

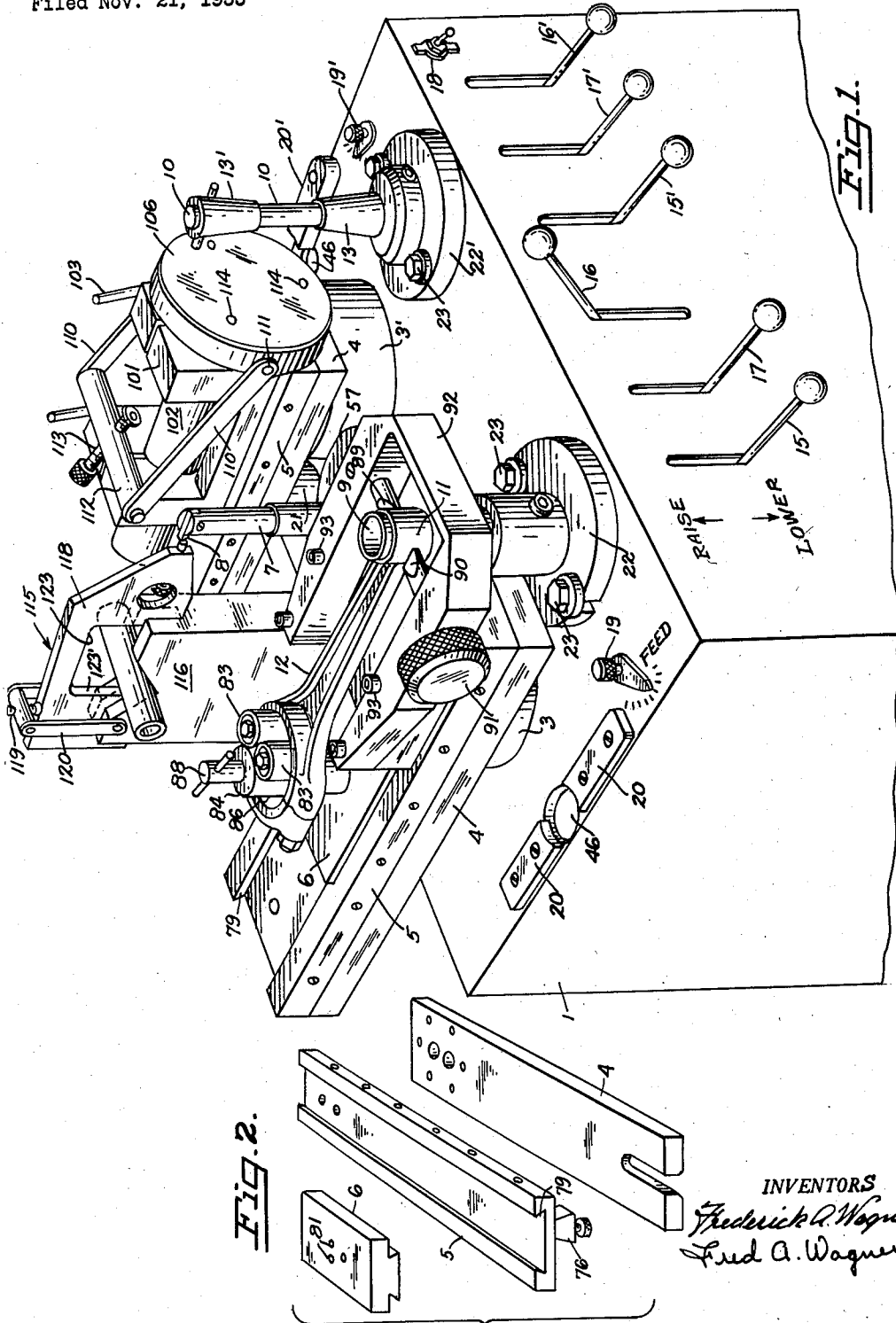
July 22, 1958

F. A. WAGNER ET AL
ENGINE PARTS BORING MACHINE

2,844,053

Filed Nov. 21, 1955

5 Sheets-Sheet 1



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Fig. 3.

