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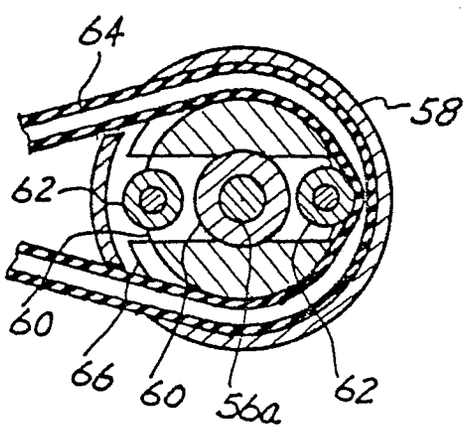
(54) Separate lubrication type engine and lubricating oil feeding device therefore.

(57) The present invention relates to a separate lubrication type engine and a lubricating oil feeding device comprising an oil pump (25) to supply oil from a lubricating oil container (46) to lubricating oil receiving portions of the engine, wherein said oil pump (25) discharges oil by squeezing a resilient tube (64) by means of a revolving squeezing means (60, 66) in contact with the resilient tube (64) and continuously driven by a drive means (54, 65).

Fig. 5



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SEPARATE LUBRICATION TYPE ENGINE AND LUBRICATING OIL FEEDING DEVICE THEREFORE

The invention relates to a separate lubrication type engine and a lubricating oil feeding device therefore, in particular, a gas engine equipped with a fuel gas supplying system and a separate lubricating oil feeding system both terminating into an intake pipe of the engine.

On the separate lubrication type engine, lubricating oil is forced to necessary portions of the engine, e.g. into the intake passage, mixed with the intake air and is fed into the crankcase or combustion chambers together with the intake air. So far, the plunger pump driven by the engine crankshaft has been widely used as the lubricating oil pump. However, oil feed by the plunger pump becomes discontinuous because it discharges oil intermittently, and there is a problem that this tendency becomes more significant and engine lubrication becomes more unstable especially as the oil feed becomes minimal.

Further, there is a problem that, since the suction force of the plunger pump becomes very weak when air comes into it, its discharge changes greatly and oil feed becomes unstable when its height relative to the lubricating oil tank is changed or reversed.

Accordingly, an object of the present invention aims to provide a separate lubricating type engine, especially a gas engine, providing continuous and reliable oil lubrication. Moreover, another object of the present invention is to provide a lubricating oil feeding device to be used in conjunction with a separate lubrication type engine, said feeding device being capable of feeding minimal amounts of oil continuously and smoothly and being also capable of feeding oil always steadily even when mixed with air or even when the height of the lubricating oil feeding device relative to the lubricating oil tank is changed or reversed.

According to a first aspect of the present invention, the above goals are achieved by means of a separate lubrication type engine, in particular a gas engine as indicated above, having a lubricating oil feeding device with the improvement of said lubricating oil feeding device to form an oil pump disposed in between the lubricating oil container and the lubricating oil receiving portions of the engine, said oil pump discharging oil by squeezing a resilient tube through which the supplied oil passes by means of a continuously revolving squeezing means in contact with the resilient tube and continuously driven by a drive means.

According to a particularly preferred embodiment of the present invention, the oil pump is made to comprise said elastic tube disposed midway of the oil feeding passage interconnecting the lubricating points of the engine with the lubricating oil container, an outer housing having a circular inner surface against which the elastic tube contacts from inside, an inner housing adapted to rotate within the outer housing, rollers rotatably supported by said inner housing for squeezing the elastic tube between the interior of the outer housing and the exterior of the rollers, and a drive means for rotating the innner housing.

Preferably, said outer housing is fastened co-axially on the case of a speed reducer driven by said drive means, with the inner housing positioned within the outer housing and fixed on an output shaft of said speed reducer to be rotatable together with said output shaft thereof.

Depicting an advantageous layout of the oil pump, said inner housing has a pulley-shaped structure supporting rotatably a pair of opposite rollers, the axes of which extend in parallel to the axis of the inner housing, said rollers leaving a space to the interior of the outer housing adapted to receive a radially compressed portion of the elastic tube which is stationarily disposed between said inner and outer housings, such that both free ends of the tube extend outwards of the outer housing adjacently spaced from each other to be connected to the lubricating oil tank and the intake pipe of the engine, respectively.

Moreover, the oil pump of the separate lubrication type engine advantageously comprises arcuate tube guides disposed oppositely at the inner housing, either separately or integrally, in order to guide those portions of the elastic tube not being squeezed by at least one of the rollers.

According to an advantageous embodiment of the present invention, an electric motor is employed to act as a drive means and is preferably integrated with said speed reducer.

