June 18, 1940. C. A. JOHNSON 2,204,860

BORING DEVICE

Filed July 17, 1937 4 Sheets-Sheet 1

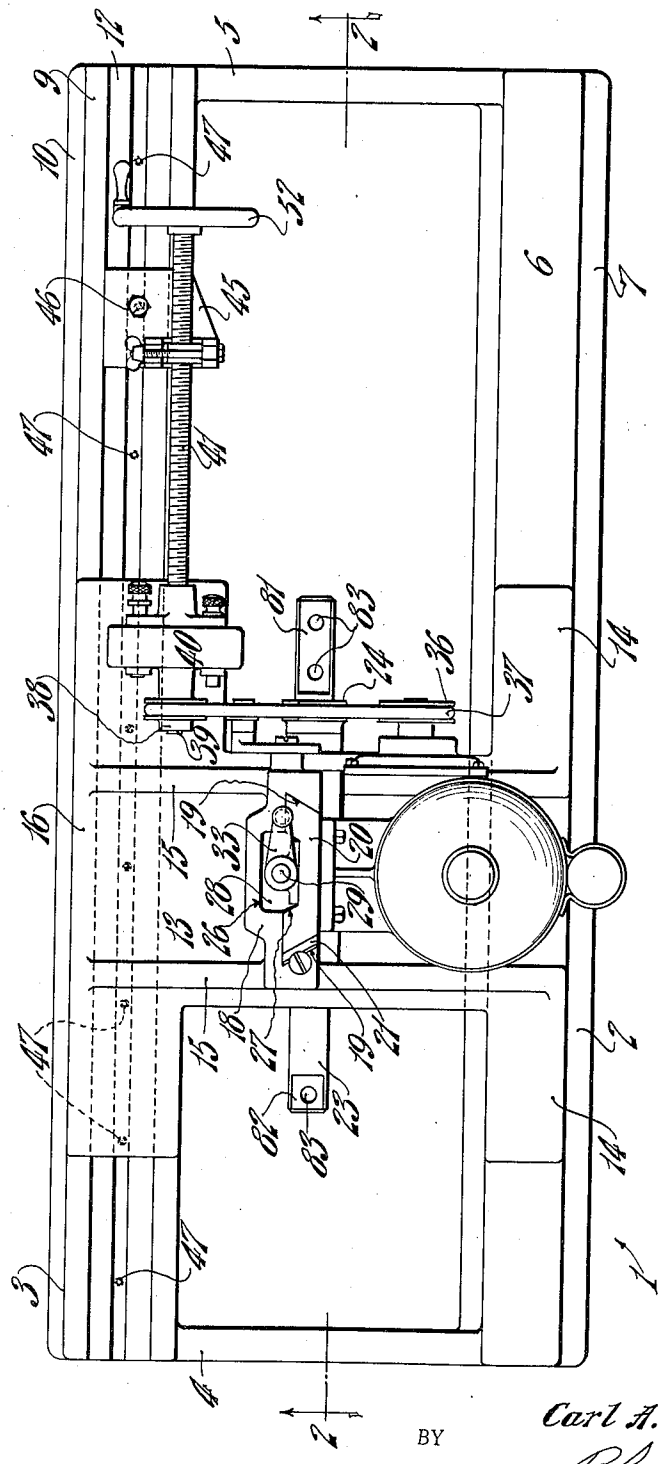


Fig. 1.

