

Oct. 31, 1950

E. T. PETERSON

2,528,075

BAR MILL

Filed Aug. 10, 1945

6 Sheets-Sheet 1

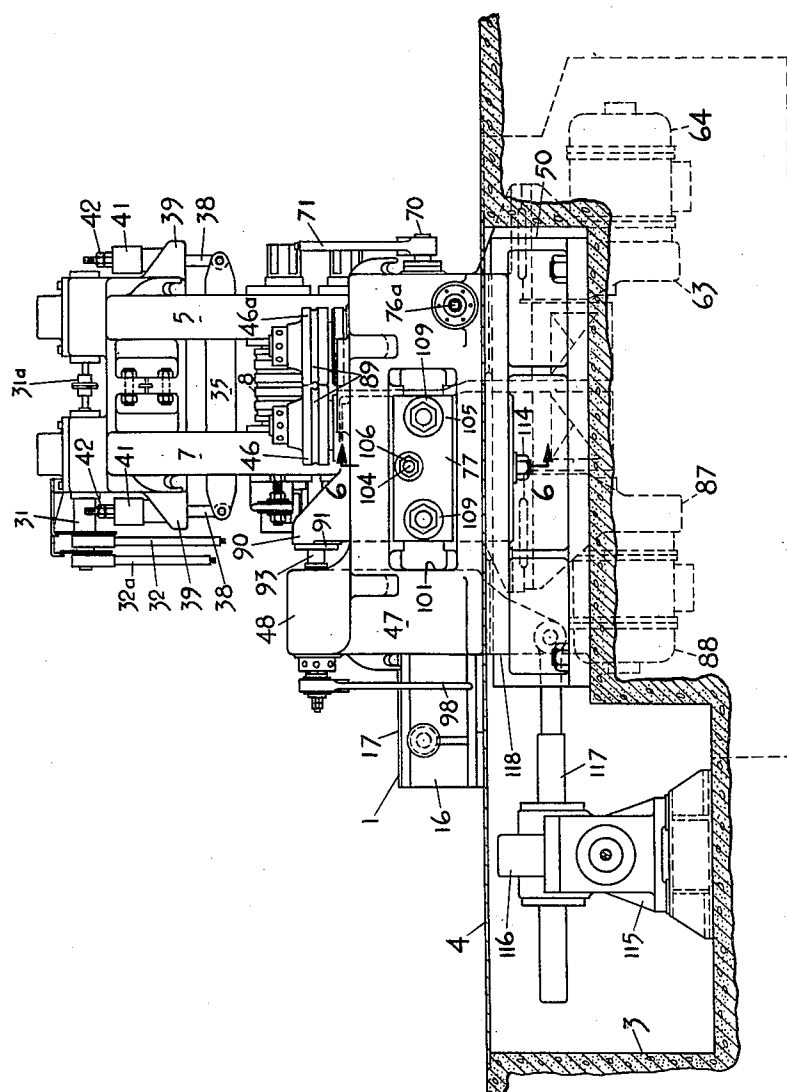


Fig. 1

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Fig. 2

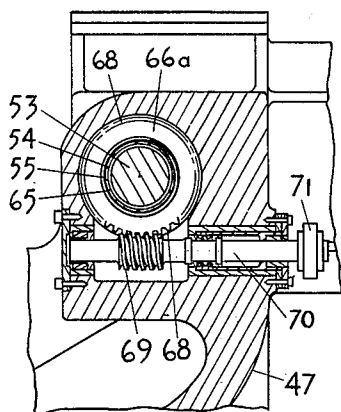
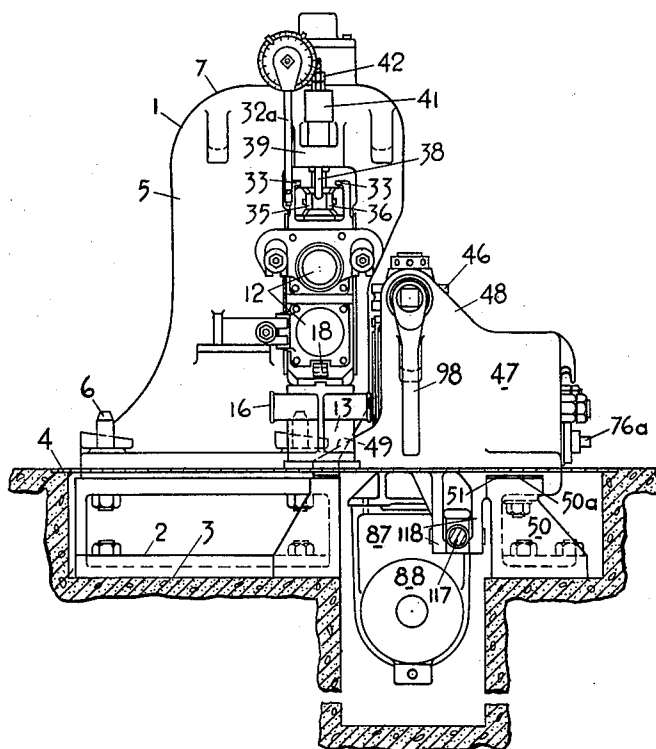


