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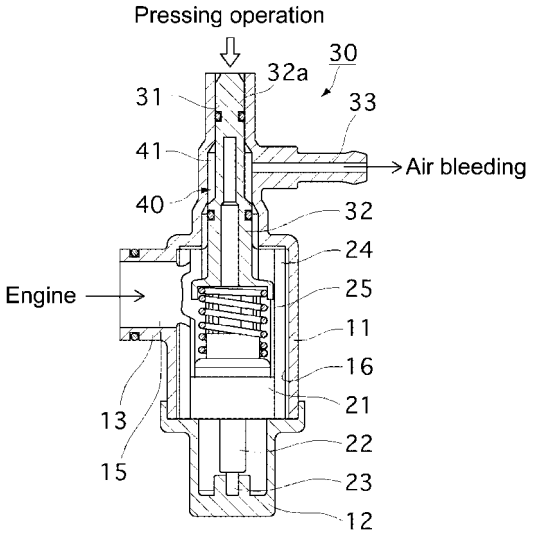
(54) FLUID DISCHARGE STRUCTURE FOR FLUID CONTROL DEVICE

(57) A fluid discharge structure for a fluid control device enables air bleeding to be performed simply and reliably by providing a simply-structured air bleeding part for bleeding air from a coolant passage. An air bleeding part for discharging fluid provided to an upper part of a housing of the device is composed of a cock retention hole that opens at an upper end of the housing, an air bleeding cock that is slidably retained in the cock retention hole and in which a cock outer end is subjected to pressing operation, an air bleeding hole that causes a part of the cock retention hole to be opened in a longitudinal direction to an outside of the housing, and a spring part for constantly causing the air bleeding cock to be biased upward for protruding the cock outer end upward. The air bleeding cock and the cock retention hole together configure an air bleeding circuit which normally blocks communication between a coolant passage and an air bleeding hole by causing the air bleeding cock to protrude upward, and allows communication between the coolant passage and the air bleeding hole when the cock outer end is pressed.

FIG. 1



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Description

[0001] The present invention relates to a fluid discharge structure for a fluid control device that can be suitably used for air bleeding, water removal, oil removal and the like in a fluid control device comprising a thermostat that performs switching by opening and closing a flow passage based on the fluid temperature and which is used, for example, in a coolant circuit of a coolant for cooling an internal-combustion engine (hereinafter simply referred to as an "engine") that is used in automobiles and the like.

[0002] A coolant-based cooling system that uses a radiator is generally used, for instance, to cool an automobile engine. This type of cooling system uses a thermostat that employs a thermal expansion body for adjusting the amount of coolant to be circulated on the radiator side in order to control the temperature of the coolant to be introduced into the engine.

[0003] However, with this kind of cooling system, in order to overcome the drawback of having to adjust the positional relationship in the height direction of the radiator cap, which is provided to the upper tank of the radiator, and the engine for eliminating air pockets in the tubing upon filling the coolant, a structure which provides an air bleeding cock at the upper part of the housing of the thermostat has been conventionally used in order to prevent cavitation caused by the air pockets in the coolant tubing and to prevent air from getting sucked into the water pump (for instance, refer to Japanese unexamined Patent Application No. S59-18224).

[0004] Nevertheless, with this kind of conventional structure, since a screw-operated type is used as the air bleeding cock, a tool or the like is required during the air bleeding process, and the air bleeding operation is troublesome and complicated. In addition, there were cases where the coolant would be discharged outside or air would enter the coolant passage as a result of the cock loosening due to the vibration of the engine or the like.

[0005] Moreover, with a screw-operated cock, it is necessary to provide a thread to the housing based on cutting work or the like, and this led to increased production costs. In addition, there was also a problem in that the 0-ring for sealing would sometimes get cut as a result of being caught in the thread groove or the transverse passage.

[0006] These problems similarly occur upon discharging fluid outside from a fluid passage in various fluid control devices, and there are demands for some kind of measure to be taken in light of the foregoing points.

