Dec. 15, 1936. S. O. JAKOBSEN 2,064,755

PRESSURE LUBRICATION PUMP

Filed Feb. 21, 1935 2 Sheets-Sheet 1

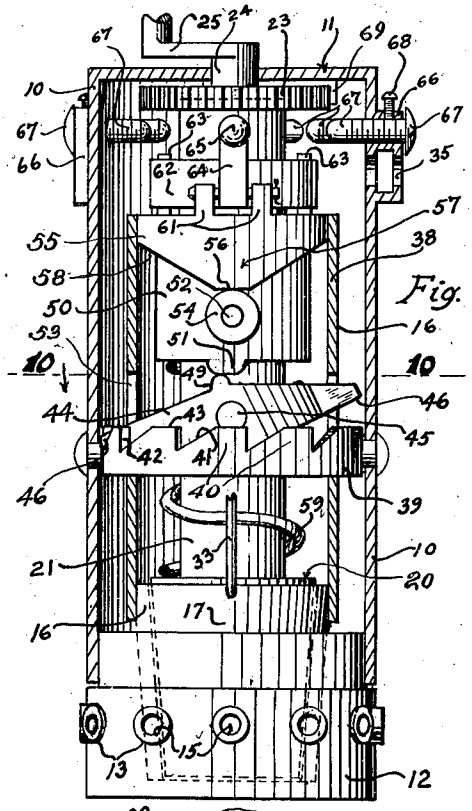


Fig. 1.

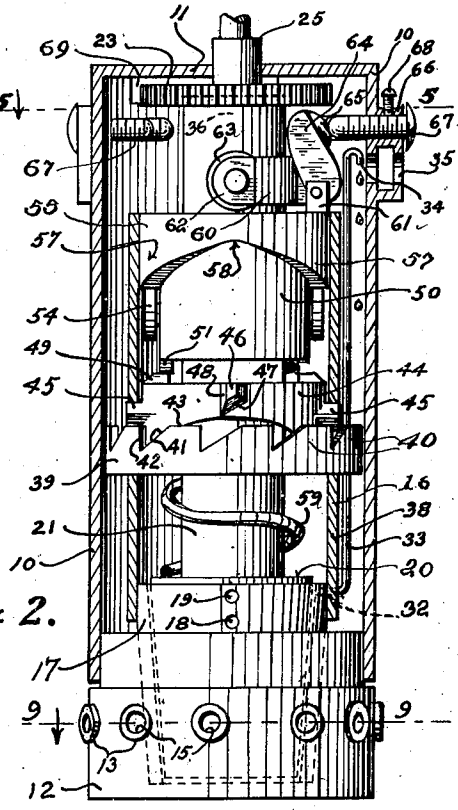


Fig. 2.

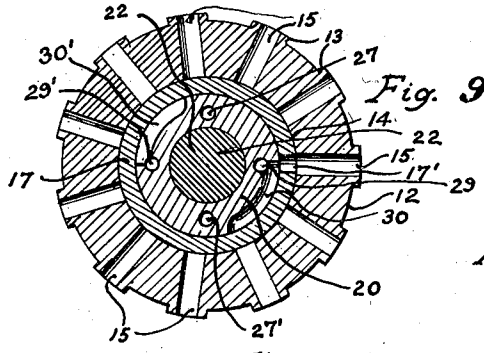


Fig. 9.

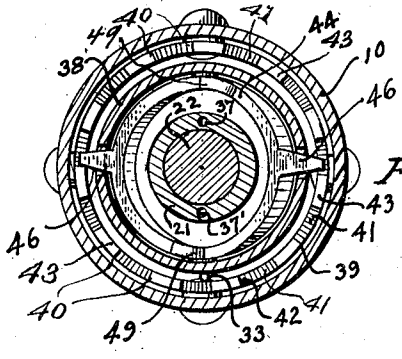


Fig. 10.

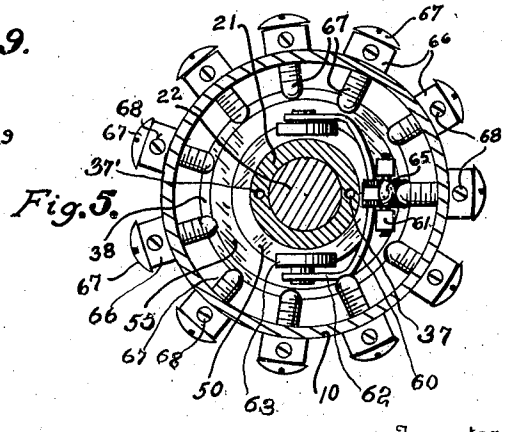


Fig. 5.

