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(54)

OIL PASSAGES OF AN ENGINE

(57) An engine including a cylinder head, a camshaft bearing cap fixed on the cylinder head through a locating pin and a bolt, and a rocker shaft, a rocker, a hydraulic tappet and the camshaft supported on the camshaft bearing cap, wherein a main oil-feeding passage that extends to the hole of the main journal of the camshaft and the center position of the internal part of the camshaft bearing cap from the cylinder head is provided inside the cylinder head, an oil passage that connects the main oil-feeding passage to a central installation hole of the rocker shaft and a plurality of secondary oil passages that connect the installation holes at two sides of the rocker shaft to

the holes of the secondary journals of the camshaft, an oil passage of the rocker shaft that connects the central installation hole of the rocker shaft to the installation holes of each rocker is provided inside the rocker shaft, an oil passage of the rocker that connects the installation holes of rockers to the interior of the hydraulic tappet is provided inside the rockers. The internal oil passage of the engine adopts the design of feeding the oil from the middle part, and is easy to be processed and can be reliably lubricated. The engine is featured by simple structure, low cost and reliable lubrication.

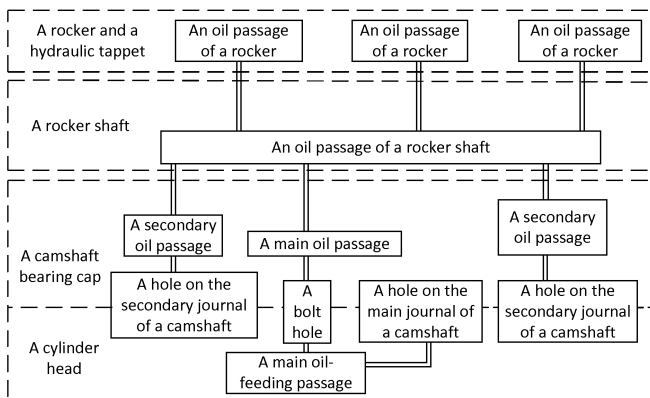


FIG 6

Description

Field of the Invention

[0001] The present invention relates to an engine with a new type of oil passage, specifically, it relates to an engine having intake valves at overhead. The technical field of this invention is machinery manufacture.

Description of the Prior art

[0002] The conventional oil passage of engines having valves at overhead is set over the cylinder head running across the length of a cylinder bank. The oil is circulated through this oil passage with oil inlet hole of the oil passage set at one end of the cylinder bank. Such engine has the following deficiencies: 1. a rather long cutting tool is required for processing the oil passage because of the lengthiness of the cylinder bank, which renders a relatively high requirement for the cutting tool, and which results in a undesirably higher processing cost; Further, the higher processing complexity, may easily result in diameter disparity of the holes on both ends of the passage and further causes unbalanced oil pressures at two ends of the oil passage; 2. The oil inlet opening is set at one end of the cylinder bank resulting in low oil pressure at the rear end of the oil way; and the unduly established oil pressure at the rear end of oil passage causes that some work pieces cannot be lubricated timely, which in turn causes potential safety hazards such as abnormal wear and breakage of the camshaft.

Summary of the Invention

[0003] In view of the above deficiencies in prior art, the technical object of the present invention is to provide an engine with simpler structure, lower cost and reliable lubrication.

[0004] The technical object of the present invention is achieved by adopting the following technical solution:

This invention provides an engine including a cylinder head, a camshaft bearing cap fixed onto the cylinder head with a locating pin and a bolt, and a rocker shaft, a rocker, a hydraulic tappet and a camshaft supported by the camshaft bearing cap. Especially, inside the cylinder head is provided a main oil-feeding passage that extends from the cylinder head to the hole of the main journal of the camshaft and the internal center position of the camshaft bearing cap. The inside of the camshaft bearing cap is provided with an oil passage which connects the main oil-feeding passage to the central installation hole of the rocker shaft and a plurality of oil passages that connect installation holes at the two sides of the rocker shaft to the holes of the secondary journals of the camshaft. The interior of the rocker shaft is provided with a rocker shaft oil passage connecting the central

rocker shaft installation hole to the side installation holes at two ends of the rocker shaft and to installation holes for each rocker. The interior of the rocker is provided with a rocker oil passage connecting the rocker installation holes to the interior of the hydraulic tappet.

