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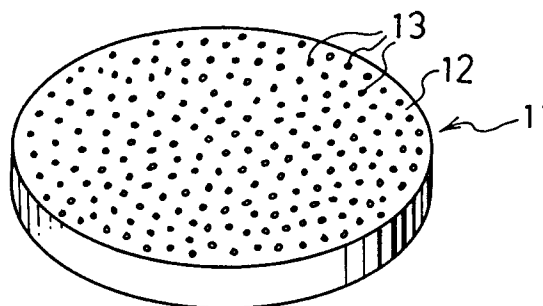
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D-89522 Heidenheim (DE)(54) **Shim for a tappet in an internal combustion engine.**

(57) A shim (11) for a tappet is used in a valve operating mechanism in an internal combustion engine. On the surface of the shim (11) which a cam slidably contacts, there are provided a number of bores (13) in which lubricating oil is put. When oil membrane disappears on the surface (12) by slidable contact with the cam, oil overflows from the bores (13) onto the surface (12). By increasing oil-keeping capability on the surface (12) of the shim (11), frictional resistance is reduced, thereby preventing wear in the shim (11) and the cam.

**FIG. 1****EP 0 675 264 A1**

BACKGROUND OF THE INVENTION

The present invention relates to a shim between a tappet and a cam in a valve operating mechanism for an internal combustion engine, and in particular, a shim which increases oil-keeping capability on the surface which the cam slidably contacts, thereby decreasing wear.

Figure 3 illustrates a conventional direct-acting type valve-operating mechanism used in a DOHC engine. A tappet body 1 which comprises a cylinder closed at the upper end is slidably inserted in a bore 2a of a cylinder head 2. In a circular recess 3 on the upper surface of an upper wall 1a of the tappet body 1, a shim 4 for adjusting a valve space is detachably engaged. A cam 5 which has a nose 5a contacts the upper surface of the shim 4, the cam 5 having a center on extension of the axis of the tappet body 1. A wear resistant tip 6 is in a press fit with the upper wall 1a of the tappet body 1. A shaft of the engine valve 7 is provided in the tappet body 1, and the end of the shaft contacts the lower surface of the tip 6.

A spring retainer 9 is engaged with the upper end of an engine valve 7 via a pair of cotters 8 which surrounds the outer circumferential surface of the valve 7, and a valve spring 10 is provided between the spring retainer 9 and a base (not shown) of the cylinder head 2. The engine valve 7 is usually energized upwards by the valve spring 10, and closes a port (not shown) of the cylinder head 2.

The shim 4 is engaged with the cam 5 which rotates with rotation of an engine, and is periodically subjected to high load, so that it is susceptible to be worn.

The shim 4 is worn to increase valve space, thereby generating large mechanical noise, or to decrease lifting range of the engine valve 7, thereby decreasing an opening area of the port to involve output power reduction. To overcome the disadvantages, the shim must be made of high-strength wear-resistant material, and it is necessary to decrease wear by increasing oil-keeping capability of the surface which contacts the cam 5. However, a conventional shim has a smooth flat upper surface, thereby decreasing oil-keeping capability. Thus, supplied lubricating oil is lost from the surface of the shim for relatively short time, thereby increasing frictional resistance and causing wear in the shim and the cam.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and the advantages will become clear based on the following description with respect to the drawings wherein:

Fig. 1 is a perspective view of one embodiment of a shim according to the present invention; Fig. 2 is a sectional view of part of Fig. 1; and Fig. 3 is a sectional view of a known valve-operating mechanism in an internal combustion engine.

SUMMARY OF THE INVENTION

To overcome the disadvantages, it is an object of the present invention to provide a shim for a tappet in an internal combustion engine wherein wear is decreased by increasing oil-keeping capability of the surface of the shim which contacts the cam.

According to the present invention, there is provided a shim which is provided on the upper wall of a tappet in a valve operating mechanism of an internal combustion engine, the shim contacting a cam which rotates with an engine, wherein there are provided a number of bores on the surface which the cam slidably contacts.

An opening area of the bore may be 0.1 to $50000\mu\text{m}^2$. A number of bores may be arranged at substantially uniform density on the surface of the shim which the cam slidably contacts. There are provided a number of bores on the surface of the shim which the cam slidably contacts, so that supplied lubricating oil is kept in the bores, thereby decreasing frictional resistance of the shim and the cam to prevent wear in the shim and the cam. Thus, the engine valve is exactly operated.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

A shim 11 is formed as a disc of material having high strength and high wear resistance as well as a conventional shim for a valve-operating mechanism. There are formed a number of minute bores 13 on the upper surface of the shim 11 which a cam 5 slidably contacts. The bore 13 may be various forms other than a circle. The area of an upper opening of the bore 13 may be 0.1 to $50000\mu\text{m}^2$, preferably 0.1 to $1250\mu\text{m}^2$. If the area is less than $0.1\mu\text{m}^2$, suitable oil maintenance could not be achieved, while if it is more than $50000\mu\text{m}^2$, strength would be vigorously decreased. The bores 13 are provided on the whole area which the cam 5 contacts except the circumferential portion of the shim 11, at substantially uniform density that is area density of 85 to 99.5%.

