

Jan. 21, 1930.

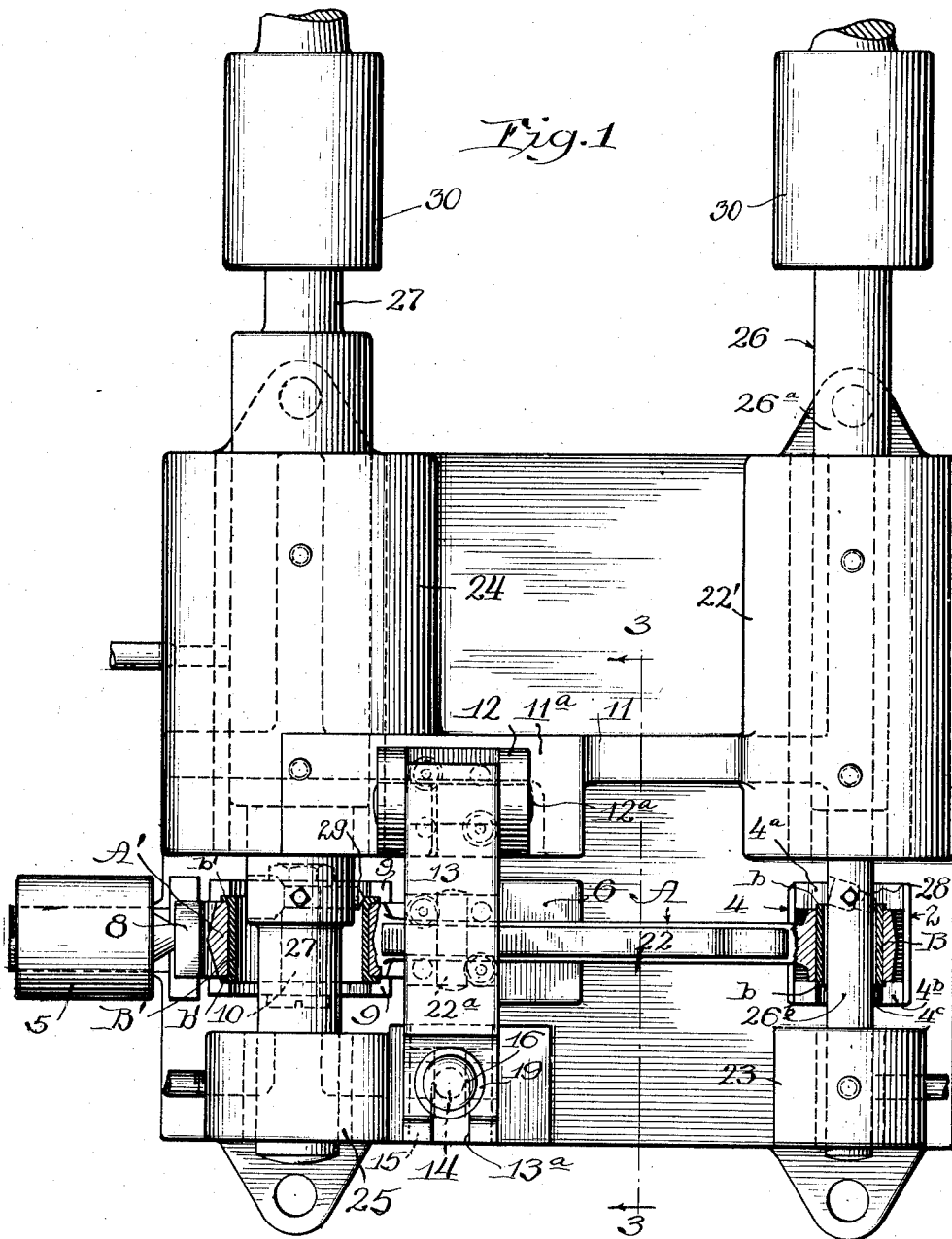
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1,744,095

