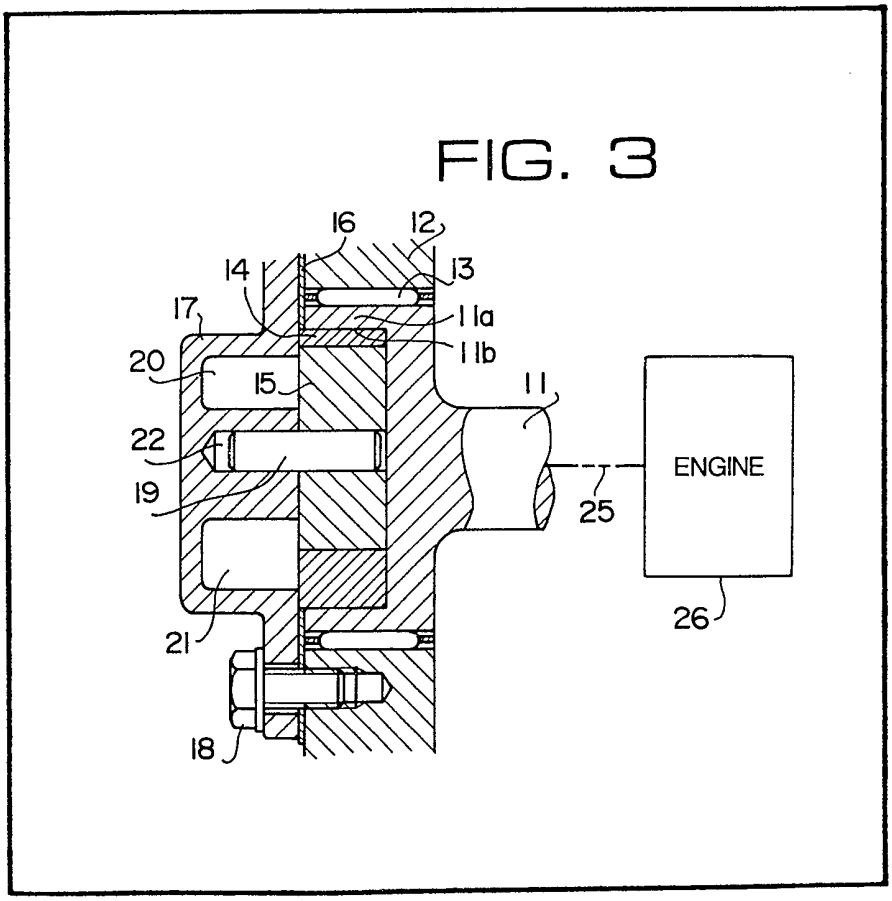
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(71) Applicant
Fuji Jukogoyo Kabushiki Kaisha,
7-2 Nishishinjuku 1-chome,
Shinjuku-ku,
Tokyo,
Japan
(72) Inventor
Shinichi Takemura
(74) Agents
Batchellor Kirk and Eyles,
2 Pear Tree Court,
Farringdon Road,
London,
EC1R 0DS

(54) **An internal-combustion engine oil pump**

(57) In an internal-combustion engine a pump drive shaft 11 is connected to the crankshaft 25 and has a large diameter portion 11a supported by a bearing 13 in a crankcase 12. An internally-toothed outer rotor 14 of the pump is secured within the large diameter portion 11a. An externally-toothed inner rotor 15 of the pump meshes with the outer rotor and is supported by eg a shaft 19, at a position which is eccentric relative to the centre of the outer rotor, said rotors being of the gerotor type. Oil is drawn into the pump through an inlet 20 and expelled through an outlet 21 by the rotors.



