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(54) **Oil pan**

(57) An object is to provide an oil pan (3) for an internal combustion engine that is capable of decreasing the number of parts, weight and cost, and capable of minimizing the axial length of the crankshaft. In the up-

per part (3d) of the oil pan (3) mounted on the bottom of an cylinder block (1), a vertical wall (3h) is formed integrally at the open end vertically crossed to the central axis (4a) of the crankshaft, and this vertical wall (3h) is provided with an oil pump (5).

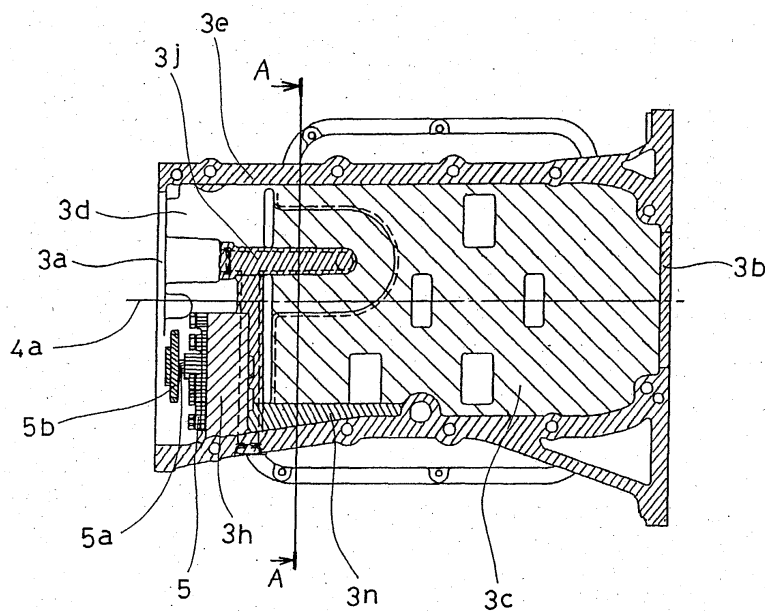


FIG. 2

Description

FIELD OF THE INVENTION

[0001] The present invention relates to the structure of an oil pan for an internal combustion engine.

BACKGROUND OF THE INVENTION

[0002] In a case of the prior art, as shown in FIG.14 or FIG.15, an oil pan 3 is mounted directly or through an adapter plate 2 on a cylinder block 1 of an internal combustion engine. The oil pan 3 comprises a boxlike upper part 3d made of aluminum alloy and a lidlike lower part 3g made of steel plate or aluminum alloy. This oil pan 3 has a structure as shown in a front view of FIG.16, plan view of FIG.17, bottom view of FIG.18, and partly sectional side view of FIG.19.

[0003] Namely, formed on the top of the upper part 3d constituting the oil pan 3 is a mounting surface 3e for mounting itself on the cylinder block 1 and formed on the bottom of the upper part 3d is a lower mounting surface 3f on which the lower part 3g is mounted. Formed at the left end of the upper part 3d is an open end 3a that is open and vertical to the central axis 4a of the crankshaft 4 and formed oppositely at the right end is a closed end 3b that is closed.

[0004] Integrally formed on the boxlike upper part 3d is a baffle plate 3c to restrict thrashing of lubrication oil surface that occurs during the operation of the internal combustion engine.

[0005] An oil pump 5 for supplying lubrication oil to the engine is a separate component, which is secured to the under surface of the cylinder block 1 or adapter plate 2 with a plurality of bolts 6. The oil pump shaft 5a is provided with a sprocket 5b to which the rotating force is transmitted through a chain, belt, gear, etc from the crankshaft 4 to operate the oil pump 5. Incidentally, an oil strainer 7 for sucking lubrication oil inside the oil pan 3 is mounted on the under surface of the oil pump 5 with bolts 6 or formed integrally with the oil pump 5.

[0006] In such a structure, there are problems such as a large quantity of parts, increase of cost and weight in the whole engine. Besides, since the oil pump 5 is a separate component, it is impossible to arrange reinforcement ribs favorably to secure the rigidity of the oil pan 3 on the periphery of the oil pump 5 in the upper part 3d. As a result, there is a problem that the rigidity of the whole oil pan 3 is insufficient, vibration of the whole engine is not controlled, and the noise is increased during the operation of the vehicle.

[0007] In order to solve the foregoing problems, such a structure may be thought that the oil pump 5 is disposed, as shown in FIG.20, coaxially on the central axis 4a of the crankshaft 4 and integrated with a cover 9 covering the open end on the side where the oil pump 5 is disposed so as to decrease the number of parts. In such a structure, the oil pump 5 must be inserted into the

crankshaft 4, so that it is required to extend the axial length of the crankshaft 4. As a result, such a structure has a weak point that the axial length of the crankshaft becomes longer, so that it is apt to be restricted to install the engine on a vehicle.

SUMMARY OF THE INVENTION

[0008] The present invention is worked out in view of the above-described problems in the prior art. It is an object of the present invention to provide an oil pan for an internal combustion engine that can decrease the number of parts and weight, enhance the rigidity and minimize the axial length of the crankshaft.

[0009] The first subject matter of the present invention is an oil pan for an internal combustion engine comprising an upper part mounted directly or through an adapter plate on the bottom of an cylinder block, a lower part covering the bottom of the upper part, the upper part provided with an open end at one end thereof vertically crossed to the central axis of the crankshaft, and the upper part provided integrally with a baffle plate made of aluminum alloy to restrict thrashing of lubrication oil, wherein a vertical wall is provided integrally near the open end of the upper part vertically crossed to the central axis of the crankshaft, and the vertical wall is provided with an oil pump to supply lubrication oil to the internal combustion engine.

[0010] The second subject matter is that in the foregoing oil pan, a lower oil passage is formed integrally on the vertical wall or the wall of the baffle plate to introduce the lubrication oil in the oil pan through an oil strainer into the oil pump.

[0011] The third subject matter is that in the foregoing oil pan, an upper oil passage is formed parallel to the central axis of the crankshaft and integrally on the baffle plate or the side wall of the upper part or the connecting part between the baffle plate and the side wall to introduce the lubrication oil in the oil pan through the discharge side into an oil filter.

[0012] The fourth subject matter is that in the foregoing oil pan, a boss portion for mounting an oil filter is formed integrally on the sidewall of the upper part on which the upper oil passage is formed as a unit.

[0013] Therefore, an advantage of the oil pan according to the invention is that it is possible to decrease the number of parts, weight and cost and to minimize the axial length of the crankshaft and further to enhance the degree of freedom for installation of the internal combustion engine on a vehicle and also the rigidity of the oil pan owing to the vertical wall.

[0014] Another advantage of this oil pan according to the second subject matter is that it is possible to minimize the addition of the weight and to enhance the rigidity of the oil pan owing to the lower oil passage.

[0015] A further advantage of this oil pan according to the third subject matter is that it is possible to minimize the addition of the weight and to enhance the rigidity of

the oil pan.

[0016] A still further advantage of this oil pan according to the fourth subject matter is that it is possible to mount an oil filter on the boss portion from the outside and to make it easy to exchange the oil filter.

[0017] Other advantageous features of the invention will be obvious after a reading of the following detailed description of a preferred embodiment shown in the drawings described as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] In the drawings:

FIG.1 is a front view of an oil pan in an embodiment of the present invention;
 FIG.2 is a plan view thereof;
 FIG.3 is a bottom view thereof;
 FIG.4 is a partly sectional side view thereof;
 FIG.5 is an enlarged sectional view taken on line A-A of FIG.2;
 FIG.6 is an enlarged sectional view taken on line B-B of FIG.4;
 FIG.7 is a sectional view taken on line C-C of FIG.6;
 FIG.8 is an enlarged sectional view taken on line D-D of FIG.4;
 FIG.9 is a sectional view taken on line E-E of FIG.8;
 FIG.10 is a front view of an oil pan in another embodiment;
 FIG.11 is a plan view thereof;
 FIG.12 is a bottom view thereof;
 FIG.13 is a partly sectional side view thereof;
 FIG.14 is a front view of an oil pan mounted directly on a cylinder block;
 FIG.15 is a front view of an oil pan mounted through an adapter plate on a cylinder block;
 FIG.16 is a front view of an oil pan in the prior art;
 FIG.17 is a plan view thereof;
 FIG.18 is a bottom view thereof;
 FIG.19 is a partly sectional side view thereof; and
 FIG.20 is a sectional front view of an improved oil pan in the prior art.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0019] Hereinafter, an embodiment of the present invention will be described with reference to the drawings.

