Jan. 24, 1950 F. C. WILSON 2,495,649

DEVICE FOR REMOVING OR INSERTING SLEEVES

Filed March 13, 1947

3 Sheets-Sheet 1

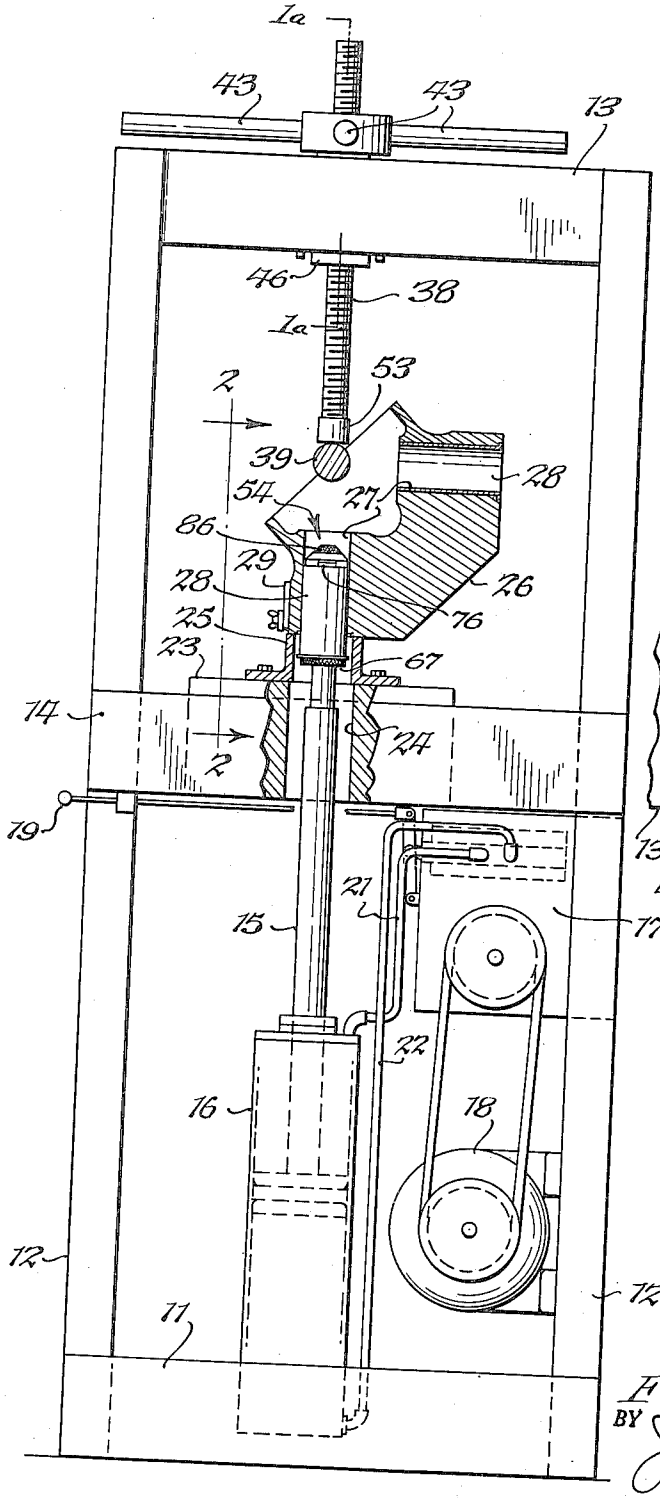

Fig. 1.

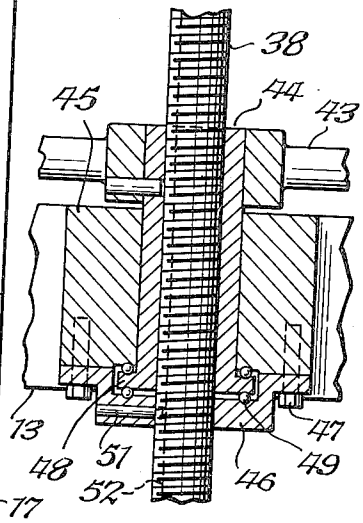

Fig. 1a.

