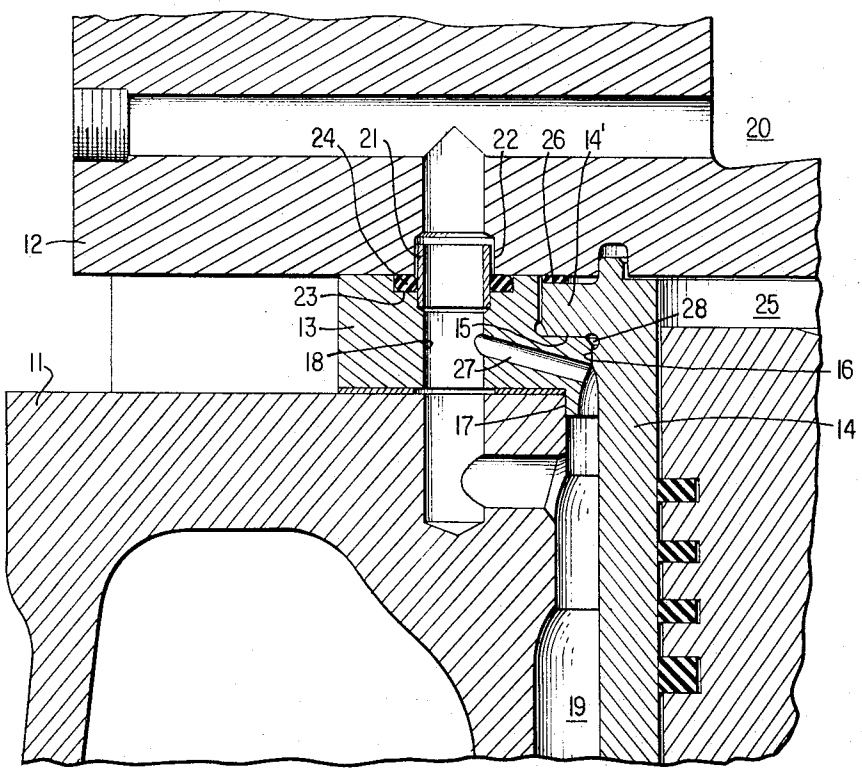
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INTERNAL COMBUSTION ENGINE

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INTERNAL COMBUSTION ENGINE

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ABSTRACT OF THE DISCLOSURE

The present disclosure relates to a ring flange support for a liner that is contacted along its exterior surface by cooling fluid, wherein the ring flange has an upwardly facing step seat receiving therein a radially outwardly extending collar on the upper end of the liner. The collar and ring flange are radially spaced from each other to allow for free radial expansion, and the ring flange and cylinder block are radially spaced from each other to allow for free radial expansion of the ring flange. Radially inward surface means are provided between the cylinder block and ring flange on the one hand and the ring flange and liner on the other hand to provide for radial centering of the liner. Cooling ducts are provided in the ring flange for conducting cooling fluid to these surface means to accurately control the thermal expansion stresses.

With water-cooled internal combustion engines having "wet" cylinder liners, i.e., liners which are in direct contact with the cooling water which flows about the same, it is already known to insert these liners with their collar directly in the crankcase or engine block. This arrangement, however, entails the disadvantage that after a longer period of operation, as a result of the force and stresses caused by clamping of the cylinder head, cracks occur in the crankcase or engine block, starting below the seat of the collar of the liner, which extend to the cooling water space disposed therebelow. In order to counter these difficulties, the cylinder liners were provided already with a larger ring flange in lieu of the customary collar whereby a larger abutment surface results on the seat of the crankcase or engine block so that the specific surface pressure is reduced. A liner collar thus enlarged in this manner in the radial direction in the form of an annular flange, however, involves technological difficulties during the manufacture of the cylinder liners. Additionally, the loads and stresses are unfavorable within the flange during operation. Furthermore, with such prior art constructions, the cooling water flow channel has to be displaced for reasons of strength and rigidity at first far below the annular flange of the liner within the crankcase or engine block and then—in the vertical direction—adjacent the same so that the cooling conditions are insufficient in the hottest area of the cylinder liner.

In order to avoid the aforementioned disadvantages, it is proposed in accordance with the present invention to insert between the cylinder head and the crankcase or engine block an annular or ring flange centered with respect to the latter which ring flange serves as seat for the upper end of the cylinder liner provided with a collar.

In further development of the present invention, it is additionally proposed to arrange at the annular flange a stepped portion pointing in the upward direction on which is seated the bottom side of the liner collar, below which is provided an annular surface externally at the liner

bushing by means of which the liner is laterally centered within the ring flange.

The advantages of the present invention further consist principally in the ring flange made appropriately of steel according to the present invention offers an assurance that no cracks can occur in the same and that it can be exchanged in a simple manner in case of repairs.

