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

(11) EP 1 258 608 A2

(12) # EUROPEAN PATENT APPLICATION

(43) Date of publication:
20.11.2002 Bulletin 2002/47

(51) Int Cl.⁷: **F01P 7/16**, F01P 11/00

(21) Application number: **02009169.0**

(22) Date of filing: **24.04.2002**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **15.05.2001 JP 2001145069**

(71) Applicant: **HONDA GIKEN KOGYO KABUSHIKI KAISHA**
Minato-ku Tokyo (JP)

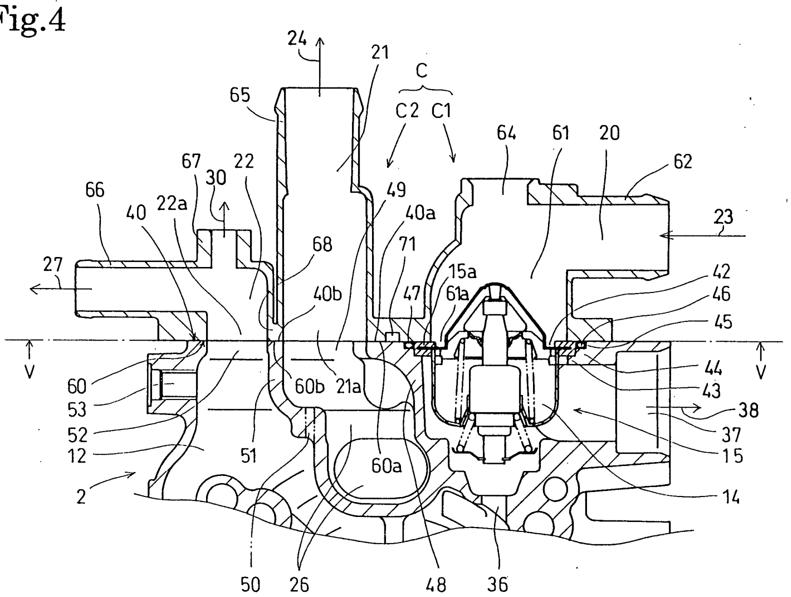
(72) Inventors:
- **Yoshino, Kouji**
  1-4-1 Chuo, Wako-shi, Saitama-ken (JP)
- **Amakawa, Yutaka**
  1-4-1 Chuo, Wako-shi, Saitama-ken (JP)

(74) Representative:
Prechtel, Jörg, Dipl.-Phys. Dr. et al
Weickmann & Weickmann
Patentanwälte
Postfach 86 08 20
81635 München (DE)

(54) **Engine having a cooling water port cover**

(57) A cooling water inlet/outlet cover affixed to a side surface of a cylinder head 2 of an engine E includes a first cover portion C1 and a second cover portion C2. The first cover portion C1 defines an inflow path 20 for introducing cooling water from a radiator 25 to an inlet 42 communicating with a thermostat-type path opening/closing mechanism 15. The second cover portion C2 defines an outflow path 21 for guiding cooling water from the outlet 49 to a radiator 25 and an outflow path 22 partitioned from the outflow path 21 by the partition wall 68 to guide cooling water from the outlet 52 to a heater core 29 and a throttle body 7. The cooling water inlet/outlet cover C further includes a reservoir portion 71 for holding an extruded part of a liquid packing 54 to be coated around the outlets 49, 52 to prevent the extruded part of the liquid packing 54 from spoiling an elastic material packing 46. This configuration contributes to facilitating connection of hoses to the cooling water inlet and outlets formed in the engine body, thereby facilitating assembly of the engine, and further reducing the number of parts.

Fig.4



EP 1 258 608 A2

Description

[0001] This invention relates to an engine having a cooling water inlet/outlet cover to be attached to an engine body, which includes an inflow path for guiding cooling water from a radiator into a cooling water inlet formed in the engine body to communicate with a thermostat, and an outflow path for guiding cooling water out of an outlet formed in the engine body to the radiator.

[0002] As one of engines having this type of cooling water inlet/outlet cover, there is known an engine having a thermostat cover disclosed in Japanese Patent Application Laid-Open Publication No. 2000-282861. In this engine, the thermostat cover fixed on one side surface of cylinder head covers the outlet of a cooling water path formed in the cylinder head and a thermostat-type path opening/closing mechanism accommodated in an accommodating chamber defined by the cylinder head to permit cooling water to flow back to a radiator. The thermostat cover defines a cooling water entrance opening connected for connection of a radiator hose for guiding cooling water from the radiator, and a cooling water exit opening for connection of a radiator hose for guiding cooling water back to the radiator. Additionally, a cooling water hose is connected to another side surface of the cylinder head to supply cooling water from the water jacket of the cylinder head to an air-conditioning heater core.

[0003] In the prior art technique, the thermostat cover integrally defines both the cooling water exit opening and the cooling water entrance opening and therefore it is certainly effective for reduce parts and assembling steps. However, since the cooling hose connected to the heater core is connected to the side surface of the cylinder head different from the side surface for mounting the thermostat cover, it results in locating cooling water outlets in separated positions of the cylinder head, and results in inefficiency of the hose connecting work. The prior art therefore had the room for improvement from the viewpoint of assembly of the engine. In addition, the separate locations of outlets prevented a satisfactory decrease in the number of parts and assembling steps.

[0004] It is therefore amain object of the invention to make it easier to connect hoses or other passage members to a cooling water inlet and a plurality of outlets formed in the engine body, thereby facilitating the assembly of the engine and further reduce parts.

[0005] From the viewpoint of facilitating the assembly of the engine, a further object of the invention is to prevent a liquid packing from spoiling an elastic material packing when using the liquid packing as a seal member between the engine body and a thermostat cover in addition to the elastic material packing.

[0006] To accomplish the main object, the invention provides an engine having a cooling water inlet/outlet cover provided on and affixed to one side surface of an engine body to cover cooling water inlet and outlet formed in the engine body, the cover including a first cover portion and a second cover portion, wherein the first cover portion covers the inlet and defines an inflow path communicating with a thermostat-type path opening/closing mechanism to introduce cooling water from a radiator, and the second cover portion covers the outlet, characterized in that the outlet including a first outlet and a second outlet, and the second cover portion is formed with a first outflow path which guides cooling water from the first outlet to the radiator, and a second outflow path which is partitioned from the first outflow path by a partition wall and guides cooling water from the second outlet to a heat exchanger.

