Oct. 3, 1939. W. G. VOLLMER 2,174,709

BORING MACHINE

Filed April 5, 1937 3 Sheets-Sheet 1

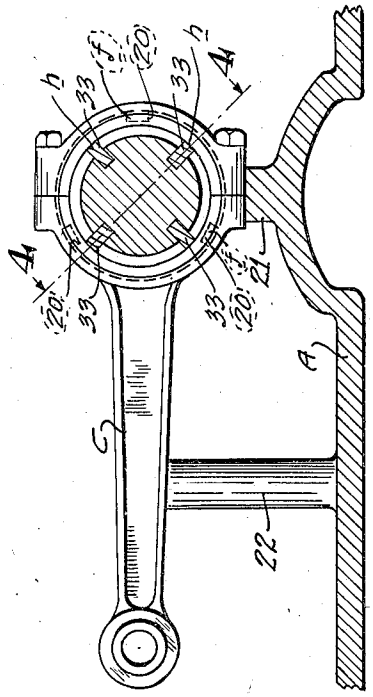

Fig. 2.

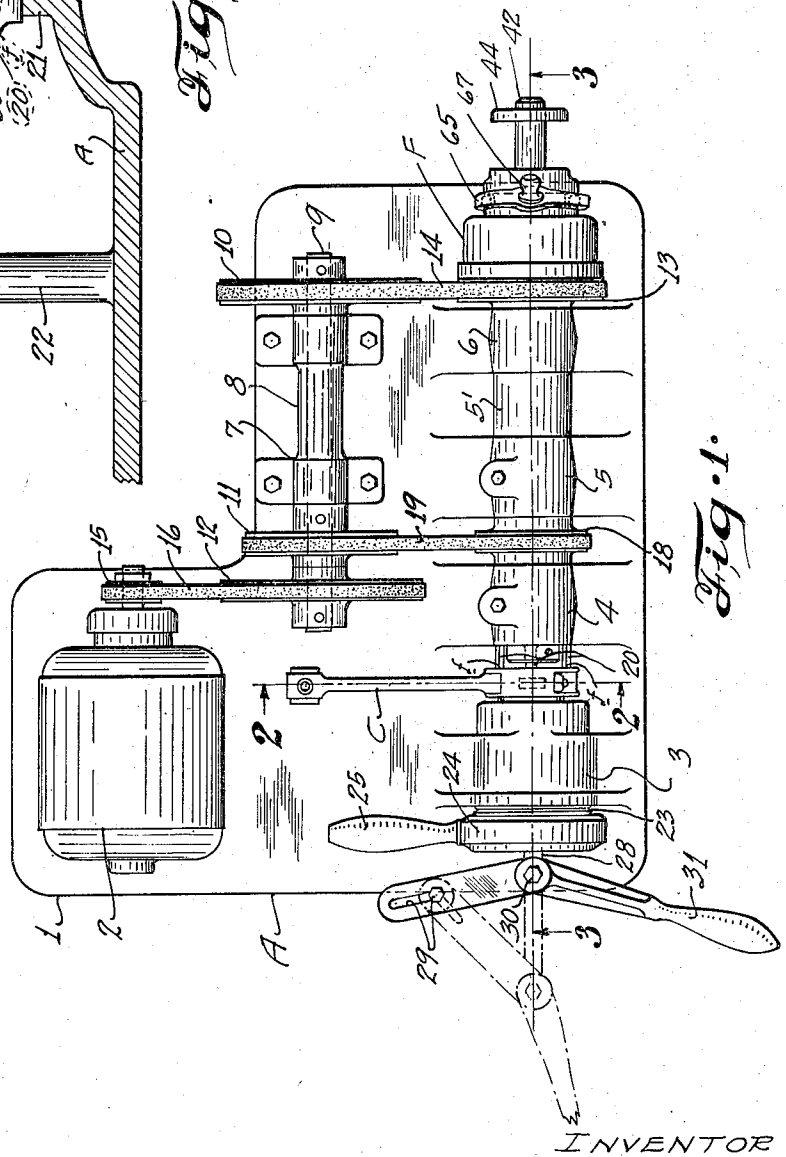

Fig. 1.

