

Aug. 1, 1967

J. PARRY

3,333,487

VALVE GUIDE REBORING DEVICE

Original Filed Jan. 21, 1965

2 Sheets-Sheet 1

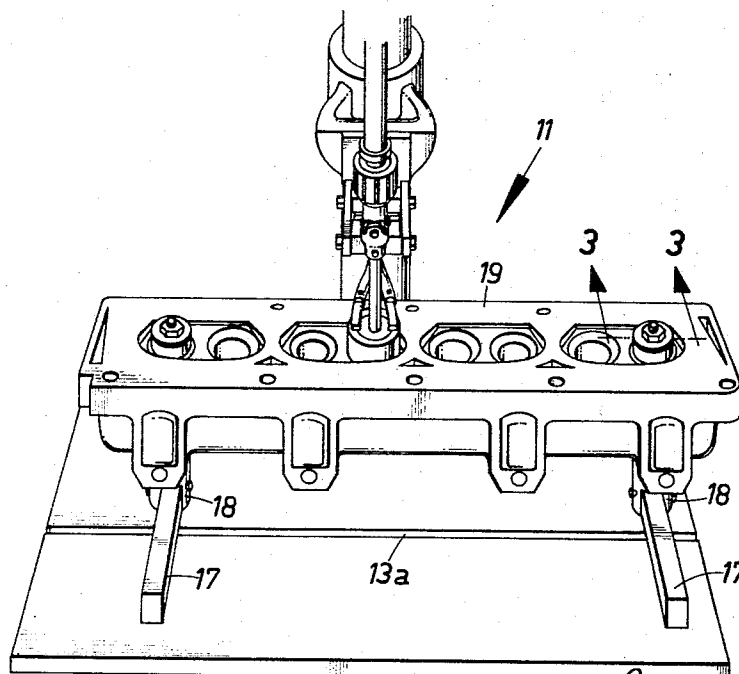
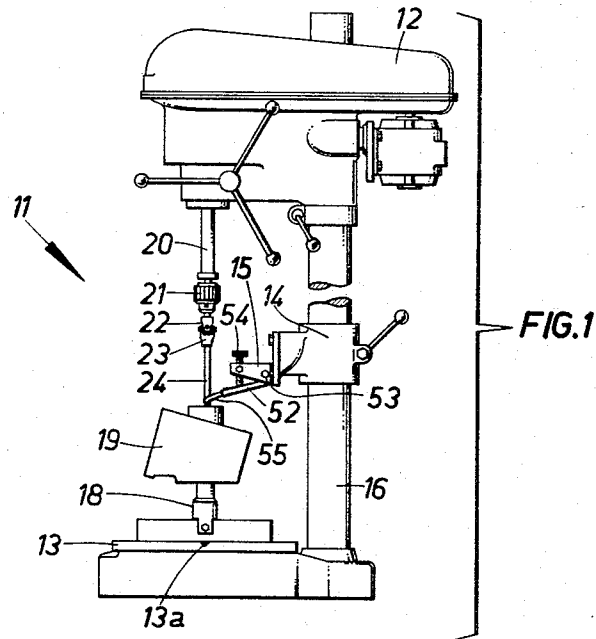


