(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 290 665 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.03.2018 Bulletin 2018/10

(51) Int Cl.:
F01M 11/04 *(2006.01)*

(21) Application number: **17184673.6**

(22) Date of filing: **03.08.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **02.09.2016 JP 2016171787**

(71) Applicant: **Toyota Boshoku Kabushiki Kaisha**
Kariya-shi, Aichi 448-8651 (JP)

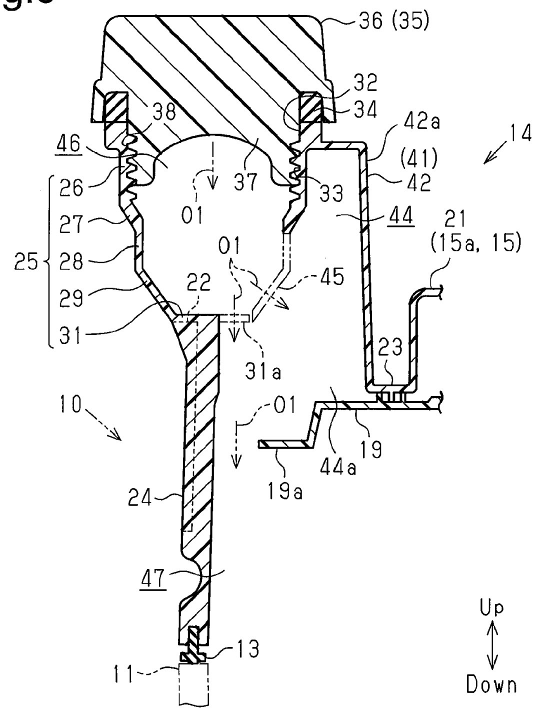
(72) Inventor: **NAWA, Teruyoshi**
Kariya-shi,, Aichi 448-8651 (JP)

(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

(54) **LUBRICANT OIL POURING STRUCTURE FOR INTERNAL COMBUSTION ENGINE**

(57) A pouring pipe (25) projects upward from a head cover body (15), which is a main portion of a cylinder head cover (14), and has a pouring port (32) for lubricant oil (O1) at the upper end of the pouring pipe (25). A filler cap (35) is detachably attached to the pouring pipe (25) from above such that the pouring port (32) is selectively closed and opened. An outer wall (41) is arranged between an outer circumferential surface of the pouring pipe (25) and the head cover body (15). The outer wall (41) surrounds at least part in the circumferential direction of the outer circumferential surface of the pouring pipe (25) with a hollow portion (44) in between. At least part of a lower end of the pouring pipe (25) and at least part of a lower end of the hollow portion (44) are open to an internal space (47) of the head cover body (15). A communicating portion (45), which allows communication between an internal space (46) of the pouring pipe (25) and the hollow portion (44), is formed in at least a lower portion of a section of the pouring pipe (25) that is surrounded by the outer wall (41).

Fig.3



EP 3 290 665 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a structure for pouring lubricant oil into an internal combustion engine.

[0002] As described in Japanese Laid-Open Patent Publication No. 2010-59936, for example, a structure including a pouring pipe and an outer wall is known as a structure for pouring lubricant oil into an internal combustion engine. The pouring pipe projects upward from a head cover body, which is a main portion of a cylinder head cover, at an end of the head cover body in the direction in which the cylinders of the engine are arranged. The pouring pipe has a pouring port for lubricant oil at the upper end. A filler cap is detachably attached to the upper end of the pouring pipe with a gasket in between such that the pouring port is selectively closed and opened. The filler cap is attached by being threaded onto the pouring pipe.

[0003] The outer wall of the conventional lubricant oil pouring structure is arranged between the outer circumferential surface of the pouring pipe and the head cover body. The outer wall surrounds at least part in the circumferential direction of the outer circumferential surface of the pouring pipe with a hollow portion in between. The outer wall enhances the rigidity of the pouring pipe. A lower end of the pouring pipe and a lower end of the hollow portion are both open to the internal space of the head cover body.

[0004] As a result, turning of the filler cap in the loosening direction is restrained even if the heat generated by the engine fatigues the gasket and vibration of the engine is transmitted to the pouring pipe in a state in which the axial force (the fastening force) of the filler cap is reduced.

[0005] A typical lubricant oil pouring structure for an internal combustion engine is demanded to, at the time of replacement of lubricant oil, ensure that the amount of the lubricant oil that can be poured into the engine through the pouring pipe is great and that pouring efficiency is high. Since other components of the engine are arranged in the vicinity of the cylinder head cover, there is limitation to increase of the diameter of the pouring pipe to avoid interference with these components. This problem occurs also in the lubricant oil pouring structure described in Japanese Laid-Open Patent Publication No. 2010-59936. However, the publication does not include consideration as to a structure for meeting the above-described demand for the high pouring efficiency.

SUMMARY OF THE INVENTION

[0006] Accordingly, it is an objective of the present invention to provide a lubricant oil pouring structure for an internal combustion engine capable of improving lubricant oil pouring efficiency while enhancing the rigidity of the pouring pipe.

[0007] To achieve the foregoing objective and in accordance with one aspect of the present invention, a lubricant oil pouring structure for an internal combustion engine is provided. The lubricant oil pouring structure is employed in a cylinder head cover including a head cover body and includes a pouring pipe and an outer wall. The pouring pipe projects upward from the head cover body and has a pouring port for lubricant oil at an upper end of the pouring pipe. A filler cap is detachably attached to the pouring pipe from above such that the pouring port is selectively closed and opened. The outer wall is arranged between an outer circumferential surface of the pouring pipe and the head cover body and surrounds at least part in a circumferential direction of the outer circumferential surface of the pouring pipe with a hollow portion in between. At least part of a lower end of the pouring pipe and at least part of a lower end of the hollow portion are open to an internal space of the head cover body. A communicating portion, which allows communication between an internal space of the pouring pipe and the hollow portion, is formed in at least a lower portion of a section of the pouring pipe that is surrounded by the outer wall.

[0008] In the above-described configuration, by adding the outer wall, the pouring pipe and the head cover body are joined to each other by the outer wall. This enhances the rigidity of the pouring pipe. As a result, even when vibration of the engine is transmitted to the pouring pipe, the pouring pipe is unlikely to vibrate.

