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Parry

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[54] APPARATUS FOR PROVIDING OIL GROOVES IN VALVE GUIDES

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[58] Field of Search..... 408/158, 79, 80, 81; 82/DIG. 3, 1.2, 1.4; 90/12.5

[56]

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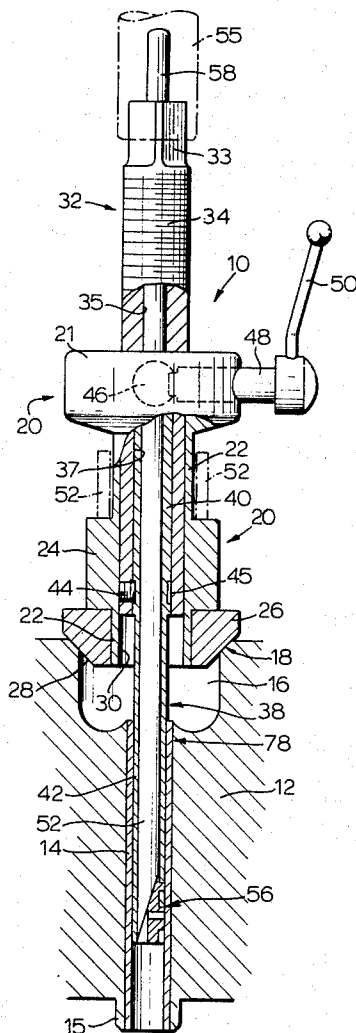
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ABSTRACT

An apparatus for cutting an oil groove into a valve guide in a cylinder head. The apparatus includes bracing means for supporting the head with the combustion chambers either up or down, a feed body rigidly held against the cylinder head, and a rotary oil-grooving tool which is screw-fed down through a split-nut in the feed body and which has a tubular boring member with a tool bit which enters the guide and inscribes a helical oil groove on its interior wall.