[0007] The present invention was devised in view of the foregoing circumstances. Thus, an object of this invention is to provide a fluid discharge structure for a fluid control device configured to enable fluid discharge such as air bleeding, water removal, and oil removal simply and reliably by providing to a part of the fluid control device, which opens and closes the flow path and performs switching based on the fluid temperature, a simply-structured fluid discharge part such as an air bleeding part for bleeding air from a coolant passage of an engine, a water removing part for removing water, or an oil removing part for removing oil if the fluid control device is to be provided to an oil circulation circuit.

[0008] In order to achieve the foregoing object, the fluid discharge structure for a fluid control device according to the present invention (invention claimed in claim 1) includes a fluid discharge part provided to a part of a housing, wherein the fluid discharge part is composed of a cock retention hole formed to open at a part of the housing, a fluid discharge cock that is slidably retained in the cock retention hole and in which a cock outer end is subjected to pressing operation from an outside of the housing, a fluid discharge hole that opens from a part of the cock retention hole in a longitudinal direction to the outside of the housing, and spring means provided inside the housing for constantly causing the fluid discharge cock to be biased upward for protruding the cock outer end outward from the housing, and wherein the fluid discharge cock and the cock retention hole together configure a fluid discharge circuit which normally blocks communication between a fluid passage inside the housing and the fluid discharge hole by the fluid discharge cock being biased outward by the spring means, and allows the fluid passage inside the housing to communicate with the fluid discharge hole when the cock outer end is subjected to pressing operation and pushed into the cock retention hole against a biasing force of the spring means.

[0009] In the fluid discharge structure for a fluid control device according to claim 1, the air bleeding structure of the fluid control device according to the present invention (invention claimed in claim 2) is **characterized in that** the fluid control device comprises a main valve and has a thermoelement built into the housing, and biasing means for biasing the main valve or the thermoelement of the fluid control device and the spring means for biasing the fluid discharge cock are commoditized.

[0010] As explained above, according to the fluid discharge structure for a fluid control device according to the present invention, although it is of a simple configuration, for instance, a tool is not required when filling a fluid in the fluid control device such as upon filling a coolant, and the fluid discharge cock can be easily operated merely by performing pressing operation from the outside of the housing, and fluid discharge such as air bleeding, water removal, and oil removal can be performed simply and reliably, whereby the user-friendliness is improved.

[0011] Moreover, since the present invention does not employ a screw-operated cock, for instance, it is possible to prevent the coolant from being discharged outside or air entering the coolant passage as a result of the cock loosening due to the vibration of the engine or the like.

[0012] In addition, with a screw-operated cock, there is a problem that the 0-ring for sealing would sometimes get cut as a result of being caught in the thread groove or the transverse passage, but the present invention is free from such problems.

[0013] Furthermore, with a screw-operated cock, it is necessary to perform cutting work to the thread, but such cutting work is not required in the present invention. In addition, since the cock of the present invention can be formed of resin, it is possible to lower production costs.

[0014] Moreover, since the present invention is configured such that the fluid discharge cock is biased with a spring that is used for biasing the main valve or thermoelement of the device to the cap, it is not necessary to prepare separate spring means for the fluid discharge cock, the total number of components can be reduced, and weight-saving and miniaturization can be sought.

Fig. 1 shows an embodiment of the fluid discharge structure for a fluid control device according to the present invention, and is a schematic cross section in the case of applying this to the air bleeding structure in a thermostat, and a schematic cross section in the case of opening the air bleeding cock of the thermostat;

Fig. 2 is a schematic cross section showing the normal state where the air bleeding cock is closed in the thermostat of Fig. 1; and

Fig. 3A and Fig. 3B are respectively a schematic side view and a bottom view of the thermostat of Fig. 1 and Fig. 2.

[0015] 10... thermostat, 11... housing, 12... cap, 13... entrance-side cylindrical part, 14... exit-side cylindrical part, 15... coolant passage, 16... cylindrical space, 21... thermoelement, 22... guide, 23... piston, 24... rib, 25... spring means, 26... communication hole, 30... air bleeding part, 31... cock retention hole, 32... air bleeding cock (fluid discharge cock), 32a... cock outer end, 33... air bleeding hole, 40... air bleeding circuit, 41... annular space part

[0016] Fig. 1 to Fig. 3 show an embodiment of the fluid discharge structure, air bleeding structure, water removal structure and oil removal structure of the fluid control device according to the present invention, and a case is now explained of applying this to the air bleeding structure in a thermostat of a fluid control device.

