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SEALING ARRANGEMENT FOR THE STEM OF SUSPENDED VALVES OF
INTERNAL COMBUSTION ENGINES
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FIG 1

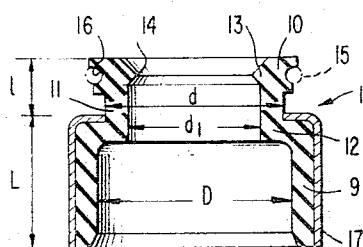
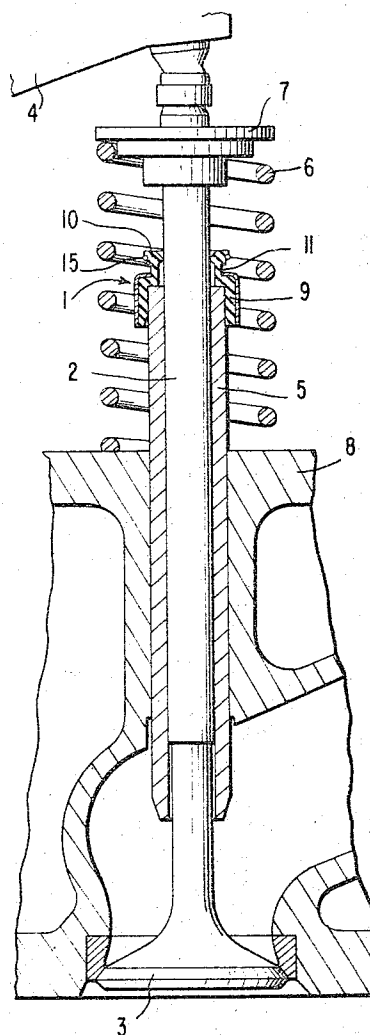


FIG 2



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SEALING ARRANGEMENT FOR THE STEM OF SUSPENDED VALVES OF INTERNAL COMBUSTION ENGINES

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13 Claims. (Cl. 123—188)

The present invention relates to a sealing arrangement for the stem of valves provided in suspended arrangement of internal combustion engines, which consists of a sealing cap composed of two mutually coaxial portions and also coaxial to the valve stem of which the portion nearer the valve disk is seated as support means on the valve stem guide means whereas the other portion serves as seal, properly speaking, and for this purpose abuts against the valve stem itself.

With a known arrangement of the aforementioned type, the cylindrically constructed sealing cap is retained at the valve stem guide means with the aid of a ring of spring steel, and the area of the cap opposite the valve disk is narrowed down by a corresponding increase in the thickness of the walls and carries an approximately cylindrical sealing ring that in turn abuts at a cylindrical sealing surface on the valve stem. However, these known sealing caps are relatively stiff to such an extent that a good sealing with a completely satisfactory abutment of the sealing material at the valve stem is possible only when the valve axis and the axis of the valve guide means coincide accurately whereas already with small deviations of the valve axis from the axis of the valve guide means, which takes place during the occurrence of transverse forces, as is the case ever so often under the influence of the rocker arm and by reason of the play between the valve stem and the valve guidance, a completely satisfactory sealing is no longer assured. With an inclination of the valve stem, the sealing lip also no longer abuts unobjectionably and reliably in this case against the stem at all places about the entire circumference of the stem which also has an unfavorable effect on the seal. The aim of the present invention resides in eliminating these shortcomings.

For purposes of achieving the aforementioned aim, the portion of the sealing cap on the side of the valve disk and the portion of the sealing cap abutting against the valve stem are connected with one another according to the present invention by a neck portion formed by a constriction at the cap circumference. For example, the portion of the sealing cap abutting against the valve stem may possess a sealing lip projecting inwardly toward the valve stem, which lip abuts against the valve stem only with a line contact. Appropriately, the inner diameter of the portion of the sealing cap nearer the valve disk is larger than the outer diameter of the portion at the other end or corresponds to this diameter whereas advantageously the inner diameters of the two coaxial portions of the sealing cap arranged one behind the other in the longitudinal direction of the stem have a ratio of 1.5:1. The sealing lip advantageously possesses in cross section the configuration of a triangle with its apex directed toward the valve stem circumference. For example, a spiral spring surrounding the sealing cap may be provided along the circumference of the sealing cap opposite the inwardly projecting sealing lip, which spiral spring presses the sealing cap against the valve stem.

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The arrangement according to the present invention excels in the first instance by an elastic construction of the connection between the two portions of the sealing cap, which has as a consequence that the sealing lip is now able to follow any deflection of the valve stem and that a reliable, completely unobjectionable abutment of the sealing lip at the valve stem is assured thereby.