FIG. 2

John Parry

Aug. 1, 1967

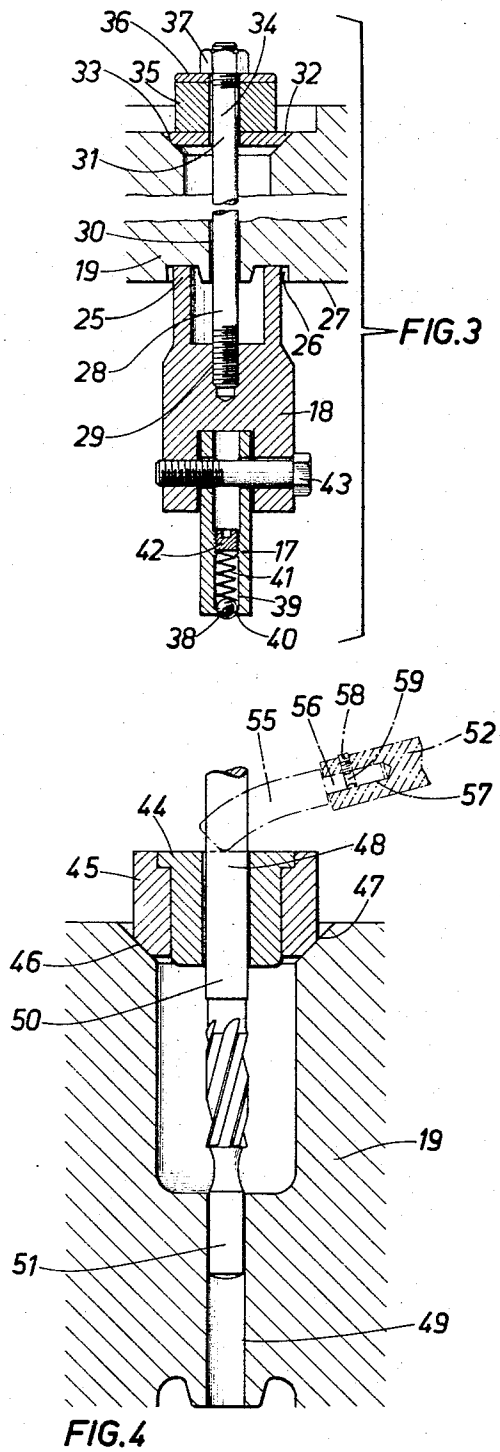
J. PARRY

3,333,487

VALVE GUIDE REBORING DEVICE

Original Filed Jan. 21, 1965

2 Sheets-Sheet 2



John Parry

1

3,333,487

VALVE GUIDE REBORING DEVICE

John Parry, R.R. 1, Orillia, Ontario, Canada

Continuation of application Ser. No. 426,935, Jan. 21, 1965. This application Oct. 20, 1965, Ser. No. 507,600
6 Claims. (Cl. 77-4)

This application is a continuation of application 426,935, filed Jan. 21, 1965 and now abandoned. This invention relates to equipment which can be utilized in the reconditioning of internal combustion engines, and more particularly, to apparatus for reboring the valve guides in cylinder heads of internal combustion engines.

In recent years, internal combustion engines (particularly automobile engines) have most commonly utilized overhead intake and exhaust valves for the combustion cylinders; the valve seats being located on the cylinder head, and the valve stems extending through valve guides in the cylinder head to contact the actuating linkage. The movement of the valve and valve stem during engine operation results in wear of the valve guide in the cylinder head, and in the past it has been common practice to provide the valve guides with cylindrical liners or inserts which could be replaced when desired. Recently, in order to reduce production costs, many engine manufacturers have ceased to provide the valve guide openings in cylinder heads with cylindrical liners or inserts, and have merely machined the valve guide openings for the valve stems directly in the cylinder head casting. Consequently, when the engine is being rebuilt or the valve guides become too worn to function properly, the cylinder head must be either discarded or, preferably, the valve guides rebored and provided with inserts.

It is very important that the valve guides be rebored in exact alignment with the original valve guides and valve seats, and it is conventional practice to utilize jigs and clamps for the supporting and positioning of the cylinder heads on reboring equipment which will properly align the valve guides with the rotating spindle of the reboring machine. In view of the numerous different shapes and types of cylinder heads used in the many different types of internal combustion engines, a large number of jigs and clamps are required, usually a lower support and an upper spindle guide for each different type of cylinder head. Because of the necessity of providing a large number of supports for the different types of cylinder heads, the cost of versatile reboring equipment is relatively high. It has also been conventional practice for the jigs and clamps to locate the cylinder head by reference to the machined surface of the cylinder head, which is adjacent the head gasket and engine block when assembled, instead of in direct relation to the original valve guide. This procedure, however, permits errors in the alignment of the rebored valve guides since the cylinder head often warps through use, or the surface of the cylinder head may have been remachined.

