June 3, 1969 A. PFLEGHAAR 3,447,524

INTERNAL COMBUSTION ENGINE CYLINDER HEAD

Filed May 9, 1967

FIG. 1

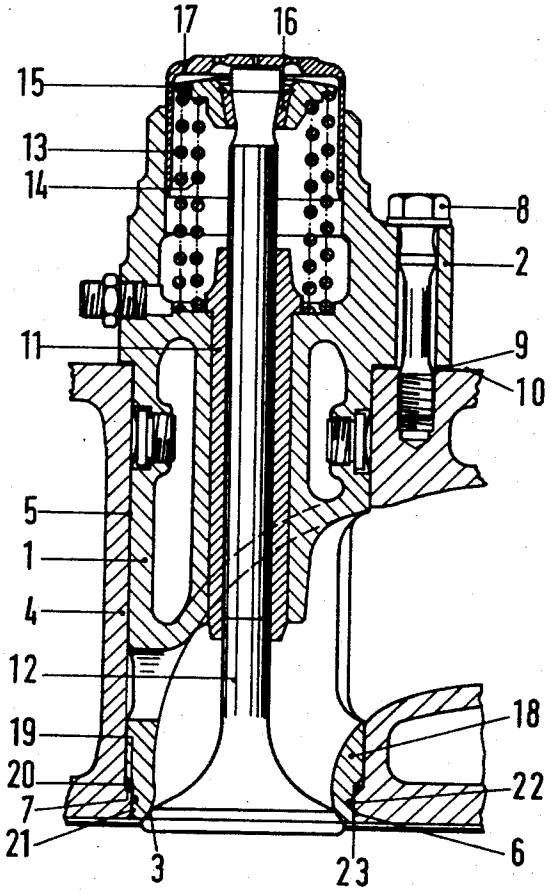
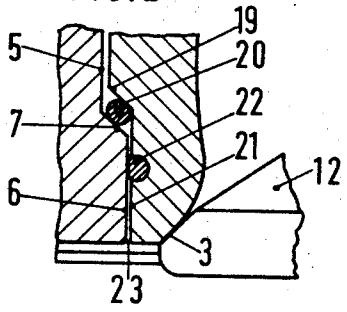


FIG. 2



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INTERNAL COMBUSTION ENGINE CYLINDER HEAD

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ABSTRACT OF THE DISCLOSURE

An internal combustion engine cylinder head has a through bore extending from a top surface to a bottom surface thereof, this bore receiving with a sliding fit a poppet valve housing. An abutment portion of the housing abuts the top surface of the head under the action of bolts attaching the housing to the head. The housing has a guide bore guiding the valve stem. An annular recess is formed coaxially in the lower end of the external periphery of the housing and receives a sealing member which slides on the internal periphery of the first bore during thermal expansion and contraction of the housing relatively to the internal periphery of the bore.

This invention relates to an internal combustion engine cylinder head with a cylindrical bore in which is inserted a poppet valve the housing of which is fixed to the cylinder head by way of an external flange.

A known apparatus of this kind has the valve housing pressed, by means of necked bolts which engage on the external flange and are screwed into a top surface of the cylinder head, against a sealing surface which is situated in the cylinder head underside in the vicinity of the valve seat. The necked bolts and the cylinder head underside are subjected to very high stress and are correspondingly liable to develop cracks particularly in the case of an exhaust valve. Furthermore, the valve housing is readily deformed under the action of the high compressive forces which occur, more particularly if, as is usual, it is weakened at one region by a gas duct. As a result of such deformation, the valve closure member may no longer bear uniformly on its seat and therefore may no longer seal perfectly. The hot exhaust gases flowing through the gap in such a case destroy the the seat surface in a very short time.

