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(54) Titre : STRUCTURE D'ARBRE DE SORTIE DE MOTOMARINE
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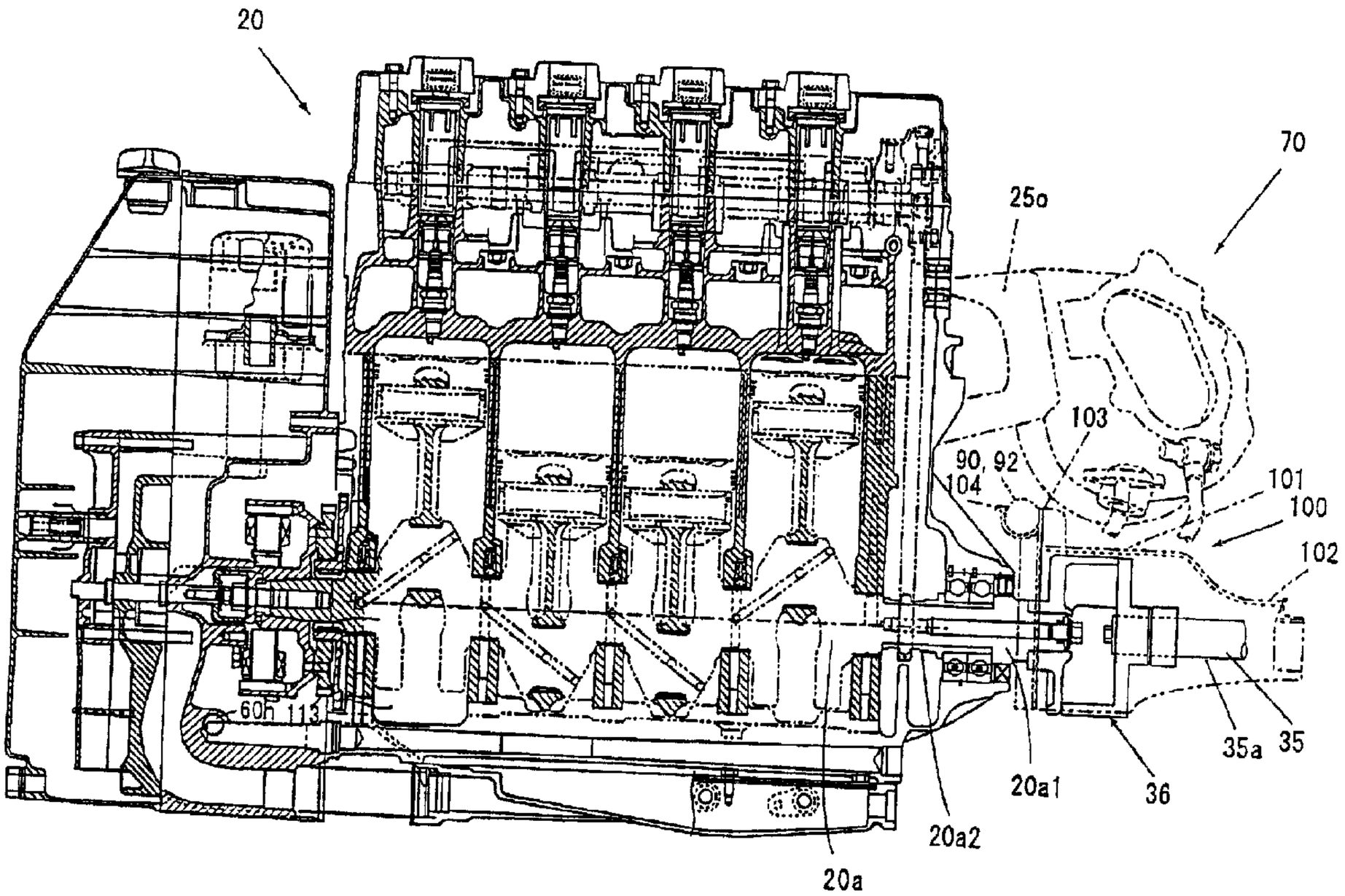

(57) Abrégé/Abstract:
To prevent scattering of water in a watercraft body, prevent interference of a coupler with piping, and prevent deterioration of the piping. An engine 20 is mounted on a watercraft body with a crankshaft 20a of the engine 20 extending along the longitudinal direction of the watercraft body and a shaft 35 of a jet pump is coupled via a coupler 36 to a rear end of the crankshaft 20a in such a manner as to be disposed on an extension of the crankshaft 20a. A coupler cover 100 is provided for covering the coupler 36, and piping for cooling water, which is communicated to the jet pump, is fixed onto the coupler cover 100. A turbo-charger 70 is disposed over the coupler 36, and the piping is fixed on the coupler cover at a position between the coupler cover and the turbo-charger. The coupler cover 100 is turnable around the shaft 35.

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ABSTRACT OF THE DISCLOSURE

To prevent scattering of water in a watercraft body, prevent interference of a coupler with piping, and prevent deterioration of the piping. An engine 20 is mounted on a watercraft body with a crankshaft 20a of the engine 20 extending along the longitudinal direction of the watercraft body and a shaft 35 of a jet pump is coupled via a coupler 36 to a rear end of the crankshaft 20a in such a manner as to be disposed on an extension of the crankshaft 20a. A coupler cover 100 is provided for covering the coupler 36, and piping for cooling water, which is communicated to the jet pump, is fixed onto the coupler cover 100. A turbo-charger 70 is disposed over the coupler 36, and the piping is fixed on the coupler cover at a position between the coupler cover and the turbo-charger. The coupler cover 100 is turnable around the shaft 35.

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TITLE: Output Shaft Structure of Personal Watercraft

FIELD OF THE INVENTION

The present invention relates to an output shaft structure of a personal watercraft.

BACKGROUND OF THE INVENTION

Personal watercrafts of a type shown in FIG. 12 have been known, wherein an engine 1 is mounted on a watercraft 2 with a crankshaft 1a of the engine 1 extending along the longitudinal direction of the watercraft body 2, and a shaft 3a of a jet pump 3 is coupled via a coupler 4 to an rear end 1b of the crankshaft 1a in such a manner as to be disposed on an extension of the crankshaft 1a.

In these personal watercrafts, a power from the crankshaft 1a of the engine 1 is transmitted to the jet pump 3 via the shaft 3a, to propel the watercraft body 2.

The above-described personal watercrafts have been frequently used for the purpose of enjoying leisure sport, and as a result of immoderate running of the watercrafts, water may be somewhat permeated in the watercraft body 2.

Accordingly, in the above-described related art personal watercraft, there has arisen a problem that when water, which has permeated in the watercraft body 2 and comes in contact with the coupler 4, is scatted in the watercraft body 2 by a centrifugal force of the coupler 4 having a diameter larger than that of each of the crankshaft 1a and the shaft 3a.

Further, in the personal watercrafts of this type, piping for taking off cooling water is connected to a portion, on the upstream side from an impeller, of the jet pump, and cooling water is supplied to the engine or

the like via the piping. As a result, there have arisen problems that the piping may interfere with the coupler 4 having a large diameter, and that the piping is liable to be deteriorated by the fact that the piping is wetted with water (particularly, sea water) scattered by the centrifugal force of the coupler 4.

Accordingly, a first object of the present invention is to solve the above-described problems and to provide an output shaft structure of a personal watercraft, which is capable of preventing scattering of water in a watercraft body, preventing interference of piping with a coupler, and preventing the piping from being deteriorated.

On the other hand, two-cycle engines have been used as power sources of general personal watercrafts; however, in recent years, to meet a requirement to lower environmental pollution, personal watercrafts using four-cycle engines as power sources have been proposed (Japanese Patent No. 2880691).

Outputs of four-cycle engines are smaller than those of two-cycle engines as compared with the same displacement, and to cope with such an inconvenience, it has been examined to develop personal watercrafts on which engines with turbo-chargers are mounted. For example, the present applicant has already proposed, in Japanese Patent Laid-open No. 2001-140641, a personal watercraft on which an engine with a turbo-charger is mounted.

A turbo-charger has a relatively large weight, and therefore, from the viewpoint of keeping a good weight balance of a watercraft, the turbo-charger may be desired to be provided near an engine, more specifically, immediately behind the engine. Even in the above document, Japanese Patent Laid-open No. 2001-140641, a turbo-charger is disposed immediately behind an engine 2,

and consequently, the turbo-charger is disposed immediately over a coupler.

Such a personal watercraft provided with a turbo-charger, however, has an inconvenience that as described above, water scattered by the coupler directly comes in contact with the turbo-charger, so that a casing of the turbo-charger kept at a high temperature is liable to be thermally fatigued.

Accordingly, a second object of the present invention is to provide an output shaft structure of a personal watercraft, which is capable of suppressing a casing of a turbo-charger from being thermally fatigued.

SUMMARY OF THE INVENTION

To achieve the above first object, according to the present invention, there is provided an output shaft structure of a personal watercraft, wherein an engine is mounted on a watercraft body with a crankshaft of the engine extending along the longitudinal direction of the watercraft body and a shaft of a jet pump is coupled via a coupler to a rear end of the crankshaft in such a manner as to be disposed on an extension of the crankshaft, the output shaft structure being characterized in that a coupler cover is provided for covering the coupler, and piping for cooling water, which is communicated to the jet pump, is fixed onto the coupler cover.

According to an aspect of the invention, in addition to the configuration of the invention described above, a turbo-charger is disposed over the coupler, and the piping is fixed onto the coupler cover at a position between the coupler cover and the turbo-charger.

According to another aspect of the invention, there is provided an output shaft structure of a personal watercraft, wherein an engine is mounted on a watercraft

body with a crankshaft of the engine extending in the longitudinal direction of the watercraft body, a shaft of a jet pump is coupled via a coupler to a rear end of the crankshaft in such a manner as to be disposed on an extension of the crankshaft, and a turbo-charger is disposed over the coupler, the output shaft structure being characterized in that a coupler cover formed into an approximately inverse U-shape in cross-section is provided for covering the coupler, and the coupler cover is turnable around the shaft of the jet pump.

According to yet another aspect of the invention, in addition to the configuration of the invention described above, a rear portion of the coupler cover is connected to a bearing member for turnably supporting the shaft of the jet pump on the watercraft body, a breather hose and/or a grease supply hose are/is connected to the bearing member, and a cutout portion for allowing the turning of the coupler cover without interference with the breather hose and/or grease supply hose is formed in the rear portion of the coupler cover.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a schematic side view showing one example of a personal watercraft to which one embodiment of an output shaft structure of a personal watercraft according to the present invention is applied.

FIG. 2 is a plan view of the personal watercraft.

FIG. 3 is a partial, enlarged sectional view taken on line III-III of FIG. 1 (with parts partially omitted).

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FIG. 4 is a view mainly showing the engine 20, which is a partial, enlarged sectional view taken on line VI-VI of FIG. 1 (with parts partially omitted).

FIG. 5 is a schematic perspective view of the engine 20 as seen from an obliquely rearward direction.

FIG. 6 is a sectional right side view of the engine 20.

FIGS. 7(a) to 7(c) are views showing details of the coupler cover 100, wherein FIG. 7(a) is a front view; FIG. 7(b) is a right side view with parts partially cutaway; and FIG. 7(c) is a view seen along an arrow "c" in FIG. 7(a), with parts partially omitted.

FIG. 8 is a back view of the coupler cover 100 (as seen from the rear side of the watercraft body).

