July 15, 1952 G. NEMETZ 2,603,158

LUBRICATING PUMP

Filed July 28, 1947 2 SHEETS—SHEET 1

Fig. 1

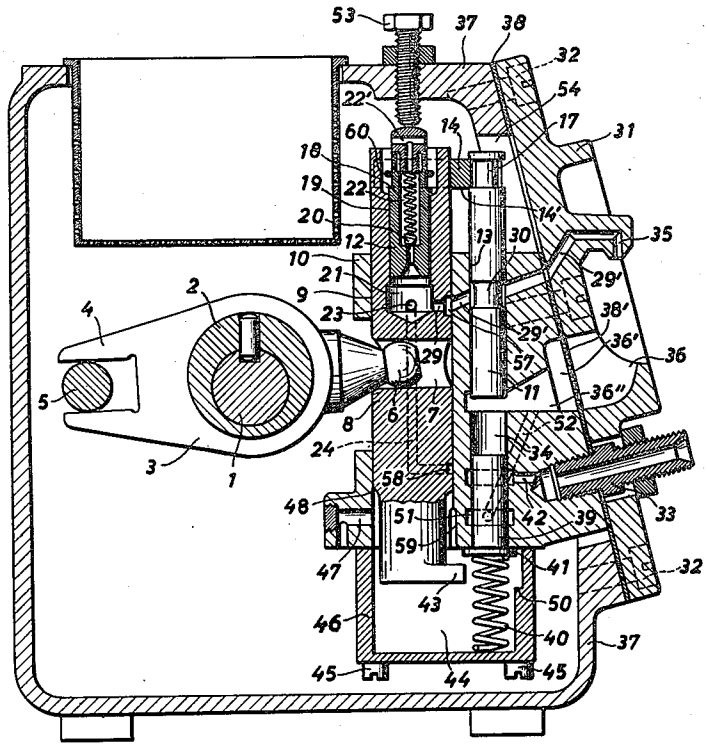
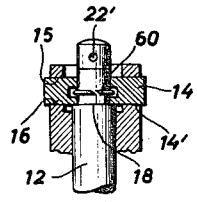


Fig. 2



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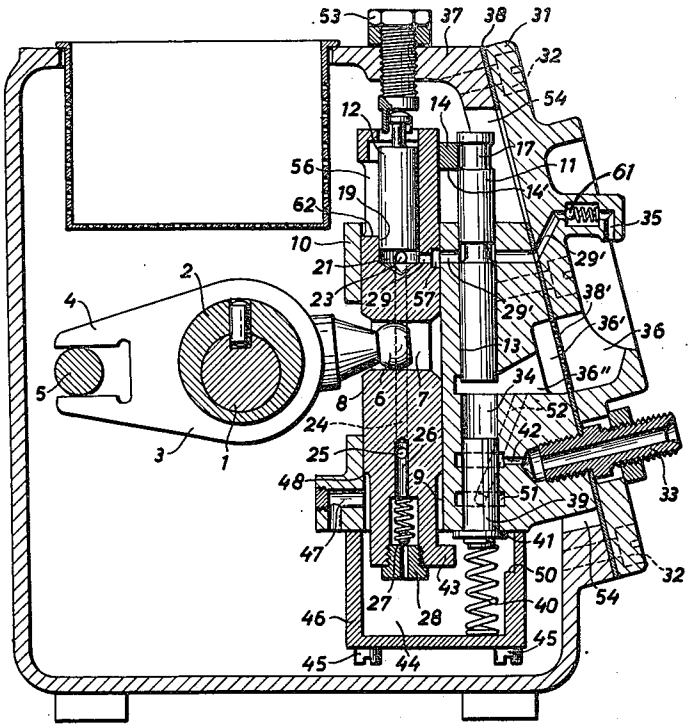
Gustav Nemetz, Deceased,
By Valerie Nemetz, Administrator
By Glascock Downing & Seibold
Attys.

