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(54) Valve seal assembly

(57) There is described a seal (1) for a valve (2) of an internal combustion engine (3); the valve (2) has a guide member (10) defining a seat (9), and a rod (11) sliding in the seat (9); and the seal (1) has a first elastically deformable portion (17a) cooperating with the rod (11) of the valve (2), a second elastically deformable portion (17b) cooperating with an outer surface of the guide member (10), and a supporting member (15) supporting the first and second elastically deformable portion (17a, 17b), and which is fitted to the guide member (10) and has a number of slits (22) for generating radial compression forces on the guide member (10).

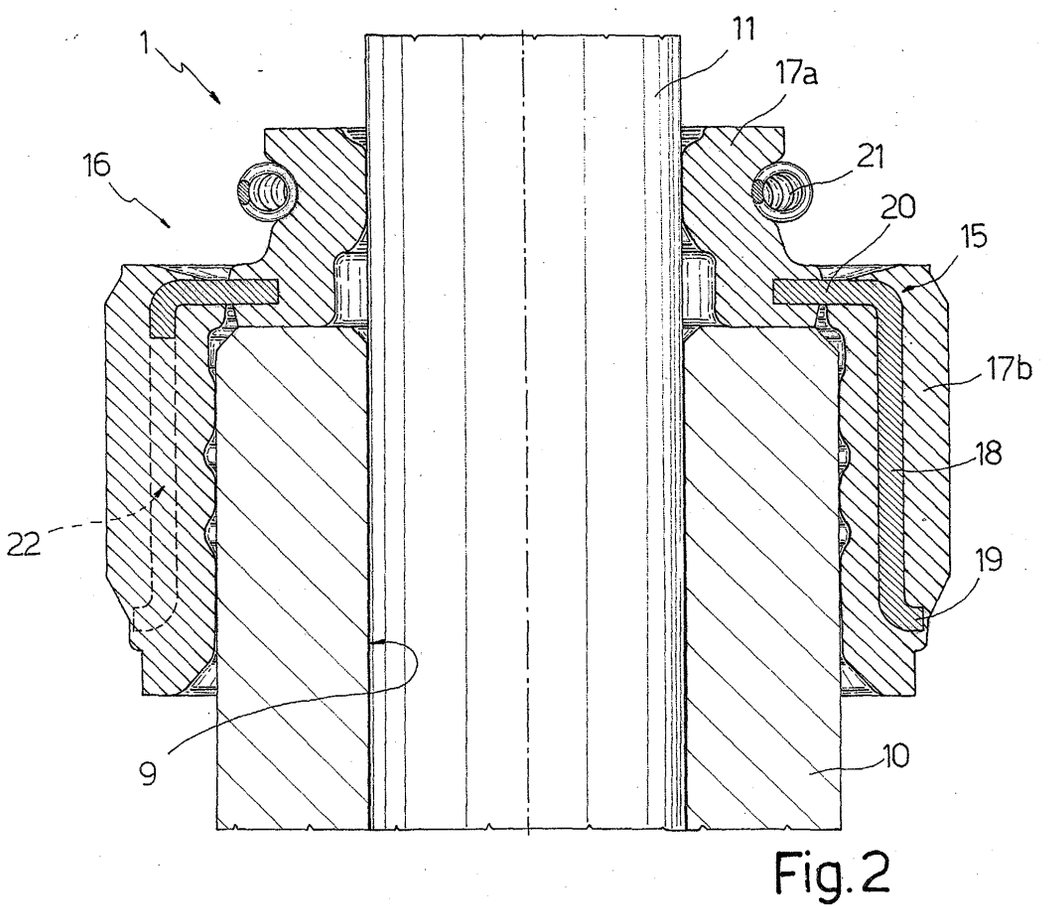

Fig.2

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Description

[0001] The present invention relates to an internal combustion engine valve seal.

[0002] As is known, automotive internal combustion engines comprise one or more cylinders, in which the engine cycle is performed, and which define respective combustion chambers of the engine. And one of the cylinder heads has seats by which the combustion chamber communicates with pipes for feeding a mixture of unburnt fuel and air into the combustion chamber ("intake pipes") and for expelling burnt gases from the combustion chamber ("exhaust pipes") .

[0003] Flow to and from the combustion chamber of each cylinder is controlled by valves acting on the seats. More specifically, each valve normally comprises a guide member fixed inside a cavity in the engine; and a rod which slides in opposite directions inside a through seat defined by the guide member, and has a shutter section at one end to cut off connection between the relative intake/exhaust pipe and the combustion chamber of the cylinder.