BORING MACHINE

Filed Jan. 31, 1927

3 Sheets-Sheet 1



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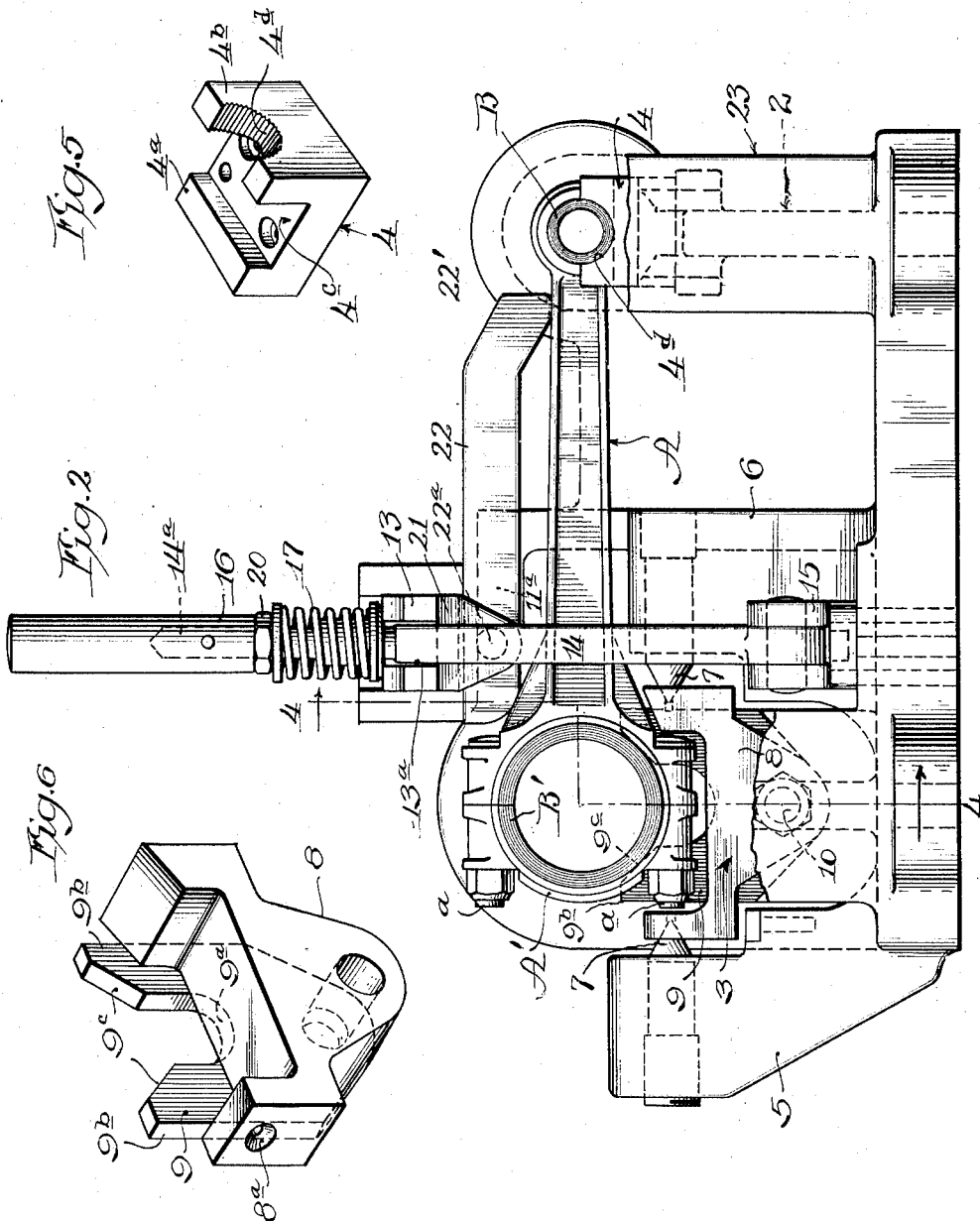
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3 Sheets-Sheet 3