Fig. 8

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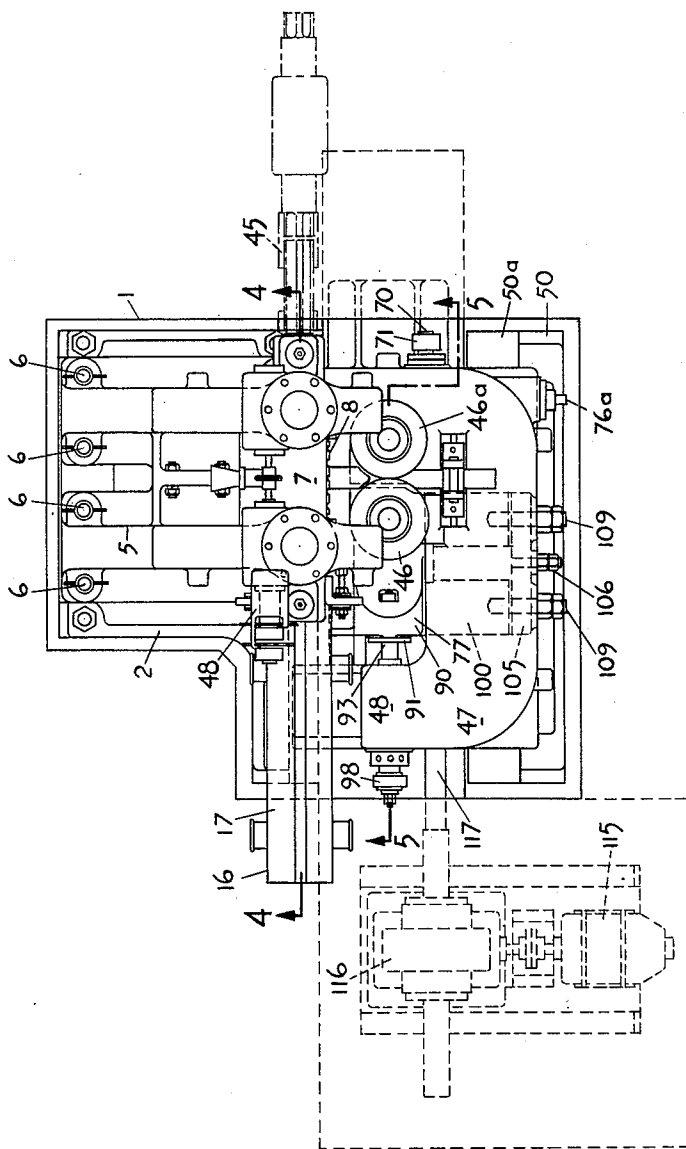
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Fig. 3



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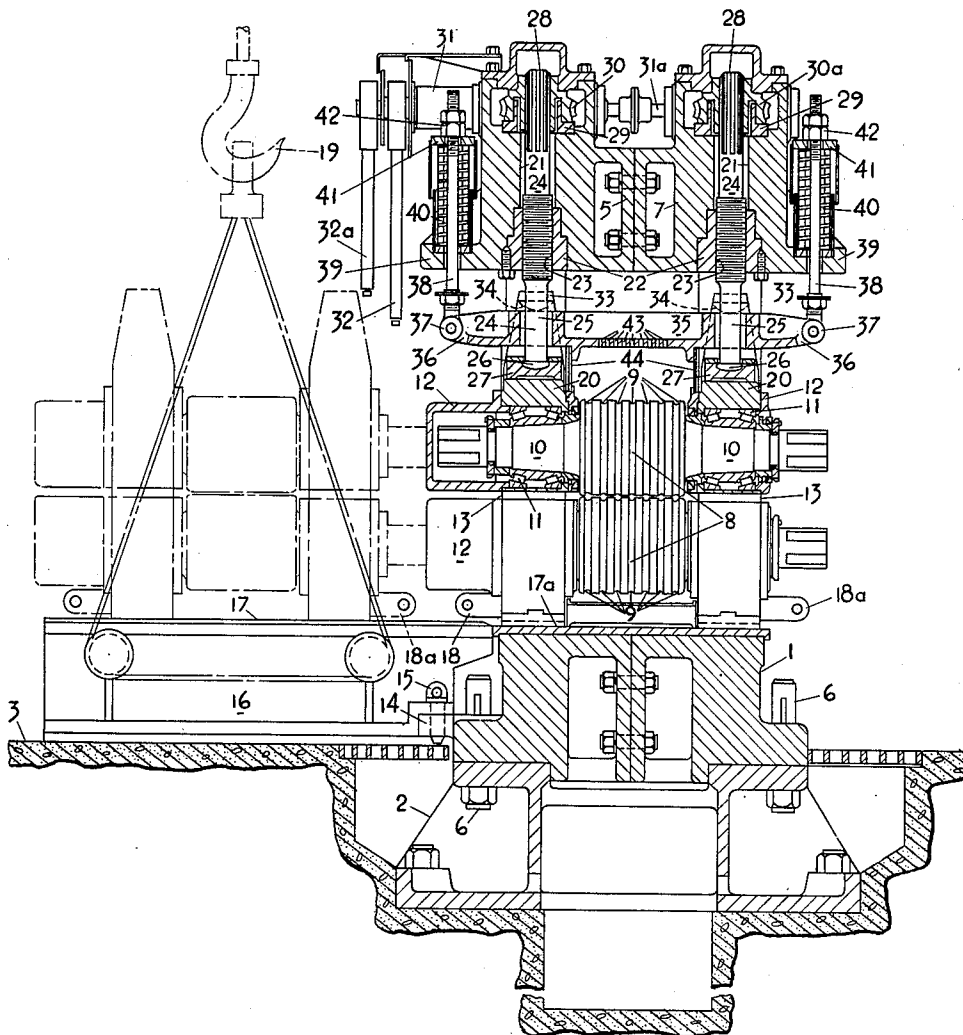


