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(71) Applicant: **VM MOTORI S.P.A.**
I-44042 Cento (Ferrara) (IT)

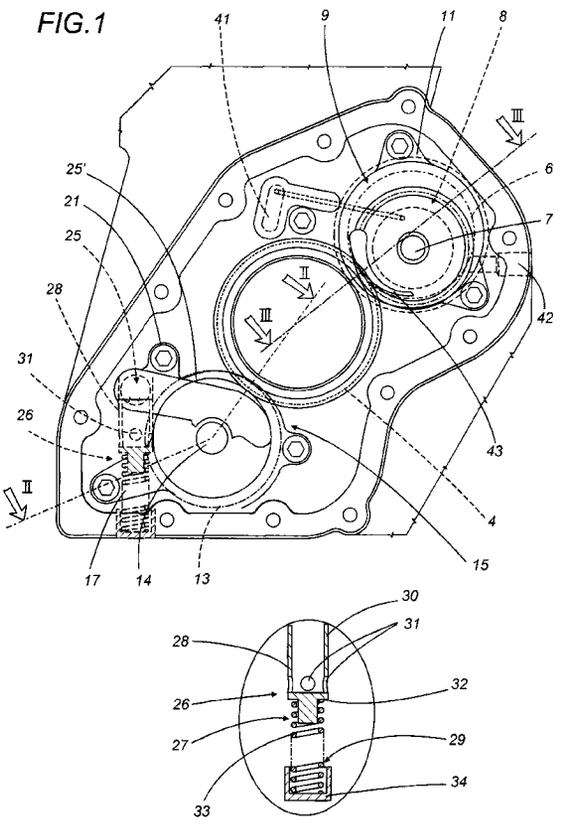
(72) Inventors:
- **Ferioli, Vilmo**
  44042 Cento (Ferrara) (IT)
- **Mingozzi, Mario**
  40017 San Giovanni in Persiceto(Bologna) (IT)

(74) Representative: **Lanzoni, Luciano**
c/o BUGNION S.p.A.
Via dei Mille, 19
40121 Bologna (IT)

(54) An engine structure for internal combustion engines

(57) A structure for an internal combustion engine comprises an engine block (1), a crankshaft (2), auxiliary means comprising means (9) for creating suction and means (15) for distributing lubricating fluid under pressure. The crankshaft (2) has keyed to it a first gear wheel (3) consisting of cup gear that meshes with a second gear wheel (6) which directly drives the means (9) for creating suction and with a third gear wheel (13) which drives the means (15) for distributing lubricating fluid under pressure. The engine block (1) also has hollows (10, 16) used to house the auxiliary means (9, 15).

FIG.1



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Description

The present invention relates to an engine structure for internal combustion engines.

The term "engine structure" is used to mean the assembly consisting of the engine block and crankcase and the built-in auxiliary services driven by the engine, in particular, the lubricating pump and the suction unit, that is, a device designed to continuously generate a vacuum in a chamber connected to the auxiliary services which require negative pressure for their operation, such as, for example, the brake system of modern cars.

In engines known up to now, said auxiliary services are separate from the engine block and are driven through transmission belts.

This type of installation has the serious disadvantage that, if a transmission belt breaks, the auxiliary service driven by that belt stops working, creating serious risks for the safety of the engine and for the vehicle on which the engine is installed.

The aim of the present invention is to overcome the disadvantages mentioned above by providing an engine structure that utilizes existing space and does not therefore increase the overall dimensions of the engine.

One aspect of the present invention is to provide an engine structure that comprises an engine block, a crankshaft with at least one first gear wheel keyed to it, means for creating suction and means for distributing lubricating fluid under pressure and where the first gear wheel meshes with a second gear wheel that directly drives the means for creating suction and with a third gear wheel that drives the means for distributing lubricating fluid under pressure.

Another aspect of the present invention is to provide an engine structure that comprises an engine block, a crankshaft with at least one first gear wheel keyed to it and auxiliary means for creating suction or for distributing lubricating fluid under pressure and where the engine block has at least one hollow to house said auxiliary means. A further aspect of the present invention is to provide an engine structure that comprises an engine block, a crankshaft with at least one first gear wheel keyed to it, means for creating suction and means for distributing lubricating fluid under pressure through suitable supply and delivery ducts and where at least one of these ducts lies mainly outside the engine block.