8 Claims, 7 Drawing Figures



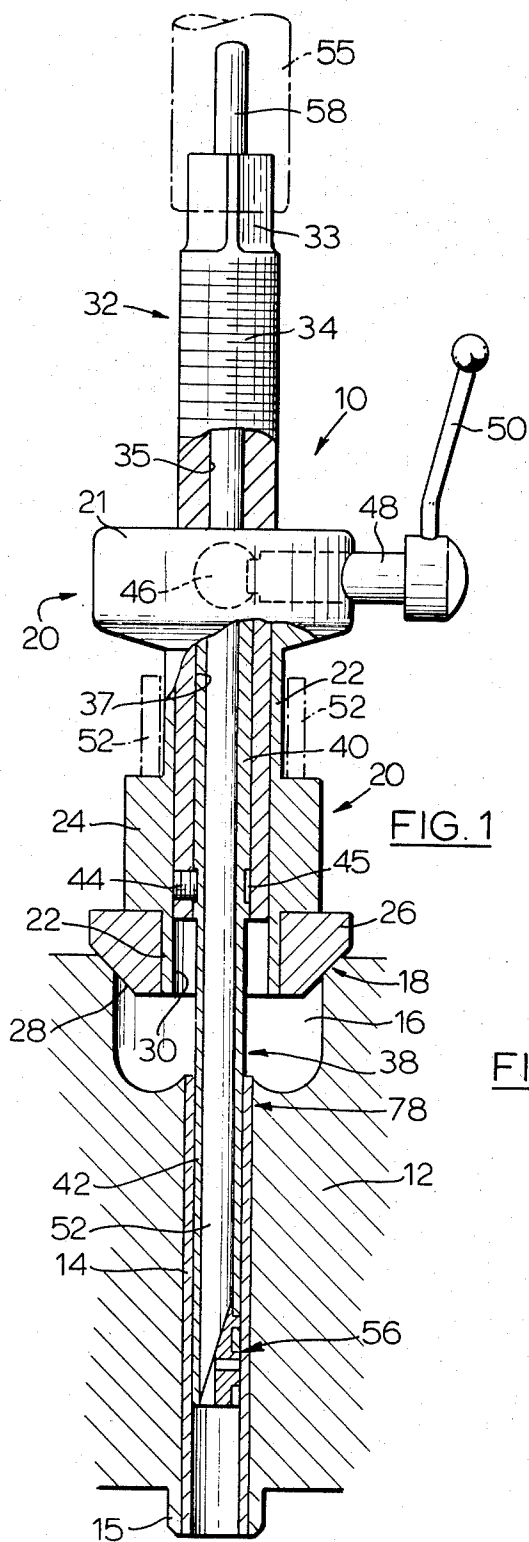


FIG. 1

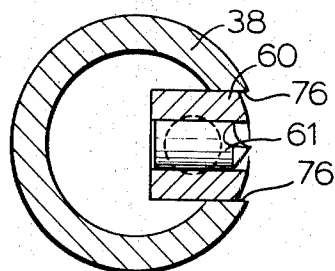


FIG. 3

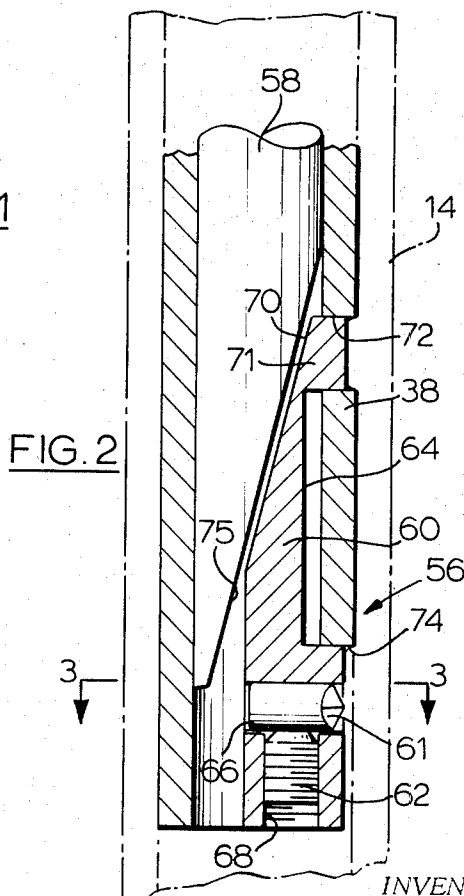
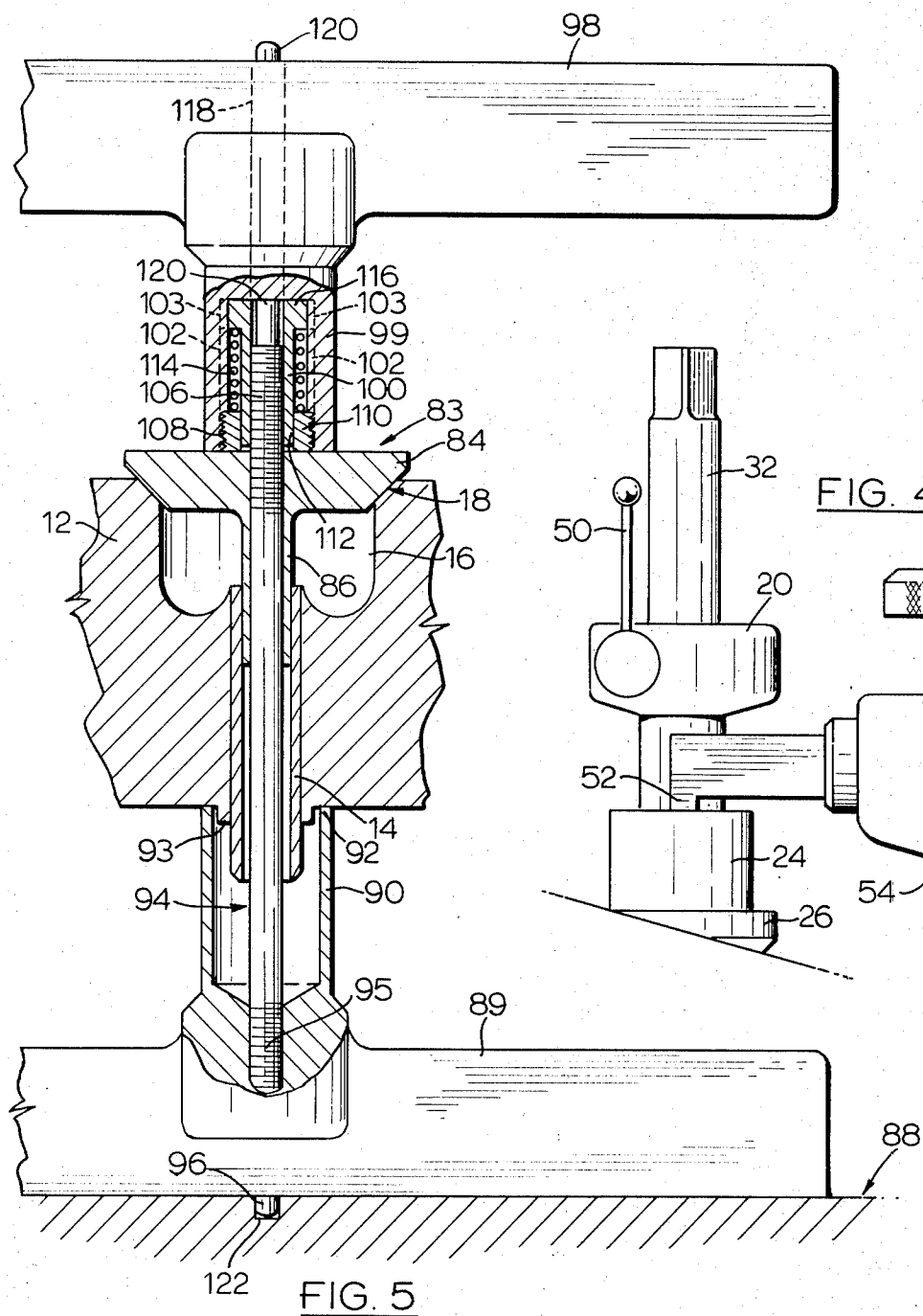