Fig. 4

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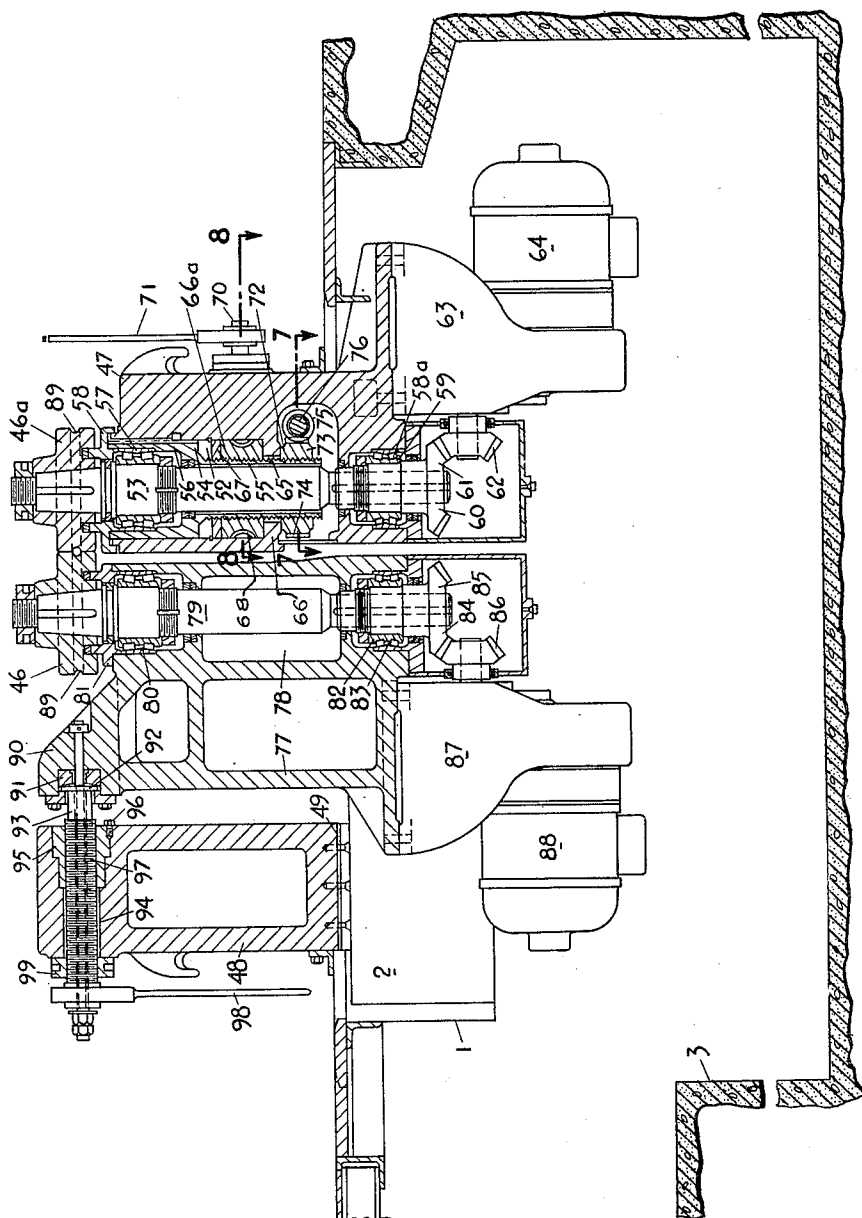