FIG. 9 is a sectional view showing the jet pump 30, and a bearing structure by means of which the shaft 35 of the jet pump 30 is supported by the watercraft body 11 (which is equivalent to a partial, enlarged sectional view of FIG. 1).

FIG. 10 is a partial, enlarged view of FIG. 9, showing the coupler cover 100 in addition to the components shown in FIG. 9.

FIG. 11 is a sectional view taken on line XI-XI of FIG. 10.

FIGS. 12(a) and 12(b) are views illustrating a related art personal watercraft.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

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

FIG. 1 is a schematic side view showing one example of a personal watercraft to which one embodiment of an output shaft structure of a personal watercraft according to the present invention is applied; FIG. 2 is

a plan view of the personal watercraft; and FIG. 3 is a partial, enlarged sectional view taken on line III-III of FIG. 1 (with parts partially omitted).

Referring to these figures (particularly, to FIG. 1), a personal watercraft 10 is a saddle type small watercraft, which is operable by a driver who sits on a seat 12 disposed on a watercraft body 11 and holds a steering handlebar 13 provided with a throttle lever.

The watercraft body 11 has a floating structure that a hull 14 is joined to a deck 15 to form a space 16 therein. In the space 16, an engine 20 is mounted on the hull 14, and a jet pump or jet propulsion pump 30 functioning as propulsion means driven by the engine 20 is provided on a rear portion of the hull 14.

Intake ducts 18 and 19 for supplying intake air in the watercraft body 11 (space 16) is provided in the watercraft body 11.

The jet pump 30 (see FIG. 9) has a flow passage 33 extending from a water inlet 17 opened in a bottom shell to both a jet port 31 opened in a rear end portion of the hull 14 and a nozzle 32, and an impeller 34 disposed in the flow passage 33. A shaft 35 of the impeller 34 is coupled to an output shaft 20a of the engine 20 via a coupler 36. When the impeller 34 is rotated by drive of the engine 20, water taken in via the water inlet 17 is jetted from the jet port 31 via the nozzle 32, to propel the watercraft body 11. A rotational speed of the engine 20, that is, a propelling force of the jet pump 30 is controlled by a turning operation of a throttle lever 13a (see FIG. 2) of the steering handlebar 13. The nozzle 32 is coupled to the steering handlebar 13 via a steering wire (not shown), and is turned by operation of the steering handlebar 13, to change a running course of the watercraft body 11.

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In the figures, reference numeral 40 denotes a fuel tank, and reference numeral 41 denotes a containing chamber.

Further, reference numeral 42 denotes a towing hook used for drawing an object to be drawn (rubber boat or the like). The towing hook 42 is fixed to a rear portion of the watercraft body 11.

FIG. 4 is a view mainly showing the engine 20, which is a partial, enlarged sectional view taken on line IV-IV of FIG. 1 (with parts partially omitted); FIG. 5 is a schematic perspective view of the engine 20 as seen from an obliquely rearward direction; and FIG. 6 is a sectional right side view of the engine 20.

The engine 20 is a DOHC type in-line four-cylinder/four-cycle engine. As shown in FIG. 1, a crankshaft (see output shaft 20a1) of the engine 20 extends along the longitudinal direction of the watercraft body 11. As is apparent from FIG. 4, the engine 20 is mounted on the watercraft body 11 with its vertical axis (center axis) tilted counterclockwise in a front view (FIG. 4).

Referring to FIG. 4, an intake port 21 is disposed on a left side of the engine 20 in the running direction of the watercraft body 11, and an exhaust port 24 is disposed on a right side of the engine 20 in the running direction of the watercraft body 11.

A throttle body 22 and a surge tank (intake chamber) 23, which are communicated to the intake port 21, are connected to the intake port 21. An inter-cooler 50 disposed immediately under the surge tank 23 is connected to the surge tank 23. In FIG. 4, reference numerals 52 and 53 denote mounting brackets, to be mounted to the engine 20, of the inter-cooler 50.

The inter-cooler 50 includes, as shown in FIGS. 4 and 5, a case 51 having an intake inlet 51i and an

outlet 51o, and a cooling unit 60. The intake inlet 51i is connected and communicated, via piping 72, to a compressor portion 71 of a supercharger (turbo-charger) 70 disposed immediately behind the engine 20, and the outlet 51o is connected, via a tube 51c, to an intake inlet 23a of the surge tank 23. The cooling unit 60 (see FIG. 4) is a heat exchange unit accommodated in the case 51.

In FIG. 5, reference numerals 91 and 92 denote cooling water hoses connected to the inter-cooler 50.

Referring also to FIG. 4, an exhaust manifold 25 is connected to the exhaust port 24 of the engine 20, and an exhaust outlet 25o (see FIG. 5) of the exhaust manifold 25 is connected to a turbine portion 73 of the turbo-charger 70.

In addition, as shown in FIGS. 1 and 2, exhaust gas, which has been used for rotating a turbine in the turbine portion 73, is discharged in water stream generated by the jet pump 30 via an exhaust pipe 74, an anti-counterflow chamber 75 for preventing counterflow of water (permeation of water in the turbo-charger 70 and the like) at the time of turn-over, a water muffler 76, and an exhaust/drainage pipe 77.

Referring to FIGS. 4 and 5, a sensor 80 for air supplied from the supercharger 70 to the surge tank 23 via the inter cooler 50 is provided on an upper portion of the surge tank 23. The throttle body 22 and the surge tank 23 form a horizontal partition assembly A extending, over the engine 20, both in the longitudinal direction and nearly in the horizontal direction. The sensor 80 is located at a position higher than that of the horizontal partition assembly A. The sensor 80 is communicated to the inside of the surge tank 23 via a pipe 80a, and is electrically connected to a control circuit (not shown) for the engine. The sensor 80 may be configured as a

supercharging pressure sensor for detecting an air pressure (supercharging pressure) in the surge tank 23, or configured as a temperature sensor for detecting a temperature of air in the surge tank 23. Alternately, the sensor 80 may be configured as a supercharging pressure- and-temperature sensor for detecting an air pressure (supercharging pressure) in the surge tank 23 and detecting the temperature of air in the surge tank 23. In the example shown in the figures, only one sensor 80 is depicted; however, both the supercharging pressure sensor for detecting an air pressure (supercharging pressure) in the surge tank 23 and a temperature sensor for detecting the temperature of air in the surge tank 23 may be separately provided on the upper portion of the surge tank 23.

An intake pressure sensor 81 for detecting an intake pressure on the downstream side from a throttle (throttle valve) 22a in the throttle body 22 is disposed between a head cover 26 of the engine 20 and the surge tank 23 at a position offset to the head cover 26. The sensor 81 is mounted to the head cover 26 by means of a mounting member 82. As is apparent from FIGS. 4 and 5, the sensor 81 is disposed at a position higher than that of the throttle body 22 (accordingly, higher than that of the horizontal partition assembly A). In addition, the sensor 81 is mounted, by means of the mounting member 82, in a state being floated from an upper surface of the throttle body 22. The sensor 81 is communicated to a portion, on the downstream side from the throttle 22a of the throttle body 22, of an intake path, by pipe 81a, and is electrically connected to the control circuit (not shown) for the engine.

The above-described sensors 80 and 81 for engine control are provided at positions higher than

those of respective openings 18a and 19a, opened in the watercraft body, of the intake ducts 18 and 19.

As shown in FIG. 4, an opening 15a is formed in an upper portion of the deck 15, and the sensors 80 and 81 are aligned to the opening 15a. Since the opening 15a of the deck 15 is opened when the seat 12 as a lid body removably mounted on the watercraft body 11 is removed from the watercraft body 11, the maintenance of the sensors 80 and 81 and the upper portion of the engine can be easily performed.

As described above and as shown in FIG. 6, the shaft 35 of the jet pump 30 is coupled to a rear end of the crankshaft 20a of the engine 20 via the coupler 36 in such a manner as to be disposed on an extension of the crankshaft 20a. in particular, according to this embodiment, an output shaft 20a1 provided separately from the crankshaft 20a is coupled to the rear end of the crankshaft 20a via a connection pipe 20a2, and the shaft 35 of the jet pump 30 is coupled to a rear end of the output shaft 20a1 via the coupler 36.

As is apparent from FIG. 6, the turbo-charger 70 is positioned over the coupler 36.

Referring to FIG. 6, a coupler cover 100 for covering the coupler 36 is provided on a rear portion of the engine 20. It is to be noted that for simplicity of the drawings, the depiction of the coupler cover 100 is omitted in FIGS. 1 to 5.

FIGS. 7(a) to 7(c) are views showing details of the coupler cover 100, wherein FIG. 7(a) is a front view; FIG. 7(b) is a right side view with parts partially cutaway; and FIG. 7(c) is a view seen along an arrow "c" of FIG. 7(a), with parts partially omitted. FIG. 8 is a back view of the coupler cover 100 (as seen from the rear side of the watercraft body).

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Referring to these figures, the coupler cover 100 has a coupler cover portion 101 formed into an inverse U-shape in cross-section as seen from the front side thereof, a shaft cover portion 102 continuous to a rear portion of the coupler cover portion 101, a flange portion 103 integrally formed on a front portion of the coupler cover portion 101, and a pipe holding portion 104 integrally formed on an upper portion of the flange portion 103.

The flange portion 103 has bolt insertion holes 103a and 103b, in which bolts (not shown) are to be inserted.

Lower ends of an inner wall surface of a rear portion of the shaft cover portion 102 partially project inwardly, to form a contracted portion 102b by two projections 102a thus formed.

A partial cutout portion 102c is formed in an upper rear portion of the shaft cover portion 102. The cutout portion 102c is adapted to allow the coupler cover 100 to be turned around the shaft 35 without interference with a breather hose 18 to be described later (and/or a grease supply hose 116).

FIG. 9 is a sectional view showing the jet pump 30, and a bearing structure by means of which the shaft 35 of the jet pump 30 is supported by the watercraft body 11 (which is equivalent to a partial, enlarged sectional view of FIG. 1); FIG. 10 is a partial, enlarged view of FIG. 9, showing the coupler cover 100 in addition to the components shown in FIG. 9; and FIG. 11 is a sectional view taken on line XI-XI of FIG. 10.

Referring to these figures, a bearing cover 43 is fixed to the hull 14, and a bearing member 110 is fixed to the bearing cover 43.

The bearing member 110 includes a rubber made main body 111, two bearings 112 accommodated in the main

body 111, a seal member (oil seal) 113 incorporated in the main body at a position located on the engine side with respect to the bearings 112, and a seal member (water seal) 114 incorporated in the main body 111 at a position located on the jet pump 30 side (the flow passage 33 side) with respect to the bearings 112.

The main body 111 has a cylindrical portion 111a, and a flange portion 111b integrated with the cylindrical portion 111a. The bearings 112, the oil seal 113, and the seal member 114 are incorporated in the cylindrical portion 111a.

A metal made reinforcing member 111c is integrally buried in the flange portion 111b.

A front wall 43a of the bearing cover 43 has a hole 43b in which the cylindrical portion 111a of the bearing member 110 is to be inserted. A ring-shaped metal made base 44 is adhesively bonded around the hole 43b. A bolt 44b is integrally planted on the base 44.

The bearing member 110 is fixed to the bearing cover 43 by inserting the cylindrical portion 111a in the hole 43b of the bearing cover 43, inserting the bolt 44b in the reinforcing member 111c of the flange portion 111b, and screwing a nut 45 around the bolt 44b, thereby fastening the flange portion 111b (accordingly, the reinforcing member 111c) to the bearing cover 43.