[0004] The opposite end of the valve rod projects axially from the relative guide member, and is activated by a relative control device.

[0005] Valves of the above type are normally fitted with seals for the lubricating oil normally circulating in the engine. In one of the commonest known forms, such seals are normally fitted to the outside of the guide member, and comprise a first elastomeric portion whose inner surface cooperates with the outer surface of the top portion of the guide member; a second elastomeric portion cooperating directly with the valve rod; and a reinforcing and/or supporting member normally made of metal and supporting the above elastically deformable portions.

[0006] Seals of the above type are widely used on all four-stroke internal combustion engines to control lubricating oil flow from the source to the combustion chamber. Excessive lubricating oil flow, besides obviously wasting oil, reduces engine efficiency and impairs performance of the vehicle catalyst. On the other hand, insufficient flow produces an increase in wear and noise of the valve, accompanied by local temperature peaks, all of which may result in premature damage of the valve by the valve rod seizing inside the guide member.

[0007] Known seals provide for static sealing by means of the elastomeric portion acting on the guide member of the valve, and for dynamic sealing by means of the elastomeric portion cooperating with the rod. In particular, static sealing must ensure sufficient radial compression on the guide member to prevent lubricating oil leakage, while dynamic sealing is designed to permit the minimum oil flow required to lubricate the rod-guide member connection.

[0008] The current state of the art poses assembly problems, due to poor assembly of the seal to the guide member, and in-service sealing problems in the presence of vibration and positive pressure generated beneath the elastomeric dynamic sealing portion.

[0009] It is an object of the present invention to provide an internal combustion engine valve seal designed to eliminate, in a straightforward, low-cost manner, the aforementioned drawbacks typically associated with known seals.

[0010] According to the present invention, there is provided a seal for a valve of an internal combustion engine, said valve comprising a guide member defining a seat, and a rod sliding in said seat, and said seal comprising:

- a first elastically deformable portion cooperating with the rod of said valve;
- a second elastically deformable portion cooperating with an outer surface of said guide member; and
- a supporting member supporting said first and said second elastically deformable portion, and which is fitted to said guide member;

characterized in that said supporting member has a number of slits for generating radial compression forces on said guide member.

[0011] A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a partial section of an internal combustion engine featuring valves and seals in accordance with the teachings of the present invention;
Figure 2 shows a larger-scale section of a valve of the Figure 1 engine, fitted with a seal in accordance with the present invention;
Figure 3 shows a view in perspective, with parts removed for clarity, of the seal in Figures 1 and 2.

[0012] Number 1 in Figure 1 indicates as a whole a seal, in accordance with the present invention, for a valve 2 of a known internal combustion engine 3 shown only partly as required for a clear understanding of the present invention.

[0013] More specifically, of engine 3, Figure 1 only shows a cylinder 4, of axis A, defining a combustion chamber 5; and a cylinder head 6 defining internally an intake pipe 7 for feeding air from the intake environment to chamber 5, and an exhaust pipe 7 for expelling a mixture of air and burnt gases from chamber 5 to the outside environment.

[0014] Pipes 7 extend symmetrically with respect to axis A, and converge, close to axis A, inside chamber 5 through two circular through openings 8 formed in cylinder head 6.

[0015] Cylinder head 6 extends symmetrically with respect to axis A, and defines, on the opposite side of openings 8 to chamber 5, two cylindrical through seats 9 for housing respective valves 2.

[0016] For the sake of simplicity, given the symmetri-

cal nature of Figure 1, reference is made in the following description to only one of valves 2, it being clear that the same considerations also apply to the other valve.

[0017] Valve 2 comprises a tubular guide member 10 interference-fitted inside a portion of seat 9; and a rod 11 which slides in opposite directions inside guide member 10, projects axially from opposite ends of guide member 10, and has a shutter section 12 at one end for engaging and fluidtight sealing opening 8.

[0018] The opposite end of rod 11 to shutter section 12 is activated by a control device 13 - in the example shown, a cam and tappet mechanism; and rod 11 is loaded in known manner towards control device 13 by a helical spring 14 housed inside seat 9.

[0019] With reference to Figures 2 and 3, the outer circumferential surface of the opposite end of guide member 10 to pipe 7 is fitted with a relative seal 1 in accordance with the invention.

[0020] More specifically, seal 1 comprises a sleeve-shaped supporting member 15 fitted with an annular elastomeric member 16 axially symmetrical and coaxial with supporting member 15.

