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(72) Inventors:
• **Kurita, Hirotaka, c/o Int. Prop. Dep. Aisin Seiki
Kariya-shi, Aichi-ken, 448-8650 (JP)**
• **Nakayoshi, Hideki, c/o Int. Prop. De. Aisin Seiki
Kariya-shi, Aichi-ken, 448-8650 (JP)**

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(74) Representative: **Kramer - Barske - Schmidtchen
European Patent Attorneys
Patenta
Radeckestrasse 43
81245 München (DE)**

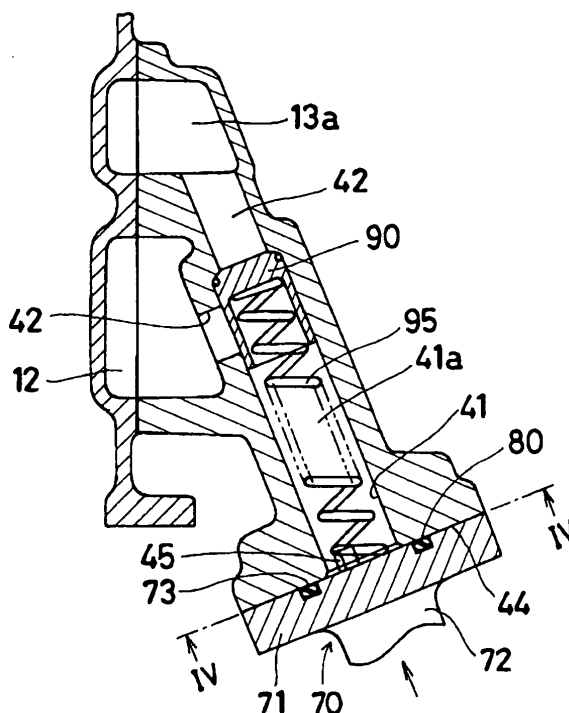
(71) Applicant: **Aisin Seiki Kabushiki Kaisha
Kariya-shi, Aichi-ken 448-8650 (JP)**

(54) **Oil pump**

(57) An oil pump includes a relief passage for communicating an intake passage and a discharge passage, a valve bore assembled with a pressure adjusting valve for controlling an opening and closing of the relief passage in accordance with pressure at the discharge

passage, an intake bore having an opening at one end thereof, the intake bore in communication with the intake passage for sucking oil, and a flange portion attached with a connection member. A first end of the valve bore is open to the flange portion.

FIG. 3



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to an oil pump. More particularly, the present invention pertains to a positioning of a pressure adjusting mechanism for an oil pump.

BACKGROUND

[0002] Known pressure adjusting mechanisms for maintaining the discharge pressure of oil pumps at a predetermined pressure likely to have an internal relief construction for returning the excessive oil to an intake passage via a relief passage in order to restrain the degradation of the oil or to adopt a roller rocker for the low friction request of the engine. With the internal relief construction, the air may be mixed in the oil or the intake performance of the oil may be deteriorated due to the establishment of the communication between the intake passage and the atmosphere via the relief passage and the clearance provided between a valve bore and a pressure adjusting valve of the pressure adjusting mechanism when the backpressure of the pressure adjusting valve is exposed to the atmosphere (i.e., outside). A known pressure adjusting mechanism described in Japanese Utility Patent No. 2523574 includes a lid for sealing a valve bore and a passage for establishing the communication between the intake side and the space defined by the lid, a pressure adjusting valve, and the valve bore.

[0003] Japanese Utility Patent Laid-Open Publication No. H08-7048 describes the positioning of the pressure adjusting mechanism. With the construction of Japanese Utility Patent Laid-Open Publication No. H08-7048, the pressure adjusting mechanism is positioned at a discharge side considering the reduction of the length in the back-and-forth direction of the oil pump and a oil strainer attachment portion is positioned at an intake side opposite to the pressure adjusting mechanism relative to a crankshaft penetration bore.