FIG. 2

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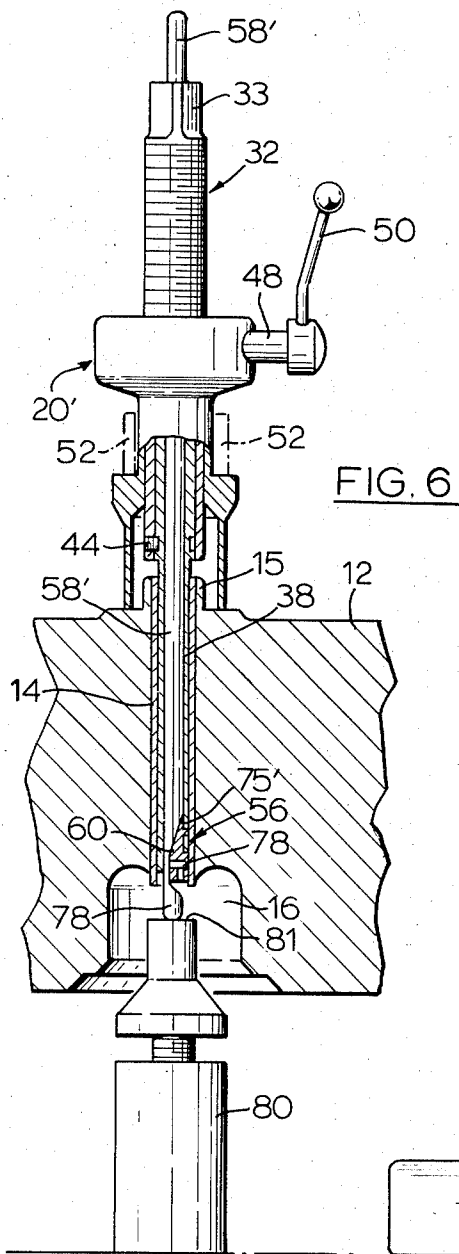
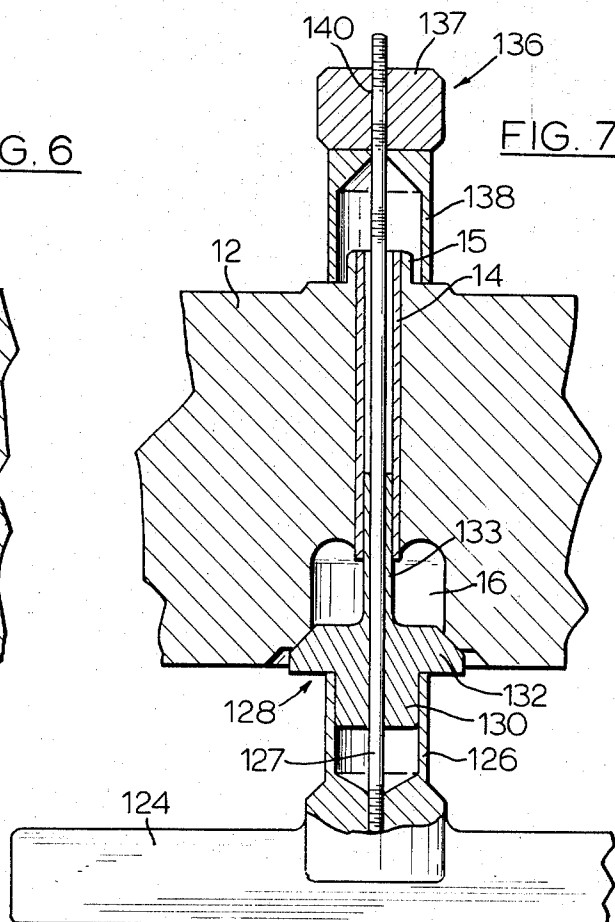
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APPARATUS FOR PROVIDING OIL GROOVES IN VALVE GUIDES

This invention relates to apparatus which can be utilized in the reconditioning of internal combustion engines, and more particularly, to apparatus for cutting a helical oil groove into the internal surface of a valve guide previously installed in the cylinder head of an internal combustion engine.

BACKGROUND OF THE INVENTION

In recent years, internal combustion engines for automobiles have commonly employed overhead intake and exhaust valves for the combustion cylinders. The valve seats are located in the cylinder head, and the valve stems extend through valve guides in the cylinder head to contact the actuating linkage for the valve. The movement of the valve and the valve stem during engine operation results in wear of the valve guide and of the valve seat in the cylinder head.

The valve guides themselves are usually provided in one of two ways. The first is to install a valve guide insert, which is simply a hollow steel cylinder, in a suitably dimensioned bore in the head. The other way is simply to machine a valve guide opening for a valve stem directly in the cylinder head casting. Some engine manufacturers have resorted to this latter method in recent years to reduce production costs.

Regardless of the method used to provide the valve guide passage, it has always been necessary to provide lubrication between the valve stem and valve guide in order to reduce frictional wear. On older, lower compression engines, the valve rocker assembly was flooded with oil, which gradually found its way along the valve stem between the latter and the valve guide. However, as the geometry of engines changed, and the compression ratios increased, oil consumption through valve guides began to constitute a major problem to the auto manufacturers. To get around this problem, many devices were employed on valve guides to curb the oil-leak problem, such as oil seals, umbrella-type seals, and metering systems which cut the volume of oil to the valve mechanism down to a minute amount. This reduction in the amount of available oil caused the guides to scuff and wear excessively at low mileage, due to the close tolerances between the valve stem and the valve guide. The wear in the valve guide allowed the oil to be sucked down rapidly with a sudden reoccurrence of oil consumption. Should an engine be operated too long in this state, the valves can flop sideways and drop off-center on their seats, causing a bending action in the valve stem, which in turn can cause the head of the valve to drop off and damage the piston.

In order to avoid these problems, many manufacturers have now adopted the measure of providing a spiral oil groove on the inner surface of the valve guides of the engines as manufactured. Ordinarily, the oil groove does not extend all the way to the end of the valve guide which opens into the combustion chamber. This spiral oil groove usually has a very small depth, of the order of .005 inches.

