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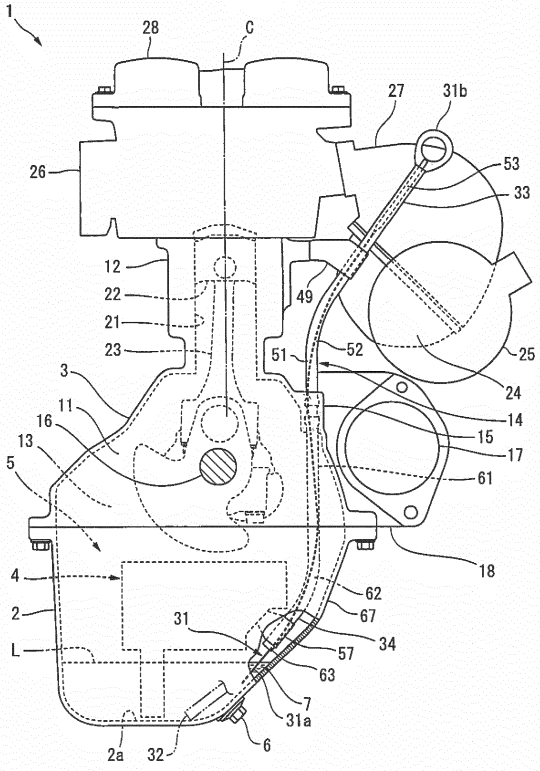
(54) **OIL LEVEL GAUGE GUIDE OF ENGINE AND ENGINE WITH OIL LEVEL GAUGE GUIDE**

(57) An oil level gauge guide includes a cylindrical portion (15), a first pipe (33), and a second pipe (34). The cylindrical portion (15) is provided on a crank case wall (11) which forms a crank chamber (13) including an oil reservoir (5) of an engine (1), and has a through hole that allows the interior and exterior of the crank chamber (13) to communicate with each other. The first pipe (33) includes one end held by the cylindrical portion (15), and the other end portion extending outside the crank chamber (13) and fixed to the engine (1). The second pipe (34) includes one end held by the cylindrical portion (15), and the other end portion extending to the bottom of the crank chamber (13) and fixed to the engine (1). This invention can provide an oil level gauge guide which adopts an arrangement pointing to the lowermost portion of an oil pan, and yet has a high degree of freedom of the attaching position.

FIG.1



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Description

[0001] The present invention relates to an engine oil level gauge guide for holding an oil level gauge of an engine and an engine with oil level gauge guide.

[0002] There is always a demand that automobile engines are to be made more compact. In an engine of this type, engine accessories are arranged close to a cylinder block, and an oil level gauge is arranged so as to avoid these accessories. The oil level gauge is used to check the amount of oil stored in a crank chamber of the engine, and retractably inserted into and held in an oil level gauge guide that is formed on the cylinder body side. An example of a conventional oil level gauge guides is described in Japanese Patent Laid-Open No. 2007-231904 (JP 2007-231904 A).

[0003] This oil level gauge guide disclosed in JP 2007-231904 A is formed by a straight pipe. The oil level gauge guide is fixed to the cylinder block in a state in which the lower part of the guide projects into the crank chamber through a through hole in the cylinder block. The lower end of the oil level gauge guide points to the bottom of an oil pan.

[0004] Generally, the oil level gauge guide has a function as a guide to lead an oil changer hose to the bottom of the oil pan, in addition to the function of holding the oil level gauge. The oil changer hose is used to draw out and discharge engine oil staying in the lowermost portion of the oil pan. Accordingly, the oil level gauge guide is arranged in a position in which the oil level gauge guide points to the lowermost portion of the oil pan as the oil level gauge guide avoids obstacles in the oil pan.

[0005] In the conventional oil level gauge guide disclosed in JP 2007-231904 A, there is a problem that it is difficult to make the engine more compact. This is because the position of the oil level gauge guide is restricted. To make the engine compact, it is effective to arrange accessories close to the cylinder block. However, the oil level gauge guide has to be arranged in a position that allows the lower end of the oil level gauge guide to point to the lowermost portion of the oil pan as the oil level gauge guide avoids obstacles in the oil pan.