[0017] In the drawings, a thermostat 10 is provided to a part of a coolant circuit (not shown) of an engine for controlling the amount of coolant as conventionally known, and comprises a housing 11 provided to the exit side or the like of a water jacket of the engine, and a cap 12 for closing the lower end opening of the housing 11. Also shown are an entrance-side cylindrical part 13 provided to the housing 11 for communicating with the engine side, and an exit-side cylindrical part 14 provided to the cap 12 for communicating with the radiator side (refer to Fig. 3).

[0018] The thermostat 10 comprises a thermoelement 21 that is disposed for opening and closing a coolant passage 15 formed in the housing 11, and the thermoelement 21 is retained to freely move vertically within a cylindrical space 16 in the housing 11. A piston 23 is provided to a lower end of the thermoelement 21 via a guide 22. The piston 23 is pushed in its protruding direction when the coolant temperature in the coolant passage 15 becomes a prescribed temperature or higher, the thermoelement 21 thereby moves upward within the cylindrical space 16, and the coolant flows from the engine side to the radiator side as a result of a cut-off part formed at the step part of the cap 12 being released.

[0019] The drawings also show a rib 24 for retaining the thermoelement 21 in a manner that allows vertical movement within the cylindrical space 16 of the housing 11, and spring means 25 disposed at the upper part of the thermoelement 21 for applying biasing force to the thermoelement 21 normally in the closing direction.

[0020] The present invention is unique in that the air bleeding part 30 is provided to the upper part of the housing 11 of the thermostat 10.

[0021] The air bleeding part 30 is configured from a cock retention hole 31 formed to open at the upper end of the housing 11, an air bleeding cock 32 that is slidably retained in the cock retention hole 31 and in which its outer end 32a is subjected to pressing operation from the outside of the housing 11, an air bleeding hole 33 that causes one longitudinal end of the cock retention hole 31 to be opened to the outside of the housing 11, and spring means 25 provided inside the housing 11 for constantly causing the air bleeding cock 32 to be biased upward for protruding the cock outer end 32a outward from the housing 11.

[0022] In addition, the air bleeding cock 32 and the cock retention hole 31 together configure the air bleeding circuit 40 which normally blocks the communication between the coolant passage 15 inside the housing 11 and the air bleeding hole 33 by the air bleeding cock 32 being biased outward by the spring means 25, and allows the coolant passage 15 inside the housing 11 to communicate with the air bleeding hole 33 when the cock outer end 32a is subjected to pressing operation and pushed into the cock retention hole 31 against the biasing force of the spring means 25.

[0023] Here, in this embodiment, the air bleeding circuit 40 performs air bleeding by being selectively communicated with or blocked from the coolant passage 15 as a result of an annular space part 41 formed at the center in the longitudinal direction of the air bleeding cock 32 and the cock retention hole 31 communicating with the air bleeding hole 33, and the annular space part 41 being guided along the outer periphery of the air bleeding cock 32 based on the vertical movement of the air bleeding cock 32. Note that sealing means such as an 0-ring is provided, as needed, to the outer periphery of the air bleeding cock 32.

[0024] Moreover, in this embodiment, the air bleeding cock 32 is disposed coaxially with the moving direction of the thermoelement 21 of the thermostat 10, and the spring means 25 for biasing the thermoelement 21 can thereby be used as the spring means for biasing the air bleeding cock 32.

[0025] According to the foregoing configuration, the air bleeding part 30 can be provided to the thermostat 10 with a simple configuration based on minimal components.

[0026] According to the foregoing configuration, as a result of the cock 32 being pushed into the housing 11 against the spring means 25 by pressing the outer end 32a of the air bleeding cock 32 from the outside, the gap along the outer periphery of the cock 32, the annular space 41 and the air bleeding hole 33 will be in communication, and the air bleeding circuit 40 is thereby released. Consequently, while the pressing operation is being performed, air bleeding from the coolant passage 15 or the like can be performed appropriately and reliably.

[0027] After the air bleeding is complete, the pressing operation is stopped. Then, as shown in Fig. 2, the air bleeding cock 32 will be subjected to the biasing force of the spring means 25 and its outer end 32a will protrude outward. Consequently, the air bleeding circuit 40 is blocked with the sealing part provided to the outer periphery of the cock 32.