When an automobile engine breaks down in one of its major parts, the owner often decides to replace it with a rebuilt or reconditioned engine, owing to the high cost of a new engine and to the inordinate length of time which would be required to repair the broken-

down engine. Thus, a considerable industry has developed involving the reconditioning or rebuilding of worn-out or broken-down engines. In my U.S. Pat. No. 3,333,487, issued Aug. 1, 1967 and entitled "Valve Guide Reboring Device," there is disclosed an apparatus for positioning a cylinder head above the table of a drill press so that worn or corroded valve guides can be re-bored to receive a new cylindrical liner or valve guide insert. Because such valve guide inserts usually have a smooth internal surface which lacks a helical oil groove, it is desirable to provide a means for inscribing a helical oil groove in the valve guide insert after it has been installed in the cylinder head and while the cylinder head is supported on the drill press table.

OBJECTS OF THIS INVENTION

Accordingly, it is an object of this invention to provide an apparatus for supporting a cylinder head above a working table while at the same time scoring a helical oil groove upon the interior surface of an installed valve guide insert or an integral valve guide in the head.

GENERAL DESCRIPTION OF THE INVENTION

In order to attain the foregoing objects, this invention provides an oil grooving apparatus for cutting an oil groove into the interior wall of a valve guide in the head of an engine which includes a valve seat concentric with the valve guide, the apparatus comprising support means for supporting the head, an oil-grooving tool including a tubular boring member dimensioned to fit snugly but slidably within the valve guide, and a coaxial cylindrical feed screw which is fixed with respect to the tubular boring member and which is exteriorly threaded. The apparatus further includes a feed body adapted to be positioned firmly against the head and having a split nut means selectively engageable with the feed screw, whereby rotation of the oil-grooving tool when engaged with the split nut causes the oil-grooving tool to advance with respect to the feed body. A tool holder is provided in the tubular boring member, and is mounted for radial movement therewithin while being restrained against longitudinal and rotational movement with respect to the tubular boring member. A tool bit is mounted in the tool holder, and an actuating rod is mounted within the oil-grooving tool to be longitudinally movable therewithin. The actuating rod has a cam contact with the tool holder, whereby movement of the actuating rod toward the tool holder pushes the tool holder radially outwardly and thus causes the tool bit to engage the interior wall of the valve guide. Movement of the actuating rod away from the tool holder permits the tool holder and the tool bit to withdraw radially inwardly. The apparatus also includes means for rotating the oil-grooving tool.

The invention also provides support means for supporting from a horizontal table, in either of two positions 180° apart rotationally, a block such as a cylinder head having an open-ended bore therethrough such as a valve guide, the support means comprising a first cross-rail adapted to rest against the table and having an intermediate portion against which the block can bear, a rod perpendicular to the first cross-rail and having one end anchored to the intermediate portion and the other end threaded, a second cross-rail also adapted to rest against said table and having an inter-

mediate part against which the block can bear, a cylindrical member keyed into the second cross-rail within the intermediate part for axial sliding movement in a direction perpendicular to the second cross-rail, but restrained from rotation with respect to the second cross-rail about an axis parallel to said perpendicular direction, the cylindrical member having an axial, threaded bore with an open end adapted threadedly to receive the threaded other end of the rod, and a compression spring member having one end bearing against a ledge portion fixed with respect to the second cross-rail and having its other end urging the cylindrical member in the direction away from said open end of the threaded bore.

GENERAL DESCRIPTION OF THE DRAWINGS

Two embodiments of this invention are shown in the accompanying drawings, in which like numerals denote like parts throughout the several views, and in which:

FIG. 1 is a part-section, part-elevation of an oil-grooving tool constructed in accordance with the first embodiment of this invention;

FIG. 2 is an enlarged longitudinal sectional view of a portion of FIG. 1;

FIG. 3 is a transverse sectional view taken at the line 3—3 in FIG. 2;

FIG. 4 is an elevational view of a portion of the mechanism shown in FIG. 1, taken from an angle 90° displaced from the angle of FIG. 1;

FIG. 5 is a longitudinal sectional view of the supporting apparatus of the first embodiment of this invention, adapted to support a cylinder head above a drill press table;

FIG. 6 is a part-section, part-elevation of an oil-grooving tool constructed in accordance with the second embodiment of this invention; and

FIG. 7 is a longitudinal sectional view of supporting apparatus forming part of the second embodiment of this invention.

DETAILED DESCRIPTION OF THE DRAWINGS

In FIG. 1, an oil-grooving apparatus shown generally at 10 is in operative relation with a cylinder head 12 which is partly broken-away. Installed within the cylinder head 12 is a valve guide insert 14 which extends from a spring seat 15 to a combustion chamber 16. The combustion chamber 16 opens upwardly to define a frusto-conical valve seat 18.

The oil-grooving apparatus of this invention includes a feed body 20 which includes an upper portion 21 and a tubular portion 22. The tubular portion has a cylindrical enlargement 24 at an intermediate location. A beveled annular member 26 is adapted to snugly embrace the lower end of the tubular portion 22 and to abut the cylindrical enlargement 24 thereof as shown in FIG. 1. The beveled annular member 26 has a frusto-conical surface 28 which is adapted to mate with the frusto-conical valve seat 18.

The feed body 20 has an internal bore 30 open at both ends. A cylindrical feed screw 32 has a square-faceted upper end 33, external screw threads 34, a small inner bore 35, and a large inner bore 37. A tubular boring member 38 has an upper portion 40 adapted to fit snugly but slidably inside the large inner bore 37 of the cylindrical feed screw 32, and has a lower por-

tion 42 adapted to fit snugly but slidably within the valve guide insert 14 in the cylinder head 12. A set screw 44 threaded radially into the cylindrical feed screw 32 as shown registers in an annular gallery 45 and secures the cylindrical feed screw 32 and the tubular boring member 38 together.