Yet another aspect of the present invention is to provide an engine structure that comprises an engine block, a crankshaft with at least one first gear wheel keyed to it and consisting of a cup gear which provides enough space for an oil seal without increasing the overall dimensions.

The technical characteristics of the invention according to the above mentioned aim are described in the claims below and the advantages of the invention will become more apparent from the detailed description which follows, with reference to the accompanying drawings, which illustrate a preferred embodiment of the invention and in which:

- Figure 1 is a partial, schematic cross section of an engine structure according to the present invention;
- Figure 2 is a section of Figure 1 along line II-II;
- Figure 3 is a section of Figure 1 along line III-III;
- Figure 4 is an enlarged detail of a part of Figure 3.

According to the accompanying drawings, the numeral 1 indicates an internal combustion engine block from which the end of a crankshaft 2 protrudes, the latter having keyed to it a first cup-shaped gear wheel 3, that is to say, a gear wheel whose teeth 4 lie in a plane that is axially offset with respect to the wheel hub 5 (see Figure 2) in such a way as to create the space necessary for the ideal positioning of an oil seal 40 without increasing the overall dimensions of the gear.

With reference to Figure 3, the first gear wheel 3 (not illustrated in this Figure) meshes with a second gear wheel 6 keyed to the shaft 7 of a rotor 8 of a suction unit 9 designed to generate a vacuum, for example for the brake system of a motor vehicle. The suction unit 9 is mounted inside a first box-shaped element 11, located in a first hollow 10, preferably blind, made in the engine block 1.

The end wall 12 of the first hollow 10 is used as a reference for locating the box-shaped element 11 in which the suction unit 9 is fitted. In this way, the clearance between the rotor 8 of the suction unit and the end wall 12 of the first hollow 10 is reduced to a minimum, depending solely on the tolerances T of the first box-shaped element 11 and that of the rotor 8 (since the first box-shaped element 11 is always in contact with the end wall 12 of the hollow 10, as can be seen in Figure 4). The first gear wheel 3 also meshes with a third gear wheel 13 (see Figure 2) keyed to the shaft 14 of the rotor 19 of a lubricating pump 15. The cup shape of the first gear wheel 3, besides providing space for fitting the oil seal 40, makes it possible to drive the second gear wheel 6 and the third gear wheel 13 even if the teeth of these wheels lie in a plane that is quite far away from the outer surface of the engine block 1.

The pump 15 is mounted inside a second box-shaped element 17 located in a second blind hollow 16 made in the engine block 1.

The end wall 18 of the second hollow 16 is used as a reference for locating the box-shaped element 17 in which the pump 15 is fitted. Thus, as for the unit described above, the clearance between the rotor 19 of the pump 15 and the end wall 18 of the second hollow 16 is reduced to a minimum, depending, in this case too, solely on the tolerances between the depth of the second box-shaped element 17 and that of the rotor 19.

The second box-shaped element 17 comprises a cover 21 that protrudes from said second hollow 16 and that has made in it a first chamber 22 into which the supply duct 23 of the pump 15 leads, in the direction of the arrows F (a part of the supply duct is illustrated in Fig-

ures 1 and 2) and a second chamber 24 from which the delivery duct 25 of the pump 15 branches (the connecting port of the delivery duct is illustrated in Figure 1).

It should be noticed that the first chamber 22 and the second chamber 24 are made around the bearing S of a shaft which mounts the third gear wheel 13 and have the same width as the bearing so as not to increase the overall dimensions of the unit.

Looking in more detail, the supply duct 23 and the delivery duct 25 of the engine block 1 communicate with the cover 21 of the box-shaped element 17 through corresponding connecting ducts 23' and 25' (partly illustrated in Figure 1) which lie mainly on the outside of the engine block 1, thus eliminating the need to make the ducts entirely in the engine block 1 using complicated and costly processes. The connecting ducts 23' and 25' connect with corresponding ports (not illustrated) made in the engine block 1 and which, after the second box-shaped element 17 has been fitted, lead into the corresponding first and second chambers 22 and 24 in the second box shaped element 17 itself.