[0004] Further, the construction of the oil passage has been simplified for simplifying the cylinder block construction of the engine in order to respond to the request for reducing the manufacturing cost. Thus, the oil pump includes an auxiliary oil passage unitarily provided on the cylinder block for connecting a main oil passage and a port for in-taking the oil discharged from the oil pump. With the foregoing construction, the auxiliary oil passage is positioned at the discharge side of the oil pump to position the pressure adjusting mechanism at the intake side. In this case, the intake bore or the oil strainer (i.e., connection member) attachment portion and the valve bore are arranged approximately in the same direction considering the productivity of the oil pump.

[0005] Notwithstanding, in case the pressure adjusting mechanism includes the internal relief construction,

because it is required to assemble sealing means (e.g., plug screw) for sealing the valve bore from the outside, the distance between the intake bore or the oil strainer (i.e., connection member) and the valve bore is increased, which increases the size of the oil pump and thus the engine block as a whole.

[0006] A need thus exists for an oil pump in which a pressure adjusting mechanism is positioned without increasing the size of the pressure adjusting mechanism and a connection member.

SUMMARY OF THE INVENTION

[0007] In light of the foregoing, the present invention provides an oil pump which includes a relief passage for communicating an intake passage and a discharge passage, a valve bore assembled with a pressure adjusting valve for controlling an opening and closing of the relief passage in accordance with pressure at the discharge passage, an intake bore having an opening at one end thereof, the intake bore in communication with the intake passage for sucking oil, and a flange portion attached with a connection member. A first end of the valve bore is open to the flange portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The foregoing and additional features and characteristics of the present invention will become more apparent from the following detailed description considered with reference to the accompanying drawings, wherein:

[0009] Fig. 1 shows a view from a back of a chain cover provided with an oil pump according to an embodiment of the present invention.

[0010] Fig. 2 is a cross-sectional view of the oil pump taken on line II-II of Fig. 1 according to the embodiment of the present invention.

[0011] Fig. 3 is a cross-sectional view of a pressure adjusting mechanism taken on line III-III of Fig. 1 according to the embodiment of the present invention.

[0012] Fig. 4 is a cross-sectional view taken on line IV-IV of Fig. 3 according to the embodiment of the present invention.

DETAILED DESCRIPTION

[0013] One embodiment of the present invention will be explained with reference to the illustrations of the drawing figures as follows.

[0014] As shown in Fig. 1, a timing chain cover 10 covers a timing chain operatively connecting cam sprockets 210 secured to a front end of a camshaft and a crank sprocket 220 for transmitting the rotational force of a crankshaft 230.

[0015] An oil pump 100 configured to be driven by the crankshaft 230 is provided at a bottom portion of the timing chain cover 10. The oil pump 100 sucks the oil re-

served in an oil pan via an oil strainer (i.e., connection member) 70 assembled to the oil pump and discharges the pressurized oil to a portion to be supplied such as a lubrication portion of bearing for engine, or the like. The oil is returned to the oil pan of the engine after being supplied to the portion to be supplied.

[0016] As shown in Fig. 2, the oil pump 100 includes a drive rotor 20, a driven rotor 30 assembled being eccentric relative to the drive rotor 20 by a predetermined amount, and a pump chamber 11 accommodating the drive rotor 20 and the driven rotor 30 and being sealed with a pump cover 40 via screws 60. An external gear of the drive rotor 20 is geared with an internal gear of the driven rotor 30 so that the driven rotor 30 is rotated by the drive rotor 20 in the peripheral direction.

[0017] The pump chamber 11 includes an intake port (i.e., intake passage) 12 and a discharge port (i.e., discharge passage) 13. The discharge port 13 is in communication with a relief passage 42 via a connection passage (i.e., discharge passage) 13a. As shown in Fig. 3, the relief passage 42 formed on the pump cover 40 is positioned between the connection passage 13a and the intake port 12 for the communication therebetween. The relief passage 42 includes a valve bore 41 assembled with a valve (i.e. pressure adjusting valve) 90 biased by a coil spring (i.e., a biasing member) 95. A pressure adjusting mechanism comprises the valve bore 41, the valve 90 and the coil spring 95. The valve 90 moves in the valve bore 41 against the biasing force of the coil spring 95 in accordance with the hydraulic pressure at the discharge portion 13 (or the connection passage 13a) for controlling the opening and closing of the relief passage 42. The clearance is ensured between the external periphery of the valve 90 and the valve bore 41 so that the valve 90 is movable with the oil lubrication.