[0009] Also, at least part of the lower end of the pouring pipe is open to the internal space of the head cover body. As a result, after lubricant oil is poured from the pouring port, some of the lubricant oil flows down in the pouring pipe and is supplied to the interior of the engine from the open portion of the lower end.

[0010] Further, by arranging the communicating portion in at least the lower portion of the section of the pouring pipe surrounded by the outer wall, communication between the internal space of the pouring pipe and the hollow portion is allowed. At least part of the lower end of the hollow portion is open to the internal space of the head cover body. Some of the lubricant oil poured into the pouring pipe thus enters the hollow portion via the communicating portion, flows down in the hollow portion, and is supplied to the interior of the engine from the open portion of the lower end of the hollow portion.

[0011] As a result, the amount of lubricant oil that can be poured into the engine through the pouring pipe is increased by the amount corresponding to the amount of the lubricant oil that passes through the open portion of the lower end of the hollow portion. The pouring efficiency is thus improved.

[0012] The above-described lubricant oil pouring structure for an internal combustion engine is capable of improving lubricant oil pouring efficiency while enhancing the rigidity of the pouring pipe.

[0013] Other aspects and advantages of the present invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1 is a perspective view of a cylinder head cover, in which a lubricant oil pouring structure for an internal combustion engine according to one embodiment is employed.
Fig. 2 is a plan view showing the cylinder head cover to which a baffle plate is attached according to the embodiment.
Fig. 3 is a cross-sectional view taken along line 3-3 of Fig. 2.
Fig. 4 is a partial plan view showing a pouring pipe without a filler cap and the vicinity of the pouring pipe according to the embodiment.
Fig. 5 is a bottom view showing the cylinder head cover to which the baffle plate is attached according to the embodiment.
Fig. 6 is a cross-sectional view taken along line 6-6 of Fig. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] A lubricant oil pouring structure for an internal combustion engine according to one embodiment will now be described with reference to the drawings.

[0016] An internal combustion engine 10 illustrated in Figs. 3 and 6 has multiple cylinders arranged in a row. A cylinder head 11 of the engine 10 incorporates a valve operating mechanism that operates an intake valve and an exhaust valve of each cylinder. The intake valves and the exhaust valves are operated by rotating an intake-exhaust camshaft, which extends in the cylinder arrangement direction. A rotation transmitting member 12, such as a sprocket, is arranged at an end of the intake-exhaust camshaft in the cylinder arrangement direction. Rotation of the crankshaft is transmitted to the intake-exhaust camshaft through the timing chain, the rotation transmitting member 12, and the like, thus driving the intake valves and the exhaust valves.

[0017] A cylinder head cover 14 is arranged on the cylinder head 11. The cylinder head cover 14 includes a head cover body 15. An end 15a of the head cover body 15 on the same side as the rotation transmitting member 12 in the cylinder arrangement direction is formed wider than other sections in the cylinder arrangement direction. The rotation transmitting member 12 and the like are arranged in the end 15a (see Fig. 2).

[0018] As shown in Figs. 1 and 2, a flange 16 is formed in a lower-end peripheral edge of the head cover body 15. The flange 16 is arranged on the cylinder head 11 with a gasket 13 in between (see Fig. 6). The flange 16 has fastening portions 17 at multiple positions. Each fastening portion 17 has a bolt insertion hole 17a. Bolts are inserted through the bolt insertion holes 17a, thus fastening the head cover body 15 to the cylinder head 11.

[0019] A baffle plate 19, which reduces the amount of oil contained in blow-by gas at the time the blow-by gas is returned to the intake passage, is attached to the backside of the head cover body 15 using fixing means such as welding (see Figs. 3, 5, and 6). Mounting holes 20, in each of which a spark plug for the corresponding one of the cylinders is mounted, are formed in the head cover body 15. The number of the mounting holes 20 is equal to the number of the cylinders. The arrangement direction of the mounting holes 20 thus coincide with the cylinder arrangement direction.

[0020] As shown in Figs. 1 and 3, a flat portion 21, a first stepped portion 22, and a second stepped portion 23 are formed at the end 15a of the head cover body 15. The first stepped portion 22 is formed at a position lower than the flat portion 21 and separated from the flat portion 21. The second stepped portion 23 is formed at a position even lower than the first stepped portion 22 between the flat portion 21 and the first stepped portion 22.

[0021] A pouring pipe 25, through which lubricant oil O1 is poured into the engine 10, projects upward from the first stepped portion 22. The pouring pipe 25 is formed as part of the cylinder head cover 14. The upper end of the pouring pipe 25 is arranged at a position higher than the flat portion 21.

[0022] The pouring pipe 25 includes a large diameter portion 26, an upper tapered portion 27, a small diameter portion 28, a lower tapered portion 29, and a bottom portion 31 sequentially in this order from the upper side to the lower side. The large diameter portion 26 is located in an upper section of the pouring pipe 25 and is shaped like a circular tube. The small diameter portion 28 is shaped like a circular tube with a diameter slightly smaller than the diameter of the large diameter portion 26. The upper tapered portion 27 is located between the large diameter portion 26 and the small diameter portion 28 and has a diameter that becomes smaller toward the lower end. The lower tapered portion 29 is located between the small diameter portion 28 and the bottom portion 31 and has a diameter that becomes smaller toward the lower end.

[0023] The upper end of the internal space of the large diameter portion 26 is open, and the opening configures a pouring port 32. To selectively close and open the pouring port 32, a filler cap 35 is detachably attached to the pouring pipe 25 from above. More specifically, the filler cap 35 includes a head portion 36 and a shaft portion 37, which has a diameter smaller than that of the head portion 36 and projects downward from the head portion 36. An external threaded portion 38 is formed on the outer circumferential surface of the shaft portion 37. An internal threaded portion 33 is formed on the inner circumferential surface of the large diameter portion 26 of the pouring pipe 25. With the gasket 34 located between the large diameter portion 26 of the pouring pipe 25 and the head portion 36 of the filler cap 35, the external threaded portion 38 is threaded onto the internal threaded portion 33. This fastens the filler cap 35 to the pouring pipe 25, thus closing the pouring port 32. The reactive force produced by depressing the gasket 34 ensures the axial force (the fastening force) of the filler cap 35.