In the upper portion 21 of the feed body 20 is a conventional split nut 46 having internal threads which match the external screw threads 34 of the cylindrical feed screw 32. The split nut 46 is selectively engageable with the feed screw 32, its engagement therewith being controlled by a rotatable shaft 48 having a manual lever 50 adapted for rotation between a first position in which the split nut 46 engages the screw threads 34 of the feed screw 32, and a second position in which the split nut 46 is withdrawn from engagement with the feed screw 32.

Shown in broken lines are two prongs 52 of a hold-down fork assembly 54 shown in side view in FIG. 4.

Also shown in dotted lines in FIG. 1 is a rotatable chuck 55 of a drill press (not shown). The rotatable chuck 55 is adapted to mate with the square-faceted upper end 33 of the cylindrical feed screw 32 and rotate the same when the split nut 46 grips the external screw-threads 34 of the cylindrical feed screw 32. Naturally, the cylindrical feed screw 32 could also be rotated manually, or by any other mechanical means.

At the lower end of the tubular boring member 38 is a scoring assembly 56 which is shown to a larger scale in FIG. 2, to which attention is now directed.

FIG. 2 shows the valve guide insert 14 in broken lines, the lower end of an actuating rod 58 as a solid surface (also visible in FIG. 1), and the remaining structure as a cross-hatched section. The scoring assembly 56 includes a tool holder 60, a tool bit 61 and a set screw 62. The tool holder 60 has a cylindrically curved surface 64 complementary to the internal cylindrical surface 65 of the tubular boring member 38, a transverse bore 66 for receiving the elongated tool bit 61, an internally-threaded bore 68 for receiving the set screw 62, and a plane cam surface 70 which is sloped at substantially 15° to the axis of the tubular boring member and is exhibited toward the feed screw 32, i.e. faces upwardly as seen in FIGS. 1 and 2. The tool holder 60 also has a cylindrical registration pin 71 which registers slidably in a cylindrical aperture 72 in the wall of the tubular boring member 38. As seen in FIG. 2, the lower end of the tubular boring member 38 is cut away at 74 to allow the lower end of the tool holder 60 to move radially outwardly against the valve guide insert 14 so that the tool bit 61 can bite into the interior surface.

The actuating rod 58 is sized so that it is frictionally gripped by the small inner bore 35 of the cylindrical feed screw 32, and thus can frictionally maintain itself in a given position until moved longitudinally by the exertion of a greater force, either manually or mechanically. At its lower end, the actuating rod 58 has a cam surface 75 which is complementary to the cam surface 70 of the tool holder 60. The two cam surfaces 70 and 75 are adapted to slide in surface contact with each other, whereby the tool holder 60 can be moved radially outwardly with respect to the tubular boring member 38 as a result of downward longitudinal movement of the actuating rod 58. Conversely, retraction

upwardly of the actuating rod 58 permits the tool holder 60, and thus the tool bit 61 to be withdrawn radially inwardly with respect to the tubular boring member 38.

In FIG. 2, the tool holder 60 is shown in a withdrawn position, with the tool bit 61 out of engagement with the valve guide insert 14.

In FIG. 3 it can be seen that the lower portion of the tool holder 60 is constrained between two parallel upright walls 76 cut into the lower end of the tubular boring member 38.

In operation, the beveled annular member 26 is first fitted onto the feed body 20 and these are placed in position against a frusto-conical valve seat 18. The prongs 52 of the hold-down fork assembly 54 are then employed to firmly maintain the feed body 20 in the position shown in FIG. 1. Then, the tubular boring member 38 and the cylindrical feed screw 32 are fastened together by means of the set screw 44, the scoring assembly 56 is assembled as shown in FIG. 2, and the actuating rod 58 is inserted down through the small inner bore 35 to a point where it is just out of contact with the tool holder 60 as shown in FIG. 2. In this condition, the tool bit 61 does not extend outwardly of the cylindrical outer surface of the tubular boring member 38. In this condition, the cylindrical feed screw 32 with the attached tubular boring member 38 are inserted down through the split nut 46 (which is in the open condition) to the point where the tool bit 61 is located within the valve guide insert 14 at about the location shown by the arrow 78. It will be noted that this latter position shown by the arrow 78 is just below the upper end of the valve guide insert 14. The split nut is then closed by using the manual lever 50, the actuating rod 58 is tapped downwardly into contact with the tool holder 60 to push the latter radially outwardly and bring the tool bit 61 into biting contact with the inner cylindrical surface of the valve guide insert 14, the rotatable chuck 55 (or other suitable means) is brought down over the square-faceted upper end 33 of the cylindrical feed screw 32 and is rotated to screw the feed screw 32 downwardly through the split nut 46, thereby causing the tool bit 61 to cut a helical groove into the interior surface of the valve guide insert 14, the helical groove beginning at about the location marked by the arrow 78 and spiralling downwardly to the very bottom of the valve guide insert 14. It is preferable that the oil groove which is cut by the tool bit 61 in this fashion terminate short of the combustion chamber 16, in order to prevent substantial oil loss into the combustion chamber 16.