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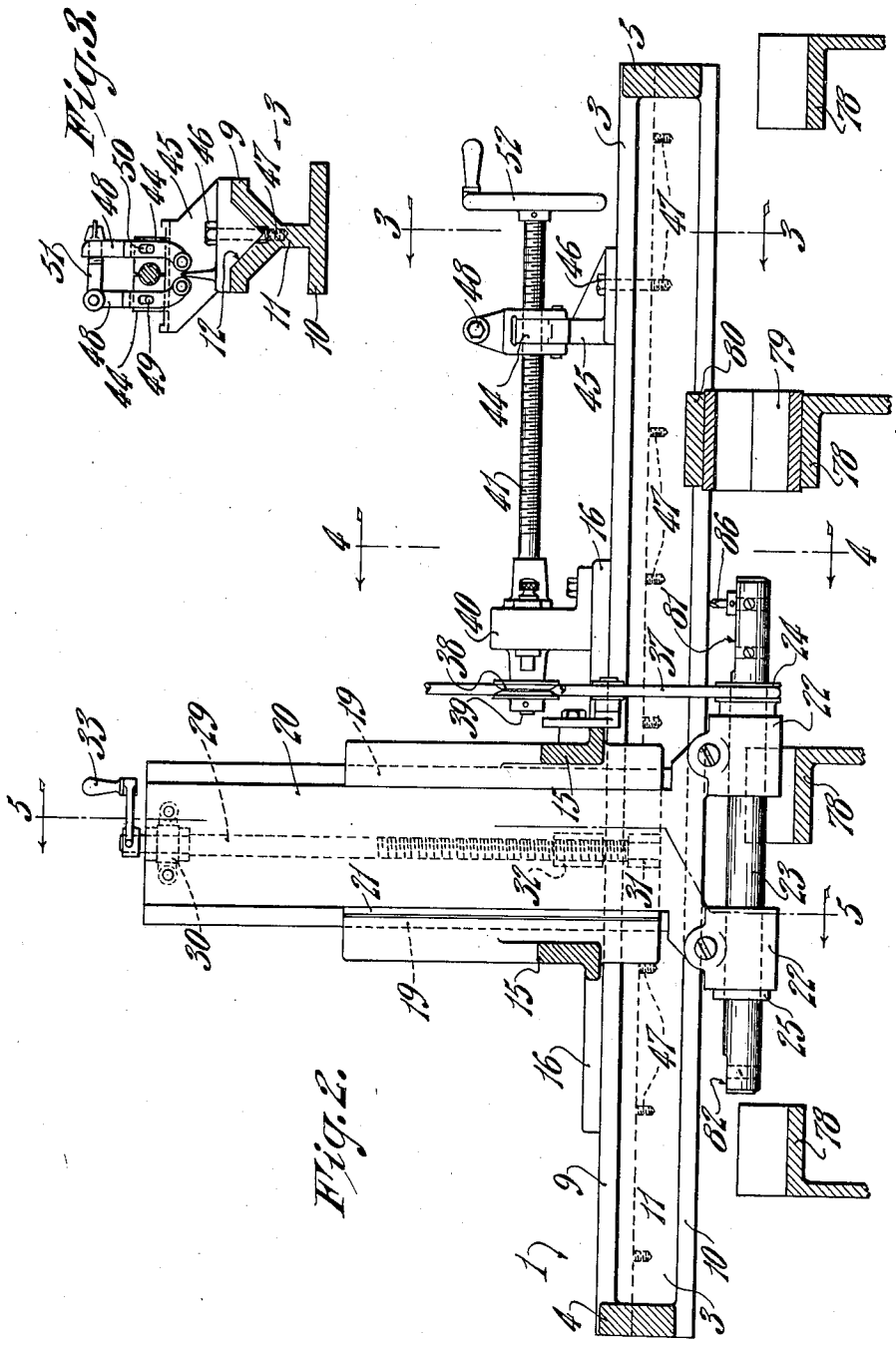


Fig. 2.

Fig. 3.

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BORING DEVICE

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Fig. 4.