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Fig. 3



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UNITED STATES PATENT OFFICE

2,603,158

LUBRICATING PUMP

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13 Claims. (Cl. 103—5)

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The invention relates to a lubricating pump, in which for each pump unit there is provided a distributing piston delivering, for example, by way of a drop nozzle, and a delivery piston forcing the oil distributed to the lubricating point, and consists essentially in that the working cylinder of the distributing piston is formed in a member which moves when the pump is operated, while the operation of the distributing piston is derived at least in part from the movement of the member containing the distributing piston. Such a design produces an advantageous construction, and in simple manner permits the designing of a moving member necessary for the operation of the pump and serving at the same time to operate the distributing piston, or on the other hand the utilization of the member forming the cylinder of the distributing piston for some other additional function. Thus, according to the invention, this member is preferably designed as supply piston, which supplies the lubricant under pressure to the working chamber of the distributing piston, and thus, even in the case of a lubricant which is viscous or of thick consistency, ensures perfect filling of the working chamber of the distributing pump.

According to the invention, the arrangement is such that the suction stroke of the distributing piston is forcibly brought about or supported by the pressure of the oil supplied to its working chamber by the supply piston, so that under any conditions the suction stroke of the distributing piston is ensured.

The distributing piston can be compelled to perform the delivery stroke by a stop which is adjustable for the purpose of varying the amount distributed but immovable during the working cycle of the pump, and against which it is brought by the movement of the supply piston. The distributing piston may, however, for the purpose of forcibly bringing about its delivery stroke be connected, in such manner as to be unable to move axially, to the fixed regulating device provided for the adjustment of its stroke. The pump action of the distributing piston is then obtained by the movement of the member of the pump unit, such as the supply piston, which contains its working chamber.

In order to permit the escape of the excess oil forced into the working chamber of the distributing piston from the working chamber of the supply piston during the latter's compression stroke, a lateral pressure release aperture is conveniently provided from the bore containing the distributing piston. This aperture is opened by the distributing piston during the suction stroke, when oil under pressure flows into its working chamber, and the distributing piston slides over and closes it during its delivery stroke. During the suction stroke, therefore, the working chamber of the distributing piston is flooded with oil under pressure, and it is impossible for its working chamber not to be completely full of oil at the commencement of the compression stroke and for inaccuracies in the delivery of the pump unit to occur.

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In the drawing the invention is diagrammatically illustrated with the aid of examples. Figs. 1 and 3 show two vertical cross-sections through lubricating pumps having pump units designed in accordance with the invention, while Fig. 2 shows details of the upper end of the distributing piston of Fig. 1 in a section at right-angles to the sectional plane of Fig. 1.

The pump units in the example illustrated in Fig. 1 are driven by an eccentric shaft 1, which carries one eccentric disc 2 for each pump unit. On each eccentric disc 2 is mounted a double lever 3, the forked end 4 of which encloses a rod 5 which is stationary in the pump housing, so that that lever end is guided as the eccentric shaft 1 turns, while its other end, which is in the form of a spherical pin 6, describes a reciprocating movement. The spherical pin 6 thus drives the appertaining pump unit by engaging in a transverse bore 7 in a bolt 8 guided in a bore 9 in the body 10 of the pump unit. The point of application of the spherical pin 6 lies within the cross-section of the bolt.

The bolt 8 is thus moved to-and-fro with a uniform stroke, and from it both the delivery piston 11 and the distributing piston 12 of the pump unit derive their movements. The delivery piston 11, which lies in a bore 13 parallel to the bore 9 in the body 10, is immovably connected by a cross-head 14 to the end of the bolt 8 projecting from the bore 9. The cross-head 14 encloses the end of the delivery piston 11, with a good fit, between the shoulders of a groove 17, and with a second fork similarly encloses the end of the bolt 8 by engaging in lateral recesses therein between the surfaces 15 and 16 (see also Fig. 2). Every axial displacement of the bolt 8 is therefore accompanied by the same axial displacement of the delivery piston 11.