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Oct. 3, 1939. W. G. VOLLMER 2,174,709

BORING MACHINE

Filed April 5, 1937 3 Sheets-Sheet 2

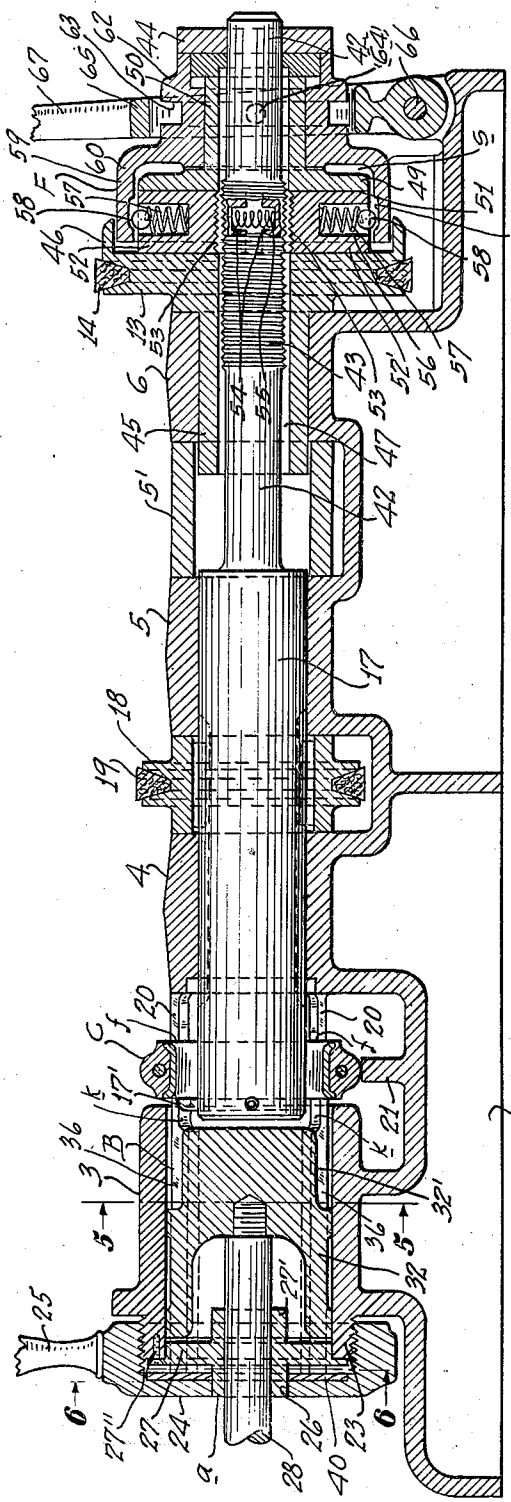

Fig. 3.

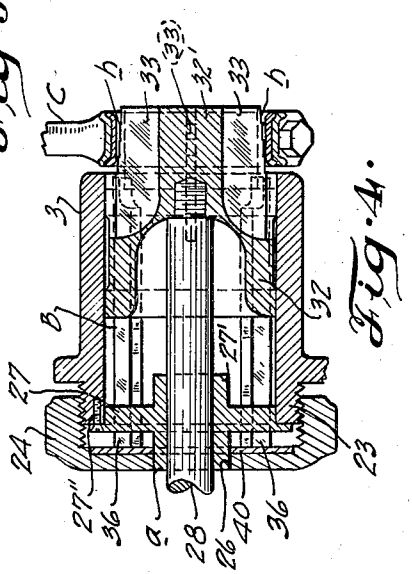

Fig. 4.

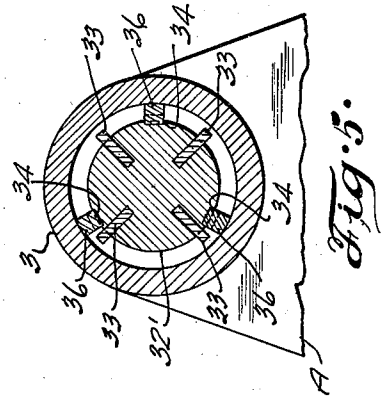

Fig. 5.

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BORING MACHINE

Filed April 5, 1937 3 Sheets-Sheet 3

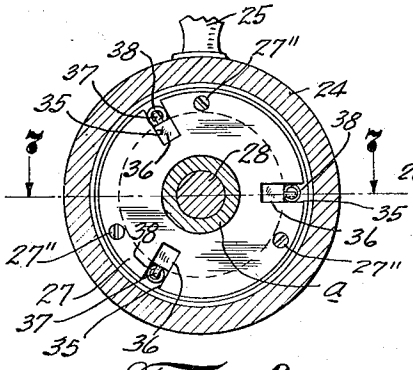

Fig. 6.

