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[54] RECIPROCATING PISTON INTERNAL COMBUSTION ENGINE WITH A CYLINDER HEAD AND CYLINDER HOUSING CONSISTING OF ONE BLOCK

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[51] **Int. Cl.** **F02f 1/20**

[58] **Field of Search** ..... 123/193 C, 193 CH, 193 H, 193 CP, 123/193 R, 41.84, 41.83, 41.75, 41.72, DIG. 6, DIG. 7, DIG. 1; 92/171, 169

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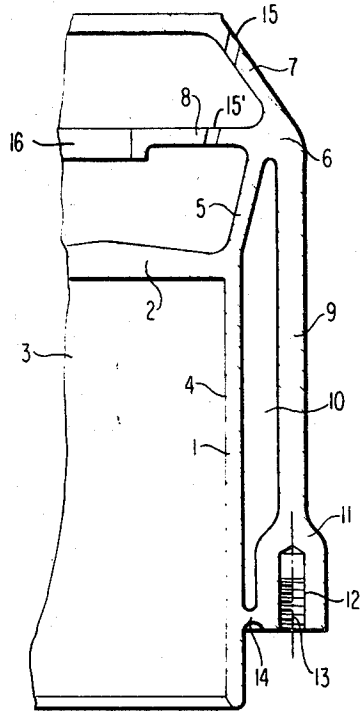
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[57] **ABSTRACT**

A reciprocating piston internal combustion engine with a cylinder head and a cylinder housing consisting of one single block, in which the cylinder housing essentially consists of an inner wall defining together with a cylinder head bottom the cylinder space and of an outer wall separated from the inner wall by a cooling space; the cylinder housing is connected with the crankcase by way of bolts or the like whose center longitudinal axes are disposed in or very close to the center of the outer wall while the outer wall extends up to connecting places disposed above the cylinder head bottom; the cylinder head bottom is supported at these connecting places by way of support walls.

14 Claims, 2 Drawing Figures



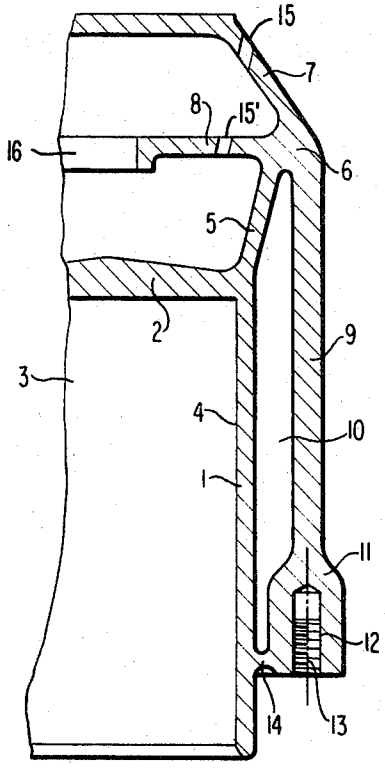


FIG. 1

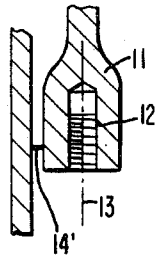


FIG. 1A

RECIPROCATING PISTON INTERNAL COMBUSTION ENGINE WITH A CYLINDER HEAD AND CYLINDER HOUSING CONSISTING OF ONE BLOCK

The present invention relates to a reciprocating piston internal combustion engine with a cylinder head and cylinder housing consisting of one block, and in which the cylinder housing essentially consists of an inner wall that defines together with a cylinder head bottom the cylinder space, and of an outer wall separated from the inner wall by a cooling space, whereby the cylinder housing is connected with the crankcase by means of screws or bolts.

