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Ferch

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[54] **VALVE STEM GUIDE FOR INTERNAL COMBUSTION ENGINES**

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[52] **U.S. Cl.** ..... **123/188 GC;** 123/188 P; 277/50; 277/178; 308/36.1

[51] **Int. Cl.** **F01l 3/08;** F16k 41/00

[58] **Field of Search**.... 123/188 GC, 188 P, 188 SA; 277/33, 36, 48, 50, 166, 168, 178; 308/36 R

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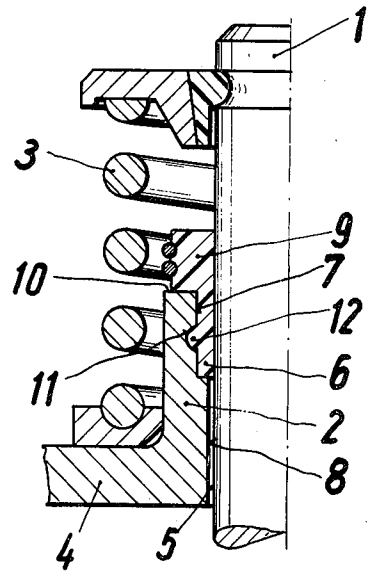
[57] **ABSTRACT**

The valve stem valve for internal combustion engines includes a valve stem guide connecting piece extending outwardly from a cylinder head wall and a sleeve-type oil scraper formed of elastic material and disposed in positive engagement with the connecting piece. An enlarged bore is formed in the connecting piece extending axially outwardly from its guide bore and the inner end of the oil scraper is located within the enlarged bore and its outer end forms a radially outwardly extending collar projecting over and in contact with the outer end face of the guide connecting piece. The oil scraper has a radially outwardly extending projection on its outer surface within the enlarged bore which seats in matching engagement with a depression in the surface of the enlarged bore. In radial section the projection and depression can have various shapes, for instance, semi-circular, multi-rectilinear sided, saw-toothed and the like. Further, the projection can be an annular member or it can be formed of a number of angularly spaced members.

13 Claims, 7 Drawing Figures



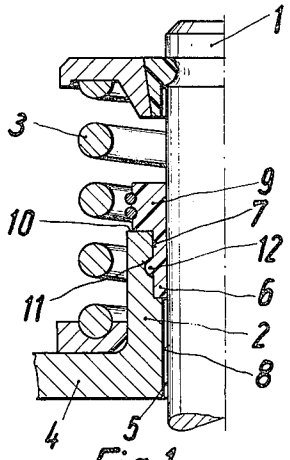


Fig. 1

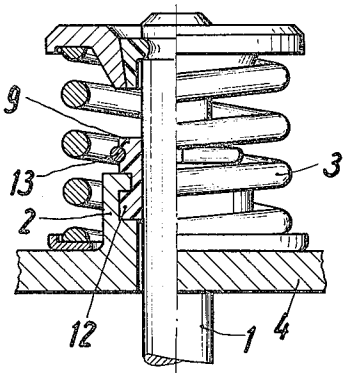


Fig. 2

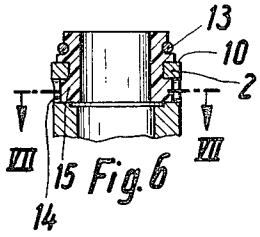


Fig. 6

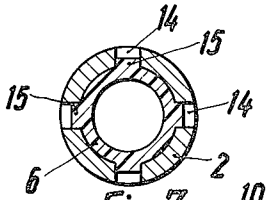


Fig. 7

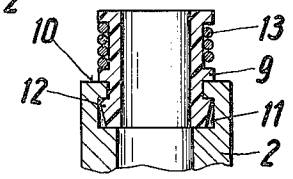


Fig. 4

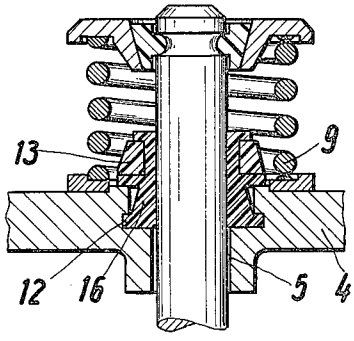


Fig. 3

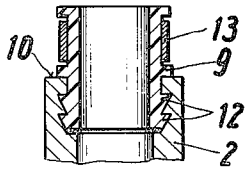


Fig. 5

VALVE STEM GUIDE FOR INTERNAL COMBUSTION ENGINES

SUMMARY OF THE INVENTION

The present invention is directed to a valve stem guide for an internal combustion engine and the like and, more particularly, it is directed to an oil scraper formed of elastic material and disposed in positive connection with the valve stem guide.