[0007] This configuration of the invention provides the following effects. That is, since the portion for connecting hoses or other passage members for connecting the inlet and the outlets to the radiator and the heat exchanger are formed in the cooling water inlet/outlet cover that is a unitary member, and they are locally formed on one side surface of the engine body, it is easier to connect the respective passage members for guiding cooling water, improve the readiness of the work therefor and the readiness of assembly of the engine. Furthermore, the configuration of the invention need not prepare special elements for supplying cooling water to the heat exchanger, such as joints, it reduces the number of parts and assembling steps related to the joints, for example. This is also advantageous for facilitating assembly of the engine.

[0008] The second outflow path may include a connecting portion for guiding cooling water from the second outlet to a throttle body.

[0009] Along opposed mount surfaces of the engine body and the cooling water inlet/outlet cover, the interface between the engine body and one of the first and second cover portions may be sealed by an elastic material packing, and the interface between the engine body and the other of the first and second cover portions may be sealed by a liquid packing. Additionally, at least one of a portion of the mount surface of the cooling water inlet/outlet cover positioned between a mount region of the elastic material packing or a mount-area-opposed region opposed to the mount region and a coating region of the liquid packing or a coating-area-opposed region opposed to the coating region may include a blocking portion which blocks intrusion of an extruded part of the liquid packing from the coating region into the mount region.

[0010] In this case, the following effects are provided. That is, when the liquid packing more advantageous in handling and cost is used in addition to the elastic material packing for sealing the interface between the cooling water inlet/outlet cover and the engine body upon affixing the cooling water inlet/outlet cover to the engine body, a part of the liquid packing extruding from the coating region and moving toward the elastic material packing is prevented from reaching the elastic material packing. Therefore, the elastic material packing is never spoiled by the extruded part of the liquid packing, and it is prevented from degrading in sealing property. The blocking portion may be a recess such as a groove.

[0011] The first cover portion and the second cover portion may be connected by a connecting element.

[0012] Details of the invention will be more clearly understood from the following explanation with reference to the drawings, in which:

Fig. 1 is a rough perspective view of an engine as an embodiment of the invention;
Fig. 2 is a schematic diagram that shows a cooling system of the engine shown in Fig. 1;
Fig. 3 is a left side elevational view of a cylinder head of the engine shown in Fig. 1;
Fig. 4 is a horizontal cross-sectional view of the substantial part of a left end portion of the cylinder head with a cooling water inlet/outlet cover being attached thereto in the engine shown in Fig. 1; and
Fig. 5 is a diagram taken along the V-V line of Fig. 4.

[0013] With reference to Fig. 1 through 5, an embodiment of the invention will be described below.

[0014] Referring to Fig. 1, the engine E to which the invention is applied is a head-top camshaft type water-cooled four-valve four-cycle engine to be borne in a vehicle. The engine E includes a cylinder block 1 with an inline arrangement of four cylinders 5 (see Fig. 2), a cylinder head 2 coupled to the top end of the cylinder block 1, a head cover 3 coupled to the top end of the cylinder head 2, and an oil pan 4 coupled to the bottom end of the cylinder block 1. The cylinder block 1, cylinder head 2, head cover 3 and oil pan 4 make up the engine body of the engine E.

[0015] In the explanation given below, front, rear, left and right directions are those directions with reference to the vehicle.

[0016] On the front face of the cylinder head 2, a suction manifold 6 is affixed. The suction manifold 6 includes a collecting tube 6a located just above the head cover 3 and having a throttle body 7 at the left end thereof, and four branch tubes 6b branching from the collecting tube 6a and connected to the front face of the cylinder head 2. Each branch tube 6b communicates with a combustion chamber 8 (see Fig. 2) of each cylinder 5 via a suction port formed in the cylinder head 2. A discharge manifold, not shown, is affixed to the rear surface of the cylinder head 2.

[0017] Mainly referring to Fig. 2, the cooling system of the engine E is next explained. The cylinder block 1 having formed a cooling water jacket 11 includes a cooling water pump 13 having a pump body 13a (see Fig. 1) integrally formed at a right-end front portion thereof. The cylinder head 2 having formed a cooling water jacket 12 accommodates a thermostat 15 in an accommodation chamber 14 formed at a left end portion that is one end portion in the alignment direction of the cylinders 5 (in this example, it corresponds to the left-and-right direction). Both cooling water jackets 11, 12 communicate through a large number of communication paths 16 formed in the cylinder head 2.

[0018] On the left end surface that is one side surface of the cylinder head 2, a cooling water inlet/outlet cover C having an inflow path 20 and two outflow paths 21, 22 is affixed. The accommodation chamber 14 accommodating the thermostat 15 communicates with a radiator 25 through the inflow path 20 and a radiator hose 23. A path 26 formed in the cylinder head 2 also communicates with the radiator 25 via the outflow path 21 and a radiator hose 24. The cooling water jacket 12 communicates with an air-conditioning heater core 29 as a heat exchanger through the outflow path 22 and a hose 27, and communicates with a cooling water path formed in the throttle body 7 as a heat exchanger via the outflow path 22 and a hose 30. An inlet 32 formed in the cylinder head 2 and an opening 33 formed in a pipe 38, explained later, communicate with the air-conditioning heater core 29 and the cooling water path of the throttle body 7 via a hose 28 and a hose 31, respectively. The hoses 23, 24, 27, 28, 30 and 31 are cooling water passage elements.

[0019] The cooling water released from the cooling water pump 13 runs through a release path 34 formed in the cylinder block and enters into the cooling water jacket 12 from an inlet 35 formed in the cylinder head 2. A known thermostat-type path opening/closing mechanism 15 is configured to shut the communication between the radiator hose 23 and the accommodating chamber 14 under a cold state of the engine E. Under such a cold state of the engine E, as shown by broken lines in Fig. 2, almost no cooling water flows into the cooling water jacket 11 through the communication path 16, and instead, the cooling water in the cooling water jacket 12 flows into the accommodating chamber 14 through a bypass 36 formed in the cylinder head 2. At the same time, a part of the cooling water is supplied through the hose 27 to the heater core 29 for heat exchange with air for warming the compartment, and thereafter returns to the accommodating chamber 141 through the hose 28 and the inlet 32. Another part of the cooling water in the cooling water jacket 12 is supplied to the throttle body 7 through the hose 30 for heating the throttle body 7 at a low temperature, and thereafter flows into a pipe 38 via the hose 31. Since the cooling water in the accommodating chamber 14 is suctioned by the cooling pump 13 through the pipe 38 connected to the outlet 37 formed in the cylinder head 2 to open into the accommodating chamber 14, the cooling water circulates in the cooling water jacket 12 without flowing in or through the radiator 25 in the cold state.