In other terms, the engine block 1 has made in it the first and second hollows 12 and 16 to house the corresponding box shaped elements 11 and 17 each of which has its own fluid supply and delivery ducts. For example (see Figures 1 and 3), the suction unit 9 is supplied with oil from the engine sump (not illustrated) so that the rotor 8 can be lubricated through a first duct 41 that leads into the area labelled 41' in Figure 3. As it rotates, the rotor 8 creates a vacuum in a second suction duct 42 which communicates with the related service tank. The delivery of the rotor 8, which consists of air mixed with oil, is in turn supplied to a third duct 43 made in the front wall of the first box-shaped element 11 and from here, the mixture is fed back into the engine sump and recycled.

The three ducts 41, 42 and 43 of the suction unit 9 are made in and lie entirely inside the engine block 1 which, once these elements have been assembled, is closed by a simple guard, labelled C in the accompanying drawings, without necessitating special machine processes or sealing elements and thereby also reducing the axial dimensions of the engine block 1 as a whole.

As shown in Figure 1, located between the supply duct 23 and the delivery duct 25 of the pump 15, there is a pressure regulating valve 26 fitted in a bypass duct 27.

The valve 26 is designed to enable a part of the fluid delivered by the pump 15 to the delivery duct 25 to be diverted directly into the supply duct 23 through the bypass duct 27 when the delivery pressure of the pump 15 exceeds a preset value.

The regulating valve 26 consists of a shutter element 30, preferably cylindrical, fitted in a first section 28 of the bypass duct 27. At a first end of it, the shutter element 30 communicates with the delivery duct 25 of the pump 15 and, close to a second end, it has a plurality of radial holes 31. The second end of the cylindrical element 30 has a shutting element 32 pushed by a spring 33 that is preloaded by a preset, adjustable value, the spring having one end resting against the shutting element 32 and the other end resting against a stop element 34. The spring 33 and the shutting element 32 are positioned inside a second section 29 of the bypass duct that is larger in diameter than the first section 28 and that communicates with the suction duct 23 of the pump 15.

When the pressure of the fluid in the delivery duct 25 of the pump 15 exceeds a preset value depending on the preload value of the spring 33, the force exerted by the fluid under pressure on the shutting element 32 exceeds the force exerted on it by the spring 33 and pushes the cylindrical element 30 further into the second section 29 of the bypass duct 27 so as to allow a part of the fluid delivered by the pump 15 to flow into the second section 29 (see Figures 1 and 2) of the bypass duct 27 and, from there, into the suction duct 23 and then into the above mentioned first chamber 22.

This prevents the pressure in the delivery duct 25 of the pump 15, and therefore in the lubricating system supplied by the pump, from reaching excessive, dangerous values.

The invention described can be subject to modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

Claims

1. An engine structure comprising an engine block (1), a crankshaft (2) having keyed to it at least one first gear wheel (3), auxiliary means comprising means (9) for creating suction and means (15) for distributing lubricating fluid under pressure, said structure being characterized in that the first gear wheel (3) meshes with a second gear wheel (6) that directly drives said means (9) for creating suction and with a third gear wheel (13) that drives the means (15) for distributing fluid under pressure.

2. An engine structure comprising an engine block (1), a crankshaft with at least one first gear wheel (3) keyed to it and auxiliary means (9) and/or (15) for creating suction and/or for distributing lubricating fluid under pressure, said structure being characterized in that the engine block (1) has hollows (10, 16) to house said auxiliary means (9, 15).

3. An engine structure comprising an engine block (1), a crankshaft (2) with at least one first gear wheel (3) keyed to it, means (9) for creating suction and means (15) for distributing lubricating fluid under pressure through suitable supply or suction ducts (23, 41, 42) and delivery ducts (25, 43), said engine

structure being characterized in that said supply or suction ducts and delivery ducts (23, 25, 41, 42, 43) extend mainly outside the engine block (1).

4. An engine structure comprising an engine block (1), a crankshaft (2) with at least one first gear wheel (3) keyed to it, means (9) for creating suction and means (15) for distributing lubricating fluid under pressure, said structure being characterized in that said first gear wheel (3) is a cup gear designed to provide a space where a seal ring (40) for the lubricating fluid of the engine block (1) can be housed.