[0005] The main oil-feeding passage comprises an oil passage which extends from the bottom of the cylinder head to the main camshaft journal and an oil passage which extends from the bottom of the cylinder head to the interior of the camshaft bearing cap through a bolt hole at the center position of the camshaft bearing cap.

[0006] To guarantee the fixation reliability and better transmission of the lubricating oil, the bolt hole running through the cylinder head and the center position of the camshaft bearing cap can be provided in multiple forms. For example, the wall of the bolt hole may be provided with a groove for transmission of the oil; or the bolt fitting with the bolt hole may be designed into a structure that is partially hollow or with holes on the surface of bolt, the hollow part being used to transmit the oil. It is preferred that the bolt hole running through the cylinder head and the center position of the camshaft bearing cap is a through hole consisting of three sections each having different diameters, and the middle section has bigger diameter than that of the outer sections at two ends.

[0007] The rocker and the hydraulic tappet are an integral build, the end of the camshaft is provided with oil drain aperture facing the camshaft, and the end of the hydraulic tappet is provided with oil hole splashing lubricating oil onto the cam of the camshaft.

[0008] The rocker shaft is provided with an oil outlet hole and an oil outlet groove at the positions where each rocker is installed; the oil outlet hole corresponds to the oil inlet hole of the oil passage of the rocker, and the oil outlet groove is opened on the supporting surface of rocker.

[0009] To optimize lubrication effect of the rocker, a small hole is provided in the middle of the oil outlet groove, the two side portions of the groove are symmetric to each other relative to the middle oil hole, and the length of the oil outlet groove matches the width of the rocker installation hole.

[0010] The rocker shafts include intake rocker shaft and exhaust rocker shaft, and the rockers include intake rocker and exhaust rocker.

[0011] The oil passage inside the camshaft bearing cap is the oil passage that extends to the central installation hole of the intake rocker shaft and to the central installation hole of the exhaust rocker shaft from the bolt hole in the middle position of the camshaft bearing cap.

[0012] The oil passage inside the camshaft bearing cap is the oil passage that extends to the holes of the secondary journals of camshaft from the installation holes at two sides of the intake rocker shaft and to the installation holes at two sides of the exhaust rocker shaft.

[0013] The oil passage inlet of the engine is provided

at the middle position. The lubrication oil enters from the middle part and is fed to two sides along the rocker shaft, so as to guarantee balanced and consistent oil pressure on both sides of engine and reduce the length of the oil passage. In this way processing of the oil passage becomes easier and requirements for the cutting tools are reduced. In addition, the oil pressure on both sides can be quickly established, so that the camshaft, the rocker shafts and rockers can be reliably lubricated.

[0014] With the engine of the present invention, the main oil passage is provided inside the camshaft bearing cap and the rocker shaft, so that the difficulty in processing the cylinder head is reduced, the quality of the whole engine can be easily guaranteed, and the processing cost is also reduced. In addition, the oil inlet is provided in the middle part of the whole engine. As compared with the case in the conventional oil passage of engine, the oil pressure on two sides of the engine of the present invention can be easily established. As a result, it is feasible to guarantee the lubrication of the whole camshaft as well as each rocker shaft, rocker and hydraulic tappet, so that the engine can work in a stable and reliable status and meet the requirements for modern vehicle.