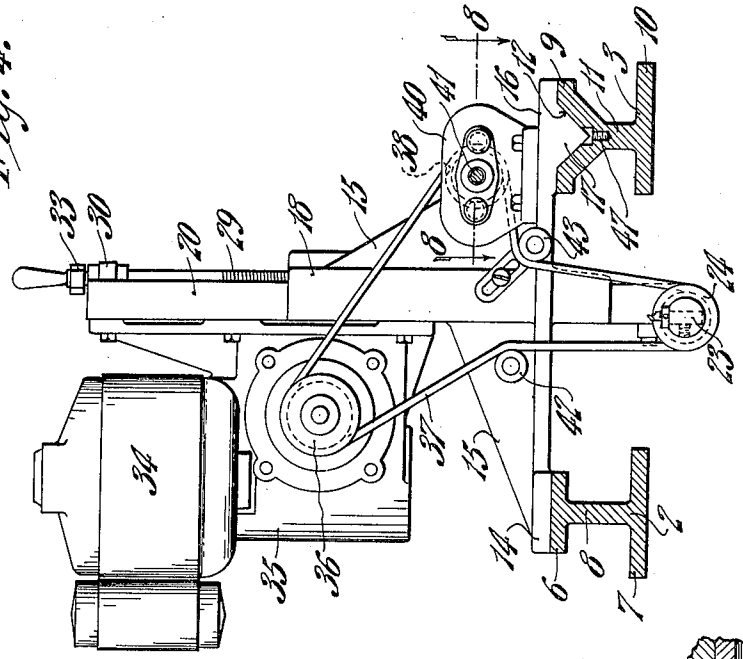


Fig. 7.

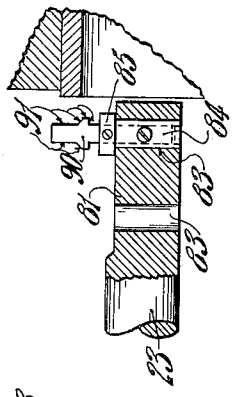


Fig. 5.

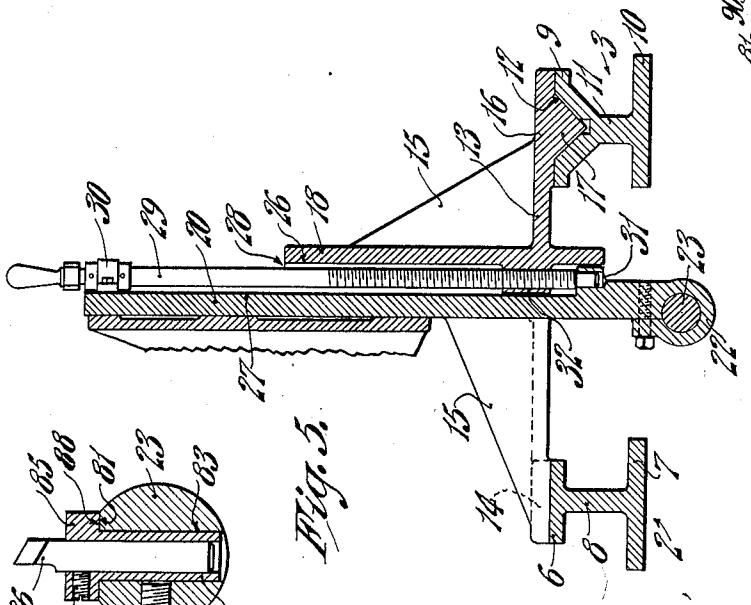


Fig. 6.

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BORING DEVICE

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Fig. 8.