The present invention overcomes some of the disadvantages of the above type of apparatus by utilizing two relatively simple and identical jigs which support and align the valve guides in axially parallel relation to the spindle of a conventional drill press independently of the shape of the cylinder head. With the apparatus of the present invention one set of supporting jigs can conveniently support and align most types of cylinder heads. The two jigs utilize the valve guide openings in the cylinder head, as well as, in a preferred embodiment, drill guide bushings that seat on the original valve seats, to ensure that the valve guides are rebored in correct perpendicular relation to the plane of the valve seats.

According to the present invention, apparatus is provided for the reconditioning of valve guides in the cylinder heads of internal combustion engines which is used in

2

combination with a conventional drill press having a table, a column, and a rotatable spindle and chuck supported by the column and capable of movement in a direction perpendicular to and in operative relationship with the table. Cylinder heads which can be reconditioned on the apparatus of this invention are of the type having valve seats and valve spring seats associated with the valve guides; the spring seats surrounding the valve guides on the side of the head opposite the valve seats and having surfaces perpendicular to the axes of the valve guides. The valve guides to be reconditioned have axes which are parallel and in the same plane with each other. The apparatus includes jigs for supporting and aligning a cylinder head on the table of the drill press. Each jig has an upper end surface which is perpendicular to the axis of the spindle when the jig is in position on the table and which is adapted to receive one of the spring seat surfaces on the cylinder head, a stud perpendicular to the upper end surface of the jig and which can be slidably received by the valve guide associated with the spring seat upon which the cylinder head is resting, a plug for the associated valve seat having a central axial opening for reception of the stud and having a tapered surface adapted to be received by the valve seat, and means which will cooperate with the stud to clamp the plug centrally in the valve seat and clamp the spring seat surface against the upper end surface of the jig so that the axis of the valve guide is parallel to and in the same plane to the axis of the drill spindle.

The apparatus can preferably include, in addition to the jigs recited above, a guide bushing having a tapered surface and adapted to be received in axial alignment with another of the valve seats on the cylinder head, and having a central axial bore for receiving and aligning a reboring tool held in the chuck of the drill press. Means are also provided for applying pressure to the guide bushing when it is in a valve seat to ensure that it is seated properly in coaxial alignment with the axis of the valve guide.

A particular embodiment of the invention will now be described with reference to the accompanying drawings, in which:

FIGURE 1 is a vertical side view of apparatus incorporating the present invention, showing a cylinder head in position for reboring.

FIGURE 2 is a front view, in perspective, showing a portion of the apparatus of FIGURE 1 in greater detail.

FIGURE 3 is a fragmentary vertical section showing a supporting jig inserted in a valve guide of a cylinder head, and taken through the axis of the valve guide along line 3-3 of FIGURE 2.

FIGURE 4 is a vertical section through the axis of a valve guide with a reamer in position for reboring the valve guide, showing the guide bushing seated on the valve seat and showing, in phantom, the hold-down prongs of the drill press of FIGURES 1 and 2 in position against the guide bushing.

FIGURE 5 is a vertical side view of a drill bit, with pilot end, used for drilling the valve guide of a cylinder head as shown in FIGURE 2.

Referring to FIGURES 1 and 2, valve guide reboring apparatus incorporating the present invention is shown and indicated generally by reference numeral 11. The apparatus includes a conventional drill press 12 having a base and table 13, a vertical column 16, and a collar 14 which is slidable on column 16 and may be secured in a desired vertical position in a conventional manner.

The apparatus includes two supporting jigs having transverse base portions 17 located on table 13 of the drill press (FIGURE 2), and vertically upwardly extending supports 18 attached to base portions 17 at substantially their midpoints and which support cylinder head 19 in

3

position for re boring. Cylinder head 19 is positioned and clamped on the supports 18 in a position inverted to its normal position when in assembled relation to the engine block, with the valve seats facing upwards.

The drill press includes a driven spindle 20 which can be moved vertically and carries a chuck 21. Inserted in chuck 21 is universal joint 22; the lower end 23 of the universal joint being adapted to interchangeably receive and drive a drill or reamer 24. Table 13 of the drill press includes a straight shallow groove 13a which extends across the table and which is directly beneath and aligned with the rotational axis of spindle 20.