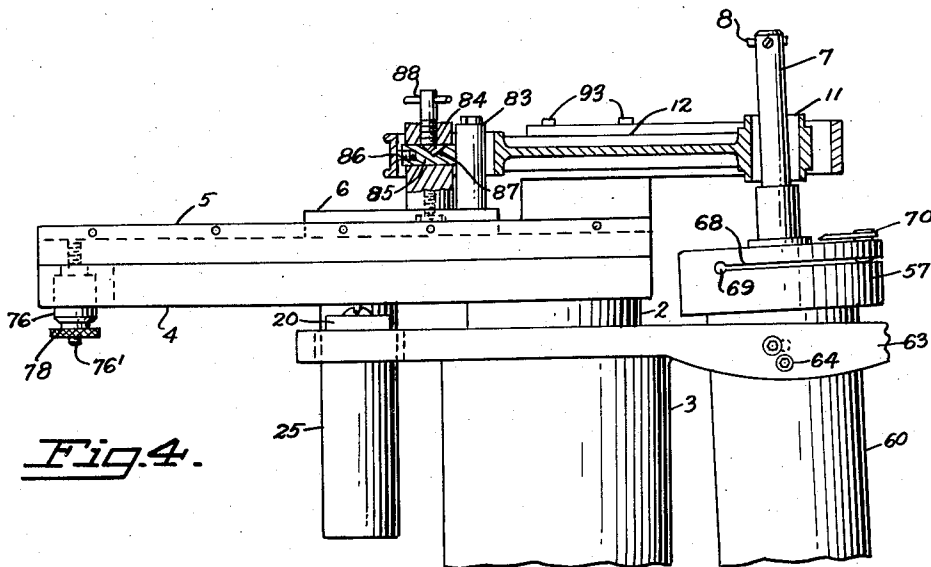
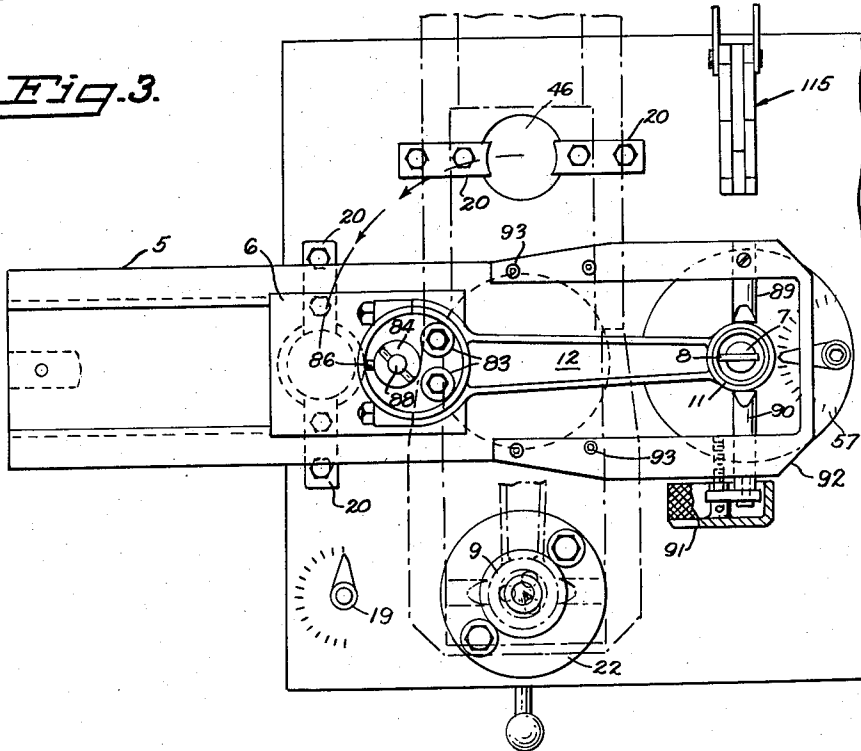


Fig. 4.

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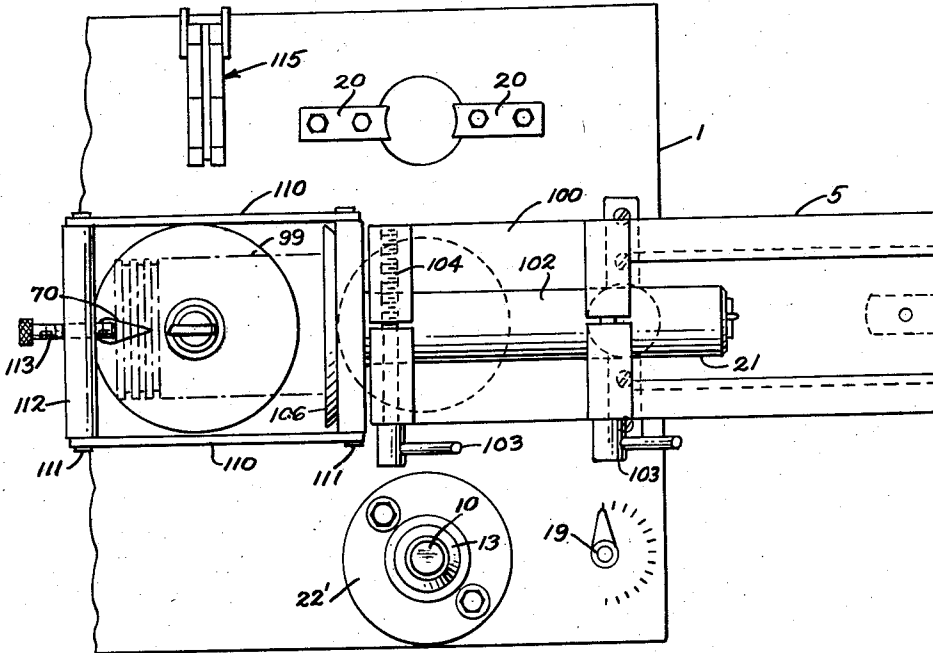


Fig-5.

