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(54) **BREATHER DEVICE OF CRANKCASE FOR 4-CYCLE ENGINE**

(57) A crankcase scavenging mechanism for a four-stroke engine is disclosed. A valve operating chamber (5) is assembled from a cylinder head and a cylinder head cover (3) and is communicated with a crankcase (6). The cylinder head cover (3) is arranged on the top of the cylinder head (9) and is provided with a gas-oil separating cavity (23) on the top thereof. A passage (37) is communicated with the valve operating chamber (5). The gas-oil separating cavity (23) is connected with a partition plate (25) to form an oil-gas separation chamber (26). The oil-gas separation chamber (26) is provided with a one-way valve (27) thereon. The one-way valve (27) is installed in a one-way valve hole (28). A passage (33) above the one-way valve (27) is provided with an inclined orifice (38), one end of which is blocked by a plug (39), the other end of which is communicated with the cylinder head (9) and is further communicated with a suction tube (14) through a cylinder head communication passage (41). An oil-returning hole (34) is formed between the inclined orifice (38) of the passage (33) and the oil-gas separation chamber (26).

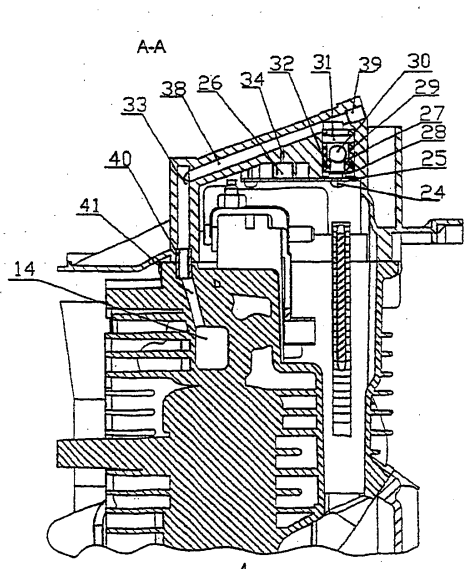


Fig. 4

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Description

TECHNICAL FIELD

[0001] The present invention relates to a crankcase scavenging mechanism for a four-stroke engine in the technical field of power device, in particular to a crankcase scavenging mechanism which can effectively prevent the lubricating oil from entering the suction system while oil mist separation effect is well during the operation of the engine.

BACKGROUND ART

[0002] During the operation of the engine, a portion of air/fuel mixture and exhaust gases in the cylinder enters into the crankcase via a gap between the piston ring and the cylinder wall, wherein the engine oil will be diluted with shorten life-span due to the condense of the fuel steam and the abrasion of parts in the engine will be caused due to the strong corrosion action of the exhaust gases to the parts, while the leakage of the engine oil occurs due to the higher pressure. Accordingly, in order to prolong the life-span of the engine oil, reduce the abrasion of the parts and prevent the leakage of the engine oil, it is necessary to provide a scavenging mechanism for expelling the exhaust gases from the cylinder of the engine. The scavenging mechanism should effectively expel the exhaust gases and separate the oil mist well to prevent the lubricating oil from entering into the suction system. The scavenging mechanism is located such that it is well separated from the lubricating oil during the operation of the engine. In the general engine, the scavenging mechanism tends to have no good effect of oil-returning; furthermore, the one-way valve is of wafer type, which the one-way valve is not opened or can not be reset due to occurrence of abrasion, aging, deformation or losing elasticity, so that the leakage of the engine oil is caused.

[0003] In the prior art, the internal combustion engine has an auxiliary equipment mounted on side wall of the cylinder block through a reinforcement bracket so that a breather chamber is formed between the side wall of the cylinder block and the reinforcement bracket. However, the auxiliary equipment would cause the increasing of parts number and the complexity of structure, which is not advantageous to light-weight design.