[0021] The elastomeric member comprises a first portion 17a which cooperates in fluidtight manner with the portion of rod 11 adjacent to the opposite end of guide member 10 to pipe 7; and a second portion 17b which cooperates in fluidtight manner with said end of guide member 10.

[0022] Supporting member 15 is defined by a cylindrical body 18 having, at one end, a turned-out edge 19, and, at the opposite end, an annular disk-shaped section 20 having a smaller inside diameter and extending perpendicularly to body 18.

[0023] Edge 19 and cylindrical body 18 of supporting member 15 are embedded inside portion 17b of elastomeric member 16, while section 20 supports in projecting manner, and is partly embedded in, portion 17a of elastomeric member 16.

[0024] More specifically, portion 17a of elastomeric member 16 projects axially from section 20 of supporting member 15, is pressed on its inside diameter against rod 11 by an outer elastic collar 21, and cooperates with the end of guide member 10 facing it.

[0025] Portion 17b of elastomeric member 16 is pressed on its inside diameter against guide member 10, and is joined at one axial end to an axial end of portion 17a in a manner not shown.

[0026] By means of portion 17a of elastomeric member 16, seal 1 provides for dynamic sealing permitting passage of the minimum oil flow required to lubricate the connection between rod 11 and guide member 10.

[0027] Moreover, by means of portion 17b of elastomeric member 16, seal 1 provides for static sealing ensuring sufficient radial compression on guide member 10 to prevent lubricating oil leakage.

[0028] An important aspect of the present invention lies in the lateral surface of supporting member 15 having a number of through slits 22 for generating radial compression forces on guide member 10.

[0029] In the example shown, slits 22 are rectangular, are equally spaced angularly, and extend coaxially with supporting member 15 from turned-out edge 19 to body 18.

[0030] In the preferred embodiment shown in Figure 3, slits 22 are alternately of a length substantially equal to the axial dimension of body 18, and a length substantially equal to half the axial dimension of body 18.

[0031] Slits 22 generate on guide member 10, in the static sealing area, a radial compression force which assists in maintaining correct assembly.

[0032] Alternatively, slits 22 may be of lengths and directions other than those shown.

[0033] The advantages of seal 1 according to the present invention will be clear from the foregoing description.

[0034] In particular, providing a number of slits 22 of different length and direction generates on guide member 10, in the static sealing area, a radial compression force ensuring correct assembly in the presence of dimensional tolerances greater than those encountered in the known state of the art, thus enabling less precise surface finish and simpler machining of guide member 10.

[0035] Slits 22 and the radial compression force exerted by supporting member 15 also enable a reduction in the amount of mix required to produce elastomeric member 16.

[0036] Finally, in the example shown, the static sealing area is reduced to the guide member 10 contact area adjacent to section 20.

[0037] Clearly, changes may be made to seal 1 as described and illustrated herein without, however, departing from the scope of the accompanying Claims.

Claims

1. A seal (1) for a valve (2) of an internal combustion engine (3), said valve (2) comprising a guide member (10) defining a seat (9), and a rod (11) sliding in said seat (9), and said seal (1) comprising:

- a first elastically deformable portion (17a) cooperating with the rod (11) of said valve (2);
- a second elastically deformable portion (17b) cooperating with an outer surface of said guide member (10); and
- a supporting member (15) supporting said first and said second elastically deformable portion (17a, 17b), and which is fitted to said guide member (10);

characterized in that said supporting member (15) has a number of slits (22) for generating radial compression forces on said guide member (10).

2. A seal as claimed in Claim 1, **characterized in that** said first and said second elastically deformable portion (17a, 17b) are defined by one member (16).

3. A seal as claimed in Claim 1 or 2, **characterized in that** said supporting member (15) is substantially sleeve-shaped, and said slits (22) are equally spaced angularly along said supporting member (15).

4. A seal as claimed in Claim 3, **characterized in that** said slits (22) extend coaxially with said supporting member (15).