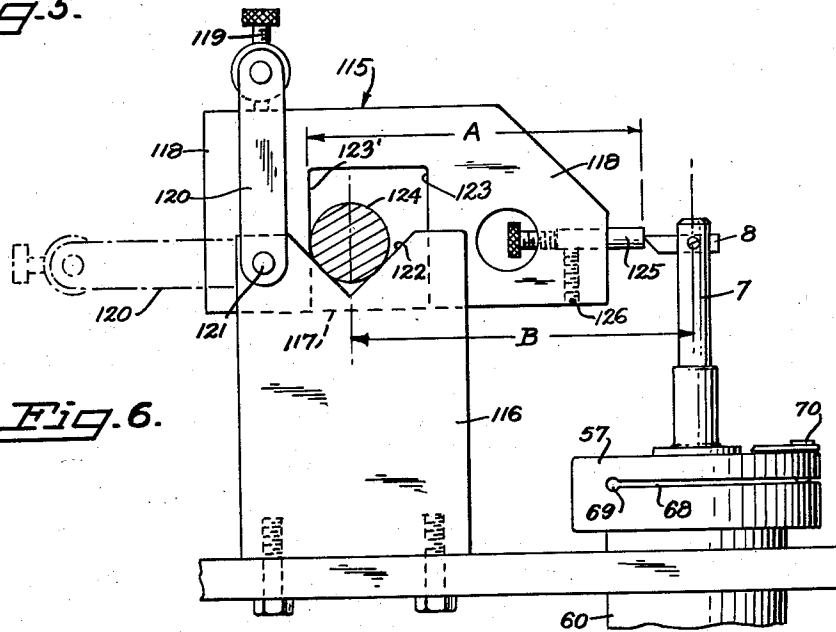


Fig. 6.

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Fig. 9.

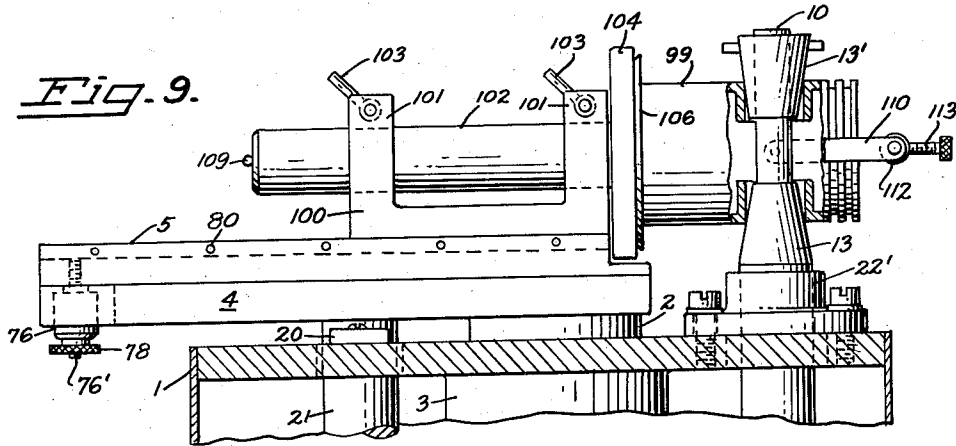


Fig. 10.

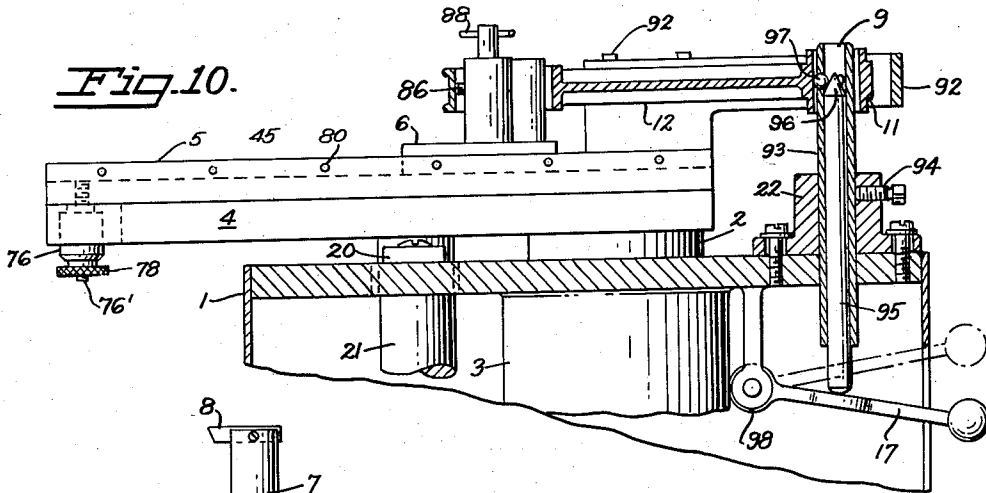


Fig. 13.

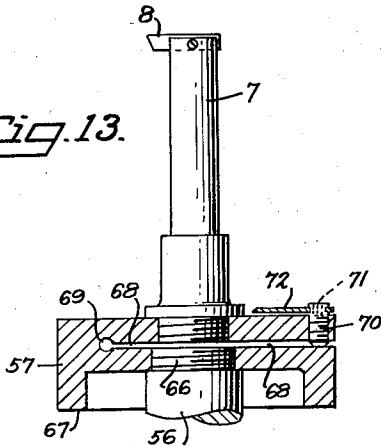


Fig. 11.