A rear end 111g of the cylindrical portion 111a is connected to a cylindrical portion 46a of a joint rubber 46, which has been mounted to the hull 14 from the flow passage 33 side, by means of a ring-shaped clamp 47.

The cylindrical portion 111a of the bearing member 110 has a grease supply hole 111d and a breather hole 111e.

The grease supply hose 116 is connected to the grease supply hole 111d via a connection pipe 115, and a grease nipple 116a is provided at a leading end of the

grease supply hole 111d. The grease nipple 116a is co-fastened, together with the above-described towing hook 42 (see FIG. 1), to a portion, near the opening 15a, of the deck 15 by a mounting fixture 116b.

Accordingly, by opening the seat 12, grease can be easily supplied from the grease nipple 116a to the seal member 114 and the bearings 112 via the grease supply hole 116.

The breather hose 118 is connected to the breather hole 111e via a connection pipe 117. A leading end 118a of the breather hose 118 is fixed at an appropriate position on the watercraft body 11 (hull 14 or deck 15) by a mounting fixture 118b.

Accordingly, expanded air generated in the bearing portion (in this case, in the cylindrical portion 111a) is discharged in the watercraft body 11 through the breather hole 111e, the connection pipe 117, and the breather hose 118.

In the cylindrical portion 111a, by suitably forming the grease passage and the breather passage, the grease supply hose 116 and the breather hose 118 can be reversely mounted (concretely, the grease supply hose 116 can be disposed on a front side of the flange portion 111b and the breather hose 118 can be disposed on a rear side of the flange portion 111b), or both the grease supply hose 116 and the breather hose 118 can be mounted on the front side of the flange portion 111b. Alternately, either the grease supply hose 116 or the breather hose 118 may be mounted to the bearing member 110.

As shown in FIGS. 6, 10 and 11 (particularly, shown by a virtual line in FIG. 6 or shown in FIG. 10), the above-described coupler cover 100 is fixed to the rear portion of the engine 20 by a manner of covering the coupler 36 with the coupler cover portion 101; inserting

the shaft 35 and a front portion 111f of the cylindrical portion 111a of the bearing member 110 in the shaft cover portion 102 in such a manner as to make them pass through the restricted portion 102b for giving a click feeling to an operator, thereby covering the front portion 111f of the bearing member 110 with the shaft cover portion 102; and inserting bolts (not shown) in the bolt insertion holes 103a and 103b of the flange portion 103 and fastening leading ends of the bolts to the rear portion of the engine.

In the state that the coupler cover 100 is mounted to the rear portion of the engine 20, the coupler 36 is covered with the coupler cover portion 101, and a front end portion 35a of the shaft 35 is covered with the shaft cover portion 102.

A rear portion of the coupler cover 100, that is, a rear portion of the shaft cover portion 102 is in a state being connected to the front portion 111f of the bearing member 110.

Piping is fitted in the pipe holding portion 104, to be held therein.

The piping to be held by the pipe holding portion 104 can be suitably selected. A cooling water hose 92 for communicating the inter cooler 50 to the water jacket of the turbo-charger cover 70 or a main cooling water hose 90 extending from the jet pump 30 to the engine 20, which hose is shown in FIG. 5, can be held by the pipe holding portion 104.

The coupler cover 100 can be turned around the shaft 35 by removing the mounting bolts by means of which the coupler cover 100 is mounted to the engine 20. Since the cutout portion 102c for allowing the turning of the coupler cover 100 without interference with the breather hose 118 is formed in the rear portion of the coupler cover 100, the coupler cover 100 can be turned, as shown

in FIG. 11, within a range B in which an end portion 102c1 of the cutout portion 102c does not come in the breather hose 118.

If the mounting of the hose to the pipe holding portion 104 obstructs the turning of the coupler cover 100, the hose may be removed from the pipe holding portion 104.

The output shaft structure of a personal watercraft configured as described above has the following functions and effects:

(a) The engine 20 is mounted on the watercraft body 11 with the crankshaft 20a of the engine 20 extending along the longitudinal direction of the watercraft body 11 and the shaft 35 of the jet pump 30 is coupled via the coupler 36 to the rear end of the crankshaft 20a of the engine 20 in such a manner as to be disposed on an extension of the crankshaft 20a. This output shaft structure is characterized in that the coupler cover 100 is provided for covering the coupler 36, and piping 90 (or 92) for cooling water, which is communicated to the jet pump 30, is fixed onto the coupler cover 100. With this structure, even if water, which has been permeated in the watercraft body 11 and comes in contact with the coupler 36, is scattered by the coupler 36, the water thus scattered can be blocked by the coupler cover 100 provided for covering the coupler 36.

Since the coupler 36 is covered with the coupler cover 100, the piping 90 (or 92) for cooling water does not interfere with the coupler 36.

Since scattering of water is blocked by the coupler cover 100, the piping 90 (or 92) is less wetted with water, with a result that the piping 90(92) is less deteriorated.

Since the piping 90 (92) is fixed on the coupler cover 100, that is, in a state being floated from the bottom shell 11a (see FIG. 4), the piping 90 (92) is less wetted with water having been permeated in the watercraft body 11. As a result, it is possible to more certainly prevent deterioration of the piping 90 (92).

(b) The turbo-charger 70 is disposed over the coupler 36, and the piping 90 (92) is fixed onto the coupler cover 100 at a position between the coupler cover 100 and the turbo-charger 70. Accordingly, the output shaft structure has the following functions and effects:

Since scattering of water by the coupler 36 is blocked by the coupler cover 100, the turbo-charger 70 is not wetted with water scattered by the coupler 36. As a result, it is possible to improve durability of the turbo-charger 70.

Also, since the piping 90 (92) is fixed on the coupler cover 100 at a position between the coupler cover 100 and the turbo-charger 70, it is possible to obtain an effect that the piping 90 (92) for cooling water can be disposed by making use of a space between the coupler 36 and the turbo-charger 70. Further, since the piping 90 (92) is disposed on the coupler cover 100, the piping 90 (92) does not come in contact with the turbo-charger 70 kept at a high temperature, with a result that the piping 90 (92) is less deteriorated.

(c) The coupler cover 100 is formed into an approximately inverse U-shape and is turnable around the shaft 35 of the jet pump 30, the coupler cover 100 is removed in a direction perpendicular to the shaft 35 of the jet pump 30 by turning the coupler cover 100 around the shaft 35 of the jet pump 30. In this embodiment, as shown in FIG. 11, the coupler cover 100 can be removed in a direction shown by an arrow D, perpendicular to the shaft 35, by turning the coupler cover 100 in a direction

shown by an arrow C (in the direction where the coupler cover 100 does not interfere with the turbo-charger 70).

That is to say, the coupler cover 100 can be removed, in the narrow, restricted inner space 16 of the watercraft body, without movement of the coupler cover 100 in the direction along the shaft 35 of the jet pump and also without interference with the turbo-charger 70.

Accordingly, only the coupler cover 100 can be removed without removal of the turbo-charger 70 and the coupler 36 can be inspected and repaired.

(d) Since a rear portion of the coupler cover 100 is connected to a bearing member 110 for turnably supporting the shaft 35 of the jet pump on the watercraft body 11. As a result, the coupler cover 100 can be mounted in a stable state.

The breather hose 118 and the grease supply hose 116 are connected to the bearing member 110. As a result, expanded air generated in the bearing portion 110 can be escaped through the breather hose 118, and grease can be supplied to the bearing portion 110 through the grease supply hose 116.

The cutout portion 102c for allowing the turning of the coupler cover 100 without interference with the breather hose 118 is formed in the rear portion of the coupler cover 100. As a result, only the coupler cover 100 can be removed by turning the coupler cover 100 without removal of the breather hose 118, and the coupler 36 can be inspected and repaired.

In the case where the grease supply hose 116 is mounted on the front side of the flange portion 111b in place of the breather hose 118, or the breather hose 118 and the grease supply hose 116 are mounted on the front side of the flange portion 111b as described above, only the coupler cover 100 can be removed by turning the coupler cover 100 without removal of the grease supply

hose 116 and/or the breather hose 118 as described above with the aid of the cutout portion 102c, and the coupler 36 can be inspected and repaired.

(e) The throttle body 22 and the surge tank 23 form a horizontal partition assembly A extending, over the engine 20, both in the longitudinal direction and nearly in the horizontal direction, and the sensors 80 and 81 for engine control are disposed over the horizontal partition assembly A. As a result, even if the personal watercraft 10 is rapidly turned or significantly rolled in a state that water has been permeated somewhat in the watercraft body 11 and thereby water in the watercraft body 11 is shook to flow to the sensors 80 and 81, the water thus shook is often blocked by the horizontal partition assembly A formed by the throttle body 22 and the surge tank 23 in such a manner as to extend, over the engine 20, both in the longitudinal direction and nearly in the horizontal direction, so that the sensors 80 and 81 are less wetted with such water.

Since the sensors 80 and 81 are provided at positions higher than those of the openings 18a and 19a, opened in the watercraft body 11, of the intake ducts 18 and 19, even if atmospheric air outside the watercraft body 11 is introduced, together with water (for example, splash) into the space 16 of the watercraft body 11 through the intake ducts 18 and 19 during running of the personal watercraft 10, the sensors 80 and 81 are less wetted with such water.

Since water, which has been permeated in the watercraft body 11, comes in contact with the coupler 36, is scattered by the coupler 36, the scattering of water is blocked by the coupler cover 100 provided for covering the coupler 36. As a result, it is possible to certainly

suppress the sensors 80 and 81 from being wetted with water.

Accordingly, it is possible to suppress occurrence of an inconvenience that an error signal is inputted from the sensors 80 and 81 to the control unit for the engine control, and hence to ensure proper operation of the engine 20.

According to the present invention there is provided an output shaft structure of a personal watercraft wherein, an engine is mounted on a watercraft body with a crankshaft of the engine extending along the longitudinal direction of the watercraft body and a shaft of a jet pump is coupled via a coupler to a rear end of the crankshaft in such a manner as to be disposed on an extension of the crankshaft. This output shaft structure is characterized in that a coupler cover is provided for covering the coupler, and piping for cooling water, which is communicated to the jet pump, is fixed onto the coupler cover. With this structure, even if water, which has been permeated in the watercraft body and comes in contact with the coupler, is scattered by the coupler, the water thus scattered can be blocked by the coupler cover provided for covering the coupler.

Since the coupler is covered with the coupler cover, the piping for cooling water does not interfere with the coupler.

Since scattering of water is blocked by the coupler cover, the piping is less wetted with water, with a result that the piping is less deteriorated.

Since the piping is fixed on the coupler cover, that is, in a state being floated from the bottom shell, the piping is less wetted with water having been permeated in the watercraft body. As a result, it is possible to more certainly prevent deterioration of the piping.

According to an embodiment of the invention above, in addition to the configuration of the output shaft structure described above, a turbo-charger is disposed over the coupler, and the piping is fixed onto the coupler cover at a position between the coupler cover and the turbo-charger. Accordingly, the output shaft structure has the following functions and effects:

Since scattering of water by the coupler is blocked by the coupler cover, the turbo-charger is not wetted with water scattered by the coupler. As a result, it is possible to improve durability of the turbo-charger.

Also, since the piping is fixed on the coupler cover at a position between the coupler cover and the turbo-charger, it is possible to obtain an effect that the piping for cooling water can be disposed by making use of a space between the coupler cover and the turbo-charger. Further, since the piping is disposed on the coupler cover, the piping does not come in contact with the turbo-charger kept at a high temperature, with a result that the piping is less deteriorated.