In compliance with a deviating layout of the engine, it could also be advantageous to utilise the crankshaft of the engine to form the drive means of the oil pump.

Preferably, said electric motor, speed reducer and tube pump are assembled co-axially to form an integrated component of a lubricating oil feeding system of the engine.

According to another aspect of the present invention, said separate lubrication type engine, in particular a liquid-cooled 2-cycle gas engine, including a generator-starter coupled to the engine as indiccated above comprises:

- a gas container containing liquefied pressurised gas,
- a receptacle incorporating a pressure regulator and a fuel cock, said receptacle being fluidly con-

nected in between the outlet of the gas container and an electromagnetic valve fluidly connected to an intake pipe of the engine to supply fuel thereto,
- an oil tank, preferably a cartridge type oil tank, containing lubricating oil to be supplied to the intake pipe of the engine via another receptacle and an oil pump,
- liquid cooling circuit associated with the cylinder block including a cylinder head of the engine, comprising a radiator integrated with an electric cooling fan, a coolant pressure regulator made of resilient material in order to balance the volumetric change of the coolant depending on its temperature change, and a coolant pump driven by the engine circulating the coolant through the cooling circuit,
- wherein said gas pressure regulator provided in conjunction with said receptacle of the container comprises a gas chamber, an atmospheric chamber, a diaphragm partitioning both said aforementioned chambers, a spring urging the diaphragm towards the atmospheric chamber and a control lever for limiting gas inflow from the gas container in conjunction with the diaphragm,
- a pressure detecting means, comprising a housing and a diaphragm partitioning the gas chamber and the atmospheric chamber from each other, with the gas chamber being subject to the gas pressure introduced from the gas container, a spring biasing the diaphragm against a counterforce resulting from the gas pressure prevailing in the gas chamber, and a switch actuating means in order to activate heating means to heat the gas container,
- a heating means associated to the gas container covering preferably the lower half of the gas container and being activated in response to a movement of the diaphragm of the gas pressure detecting means towards the gas chamber thereof when the internal pressure of the gas container drops to or below a preset pressure value.

According to another aspect of the present invention, the aforeindicated separate lubricating type engine is designed to be assembled comprising:
- a box-shaped case receiving the radiator on the right of the vertically disposed battery, the coolant circulating pump, the coolant pressure regulator, an electromotive lubricating oil pump, with the radiator being adapted to suck ambient air into the case through an opening on the right side of the case, whereas
- the engine and the generator are disposed on the left of the battery,
- a muffler near the left side of the case in order to discharge the exhaust gas of the engine through an opening of the case,
- having the engine, the generator and the muffler surrounded by an air guide wall to guide the air sucked by the fan of the radiator or by another fan fixed to the crankshaft of the engine passing the air round the generator, engine and muffler prior to being exhausted through the opening,
- the gas container being loaded after opening a cap and is positioned on the left side of the case with the tip of the gas container connected to the receptacle after loading of the gas container, said receptacle being integral with a pressure regulator and a fuel cock and, moreover, being associated with a pressure detecting means adapted to activate a heating means assembled in conjunction with said gas container, the fuel being supplied to the intake pipe of the engine through an electromagnetic valve after having passed through said receptacle,
- a cartridge type lubricating oil tank loaded after opening a cap and positioned on the right side of the case to be connected to another receptacle after loading to supply lubricating oil from said other receptacle through an oil pump to the intake pipe of the engine,
- an operating switch on the top surface of the case to conect the electric source, and
- a start switch to start the engine by means of the generator.

According to yet another aspect of the present invention, a lubricating oil feeding device for a separate lubrication type engine is provided adapted to supply lubricating oil from the lubrication oil container to lubrication points of the engine, especially to the intake pipe of a gas engine, with the improvement to comprise an oil pump disposed in between the lubricating oil container and a lubricating oil receiving means of the engine, said oil pump discharging oil by squeezing a resilient tube forming part of the oil feeding passage between the lubricating oil container and the engine by means of a revolving squeezing means which is kept in contact with the resilient tube and is continuously driven by a drive means.

Preferably, said oil pump is designed to form a tube pump comprising an elastic tube disposed midway of the oil feeding passage interconnecting the lubricating points of the engine with the lubricating oil container, an outer housing having a cylindrical inner surface with the elastic tube contacting the interior of the outer housing, an inner housing adapted to be rotatably supported within the outer housing, rollers mounted on the inner housing for squeezing the elastic tube extending along the interior of the outer housing and the rollers, and a drive means for rotating the innner housing.

Both a simplified and reliable design of the pump means can be attained through the outer housing being co-axially secured to the case of a speed reducer driven by said drive means, with

said inner housing positioned within the outer housing and fixed on an output shaft of said speed reducer to be rotatable together with said output shaft.

