ABSTRACT

The invention relates to an oil pump assembly comprising a casing in which pumping elements are disposed and in which fluid intake and exhaust passages are formed. A bypass passage with valve means therein is between the intake and exhaust passages. An electromagnet is mounted in the casing and the armature thereof is associated with and operates the valve means. The electromagnet is controlled jointly with the motor which drives the pump assembly in a manner such that the valve means are closed when pump assembly is operating and open when the pump assembly is turned off. The opening of the valve means in this manner permits pressurized fluid to be bypassed to the intake passage such that the usual pressure regulating and cut-off valve connected to the exhaust or pressure outlet side will close instantaneously upon the motor being turned off by reason of the instantaneous reduction of pressure caused by the instantaneous bypassing of the pressurized fluid.

2 Claims, 5 Drawing Figures
OIL PUMP FOR HEATING INSTALLATIONS

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The invention relates to an oil pump for heating installations, in which a pump and a pair of gear wheels, held between a cover plate and a wall solid with the casing, is located between the casing, accommodating the drive shaft, and a cover.

Oil pumps of this kind have proved successful on a large scale. The cover encloses a filter and an intake chamber. The casing contains ports for pipework supplying the nozzles, an intake pipe and a discharge pipe, as well as a pressure-regulating and cut-off valve.

It is also known to fit an oil pump for heating installations with a magnetic valve which, when the pump is switched off, connects the delivery side with the low-pressure side (intake and discharge side respectively). This causes the pump pressure to drop rapidly when the pump is switched off, so that the cut-off valve closes more rapidly even if the design is a simple one, and dripping of oil and its consequent effect can thus be prevented. In this connection a magnetic valve comprising a plunger-type armature is known, the casing of which valve can be fitted between an oil pump and a pressure-regulating and cut-off valve arrangement, the magnet being arranged at the side of this casing. This arrangement occupies a lot of space and is expensive.

The object of the invention is that of fitting an oil pump with a magnetic valve in such a way that a construction that occupies little space and is cheap is obtained.

According to the invention, this object is achieved by means of an oil pump of the initially stated kind that is characterized in that there is a magnetic valve therewith in known manner a magnetic valve which, when the pump is switched off, connects the delivery side to the low-pressure side (intake and discharge side respectively) and in that the magnet is accommodated in the cover, and an armature plate, actuated by the magnet, is accommodated in a low-pressure chamber between the cover and cover plate, a valve opening connected to the delivery side being closed with the aid of said armature plate.

In this construction, the oil pump only requires to be extended slightly in the axial direction. Because of its slight thickness, the armature plate contributes hardly anything to this increase. Since an adequate cross-sectional area is available, the magnet can be made flat. The additional cost as compared with the known magnetic valves that are not built into the system is considerably lower since economies can be effected not only in material but also in pipe connections.

In a preferred arrangement, the armature plate is designed as the valve plate and, for the purpose of closing the valve opening, it bears against a wall by that of its end faces remote from the casing. In this way, the functions of the valve and the armature are combined. Special valves for effecting opening can generally be dispensed with, since when the magnet is energized the armature plate lifts from the wall under the effect of the pressurized oil that is to be sealed off, whereupon the valve opening communicates with the low-pressure chamber.

Considerable advantage accrues if the valve opening is provided in the armature plate, and pressure-valve passages in the armature plate and the cover plate are interconnected by way of a movable coupling. In this way, a short connection between the delivery side and the associated valve opening is achieved. Moreover, this valve opening can be provided within the cross-section of the magnet, i.e., in the zone where the greatest force of attraction is present.

In another very advantageous arrangement, the armature plate actuates the closure member which closes the valve opening. By separating the functions of the armature and the closure member from each other, the two parts can be designed in the best possible manner.

It is particularly advantageous if the armature plate is part of a swingable double-armed lever, that arm of which remote from the magnet actuates the closure member, the latter being guided in a bore formed in the cover plate and disposed parallel with the drive shaft. In this way, the closure member is closed towards the pair of gear wheels and, since it is accommodated in the cover plate, it does not occupy any additional space. Furthermore, the closure member may close the valve opening in a direction opposite that of the flow of the oil passing from the delivery side to the low-pressure side. When the magnet is energized, the oil under pressure automatically opens the valve and lifts the armature plate.