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FIG. 1

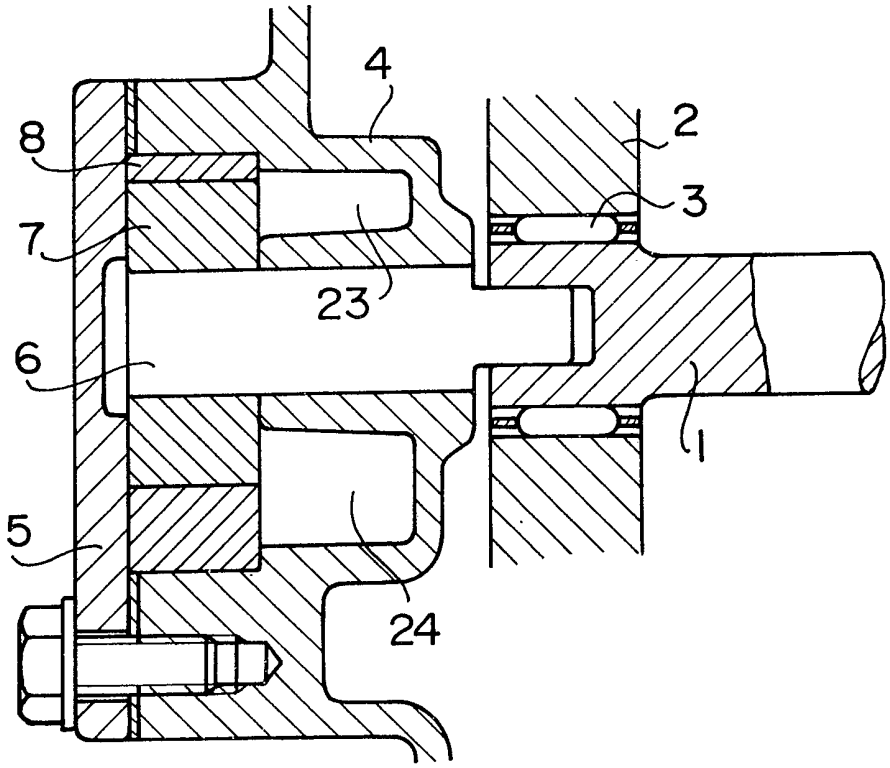
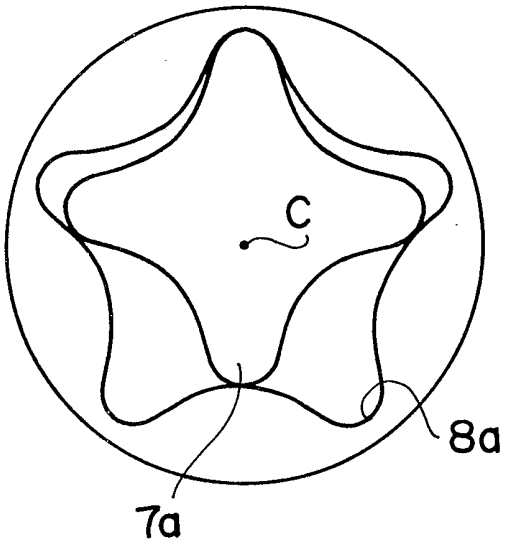