Fig. 5

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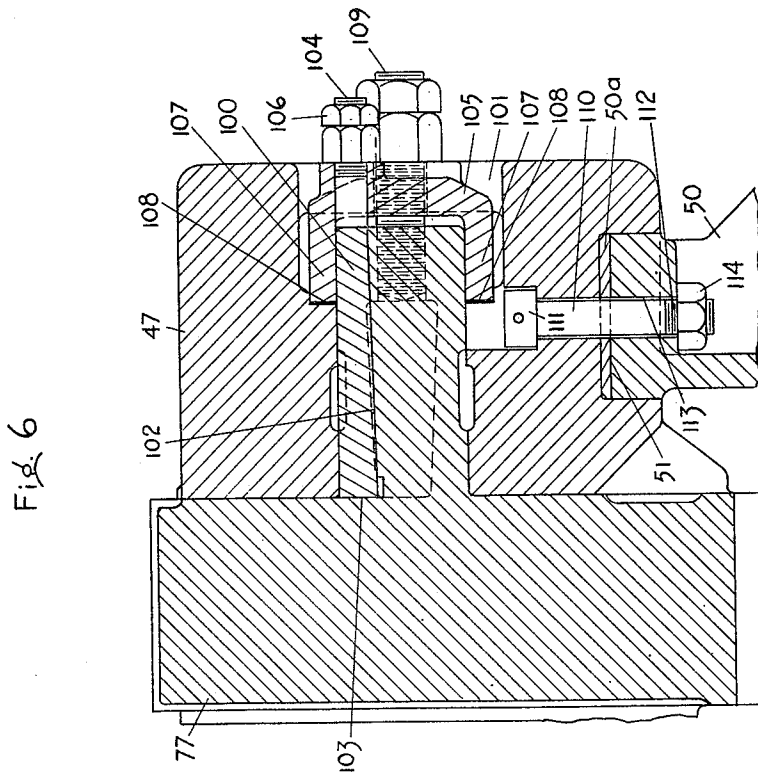
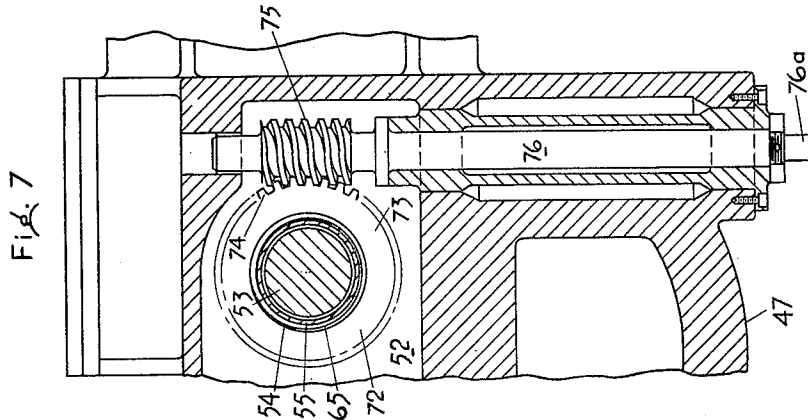
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6 Sheets-Sheet 6



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## UNITED STATES PATENT OFFICE

2,528,075

BAR MILL

Edward T. Peterson, Reading, Pa.

Application August 10, 1945, Serial No. 610,122

2 Claims. (Cl. 80—31.1)

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The invention pertains to a mill for use in the fabrication of bars or the like.

An object of the invention is the provision, in a bar mill, of a pair of precision rolls placed in the close proximity to a pair of finishing rolls so that as a bar passes from the finishing rolls to the precision rolls it will be intercepted immediately and therefore the bar will be stiff enough to resist a turning action.

Another object of the invention is the provision, in a bar mill, of a set of precision rolls so mounted as to be movable with respect to a set of finishing rolls and the former rolls being so arranged and constructed that they may be moved in unison longitudinally of the finishing rolls and may be moved relative to one another horizontally and vertically.

A further object of the invention is the provision, in a bar mill, of a plurality of finishing rolls supported by a stand in such a manner that the finishing rolls are removable from the stand in a direction horizontally or longitudinally of said finishing rolls, and a set of precision rolls mounted in close proximity to the finishing rolls and arranged adjustably so as to align the precision rolls relative to each other as well as with a particular pass of the finishing rolls.

These and many other objects of the invention will become apparent from the succeeding description considered together with the accompanying drawings, the latter of which disclose a form of the invention, and wherein:

Figure 1 is a front elevational view of a portion of a bar mill embodying the present invention.

Figure 2 is a side elevational view of the structure disclosed in Figure 1.

Figure 3 is a plan view of the structure shown in Figure 1.

Figure 4 is a vertical sectional view taken along the lines 4—4 of Figure 3, looking in the direction of the arrows.

Figure 5 is a vertical sectional view taken along the lines 5—5 of Figure 3, looking in the direction of the arrows.

Figure 6 is an enlarged vertical cross sectional view taken along the lines 6—6 of Figure 1, looking in the direction of the arrows.

Figure 7 is an enlarged horizontal sectional view taken along the lines 7—7 of Figure 5, looking in the direction of the arrows.

Figure 8 is an enlarged horizontal sectional view taken along the lines 8—8 of Figure 5, looking in the direction of the arrows.