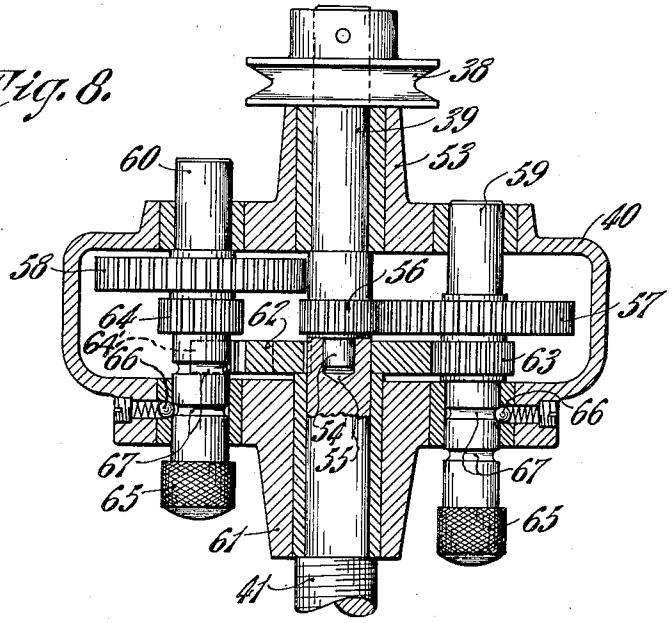


Fig. 9.

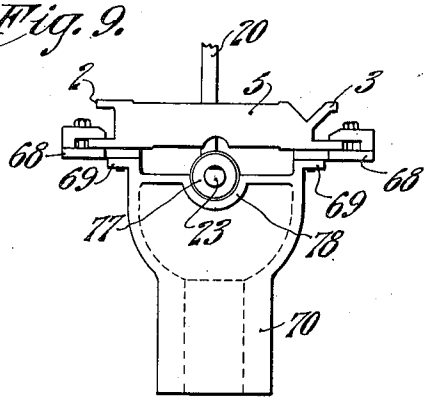


Fig. 10.

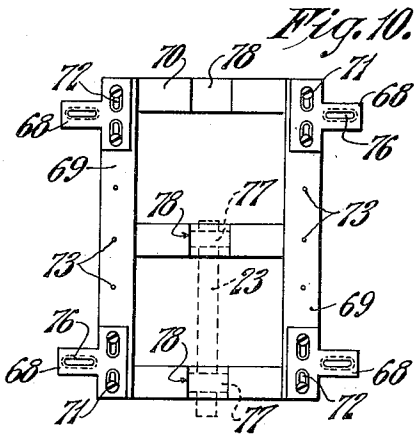


Fig. 11.

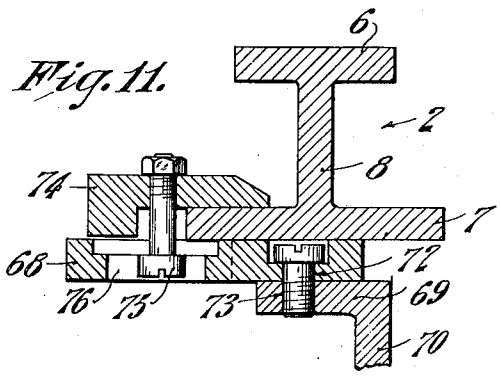
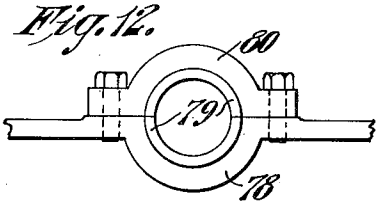


Fig. 12.



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UNITED STATES PATENT OFFICE

2,204,860

BORING DEVICE

Carl A. Johnson, Springfield, Mass.

Application July 17, 1937, Serial No. 154,288

3 Claims. (Cl. 77—2)

This invention relates to improvements in boring devices, and is particularly pertinent to the type of boring device used in the boring and reaming, or reboring and reaming, of the main bearings in the block of an internal combustion engine.

An object of this invention is to provide a boring device which is adapted to utilize an inverted engine block as a base or bed, in combination with means for properly centering, supporting, and securing the device on any of the standard engine blocks manufactured, which vary widely in width, length, and position and number of bearings. In the manufacture of engine blocks for internal combustion engines, it is customary to determine the axis of the bearings from the plane of the flanges of the block. It is, therefore, an object of this invention to utilize these same flanges as a foundation for the support of the boring device, thereby maintaining the original relation between the axis of the rebored bearings and the flanges of the block.