[0024] Part in the radial direction of the pouring pipe 25 projects from the end 15a of the head cover body 15 in the cylinder arrangement direction. In the present embodiment, substantially half in the radial direction of the pouring pipe 25 projects from the end 15a.

[0025] An outer wall 41 is arranged between the outer circumferential surface of the large diameter portion 26 of the pouring pipe 25 and the second stepped portion 23 of the head cover body 15. The outer wall 41 surrounds at least part in the circumferential direction of the outer circumferential surface of the pouring pipe 25 with a hollow portion 44 in between. In the present embodiment, the outer wall 41 is arranged in the part of the pouring pipe 25 that does not project from the end 15a of the head cover body 15. The lower end of the outer wall 41 is continuous with the second stepped portion 23. The upper end of the outer wall 41 is continuous with the upper end of the large diameter portion 26.

[0026] As shown in Fig. 4, the outer wall 41 includes a curved portion 42 and a projecting portion 43, which is adjacent to the curved portion 42 in the circumferential direction of the pouring pipe 25. The curved portion 42 has a curved surface 42a, which is curved in the circumferential direction and extends in the vertical direction to form part of a cylindrical shape. The projecting portion 43 has two flat surfaces 43a, which are adjacent to each other in the circumferential direction and each extend in the vertical direction. The projecting portion 43 projects outward in the radial direction of the pouring pipe 25.

[0027] As illustrated in Figs. 1 and 3, in the head cover body 15, multiple ribs 24, which extend in the vertical direction, are formed in the first stepped portion 22, which is located below the projecting section of the pouring pipe 25.

[0028] As shown in Fig. 3, at least part of the lower end of the hollow portion 44 is open to an internal space 47 of the head cover body 15. A bottom portion 31, which forms part of the lower end of the pouring pipe 25, is open to the internal space 47 of the head cover body 15 in the part that does not project from the end 15a of the head cover body 15. In other words, at least part of the lower end of the pouring pipe 25 is open to the internal space 47. This part is referred to as an open portion 31 a of the bottom portion 31.

[0029] A communicating portion 45, which allows communication between an internal space 46 of the pouring pipe 25 and the hollow portion 44, is formed in at least a lower part of the section of the pouring pipe 25 surrounded by the outer wall 41. Specifically, the communicating portion 45 is formed by cutting out a section of the pouring pipe 25 corresponding to the small diameter portion 28 and the lower tapered portion 29 that does not project from the end 15a of the head cover body 15. The communicating portion 45 is formed to be continuous with the open portion 31 a of the bottom portion 31 of the pouring pipe 25. The upper end of the communicating portion 45 is located at the boundary between the upper tapered portion 27 and the small diameter portion 28. The boundary is at the highest or substantially highest position at which sufficient strength of the internal threaded portion 33 is ensured. The open portion 31 a and the communicating portion 45 configure an outflow port of the pouring pipe 25 for the lubricant oil O1.

[0030] As shown in Figs. 5 and 6, a guide portion 19a is formed in part of the baffle plate 19. The guide portion 19a guides lubricant oil 02, which is splashed by the rotation transmitting member 12 as the valve operating mechanism of the engine 10 operates, to the pouring port 32 of the pouring pipe 25. The guide portion 19a is located below the communicating portion 45 of the pouring pipe 25 (see Fig. 3). The guide portion 19a is arranged to be inclined with respect to the horizontal direction such that a downstream section in the splashing direction of the lubricant oil 02 is closer to the pouring pipe 25 (is higher) than an upstream section.

[0031] Operations and advantages of the present embodiment, which is configured as described above, will now be described.

<During Operation of Internal Combustion Engine 10>

[0032]

(1) As shown in Figs. 1 and 3, the pouring pipe 25 projects upward from the head cover body 15 and has an elongated shape. This may cause the problem described below. As the heat generated by the engine 10 is transmitted to the gasket 34, the gasket 34 fatigues and the dimension of the gasket 34 in the height direction decreases. This reduces the reactive force produced by depressing the gasket 34, thus reducing the axial force (the fastening force) of the filler cap 35. If, in this state, vibration of the engine 10 is transmitted to the pouring pipe 25 and the pouring pipe 25 vibrates, the filler cap 35 may turn in the loosening direction.

However, the outer circumferential surface of the pouring pipe 25 and the second stepped portion 23 of the head cover body 15 are joined to each other by the outer wall 41, which enhances the rigidity of the pouring pipe 25. Particularly, in the present embodiment, the outer wall 41 projects upward from the second stepped portion 23 and the upper end of the outer wall 41 is continuous with the upper end of the large diameter portion 26 of the pouring pipe 25. As a result, the outer wall 41, which is arranged substantially along the pouring pipe 25 in the height direction, enhances the rigidity of the pouring pipe 25 in a large range in the height direction.

Also, as shown in Fig. 4, the outer wall 41 includes the projecting portion 43, which has the two flat surfaces 43a adjacent to each other in the circumferential direction, as well as the curved portion 42 having the curved surface 42a. This effectively enhances the rigidity of the pouring pipe 25 compared with a case in which the outer wall 41 is configured simply by the curved portion 42.

Further, the ribs 24, which are arranged in the first stepped portion 22 in the lower part of the pouring pipe 25, are continuous with the bottom portion 31, thus enhancing the rigidity of the pouring pipe 25.

Since the rigidity of the pouring pipe 25 is enhanced in the above-described manners, the pouring pipe 25 is unlikely to vibrate even when vibration of the engine 10 is transmitted to the pouring pipe 25. As a result, even if the heat of the engine 10 fatigues the gasket 34, as has been described, the filler cap 35 is unlikely to turn in the loosening direction.