Referring now to FIGURE 3, a portion of cylinder head 19 is shown in a vertical cross-section of base 17 and upwardly extending support 18 taken through the centre of base 17 and support 18 along the plane 3—3 of FIGURE 2. Upwardly extending support 18 is secured to base 17 by bolt 43. Cylinder head 19 includes a circular surface surrounding valve guide 30 and located in recess 26 on the opposite side 27 of the cylinder head from the valve seat. This surface on cylinder heads is accurately machined to be perpendicular to the axis of the valve guide 30, and is necessary to carry the valve spring when the engine is assembled in operating condition. The cylinder head 19 is supported on that surface in recess 26 by the upper tubular portion 25 of support 18. The top end surface of upper portion 25 which contacts the surface of the cylinder head is accurately machined so that it is perpendicular to the axis of the spindle 20. The supporting of the cylinder head in this manner on surfaces perpendicular to the spindle axis and valve guide axis places the valve guides parallel to the axis of rotation of the spindle. Stud 28 extends through valve guide 30 in cylinder head 19, and is received in threaded engagement in hole 29 concentric with the axis of support 18. The upper portion 31 of stud 28 passes through valve seat 33 on cylinder head 19, and the centre hole 34 of a plug 32 having a tapered surface contacting valve seat 33. The plug 32 ensures that the stud is correctly centred in valve seat 33. Washers and spacers 35 and 36 rest on plug 32 and nut 37 is firmly tightened on the upper end of stud 28. The use of two supporting jigs with their accurately machined upper surfaces which receive the valve spring seats of the cylinder head, together with the clamping studs and tapered plugs in the valve seats, ensure that the cylinder head is supported on the table of the drill press with the axes of the valve guides parallel and in the same flat plane to the rotating axis of spindle 20.

Base 17 includes a vertical bore 39 concentric with the axis of stud 28. A ball 38 is located in bore 39 and held in the bore by retaining ridge 40. A spring 41 is also located in bore 39 and is seated against screw 42. Spring 41 biases the ball down and out of bore 39 against ridges 40 so that its surface extends beyond the bottom of base 17.

As will be apparent from the foregoing, cylinder head 19 is supported in position for re boring upon two supporting jigs. The two studs of the supporting jigs are located in valve guides which are remotely situated from each other in the cylinder head. By locating the two base portions 17 on table 13 and firmly tightening the jigs with the valve seat plugs properly seated, the axes of the two valve guides containing the studs will be vertically aligned with the axis of the spindle of the drill. All other valve guides which are parallel and in the same flat plane will also be vertically aligned with the drill spindle and thus in correct position for re boring, independent of the general shape of cylinder head 19.

Referring now to FIGURE 4, a reamer is shown in position ready to ream a parallel valve guide other than that through which the cylinder head is mounted. A guide bushing 44 is located centrally in and axially aligned with a valve seat plug 45 having a lower bevelled surface 46. The lower surface 46 is adapted to seat in tapered valve seat 47 thus aligning the plug 45 and bushing 44 with the

4

axis of the valve guide 49 which is to be reamed. Bore 48 in bushing 44 receives reamer tool 50 and provides the final guiding which ensures that the tool is in axial alignment with valve guide 49. Reamer 50 can be further provided with a pilot end 51 which follows original valve guide 49. The use of a guide bushing permits the use of a universal joint 22, since the chuck of the drill press no longer must guide the drill or reaming tool, and therefore eliminates the necessity of completely and accurately aligning the spindle with the valve guide to be re bored. It should be noted that bushing 44 and plug 45 could be combined into a single unitary construction.

Referring to FIGURES 1, 2, and 4, in order to hold guide plug 45 in solid contact with valve seat 47, a forked prong 52 is provided which engages the upper surfaces of plug 45 or bushing 44. The forked prong 52 is pivoted at 53 on a bracket 15 attached to collar 14, and is biased upwards by a coil spring (not shown). It can be moved down against the action of the spring by means of adjustment screw 54 so as to contact and firmly press down on plug 45 and bushing 44. Forked end portion 55 of prong 52 can swivel on cylindrical extension 56 which is located in cylindrical opening 57 in prong portion 52, and is maintained in position by screw 58 which rides in groove 59. This permits the forked end portion 55 to rotate so that even pressure is applied by both forks of end portion 55 to the guide plug 45, ensuring proper alignment with the valve seat 47 and thus valve guide 49.