5. The engine structure according to claim 1 characterized in that the engine block (1) has hollows (10, 16) designed to house the auxiliary means (9, 15).

6. The engine structure according to claim 1 characterized in that the means (15) for distributing lubricating fluid under pressure are connected to a supply duct (23) and to a delivery duct (25) for said lubricating fluid, at least one of which lies mainly outside the engine block (1).

7. The engine structure according to claim 1 characterized in that said first gear wheel (3) is a cup gear designed to provide a space where a seal ring (40) for the lubricating fluid of the engine block (1) can be housed.

8. The engine structure according to claim 2 characterized in that said means (15) for distributing lubricating fluid under pressure are connected to a supply duct (22, 23) and to a delivery duct (25) for said lubricating fluid, at least one of which lies mainly outside the engine block (1).

9. The engine structure according to claim 2 characterized in that said first gear wheel (3) is a cup gear designed to provide a space where a seal ring (40) for the lubricating fluid of the engine block (1) can be housed.

10. The engine structure according to claim 3 characterized in that said first gear wheel (3) is a cup gear designed to provide a space where a seal ring (40) for the lubricating fluid of the engine block (1) can be housed.

11. The engine structure according to claim 2 characterized in that the engine block (1) has a first hollow (10), preferably blind, used to house the means (9) for creating suction and a second hollow (16) to house the means (15) for distributing lubricating fluid under pressure.

12. The engine structure according to claim 11 characterized in that the means (9) for creating suction are mounted inside a first box-shaped element (11) located in the first hollow (10), an end wall (12) of the first hollow (10) being used as a reference for locating the box-shaped element (11) in the hollow (10).

13. The engine structure according to claim 11 characterized in that the means (15) for distributing lubricating fluid under pressure are mounted inside a second box-shaped element (17) located in the second hollow (16), an end wall (18) of the second hollow (16) being used as a reference for locating the box-shaped element (17) in the hollow (16).

14. The engine structure according to claim 3 characterized in that the means (15) for distributing lubricating fluid under pressure are equipped with a cover (21) that protrudes from the engine block (1) and that has made in it a first chamber (22) into which the supply duct (23) leads, and a second chamber (24) from which the delivery duct (25) branches; said first and second chambers (22, 24) being made around the bearing (S) of a shaft which mounts the third gear wheel (13) and have the same width as the bearing.

15. The engine structure according to claim 14 where the supply duct (23) and the delivery duct (25) lead into an area, through corresponding ports close to the distributing means (15), characterized in that said supply duct and said delivery duct communicate with the corresponding first and second chambers (22, 24) through connecting ducts (23', 25') lying on the outside of the engine block (1) and leading into corresponding ports made in the engine block (1) and connected in turn to the first and second chambers (22, 24) when the distributing means (15) are assembled.

16. The engine structure according to claim 14 characterized in that the supply duct (23) and the delivery duct (25) are connected to each other through a bypass duct (27) regulated by a valve (26).