Brief Description of the Drawings

[0015]

FIG 1 is the schematic diagram of the oil passage in the cylinder head ;

FIG 2 is the schematic diagram of the oil passage in the camshaft bearing cap ;

FIG 3 is the structural diagram of the bolt hole running through the cylinder head and the center position of the camshaft bearing cap;

FIG 4 is the schematic diagram of the rocker shaft oil passage in the rocker shaft ;

FIG 5 is the schematic diagram of the rocker oil passage in the rocker ;

FIG 6 is the schematic diagram of the engine oil passage.

Detailed Description of the Preferred Embodiments

[0016] The present invention is described in details below referring to the attached drawings and the specific embodiments.

[0017] FIG 1 is the schematic diagram of the oil passage in the cylinder head. As shown in FIG 1, the inside of the cylinder head is provided with main oil-feeding passages that extend from the cylinder head to the hole of the main journal of the camshaft and to the internal center position of the camshaft bearing cap respectively. The main oil-feeding passages includes an oil passage 2-1 that extends from the bottom of cylinder head to the hole of the main journal of the camshaft and an oil passage 2-2 that extends from the bottom of the cylinder head to the internal center position of the camshaft bearing cap

via the bolt hole running through the cylinder head and the center position of the camshaft bearing cap. Using the bolt hole that runs through the cylinder head and the center position of the camshaft bearing cap for transmission of the lubrication oil helps to reduce the processing complexity of the cylinder head and camshaft bearing cap, and the manufacturing complexity and cost of the whole engine are decreased accordingly. The main oil-feeding passage comprises the oil passage that extends to the hole of the main journal of the camshaft so that the hole of the main journal of the camshaft is lubricated. The main oil-feeding passage also plays the role of feeding oil to the camshaft bearing cap.

[0018] FIG 2 is the schematic diagram of the oil passage in the camshaft bearing cap. As shown in FIG 2, a plurality of oil passages 5 are provided inside the camshaft bearing cap, including the oil passages that extend from the bolt hole in the center position of the camshaft bearing cap to the central installation hole of the intake rocker shaft 3 and to the central installation hole of the exhaust rocker shaft 4. The lubrication oil enters the inside of the camshaft bearing cap from the bolt hole in the center position, and then flows towards the interior of the intake rocker shaft oil passages and the exhaust rocker shaft oil passage through the central installation hole of the intake rocker shaft and the central installation hole of exhaust rocker shaft. The lubrication oil enters the intake rocker shaft from the two side installation holes of the intake rocker shaft and the two side installation holes of the exhaust rocker shaft, and then is distributed to other main shaft journals through the camshaft so as to lubricate the secondary journals at two sides of the camshaft. Such a structure of oil passage enables that the oil pressure inside the intake rocker shaft and inside the exhaust rocker shaft are well balanced so that the lubrication effect for the intake rocker shaft and the exhaust rocker shaft is guaranteed.

[0019] As shown in FIG 3, the bolt hole is a through-hole running through the cylinder head 19 and the center position of the camshaft bearing cap, and it is composed of three sections with different diameters. The diameter of the through hole at the middle section is bigger than the diameters of the threaded sections at two sides. The bolt flange face of the upper through-hole section with smaller diameter mates with the rocker shaft to guarantee sealing, and the lower threaded through-hole section with smaller diameter may be used for fixing the bolt. The middle section of the through-hole with bigger diameter may be used as oil passage to guarantee the effect of component fixing and transmission of lubrication oil. Furthermore, the processing of such bolt hole is relatively simple and can be realized easily. With such bolt hole, the threaded sections at its two sides with smaller diameter can be used to fix the bolt, and the middle section with bigger diameter can be used as oil passage so that the effect of component fixing and transmission of lubrication oil are simultaneously guaranteed. Furthermore, the processing of such bolt hole is relatively simple and

thus can be realized easily.