[0020] In the hot state of the engine E, the thermostat-type path opening/closing mechanism 15 functions to make communication between the radiator hose 23 and the accommodating chamber 14 and simultaneously close the bypass 36. Therefore, the cooling water in the cooling water jacket 12 does not flow into the accommodating chamber 14 through the bypass 36. Instead, as shown by solid lines in Fig. 2, it flows into the cooling water jacket 11 through the communication path 16 to cool the cylinder block 1, thereafter flows into the radiator 25 through a path 39 formed in the cylinder block 1, path 26 of the cylinder head 2 and radiator hose 24, where it is cooled by heat radiation, and flows into the accommodating chamber 14 through the radiator hose 23, inflow path 20 and thermostat 15. In this process, similarly to the cold states a part of the cooling water in the cooling water jacket 12 is supplied to the heater core 29 through the hose 27, and cooling water after heat exchange returns to the accommodating chamber 14 through the hose 28. The cooling water supplied to the throttle body 7 is controlled in quantity of flow by a control valve (not shown) to prevent the throttle body 7 from overheat. The cooling water in the accommodating chamber 14 is suctioned by the cooling water pump 13 through the outlet 37 and the pipe 38, and in the hot state, cooling water running through the radiator 25 circulates in both cooling water jackets 11, 12.

[0021] Next referring to Figs. 1 and 3 through 5, the left end portion of the cylinder head 2 and the cooling water inlet/outlet cover C will be further explained below. Referring to Figs. 3 and 4, a mount surface 40 for affixing the cooling water inlet/outlet cover C is formed on the left end surface of the cylinder head 2. The accommodating chamber 14 in form of a cavity formed in the left end portion of the cylinder head 2 is located in a lower position nearer to the suction end (forward) than a cylindrical projection 41 defining an opening 41a (Fig. 3) along the axial extension of the cam shaft, and defines an approximately circular inlet 42 opening to the mount surface 40. Along the circumferential portion of the inlet 42, an annular step portion 43 for receiving an annular hold portion 15a of the thermostat-type path opening/closing mechanism 15 is formed so as to tightly hold the hold portion 15a of the thermostat-type path opening/closing mechanism 15 between the step portion 43 and the cooling water inlet/outlet cover C. Thus the thermostat-type path opening/closing mechanism 15 is fixed to the cylinder head 2 at the position aligned with the inlet 42.

[0022] Along the outer circumferential portion of the step 43, an annular step portion 44 shallower than the step 43 is formed such that an O-ring or other type of annular elastic material packing 46 of synthetic rubber or synthetic resin is mounted in an annular groove 45 formed between the step portion 44 and the outer circumference of the hold portion 15a. This groove 45 provides a mount region 47 for the elastic material packing 46 on the mount surface 40.

[0023] The path 26 located nearer to the discharge side (rear side) than the accommodating chamber 14 via a partition surface 48 has an outlet 49 that opens to the mount surface 40. The partition wall 48 has formed a bolt hole H2 that opens at a lower position of the partition surface 40a as one of four bolt holes H1 through H4 for receiving four bolts B (see Fig. 1) to fix the cooling water inlet/outlet cover C to the cylinder head 2. Reference numeral 50 denotes a communication hole for releasing air dwelling in the cooling water jacket 12.

[0024] In the mount surface 40, an outlet 52 of the cooling water jacket 12 opens nearer to the discharge side than the outlet 49. The outlet 52 and the outlet 49 are located at opposite sides of a partition surface 40b (apart of the mount surface 40) of a partition wall 51 extending between the cooling water jacket 12 and the outlet 49. There is further formed a mount hole 53 for mounting a water temperature sensor that detects the temperature of cooling water at the outlet 52, which opens from the rear surface of the cylinder head 2 to the outlet 52.

[0025] Still in the mount surface 40, there is provided a non-circular, annular coating region 55 around the outlets 49, 52 excluding the partition surface 40b, on which liquid packing 54 (shown in Fig. 3 by hatching) of, for example, a silicone material that is a FIPG sealing material. Therefore, the partition surface 40a is a part of the mount surface 40 located between the mount region 47 and the coating region 55.

[0026] On the other hand, referring to Figs. 1, 4 and 5, the cooling water inlet/outlet cover C affixed to the mount surface 40 is made by casting as an integral member of an aluminum alloy, which includes a first cover portion C1 that forms an accommodating chamber 61 for accommodating a part of the thermostat-type path opening/closing mechanism 15 and covers the thermostat-type path opening/closing mechanism 15 and the inlet 42, and a second cover portion C2 that covers two outlets 49, 52. The cooling water inlet/outlet cover C has further formed four insertion holes H5 through H8 for receiving four bolts B to fix the cooling water inlet/outlet cover C to the cylinder head 2.

[0027] The first cover portion C1 has formed a connecting portion 62 for connection of the radiator hose 23, an inflow path 20 communicating with the radiator hose 23 to introduce and guide the cooling water cooled by the radiator 25 to the accommodating chamber 61 and further to the inlet 42, and a mount hole 64 for receiving a temperature switch 63 (see Fig. 1) that detects the temperature of the cooling water from the radiator 25 to control the motion of the radiator fan in response to the temperature of the cooling water.

[0028] The second cover portion C2 has formed a connecting portion 65 located near the first cover portion C1 for connection of the radiator hose 24 (see Fig. 2), a connecting portion 66 located nearer to the discharge side than the connecting portion 65 for connection of the hose 27 (see Fig. 2), and a connecting portion 67 for connection of the hose 30 (see Fig. 2). Furthermore, the second cover portion C2 has formed an outflow path 21 having an entrance 21a approximately aligned with the outlet 52 and communicating with the radiator hose 24 (see Fig. 2) to guide the cooling water out of the outlet 49 to the radiator 25, and an outflow path 22 having an entrance 22a substantially aligned with the outlet 52 and communicating with both hoses 27, 30 to guide the cooling water out of the outlet 52 to the heater core 29 and the throttle body 7. The outflow path 21 and the outflow path 22 are partitioned by the partition wall 68.