According to yet another advantageous development of the lubricating oil feeding device according to the present invention, said inner housing has a pulley-shaped structure supporting rotatably a pair of opposite rollers, the axes of which extend in parallel to to the axis of the inner housing, said rollers leaving a space in between to the interior of the outer housing adapted to receive a radially compressed portion of the elastic tube therein, said elastic tube being stationarily disposed between said inner and outer housings, such that both free ends of the elastic tube extend outwards of the outer housing adjacently spaced from each other to be connected to the lubricating oil tank and the intake pipe of the engine, respectively.

In order to prevent said portions of the elastic tube from floating up from the interior of the outer housing not being squeezed, a pair of arcuate tube guides is opositely provided at the inner housing, either separately or integrally therewith, to guide those portions of the elastic tube not being squeezed by at least one of the rollers.

Depending on the general layout of the lubricating oil feeding system of the engine, either an an electric motor, preferably integrated with the speed reducer, or the crankshaft of the engine itself could be utilised advantageously to establish a drive means for the lubricating oil feeding device according to the present invention.

Preferably, said electric motor, speed reducer and tube pump are assembled co-axially to form an integrated component of a lubricating oil feeding system of the engine.

Other objects, features and advantages of the present invention will become more appararent from the following explanation of preferred embodiments of the invention when taken in conjunction with the accompanying drawings in which:

Fig 1 is an exploded perspective view of a lubricating oil feeding device according to an embodiment of the present invention,

Fig 2 is a front view of the device according to Fig 1,

Fig 3 is a right side view of the device according to Fig 1,

Fig 4 is a sectional view along the line IV-IV of Fig 2,

Fig 5 is a sectional view along the line V-V of Fig 3,

Fig 6 is a system diagram of a separate lubrication type engine according to the present invention applying a lubricating oil feeding device according to Fig 1,

Fig 7 is a diagrammatic arrangement plan for the components of the layout according to Fig 6.

In Figs 6 and 7 the general layout and arrangement of a separate lubrication type engine with a lubricating oil feeding device related thereto according to the present invention is shown with some details as selectively shown in Figs 1 to 4 being omitted.

In Figs 6 and 7, the reference numbers 10 and 12 denote a liquid-cooled 2-cycle engine and a combination generator-starter, respectively, and both are coupled with each other through a belt system or the like. That is, when starting the engine 10, the generator 12 drives the engine as a starter motor and, after the engine is started, the generator 12 is driven by the engine 10 to generate electricity. Reference numeral 14 denotes a radiator integrated with the electric fan 16; reference numeral 18 denotes a water pump driven by engine 10; reference numeral 20 denotes a coolant pressure regulator, and the coolant circulats through a hermetically sealed passage comprising a cylinder and a cylinder head of the engine 10, coolant pump 18, coolant pressure regulator 20 and radiator 14. The coolant pressure regulator 20 comprises a variable-volume vessel made of an elastic material such as rubber to absorb volumetric change of the coolant caused by its temperature change.

Reference numeral 22 in Fig 7 denotes a box-shaped case in which are arranged the radiator 14 on the right of the vertically disposed battery 24, an electromagnetic valve 44, the coolant pressure regulator 20, and an electromotive lubricating oil pump 25 to be described in detail later, and the radiator 14 inhales the outside air into the case 22 through an opening 26 on the right side of the case 22. The engine 10 and the generator 12 are disposed on the left of the battery 24. The exhaust gas of the engine 10 is exhausted out of the muffler 28 near the left side of the case 22 through an opening 30 of the case 22. The engine 10, generator 12 and the muffler 28 are surrounded by an air guide wall 32, and the air in the case 22 is introduced within this air guide wall 32 by an air fan 34 fastened on the crankshaft of the engine 10.

Reference numeral 36 denotes a gas bomb and contains liquefied butane gas or liquefied propane gas. This bomb 36 is loaded after opening the cap 38 positioned on the left side of the case 22. When loaded, the tip of the bomb 36 is connected to the receptacle 40. This receptacle 40 is incorporated with a pressure regulator 41 and a fuel cock 42, and the fuel after passing through this receptacle 40 is supplied into the intake pipe of the engine 10 through an electromagnetic valve 44 (Fig 6).

Preferably, a gas pressure detecting means integrated into the receptacle 40 of the gas con-

tainer 36 is provided and a heating means is associated to the gas container in order to increase the internal gas pressure of the gas container upon detecting a pressure drop therein below a predetermined level.

Reference numeral 46 denotes a cartridge type lubricating oil tank which is loaded after opening a cap 48 positioned on the right side of the case 22. When this tank 46 is loaded, its tip is connected to another receptacle 50. The lubricating oil is supplied from this other receptacle 50 into the intake pipe of the engine 10 through the oil pump 25.