A reciprocating piston internal combustion engine of the aforementioned type is known in the prior art in which flanges arranged laterally at the outer wall receive the bolts which establish the connection between the cylinder housing and the crankcase. Furthermore, the cylinder head bottom is supported on the outer wall by way of cross walls arranged essentially horizontally at the height thereof. As a result thereof, the inner wall is stressed by considerable forces, especially cross and longitudinal forces which cause a deformation of the cylinder surfaces. The cross walls between the cylinder head bottom and the outer wall do not permit a uniform cooling of the upper part of the inner wall so that thermal stresses occur in this thermally highly stressed part.

The present invention is concerned with the task to so construct the cylinder head and cylinder housing that the inner wall remains free of any forces and a uniform cooling of the inner wall is achieved in order to avoid thereby a deformation of the cylinder running surface.

The underlying problems are solved according to the present invention in that the center longitudinal axes of the bolts or screws are disposed in or very near to the center of the outer wall and that the outer wall extends uninterruptedly up to the connecting places disposed above the cylinder head bottom on which the cylinder head bottom is supported by way of support walls.

The forces occurring between the cylinder head bottom and the crankcase are conducted by the construction in accordance with the present invention from the cylinder head bottom by way of the support walls to the connecting places and from there in straight line by way of the outer wall and the bolts to the crankcase. As a result of this straight direction, no cross forces can act on the inner wall. The cooling of the inner wall takes place uniformly since the cooling space between the inner and outer wall is not interrupted by any cross walls and therewith the cooling medium can flow uniformly about the inner wall.

In one advantageous construction of the present invention, inlet and exhaust channel walls, spark plug recess walls and/or walls receiving other functional parts may serve as support walls. It is thus possible by a corresponding arrangement of these walls that the support walls carry out simultaneously several functions.

Accordingly, it is an object of the present invention to provide a reciprocating piston internal combustion engine with a cylinder head and cylinder housing consisting of a single block which avoids by simple means the aforementioned shortcomings and drawbacks encountered with the prior art constructions.

Another object of the present invention resides in a reciprocating piston internal combustion engine of the type described above in which the inner wall of the cylinder housing, consisting of an inner and of an outer wall, is farreachingly relieved of any cross and longitudinal forces.

A further object of the present invention resides in a reciprocating piston internal combustion engine with a cylinder head and cylinder housing consisting of one block and with the cylinder housing consisting of inner and outer walls, in which the danger of deformation of the cylinder surfaces at the inner wall are avoided.

Still another object of the present invention resides in an internal combustion engine of the type described above in which a uniform cooling of the inner wall is assured.

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:

FIG. 1 is a partial longitudinal vertical cross-sectional view through the cylinder head and cylinder housing consisting of one block of an internal combustion engine in accordance with the present invention.

FIG. 1A is a partial view corresponding to a portion of FIG. 1 with a seal means in place of the thin wall connecting the lower end of the outer wall to the inner wall.

Referring now to the FIG. 1 of the drawing, the reciprocating piston internal combustion engine illustrated in this figure includes a cylinder head and cylinder housing consisting of one block. An inner wall of the cylinder housing is designated by reference numeral **1** which, together with a cylinder head bottom **2**, delimits a cylinder space **3**. The inner wall **1** carries on its inner side the cylinder working surface **4**. A support wall **5** leads from the edge of the cylinder head bottom **2** to a connecting place **6** disposed above the cylinder head bottom **2** from which extends, in addition to the walls **7** and **8** belonging to the cylinder head, an outer wall **9** disposed parallel to the inner wall **1** which, together with the inner wall **1** and the support wall **5** encloses a cooling space **10**.

Spark plug recess walls **15** and **15'** can be provided in the walls **7** and **8** of the cylinder head. Inlet and exhaust channel walls **16** can also be provided in the walls of the cylinder head. The outer wall **9** is provided at its lower end with several reinforcements **11** distributed over the circumference in which are arranged threaded bores **12**. Screws or bolts (not shown) are threadably inserted into these bores **12** which connect the cylinder housing with a crankcase (not shown). The center longitudinal axes **13** of the threaded bores **12** and therewith of the bolts are disposed in the center of the outer wall **9**. As a result thereof, the forces occurring between the cylinder head bottom **2** and the crankcase (not shown) are conducted by way of the support wall **5** to the connecting place **6** and from there in a straight direction by way of the outer wall **9** and the bolts to the crankcase.