[0006] As the engine accessories and oil level gauge interfere with each other, it becomes an obstacle to make the engine more compact. Note that it may be possible to change the position of the oil level gauge guide and avoid the interference by bending the upper portion of the oil level gauge guide appearing outside the crank chamber and the lower portion thereof in the crank chamber. However, the oil level gauge guide bent like this cannot be inserted into the through hole of the cylinder block.

[0007] It is the object of the present invention to provide an oil level gauge guide and engine with an oil level gauge guide that adopts an arrangement in which the lower end of the oil level gauge guide points to the lowermost portion of an oil pan, and yet has a high degree of freedom of the attaching position of the oil level gauge guide.

According to the present invention said object is solved by an oil level gauge guide of an engine having the features of independent claim 1. Preferred embodiments are laid down in the dependent claims.

[0008] Accordingly, it is provided an oil level gauge guide of an engine that includes a cylindrical portion provided on a wall that forms a crank chamber including an oil reservoir of the engine, the cylindrical portion including a through hole that allows the interior and exterior of the crank chamber to communicate with each other, a first pipe including one end held by the cylindrical portion, and the other end portion extending outside the crank chamber and fixed to the engine, and a second pipe including one end held by the cylindrical portion, and the other end portion extending to the bottom of the crank chamber and fixed to the engine. Brief Description of the Drawings

Fig. 1 is a front view showing the arrangement of an engine including an oil level gauge guide according to a preferred embodiment; and

Fig. 2 is a sectional view showing main parts in an enlarged scale.

Description of the Preferred Embodiment

[0009] An embodiment of an oil level gauge guide of an engine will be explained in detail below with reference to Figs. 1 and 2.

<Arrangement of Engine>

[0010] An engine 1 shown in Fig. 1 is an automobile engine, and mounted in a vehicle body (not shown) in a state in which an oil pan 2 shown in the lowermost position in Fig. 1 is positioned in the lower portion of the vehicle body. For the sake of convenience, the right side of the engine 1 in Fig. 1 will be called one side, and the left side of the engine 1 will be called the other side.

[0011] The oil pan 2 is formed into a boxy shape which opens upward, and attached to the lower end portion of a cylinder block 3. An oil pump 4 is accommodated in the oil pan 2, and engine oil is stored in the oil pan 2. The interior of the oil pan 2 is an oil reservoir 5 of the engine 1. An oil drain bolt 6 is threadably provided near the bottom of the oil pan 2.

[0012] The oil pump 4 is supported by the lower end portion of the cylinder block 3 via a bracket (not shown). The oil pump 4 draws up engine oil 7 in the oil pan 2 and supplies the engine oil 7 to portions to be lubricated of the engine 1.

[0013] The cylinder block 3 includes a crank case wall 11 formed into a boxy shape which opens downward, and a cylinder unit 12 extending upward from the crank case wall 11.

[0014] The crank case wall 11 closes the opening of the oil pan 2. A crank chamber 13 that involves the above-described oil reservoir 5 is formed between the crank case wall 11 and the oil pan 2.

[0015] The crank case wall 11 has a cylindrical portion

15 as a part of an oil level gauge guide 14 (to be described later). In this embodiment, the crank case wall 11 is equivalent to "a wall that forms a crank chamber" of the present teaching.

[0016] A crank shaft 16 is accommodated in the crank chamber 13.

[0017] A starter motor 17 is arranged on one side of the crank case wall 11. The starter motor 17 is attached to a bracket 18 provided in one end (the end portion positioned behind on the drawing surface of Fig. 1) of the crank case wall 11 in the axial direction of the crank shaft 16 (the direction perpendicular to the drawing surface of Fig. 1). The starter motor 17 is attached to the bracket 18 by translating the starter motor 17 toward the bracket 18 from the other side (the side positioned forward on the drawing surface of Fig. 1) in the axial direction of the crank shaft 16.