According to the present invention, there is provided a combination comprising an internal combustion engine cylinder head, first external surface portions of said cylinder head for bounding a combustion chamber of said engine, second external surface portions of said cylinder head disposed opposite said first external surface portions, portions of said cylinder head defining a bore extending therethrough from said first external surface portions to said second external surface portions, a valve housing mounted in said bore, connecting means connecting said housing to said cylinder head and urging said housing towards said first external surface portions, portions of said valve housing defining a valve port in the region of said first external surface portions and a valve seat encircling said port, other portions of said cylinder head and intermediate portions of said valve housing between said valve seat and said second external surface portions defining a gas duct extending to said valve port, other portions of said valve housing defining a guide bore therein substantially coaxial with said valve seat and extending from said gas duct in a direction away from said valve seat, a valve closure member cooperating with said valve seat, and a guide stem of said valve closure member longitudinally slidably mounted in said guide bore, wherein the improvement comprises an abutment portion of said valve housing bearing against said second external surface portions, portions of one of the external peripheral surface of said housing and the internal peripheral surface of the first-mentioned bore defining a substantially annular recess therein substantially coaxial with said first-mentioned bore and in the region of said valve seat, a substantially annular sealing member accommodated in said annular recess and bearing on the other of said external peripheral surface and said internal peripheral surface for sliding on that other surface during longitudinal relative movement between said internal peripheral surface and said external peripheral surface owing to thermal expansion and contraction, said valve housing being a sliding fit in said bore.

This improvement so increases the rigidity of the connection, which is a significant factor in the stressing of the dynamically loaded connection, that the variable tensile stress in the bolts is of a completely safe value. Also the head underside is effectively relieved of compressive forces. The operational reliability of the cylinder head is thus considerably improved.

It has been found that the sealing effect of the slidable sealing member is promoted by the deposition of oil and carbon between the external surface of the housing and the bore receiving the same. Since the accumulation of a deposit of this kind requires a certain length of working life, it may happen that the sealing members are not quite gas-tight for a short period after fitting.

This problem can be solved by compressing a compressible sealing gasket between a shoulder of the internal peripheral surface of the bore and a shoulder of the external peripheral surface of the housing, these shoulders being located in the vicinity of the valve seat. In this case, the sealing member is disposed between the former shoulder and the valve seat.

The gasket effects the sealing of the gap between the housing and the receiving bore at the beginning of the working life. Later on, when sufficient oil and carbon has been deposited in the gap, the sealing effect is provided mainly by the slidable sealing member.

An adequate sealing effect between the shoulders is advantageously achieved by forming the gasket as a ring of originally substantially circular cross-section, which is flattened at diametrically opposite regions during fitting. This cross-sectional deformation produces the necessary sealing pressure. The basket preferably consists of a hollow asbestos ring encased in a sheet metal sheath.

A good sealing effect with the slidable sealing member, particularly in the newly fitted state when no oil and carbon has yet been deposited, is advantageously achieved by forming the slidable sealing member as a metal ring which is rolled into, or caulked into, an annular recess in the external peripheral surface of the housing. With this construction, it is possible to have the metal ring slightly oversize relatively to the housing-receiving bore, without making the fitting of the valve housing too difficult.

Reliable bearing of the slidable sealing member in the annular recess and on the internal peripheral surface of the bore when in a hot state is advantageously promoted by making the sealing member of a metal which has a higher coefficient of thermal expansion than does the material of the housing.

Conveniently, the slidable sealing member can be produced by metal spraying.

In order that the invention may be clearly understood and readily carried into effect, reference will now be made, by way of example, to the accompanying drawing, in which:

FIGURE 1 is an axial section through a poppet valve of an internal combustion engine, and

FIGURE 2 is a detail of FIGURE 1.