(2) As shown in Figs. 5 and 6, when the engine 10 operates, the rotation transmitting member 12 rotates and splashes the lubricant oil 02. As represented by the long dashed double-short dashed arrows in Fig. 6, the splashing direction of some of the lubricant oil 02 is changed by the guide portion 19a to the direction inclined such that a downstream section is closer to the pouring pipe 25 (is higher) than an upstream section. By being splashed in the inclined direction, the lubricant oil 02 is guided to the pouring port 32 of the pouring pipe 25. Since the communicating portion 45 is located above the guide portion 19a (see Fig. 3), the lubricant oil 02 is easily introduced into the pouring pipe 25 by passing through the communicating portion 45. The lubricant oil 02 is thus struck against the backside of the shaft portion 37 of the filler cap 35.

[0033] As a result, even when water contained in the lubricant oil is condensed so that the lubricant oil becomes cloudy and collects on the backside of the shaft portion 37, the cloudy lubricant oil is scraped off the filler cap 35 by causing the lubricant oil 02, which is guided by the guide portion 19a in the above-described manner, to strike the backside of the shaft portion 37 of the filler cap 35.

<During Pouring of Lubricant Oil O1>

[0034] To add the lubricant oil O1 or replace the lubricant oil O1 (oil replacement) for the engine 10, the filler cap 35 is detached from the pouring pipe 25 to open the pouring port 32, as shown in Fig. 4, with the engine 10 in a stopped state. Then, as represented by the long dashed double-short dashed lines in Fig. 3, the lubricant oil O1 is poured from the pouring port 32.

[0035] Specifically, the open portion 31a of the lower end (the bottom portion 31) of the pouring pipe 25 is open to the internal space 47 of the head cover body 15. As a result, some of the lubricant oil O1 poured from the pouring port 32 flows down in the pouring pipe 25 and is supplied to the interior of the engine 10 from the open portion 31 a of the bottom portion 31.

[0036] The lower end of the pouring pipe 25 is closed by the bottom portion 31 particularly in the part of the pouring pipe 25 that projects from the end 15a of the head cover body 15 in the cylinder arrangement direction. This reduces the size of the open portion 31 a with respect to the internal space 47 of the head cover body 15 in the lower end of the pouring pipe 25. Without the communicating portion 45, the outflow port of the pouring pipe 25 would be configured simply by the open portion 31 a. This would cause an insufficient outflow efficiency of the lubricant oil. In this case, the amount of the lubricant oil O1 that can be poured into the pouring pipe 25 from the pouring port 32 would be small, resulting in a poor pouring efficiency.

[0037] However, since the communicating portion 45 is arranged in at least the lower portion of the section of the pouring pipe 25 surrounded by the outer wall 41, the internal space 46 of the pouring pipe 25 and the hollow portion 44 are allowed to communicate with each other. At least part of the lower end of the hollow portion 44 is open to the internal space 47 of the head cover body 15.

[0038] As a result, some of the lubricant oil O1 poured into the pouring pipe 25 enters the hollow portion 44 via the communicating portion 45, flows down in the hollow portion 44, and is supplied to the interior of the engine 10 through the open portion 44a in the lower end.

[0039] This increases the amount of the lubricant oil O1 that can be poured into the engine 10 through the pouring pipe 25 by the amount corresponding to the amount of the lubricant oil O1 passing through the open portion 44a of the hollow portion 44, thus improving the pouring efficiency.

[0040] Particularly, in the present embodiment, the communicating portion 45 is formed to be continuous with the open portion 31 a of the bottom portion 31 of the pouring pipe 25. This efficiently increases the cross-sectional area of the outflow port of the pouring pipe 25 for the lubricant oil O1 compared with a case in which the communicating portion 45 is separated from the open portion 31 a.

[0041] Also, the upper end of the communicating portion 45 is arranged at the highest or substantially highest position at which sufficient strength of the internal threaded portion 33 is ensured. This arrangement is also effective to efficiently increase the cross-sectional area of the outflow port of the pouring pipe 25.

[0042] Further, in the present embodiment, substantially half in the radial direction of the pouring pipe 25 projects from the end 15a of the head cover body 15. The size of the open portion 31 a with respect to the internal space 47 of the head cover body 15 is small in the lower end of the pouring pipe 25. This greatly influences the amount of the lubricant oil O1 that can be poured into the engine 10 through the pouring pipe 25. However, by arranging the communicating portion 45 as has been described, the cross-sectional area of the outflow port of the pouring pipe 25 is efficiently increased to reduce the influence on the pouring amount of the lubricant oil O1. As a result, overflow of some of the lubricant oil O1, which has been poured, from the pouring port 32 is restrained.

[0043] The greater the projecting amount of the pouring pipe 25 from the end 15a, the more pronounced the above-described effect becomes. This is because the greater the size of the part of the bottom portion 31 of the pouring pipe 25 that projects from the end 15a, the smaller the size of the open portion 31 a becomes.

[0044] Also in Japanese Laid-Open Patent Publication No. 2010-59936, the pouring pipe is surrounded by the outer wall with the hollow portion in between. The lower end of the pouring pipe and the lower end of the hollow portion are both open to the internal space of the head cover body. However, the pouring pipe lacks the part corresponding to the communicating portion 45 of the present embodiment. As described in the aforementioned publication, "the hollow portion restrains entry of the lubricant oil splashed in the head cover into the interior of the pouring pipe." The pouring pipe thus must be extended to the lowest possible point without providing a portion like the communicating portion 45 of the present embodiment. As a result, the device of the publication cannot exert an effect of improving the pouring efficiency, unlike the present embodiment.

<At the Time of Inspection>

[0045] In a periodic inspection of the vehicle, there may be a case in which the filler cap 35 is detached from the pouring pipe 25 and the backside of the shaft portion 37 of the filler cap 35 is visually inspected. At this time, if the shaft portion 37 has collected cloudy lubricant oil, erroneous determination that the engine 10 is in failure may be made.

[0046] However, in the present embodiment, the cloudy lubricant oil is scraped off by causing the splashed lubricant oil 02 striking the backside of the shaft portion 37, as has been described. The cloudy lubricant oil is thus unlikely to remain on the backside of the shaft portion 37. As a result, the erroneous determination of failure is unlikely to be made at the time of inspection.

[0047] In addition to the ones listed above, the present embodiment achieves the following operations and advantages.