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3 Sheets-Sheet 2

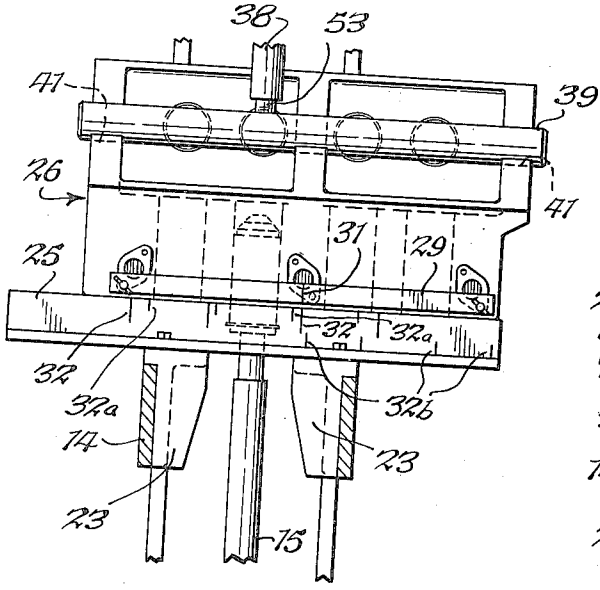

Fig. 2.

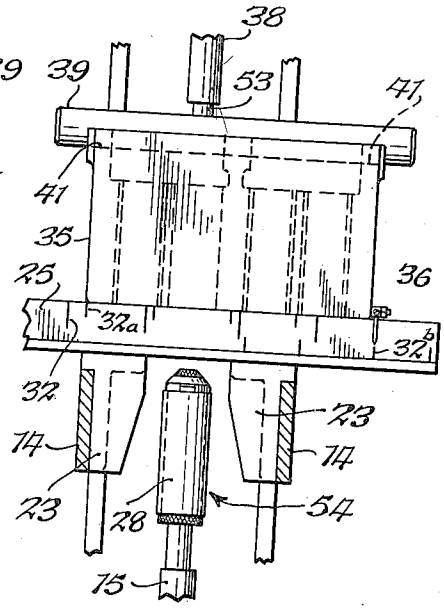

Fig. 3.

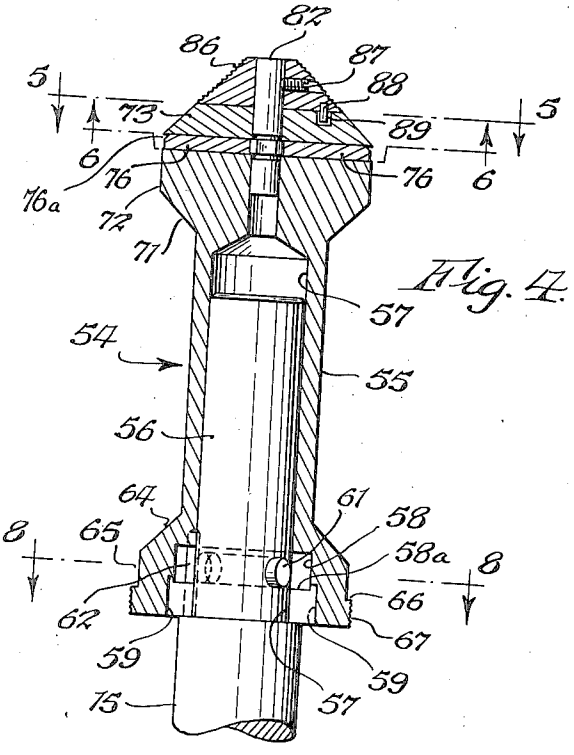

Fig. 4.

