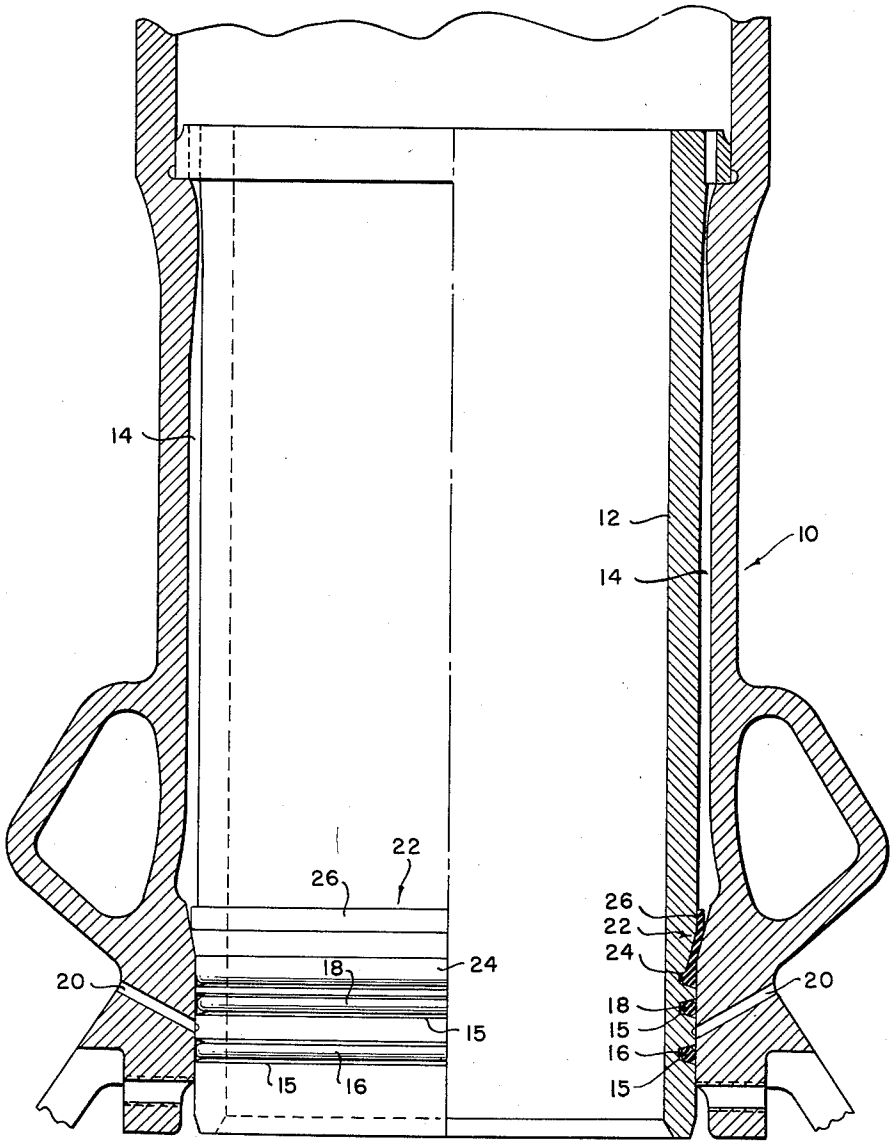
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SEAL FOR ENGINE CYLINDER LINER

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SEAL FOR ENGINE CYLINDER LINER

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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention pertains to seals for wet cylinder liners of internal combustion engines.

The problem of protecting the lower part of the engine blocks of diesel or internal combustion type engines against corrosion induced by cavitation has continued to be a serious one where a wet cylinder design is utilized.

Hitherto O-rings of round cross-section have been utilized as have rectangular compression seals, but without their providing an effective solution to the problem of engine block damage from cavitation corrosion.

The factors entering into this problem are those attendant upon the use of wet cylinder liners and seals in close proximity to a cylinder liner immediately above the upper seal part.

It is understood that much corrosion will not occur on the block during engine operation in the absence of contact with the coolant. Hence it is a principal object of this invention to insure against such undersired destructive contact.

This is accomplished simply and effectively by providing means preventing the coolant from reaching the surface of the block that is out of contact with the coolant.

In order to accommodate the installation of wet cylinder liners and seals, the engine block is conformed and disposed to be in close proximity to the cylinder liner just above the upper seal.

It has been found that high frequency vibration together with small amplitude vibration of the cylinder liner permitted by clearance for manufacturing tolerances and thermal expansion permit cavitation corrosion of the block. When this occurs, the damage done to the block calls for replacement or repair thereof to prevent coolant leakage.

It is therefore, the primary object of this invention to provide instrumentalities for keeping the coolant away from the most vulnerable zone of the block at the surfaces extending in parallelism to the center line of the cylinder liner just above the top seal.

Cavitation corrosion cannot occur on the block unless there is contact with the coolant.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

The sole FIGURE is a vertical section of a cylinder for a typical internal combustion engine.

In the drawing there is shown a conventional internal combustion engine block **10** provided with a wet cylinder liner **12** an annular coolant space **14** converging at its upper and lower ends as shown.