[0048] When the vehicle travels and the atmospheric air including relative wind flows in the exterior of the cylinder head cover 14, the heat in the pouring pipe 25 is released to the atmospheric air. This cools droplets of the lubricant oil in the pouring pipe 25 to condense water in the lubricant oil. The lubricant oil thus becomes cloudy, accelerating deterioration of the lubricant oil as a whole.

[0049] However, in the present embodiment, the hollow portion 44 exerts a heat insulating effect to make it unlikely that the heat in the pouring pipe 25 will be released to the atmospheric air. The lubricant oil is thus unlikely to become cloudy, and deterioration of the lubricant oil is restrained.

[0050] The pouring pipe 25 projects upward and the filler cap 35 is mounted at the upper end of the pouring pipe 25. This facilitates work for attachment/detachment of the filler cap 35 and improves the work efficiency.

[0051] Also, the pouring port 32, which is arranged at a high position, facilitates the work for pouring the lubricant oil O1.

[0052] When molding the head cover body 15, which is made of plastic, using a mold, it is demanded to mold the internal threaded portion 33, particularly, with high accuracy. To meet such demand, it is preferable to cool the part in the vicinity of the internal threaded portion 33 after molding. In this regard, in the head cover body 15 of the present embodiment, the outer wall 41 is molded around the pouring pipe 25, which has the internal threaded portion 33, with the hollow portion 44 in between. Therefore, by arranging a cooling pipe in part of the mold that molds the hollow portion 44, the internal threaded portion 33 is efficiently cooled. Sink marks or the like are thus unlikely to be caused.

[0053] The above described embodiment may be modified as follows.

[0054] The pouring pipe 25 may be arranged at such a position in the head cover body 15 that the pouring pipe 25 does not project from the end 15a on one side in the cylinder arrangement direction of the engine. In this case, a large portion (including the entirety) of the lower end of the pouring pipe 25 may be open to the internal space 47 of the head cover body 15. The pouring pipe 25 may be arranged at such a position that the pouring pipe 25 projects from the end 15a by an amount smaller or greater than that of the present embodiment.

[0055] The outer circumferential surface of the pouring pipe 25 as a whole in the circumferential direction may be surrounded by the outer wall 41 with the hollow portion 44 in between. In this case, a large portion (including the entirety) of the lower end of the hollow portion 44 may be open to the internal space 47 of the head cover body 15.

[0056] The pouring pipe 25 may project upward from the head cover body 15 with part of the pouring pipe 25 projecting from a corner of the end 15a.

[0057] The position of the upper end of the communicating portion 45 may be changed to a position lower than that in the above illustrated embodiment.

[0058] As long as the communicating portion 45 is formed in at least a lower portion of the section of the pouring pipe 25 surrounded by the outer wall 41, the communicating portion 45 may be formed in part of the pouring pipe 25 separated from the open portion 31 a of the bottom portion 31.

[0059] The communicating portions 45 may be arranged at multiple circumferential positions of the pouring pipe 25.

[0060] A pouring pipe (25) projects upward from a head cover body (15), which is a main portion of a cylinder head cover (14), and has a pouring port (32) for lubricant oil (O1) at the upper end of the pouring pipe (25). A filler cap (35) is detachably attached to the pouring pipe (25) from above such that the pouring port (32) is selectively closed and opened. An outer wall (41) is arranged between an outer circumferential surface of the pouring pipe (25) and the head cover body (15). The outer wall (41) surrounds at least part in the circumferential direction of the outer circumferential surface of the pouring pipe (25) with a hollow portion (44) in between. At least part of a lower end of the pouring pipe (25) and at least part of a lower end of the hollow portion (44) are open to an internal space (47) of the head cover body (15). A communicating portion (45), which allows communication between an internal space (46) of the pouring pipe (25) and the hollow portion (44), is formed in at least a lower portion of a section of the pouring pipe (25) that is surrounded by the outer wall (41).

Claims

1. A lubricant oil pouring structure for an internal combustion engine (10) employed in a cylinder head cover (14) including a head cover body (15), the structure comprising:

    a pouring pipe (25), which projects upward from the head cover body (15) and has a pouring port (32) for lubricant oil (O1) at an upper end of the pouring pipe (25), wherein a filler cap (35) is detachably attached to the pouring pipe (25) from above such that the pouring port (32) is selectively closed and opened; and
    an outer wall (41), which is arranged between an outer circumferential surface of the pouring pipe (25) and the head cover body (15) and surrounds at least part in a circumferential direction of the outer circumferential surface of the pouring pipe (25) with a hollow portion (44) in between,
    wherein at least part of a lower end of the pouring pipe (25) and at least part of a lower end of the hollow portion (44) are open to an internal space (47) of the head cover body (15),
    the lubricant oil pouring structure for the engine (10) being **characterized in that** a communicating portion (45), which allows communication between an internal space (46) of the pouring pipe (25) and the hollow portion (44), is formed in at least a lower portion of a section of the pouring pipe (25) that is surrounded by the outer wall (41).

2. The lubricant oil pouring structure for the engine (10) according to claim 1, **characterized in that**
    part of the pouring pipe (25) projects in a cylinder arrangement direction of the engine (10) from an end (15a) of the head cover body (15) in the cylinder arrangement direction,
    the outer wall (41) surrounds, with the hollow portion (44) in between, a section of the pouring pipe (25) that does not project from the end (15a) of the head cover body (15), and
    the pouring pipe (25) is open to the internal space (47) of the head cover body (15) in a section of a bottom portion (31) of the pouring pipe (25) that does not project from the end (15a).

3. The lubricant oil pouring structure for the engine (10) according to claim 2, **characterized in that** the communicating portion (45) is formed to be continuous with an open portion (31 a) of the bottom portion (31) of the pouring pipe (25).

4. The lubricant oil pouring structure for the engine (10) according to any one of claims 1 to 3, **characterized in that** the outer wall (41) includes
    a curved portion (42) having a curved surface 42a, which is curved in a circumferential direction and extends in a vertical direction to form part of a cylindrical shape, and
    a projecting portion (43), which has two flat surfaces (43a) that are adjacent to each other in the circumferential direction and each extend in the vertical direction, wherein the projecting portion (43) projects outward in a radial direction of the pouring pipe (25).