[0029] The cooling water inlet/outlet cover C has a mount surface 60 for mating the mount surface 40 of the cylinder head 2. The mount surface 60 includes a mount-area-opposed region 69 (Fig. 5) that is a region opposed to the groove 45, i.e. the mount region 47, including a contact surface for contact with the elastic material packing 46. The mount-area-opposed region 69 is a region mating the mount region 47 when the cooling water inlet/outlet cover C is normally coupled to the cylinder head 2 along the circumferential portion of the circular outlet 61 of the accommodating chamber 61 opening to the mount surface 60 in substantial alignment with the inlet 42. The mount surface 60 further has a bonding-area-opposed surface 70 that is a region opposed to the coating region 55. This coating-area-opposed region 70 is located around both entrances 21a, 22a opening to the mount surface 60 excluding the partition surface 60b that is a part of the mount surface 60 of the partition wall 68.

[0030] In a location between the mount-area-opposed region 69 and the coating-area-opposed region 70, a reservoir portion 71 of the liquid packing 54 in form of a groove or other type of recess is formed in the partition surface 60a that is the part of the mount surface 60 opposed to the partition surface 40a. The reservoir portion 71 extends from just above the insertion hole H6 in alignment with the bolthole H2 in a lower position of the partition surface 60a to near the top end of the partition surface 60a. The reservoir portion 71 holds a part of the liquid packing 54 overflowing from the coating region 55 and moving toward the elastic material packing 46 when the cooling water inlet/outlet cover C is mounted and fastened to the mount surface 40 of the cylinder head 2 with bolts B, so as to prevent intrusion of the packing 54 into the mount region 47, thereby to prevent the packing 54 from befouling the elastic material packing 46 or entering into the groove 45. The groove shape of the reservoir portion 71 may be adequately determined taking account the range and quantity of extrusion of the liquid packing 54. In this embodiment, considering that the fastening force of the bolt B presses the surrounding portion of the insertion hole H6 against the mount surface 40 of the cylinder head 2 with a pressing force enough to prevent movement of the liquid packing 54, the reservoir portion 71 is formed in the area excluding the surrounding portion of the insertion hole H2.

[0031] As shown in Fig. 1, the cooling water inlet/outlet cover C has a connecting element 72 connecting the first cover portion C1 and the second cover portion C2. The connecting element 72 reinforces the first and second cover portions C1, C2 formed to cylindrically project. At the same time, upon casting the cooling water inlet/outlet cover C, the connecting element 72 serves to make smooth flow of the molten metal into dies used to mold the first cover portion C1 and the second cover portion C2.

[0032] Next explained are operations and effects of the embodiment having the above-explained configuration.

[0033] On the part of the first cover portion C1 of the cooling water inlet/outlet cover C that is an integral member including the first and second cover portions C1, C2, the radiator hose 23 is connected to the connecting portion 62 to make up the inflow path 20 for introducing cooling water from the radiator 25 to the inlet 42 where the thermostat-type path opening/closing mechanism 15 is located. On the part of the second cover C2, the radiator hose 24 is connected to the connecting portion 65 to make up the outflow path 21 for releasing the cooling water from the outlet 49 to the radiator 25 and the outflow path 22 adjacent to and partitioned from the outflow path 21 by the partition wall 68 to guide the cooling water from the outlet 52 to the heater core 29 and the throttle body 7 in conjunction with the hoses 27, 30 connected to the connecting portions 66, 67. Therefore, the connecting portions 62, 65, 66, 67 connected to the hoses 23, 24, 27 30 for connecting the inlet 42 and both outlets 21, 22 to the radiators 25, heater core 29 and throttle body 7 are formed in the cooling water inlet/outlet cover C that is a unitary member. At the same time, the connecting portions 62, 65, 66, 67 are concentrated on the left end surface of the cylinder head 2. As a result, connection of the hoses 23, 24, 27, 30 for the cooling water to flow through is facilitated to improve the working efficiency therefor and hence improve the assembling work of the engine E. Moreover, unlike the conventional technique, the embodiment does not need to prepare any additional member such as joints heretofore required to supply cooling water to the heater core 29 and the throttle body 7. Thus the embodiment reduces parts, hence reduces the assembling steps related to the joints, etc., and improves the assembling efficiency of the engine E from this viewpoint as well.

[0034] For the sealing between the cooling water inlet/outlet cover C and the cylinder head 2, the embodiment uses the liquid packing 54 easier to handle and lower in cost than the elastic material packing 46 in addition to the elastic material packing 46. However, when the cooling water inlet/outlet cover C is mounted to the cylinder head 2, a part of the liquid packing 54 extruding from the coating region 55 and moving toward the elastic material packing 46 is held in the reservoir portion 71 formed in a portion of the mount surface 60 of the cooling water inlet/outlet cover C between the mount-area-opposed region 69 opposed to the mount region 47 of the elastic material packing 46 and the coating-area-opposed region 70 opposed to the coating region 55 of the liquid packing 54. Therefore, the embodiment prevents intrusion of the elastic material packing 46 from intruding into the mount region 47, thereby prevents the extruded part of the liquid packing 54 from befouling the elastic material packing 46 and prevents deterioration of the sealing effect of the elastic material packing 46 due to stains of the liquid packing 54.

[0035] Furthermore, since both the outflow paths 21, 22 are paths of cooling water flowing out of the cylinder head 2, the liquid packing 54 is coated on the coating region 55 that surrounds both outflow paths 21, 22 altogether, excluding the partition surface 40b to permit cooling water to slightly leak between the paths along the mount surfaces 40, 60. Therefore, the coating region 55 is narrower, the time required for coating is shorter, and the productivity of the engine E is improved. If the leakage of cooling water between the paths 21, 22 exceeds an allowable value, the partition surface 40b will also need a seal. In this case, however, since the liquid packing 54 is used, it is sufficient to coat the liquid packing 54 also on the partition surface 40b. Therefore, it is easy to change the design for limit the leakage of cooling water between the paths 21, 22 within the allowable value without inviting a significant increase of the cost.