[0020] FIG.1 is a front view of an oil pan 3 that is mounted directly or through an adapter plate 2 on a cylinder block 1 as shown in FIG.14 or FIG.15 described above, FIG.2 is a plan view thereof, FIG.3 is a bottom view thereof, and FIG.4 is a partly sectional side view thereof.

[0021] Incidentally, the same component as in the structure described above will be described by assigning the same reference number thereof.

[0022] The oil pan 3 comprises an upper part 3d and a lower part 3g. In both ends of the upper part 3d verti-

cally crossed to the central axis 4a of the crankshaft, the left side is open and forms an open end 3a and the right side closed and a closed end 3d, as best shown in FIG.2.

[0023] The upper part 3d is provided integrally with a baffle plate 3c made of aluminum alloy between the side walls 3p parallel to the central axis 4a of the crankshaft, as shown in the A-A line sectional view of FIG.5. The baffle plate 3c is partly provided with a wall surface 3m formed downward in a hollow fashion.

[0024] The top periphery of the upper part 3d forms a mounting surface 3e to be mounted on the cylinder block 1 or adapter plate 2 and the under periphery of the same forms a lower mounting surface 3f to mount the lower part 3g thereon.

[0025] Integrally formed near the open end 3a of the boxlike upper part 3d is a vertical wall 3h crossed at right angles to the central axis 4a of the crankshaft. This vertical wall 3h is fitted with an oil pump 5.

[0026] Now, referring to FIG.6, FIG.7, and FIG.8, the vertical wall 3h is formed in a hollow fashion and the oil pump 5 is fitted thereto with bolts from the open end 3a. A gear 5c of the oil pump 5 is disposed inside the vertical wall 3h. The inside of the vertical wall 3h forms an oil chamber, from which a shaft 5a of the oil pump 5 is projected toward the open end 3a. Provided on the tip of the shaft 5a is a sprocket 5b, which is engaged with a chain, belt, gear, or the like so as to receive the rotating force from the crankshaft 4.

[0027] As shown in FIG.3, FIG.8, and FIG.9, the bottom of the baffle plate 3c is provided with an oil strainer 7 with a suction inlet 7a projecting downward into the lower part 3g. This oil strainer 7 is disposed in a position to immerse itself in the lubrication oil collected in the oil pan 3.

[0028] As shown in FIG.5, FIG.8, and FIG.9, integrally formed on the bottom of the wall 3m forming the baffle plate 3c is a lower oil passage 3j to be nearly parallel to the central axis 4a of the crankshaft. The lower oil passage 3j makes the suction inlet 7a of the oil strainer 7 communicate through an inlet 7b with the oil chamber inside the vertical wall h involving the gear 5c of the oil pump 5.

[0029] Accordingly, this lower oil passage 3j is capable of introducing the lubrication oil sucked from the oil strainer 7 through the inlet 7b to the gear 5c of the oil pump 5.

[0030] As shown in FIG.5, FIG.6, and FIG.7, integrally formed on the baffle plate 3c parallel to the central axis 4a of the crankshaft, or on one of the side walls 3p parallel to the central axis 4a, or on the area joining the baffle plate 3c to the side wall 3p is an upper oil passage 3n to introduce the lubrication oil from the sectional area-changing portion 7c at the discharge side of the oil pump 5 to the oil filter 8.

[0031] Accordingly, the lubrication oil discharged by rotation of the gear 5c of the oil pump 5 runs along this upper oil passage 3n and is supplied through the oil filter 8 into the internal combustion engine.

[0032] Incidentally, it is possible that the lower and the upper oil passage 3j, 3n are formed integrally with the upper part 3d of the oil pan 3 by pressure die-casting, which is relatively inexpensive as the process of aluminum alloy casting.

[0033] Also, the foregoing vertical wall 3h may be formed integrally with the upper part 3d. The vertical wall 3h, lower oil passage 3j and upper oil passage 3n are capable of functioning as rigidity members in addition to the oil passages, so that the whole of the oil pan 3 is enhanced in its rigidity.

[0034] Besides, another embodiment of the invention is illustrated in FIG. 10 and FIG. 11. Integrally formed on the sidewall 3p of the upper part 3d is a boss portion 3q communicating with the foregoing upper oil passage 3n so that the oil filter 8 may be mounted on this boss portion 3q from the outside. In case the boss portion 3q is integrally formed, it becomes easy to exchange the oil filter 8, so that the dust in the lubrication oil is favorably caught through this oil filter 8 and the lubrication oil without dust may be satisfactorily supplied into the internal combustion engine.

[0035] Having described the invention in detail and by reference to the preferred embodiment thereof, it will be apparent that other modifications and variations are possible without departing from the scope of the invention defined in the appended claims.

Claims

1. An oil pan (3) for an internal combustion engine, comprising:

an upper part (3d) to be mounted directly or through an adapter plate (2) on a bottom of a cylinder block (1), wherein said upper part (3d) is provided with an open end (3a) transverse to an axis (4a) of a crankshaft at one end thereof and is provided integrally with a baffle plate (3c) to restrict thrashing of lubrication oil; and a lower part (3g) covering the bottom of said upper part (3d):

characterized in that

a vertical wall (3h) extending transversely to said axis (4a) of the crankshaft is provided integrally on said upper part (3d) at a side of said open end (3a) of said upper part (3d), and an oil pump (5) for supplying lubrication oil to the internal combustion engine is attached to said vertical wall (3h).

2. An oil pan (3) as claimed in claim 1, wherein an oil passage (3j) to introduce lubrication oil through an oil strainer (7) to said oil pump (5) is formed integrally on said vertical wall (3h) or said baffle plate (3c).

3. An oil pan (3) as claimed in claim 2, wherein said oil strainer (7) is provided on the bottom of said baffle plate (3c).

4. An oil pan (3) as claimed in claim 2 or 3, wherein said baffle plate (3c) includes a wall (3m) projecting downward into said lower part (3g) as a part of said baffle plate (3c), and said oil passage (3j) is formed integrally on said wall (3m) of said baffle plate (3c).

5. An oil pan (3) as claimed in any preceding claim, wherein an oil passage (3n) to introduce lubrication oil from said oil pump (5) to an oil filter (8) is formed parallel to said axis (4a) of the crankshaft and integrally on said baffle plate (3c) or a side wall (3p) of said upper part (3d) or a connecting part between said baffle plate (3c) and said side wall (3p).

6. An oil pan (3) as claimed in claim 5, wherein a boss portion (3q) for mounting said oil filter (8) is formed integrally on a side of said side wall (3p) where the oil passage (3n) is formed.

7. An oil pan (3) as claimed in any preceding claim, wherein said vertical wall (3h) forms a part of an oil chamber of said oil pump (5).

