May 14, 1968 J. GALLOIS ETAL 3,382,858

DEVICES FOR MOUNTING CYLINDERS IN RECIPROCATING ENGINES

Filed Nov. 12, 1965 2 Sheets-Sheet 1

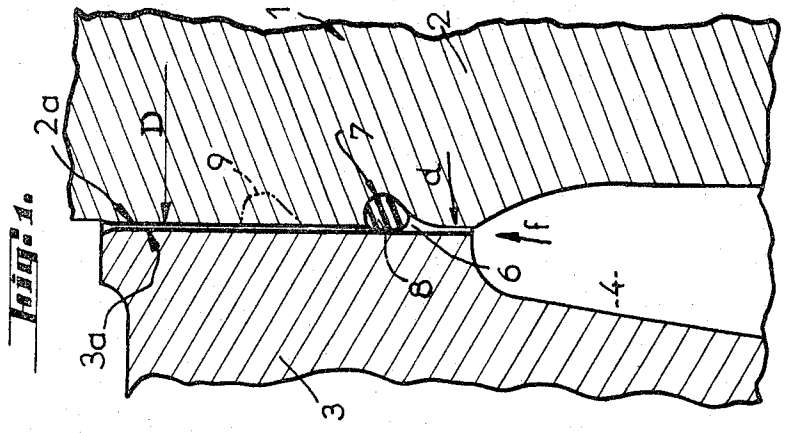


Fig. 1.

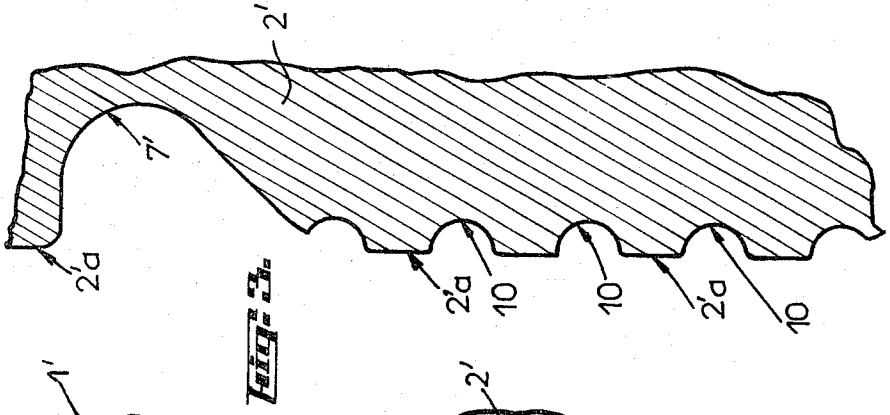


Fig. 3.

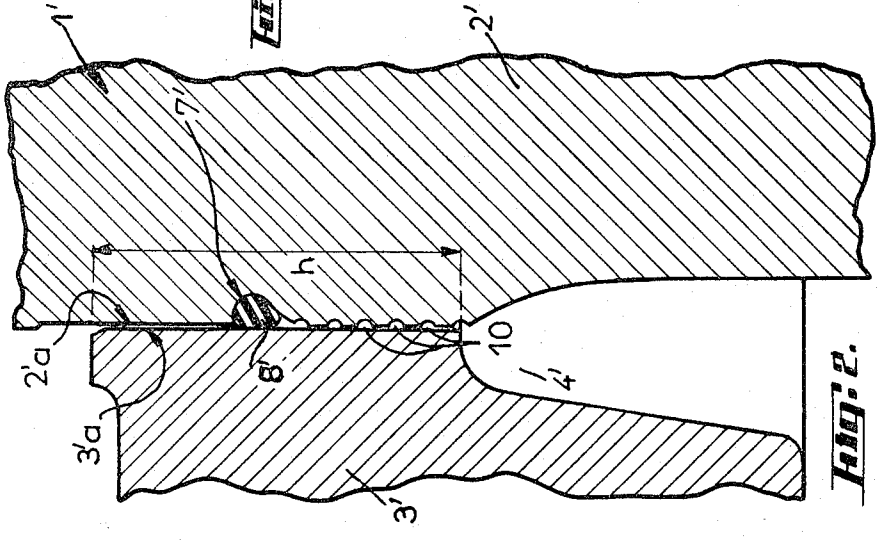


Fig. 2.

