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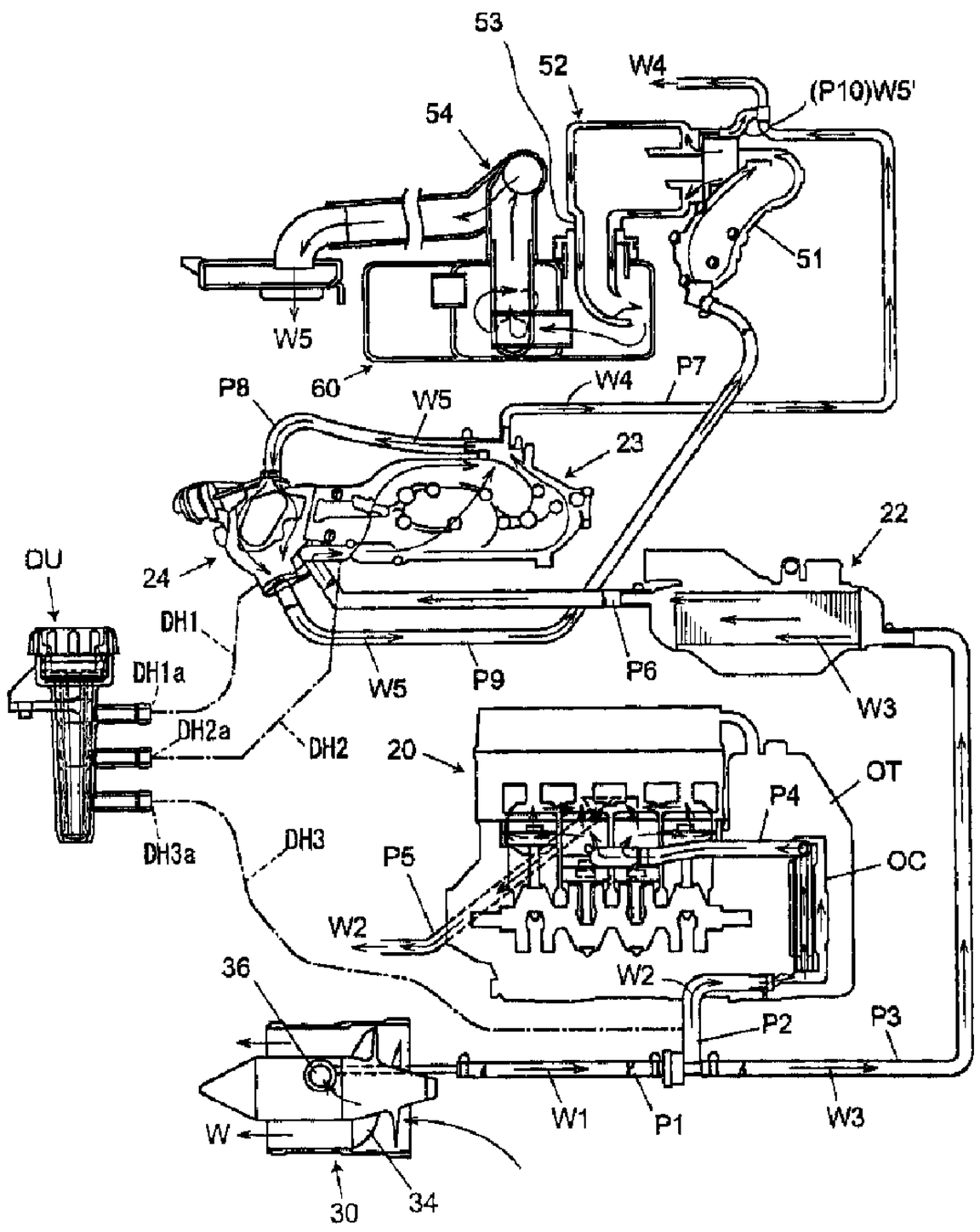

(57) Abrégé/Abstract:
To provide a cooling system for a small vessel which can prevent corrosion or freezing in a water channel. Water outside the vessel is fed through a pump 30 and piping P1 or the like to a cooling object in the vessel and cools the same, and then is drained from

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(57) Abrégé(suite)/Abstract(continued):
the vessel. Drain hoses DH1 to 3 are connected to portions of the cooling object and piping where water tends to remain, and drain ports DH1a to 3a which are openable and closable are provided at the other ends of the drain hose. A single drain unit DU for opening and closing the drain port is provided at the drain port of the drain hose.

ABSTRACT OF THE DISCLOSURE

To provide a cooling system for a small vessel which can prevent corrosion or freezing in a water channel. Water outside the vessel is fed through a pump 30 and piping P1 or the like to a cooling object in the vessel and cools the same, and then is drained from the vessel. Drain hoses DH1 to 3 are connected to portions of the cooling object and piping where water tends to remain, and drain ports DH1a to 3a which are openable and closable are provided at the other ends of the drain hose. A single drain unit DU for opening and closing the drain port is provided at the drain port of the drain hose.

COOLING SYSTEM FOR A SMALL VESSEL

FIELD OF THE INVENTION

The present invention relates to a cooling system for a small vessel.

BACKGROUND OF THE INVENTION

In the related art, a cooling system for a small vessel is constructed in such a manner that water outside the vessel is fed through a jet pump and piping to a cooling object, which is a heat generating body such as an engine of the line, in the vessel and cools the same, and then is discharged outside the vessel (for example, JP-A-2001-98942 (P.2, left column, Figs. 1 to 6)

In the cooling system in the related art as described above, there was a problem in that when the small vessel is shored and stored, water may remain in portions of the cooling object or piping, and the portions having water remained may corrode, or in winter, the water may freeze.

An object of the present invention is to provide a cooling system for a small vessel which overcomes the problem described above and is capable of preventing water from remaining in a water channel.

SUMMARY OF THE INVENTION

In order to achieve the object described above, a cooling system for a small vessel according to the present invention is a cooling system for a small vessel in which water outside the vessel is fed through a pump and piping to a cooling object in the vessel and cools the same, and then is drained from the vessel, including a drain hose connected to portions of the

cooling object and piping where water tends to remain, and a drain port which is openable and closable provided at the other end of the drain hose.

The cooling system for a small vessel according to the present invention is constructed in such a manner that water outside the vessel is fed through a pump and piping to a cooling object in the vessel and cools the same, and then is drained from the vessel, including a drain hose connected to portions of the cooling object and piping where water tends to remain, and a drain port which is openable and closable provided at the other end of the drain hose. Therefore, according to the cooling system for a small vessel, when the small vessel is shored and stored, water in the portions of the cooling object or piping where water tends to remain may be drained by opening the drain port.

Therefore, corrosion or freezing in the water channel may be prevented.

A cooling system for a small vessel according to an aspect of the invention is a cooling system for a small vessel as stated above, characterized in that a plurality of drain hoses are provided and a single drain unit for opening and closing the drain port is provided at the drain port.