SUMMARY OF THE INVENTION

[0004] For overcoming the above-mentioned deficiencies in the prior art, an objective of the present invention is to provide a compact and reliable scavenging mechanism for an engine, in which the remained gases in the crankcase can be sucked into the suction tube via a communication passage and then enter into the combustion chamber for combustion during the operation of the engine, while the lubricating oil can be prevented from entering the suction system by air-fuel separation and oil-returning effect is well. The scavenging mechanism is totally arranged inside the engine with better space utilization efficiency so as not to enlarge dimensions of the engine, while ensuring weight-reducing of the four-stroke engine with the scavenging mechanism.

[0005] To achieve the above mentioned objective, the technical solution of the present invention is as follows:

A main body 1 according to the present invention of the engine comprises a casing 7, a cylinder sleeve 8 and a cylinder head 9; wherein a crankcase 6 of the engine is assembled from the casing 7 and a crankcase cover 2, the crankcase 6 being provided with a rotatable support crankshaft 4 therein and containing lubricating oil 35; a valve operating chamber 5 is assembled from the cylinder head 9 and a cylinder head cover 3 and is communicated with the crankcase 6; a piston 10 is connected to a crankpin of the crankshaft 4 via a connecting rod 11; the cylinder head 9 is communicated with a combustion chamber 19; a suction system 20 is held on the cylinder head 9 to communicate with a gas inlet 17 of the cylinder head 9; the cylinder head cover 3 is arranged on the cylinder head 9; the present invention is characterized in that the cylinder head cover 3 is provided with a gas-oil separating cavity 23 on the top thereof, the gas-oil separating cavity 23 being of labyrinth formed by three labyrinth-forming walls 36, being communicated with the valve operating chamber 5 via a passage 37 and being connected with a partition plate 25 to form the oil-gas separation chamber 26; the oil-gas separation chamber 26 is provided with a one-way valve 27 thereon, the one-way valve 27 being installed in a one-way valve hole 28; a passage 33 above the one-way valve 27 is provided with an inclined orifice 38, one end of which is blocked by a plug 39, the other end of which is communicated with the cylinder head 9 and is further communicated with a suction tube 14 through a cylinder head communication passage 41; an oil-returning hole 34 is formed between the inclined orifice 38 of the passage 33 and the oil-gas separation chamber 26.

[0006] In comparison with the prior art, the present invention has the following advantages:

The crankcase scavenging mechanism for a four-stroke engine in the present invention has a simple, compact and reasonable structure. Secondly, the remained gases in the crankcase can be sucked into the suction tube via a communication passage and then enter into the combustion chamber for combustion during the operation of the engine, while the lubricating oil can be prevented from' entering the suction system by air-fuel separation and oil-returning effect is well. Finally, the scavenging mechanism is

totally arranged inside the engine with better space utilization efficiency so as not to enlarge dimensions of the engine, while ensuring light-weight of the four-stroke engine with the scavenging mechanism.

BRIEF DESCIRPTION OF THE DRAWINGS

[0007]

FIG. 1 is a longitudinal sectional view of the structure of the present invention;

FIG. 2 is a transversal sectional view of the structure of the present invention;

FIG. 3 is a bottom view at portion A shown in FIG. 2;

FIG. 4 is a section view along line A-A shown in FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0008] The present invention will be further described with reference to the embodiment shown in the drawings.

[0009] The present invention comprises a main body 1 of the engine, a crankcase cover 2, a cylinder head cover 3, a crankshaft 4, a valve operating chamber 5, a crankcase 6, an engine casing 7, a cylinder sleeve 8, a cylinder head 9, a piston 10, a connecting rod 11, a connecting-rod cap 12 for big-end of the connecting rod, an oil-scattering needle 13, ball bearings 15 and 16, a gas inlet 17, a gas outlet 18, a combustion chamber 19, a suction system 20, an air filter 21, a carburetor 22, a gas-oil separating cavity 23, a bolt 24, a partition plate 25, an oil-gas separation chamber 26, a one-way valve 27, a one-way valve hole 28, a valve seat 29, a plastic ball 30, a cylindrical pin 31, a seal ring 32, a cylinder head cover passage 33, an oil-returning hole 34, lubricating oil 35, labyrinth-forming walls 36, a passage 37, an inclined orifice 38, a plug 39, a hollow pin 40, a cylinder head communication passage 41 and a suction tube 14, etc.