Referring now in detail to the drawings, where-

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in like reference characters refer to like parts, the numeral 1 is employed to indicate, in a somewhat general manner, an arrangement of a portion of a bar mill employed in the manufacture or fabrication of metallic bars. The mill illustrated comprises a shoe plate 2 suitably anchored to a foundation 3 and which has a top portion underlying a floor plate 4 forming the floor line of the mill. Mounted upon the shoe plate is a stand, casting or housing 5 rising above the floor line and removably secured to the shoe plate through the bolts 6 conveniently and suitably spaced about the base of the stand. Because of the particular arrangement and association of components making up the structure of the present invention, a head 7 of the stand is desirably formed integral with the lower portion thereof and in this regard the stand is of a unitary design capable of withstanding the stresses to which it will be subjected in service. Associated with the stand is a pair or set of finishing rolls 8 having a series of matched, peripheral recesses or grooves 9 formed therein and which may be of any desired configuration. By way of illustration, the grooves shown in the finishing rolls are substantially semicircular in section which will form a bar of substantially circular cross section. However, if it is desired to form bars of any other cross sectional configuration, it will be clearly understood that the grooves in the finishing rolls need be made only to correspond to the desired cross section. Each roll is provided with spaced journals 10 which have associated therewith roller or anti-friction bearings 11 affording a free rotative movement of the rolls and each roller bearing is encased within a suitable bearing box or housing 12. Because the finishing rolls extend horizontally or transversely of the stand and are arranged vertically or one above the other, the journal housings are interlocked in any desired manner with stanchions 13 so that the stanchions and finishing rolls are removable from and insertible within the stand as a unit and if or when the finishing rolls become worn beyond a permissible degree or it is desired to change the rolls for any reason, such as for the formation of a bar of another cross section, the rolls associated with the stand may be withdrawn and another set replaced in lieu thereof. To facilitate a roll changing operation the stand is provided with a lug 14 to which is removably secured through the medium of a pin 15 or any such means a roll changing rig 16 having a surface 17 in horizontal alignment with a surface 17a of the stand upon which the stanchion and

finishing roll assemblage bears. The finishing rolls and stanchion assemblage is provided with oppositely or transversely extending draw bars 18 and 18a so that for a removable operation a means (not shown) is associated with the draw bar 18 and the assemblage is withdrawn from the stand on to the roll changing rig and a removal of the pin 15 will permit the roll changing rig and its superimposed assemblage to be carried by any means such as a sling and crane hook 19 to any desired location. A renovated or new assemblage can then be transported to adjacent the stand and by attaching a means to the draw bar 18a the assemblage can be moved horizontally from the roll changing rig to its normal or illustrated position within the stand.

Means has been associated with the stand to retain an assemblage in a predetermined position as well as overcome any lifting or raising action of the top finishing roll during a bar forming operation and as exemplary of such a means: each stanchion has associated therewith an anvil or bearing block 20 resting upon each uppermost housing and being removable from the stand with the assemblage including the stanchions and associated components. The stand 7 has, extending vertically therethrough, a set of bores or circular openings 21 disposed transversely of the stand and which lie in a vertically extended plane bisecting the vertically aligned axes of the finishing rolls. The lower extremity of each opening is of stepped arrangement for the accommodation of a bushing 22 removably secured to the stand and being provided with internal threads 23. Extending through each bore is a power means, stem or screw 24 having an intermediate portion exteriorly threaded so as to interlock with the threads of a related bushing and, accordingly, the vertical position or disposition of the power means is controlled by the intermeshing threads. The lower portion of each stem below the threaded intermediate portion presents a shank 25 of reduced cross sectional area and terminating in a circular, force transmitting head 26, the latter of which is rotatably associated and interlocked with a suitable block 27 bearing downwardly against a subjacent anvil. Stem actuating or rotating means is provided in the stand and while various arrangements may be here employed, the preferred means is to arrange splines or longitudinally extending grooves 28 in an upper extremity of each stem or an extremity thereof removed from the head. Disposed within a suitable recess in the stand is a collar 29 desirably spaced from but, however, surrounding the upper extremity of each stem. Rotatably associated and in supported relation with the collars are a plurality of spur gears 30 and 30a which are interiorly configured to interlock with the splines of the respective stems. Accordingly, any rotative motion of the gears 30 and 30a will impart a like action to the stems to cause the stems to move axially relative to the gears and because of the presence of the threaded relationship between the stems and bushings the blocks 27 will be moved or urged upwardly or downwardly depending, of course, on the direction of rotation of the gears. Extending transversely of the stand and associated with the head thereof is a plurality of gear actuating means exemplified by telescoping shafts 31 and 31a, the latter of which extends through the former as indicated in Figure 4 particularly because of their relative sizes. Associated with an extremity of each shaft is a worm gear (not shown) which intermeshes

with a related spur gear while the opposite ends of the shafts are provided with ratchet wrenches 32 and 32a. Accordingly, the stems are individually adjustable so that the proper pressure may be applied to each anvil individually and the finishing rolls may be adjusted or have force applied thereto so that the rolls will function properly and as intended.

Means has been provided in the structure of the present invention to take up any slack or lost motion in the threads of the stem-bushing relationship and, as exemplary of such a means, the stanchions are provided with reentrant shoulders 33 each having an arcuate downwardly facing surface 34. Extending horizontally or transversely of the head or structure is a beam or bridge 35 having accommodating apertures for the reception of the stem and in bearing relation with the stanchion arcuate surfaces. Each extremity of the bridge is jaw-shaped as at 36 to be pin connected to an eyelet or lower extremity 37 of a hanger means 38, the latter of which extends vertically or upwardly from the bridge extremities. Outstanding horizontally from the head adjacent the vertical limits of the bushings is a pair of oppositely directed shelves, ledges or brackets 39 suitably apertured for the extension of the hanger means therethrough. Sleeved over each hanger means and supported by a related shelf is a resilient means, coil or helical spring 40 having mounted thereon a spring plate or cap 41 which is held in a predetermined position by a rotatable element or nut or nuts 42 associated with an extremity of the hanger element removed from the eyelet thereof. By a rotation of the nuts a predetermined compressive value of the springs can be definitely established and these forces transmitted to the stanchions through the hangers and bridge will eliminate any slack between the threads of the stems and bushings. It might be here stated, incidentally, that the bridge is perforated as at 43 and baffle plates 44 are arranged between the bearing housings and bridge so that a coolant may be directed to the finishing rolls during a bar fabricating operation.