[0020] As shown in FIG 4 and FIG 5, the interior of the rocker shaft is provided with oil passages 11 that connect the central installation hole 10 of rocker shaft and to the installation holes 20 at two sides as well as to each of rocker installation holes 17. For installation of the rockers, the installation hole 17 of each rocker is fitted over the rocker shaft and thus each rocker 16 is fixed. Both ends of the rocker shaft are sealed with bowl-shaped plugs, the upper side of the rocker shaft bolt hole is sealed with the flange face of the rocker shaft bolt, and the lower side of the rocker shaft bolt hole is sealed with the camshaft bearing cap, so that stable oil pressure inside the rocker shaft oil passage is guaranteed. The rocker shaft is provided with an oil outlet hole 8 and an oil outlet groove 9 at the positions corresponding to the rocker installation holes 17. The oil outlet hole 8 corresponds to the oil inlet 12 of the rocker oil passage 14, so that the rocker shaft oil passage 11 is communicated with the rocker oil passage 14. The oil outlet groove 9 is opened on the supporting surface of the rocker 16, and a small oil hole is set in the middle part of the oil outlet groove 9 with the two side portions of the groove being symmetric with each other relative to the middle oil hole and the length of the oil outlet groove matching the width of the rocker installation hole 17, so that the oil in the rocker shaft oil passage can enter the rocker oil passage and the hydraulic tappet on the rocker through the oil outlet hole and makes lubrication for the rocker and the hydraulic tappet. The oil outlet groove is opened at the supporting surface where the rocker endures the greatest stress in operation. In this way, sufficient lubrication and service life of the rocker is realized. The interior of the rocker 16 is provided with oil passages 14 that connect the rocker installation holes 17 with the interior of the hydraulic tappet 15. The rocker 16 and the hydraulic tappet 15 are formed as an integral structure, and the head end of the hydraulic tappet 15 is provided with an oil draining hole 13 opening at the camshaft. The hydraulic tappet is formed as an integral part at the head end of rocker so as to realize compact structure of the engine and reliable oil passage. The oil draining hole has the following functions: 1. The oil draining hole helps to expel the air from the inside of the hydraulic tappet and eliminates the flaws such as insufficient stroke, vibration and noise that are caused by the compressibility of the air. As is known the air can infiltrate into the hydraulic system in the process of assembly and after long time of no-operation, and, the air can be mixed into the oil and get into the hydraulic system. During the movement of the hydraulic tappet, the air can be expelled from the oil drain hole, and the normal working of the hydraulic tappet is so guaranteed; 2. Oil is sprayed through this oil draining hole during the movement of hydraulic tappet, and an oil mist is formed under the swing of the rocker inside the cover cap of valve chamber, and the oil is splashed onto the cam lobe and the contact position between the hydraulic tappet and the valve stem, so as to realize the lubrication for the whole valve mechanism.

The oil draining hole 13 is communicated with the interior of the hydraulic tappet 15. One side of the rocker 16, where the hydraulic tappet 15 is installed, contacts the valve stem of engine, and the swing of the rocker 16 and in turn the opening and closing of the valve is driven by the rotation of camshaft. In the operating process of engine, the valve may grow longer after being heated continuously resulting in that the valve clearance fails to meet the operating requirement. In order to adjust the valve clearance, two chambers and check valves are provided in the hydraulic tappet, and they can use the oil fed from the rocker oil passage to adjust the extension length and to adjust the valve clearance accordingly. When the oil pressure in the hydraulic tappet changes, the oil draining hole 13 sprays lubrication oil, and because of the rotation of the camshaft, the lubrication oil is splashed to the cams on the camshaft as well as to the position where the hydraulic tappets contact the valve stem, so as to realize lubrication for the whole valve mechanism.

[0021] The rocker shafts include intake rocker shafts and exhaust rocker shafts, and the rockers include the intake rockers and the exhaust rockers. Each rocker is installed on each rocker shaft, and the rocker shafts are separated by means of rocker stoppers to prevent the axial displacement of the rockers in the process of working. Rocker shaft oil passage is provided in each of the intake rocker shafts and the exhaust rocker shafts; rocker oil passage is provided in each of the intake rockers and the exhaust rockers.

