(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 January 2012 (05.01.2012)

PCT

(10) International Publication Number
WO 2012/001731 A1

(51) **International Patent Classification:**
F02M 35/04 (2006.01) *F02M 17/34* (2006.01)
F02M 35/024 (2006.01)

(21) **International Application Number:**
PCT/JP2010/004276

(22) **International Filing Date:**
28 June 2010 (28.06.2010)

(25) **Filing Language:** English

(26) **Publication Language:** English

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available):* AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

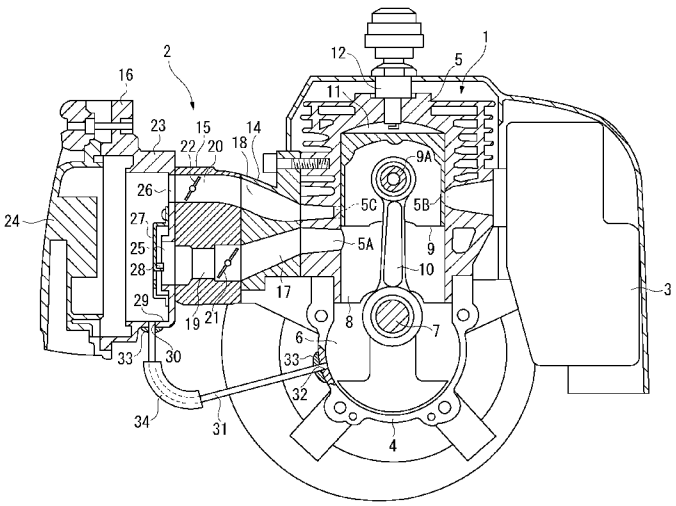
(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available):* ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) **Title:** AIR SUPPLY DEVICE

[Fig. 1]



(57) **Abstract:** An air supply device (2) used in a two-stroke engine includes: an insulator (14) having an insulator mixture passage (17) that is in communication with an intake port (5A) provided in an engine body (1) of the two-stroke engine, the insulator being attached to the engine body (1); a carburetor (15) having an insulator mixture passage (17) that is in communication with an insulator mixture passage (17), the carburetor (15) being attached to the insulator (14); an air cleaner (16) having a mixture-side opening (25) that is in communication with the carburetor mixture passage (19), the air cleaner (16) being attached to the carburetor (15); an accumulating portion (29) that accumulates a blow-back fuel returned through the mixture-side opening 25, the accumulating portion (29) being provided inside the air cleaner (16); and an auxiliary passage having a base end connected to the accumulating portion (29) and a distal end connected to a portion affected by a pressure fluctuation inside a crankcase chamber provided in the engine body (1).

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Description

Title of Invention: AIR SUPPLY DEVICE

Technical Field

[0001] The present invention relates to an air supply device for a two-stroke engine and especially relates to an air supply device having an arrangement suitable for utilizing blow-back fuel.

Background Art

[0002] Two-stroke combustion engines are well known in the art. In two-stroke combustion engines, a complete cycle of the engine includes an upward stroke and a downward stroke of a piston. During an upward stroke, intake of fresh air-fuel takes place whereas, during a subsequent downward stroke after ignition, scavenging occurs. During the downward stroke, a part of fuel or air-fuel mixture may flow in a direction away from the engine from a carburetor and enter an air cleaner. The fuel that enter the air cleaner is generally referred to as blow-back fuel. Blow-back fuel results in loss of fuel and also clog filter elements in the air cleaner.

[0003] Various measures have been adopted in the art to reduce the blow-back fuel. One way is to provide a preventive plate in the air cleaner to prevent a flow of the blow-back fuel from the carburetor into the filter element such that the blow-back fuel is securely reused in the next upward stroke of the piston.

Another commonly known measure is to improve a structure of a piston reed valve.

Summary of Invention

Technical Problem

[0004] However, when a preventive plate is provided, the intake of the air is impeded to cause an intake resistance according to the size of the preventive plate, thereby reducing an output of the two-stroke engine.

Further, in order to improve the structure of the piston reed valve, the structure of the piston reed valve may become more complicated and expensive. Moreover, such a structure may also be susceptible to failures.

[0005] In light of the foregoing, an object of the invention is to provide an air supply device for a two-stroke combustion engine to use the blow-back fuel without waste and without involving a complicated construction or decreasing the output of the two-stroke combustion engine.

Solution to Problem

[0006] An air supply device according to an aspect of the invention is used for a two-stroke engine, the air supply device including: an insulator having an insulator mixture passage that is in communication with an intake port provided on an engine body of

the two-stroke engine, the insulator being attached to the engine body; a carburetor having a carburetor mixture passage that is in communication with the insulator mixture passage, the carburetor being attached to the insulator; an air cleaner having a mixture-side opening that is in communication with the carburetor mixture passage, the air cleaner being attached to the carburetor; an accumulating portion provided inside the air cleaner, the accumulating portion accumulating a blow-back fuel returned from the mixture-side opening; and an auxiliary passage having a base end connected to the accumulating portion and a distal end connected to a portion affected by a pressure fluctuation inside a crankcase chamber provided to the engine body.

[0007] Examples of the "portion affected by a pressure fluctuation inside a crankcase chamber" include: the crankcase chamber itself; a cylinder chamber provided in the engine body; the carburetor mixture passage of the carburetor; the insulator mixture passage of the insulator; a gap provided between opposing surfaces of the carburetor and the air cleaner; and the mixture-side opening.

[0008] According to the above aspect of the invention, since the accumulating portion provided in the air cleaner and the portion affected by the pressure inside the crankcase chamber are connected by the auxiliary passage, the blow-back fuel accumulated in the air cleaner can be sucked into the engine body through the auxiliary passage, thereby efficiently using the blow-back fuel without waste. Further, since the blow-back fuel accumulated at the accumulating portion is securely used, less amount of blow-back fuel is to be trapped by a conventional preventive plate. Thus, no large preventive plate is necessary so that the increase in the intake resistance can be prevented, thereby favorably maintaining the engine performance.

[0009] In the air supply device according to the above aspect of the invention, the auxiliary passage is preferably provided within the air cleaner when a distal end of the auxiliary passage is connected to a gap between the air cleaner and the carburetor or when the distal end of the auxiliary passage is connected to the mixture-side opening of the air cleaner itself.

With this arrangement, since it is not necessary to expose the auxiliary passage to the outside, the structure can be simplified. In addition, since the auxiliary passage is insusceptible to the influence of the heat from the engine body, the durability of the auxiliary passage can be improved. Further, since the length of the auxiliary passage can be reduced, the pressure loss in the auxiliary passage can be reduced, so that the pressure difference between the accumulating portion and the portion to be connected can be sufficiently effected, thereby securely sucking the blow-back fuel at the accumulating portion.