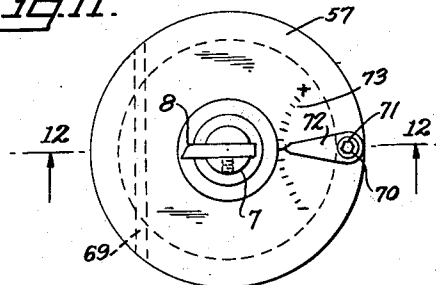
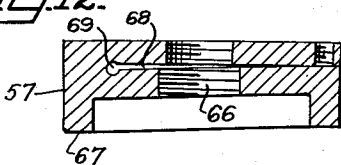


Fig. 12.



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ENGINE PARTS BORING MACHINE.

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Application November 21, 1955, Serial No. 548,007

15 Claims. (Cl. 77—4)

This invention relates to a machine for boring or re-boring the bearings of engine parts, particularly engine connecting rods and piston wrist pin bearings for accurately fitting new pins therein, and if desired boring the bearings slightly elliptical to release the pressure at the non-thrust sides, all under close precision, and after pre-centering of the part to be bored, away from the boring tool and then swinging the pre-centered part over the tool, and lowering the part under hydraulic control feeding for the cut.

The construction of the machine and the manner of its operation will follow a brief description of the accompanying five sheets of drawings:

In the drawings:

Fig. 1 is a perspective view looking downwardly at an angle toward the top of the machine showing an engine piston connecting rod secured on its elevating ram in pre-centered position preparatory to being elevated and lowered over the boring cutter, and showing also a piston receiving fixture on another elevating ram adjacent its pre-centering spindle.

Fig. 2 is an exploded perspective view of the upper two adjustable work receiving plates, and the main supporting plate which is normally secured to the upper end of the elevating ram.

Fig. 3 is a plan view of half of the machine showing the connecting rod swung to position for boring.

Fig. 4 is a vertical view of the main elements of Fig. 3 with the connecting rod shown in section to reveal its large end squared up in fixed relation to the upper work plate, and small end over the boring bar, with the latter set over for boring an elliptical hole.

Fig. 5 is a plan view similar to that of Fig. 3 but showing the other half of the machine with a piston fixture on its ram, and with the piston dotted in position.

Fig. 6 is an elevation of a portion of the machine showing the boring bar with its cutting tool set to proper boring diameter directly by gage contact with the actual pin or shaft to be fitted to the bore to be made by the cutter.

Fig. 7 is a vertical section of the machine taken through one of the work elevating rams with a piston secured to its work receiving plate after being bored and with the boring tool axis set over for boring a slight elliptical hole, also showing the air clamping of the work plates to the work carrying ram, and also the hydraulic control of the gravity feed descent of the work past the cutting tool.

Fig. 7A is an extended diagram from Fig. 7 showing one of the ram three way air valve connections from a source of compressed air.

Fig. 8 is an end view of the upper portion of Fig. 7 as seen from the line 8—8.

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Fig. 9 is an elevation of a portion of the machine showing an engine piston secured on its elevating ram with its wrist pin bore holes centered on its pre-centering spindle.

Fig. 10 is an elevation of a portion of the machine showing an engine connecting rod secured on its elevating ram with its wrist pin bore hole centered on its pre-centering spindle.

Fig. 11 is an enlarged plan view of the boring head of the machine whereby extremely fine micrometric adjustment of the final size of the bored hole may be secured.

Fig. 12 is a cross section of Fig. 11 as seen from the line 12—12 thereof.

Fig. 13 is a similar cross section to that of Fig. 12 but showing the boring bar and upper part of the boring spindle in place, and with the transverse split or kerf in the head opened up by the adjusting screw to normal vertical position of the boring bar, as for boring round holes.

In further detail and with respect to Fig. 1 the drawings show the machine to comprise a pedestal or base 1 of a height adapted for the average operative to work over, while projecting above the top of the pedestal is one or more vertical rams 2, working in fixed cylinders 3 carried by the pedestal, and securely fitted to the upper end of the ram is a base plate 4 upon which is adjustably mounted work supporting fixtures, generally comprising an intermediate plate 5 and an upper plate 6, to which the work is secured, though for special work special fixtures may be substituted and/or added.

The upwardly extending boring bar is shown at 7 with its laterally extending and adjustable cutting tool 8, while the upwardly extending pre-centering gage device for one ram is indicated at 9 and the other at 10, the first in engagement within the bore of the small end 11 of an engine connecting rod 12 carried on ram 2, and the latter provided with confronting tapered sleeves 13 for centering the opposite hub bores of an engine piston not shown in this figure, but which attaches to a special holding fixture 14 mounted on ram 2' as will later be more fully described.

The rams within cylinders 3 and 3' are each spaced from the center line of its pre-centering gage 11 and 10 exactly the same distance, and also to the center of the boring bar 7 so that after first pre-centering the work with its gage and firmly securing the work in place, the work may be elevated with its ram away from the gage and then swung laterally about the vertical axis of the ram and lowered directly over the boring tool and bored under slow descending hydraulic feed control, to be described.