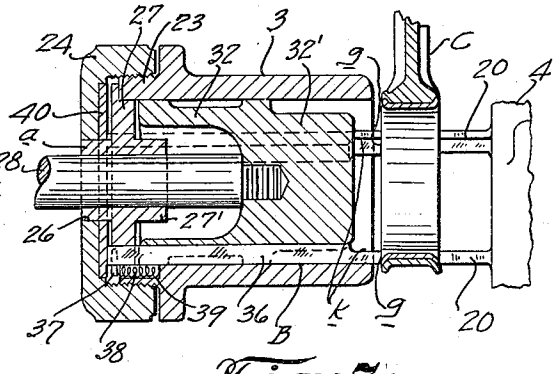

Fig. 7.

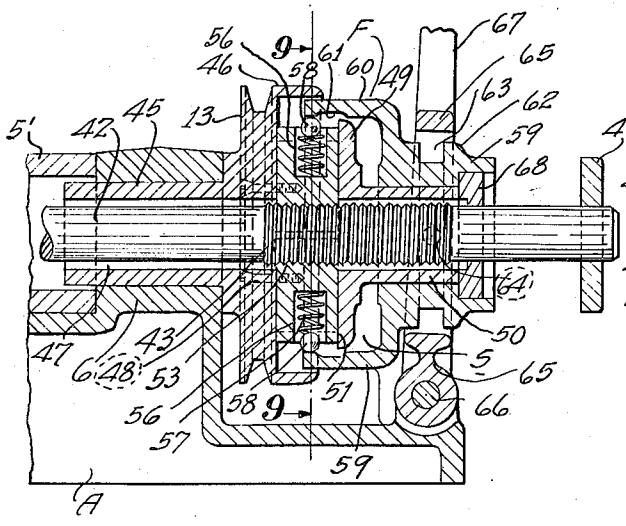

Fig. 8.

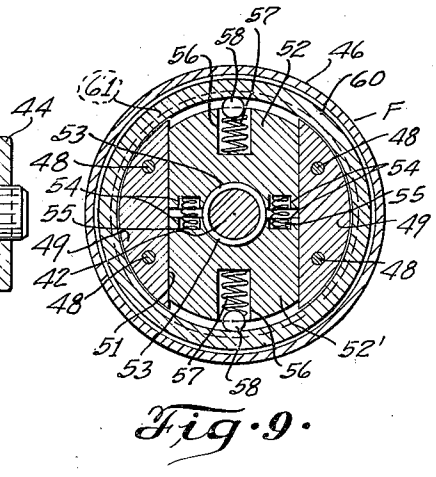

Fig. 9.

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Patented Oct. 3, 1939 2,174,709

UNITED STATES PATENT OFFICE

2,174,709

BORING MACHINE

Walter G. Vollmer, St. Louis, Mo., assignor to H. & H. Machine & Motor Parts Co., St. Louis, Mo., a corporation of Missouri

Application April 5, 1937, Serial No. 134,996

8 Claims. (Cl. 77—62)

This invention relates generally to boring machines and, more particularly, to a certain new and useful improvement in boring machines especially, though not exclusively, adapted for finishing the inner bearing surface of automotive connecting-rods.

The present invention has for its primary object the provision of a machine for accurately sizing the bearing-portion of a connecting rod to a predetermined dimension for precise engagement upon the crank-shaft with which the particular connecting-rod is to be associated.

My invention has for a further object the provision of a machine of the type stated which, in successive closely connected facile operations, positions a particular connecting-rod for finishing, clamps and holds the connecting-rod in such position, and then directs a power-driven automatically-fed tool into the bearing member of the connecting-rod for sizing and finishing.

My invention has for an additional object the provision of a machine of the type and for the purposes stated, which is simple, accurate, precise, and automatic in operation, is compact, economical, durable, and sturdy in construction, and is exceedingly efficient in the performance of its intended functions.

And with the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawings (3 sheets)—

Figure 1 is a plan view of a connecting-rod boring machine of my invention, showing a connecting-rod positioned and clamped for finishing;

Figure 2 is an enlarged fragmentary transverse sectional view of the machine, taken approximately along the line 2—2, Figure 1;

Figure 3 is an enlarged longitudinal sectional view of the machine, taken approximately along the line 3—3, Figure 1, showing the tool-shaft feeding mechanism in released or disengaged position;

Figure 4 is a detail sectional view of the machine, taken approximately along the line 4—4, Figure 2;

Figure 5 is a detail sectional view of the machine, taken approximately along the line 5—5, Figure 3;

Figure 6 is a detail sectional view of the machine, taken approximately along the line 6—6, Figure 3;

Figure 7 is a detail sectional view of the machine, taken approximately along the line 7—7, Figure 6;

Figure 8 is a fragmental longitudinal sectional view of the machine, showing its tool-shaft feeding mechanism in engaged position; and

Figure 9 is a detail sectional view of the tool-shaft feeding mechanism of the machine, taken approximately along the line 9—9 Figure 8.