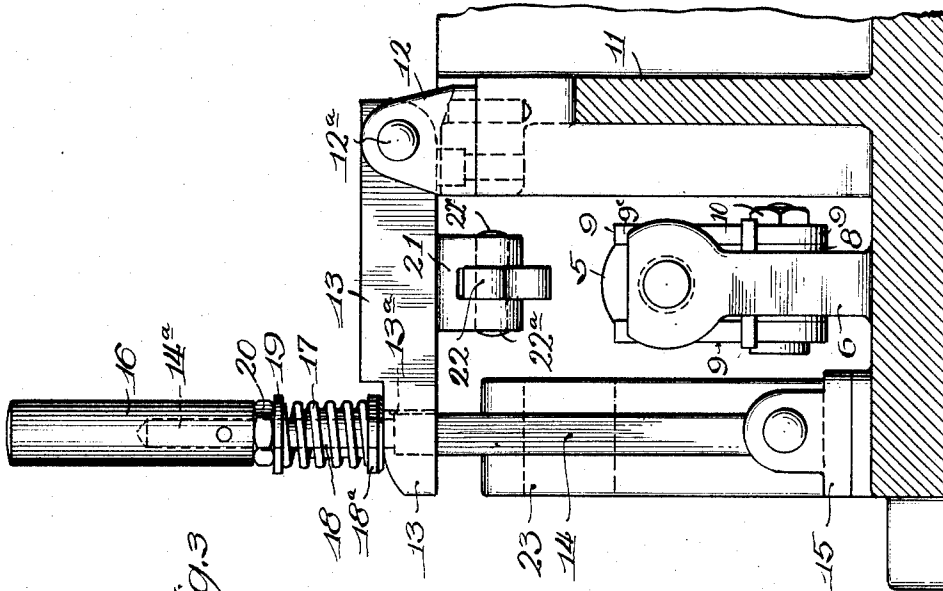


Fig. 3

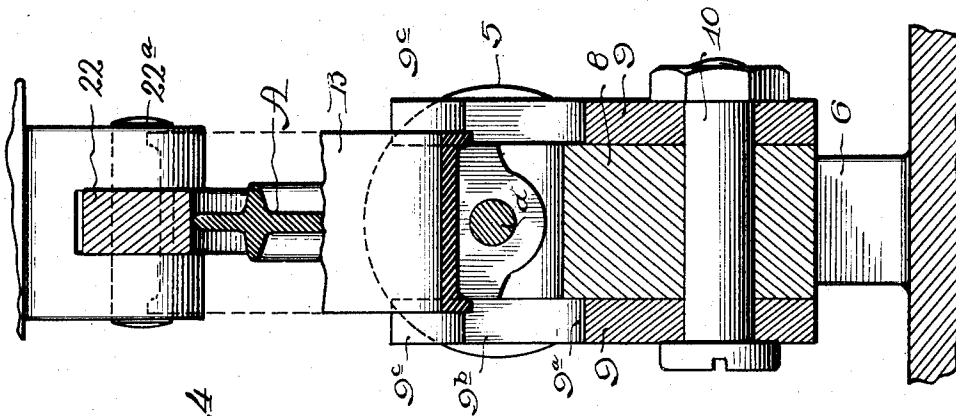


Fig. 4

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UNITED STATES PATENT OFFICE

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BORING MACHINE

Application filed January 31, 1927. Serial No. 164,686.

This invention relates to improvements in boring machines, and more particularly to a fixture to be used in conjunction with boring tools for holding or clamping the work in a fixed position during the operation of boring two or more parallel holes, either simultaneously or consecutively and with one setting.

The fixture herein disclosed is especially designed for boring the bearings at the opposite ends of connecting rods for internal combustion motors, although it may also be adapted for other boring operations where the same degree of accuracy and uniformity of result is desired.

As typical of all special appliances and machines devised to meet the demands for greater efficiency and increased production, the object of the present invention is to provide a fixture or support for connecting rods during the final and exacting operation of boring out the bearing bushings at the ends of the rods, the essential characteristics of such a fixture being its ability to hold the work in a fixed position, yet free from strains which would tend to distort the same during the boring operation, thus destroying the parallelism of the bores when the work is released. Moreover, such a fixture is essentially one which automatically compensates for any slight inaccuracies in the dimensions of the work, the operation of the tools, or the handling of the work by the operator.