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PRESSURE LUBRICATION PUMP

Filed Feb. 21, 1935 2 Sheets-Sheet 2

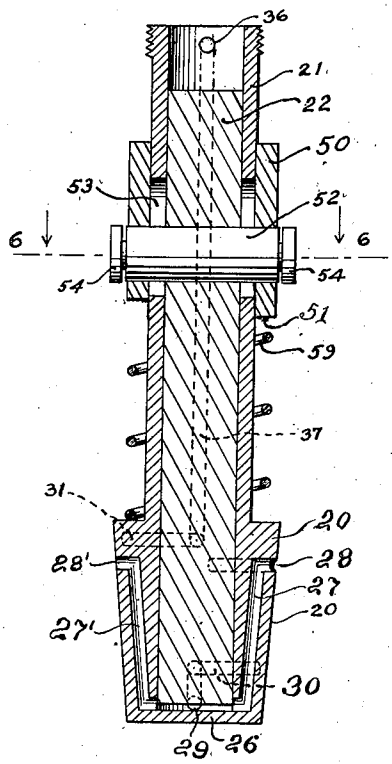


Fig. 3.

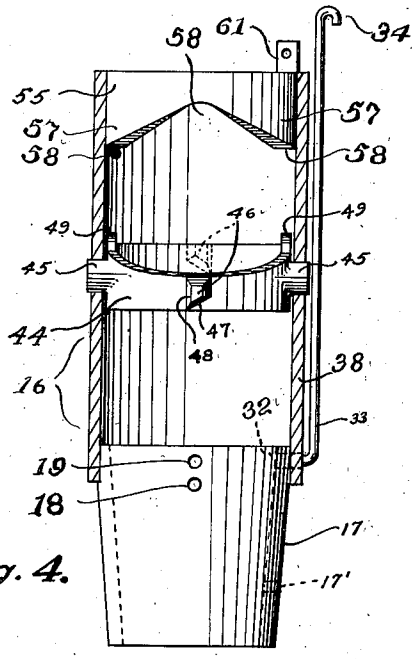


Fig. 4.

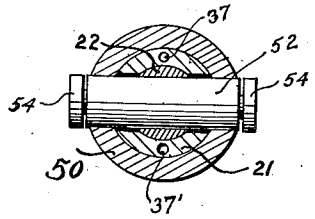


Fig. 6.

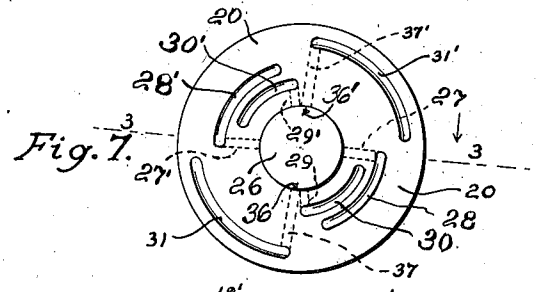


Fig. 7.

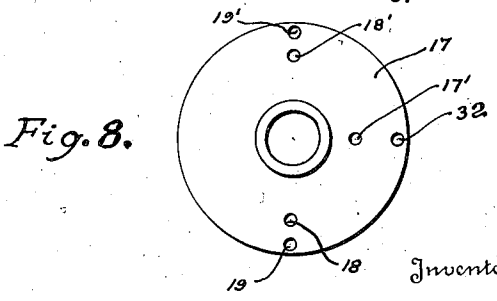


Fig. 8.

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UNITED STATES PATENT OFFICE

2,064,755

PRESSURE LUBRICATION PUMP

Svend Older Jakobsen, Hoievarde, near Haugesund, Norway

Application February 21, 1935, Serial No. 7,626
In Norway February 26, 1934

11 Claims. (Cl. 184—35)

The invention has for an object to present a lubricator device adapted to supply oil to individual feed pipes by individual impulses of a piston pump, utilizing a novel mechanism for effecting a selective distributing function coordinated with operation of the piston.

An important purpose is to construct a novel means for effecting connection between a supply source and a multiplicity of feed ducts.