[0010] The present invention is directed to a four-stroke engine. The main body 1 of the engine comprises the casing 7, the cylinder sleeve 8 and the cylinder head 9. The crankcase 6 of the engine is assembled from the casing 7 and the crankcase cover 2. The crankcase 6 contains lubricating oil 35 and is provided with a rotatable support crankshaft 4 therein which is oriented horizontally during the operation of the engine. The valve operating chamber 5 is assembled from the cylinder head 9 and the cylinder head cover 3 and is communicated with the crankcase 6. The piston 10 is connected to the crank-pin of the crankshaft 4 via the connecting rod 11. The oil-scattering needle 13 integrally formed on the connecting-rod cap 12 for big-end of the connecting rod is used for scattering the lubricating oil 35 in the crankcase 6. Both ends of the crankshaft 4 are supported by the ball bearing 15 and bearing block 16. The cylinder head 9 comprises the gas inlet 17 and the gas outlet 18 which are communicating with the combustion chamber 19. The suction system 20 comprises the air filter 21 and the carburetor 22 and is held on the cylinder head 9 to communicate with the gas inlet 17. The cylinder head cover 3 is arranged on the cylinder head 9 and is provided with the gas-oil separating cavity 23 on the top thereof. The gas-oil separating cavity 23 is of labyrinth formed by three labyrinth-forming walls 36 and is communicated with the valve operating chamber 5 via the passage 37; furthermore, the gas-oil separating cavity 23 is connected to the partition plate 25 by the bolt 24 to form the oil-gas separation chamber 26. The one-way valve 27 is provided on the oil-gas separation chamber 26 and installed in the one-way valve hole 28. The one-way valve 27 comprises the valve seat 29, the plastic ball 30 within the valve seat 29, the cylindrical pin 31 and the seal ring 32. The cylinder head cover passage 33 is located above the one-way valve 27. A portion of the passage 33 is in a form of the inclined orifice 38, one end of which is blocked by the plug 39, the other end of which communicates with the cylinder head 9 through the hollow pin 40 and further communicates with suction tube 14 through the cylinder head communication passage 41. The oil-returning hole 34 is formed between the inclined orifice 38 of the passage 33 and the oil-gas separation chamber 26 so as to separate the lubricating oil and thereby prevent the lubricating oil from entering into the suction system.

[0011] The operation principle and process of the present invention is described hereinafter:

When the piston 10 drives the crankshaft 4 to rotate, the oil-scattering needle 13 on the connecting-rod cap 12 for big-end of the connecting rod scatters the lubricating oil 35 and then the lubricating oil 35 in a form of oil mist reaches the valve operating room 5 via the crankcase 6. At the same time, the scavenging gas appeared in the crankcase 6 also enters into the valve operating room 5 and further into the oil-gas separation chamber 26 via the passage 37. Due to the pressure pulse appeared in the crankcase 6 with reciprocation movement of the piston 10, the plastic ball 30 of the one-way valve 27 is pushed out so that the scavenging gas enters into the cylinder head cover passage 33 and then into the suction tube 14 through the hollow pin 40 and the cylinder head communication passage 41 and finally into the combustion chamber 19 via an intake valve. When the scavenging gas goes through the gas-oil separating cavity 23, the oil mist is separated from the oil gas mixture by the labyrinth-forming walls 36 and then returns to the crankcase 6 via the passage 37. After the scavenging gas enters into the cylinder head cover passage 33, the oil mist will be separated again and returns to the oil-gas separation chamber 26 via the oil-returning hole 34, thereby enhancing

the capability of oil mist separation. Additionally, when the one-way valve 27 installed in the one-way valve hole 28 is closed, the seal ring 32 of the one-way valve 27 can reliably prevent the oil mist from entering into the cylinder head cover passage 33. The plastic ball 30 can move freely in the valve seat 29 and can self-return due to its gravity so as to prevent the redundant gas sucked by the suction system 20 from entering into the crankcase 6.

