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(54) WATER-COOLED RECIPROCATING-PISTON INTERNAL COMBUSTION ENGINE

(71) We, KLÖCKNER-HUMBOLDT-DEUTZ AKTIENGESELLSCHAFT, a German Body Corporation, of Köln-Deutz, German Federal Republic, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to a water-cooled reciprocating-piston internal combustion engine having a jacket, comprising a cylinder block having a supporting surface, a bore in the block perpendicular to the supporting surface, the portion of the bore adjacent the supporting surface being formed to a predetermined locating diameter, a cylinder liner in the bore, an outwardly extending flange around one end of the liner by which the liner is clamped to the supporting surface, a collar formed around the liner adjacent the flange having a diameter which fits into the locating diameter to centre the liner in the bore, an annular sealing ring groove around the liner at the side of the collar remote from the flange, and a sealing ring in the groove.

It is known, where a cylinder liner is inserted into a bore in the cylinder block, to arrange a sealing ring beyond the locating diameter which serves to centre the cylinder liner in the bore, the sealing ring being clamped between a collar on the cylinder liner and a surface of the cylinder block. Because the collar on the cylinder liner is exposed to high temperatures, the sealing effect of the sealing ring diminishes after only a relatively short operational life of the internal combustion engine due to the temperature-induced ageing of the sealing ring, and because of differential thermal stressing of the liner collar and the casing, with a consequent frictional movement. A further drawback of the known construction is that crevice cavitation or corrosion occurs at the centering diameter serving to centre the cylinder liner which, in an advanced state, leads to the destruction of the sealing surfaces of the sealing ring.

It is therefore the aim of the present invention to prevent the above described drawbacks and to provide an effective ageing-resistant sealing of the cooling water space or jacket in the high temperature region of the cylinder liner, i.e., at the end of the cooling water jacket adjacent the cylinder head.

This aim is achieved by providing a water-cooled reciprocating-piston internal combustion engine having a water jacket, comprising a cylinder block having a supporting surface, a bore in the block perpendicular to the supporting surface, the portion of the bore adjacent the supporting surface being formed to a predetermined locating diameter, a cylinder liner in the bore, an outwardly extending flange around one end of the liner by which the liner is clamped to the supporting surface, a collar formed around the liner adjacent the flange having a diameter which fits into the locating diameter to centre the liner in the bore, an annular sealing ring groove around the liner at the side of the collar remote from the flange, and a sealing ring in the groove engaging the locating diameter to close and seal the end of the water jacket nearest the flange while, at the same time, bounding a part of the water jacket, the external surface of the liner on the side of the sealing ring remote from the flange and the portion of the bore which likewise ties on the said side of the sealing ring also bounding the water jacket.

In this way it is achieved that the cooling water is led directly as far as the sealing ring so that direct flushing of the sealing ring eliminates high temperatures and hence premature ageing of the sealing ring.

As an optional feature, the bore in the

cylinder block may be enlarged on the side of the sealing ring remote from the flange to allow a free flow of cooling water to the sealing ring. The large water space created adjacent the sealing ring prevents crevice cavitation or corrosion. As a result of the direct flushing of the sealing ring the cooling thereof is considerably improved. The sealing ring may initially have a circular cross-section and its cross-section may be changed to that of the sealing ring groove when compressed by the locating diameter.

As a further optional feature, the sealing ring may be fabricated of a high-temperature resistant, permanently elastic material, for example Viton (Registered Trade Mark). To improve the corrosion and ageing resistance, the sealing ring may be enveloped over at least the part of its surface facing the cooling water space by a high-temperature and cooling-medium resistant protective coating, for example P.T.F.E. (polytetrafluoroethylene).

The invention will now be described in greater detail with reference to the accompanying drawings illustrating two embodiments thereof in simplified form, in which -

Figure 1 shows part of a longitudinal section through a cylinder liner and a cylinder block with a sealing ring in accordance with the invention; and

Figure 2 shows part of a longitudinal section through the sealing assembly with a sealing ring which is partially enveloped by a high-temperature and cooling-medium resistant protective coating.