While still considering Fig. 1 the manual controls may be described, thus 15 and 15' are air pressure valve levers for quickly raising and lowering the rams 2 and 2' respectively as the levers are moved up or down. 16 and 16' are to operate air pressure clamping of the adjustable work carrying plates 5 and 6 to ram base plate 4 to hold the work rigidly in adjusted pre-centered position with the ram. 17 is a hand lever for directly operating centering head within the bore of connecting rod end 11 (shown in detail in Fig. 10). 17' raises and lowers the centering spindle for the piston bores. 18 is a switch to start the motor (not shown) for running the boring bar. 19 is the bleeder valve control for the hydraulic feed for the boring cut, best shown in Fig. 7. 20 is the vertical guides for pin 21 of each ram (see Fig. 7) to prevent ram from turning during its descent while the

boring tool is cutting, and also while in pre-centering position.

The driving motor and source of air pressure are omitted herein as being fully understood by anyone skilled in the art to which this machine tool pertains, and but one of the three way ram elevating valves X is shown diagrammatically in Fig. 7A extending from the lower part of Fig. 7.

The bases for the pre-centering gages are designated 22, 22' and bolted to the top of the pedestal 1 by loosely fitting bolts 23 for adjusting to precise position before final tightening.

In Fig. 7 the operative relation and construction of one of the air controlled work carrying rams, also the boring-bar mounting, and the hydraulic feed control for the ram is shown, all in operative relation, as after just finishing the boring of the wrist pin bearings of an engine piston. In this figure the parts numbered as already given herein will be recognized, and it will be seen that the ram 2 is closed on the lower end by a plug 2'', and the cylinder closed by a cap 24 spacedly surrounding the ram and through which cap and plug a control rod 25 slidably passes, and spacedly surrounding the lower portion of the rod is a tube 26 screwed tightly into said plug and at its lower end is welded to a disk 27 which is recessed at 28 on its under side and covered with a flexible diaphragm 29 secured by a marginal ring 30 held by screws 30'. A diaphragm backing plate 31 is provided at the under side of the diaphragm and through which the reduced threaded end 32 of the rod 25 passes and is secured by a nut 33 clamping the diaphragm against a washer 34 bearing against the shoulder of the rod where reduced in diameter. The extreme lower end of tube 26 is slightly recessed and provided with a cup-leather 35 to seal the diaphragm recess 28 from the space 36 between the rod 25 and the tube 26. An air passage 37 extends from the recess 28 through the side of rod 25 and through its threaded extension to an air hose 38 which leads to a three way air valve (not shown) operated by hand lever 16 to admit air under pressure to said recess to expand the diaphragm and pull rod 25 downward to clamp the work plates 4 and 5 tightly together, and by opposite movement of the lever to break the air pressure and release the plates.

To so clamp the plates, the upper end of rod 25 is provided with a hub 39 extending upwardly from which are several cap-screws 40 which pass freely through ram base plate 4 with their heads 41 engaging plate 5. The screws are spaced loose in plate 4 to permit adjusting movement of that end of plate 5 above it.

To raise and lower the ram together with the work secured to the work plates for swinging the work around from pre-centering to boring position, and back, air under pressure is admitted from a hose or pipe 42 through a fitting 43 to the space 44 within the cap 24 to force the ram upward together with its locking diaphragm, and upon breaking the pressure the ram will fall by gravity, all under control of a conventional three-way air valve X indicated in Fig. 7A controlled by hand lever 15.

When the ram is raised the work is lifted with it to a position above the pre-centering device and the boring tool so that it may be swung about the vertical axis of the ram and lowered over the boring bar, but when in the latter position a guide pin 21 extending downwardly from the ram base plate 4 will be in position to prevent it from turning and enter an opening 46 between two vertical blocks 20 to strike the upper end 47 of a vertically movable plunger rod 48 of an oil filled cylinder 49 before the work can reach the boring cutter, and thereafter can only descend during the boring operation at a speed depending on the oil displaced by the plunger as permitted by the adjustment of an oil by pass bleeder valve 50 operated by a manual indicator device 19 on the outer side of the pedestal.

Oil plunger 48 is automatically raised by a coiled spring 51 upon air lifting and swinging the ram away from boring position and consequent removal of pin 21 from the upper end of the plunger rod. As the plunger rod then rises again it lifts a floating valve block 52 engaged by its lower end within the cylinder 49 and automatically opens a through passage dotted at 53 which cuts out the by-pass 54 route of the oil 55 through the bleeder or control valve 50, and when the plunger rod is up and next pushed downward again it first closes passage 53 in the block 52 and then pushes the block ahead of it the rest of the way down.

The boring bar 7 is mounted on the upper end of a relatively long spindle 56 through the intermediary of a boring head member 57, and the spindle provided with ball bearing 58, 59 at opposite ends in a preferably cylindrical casing 60 and with a belt pulley 61 at the lower projecting end of the spindle for driving from a suitable motor not shown, or the motor may be direct connected to the spindle if desired, as well understood in the art, though as a carboloy boring tool is preferred its speed should be about 3000 R. P. M.