Fig. 5.

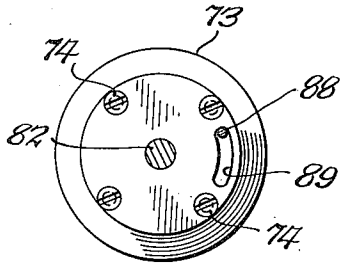

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Fig. 6.

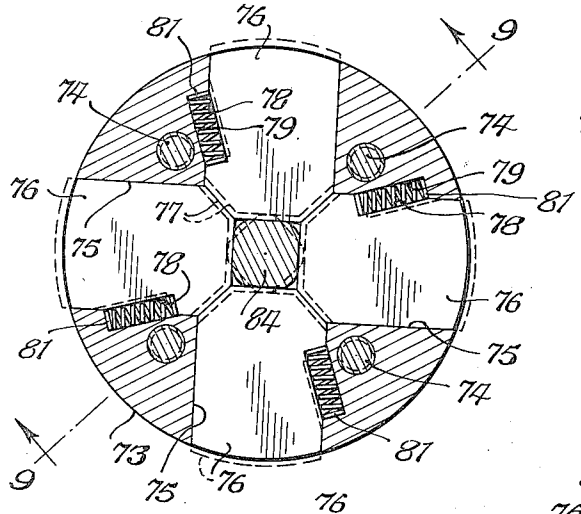


Fig. 9.

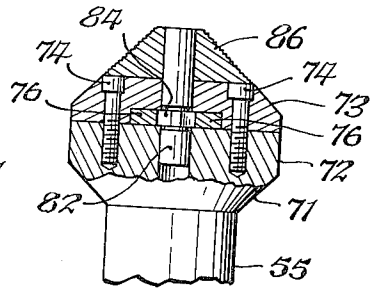
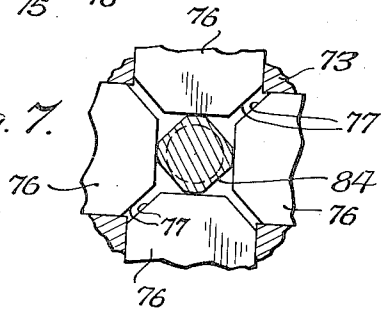


Fig. 7.



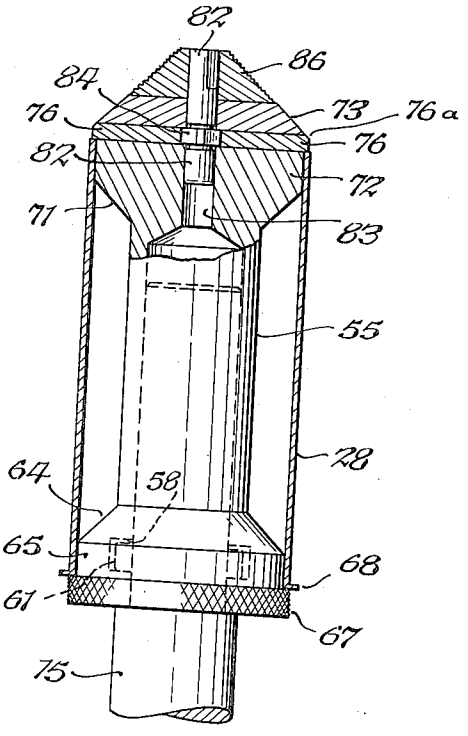
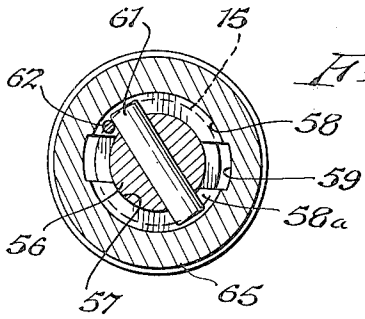


Fig. 10.