Oil scrapers are used to prevent the penetration of oil from the oil-filled space for the cam shaft, located outside the cylinder chamber, through the annular gap between the valve stem and its guide into the piston displacement or stroke volume, since such leakage or penetration might result in critical oil losses.

There are a variety of known oil scrapers which are particularly directed to the features of scraping, sealing and affording a reliable seat on the valve stem guide piece. Such known oil scrapers are cupped over the outer end of the valve stem guide piece with a split ring or similar member pressing the elastic oil scraper firmly against the outer surface of the valve stem guide piece to assure that it is held in place. This type of fit can be improved by a positive connection (cf. German Utility Model No. 1,971,307).

The known oil scrapers have certain disadvantages, for instance, they require a relatively great amount of high-grade material and, further, because of the space they require, it is often impossible to accommodate them or to do so only at considerable expense in both time and labor. This space problem results from the continual effort to make internal combustion engines more compact so that very little space exists between the valve spring and the valve stem guide piece.

Therefore, it is the primary object of the present invention to provide an oil scraper which can be used in internal combustion engines where the valve spring closely surrounds the valve stem guide piece.

In accordance with the present invention, a sleeve-type oil scraper formed of elastic material is positively connected to the valve stem guide piece in an internal combustion engine and the oil scraper is seated within an enlarged bore extending outwardly through the valve stem guide piece from the guide bore. To afford the positive connection between the oil scraper and the guide piece a portion of the outer surface of the oil scraper fits into a corresponding depression in the surface of the enlarged bore. The depression and the projection are matchingly shaped to provide interfitting relationship and the depression can be formed by a singular annular groove or a number of angularly spaced depressions or bores formed in the guide piece.

By means of the novel arrangement of the oil scraper and its orientation relative to the valve stem guide piece, the disadvantages experienced in known oil scrapers are avoided in a simple manner by economizing in the use of expensive materials and by limiting the size of the oil scraper so that it can be used in those internal combustion engines where previously a lack of space was available, usually between the valve spring and the valve stem guide piece. Moreover, with the present arrangement the oil scraper need not be connected as tightly with the valve stem guide piece, because the valve stem presses the oil scraper against the enlarged bore wall. Additionally, assembly of the oil scraper into position is easier and less time-consuming.

To anchor the sleeve-type oil scraper in the axial direction, in one embodiment, an annular groove or depression is formed in the guide piece and the radial cross-section of the groove may be semi-circular, rectangular, saw-toothed or similarly shaped. If, however, the wall of the guide piece is too thin to permit the formation of an annular groove of sufficient depth into its surface, in another embodiment radially extending bores are formed in the guide piece into which similarly shaped projections on the oil scraper can seat. If the use of the bores is not practicable, several smaller annular grooves can be used.

Another feature of the present invention is the formation of a collar or flange on the end of the oil scraper extending outwardly from the enlarged bore so that the collar extends radially outwardly over and contacts the outwardly directed end face of the valve stem guide piece. This arrangement has the advantage that in assembling the oil scraper into the guide piece, its intended position can be checked to assure that it is secured against axial displacement.

The sleeve-type oil scraper is preferably extruded, cast or injection-molded from polytetrafluoroethylene and the collar on its outer end which seats against the end face of the valve stem guide piece is laterally engaged by a resilient element for increasing the contact pressure against the valve stem. The resilient element, for example, may be a split ring, a spiral spring, a flat keep spring ring, or a highly tensioned rubber ring.