Normally casing 60 and the contained spindle are vertically disposed parallel with the work ram 2, but may optionally be set over at a slight angle as shown to bore slightly elliptical bearing holes as and for the purpose hereinbefore stated, and is so shown in Fig. 7. This may be accomplished by mounting the casing through openings in two spaced brackets 62 and 63, with the openings slightly elongated toward the right in Fig. 7, the opening of the lower bracket 63 being the longest, and providing means to lock the casing 60 when pushed back solid against the left-hand ends of the openings to make the casing vertical (as shown by the dotted line position), or pull it out to the right-hand ends of the openings to the full line position and firmly lock it in either position.

It should be noted that in the position shown the boring spindle is rocked from a point where the axis of the boring bar intersects a horizontal line from the cutting edge of the tool, indicated at Ct on the drawing. This results in the bored bearings such as those of the engine piston 64, shown in the drawing, being very slightly less longitudinally of the piston than transversely. The locking of the spindle casing in either position may be effected in any way desired, but is here shown as by set screws 64 for in and out positions passing through the sides of the brackets with corresponding centering seats drilled in the outer wall of the casing 60. Also there is preferably a pin 65 projecting from the casing 60 just above the bracket to prevent the assemblage falling when the set screws are released.

The boring head 57 provides for micrometric adjustment of the bore diameter. The construction of this head is best shown in Figs. 11, 12 and 13 wherein it comprises a thick high grade solid steel disk 57 threaded below as at 66 to receive the threaded upper end of the spindle 56 and provided with an outer flange 67 to embrace the upper end of casing 60 and upper ball bearing 58, and is threaded on top to receive the lower threaded end of the boring bar 7, and horizontally split as by a saw kerf 68 at about a third of its thickness from the top down, with the kerf preferably terminating by a drilled hole 69 passing horizontally through the disk at about 1/4 of its diameter. After the disk is slotted it is heated and/or hammered to bend the upper portion down to substantially close the kerf at its outer edge as shown in Fig. 12 and is provided with a large round nose set screw 70 threaded through a hole in the upper section of the disk and bearing on the slotted surface of the lower section so as to force the kerf to open as in Fig. 13 when the set screw is turned, against its powerful tendency to close, and the head of the set screw is preferably provided with a wrench socket 71 for turning it, and also a pointer or indicator 72 passing adjacent spaced graduations 73

indicating minus or plus over the central or normal setting for boring of a size hole for which the cutting tool 8 had been set, all so that micrometric variations in the bore either way may be made with ease and precision. It should be noted that the hole 69 is at right angles to the extension of the cutting tool 8, and the adjusting screw 70 is diametrically in line with the tool at right angles to the hole 69 so that upon adjusting the screw the tool will move to enlarge or reduce the size of the bore very slightly.

In arranging the work on the machine, say an engine connecting rod 12 as in Fig. 1 the construction of the work receiving plates 4, 5 and 6 should be noted with respect to Figs. 1 and 2, also 7 and 8. The lower or base plate 4 as previously stated is firmly secured at one end to the ram as by cap screws 74 and the outer end is slotted as at 75 to receive from below a wedge block 76 with a stud 76' screwed into the plate 5 above and which passes through a round sleeve 77 turnable within the wedge block when the thumb nut 78 on the stud is slightly released all so that plate 5 may be moved longitudinally and/or slightly swung about the stud, and locked at any point in such movement and also by air locking rod 25' may be firmly locked to lower plate 4.

Plate 5 has V guides 79 along its upper edges to slidably receive the top plate 6 which may be secured at any point along plate 5 as by one or more set screws 80, and is provided with three threaded holes 81 nearer to its forward end to which the expanding centering elements for the large bearing end of the engine connecting rod 12 are secured to the plate and which comprise (see Figs. 1 and 4) a pair of round sleeves 83 and a round block 84 all held rigidly in place by cap screws indicated, and which block is provided with a transversely slidable pin 85 with a small screw 86 projecting from its rear end, and a large V notch 87 formed in its upper side impinging against one slanted edge of the notch by the lower tapered end of a hand screw 88, all so that after adjusting small screw 86 to a point just permitting the crank opening to go over the assemblage, a slight turn of the hand screw 88 will force pin 85 outward and take up all slack within the crank bearing and hold the rod in right angled extension to the axis of its large end bearing, and with the hub 11 of the small bearing end (to be bored or re-bored) positioned between the confronting chisel-shaped jaws 89, 90, the latter being threadedly adjustable in and out by means of a thumb knob 91 for tightly gripping the hub 11 from opposite sides. These jaws are preferably carried by a removable yoke member 92 secured to the forward part of plate 5 by screws 93.

The rod may, before or after this positioning, have been lowered over the small end centering device 9 and by suitably shifting it back and forth with plate 6 and before locking plate 6 and finally tightening screw 88, or plate 5, with its air lock, all so that the rod small end opening may be accurately positioned by its centering device 9 and then all parts locked so that when the finally positioned rod is raised clear of its centering device by its air ram and swung over to and lowered over the boring tool it will be in exact position for the cut.