FIGURE 5 shows a drill bit useful for the re boring of valve guides. It comprises a shank portion 60, including a squared end adapted to engage lower portion 23 of universal joint 22, a cutting portion 61, and a pilot portion 62. The pilot portion follows the original valve guide giving additional guidance to the bit to follow the old valve guide in correct axial alignment.

In use, a cylinder head is fastened to upper jig portions 18, and base portions 17 of the supports are located on table 13 of the drill press with balls 38 in groove 13a. When the balls 38 are engaged in groove 13a, since the balls are aligned with studs 28 and grooves 13a are aligned with spindle 20, the valve guides will be closely aligned with the spindle 20 in the direction indicated by arrows 3—3 on FIGURE 2. The balls can slide in groove 13a so that the support jigs and cylinder head can move sideways back and forth as viewed in FIGURE 2 until one of the valve seats is closely aligned with spindle 20. Plug 45 is located in the pertinent valve seat 47, drill 60 is located in the universal joint 22 and inserted through bushing 44. Forked prong 52 is placed on top of bushing 44 and plug 45 and clamped down to hold it in solid engagement with valve seat 47. Universal joint 22 permits minor misalignment of the valve guide with spindle 20 of the drill press in placing the cylinder head in position, but the supports ensure that the axis of the valve guide is parallel to the axis of spindle 20 and guide bushing 45 acts as the final guide for the drill bit. When the valve guide has been re bored with drill 60, the drill bit is replaced with a reaming tool and its appropriate guide bushing on valve seat 47, and the pre-drilled valve guide is reamed in readiness to receive a cylindrical liner or insert, which is then inserted in a conventional manner. In most cylinder heads the axes of all of the valve guides are parallel, and each open valve guide is re bored and reamed as described above. Stud 28 are then removed from their valve guides and placed in two already re bored valve guides, and the same procedure is carried out for the two valve guides in which studs 28 were originally placed. The complete cylinder head is then ready to receive new valve guide inserts or liners. In cylinder heads in which the intake valve guides and exhaust valve guides are at an angle to each other, the above procedure could be repeated for each set.

With the present invention, the same apparatus provided with a set of drills and reaming tools of varying diameters, and guide bushings for each, and tapered valve seat mounting plugs, can re bore the valve guides of almost all com-

5

mon cylinder heads. It is not necessary to have an expensive and complicated set of jigs and clamps for each head, and the operation of reconditioning the valve guides in a cylinder head can be performed quickly and easily.

It will be understood that although a specific embodiment of the invention has been described and illustrated, variations and changes can be made in the apparatus within the scope of the following claims.

What I claim as my invention is:

1. Apparatus for use in combination with a drill press in the reconditioning of valve guides in the cylinder heads of internal combustion engines; said drill press having a table, a column, and a rotatable spindle and chuck supported by said column and capable of movement in a direction perpendicular to and in operative relationship with said table, said cylinder heads being of the type having valve seats and valve spring seats associated with the valve guides, said valve spring seats surrounding the valve guides on the side of the cylinder head opposite the valve seats, the surfaces of said spring seats being perpendicular to the axes of the valve guides, and the axes of said valve guides being parallel to and in the same plane with each other; said apparatus comprising jigs for supporting and aligning a cylinder head on the table of said drill press, each of said jigs including; an upper end surface which is perpendicular to the axis of said spindle when said jig is in position on said table and which is adapted to receive one of said spring seat surfaces on said cylinder head, a stud perpendicular to said upper end surface and adapted to be slidably received by the valve guide associated with said one of said valve spring seats, a valve seat plug having a central axial opening for reception of said stud and having a tapered surface adapted to be received by the valve seat associated with said one of said valve guides, and means which will cooperate with said stud to clamp said valve seat plug centrally in said valve seat and clamp said spring seat surface against said upper end surface with the axis of said valve guide parallel and in the same plane to the axis of said spindle.