In Figures 1 and 2, reference 1 denotes a cylinder liner surrounded by a cooling water space or jacket 2 formed by a bore in a cylinder block 3. The cylinder liner 1 is clamped to a supporting surface 5 of the cylinder block 3 via a flange 4 and is centered in the cylinder block 3 by means of a centering collar 6 engaging a locating diameter 10. In an annular sealing ring groove 7 formed around the cylinder liner 1 adjacent the centering collar 6 is a sealing ring 8 which, viewed in cross-section, is initially circular and has a large part of its surface in communication with the cooling medium in the cooling water space 2. The cross-section of the sealing ring 8 is changed from its initial circular shape to conform with the shape of the sealing ring groove 7 when the parts are assembled and the sealing ring is compressed by the locating diameter 10. On the side of the locating diameter 10 remote from the flange 4 the bore in the cylinder block is enlarged due to the slope 9 of the wall of the water jacket.

The sealing ring 8 may advantageously be made of a high-temperature resistant, permanently elastic material, for example, Viton (Registered Trade Mark).

In Figure 2 the sealing ring 8 is enveloped

over a part of its surface by a high-temperature and cooling-medium resistant protective coating 11 over the area facing the cooling water space. The material of which this coating is composed may advantageously be P.T.F.E. (polytetrafluoroethylene).

By virtue of the direct bounding of a part of the cooling water space 2 by the surface of the sealing ring 8 and hence flushing of the sealing ring 8, which is enhanced further by the enlargement of the bore in the cylinder block 3, high temperatures on the sealing ring and, thus, premature ageing of the material of the sealing ring, are avoided. Since no obstructions are present in the cooling water space 2 in the immediate vicinity of the sealing ring 8, there is a free flow of coolant and no damage can occur to the surfaces bounding the cooling water space due to crevice cavitation or corrosion.

WHAT WE CLAIM IS:-

1. A water-cooled reciprocating-piston internal combustion engine having a water jacket, comprising a cylinder block having a supporting surface, a bore in the block perpendicular to the supporting surface, the portion of the bore adjacent the supporting surface being formed to a predetermined locating diameter, a cylinder liner in the bore, an outwardly extending flange around one end of the liner by which the liner is clamped to the supporting surface, a collar formed around the liner adjacent the flange having a diameter which fits into the locating diameter to centre the liner in the bore, an annular sealing ring groove around the liner at the side of the collar remote from the flange, and a sealing ring in the groove engaging the locating diameter to close and seal the end of the water jacket nearest the flange, while at the same time bounding a part of the water jacket, the external surface of the liner on the side of the sealing ring remote from the flange and the portion of the bore which likewise lies on the said side of the sealing ring also bounding the water jacket.

2. An engine according to claim 1, in which the bore in the cylinder block is enlarged on the side of the sealing ring remote from the flange to allow a free flow of cooling medium to the sealing ring.

3. An engine according to claim 1 or claim 2, in which the sealing ring is initially of circular cross-section, and its cross-section is changed to conform to that of the sealing ring groove when compressed by the locating diameter.

4. An engine according to any preceding claim, in which the sealing ring is made of a high-temperature resistant, permanently elastic material.

5. An engine according to any preceding claim, in which the sealing ring is covered

over at least a part of its surface facing the cooling water space by a high-temperature and cooling-medium resistant coating, for example P.T.F.E. (polytetrafluoroethylene).

5 6. A water-cooled reciprocating-piston internal combustion engine having a water jacket, comprising a cylinder block having a supporting surface, a bore in the block
10 perpendicular to the supporting surface, the portion of the bore adjacent the supporting surface being formed to a predetermined locating diameter, a cylinder liner in the
15 bore, an outwardly extending flange around one end of the liner by which the liner is clamped to the supporting surface, a collar formed around the liner adjacent the flange
20 having a diameter which fits into the locating diameter to centre the liner in the bore, an annular sealing ring groove around the liner at the side of the collar remote from the flange, and a sealing ring in the groove, constructed and arranged substantially as
25 herein described, with reference to and as illustrated in the accompanying drawings.

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