[0018] A plurality of cylinder holes 21 are formed in the cylinder unit 12. Pistons 22 movably fit in the cylinder holes 21. Each piston 22 is connected to the crank shaft 16 by a connecting rod 23. On one side of the cylinder unit 12, a surge tank 24 (to be described later) is arranged, and an alternator 25 is provided. The alternator 25 is supported by the other end portion (the end portion shown forward on the drawing surface of Fig. 1) of the cylinder block 3 in the axial direction of the crank shaft 16 via a bracket (not shown).

[0019] The cylinder hole 21 opens in the upper end portion of the cylinder unit 12, and is closed by a cylinder head 26.

[0020] Although details are not shown, the cylinder head 26 includes an intake valve, an exhaust valve, valve gears for driving these valves, and the like. An intake manifold 27 is attached to one side of the cylinder head 26, and an exhaust device (not shown) is attached to the other side thereof. A head cover 28 is attached to the upper end portion of the cylinder head 26.

[0021] The intake manifold 27 guides intake air to all cylinders from the surge tank 24 positioned on one side of the cylinder unit 12.

<Arrangement of Oil Level Gauge Guide>

[0022] The oil level gauge guide 14 is an engine part that has a function of holding an oil level gauge 31, and a function of guiding an oil changer hose 32 to a lowermost portion 2a of the oil pan 2 to change engine oil. The oil level gauge guide 14 includes the cylindrical portion 15 provided on the crank case wall 11, a first pipe 33 extending upward from the cylindrical portion 15, and a second pipe 34 extending downward from the cylindrical portion 15.

[0023] The oil level gauge 31 includes a narrow band-like main gauge body 31 a inserted into the oil level gauge guide 14, and a ring 31b provided on one end (the upper end) of the main gauge body 31 a. The oil level gauge 31 is held by the oil level gauge guide 14 such that the ring 31 b is stuck out of the upper end of the first pipe 33.

[0024] The lower end portion of the main gauge body 31 a projects downward from the second pipe 34, and enters the engine oil 7. When the engine 1 is not in operation, a liquid surface L of the engine oil 7 is positioned lower than the lower end of the oil level gauge guide 14.

[0025] The ring 31 b is used by a worker who puts his or her finger on to pull out or insert the main gauge body 31a from or into the oil level gauge guide 14 when checking the storage amount of the engine oil 7.

[0026] One end of the oil changer hose 32 is connected to an oil suction device (not shown), and the other end portion thereof is inserted into the oil level gauge guide 14 in this state. When the suction device operates in a state in which the distal end of the oil changer hose has reached the lowermost portion 2a of the oil pan 2, the engine oil 7 remaining on the bottom of the oil pan 2 is drawn and exhausted by the oil changer hose 32.

<Arrangement of Cylindrical Portion>

[0027] The cylindrical portion 15 is integrated with the crank case wall 11. As shown in Fig. 2, the cylindrical portion 15 includes a first cylindrical portion 41 projecting from the crank case wall 11 to the side opposite to the crank chamber 13, and a second cylindrical portion 42 projecting into the crank chamber 13 from the crank case wall 11.

[0028] As shown in Fig. 1, the cylindrical portion 15 according to this embodiment is positioned closer to the cylinder unit 12 than the starter motor 17 when viewed in the axial direction of the crank shaft 16. Since the cylindrical portion 15 is formed in this position, the first pipe 33 (to be described later) does not become an obstacle when the starter motor 17 is assembled in the engine 1.

[0029] As shown in Fig. 2, the cylindrical portion 15 has a through hole 43 which makes the interior and exterior of the crank chamber 13 communicate with each other. The through hole 43 includes a first hole 44 formed in the first cylinder 41, a second hole 45 formed in the second cylinder 42, and a communication hole 46 for connecting the first and second holes 44 and 45.

[0030] The first and second holes 44 and 45 have the same diameter, and are formed on the same axis. The diameter of the communication hole 46 is smaller than that of the first and second holes 44 and 45.

[0031] The boundary portion between the first hole 44 and the communication hole 46 is formed by a first tapered surface 47 which gradually decreases the diameter in the direction from the first hole 44 to the communication hole 46.