[0010] In the air supply device according to the above aspect of the invention, the auxiliary passage is preferably provided by a pipe.

According to the above arrangement, the accumulating portion and the portion to be connected can be easily connected. Further, since design alteration is facilitated, the portion to be connected can be selected from various portions such as the crankcase chamber and the insulator mixture passage, thereby enhancing the design freedom.

[001 1] In the air supply device according to the above aspect of the invention, at least a part of the auxiliary passage is preferably covered by an insulating material.

Especially, when the auxiliary passage is provided by a pipe and the like and is exposed to an outside, covering the necessary portions with an insulating material so as not to be influenced by the heat from the heated portion of the engine body is effective for improving the durability.

[0012] In the air supply device according to the above aspect of the invention, the accumulating portion is preferably provided at a position at which the blow-back fuel from the mixture-side opening drips to be accumulated.

According to the above arrangement, since the accumulating portion can be provided at the portion at which the blow-back fuel drips by virtue of gravity, a complicated guide mechanism for introducing the blow-back fuel to the accumulating portion is not necessary, thereby further simplifying the structure.

[0013] In the air supply device according to the above aspect of the invention, the air supply device is preferably applied to a piston-valve two stroke engine in which the intake port is opened and closed by a piston.

Since the piston-valve engine tends to produce more blow-back fuel as compared a reed-valve engine, the advantages of the invention can be eminently and effectively exhibited when the air supply device of the invention is applied to the piston-valve engine in order to efficiently use the blow-back fuel.

Brief Description of Drawings

[0014] [fig. 1]Fig. 1 is a cross section showing an engine installed with an air supply device according to a first exemplary embodiment of the invention.

[fig.2]Fig. 2 is a cross section showing an engine installed with an air supply device according to a second exemplary embodiment of the invention.

[fig.3]Fig. 3 is a cross section showing an engine installed with an air supply device according to a third exemplary embodiment of the invention.

[fig.4]Fig. 4 is a cross section showing an engine installed with an air supply device according to a fourth exemplary embodiment of the invention.

[fig.5]Fig. 5 is a cross section showing an engine installed with an air supply device according to a fifth exemplary embodiment of the invention.

[fig.6]Fig. 6 is a cross section showing an engine installed with an air supply device according to a sixth exemplary embodiment of the invention.

Description of Embodiments

[0015] First Exemplary Embodiment

A first exemplary embodiment of the invention will be described below with reference to Fig. 1. Incidentally, the same reference numeral will be used in below-described the second and subsequent exemplary embodiments for the same components as those in the first exemplary embodiment to omit or simplify the description thereof in the second and subsequent exemplary embodiments.

[0016] As shown in Fig. 1, a two-stroke engine (will be simply referred to as an engine hereinafter) according to this exemplary embodiment includes: an engine body 1; an air supply device 2 provided on an intake side of the engine body 1; and an exhaust muffler 3 provided on an exhaust side of the engine body 1.

[0017] The engine body 1 includes a crankcase 4 and a cylinder 5 attached to an upper part of the crankcase 4. A crank shaft 7 is rotatably supported in a crankcase chamber 6 provided in the crankcase 4. A piston 9 is slidably housed within a cylinder chamber 8 provided in the cylinder 5. A piston pin 9A of the piston 9 and the crank shaft 7 are connected by a connecting rod 10.

[0018] The crankcase 4 of this exemplary embodiment is provided by a pair of case components (i.e. dual-divided). The respective case components are mutually connected along an axial direction of the crank shaft 7. One of the case components is illustrated in Fig. 1. However, the crankcase 4 may be provided by another dual-divided structure in which the crank shaft 7 is vertically (in the drawing) held. The crankcase chamber 6 of the crank case 4 is communicated with the cylinder chamber 8 at a lower part of the piston 9.

[0019] An intake port 5A for drawing the air-fuel mixture is provided on a cylinder wall of the cylinder 5 on a side at which the air supply device 2 is attached. An exhaust port 5B for exhausting exhaust gas is provided on the cylinder wall on a side at which the exhaust muffler 3 is attached.

[0020] Further, though not illustrated, a transfer passage for communicating the crankcase chamber 6 with a combustion chamber 11 above the piston 9 is provided in the cylinder wall. An upper end of the transfer chamber is opened at the combustion chamber 11 as a transfer port.

[0021] Further, the engine according to this exemplary embodiment is a stratified scavenging engine. Accordingly, an air port 5C for drawing fresh air is provided on an upper side of the intake port 5A of the cylinder wall. The air port 5C is biforked to be opened at two positions to the combustion chamber 11. In the last stage of the upward stroke of the piston 9, the air port 5C is in communication with a recessed communication groove (not shown) provided on an outer circumference of the piston 9 to be

in communication with the transfer port.

[0022] The piston 9 serves as a piston valve for opening/closing the intake port 5A, the exhaust port 5B, the air port 5C and the transfer port. Specifically, in the last stage of an upward stroke (shown in Fig. 1), the piston 9 opens the intake port 5A and the air port 5C. Accordingly, on account of a negative pressure in the crankcase chamber 6, a fresh air-fuel mixture is drawn from the air supply device 2 to be filled in the crankcase chamber 6 through a lower side of the cylinder chamber 8.

[0023] At the same time, fresh air from the air supply device 2 is drawn from the air port 5C. Then, the fresh air is filled to an upper side (a side near the transfer port) of the transfer passage through the communication groove of the piston 9 from the transfer port.

[0024] When combustion takes place within the combustion chamber 11 by ignition of a spark plug 12 to turn the stroke of the piston 9 downward, the piston 9 opens the exhaust port 5B while closing the air port 5C and the intake port 5A.

[0025] By opening the combustion chamber 11 by the exhaust port 5B and pressurizing the interior of the crankcase chamber 6 by the downward stroke of the piston 9, the air-fuel mixture within the crankcase chamber 6 is supplied to the combustion chamber 11 through the transfer passage and simultaneously scavenges combustion gas within the combustion chamber 11 to exhaust the combustion gas from the exhaust port 5B as the exhaust gas.

[0026] At this time, since the fresh air is filled in the transfer passage near the transfer port, when the combustion gas is scavenged, the fresh air initially works as lead air for scavenging the combustion gas. Accordingly, during the scavenging process, unburned fuel contained in the air-fuel mixture is unlikely to be blown off through the exhaust port 5B, thereby reducing the emission.

[0027] Incidentally, in a two-stroke engine, air-fuel mixture may sometimes reversely return in accordance with the downward stroke of the piston 9 (blow-back). In this exemplary embodiment, when a piston valve is used, since a time lag until the intake port 5A is closed is large as compared with an arrangement using a reed valve, the amount of the reversely returning blow-back fuel tends to increase.