According to the cooling system for a small vessel of an aspect of the invention, in the cooling system for a small vessel according to the above, a plurality of drain hoses are provided, and a single drain unit for opening and closing the drain port is provided at the drain port. Therefore, water in the plurality of portions of the cooling object or piping where water tends to remain may be drained simultaneously by opening the plurality of draining port with the single drain unit.

Therefore, a trouble required for drainage at the plurality of portions may significantly be alleviated.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are shown in the drawings, wherein:

Fig. 1 is a side view showing an example of a small planing vessel employing an embodiment of a cooling system for a small vessel according to the present invention.

Fig. 2 is a plan view of the same.

Fig. 3 is a partly enlarged cross section (partly omitted cross section) showing mainly an engine 20 taken along the line III-III in Fig. 1.

Fig. 4 is a drawing of a coolant system showing a rout of a coolant.

Fig. 5 is an enlarged view of a drain unit DU.

Fig. 6 is a drawing showing a main body of the drain unit DU, in which (a) is a plan view, (b) is a front view, and (c) is a left side view.

Fig. 7 is a drawing showing a plug of the drain unit DU, in which (a) is a plan view and (b) is a front view partly in section.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, an embodiment of the present invention will be described.

Fig. 1 is a side view showing an example of a small planing vessel employing an embodiment of a cooling system for a small vessel according to the present invention. Fig. 2 is a plan view of the same.

As shown in these drawings (mainly in Fig. 1), a small planing vessel 10 is a saddle riding type small vessel in which a crew is able to sit on a seat 12 of a vessel body 11 and to operate while gripping a steering handle 13 with a throttle lever.

The vessel body 11 is a floating structure formed by joining a hull 14 and a deck 15 for defining a space 16 inside. In the space 16, an engine 20 is mounted on the hull 14, and a jet pump (jet propulsion pump) 30 as propulsion means driven by the engine 20 is mounted at the rear of the hull 14.

The jet pump 30 includes a channel 33 extending from a water intake 17 opening toward the bottom through a jet flow port 31 opening toward the rear end of the vessel body to a nozzle 32, and an impeller 34 disposed in the channel 33, and a shaft 35 of the impeller 34 is connected to a crankshaft 20a of the engine 20. Therefore, when the impeller 34 is rotated by the engine 20, water taken from the water intake 17 is injected from the jet flow port 31 through the nozzle 32, whereby the vessel body 11 is propelled. The number of rotation of the engine 20, that is, a propelling power generated by the jet pump 30, is controlled by rotating the throttle lever 13a (See Fig. 2) of the operating handle 13. The nozzle 32 is linked to the operating handle 13 via an operating wire, not shown, and rotated by operating the handle 13, whereby the direction of travel can be changed.

Fig. 3 is a partly enlarged cross section (partly omitted cross section) showing mainly the engine 20 taken along the line III-III in Fig. 1.

The engine 20 is a DOHC in-line four cylinder, dry-sump, four-cycle engine, and as shown in Fig. 1, a crankshaft 20a is disposed so as to extend along the fore-and-aft direction of the vessel body 11.

As shown in Fig. 3, a serge tank (intake chamber) 21 in communication with an intake port 20i and an intercooler 22 are connected on the left side of the engine 20 when viewed in the direction of travel of the vessel body 11, and an exhaust manifold 23 in communication with an exhaust port 20o is connected on the right side of the engine 20.

As shown in Fig. 1, a turbocharger (supercharger) 24 is disposed rearwardly of the engine 20, and an exhaust port of the exhaust manifold 23 is connected to a turbine section of the turbocharger 24, and the intercooler 22 is connected to the compressor section of the turbocharger 24.

As shown in Fig. 1, exhaust air that has rotated a turbine at the turbine section of the turbocharger 24 passes through a first exhaust pipe 51, a back-flow preventing chamber 52 for preventing water from flowing back (entering of water into the turbocharger 24 and so on) when rolled over, and a second exhaust pipe 53 into a water muffler 60. From the water

muffler 60, the exhaust air passes through an exhaust/drain pipe 54 and discharged into a water flow generated by the jet pump 30.

Fig. 4 is a drawing of a coolant system showing a route of the coolant.

As shown in the same figure, a coolant intake port 36 is provided on the jet pump 30 downstream from the impeller 34, so that part W1 of jet water flow W generated by the impeller 34 is taken through the intake port 34 and used as coolant W1. The coolant W1 is supplied to a water jacket of the cooling object (engine 20, intercooler 22, and so on) through a coolant pipe P1- connected to the intake port 34.

According to the embodiment, the coolant W1 from the coolant pipe P1 connected to the intake port 34 is branched into pipes P2 and P3.

A coolant W2 in one pipe P2, being fed to and cools an oil cooler OC stored in an oil tank OT provided on the front portion of the engine 20, and is fed to and cools a cylinder block and a cylinder head of the engine 20 via a pipe P4, and then is drained outside the vessel via a pipe P5.

A coolant W3 in the other pipe P3 is fed to and cools the intercooler 22, and then fed through the pipe P6 to and cools the exhaust manifold 23.

The coolant W3 which has cooled the exhaust manifold 23 is branched into the pipes P7 and P8 above the exhaust manifold 23.

One pipe P7 is connected to a pilot water nozzle, not shown, at the extremity thereof, and a coolant W4 flown to the pipe P7 is drained from the pilot water nozzle to the outside the vessel.

A coolant W5 flown to the other pipe P8 is fed to and cools the turbocharger 24, and is fed through the pipe P9 to and cools the first exhaust pipe 51, the back-flow preventing chamber 52, and the second exhaust pipe 53, and then is injected from the lower end of the second exhaust pipe 53 into and cools the water muffler 60, and simultaneously is joined with exhaust gas in the water muffler 60 and discharged through

the exhaust/drain pipe 54 into a water flow (outside the vessel) generated by the jet pump 30.

Part W5' of the coolant W5 which has cooled the first exhaust pipe 51 is flown through the pipe P10 and joined into the aforementioned pipe P7, and then drained from the vessel through the pilot water nozzle with the coolant W4.

For example, when storing the small vessel employing the cooling system as described above is shored and stored, there is a case where water remains in part of the cooling object (engine 20 or the like) or piping P. In addition, when the small vessel is used on the ocean, it is necessary to feed fresh water into the cooling object and piping P to wash sea water off. For example, it is necessary to flow running tap water from the pipe P5 backward and wash the interior of the cooling object and piping P. However, in such a case, there is a case where water remains in part of the cooling object or the piping P.

When remaining water is left as it stands, portions having water remained may corrode or, in winter, may freeze.

