so that rotary movement of said member alters the position of the piston to vary the feed of the pump.

46. A lubricator having in combination an adjustable tubular piston having a lateral slotted opening, a reciprocating cylinder for the piston, and a pin extending into the slotted opening and preventing rotary movement of the piston while the same is being adjusted longitudinally.

In witness whereof, I have hereunto subscribed my name.

FLOYD L. SWANBERG.