[0036] Since the embodiment seals the connection between the inlet 42 and the inflow path 20 and the connection between the outlets 49, 52 and the outflow paths 21, 22, respectively, by using the elastic material packing 46 and the liquid packing 54, the embodiment can reduce the cost of the engine E from that of a model using the elastic material packing 46 alone, which needs the cost of the elastic material packing 46 and the cost for more accurate machining to ensure better sealing.

[0037] Since the thermostat-type path opening/closing mechanism 15 is disposed, the elastic material packing 46 may be an annular packing encircling the circular inlet 42 and outlet 61a. Therefore, its cost is lower than the non-circular, annular elastic material packing used in a model in which the elastic material packing is provided around the outlets 49, 52, and the cost of the engine E is reduced.

[0038] The connecting element 72 between the first cover portion C1 and the second cover portion C2 not only reinforces the first and second covers projecting in a cylindrical form, but also makes it easier to cast the cooling water inlet/outlet cover C because molten metal flows to dies for the first cover portion C1 and the second cover portion C2 through the die for the connecting element 72.

[0039] Next, modifications in part of the foregoing embodiment will be described.

[0040] The heat exchanging mechanism supplied with cooling water from the outflow paths 21, 22 may be made up of the heater core 29 or the throttle body 7 alone.

[0041] At least one of the mount region and the coating region may be formed on the mount surface 60 of the cooling water inlet/outlet cover C, and at least one of the mount-area-opposed region and the coating-area-opposed region may be formed on the mount surface 40 of the cylinder head 2. It is also possible to seal the connection between the first cover portion C1 and the cylinder head 2 with a liquid packing and to seal the connection between the second cover portion C2 and the cylinder head 2 with an elastic material packing.

[0042] The reservoir portion may be formed in the partition surface 40a that is the mount surface 40 of the cylinder head 2, instead of the partition surface 60a of the mount surface 60 of the cooling water inlet/outlet cover C. Alternatively, it may be formed in both mount surfaces 40, 60 of the partition surface 60a of the cooling water inlet/outlet cover C and the partition surface 40a of the cylinder head 2. For the purpose of raising the surface pressure instead of using the groove holding an extruded part of the liquid packing 54 to interrupt the movement of the liquid packing 54 toward the mount region 47, a bead may be provided on the partition surface 60a to slightly rise from the mount surface 60, or on the partition surface 40a to slightly rise from the mount surface 40.

[0043] Although the foregoing embodiment locates the thermostat-type path opening/closing mechanism 15 to extend through the inlet 42 and lie over the accommodating chamber 14 of the cylinder head 2 and the accommodating chamber 61 of the cooling water inlet/outlet cover C, the entirety of the thermostat may be accommodated in an accommodating chamber defined by the cylinder head 2 alone, or in an accommodating chamber defined by the cooling water inlet/outlet cover alone. The thermostat-type path opening/closing cover may be provided in the cylinder block.

[0044] A cooling water inlet/outlet cover affixed to a side surface of a cylinder head 2 of an engine E includes a first cover portion C1 and a second cover portion C2. The first cover portion C1 defines an inflow path 20 for introducing cooling water from a radiator 25 to an inlet 42 communicating with a thermostat-type path opening/closing mechanism 15. The second cover portion C2 defines an outflow path 21 for guiding cooling water from the outlet 49 to a radiator 25 and an outflow path 22 partitioned from the outflow path 21 by the partition wall 68 to guide cooling water from the outlet 52 to a heater core 29 and a throttle body 7. The cooling water inlet/outlet cover C further includes a reservoir portion 71 for holding an extruded part of a liquid packing 54 to be coated around the outlets 49, 52 to prevent the extruded part of the liquid packing 54 from spoiling an elastic material packing 46. This configuration contributes to facilitating connection of hoses to the cooling water inlet and outlets formed in the engine body, thereby facilitating assembly of the engine, and further reducing the number of parts.

Claims

1. An engine having a cooling water inlet/outlet cover (C) provided on and affixed to one side surface of an engine body (2) to cover cooling water inlet and outlet formed in the engine body, said cover (C) in-

cluding a first cover portion (C1) and a second cover portion (C2), wherein said first cover portion (C1) covers said inlet and defines an inflow path communicating with a thermostat-type path opening/closing mechanism (15) to introduce cooling water from a radiator (25), and said second cover portion (C2) covers said outlet, **characterized in that**:

said outlet includes a first outlet (49) and a second outlet (52), and said second cover portion (C2) is formed with a first outflow path (21) which guides cooling water from said first outlet (49) to said radiator (25), and a second outflow path (22) which is partitioned from said first outflow path (21) by a partition wall (68) and guides cooling water from said second outlet (52) to a heat exchanger (29).

2. An engine according to claim 1 wherein said second outflow path (22) includes a connecting portion (67) which guides cooling water from said second outlet (52) to a throttle body (7).

3. An engine according to claim 1 or 2 wherein, along opposed mount surfaces (40, 60) of said engine body (2) and said cooling water inlet/outlet cover (C), an interface between said engine body (2) and one of said first and second cover portions (C1, C2) is sealed by an elastic material packing (46) while an interface between said engine body (2) and the other of said first and second cover portions (C1, C2) is sealed by a liquid packing (54), and at least one of a portion of said mount surface (60) of said cooling water inlet/outlet cover (C) positioned between a mount region (47) of said elastic material packing (46) or a mount-area-opposed region (69) opposed to said mount region (47) and a coating region (55) of said liquid packing (54) or a coating-area-opposed region (70) opposed to said coating region (55) includes a blocking portion (71) which blocks intrusion of an extruded part of said liquid packing (54) from said coating region (55) into said mount region (47).

4. An engine according to claim 3 wherein said blocking portion (71) is a recess.

5. An engine according to claim 4 wherein said recess is a groove.

6. An engine according to claim 1 or 3 wherein said first cover portion (C1) and said second cover portion (C2) are connected by a connecting element (72).