Therefore, in this embodiment, as shown in Fig. 4 by dashed lines, drain hoses DH1, DH2, DH3 are connected to the portions of the cooling object or piping where water tends to remain, and drain ports DH1a, DH2a, DH3a which are openable and closable are provided on the other ends (DH1a, DH2a, DH3a) of the drain hoses DH1, DH2, DH3.

In this embodiment, the drain hose DH1 is connected to the lower portion of the water jacket of the turbocharger 24, the drain hose DH2 is connected to the lower portion of the water jacket of the exhaust manifold 23, and the drain hose DH3 is connected to the coolant pipe P2 into the oil cooler OC.

In this embodiment, the drain ports DH1a, DH2a, DH3a are provided with a single drain unit DU for opening and closing the drain ports.

Fig. 5 is an enlarged view of the drain unit DU. Fig. 6 is a drawing showing a main body of the drain unit DU, in which (a) is a plan view, (b) is a front view, and (c) is a left side view. Fig. 7 is a drawing showing a plug of the drain unit DU, in which (a) is a plan view and (b) is a front view partly in section.

As shown in these figures, the drain unit DU is constructed of a main body 70 and a plug 80 to be inserted thereto and removed therefrom.

As shown in Fig. 5 and Fig. 6, the main body 70 includes a tapered cylindrical portion 70a and three connecting pipes 71, 72, 73 in communication with the cylindrical portion 70a. The cylindrical portion 70a and these three connecting pipes 71, 72, 73 are communicated at communication ports 71a, 72a, 73a, respectively. The aforementioned drain hoses DH1, DH2, DH3 are connected respectively to the connecting pipes 71, 72, 73, and consequently, the aforementioned communication ports 71a, 72a, and 73a construct the drain ports DH1a, DH2a, DH3a which are openable and closable.

A receiving port (fitting portion) 70b for the plug 80 is provided on top of the cylindrical portion 70a. The main body 70 is provided with a mounting portion 74 for being mounted to a suitable place of the vessel body 11.

As shown in Fig. 5 and Fig. 7, the plug 80 includes a cap portion 81 and a plug portion 82 formed integrally with the cap portion 81 downwardly thereof. The cap portion 81 includes a tab portion 81a and a fitting portion 81b to be fitted into the fitting portion 70b of the aforementioned main body 70. The plug portion 82 includes three ring-shaped sealing lips 83, 84, 85 and a sealing tip 86.

As shown in Fig. 5, when the plug 80 is tightly inserted into the body 70, the fitting portion 81b of the cap portion 81 is brought into intimate contact with the fitting portion 70b of the main body 70, and the sealing tip 86 of the plug portion 82 is brought into intimate contact with the lower inner surface of the main body 70, so that the entirety of the body 70 is tightly closed. Therefore, the drain ports DH1a, DH2a, DH3a of the

aforementioned drain hoses DH1, DH2, DH3 are also closed and furthermore, the drain port DH1a is isolated by the sealing lips 83 and 84, the drain port DH2a is isolated by the sealing lips 84 and 85, and the drain port DH3a is isolated by the sealing lip 85 and the sealing tip 86. Consequently, the drain ports DH1a, DH2a, DH3a and the main body 70 are suitably sealed.

Therefore, in a state in which the plug 80 is fitted to the main body 70, the state of water current in the aforementioned cooling system is suitably maintained.

On the other hand, when the small vessel is shored and stored, fresh water is fed to the interior of the cooling object and piping P to wash sea water off when necessary (for example, after being used on the ocean), and then the plug 80 is pulled out from the main body 70.

Accordingly, the aforementioned drain ports DH1a, DH2a, DH3a are opened, and water that tends to remain in part of the cooling object and piping P is drained out of the aforementioned cooling system through the drain hoses DH1, DH2, DH3 and the main body 70.

As described thus far, the cooling system for a small vessel is a cooling system for a small vessel in which water outside the vessel is fed through the jet pump 30 and piping P1 and the like to the cooling object in the vessel and cools the same, and then is drained from the vessel, including the drain hose DH1 and so on connected to portions of the cooling object and piping where water tends to remain, and the drain port DH1a and so on which is openable and closable provided at the other end of the drain hose DH1. Therefore, according to the cooling system for a small vessel, when the small vessel 10 is shored and stored, water in the portions of the aforementioned cooling object or piping where water tends to remain can be drained by opening the aforementioned drain port DH1a and so on. Therefore, corrosion or freezing in the water channel may be prevented.

Since the plurality of drain hoses are provided and the drain ports DH1a, DH2a, DH3a are provided with the single drain unit DU for opening and closing the drain ports DH1a, DH2a, DH3a, water in a plurality of portions

of the aforementioned cooling object or piping where water tends to remain may be drained simultaneously by opening the plurality of drain ports DH1a, DH2a, DH3a.

Therefore, a trouble required for draining at a plurality of locations is significantly alleviated.

Although an embodiment of the present invention has been described thus far, the present invention is not limited to the aforementioned embodiment, and various modification may be made within the scope of the present invention.

For example, while the drain hose DH1 is connected to the lower portion of the water jacket of the turbocharger 24, the drain hose DH2 is connected to the lower portion of the water jacket of the exhaust manifold 23, and the drain hose DH3 is connected to the coolant pipe P2 into the oil cooler OC in the aforementioned embodiment, the number of the drain hose and the connecting positions may be set as needed.

Although various preferred embodiments of the present invention have been described herein in detail, it will be appreciated by those skilled in the art, that variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A cooling system for a small watercraft in which water outside the watercraft is fed through a pump and piping to at least one cooling workpiece in a watercraft and cools the same, and then is drained from the watercraft, said cooling system comprising: a drain hose connected to at least one portion of the cooling workpiece or to said piping where water tends to remain, and a drain port, provided at the other end of the drain hose, comprising a valve which can be manually opened and closed to regulate fluid flow therethrough; wherein the valve comprises a hollow elongated main body and a plug which fits inside of said main body, said plug being manually removable from said main body to allow water to drain outwardly therefrom.

2. A cooling system for a small watercraft according to claim 1, wherein the cooling system comprises a plurality of drain hoses, and a single drain valve for opening and closing the drain port, each of said drain hoses being in fluid communication with said drain valve.

3. The cooling system for a small watercraft according to claim 2, wherein the main body includes a tapered cylindrical portion having a tapered bore formed therein, and a plurality of connecting pipes, each of the connecting pipes being integrally attached to the cylindrical portion and in fluid communication with the tapered bore of the main body.

4. The cooling system for a small watercraft according to claim 3, wherein the drain valve comprises three of said connecting pipes.

5. The cooling system for a small watercraft according to claim 3, wherein the drain valve further comprises a plug having a tapered portion which fits sealingly to the tapered bore of said main body.