Fig. 8.



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DEVICE FOR REMOVING OR INSERTING SLEEVES

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Application March 13, 1947, Serial No. 734,319

4 Claims. (Cl. 29—283)

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This invention relates to a device for removing or inserting sleeves of internal combustion engine cylinders and consists of a sleeve supporting and engaging jig operable by movement in one direction to remove a sleeve and by movement in the opposite direction to insert one.

The device is utilized with an arbor press of suitable or known form which supports the cylinder block. It is moved by the ram element of the press axially of a cylinder of the block, its movement in one direction effecting the removal of the sleeve and its movement in the opposite direction effecting the insertion of a sleeve. In these operations the device also acts with centering effect upon the work piece, correcting errors of misalinement and enabling the work piece to be set up quickly in the press.

The device includes a cylindrical member having a bore at one end to enable its mounting on a press ram element and a conical head at its opposite or free end which head, as it enters the cylinder, effects such shifting of the work piece as may be required accurately to aline the cylinder with the device. The sleeve to be removed or inserted has a position on the device between a relatively fixed shoulder at the ram connected end and an adjustable or removable shoulder adjacent the head or free end. Thus a straight line movement of the sleeve, on removal or insertion, is insured with resultant elimination of binding action and liability of its distortion and also a minimum power requirement.

In the accompanying drawings:

Figure 1 is an elevation, with parts in section showing a standard arbor press in operatively associated relation with the device of the invention and with a cylinder block of V-type of internal combustion engine.

Figure 1*a* is a section on the line 1*a*—1*a* of Figure 1, showing the mounting of the press clamp screw.

Figure 2 is a view on the line 2—2 of Figure 1, looking in the direction of the arrows, the device of the invention being shown as having entered a cylinder of the block.

Figure 3 is a view similar to Figure 2 but showing another form of cylinder block and the device in retracted position.

Figure 4 is an enlarged axial section of the device in association with the ram element of the press.

Figure 5 is a section on the line 5—5 of Figure 4, looking in the direction of the arrows.

Figure 6 is an enlarged section on the line 6—6 of Figure 4, looking in the direction of the

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arrows, and showing the adjustable upper shoulder means.

Figure 7 is a fragmentary view in plan and section of the parts shown in Figure 6, with the shoulder members shown in an alternate position.

Figure 8 is a section on the line 8—8 of Figure 4, looking in the direction of the arrows, illustrating the connection between the device and the ram element of the press.

Figure 9 is a section on the line 9—9 of Figure 6.

Figure 10 is a view, partly in elevation and partly in section, of the device in operative association with a sleeve to be removed or inserted.

Figure 1 shows an arbor press having a base 11, vertical frame posts 12, overhead beams 13, and a deck including transverse beams 14, these parts being assembled and related in the usual manner. The press also includes a vertically mounted and moveable ram element 15, an associated piston 15*a* and a cylinder 16, these elements being shown in connection with other elements required for their operation, e. g., a pump 17 operated by a motor 18, a valve control lever 19 and pipes 21 and 22 between the pump and cylinder. The details of the press operation unit form no part of the invention and, therefore, require no further discussion. It will be sufficient to point out that hydraulic fluid under pressure is applied in alternation at opposite sides of the ram piston 15*a*, thereby to cause the ram element 15 to move toward or away from the deck. Control of this action is manually governed by the position of the lever 19 which, in turn, operates the valves (not shown), all in accordance with well-known design and practice.

The deck includes a support block 23 secured to and mounted between the beams 14 and having a central vertical opening 24 through which the ram element 15 is moveable. The block 23 preferably carries spaced upright deck rails 25 which serve as the immediate support for the work piece 26. This piece is shown in Figures 1 and 2 as the cylinder block of the well-known V-8 design of internal combustion engine characterized by two lines of four cylinder bores 27, the bores of one line being set axially at an angle of 90° to the bores of the other line. The cylinder bores in this and other internal combustion engine designs are equipped with sleeves 28, press fitted into place and which, due to wear in service, must from time to time be withdrawn and replaced. For this purpose the cylinder bores 27 of the block (work piece) are successively alined with the ram element 15 whereby the device, car-

ried by and projecting axially beyond the ram element, may enter a bore, either to remove or insert the sleeve 28 with respect to the several cylinders.