Next, this oil pump 25 is described in detail referring to Figs 1 through 5. This pump is usually called a tube pump and comprises an electric motor 54, a speed reducer 56 is integrated with this motor 54, a cylindrical outer housing 58 is fastened on the case of the speed reducer 56, an inner housing 60 is positioned within this outer housing 58 and mounted on the output shaft 56a of the speed reducer 56, a pair of rollers 60 mounted on the inner housing 60 and opposite to the inner surface of the outer housing 58, and an elastic tube 64 to be squeezed between the inner surface of the outer housing 58 and the rollers 60. Both end portions of the tube 64 are extended outward through the outer housing 58, with one connected with the receptacle 50 and the other connected with the intake pipe. Reference numeral 66 denotes a pair of arcuate tube guides positioned between a pair of rollers 62 for preventing the tube from floating up from the inner surface of the outer housing 58 while not being saueezed. Alterntaively, said tube guides could be formed integral with the inner housing 60 to provide flanged grooves therein accordingly. Reference numeral 68 denotes shafts for holding the rollers 62, and 70 is a bolt for fastening the inner housing 60 on the output shaft 56a of the speed reducer 56.

Now, open the cock 42, depress the operating switch 72 on the top surface of the case 22 to connect the electric source, then depress the start switch 74, and the generator 12 drives the engine 10 as a starter motor. When the engine speed exceeds a preset value, the electromagenetic valve 44 is opened and the fuel gas is supplied to the engine 10. Also the motor 54 of the oil pump 25 is started and the inner housing 60 is rotated by the output shaft 56a of the speed reducer 56 at a low speed (e.g. 1~50 rpm). Therefore, the rollers 62 squeeze the tube 64 in rolling contact with it. Consequently, the lubricating oil in the tube 64 is pushed out of the tube 64 in the rolling-contact direction of the rollers 62 and is fed into the intake pipe.

After the engine 10 is started and hence the starter switch 74 is released, the generator 12 ceases to function as a starter motor and begins to function as a generator as originally intended. The output terminals of the generator 12 are connected to the battery 24 in parallel, and its electric power is taken out through an output receptacle 76.

This tube pump employed as the oil pump 25 can steadily discharge oil even if some air or minute dust particles come in it and can discharge almost without being affected by the height change of the tank 46 even if some height change occurs. Therefore, oil discharge is not affected by the lubricating system structure into which air or dust is apt to come from the pouring opening of the tank 46 when the exchangeable tank 46 is loaded or unloaded as in this embodiment.

Although the oil pump 52 is driven by an electric motor 54 in this embodiment, it may be driven by the crankshaft of the engine 10 instead of the motor 54. Although this invention is applied to a 2-cycle engine in this embodiment, it can also be applied to a 4-cycle engine if only the engine is of a separate lubrication type like those for models. Further, this invention can be applied not only to engines fuelled by gas but also to those fuelled by gasoline or alcohol, and it is a matter of course that this invention includes these.

Since the device according to this invention feeds lubricating oil by means of a so-called tube pump which discharges oil by squeezing the tube with rollers in rolling contact with the tube, even minimal amount of oil can be fed continuously and smoothly and its operation is very stable. Since air or minute dust particles in the tube, even if some comes in, can be discharged together, its operational disorder hardly occurs and it can steadily feed oil. Further, since this pump has a strong suction force, change of the feeding amount is small even if the tank position is changed and, since this pump also has a large discharging force, change of the feeding amount does not occur even if the height of its discharge end is changed. Further, since the rollers continually squeeze the tube in this pump, it has a high oil cutoff ability and oil will never leak out even if the engine is left stopped.

Claims

1. Separate lubrication type engine, in particular, a gas engine, having a lubricating oil feeding device to continuously supply lubricating oil to the engine, **characterised in that** said lubricating oil feeding device comprises an oil pump (25) disposed between a lubricating oil container (46) and a lubricating oil receiving means of the engine (10), said oil pump (25) discharging oil by squeezing a resilient tube (64) by means of a revolving squeezing means (60, 66) in contact with the resilient tube

(60) and continuously driven by a drive means (54).

2. Separate lubrication type engine as claimed in claim 1, **characterised in that** said oil pump is designed as a tube pump (25) comprising:
- an elastic tube (64) disposed midway of an oil feeding passage interconnecting the lubricating points of the engine (10) with the lubricating oil container (46),
- an outer housing (58) having a cylindrical inner surface with the elastic tube (60) extending along the interior of the outer housing (58),
- an inner housing (60) adapted to rotate within the outer housing (58),
- rollers (62) rotatably supported on the inner housing (60) for squeezing the elastic tube (64) between the interior of the outer housing (58) and the exterior of the rollers (62),
- and a drive means (54) for rotating the inner housing (60).