Attention is now directed to FIG. 6, in which the second embodiment of this invention is shown. In FIG. 6, the cylinder head 12 is shown inverted, with the combustion chamber 16 downwardly. Elements in FIG. 6 which are unchanged from the first embodiment shown in FIG. 1 have the same numerals, whereas elements which are modified have either new numerals or primed numerals. The cylindrical feed screw 32 remains unchanged, as does the tubular boring member 38. However, the feed body 20' shown in FIG. 6 has its lower portion adapted to fit around the spring seat 15 and rest firmly against the cylinder head 12. The prongs 52 of the hold-down fork assembly 54 are unchanged. However, the actuating rod 58' shown in FIG. 6 has its

lower end modified for a purpose presently to be explained. The scoring assembly 56 remains unchanged, and its sloping cam surface contact with the actuating rod 58' is also the same as that shown in FIG. 2. The actuating rod 58' itself, however, has an extended portion 78 which reaches down below the scoring assembly 56. As can be seen in FIG. 6, the actuating rod 58' is, in a sense, cut away to receive the scoring assembly 56. The reason for the extension 78 will now be explained.

It will be recalled that it is important to have the oil groove terminate short of the combustion chamber 16. In order to accomplish this with the second embodiment shown in FIG. 6, an adjustable stop 80 is provided, and has a flat surface 81 against which the extended portion 78 of the actuating rod 58' can come in contact. The cutting of the oil groove within the valve guide insert 14 begins at the top end of the valve guide insert 14 as seen in FIG. 6 and continues downwardly until the extended portion 78 comes in contact with the flat surface 81 of the adjustable stop 80. This contact effectively prevents the actuating rod 58 from further descent, and as the cylindrical feed screw 32 continues to feed downwardly while rotating, it carries the tool holder 60 downwardly away from the actuating rod 58' and permits the tool holder 60 to withdraw radially inwardly of the tubular boring member 38.

The operation of the second embodiment is as follows. The feed body 20' is positioned against the cylinder head 12 as shown in FIG. 6, and the prongs 52 of the hold-down fork assembly 54 are brought into operative position against the feed body 20' to maintain it firmly in place against the cylinder head 12. The cylindrical feed screw 32 and the tubular boring member 38 are connected together by means of the set screw 44, and the actuating rod 58' is inserted therethrough so that the entire lower portion thereof, including its cam surface 75', is clear of the lower end of the tubular boring member 38. Then, the tool holder 60, with the tool bit 61 installed, is held within the "cut-away" at the lower end of the actuating rod 58' (so that no part of the scoring assembly 56 projects beyond the hypothetical continued cylindrical surface of the actuating rod 58'). In this "collapsed" condition, the actuating rod and the scoring assembly are drawn upwardly with respect to the tubular boring member 38 as viewed in FIG. 6 until the tool holder 60 is in a position where the cylinder registration pin 71 is opposite the cylindrical aperture 72 in the tubular boring member 38. This registration is then effected, although the actuating rod 58' is pulled upwardly so that the tool bit 61 does not project beyond the hypothetical extended cylindrical outer surface of the tubular boring member 38. Then, the combined feed screw and tubular boring member 38, with the inserted actuating rod 58' and scoring assembly 56 is inserted through the split nut within the feed body 25 (with the split nut in the open condition), to the point where the tool bit 61 is just above the upper end of the valve guide insert 38. The split nut is then closed to engage the exterior threads of the cylindrical feed screw 32, the actuating rod 58' is tapped downwardly to its lowermost position, thereby forcing the tool holder 60 radially outwardly. Then, a rotatable chuck, or other suitable rotating means, is brought into engagement with the square-faceted upper end 33 of the cylindrical feed screw 32, and the

latter is rotated and screwed downwardly through the split nut within the feed body 20'. As soon as this rotation has begun, the tool bit 61, originally positioned just above the upper end of the valve guide insert 14, begins to cut into the interior surface of the upper end of the valve guide insert 14 and continues to cut a spiral oil groove downwardly along the insert. When the tool bit 61 reaches the position shown in FIG. 6, the extended portion 78 of the actuating rod 58' contacts the adjustable stop 80, thereby effectively moving the actuating rod 58' upwardly with respect to the tubular boring member 38 as viewed in FIG. 6. This upward movement of the actuating rod 58' permits the tool holder 60 and the tool bit 61 to withdraw radially inwardly of the tubular boring member 38, and thus terminate the spiral oil groove. Thus it is assured that the spiral oil groove will not continue all the way to the lower end of the valve guide insert 14 and into the combustion chamber 16.

In both the first and second embodiments shown in FIGS. 1 and 6, the apparatus can be removed from the cylinder head 12 by first assuring that the actuating rod 58, 58' is adjusted upwardly to permit the tool holder 60 and the tool bit 61 to withdraw radially inwardly of the tubular boring member 38, and then opening the split nut 46 by means of the manual lever 50, so that the combined cylindrical feed screw 32 and tubular boring member 38 can simply be manually withdrawn from the valve guide insert 14.

Attention is now directed to FIGS. 5 and 7 which illustrate additional apparatus which is adapted to hold and support a cylinder head 12 in either the upright or inverted position, i.e., with the combustion chamber 16 either up or down as shown respectively in FIGS. 1 and 6.

FIG. 5 shows a double-brace arrangement which is adapted to support the cylinder head 12 either upright or inverted, while FIG. 7 shows a single-brace arrangement adapted to support the cylinder head only in the inverted position.