5. The lubricant oil pouring structure for the engine (10) according to any one of claims 1 to 4, **characterized in that**
    a baffle plate (19) is attached to a backside of the head cover body (15), and
    a guide portion (19a) is formed in part of the baffle plate (19), wherein the guide portion (19a) guides, to the pouring port (32) of the pouring pipe (25), lubricant oil (02) splashed by a rotation transmitting member (12) that rotates as a valve operating mechanism of the engine (10) operates.

6. The lubricant oil pouring structure for the engine (10) according to claim 5, **characterized in that** the guide portion (19a) is inclined such that a downstream section in a splashing direction of the lubricant oil (02) is closer to the pouring pipe (25) than an upstream section.

Fig.1

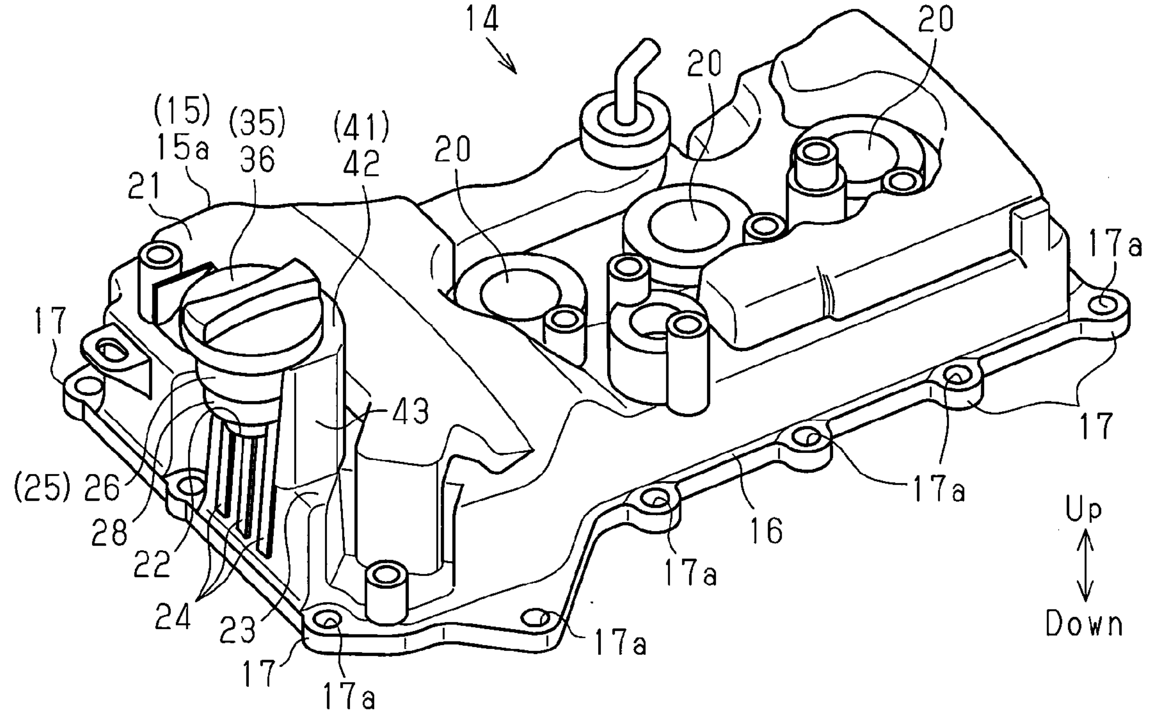

14
20
20
20
(15)
15a
(35)
36
(41)
42
21
17a
17
43
17
(25) 26
17a
28
Up
16
22
17a
24
23
Down
17a
17
17a