Another advantage of the novel oil scraper according to the present invention is that it can be used for internal combustion engines whose valve stem guide piece is too flat to receive an oil scraper slipped or "cuffed" over it or, when for obtaining a more compact design, the valve stem guide piece does not project outwardly from the cylinder wall.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. **1** is a partial axial section of a valve stem guide piece containing an oil scraper in accordance with the present invention;

FIG. **2** is an axial extending view, similar to FIG. **1**, of another embodiment of the present invention;

FIG. **3** is an axially extending sectional view of a short valve stem guide piece including another embodiment of the present invention;

FIGS. **4** to **6** indicate additional embodiments of the oil scraper; and

FIG. **7** is a transverse sectional view taken along the line VII—VII in FIG. **6**.

DETAILED DESCRIPTION OF THE INVENTION

In the various figures of the drawing, similar parts have been given the same reference numerals.

In the drawing, a valve stem **1**, operable from above by means of cams or eccentrics, not shown, is guided in the embodiments shown in FIGS. **1** and **2** with a sliding fit in a valve stem guide piece **2** which projects out-

wardly from a cylinder head wall 4 and is surrounded in a narrow space by a restoring valve spring 3. The upper end of the valve stem 1 as well as the guide piece 2 and the valve spring 3 are contained in a space filled with motor oil.

To prevent oil from passing through the clearance 5 between the valve stem 1 and the guide piece 2 into the space within the cylinder head wall 4, an oil scraper 6 is seated into an enlarged bore 7 extending coaxially outwardly from the bearing bore 8 through the guide piece 2 and the cylinder head wall.

The oil scraper is an elastic, bushing or sleeve type extrusion, casting or molded part of polytetrafluoroethylene and, at its outer end, that is the end extending outwardly from the guide piece 2, it has a radially extending collar or flange 9 which extends outwardly over and seats against the outer end face 10 of the guide piece. Within the enlarged bore 7 of the guide piece 2 an annular groove 11 is formed and a similarly shaped annular collar 12 formed on the outer surface of the oil scraper 6 fits into the groove and secures the scraper against axial displacement. Since the oil scraper 6 encloses the valve stem 1 with some initial tension, the collar 12 is also forced into the annular groove 11 by the valve stem 1.

The collar 12 and its matching annular groove 11 may have a variety of cross-sectional shapes. In FIG. 1 the groove and collar each have a semi-circular cross-section while in FIG. 2 they have a rectangular cross-section, that is, the collar and groove are formed of multi-rectilinear sides. In FIG. 4, the groove 11 is rectangularly shaped, however, the collar 12 has a trapezoidal shape with its outer surface facing into the groove tapering inwardly in the direction of the cylinder wall head 4. The cross-sectional configuration shown in FIG. 4 can be selected due to the elasticity of the material of the oil scraper so that it is ensured when the valve stem 1 is inserted through it, that the collar 12 extends into the annular groove 11 in the manner shown.

To ensure a tight closure for the annular gap or clearance 5 after the oil scraper 6 has been in operation for a period of time, the collar 9 on its outer end is tightly enclosed by a spring element 13 having an initial tension. Various members may be used as the spring element 13 as long as it does not interfere with the valve spring 3. For example, in FIGS. 1 and 4 the spring element 13 is a spiral spring, in FIGS. 2 and 6 it is a split ring, in FIG. 5 it is a flat keep spring ring, and in FIG. 3 a tightly pretensioned rubber ring is illustrated.

As indicated above, the collar 12 on the oil scraper 6 located within the enlarged bore 7 and which fits into the annular groove 11 can be formed in a number of different shapes. Accordingly, FIG. 4 shows a very appropriate form which, while having a simple design and being easy to mount, ensures a reliable hold. In FIG. 5 the collar 12 has a saw-tooth configuration as do the annular grooves 11 and this arrangement is particularly advantageous where grooves and collars of small depths are needed because of the relatively thin-walled guide piece 2.

Another shape of the grooves 11 and collars 12 which is suitable for thin-walled guide pieces 2 is shown in FIGS. 6 and 7. In these figures, instead of one or more annular grooves, four angularly spaced throughbores 14 are provided through the guide piece near its outer end and individual and matchingly shaped projections 15 on the oil scraper 6 fit into the throughbores.