[0018] The intake port 12 is in communication with an intake bore 43 formed on the pump cover 40. As shown in Fig. 4, the valve bore 41 and the intake bore 43 are arranged to be adjacent and in the same direction. Respective ends of the valve bore 41 and the intake bore 43 are open to a common flange 44. A communication groove 45 serving as a communication passage and communication groove 45 is formed at the flange portion 44 for communicating the valve bore 41 and the intake bore 43 via respective opening end portions. The valve 90 is moved smoothly in accordance with the application of the hydraulic pressure because the communication between a spring chamber 41a, defined by a back surface of the valve 90, the valve bore 41 and a plate 71 and provided with the coil spring 95, and the intake bore 43 is established.

[0019] An oil strainer 70 serving as a connection member is connected to the flange portion 44 via connecting members. The oil strainer 70 includes a pipe 72 in communication with the intake bore 43, and the plate 71 unitarily provided at the end portion of the pipe 72. The plate 71 seals the intake bore 43 and is engaged with the coil spring 95 for biasing the valve 90. A seal

member 80 for sealing the valve bore 41 and the intake bore 43 from the atmosphere is positioned in a groove 73 between the flange 44 and the plate 71. The seal member 80 may include gasket, O-ring, or the like.

[0020] The communication groove 45 may be provided at the plate 71.

[0021] The operation of the oil pump according to the embodiment of the present invention will be explained as follows. The oil pump 100 operates in accordance with the rotation of the drive rotor 20 rotated by the rotational force of the crankshaft 230 in accordance with the operation of the engine, and the drive rotor 30 geared with the drive rotor 20. The oil reserved in the oil pan is sucked via the oil strainer 70, pumped to the discharge port 13 via the intake bore 43 and the intake port 12, and discharged to the portion to be supplied. When the hydraulic pressure of the oil discharged from the discharge port 13 reaches a predetermined level, the valve 90 positioned in the valve bore 41 opening to the relief passage 42 in communication with the discharge port 13 moves against the biasing force of the coil spring 95 to open the relief passage 42.

[0022] In this case, the oil supplied to the spring chamber 41a via the clearance between the external periphery of the valve 90 and the valve bore 41 likely to disturb the movement of the valve 90. However, because the oil is introduced to the intake bore 43 via the communication groove 45, the valve 90 moves smoothly.

[0023] According to the embodiment of the present invention, the first end of the valve bore is open to the flange portion. Thus, the valve bore and the intake bore can be positioned at the flange to reduce the size of the oil pump. Further, because the machining of the valve bore and the intake bore, and the assembling of the connection member connected to the pressure adjusting valve and the intake bore can be conducted from the common direction, the machining and the assembling process can be simplified.

[0024] According to the embodiment of the present invention, because the opening portion formed at the flange portion of the valve bore is sealed with the connection member, the number of the parts can be reduced to simplify the machining and the assembling process and to reduce the size of the oil pump.

[0025] According to the embodiment of the present invention, because the connection member is engaged with the biasing member positioned in the valve bore for biasing the pressure adjusting valve, separate member for engaging the biasing member is not necessary to be provided. Thus, the number of the parts is reduced, which simplifies the machining and the assembling process and reduces the size of the oil pump.

[0026] According to the embodiment of the present invention, because the communication passage for communicating the intake bore and the first end of the valve bore is provided, it is not required to expose the back-pressure of the pressure adjusting valve to the atmosphere, which prevents the deterioration of the intake

performance of the oil and the increase of the air mixture in the oil by the communication between the intake passage and the atmosphere via the clearance provided between the pressure adjusting valve of the pressure adjusting mechanism and the valve bore, and the relief passage.

[0027] According to the embodiment of the present invention, because the communication passage includes the communication groove formed at the flange, it is not required to provide separate communication passage, which simplifies the machining process and reduces the size of the oil pump.