When it is desired to replace an assemblage the nuts 42 are rotated to relieve the springs and the pressure is relieved from the bridge-stanchion connections. The ratchet wrenches are rotated to cause the blocks 27 to move upwardly away from the anvils and upon removal of the baffle plates the assemblage is in condition to be shifted horizontally out of the stand as hereinbefore described.

It might be well to state at this time that the finishing rolls may be driven by any means but it is preferred to couple adjacent extremities of the finishing rolls to a related three-high mill as indicated diagrammatically by the reference character 45 in Figure 3 only of the drawings.

Because of the possibility of a bar emerging from the finishing rolls not of true cross sectional area, and by that is meant, a bar, preparatory to being subjected to a pass of the finishing rolls, may contain more metal in cross section than required in the finished bar and, accordingly, it may emerge from the rolls with burrs or fins extending longitudinally of the bar and in order to complete a final operation on the bar to ensure a true predetermined cross sectional configuration, precision rolls 46 and 46a are disposed adjacent to the finishing rolls. The precision rolls are, as will be hereinafter more clearly pointed out, arranged to intercept the bar as soon as possible after it has left the fin-

ishing rolls so as not to subject the bar to any abnormal or bending stresses and, for this reason, the bridge, gap or space between the finishing and precision rolls is such that, considered by the size of the rolls, is less than the diameter of either of the rolls. By spacing the rolls thus in close proximity to one another the bar or bars are acted upon almost immediately as they emerge from the finishing rolls.

The precision rolls are carried by a main vertical roll housing 47 which comprises an upright barrier 48 having a lower extremity or foot 49 thereof extending into the horizontal limits of the standard and being supported by and in sliding engagement with the shoe plate. The vertical roll housing is, therefore, in telescoping relation with the stand and thus, among other reasons hereinafter made apparent, the precision rolls are capable of being placed in a close proximity to the finishing rolls. Spaced a predetermined distance away from the stand and extending parallel to the stand transversely thereof is a shoe beam 50 suitably anchored to the foundation and having a top surface 50a in the proximity of the floor line and substantially in horizontal alignment with the barrier foot. The main housing has, spaced horizontally from the foot, away from the stand, a downwardly facing channel-shaped guideway 51 which fits neatly over the shoe beam 50 and this arrangement functions as an outer support for the main housing. By reason of the shoe beam fitting into the guideway, a definite interlock is thus formed to absolutely fix the position of the main housing or prevent it from shifting in a direction directly away from or toward the stand. The main vertical roll housing has, in the area between the shoe beam and stand, a vertically extending bore 52 separated into various communicating chambers for the accommodation of related structure hereinafter described in detail. Extending axially of the bore 52 is a spindle 53 having suitably secured to its upper or free extremity the precision roll 46a which is adapted to rotate in response to a rotative action imparted to the spindle. Disposed within the bore and movable vertically therein relative to the main housing is a sleeve 54 having a lower portion 55 extending about the intermediate part of the spindle and an upper enlarged portion 56 encasing an anti-friction bearing 57 interposed between the spindle and sleeve to afford a free running movement of the spindle. A cap or cover 58 is interposed between the precision roll 46a and enlarged portion of the sleeve and is removably secured to the latter in supporting relation with the precision roll 46a. While the bearing 57 forms a suitable guide for the upper extremity of the spindle the lower extremity is guided by a roller or anti-friction bearing 58a having an inner raceway 59 thereof forming a part of a drive gear 60 which is splined to the spindle so as to move the latter in a rotative direction but arranged to move relatively thereto axially of the spindle. Forming a part of the running gear removed from the raceway, axially of the spindle, is a beveled gear 61 which intermeshes with a correspondingly formed beveled gear 62, the latter of which is operatively connected to a train of gears (not shown) housed by a gear box 63. The gear box is removably secured to the main vertical roll housing and has associated therewith a motor 64 so that the latter is, through the train of gears, adapted to impart a rotative motion to the beveled gears, spindle and precision