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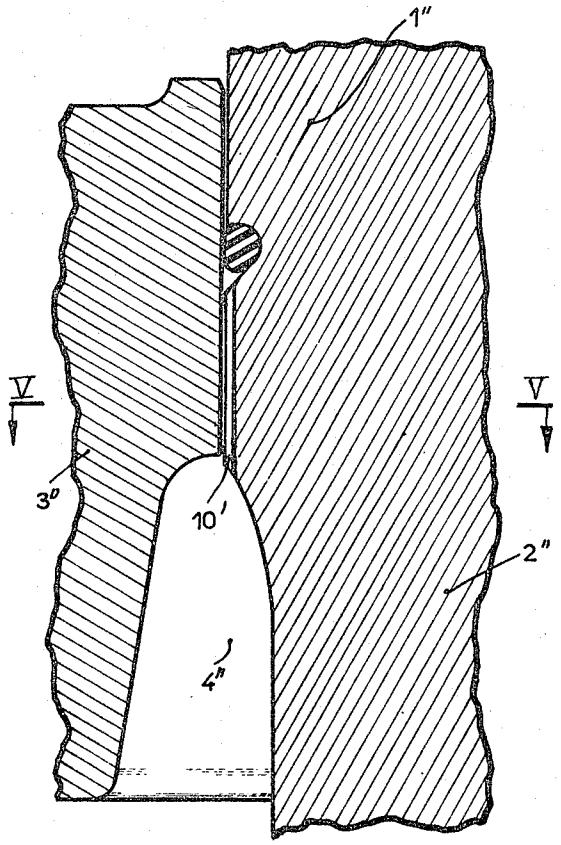


Fig: 4.

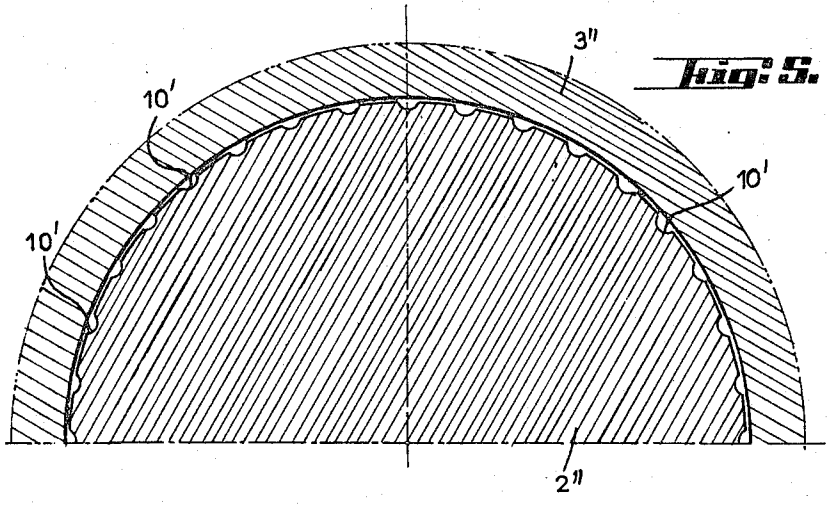


Fig: 5.

United States Patent Office 3,382,858 Patented May 14, 1968

3,382,858

DEVICES FOR MOUNTING CYLINDERS IN RECIPROCATING ENGINES

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Filed Nov. 12, 1965, Ser. No. 507,329
Claims priority, application France, Nov. 17, 1964, 995,230
4 Claims. (Cl. 123—193)

ABSTRACT OF THE DISCLOSURE

A device for preventing a lubricant contained in the crankcase of an engine from being sucked and laminated between the wall of a cylindrical bore in the crankcase and the lower base of a cylinder fitted therein, comprising a ring seal recessed in a groove formed in the lower base of the cylinder and at least one lubricant pressure releasing recess provided on the portion of the cylinder which is comprised between the ring seal and the inner space of the crankcase.