2. Apparatus for use in combination with a drill press in the reconditioning of valve guides in the cylinder heads of internal combustion engines; said drill press having a table, a column, and a rotatable spindle and chuck supported by said column and capable of movement in a direction perpendicular to and in operative relationship with said table, said cylinder heads being of the type having valve seats and valve spring seats associated with the valve guides, said valve spring seats surrounding the valve guides on the side of the cylinder head opposite the valve seats, the surfaces of said spring seats being perpendicular to the axes of valve guides, and the axes of said valve guides being parallel to and in the same plane with each other; said apparatus comprising, jigs for supporting and aligning a cylinder head on the table of said drill press, each of said jigs including; an upper end surface which is perpendicular to the axis of said spindle when said jig is in position on said table and which is adapted to receive one of said spring seat surfaces on said cylinder head, a stud perpendicular to said upper end surface and adapted to be slidably received by the valve guide associated with said one of said valve spring seats, a valve seat plug having a central axial opening for reception of said stud and having a tapered surface adapted to be received by the valve seat associated with said one of said valve guides, and means which will cooperate with said stud to clamp said valve seat plug centrally in said valve seat and clamp said spring seat surface against said upper end surface with the axis of said valve guide parallel and in the same plane to the axis of said spindle; a guide bushing having a bevelled surface and adapted to be received in axial alignment with another of said valve seats on said cylin-

6

der head, and having a central axial bore therein for receiving and aligning a reboring tool held in said chuck on said spindle; and means for applying pressure to said guide bushing when it is in said valve seat so as to ensure coaxial alignment of said guide bushing with the axis of the valve guide associated with said another valve seat.

3. Apparatus for use in combination with a drill press in the reconditioning of valve guides in the cylinder heads of internal combustion engines; said drill press having a table, a column, and a rotatable spindle and chuck supported by said column and capable of movement in a direction perpendicular to and in operative relationship with said table, said cylinder heads being of the type having valve seats and valve spring seats associated with the valve guides, said valve spring seats surrounding the valve guides on the side of the cylinder head opposite the valve seats, the surfaces of said spring seats being perpendicular to the axes of the valve guides, and the axes of said valve guides being parallel to and in the same plane with each other; said apparatus comprising, jigs supporting and aligning a cylinder head on the table of said drill press, each of said jigs including an upper end surface perpendicular to the axis of said spindle when said jig is in position on said table and receiving one of said spring seat surfaces of said cylinder head, a stud perpendicular to said upper end surface and slidably received by the valve guide associated with said one of the valve spring seats, a valve seat plug having a tapered surface and seated on the valve seat associated with said one of the valve guides and having a central axial opening receiving said stud, and means cooperating with said stud clamping said valve seat plug centrally in said valve seat and clamping said spring seat surface against said upper end surface with the axis of said valve guide parallel and in the same plane to the axis of said spindle; a guide bushing having a tapered surface and received in axial alignment with another of said valve seats on said cylinder head and having a central axial bore therein which will receive and align a reboring tool held in said chuck on said spindle; and means applying pressure to said guide bushing on said valve seat so as to ensure axial alignment of said guide bushing with the axis of valve guide associated with said another valve seat.

4. Apparatus as defined in claim 2 in which the end of said stud remote from said upper end surface is threaded and extends through said valve seat plug, and said means cooperating with said stud to clamp said valve seat plug in said valve seat comprises a threaded nut which can be received in threaded engagement with said stud.

5. Apparatus as defined in claim 2 in which a straight groove extends across the table of said drill press and each said jig includes a ball which is spring biased to protrude from the surface of said jig adjacent said table when said jig is in position on said table, the centre of said ball being aligned with the longitudinal axis of said stud, said groove being aligned in a plane passing through the axis of rotation of the spindle of said drill press, and said groove being adapted to receive said ball and align said stud in a plane parallel to the axis of said spindle.

6. Apparatus as defined in claim 2 in which said means for applying pressure to said guide bushing includes a forked prong pivotably and rotatably mounted on a collar which is slidably supported on the column of said drill press, and an adjustment screw associated with said prong and collar.

No references cited.

WILLIAM W. DYER, JR., *Primary Examiner.*
GERALD A. DOST, *Assistant Examiner.*