The construction of the device is such that it is not required that the work piece as originally placed upon the deck be in strict co-axial alinement with the ram element. A sufficient approximation may be made by means of an index bar 29 having an index mark 31 and which is positioned on a side of the block 26 so that the mark 31 may be alined successively with gage marks 32 on one of the supporting rails 25, the alinement of the mark 31 successively with each of the marks 32 indicating the sufficient approximation of the alinement of the successive cylinders of the block with the ram cylinder. Thus, as the cylinder block is shifted along the rails 25, thereby to bring another cylinder into operative relation to the device, the alinement of the index mark 31 with the next succeeding gage mark 32 on the supporting rail 25 will indicate that the cylinder (from which a sleeve is to be removed or into which a new sleeve is to be inserted) will have been brought into the sufficient approximate alinement with the ram cylinder 15.

Figure 3 shows a four cylinder engine block 35 mounted on the press. In this case, instead of the index bar 29, a pointer 36 may be used, this pointer being so positioned at one end of the block that it can register with the gage marks 32. The effect is the same in both instances; and obviously the rails 25 may be provided with a number of series of gage marks, e. g., the additional series 32*a* and 32*b*, as shown, in order that it may conform to engines of different models and makes.

The cylinder block, as set in proper position on the supporting rails 25 in the manner above described, may be held by a clamping screw 38, having at its inner end a contact pad 53 for light engagement with a dummy shaft 39, temporarily fitted in the main bearing recesses 41. The dummy 39 is convenient but may, of course, be dispensed with in certain cases. It is a simple expedient for assuring that the pressure required for the removal or insertion of the sleeve will, in all cases, be properly applied. The adjustment of the screw 38 is effected by a capstan wheel 43 pinned to a nut 44 (Figure 1*a*) rotatably mounted in a fixed block 45 interposed between and supported by the beams 13. The block 45 carries at its lower side a recessed holding plate 46 secured by screws 47. The nut 44 is provided at its lower end with an annular circumscribing shoulder 48 located between the plate 46 and block 45 and grooved on both flat faces to provide races for ball bearings 49. The screw 38 is held against rotation by a pin 51, conveniently carried by the holding plate 46, which engages in a longitudinal keyway in the surface of the screw.

The ram element 15 carries, and operatively moves, the device 54 (jig) which embodies the invention and is constructed to hold a sleeve 28 to be removed or inserted. Figure 1 assumes the ram element as pressing home a replacement sleeve; and Figure 3 assumes the ram element as having effected the removal of a worn sleeve.

As shown in Figures 4 and 10 the jig comprises a generally cylindrical body member 55 having enlarged ends by and between which a sleeve 28 may be held. The member 55 is formed with a recess 57 extending axially from its bottom or inner face whereby it may be fitted securely, but removably, upon a reduced section 56 at the upper or outer end of the ram element 15. A detachable connection of any suitable construction is provided between the ram element 15 and the member 55, a standard type of bayonet joint being shown.

For this purpose the lower portion of the member 55 is counterbored to provide an annular recess 58 extending beyond the bore 57, the lower wall of this recess providing a shoulder 58*a* which is interrupted by diametrically opposed slots 59 extending to the bottom or inner face of the member 55. The reduced section 56 carries a diametrically arranged pin 61 having projecting end portions. Hence, when the member 55 is positioned upon the section 56 with the pin ends in registry with the slots 59, the member may be pressed down as shown in Figure 4. Rotation of the cylinder 56 then brings the pin ends against the bottom wall of the internal shoulder 58 to prevent displacement of the parts. A stop pin 62, fitted in the lower portion of the member 55 adjacent one of the slots 59, and extending through the recess 58, prevents the turning of the member 55 beyond a proper distance.