The present invention relates essentially to a device for mounting cylinders in reciprocating engines, notably in combustion engines, this device being intended more particularly for preventing the deterioration of contact surfaces between the cylinder base and the cylinder block or crankcase of the engine in which said base is force-fitted.

It is known that cylinders have their bases mounted in the crankcase or cylinder block of the engine and that this mounting is effected as a rule with relatively close tolerances.

However, unless abnormally high strain is applied to the crankcase or cylinder block, or to the cylinder itself, it is not possible to obtain sufficiently tight mountings, capable of avoiding a slight beat of the cylinder along its base during the engine operation.

This beat is mainly of lateral character and caused by the lateral reciprocating movement of the connecting rod and therefore of the piston within the cylinder when the engine is operating.

Under these conditions, and in spite of all the care taken to avoid this detrimental phenomenon, there appears or develops at each engine revolution cycle, between the cylinder base and the crankcase or cylinder block in which said base is mounted, a certain play or small gap which, immediately thereafter, is eliminated upon reversal of the lateral pressure exerted by the piston on the cylinder liner.

Consequently, during each engine cycle, crankcase oil is sucked up very strongly through said small gap formed between the cylinder base and the surrounding wall of the crankcase or cylinder block of the engine. Immediately thereafter this gap is reclosed and the previously sucked oil is strongly expelled.

The throttling pressure of the oil thus trapped between the cylinder base and the crankcase or cylinder block of the engine may attain considerable values, frequently of the order of several thousand p.s.i. The gas-containing hot oil is decomposed, thus releasing oxidation products

causing rapid and considerable damages to the cylinder bases and also to the crankcase or cylinder block of the engine. Cavitation effects appear which cause metal particles to be torn off the two contacting metal surfaces, these metal particles being sometimes transferred from one metal wall to the other as a consequence of local excess pressure and temperature (micro-welds). Fissures and incipient cracks may thus develop and cause breakages in the cylinder or cylinder block.

It is the essential object of the mounting device of this invention to avoid these inconveniences. This device is remarkable notably in that there is provided at least one free recess between the registering surfaces of the cylinder or cylinder liner and of the crankcase or cylinder block in which said cylinder or liner is fitted.

Under these conditions, it is clear that any oil sucked up from the engine crankcase or sump when slight gaps occur between the cylinder and its lower seat is no longer subjected to the throttling action causing the destruction of this oil by oxidation and similar phenomena, and that the oil sucked up cannot cause any damage either to the cylinder bases or to the crankcase or cylinder blocks in which these bases are fitted. On the other hand, due to the permanent recess, thus provided, the suction exerted on the crankcase or sump oil is less efficient and any likelihood of causing this oil to rise to an appreciable level up the cylinder base is precluded.

According to another feature characterizing this invention, the aforesaid free recess or recesses are formed on the cylinder or its liner, and/or on the crankcase or cylinder block, beneath the registering bearing surfaces respectively of each cylinder base and of the cylinder block or crankcase, said bearing surfaces ensuring the positioning of the engine cylinders. These recesses may be formed as screw-threads whereby the oil can flow back to the crankcase or sump while reliably guiding and holding the cylinder liner in the block.

According to another feature characterizing this invention, a gasket is provided between the aforesaid bearing surfaces and the aforesaid free recess or recesses.

According to this specific form of embodiment, the detrimental effects described hereinabove are eliminated in a simple manner.

According to another feature of this invention and to a modified form of embodiment thereof, the aforesaid free recesses are formed on the surface or surfaces of the registering bearing portions of each cylinder base and of the cylinder block, said bearing portions ensuring the proper positioning of the cylinders.