Referring now in more detail and by reference characters to the drawings, which illustrate a preferred embodiment of the present invention, A designates a base-casting having a preferably integral laterally presented extension 1, upon which latter is mounted a suitable prime mover, such as an electric motor 2.

Preferably integrally disposed upon the base A in parallel relation to the shaft of motor 2, is a tubular shell or barrel 3 operatively housing connecting-rod work-positioning and clamping mechanism B, presently more fully and in detail described.

Likewise preferably integral with the base A and disposed in spaced axial alignment with the shell 3, as best seen in Figure 3, are longitudinally spaced registering bearing sleeves 4, 5, and 6, respectively, a pressed-fit sleeve-joint 5', best seen in Figure 3, being mounted intermediate the sleeves 5 and 6 for preventing the entrance thereinto of dirt, dust, and other foreign matter.

Fixed upon and upstanding from the base A laterally of the sleeves 4, 5, 6, as best seen in Figure 1, is a bracket-casting 7 having a shaft-receiving sleeve or bearing 8, the axial line of which is preferably parallel both to the plane of the upper face of the base A and the axial line of the bearing-sleeves 4, 5, 6.

Mounted for rotation within, and projecting at its opposite ends outwardly of, the bearing 8, is a shaft 9, upon one end of which is pinned or otherwise fixed a pulley 10 and upon the other end of which are pinned or otherwise fixed two parallel pulleys 11, 12, the pulley 10 being in operative alignment with a driving-pulley 13 of the shaft-feeding mechanism F of the machine, to which it is connected by a belt or other suitable flexible member 14, and the pulley 12 being in operative alignment with the shaft-pulley 15 of the motor 2, to which it is connected by means of a belt or the like 16, all as best seen in Figure 1.

Disposed rotatably within, and extending longitudinally through, the bearing sleeves 4, 5, 6, is a shaft 17 provided at its left-hand or rear end, reference being to Figure 3, with a radially adjustable cutting-tool or bit 17'.

Slidably keyed to and upon the shaft 17 and positioned for rotation intermediate the bearing sleeves 4, 5, is a shaft-driving pulley 18, which is in peripheral alignment, and operatively connected as by means of a belt 19, with the pulley 11. Thus it will be evident that the shaft 17 will be rotatably driven by the motor 2 through the belt 16, pulley 12, pulley 11, belt 19, and pulley 18, and, at the same time, may be longitudinally shifted relatively to the sleeves 4, 5, and 6, as best seen in Figure 3 and for purposes presently more fully appearing.

Extending axially outwardly from, and preferably symmetrically spaced at 120° from each other annularly about, the rear face of the sleeve 4, are three preferably integral stationary rod-positioning shoulders 20, as best seen in Figure 2, the shoulders 20 being provided with accurately machined transverse abutment faces *f*, which are precisely positioned in a single plane, for purposes presently more fully appearing.

Preferably integral with the base A and disposed intermediate the shell or housing 3 and the sleeve 4 for subjacently supporting and positioning a connecting-rod C, is an upstanding lug 21. Likewise preferably integral with and upstanding from the base A in transverse alignment with the lug 21, is a post 22 also for subjacently supporting and positioning the particular connecting-rod C, as best seen in Figure 2. It will hence be evident that a particular connecting-rod C may be placed upon the lug 21 and post 22, as shown in Figure 2, and brought into facewise abutting engagement with the positioning-shoulders 20.

B designates the rod clamping-mechanism of the machine, forming part of which mechanism, and threaded for movement or adjustment upon an externally threaded axially extending end-portion 23 of the housing 3, is a suitably flanged end-cap 24 provided with a radially outwardly extending hand-grip 25 and centrally apertured, as at 26, for accommodating an end-portion *a* of a shaft-supporting hub-portion 27' of a guide-plate 27 fixed, as by means of suitable screws or other fastening members 27'', across the rear end face of the shell or housing 3, as best seen in Figures 4 and 7.