[0012] In conclusion, the scavenging mechanism is totally arranged inside the engine with better space utilization efficiency so as not to enlarge dimensions of the engine, which can also be utilized for any four-stroke engine. The remained gases in the crankcase can be sucked into the suction tube via a communication passage and then enter into the combustion chamber for combustion, while the lubricating oil can be prevented from entering the suction system by oil mist separation and oil-returning effect is well.

Claims

1. A crankcase scavenging mechanism for a four-stroke engine comprising
a main body (1) with a casing (7), a cylinder sleeve (8) and a cylinder head (9);
a crankcase (6) being assembled from the casing (7) and a crankcase cover (2), wherein the crankcase (6) is provided with a crankshaft (4) therein and having lubricating oil (35);
a valve operating chamber (5) being assembled from the cylinder head (9) and a cylinder head cover (3) and communicating with the crankcase (6);
a piston (10) being connected to a crankpin of the crankshaft (4) via a connecting rod (11); wherein the cylinder head (9) is communicating with a combustion chamber (19);
a suction system (20) being held on the cylinder head (9) to communicate with a gas inlet (17); wherein the cylinder head cover (3) is arranged on the cylinder head (9); **characterized in that**
the cylinder head cover (3) is provided with a gas-oil separating cavity (23) thereon,
wherein the gas-oil separating cavity (23) is communicated with the valve operating chamber (5) via a passage (37) and is connected with a partition plate (25) to form the oil-gas separation chamber (26);
wherein the oil-gas separation chamber (26) is provided with a one-way valve (27) thereon, wherein the one-way valve (27) is placed in a one-way valve hole (28);
wherein a passage (33) above the one-way valve (27) is provided with an inclined orifice (38), wherein one end of the inclined orifice (38) is blocked by a plug (39), the other end of the inclined orifice (38) is communicated with the cylinder head (9) and is further communicated with a suction tube (14) through a cylinder head communication passage (41); and
wherein an oil-returning hole (34) is formed between the inclined orifice (38) of the passage (33) and the oil-gas separation chamber (26).

2. The crankcase scavenging mechanism for the four-stroke engine according to claim 1, being **characterized in that** the gas-oil separating cavity (23) is of labyrinth formed by three labyrinth-forming walls (36).

3. The crankcase scavenging mechanism for the four-stroke engine according to claim 1 or 2, being **characterized in that**; the one-way valve (27) comprises a valve seat (29), a plastic ball (30) a cylindrical pin (31), and a seal ring (32);
wherein the plastic ball (30) and the seal ring are placed in the valve seat (29).

