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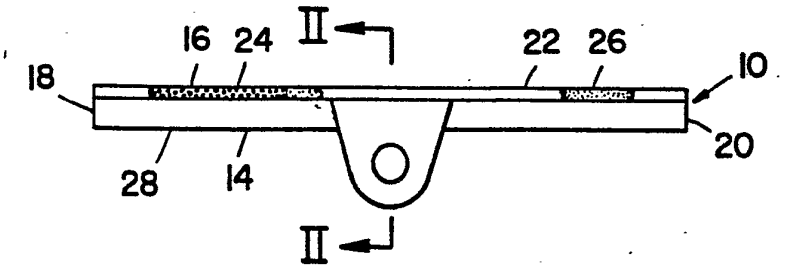
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(54) Title: CYLINDER LINER HONING



(57) Abstract

The honing of the inner cylindrical wall of engine cylinders or cylinder liners. Coarse honing of an inner cylindrical wall of a cylinder or cylinder liner allows more oil to remain in scratches in the wall after the piston rings pass a particular point on the wall than if the wall is fine honed. The more oil that remains in the scratches the more oil there is to burn during the expansion stroke of the piston. It is desirable to provide a relatively coarse finish (24) at one end (18) of an inner cylindrical wall (12) of a cylinder or a cylinder liner (13) and a relatively finer finish (26) towards another end (20) of said inner cylinder wall (12). A honing member (14) is provided for rotation and oscillation in contact with the inner cylinder walls (12). A first section (16) of the honing member has a relatively coarse grit surface (24) and a second section (22) of the honing member (14) has a relativley fine grit surface (26). The above mentioned oscillation and rotation of such a honing member (14) comprises an improved method for honing a cylindrical wall (12).

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Description

Cylinder Liner Honing

Technical Field

The invention relates to the honing of the inner cylindrical wall of engine cylinders or cylinder liners and more particularly to providing a surface on an inner cylinder wall which has graduated roughness, with one end of the inner cylindrical wall being relatively rough and another end thereof being relatively fine and with intermediate sections blending the relatively rough and relatively fine sections into one another.

Background Art

Coarse honing of an inner cylindrical wall of a cylinder or cylinder liner allows more oil to remain in scratches in the wall after the piston rings pass a particular point on the inner cylindrical wall than if the wall is fine honed. At least part of the trapped oil is burned during the expansion stroke of the piston and the more oil that remains in the scratches, the more oil there is to burn. Coarse honing in the upper end of an inner cylindrical wall smoothes break-in of the engine considerably. A combination of coarse and fine honed surfaces on an inner cylindrical wall could be obtained by using two separate honing operations, but there would be a sharp step or change in quality of the honing of the wall at the boundary of the two surfaces. It is possible to chemically produce inner cylindrical walls having a rough surface towards a first end thereof and a relatively fine surface towards a second end thereof. However, in such a situation the boundary between the relatively rough surface and the relatively fine surface tends to be rather abrupt, leading to an undesirable action of the piston as it reciprocates within the inner cylindrical wall.

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Disclosure of Invention

The present invention is directed to overcoming one or more of the problems as set forth above.

According to the present invention, there is provided a hone (or honing tool) for an inner cylindrical wall of a cylinder or cylinder liner for obtaining surfaces of controlled and different finish roughness along the length of the inner cylindrical wall. The honing tool comprises a honing member having a first section extending from a first end thereof towards a second end thereof and a second section extending from said first section to said second end of said member. Said first section comprises a relatively coarse grit surface and said second section comprises a relatively fine grit surface.

In another sense the invention relates to a method of providing a finish comprising a plurality of generally discreet annular sections of varying roughness on an inner cylindrical wall of a cylinder or a cylinder liner. The method comprises contacting a honing member with the inner cylindrical wall with the member being aligned parallel to the axis of the cylindrical wall, the member having a plurality of sections with a first of said sections beginning at a first end of said member and successive of said sections proceeding in order towards a second end of said member, said first section having relatively coarse grit surface and successive of said sections having relatively finer grit surfaces in order towards said second end of said member, said member having a length of less than the length of said inner cylindrical wall, said second end of said member extending axially within a cylindrical cavity formed by said cylindrical wall. The member is moved circularly while in contact with said inner cylindrical wall and simultaneously is oscillated axially relative to said inner cylindrical wall.

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Brief Description of Drawings:

Figure 1 is a side elevation of one embodiment of a hone;

Figure 2 is a sectional view taken along the line II-II of Figure 1;

Figure 3 is a top view of an alternate embodiment of a hone;

Figure 4 is an end view of a hone in contact with an inner cylindrical wall during honing; and

Figure 5 is a sectional view through the inner cylindrical wall illustrating the hone in several positions of oscillation.