A preferred construction for a fixture or device embodying the foregoing features, is disclosed in the accompanying drawings, in which

Figure 1 is a general top plan view of the fixture showing a connecting rod clamped therein preparatory to the boring operation.

Figure 2 is a view in side elevation of the fixture showing a connecting rod clamped therein.

Figure 3 is an end view of the fixture with the connecting rod removed, but the parts in clamping position.

Figure 4 is an enlarged view in vertical section taken on line 4—4 of Figure 2 and showing the cradle for the crank end of the rods.

Figure 5 is a perspective view of the supporting block for the piston end of the rod.

Figure 6 is a perspective view of the supporting block for the crankshaft end of the rod.

In general, the fixture comprises a base on which is mounted a fixed support or cradle for one end of a connecting rod and a floating or self-adjusting support or cradle for the opposite end. Also mounted on the base are guide bearings for the boring bars, there being two bearings for each bar, one on either side of the connecting rod supports. The pairs of guide bearings for the boring bars are manifestly accurately located so that their axes are parallel and at the predetermined distance between centers of the annular bearing surfaces to be bored.

The base of the fixture in the form of a cast metal plate 1 is adapted to be bolted down to the carriage of a boring machine, being utilized either as an attachment or as an integral part of a special boring machine. Rods A are supported at their ends indirectly through the bearing bushings B, B' at the piston, (small) and crank (large) ends respectively, and not directly at the ends of the rod itself, these bushings being sleeves of brass, Babbitt metal or other suitable bearing metal, which are assembled in the ends of the connecting rods, the bushing at the crank end being held in place by the end bearing cap A' and bolts a, in accordance with the usual practice.

It will be understood, therefore, that the bearing bushings are formed to approximately the final diameter of the bearing, and after assembly in the connecting rod ends, are bored out to fit the crank and piston pins to exact size. These bearing bushings B, B' are so made as to project beyond the sides of the connecting rod at each end, in the form of flanges b, b' and it is upon these flanges that the ends of the rod are supported in the fixture. For the purpose of this disclosure, the bushing at the smaller or piston end of the rods are assumed to be of brass, and at the larger or crank end the bearing bushings are of Babbitt metal, although the material used

is of no particular importance in so far as the results are concerned.

With this general explanation of the essential parts of the device, the details of construction will be understood from the following:

As shown in Figure 1, the base plate is rectangular but elongated slightly in one direction so that the connecting rod and its end supports are transverse to the axes of the boring tools, the latter being horizontal so that the base plate 1 is likewise horizontal and the connecting rod supports vertical. Thus in position for boring the rods are held horizontally and on edge, as clearly shown in Figure 2.

The rod supports or cradles 2 and 3 are located along one side of the base plate 1 and inwardly from each end, the cradle 2 for the piston ends of the rods being fixed, whereas the support 3 for the crank end comprises a cradle shiftable in two directions. Coacting with the supports is a clamping bar, later to be described, which holds the connecting rod down upon the supports.

The support 2 for the smaller or piston end of the rod, consists of a pedestal having a block 4 mounted at its upper end, said block being machined to provide two upwardly facing bearings 4^a and 4^b on opposite sides with a recess or channel 4^c between. The left-hand bearing 4^a is flat or plane whereas the right-hand bearing 4^b is extended upwardly and has a semi-circular seat 4^d with teeth cut in the surface thereof, the bottom of the seat being on the level of the face of plane bearing 4^a. (Figure 5). These bearings are spaced apart a distance slightly greater than the thickness of the piston end of the rod proper, which extends into the recess 4^c out of contact with the block, so that the support is wholly through the point of contact of one flange *b* with the flat bearing face 4^a and the seating contact of the other flange *b* in the seat 4^d.