By reason of the fact that only a line contact exists between the sealing lip and the valve stem, there results the further advantage that the sealing lip abuts fully and completely against the entire valve circumference in every given position of the valve stem with respect to the valve guidance, which again contributes to the achievement of a completely satisfactory and reliable sealing. The spiral spring thereby increases the abutment force at the sealing place opposite the sealing lip.

Accordingly, it is an object of the present invention to provide a sealing arrangement for the valve stems of suspended valves in internal combustion engines which avoids by extremely simple means the aforementioned shortcomings and drawbacks encountered with the prior art constructions.

Another object of the present invention resides in a relatively more flexible sealing arrangement for the valve stems of suspended valves of internal combustion engines which assures a completely satisfactory seal under all operating conditions.

A further object of the present invention resides in a sealing arrangement for the valve stems of suspended valves which permits slight, relative angular movements between the valve stem and the valve guidance without impairing the completely satisfactory seal therebetween.

Still another object of the present invention resides in a unitary sealing cap for use with suspended valves of internal combustion engines which is capable of following all movements of the valve stems while assuring a completely satisfactory seal regardless of the position of the stem.

These and further objects, features, and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing, which shows, for purposes of illustration only, one embodiment in accordance with the present invention, and wherein:

FIGURE 1 is a vertical axial cross-sectional view through a sealing cap structure according to the present invention, illustrating the sealing cap by itself, and

FIGURE 2 is a partial cross-sectional view through a valve and valve actuating mechanism of an internal combustion engine and illustrating the sealing arrangement of FIGURE 1 in its assembled position, FIGURE 2 being on a reduced scale compared to FIGURE 1.

Referring now to the drawing wherein like reference numerals are used throughout the two views to designate like parts, the sealing arrangement according to the present invention consists of a sealing cap generally designated by reference numeral 1, which in the operating position thereof is coaxial to the valve stem 2 as can be seen from FIGURE 2. The sealing cap 1, which serves for purposes of sealing the valve stem 2, is thereby arranged within the area of the end of the valve stem 2 opposite the valve disk 3. The sealing cap 1 serves, as mentioned above, for the sealing of stems of suspended valves—to which, for example, rocker arms may be coordinated as indicated by reference numeral 4—which suspended valves are intended primarily for internal combustion engines, especially in motor vehicles. The

sealing cap 1 has the task to prevent oil and/or dirt penetrating between the valve stem 2 and its bushing-like guidance 5. As to the rest, the valve stem 2 is under the influence of the spring 6 in a conventional manner which rests, on the one hand, against the valve spring retainer 7 and, on the other, against the housing 8.

The sealing cap 1 consists of two portions 9 and 10, of which the portion 9 on the side of the valve disk 3 serves as support means and for this purpose is seated on the valve guide means 5, whereas the portion 10 carries out the sealing function, properly speaking, and abuts against the valve stem 2 at the other end of the cap 1. According to the present invention, the portion 9 nearer the valve disk and the portion 10 at the other end of the sealing cap 1 are connected with each other by a neck or collar portion 11 which corresponds approximately to a reduction or constriction at the cap circumferences. The two portions 9 and 10 of the sealing cap 1 thereby extend mutually coaxially, are disposed one behind the other in the longitudinal direction of the stem and are connected with each other by a flange 12 extending radially from the outside toward the inside so that altogether within the area 11 a neck-like constriction or reduction results which determines the elastic behavior of the sealing portion 10 of the sealing cap 1. The inner diameter D of the portion 9 nearer the valve disk 3 of the sealing cap 1 is larger than the outer diameter d of the portion 10 at the other end of the valve stem 2 or may possibly correspond to this diameter. The inner diameter D is also larger than the inner diameter d_1 of the portion 10 at the other end of the stem whereby these two diameters are related to one another appropriately at the ratio of about 1.5:1. The lengths L and l of the two portions 9 and 10 are appropriately related to each other at a ratio from about 10:3.5 to about 10:7, i.e., the length L of the portion 9 is correspondingly larger than the length l of the other portion 10. The portion 10 of the cap 1 abutting against the valve stem 2 possesses an inwardly projecting sealing lip 13 projecting inwardly toward the valve stem 2 which, by reason of its particular shape, abuts against the valve stem 2 with a line contact. The sealing lip 13 has, in cross section, the configuration of a triangle whose apex 14 is directed toward the valve stem circumference and, as a rule, is located in the immediate area of the end of the sealing cap 1 opposite the valve disk 3. A spiral spring, which is indicated in full lines in FIGURE 2 and designated therein by reference numeral 15 and which is indicated only in dash line in FIGURE 1, is provided along the circumference of the sealing cap 1 at a place opposite the inwardly projecting sealing lip 13. This spiral spring 15 surrounds the sealing cap 1 and presses the same against the valve stem 2. The spring 15 is inserted in a groove or notch 16 of approximately semi-circular shape provided along the circumference of the sealing cap 1.