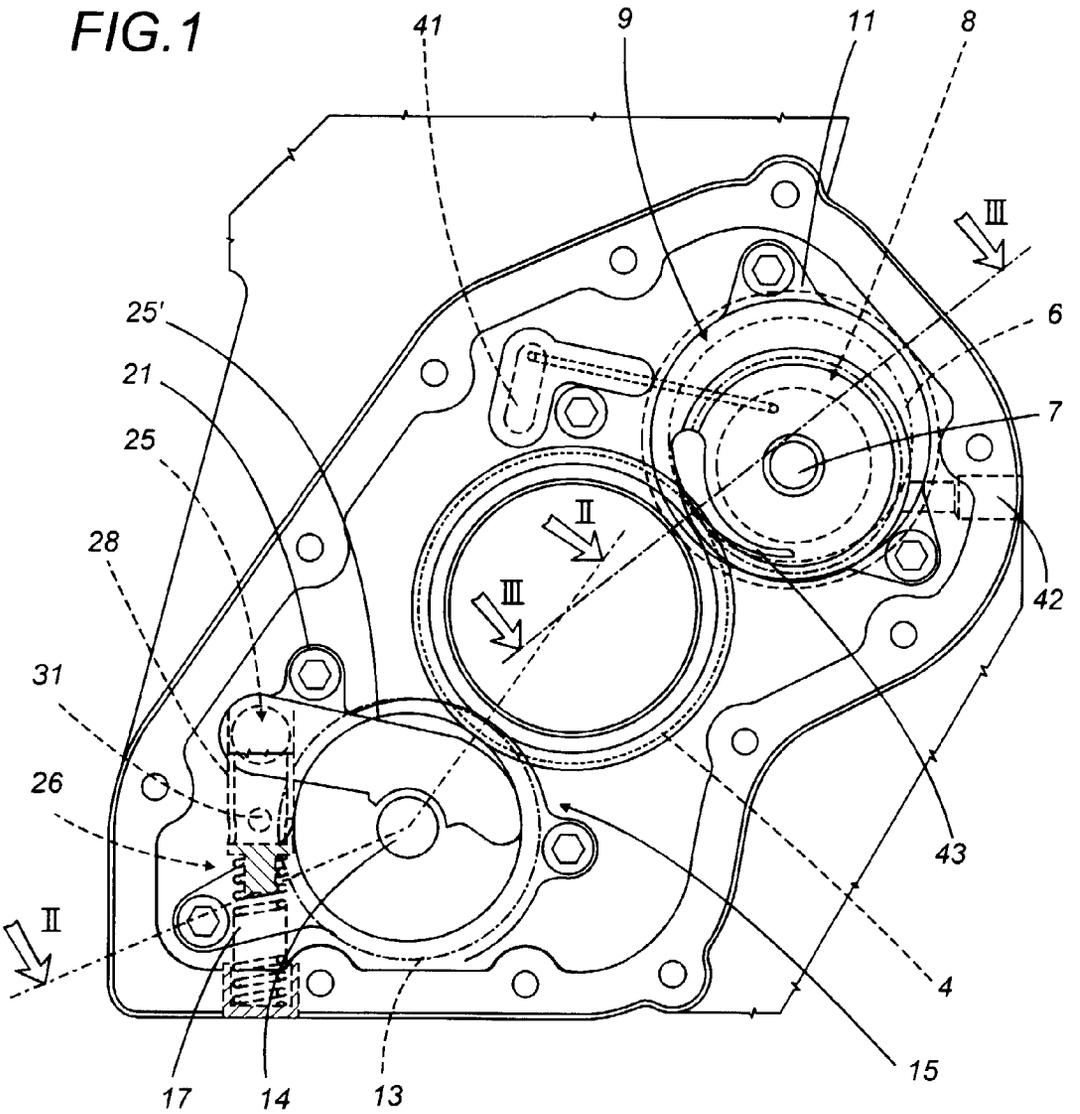
17. The engine structure according to claim 16 characterized in that the bypass duct (27) comprises a first section (28), that communicates with the delivery duct (25), and a second, consecutive section (29), that communicates with the suction duct (23), said second section (29) being larger in diameter than said first section (28).

18. The engine structure according to claim 17 characterized in that the regulating valve (26) comprises a shutter element (30) fitted by sliding into the first section (28) of the bypass duct (27), a first end of said shutter element (30) communicating with the delivery duct (25) and a second end of it having close to it a plurality of radial holes (31).

19. The engine structure according to claim 18 characterized in that the second end of the shutter element (30) has a shutting element (32) acted on by preloaded elastic means (33) one end of which rests against the shutting element (32) and the other end rests against a stop element (34).

20. The engine structure according to claim 19 characterized in that the shutter element (30) slides inside the second section (29) of the bypass duct (27) against the action of the elastic means (33).