The support 3 for the larger or crank end of the connecting rods, comprises a pair of upright posts 5, 6 integral with the base 1, and spaced apart longitudinally, one of said posts being extended outwardly from the side edge of the base, and the other substantially midway between the first mentioned post and the pedestal 2. At the upper end of each of these posts is a pin 7, mounted in horizontal bores and having a pointed extremity projecting inwardly into the space between the posts. These pins 7, 7 form a trunnion for a U-shaped cradle block 8 having conical depressions at opposite ends by which the block is suspended between the pins 7, 7 and within the space between the posts 5 and 6, said block being free to swing about the horizontal axis of the trunnion. The central portion of the block 8 is recessed to provide clearance for the depending portions of the

connecting rod end, as shown in Figure 2. On opposite sides of the block 8 is a pair of bearing plates 9, 9 generally of V-shape and having pivotal connection with the block 8, by means of a hinge pin 10 extending through the lower ends of the block and the plates. It will be observed that the block 8 is of the same thickness as the adjacent end of the connecting rod proper, whereas the plates 9 on opposite sides of the block are relatively thin. Moreover, the bearing plates extend above the top of the yoke, and each has a deep semi-circular recess 9^a between its projecting end portions 9^b, the latter having inwardly facing bearing edges 9^c, 9^c inclined at an angle of about 45°. These inclined bearing faces 9^c, 9^c form the actual supports for the larger end of the rod, the contact being tangential with the two flanged ends *b*, *b'* of the bearing sleeve *B'* and at points on either side of the central axis of the bearing. The bearing plates 9, 9 being hinged to the yoke 8, are thus free to swing or oscillate through a limited arc in the plane of the connecting rod, so that their movement relative to each other and to the block 8, coupled with the bodily swinging movement of both block and plates about the axis of the trunnion at right angles to the axis of the hinge pin 10, provide what may be termed a universal or self-adjusting support or cradle for the crank end of the connecting rod.

It will thus be seen that having positioned the connecting rod upon the two supports or cradles with the small end seated first, the larger end seeks its natural position in contact with the four points of support with the plates 9, 9. Thus when pressure is applied upon the rod, the plates 9, 9 and block 8 adjust themselves so that the pressure is distributed equally at all four points. To bring this out more clearly, it may be explained that each connecting rod is a separate forging and therefore one may vary ever so slightly from another and in one dimension or another,—some may be slightly longer or shorter than others, some may be slightly thicker, or warped, or twisted, and although none of the differences or discrepancies may be appreciable, nevertheless they influence the degree of distortion which a rod undergoes when subjected to the clamping pressure in the boring fixture which will ultimately manifest itself in a departure from true parallelism of the finished bearings.

As already explained, the smaller end of the connecting rod is placed in its seat or cradle first, thus permitting the larger end to find its own bearing in its adjustable cradle. In both cases the contact being between the supports and the ends of the bearing bushings and not with the rod proper. Thus when the clamping pressure is applied to the rod from above, it is relieved from all strains which would tend to distort the rod during

the boring operation only to resume its natural contour when the pressure is relieved with a consequent and permanent deviation from parallelism in the axes of the bored bearings.

Moreover, it is to be observed that the smaller end of the rod is not fixed against displacement in all directions, but only against longitudinal displacement and lateral movement from the pressure of the boring tool, inasmuch as only one side of the bearing is held in its seat, the other side having point contact on a flat bearing face, so that the rod is free to pivot slightly in its seat and thus relieve the rod from any lateral or torsional stresses which would tend to introduce additional strains and attendant distortion.

Intermediate the supports 2 and 3 for the connecting rod ends, is a tension clamping bar assembly for holding the connecting rod in the supports 2 and 3, and consisting of parts as follows: Extending transversely of the base plate and midway between its side edges is a vertical web 11 slightly higher than the connecting rod supports. Integral with this web is a bracket 11^a substantially midway between the supports 2 and 3. Fixed to this bracket 11^a is a hinge block 12, slotted crosswise to receive the end of a cross bar 13, pivotally connected thereto by a pin 12^a and extending transversely above the connecting rod near its larger end. The free end of the cross bar 13 is detachably connected with a vertical rod 14 hinged at its lower end to a hinge block 15, recessed to the base 1 near its edge. At the free end of the cross bar 13 is a slot 13^a opening endwise and adapted to receive the rod when swung into vertical position. The upper end portion of the rod 14 extends above the bar and carries at its upper end a knurled tension sleeve 16 having screw-threaded engagement with a threaded end portion 14^a of the rod. Between the sleeve 16 and the top face of the bar is a coiled tension spring 17 surrounding the rod with an intermediate bearing sleeve 18 having a flange 18^a at its lower end against which the adjacent end of the spring bears. The upper end of the spring 17 bears against a washer 19 which in turn bears against a tension adjusting nut 20 threaded on rod adjacent the sleeve 16.