It is a further feature of this invention that said free recesses consist of grooves or splines.

It is clear that in this specific form of embodiment the above-depicted detrimental effects are also suppressed, and that the surfaces of the registering bearing portions ensuring the positioning of the cylinders may be selected to have particularly large areas.

Other features and advantages of this invention will appear as the following description proceeds with reference to the attached drawing in which various forms of embodiment of the device of this invention are shown diagrammatically by way of example. In the drawing:

FIGURE 1 shows in fragmentary section the base of a cylinder liner mounted in an engine block according to the teachings of this invention;

FIGURE 2 is a view similar to FIGURE 1, but showing a modified mounting also according to the teachings of the invention;

FIGURE 3 shows on a larger scale a detail sectional view of the free recesses formed on the base of the cylinder liner illustrated in FIGURE 2;

FIGURE 4 is a view similar to FIGURE 1 showing a modified form of construction; and

FIGURE 5 is a sectional view taken on line V—V in FIG. 4.

In the specific form of embodiment illustrated in FIGURE 1, a cylinder liner 1 of which one portion of the base is visible at 2 is mounted in a cylinder block 3. At the lower portion of said base 2 and block 3 a free space 4 is provided which communicates with the crankcase and therefore with the oil contained therein or in the engine sump. During the beats imparted to the cylinder liner in the cyclinder block, as explained hereinabove, the crankcase oil is splashed and sucked up in the direction of the arrow *f* as shown in FIGURE 1. The oil is thus splashed and sucked up each time said small gap is formed, that is, during each engine cycle, between the liner 2 and cylinder block 3, and tends to seep between the registering surfaces of the cylinder block and liner, thus causing the detrimental effects described hereinabove.

According to the present invention, this phenomeon is avoided by providing in the lower portion of the registering bearing surfaces 2*a* and 3*a* between the cylinder base and the crankcase or cylinder block a recess 6 obtained in this example by making the outer diameter *d* of the lower portion of the base of cylinder liner 2 slightly less than the outer diameter D of the liner proper which constitutes the cylinder positioning bearing surface 2*a*. The clearance thus provided at 6 may be for example of the order of 0.04". Advantageously, an annular groove 7 is formed in the upper portion of said recess 6, in the wall of the cylinder liner 2, a sealing gasket 8 being fitted in this groove during the assembly operation to prevent any subsequent seeping of oil from the engine crankcase, between the bearing surfaces 2*a* and 3*a* constituting the active bearing surfaces of the assembly.

The reference numeral 9 designates in chain-dotted lines another annular groove similar to groove 7, which may advantageously be formed in the wall of cylinder liner 2, an additional sealing gasket similar to gasket 8 being fitted in this other groove 9 in order further to improve the tightness and safety of the assembly. However, the sealing gasket should desirably be located as low as possible in order to increase the length of the co-acting bearing and holding surfaces overlying this gasket.

In the above-described example, the recess 6 is formed in the outer surface of the cylinder liner. Of course, the operation is exactly the same in the case of a cylinder block without liners, or alternately the recess 6 may be formed in the cylinder block 3 or in the crankcase, the assembly being exactly the same. Similarly, the recess 6 may be formed on both registering surfaces of the cylinder liner and crankcase or cylinder block. However, from the point of view of machining, it is more convenient to form this recess in the wall of liner 2 by slightly reducing the outer diameter D thereof, than slightly increasing the bore diameter of the crankcase or cylinder block at the corresponding level.

In the modified form of embodiment illustrated in FIGURE 2, there is shown as in FIGURE 1 a liner 1′ of a cylinder of which the base 2′ force-fitted in the engine crankcase or cylinder block 3′, is also visible, a recess 4′ communicating with the engine crankcase.

In this example, the recess 6 of FIGURE 1 is replaced with circular grooves or splines 10 shown on a larger scale in FIGURE 3.