[0022] As shown in FIG 6, the specific layout of the oil passages of engine in this embodiment is described as follows: The lubrication oil enters the hole of the main journal of camshaft in the middle position of camshaft from the main oil-feeding passage in the cylinder head, so as to make lubrication for the main shaft journal of camshaft. At the same time, the lubrication oil also enters the oil passage in the camshaft bearing cap through a bolt hole running through the cylinder head and the center position of the camshaft bearing cap. After having entered the oil passage in the camshaft bearing cap, the lubrication oil enters the rocker shaft oil passage through the central installation hole of rocker shaft. After having entered the rocker shaft oil passage, the lubrication oil enters the oil passage inside the camshaft bearing cap through the installation holes at two sides of the rocker shaft, and then enters to the holes of secondary journal at two sides of the camshaft, so as to make lubrication for the secondary journals at two sides of camshaft. The lubrication oil in the rocker shaft oil passage also enters to the rocker oil passage inside each rocker, so as to lubricate each rocker and the hydraulic tappet in each rocker.

[0023] With the engine of the present invention, the main oil passage is provided inside the camshaft bearing cap and the rocker shaft, so that the difficulty in processing the cylinder head is reduced, the quality of the whole engine is improved, and the processing cost is also reduced. In addition, the oil inlet is provided in the middle

part of the whole engine. Compared with the conventional oil passage of engine, the oil pressure on two ends of the engine of the present invention can be easily established. As a result, it is feasible to guarantee the lubrication of the whole camshaft as well as each rocker shaft, rocker and hydraulic tappet, so that the engine can work in a stable and reliable status and meet the requirements for modern vehicle.

Claims

1. An engine comprising a cylinder head, a camshaft bearing cap fixed on the cylinder head by the means of a locating pin and a bolt, and a rocker shaft, a rocker, a hydraulic tappet and the camshaft supported on the camshaft bearing cap, said engine **characterized in** the following: The inside of the cylinder head is provided with a main oil-feeding passage that extends from the cylinder head to the hole of the main journal of the camshaft and to the internal center position of the camshaft bearing cap; the inside of the camshaft bearing cap is provided with an oil passage that connects the main oil-feeding passage to a central installation hole of the rocker shaft, and a plurality of oil passages that connect the installation holes at two sides of the rocker shaft to the holes on the secondary journal of the camshaft; the interior of the rocker shaft is provided with a rocker shaft oil passage that connect the central installation hole of the rocker shaft to the installation holes at two sides of the rocker shaft and to each of the rocker installation holes; an oil passage of the rocker that connects the installation holes of rockers to the interior the hydraulic tappet is provided inside the rockers.
2. The engine as recited in claim 1, **characterized in** the following: the main oil-feeding passage comprises an oil passage that extends from the bottom of cylinder head to the hole of the main journal of the camshaft, and an oil passage extends from the bottom of the cylinder head to the inside of the camshaft bearing cap through a bolt hole running through the cylinder head and the center position of camshaft bearing cap.
3. The engine as recited in claim 2, **characterized in** the following: the bolt hole running through the cylinder head and the center position of the camshaft bearing cap is composed of three sections of a through hole with different diameters; the diameter of the through hole at the middle section is bigger than the diameter of the threaded sections at two sides.
4. The engine as recited in any of claims 1-3, **characterized in** the following: the rocker and the hydraulic tappet are formed as an integral structure and an oil

draining hole that opens towards the camshaft is provided at the head end of the hydraulic tappet.