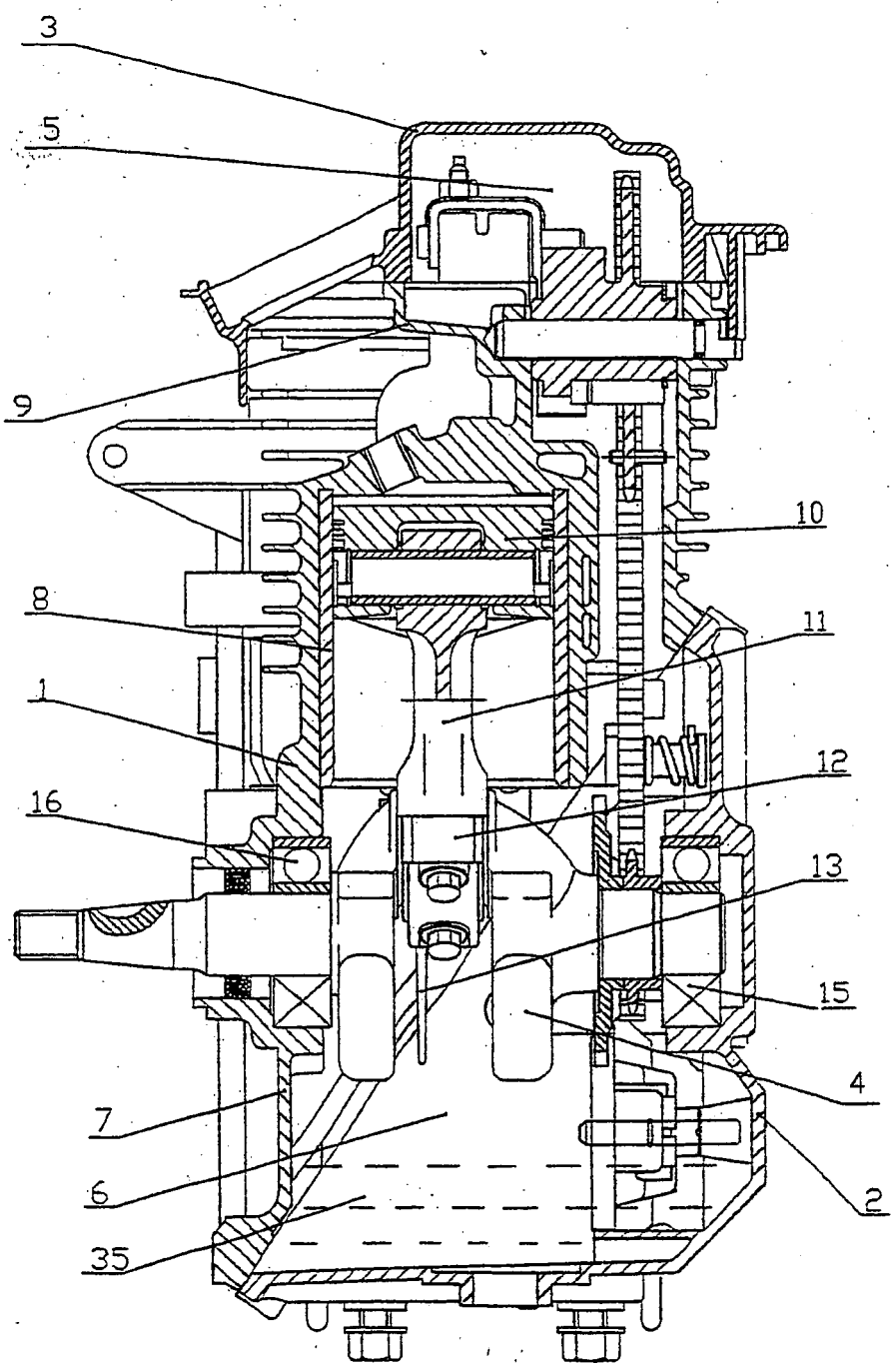


Fig. 1

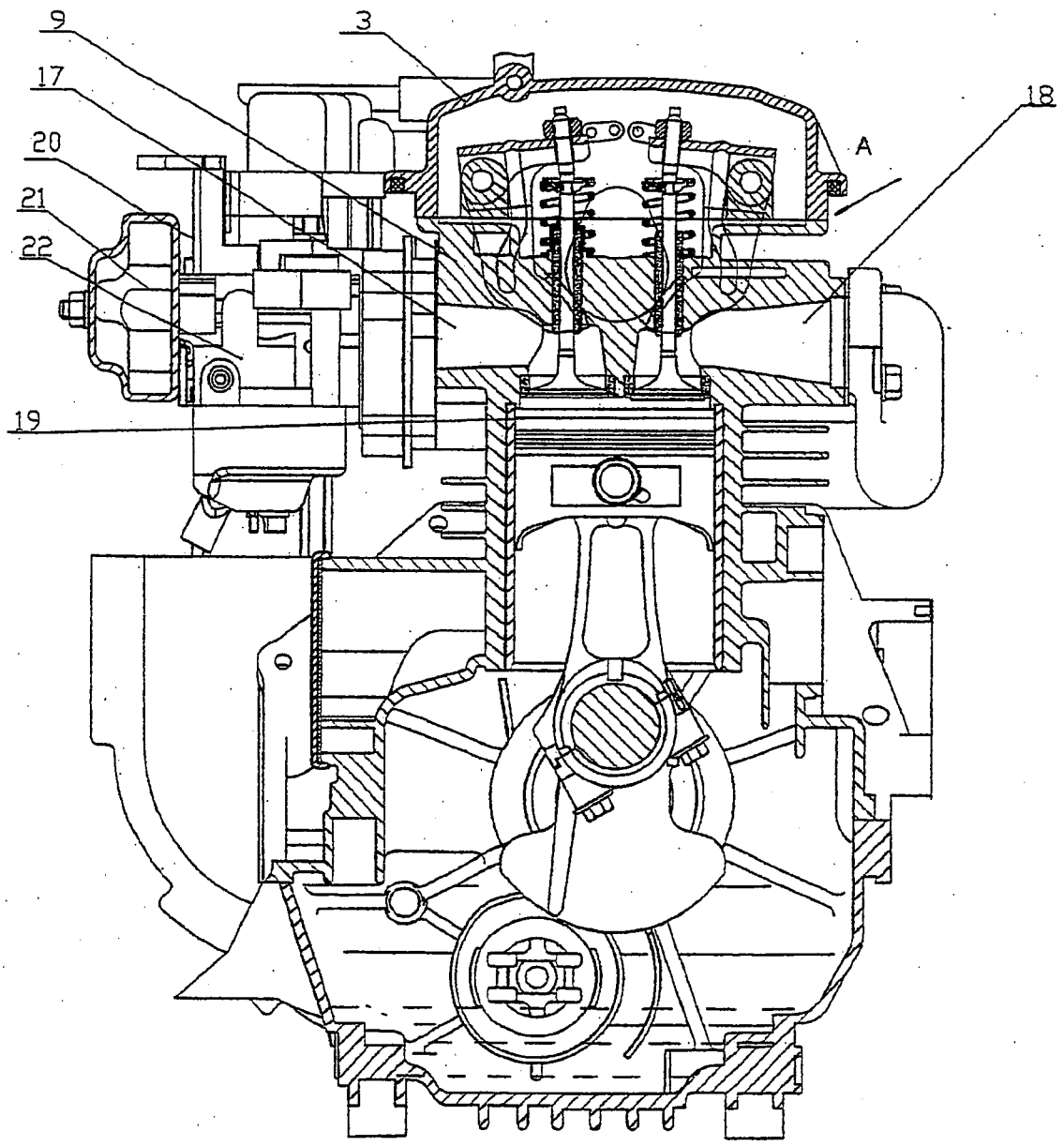


Fig. 2

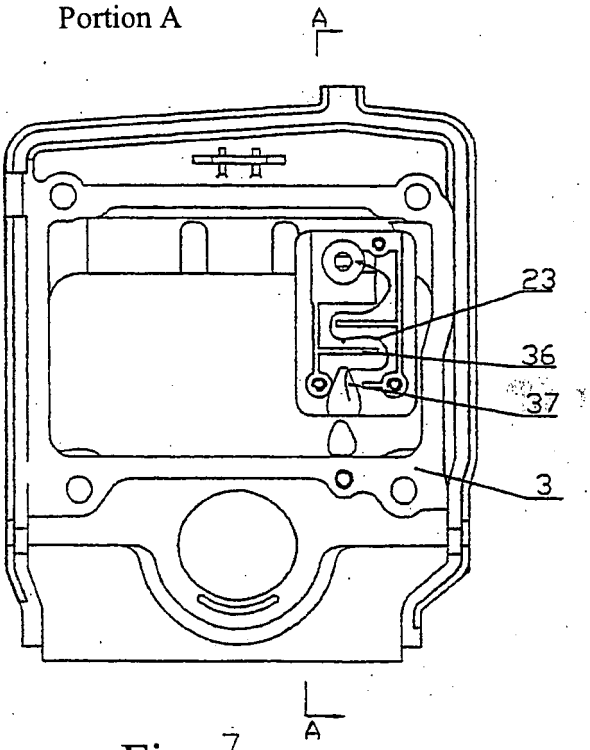

Portion A
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Fig. 3

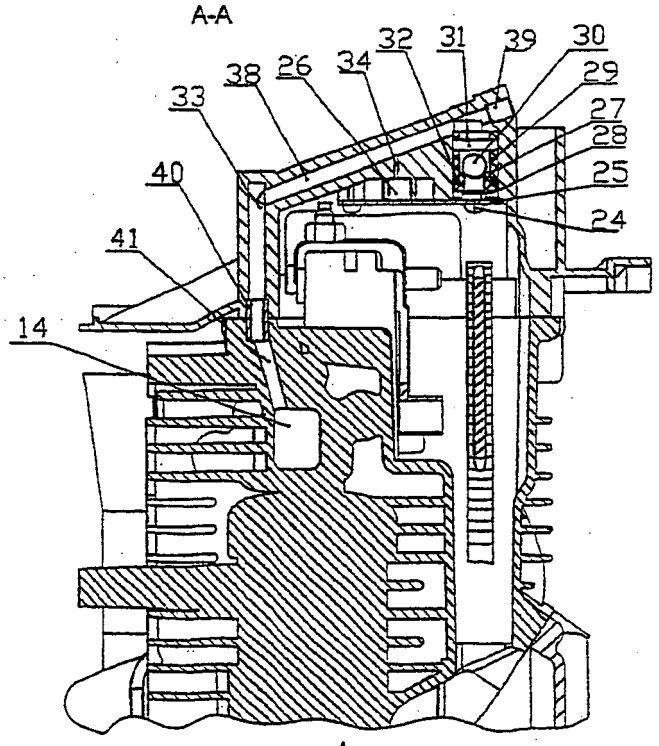

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Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2007/000290

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC F01M13/04 F01M13/00 F02F7/00 F02F1/00 F02F1/24 F02M25/06

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 practicable, search terms used)