Fig.1

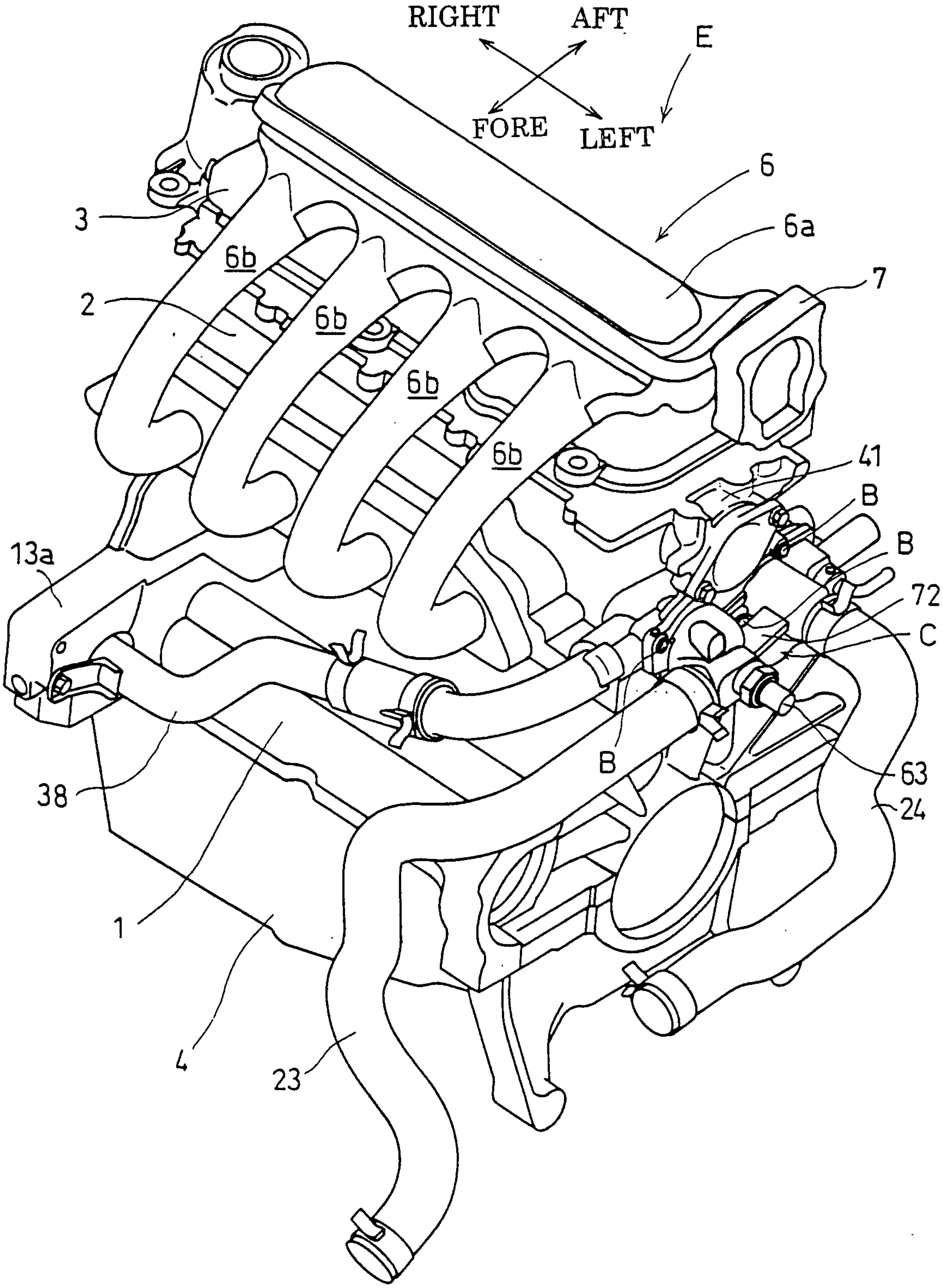

RIGHT
AFT
FORE
LEFT
E
6
6a
7
3
6b
2
6b
6b
6b
41
B
B
72
13a
C
B
63
38
24
1
4
23

Fig.2

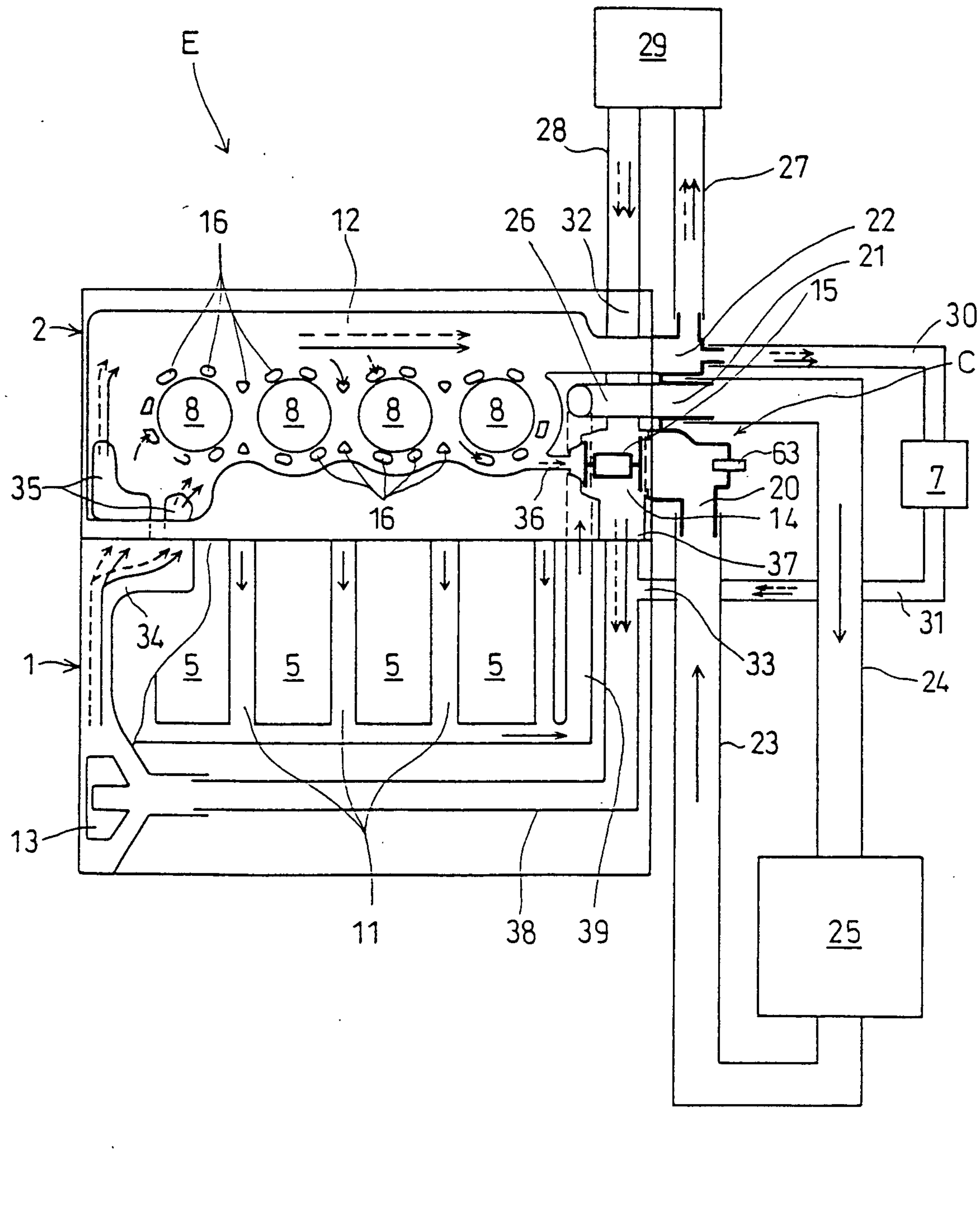

E
29
28
27