[0028] Moreover, with the foregoing thermostat 10, when the coolant temperature rises and the thermoelement 21 detects a prescribed temperature, the piston 23 protrudes and the thermoelement 21 moves upward to cause the coolant passage 15 in the housing 11 to communicate with the exit-side cylindrical part 14 on the radiator side via the inner chamber on the cap 12 side.

[0029] As shown in Fig. 3B, note that the housing 11 is provided with a small-diameter communication passage 26 for causing its internal coolant passage 15 to communicate with the inner chamber on the cap 12 side, and configured so that a slight amount of coolant will flow when the thermostat 10 is closed. Needless to say, when the coolant temperature rises and the thermoelement 21 moves in the opening direction, a large flow of the coolant will occur.

[0030] In the foregoing embodiment, although the air bleeding circuit 40 for causing the coolant passage 15 inside the housing 11 to communicate with the air bleeding hole 33 is configured from the annular space part 41 and the like formed at the outer periphery of the air bleeding cock 32 and the inner periphery of the cock retention hole 31, the present invention is not limited thereto, and various structures may be freely adopted.

[0031] For example, it should be easy to understand that the air bleeding circuit 40 can also be configured from a communication provided radially to the air bleeding cock 32 and a communication hole provided in the axial direction.

[0032] Moreover, in the foregoing embodiment, although the thermoelement 21 configuring the thermostat 10 is disposed coaxially in the sliding direction of the air bleeding cock 32 in the housing 11 and the spring means 25 (coil spring) for biasing the air bleeding cock 32 and the biasing means for biasing thermoelement 21 are commoditized in the housing of the thermostat 10 as the fluid control device, the present invention is not limited thereto.

[0033] For example, the moving direction of a valve plug which freely opens and closes in the main valve provided to the fluid control device and the moving direction of the fluid discharge cock (air bleeding cock 32) can be disposed roughly coaxially so as to achieve a modified example of commoditizing the biasing means of the valve plug and the biasing means of the fluid discharge cock.

[0034] Note that the present invention is not limited to the structure explained in the foregoing embodiments, and it goes without saying that the shape, structure and the like of the respective components configuring the fluid control device such as the thermostat 10 or a cooling system of an engine using such thermostat 10 can be modified or changed as needed.

[0035] For example, although the air bleeding hole 33 was released to the outside of the housing 11 in the foregoing explanation, a reservoir tank or atmospheric release may be suitably selected.

[0036] Moreover, in the foregoing embodiment, although a case of performing air bleeding in an engine cooling system using the thermostat 1 was explained, the present invention is not limited thereto and is able to yield effects by being used in various fluid discharge structures for various fluid control devices for performing air bleeding, water removal, oil removal or the like.

[0037] For example, it should be easy to understand that the foregoing effects can be yielded by applying the present invention to the water removal structure when replacing the coolant or discharging the coolant upon discarding the engine in a cooling system of an internal-combustion engine shown in Japanese Unexamined Utility Model Registration Application Publication No. S61-26588.

[0038] Moreover, it should be easy to understand that the foregoing effects can be yielded by applying the present invention to the oil removing part for removing oil in a fluid control device such as an oil cooler thermovalve shown in Japanese Unexamined Utility Model Registration Application Publication No. S60-25021.

[0039] It goes without saying that the fluid discharge cock to perform the water removal or oil removal in the foregoing fluid discharge part differs from the type that is provided to the upper part of the housing for performing air bleeding in the foregoing embodiment, and is provided downward or sideways to the lower part of the housing.

Claims

1. A fluid discharge structure for a fluid control device, comprising:

   a fluid discharge part provided to a part of a housing;

   wherein the fluid discharge part is composed of a cock retention hole formed to open at a part of the housing, a fluid discharge cock that is sl-

idably retained in the cock retention hole and in which a cock outer end is subjected to pressing operation from an outside of the housing, a fluid discharge hole that opens from a part of the cock retention hole in a longitudinal direction to the outside of the housing, and spring means provided inside the housing for constantly causing the fluid discharge cock to be biased upward for protruding the cock outer end outward from the housing, and
wherein the fluid discharge cock and the cock retention hole together configure a fluid discharge circuit which normally blocks communication between a fluid passage inside the housing and the fluid discharge hole by the fluid discharge cock being biased outward by the spring means, and allows the fluid passage inside the housing to communicate with the fluid discharge hole when the cock outer end is subjected to pressing operation and pushed into the cock retention hole against a biasing force of the spring means.