3. Separate lubrication type engine as claimed in claim 1 **characterised in that** said outer housing (58) is co-axially secured to the case of a speed reducer (56) with said with said inner housing (60) positioned within the outer housing (58) and fixed on an output shaft (56a) of the speed reducer (56) to be rotatable together with said output shaft (56a).

4. Separate lubrication type engine as claimed in claim 2, **characterised in that** said inner housing (58) has a pulley-shaped structure supporting rotatably a pair of opposite rollers (62), the axes of which extend in parallel to the axis of the inner housing (60), said rollers (62) leaving a space in between to the interior of the outer housing (58) to receive a radially compressed portion of the elastic tube (64) therein, said elastic tube (64) being stationarily disposed between said inner and outer housings (60, 58), such that both free ends of the elastic tube (64) extend outwards of the outer housing (58) adjacently spaced from each other to be connected to the lubricating oil tank (46) and the intake pipe of the engine (10), respectively.

5. Separate lubrication type engine as claimed in claim 2, **characterised by** arcuate tube guides (66) provided oppositely at the inner housing (60) either separately or integrally therewith to guide those portions of the elastic tube (64) not being squeezed by at least one of said rollers (62).

6. Separate lubrication type engine as claimed in claim 1, **characterised in that** said drive means is an electric motor (54) preferably integrated with said speed reducer (56).

7. Separate lubrication type engine as claimed in claim 1, **characterised in that** said drive means is the crankshaft of the engine (10).

8. Separate lubrication type engine as claimed in claim 6, **chacacterised in that** said electric motor (54), speed reducer (56) and elastic tube (64) are assembled co-axially to one another to form an integrated component of the lubricating oil feeding system of the engine (10).

9. Separate lubrication type engine, in particular a liquid-cooled 2-cycle gas engine, including a generator-starter coupled to the engine, as claimed in claim 1, comprising:
- a gas container (36) containing liquefied pressurised gas,
- a receptacle (40) incorporating a gas pressure regulator (41) and a fuel cock (42) providing fluid connection in between the outlet of the gas container (36) and an intake pipe of the engine (10) via an electromagnetic valve (44) to supply fuel from the gas container (36) to the engine (10),
- an oil tank (46), preferably a cartridge type oil tank, containing lubricating oil to be supplied to the intake pipe of the engine (10) via another receptacle (50) and an oil pump (25),
- a liquid cooling circuit associated with the cylinder block including the cylinder head of the engine, comprising a radiator (14) integrated with an electric cooling fan (16), a coolant pressure regulator (20) made of a resilient material in order to elastically balance the volumetric change of the coolant volume depending on its temperature change, and a coolant pump (18) driven by the engine (10) to circulate the coolant through the cooling circuit,
- wherein said gas pressure regulator (41) provided in conjunction with said receptacle (40) of the container (36) comprises a gas chamber (41a), an atmospheric chamber (41b), a diaphragm (41c) partitioning both said aforementioned chambers (41a, 41b), a spring (41d) to urge the diaphragm (41c) towards the atmospheric chamber (41b) and a control lever (41e) for limiting gas inflow from the gas container (36) in conjunction with the related diaphragm (41c),
- a gas pressure detecting means (52), comprising a housing and a related diaphragm (52) partitioning a gas chamber (52a) and an atmospheric chamber (52b) from each other, with the gas chamber (52b) being subject to the gas pressure introduced from the gas container (36), a spring (52c) biasing the diaphragm (52) against a counterforce resulting from the gas pressure prevailing in the gas chamber (52a), and a heating means activating member,
- a heating means (54) associated to the gas container (36), preferably to cover the lower half thereof, activated in response to a movement of the diaphragm (52) towards the gas chamber (52a), when the internal pressure of the gas container (36) drops on or below a preset pressure value.

10. Separate lubrication type engine as claimed in claim 9, **chacacterised by:**
- a box-shaped case (22) receiving the radiator (14)