FIG. 2



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FIG. 3

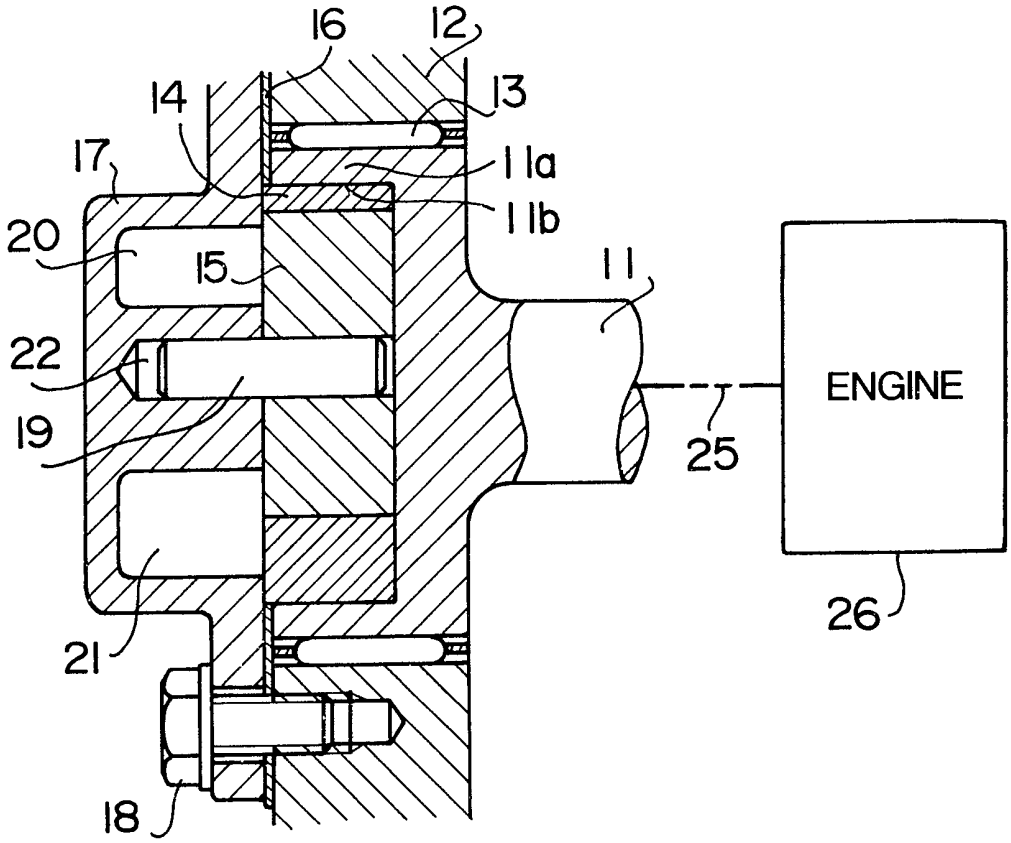
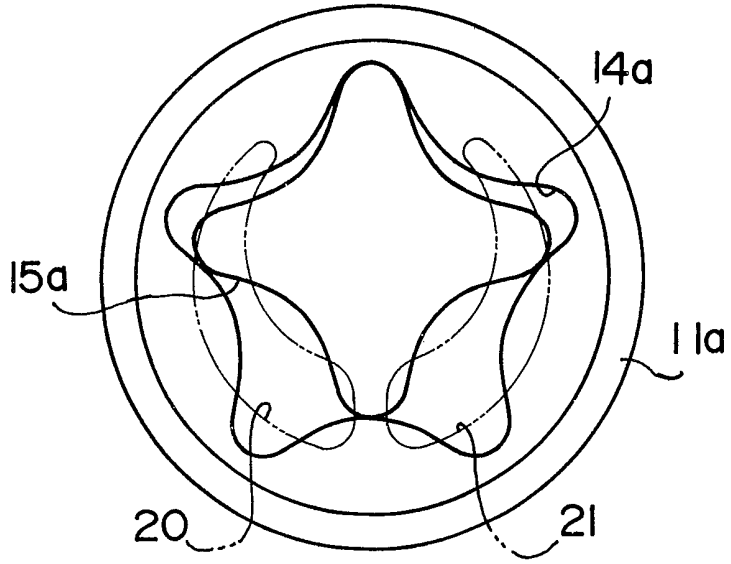


FIG. 4



SPECIFICATION

An oil pump for an internal combustion engine

The present invention relates to an oil pump for an internal combustion engine, and to a rotor-type oil pump.

A conventional rotor-type oil pump requires a large installation space and has a complicated structure as, for example, shown in figures 1 and 2.

Referring to Fig. 1 a conventional rotor-type (trochoid) oil pump has a drive shaft 1 connected to a crankshaft (not shown) of an engine and is rotatably supported in a wall 2 of a crankcase by a bearing 3. A pump casing 4 is secured to the wall 2 at the outside thereof. An oil pump shaft 6 coupled to the drive shaft 1 is rotatably mounted in the pump casing 4. An inner rotor 7 is securely mounted on the oil pump shaft 6. An outer rotor 8 is rotatably mounted within the pump casing 4 and a pump cover 5 is secured to the casing 4 to retain the rotors 7 and 8. As shown in Fig. 2, the inner rotor 7 has four teeth 7a, while the outer rotor 8 has five internal indentations 8a for co-operating engagement with the four teeth of the inner rotor 7. The centre C of the outer rotor 8 is eccentric with respect to the centre of the inner rotor 7. In the pump casing 4, an inlet 23 and outlet 24 are provided adjacent the inner and outer rotors 7, 8.

An oil pump of this type occupies a large space in both axial and radial directions, because the pump has a separate structure, and moreover, the pump is complicated in construction. Further, the discharge performance is not sufficient in delivery rate considering its large construction.

In order to improve on such an oil pump, it has been proposed, e.g. Japanese Utility Model Application Publication No. 50-156626, to provide an oil pump which has a pump case provided in a crankcase of an engine. However, the pump of this type is no better in delivery rate than the pump of Fig. 1.

The present invenion seeks to overcome the above described disadvantages of the prior art and to provide a rotor-type oil pump requiring a small installation space, which has a simple construction and, in addition, provides a high delivery rate.