In addition a blind bore 19, into which the distributing piston 12 is fitted, is bored into the face of the bolt end 8 which carries the cross-head 14. The distributing piston has, in an axial bore 22, a spring-loaded overflow valve 20, which releases excess pressure through the outlet aperture 22'

when a corresponding pressure occurs in the working chamber 21 bounded by the piston 12 in the bore 19. A radial bore 23 also leads from the working chamber 21 to a lateral longitudinal groove 24 in the surface of the bolt 8, which groove extends in the direction of the lower end of the bolt as far as a groove-like cavity 58 in the surface of the bolt. In the hollow surface of the cylindrical bore 9 is provided an axially parallel cavity 59 extending from its lower end upwards to a certain height. The cavities 58 and 59 form a control, the purpose of which will be explained below.

In addition, the pressure passage 29 leads from the working chamber 21 of the distributing piston 12 radially out of the bolt 8, and discharges to the surface of the bolt into a cavity 57, which connects with the opening of the part 29' of the pressure passage, which continues in the body 10 of the pump unit, in the illustrated highest position of the bolt 8. A control for the pressure passage 29, 29' is thereby formed. The bore 29' crosses the cylinder bore 13 in which lies the delivery piston 11. The latter has a groove 30, which connects the parts of the portion 29' of the pressure passage which are interrupted by the bore 13. The groove 30 is of such a width that it controls the passage through the pressure passage 29' in the same manner as is done by the movements of the bolt cavity 57 relatively to the aperture of the portion 29' of the pressure passage. The groove 30 thus has the smallest possible width. This alignment of the passages, in conjunction with the groove 30, is advantageous for reasons of manufacture, since in this way the axes of both the bores 9 and 13 and the pressure passage 29, 29', and that of the drop nozzle 35 can lie in one plane.

The body 10 of the pump unit is fastened to the cover 31 by means of the screws 32 and the outlet nipple 33. A plurality of pump units can be mounted side by side on the same cover 31. A bowl 36, to which is connected a bowl portion 36' in the body 10 of each pump unit, is provided in the cover 31 to collect the drops falling from the nozzle 35. The bowl parts are separated from one another by a part 38', designed after the style of a sieve, of a packing plate 38 disposed between the bodies 10 of the pump units and the cover 31. The insertion aperature 54 in the pump housing 37 is closed by means of the cover 31.

From the bowl 36' a suction passage 36'' leads to the working chamber 34 of the delivery piston 11, and is bounded at the bottom by a control piston 39 which is guided in the cylinder bore 13 and acts after the manner of a valve. The control piston 39 is pressed upwards by the spring 40, so that it constantly seeks to slide over and close the delivery passage 42 leading out of the bore 13. This passage is continued by the connecting nipple 33 in the direction of the lubricating point. The highest position of the control piston 39 is determined by a collar 41. A projection 43 on the lower end of the bolt 8 engages beneath this collar in such a manner that, as the bolt 8 moves upwards, the control piston 39 is carried with it in the event of the failure of the spring 40, and closes the pressure passage 42. The bottom end of the bolt 8 and the spring-loaded end of the control piston 39 both lie in the hollow space 44 of a cap 46, which is tightly fastened to the body 10 of the pump unit by means of screws 45, and which forms the working chamber for the bolt 8 acting as supply piston.

The pump unit works as follows:

When the shaft 1 is driven in any rotational direction, the bolt 8 is moved up and down with a uniform stroke by the spherical pin 6 of the lever 3, and by means of the cross-head 14 carries with it the delivery piston 11, which in the position illustrated, is just beginning its delivery stroke from top to bottom. The bolt 8 penetrates with its lower end into the working chamber 44, and first forces the oil back through the aperture 47 into the oil storage vessel of the pump housing 37 until its control edge 48 covers the aperture of the bore 47, whereupon the oil in the working chamber 44 is placed under superatmospheric pressure. In the meantime, the cavity 57 on the bolt 8 has moved so far down that passage through the pressure passage 29, 29' is interrupted, whereupon the groove-like cavity 58 connects with the cavity 59 of the bore 9, so that the chamber 44 is brought into communication with the working chamber 21 of the distributing piston 12 by way of the cavities 59, 58, the longitudinal groove 24, and the transverse passage 23. The oil under pressure then flows out of the working chamber 44 into the working chamber 21, and forces the distributing piston 12 upwards out of the blind bore 19, until its shoulder 18 bears against the lower surface 14' of the cross-head 14. The excess amount of oil forced out of the working chamber 44 into the working chamber 21 escapes through the overflow valve 20 and the outlet aperture 22' and, lubricating the driving parts of the pump unit on its way, flows off.

Simultaneously with the bolt 8, the delivery piston 11 also moves downwards and penetrates into its working chamber 34, enclosing between its lower face and the upper face of the control piston 39 an amount of oil which, overcoming the power of the control piston spring 40 it pushes down together with the control piston 39, until the upper face of the control piston 39 arrives beneath the aperture of the delivery passage 42, through which the oil is forced through the nipple 35 to the lubricating point. The downward movement of the control piston 39 with the collar 41 is limited by the shoulder 50 on the cap 46. Oil passing downwards between the control piston 39 and its guide 13 passes back into the bowl 36 by way of the groove 51 and the bore 52.

During their suction stroke, the bolt 8 and the delivery piston 11 move upwards. A negative pressure is produced in the working chamber 44 of the bolt 8 and, as long as said chamber remains in communication with the working chamber 21 of the distributing piston 12, also in the latter chamber, until the control edge 48 of the bolt 8 slides upwards over the suction aperture 47 and opens it. Thereupon oil is sucked into the working chamber 44 from the storage vessel in the pump housing 37, by way of the suction passage 47.

In order to prevent the distributing piston 12 from being sucked downwards into the blind bore 19 by the negative pressure in the working chamber 44, a brake is provided for the distributing piston 12, which consists of a clamp spring 60 held in a groove in the cross-head 14 (see Fig. 2).

Shortly after the commencement of the suction stroke of the bolt 8, communication between the cavities 59 and 58, and hence communication between the working chambers 44 and 21, is interrupted. Towards the end of the suction stroke the cavity 57, into which discharges the

pressure passage 29 which leads out of the working chamber 21' comes into communication with the portion 29' of the pressure passage. Thereupon, the upper end of the distributing piston 12 strikes against the regulating screw 53 and, depending on the setting of the regulating screw 53, the distributing piston 12 is forced to a greater or lesser extent into the blind bore 19, delivering an accurately measured amount of oil from the working chamber 21, through the passage 29, the cavity 57, the portion 29' of the pressure passage, and the groove 30 in the delivery piston 11, to the drop nozzle 35. Since this delivery takes place during the period of quite low load on the driving parts of the pump unit (at this time only the suction strokes of the bolt 8 and delivery piston 11 are b eing carried out), and the working chamber 34 is not under pressure, no inaccuracies in the delivery of the distributing piston 12 on the score of elastic deformations of the pump units can occur.

In the position of the regulating screw 53 illustrated in Fig. 1, there is no delivery stroke for the distributing piston. In order to obtain such a stroke, the regulating screw 53 must be screwed down as required. In this manner regulation of the delivery amount of the pump unit between zero and a certain maximum value is possible.

From the drop nozzle 35 the oil falls into the bowl 36 of the cover 31 and, purified by the sieve-like part 38' of the packing plate 38 lying between the body 10 of the pump unit and the cover 31, flows into the bowl part 36' and thence by way of the suction passage 36'' into the working chamber 34 of the delivery piston 11.

Owing to the force of the spring 40, the control piston 39 also follows the upward suction stroke of the delivery piston 11. If that force should not be sufficient for the purpose, it is pushed upwards by the projection 43 on the bolt 8, which bears from below against the collar 41. The control piston, in moving upwards, slides over and closes the delivery passage 42.