6. A cooling system for a small watercraft in which water outside the watercraft is fed through a pump and piping to at least one cooling workpiece in a watercraft and cools the same, and then is drained from the watercraft, said cooling system comprising: a plurality of drain hoses having proximal ends respectively connected to portions of the cooling workpiece and to said piping in areas where water tends to remain, said drain hoses having distal ends remote from said proximal ends, and a drain port, provided at the distal ends of the drain hoses which can be manually opened and closed to regulate fluid flow therethrough; said drain port comprising a single drain valve for opening and closing the drain port; wherein the drain valve comprises a hollow elongated main body which includes a tapered cylindrical portion having a tapered bore formed therein, and a plurality of connecting pipes, each of the connecting pipes being integrally attached to the cylindrical portion, and in fluid communication with the tapered bore of the main body.

7. The cooling system for a small watercraft according to claim 6, wherein the drain valve comprises three of said connecting pipes.

8. The cooling system for a small watercraft according to claim 6, wherein the drain valve further comprises a plug having a tapered portion which fits scalingly into the tapered bore of said main body.

9. The cooling system for a email watercraft according to claim 8, wherein said plug comprises a central shaft and a plurality of ring-shaped sealing lips operatively attached to and extending outwardly from said central shaft and a handle attached to an end portion of said central shaft.

10. A cooling system for a small watercraft in which water outside the watercraft is fed through a pump and piping to at least one cooling workpiece in watercraft and cools the same, and then is drained from the watercraft, said cooling system comprising: a plurality of drain hoses connected to portions of

the cooling workpiece and to said piping in areas where water tends to remain, and a drain port, provided at the other ends of the drain hoses, which can be opened and closed to regulate fluid flow therethrough; said drain port comprising a single drain valve for opening and closing the drain port; wherein the drain valve comprises a main housing which includes a tapered cylindrical portion having tapered bore formed therein, and a plurality of connecting pipes, each of the connecting pipes being integrally attached to the main housing, and in fluid communication with the tapered bore of the main housing, and a single plug comprising a tapered portion which fits sealingly into the tapered bore of the main housing.

11. The cooling system of claim 10, wherein the main housing comprises a single outlet opening positioned at a lower end thereof and coincident with a longitudinal axis of the main housing.

12. The cooling system of claim 10, wherein the connecting pipes are arranged upon the main housing so as to extend in a direction normal to an axial direction of the housing.

13. The cooling system of claim 10, wherein the main housing comprises a single outlet opening positioned at a lower end thereof and coincident with a longitudinal axis of the main housing, wherein the connecting pipes are arranged upon the main housing so as to extend in a direction normal to the longitudinal axis of the housing and wherein the plug is provided with plural circumferentially extending lip positioned so as to be spaced apart in the longitudinal direction.

14. The cooling system of claim 10, wherein the plug comprises a connecting portion, end wherein the main housing comprises a portion which is shaped to operatively engage the connecting portion of the plug such that when the plug is received within the main body the connecting portion maintains the

plug in a sealed relationship within the main housing.

15. The cooling system of claim 1, wherein said main body of said valve comprises an elongaged cylindrical portion having a longitudinal axis, and a plurality of substantially parallel connecting pipes extending outwardly from said cylindrical portion, said connecting pipes being oriented substantially normal to the longitudinal axis of said cylindrical portion; and wherein said plug comprises a central shaft and a plurality of ring-shaped sealing lips operatively attached to and extending outwardly from said central shaft and a handle attached to an end portion of said central shaft.

Fig. 1

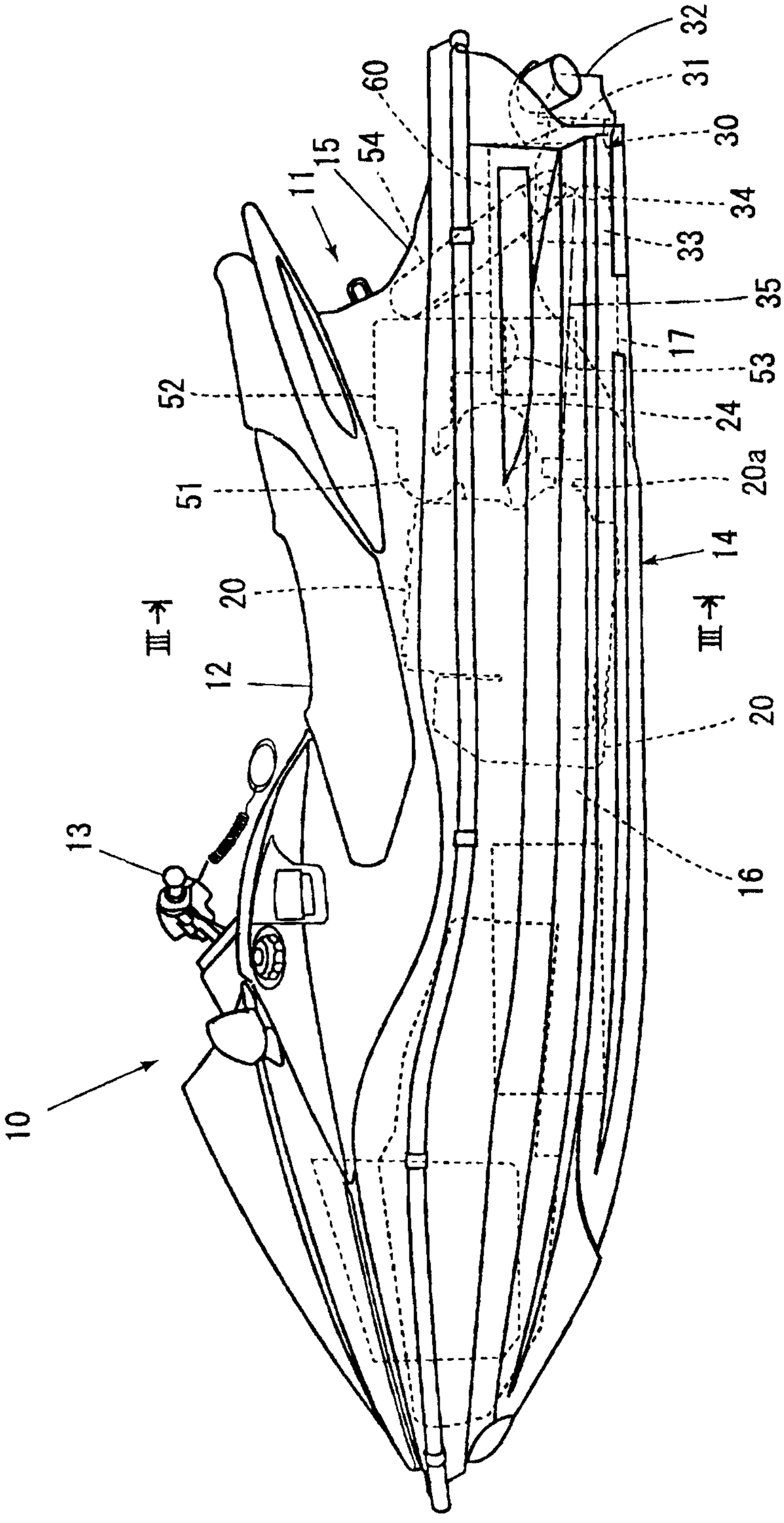
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Fig. 2