2. The fluid discharge structure for a fluid control device according to claim 1,
wherein the fluid control device comprises a main valve and has a thermoelement built into the housing, and
wherein biasing means for biasing the main valve or the thermoelement of the fluid control device and the spring means for biasing the fluid discharge cock are commoditized.

FIG. 1

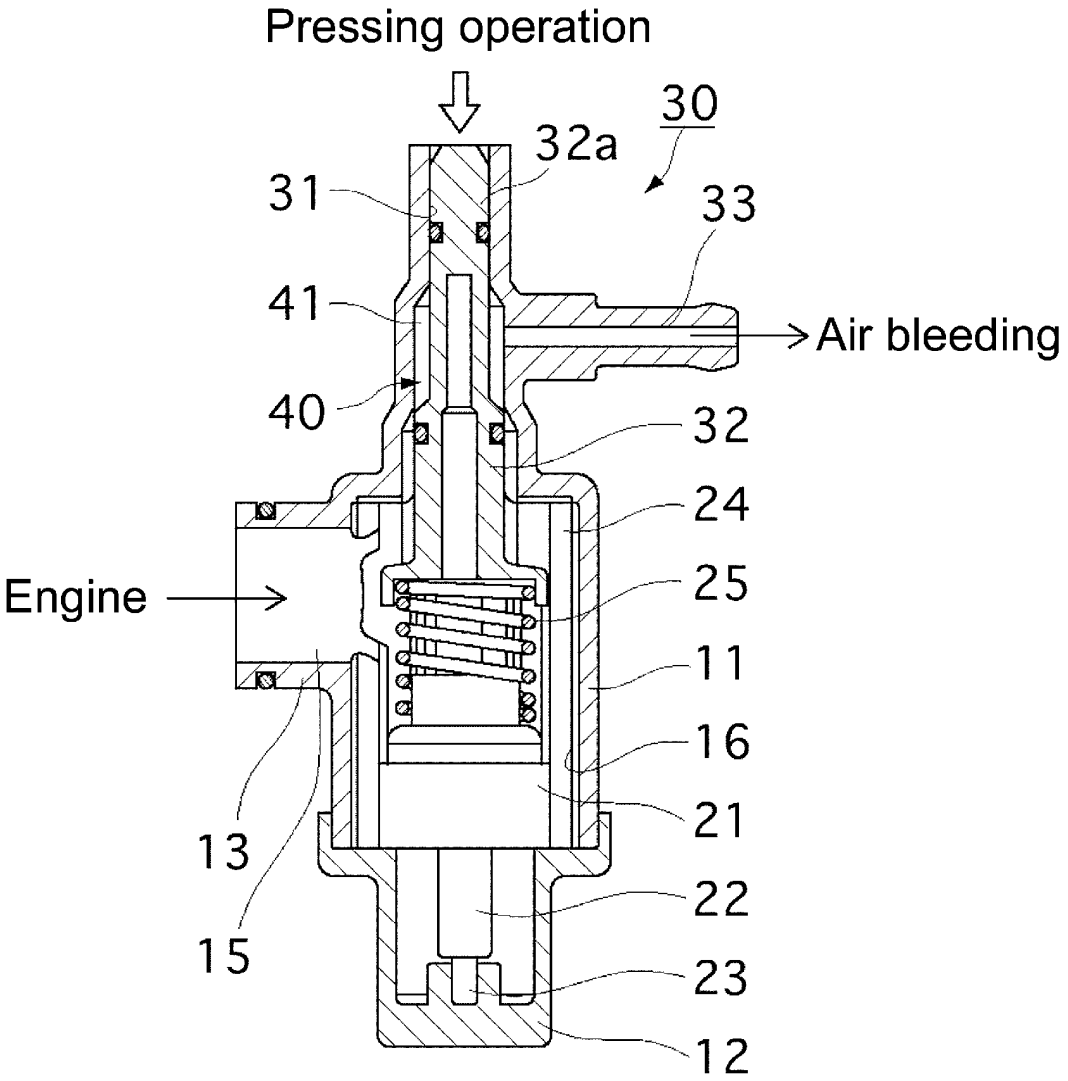
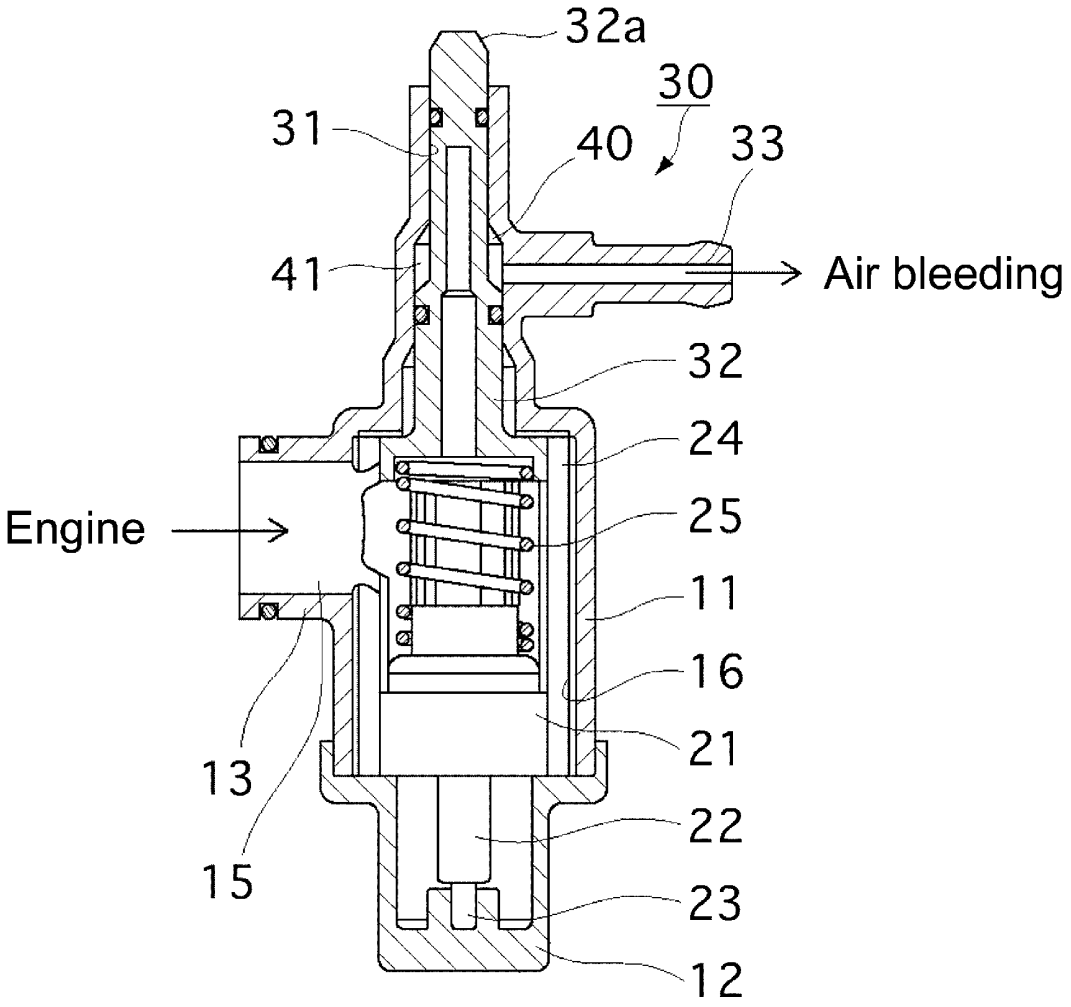

Pressing operation
30
32a
31
33
41
Air bleeding
40
32
24
Engine
25
11
16
21
13
22
15
23
12

FIG. 2


32a
30
31
40
33
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Air bleeding
32
24
Engine
25
11
16
21
13
22
15
23
12

FIG. 3(a)