Supported for reciprocation in the shell or housing 3 by the hub-portion 27' of bearing or guide-plate 27 and projecting at its rear end portion outwardly of the housing 3 through said plate hub-portion 27, as also best seen in Figures 3, 4, and 7, is a shaft 28; and having slot-and-pin connection at or adjacent one end, as at 29, with the base A, and pivotally secured intermediate its ends, as at 30, to the rearwardly presented projecting end-portion of the shaft 28, is an angular shaft-shifting lever 31.

Machined for accurately fitting slidably within the housing or sleeve 3 and forming substantially a forwardly presented continuation of the shaft 28, is a plunger 32 provided with a diametrically reduced forward end-portion 32' for projection outwardly of the shell 3 and into the adjacent sleeve 4 when the shaft 28 and its connected plunger 32 is in forwardly advanced position, the plunger end-portion 32' having four symmetrically arranged, axially extending rod-positioning fins 33 spaced annularly at 90° from each other and at 45° from the horizontal axial plane of the machine and having work-contacting faces *h* consisting of a progression of graduated step surfaces, so that the plunger end-portion or barrel 32' is in effect, equipped with a series of rearwardly increasing rod-contacting radii having increments of .002 inch, as best seen in Figure 4. It has been found in this connection, it may be stated, that such a series of step-surfaced fins 33 provides a much more accurate and efficient position means than an ordinary or plain taper, as will be presently more fully explained and described.

The plunger 32 is peripherally provided with three circumferentially spaced rectangular channels or ways 34, which are in alignment with the rod-positioning shoulders 20, for purposes presently appearing and as best seen in Figures 4 and 5. Likewise, the fixed guide-plate 27 is provided with three rectangular apertures or openings 35 in alignment with the ways or channels 34 for accommodating three longitudinally shiftable locking bars 36, each of which latter is provided at its rearward end with a radially presented pin 37 for engagement with a respective spiral compression spring 38 mounted in and extending axially outwardly from a suitable recess 39 formed in the housing end-portion 23, as best seen in Figures 6 and 7. The springs 38 thus normally urge the respective locking bars 36 rearwardly into abutting engagement with a disk-shaped thrust-washer or disk 40 mounted loosely within and against the inner face of the end wall of the cap 24. It will hence be evident that, through application manually of suitable power on hand-grip 25, the cap 24 will be threadedly shifted forwardly upon the sleeve end-portion 23 and thus be translated axially with respect to the housing 3, the thrust plate 40 being thereby forced against the locking bars 36 and the latter, in turn, being urged through the apertures 35 of the guide-plate 27 and the channels or ways 34 of the plunger 32 toward the seated or positioned connecting-rod C, the several locking bars 36 being provided at their respective forward ends with vertically aligned engagement faces *g* for clampwise holding the particular connecting-rod C against the corresponding faces *f* of the positioning-shoulders 20, as best seen in Figure 7. It may be pointed out in this connection that the forward or rod-engaging ends of the locking bars 36 are preferably relieved along their radially inwardly presented faces, as at *k*, for avoiding interference with the cutting bit 17' on the shaft 17 when the latter passes completely through the bearing end of the particular rod C at the end of a boring operation.

The shaft 17 is provided with a preferably integral diametrically reduced tail-continuation 42, which extends axially forwardly through the bearing sleeve 6 and the shaft-feeding mechanism F, the shaft 42 being threaded intermediate its ends, as at 43, and being equipped at its forwardly extended end with a so-called kick-off plate 44, for purposes presently more fully appearing and as best seen in Figures 3 and 8.

The feeding mechanism driving-pulley 13 is equipped with a preferably integral rearwardly presented hub-extension 45, which has a bearing for rotation within the sleeve 6, as best seen in Figures 3 and 8, and rimwise the pulley 13 is provided on its forward face with a preferably integral forwardly presented circumferential flange 46, the pulley 13 and its extended hub 45 having an axially extending aperture 47 substantially larger diametrically than the diametrical dimension of the tail-shaft 42, so as to freely permit independent rotation of the tail-shaft 42 and the pulley 13.

Integral with or fixed, as by means of dowels 48 or other suitable attaching means, upon the forward face of the pulley 13, is an annular or disk-shaped member 49 substantially smaller in outer diametrical dimension than the inner diametrical dimension of the pulley-flange 46. A corresponding substantial annular free space, as at *s*, is thereby provided intermediate the outer peripheral face of the member 49 and the inner peripheral face of the flange 46, the member 49 having a preferably integral forwardly projecting tubular extension 50 of substantially the same inside diametrical dimension as the shaft-accommodating bore of the pulley-hub 45, as best seen in Figures 3 and 8 and for purposes presently more fully appearing.