A very important aim is to present such a structure in which the amount of lubricant supplied to various ducts may be individually and selectively proportioned to the need of the particular mechanism or parts being lubricated by the respective ducts, and particularly to enable this by the use of a single pump.

A specific object is to provide means coordinated to simultaneously proportion the stroke of a pump selectively to the need of each of a number of given parts and effect the selective connection of the necessary ducts in synchronism with the action of the pump.

Additional objects, advantages and features of invention reside in the construction, arrangement and combination of parts involved in the embodiment of the invention as will appear from the following description and accompanying drawings, wherein

Figure 1 is an elevation of one embodiment of the invention with parts broken away to show interior parts.

Figure 2 is a similar view at right angles to Figure 1.

Figure 3 is a vertical axial section of the valve proper, and immediately associated parts.

Figure 4 is an elevation of the distributor.

Figure 5 is a horizontal section on the line 5—5 of Figure 2, looking downward.

Figure 6 is a section on the line 6—6 of Figure 3.

Figure 7 is a diagrammatic development of the valve face.

Figure 8 is a diagrammatic development of the valve seat of the distributor.

Figure 9 is a section on the line 9—9 of Figure 2 (in a plane with the individual feed duct connections).

Figure 10 is a section on the line 10—10 of Figure 1.

There is illustrated a lubricator unit adapted to use for various kinds of machinery or for other purposes, and adapted to be operated in any approved manner suitable to the particular use. It includes an outer casing 10, having an upper closed head 11, and a bottom including a manifold 12 which in the present showing is circular and provided with a multiplicity of radial duct connections 13 in its lower part from which tubes may be led to various points of application of lubricant. The casing constitutes a reservoir for lubricant. The manifold includes a conical concentric seat 14 on which open respective discharge ports 15 from each of the duct connections. This seat portion is deepened to afford a good bearing for a step-by-step rotating distributor 16, which includes a bushing 17 fitting the seat 14 and having an inner conical seat parallel and concentric with the seat 14, being formed with a single radial discharge port 17' therethrough at a level with the ports 15. The distributor bushing extends above the top of the manifold bottom 12 and in this upper part is formed with two radial inlet ports 18—19 vertically spaced and both communicating exteriorly with the reservoir space in the casing 10. The latter ports are on an element of the conical face of the seat spaced 90 degrees from the port 17'. Similar ports 18' and 19' at the same levels are formed in the bushing diametrically opposite the ports 18—19. Means is provided to rotate the distributor, step-by-step, so that its port 17' registers successively with the ports 15 at respective stations in its movement, as will be described. Seated in the distributor bushing there is a hollow distributor valve 20 having a coaxial tubular stem or cylinder 21, the valve and stem being cylindrically bored to serve as a pump cylinder open only at the upper end, except for ports opening laterally from the lower end of the bore through the valve, and fitted with a piston 22 consisting of a simple solid cylinder sufficiently shorter than the bore of the valve to permit the necessary stroke as will be described. The lower end of the bore is closed except when the ports of the valve and bushing are registered. The upper end of the bore of the cylinder 21 is closed by means of a gear 23 by which the cylinder 21 may be rotated through any usual operative connections although other means may be employed, if desired. The gear is provided with a hub 24 revolubly mounted in the head 11, and above this head a crank 25 is provided on the gear hub by which it may be operated manually when or if desired. It is contemplated that the cylinder and valve will be sustainedly rotated when in use.

The valve 20 consists of an enlargement of the wall of the cylinder 21, and is formed with an integral imperforate end wall 26. It is formed with an inlet passage 27 in the wall of the valve, opening inwardly at the extreme bottom of the cylinder at one end and opening outwardly on to

a horizontal port 28 located in the upper part of the face of the valve on a level with the lower inlet port 18 of the distributor bushing. The port 28 extends over slightly less than 90 degrees of arc on the periphery of the valve. Diametrically opposite the passage and port last described there are a similar inlet passage and port 27' and 28' respectively, having similar form, extent, and communication at the same levels. An outlet passage 29 is formed in the wall of the valve spaced ninety degrees from the passage 27, also opening on the interior of the valve at the bottom thereof, and opening outwardly on to an outlet port 30 extending horizontally over less than ninety degrees of arc on the face of the valve in the lower part thereof at the level of the port 17'. A port 30' at the same level and of the same extent is located diametrically opposite the one 30, and from this there leads a passage 29' opening inwardly at the bottom of the cylinder bore.