A second object of this invention is to provide a boring device having a boring spindle, a feed screw, and an integral electric drive for the spindle and screw, means for reversing the rotation of the feed screw, a support for these elements, a frame on which the support is slidably supported and guided, and from which the support may at any time be lifted and removed, and means for aligning and removably securing the frame on the flanges of the block of an internal combustion engine.

A third object of this invention is to provide, in a boring device of the character described, a boring spindle, means for accurately positioning and securing a cutting or reaming tool in either end of the spindle, and means for feeding the spindle in either direction, whereby either end of the spindle may be utilized, and the center of gravity of the boring device may be maintained while in operation well within the ends of the supporting engine block.

A further object of this invention is to provide a boring device of the character described which is compact, lightweight, easy to handle and operate, economical of manufacture and use, capable of extremely accurate work, and which may be quickly and easily positioned and aligned.

These, and other objects and advantages of this invention will be more completely and clearly described and disclosed in the following specification, the accompanying drawings, and the appended claims.

A preferred embodiment of this invention is illustrated in the accompanying drawings, in which—

Fig. 1 is a plan view of the assembled boring device.

Fig. 2 is a longitudinal sectional view, taken on the line 2—2 of Fig. 1, with the motor and gear reduction unit removed.

Fig. 3 is an end view, partially in section, of the split nut anchorage for the feed screw.

Fig. 4 is a cross sectional view, taken on the line 4—4 of Fig. 2.

Fig. 5 is a cross sectional view, taken on the line 5—5 of Fig. 2.

Fig. 6 is a cross sectional view of the spindle illustrating the means for positioning and securing a tool therein.

Fig. 7 is a partial longitudinal sectional view of the spindle illustrating another form of tool.

Fig. 8 is a detail plan sectional view, taken on the line 8—8 of Fig. 4, showing the reversing mechanism for the feed screw.

Fig. 9 is an end view of an inverted engine block with the boring frame in place thereon.

Fig. 10 is a diagrammatic plan view of an inverted engine block, showing the connecting bars in place.

Fig. 11 is a detail sectional view, illustrating the means for securing the boring frame on the engine block, and

Fig. 12 is a diagrammatic end view of a typical main bearing, more or less standard in main bearings of internal combustion engines.

Referring now to the drawings in detail, in which like numerals refer to like parts throughout:

A main supporting and guiding frame 1 is formed with oppositely disposed and parallel rails 2 and 3, connected at each end by integral transverse bar or bridge portions 4 and 5. The rail 2 is formed with parallel top and bottom flanges 6 and 7 connected by a web 8, and the rail 3 is formed with top and bottom flanges 9 and 10 and a web 11, with a V way 12 cut into the top flange 9 and web 11, as shown. A table 13 is provided with foot pads 14 which are slidably supported on the flange 6 and connected by means of arm portions 15 to a pad portion 16 slidably supported on the flange 9. The pad portion 16 is provided on its underside with a V-shaped ridge portion 17 which is fitted to and slidably guided in the way 12. Thus, the portion 17 and way 12 co-operate to maintain the table 13 in true alignment with the frame 1. The table 13 is slidably supported and guided on the table 1, but is not secured to the table 1, and may be lifted off of the table 1 and replaced thereon at will. The table 13 is also provided with a vertical wall portion 18 formed with guide ways 19, in which is slidably guided for vertical movement a plate 20. An adjustable shim 21 provides means for accurately aligning the plate 20 in the ways 19, in the usual manner. The plate 20 is formed with adjustable bearings 22, in which is rotatably supported a shaft or spindle 23, and the spindle 23 is restrained from longitudinal movement relative to the bearings 22

by co-operation of a pulley 24 and collar 25. Co-operation of a recess 26 formed in the face of the portion 18 with a recess 27 formed in the back of the plate 20 provides a vertical opening 28 in which is located an adjusting screw 29 for vertically and adjustably positioning the spindle 23, relative to the table 13 and frame 1. The screw 29 is supported on the plate 20 by co-operation of a bracket 30 secured on the plate 20 and a socket 31 formed in the plate 20, and the screw 29 is threadably engaged in a boss 32 on the table 13, as indicated most clearly in Fig. 5. Revolution of the screw 29 will move the plate 20 and spindle 23 vertically, relative to the table 13 and frame 1. A crank 33, secured to the top of the screw 29, provides convenient operating means for the screw 29.