Extending diametrically through the member 49 and opening at a side upon the forward face of the pulley 13 and at its opposite ends upon the periphery of the member 49, is a slot 51, housed within which for shiftable movement radially of the member 49 are two complementary segments or halves 52, 52', of a split feed-nut provided centrally upon their radially inwardly presented faces with complementary and matching sections of a thread 53 for engagement with the threaded portion 43 of the tail-shaft 42, as best seen in Figures 8 and 9.

As also seen in Figure 9, the feed-nut segments 52, 52', are provided upon their radially inwardly presented faces with suitable recesses 54 for housing comparatively lightweight compression springs 55 for normally yieldingly urging the feed-nut segments 52, 52', radially away from each other and out of engagement with the tail-shaft thread 43.

Formed in the respective peripheral faces of the feed-nut segments 52, 52', are diametrically juxtaposed recesses 56, 56', seated within which are compression springs 57, which at their respective outer extremity engage free ball bearings 58. It may be stated in this connection that the springs 57 are of fairly stiff character and substantially equal in strength, being compressible only through a relatively small range of movement and under relatively high compressive force, as best seen in Figure 9 and for purposes presently more fully appearing.

Mounted freely for axially shiftable movement upon the feed-nut hub-extension 50, is a so-called feed-nut actuator 59 having an annular flange 60 presented rearwardly into and for movement in said space *s*, the flange 60 having an outer diametrical dimension slightly smaller than the inner diametrical dimension of the pulley-flange 46 and having an inner diametrical dimension slightly larger than the outer diametrical dimension of the feed-nut housing 49. The relative inner marginal diametrical dimension of the flange 60 is, however, such that the flange 60, in one position of the actuator 59, will ride upon the ball bearings 58 and force the respective feed-nut members or segments 52, 52', into engagement with the tail-shaft thread 43, as best seen in Figure 8.

Adjacent its margin, the flange 60 is provided upon its inner face with an annular recess 61 of sufficient depth, so that the flange 60, in another position of the actuator 59, will clear the bearings 58 and thereby permit the internal compression springs 55 to yieldingly space the feed-nut segments 52, 52' radially one from the other and out of engagement with the tail-shaft thread 43.

The actuator member 59 also includes a forwardly extending hub-portion 62 having a circumferential slot 63 for engagement with pins or shoes 64 presented inwardly from an embracing yoke 65 pivotally mounted, as at 66, upon the base A and provided with a preferably diametrically opposite hand-grip 67. Thus it will be seen that, as the yoke 65 is swingably actuated in one or the other direction, the actuator 59 will be axially shifted toward or away from the drive pulley 13, as the case may be, as best seen in Figures 3 and 8.

I might add that the actuator hub-portion 62 is equipped at its forward extremity with a removable pressed-fit disk-shaped closure 68 centrally apertured for providing a bearing for the forwardly extending end of the tail-shaft 42.

In use and operation, the yoke 65 is swung rearwardly to the position shown in Figure 3. The flange 60 is accordingly shifted to present its recess 61 over the bearings 58. The springs 57 are hence free to expand, and the feed-nut segments 52, 52', are accordingly, under the tension of the springs 55, shifted out of engagement with the tail-shaft thread 43. The tool shaft 17 may then be longitudinally shifted forwardly away from the shell 3, as shown in Figure 7, and a connecting-rod C disposed or seated upon the positioning shoulder 21 and post 22, as previously described. The clamp-head lever 31 is then pivotally moved forwardly for, in turn, longitudinally shifting the plunger 32 forwardly toward the so disposed or seated connecting-rod C. As the plunger 32 moves forwardly, the positioning fins 33 enter the main bearing of the seated connecting-rod C and the step-like faces *h* thereof come into engagement with its inner bearing surface. In the course of normal use, a connecting-rod becomes worn to a greater extent along its line of thrust and, therefore, after extended use, is somewhat elliptical in shape. The four fins 33, in entering and engaging such elliptical surface, will not snugly fit the inner bearing surface of the connecting-rod unless this latter elliptical surface is disposed symmetrically thereabout. In the event that the connecting-rod, in being manually placed in position, is slightly out of proper alignment, one or more of the fins 33 will strike the bearing surface, momentarily at least, with greater force, which will cause the entire connecting rod to be shifted into a position of proper orientation with respect to the entire machine. As soon, however, as the particular connecting-rod is properly oriented, the end cap 24 is rotarily actuated by means of the hand-grip 25 and the locking bars 36 thereby forced forwardly for clamping the particular connecting-rod securely against the stationary positioning shoulders 20. The lever 31 may then be pivotally swung rearwardly to the position shown in dotted lines in Figure 1, the plunger 32 being thereby rearwardly shifted or retracted into the shell or housing 3 and leaving the particular connecting-rod C accurately and precisely clamped in position for a boring operation by and between the shoulders 20 and the locking-bars 36.