The lower end of the member 55 is formed with a conical portion 64 merging into a right cylinder section 65, the lower end of which is defined by an annular shoulder 66 contiguous with a knurled lower section 67. As shown in Figure 10 the shoulder 66 provides a seat for the lower rim, or engine head end, of a sleeve 28 which is shown as having at its lower rim a circumscribing annular flange 68 in accordance with a cylinder sleeve design that is frequently used. The diameter of the right section 65 is such that it fits closely within the sleeve 28, thereby to maintain the sleeve concentric with the axis of the ram 15. The knurled section 67 facilitates the removal or positioning of the jig on the end of the ram element, through the bayonet joint above described.

The upper or head end of the member 55 is also formed with a conical section 71 merging into a right cylinder section 72 of the same diameter as the section 65. The sleeve 28, when positioned on the jig, will therefore be supported both radially and axially, and maintained concentric with the axis of the ram element. As also shown in Figure 10 the distance between the upper face of the section 72 and the shoulder 66 equals the length of the sleeve 28; and the upper cylinder section 72 is provided with removable or adjustable shoulder elements which, when utilized, project over the upper end of the sleeve 28, but not beyond it, thereby to lock the sleeve to the jig.

As shown in Figures 6 and 9 the section 72 has attached to its upper face a frusto-conical block 73 having a maximum or base diameter equal to that of the section 72, the block being secured by screws 74 entering taps in the section 72. The under side of the block 73 is formed with two intersecting diametrical recesses 75, and, in the cruciform recess thus provided, there are placed four radially slidable plates 76. The inner ends of the plates 76 are beveled, as shown at 77 in order that the plates may be withdrawn into the guide recesses 75 without mutual interference. Each plate is also formed in one of its side edge faces with a notch 78, which, in conjunction with a companion notch 79 formed in the adjacent wall of the recess 75 in which the plate is located, provides a pocket for a coiled spring 81. These springs urge the plates 76 inwardly, and hence inside of, or at least flush with, the circumferential face of the section 72. The

plates 76 have their perimetric faces formed with upper beveled portions 76a.

In Figures 4 and 6, the plates 76 are shown in their retracted positions, while in Figures 7 and 10 they are shown in extended positions to overlap the end of the sleeve 28. The projection of the plates to overlap the end of the sleeve 28 is to an extent not exceeding the outside diameter of the sleeve. Actuation of the plates to the extended positions is effected by means of a cam shaft 82 having an inner end portion rotatably mounted in an axial passage 83 formed in the cylindrical section 72. The shaft 82 is formed with a somewhat enlarged square section 84 coplanar with the plates 76 and arranged within the rectangle delimited by the inner end faces. The upper portion of the shaft 82 extends beyond the enlarged section 84 through an aperture formed in the block 73 into a finger piece 86 mounted above the block. The piece 86 is conical, and in effect it constitutes a continuation of the conical portion of the block 73. It is secured to the shaft 82 by a set screw 87 (Figure 4), and it is also provided with a knurled surface, so that it may easily be turned with the fingers. The square section 84, of course, cannot pass through the shaft bearing apertures, and therefore the finger piece is secured to the assembly.

When the finger piece 86 is partially rotated, the section 84 is also rotated whereby its corner portions, which are preferably flat faced, by engagement with the inner end faces of the plates 76 are operative to force the plates radially outward, and thereby cause them to project beyond the section 72 and overlap the upper ends of the sleeve 28. Limitation of the rotary movement is effected by means of a pin 88 (Figures 4 and 5) projecting from the under side of the piece 86 for engagement in an arcuate recess 89 in the upper surface of the block 73. When the piece 86 is turned in the opposite direction, the plates 76 are retracted under the urge of the springs 81. Hence the plates may be shifted in the recesses 75 between their retracted and extended positions, respectively shown by the full and broken lines of Figure 6.