[0032] The boundary portion between the communication hole 46 and the second hole 45 is formed by a second tapered surface 48 which gradually increases the diameter in the direction from the communication hole 46 to the second hole 45.

<Arrangement of First Pipe>

[0033] The first pipe 33 is formed by bending a metal pipe having a circular section into a predetermined shape. One end (the lower end) of the first pipe 33 is held by the above-described cylindrical portion 15, and the other end thereof extends outside the crank chamber 13. The other end of the first pipe 33 is fixed to the cylinder unit 12 by a first support stay 49 (see Fig. 1).

[0034] The first pipe 33 according to this embodiment includes a first straight pipe 51 extending upward parallel to an axis C of the cylinder unit 12 from the crank case wall 11, and a second straight pipe 53 connected to the first straight pipe 51 via a first curved portion 52.

[0035] As shown in Fig. 2, the first straight pipe 51 is inserted into the first hole 44 of the cylindrical portion 15 from above. The distal end portion of the first straight pipe 51 is formed into a bellow shape by pressure forming, and includes first and second large-diameter portions 51 a and 51 b. The outer diameter of the first and second large-diameter portions 51 a and 51 b is larger than the outer diameter of the rest of the first pipe 33, and smaller than the diameter of the first hole 44.

[0036] Of the first and second large-diameter portions 51 a and 51 b, the first large-diameter portion 51 a positioned at the distal end of the first straight pipe 51 has a third tapered surface 54 pointing to the communication hole 46. The third tapered surface 54 forms the opening edge of one end of the first pipe 33, and has a shape which gradually increases the diameter toward the communication hole 46 (toward the distal end of the first straight pipe 51).

[0037] A first annular groove 55 is formed between the first and second large-diameter portions 51 a and 51 b. A first O-ring 56 is fitted in the first annular groove 55. The first O-ring 56 is compressed between the first annular groove 55 and the wall of the first hole 44. Accordingly, the first straight pipe 51 (the lower end portion of the first pipe 33) is held in the first hole 44 via the first O-ring 56.

[0038] As shown in Fig. 1, the first curved portion 52 is positioned on one side of the cylinder unit 12, and has an upper end which is bent diagonally upward so as to point to one side of the engine 1. The second straight pipe 53 extends from the first curved portion 52 to one side of the cylinder head 26. The upper end of the second straight pipe 53 is located in a position which is opposite to the alternator 25 in the axial direction of the crank shaft 16, and overlaps the intake manifold 27 when viewed in the axial direction of the crank shaft 16. The above-described first support stay 49 is welded to the second straight pipe 53.

<Arrangement of Second Pipe>

[0039] The second pipe 34 is formed by bending a pipe identical to the first pipe 33 into a predetermined shape. One end (the upper end) of the second pipe 34 is held by the above-described cylindrical portion 15, and the other end thereof extends to the bottom of the crank chamber 13. The other end of the second pipe 34 is fixed to the oil pump 4 via the second support stay 57. That is, the other end of the second pipe 34 is fixed to the engine 1.

[0040] The second pipe 34 according to this embodiment includes a third straight pipe 61 extending downward parallel to the axis C of the cylinder unit 12 from the crank case wall 11, and a fourth straight pipe 63 connected to the third straight pipe 61 via a second curved portion 62.

[0041] As shown in Fig. 2, the third straight pipe 61 is inserted into the second hole 45 of the cylindrical portion 15 from below. Like the above-described first straight pipe 51, the distal end portion of the third straight pipe 61 is formed into a bellows shape by pressure forming, and includes third and fourth large-diameter portions 61 a and 61 b.

[0042] The outer diameter of the third and fourth large-diameter portions 61 a and 61b is larger than the outer diameter of the rest of the second pipe 34, and smaller than the diameter of the second hole 45. Of the third and fourth large-diameter portions 61 a and 61 b, the third large-diameter portion 61 a positioned at the distal end of the third straight pipe 61 has a fourth tapered surface 64 pointing to the communication hole 46. The fourth tapered surface 64 forms the opening edge of one end of the second pipe 34, and is formed into a shape which gradually increases the diameter toward the communication hole 46 (toward the distal end of the third straight pipe 61).