roll 46a. The driving gear is made, as previously described, so as to remain fixed vertically relative to the main housing but, however, have the spindle move axially thereof and thereby provide an adequate guide means for the spindle while permitting a vertical adjustment of the precision roll 46a to be made hereinafter apparent. As implied, therefore, means has been associated with the main housing so that a vertical adjustment of the precision roll 46a may be effected and as exemplary of such a means, the lower portion 55 of the sleeve is exteriorly threaded as at 65. Bearing upon a suitable shoulder 66 within the bore is a rotatable element or actuating means or annular gear nut 66a having interior threads intermeshing with the exterior threads of the sleeve. A retaining ring 67 interlocked with the main housing bears upon the gear nut so as to maintain it in bearing relation with the shoulder and while permitting a rotative action of the gear nut, the retaining ring prevents it from moving vertically relative to the main housing. The exterior of the gear nut is provided with teeth 68 which mesh with correspondingly formed teeth of a horizontally disposed worm gear 69 suitably journaled in the main housing. An operating bar 70 is outstanding from the worm gear to project beyond the limits of the main housing where it has attached thereto a ratchet 71. By reason of the particular arrangement just described, a manipulation of the ratchet 71 will, through the rotative actions of the worm and nut gears, cause the sleeve to be moved vertically and alter the vertical disposition of the precision rolls 46a relative to the main vertical roll housing.

A locking mechanism 72 has been associated with the sleeve of the main housing to hold the spindle in a fixed position after it has been set at a required height. The locking mechanism desirably comprises an annular jamb nut 73 interiorly threaded to be intermeshed with the threads 65 of the sleeve and is normally in bearing relation with the overlying shoulder 66 to thereby prevent an unwarranted rotative motion of the sleeve. Exterior teeth 74 are formed on the jamb nut to accommodate correspondingly formed teeth on a worm gear 75 which has an axis extending horizontally or perpendicularly to the axis of the spindle or jamb nut. The worm gear 75 has a shaft 76 which extends beyond the horizontal limits of the main housing as at 76a and is suitably journaled within the main housing. A ratchet wrench or any power means (not shown) may be associated with the shaft extremity to impart a rotative motion to the related worm gear. A rotative action of the worm gear will move the jamb nut away from its related shoulder to afford a vertical adjustment of the precision roll 46a and after the completion of that operation the jamb nut is again moved into contact with the overlying shoulder to maintain the thus established precision roll height.

Associated with the main vertical roll housing is an auxiliary vertical roll housing 77 which is formed with a cored chamber forming partitions 78 adjacent one side thereof. Extending vertically through the cored portion is a spindle 79 having, at its upper extremity, the precision roll 46 keyed or otherwise secured thereto. Surrounding the spindle 79 below the associated roll is a roller or anti-friction bearing 80 which is received neatly by the auxiliary housing bore to guide the upper extremity of the spindle and thus afford a free running movement thereof. Lock-

ing the bearing within the auxiliary housing is a cap 81 removably secured to the auxiliary housing by any desired means. The cap 81 also functions as a support for the precision roll 46 and because of this relationship this particular precision roll is at all times maintained at a constant predetermined height. For the sake of economy and sound manufacturing practice, the two spindles are made counterparts of one another and, accordingly, the lower extremity of the spindle 79 is also guided by a roller or anti-friction bearing 82 having an inner raceway 83 thereof forming a part of a driving gear 84 which is splined to the related spindle so as to move the latter in a rotative direction. Removed from the inner raceway but forming an integral part thereof is a beveled gear 85 which intermeshes with a correspondingly formed beveled gear 86, the latter of which is operatively coupled to a train of gears (not shown) housed by a gear box 87. The gear box 87 is removably secured to the auxiliary vertical roll housing and has associated therewith a suitable motor 88 so that the latter is, through the medium of the train of gears and related beveled gears, capable of imparting a rotative motion to the spindle 79 and its associated precision roll.

The vertical or precision rolls are each provided with a peripheral groove or recess 89 of a configuration to correspond identically with a half of the desired or final configuration of the completed bar so that when placed in juxtaposition the grooves will be properly mated to perform the final operation on the bar. As previously described, the precision roll 45a may be adjusted vertically only so as to align vertically the grooves of the precision rolls. However, a horizontal adjustment of the precision rolls is also desired because, among other numerous reasons, the precision rolls after continued usage may be required to be redressed due to wear caused thereto incident to service. As exemplary of various means for moving the precision roll 46 toward or away from the precision roll 46a or, in other words, moving the precision roll 46 perpendicular or normal to the flight of the rod between the precision rolls, the auxiliary housing is provided with an abutment 90 adjacent to the upper limits thereof and desirably adjacent the horizontal plane of the precision rolls. The abutment has an interlocking cage 91 associated therewith and the latter is arranged to movably accommodate or interlock with a head 92 of a horizontally directed ram 93. The upright barrier of the main vertical roll housing has a horizontal bore 94 in substantial alignment with the cage and has at one end thereof an interiorly threaded bushing 95 interlocked with the barrier by any desired means such as the illustrated cap screws 96. Exterior threads 97 are provided on the ram intermediate its ends to intermesh with the interior threads of the related bushing and a ratchet wrench 98 is associated with the free extremity of the ram to impart a rotative motion to the latter. Any rotative movement of the ram will, therefore, move the auxiliary housing horizontally and the precision roll carried thereby toward or away from the related precision roll. A lock nut 99 is rotatably associated with the exterior threads of the ram so that after a presetting of the precision rolls has been effected the lock nut is turned up against the barrier to prevent an accidental movement of the ram. Also to be noted is that the horizontal axis of the ram is in alignment with the axis of the rod forming grooves in the

precision rolls and, by reason of this relationship, any tendency of the precision roll 46 to shift away from the precision roll 46a will be directly transmitted to the ram.