A wall **14** arranged at the lower edge of the outer wall **9** between the latter and the inner wall **1** serves as terminal wall of the cooling space **10**; its wall thickness is, however, so slight that it cannot transmit any significant forces. Its function can also be taken over by a seal **14'** of any conventional construction as shown in FIG. 1A.

While we have shown and described only 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 those skilled in the art, and we 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.

We claim:

1. A cylinder head and cylinder housing construction for a reciprocating piston internal combustion engine comprising: a cylinder housing having an inner and an outer wall, a cylinder head formed in one piece with the cylinder housing, said inner wall and the bottom of said cylinder head together forming a working cylinder space, said outer wall being spaced from said inner wall to form a cooling space therebetween, connecting means for connecting the cylinder head and inner wall to the outer wall, said connecting means including support wall means extending upwardly from the bottom of the cylinder head to a connecting place at the upper end of the outer wall, and at least one threaded fastener means for threadably fastening the one piece cylinder head and cylinder housing to an engine crankcase, each of said at least one threaded fastener means having longitudinal centerlines located adjacent the center of the outer wall.

2. A construction according to claim 1, characterized in that said cooling space consists of a single chamber delimited at the top by the support wall means and at the bottom by closure means provided adjacent the threaded fastener means.

3. A construction according to claim 2, characterized in that said threaded fastener means comprise threaded apertures formed at the bottom of the outer wall.

4. A construction according to claim 2, characterized in that said closure means is a cross wall between said inner and outer walls, said cross wall being substantially thinner than any of said inner and outer walls and said support wall means whereby substantially all forces are transferred between said inner wall and said threaded fastener means by way of said support wall means and said outer wall.

5. A construction according to claim 2, characterized in that said closure means is a seal between said inner and outer walls, said seal being constructed such that substantially all forces are transferred between said inner wall and said threaded fastener means by way of said support wall means and said outer wall.

6. A construction according to claim 1, characterized in that the longitudinal centerlines of the threaded fastener means are disposed substantially in alignment with the center of the outer wall.

7. A construction according to claim 1, characterized in that said connecting means further includes other walls extending from above said cylinder head bottom to the connecting place, said other walls including meanS for accommodating other functional parts of the engine.

8. A construction according to claim 7, characterized in that said other walls include inlet and exhaust channel walls.

9. A construction according to claim 7, characterized in that said other walls include spark plug recess walls.

10. A construction according to claim 1, characterized in that said outer wall includes reinforcements adjacent each of the threaded connecting means.

11. A construction according to claim 10, characterized in that said threaded connecting means are symmetrically spaced around the circumference of said outer wall.

12. A construction according to claim 1, characterized in that said support wall means is inclined with respect to the inner and outer walls such that the horizontal extent of the support wall means is substantially less than its vertical extent, whereby the transfer of forces from the outer wall to the inner wall by way of the support wall means is primarily in the vertical direction with a consequent reduction in transverse forces to the inner wall.

13. A construction according to claim 2, characterized in that said support wall means is inclined with respect to the inner and outer walls such that the horizontal extent of the support wall means is substantially less than its vertical extent, whereby the transfer of forces from the outer wall to the inner wall by way of the support wall means is primarily in the vertical direction with a consequent reduction in transverse forces to the inner wall.

14. A construction according to claim 4, characterized in that said support wall means is inclined with respect to the inner and outer walls such that the horizontal extent of the support wall means is substantially less than its vertical extent, whereby the transfer of forces from the outer wall to the inner wall by way of the support wall means is primarily in the vertical direction with a consequent reduction in transverse forces to the inner wall.

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