Best Mode for Carrying Out the Invention

Figure 1 illustrates a hone 10 for use in honing an inner cylindrical wall 12 (see Figures 4 and 5) of a cylinder or a cylinder liner 13. By use of the particular hone 10 of the present invention, there are obtained finished surfaces of controlled and different roughness along the length of the inner cylindrical wall. The hone 10 comprises a longitudinally extending honing member 14. The member 14 has a first section 16 extending from a first end 18 thereof towards a second end 20 thereof and a second section 22 extending from the first section 16 to the second end 20 of the member 14. The first section 16 comprises a relatively coarse grit surface 24 and the second section 22 comprises a relatively fine grit surface 26. The entire member 14 is generally supported upon a metallic undermember 28. The honing member 14 can be made in any of a number of ways. For example, a separate coarse grit surface 24 and fine grit surface 26 can be formulated and then these can each be glued or otherwise sealed in place to the metallic undermember 28. Alternatively, in a single moulding operation both the coarse grit surface 24 and the fine grit surface 26 can be moulded on to the metallic undermember 28. As yet another alternative a pair of partial metallic undermembers can be formulated; one with the relatively coarse grit

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surface 24 thereon and the other with the relatively fine grit surface 26 thereon and then the two partial metallic undermembers can be fastened together mechanically as by welding, clamping, bolting or the like to form the overall metallic undermember 28.

The first section 16 of the honing member 14 will preferably extend about one-third the length of the overall member 14. Accordingly, the second section 22 will generally extend about the remaining two-thirds of the length of the member 14. It is preferred that the coarse grit surface 24 be selected to provide about a 20 to 30 microinch (0.5 mμ - 0.75 mμ) finish on the inner cylindrical wall 14 and that the fine grit surface 26 be selected to provide about a 5 to 15 microinch (0.125 mμ - 0.375 mμ) finish on the inner cylindrical wall 12. These finishes will provide generally optimal operation for a piston-cylinder arrangement.

In the embodiment shown in Figure 3, the first section 16 and second section 22 meet in an oblique line 30. The second section 22 preferably extends from the second end 20 of the member 14 along a leg 32 a greater distance than the first section 16 extends from the first end 18 of the member 14 along a leg 34. The coarse and fine grit surfaces 24 and 26 are generally selected as with the embodiment of Figures 1 and 2.

In accordance with the method of the present invention there is provided a finish comprising a plurality of generally discreet annular sections of discreet and different roughness on the inner cylindrical wall 12 of a cylinder or a cylinder liner. Basically, a honing member 14 as just described above with respect to the two alternate embodiments of the invention is utilized as a hone. The honing member 14 may, if desired, have more than two sections with successive sections having successively changing coarseness of grit therein from a coarse section at a first end 18 of the honing member 14 to a fine grit section at the second end 20 of the

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member 14. In any event, the aforementioned honing member is contacted with the inner cylindrical wall with the longitudinal extension of the member 14 being parallel to the axis of the cylindrical wall 12. The member 14 is restricted to having a length of less than that of the inner cylindrical wall 12. The second end 20 of the member 14 extends axially within a cylindrical cavity 40 formed by the inner cylindrical wall 12.

The member 14 is moved circularly, either in one direction or back and forth, relative to the axis of the cylinder while being maintained in contact with the cylindrical wall 12. Simultaneously to the circular movement and the contacting, the member 14 is oscillated axially relative to the inner cylindrical wall 12. The member 14 is generally oscillated so that its ends 18 and 20 oscillate to protrude slightly out of the respective corresponding ends 36 and 38 of the cylindrical wall 12 whereby the first end 36 of the inner cylindrical wall 12 is ground primarily by the relatively coarse grit surface 24 and the second end 38 of the inner cylindrical wall 12 is ground primarily by the relatively fine grit surface 26. Because of the combined circular movement and oscillation of the member 14, the inner wall 12 is generally scored with a criss-cross pattern. It will be clear that intermediate the two ends 36 and 38 of the inner cylindrical wall 12, portions of the inner cylindrical wall 12 are alternately contacted with the relatively coarse grit surface 24 and the relatively fine grit surface 26 to provide an overall smooth gradation in roughness along the length of the cylinder wall 12.