According to another embodiment of the invention, there is provided the output shaft structure of a personal watercraft wherein, an engine is mounted on a watercraft body with a crankshaft of the engine extending in the longitudinal direction of the watercraft body, a shaft of a jet pump is coupled via a coupler to a rear end of the crankshaft in such a manner as to be disposed on an extension of the crankshaft, and a turbo-charger is disposed over the coupler. This output shaft structure is characterized in that a coupler cover formed into an approximately inverse U-shape in cross-section is provided for covering the coupler, and the coupler cover is turnable around the shaft of the jet pump. With this structure, since scattering of water by the coupler is

blocked by the coupler cover, the turbo-charger is not wetted with the water scattered by the coupler. As a result, it is possible to improve durability of the turbo-charger.

Since the coupler cover is formed into an approximately inverse U-shape and is turnable around the shaft of the jet pump, the coupler cover is removed in a direction perpendicular to the shaft of the jet pump by turning the coupler cover around the shaft of the jet pump.

That is to say, the coupler cover can be removed, in the narrow, restricted inner space of the watercraft body, without movement of the coupler cover in the direction along the shaft of the jet pump and also without interference with the turbo-charger.

Accordingly, only the coupler cover can be removed without removal of the turbo-charger and the coupler can be inspected and repaired.

According to another embodiment of the invention, in addition to the configuration of the output shaft structure described above, a rear portion of the coupler cover is connected to a bearing member for turnably supporting the shaft of the jet pump on the watercraft body. As a result, the coupler cover can be mounted in a stable state.

Also, in this structure, a breather hose and/or a grease supply hose are/is connected to the bearing member. As a result, expanded air generated in the bearing portion can be escaped through the breather hose, and/or grease can be supplied to the bearing portion through the grease supply hose.

Further, in this output shaft structure, a cutout portion for allowing the turning of the coupler cover without interference with the breather hose and/or grease supply hose is formed in the rear portion of the

coupler cover. As a result, only the coupler cover can be removed by turning the coupler cover without removal of the hose, and the coupler can be inspected and repaired.

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.

What is claimed is:

1. An output shaft structure of a personal watercraft, wherein an engine is mounted on a watercraft body with a crankshaft of said engine extending along the longitudinal direction of said watercraft body and a shaft of a jet pump is coupled via a coupler to a rear end of said crankshaft in such a manner so as to be disposed on an extension of said crankshaft, said output shaft structure comprising:

a coupler cover provided for covering said coupler; and

piping for cooling water in communication with said jet pump, said piping being fixed onto said coupler cover.

2. The output shaft structure of a personal watercraft according to claim 1, wherein a turbo-charger is disposed over said coupler, and said piping is fixed onto said coupler cover at a position between said coupler cover and said turbo-charger.

3. An output shaft structure of a personal watercraft, wherein an engine is mounted on a watercraft body with a crankshaft of said engine extending in the longitudinal direction of said watercraft body, a shaft of a jet pump is coupled via a coupler to a rear end of said crankshaft in such a manner as to be disposed on an extension of said crankshaft, and a turbo-charger is disposed over said coupler, said output shaft structure comprising:

a coupler cover formed into an approximately inverse U-shape in cross-section, said coupler cover being provided for covering said coupler, and said coupler cover being

rotatably mounted and turnable around said shaft of said jet pump.

4. The output shaft structure of a personal watercraft according to claim 3, wherein a rear portion of said coupler cover is connected to a bearing member for turnably supporting said shaft of said jet pump on said watercraft body, a breather hose and a grease supply hose are connected to said bearing member, and

a cutout portion for allowing the turning of said coupler cover without interference with said breather hose and grease supply hose being formed in the rear portion of said coupler cover.

5. The output shaft structure of a personal watercraft according to claim 3, wherein a rear portion of said coupler cover is connected to a bearing member for turnably supporting said shaft of said jet pump on said watercraft body, a grease supply hose is connected to said bearing member, and

a cutout portion for allowing the turning of said coupler cover without interference with said grease supply hose being formed in the rear portion of said coupler cover.

6. An output shaft structure of a personal watercraft comprising:

a shaft of a jet pump being adapted to be coupled via a coupler to a rear end of a crankshaft and being disposed on an extension of said crankshaft;

a coupler cover provided for covering said coupler; and

piping for providing cooling water to be in communication with said jet pump, said piping being fixed onto said coupler cover.

7. The output shaft structure of a personal watercraft according to claim 6, wherein a turbo-charger is disposed over said coupler, and said piping is fixed onto said coupler cover at a position between said coupler cover and said turbo-charger.

8. An output shaft structure of a personal watercraft comprising:

a shaft of a jet pump being adapted to be coupled via a coupler to a rear end of said crankshaft and being disposed on an extension of said crankshaft;

a turbo-charger disposed over said coupler;

a coupler cover formed into an approximately inverse U-shape in cross-section, said coupler cover being provided for covering said coupler, and said coupler cover being turnable around said shaft of said jet pump.

9. The output shaft structure of a personal watercraft according to claim 8, wherein a rear portion of said coupler cover is connected to a bearing member for turnably supporting said shaft of said jet pump on said watercraft body, a breather hose and a grease supply hose are connected to said bearing member, and

a cutout portion for allowing the turning of said coupler cover without interference with said breather hose and

grease supply hose being formed in the rear portion of said coupler cover.

10. The output shaft structure of a personal watercraft according to claim 8, wherein a rear portion of said coupler cover is connected to a bearing member for turnably supporting said shaft of said jet pump on said watercraft body, a grease supply hose is connected to said bearing member, and

a cutout portion for allowing the turning of said coupler cover without interference with said grease supply hose being formed in the rear portion of said coupler cover.