[0043] A second annular groove 65 is formed between the third and fourth large-diameter portions 61 a and G1b. A second O-ring 66 is fitted in the second annular groove 65. The second O-ring 66 is compressed between the second annular groove 65 and the wall of the third hole. Accordingly, the third straight pipe 61 (the upper end portion of the second pipe 34) is held in the second hole 45 via the second O-ring 66.

[0044] As shown in Fig. 1, the second curved portion 62 is positioned between the oil pump 4 and an inclined side wall 67 of the oil pan 2, and has a lower end which is bent along the side wall 67 of the oil pan 2. The side wall 67 of the oil pan 2 inclines downward so as to gradually approach the other side of the engine 1, when viewed in the axial direction of the crank shaft 16.

[0045] The fourth straight pipe 63 extends toward the lowermost portion 2a of the oil pan 2 from the second curved portion 62. The above-described second support stay 57 is welded to the fourth straight pipe 63.

<Explanation of Effects of Embodiment>

[0046] The first pipe 33 of the oil level gauge guide 14 configured as described above is attached to the engine 1 outside the crank chamber 13. This attachment is performed by inserting one end (the lower end) of the first

pipe 33 into the first hole 44 with the first O-ring 56 being fitted, and fixing the first support stay 49 to the cylinder unit 12 after that. Thus, the first pipe 33 can be attached to the engine 1 separately from the second pipe 34 in the crank chamber 13, so the first pipe 33 can be formed into the shape disclosed in this embodiment. More specifically, this shape extends along the cylinder unit 12 while avoiding interference with, e.g., the accessories (the starter motor 17 and alternator 25) of the engine 1 and other obstacles (the intake manifold 27).

[0047] The second pipe 34 is attached to the engine 1 from the crank chamber side with the oil pan 2 being unattached to the crank case wall 11, The attachment of the second pipe 34 is performed by inserting one end (the upper end) of the second pipe 34 into the second hole 45 with the second O-ring 66 being fitted, and fixing the second support stay 57 to the oil pump 4 after that. Therefore, the second pipe 34 can be formed into a shape by which the lower end points to the lowermost portion 2a of the oil pan 2 while avoiding the accessory (the oil pump 4) in the crank chamber 13 and other obstacles.

[0048] Accordingly, this embodiment can provide the oil level gauge guide 14 which adopts the arrangement in which the second pipe 34 points to the lowermost portion 2a of the oil pan 2, and yet has a high degree of freedom of the attaching position. The accessories (the starter motor 17 and alternator 25) of the engine 1 including the oil level gauge guide 14 can be arranged near the engine 1 while avoiding interference with the oil level gauge guide 14. Consequently, the engine 1 can be made more compact by adopting the oil level gauge guide 14 according to this embodiment.

[0049] The cylindrical portion 15 according to this embodiment includes the first hole 44 into which the first pipe 33 is inserted, the second hole 45 into which the second pipe 34 is inserted, and the communication hole 46 for connecting the first and second holes 44 and 45. The first pipe 33 is held in the first hole 44 via the first O-ring 56, and the second pipe 34 is held in the second hole 45 via the second O-ring 66.

[0050] In this embodiment, one end of the first pipe 33 and one end of the second pipe 34 are elastically supported by the cylindrical portion 15 via the first and second O-rings 56 and 66, respectively, without any contact between them.

[0051] Although the oil level gauge guide 14 is divided into the first and second pipes 33 and 34, therefore, the work of attaching the oil level gauge guide 14 to the engine 1 can easily be performed. In addition, this embodiment can also prevent the first and second pipes 33 and 34 from being worn by metal contact or generating noise and vibrations.

[0052] The communication hole 46 according to this embodiment is formed to have a diameter smaller than that of the first and second holes 44 and 45. The boundary portion between the first hole 44 and the communication hole 46 is formed by the first tapered surface 47. One end (the upper end) of the second pipe 34 is formed by the fourth tapered surface 64.