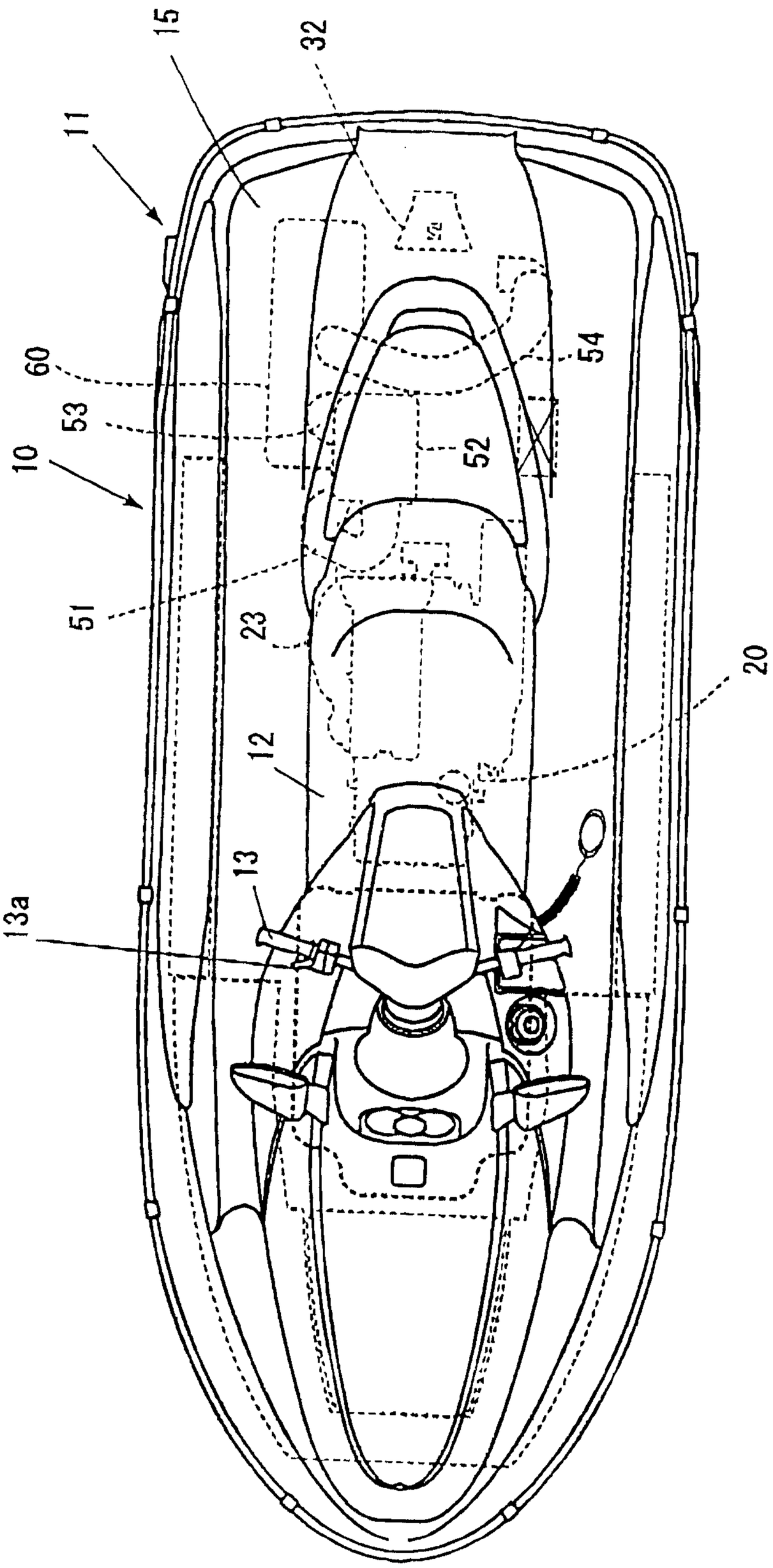

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Fig. 3