16
12
26
32
22
21
15
30
2
C
8
8
8
8
63
7
35
16
36
20
14
37
34
31
33
24
1
5
5
5
5
23
13
25
11
38
39

Fig.3

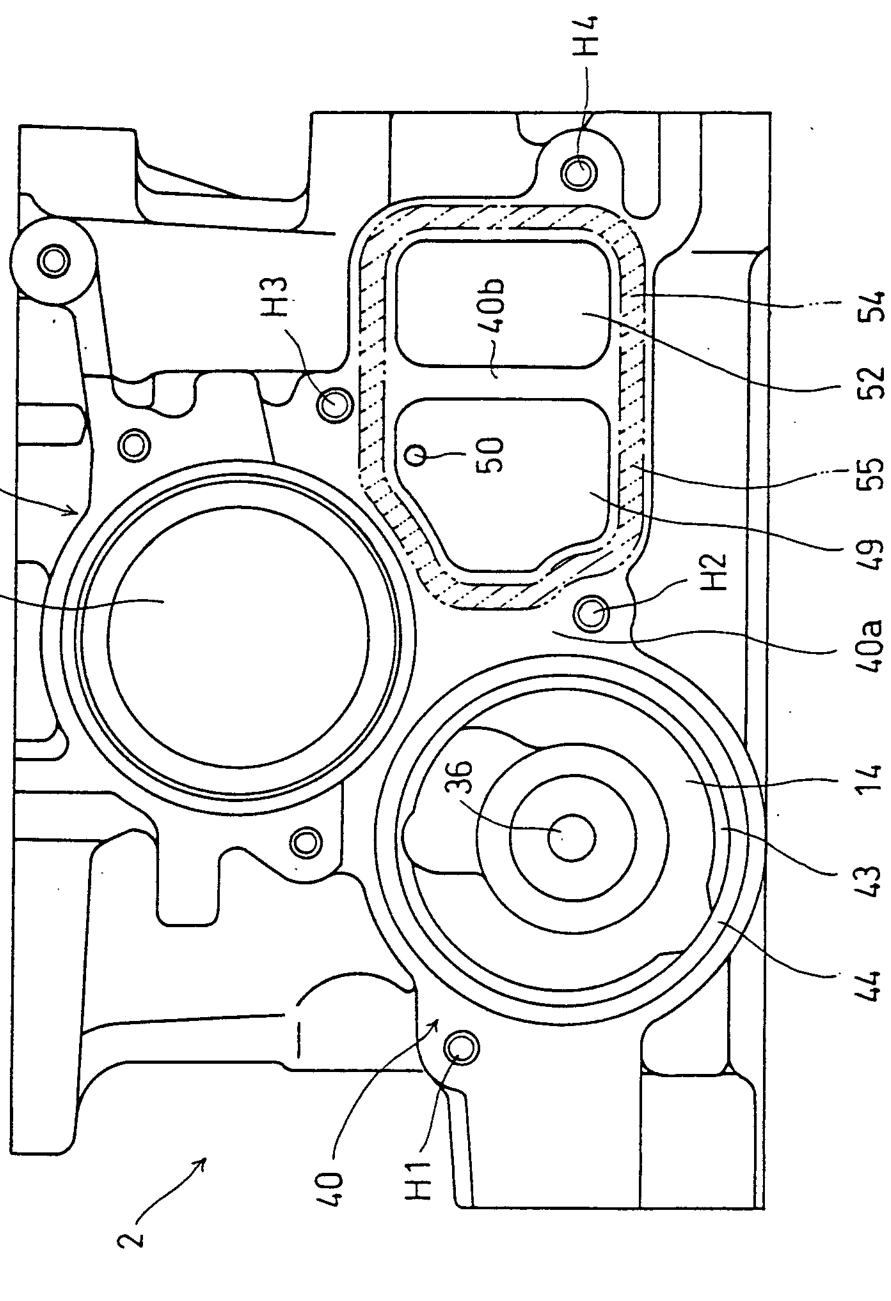
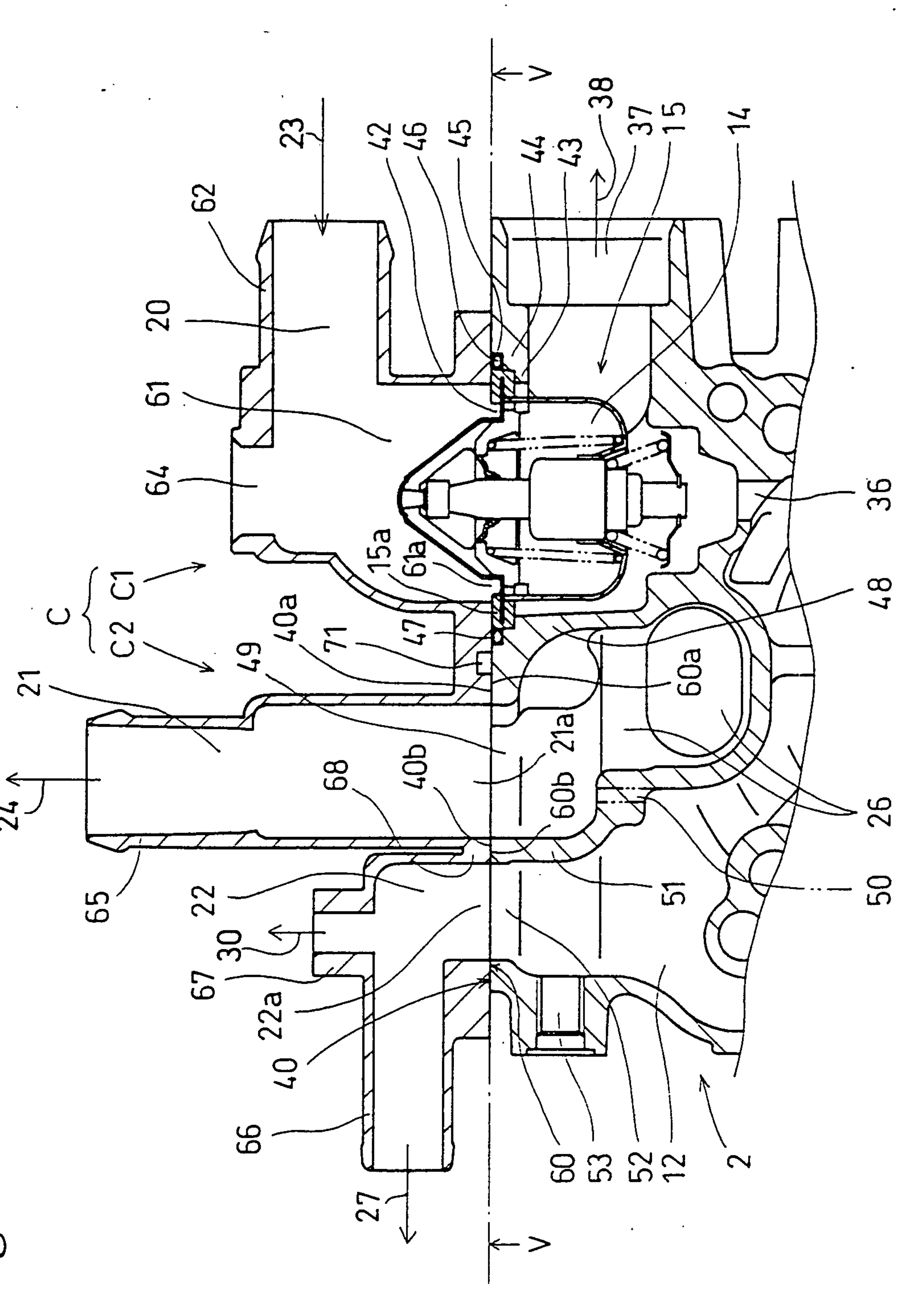