It is preferred that the length of the member 14 be only about one-half the length of the inner cylindrical wall 12. It is further preferred with respect to the embodiment of Figures 1 and 2 that the first (coarse) section 16 of the member 14 extends about one-third the

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length of said member 14 and that the second (fine) section 22 of the member 14 extends about the remaining two-thirds of the length of said member 14. In this manner, as the member 14 is oscillated from one end to the other of the cylindrical cavity 40, there is provided a relatively coarse finish on about one-sixth of the inner cylindrical wall (from the first leg 32 thereof to about one-sixth down the length thereof), a progressively relatively finer finish on the next intermediate one-half of said inner cylindrical wall 12 (from about one-sixth of the distance from the first end 32 of the inner cylindrical wall 12 to the second leg 34 of the inner cylindrical wall 12 and about two-thirds of said distance), and a relatively fine finish the final one-third of said inner cylindrical wall. It is further clear that intermediate the first leg 32 of the inner cylindrical wall 12 and the second leg 34 thereof, the coarse and fine finishes formed on the inner cylindrical wall 12 will relatively smoothly blend into one another.

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Claims

1. A hone (10) for an inner cylindrical wall (12) of a cylinder or cylinder liner (13) for obtaining surfaces of controlled and different finish roughness along the length of said wall (12), comprising:

a honing member (14) having a first section (16) extending from a first end (18) thereof towards a second end (20) thereof and a second section (22) extending from said first section (16) to said second end (20) of said member (14), said first section (16) comprising a relatively coarse grit surface (24) and said second section (22) comprising a relatively fine grit surface (26).

2. A hone (10) as in claim 1, wherein said first section (16) extends about 1/3 the length of said member and said second section (22) extends about the remaining 2/3 the length of said member.

3. A hone (10) as in claim 1, wherein said coarse grit surface (24) is selected to provide about a 20 to 30 microinch (0.5 mμ to 0.75 mμ) finish and said fine grit surface (26) is selected to provide about a 5 to 15 microinch (0.125 mμ to 0.375 mμ) finish.

4. A hone (10) as in claim 1, wherein said first and second sections (18,20) meet in an oblique line (30).

5. A hone (10) as in claim 4, wherein said second section (22) extends from said second end (20) of said member (14) a greater distance than said first section (16) extends from said first end (18) of said member (14).

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6. A method of providing a finish of graded smoothly varying roughness from one end to another of an inner cylindrical wall (12) of a cylinder or a cylinder liner (13), comprising:

contacting a honing member (14) having a longitudinal extension parallel to the axis of said cylindrical wall (12) with said cylindrical wall (12), said member having a plurality of sections (16,22) with a first (16) of said sections beginning at a first end (18) of said member (14) and successive of said sections proceeding in order towards a second end (20) of said member (14), said first section (16) having a relatively coarse grit surface (24) and successive of said sections having relatively finer grit surfaces (26) in order towards said second end (20) of said member (14), said member (14) having a length of less than said cylindrical wall (12), said second end (20) of said member (14) extending axially within a cylindrical cavity (40) formed by said cylindrical wall (12);

moving said member (14) circularly relative to said cylindrical axis while maintaining said contacting with said cylinder wall (12); and

simultaneously with said circular moving and contacting, oscillating said member (14) axially relative to said cylindrical wall (12).

7. A method as in claim 6, wherein said first section (16) extends about 1/3 the length of said member, said second section (22) extends about the remaining 2/3 the length of said member (14) and said oscillating comprises oscillating said member (14) from one end to the other of said cylindrical cavity (40) to provide a relatively coarse finish on about 1/6 of said cylindrical wall (12), a progressively relatively finer finish on an intermediate about 1/2 of said cylinder wall (12), and a relatively fine finish on the remainder of said

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cylinder wall (12) with said coarse and fine finishes blending into one another via said intermediate about 1/2 of said cylinder wall (12).

8. A method as in claim 7 including selecting said coarse grit surface (24) to provide about a 20 to 30 microinch (0.5 mμ to 0.75 mμ) finish and said fine grit surface (26) to provide about a 5 to 15 microinch (0.125 mμ to 0.375 mμ) finish.

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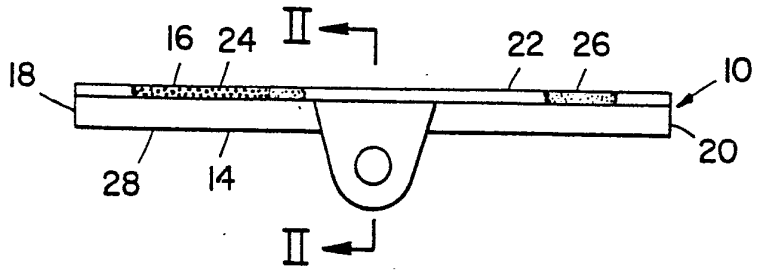