It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

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Claims

1. An oil pump comprising:

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a relief passage (42) for communicating an intake passage (12) and a discharge passage (13);

a valve bore (41) assembled with a pressure adjusting valve (90) for controlling an opening and closing of the relief passage in accordance with pressure at the discharge passage;

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an intake bore (43) having an opening at one end thereof, the intake bore in communication with the intake passage for sucking oil; and

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a flange portion (44) attached with a connection member (70); **Characterized In That** a first end of the valve bore is open to the flange portion.

2. The oil pump according to Claim 1, wherein an opening portion formed at the flange portion of the valve bore is configured to be sealed with the connection member.

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3. The oil pump according to Claim 2, wherein the connection member is engaged with a biasing member (95) positioned in the valve bore for biasing the pressure adjusting valve.

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4. The oil pump according to any one of claims 1-3 further comprising:

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a communication passage (45) for communi-

cating the intake bore and the first end of the valve bore.

5. The oil pump according to Claim 4, wherein the communication passage includes a communication groove (45) formed at the flange portion.

FIG. 1

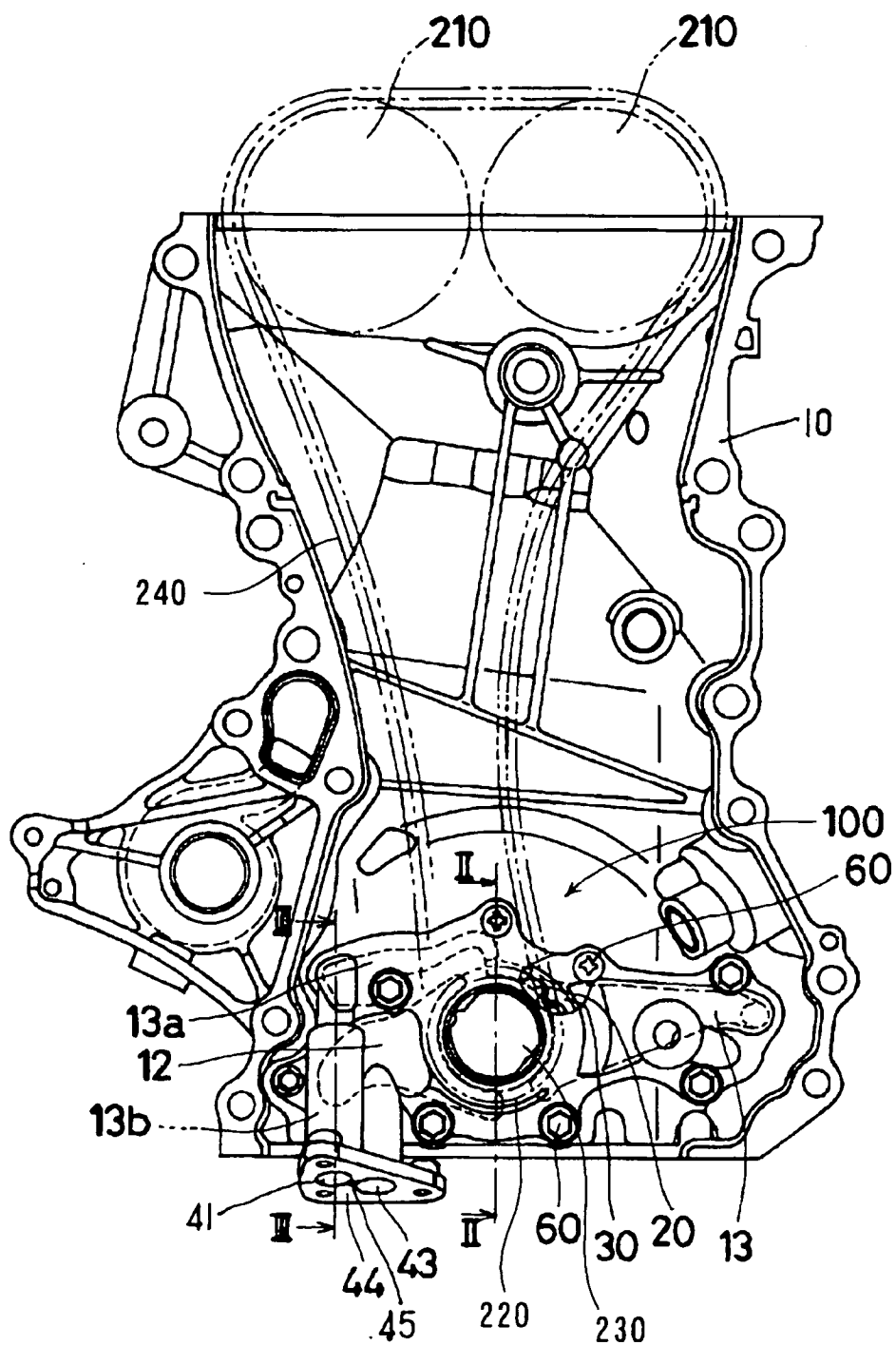


FIG. 2

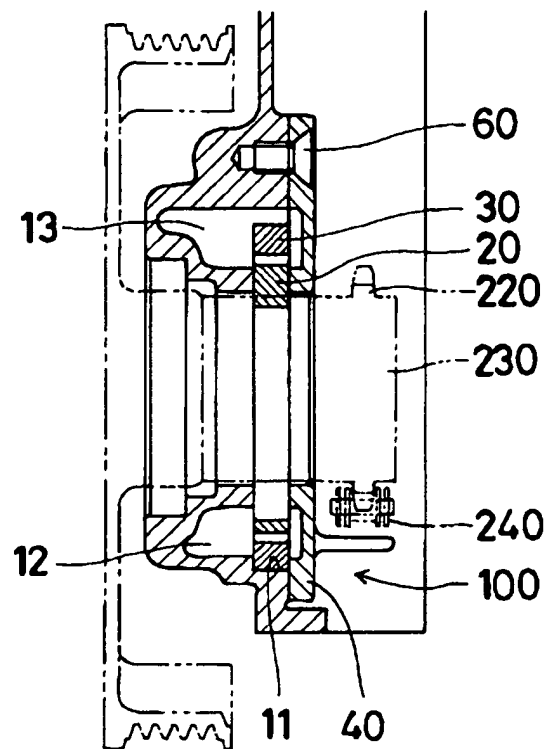


FIG. 3

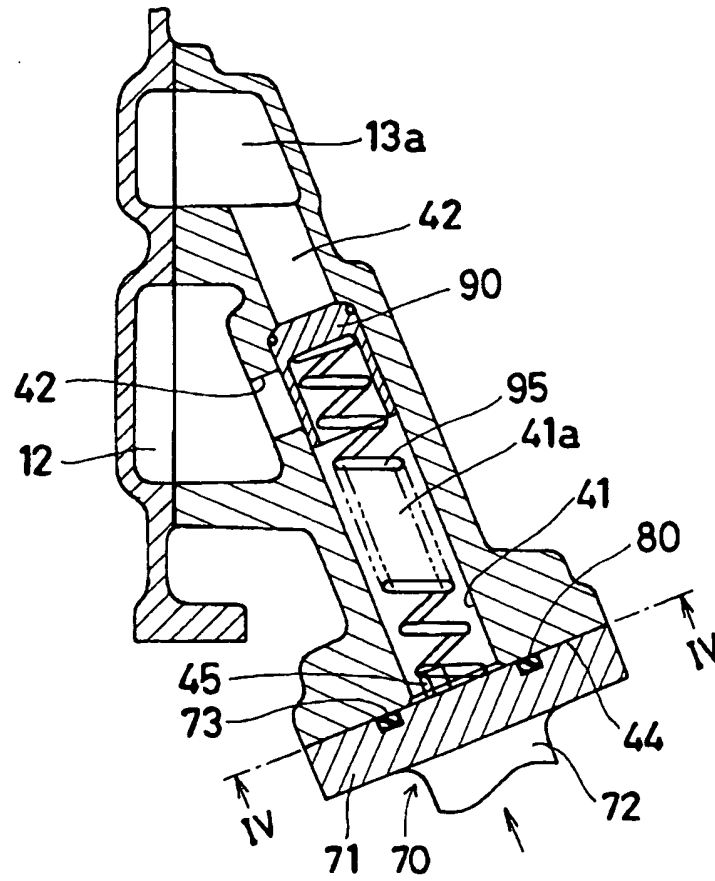


FIG. 4