An electric drive unit, including a motor 34 and gear reduction unit 35, is secured on the plate 20, and the unit 35 is operably connected to the spindle 23 by means of pulleys 24 and 36 and belt 37. The unit 35 is also operably connected by the belt 37 and a pulley 38 to a shaft 39 rotatably supported in a gear box 40 secured on the portion 16 of the table 13, and the shaft 39 is operably connected through a reversible gear system in the gear box 40 to a feed screw 41. Thus, the unit 35, spindle 23, and feed screw 41 are operably connected by the belt 37 and pulleys 24, 36, and 38. The belt 37, between the pulley 24 and the pulley 36, passes over a guide roller 42, and an adjustable guide roller 43 is slidably supported on the table 13, as indicated in Fig. 4, and provides means for adjusting the length of the belt 37 to compensate for relative movement of the plate 29, unit 35, and spindle 23, relative to the shaft 41. This relative movement is caused by vertical movement of the plate 20 to position the axis of the spindle 23 on the axis of the bearing to be bored.

The feed screw 41 is normally anchored to the rail 3 on the frame 1 by a split nut 44, the halves of which are slidably supported in a bracket 45 which is secured in the way 12 by a screw 46 engaged in one of a series of spaced tapped holes 47 in the web 11 of the rail 3. Thus, the bracket 45 may be conveniently secured in any one of a plurality of spaced positions on the rail 3. Clevises 48, pivotally supported on the bracket 45 and connected to the halves of the split nut 44 by engagement of studs 49 in slots 50, are normally secured together to hold the split nut 44 in engagement with the feed screw 41 by a pivoted bolt 51. (See Fig. 3.) By releasing the bolt 51, the halves of the split nut may be spread apart, and the feed screw 41 released therefrom. With the feed screw 41 released from its anchorage, the table 13, completely assembled and including the feed screw 41, may be lifted off and removed from the frame 1. A handwheel 52 is secured on the end of the feed screw 41 and provides means for manual operation of the device, if desired. Also, the device may be operated with the spindle 23 motor driven and the feed screw 41 manually operated, by using a shorter belt connecting the pulleys 24 and 36 and the rolls 42 and 43, but omitting the pulley 38.

The pulleys 24, 36, and 38 are all secured on their respective shafts between the bearings and the free ends of the shafts, and may be readily removed and replaced by other pulleys of different diameter. Thus, the speed of rotation of the spindle 23 and feed screw 41, relative to the unit 35 and to each other, may be varied at will.

The reverse gear system operably connecting the shaft 39 and feed screw 41 is best illustrated in Fig. 8. The shaft 39 is rotatably supported in a hub 53 on the gear box 40, and the end 54 of the shaft 39 is rotatably supported in a socket 55, formed in the end of the screw 41. A pinion 56 is formed, or secured, on the shaft 39, and may be operably connected to either one of gears 57 and 58, secured on shafts 59 and 60, respectively. The screw 41 is rotatably supported in a hub 61 on the gear box 40, and a gear 62 is secured on the end of the screw 41, as shown. A pinion 63, formed or secured on the shaft 59, may be operably connected with the gear 62 on the screw 41. A pinion 64, on the shaft 60, may be operably connected with the gear 62 through an idler gear 64'. Thus, when the pinion 56 is connected to the gear 57, the pinion 63 will be connected to the gear 62, and the screw 41 will be rotated in one direction, and when the pinion 56 is connected to the gear 58, the pinion 64 will be connected to the gear 62 through the idler 64', and the screw 41 will be rotated in the opposite direction. The shafts 59 and 60 are slidably and rotatably supported in the gear box 40, and are provided with knurled heads 65 for manual operation. The shafts 59 and 60 are latched in proper position by engagement of a spring-actuated ball 66 with one or the other of two positioning grooves 67 formed in the shafts, as indicated.