8. An internal combustion engine with an oil pan according to any preceding claim.

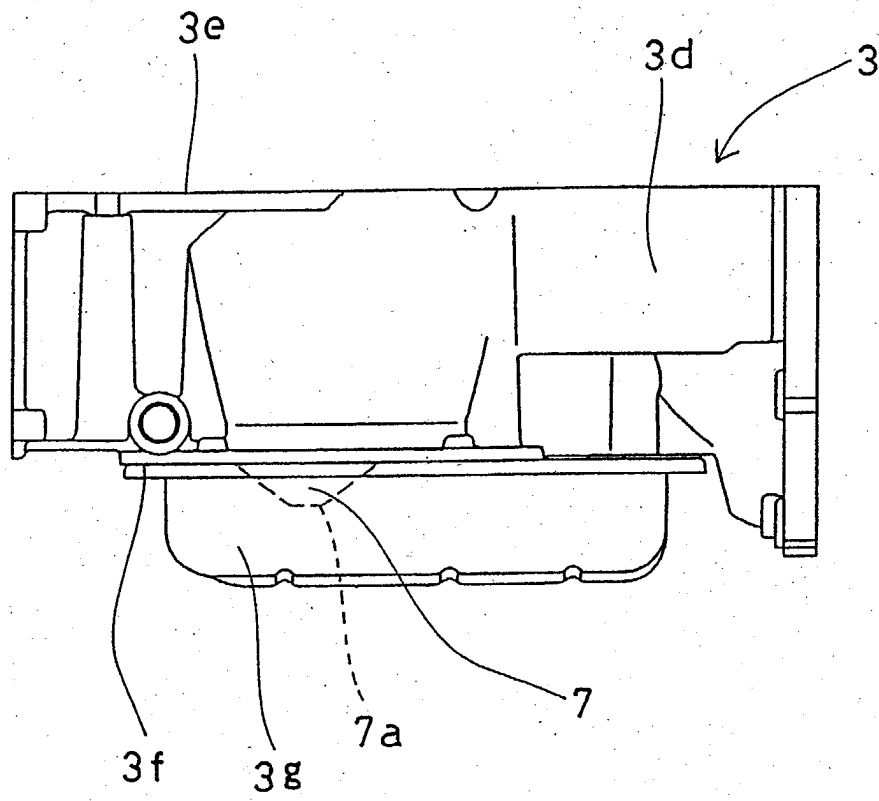


FIG. 1

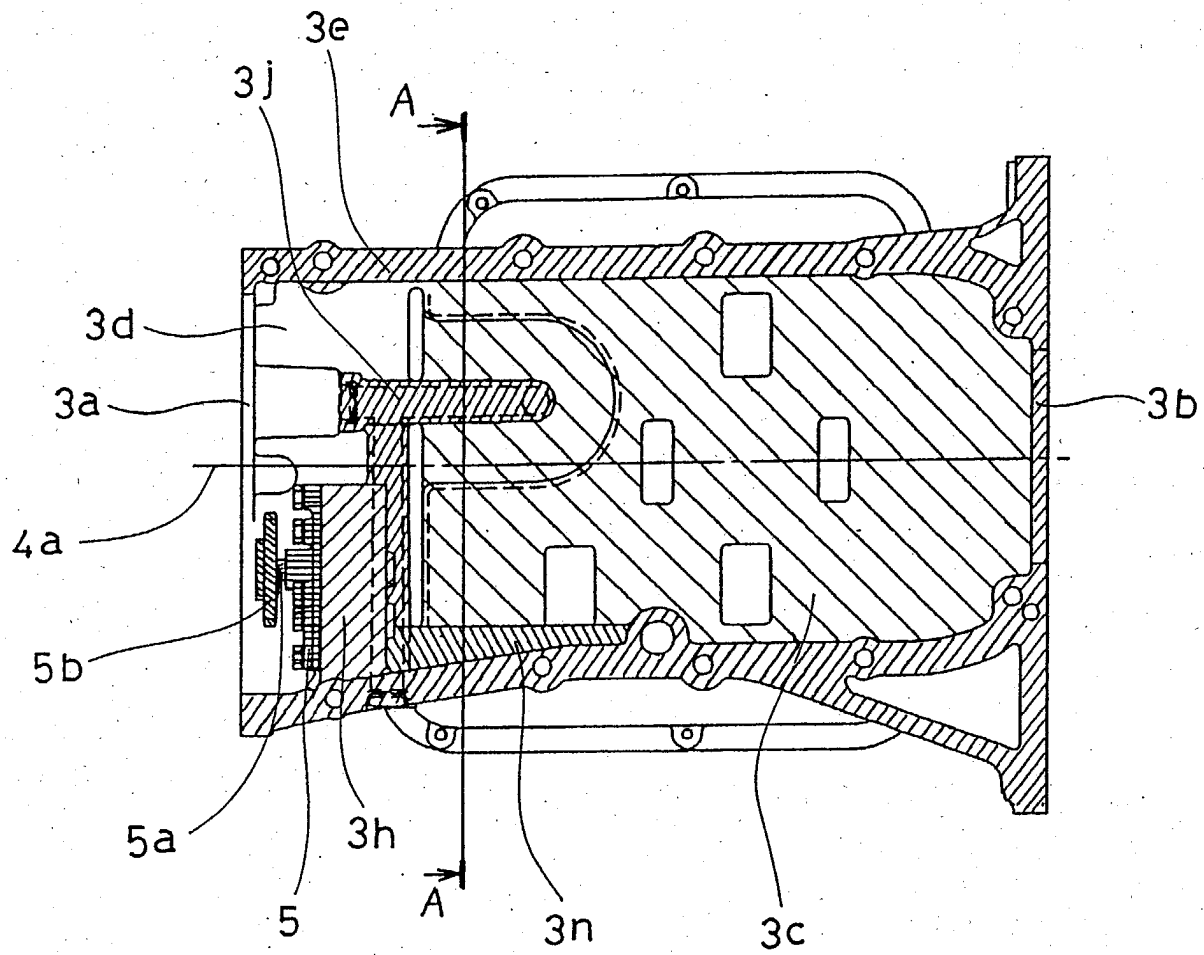


FIG. 2

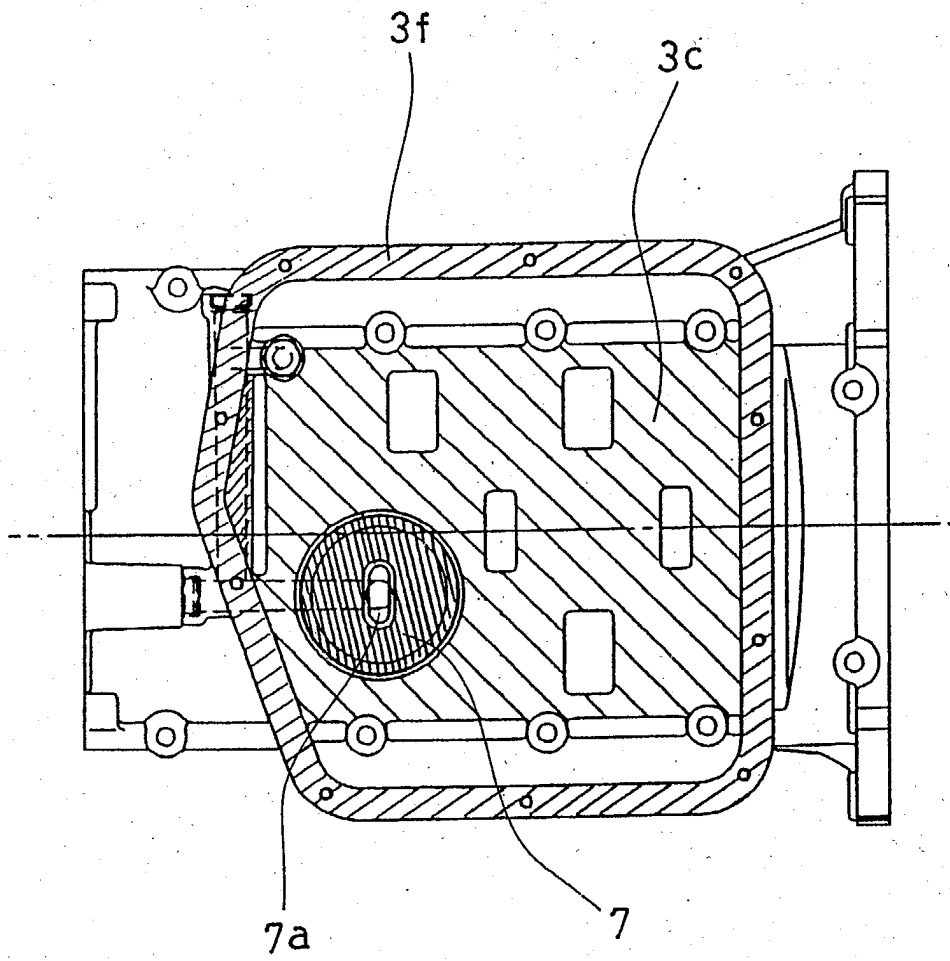