In operation, the work piece, such as the engine block 26, is mounted on the rails 25, with the first cylinder to be treated brought into approximate alinement with the axis of the ram element 15, with the aid of the indexing scales 31 and 32. The capstan wheel 43 is then rotated to move the clamping screw 38 down to the dummy shaft 39 (Figure 1) but not into full or strong contact with it. The ram element 15, while in its lower position, is then equipped with that size jig which is appropriate to the cylinders of the engine.

Assuming that the operation involves the removal both of a worn sleeve and the insertion of a new one, the ram element with the appropriate jig fitted upon it is then moved upward, the plates 76 being in their retracted positions. As the conical surface of the block 73 engages the cylinder bore 27, it will act like a cam to shift the block to an extent necessary to bring the parts into exact alinement. Because of this expected action, the screw 38 should therefore not be tightened against the shaft 39 in the first instance. When the cylindrical portion 72 of the jig has entered the bore 27, and effected the perfect alinement of the cylinder block the screw 38 is tightened against the shaft 39, thereby positively to hold the block rigidly in position. At the end of the upper stroke of the ram, the

shoulder 66 at the lower end of the jig will abut the lower rim of the worn sleeve, i. e., the flange 68 when the sleeve is of the design shown, and the knurled piece 86 will project into the crankcase portion of the engine block, with the plates 76 just above the inner end of the sleeve 28.

The finger piece 86 is then manipulated to project the plates 76 into overlapping relation to the adjacent rim of the sleeve 28, whereupon the ram element is returned to its initial position. Inasmuch as the sleeve is now locked between the shoulders at the ends of the jig, it is obvious that it must be withdrawn in a straight line direction. Such repair work as is required in the bore 27 is then performed, the cylinder block, if necessary, being removed from the press for this purpose and when the work has been completed being restored to proper position upon the rails 25. A replacement sleeve is inserted. The action is, of course, the reverse of what has been described except that the beveled faces 76a of the plates 76 complete the accurate centering of the block, the plates at such time being projected. The new sleeve is supported on the jig as it is forced home by the ram element 15 whereupon the plates 76 are retracted to disengage the sleeve and the jig is then withdrawn by the downward motion of the ram element 15, leaving the sleeve properly positioned in the bore 27.

The transformation of the device for either purpose of the removal or insertion of a sleeve 28 involves merely a slight manipulation to control the adjustable upper holding or shoulder member, herein shown as constituted by the plates 76, the jig in either case operating as a centering and alining means. Hence the device possesses significant advantages for rapid, accurate, inexpensive and complete operation.

The device may, of course be used with various types of presses and other types of power and it may also be made in forms differing in sundry details from the embodiment described but without departure from the described principles of use and operation.

I claim:

1. A jig comprising a body member formed with detachable connection means at one end, an annular shoulder formed on the member adjacent said end, a tapered element secured to the member at its opposite end, radial guide recesses formed between the tapered element and the adjacent end of the member, plates slidably mounted in the recesses, a tapered finger piece rotatably connected to the tapered element, a cam shaft extending from the finger piece to said recesses and formed with a cam element engaging said plates, said shaft when rotated in one direction by the finger piece causing said cam to thrust the plates outwardly, spring means for returning said plates to their inner positions when the cam is returned to its initial position and cylindrical sections formed on the body member between the shoulder and plates to align and support a sleeve having an end engaging said shoulder.