FIG. 1

H101-1053-01

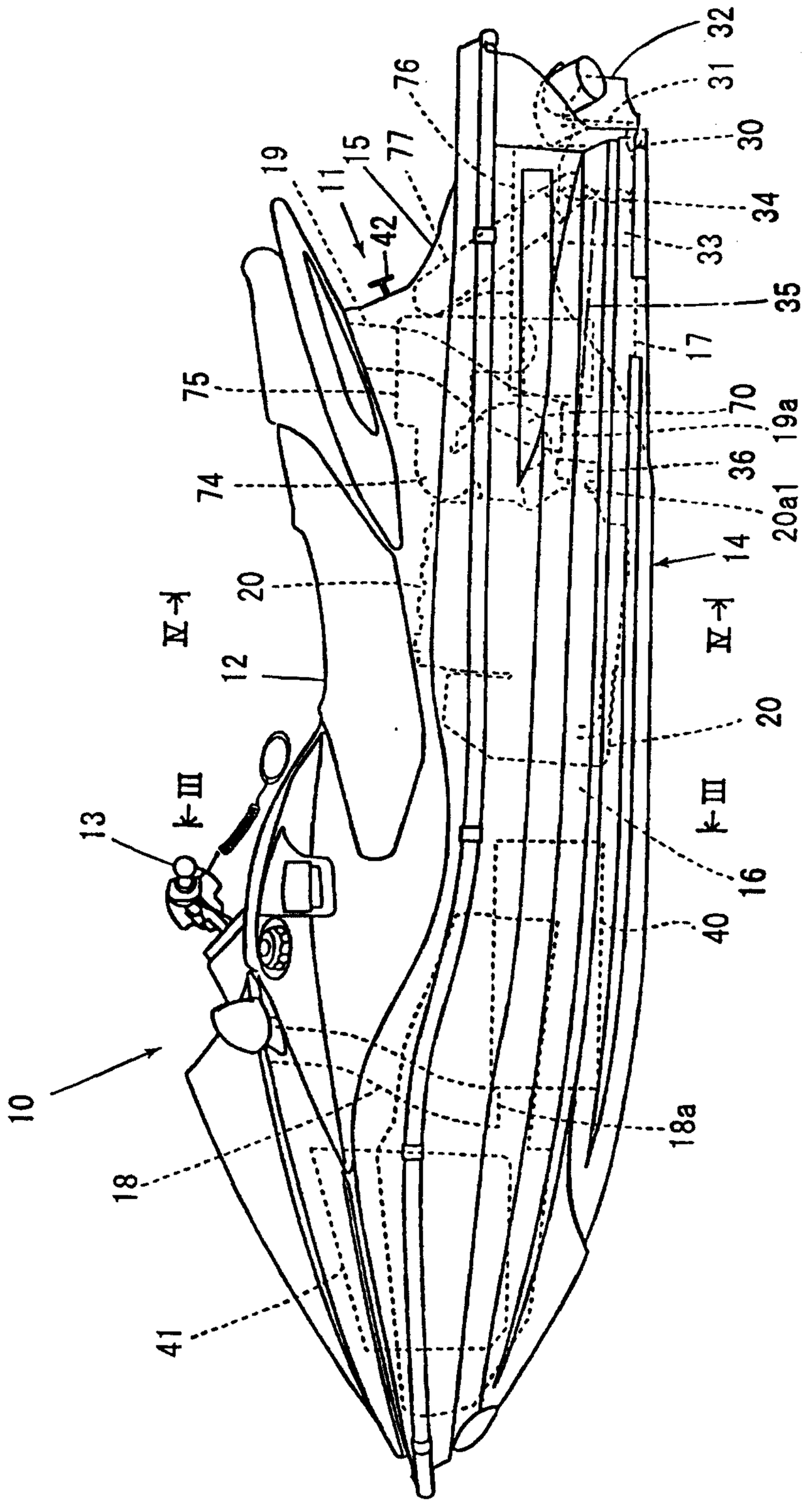

FIG. 2

H101-1053-02

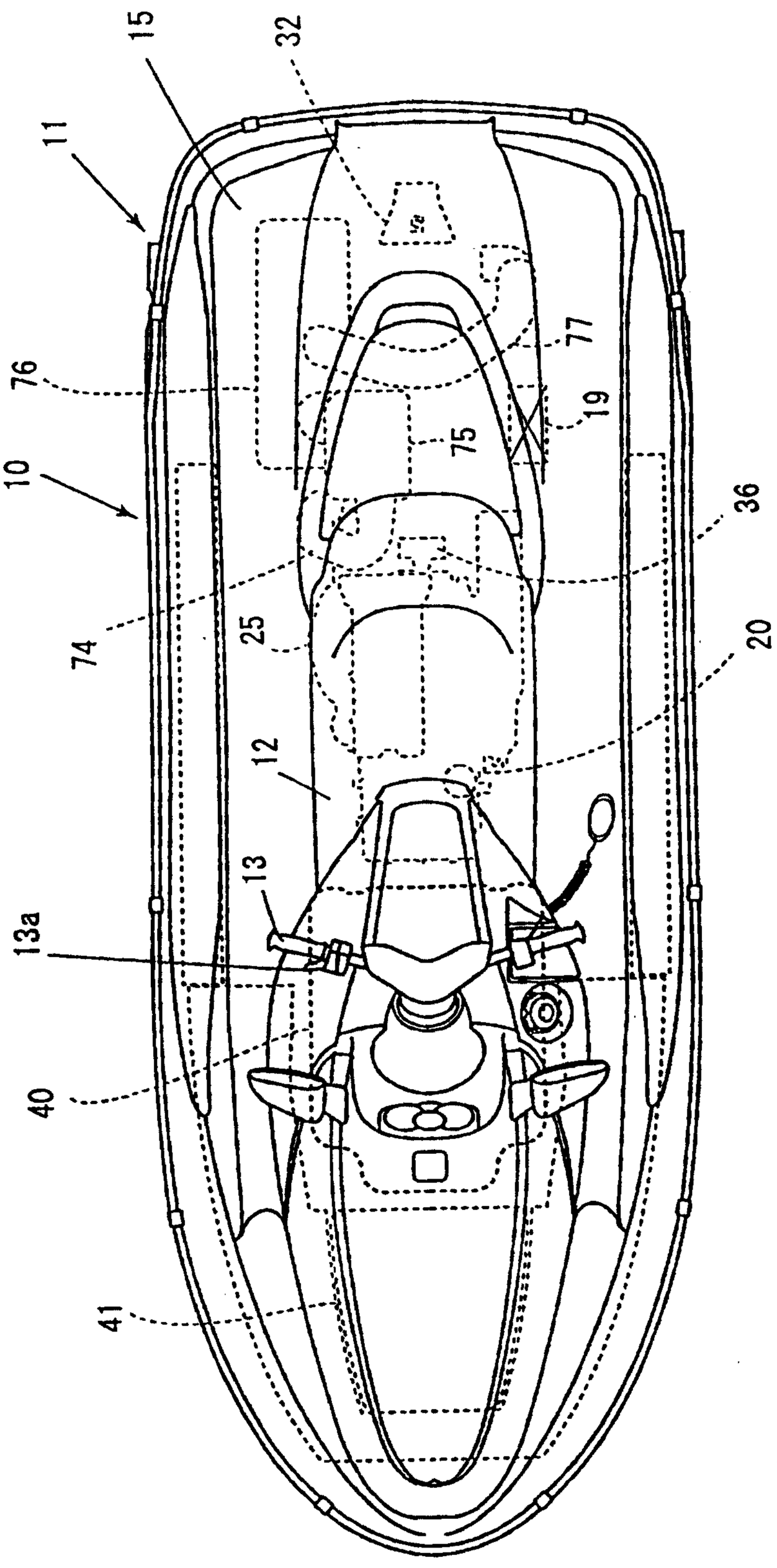

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FIG. 3

H101-1053-03

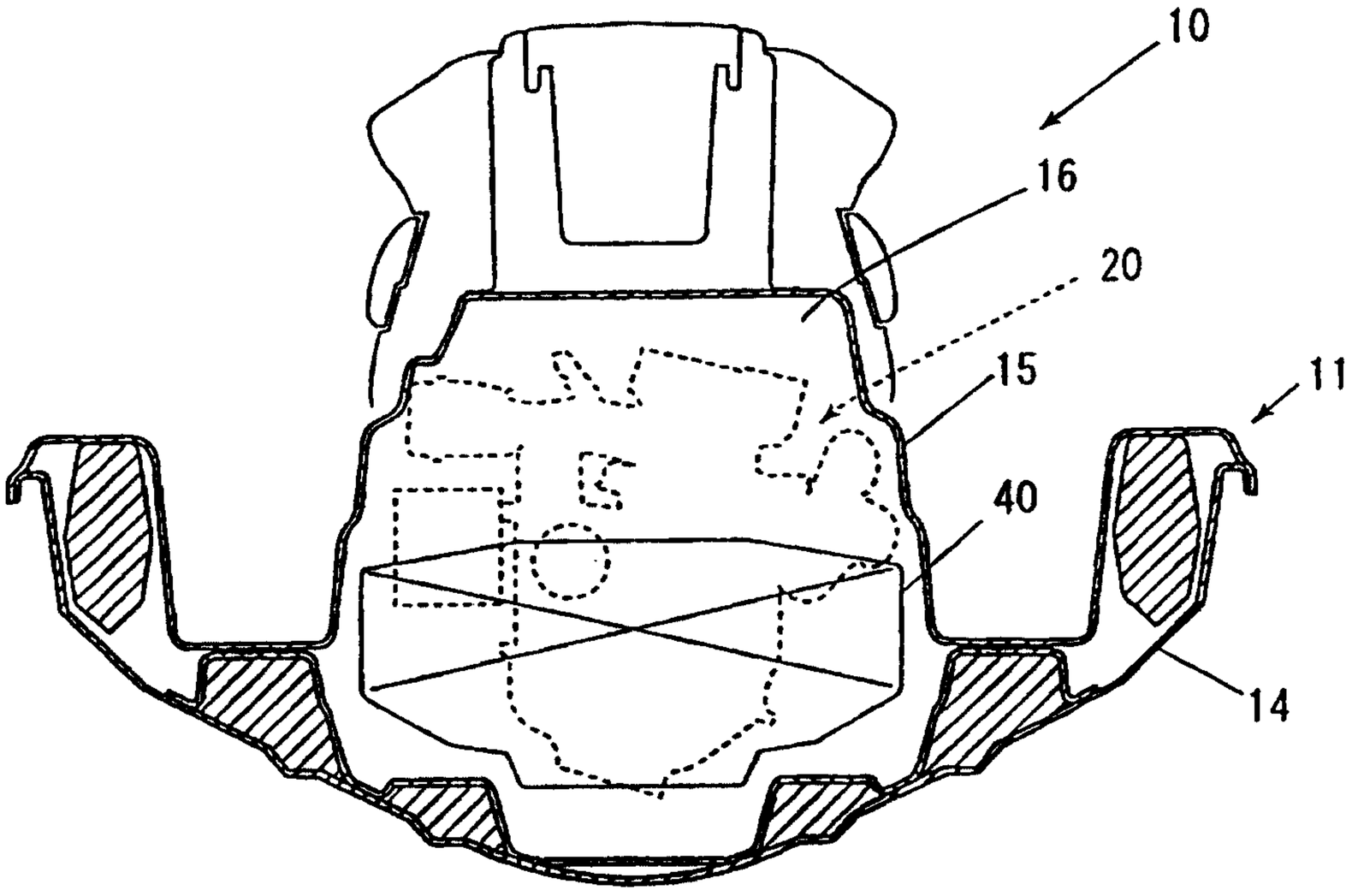

FIG. 4

H101-1053-04

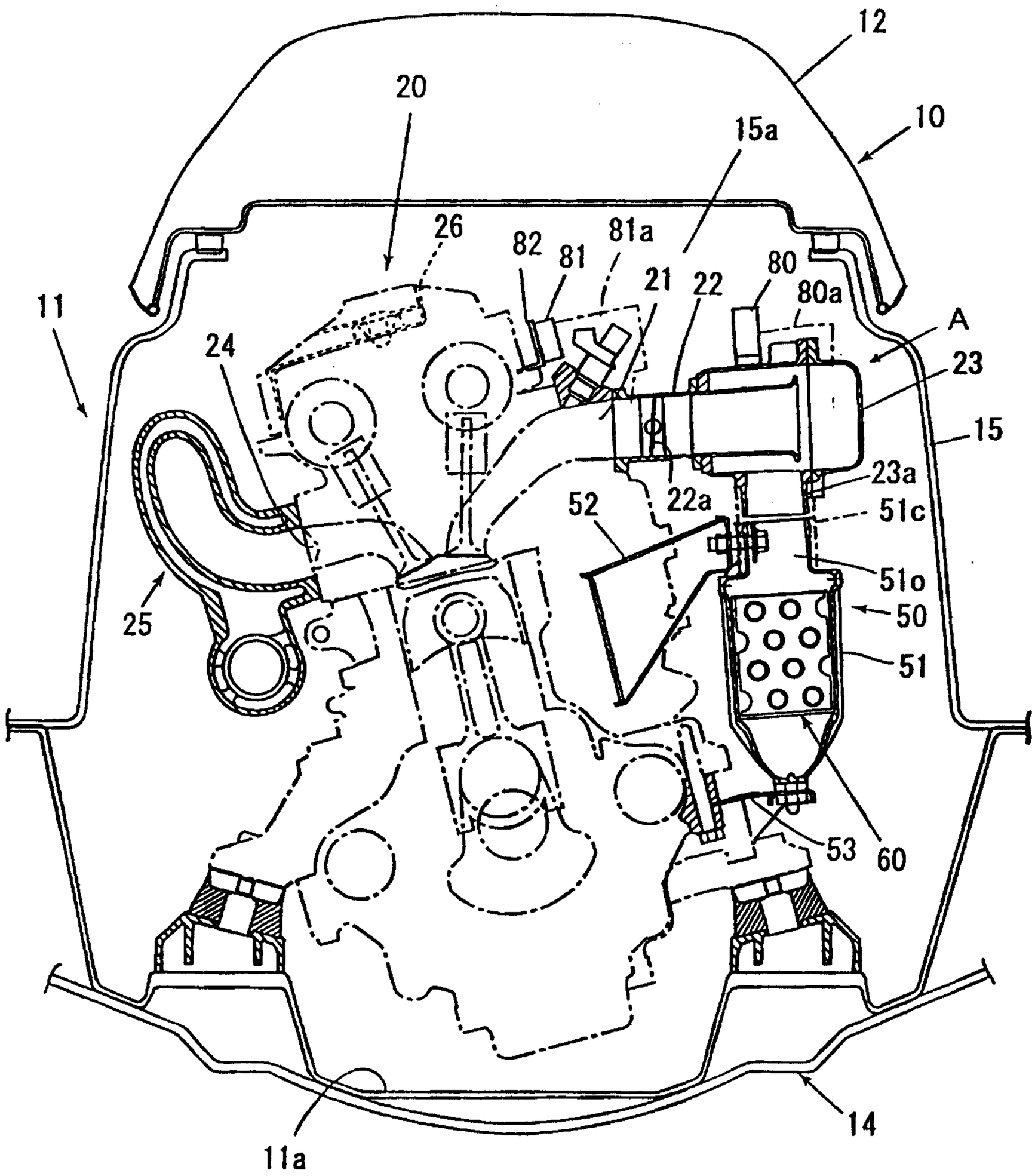