FIG. 3

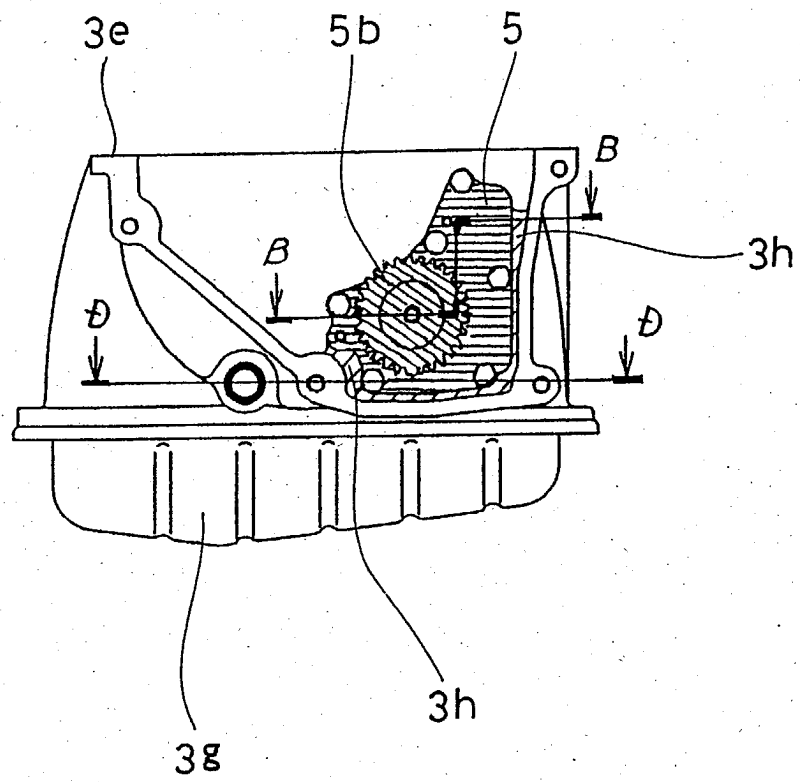


FIG. 4

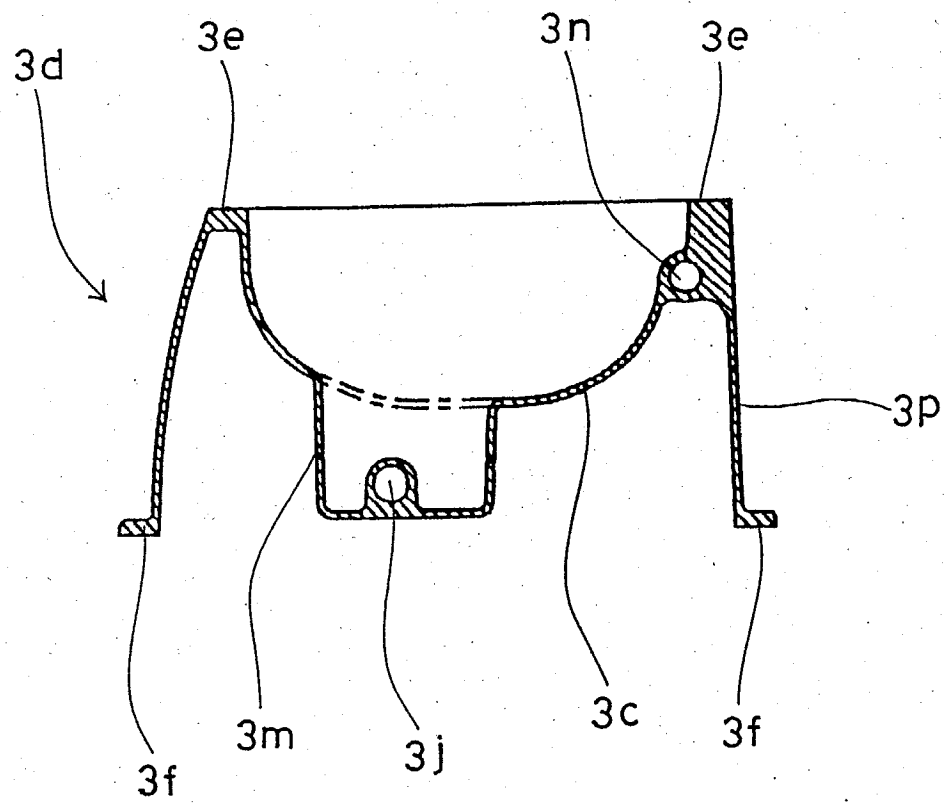


FIG. 5

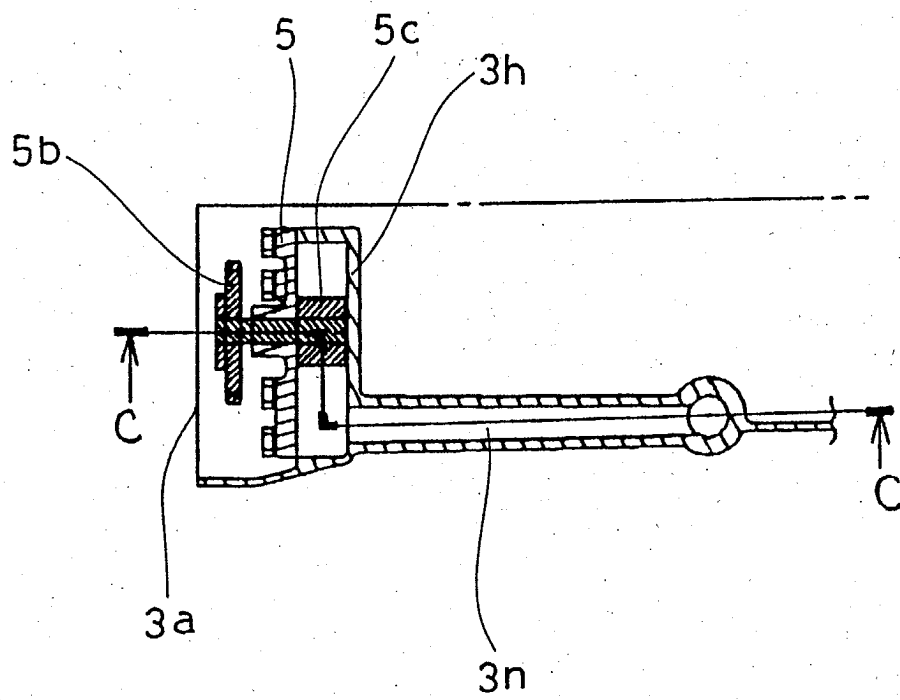


FIG. 6

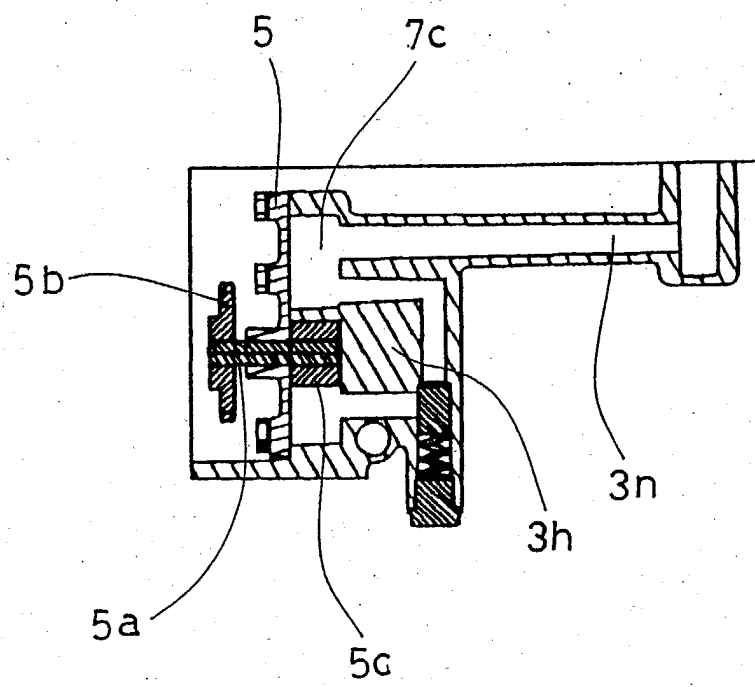


FIG. 7