As can be seen, the pump unit is of very simple design. The fitting bores for the pistons are disposed parallel to one another in the body 10 of the pump unit, and can therefore be made with the required accuracy at little expense of labor. The assembly of the individual parts is also a simple task, mistakes being impossible.

In Fig. 3 is illustrated a similar lubricating oil pump unit designed in accordance with the invention. Communication between the working chamber 44 of the bolt 8 working as supply piston and the working chamber 21 of the distributing piston 12 is in this case established by a bore 26 in the bolt 8, which contains a check valve 27 opening upwards, the seat of which is formed by a screw cap 28. A bore 25 leads radially from the bore 26 to the lateral longitudinal groove 24 in the surface of the bolt, so that controlled communication is established between the working chambers 44 and 21 by way of the passages 23, 24, 25, and 26 and the check valve 27.

The distributing piston 12 is joined in this embodiment to the regulating screw 53 by a claw connection which prevents axial displacement, so that it is held fast relatively to the bolt 8 in every position of the regulating screw 53, and performs in the blind bore 19 the same stroke as the bolt 8 in the bore 9 of the body 10 of the pump unit.

As an overflow for the excess of oil delivered during the compression stroke from the working chamber 44 into the working chamber 21, the bolt 8 carries a lateral aperture 56, which is passed over and closed by the lower face of the distributing piston 12 during the suction stroke of the bolt 8, whereupon it performs its delivery stroke.

In order that oil cannot be sucked back into the working chamber 21 from the pressure passage 29, 29' at the commencement of the suction stroke of the distributing piston 12, as long as the pressure passage is still open, a spring-loaded check valve 61 is provided in the part 29' of the pressure passage. This also prevents oil from being delivered through the drop nozzle 35 before the overflow aperture 56 is closed by the distributing piston 12 during the latter's compression stroke. Except for the above described details, the pump unit illustrated in Fig. 3 is of exactly the same design as that illustrated in Fig. 1. It works in the following manner:

The bolt 8 moves downwards out of the position illustrated at the beginning of the compression stroke. The distributing piston 12 held fast by the regulating screw 53 is drawn out of the blind bore 19. If there should be produced a greater degree of vacuum in the working chamber 21, the check valve 27 will open and oil will flow into the working chamber 21 through the passages 23, 24, 25, and 26, while the check valve 61 in the pressure passage 29' remains closed. As long as the control edge 48 of the bolt 8 leaves the suction passage 47 free, oil is forced out of the working chamber 44 through the passage 47. After the closing of the passage 47, the oil is forced out of the working chamber 44, after the lifting of the check valve 27, through the connections 23, 24, 25, and 26 and into the working chamber 21 of the distributing piston. In the meantime, however, the distributing piston 12 has moved above the lower edge 62 of the lateral aperture 56 of the supply piston 8, and the oil therefore flows through the overflow aperture 56 into the storage vessel of the pump housing 37, lubricating the driving parts.

During the suction stroke of the bolt 8, negative pressure is first produced in the working chamber 44, but owing to the check valve 27 this cannot extend to the working chamber 21 which is full of oil. After the cavity 57 has come into communication with the part 29' of the pressure passage, the distributing piston 12 slides over the edge 62 and, towards the ends of the suction stroke of the bolt 8, forces the oil enclosed by it in the working chamber 21 to the drop nozzle 35 by way of the pressure passage 29, 29' and the check valve 61. From the drop nozzle the oil drops into the bowl 36, from which it flows to the working chamber 34 of the delivery piston 11.