In FIG. 3 another embodiment of the oil scraper 6 is illustrated with a frusto-conically shaped section 16 extending in the axial direction between the collars 9 and 12 and tapering inwardly toward the collar 12, so that the oil scraper can yield to any lateral force exerted by the valve stem 1.

FIG. 3 also is an example of a valve stem guide without the outwardly extending guide piece so that an extremely flat design of the engine cylinder head is afforded.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. Valve stem guide for internal combustion engines comprising a cylinder head wall, a valve stem guide connecting piece connected to said cylinder head wall, said guide connecting piece forming a guide bore extending therethrough and communicating with the interior of said cylinder head wall and having an end face at its end opposite the interior of said cylinder head wall, and a sleeve-type oil scraper formed of an elastic material disposed within and in positive engagement with said guide connecting piece, wherein the improvement comprises that said guide connecting piece has an enlarged bore section coaxial with and extending radially outwardly from said guide bore and extending axially from the end face of said guide connecting piece toward but spaced from the interior of said cylinder head wall, said enlarged bore section having a depression formed therein extending radially outwardly from the surface thereof relative to the axis of said enlarged bore section, an outwardly extending projection formed integrally on the outer surface of said sleeve-type oil scraper extending into said depression in matching and positive engagement therewith, and said oil scraper extending axially outwardly from the end face of said guide connecting piece at the end of said enlarged bore section and including an integral annularly-shaped collar extending radially outwardly over and in contact with the end face of said guide connecting piece.

2. Valve stem guide, as set forth in claim 1, wherein the outer surface of said projection integrally formed on said sleeve-type oil scraper tapers outwardly in the axial direction of the enlarged bore section from the inner end of said projection toward its end closer to the end face of said guide connecting piece, and at least a major portion of the axially extending tapering outer surface of said projection being disposed in spaced relation to the juxtaposed surface of said depression in the surface of said enlarged bore so that said oil scraper can elastically absorb lateral forces of said valve stem.

3. Valve stem guide, as set forth in claim 1, wherein said depression in the enlarged bore section of said guide connecting piece and the matching said projection on said oil scraper are annularly-shaped.

4. Valve stem guide, as set forth in claim 3, wherein said depression in the enlarged bore section of said guide connecting piece and the matching said projection have a multi-rectilinear sided cross-section.

5. Valve stem guide, as set forth in claim 3, wherein said depression and projection each have a semi-circular cross-section.

6. Valve stem guide, as set forth in claim 3, wherein said depression and projection each have a multiple saw-tooth-like configuration.

7. Valve stem guide for internal combustion engines including a valve stem guide connecting piece associated with a cylinder head wall, and a sleeve-type oil scraper formed of elastic material disposed in positive engagement with said guide connecting piece, said guide connecting piece having a guide bore therein, wherein the improvement comprises an enlarged bore coaxial with and extending radially outwardly from said guide bore through said guide connecting piece, said enlarged bore having a depression formed therein extending radially outwardly from the surface thereof relative to the axis of said enlarged bore, an outwardly extending projection on the outer surface of said sleeve-type oil scraper extending into said depression in matching engagement therewith, the depression in said valve stem guide connecting piece comprises a number of angularly spaced bores formed through said guide connecting piece, and said projection on said oil scraper comprises a number of matching angularly spaced projections each extending into one of said bores with its radially outer face spaced inwardly from the radially outer end of the bore.

8. Valve stem guide, as set forth in claim 1, wherein a resilient element engages the radially outer surface of said collar.

9. Valve stem guide, as set forth in claim 8, wherein said resilient element is a spiral spring.

10. Valve stem guide, as set forth in claim 8, wherein said resilient element is a split ring.

11. Valve stem guide, as set forth in claim 8, wherein said resilient element is a flat keep spring ring.

12. Valve stem guide, as set forth in claim 8, wherein said resilient element is a pretensioned rubber ring.

13. Valve stem guide, as set forth in claim 1, wherein said oil scraper is a shaped member formed of polytetrafluoroethylene.

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