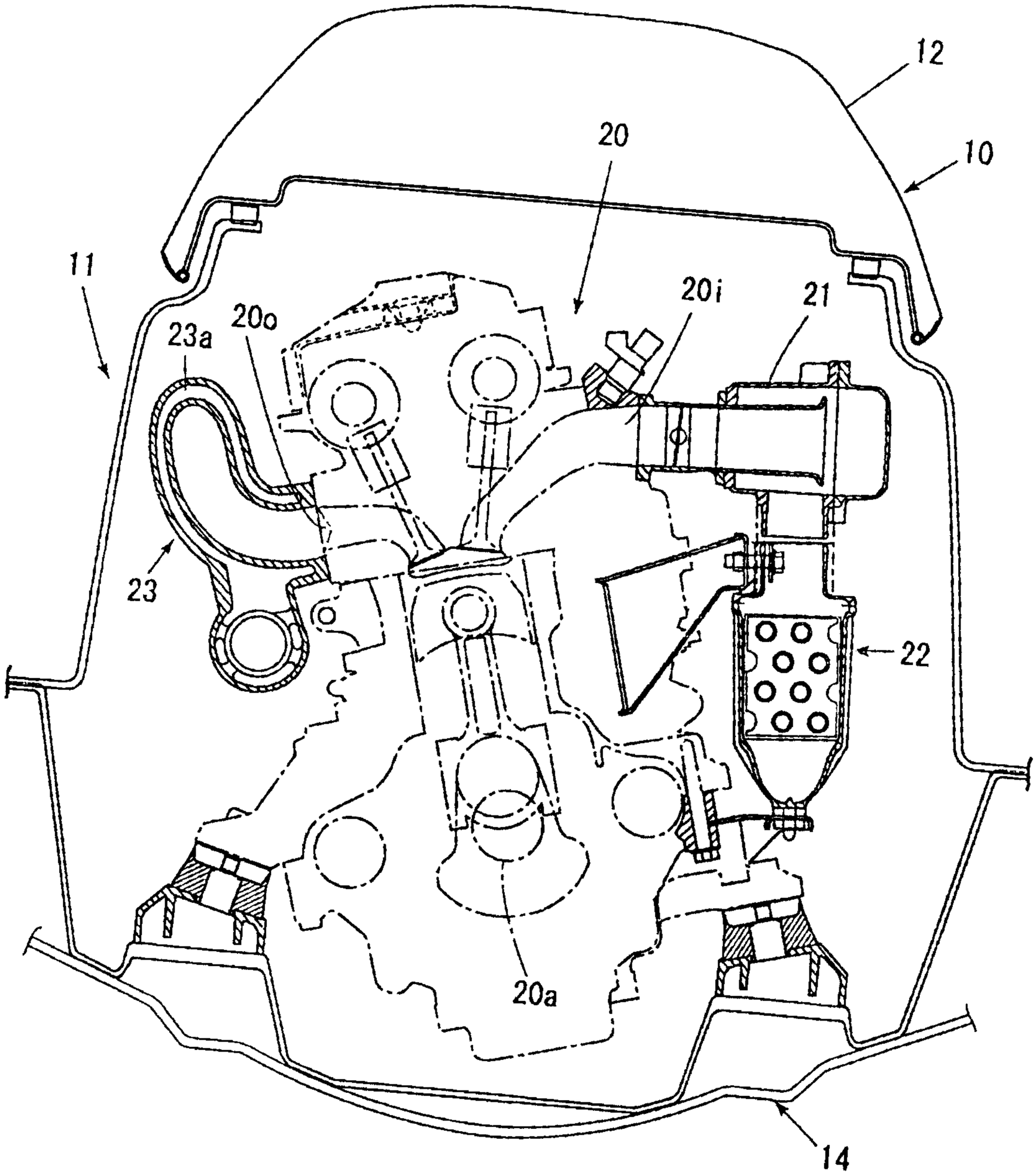
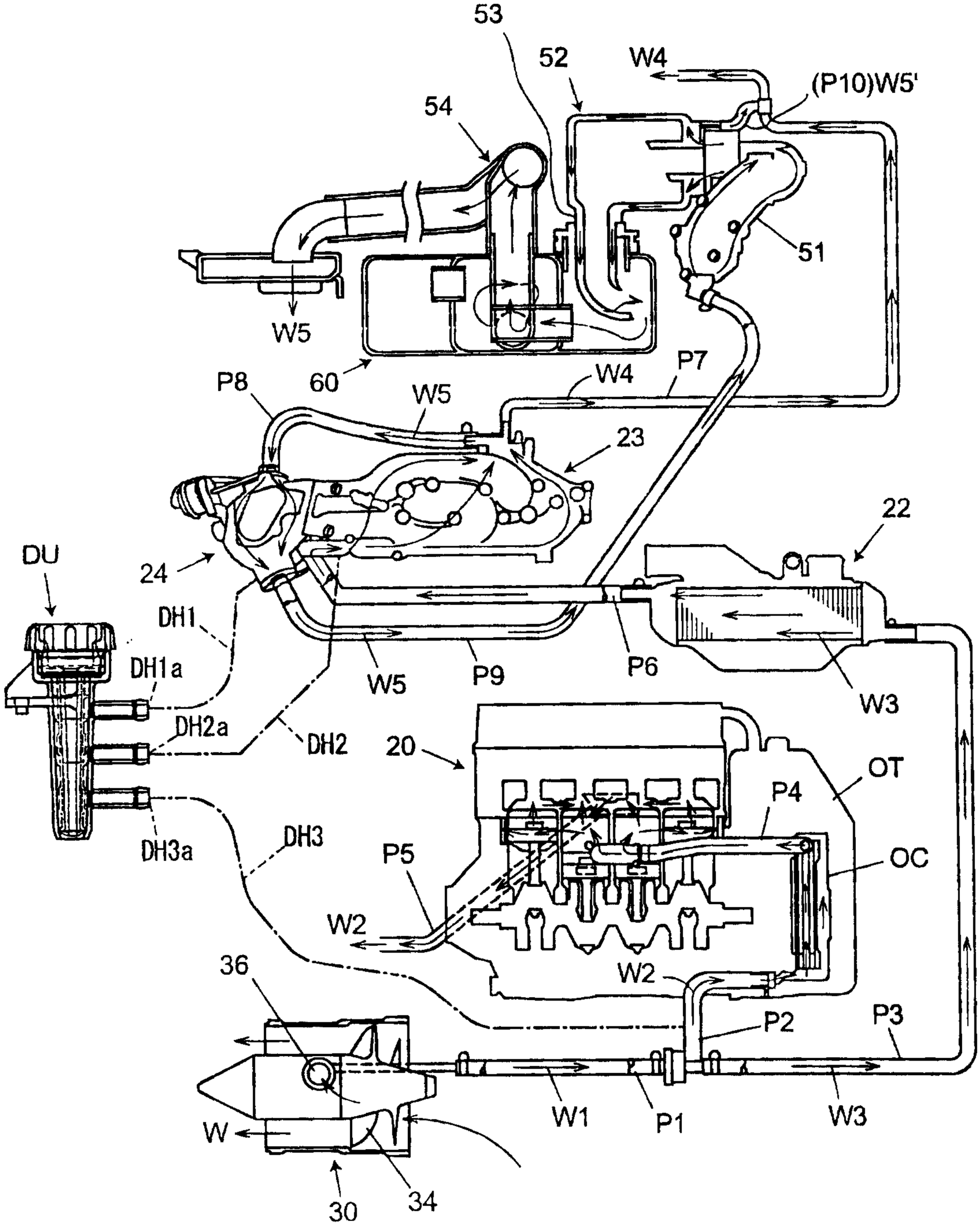