Referring to the drawing, the poppet valve includes a housing including an external abutment flange **2**. The housing **1** comprises at its lower end **18** the valve seat **3** encircling the valve port and in a sliding fit in a bore **5, 6** of the cylinder head **4**. The external peripheral surface of the bore consists of a larger-diameter cylindrical surface portion **5**, a smaller-diameter cylindrical surface portion **6** spaced axially from the portion **5**, and an annular shoulder **7** connecting the portions **5** and **6**. The flange **2** is urged by means of bolts **8** to bear against the top external surface **10** of the cylinder head by way of a sealing element **9**. A valve guide **11** of the housing is formed with a guide bore in which the stem of the valve closure member **12** slides. Helical compression springs **13** and **14** which act on the valve closure member **12** by way of a spring plate **15** and a conical clamping sleeve **16**, tend to press the valve closure member **12** against the valve seat **3**. To open the member **12**, the valve drive (not shown) depresses a cup-shaped part **17**, and the member **12** therewith, downwards. The external peripheral surface of the housing **1** consists of a larger-diameter cylindrical surface portion encircled by the portion **5**, a smaller-diameter cylindrical surface portion **21** encircled by the portion **6**, and an annular shoulder **19** facing the shoulder **7** and axially spaced therefrom. The faces of the two shoulders **7** and **19** are disposed parallel to each other. Situated between the shoulders **7** and **19** is a compressible gasket **20** which consists of a hollow asbestos ring encased by a sheet metal sheath. The gasket **20** in its original state is of approximately circular cross-section, but is flattened, at diametrically opposite regions, by the shoulders **7** and **19** when the bolts **8** are tightened. The cross section of the hollow space bounded by the shoulders **7** and **19** is larger than the cross section of the gasket **20**. Fitted in an annular recess in the surface portion **21** and situated between the shoulder **7** and the valve seat **3** is a sealing member **22** which consists of a copper ring rolled into or caulked into the recess. The annular recess in which the copper ring **22** is situated can have walls so inclined that it widens towards its base. The surface portions **6** and **21** bound a cylindrical gap **23** which becomes filled with oil and carbon during the operation of the internal combustion engine. The external diameter of the sealing member **22** can be 0.05 mm. larger than the internal diameter of the surface portion **6**. Instead of the rolled-in or caulked-in copper ring **22**, a sealing member in the form of a per se known piston ring can be used.

I claim:

1. In combination with an internal combustion engine having a combustion chamber, apparatus comprising a cylinder head including first external surface portions adapted for bounding said combustion chamber of said engine, said head including second external surface portions opposite to said first external surface portions, said cylinder head including further portions between said first and second portions and defining a bore extending therethrough from said first external surface portions to said second external surface portions, a valve housing slidably mounted in said bore, connecting means connecting said housing to said cylinder head and urging said housing towards said first external surface portions, said valve housing being provided with a valve port in the region of said first external surface portions and including a valve seat encircling said port, said cylinder head and said valve housing intermediate said valve seat and said second external surface portions defining a gas duct extending to said valve port, said valve housing being further provided with a guide bore at least substantially coaxial with said valve seat and extending from said gas duct in a direction away from said valve seat, a valve closure member cooperating with said valve seat, and a guide stem connected with said valve closure member and longitudinally slidable in said guide bore, said valve housing including an abutment portion bearing firmly against said second external surface portions, said housing defining a substantially annular recess at least substantially coaxial with the first-said bore and adjacent said valve seat, a substantially annular sealing member accommodated in said annular recess and sandwiched between said head and housing for sliding therebetween during longitudinal relative movement between said head and housing due to thermal expansion and contraction, the first said bore having a larger-diameter cylindrical portion and a smaller-diameter cylindrical portion spaced axially from said larger-diameter portion and an annular shoulder portion connecting said cylindrical portions, said housing having a peripheral surface consisting of portions corresponding to said portions of the first said bore, one of the portions of the peripheral surface being an annular shoulder spaced axially from the first said annular shoulder portion, and an annular compressible gasket at least substantially coaxial with the first said bore and interposed between said annular shoulder portions for compression therebetween during thermal expansion of said housing.

2. Apparatus according to claim **1**, wherein said gasket is a ring of normally substantially circular cross section.

3. Apparatus according to claim **1**, wherein said sealing member is a metal ring.

4. Apparatus according to claim **1**, wherein said gasket includes a hollow asbestos ring and a sheet metal sheath enclosing said asbestos ring.

5. Apparatus according to claim **1**, wherein said head and housing define therebetween a cylindrical gap extending from said sealing member to said first external surface portions adapted for gradually filling with oil and carbon during use.

6. Apparatus according to claim **1**, wherein said sealing member has a greater coefficient of thermal expansion than said head.

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