The detail of the small end bearing centering device 9 is shown in Fig. 10 and wherein the base 22 of the device carries an upright thick tube 93 held by a set screw 94 within which tube is a freely slidable pin 95 with a tapering point 96 at its upper end and with its lower end supported on hand lever 17 for raising and lowering the pin, while spaced within the tube 93 adjacent the center of the rod bearing are three steel balls 97 mounted freely in corresponding holes equally spaced around the tube and which are equally pushed outward upon raising the pin 95 to center the bearing opening around the axis of the pin, and which axis is precisely the same distance from the vertical axis of the ram 2 as is the distance from the ram axis to the axis of the boring bar. The lever 17 will stay in adjusted position by means of a large fric-

tional pivotal mounting 98 or other suitable means. The openings for the balls are slightly peened to prevent balls falling out. After centering the rod as above described plate 6 is locked to plate 5 by set screws 45, hand screw 88 is set up tight, the ram air lock handle 16 is raised to lock plate 5 to the ram, then the ram and its centered work is raised to clear the centering device and is swung over the boring tool for the cut as described.

The same procedure is carried out for the boring out of the wrist pin bearings of a piston except that a special holding fixture to support the piston is used and a different pre-centering device shown in the right hand portion of Fig. 1 and in Fig. 9 and wherein the base 22' carries a vertically movable shaft 10 fitted with long tapering confronting sleeves or cones 13, 13' the latter being free and which cones fit into opposite hub bores of a piston 99 as shown in Fig. 9. The piston is held in place by a special fixture 100 secured to ram plate 5 and is provided with two spaced clamping bearing blocks 101 slidably supporting a horizontal tubular shaft 102, which may be clamped at any position in the blocks 101 by hand screws 103.

A disk 104 is secured to the inner end of shaft 102 and which disk has its outer face inwardly dished as at 105 against which is rockably seated another disk 106 having a complementally formed margin and normally held thereagainst by a coiled tension spring 107 within the tubular shaft secured at one end to a stud 108 projecting from the disk 106 and at the remote end to the outer end of the shaft as by a cross pin 109 or otherwise.

The piston 99 to be clamped in position is seated at its open end against the rockable disk 106 and pulled loosely thereagainst by a yoke clamp comprising a pair of links 110 pivoted at one end at 111 to opposite edges of disk 104 and at their opposite ends to a cross bar 112 provided with a screw 113, all so that the yoke may be swung over the piston and forced against the rockable disk as shown in Figs. 5, 7 and 9, the various clamping screws 84, 88, 113 of course not being finally fully tightened until the piston bores are centered over the cones 113 of pre-centering device 10, and then the movable work carrying plates, clamped to the ram by its air lock rod 25 by means of its valve lever 16', before raising the ram to swing the piston over the boring tool and lower it thereover to the bored position shown in Fig. 7. It should be noted that plate 104 and 106 may also have any number of holes 114, threaded or plain, for securing work thereto. Also that various other fixtures may be used to meet the securing or holding requirements of some work.

A feature of great importance is the setting of the cutting edge of the boring tool to the exact size of the wrist pin or shaft by directly transferring or taking it directly from the pin itself without measuring or the use of calipers or a micrometer. This is shown generally at 115 in Fig. 6 in side elevation with a new pin and cutting tool in gaging position, also indicated in plan at 115 in Figs. 3 and 5. The device cooperates directly with the cutting tool 8 on top of the boring bar 7 and comprises a standard 116 secured to the top of pedestal 1 spaced from the boring bar and formed with a slot 117 extending radially from the boring bar axis and in which slot is a slidable plate 118 which may be slid toward and away from the cutting edge of the boring tool 8 and clamped at any point of sliding by a swing-over clamp screw 119 carried on a yoke 120 pivoted at 121 to the standard 116.

The standard is provided with a V notch 122 extending downward from its upper end and at right angles to a radial line from the boring axis, and the slidable plate 118 is provided with a gap 123 extending upwardly through its lower edge to provide a space to straddle a shaft or wrist pin 124 laid in the notch, all so that one vertical edge 123' of the gap may be moved into contact with said shaft. The distance A from the shaft contacting edge 123' of the gap measured to the end of the plate

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(or any fixed extension thereof such as the screw 125) is precisely the same as the fixed distance B from the center line of the V notch to the axis around which the boring tool revolves, and while the plate 118 could be made exactly the right length the extension screw 125 with flat hardened end is provided and locked by a set screw 126 to more easily secure the correct length.

In using the gaging device the tool 8 is released on its bar 7, the pin or shaft for which the piston or crank is to be bored is placed in the V notch and the plate 118 moved forward to contact its edge 123' with the shaft and the plate locked with yoke screw 119, then the boring tool 8 is pushed toward screw 125 until the extreme cutting tip touches the hardened end of the screw and then locked to the boring bar. The hole bored by the tool will then be precisely the diameter of the pin or shaft 124, regardless of what size it is, or the screw 125 may be set for any desired over or undersize, or this may be taken care of by the boring head screw 70.

As the general operation of the machine and the specific operation of each part has been explained along with the description of the part, a clear understanding of the invention is thought given to any one skilled in the art, though it should be noted that many changes in the details of construction may be made within the scope of the invention and as may fall within the appended claims.