5. The engine as recited in claim 4, **characterized in** the following: the rocker shaft is provided with an oil outlet hole and an oil outlet groove at the position corresponding to the installation hole of each rocker; the oil outlet hole corresponds to the oil inlet hole of the rocker oil passage, and the oil outlet groove is opened on the supporting surface of the rocker.
6. The engine as recited in claim 5, **characterized in** the following: the oil outlet groove is provided with a small oil hole in the middle position, and the two side portions of the groove are symmetric with each other relative to the middle hole, and the length of the oil outlet groove matches the width of the rocker installation hole.
7. The engine as recited in any of claims 1-3, **characterized in** the following: the rocker shafts include intake rocker shaft and exhaust rocker shaft, and the rockers include intake rocker and exhaust rocker.
8. The engine as recited in claim 7, **characterized in** the following: the oil passage inside the camshaft bearing cap is the oil passage that extends from the bolt hole at the center position of the camshaft bearing cap to the central installation hole of the intake rocker shaft and the central installation hole of the exhaust rocker shaft.
9. The engine as recited in claim 7, **characterized in** the following: the oil passage inside the camshaft bearing cap is an oil passage that extends to the holes of the secondary journals of the camshaft from the two side installation holes on the intake rocker shaft and the two side installation holes on the exhaust rocker shaft.
10. The engine as recited in claim 4, **characterized in** the following: the rocker shafts include intake rocker shaft and exhaust rocker shaft, and the rockers include an intake rocker and an exhaust rocker.