On the underside of the cross bar 13 is mounted an equalizing block 21 having depending arms which straddle a clamping bar 22 which is pivotally connected to the block by means of a hinge pin 22^a passing through the clamping bar a short distance from one end, thus forming a relatively long arm having a downturned end bearing upon the shank of the connecting rod just short of the smaller end, and a relatively short arm bearing on the rod substantially at the junction of the shank with the larger head of the rod.

From this arrangement of parts it is manifest that clamping pressure is exerted down-

wardly upon the connecting rod at points just inwardly from its ends and through the tips of the clamping bar, which in turn is pivoted so that the pressure is equalized at each end, this pressure being exerted by the spring 17 acting through the cross bar 13 and equalizing block 21. For inserting and releasing the work the rod 14 is forced into and out of the slotted end of the cross bar 13, the spring 16 acting to hold the parts in clamping position. When the rod is released, the cross bar 13 can be swung upwardly, the finished rod removed and a new one put in place.

The remaining parts of the fixture are the guide bearings for the boring bars, which are cast integral with the base 1, and hence integral with the connecting rod supports.

These guide bearings are essentially cylindrical with bores therethrough, accurately machined to fit the pilots of the boring bars. Associated with each of the connecting rod end supports and in axial alignment therewith, is a pair of guide bearings, one pair 22 and 23 being positioned in opposite sides of the piston end connecting rod support 2, and the other pair 24 and 25 in corresponding positions on opposite sides of the crank end connecting rod support 3.

The two corresponding guide bearings 22' and 24 on the right or power side are of relatively large diameter and are cast integral with the web 11. The guide bearings 23 and 25 are somewhat shorter and of smaller diameter, being located on the opposite side from which the power is delivered and serve to pilot the ends of the boring bars beyond the cutting tool. The boring bars 21 and 27 may be of any approved or standard design driven from a power head whereby the bars are rotated and fed axially as the boring tools advance. Since the boring bars are practically alike except for difference in the diameters to correspond to the size of the bores, a description of one will suffice. The boring bar 26 for instance, has an enlarged bearing portion 26^a which journals in the large bearings 22 and a reduced end portion 26^b, the extremity of which journals in the smaller bearing 23. In this reduced end portion is a diamond pointed cutting tool 28 which cuts the bore in the bearing bushing as the bar is fed axially therethrough. For the larger bearing the same arrangement is used, but with the cutting tool 29 arranged at a slightly different cutting angle. At the power end of the boring bars are the tool holders 30, 30 which are driven through an intermediate universal connection with the power heads of the boring machine, so that any inaccuracies in the drive will not be transmitted to the boring bars.

As is the practice in machining operations of this kind, the connecting rods are placed in the fixture and bored in rapid succession,

the bearings at each end being bored either simultaneously or consecutively, in the manner and with the results herein set forth.

Having set forth the features embodying my invention, I claim:

1. In a device of the character described, the combination of a base, work supporting members mounted on said base and comprising a relatively fixed seat for one end of the work and an adjustable seat for the other end of said work, and a clamping member for holding the work against said seats, comprising a bar extending longitudinally of and adapted to bear at its ends against said work a block pivotally connected with said bar intermediate its ends, a supporting bar for said block, hinged at one end to said base, to swing said clamping bar to and from clamping position, a rod hinged to said block and adapted to have locking connection with the free end of said supporting bar, and a spring mounted on said rod and adapted to bear on said supporting bar in locking position.