There is also formed on the face of the valve very near the top thereof a peripheral horizontal combined inlet and outlet port 31 extending over somewhat less than 90 degrees, and a diametrically opposite port 31' of similar level and extent, both positioned to register with the upper inlet port 19 of the distributor bushing, and located in sectors of the valve intermediate those containing the ports 28 and 28'. The distributor bushing is also formed with a radial upper outlet port 32 located vertically above the port 17' and on a level with the inlet port 19. Attached to the side of the bushing there is a vertically extending pipe 33 leading from the port 32, and having a goose neck termination 34 in close spaced relation to the wall of the casing 10. The casing is provided with a multiplicity of sight openings 35 immediately below the level of the upper end of the pipe and alined over respective ports and connections 15—13. The pipe is so located on the distributor that when the piston is raised the goose neck will be in front of an opening 35 over the port 15 through which lubricant will be discharged on the next downward movement of the piston, as will be explained.

From the upper end of the interior face of the cylinder a port 36 opens into a passage 37 formed in the wall of the cylinder, extending down to a level with the port 32 of the bushing, where it opens outwardly into the port 31. A similar port and passage 36' and 37' are formed on the cylinder diametrically opposite those last named opening through port 31'. On the distributor bushing there is mounted a frame or case 38, spaced from the casing 10. Fixed on the casing 10 around and clearing the case 38 there is a horizontal stationary annular rack 39 concentric with the cylinder 21 having teeth 40 on its upper side formed with inclined cam faces 41, all inclined in a common direction, and vertical stop sides 42, the tops 43 of the teeth being flat for a distance of approximately half the interval between teeth or less. On the frame 38 there is a rocking ring 44 having diametrical trunnions 45 revolubly engaged in the frame 38 and provided with wiper arms 46 at right angles to the axis of the trunnions extended over the rack ring and formed with under sides 47 inclined the same as and adapted to engage the cam faces 41 and by bearing downwardly thereon cause the distributor to be propelled clockwise as viewed from above. They also have properly formed stop sides 48 adapted to engage the stop sides 42 of the teeth 40. There is an odd number of teeth on the rack ring 39 so that when one of the arms is fully depressed, the wiper face 47 of the opposite arm will when moved downward engage a cam face thereunder to propel the distributor one stage in its movement. The arms 46 are also so positioned relatively that when one is at the full depth of movement on one cam face, the opposite arm will clear the ring in such spaced relation that on the next rocking movement, some lost motion will occur and the rising arm will clear the top of the next advancing tooth before or as the opposite arm engages the cam face 41 thereunder, thus avoiding obstruction of the step movement. On the top side of the rocking ring 44 close beside the cylinder 21, there are formed strikes or cam knobs 49, arranged on a diametrical line spaced above the pivot axis of the rocking ring.

Slidable vertically on but rotating with the cylinder 21, there is a sleeve 50 having a single wiper knob 51 on its under side adapted to engage the knobs 49 to rock the ring 44 as will be described. This sleeve has a diametrical cross pin 52 therethrough, fixed on the piston 22, and engaged loosely through a longitudinal slot 53 in the sides of the cylinder 21. The pin is tenoned at its ends and has mounted thereon respective wiper wheels 54 located outwardly of the sleeve 50 to be engaged by a ring cam 55 fixed on the upper part of the distributor frame. The latter is formed with two diametrically opposite flats or "tops" 56 which are the extremes of downwardly projecting lobes 57 of the cam, and intermediate recesses 58. The flats 56 are extended horizontally a short distance.

Between the lower side of the sleeve 50 and the top side of the valve 20 a helical spring 59 is confined to yieldingly hold the sleeve upwardly against the cam so that for each rotation of the sleeve relative to the cam, the sleeve will be reciprocated twice in each direction.