In this example it will be seen that the bearing surfaces 2*a*′ and 3*a*′ of the cylinder liner and crankcase or cylinder block, respectively, actually extend throughout the height *h* of the assembly. There is shown respectively at 7′ and 8′ a groove and a gasket similar to the groove 7 and gasket 8 described with reference to FIGURE 1. The grooves or splines 10 may be circular and annular, and disposed substantially in a plane at right angles to the cylinder axis, but it may also have a helical configuration and lie in a plane substantially perpendicular to the cylinder axis. These grooves or splines may also extend in the axial or longitudinal direction, as shown in FIGS. 4 and 5 wherein the grooves 10′ extend parallel to the generatrices of the bore in the crankcase or cylinder block 3″.

These grooves or splines 10 or 10′ may advantageously have a rounded contour with a substantially U-shaped bottom.

Of course, these splines may also be formed on the surface of the crankcase or the cylinder block, a very similar result being thus obtained.

With these grooves or splines, the oil sucked up between the surfaces of the crankcase and cylinder liner cannot attain detrimental throttling pressures, since the oil expands in each groove or spline 10, 10′.

This invention is also concerned, by way of novel industrial products, with the cylinders, cylinder liners, crankcases, cylinder block and engines utilizing the above-described cylinder mounting device.

Of course, this invention should not be construed as being limited by the specific forms of embodiment shown and described herein by way of example, since many modifications and variations may be brought thereto without departing from the scope of the invention as set forth in the appended claims.

What we claim is:

1. In a reciprocating engine having a crankcase and at least one cylinder with a base inserted in said crankcase, said crankcase and said cylinder base having registering opposed cylindrical bearing surfaces, said crankcase defining an inner space for lubricant, a device for preventing lubricant contained in said inner space of the crankcase from being sucked and laminated between said registering surfaces, by transverse oscillations of the cylinder during operation of the engine, said device comprising at least one annular gasket, one of said registering bearing surfaces being provided with an annular groove therein, said gasket being disposed in said annular groove to provide a seal between said surfaces, at least one of the registering surfaces between said groove and said inner space of said crankcase being provided with a cylindrical recess to form an annular space between said registering surfaces extending from said annular groove to said inner space of the crankcase such that the clearance between said registering surfaces between said inner space of the crankcase and said groove is greater than the clearance on the other side of said groove.

2. A device according to claim 1 wherein said annular space is formed by uniform reduction of the outer diameter of said cylinder bearing surface between the inner space of the crankcase and the groove.

3. In a reciprocating engine having a crankcase and at least one cylinder with a base inserted in said crankcase, said crankcase and said cylinder base having registering opposed cylindrical bearing surfaces, said crankcase defining an inner space for lubricant, a device for preventing lubricant contained in said inner space of the crankcase from being sucked and laminated between said registering surfaces, by transverse oscillations of the cylinder during operation of the engine, said device comprising at least one annular gasket, one of said registering bearing surfaces being provided with an annular groove therein, said gasket being disposed in said annular groove to provide a seal between said surfaces, at least one of the registering surfaces between said groove and said inner space of said crankcase being provided with a plurality of circumferentially spaced longitudinal grooves extending parallel to the cylinder axis.

4. In a reciprocating engine having a crankcase and at least one cylinder with a base inserted in said crankcase, said crankcase and said cylinder base having registering opposed cylindrical bearing surfaces, said crankcase defining an inner space for lubricant, a device for preventing lubricant contained in said inner space of the crankcase from being sucked and laminated between said registering surfaces, by transverse oscillations of the cylinder during operation of the engine, said device comprising at least one annular gasket, one of said registering bearing surfaces being provided with an annular groove therein, said gasket being disposed in said annular groove to provide a seal between said surfaces, at least one of the registering surfaces between said groove and said inner space of said crankcase being provided with a plurality of

circular grooves lying in planes at right angles to the cylinder axis and separated by cylindrical bearing surfaces, the groove closest to said crankcase being in direct communication with said inner space.

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WENDELL E. BURNS, *Primary Examiner.*