on the right of the vertically disposed battery (24), a coolant pump (18), a coolant pressure regulator (20), an electromotive lubricating oil pump (25), with the radiator (14) sucking ambient air into the case (22) through an opening (26) on the right side of the case (22),
- whereas the engine (10) and the generator (12) are disposed on the left of the battery (24), a muffler (28) near the left side of the case (22) in order to discharge the exhaust gas of the engine (10) through an opening (30) of the case (22),
- having the engine (10), the generator (12) and the muffler (26) surrounded by an air guide wall (32) to guide the air sucked by the fan (16) of the radiator (14), said sucked air passing around the generator (12), engine (10) and muffler (26) prior to being exhausted through the opening (30),
- the gas container (36) being loaded after opening a cap (38), positioned on the left side of the case (22) with the tip of the gas container (36) being connected to the receptacle (40) after loading of the gas container (36), said receptacle (40) being integral with a gas pressure regulator (41) and a fuel cock (42) as well as being associated with a gas pressure detecting means (52) adapted to operate a heating means (54) assembled in conjunction with said gas container (36), the fuel being supplied into the intake pipe of the engine (10) through an electromagnetic valve (44) after having passed through said receptacle (40),
- a cartridge type lubricating oil tank (46), loaded after opening a cap (48) positioned on the right side of the case (22) to be connected to another receptacle (50) after loading to supply lubricating oil from said other receptacle (50) through an oil pump (25) to the intake pipe of the engine (10),
- an operating switch (72) on the top surface of the case (22) to connect the electric source, and
- a start switch (24) to start the engine (10) by means of the generator (12).

11. Lubricating oil feeding device for a separate lubrication type engine, adapted to supply lubricating oil from a lubricating oil container to lubrication points of an engine, especially to the intake pipe of a gas engine, **characterised in that** said lubricating oil feeding device comprises an oil pump (25) disposed between a lubricating oil container (46) and a lubricating oil receiving means of the engine (10), said oil pump (25) discharging oil by squeezing a resilient tube (64) by means of a revolving squeezing means (60, 66) in contact with the resilient tube (60) and continuously driven by a drive means (54).

12. Lubricating oil feeding device as claimed in claim 11, **characterised in that** said oil pump is designed as a tube pump (25) comprising:
- an elastic tube (64) disposed midway of an oil feeding passage interconnecting the lubricating points of the engine (10) with the lubricating oil container (46),
- an outer housing (58) having a cylindrical inner surface with the elastic tube (60) extending along the interior of the outer housing (58),
- an inner housing (60) adapted to rotate within the outer housing (58),
- rollers (62) rotatably supported on the inner housing (60) for squeezing the elastic tube (64) between the interior of the outer housing (58) and the exterior of the rollers (62),
- and a drive means (54) for rotating the inner housing (60).

13. Lubricating oil feeding device as claimed in claim 11, **characterised in that** said outer housing (58) is co-axially secured to the case of a speed reducer (56) with said with said inner housing (60) positioned within the outer housing (58) and fixed on an output shaft (56a) of the speed reducer (56) to be rotatable together with said output shaft (56a).

14. Lubricating oil feeding device as claimed in claim 11, **characterised by** arcuate tube guides (66) provided oppositely at the inner housing (60) either separately or integrally therewith to guide those portions of the elastic tube (64) not being squeezed by at least one of said rollers (62).

15. Lubricating oil feeding device as claimed in claim 11, **characterised in that** said drive means is either an electric motor (54) preferably integrated with the speed reducer (56) or the crankshaft of the engine (10) itself.

16. Lubricating oil feeding device as claimed in claim 11, **characterised in that** said electric motor (54), speed reducer (56) and elastic tube (64) are assembled co-axially to one another in order to form an integrated component of the lubricating oil feeding system of the engine (10).