A particularly simple form of construction is obtained if the cover plate contains a recess matched to the shape of the armature plate, and the point of rotation of the double-armed lever is formed by a spindle which engages in a groove in the armature plate and in a groove in the cover plate on both sides of the recess. The individual components then only require to be pushed one into the other for the purpose of their assembly.

In order to prevent overloading of the valve, the armature plate may be provided with a leaf spring which acts on the closure member. The bias of the leaf spring may be so selected that when the armature is pulled up, exactly the correct valve-closing pressure is obtained.

In a preferred arrangement, connecting ports and/or a pressure-regulating and cut-off valve are located in the cover alongside the magnet. In this way, the somewhat greater depth of cover necessitated by the magnet can be used for accommodating further components. Conversely, in many cases the pump casing can then be reduced in size in the axial direction.

The invention will now be described in more detail by reference to embodiments illustrated in the drawing, in which:

FIG. 1 is a longitudinal section through part of an oil pump in accordance with the invention,
FIG. 2 is a diagram showing how the pump seen in FIG. 1 is connected up,
FIG. 3 illustrates a special form of the valve plate,
FIG. 4 is a longitudinal section through part of another form of the oil pump in accordance with the invention, and
FIG. 5 is a plan view of the cover plate of the pump seen in FIG. 4.

Referring to FIG. 2, an oil pump 2, a pressure-regulating and cut-off valve 3, and a magnetic valve 4 constitute part of a unit 1. The pipework supplying the nozzles is connected to the port 5, the intake pipe running from the oil tank is connected to the port 6, and
the discharge pipe returning to the oil tank is connected to the port 7. In a single-line operation, the intake side 8 and the discharge side 9 may be connected through a passage 10, the port 7 being closed. The magnetic valve 4 connects the delivery side 11 of the pump to the discharge side 9. When the pump 2 is switched off, this valve opens. Consequently, the pressure on the delivery side 11 drops immediately and the cut-off valve 3 closes.

As shown in more detail in FIG. 1, the unit 1 consists of an armature 12 in which the drive shaft 13 is mounted, and of a cover 14 which is secured to the casing 12 by means of screws 15, an O-ring 16 being interposed between the cover and the casing. The pump 2 is located between a casing wall 17 and a cover plate 18. It comprises an externally toothed wheel 19 which is arranged eccentrically in an internally toothed ring, which in turn is rotatable in a ring 21 solidly connected to the casing. The cover plate 18 is secured to the casing 12 by means of screws not illustrated. The cover-plate contains an intake groove 22 which is connected by way of a passage 23 to an annular intake chamber 24 in which is also located a filter 25. This intake chamber communicates by way of a passage 26 with a bore 27 in the cover 14, at the inlet of which is located the port 6. Also provided in the cover plate 18 is a pressure groove 28 which communicates with the pipework for the nozzles and, by way of the passage 29, with a firmly inserted small tube 30.

The cover plate 18 contains a recess 31 which is of less depth near the tube 30. Fitted in this recess is an armature plate 32 in which there runs a pressure passage 33. This connects the tube 30 to a valve opening 34. For the purpose of effecting a pressure-tight transfer at the coupling point, there is provided an O-ring 35 which surrounds the tube 30 and is axially compressed between the armature plate 32 and an intermediate plate 18. This compression takes place when the cover 14 is driven into the casing 12 with the aid of the screws 15, and the inner face of the cover bears against the armature plate 32, a partition 36 being interposed.

Provided in the cover 14 is a magnet 37 consisting of E-shaped laminations and of a coil 39. It is pressed against the partition 36 by a spring 40 backed by a closure plate 41. The closure plate 41 is secured to the cover 14 with the aid of screws 42. Near the screws 15, the closure plate 41 contains openings so that this plate 41 and the electro-magnet 37 can be removed after the screws 42 have been loosened, without the cover 14 being detached from the casing 12. The recess 31 accommodating the armature plate 32 constitutes a low-pressure chamber 43 which, by way of a passage 44 in the intermediate plate 18, the partition 36 and the cover 14, communicates with a bore which is an extension of the bore 27 and constitutes the port 7 at the opposite end. A screw 45 between this bore and the bore 27 closes the passage 10.