FIG. 5

H101-1053-05

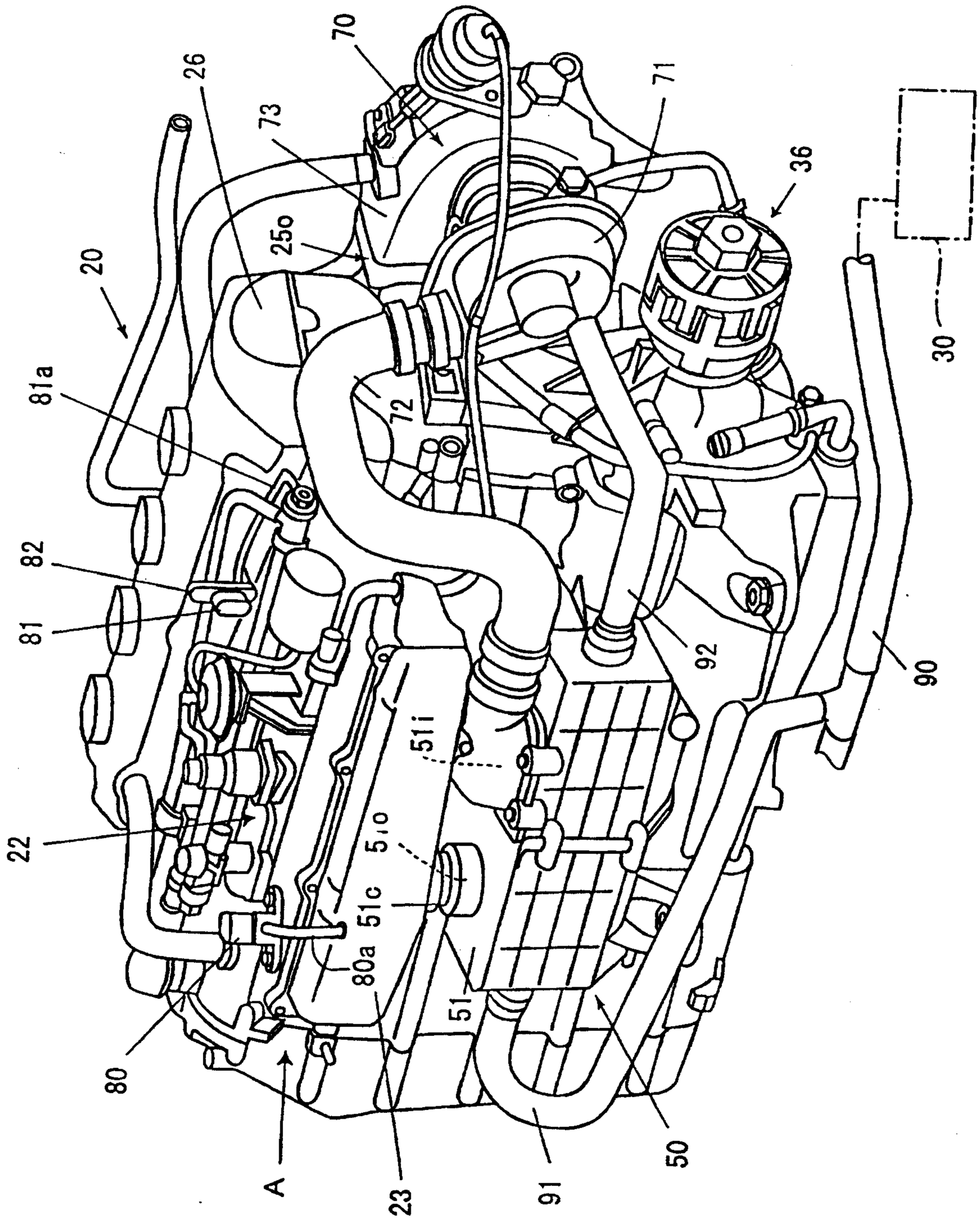

FIG. 6

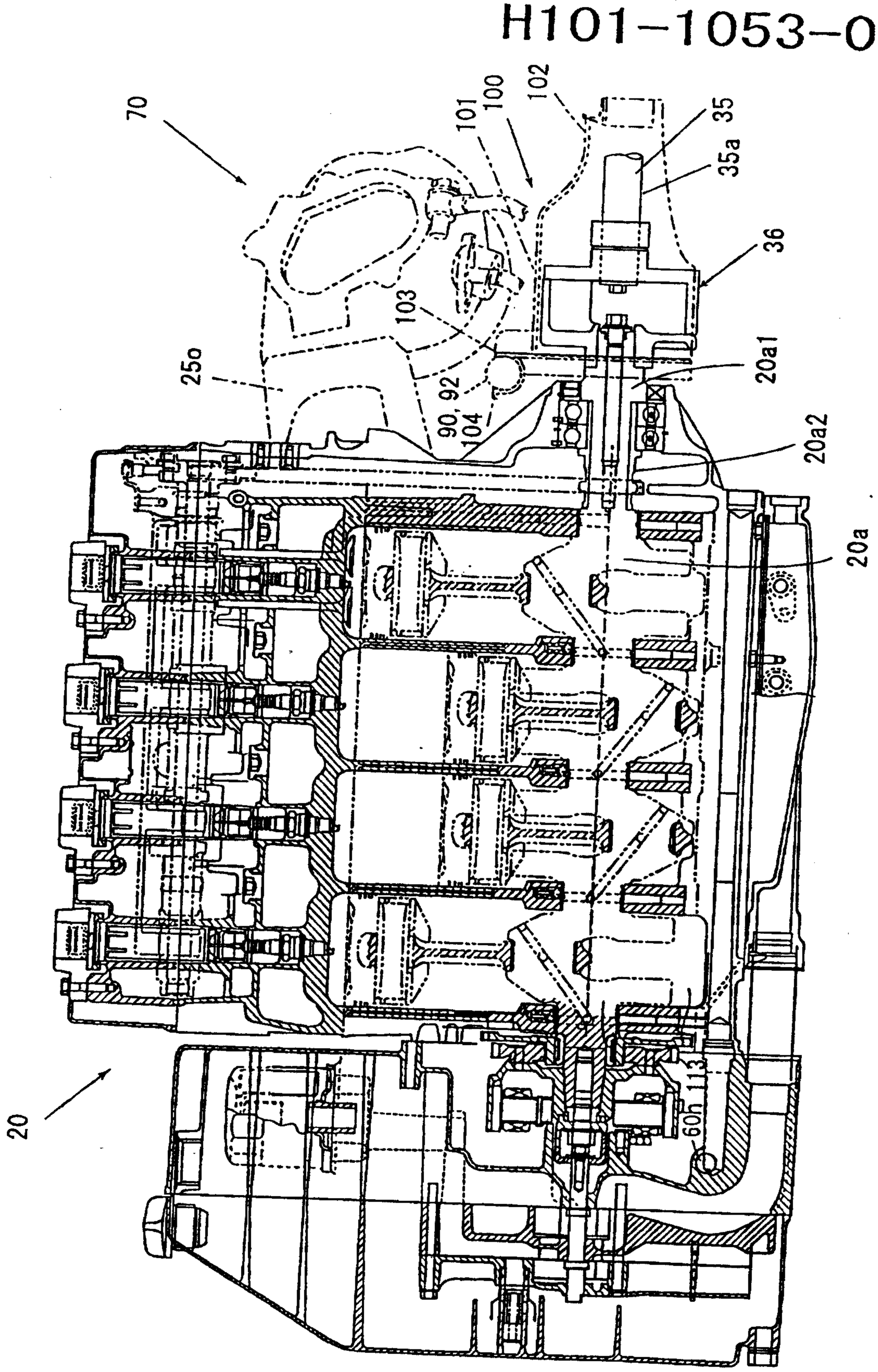
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FIG. 7

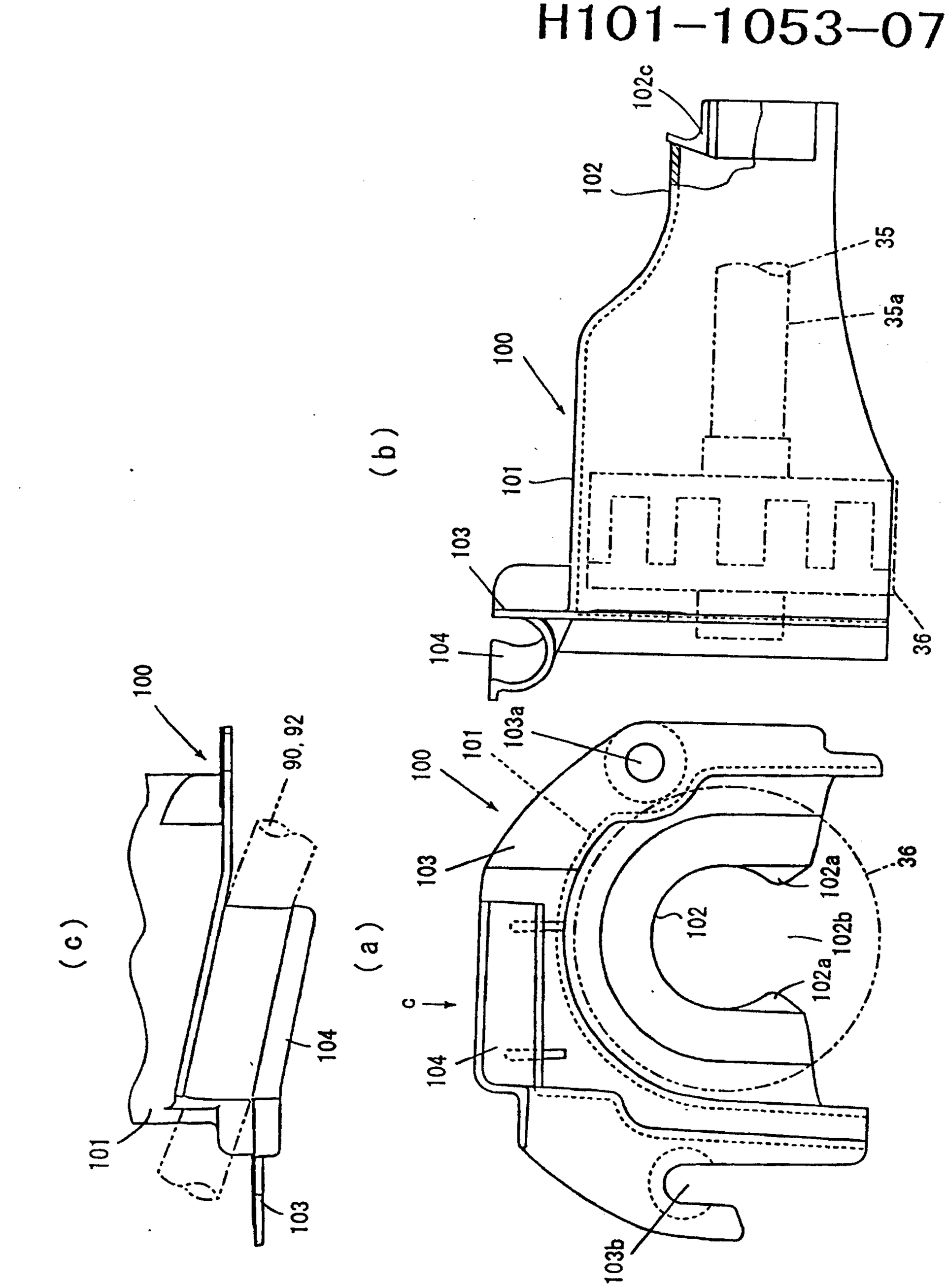
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FIG. 8