Turning first to FIG. 5, a cylinder head 12 is shown with the combustion chamber 16 upwardly and with an installed valve guide insert 14 coaxially arranged with respect to the valve seat 18 which is cut into the cylinder head 12. A head stand adapter 83 can be seen to consist of a centrally-bored, beveled disc 84 having a tubular extension 86 adapted to fit snugly but slidably within the valve guide insert 14. A drill press table is shown at 88, and a first cross-rail 89 rests against the drill press table 88. The first cross-rail 89 has a hollow cylindrical portion 90 having an open upper end 92 adapted to rest against and support the cylinder head 12 at a location encircling the spring seat 93. As can be seen, the hollow cylindrical portion 90 has its axis perpendicular to the main direction of the first cross-rail 89. A rod 94 has its one end 95 anchored into the first cross-rail 89 and has a terminal portion 96 which extends beyond the lower edge of the first cross-rail 89. As shown, the rod 94 is threadably engaged with the first cross-rail 89, although the rod 94 could be fixed to the first cross-rail 89 by other conventional means. The rod 94 is coaxial with the hollow cylindrical portion 90 and thus extends perpendicularly away from the first cross-rail 89. The rod 94 passes through the valve guide insert 14 and passes snugly through the tubular extension

sion 86 of the head stand adapter 83 to project upwardly above the cylinder head 12.

A second cross-rail 98 substantially identical with the first cross-rail 89 has an integral cylindrical extension 99 within which an internally-threaded cylindrical member 100 is keyed to slide longitudinally, i.e., perpendicularly to the second cross-rail 98. The integral cylindrical extension 99 of the second cross-rail 98 has internal splines 102 and the internally-threaded cylindrical member 100 has projections 103 which are adapted to slide longitudinally in the internal splines 102. The internal threads of the cylindrical member 100 are sized to threadably receive the upper threaded end 106 of the rod 94.

The integral cylindrical extension 99 has an internal thread 108 at its end remote from the second cross-rail 98, and this internal thread is adapted to receive an annular insert 110 having an internal bore 118 adapted snugly to receive the cylindrical member 100. A helical compression spring 114 bears with its one end against the annular insert 112 and with its other end against an upper expanded portion 116 of the cylindrical member 100. Thus, the helical compression spring 114 tends to bias the cylindrical member 100 upwardly toward the second cross-rail 98 and away from the first cross-rail 89. Because of the internal splines 102 and the cooperating portion of the internally-threaded cylindrical member 100, the latter is restrained against rotation with respect to the second cross-rail 98, but is permitted to slide longitudinally of the cylindrical extension 99. The second cross-rail 98 has an internal bore 118 through which the upper end of the rod 94 can pass.

To assemble the double-brace apparatus shown in FIG. 5, the head stand adapter 83 is first positioned as shown, and then the first cross-rail 89 with the rod 94 attached thereto is inserted from below so that the rod 94 passes upwardly through the head stand adapter 83 and projects upwardly therefrom. Then, the second cross-rail 98 is positioned so that the reduced upper end 120 of the rod 94 can pass upwardly through the internal bore 118, and the second cross-rail 98 is brought down until the threads of the rod 94 engage with threads of the cylindrical member 100. The second cross-rail 98 is then rotated and thus screwed onto the threads of the rod 94 until the integral cylindrical extension 99 contacts the head stand adapter 83. It will be noted in FIG. 5, which shows the position at the first contact between the cylindrical extension 99 and the head stand adapter 83, that the cylindrical member 100 has its lower end spaced slightly from the head stand adapter 83. In other words, when the cylindrical member 100 is in its uppermost position there is a slight clearance between its bottom end and the bottom end of the cylindrical extension 99.

If, after screwing the second cross-rail 98 downwardly until the cylindrical extension 99 contacts the head stand adapter 83, the second cross-rail 98 is not aligned with the first cross-rail 89, it is simply turned further until alignment takes place, and during this additional turning the internally-threaded cylindrical member 100 will gradually move downwardly with respect to the second cross-rail 98 compressing the helical spring 114.

The drill press table 88 preferably has a rectangular groove 122 in which the terminal portion 96 of the rod 94 can register, for the purpose of aligning one of the other valve guide inserts 14 in the cylinder head 12 with the chuck of a drill press in order that the apparatus shown in FIGS. 1 and 6 can be utilized.

It will also be noted that the upper tip of the rod 94 extends above the second cross-rail 98, such that when the cylinder head 12 is inverted and rests on the second cross-rail 98, the tip of the rod 94 can likewise register in the groove 122.

Attention is now directed to FIG. 7, which shows a variation of the apparatus of FIG. 5, specifically adapted to support a cylinder head 12 when the latter is in its inverted position with the combustion chamber 16 downward. In FIG. 7, a cross-rail 124 has an integral hollow cylindrical portion 126, and a rod 127 is anchored to the cross-rail 124 coaxially with the cylindrical portion 126. Both the rod 127 and the cylindrical portion 126 are arranged perpendicularly to the main axis of the cross-rail 124. A head stand adapter 128 has a cylindrical boss 130, a conically beveled portion 132, and a tubular extension 133. As in the embodiment shown in FIG. 5, the tubular extension 133 is adapted to be inserted snugly but slidably within a valve guide insert 14 in the cylinder head 12. The rod 127 passes upwardly through the head stand adapter 128 and continues on through the valve guide insert 114 to project above the cylinder head 12. A thimble nut 136 having a knurled portion 137, a cylindrical extension 138 adapted to fit around the spring seat 15 and a central threaded bore 140, is screwed onto the exteriorly-threaded upper end of the rod 127 as shown, until the cylindrical extension 138 comes down firmly against the cylinder head 12.

Naturally, in the case of the apparatus shown in both FIGS. 5 and 7, a cylinder head would be supported on at least two such support mechanisms, preferably arranged in the most widely separated valve guides of the cylinder head. The modus operandi when working on a complete cylinder head is to use two of the valve guides to support the cylinder head above the drill press table with apparatus as shown in either FIG. 5 or FIG. 7, and then utilize apparatus as shown in either FIG. 1 or FIG. 6 to provide a helical oil groove on the interior surfaces of the remaining valve guide inserts. Then, the bracing mechanism is removed from the original two valve guide inserts, and positioned in two other valve guide inserts, while the oil grooving apparatus of FIGS. 1 or 6 is used to work on the two valve guide inserts that were originally occupied by the support apparatus.