Fig.2

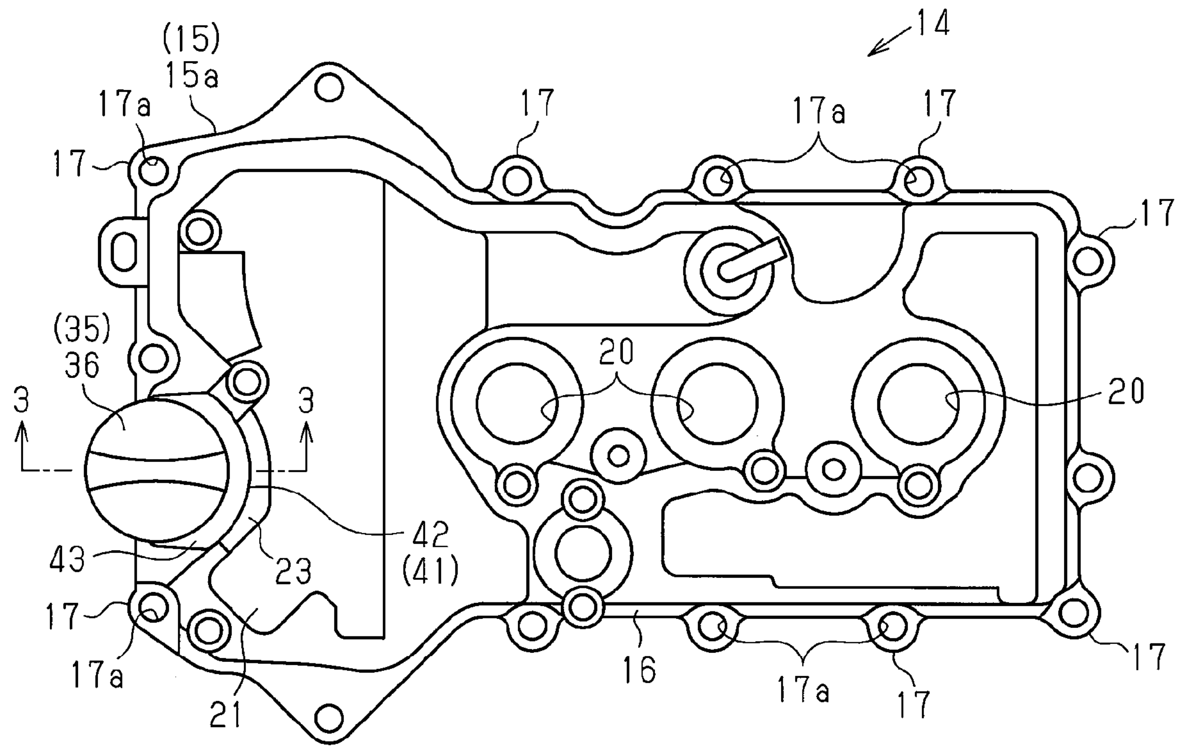
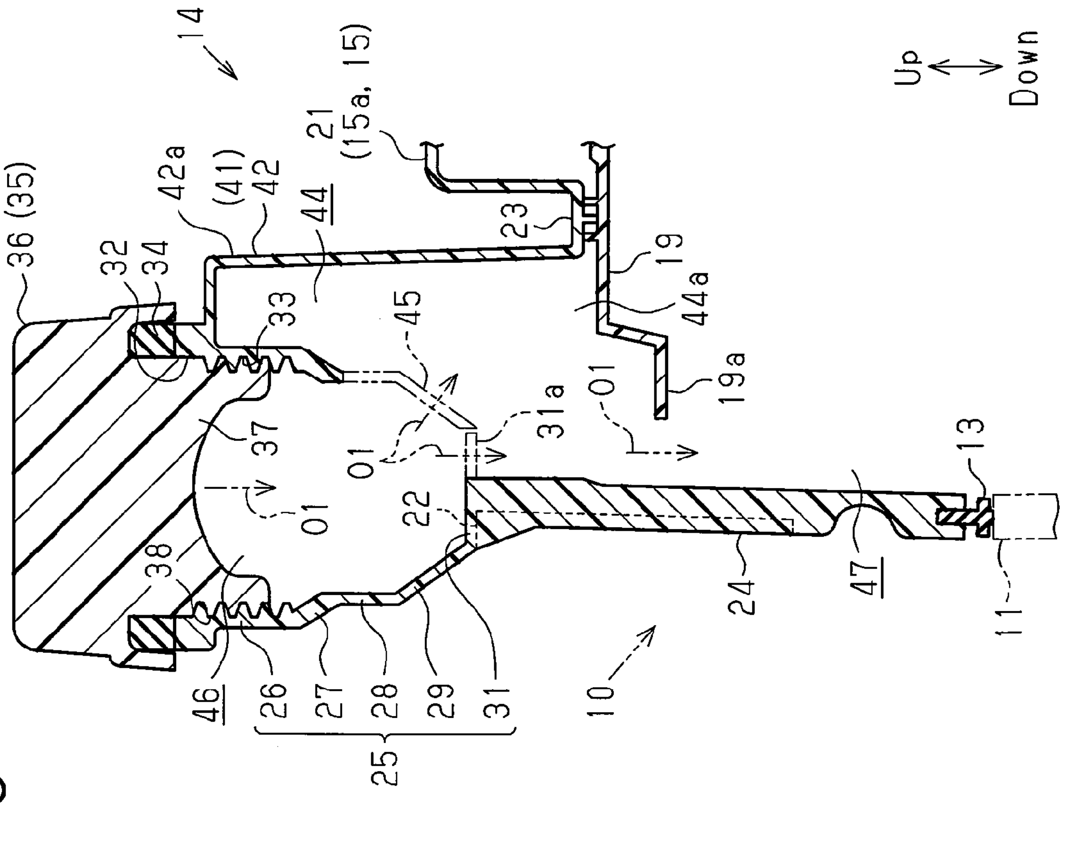
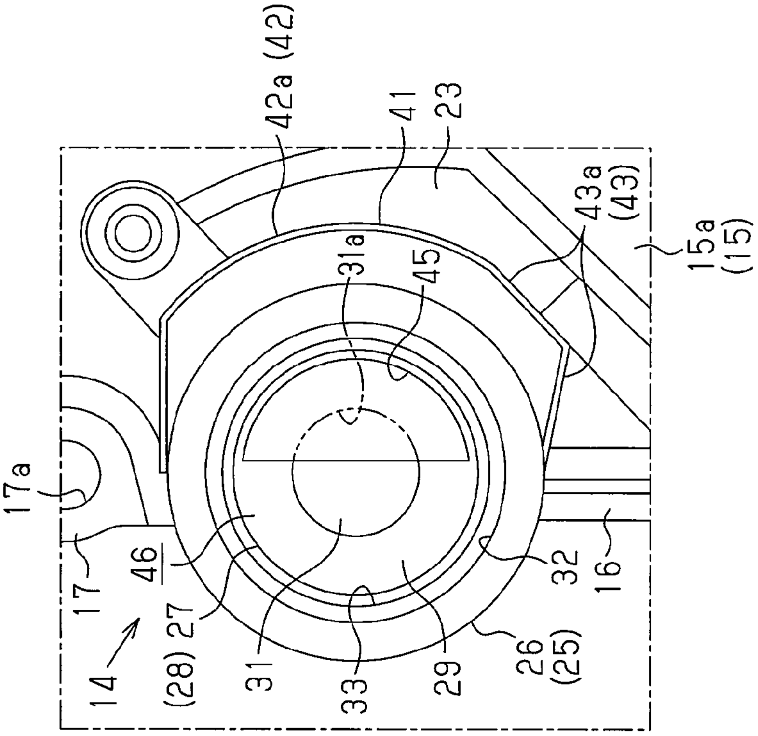

(15)
15a
14
17a
17
17a
17
17
17
17
(35)
36
20
3
3
20
43
42
(41)
23
17
17a
16
21
17a
17
17

Fig.3



36 (35)
32
34
42a
(41)
42
21
(15a, 15)
14
44
33
23
45
19
44a
37
01
31a
19a
38
22
13
46
26
27
28
29
31
24
47
11
10
25
Up
Down

Fig.4



42a (42)
41
23
31a
45
43a
(43)
15a
(15)
17a
17
46
32
16
14
(28) 27
31
33
29
26
(25)