H101-1053-08

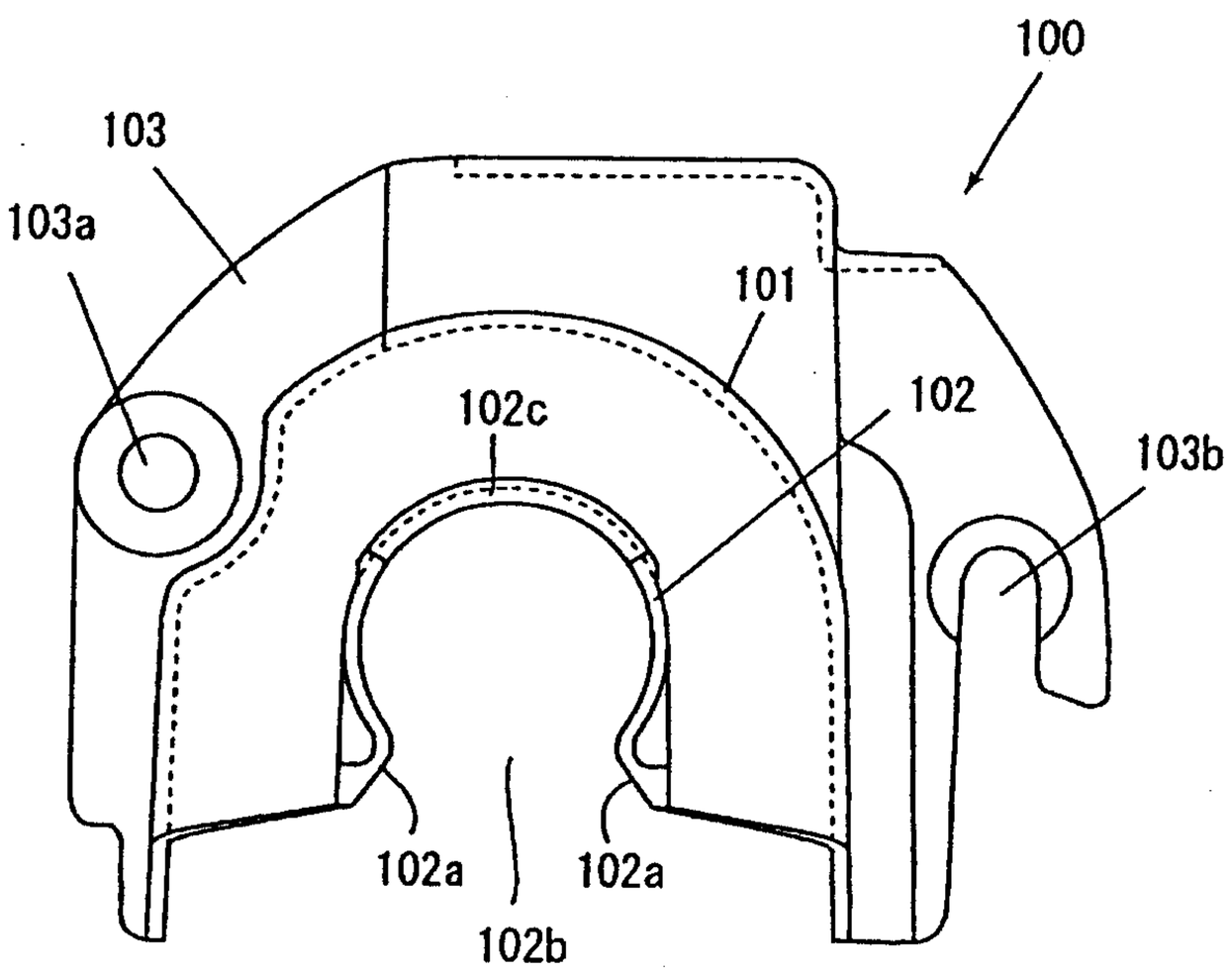

FIG. 9

H101-1053-09

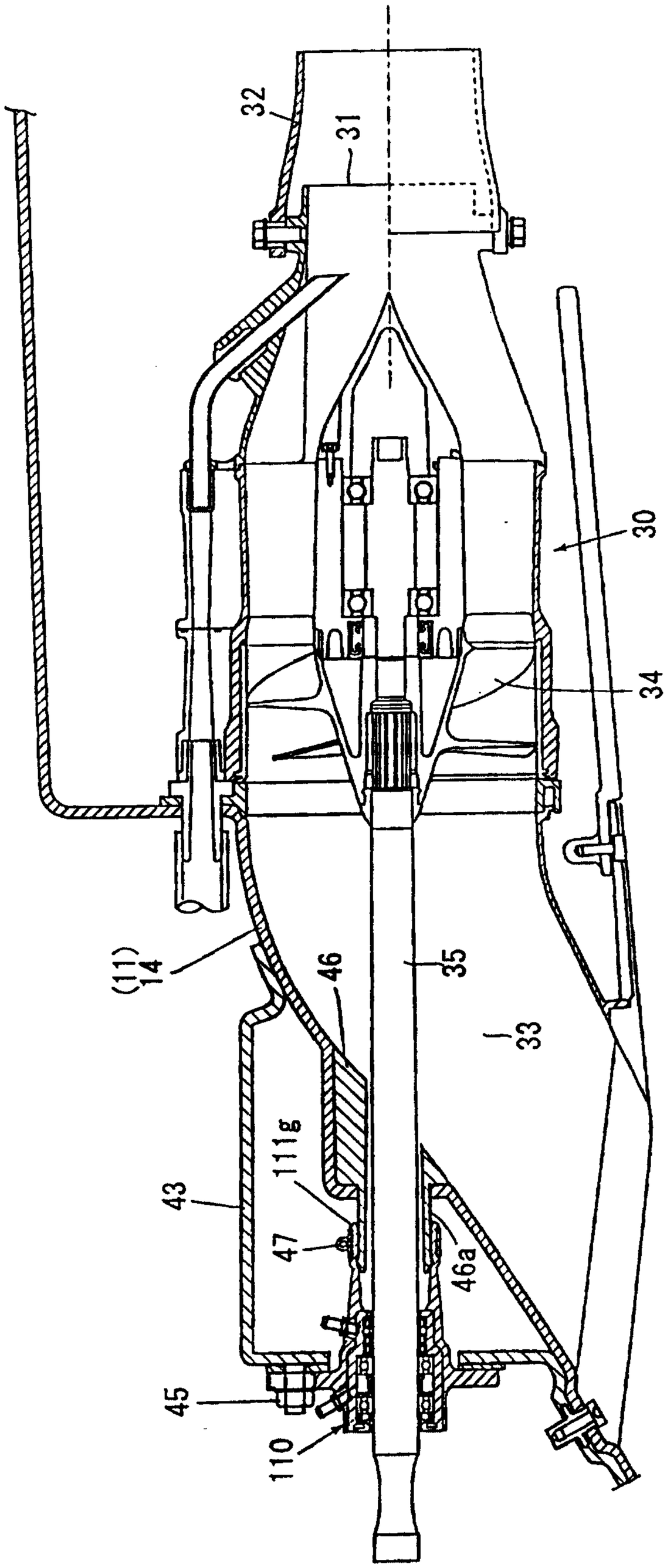

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FIG. 10

H101-1053-10

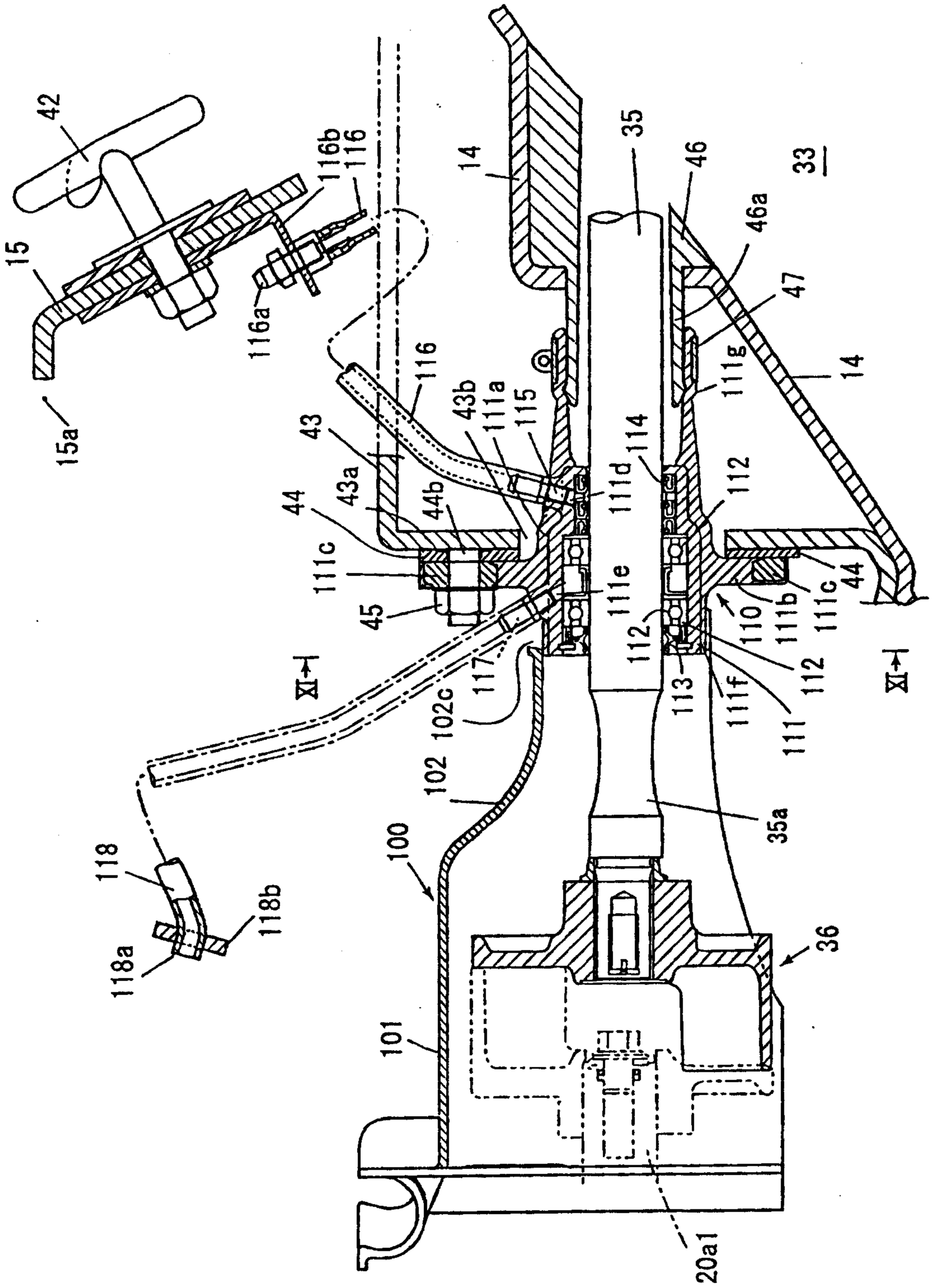


FIG. 11

H101-1053-11