It will be seen that the sleeve is moved positively downward to a definite fixed limit by the cam, but means is provided to variably and adjustably limit its upward movement and consequent suction movement of the piston to adapt the pumping capacity in respect to each stage of movement so that specific quantities of lubricant predetermined, and/or variable at will, will be delivered to the respective oil ducts. This means consists of a yoke 60, pivoted between ears 61 on the top of the cam 55 or distributor frame at one side, the yoke having divergent arms 62 extending on opposite sides of the cylinder and carrying respective wiper rolls 63 at diametrically opposite sides of the cylinder, positioned to bear on the horizontal top face of the sleeve 50 to limit the upward movement thereof according to the position of the yoke. The yoke has an upwardly extending central regulator arm 64 at its pivot base, formed with an inclined cam or wiper 65 on its outer side at its extremity, while set in the wall of the casing 10 with a suitable mounting 66 there are respective regulating screws or the like over each of the ports 15, respective set screws 68 being provided to secure the screws 67 in adjusted positions. The ends of the screws 67 are suitably formed to engage and slide easily on and off the cam 65 if need be.

As the distributor is moved step by step to aline the port 17' with respective ports 15, the regulator cam will engage the respective screws 67 on or after arrival at each stage, thereby limiting the upward movement of the sleeve and consequent suction stroke of the piston distinctively for each operation. The succeeding correspondingly limited downstroke of the piston will force

the desired amount of lubricant through one of the ports 30—30' to the port 17' from which it gains access to the particular port and conduit connection 15—13 then in registry. Since there are two step movements for each rotation of the cylinder and valve relative to the distributor and only one port 17' and one port 32 discharge ports 30—30' and 31—31' on each side of the valve will be operative on alternate operation of the piston and distributor for discharge function. But the ports 28—28' and 31—31' all will function for inlet function on each operation owing to the provision of diametrically opposite ports 18—18' and 19—19'.

In use, the device being mounted suitably for convenient access, operative connections being made whereby to rotate the cylinder clockwise as viewed from above, and pipes being led from respective ports 15 to particular machine elements or other parts where lubricant or the like is to be delivered, the reservoir or casing 10 is filled to an intermediate level with proper lubricant. After a short period of operation to expel air from the cylinder, ports and passages, the piston will operate to pump lubricant at both ends of the cylinder, only that from the lower end being discharged to the delivery pipes.

Assuming now, that the ring 44 is positioned with one arm 46 at the lower limit of its movement and wheels 54 just engaging the flats 56 one stage of movement of the distributor will have been previously completed and the distributor will be stationary and will so remain, with the port 17' of its bushing 17 registered with one of the ports 15 while the rollers 54 complete the last part of their movement on the flats 56. The piston will be at its lowest position, having just expelled one charge of lubricant through, say, port passage 29 and port 30 to the port 17' and so to a respective point of delivery through one port 15. The piston will also have just completed intake of lubricant at the upper end of the cylinder through port 36, passage 37 and ports 31 and 19, and similarly through ports and passage 36', 37' and 31'—19'.

The port 30 will now be in lap position away from port 17' and ports 31 and 19, 31'—19' will also be lapped. The wiper knob 51 is in position to engage the strike knob 49 and operate the rocking ring to effect a further stage of movement of the distributor, and the wheels 54 are about to move upwardly against the upwardly sloping faces of the departing lobes. When the next movement of the distribution occurs the inlet ports 28 and 28' of the valve will register respectively with inlet ports 18 and 18' of the bushing, and the port 31' comes into alinement with the port 32, while port 31 remains in lap. The wiper 51 clears strike knob 49 and leaves the distributor stationary while the rolls 54 move upward on the cam 55. The port 17' will now have been moved to register with a new port 15, the screw 67 thereover will be alined with the wiper 65 of the regulator yoke, so as to stop upward movement of the rolls 63 at the desired level to properly limit the upward movement of the piston and consequently limit the amount of lubricant which will be drawn in by the next upward stroke of the piston. Rotation of the cylinder and sleeve 50 continuing, the wheels 54 now by pressure of spring 59 ascend on the cam until upward movement of the sleeve 50 is stopped by the rolls 63 of the regulator device, when rotation of the cylinder and sleeve continue, the wheels 54 moving horizontally clear of the cam. Oil will thus be drawn inward through ports and passages 18—28—27 and 18'—28'—27' in a quantity exactly the same as that expelled at the top of the cylinder. The oil so expelled, passing through port 30', passage 37', ports 31'—32 and pipe 33 may be viewed through the opening 35. Should it not be in accordance with requirements of the part to be lubricated by that taken in at the bottom at the same time, the particular regulator screw 67 may then be adjusted to effect the desired correction. This adjustment can be very easily made when the wheels 54 are depressed to their lower limits by the cam, as there is then a minimum of friction and pressure at the point of contact of screw 67 and wiper 65. In fact, due to the weight of the rolls 63 and yoke parts inwardly of the pivot at 61, the yoke will fall to disengaged position on each downward movement of the sleeve.