According to the present invention, there is provided an oil pump for an internal combustion engine which has a crankcase, comprising: a drive shaft operatively connected to the engine; the drive shaft terminating in a portion of increased diameter which is rotatably supported in a wall of the crankcase and is provided with a recess in the end thereof; an annular outer rotor secured within the recess coaxial with the drive shaft, and provided with a plurality of internal indentations; an inner rotor rotatably supported at a position eccentric to the outer rotor, and having a plurality of teeth for engagement with the identations of the outer rotor, the number of teeth being one less than the number of indentations; a casing secured to the crankcase for sealing the outer and inner rotors; and an inlet and an outlet for the oil provided adjacent the outer and inner rotors.

A preferred embodiment of the invention will now be described, by way of example and with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view of a conventional rotor-type oil pump;

Fig. 2 is an illustration showing an inner rotor and an outer rotor of the conventional oil pump;

Fig. 3 is a sectional view showing a rotor-type oil pump according to the preferred embodiment of the present invention; and

Fig. 4 is an illustration showing an inner rotor and outer rotor of the preferred embodiment.

Referring to Figures 3 and 4 of the drawings, an oil pump includes a drive shaft 11 connected to a crankshaft or cam shaft 25 of an engine 26, and terminating in a large diameter annular portion 11a having a recess 11b in the end thereof. The recess defines a cylindrical inner surface. The annular portion 11a is rotatably supported in a crankcase 12 by a bearing 13. An outer rotor 14 is engaged and secured within the recess 11b, for example by being a force fit within the recess. The outer rotor 14 is coaxial with the drive shaft 11. The inner rotor 15 is rotatably mounted on a shaft 19 secured in a bore 22 of a pump casing 17 and the rotational axis of the inner rotor 15 is eccentric with respect to the axis of the outer rotor 14. The outer rotor 14 has five internal indentations 14a, while the inner rotor 15 has four teeth 15a.

The pump casing 17 is fastened to the crankcase 12 by bolts 18, and packing 16 is interposed between the pump casing and crankcase. An inlet 20 and outlet 21 are formed in the pump casing 17. The inlet 20 is located at a position where the space between the indentations 14a and the teeth 15a becomes larger and the outlet 21 is at a position where the space becomes smaller.

In operation, the outer rotor 14 rotates together with the drive shaft 11 and the inner rotor 15 is rotated by the outer rotor. Oil is drawn into the space between the outer 14 and the inner rotor 15 from the inlet 20 by expansion of the space between the indentations 14a and teeth 15a and is discharged through the outlet 21 by contraction of that space.

Since the outer rotor is driven by the drive shaft and the inner rotor is driven by the outer rotor, the delivery rate of the oil pump having five indentations in the outer rotor is 1.25 (5/4) times as large as the conventional oil pump of Fig. 1 in which the outer rotor is driven by the inner rotor. In addition, since the large diameter annular portion 11a, outer rotor 14 and inner rotor 15 are built in the wall of the crankcase 12, the oil pump is small in size compared with the conventional oil pump of Fig. 1. The oil pump of the preferred embodiment of the present invention also has a small number of parts than the conventional oil pump.

From the foregoing, it will be understood that

the present invention provides an oil pump which may be installed within a small space, which has a large delivery rate, a simple construction and a small number of parts.

Claims

1. An oil pump for an internal combustion engine which has a crankcase, comprising: a drive shaft operatively connected to the engine; the drive shaft terminating in a portion of increased diameter which is rotatably supported in a wall of the crankcase and is provided with a recess in the end thereof; an annular outer rotor secured within the recess coaxial with the drive shaft, and provided with a plurality of internal indentations; an inner rotor rotatably supported at a position eccentric to the outer rotor, and having a plurality of teeth for engagement with the indentations of the outer rotor, the number of teeth being one less than the number of indentations; a casing secured to the crankcase for sealing the outer and inner rotors; and an inlet and outlet for the oil provided adjacent the outer and inner rotors.

2. An oil pump as claimed in claim 1 wherein the drive shaft is operatively connected to the crankshaft of the engine.

3. An oil pump as claimed in claim 1 or 2 wherein the inner rotor is rotatably supported by a shaft secured to the casing.

4. An oil pump as claimed in any preceding claim wherein the inlet and outlet are formed in the casing.

5. An oil pump for an internal combustion engine substantially as herein described with reference to figures 3 and 4 of the accompanying drawings.

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