2. In a fixture for the purpose described, the combination of a fixed support for one end of a connecting rod comprising bearing seats spaced apart for contact with the projecting ends of the bearing bushing at said end of the rod, one of said seats being semi-circular to hold the rod against longitudinal displacement, and a self-adjusting support for the opposite end of said rod, comprising a block supported on trunnions to turn on a longitudinal axis, bearing plates mounted on opposite sides of said block and having bearing contact with the ends of the bearing bushings at the adjacent end of the rod, said plates having pivotal connection with said block whereby each is shiftable relative to said block about an axis transverse to the axis of said trunnions.

3. In a fixture for the purpose described, the combination of a base plate, vertical supports for the ends of a connecting rod mounted on said base plate and comprising upwardly facing bearing seats positioned to support said rods in horizontal position with the ends of the bearing bushings thereof resting on said seats, one of said seats being shaped to hold said rod against longitudinal and transverse displacement, the other of said seats being suspended from trunnions mounted on said base plate and free to turn on a longitudinal axis, and comprising pivoted bearing plates free to turn on an axis transverse to the axis of said trunnions, and a clamping bar pivotally mounted on said base plate and adapted to engage said rod intermediate its ends.

4. In a fixture for the purpose described, the combination of a fixed support for one end of a connecting rod, and comprising bearing seats spaced apart to engage the projecting ends of the bearing bushing at said end

of the rod, one being semi-circular and the other flat, and a self-adjusting support for the opposite end of said rod, comprising fixed trunnions, a block supported between said trunnions and rotative about an axis parallel with said rod, and bearing plates pivotally mounted on said block and rotating relative thereto about an axis transverse to the axis of said trunnions, and adapted for seating contact with the ends of the bearing bushing at said end of the rod.

5. A fixture for boring connecting rod bearings, comprising seats adapted to contact with the projecting ends of the bearing bushings at opposite ends of the rod, one of said seats being fixed and the other capable of universal adjustment, and a clamping member including a bar engaging said rod adjacent its ends, means for applying a yielding pressure on said bar to force the same to its seats, and means for equalizing the pressure exerted at each end of said rod by said bar.

6. A work holding fixture comprising stationary supports spaced apart a distance to engage the ends of the work, one of said supports having a fixed seat adapted to hold one end of the work against longitudinal and transverse displacement, and the other support consisting of a primary member supported on fixed trunnions and shiftable about the axis thereof, and a secondary member forming a seat for the other end of the work and pivotally mounted on said primary member for relative movement about an axis transverse to the axis of said trunnions, and clamping means acting on the work intermediate its ends to force the same against said supports.

7. In a fixture for holding connecting rods and the like during the operation of boring the bearing bushings at the ends thereof, the combination with boring tools of a base plate, supports mounted on said base plate in substantial alignment with axes of said boring tools, and each comprising a seat adapted to contact with the projecting ends of the bearing bushings at each end of said rods, one of said seats being fixed relative to said base plate, the other comprising a block supported on trunnions mounted on said base plate, and plates pivotally mounted on said block for movement relative thereto about an axis transverse to the axis of said trunnions, a clamping member engaging the rod intermediate its ends and adapted to force the same against said seats.

8. A boring fixture comprising upwardly opening seats for supporting the ends of the work to be bored, one of said seats being fixed and adapted to hold one end of the work against longitudinal displacement and the other seat having free universal movement about transverse pivotal axes whereby to adjust itself automatically in contact with the

portion of said work supported thereby, and clamping means located substantially opposite each of said seats and adapted to force the bearing portions of said work to said seats.

8 9. A work holding fixture for boring operations comprising a fixed upwardly opening seat for one end of the work to be bored and acting to hold the same against longitudinal displacement, a seat for the other end of the work consisting of two pivotally connected members universally movable about transverse axes, one of said members opening upwardly and adapted to adjust itself in contact with the adjacent end of the work when
10 its opposite end is held in said fixed seat, and a clamping means intermediate said seats and adjustable into and out of bearing contact with said work to force its ends downwardly
15 onto said seats.

20 Signed at Milwaukee, Wis., this 26th day of January, 1927.

JAMES E. AUTEN.

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