We claim:

1. In a boring machine of the character described, the combination of a supporting pedestal, a boring spindle extending upwardly above the pedestal with a boring tool extending laterally from adjacent its upper end, bearing means carried by said pedestal supporting said spindle for rotation, and power means for rotating the spindle, an upwardly extending elevating and lowering work carrying ram spaced from said boring spindle, means mounting said ram for vertical movement and rotary movement about its vertical axis, adjustable work securing means carried by the upper end of said ram, a pre-centering device extending upwardly from said pedestal over which the work to be bored is adapted to be centered for boring and the work then rigidly secured to said ram, so that the ram with the adjusted work may be swung on its vertical axis and the work lowered over the boring tool, means locking the ram against further turning, and means for lowering the ram under feed control past the rotating boring tool for boring the work where pre-centered, said ram being raisable again to lift the bored work clear of the boring spindle and swinging away therefrom.

2. In a boring machine as set out in claim 1, the distance from the center of said pre-centering device to the vertical axis of said ram being exactly equal to the distance from the center of rotation of the boring tool to said axis.

3. In a boring machine as set out in claim 1, there being two such rams and such a pre-centering device for each ram, the axis of rotation of each ram from the axis of its pre-centering device being exactly the same distance from the center of rotation of the boring tool to the axis of the ram.

4. In a boring machine as set out in claim 1 said pre-centering device comprising a retractable spindle and means for operating the spindle, and bore centering means carried by said spindle.

5. In a boring machine as set out in claim 1 said ram mounted in an air cylinder, and valve means provided for admitting and exhausting air under pressure to and from said cylinder to operate the ram.

6. In a boring machine as set out in claim 1 said ram mounted in an air cylinder, and valve means provided for admitting and exhausting air under pressure to and from said cylinder to operate the ram comprising a handle at the exterior of the pedestal movable upward for upward movement of the ram and vice versa.

7. In a boring machine as set out in claim 1 said ram mounted in an air cylinder, and valve means provided

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for admitting and exhausting air under pressure to and from said cylinder to operate the ram, and the feed control comprising a hydraulic piston with adjustable bleeder valve controlling the downward feed movement of the ram during the boring operation.

8. In a boring machine as set out in claim 1 said ram mounted in an air cylinder, and valve means provided for admitting and exhausting air under pressure to and from said cylinder to operate the ram, and the feed control comprising a hydraulic piston with adjustable bleeder valve controlling the downward feed movement of the ram during the boring operation, operative only when the ram is turned to place the work into boring position.

9. In a boring machine as set out in claim 1 said work-securing means at the upper end of the ram being movable with the work secured therein for pre-centering its part to be bored over the pre-centering device, and means for thereafter fastening the work rigidly to the ram before removing it from said pre-centering device.

10. In a boring machine as set out in claim 1 said work-securing means at the upper end of the ram being movable with the work secured therein for pre-centering its part to be bored over the pre-centering device, and means for thereafter fastening the work rigidly to the ram before removing it from said pre-centering device, said means including a main base plate permanently secured to the ram, and a second plate universally movable on the base plate, and means securing the second plate to the base plate.

11. In a boring machine as set out in claim 1 said work-securing means at the upper end of the ram being movable with the work secured therein for pre-centering its part to be bored over the pre-centering device, and means for thereafter fastening the work rigidly to the ram before removing it from said pre-centering device, said means including a main base plate permanently secured to the ram, and a second plate universally movable on the base plate, a third plate movably guided on the second plate with means for securing the two plates together.

12. In a boring machine as set out in claim 1 said work-securing means at the upper end of the ram being movable with the work secured therein for pre-centering its part to be bored over the pre-centering device, and means for thereafter fastening the work rigidly to the ram before removing it from said pre-centering device, said means including a main base plate permanently secured to the ram, and a second plate universally movable on the base plate, and means securing the second plate to the base plate, comprising fluid pressure means arranged for drawing the second plate into tight contact with said base plate controlled by a remote control valve accessible on the machine.

13. In a boring machine as set out in claim 1 means for optionally tilting the normally vertical axis of the boring spindle from a point substantially coincident with the center and plane of rotation of the cutting tool, to thereby bore a slightly elliptical hole, and means for locking the boring spindle in tilted and in normal position.

14. In a boring machine provided with a boring bar with a boring tool extending transversely thereof, a metal block to one side of which the base of said bar is secured, a drive spindle secured to the opposite side of said block in normal alignment with said boring bar, said block being split part way through between the secured ends of the bar and spindle so that the sides of the block may be warped out of alignment to thereby slightly tilt the axis of the bar with respect to the spindle in direction to move the cutting edge of the tool slightly toward plus or minus diameter boring, and screw means for controlling such warping.

15. In a boring machine provided with a boring bar with a boring tool extending transversely thereof, a metal block to one side of which the base of said bar is secured,

a drive spindle secured to the opposite side of said block in normal alignment with said boring bar, said block being of two relatively close spaced sections extending across the boring axis and with the spindle and boring bar extending respectively from opposite sides, means 5 connecting the sections of the block at one edge to permit the opposite edges to be moved slightly from and toward one another for slightly misaligning the boring bar to thereby move the boring tool toward plus or minus diameter boring, and means for so moving and 10 locking the sections of the block.

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