DATABASES:CNPAT WPI PAJ EPODOC CNKI; KEYWODRS: valve oil crankcase cover(cap)

C. 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	EP0911496A1 (HONDA GIKEN KOGYO KK et al) 28.April.1999 (28.04.1999) see whole document	1—3
A	EP 1233155A1 (HONDA GIKEN KOGYO KK et al) 21.Aug.2002 (21.08.2002) see whole document	1—3
A	EP1524414A2 (TSUCHIYA SEISAKUSHO KK et al) 20.April.2005 (20.04.2005) see whole document	1—3
A	US20020083934A1 (CHEN D et al) 4.Jul.2002 (04.07.2002) see whole document	1—3
A	US5129371A (SATURN CORP) 14.Jul.1992 (14.07.1992) see whole document	1—3

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

* Special categories of cited documents:

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 Apr. 2007 (05.04.2007)	**17 May 2007 (17.05.2007)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer YAN, Lv Telephone No. (86-10)62085391

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2007/000290

CLASSIFICATION OF SUBJECT MATTER

F01M13/04(2007.01)i
F01M13/00(2007.01)i

F02F7/00(2007.01)i

Form PCT/ISA/210 (extra sheet) (April 2005)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2007/000290

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Form PCT/ISA /210 (patent family annex) (April 2005)