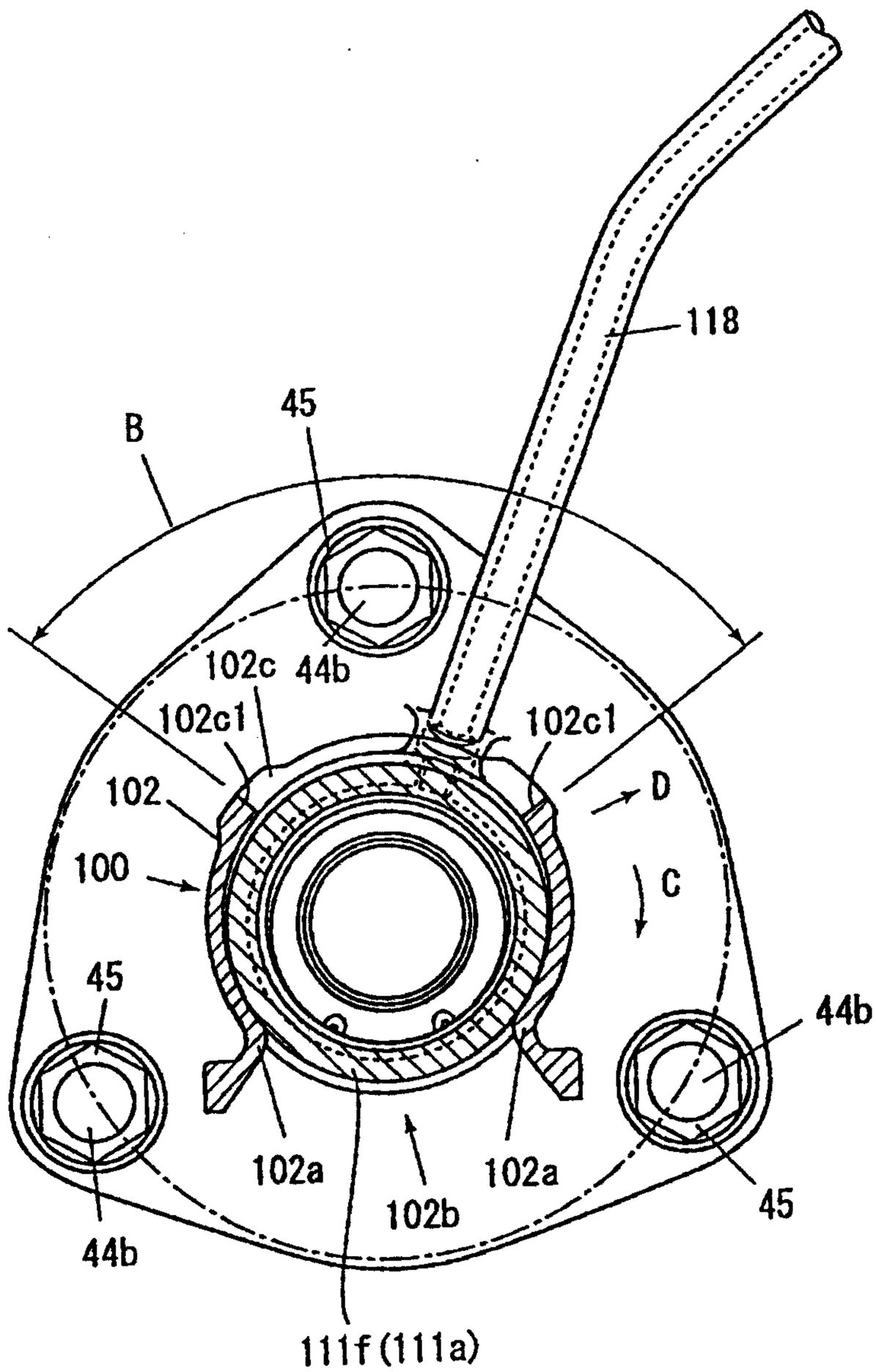
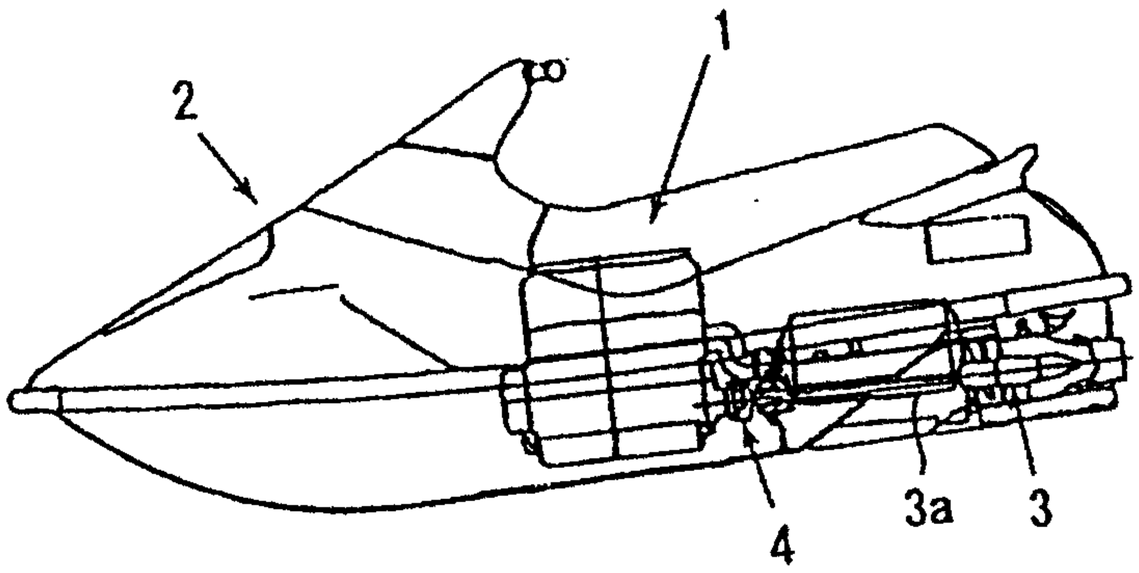


FIG. 12

(a)



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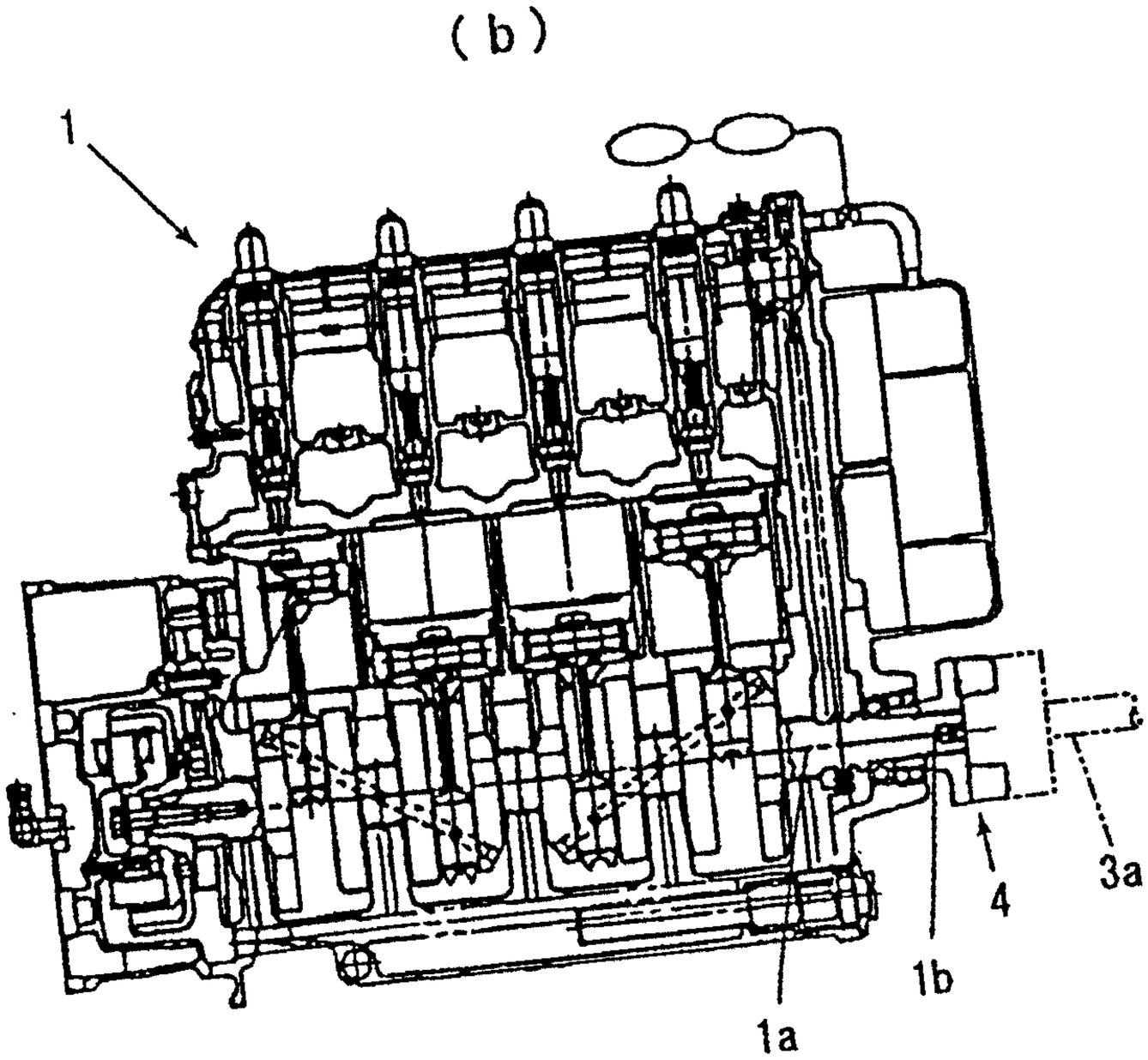

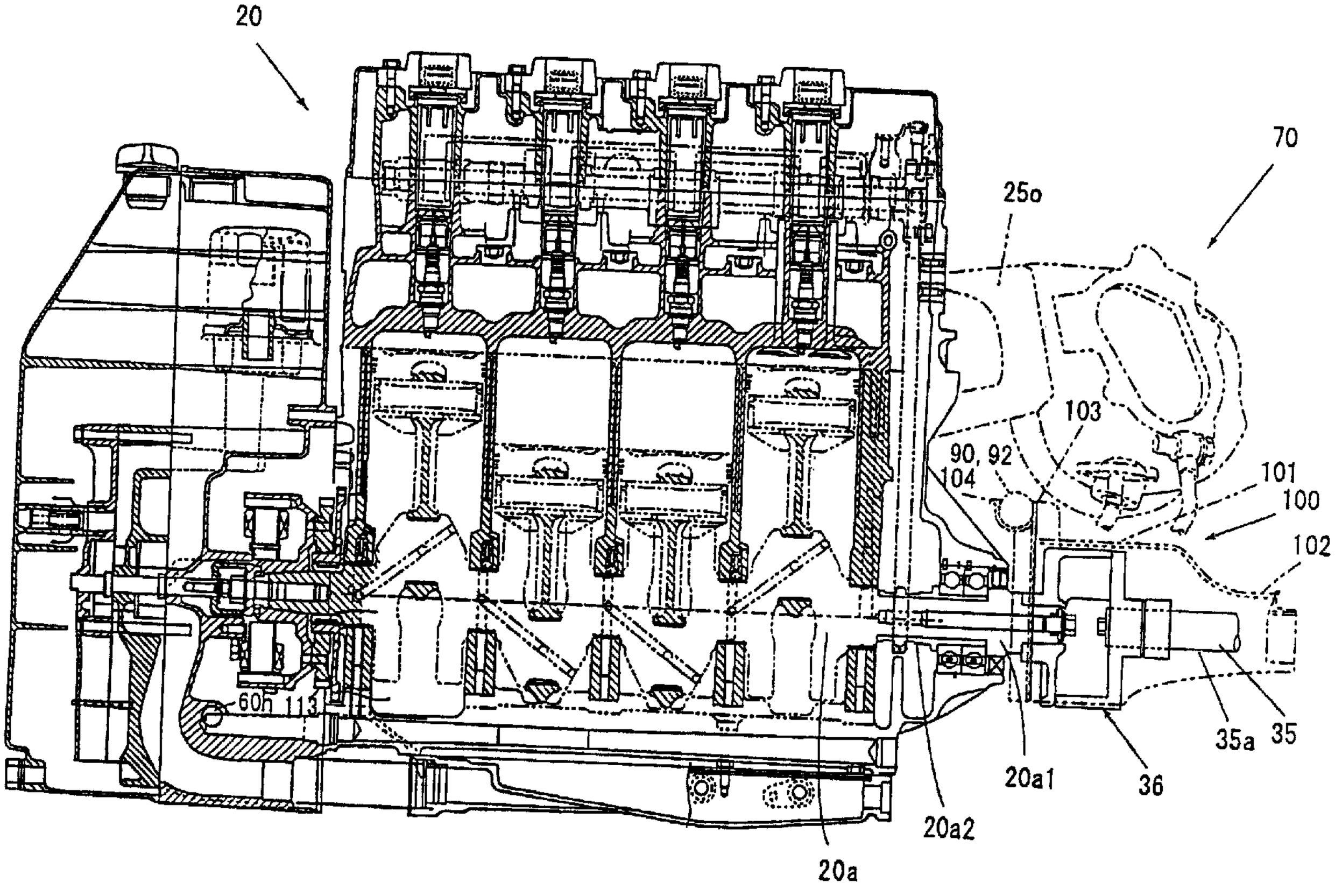
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