Fig. 4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W4
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W5
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DH1a
W5
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P6
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DH2a
DH2
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OT
P4
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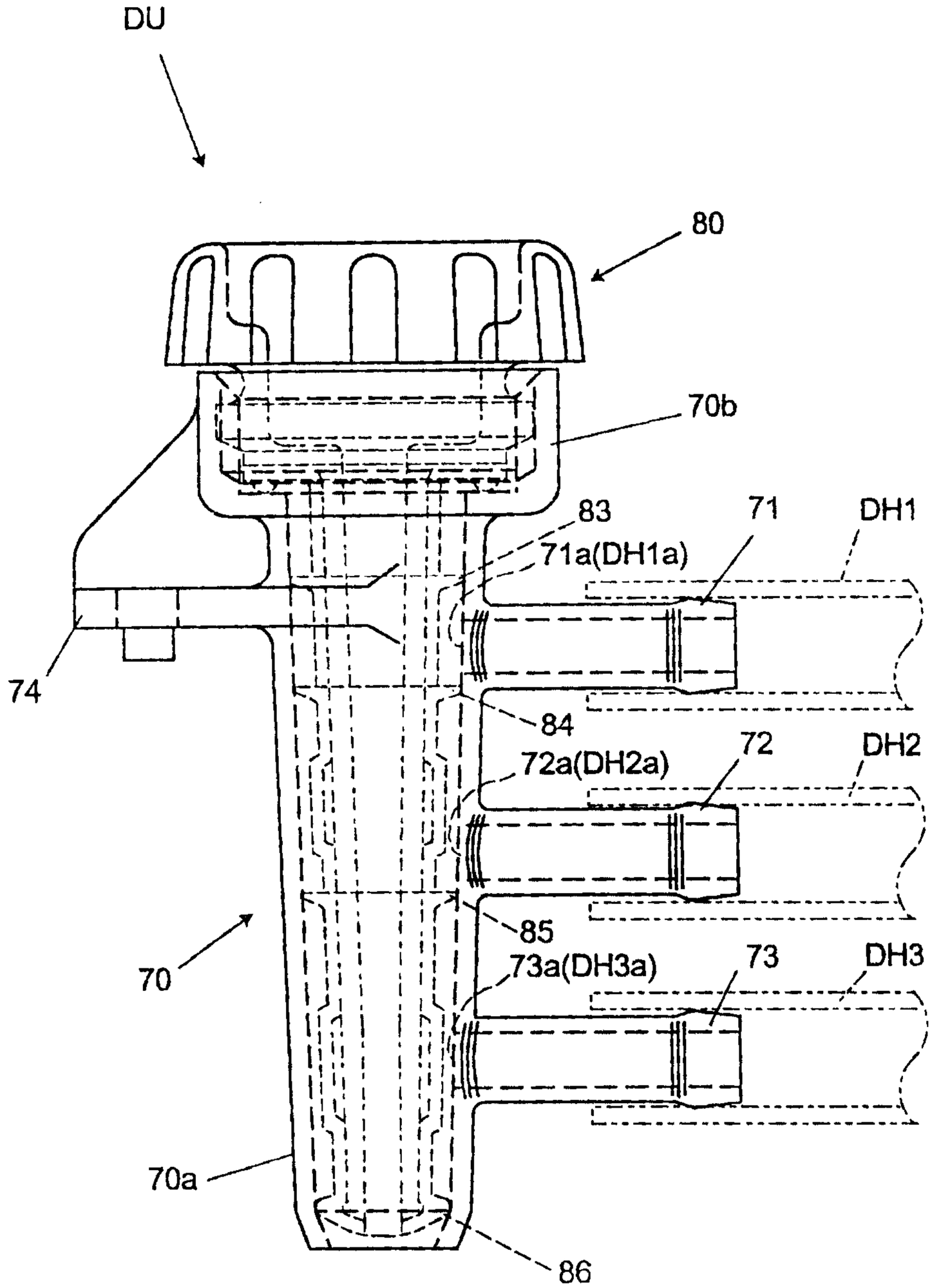
Fig. 5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72a(DH2a)
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DH2
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70
73a(DH3a)
73
DH3
70a
86