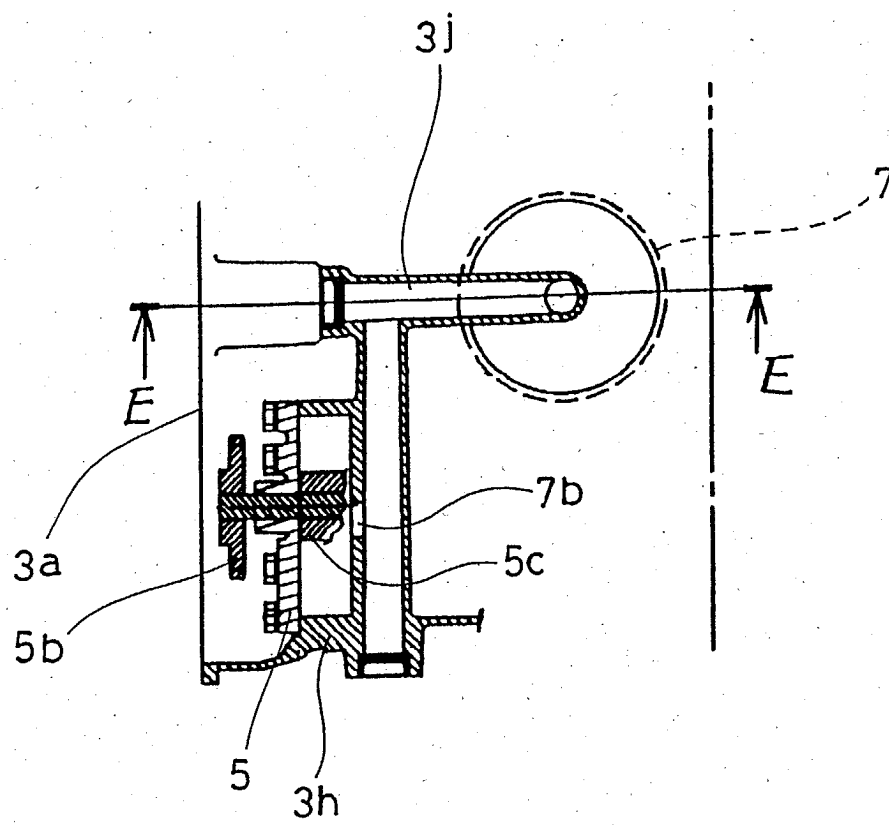


FIG. 8

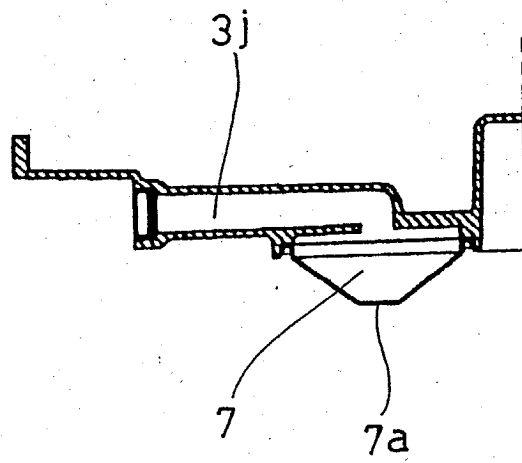


FIG. 9

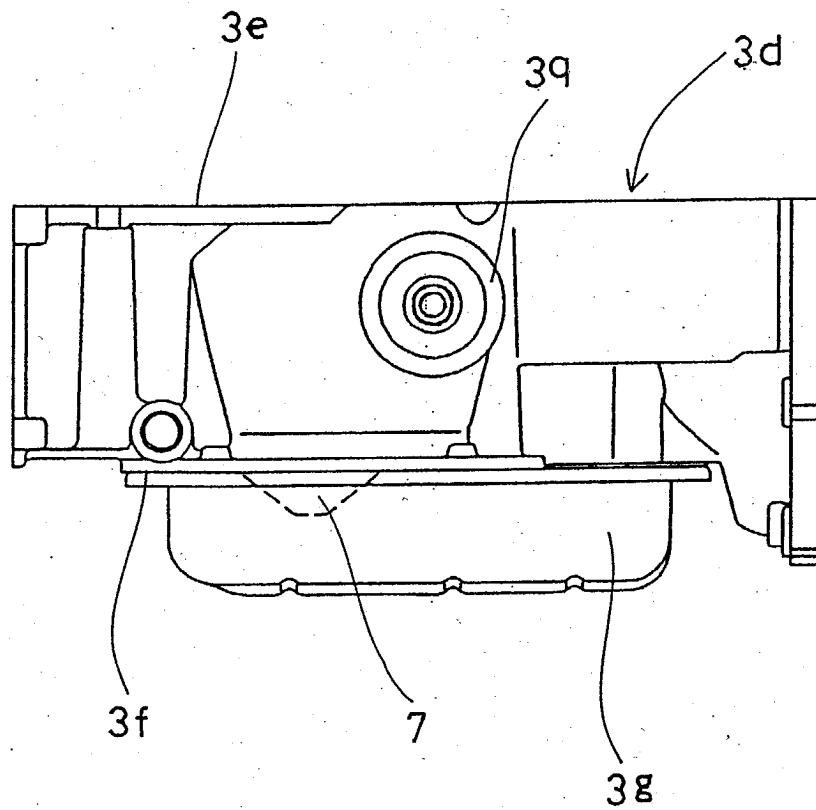


FIG. 10

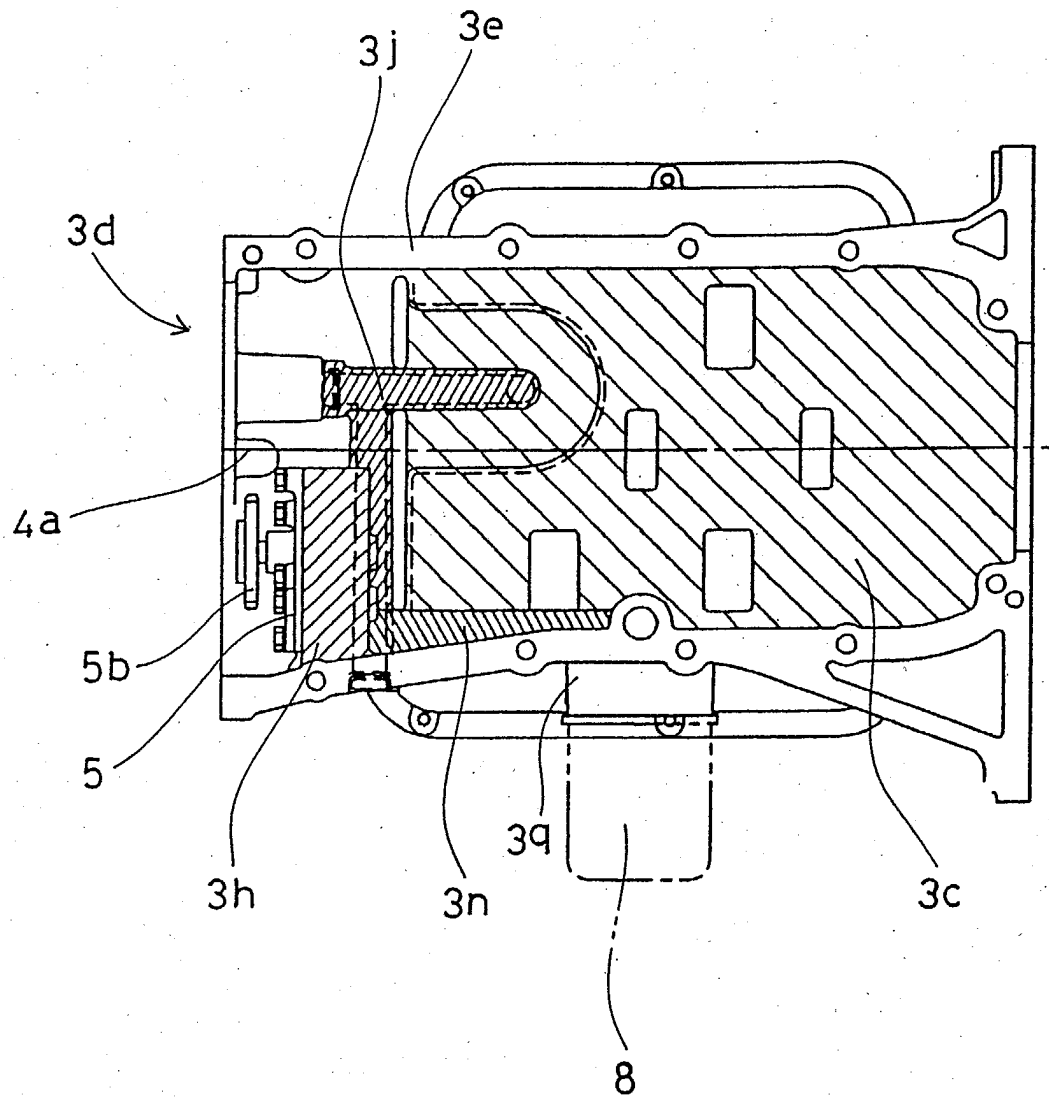


FIG. 11

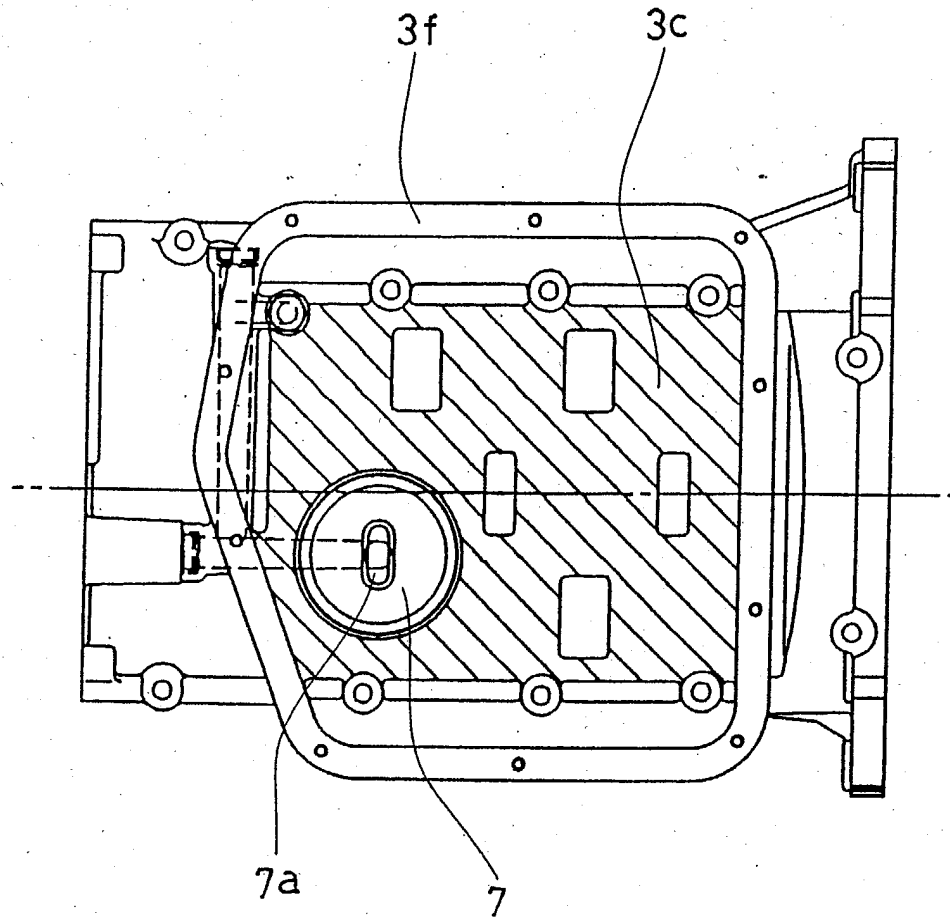