Fig. 1

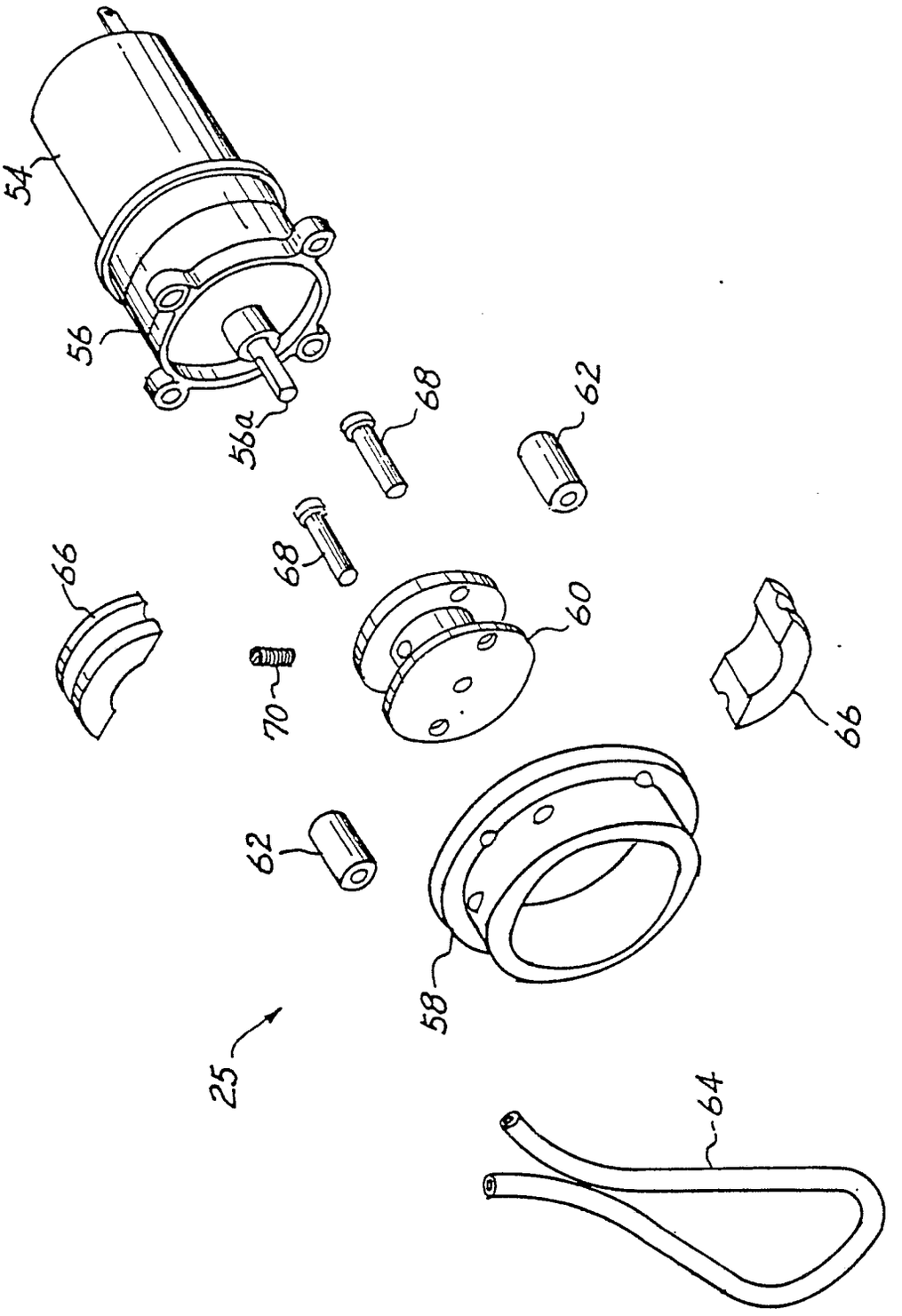

Fig. 5

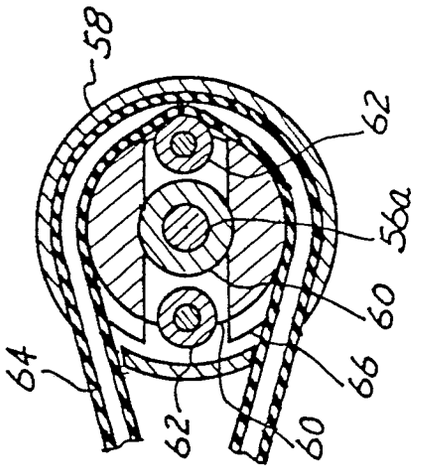

Fig. 3

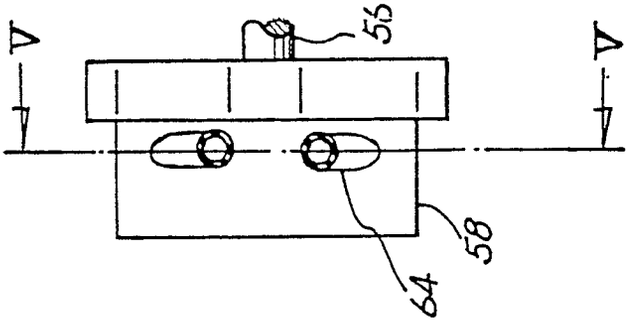