Fig.4


V
V
23
62
20
61
64
42
46
45
44
43
38
37
15
14
36
48
60a
15a
61a
C
C1
C2
21
40a
71
47
49
21a
24
68
40b
60b
26
51
50
65
22
30
67
22a
40
66
27
60
53
52
12
2

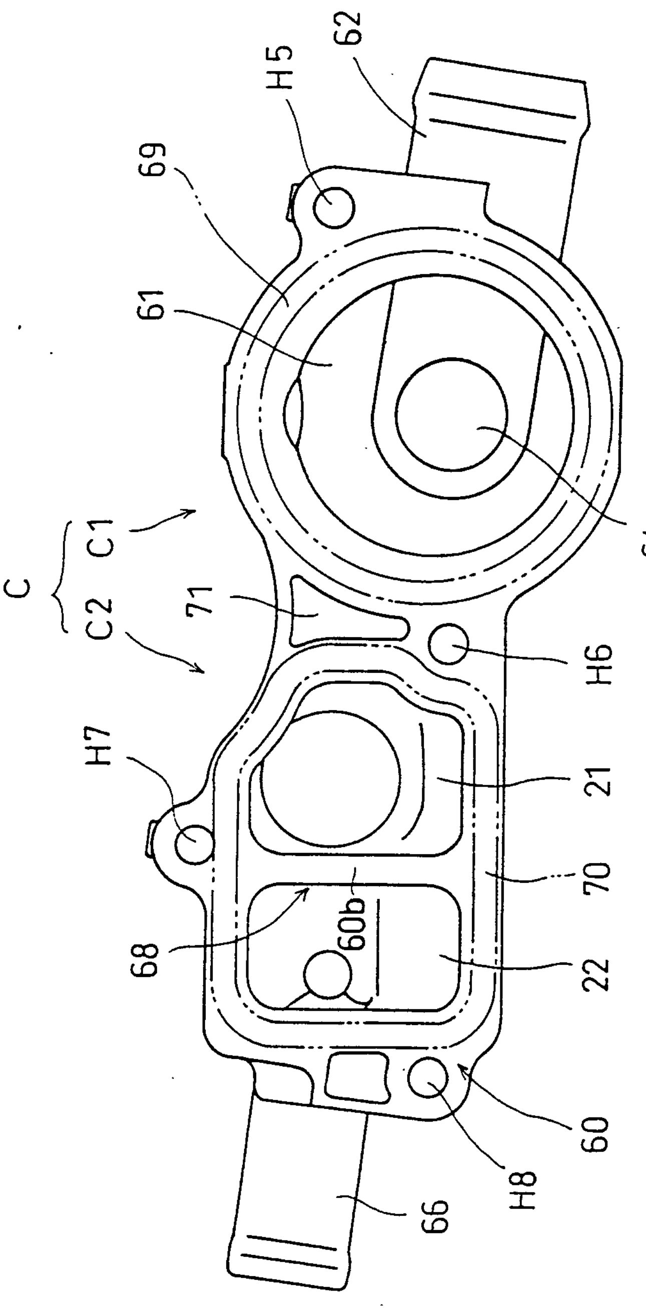


Fig.5