As the wheels pass the medial plane of the recesses 58 of the cam the ports 28—28' are lapped, port 30' registers with port 17', and ports 31 and 31' register with inlet ports 19' and 19 respectively. Rotation of the cylinder now carries the wheels 54 against the lobes of the cam, causing depression of the sleeve and piston, forcing lubricant out through passage 29', ports 30' and 17' and drawing lubricant in through ports 19, 31', passage 37' and port 36' and through ports 19', 31, passage 37 and port 36. As soon as the flats 56 are again reached by the wheels 54, ports 31 and 31' become lapped, for a short time, after which the ports 28'—28 register with ports 18 and 18' respectively and port 31 registers with port 32 just as the wiper 51 engages the second knob 49 to rock the ring 44. The distributor is now advanced another step to deliver lubricant to the next port 15 and pipe. Another intake of lubricant in the lower part of the cylinder now occurs as the piston moves upward by further rotation of the cylinder and sleeve, and lubricant is again expelled in like quantity through the pipe 33 in front of the view opening over the pipe to which the lubricant taken in at the bottom is to be discharged, and that discharge and further intake at the top will occur as before indicated, the cycle being thus continued from the point first mentioned, two such actions occurring on each rotation of the cylinder with respect to the distributor, but the actual rotation of the cylinder and sleeve being slightly more, due to the stepping forward, or precession motion, of the distributor.

It will be observed that the step-by-step action is clockwise, and it is considered desirable to rotate the cylinder in the same direction in order to minimize friction and facilitate the rocking action of the ring 44, as will be understood, as well as avoid possibility of direct rotation of the ring by the wipers 51. The stop faces of the teeth 40 and faces 48 of the arms of the ring 44 engage to prevent casual rotation of the distributor directly by the wiper 51 beyond the desired limit at each operation, so that the rack ring 39 and rocking ring 44 operate as an escapement.

The pump may be broadly termed an expansible chamber device, and while a single piston is shown in the cylinder, there are in fact two pump cylinder elements and two pistons, formed by the respective ends of the cylinder 21 and the piston 22, arranged in tandem relation. The cylinder, and distributor parts together may be termed a rotor for brief designation in the

claims, and the bushing 17 may be termed a valve for the purposes of the claims.

I claim:

1. A liquid pump charge distributing device comprising a double expansion chamber pump device including means in one chamber operative for compression action while the other is operative for suction, means to operate the pump, means operatively connected with the pump including a valve operatively connected with the discharge of one expansible chamber only to distribute charges therefrom successively to a plurality of discharge points, and operatively connected to the other expansible chamber to deliver charges at respective view ports associated indicatively with respective discharge points.

2. The structure of claim 1 in which the pump device consists of tandem chambers, a common piston device therefor, the chambers having separate discharge outlets connected to said distributor device in operative association with the discharge elements and the view ports respectively.

3. A device of the character described comprising a rotor, a tandem piston pump device revoluble therewith, a piston operating member mounted on the rotor reciprocable longitudinally of the axis of the pump piston, a rotary annular cam concentric with and revoluble relatively to the rotor, means including a wiper on the piston engaged with the cam to reciprocate the piston, means to supply lubricant to the pump, a stationary case concentric with the axis of the rotor having a multiplicity of circumferentially spaced radial ports and having inlet means, a revoluble valve having ports to form communication between the inlet, the pump and said radial ports successively, and means to rotate the cam and valve in unison, step-by-step, proportioned to the spacing of the said radial ports.

4. A device of the character described comprising a rotary tandem cylinder device, tandem pistons therein, means to rotate the pistons on their longitudinal axis, a reciprocable member slidable on the cylinders and fixed to the pistons, a distributor frame revoluble on the axis of the cylinder, a revoluble annular cam thereon, wipers on the reciprocable member to travel by relative rotation on the cam whereby to reciprocate the piston, a rotary valve device including a stationary seat concentric with the axis of the pistons and having a multiplicity of ports circumferentially spaced, a distributor valve revoluble on said seat and having a main port movable to aline successively with said first ports, and having inlet port spaced longitudinally therefrom, means to supply lubricant to the inlet port, a valve operatively connected with the piston and receiving from the pump revoluble in the distributor valve and having ports to aline with the said main port and inlet ports alternately, on respective movements of the pistons and to communicate with the pump on compression and suction strokes alternately, and intermittent means operatively connected with the reciprocable member to rotate the cam and distributor valve step-by-step to aline the said main port successively with the ports of the said seat.