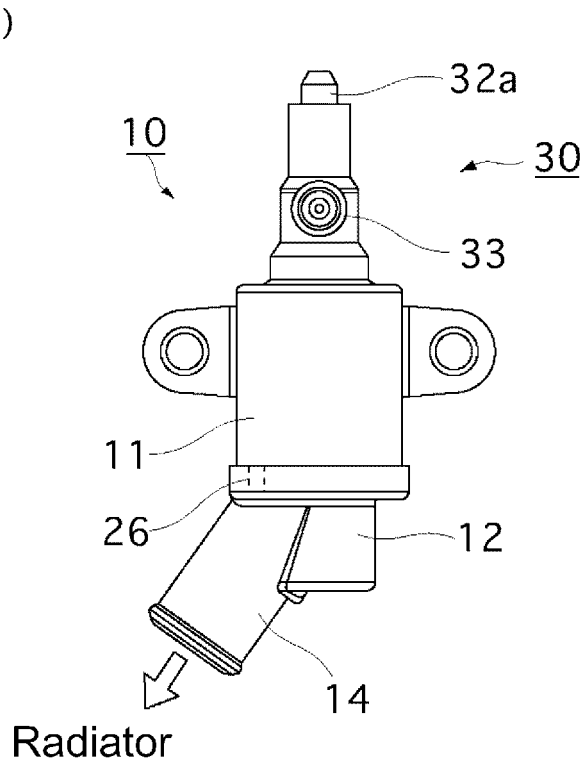
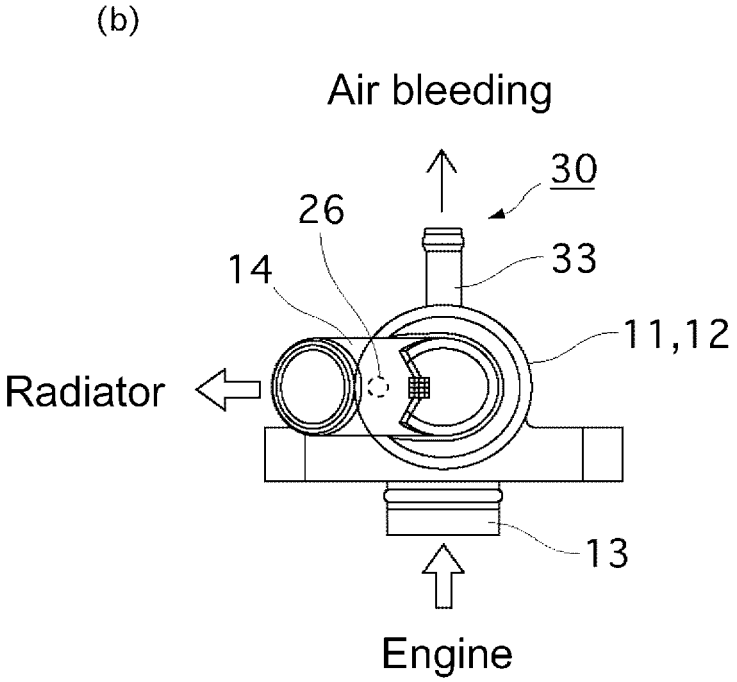


FIG. 3(b)



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/000313

A. CLASSIFICATION OF SUBJECT MATTER
F01P11/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F01P11/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2009
Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 015843/1993(Laid-open No. 073333/1994) (Isuzu Motors Ltd.), 18 October, 1994 (18.10.94), Par. No. [0002]; Fig. 8 (Family: none)	1 2
Y	JP 2007-100588 A (Denso Corp.), 19 April, 2007 (19.04.07), Figs. 1 to 5 (Family: none)	1

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 April, 2009 (03.04.09)	14 April, 2009 (14.04.09)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/000313

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 59-018224 A (Nissan Motor Co., Ltd.), 30 January, 1984 (30.01.84), Full text; all drawings (Family: none)	1,2
A	JP 07-019043 A (Kubota Corp.), 20 January, 1995 (20.01.95), Full text; all drawings (Family: none)	1,2
A	JP 51-095547 A (Kubota Tekko Kabushiki Kaisha), 21 August, 1976 (21.08.76), Full text; all drawings (Family: none)	1,2

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP S5918224 B **[0003]**
- JP S6126588 B **[0037]**
- JP S6025021 B **[0038]**