[0053] Accordingly, in the process of inserting the oil level gauge 31 and oil changer hose 32 into the oil level gauge guide 14, it is possible to prevent the distal ends of these inserted components from being caught by the connecting portion between the first and second pipes 33 and 34 and preventing the advancement.

[0054] That is, if these inserted components come in contact with the first tapered surface 47 when entering the through hole 43 from the first pipe 33, the advancing direction is changed toward the center of the through hole 43. Also, if these inserted components come in contact with the fourth tapered surface 64 when entering the second pipe 34 from the through hole 43, the advancing direction is changed toward the center of the second pipe 34.

[0055] Even when the first and second pipes 33 and 34 are formed into largely bent shapes, therefore, the oil level gauge 31 and oil changer hose 32 are smoothly guided into the crank chamber 13, so the degree of freedom of the position of the oil level gauge guide 14 further rises.

[0056] According to the present teaching, the first pipe is attached to the engine outside the crank chamber, and the second pipe is attached to the engine inside the crank chamber. Therefore, the first pipe can be formed into the shape extending along the cylinder while avoiding interference with the engine accessories and other obstacles. The second pipe can be formed into the shape in which the lower end points to the lowermost portion of the oil pan, while avoiding interference with accessories and other obstacles in the crank chamber.

[0057] Accordingly, the present teaching can provide an oil level gauge guide which adopts an arrangement in which the lower end of an oil level gauge points to the lowermost portion of an oil pan, and yet has a high degree of freedom of the attaching position. The accessories of an engine including this oil level gauge guide can be arranged closer to the engine while avoiding interference with the oil level gauge guide. As a consequence, the engine can be made more compact by adopting the oil level gauge guide according to the present teaching.

Claims

1. An oil level gauge guide (14) of an engine (1), comprising:

   a cylindrical portion (15) configured to be provided on a wall (11) that forms at least part of a crank chamber (13) including an oil reservoir (5) of the engine (1), the cylindrical portion including hole (43) configured to allow an interior and exterior of the crank chamber (13) to communicate with each other;

   a first pipe (33) including one end held by the cylindrical portion (15), and an other end portion

configured to extend outside the crank chamber (13) and configured to be fixed to the engine (1); and

a second pipe (34) including one end held by the cylindrical portion (15), and an other end portion configured to extend to a bottom of the crank chamber (13) and configured to be fixed to the engine (1).

2. An oil level gauge guide (14) of the engine (1) according to claim 1, wherein
the through hole (43) of the cylindrical portion (15) includes:

a first hole (44) into which the first pipe (33) is inserted;
a second hole (45) into which the second pipe (34) is inserted; and
a communication hole (46) configured to connect the first hole (44) and the second hole (45),
O-rings (56, 66) are respectively fitted on the one end of the first pipe (33) and the one end of the second pipe (34),
the first pipe (33) is held in the first hole (44) via the O-ring (56), and
the second pipe (34) is held in the second hole (45) via the O-ring (66).

3. An oil level gauge guide (14) of the engine (1) according to claim 2, wherein
the communication hole (46) is formed to have a diameter smaller than that of the first and second holes (44, 45),
a boundary portion between the first hole (44) and the communication hole (46) is formed by a tapered surface (47) which gradually decreases a diameter toward the communication hole (46), and
an opening edge of the one end of the second pipe (34) is formed by a tapered surface (64) which gradually increases a diameter toward the communication hole (46).

4. An engine comprising an oil level gauge guide (14) according to at least one of the
claims 1 to 3, comprising:

a cylinder block (3) that includes the wall (11) that forms at least part of the crank chamber (13).

5. An engine comprising an oil level gauge guide (14) according to claim 4, wherein the cylindrical portion (15) is integrated with the wall (11) of the crank chamber (13).

6. An engine comprising an oil level gauge guide (14) according to claim 4 or 5, wherein the cylinder block (3) includes a cylinder unit (12), the first pipe (33) is fixed to the cylinder unit (12) by a first support stay (49).

7. An engine comprising an oil level gauge guide (14) according to at least one of the claims 4 to 6, comprising:

an oil pan (2) attached to the cylinder block (3), the second pipe (34) is fixed to the oil pan (2).