The motor 2 being then set in motion, the tool shaft 17 and simultaneously the feed-drive pulley 13 are rotarily driven. The actuator yoke 65 is then pivotally swung forwardly, whereby the flange 60 engages the ball bearings 58 and the feed-nut segments 52, 52', through compressive force of the springs 57, shifted radially inwardly into engagement with the tail-shaft thread 43. In the event that the threads of the feed-nut segments 52, 52', and of the tail-shaft thread 43

do not accurately mesh or match-up at the initial moment of engagement, the excessive distorting stresses which might otherwise strip the threads thereof will be dissipated against the resilience of the relatively heavy springs 57. Meanwhile, as has been above pointed out, the feed-drive pulley 13 is revolving at a somewhat lower rate of speed than the shaft 17 and its tail-continuation 42. Hence, at the moment that the feed-nut segments 52, 52', are brought into engagement with the tail-shaft thread 43, the tail-shaft 42 will tend to move longitudinally with respect to the feed-nut segments 52, 52', so that, in the event the respective threads do not momentarily match-up, this relative motion will almost immediately bring the threads into mesh.

As soon as the feed-nut segments 52, 52', are in meshing engagement with the tail-shaft thread 43, the shaft 17 and its tail-continuation 42 will begin to move threadingly within the feed-nut segments 52, 52', by reason of the difference in the relative rates of revolution therebetween. If, as in the present embodiment, the feed-drive pulley 13 runs at a speed which, for instance, is ten R. P. M. slower than the speed of the tool shaft 17, then the tail-shaft thread 43 will, in effect, move within the feed-nut segments 52, 52', at a speed of ten R. P. M. Consequently, if the tail-shaft 42 has, for instance, thirty threads per inch, it will be evident that the tool shaft 17 will be fed into the work at the rate of one-third of an inch per minute. Obviously, by a proper selection of relative pulley speeds and by varying the number of threads per inch on the tail-shaft, a feeding mechanism may be designed to provide the desired rate of feeding speed.

As the tool shaft 17 and its associated tail-shaft 42 are rearwardly fed into the work, the kick-off plate 44 will move longitudinally with the shaft 42 toward, and finally engage, the forwardly presented face of the actuator 59, whereupon the actuator yoke 65 will be pivotally urged rearwardly as the tool shaft 17 continues its rearward rotative movement. In the course of its subsequent movement, the tool shaft 17, and with it the kick-off plate 44, will in such manner shift the actuator 59 and its flange 60 rearwardly into original position, permitting expansion of the springs 57 through the ball bearings 58 riding freely into the recess 61 of the actuator flange 60, thereby, in turn, allowing the feed-nut segments 52, 52', under the tension of the springs 55, to move radially away from each other and out of engagement with the tail-shaft thread 43, when the feed-shaft 42 ceases its longitudinal travel through the particular connecting-rod C.

It will, of course, be evident that the kick-off plate 44 may be so adjusted on the extended end of the tail-shaft 42 as to effect disengagement of the feeding mechanism just after the tool 17' on the shaft 17 has completed the boring operation. The motor 2 may then be stopped, the tool shaft 17 shifted forwardly out of operative position, and the locking bars 36 withdrawn from clampwise engagement to permit removal of the finished connecting-rod.

Thus, it will be seen that, by my present invention, I provide a boring machine substantially automatically capable in a connected series of quick, convenient, and economical movements, of accurately boring the bearing of connecting rods and similar machine parts to any predetermined dimension for precise bearing engagement upon the particular crankshaft with which the connecting-rod is to be associated.

The machine is rugged and durable, exceptionally simple and accurate in operation, is exceedingly compact and economical in construction, and is highly efficient in the performance of its intended functions.