When there are provided a number of bores 13 on the upper surface 12 of the shim 11, lubricating oil is kept in the bores 13, and a certain amount of lubricating oil is stored in the bores 13 even if the cam 5 slides on the upper surface 12 to exclude oil membrane on the upper surface 12. As the

lubricating oil in the bores 12 overflows onto the upper surface 12 to form oil membrane. A number of bores 13 are formed on the upper surface 12 to provide oil-keeping capability, thereby reducing frictional resistance between the shim 11 and the cam 5 to prevent wear of the shim 11 and the cam 5. 5

The above merely relates to an embodiment of the invention. Any modifications and changes may be made by person skilled in the art without departing from the scope of claims wherein: 10

Claims

1. A shim for a tappet in an internal combustion engine, the shim being provided on an upper wall of the tappet of a valve operating mechanism and rotating with an engine, wherein there are provided a number of bores on the surface which the cam contacts. 15 20
2. A shim as defined in claim 1 wherein an opening area of the bore is 0.1 to 50000 μm^2 .
3. A shim as defined in claim 1 wherein a number of bores are arranged on a surface which the cam slidably contacts at substantially uniform density. 25

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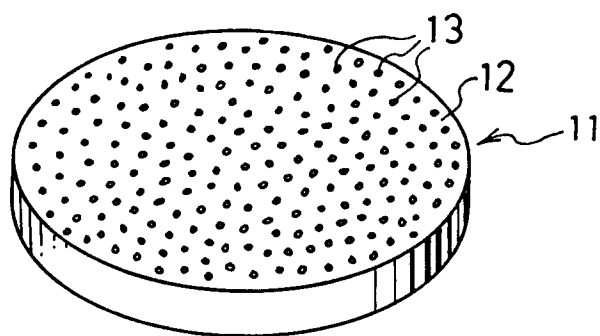


FIG. 1

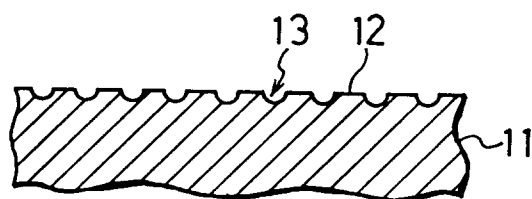


FIG. 2

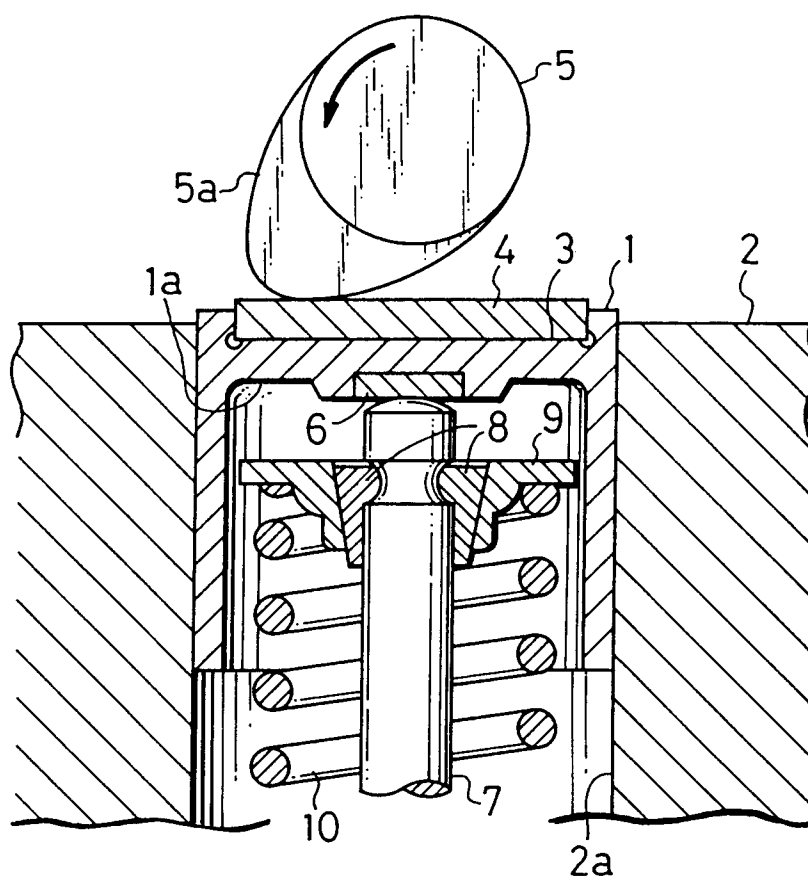


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 95 10 2200

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	PATENT ABSTRACTS OF JAPAN vol. 007 no. 203 (M-241) ,8 September 1983 & JP-A-58 101204 (YAMAHA HATSUDOKI KK) 16 June 1983, * abstract *	1,3	F01L1/20 F01L1/14 F01M9/10
Y	US-A-4 856 466 (TING) * column 2, line 50-60 * * figure 4 4A *	1,3	
A	GB-A-2 253 255 (NTN) * page 2, line 25 - page 4, line 1 * * page 12, line 1-13 * * claims 1-4 * * figure 3 *	1-3	
A	EP-A-0 523 691 (SUMITOMO) * page 2, line 45-55 * * figures 1,2 *	1-3	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F01L F01M
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 June 1995	Examiner Lefebvre, L
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	