2. A jig comprising a body member formed with detachable connection means at one end, an annular shoulder formed on the member adjacent said end, and a cylindrical section adjacent said shoulder and a second cylindrical section at its opposite end and of the same diameter as the cylindrical section first named, said cylindrical sections providing radial support for a sleeve resting on said shoulder, a tapered element secured to the body member adjacent said second

cylindrical section and having its maximum diameter of the same extent as the diameter of said second cylindrical section, radial guide recesses formed between the tapering element and the adjacent end of the member, plates slidably mounted in the recesses, a cam mounted in the recesses adjacent the inner ends of the plates and adjacent the upper face of the second cylindrical section, a shaft upon which said cam is provided and which is journaled in the second cylindrical section and in the tapered element, said cam as fitted between the tapered element and the second cylindrical section preventing the axial displacement of said shaft, said cam when turned in one direction effecting the projection of said plates and when turned in the opposite direction permitting the retraction of said plates, spring means for effecting the retraction of said plates, the cam shaft projecting beyond said tapered element, and a finger piece mounted on the projecting portion of the cam shaft adjacent said tapered element and having a maximum diameter not greater than the minimum diameter of said tapered element.

3. A jig for the removal or insertion of a sleeve used as a liner for the cylinder of an internal combustion engine comprising an elongated body member formed at one end with an annular shoulder which provides a seat for a sleeve to be inserted or removed, with a cylindrical surface adjacent the shoulder to provide internal radial support for the sleeve and with a second cylindrical surface at its opposite end also to provide internal radial support for the sleeve, a tapered element mounted on the member adjacent said second cylindrical surface, means for connecting said element to the member and providing for the removal of said element from the member, said element as the jig is moved toward the cylinder engaging the end of the cylinder and effecting the shifting of the cylinder block in a direction and to an extent such that as the movement of the jig into the cylinder is continued the cylinder will be brought into accurate axial alinement with the jig, releasable means fitted between the body member and said element adjacent said second cylindrical surface for overlapping and engaging the end of the sleeve opposite to the end which is seated upon said shoulder, thereby to lock the sleeve to the jig, said releasable means comprising radially guided shoulder elements mounted for radial projection beyond said second cylindrical surface to an extent not exceeding the outside diameter of the sleeve for the purpose of said overlapping engagement and for radial retraction within said second cylindrical surface for releasing the sleeve, and manually operated rotatable means having an actuating shaft journalled in said tapering element and projecting outwardly beyond said tapering element, the projecting portion of said shaft being accessible for manual operation to effect the actuation of said releasable means in engaging or releasing the sleeve.

4. A jig for the removal or insertion of a sleeve used as a liner for the cylinder of an internal combustion engine comprising an elongated body member formed at one end with an annular shoulder which provides a seat for a sleeve to be inserted or removed, with a cylindrical surface adjacent the shoulder to provide internal radial support for the sleeve and with a second cylindrical surface at its opposite end also to provide internal radial support for the sleeve, a tapered element mounted on the member adjacent said second cylindrical surface, said element as the jig is moved toward the cylinder engaging the end of the cylinder and effecting the shifting of the cylinder block in a direction and to an extent such that as the movement of the jig into the cylinder is continued the cylinder will be brought into accurate axial alinement with the jig, releasable means fitted between the body member and said element adjacent said second cylindrical surface for overlapping and engaging the end of the sleeve opposite to the end which is seated upon said shoulder, thereby to lock the sleeve to the jig, said releasable means comprising radially guided shoulder elements mounted for radial projection beyond said second cylindrical surface to an extent not exceeding the outside diameter of the sleeve for the purpose of said overlapping engagement and for radial retraction within said second cylindrical surface for releasing the sleeve, means for connecting said element to the member and providing for the removal of said element from the member, means including a shaft which extends through said tapering element and a cam fixed upon said shaft below said tapering element for operative engagement with the shoulder elements in effecting their sleeve engaging or sleeve releasing actions, and rotatable means located accessibly for manual operation beyond said tapering element and operatively connected to said shaft, the rotation of said manually rotatable means in either direction effecting the rotation of said shaft and the cam whereby to actuate said releasable means for engaging or releasing the sleeve.

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