8. An engine comprising an oil level gauge guide (14) according to claim 7, wherein an oil pump (4) is accommodated in the oil pan (2), the second pipe (34) is fixed to the oil pump (4) via a second support stay (57).

FIG.1

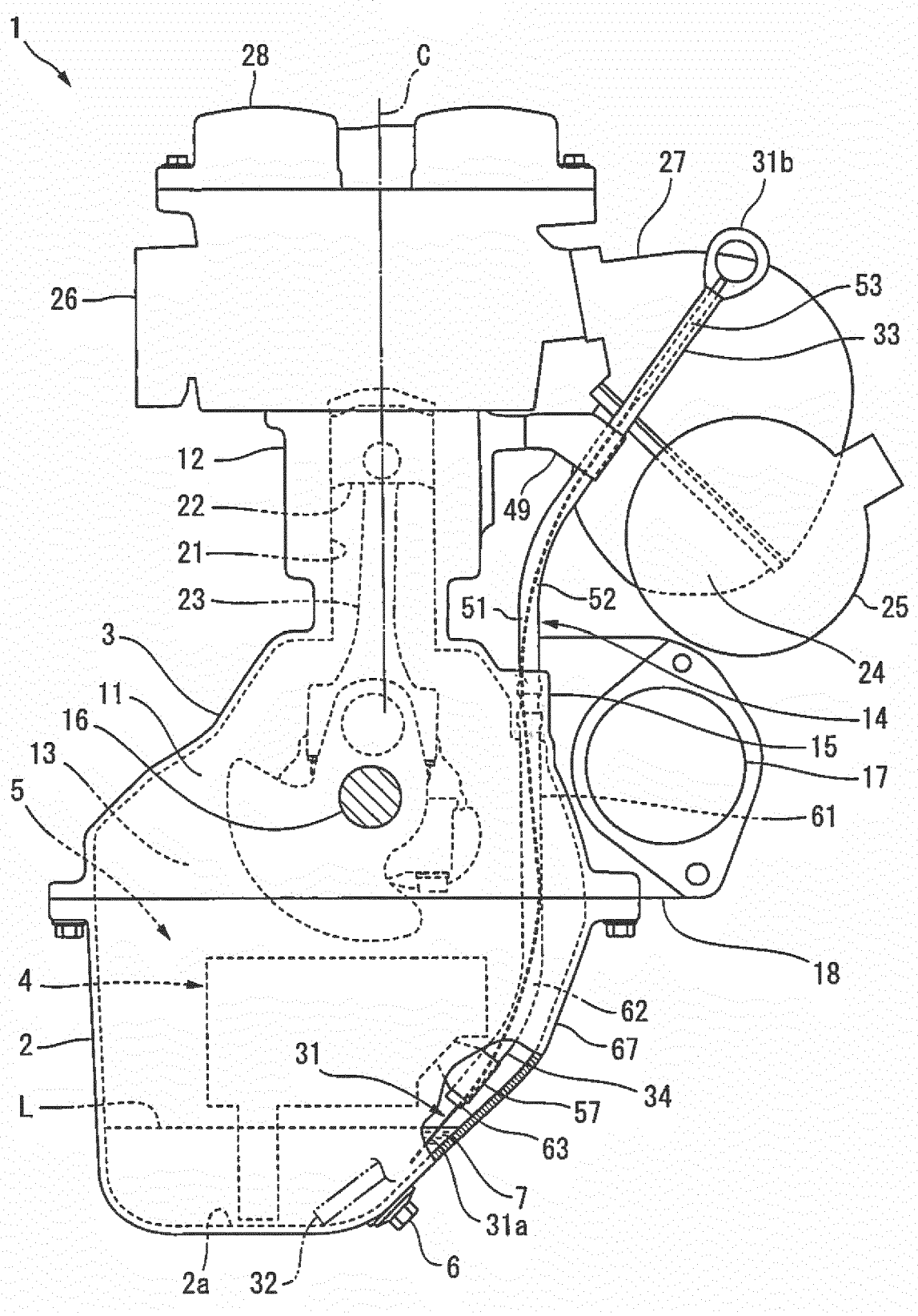
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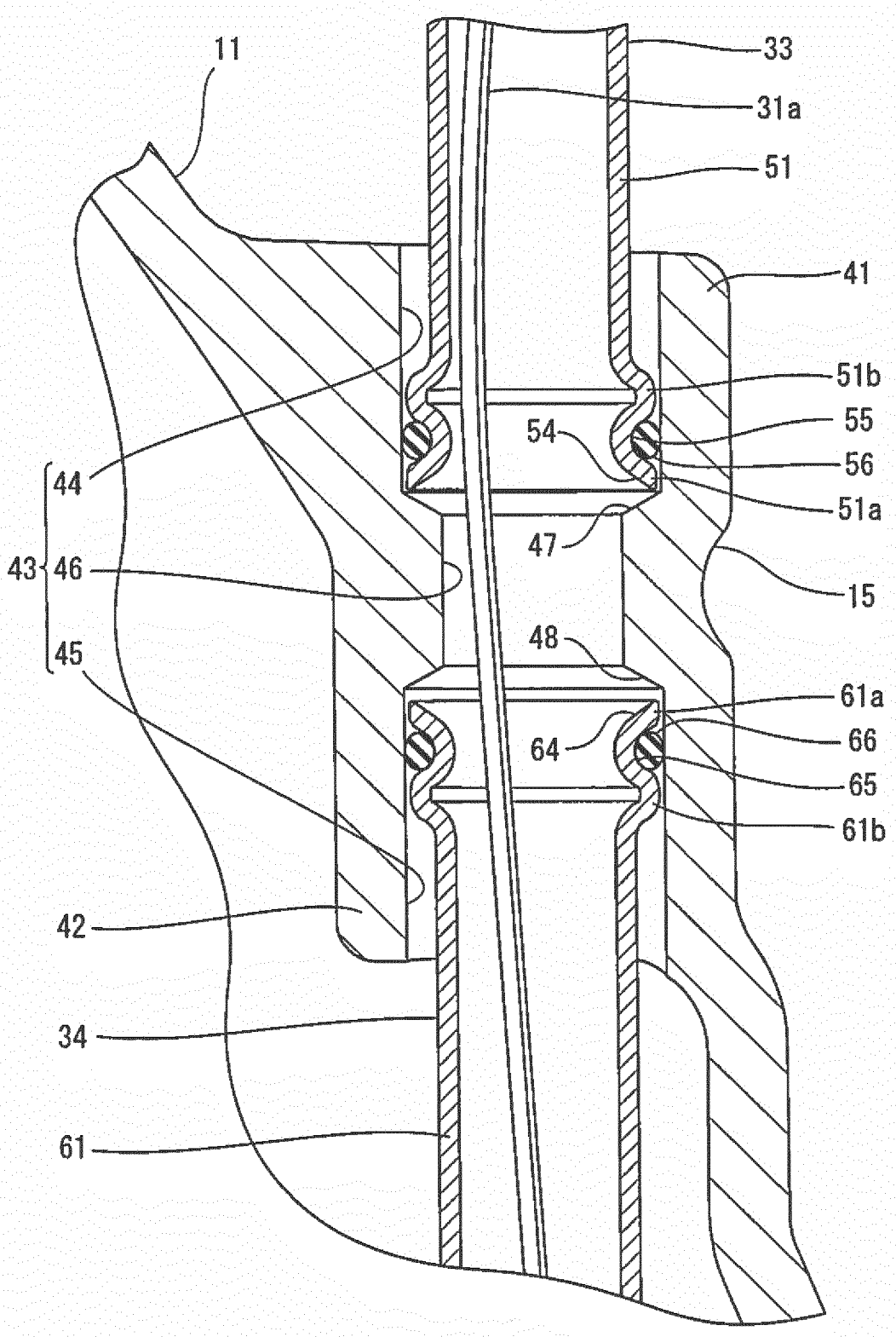
FIG.2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EUROPEAN SEARCH REPORT

Application Number
EP 17 18 1137

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F01M
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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 November 2017	Delzor, François

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 18 1137

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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