FIG_1

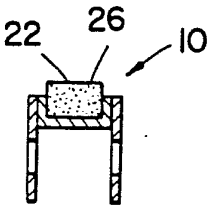


FIG_2

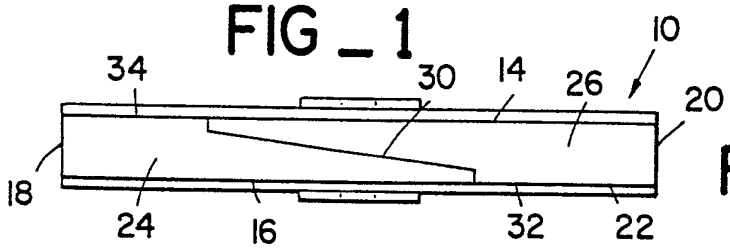


FIG_3

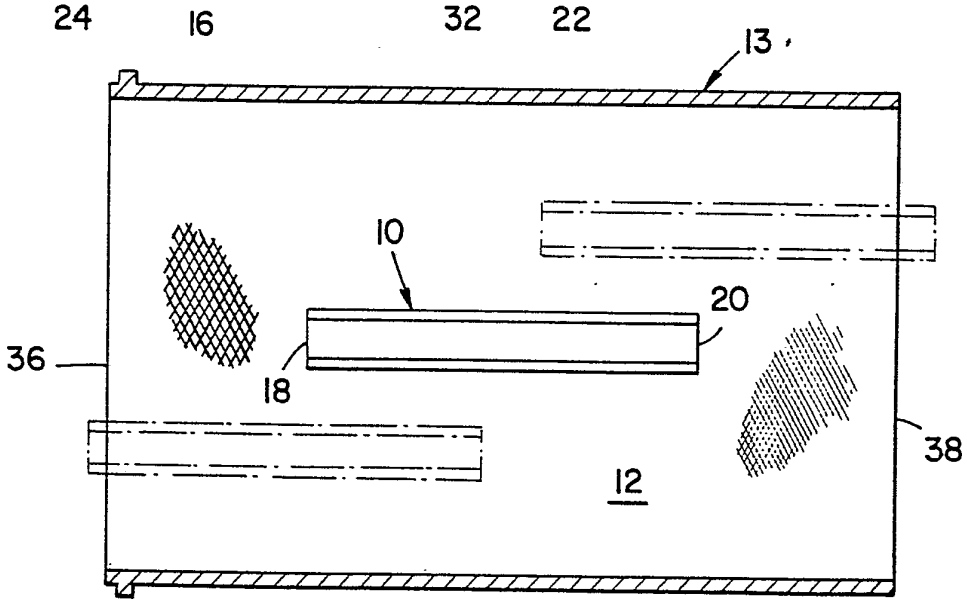


FIG_5

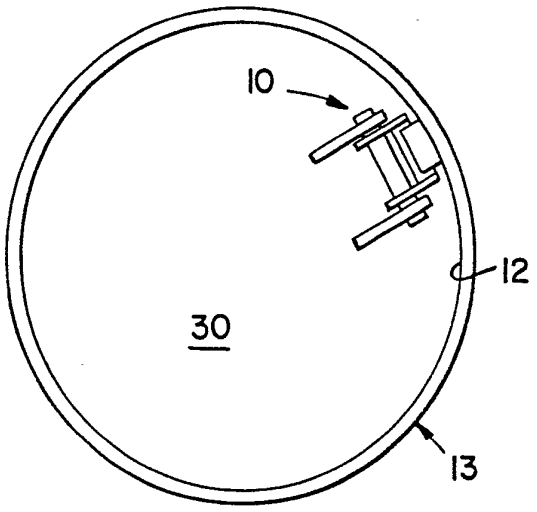


FIG_4

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INTERNATIONAL SEARCH REPORT

International Application No PCT/US79/00010

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL. B24B 33/02
U.S. CL. 51/326, 51/330

WO 79/00649

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	51/34R, 181R, 204, 206R, 206.4, 290, 326, 327, 328, 330, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	U.S., A, 1,715,255, PUBLISHED 28 MAY 1929, STRAND ET AL.	1-8
X	U.S., A, 2,404,192, PUBLISHED 16 JULY 1946, RIES ET AL.	1-8
X	G.B., A, 596,318, PUBLISHED 01 JANUARY 1948, MICROMATIC HONE CORPORATION	1-8
A	U.S., A, 1,864,616, PUBLISHED 28 JUNE 1932, RAYNER	1-5
A	U.S., A, 2,496,352, PUBLISHED 07 FEBRUARY 1950, METZGER ET AL.	1-5
A	U.S., A, 3,537,216, PUBLISHED 03 NOVEMBER 1970, BORGH	1-5

* Special categories of cited documents: [15]

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"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
01 MARCH 1979	04 APR 1979
International Searching Authority [1]	Signature of Authorized Officer [20]
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