Means are provided for removably securing the frame 1 on the flanges of the block of an internal combustion engine, with the spindle 23 properly located on the axis of the motor bearings, and Figs. 9, 10, and 11 are illustrative of such means. T-shaped plate members 68 are secured on the flanges 69 of an engine block 70 by engagement of screws 71 located in counterbored slots 72 in the plates 68 in tapped holes 73 in the flanges 69. Use is made of the tapped holes 73 which are provided in the flanges 69 of the block 70 for securing the crank case on the block. The frame 1 is then placed on the plates 68 with the rails 2 and 3 resting on the plates, and clamps 74 are placed in position, as shown in Fig. 11, and lightly secured to the plates 68 by means of bolts 75 engaged in counterbored slots 76 formed in the members 68. Gage collars 77 are provided, having a carefully fitted slip fit on the spindle 23, and are arranged in series to provide a gage collar having the same radius as the bearing case 78 for each make of car services. With the frame 1 lightly secured on the flanges 68, the table 13 is set on the frame 1, a gage collar 77 of the proper size is slipped onto the spindle 23, and the table 13 positioned to place the gage collar 77 over one of the bearing cages 78. Revolution of the adjusting screw 29 in the proper direction will lower the collar 77 into the cage 78, and lateral shifting of the table 1, co-operating with the downward movement of the spindle 23, will position the gage collar accurately in the bearing cage 78, thus positioning the axis of the spindle 23 on the axis of the bearings of the block. This positioning operation may be repeated at both ends of the block by moving the table 13 longitudinally on the frame 1, with the gage collar 77 placed on either end of the spindle 23, whichever is most convenient. With the axis of the spindle 23 thus accurately aligned with the axis of the block bearings, the screws 75 are tightened, firmly and securely clamping the frame 1 on the flanges 69 of the block 70 in cooperation with the plates 68.

With the spindle 23 thus accurately and securely located on the axis of the block bearings,

the device is ready for use. A bushing 79, to be bored or reamed, is placed in the bearing cage 78 and clamped in place with a standard bearing cap 80, as shown in Fig. 12. The spindle 23 is formed with flat surfaces 81 and 82 at opposite ends, and these surfaces are accurately machined to position them at identical distances from the axis of the spindle. The spindle 23 is also provided with bores 83 communicating with the surfaces 81 and 82. A sleeve member 84, formed with a collar portion 85, adjustably supports a tool 86, the tool 86 being secured in adjusted position by a setscrew 87. Having a predetermined diameter for the bushing 79, the tool 86 may be accurately set by gage or micrometer in the sleeve 84, relative to the face 88 of the shoulder 85, and when the sleeve 84 is secured in the bore 83 by a setscrew 89 with the face 88 superposed on either of the flat surfaces 81 or 82 of the spindle 23, the point of the tool 86 will be accurately located relative to the axis of the spindle 23 and bushing 79. With the tool 86 properly set, the table 13 is moved longitudinally until the spindle 23 is in proper juxtaposition to a bushing 79 to be bored or reamed, the split nut 44 engaged on the feed screw 41, the gears in the gear box 40 properly meshed for the desired feed, and operation of the motor 34 and gear unit 35 will revolve the spindle 23 and feed the revolving tool 86 through the bearing 79. After finishing one bushing, the bushing and cap are marked and removed, a bushing to be bored and reamed and a cap for the same installed on another of the cages 78, and the operation repeated, until all of the bushings have been finished.