Fig. 6

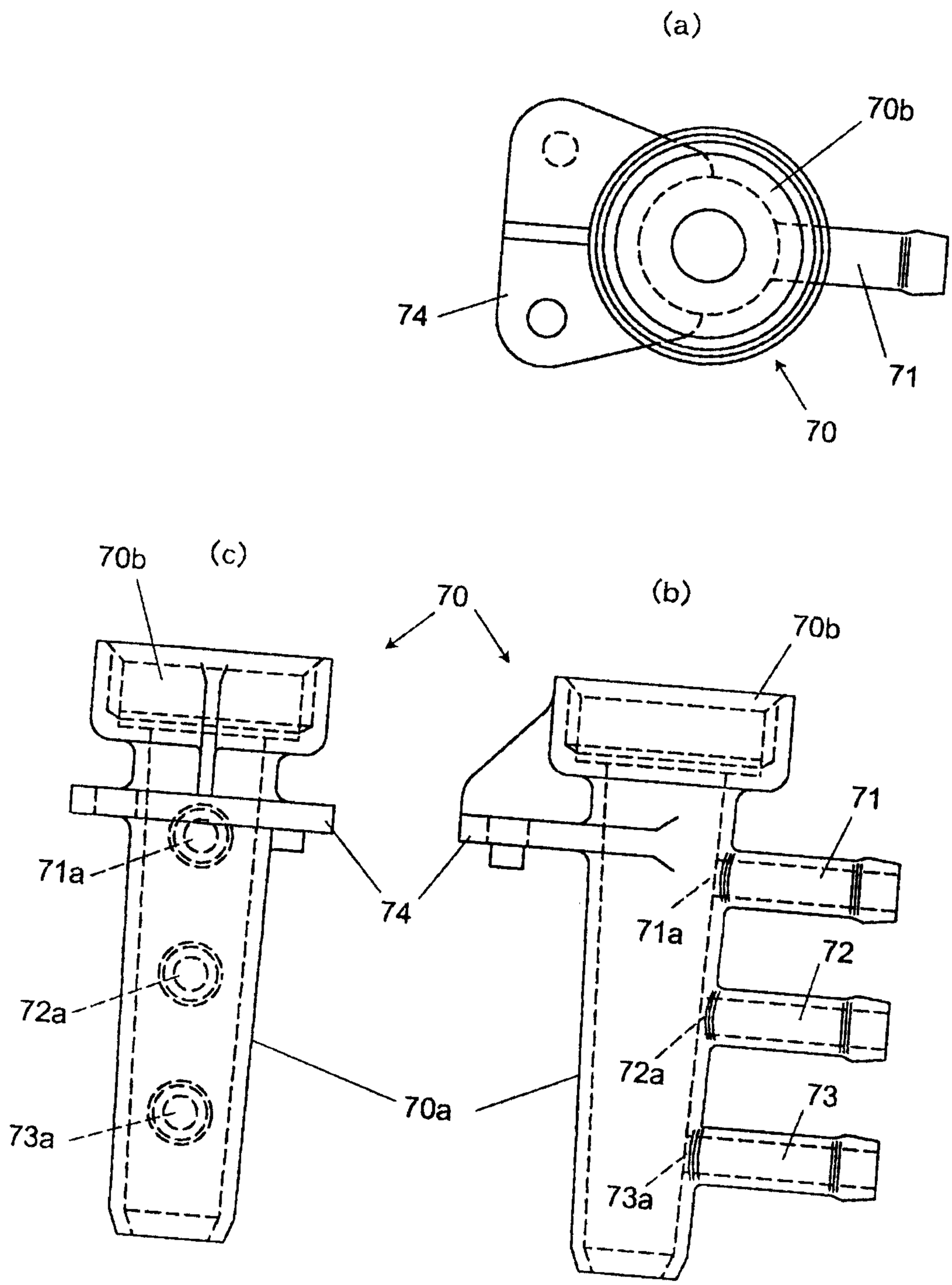
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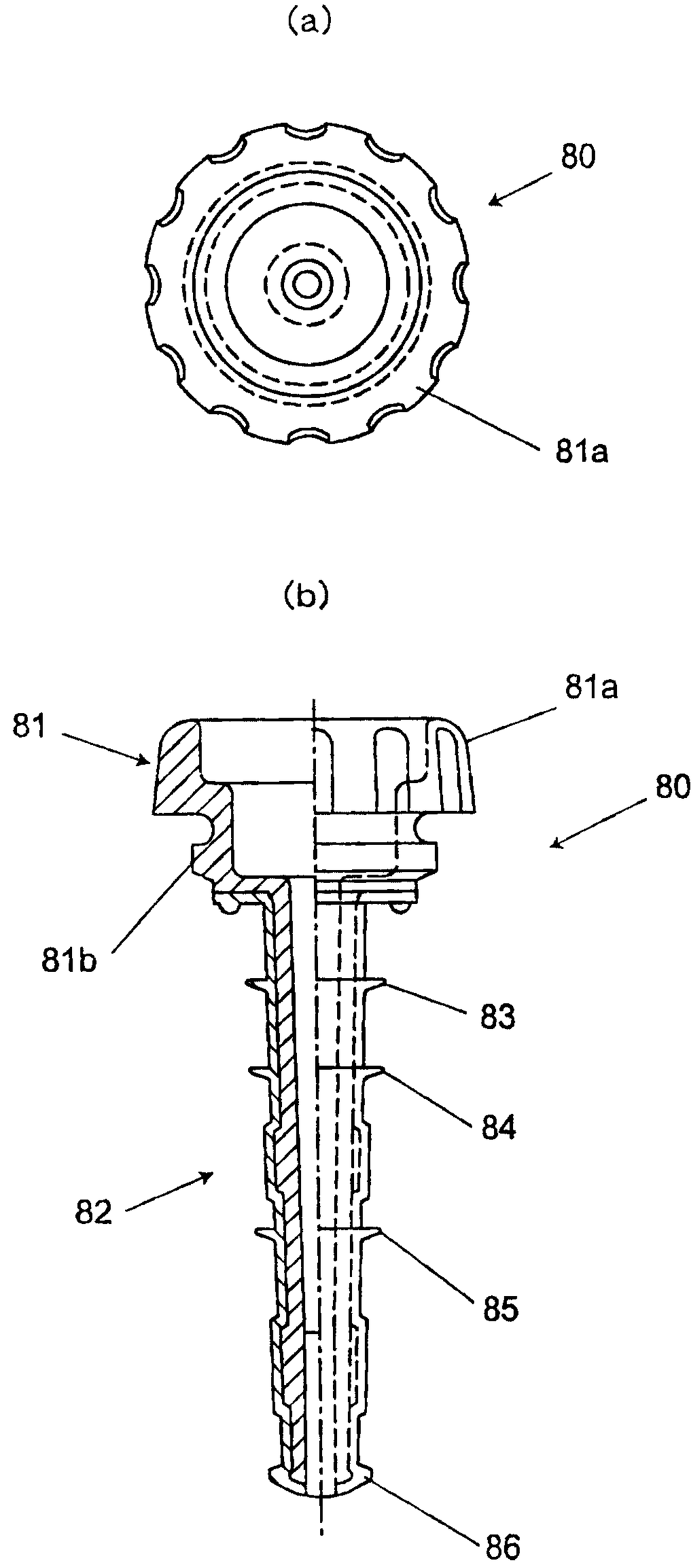
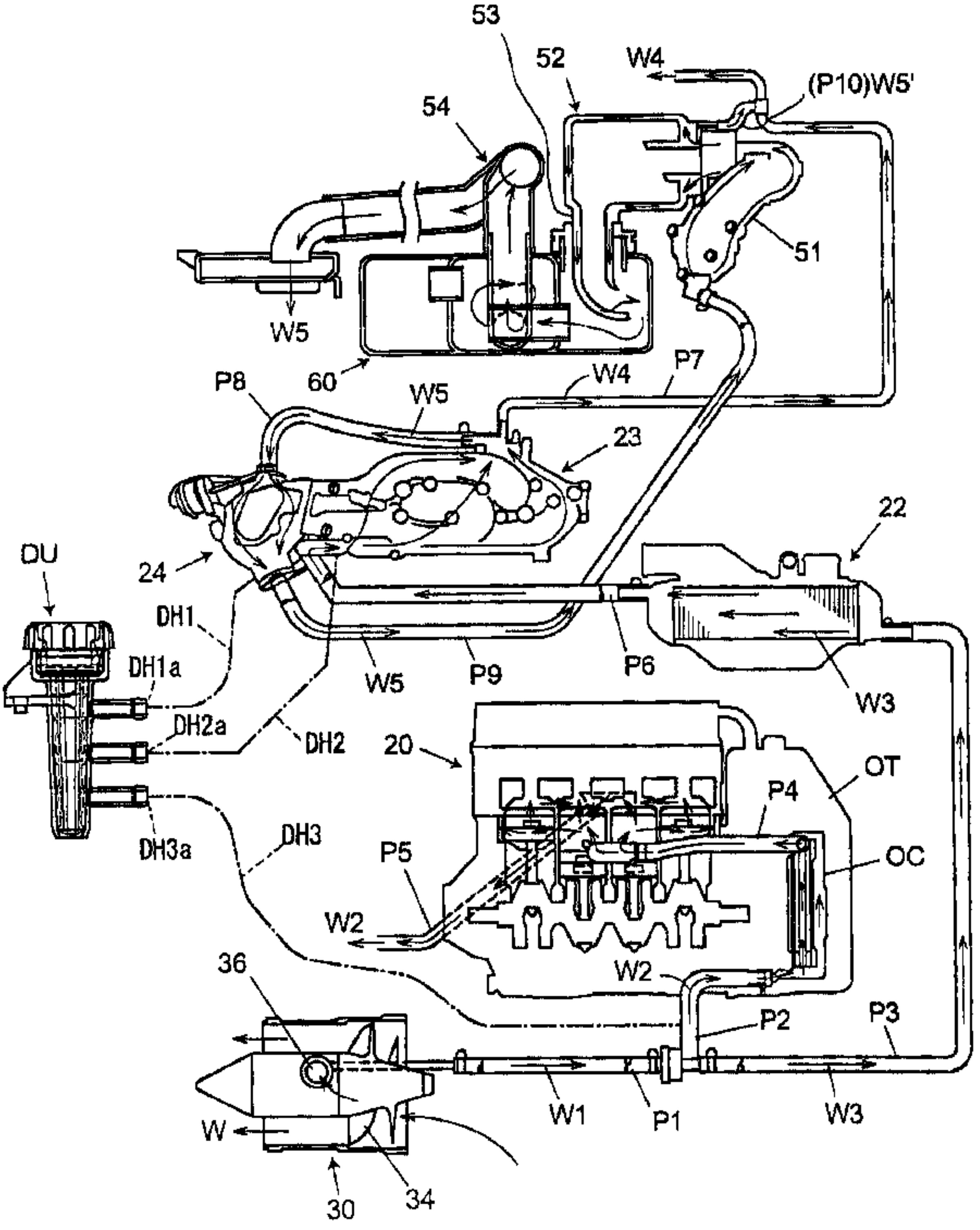
Fig. 7

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