For reasons which will be hereinafter made apparent, the auxiliary vertical roll housing is desirably supported by the main vertical roll housing and because of this preferred relationship, the auxiliary housing is provided with an arm or extension 100 directed horizontally into a suitably formed recess, guideway or pocket 101 in the main housing. The arm is of a width less than the length of the pocket so as to afford an adjustment of the precision roll 46 toward or away from the precision roll 46a. The thickness of the arm is slightly less than the height of the pocket and preferably a sliding fit is provided between upper and lower surfaces of the arm so that a full surface bearing relationship will be presented between the arm surfaces mentioned and contiguous surfaces of the pocket. So as to ensure a full bearing relation between the arm and main housing the arm of the auxiliary housing is provided with a wedge-shaped groove 102 extending throughout its width and disposed within the groove is a wedge 103 having a threaded shank 104 extending beyond a guide clip 105 where the wedge is provided with a nut or nuts 106. A proper manipulation of the nut or nuts 106 will draw the wedge longitudinally of the groove 102 to positively and effectively bind the arm within the pocket. It will be noted that this relationship also assists in locking together the auxiliary and main vertical roll housings to prevent unwarranted shifting horizontally therebetween. The guide clip 105 is disposed within the main housing pocket and has vertically spaced legs 107 thereof abutting suitable shoulders 108. Stud bolts 109 interlock the guide clip with the arm and, accordingly, when upon release of the wedge, the auxiliary housing in being moved for precision roll horizontal adjustment, follows a definite fixed predetermined path.

The arrangement formed by the auxiliary and main vertical roll housings is fixed with respect to a predetermined position by a bolt 110 having a head 111 disposed in a counterbore opening into the main housing pocket and a shank 112 which extends through a suitable accommodating aperture in the main housing and an elongated opening 113 in the shoe beam. The lower extremity of the bolt is provided with a nut 114 so that after the arrangement has been set at a desired location the effective length of the bolt 110 can then be shortened to definitely maintain the arrangement fixed.

As previously described, the finishing rolls are provided with a plurality of circumferential bar-forming grooves and any pair of related grooves may be employed in the fabrication of bars. The primary reason for utilizing finishing rolls with a multiplicity of bar-forming grooves is so that as one mating pair or set of grooves wears beyond a permissible degree then the next set may be employed and so on until the last set has become worn. By reason of this common expediency a pair of finishing rolls need not be replaced or reconditioned until after all the bar-forming grooves have become worn and also the arrangement formed by the two housings is made movable in a direction axially of the horizontal or finishing rolls so that the grooves in the precision rolls can be aligned horizontally with the set of finishing roll grooves

being employed. The means for imparting a horizontal movement to the arrangement is characterized by a motor 115 operatively connected to a gear box 116 containing a train of gears (not shown). Both the motor and gear box just described are suitably anchored to the foundation by any desired means not shown. Associated with the train of gears in the box 116 is a reciprocating plunger 117 adapted to be moved axially thereof through the action of the motor. One or a free extremity of the plunger is pin connected to a jaw 118 formed integrally with the main vertical roll housing so that any motion imparted to the plunger will be reflected in the arrangement formed by the two housings and related components.

From the above it will be noted that various changes and alterations may be made to the illustrated and described construction without departing from within the spirit of the invention and scope of the appended claims.

I claim:

1. In a bar mill, the combination of, a main housing having a vertical bore, a sleeve within said bore, a spindle carried by said sleeve and having a precision roll secured to an upper end thereof, a gear nut supported by said main housing and being threadedly associated with said sleeve for moving the latter vertically, a jamb nut carried by said sleeve and reacting against said main housing, an auxiliary housing within and carried by said main housing, a vertical spindle carried by said auxiliary housing and having a precision roll secured to an upper end thereof, a barrier on said main housing, adjusting means carried by said barrier and connected to said auxiliary housing in alignment with said precision rolls for moving one of said precision rolls away or toward the other of said precision rolls, and synchronized motor means carried by each of said housings for driving said spindles in-

dependently of one another and at the same peripheral speed.

2. In a bar mill, the combination of, a main housing having a vertical bore, a sleeve within said bore, a spindle carried by said sleeve and having a precision roll secured to an upper end thereof, a gear nut supported by said main housing and being threadedly associated with said sleeve intermediate the ends thereof for moving the latter vertically, means carried by said main housing for rotating said gear nut, a jamb nut carried by said sleeve in spaced relation with said gear nut and reacting against said main housing, means for rotating said jamb nut for allowing vertical adjustment of said sleeve, an auxiliary housing within and carried by said main housing, a vertical spindle carried by said auxiliary housing and having a precision roll secured to an upper end thereof, a barrier on said main housing, adjusting means carried by said barrier and connected to said auxiliary housing in alignment with said precision rolls for moving one of said precision rolls away or toward the other of said precision rolls, and synchronized motor means carried by each of said housings for driving said spindles independently of one another and at the same peripheral speed.

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