In order to impart to the over-all structure a better support and a corresponding better appearance, the portion 9 of the sealing cap 1 nearer the valve disk 3 is surrounded additionally by an approximately cylindrical sleeve 17, for example, of metal or the like.

While I have shown and described one embodiment in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of numerous changes and modifications as known to a person skilled in the art, and I therefore do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

I claim:

1. A valve stem seal for the axially reciprocable valve stem of suspended valves, especially of internal combustion engines, in which the valve stem is at one end with a valve disc and is guided within a valve guide, said seal comprising: a first tubular portion having opposite axial

ends; a second tubular portion having opposite axial ends and being of a substantially smaller diameter than said first portion; a third annular neck portion connecting said first and second portions at their adjacent ends; said first portion and said second portion being substantially coaxial with respect to each other; said second portion including an annular projecting sealing lip extending inwardly toward the valve stem and constituting sealing means for sealingly engaging around the valve stem; said first portion constituting support means for tightly engaging around the valve guide to support the sealing lip; said sealing lip being located at the free end of said second portion spaced a substantial distance from the corresponding one of said adjacent ends; said second portion consisting essentially of a relatively thin, flexible portion adjacent said first portion and a relatively thick reinforced portion having said sealing lip to constitute means for firmly supporting said sealing lip and facilitating relative radial movement between said sealing lip and reinforced portion and said first portion to compensate for uneven spots and eccentricity of the valve stem; and including a relatively rigid tubular reinforcement surrounding substantially the entire outer circumference of said first portion and said third portion to provide a relatively rigid support for said second portion.

2. The seal according to claim 1, wherein said sealing lip is in cross-section the shape of a triangle with its apex directed inwardly for engagement with the valve stem with line sealing contact.

3. The seal according to claim 2, including spiral spring means surrounding said second portion only around the external circumference thereof opposite said sealing lip for resiliently pressing said sealing lip into tight sealing engagement with the valve stem; said second portion being provided with semi-spherical cross-sectional groove means around its circumference for receiving therein said spiral spring means.

4. The seal according to claim 3, wherein said first portion is cylindrical and has an inner diameter at least equal to the outer diameter of said second portion; and the inner diameter of said first portion being related to the inner diameter of said second portion approximately at the ratio of 1.5:1.

5. The seal according to claim 4, wherein the length of said first portion is related to the length of said second portion at the ratio of about 10:3.5 to about 10:7.

6. The seal according to claim 5, wherein said first portion, said second portion, said third portion and said sealing lip consist essentially of a homogeneously integrally molded elastomeric material, and said reinforcement consists essentially of sheet metal; the free axial end of said first portion opposite the corresponding one of said adjacent ends having a tapered inner edge to constitute cam means for facilitating assembly of said first portion on the valve guide.

7. The seal according to claim 1, including spiral spring means surrounding said second portion only around the external circumference thereof opposite said sealing lip for resiliently pressing said sealing lip into tight sealing engagement with the valve stem; said second portion being provided with semi-spherical cross-sectional groove means around its circumference for receiving therein said spiral spring means.

8. The seal of claim 1, in combination with an internal combustion engine having at least one reciprocable valve including a valve stem and a valve guide, said seal first portion being mounted on said valve guide and said seal second portion being mounted on said valve stem.

9. The device according to claim 8, wherein said second portion has an internal surface spaced a substantial distance from said valve stem except for said sealing lip.

10. The device of claim 7, in combination with an internal combustion engine having at least one reciprocable valve including a valve stem and a valve guide, said seal

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first portion being mounted on said valve guide and said seal second portion being mounted on said valve stem.

11. The device of claim 3, in combination with an internal combustion engine having at least one reciprocable valve including a valve stem and a valve guide, said seal first portion being mounted on said valve guide and said seal second portion being mounted on said valve stem.

12. The device of claim 6, in combination with an internal combustion engine having at least one reciprocable valve including a valve stem and a valve guide, said seal first portion being mounted on said valve guide and said seal second portion being mounted on said valve stem.

13. The device of claim 12, wherein said second portion has an internal surface spaced a substantial distance from said valve stem except for said sealing lip.

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