[0028] Accordingly, a mechanism for securely using the blow-back fuel without waste is adopted in the air supply device 2 in this exemplary embodiment. The air supply device 2 will be described in detail below.

[0029] The air supply device 2 includes an insulator 14 attached to the cylinder 5 of the engine body 1, a carburetor 15 attached to the insulator 14 and an air cleaner 16 attached to the carburetor 15.

[0030] The insulator 14 is made of synthetic resin and is heat insulative so as to restrain the transmission of the heat of the engine body 1 to the carburetor 15. The insulator 14 includes an insulator mixture passage 17 that is in communication with the intake port

5A of the cylinder 5 and an insulator air passage 18 that is in communication with the air port 5C of the cylinder 5.

[0031] The carburetor 15 used for a stratified scavenging engine includes a carburetor mixture passage 19 that is in communication with the insulator mixture passage 17 and a carburetor air passage 20 that is in communication with the insulator air passage 18. A main jet (not shown) is provided in the carburetor mixture passage 19. Fuel is drawn from the main jet due to the negative pressure inside the crankcase chamber 6. The fuel and intake air (fresh air from the air cleaner 16) are mixed to produce the air-fuel mixture.

[0032] Butterfly valves 21, 22 that are opened/closed in conjunction with an operation of an accelerator lever are provided in the respective passages 19, 20 of the carburetor 15. Intake flow rate in the carburetor mixture passage 19 and air flow rate in the carburetor air passage 20 are adjusted according to the opening degree of the butterfly valves 21, 22 in accordance with the drive condition of the engine.

[0033] Incidentally, a rotary valve may alternatively be used instead of the butterfly valves 21, 22 in this exemplary embodiment. The rotary valve may include a single cylindrical valve body penetrating the respective passages 19, 20. By rotating the single valve body in conjunction with the accelerator lever, the flow rate in the respective passages 19, 20 can be adjusted.

[0034] The air cleaner 16 includes a case 23 attached to the carburetor 15, a cover 24 attached to the case 23 and a filter element (not shown) disposed in the case and held against the cover 24.

[0035] The case 23 includes a mixture-side opening 25 that is in communication with the carburetor mixture passage of the carburetor 15 and an air-side opening 26 that is in communication with the carburetor air passage 20. The fresh air passing through the filter element is supplied to both of the openings 25, 26. The intake air (fresh air drawn through the mixture-side opening 25) is, as described above, mixed with the fuel in the carburetor mixture passage 19 to be delivered toward the intake port 5A as the air-fuel mixture. The fresh air drawn through the air-side opening 26 is directly supplied toward the air port 5C via the carburetor air passage 20 and the insulator air passage 18.

[0036] Further, a preventive plate 27 for trapping the blow-back fuel and preventing the blow-back fuel from being blown to the filter element is attached to the case 23 at a position opposing the mixture-side opening 25. The preventive plate 27 is a metal plate member that is sized not to impede the inhalation of the intake air sucked through the mixture-side opening 25. A choke plate may be advanceably and retractably provided between the preventive plate 27 and the mixture-side opening 25 to open/close the respective openings 25 and 26 as necessary. The choke plate is not illustrated herein.

[0037] A trap 28 for trapping the blow-back fuel projects from the preventive plate 27 toward the mixture-side opening 25. The blow-back fuel trapped by the trap 28 is again sucked together with the intake air toward the carburetor 15 to be used for producing the air-fuel mixture. However, the above-described preventive plate 27 is provided as necessary and may be omitted.

[0038] Incidentally, even in this exemplary embodiment having the preventive plate 27, it is difficult to completely trap the blow-back fuel by the preventive plate 27. The untrapped blow-back fuel drips downward on account of gravity to be accumulated at an accumulating portion 29 provided on a bottom side of the case 23. In the air supply device 2 of this exemplary embodiment, the blow-back fuel accumulated at the accumulating portion 29 can be utilized.

[0039] A through hole 30 that communicates the inside with an outside of the case 23 is provided on the bottom side of the case 23 that provides the accumulating portion 29. A base end of a pipe 31 made of a resin that is resistant to degradation against fuel is inserted from the outside into the through hole 30 to be connected to the accumulating portion 29. A distal end of the pipe 31 is inserted into a through hole 32 provided in the crankcase 4 to be connected with the crankcase chamber 6. Thus, the pipe 31 directly communicates the accumulating portion 29 with the crankcase chamber 6.

[0040] The connection between the pipe 31 and the respective through holes 30, 32 are sealed by a seal 33. The reference numeral 34 in Fig. 1 denotes an insulating material covering a middle part of the pipe 31. The area covered by the insulating material 34 may be determined so as to protect the pipe 31 from a heated portion of the engine body 1 considering an installation path of the pipe 31 and is not limited to the illustrated area.

[0041] The pipe 31 provides an auxiliary passage for delivering the blow-back fuel from the accumulating portion 29 to the inside of the crankcase chamber 6. The blow-back fuel accumulated at the accumulating portion 29 is sucked through the pipe 31 toward the crankcase chamber 6 with a lower pressure due to a pressure difference caused between the accumulating portion 29 and the crankcase chamber 6.

[0042] At this time, since the fuel amount sucked as the blow-back fuel is small as compared with the fuel amount flowing from the intake port 5A to the inside of the crankcase chamber 6, the engine performance is not greatly affected by adding the blow-back fuel.

[0043] Further, the inner diameter of the pipe 31 is sufficiently small and an opening area of the pipe 31 opened to the inside of the crankcase chamber 6 is also small. Accordingly, even when the stroke of the piston 9 turns downward, the air-fuel mixture in the crankcase chamber 6 scarcely enter into the pipe 31 and thus scarcely returns to the accumulating portion 29.

[0044] The above-described exemplary embodiment provides the following advantages.

The air supply device 2 is provided with the auxiliary passage in the form of the pipe 31 for communicating the accumulating portion 29 provided inside the case 23 of the air cleaner 16 and the crankcase chamber 6. Accordingly, even in an engine using a piston valve, the blow-back fuel can be sucked to the engine body 1 by the simply-structured pipe 31 without providing a complicated structure on the piston 9 and the cylinder 5.

[0045] Further, since the blow-back fuel accumulated at the accumulating portion 29 is securely used, less amount of blow-back fuel is to be trapped by the preventive plate 27. Thus, no large preventive plate 27 is necessary and the preventive plate 27 may be totally omitted as necessary. Accordingly, the increase in the intake resistance by the preventive plate 27 can be prevented and the engine performance can be favorably maintained.