5. The structure of claim 4, in which the second named valve includes two sets of ports, one set operative between one cylinder only and said main port, the valve including a separate discharge port and the other set of ports operatively associated with the other cylinder of the pump and said separate discharge port, respective delivery ducts connected to the said circumferentially spaced ports of said seat, and observation means included with the said separate discharge port, for the purposes described.

6. The structure of claim 4, in which the said cam is positively operative on said wiper in one direction only, yielding means to move the reciprocable member in the opposite direction, and a plurality of adjustable stroke limiting devices spaced about the axis of the pistons and means on the cam device including a member to aline successively with said stroke limiting devices and having a part in the path of the reciprocating member opposed to said yielding means to be moved thereby.

7. The device of claim 4 in which said intermittent means comprises a stationary ring having teeth projected parallel to its axis having inclined cam faces in one direction circumferentially and stop faces in the other direction, a rocking member mounted on an axis fixed and diametrical with respect to the cam and arms thereon adapted to engage the cam faces on rocking movement in respective directions, strikes on the rocking member spaced from its axis of rocking and a wiper on the reciprocating member positioned to engage the strikes alternately on terminal compression movement of the piston, said cam having two lobes.

8. In a lubricator of the character described, mutually reversed cylinders, respective pistons therein rigidly connected, yielding means to move the pistons in one direction, mechanical means to move the pistons in the opposite direction, a distributor device comprising an annular stationary manifold and a step-by-step rotating distributor valve device having inlet relation to one cylinder for delivery of charge therefrom to successive ports of the manifold, said rotating distributor having an observation discharge device positioned thereon for observation and having means in receiving relation to the other cylinder constructed to deliver therefrom to said observation discharge device, means to operate the distributor step-by-step in unison with the compression stroke of the piston in said cylinder, a movable stroke limit device mounted on the rotating distributor having one part movable radially of the distributor and another movable longitudinally with respect to the pistons, a member fixed with the pistons in the path of the second named part of the stroke limit device, and respective radially adjustable fixed regulator devices spaced circumferentially of the orbital path of the stroke limit device adjacent respective ports of the manifold.

9. A device for the general uses indicated comprising a casing and reservoir element having a conical seat in its lower part and a multiplicity of radial ports opening therefrom, a hollow valve revoluble in said seat and having discharge ports, at least one arranged to register successively with the radial ports, and inlet ports communicating with the reservoir, a revoluble tandem cylinder device revoluble on its longitudinal axis having a concentric valve head thereon revoluble in the hollow valve and having separate inlet and discharge means operative with respective cylinders and arranged to deliver to said discharge ports respectively, a framing on the hollow valve, an annular cam thereon around the cylinder having two lobes extended longitudinally of the valve and cylinder in one direction, a sleeve slidable around the cylinder having a wiper mounted thereon arranged to travel on the cam and con-

nected to the piston to move in fixed relation to the piston, resilient means confined between the framing and sleeve to bear the wiper against the cam, means to rotate the framing and hollow valve step-by-step for the purpose described, a yoke pivoted on the said framing having an arm projected transversely in the path of the sleeve and having slidable bearing thereon, said yoke having an arm extended longitudinally with respect to the sleeve, and a plurality of radially adjustable fixed stop devices alined with respective positions of the last named arm under step-by-step movement of the framing.

10. The structure of claim 9 in which said stop devices are mounted on said casing at an upper part, a discharge tube being extended from one of said discharge ports of the hollow valve to an elevated point within said casing, sight openings being formed in the casing alined with respective radial ports at the level of the discharge end of said tube.

11. The structure of claim 9 in which a stationary annular rack ring is fixed in the casing around said framing formed with teeth inclined in one direction, a rocking ring around the cylinder on the framing having swinging arms over the rack ring to engage the teeth alternately as an escapement device, strikes on opposite sides of the rocking ring spaced above its rocking axis and a wiper on said sleeve arranged to engage the strikes, the lobes of said cam having their major projections over the said rocking axis.

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