The shape of the oil groove cut by the tool bit 61 can be V-shaped, a radius, or any other desirable cross-section, and the shape or pitch of the spiral of the oil groove has not been found to be critical to the proper functioning of the valve guide insert. Since it is known to provide spiral oil grooves in valve guides, the invention herein defined and claimed is not directed to helical oil grooves per se. The most common pitches for the spiral oil groove lie in the area from 28 to 32 threads per inch, and this is also the preferred range for the present invention. It is obvious that an alteration of the pitch of the helical oil groove cut into the virgin valve guide insert is simply a matter of changing the feed screw 32 and the split nut 46.

Preferably, the depth of the oil groove should lie in the range from .004 inches to .007 inches. If the groove is too deep, it causes increased oil consumption in the engine, and it reduces the bearing area inside the valve guide insert.

The preferred materials for the manufacture of the tool bit are high-speed steel and carbide, although other known bit materials could also be employed.

The actuating rod can be made from any high carbon steel which can be heat-treated to prevent wear.

It is preferred that the spiral groove terminate between $\frac{3}{8}$ inch and $\frac{1}{2}$ inch from the combustion chamber, since, as mentioned earlier, it is undesirable for the spiral groove to communicate directly with the combustion chamber.

It is to be understood that, while this invention has been particularly disclosed in relation to the scoring of an oil-groove in a valve guide insert, it would also function in the identical way to inscribe an oil-groove in an integral guide hole in a cylinder head, such as in the case where an original integral valve guide (no insert) is enlarged by boring it out and an oversize valve stem is installed, without requiring a separate valve guide insert.

What I claim is:

1. An oil grooving apparatus for cutting an oil groove into the interior wall of a valve guide in the head of an engine which includes a valve seat concentric with said valve guide, said apparatus comprising:

support means for supporting said head,

an oil-grooving tool including a tubular boring member dimensioned to fit snugly but slidably within said valve guide, and a coaxial cylindrical feed screw which is fixed with respect to said tubular boring member and which is exteriorly threaded,

a feed body adapted to be positioned firmly against the head and having split nut means selectively engageable with said feed screw, whereby rotation of the oil-grooving tool when engaged within the split nut causes the oil-grooving tool to advance with respect to the feed body,

a tool holder in said tubular boring member mounted for radial movement therewithin but restrained against longitudinal and rotational movement with respect thereto,

a tool bit mounted in said tool holder,

an actuating rod mounted within said oil-grooving tool and longitudinally movable therewithin, the actuating rod having a cam contact with said tool holder whereby movement of the actuating rod toward said tool holder pushes the tool holder radially outwardly and thus causes the tool bit to engage the interior wall of the valve guide, and movement of the actuating rod away from said tool holder permits the tool holder and the tool bit to withdraw radially inwardly,

and means for rotating said oil-grooving tool.

2. The invention claimed in claim 1, in which said actuating rod frictionally maintains itself in a given position longitudinally of the oil-grooving tool, longitudinal displacement of the actuating rod taking place upon the exertion of adequate axial force.

3. The invention claimed in claim 1, in which the support means is adapted to support said head with the

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valve guide substantially vertical and the valve seat downward, said actuating rod being frictionally engageable longitudinally within said oil-grooving tool and extending beyond the location of the tool bit within the tubular boring member, the said apparatus further comprising an adjustable stop member adapted to be positioned beneath the head in line with the actuating rod, such that longitudinal movement of the oil grooving tool with respect to the valve guide brings the actuating rod into contact with the stop member.

4. The invention claimed in claim 1, in which the tool holder has a plane cam surface sloped at substantially 15° to the axis of the tubular boring member, the plane cam surface being exhibited toward the feed screw, and in which the actuating rod has a complementary cam surface adapted to slide in surface contact with said plane cam surface whereby the tool holder can be moved radially of the tubular boring member.

5. The invention claimed in claim 1, which further comprises hold-down means for firmly positioning the feed-body against the head.

6. The invention claimed in claim 1, in which the support means for supporting the head comprises:

a head stand which includes a cross-rail adapted to rest against the table of a drill-press, and a cylindrical portion extending perpendicularly from the cross-rail;

a valve seat insert having a conical surface adapted to contact the valve seat concentric with a valve

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guide and a tubular extension adapted to fit snugly within the valve guide;

the head stand further including a rod coaxial with said cylindrical portion and adapted to extend through said tubular extension and said valve guide to terminate in a threaded end above the engine head when the latter is being supported by said support means,

and nut means adapted to be threaded onto said threaded end into tight engagement with the engine head, thereby to clamp the engine head to the head stand.

7. The invention claimed in claim 6, in which the said nut means is a further head stand having a cross-rail adapted to rest against the table of a drill-press, and a cylindrical portion extending perpendicularly from said last-mentioned cross-rail, the latter having coaxially within said last-mentioned cylindrical portion a threaded bore adapted to receive said threaded end of the rod.

8. The invention claimed in claim 7, in which the rod is longitudinally displaceable with respect to said first-mentioned cross-rail between a first position and a second position, the said threaded end being closer to the first-mentioned cross-rail when the rod is in said first position than it is when the rod is in said second position, and means biasing the rod toward said first position.

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