[0046] Second Exemplary Embodiment

Fig. 2 shows a second exemplary embodiment of the invention. In this exemplary embodiment, a distal end of the pipe 31 is inserted into a through hole 35 provided in the cylinder 5 to be connected with the cylinder chamber 8. The through hole 35 is bent within the cylinder wall to communicate the inside with the outside of the cylinder chamber 8 at a lower part of the piston 9. Incidentally, the through hole 35 may be provided at a position opened and closed during a stroke of the piston 9 or at a position constantly opened. Further, the through hole 35 may extend horizontally and linearly at a portion at which the cylinder 5 and the crankcase 4 are overlapped so that the through hole 35 penetrates both of the cylinder 5 and the crankcase 4.

[0047] The blow-back fuel accumulated at the accumulating portion 29 of the air cleaner 16 can also be sucked into the crankcase chamber 6 through the cylinder chamber 8 in this exemplary embodiment, thereby attaining an object of the invention.

[0048] Third Exemplary Embodiment

Fig. 3 shows a third exemplary embodiment of the invention. In this exemplary embodiment, a distal end of the pipe 31 is inserted into a through hole 36 provided at a lower part of the carburetor 15 to be connected with the carburetor mixture passage 19. The through hole 36 is vertically situated so as to communicate the carburetor mixture passage 19 with the outside. However, the lower side of the carburetor 15 is often occupied by a pump mechanism for sucking the fuel from the fuel tank, so that it is sometimes difficult to provide the through hole 36. In this case, the through hole 36 may be provided on a lateral portion of the carburetor 15.

This exemplary embodiment also allows sucking of the blow-back fuel at the accumulating portion 29 toward the carburetor mixture passage 19 and using the blow-back fuel without waste.

[0049] Fourth Exemplary Embodiment

Fig. 4 shows a fourth exemplary embodiment of the invention. In this exemplary embodiment, a distal end of the pipe 31 is inserted into a through hole 37 provided at a lower part of the insulator 14 to be connected with the insulator mixture passage 17. The through hole 37 is a vertical hole that communicates the insulator mixture passage 17 with the outside. However, in the same manner as the third exemplary embodiment, when it is difficult to provide the through hole 37 on the lower side of the insulator 14 for some reason, the through hole 37 may be provided on a lateral or an upper portion of the insulator 14.

[0050] Fifth Exemplary Embodiment

In the fifth exemplary embodiment of the invention shown in Fig. 5, the carburetor 15 and the case 23 of the air cleaner 16 are contacted via an O-ring 38 provided on the carburetor 15. A gap 39 is provided between the opposing surfaces of the carburetor 15 and the case 23. A through hole 40 that communicates an interior of the case 23 with the gap 39 is provided on a wall of the case 23 opposing against the carburetor 15. The through hole 40 is provided at an interior position surrounded by the O-ring 38. A base end of the pipe 31 (auxiliary passage) is located at the accumulating portion 29 and a distal end of the pipe 31 is inserted into the through hole 40 to be connected with the gap 39. Such a pipe 31 is disposed inside the case 23 and is fixed by a suitable fixing means such as an adhesive.

[0051] In this exemplary embodiment, since the gap 39 is in communication with the respective passages 19 and 20, a negative pressure is also applied to the gap 39. Accordingly, the blow-back fuel at the accumulating portion 29 is sucked into the gap 39 through the pipe 31 due to the pressure difference between the accumulating portion 29 and the gap 39. The sucked blow-back fuel flows into the respective passages 19, 20 to be supplied toward the engine body 1 to be used.

[0052] In this arrangement, since a part of the blow-back fuel is supplied to the air port 5C via the carburetor air passage 20 and the insulator air passage 18, the blow-back fuel is mixed in the lead air. However, since the mixed amount is small, even when the fuel is blown off together with the lead air during the scavenging process, the reduction in emission is not impeded. Incidentally, though the preventive plate 27 (Figs. 1 to 4) is not illustrated in this exemplary embodiment, the preventive plate 27 may be provided as necessary, which also applies in the next sixth exemplary embodiment.

[0053] Sixth Exemplary Embodiment

In the sixth exemplary embodiment shown in Fig. 6, a base end of the pipe 31 is located at the accumulating portion 29 and a distal end of the pipe 31 is inserted into and positioned at a cut 42 provided on a cylindrical rib 41 provided around the mixture-side opening 25 to be connected to the mixture-side opening 25. The pipe 31

is also fixed by a suitable fixing means such as an adhesive in this exemplary embodiment. However, when the position of the distal end of the pipe 31 can be sufficiently determined by fixing the pipe by an adhesive and the like, the cut 42 of the cylindrical rib 41 is not necessary.

[0054] The blow-back fuel is sucked through the pipe 31 due to the negative pressure applied from the carburetor mixture passage 19 to go out through the distal end of the pipe 31. The sucked blow-back fuel is sucked toward the carburetor mixture passage 19 after being mixed with the intake air to be supplied toward the engine body 1 after being mingled with the mixture produced in the carburetor mixture passage 19 to be used.

[0055] Incidentally, it should be understood that the scope of the invention is not limited to the above-described embodiments but includes modifications as long as an object of the invention can be achieved.

For instance, though the engine of the respective exemplary embodiments is a stratified scavenging engine, the air supply device according to the invention can be applied to a conventional (i.e. not stratified scavenging) two-stroke engine.

[0056] Though the carburetor 15 has the integrated carburetor air passage 20, the air passage may be provided by a separate pipe member independent of the carburetor and may be disposed independently of the carburetor. In this case, the carburetor may be provided by the one used for a conventional two-stroke engine.

[0057] Though the single pipe 31 is employed for providing the auxiliary passage in the respective exemplary embodiments, a plurality of pipes may alternatively be employed to provide a plurality of auxiliary passages. In this case, though all of the base ends of the plurality of pipes are in communication with the accumulating portion 29 of the air cleaner 16, it is not necessary for all of the distal ends thereof to be in communication with the same location but the distal ends may be in communication with different locations. For instance, the distal end of one pipe may be connected to the crankcase chamber 6 and the other distal end of the pipe may be connected to the cylinder chamber 8.

[0058] Though the pipe 31 is disposed inside the air cleaner 16 in the fifth and sixth exemplary embodiments, a pipe-shaped auxiliary passage may alternatively be, for instance, integrally molded on an inner surface of the case 23 of the air cleaner 16 to eliminate the use of the pipe 31.

Industrial Applicability

[0059] The air supply device according to the invention is suitably applied to a two-stroke engine used for portable operating machine such as a mower and a chain saw.