FIG. 12

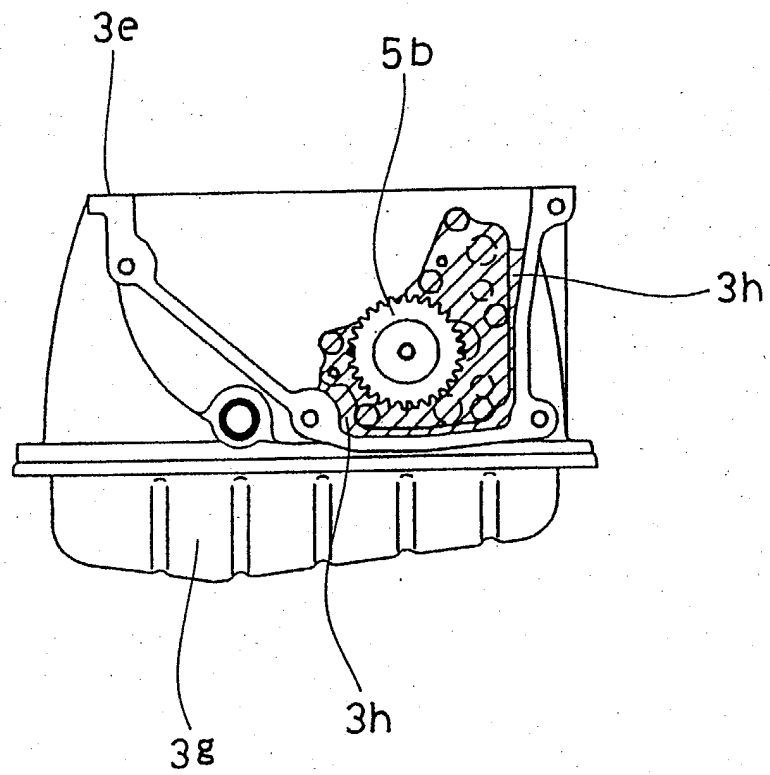


FIG. 13

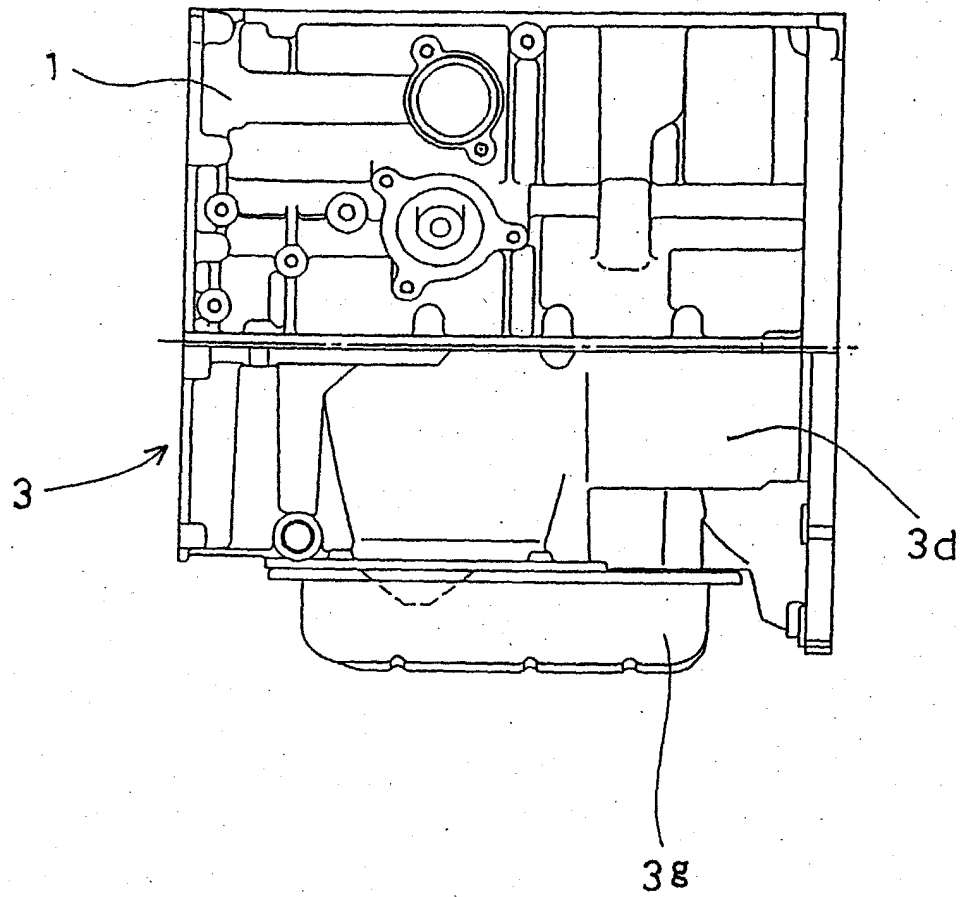


FIG. 14 PRIOR ART

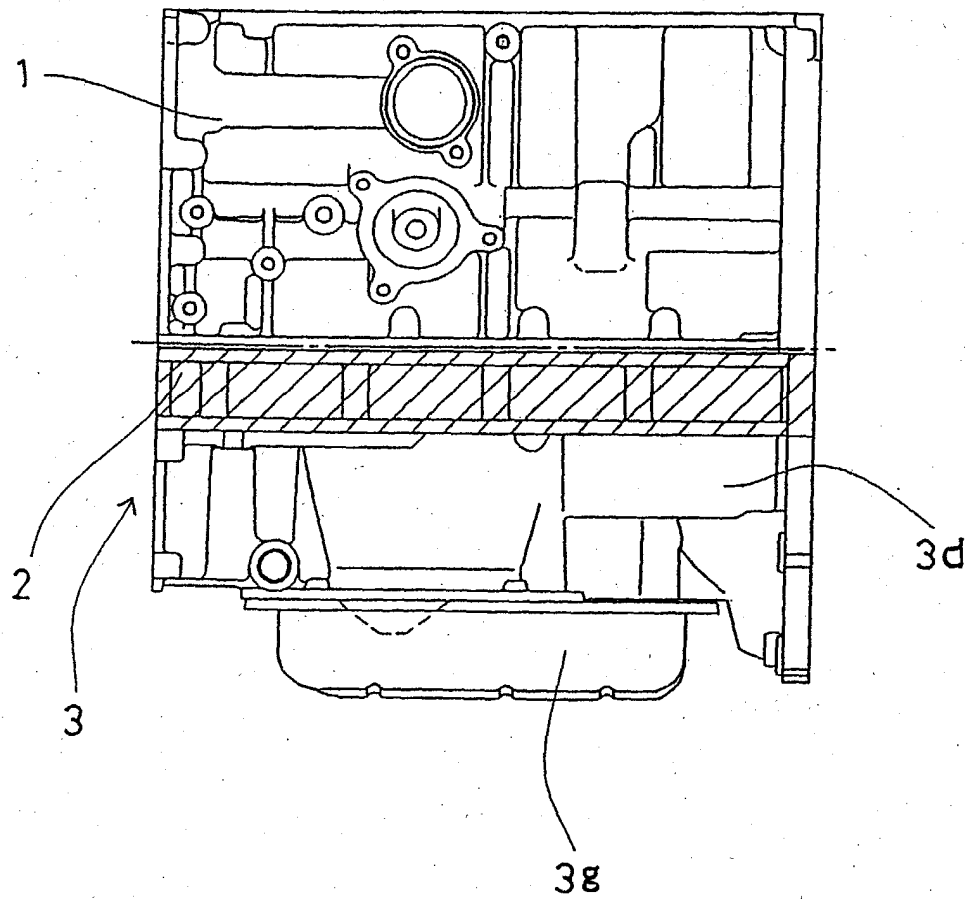


FIG. 15 PRIOR ART

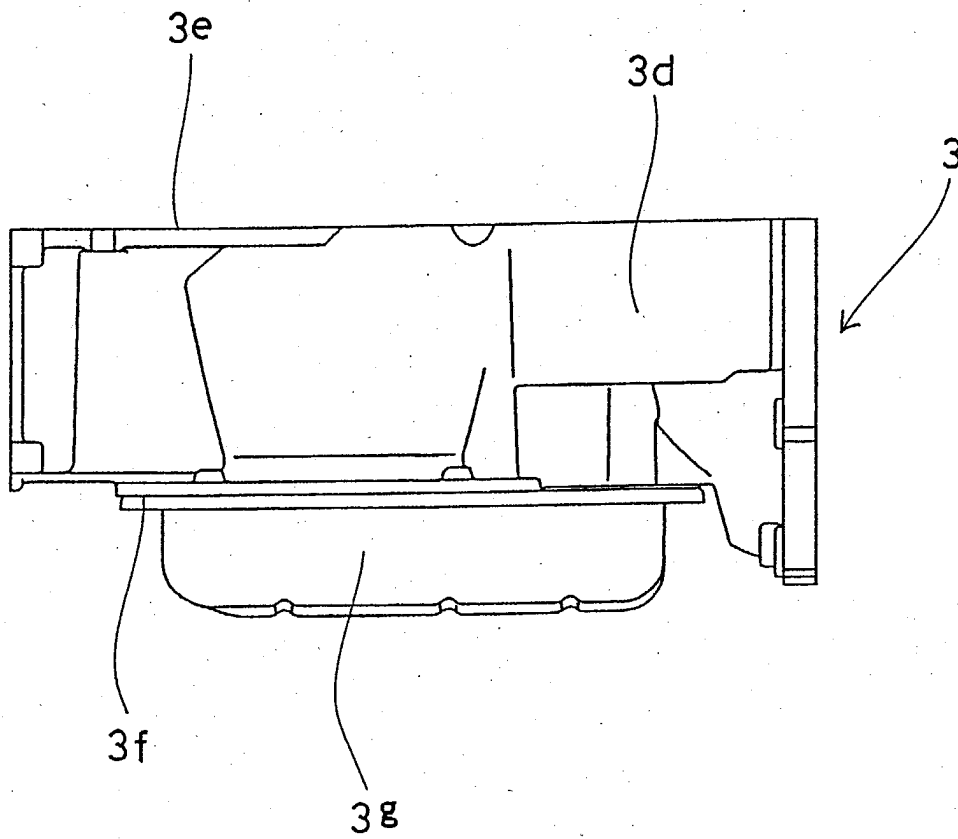