Fig. 2

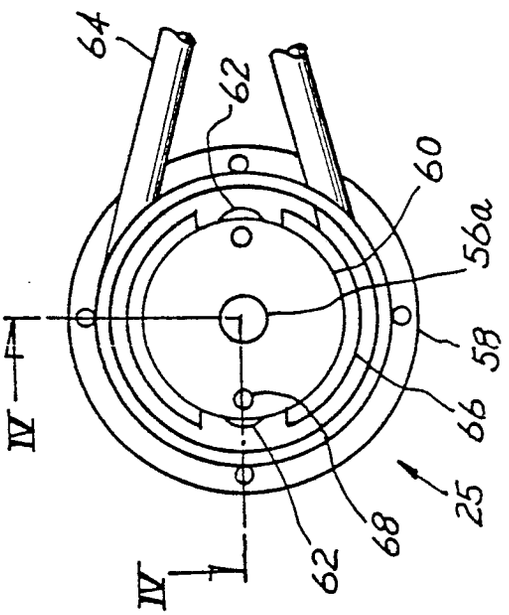

Fig. 4

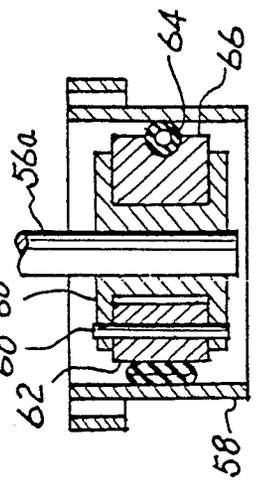

Fig. 6

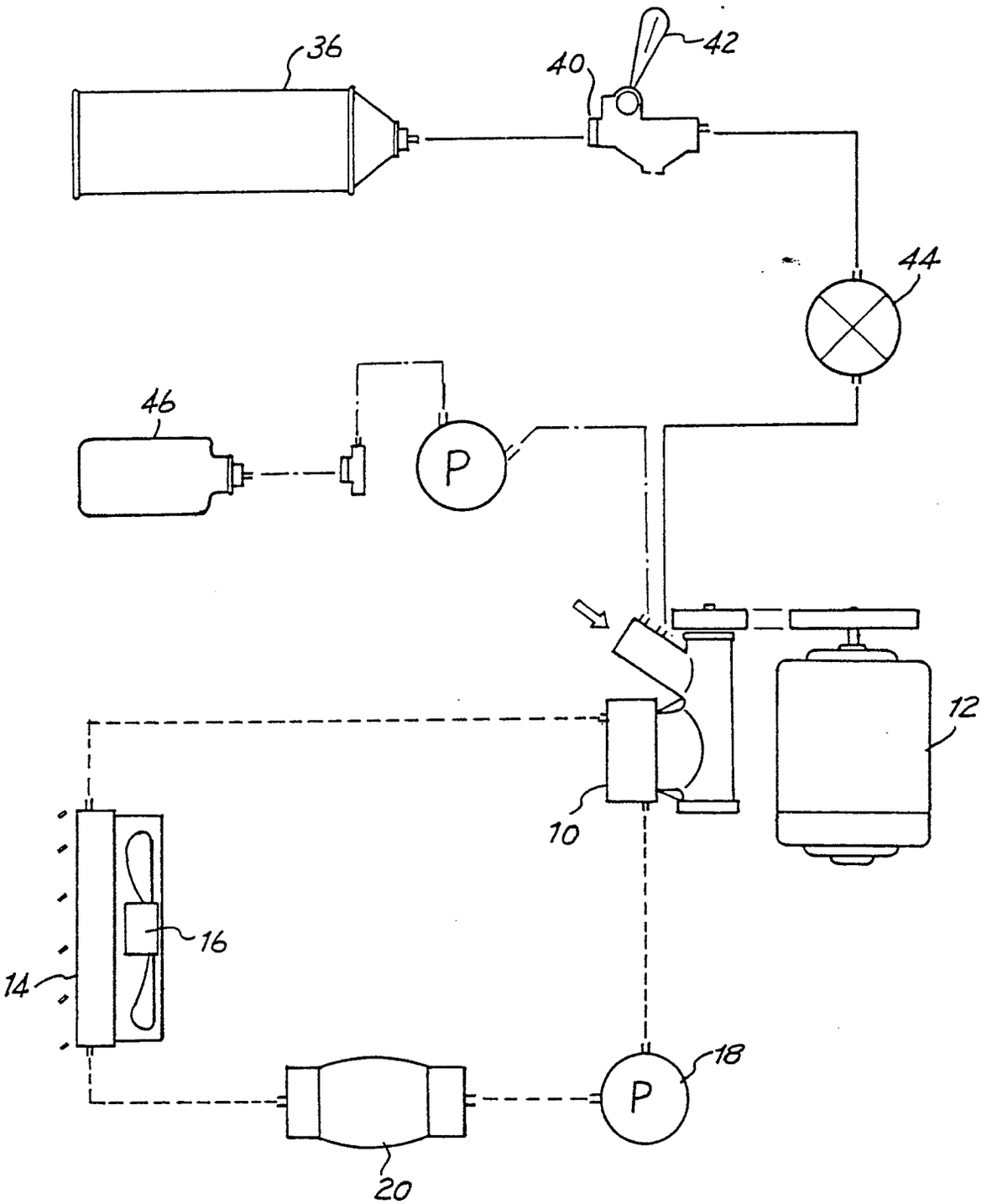

Fig. 7