Reference Signs List

[0060] 1...engine body
2...air supply device
5A...intake port
6...crankcase chamber
8...cylinder chamber
14...insulator
15...carburetor
16...air cleaner
17...insulator mixture passage
19...carburetor mixture passage
25...mixture-side opening
29...accumulating portion
31...pipe as an auxiliary passage
34...insulating material
39...gap

Claims

[Claim 1] An air supply device used for a two-stroke engine, comprising:
an insulator having an insulator mixture passage that is in communication with an intake port provided on an engine body of the two-stroke engine, the insulator being attached to the engine body;
a carburetor having a carburetor mixture passage that is in communication with the insulator mixture passage, the carburetor being attached to the insulator; and
an air cleaner having a mixture-side opening that is in communication with the carburetor mixture passage, the air cleaner being attached to the carburetor, characterized by:
an accumulating portion provided inside the air cleaner, the accumulating portion accumulating a blow-back fuel returned from the mixture-side opening; and
an auxiliary passage having a base end connected to the accumulating portion and a distal end connected to a portion affected by a pressure fluctuation inside a crankcase chamber provided to the engine body.

[Claim 2] The air supply device according to claim 1, wherein
the distal end of the auxiliary passage is connected to the crankcase chamber itself.

[Claim 3] The air supply device according to claim 1, wherein
the distal end of the auxiliary passage is connected to a cylinder chamber provided in the engine body.

[Claim 4] The air supply device according to claim 1, wherein
the distal end of the auxiliary passage is connected to the carburetor mixture passage of the carburetor.

[Claim 5] The air supply device according to claim 1, wherein
the distal end of the auxiliary passage is connected to the insulator mixture passage of the insulator.

[Claim 6] The air supply device according to claim 1, wherein
the distal end of the auxiliary passage is connected to a gap provided between opposing surfaces of the carburetor and the air cleaner, and
the gap is in communication with the carburetor mixture passage.

[Claim 7] The air supply device according to claim 1, wherein
the distal end of the auxiliary passage is connected to the mixture-side opening.

[Claim 8] The air supply device according to claim 6 or 7, wherein

the auxiliary passage is provided inside the air cleaner.

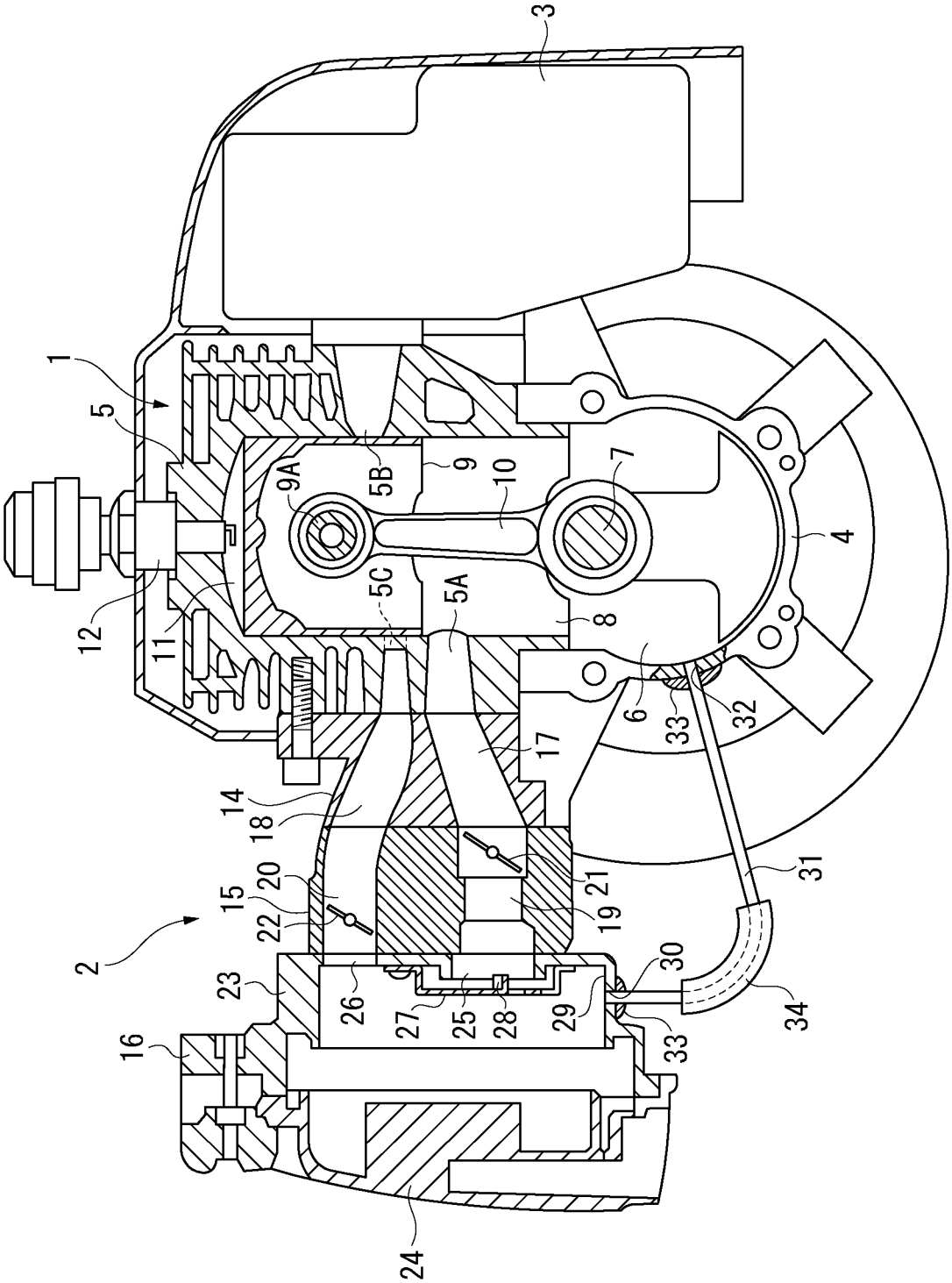
[Claim 9] The air supply device according to any one of claims 1 to 8, wherein the auxiliary passage is provided by a pipe.

[Claim 10] The air supply device according to any one of claims 1 to 9, wherein at least a part of the auxiliary passage is covered by an insulating material.

[Claim 11] The air supply device according to any one of claims 1 to 10, wherein the accumulating portion is provided at a position at which the blow-back fuel from the mixture-side opening drips to be accumulated.

[Claim 12] The air supply device according to any one of claims 1 to 11, wherein the air supply device is applied to a piston-valve two stroke engine in which the intake port is opened and closed by a piston.