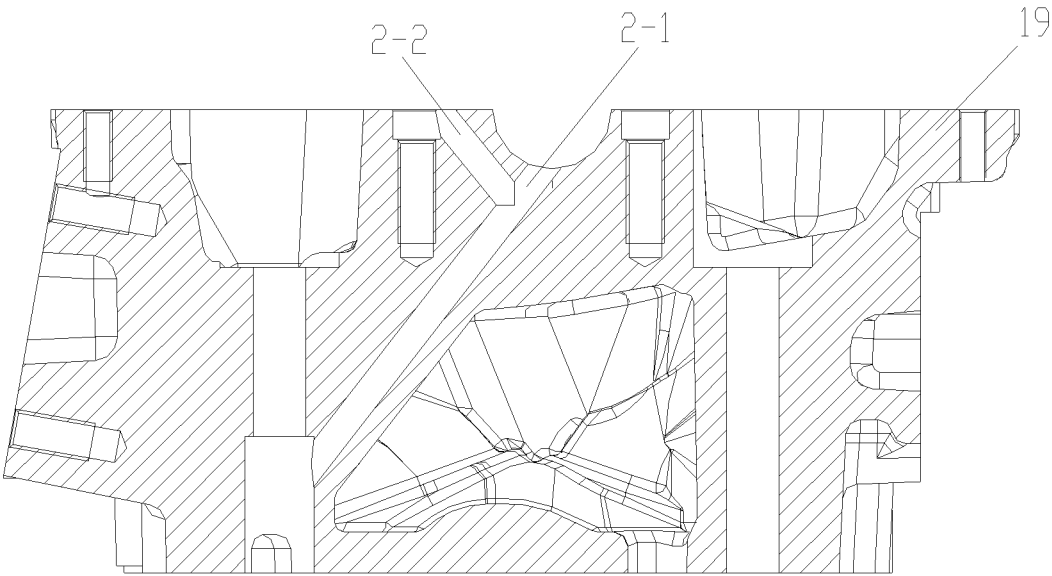


FIG 1

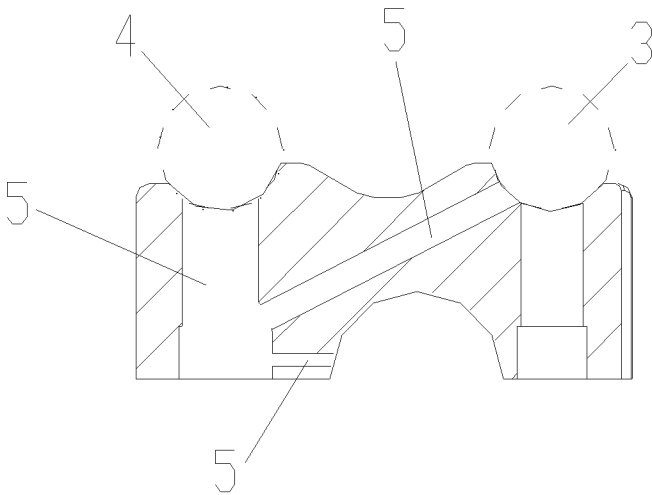


FIG 2

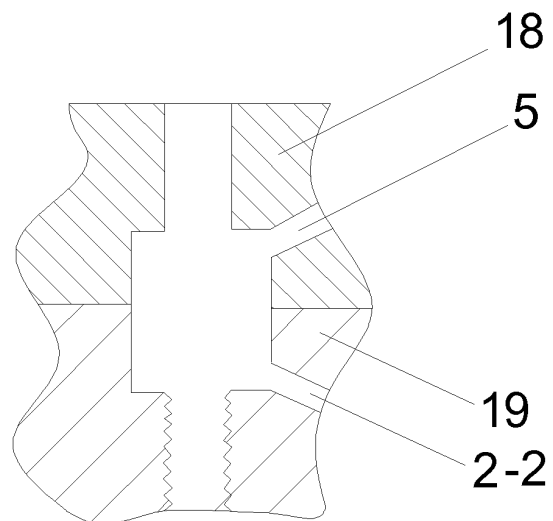


FIG 3

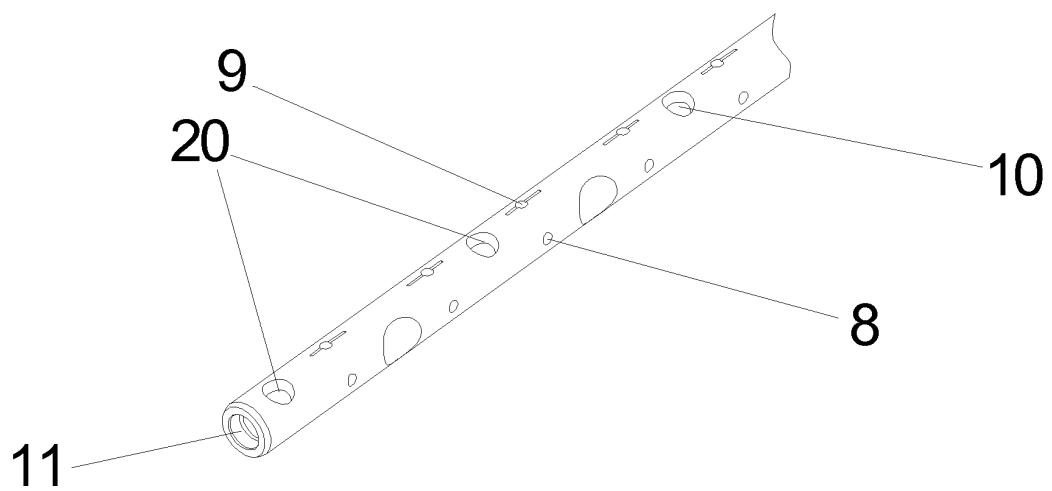


FIG 4

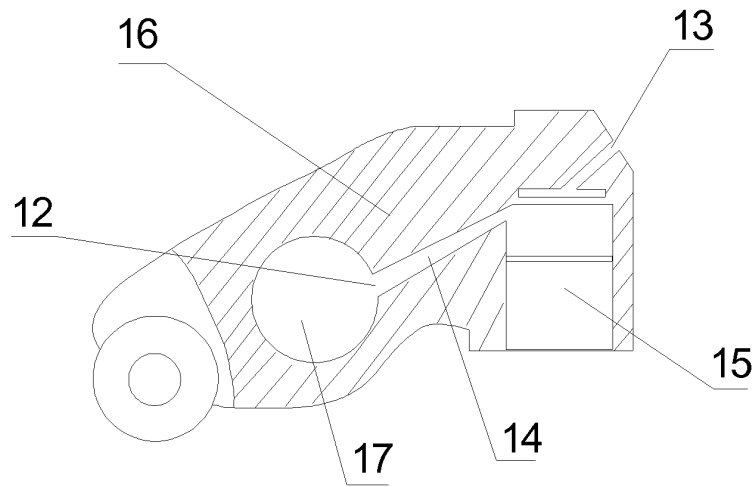


FIG 5

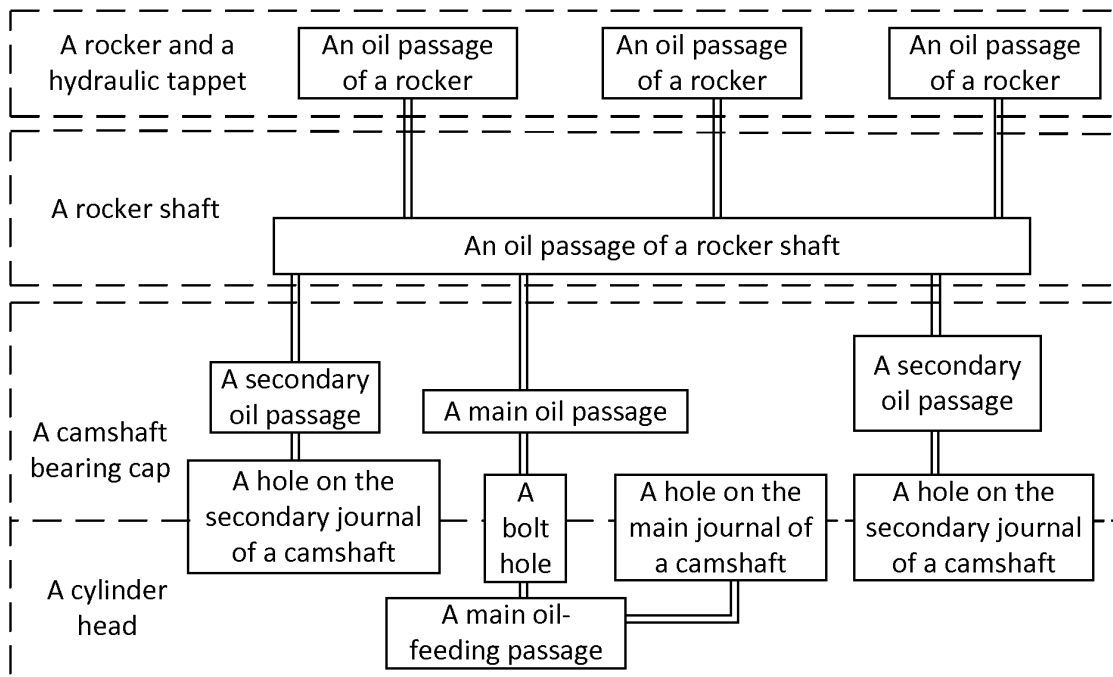


FIG 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/073238

A. CLASSIFICATION OF SUBJECT MATTER		
F01M9/10(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)		
IPC: F01M9/00,9/10,9/12;F01M11/00,11/02;F01L9/00,9/02		
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)		
WPI,EPODOC,PAJ,CNPAT,CNKI: cylinder head, bearing cover, oil, passage, slot, groove, hole, rocker, arm, tappet, OHC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	CN101344024A (CHERY AUTOMOBILE CO LTD) 14 Jan.2009 (14.01.2009) See claims 1-10	1-10
A	CN2523956Y (HONGQI CYLINDER ENDS MFG CO LT) 04 Dec.2002 (04.12.2002) See the whole document	1-10
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☒ 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 "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "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 01 Nov.2009 (01.11.2009)		Date of mailing of the international search report 26 Nov. 2009 (26.11.2009)
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 LI, Xiao Telephone No. (86-10)62085292

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International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Information on patent family members

International application No.

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