When the electro-magnet 37 is energized, the armature plate 32 is drawn towards the partition 36, so that the valve opening 34, which communicates with the delivery side of the pump, is closed. When the electro-magnet 37 is de-energized and the pump is switched off, the pressure obtaining in the passage 33 applies a force to that the armature plate 32 swings about the point of suspension on the tube 30, so that the pressure rapidly relaxes towards the low-pressure side. Consequently, the pressure-regulating and cut-off valve 3, disposed alongside the magnet 37 in the cover 14, rapidly closes the pipe leading to the port 5.

The armature plate 32 can be produced in a very simple manner from two discs 46 and 47, each of which contains an opening 48 and 49 and at least one channel 50 which interconnects the openings. These two discs can be welded or bonded to each other.

In an arrangement shown in FIGS. 4 and 5, the pump has a casing 51 in which the drive shaft 52 is mounted. A cover 53 is secured to these two parts is a cover plate 54 and a ring 53 solidly connected to the casing. In the annular space 53 surrounding these parts there is located a filter 57. Rotatable in the ring 55 is an internally toothed ring 58 which cooperates with an externally toothed wheel 59 which is driven by the shaft 52. Associated with the chambers formed between the teeth is an intake groove 60 which communicates through a passage 61 with the annular chamber 56, and also associated with the chambers is a pressure groove 62 which communicates with the delivery side of the pump and, through a passage 63, with a valve bore 64.

The coil 65 of an electro-magnet 66 is located in a recess in the cover 53. The coil surrounds a magnet core 67, which is secured to an end plate 68 which presses the coil against the spring 69. The magnet core 67 extends through a sleeve 70 of non-magnetic material which is supported on the magnetically conductive cover 53, an O-ring being interposed between the sleeve and the cover. The cover also accommodates a pressure-regulating and cut-off valve 71. Further bores 72 are provided for connecting intake and pressure passages.

A low-pressure chamber 73, of a shape corresponding to that of an armature plate 74, is formed in the cover plate 54. The armature plate 74 comprises one arm of a double-armed lever which is mounted on a spindle 75 and is pivoted about edge 74a. This spindle consists of a rod which is fitted in a groove 76 in the armature plate and in grooves 77 on both sides of the chamber 73. Connected to the armature plate is a leaf spring 78 which is outwardly biased within a range defined by a clip 79. The free end 80 of this spring presses on a closure member 81 of a valve that closes the opening 64 and is guided in a bore 82 parallel with the drive shaft 52.

FIG. 5 illustrates the form of the armature plate 74 and of the low-pressure chamber 73. It can also be seen that the cover plate 54 is secured to the casing 51 with the aid of screws 83, and that passages 84 run out from the cover plate 54 and cooperate with corresponding passages in the cover 53.

When current is received by the electric motor driving the geared pump, the electro-magnet 66 is also energized. The armature plate 74 is pulled up and the closure member 81 is pressed against the opening 64 by the end 80 of the spring, so that this opening is closed. When the motor is switched off and the electro-magnet 66 is therefore de-energized, oil located on the delivery side 62, 63 of the pump, presses the closure member 81 to the left, so that the armature plate 74 is swung about the spindle 75 in the clockwise direction. The pressure in the direction of the low-pressure side relaxes very rapidly, with the result that the cut-off valve also closes rapidly.

We claim:
1. A pump assembly comprising a casing, pumping element mounted in said casing, fluid intake and exhaust passages formed in said casing, said casing forming a low pressure chamber fluidly connected to said intake passages, passage means between said intake and exhaust passages, a valve in said passage means biasable to an open position by pressurized fluid in said exhaust passages, electromagnetic means housed in said casing including an armature plate in said low pressure chamber and spring means for biasing said armature plate to a predetermined position when said electromagnetic means is deactivated, a leaf spring attached to said armature plate and having one end thereof engage said valve for biasing it to a closed position when said armature plate is biased to said predetermined position and spindle means between said armature plate and said casing to allow a swinging movement for said armature plate.

2. A pump assembly according to claim 1, including a clip attached to said armature plate and engageable with said leaf spring to set the biasing range for said leaf spring.

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