It is to be understood that changes and modifications in the form, construction, arrangement, and combination of the several parts of the machine may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. In a boring machine for connecting-rods, in combination, an axially shiftable rotary shaft, a cutting-tool mounted on and movable with the shaft, positioning means for centering a connecting-rod bearing with respect to the shaft and tool, and means for releasably securing the connecting-rod in centered position, said securing means including a plurality of shoulders in fixed position for bearing engagement, a tubular housing, a series of annularly spaced bars endwise shiftable in the housing for bearing engagement in opposed relation to the shoulders, and an end-cap adjustably threaded on the housing for endwise shifting the bars.

2. In a boring machine for connecting-rods, a sleeve, a tubular housing in spaced axially aligned relation with the sleeve, a shaft disposed for axial and rotary movement within the sleeve, a cutting-tool mounted on and movable with the shaft, positioning means for centering a connecting-rod bearing intermediate the sleeve and housing with respect to the shaft and tool, and means for releasably securing the bearing in centered position, said securing means including a series of annularly spaced shoulders on the sleeve, a series of annularly spaced bars endwise shiftable in the housing for bearing engagement in opposed relation to the shoulders, and a member shiftable with respect to the housing for endwise shifting the bars.

3. A connecting rod boring machine comprising boring tool means, a cylindrical shell disposed in axial alignment with the tool means, a plunger mounted for longitudinal movement within the shell, said plunger having a diametrically reduced barrel-portion shiftable axially into and out of the shell responsive to movement of the plunger, an annular series of symmetrically positioned radially outwardly extending rigid fins mounted on said barrel-portion for centeringly engaging the internal bearing surface of the connecting rod when said barrel-portion is in outwardly shifted position, and means including a lever pivotally mounted externally of the shell for plunger-actuation.

4. A connecting rod boring machine comprising boring tool means, a cylindrical shell disposed in axial alignment with the tool means, a plunger mounted for longitudinal movement within the shell, said plunger having a diametrically reduced barrel-portion shiftable axially into and out of the shell responsive to movement of the plunger, and means including an annular series of symmetrically positioned radially outwardly extending rigid fins upon said barrel-portion for centeringly engaging the internal bearing surface of the connecting rod when the barrel is in outwardly shifted position.

5. A connecting rod boring machine comprising boring tool means, a plurality of work-

positioning bosses against which the connecting rod may be facewise abuttingly presented, said bosses having aligned faces disposed accurately in a plane at right angles to the boring axis of the tool, a cylindrical shell disposed in axial alignment with the tool means, a plunger mounted for longitudinal movement within the shell, said plunger having a diametrically reduced barrel-portion shiftable axially into and out of the shell responsive to movement of the plunger, an annular series of symmetrically positioned radially outwardly extending rigid fins upon said barrel-portion for centeringly engaging the internal bearing surface of the connecting rod when the barrel is in outwardly shifted position, a plurality of locking bars mounted for longitudinal movement within the shell, and means for shifting the locking bars for releasably clampwise securing the connecting rod against the positioning bosses.

6. With a connecting rod bearing boring machine having a boring tool axially movable during the boring operation, means concentrically around said boring tool engageable with one side of a connecting rod bearing around the opening to be bored, means endwise movable for entering the opening of the connecting rod for centering said opening with respect to the boring tool and withdrawable therefrom, and means separated from said first means engageable with the opposite side of the connecting rod bearing around the opening thereof, thereby clamping said bearing and leaving the opening unobstructed.

7. With a connecting rod bearing boring machine having an axially movable boring tool, a bearing positioning and supporting shoulder presented around the retracted position of the boring tool engageable with one side of a connecting rod bearing around the opening to be bored, a tubular shell axially aligned with and longitudinally spaced from the retracted position of the boring tool, bearing centering means substantially axially reciprocable in said tubular shell having a centering portion entered into the bearing opening of a connecting rod as said centering means is extended and retractable to withdraw from the opening, and means within the tubular shell endwise movable to extend from and clamp against the opposite side of a connecting rod bearing around the opening thereof as thus centered.

8. In a connecting rod bearing boring machine having an axially movable boring tool, a sleeve around the retracted location of the boring tool and having a shoulder extending beyond the tool in such retracted position engageable with one side of a connecting rod bearing around the opening to be bored, means endwise movable for entering the opening of the connecting rod bearing for centering said opening with respect to the boring tool and withdrawable therefrom, a tubular shell axially aligned with and longitudinally spaced outwardly from said sleeve, locking bar means within said shell longitudinally movable to extend from said shell into engagement with the opposite side of a bearing positioned against the bearing shoulder, and means to move said locking bar means into connecting rod bearing holding and releasing positions.

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