Fig.5

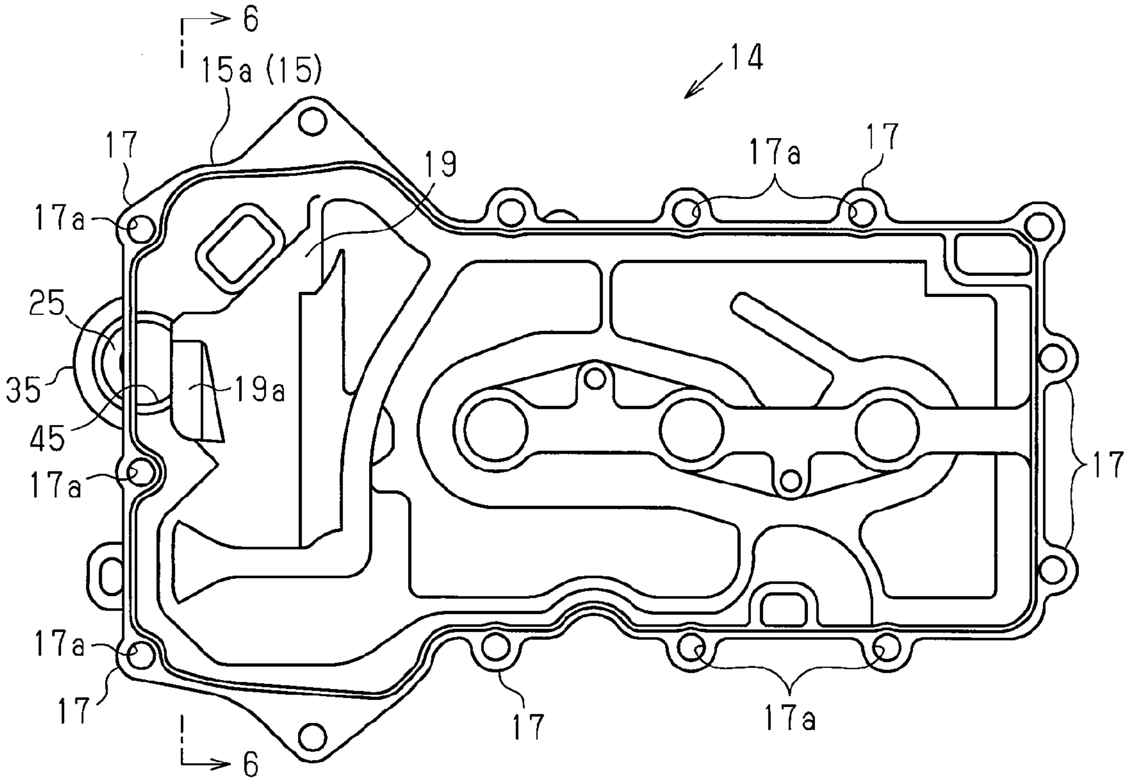
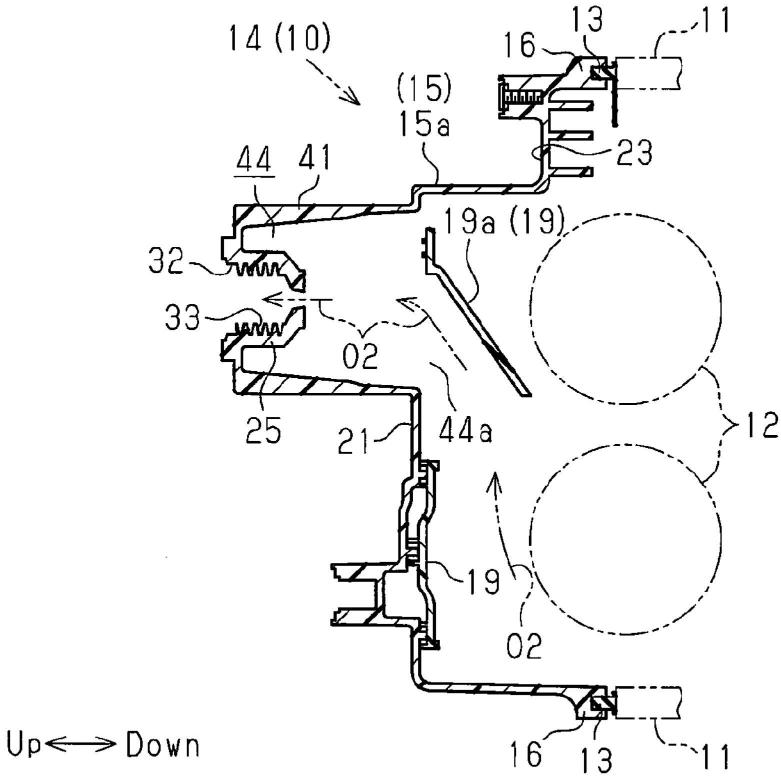

6
15a (15)
14
17
19
17a
17
17a
25
35
19a
45
17a
17
17a
17
6
17
17a

Fig.6


14 (10)
13
11
16
(15)
15a
23
44
41
19a (19)
32
33
02
25
21
44a
12
19
02
Up Down
16
13
11

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 18 4673

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	JP 2010 059936 A (DAIHATSU MOTOR CO LTD; TOYOTA MOTOR CORP) 18 March 2010 (2010-03-18) * abstract; figures 1-4 * -----	1-3	INV. F01M11/04
X	JP H07 293220 A (DAIHATSU MOTOR CO LTD) 7 November 1995 (1995-11-07) * abstract; figures 1-4 * -----	1-3	
X	JP S62 133911 U (MATSUSHITA ELECTRIC IND CO LTD) 24 August 1987 (1987-08-24) * the whole document * -----	1-3	
A	JP H02 67412 A (SUZUKI MOTOR CO) 7 March 1990 (1990-03-07) * abstract; figures 1-3 * -----	1-3	
A	DE 100 52 227 A1 (DAIMLER CHRYSLER AG [DE]) 2 May 2002 (2002-05-02) * the whole document * -----	1-3	

TECHNICAL FIELDS SEARCHED (IPC)

F01M

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	19 January 2018	Van Zoest, Peter

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 18 4673

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-01-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2010059936 A	18-03-2010	NONE	
JP H07293220 A	07-11-1995	NONE	
JP S62133911 U	24-08-1987	NONE	
JP H0267412 A	07-03-1990	JP 2629294 B2 JP H0267412 A	09-07-1997 07-03-1990
DE 10052227 A1	02-05-2002	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- JP 2010059936 A **[0002] [0005] [0044]**