The spindle 23 is equally adapted to receive other tools in addition to the boring or reaming tool 86, as illustrated in Fig. 7. As an example, a side trimming tool 90 may be secured in the spindle 23 in the same manner as the tool 86, and the tool 90 is provided with oppositely disposed cutting edges 91, which may be used for trimming, chamfering, or otherwise shaping the ends of the bushings 79. The tool 90 may be used at either end of the spindle 23, and as the tool 90 is double edged, it is adaptable for facing and finishing both ends of a bearing bushing.

It will be readily understood by those skilled in the art, in view of the above specification and Fig. 2 of the drawings, that with this device embodying the double ended spindle 23, boring of a multiple bearing engine block may be started at either end, in the center, or at any desired bearing, and completed without changing the setting of the spindle, table, or frame. Extreme accuracy and alignment are assured. In fact, this device is in production operation providing for standard maximum running fit of .002" for seven bearing crank shafts, and is capable of fits as low as .0005, when desired, or specified.

The bearings may all be finished with the center of gravity of the boring device always positioned well within the ends of the supporting engine block, and with a minimum of longitudinal movement of the table 13. For this reason, the frame 1 may be much shorter than frames required for boring devices operable from one end of the spindle only. The device is lightweight and easy to handle, as the table 13 may be lifted from the frame 1 and the two parts handled separately. The automatic screw feed provides for very smooth operation, extreme accuracy, and a very smooth finish for the bushing.

What I claim is:

1. A boring device for crank case bearings comprising a frame member, a table slidably supported on said frame member, cooperating rail elements on said frame and said table for guiding said table longitudinally on said frame, a plate slidably supported and guided in said table for vertical movement, a manually operable feed screw for vertical adjustment of said plate, a boring spindle rotatably supported on said plate, a second feed screw operably connected to said table for moving said table and said spindle longitudinally on said frame, means for adjustably anchoring said feed screw on said frame, means for releasing said anchoring means, whereby said table, plate, and spindle may be lifted from said frame, a motor supported on said vertically movable plate, a belt and pulley drive for driving said spindle and feed screw from said motor, means for adjusting said belt to compensate for movement of said plate relative to said feed screw, whereby said table, said plate, and said spindle are moved as a unit by said feed screw.

2. A boring device comprising a frame provided with parallel flanged rails, means for adjustably positioning and securing said frame on the flanges of an engine block, a table slidably supported and guided on said frame for longitudinal movement parallel to the axis of the bearing cases in said engine block, a rotatable spindle slidably supported and guided in said table for vertical movement, means for preventing longitudinal movement of said spindle relative to said table, means for adjustably controlling the vertical position of said spindle, gage means cooperating with said spindle for locating said spindle in said bearing cases with the axis of said spindle on the axis of said cases, means on said spindle for accurately positioning and securing a tool adjacent either end of said spindle, a feed screw operably connected to said table, a motor mounted on said frame, operable connecting means between the motor, the spindle, and the feed screw, said connecting means being capable of disconnection from said feed screw, whereby said feed screw may be manually operated.

3. A boring device for an engine block provided with substantially parallel flanges and a plurality of spaced and longitudinally aligned bearing cages comprising a frame member, a plurality of slotted plate members removably secured on said flanges in spaced relation, said frame member being provided with spaced parallel flanged rails supported on said plate members, clamping means adjustably securing said frame on said plate members, a table slidably supported and guided for longitudinal movement on said rails, a plate member slidably supported and guided for vertical movement on said table, a spindle rotatably supported on said plate member, means on each end of said spindle for securing a tool therein, means for preventing longitudinal movement of said spindle relative to said plate, gage means cooperating with said spindle for locating said spindle with its axis on the axis of said bearing cases, a motor secured on said plate member, a feed screw connected to said table, operable connecting means between said motor, said spindle, and said feed screw, means for reversing the rotation of said feed screw relative to said spindle.

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