[Fig. 1]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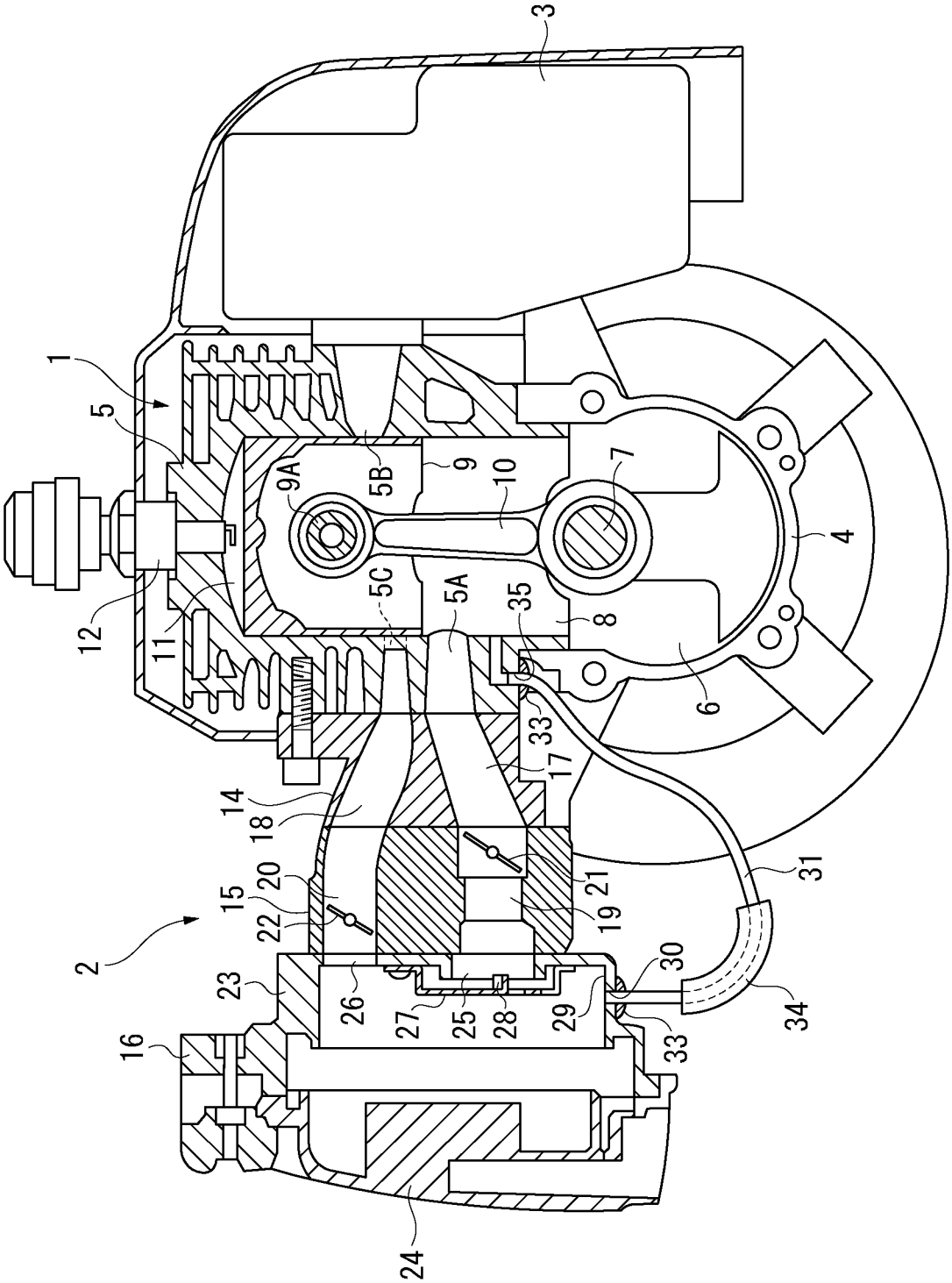
[Fig. 2]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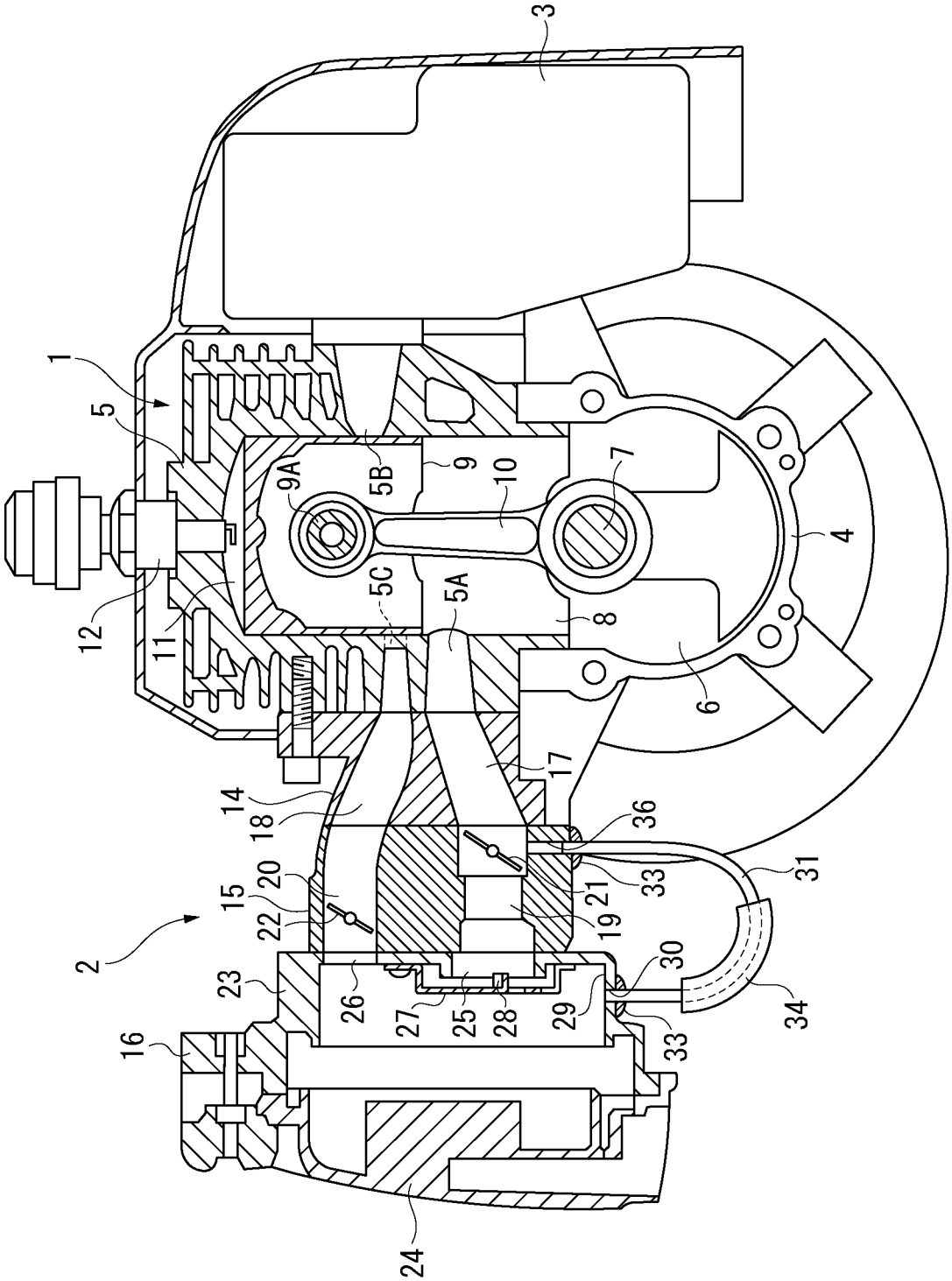
[Fig. 3]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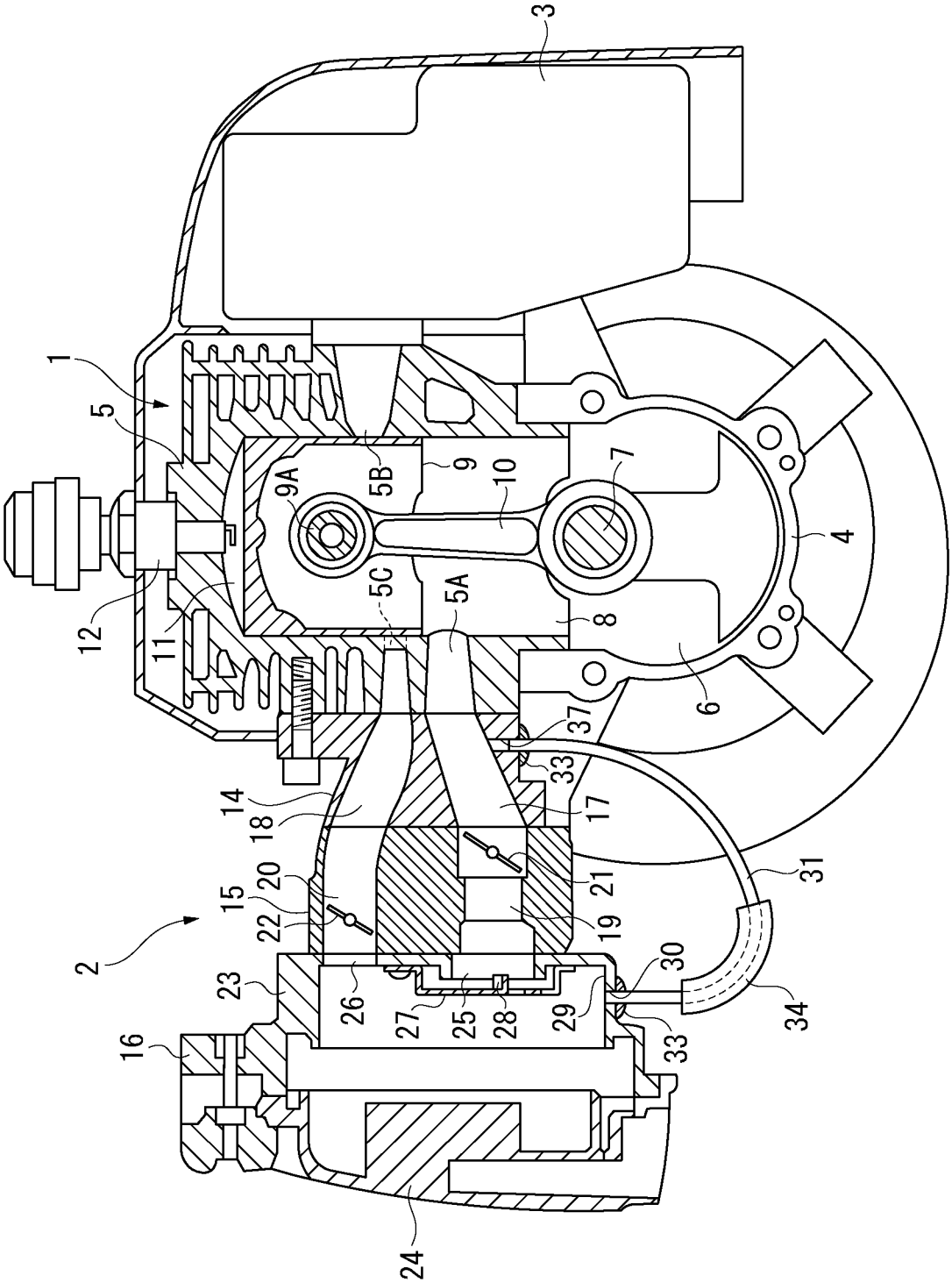
[Fig. 4]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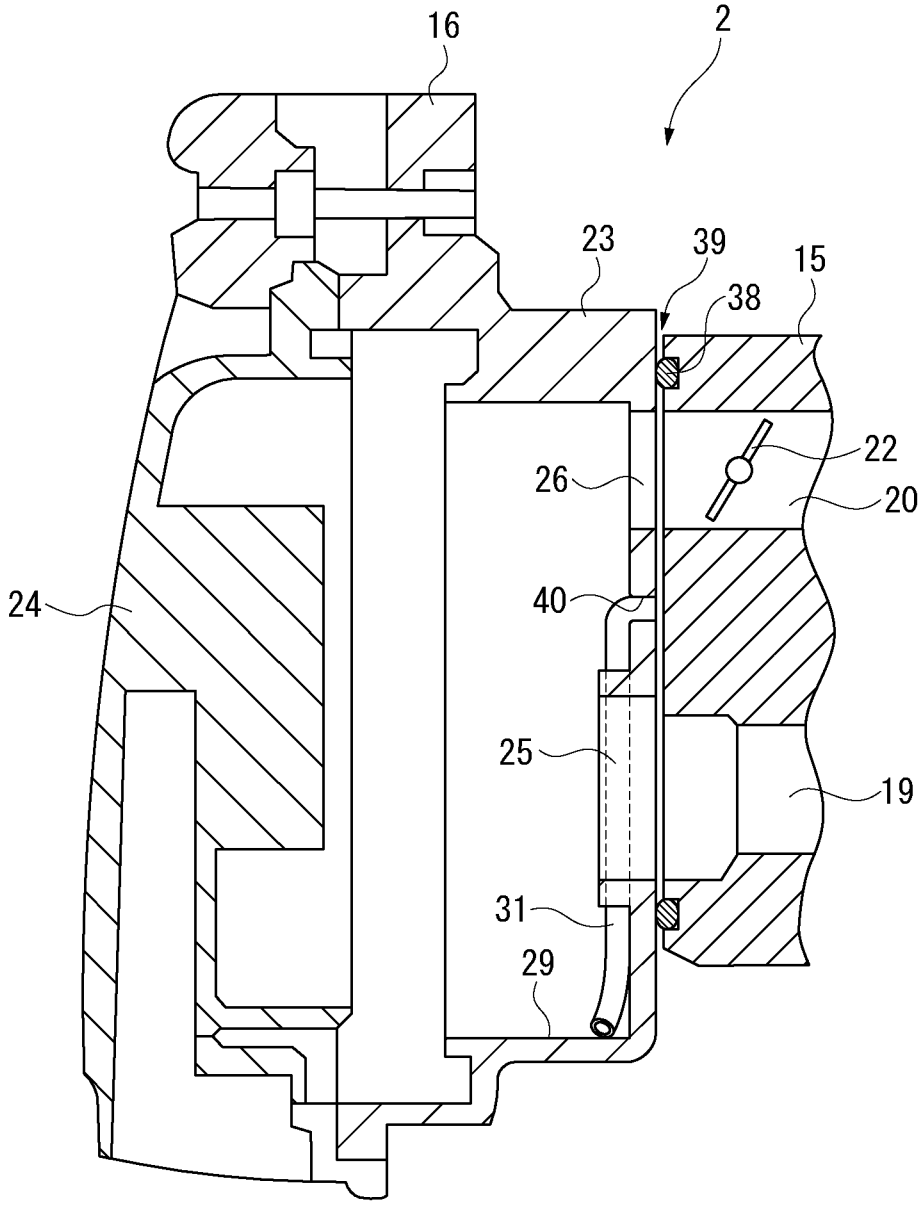
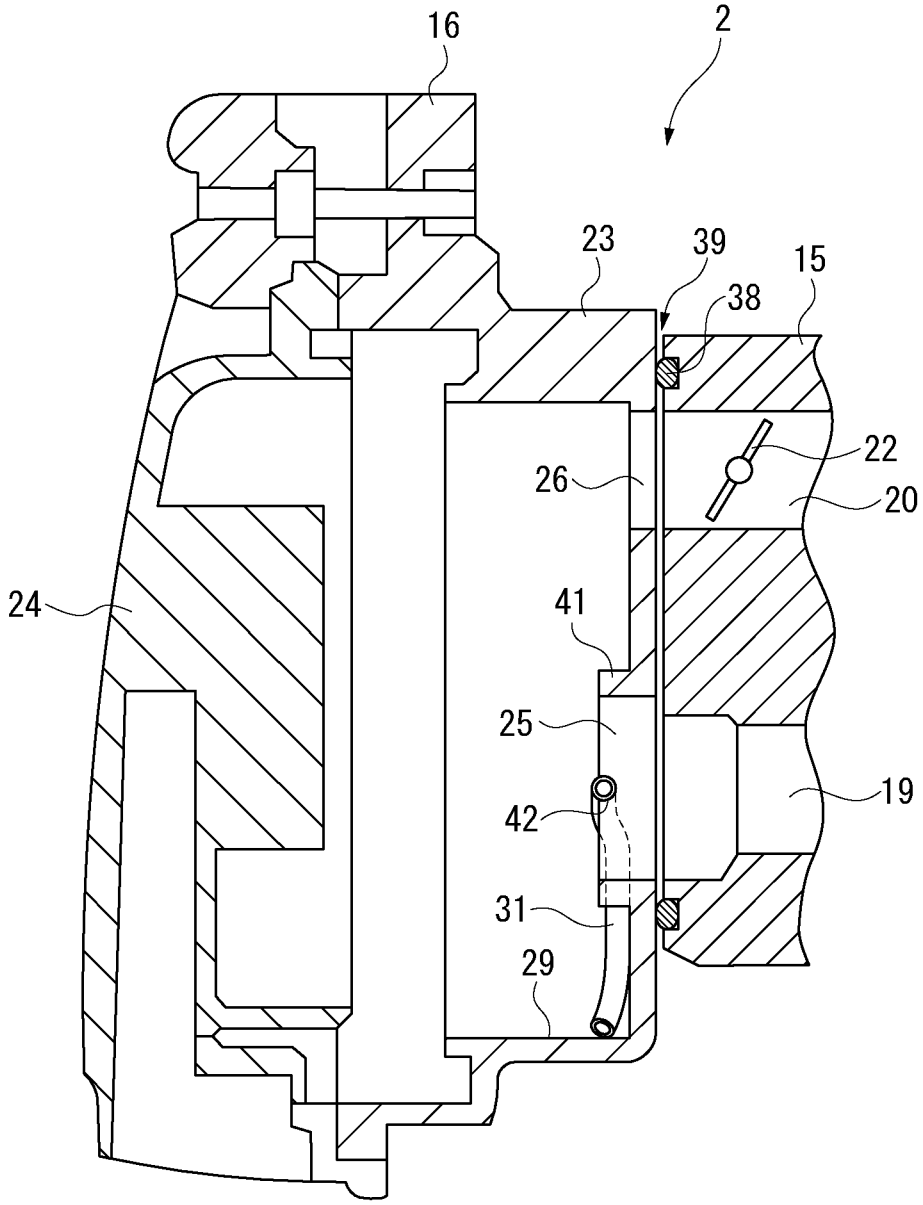
[Fig. 5]



[Fig. 6]



INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2010/004276

A. CLASSIFICATION OF SUBJECT MATTER
INV. F02M35/04 F02M35/024 F02M17/34
ADD.

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)
F02M B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 63 075560 U (FUJI HEAVY INDUSTRIES LTD) 19 May 1988 (1988-05-19) figures 1,2,4	1-3,9-12
X	JP 63 075559 U (FUJI HEAVY INDUSTRIES LTD) 19 May 1988 (1988-05-19) figures 1,2,3	1,4,5, 9-12
X	JP 55 177057 U (SUZUKI MOTOR CORPORATION LTD) 19 December 1980 (1980-12-19)	1,5,7, 9-12
Y	figure	6
Y	JP 59 174364 U (FUJI HEAVY INDUSTRIES LTD) 21 November 1984 (1984-11-21) figure 4	6

-/- .

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 May 2011	27/05/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Dorfstatter, Markus

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2010/004276

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 2009/283079 Al (TSUNODA HIDEKAZU [JP]) 19 November 2009 (2009-11-19) the whole document	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/JP2010/004276

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