FIG. 16 PRIOR ART

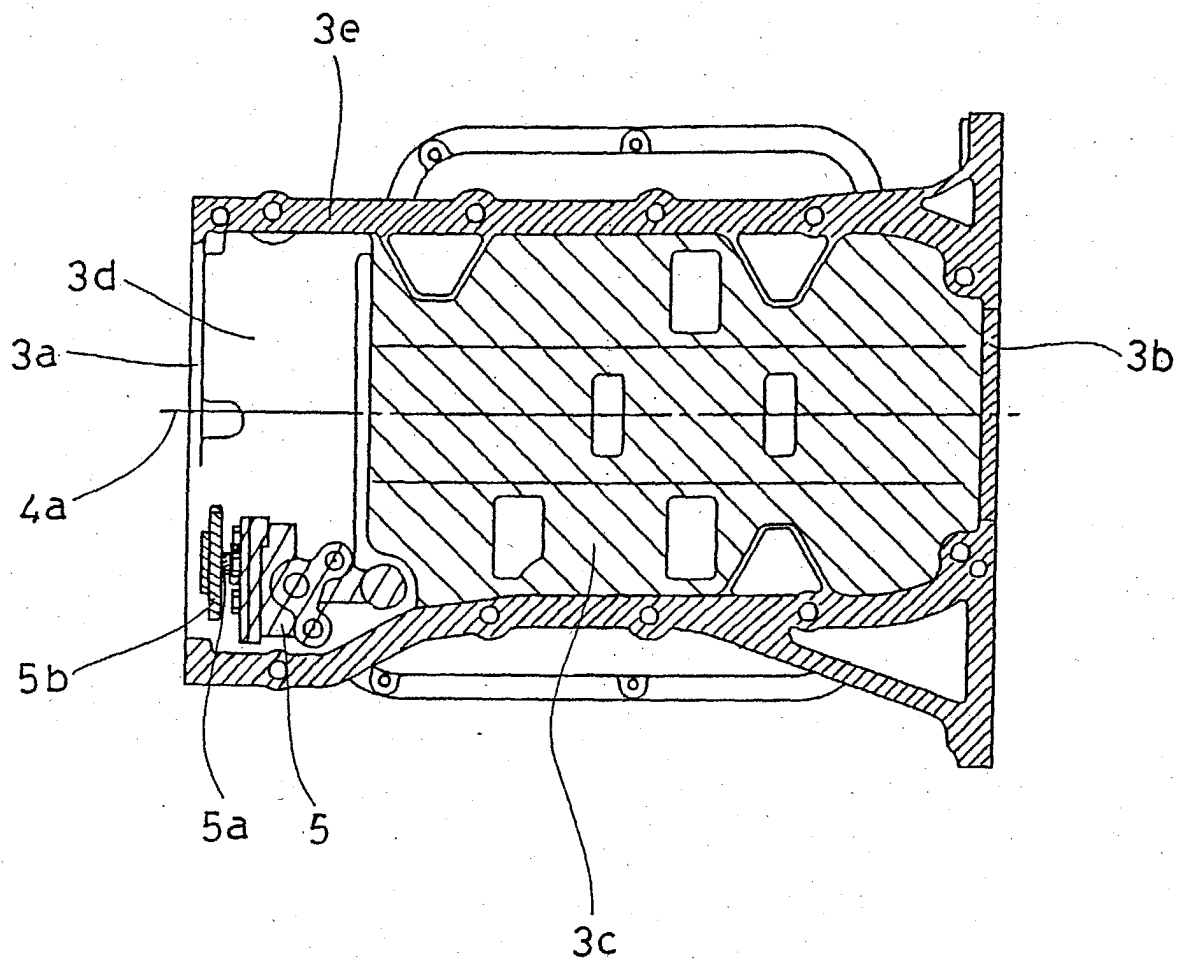


FIG. 17 PRIOR ART

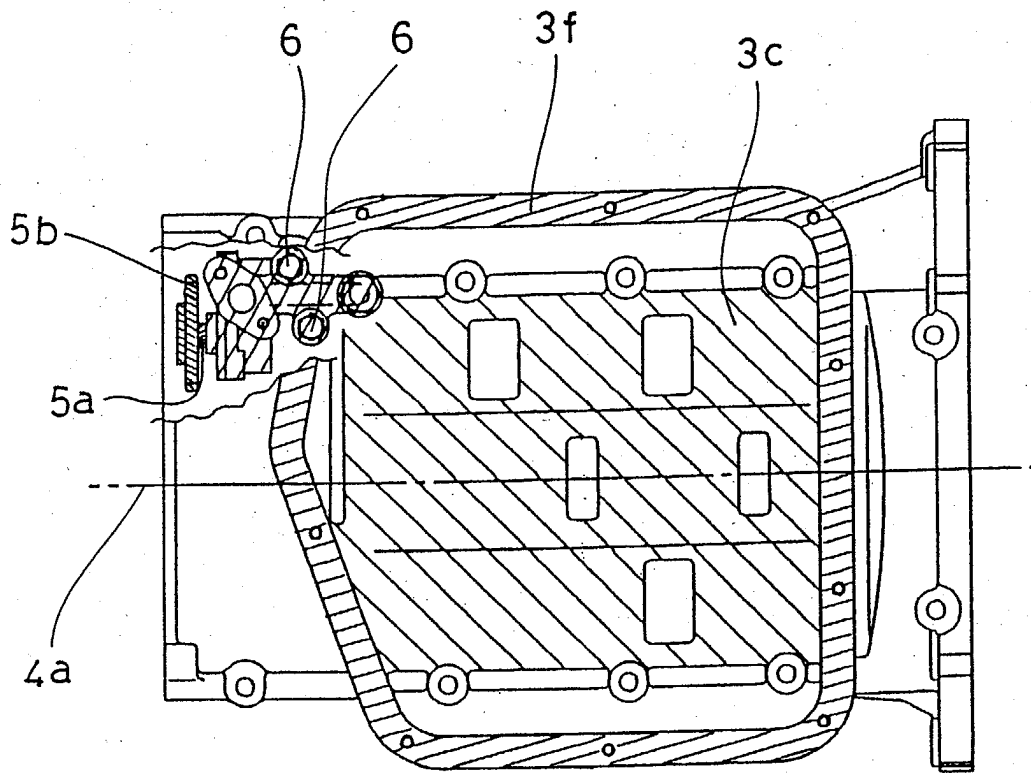


FIG. 18 PRIOR ART

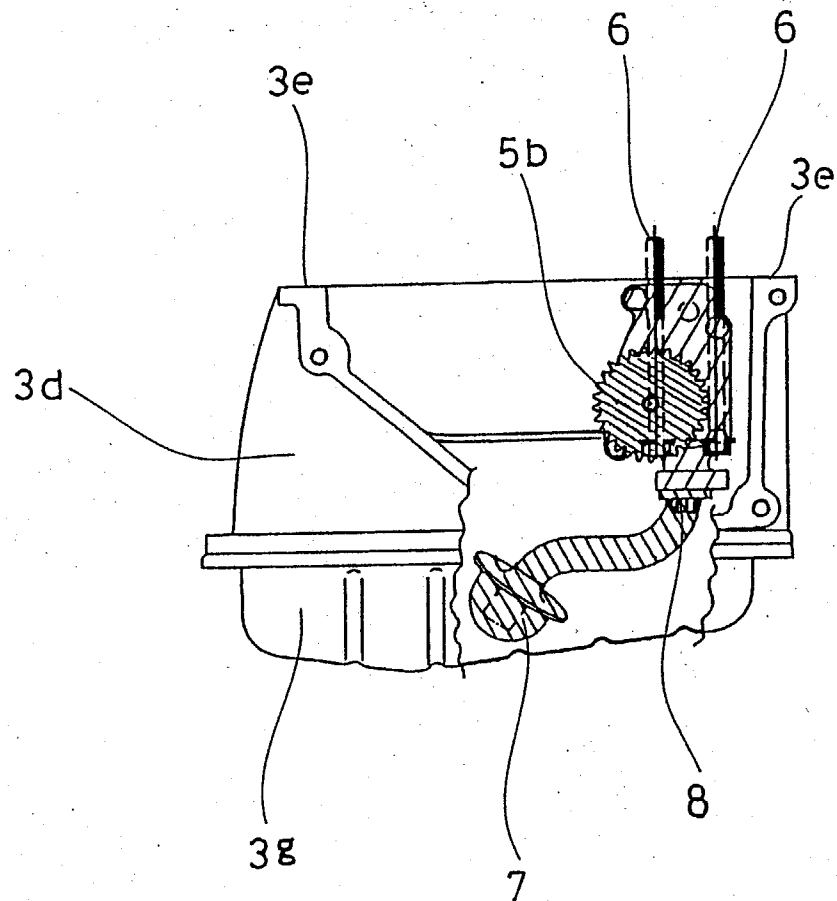


FIG. 19 PRIOR ART

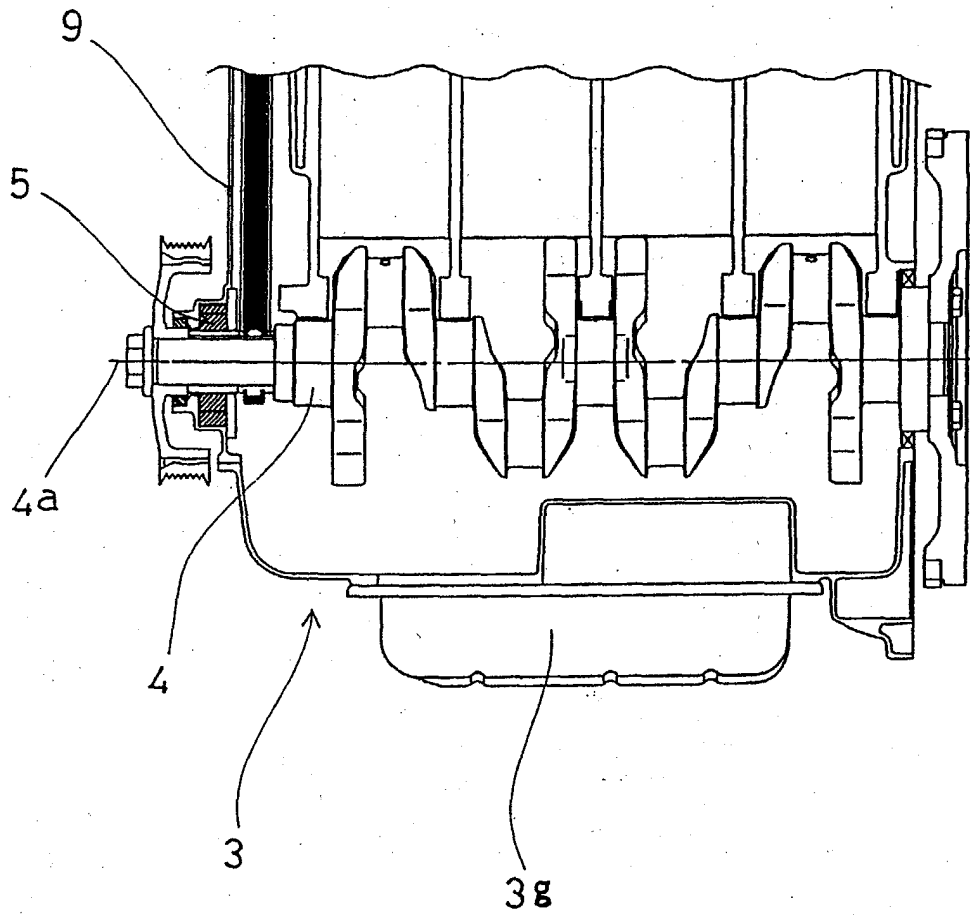


FIG. 20 PRIOR ART



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 25 2862

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		9 July 2003	Mouton, J
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