The outer cylindrical surface of the wet cylinder **12** is formed at its lower end in the position shown with a plurality of vertically spaced O ring grooves **15** of inwardly converging trough shape in cross-section, and having truncated bottoms.

Resilient O-ring seals **16** and **18** are disposed in the two lowermost grooves. An intermediate lateral conduit **20** extending downwardly between seals **16** and **18** affords communication between the outside of the engine

block **10** and the grooves in the lower end of the wet cylinder liner **12**.

Of especial significance is the combined resilient seal band and seal ring unit **22** having an inwardly directed and integral seal ring part **24** and an upstanding seal band part **26** for purposes that will now be explained.

It is obvious that cavitation corrosion cannot occur on the block during operation where there is no contact with the active coolant.

The special rubber-like seal band unit **22** cannot follow the movement of the wet cylinder liner **12**, but is forced out and firmly held against the adjacent surface of the engine block **10** by downwardly directed pressure of the coolant in the annular space **14**.

Thus the coolant is kept apart from the most vulnerable zone of the engine block **10** between surfaces parallel to the centerline above the top seal band **26**.

During the operation of the engine the seal **22** is so constrained that it cannot follow the movement of the cylinder liner **12**, but is forced out and held firmly against the block **10** by the coolant pressure. The bubbles therefore form and collapse between the liner **12** and the resilient seal band **22**.

The fit of the seal means is such that no coolant reaches the annular space immediately above the location of the top seal groove where the cylinder liner and block surfaces are parallel. The groove is sufficient to hold the seal in place during installation and operation.

The wet cylinder liner **12** requires no protection at its lower part because it is usually made of steel which inherently has much greater resistance to cavitation than cast materials such as iron or aluminum. Although the life of the cylinder liner is limited by internal wear, the engine block normally should last for the life of the engine.

Thus there has been provided a novel and useful combination of means for protecting the lower part of the cylinder of an internal combustion engine against cavitation corrosion, and preventing leakage of coolant where a wet cylinder liner is used.

Alternate forms of seals may be used to prevent cavitation corrosion. The illustrative embodiment can be used where installation clearance is restricted in the upper part of the block. Where more diametrical clearance is provided at the upper part of the block, the seal will be designed to fill completely the space between the cylinder liner **12** including the tapered position.

The efficacy of the seal of ths invention for wet cylinder liners as described has been proved in test periods of substantial duration. At the end of these tests the condition of the seal band was found to be good, and there was no measurable increase in crankcase deterioration, both of which are directly atributable to the use of a seal on a wet cylinder liner of a gasoline or diesel engine where the seal is not completely restrained.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In an internal combustion engine having means for preventing cavitation on the block of said engine, a wet cylinder liner spaced inwardly of the bore of the engine block and provided therewith a downwardly converging annular space at the lower end portion of the cylinder liner, the lower outer surface of said liner being formed with a plurality of longitudinally spaced O-ring grooves, and an O-ring formation positioned in each groove, the uppermost O-ring formation having an upwardly extending seal band free to follow the movement of the cylinder liner and keep the coolant out of the zone of the engine block.

2. The combination of claim 1 in which the cylinder liner is formed of steel.

3. The combination as defined in claim 1 in which the cylinder liner is of steel and the seal ring is of resilient rubber-like composition.

4. The combination as defined in claim 1 in which a plurality of resilient rubber-like seal rings are fitted in respective ring grooves.

5. In an internal combustion engine having a wet cylinder liner spaced inwardly of the bore of the engine block and providing therewith a downwardly converging annular space at the lower end portion of the said cylinder liner, the lower outer surface of said liner being formed with a plurality of longitudinally spaced seal-ring-receiving grooves, and a seal-ring formation positioned in each groove, the uppermost seal-ring having an upwardly extending seal band free to follow the movement of the cylinder liner and to keep the coolant out of the zone of the engine block.

6. In an internal combustion engine having means for preventing cavitation corrosion on the block of said engine, a wet cylinder liner spaced inwardly of the bore of the engine block and providing therewith a downwardly extending converging annular space at the lower end portion of the cylinder liner, the lower outer surface of said liner being formed with at least one O-ring groove, and having an O-ring formation positioned in a respective groove, the said O-ring formation having an upwardly extending seal band free to follow the movement of the cylinder liner and keep the coolant out of the zone of the engine block.

7. In an internal combustion engine having means for preventing cavitation on the engine block, a wet cylinder liner spaced inwardly of the bore of the engine block and providing therewith an inwardly converging annular space at the inward end portion of the cylinder liner, the outer surface of said liner being formed with a seal-ring-receiving groove, and a circular seal ring formation anchored at its innermost end in said groove and having an upwardly extending seal band free to follow the movement of the cylinder liner and keep the coolant out of the zone of the engine block.

8. In an internal combustion engine having a cylinder bore therein, a wet cylinder liner positioned within said bore and spaced inwardly therefrom providing therewith an inwardly converging annular space at the inward end portion of the cylinder liner, the outer surface of said liner being formed with a seal-ring-receiving groove; the improvement comprising a circular seal ring formation anchored at its innermost end in said groove and having an upwardly extending seal band free to follow the movement of the cylinder liner and thus prevent coolant from causing cavitation in said inwardly converging annular space.

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