5. A seal as claimed in Claim 4, **characterized in that** said slits (22) are alternately of different lengths.

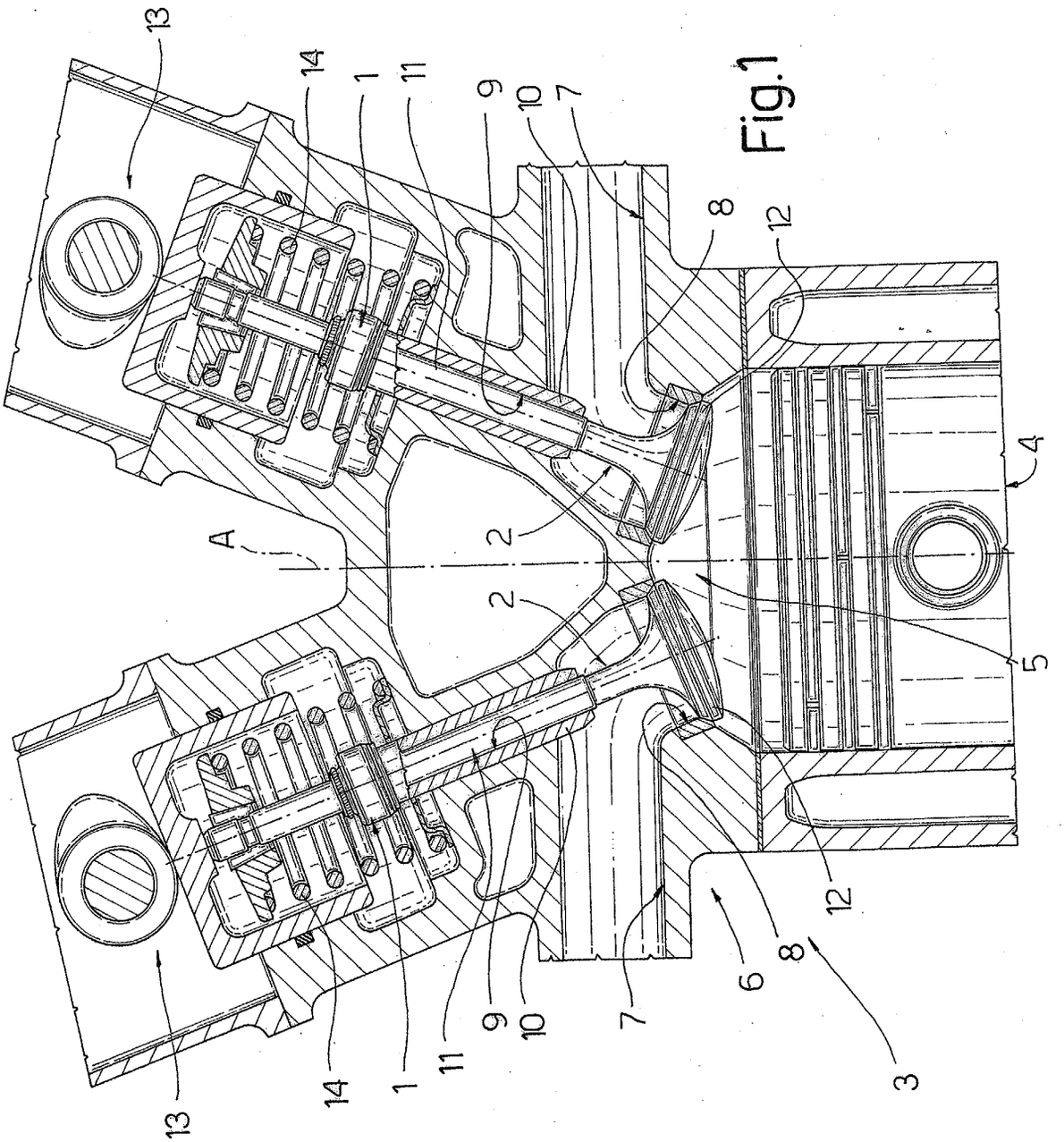

Fig.1

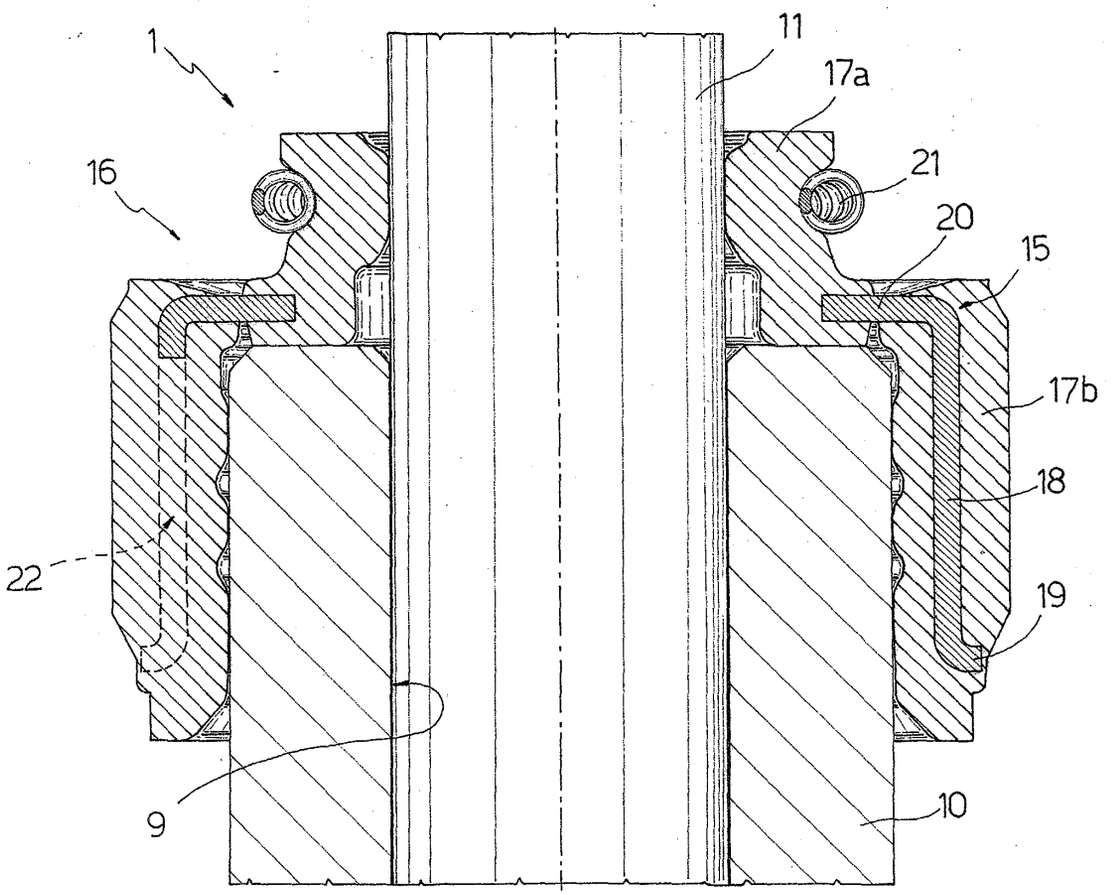

Fig.2

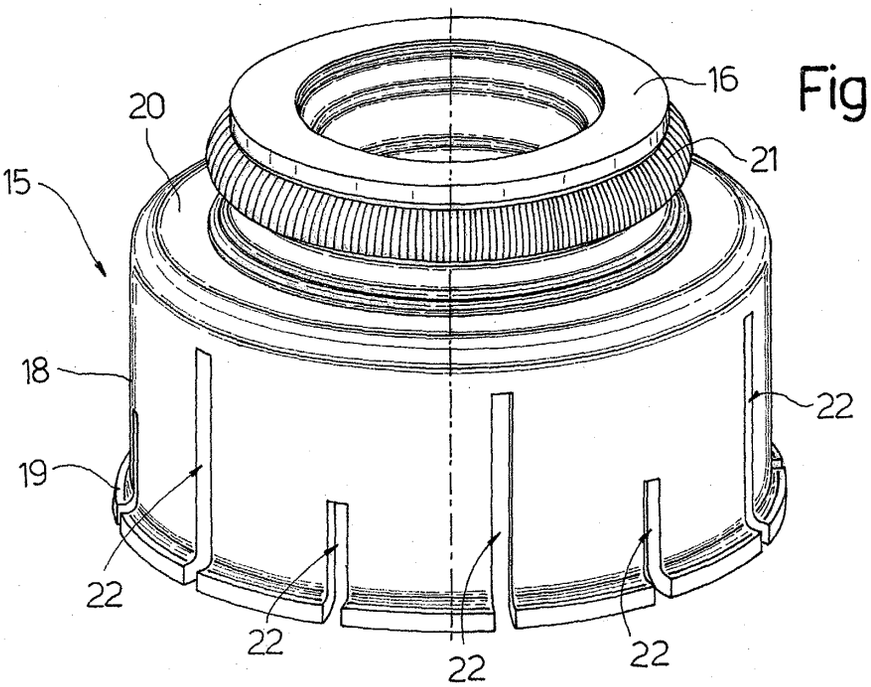

Fig.3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5250

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.7)
X	FR 2 057 627 A (LECHLER ELRING DICHTUNGSWERKE) 21 May 1971 (1971-05-21)	1-4	F01L3/08
A	* the whole document *	5	

X	US 2003/146580 A1 (HEGEMIER TIMOTHY ALAN) 7 August 2003 (2003-08-07)	1-3	
	* the whole document *		

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F01L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 August 2004	Klinger, T

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 42 5250

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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31-08-2004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2057627 A	21-05-1971	FR 2057627 A5	21-05-1971
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