The ring flange consisting of steel additionally offers the possibility to place into the same cooling water channels in accordance with the present invention. Thus, the cooling water passage or flow channel extends in accordance with the present invention through the ring flange as connection between the cooling water jacket disposed about the cylinder liner and the cooling water spaces in the cylinder head. Furthermore, cooling water channels are provided in accordance with the present invention in the ring flange within the area of the liner collar, that is, quite in proximity to the hottest zone of the liner. Hence, the advantages are produced by the measures proposed in accordance with the present invention that, on the one hand, the crankcase or engine block is relieved from a rigidity point of view by the ring flange and that, on the other, an intensive cooling is achieved within an area exposed to heat.

Accordingly, it is an object of the present invention to provide a cylinder liner construction which avoids in a simple manner the aforementioned drawbacks and shortcomings of the prior art constructions.

Another object of the present invention resides in the provision of an internal combustion engine having a cylinder liner which is so constructed and arranged and so installed into the cylinder block that cracks in the engine block or crankcase are avoided that might otherwise occur as a result of clamping stresses produced by the clamping forces securing the cylinder head to the engine block or crankcase.

A further object of the present invention resides in the provision of a cylinder liner for internal combustion engines, particularly water-cooled internal combustion engines which are simple to manufacture, easy to install and equally simple to exchange in case of repairs.

Still another object of the present invention resides in the provision of a cylinder liner for water-cooled internal combustion engines which permits an effective cooling by means of the water, particularly within the hottest areas of the cylinder liner, without involving difficulties as regards sufficiency of strength and rigidity of the individual parts and/or of the entire assembly.

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 the single figure is a partial cross sectional view through the upper end of the cylinder liner of an internal combustion engine in accordance with the present invention.

Referring now to the single figure of the drawing, a ring flange **13** is clamped between the crankcase or engine block **11** and the cylinder head **12**. The ring flange **13** serves for the arrangement and accommodation of the collar **14'** of the "wet," inserted cylinder liner **14**. For that purpose, the ring flange **13** is provided with a stepped portion **15** on which is seated the collar **14'**. The liner **14** is centered within the ring flange **13** by means of an annular surface **16** disposed below the collar **14'**. The ring flange **13**, in turn, is centered with respect to the crankcase or engine block **11** by an annular surface **17**. The flow channel **18** for the liquid cooling medium extends through the ring flange **13**. The liquid cooling medium is able to flow through the channel **18** in the

ring flange 13 from the cooling medium space 19, which extends directly about the cylinder liner 14, into the cooling medium space 20 within the cylinder head 12. A thin-walled bushing 21 is pressed into each flow channel 18 in the upper part of the ring flange 13; the projecting part of the thin-walled bushing 21 forms together with the bore of the flow channel 18 in the cylinder head 12 an annular gap 22 serving as labyrinth. A sealing ring 24 is inserted into a recess or aperture 23; the sealing ring 24 is pressed into sealing engagement on all sides thereof by the clamping force of the cylinder head bolts and by reason of the inserted bushing 21. Sealing with respect to the combustion space 25 is realized by a seal 26. In order to enable intensive cooling of the hot zone within the area of the collar 14' of the cylinder liner 14, cooling channels 27 are provided within this area which extend from the cooling space 19 to the flow channel 18. A further seal 28 is provided above the centering surface 16.

While we 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 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. An arrangement for cylinder liners in internal combustion engines especially of "wet" inserted types of liners of liquid cooled internal combustion engines, comprising: a cylinder block; a cylinder head; a separate ring flange between said cylinder head and said cylinder block and centered with respect to said cylinder block; a separate cylinder liner including a radially outwardly extending collar having an annular top wall, an annular side wall and an annular bottom wall; said ring flange having an upwardly facing step portion including an inner side wall and a top wall on which rests said bottom wall of said collar; said ring flange inner side wall and said collar side wall being spaced from each other to form means for allowing substantially free radial expansion of said collar; said ring flange having a relatively large reinforcing annular radially exterior portion with means for allowing substantially free radial expansion with respect to said cylinder head and said cylinder block; said ring flange having radially inward side surface means and said liner having annular exterior side surface means below and radially inward of said collar engaging each other for radially centering said ring flange; means for conducting cooling fluid around the exterior of said liner in a cooling fluid space and including cooling channels in said ring flange substantially parallel to and closely adjacent to said collar, and said cooling channels being closely adjacent to said ring flange surface means and said liner surface means; said ring flange having a radially inward, exterior side surface means and said cylinder block having side surface means for engaging each other and centering said ring flange.

2. The device of claim 1, wherein said means for conducting cooling fluid includes a cooling fluid chamber between said liner and said ring flange radially opposite from said ring flange radially inward, exterior side surface means and said cylinder block side surface means in direct fluid communication with said cooling channels and forming means for conducting the cooling fluid between said cooling channels and the cooling fluid space between said cylinder block and said liner.

3. The device of claim 2, including seal means for sealing off the combustion space and being disposed between said collar and the bottom side of said cylinder head.

4. The device of claim 3, including further seal means located above said cooling channels and said ring flange radially inward side surface means for sealing off the cooling liquid space about said liner.

5. The device of claim 1, including seal means for sealing off the combustion space and being disposed between said collar and the bottom side of said cylinder head.

6. The device of claim 1, including further seal means located above said cooling channels and said ring flange radially inward side surface means for sealing off the cooling liquid space about said liner.

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