What is claimed is:

1. A lubricating pump comprising a pump housing, a drive member therein, at least one pump unit mounted in said pump housing, each pump unit including a body, an intake piston mounted in the body and in driving connection with the said drive member and driven in reciprocatory movement, means connected to the body and providing a working space for the said intake piston, said pump unit body having an inlet bore into the said working space, said intake piston having a cylindrical bore, a distributing piston mounted in the said cylindrical bore, an adjustable abutment in the said housing, which coacts with the said distributing piston to press the same inwardly into the said cylindrical bore when the said intake piston is moved toward the said abutment, a channel in said intake piston extending from the said working space to the said cylindrical bore through which the lubricant is forced from the said working space to the said cylindrical bore, a feed piston

in the body of the pump unit in driving connection with the said drive member, a working space provided in the body for said feed piston, a lubricant line from the said cylindrical bore to the last-mentioned working space through which the lubricant is conveyed in measured quantities to the said feed piston, and a lubricant outlet in connection with the last-mentioned working space through which the said feed piston ejects the lubricant.

2. A lubricating pump according to claim 1, in which the said distributing piston is secured to the said abutment.

3. A lubricating pump according to claim 1, in which the intake piston is provided with a transverse bore, a lever on the said drive member which engages in the said transverse bore, the said cylindrical bore for the distributing piston being situated at the upper end of the said intake piston.

4. A lubricating pump according to claim 1, in which the cylindrical bore is provided with a discharge opening for excess lubricant which is closed by the said distributing piston at the beginning of its feed stroke.

5. A lubricating pump according to claim 1, in which the lubricant line between the cylindrical bore and the last mentioned working space includes a check valve and a drop nozzle.

6. A lubricating pump according to claim 1, in which the lubricant line includes a cavity in the said intake piston communicating with the said cylindrical bore, a drop nozzle in the said line, and the body of the pump unit having a channel which leads from the said intake piston to the said drop nozzle and which also forms a part of the lubricant line between the said cylindrical bore and the last mentioned working space, the said cavity and the last mentioned channel being arranged so that they come into registration with each other only toward the end of the suction stroke of the said intake piston.

7. A lubricating pump according to claim 1, in which the said feed piston is arranged so that it crosses the lubricant line between the said cylindrical bore and the last mentioned working space, and the said feed piston having a groove which controls the flow of lubricant through the said line.

8. A lubricating pump according to claim 1, in which a check valve is positioned in the channel in the intake piston extending from the first mentioned working space to the said cylindrical bore.

9. A lubricating pump according to claim 1, in which the said intake piston and the said feed piston are arranged parallel to each other and connected with each other at their upper ends.

10. A lubricating pump according to claim 1, in which the pump unit body has a cylindrical bore for receiving the said intake piston, said bore having a cavity which forms an extension of the working space of the intake piston, a

channel in the said intake piston terminating in a cavity at the periphery of the said intake piston, the two mentioned cavities periodically registering with each other for the control of the communication between the first mentioned working space for the intake piston and the cylindrical bore which receives the distributing piston.

11. A lubricating pump as claimed in claim 1, in which means is provided in the lubricant line for controlling the passage of the lubricant to the lubricant outlet, said means comprising a spring loaded piston traversing the line adjacent the outlet.

12. A lubricating pump as claimed in claim 11, in which a projection is provided on the lower end of the intake piston and cooperates with the spring loaded piston to insure of operation of the latter in event of spring failure.

13. A lubricating pump comprising a pump housing, a drive member therein, a pump unit comprised in part by a body mounted in said housing and having a pair of piston receiving bores therein, said pump unit body having a pressure passage extending from the first bore through the second bore, a delivery piston reciprocable within the second bore and controlling the flow of fluid therethrough, an intake piston reciprocable within the first bore and having an axial cylindrical bore therein, a port adapted to communicate said axial cylindrical bore with the inner end of the pressure passage in the pump body and a groove adapted to communicate the axial bore with a source of fluid lubricant, said intake piston being driven in reciprocatory movement by said drive member, a distributing piston reciprocable within the axial cylindrical bore in the said intake piston and adapted to force the fluid lubricant through the pressure passage in the pump body past the delivery piston, and an adjustable abutment in the pump housing which coacts with the said distributing piston and presses same into the said axial cylindrical bore when the said intake piston is moved toward the said abutment.

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