FIG.1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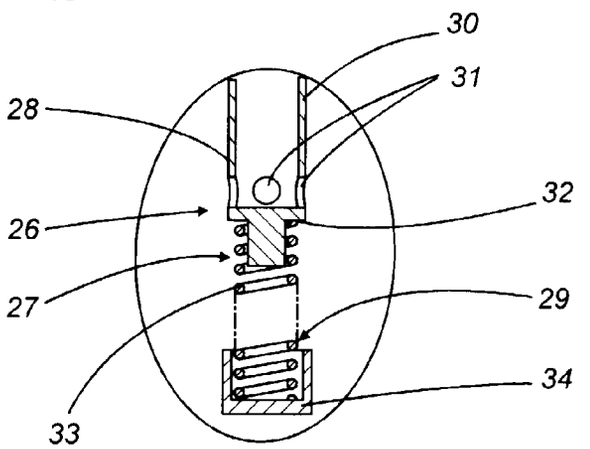
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FIG.2

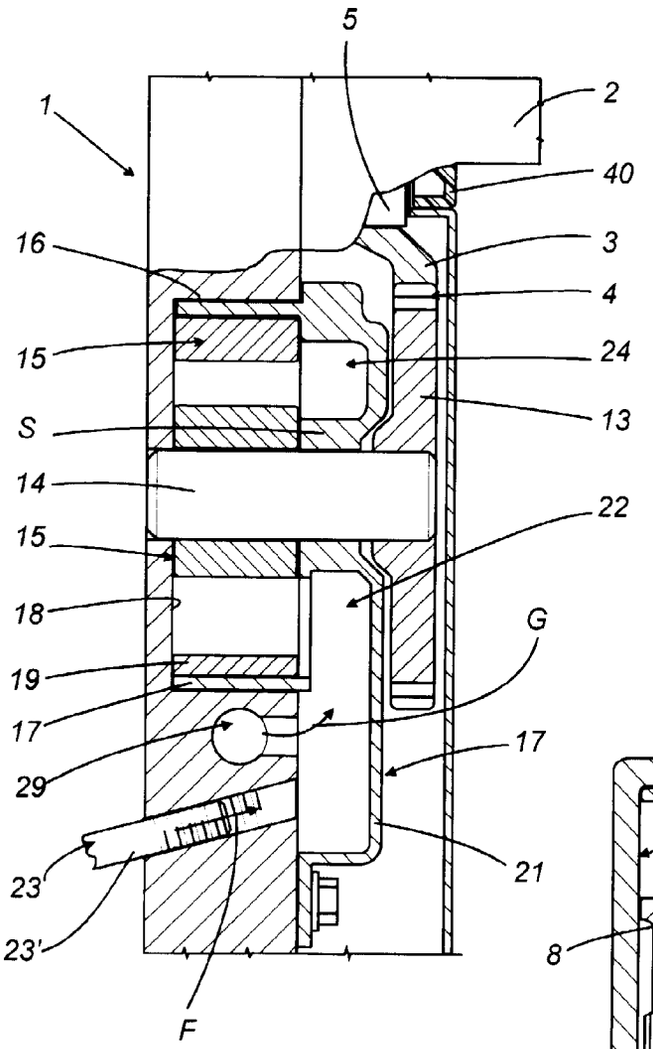

FIG.3

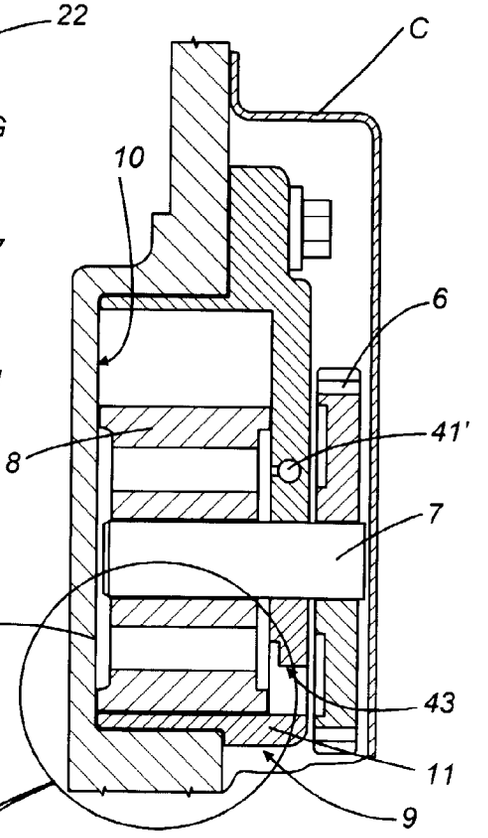

FIG.4