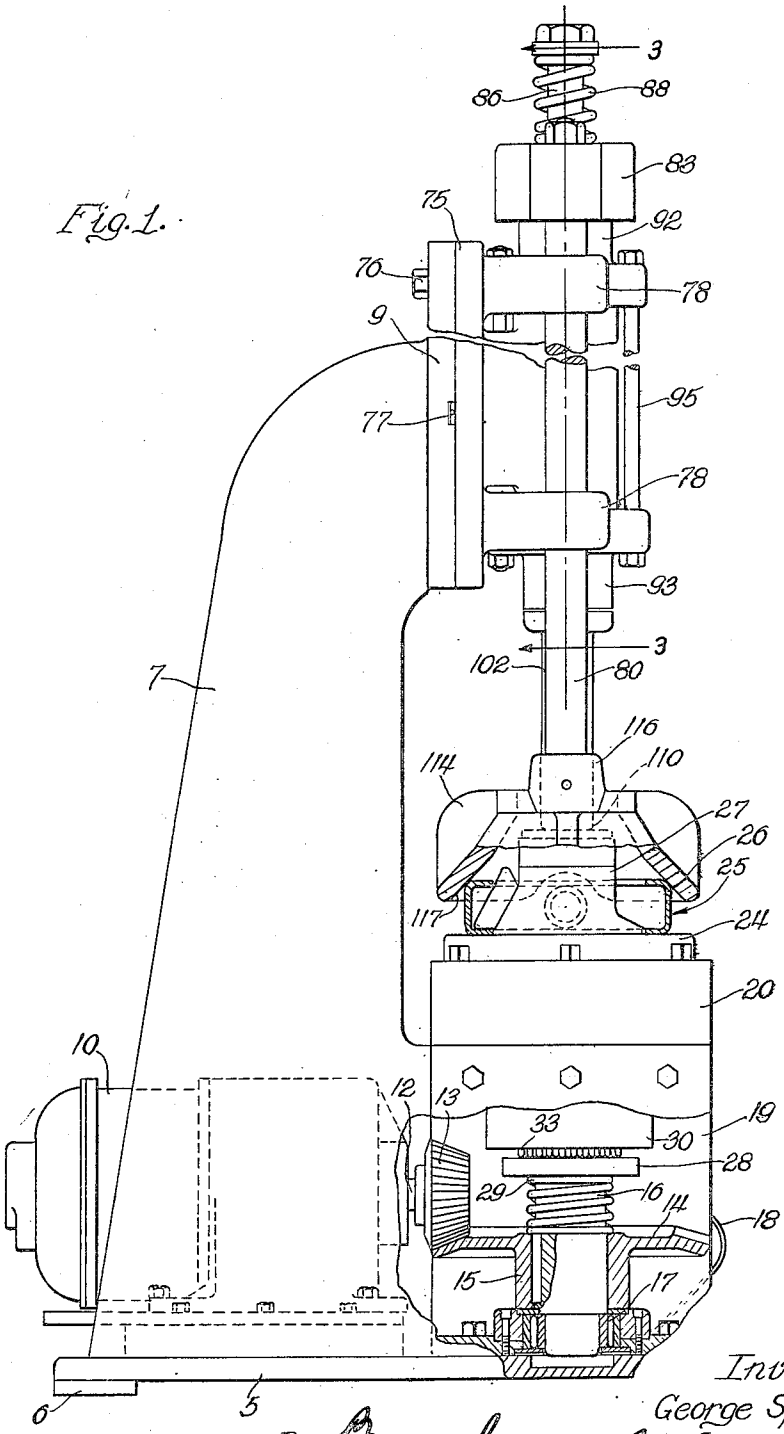
May 30, 1939. G. SPATTA 2,160,179

METHOD OF AND MEANS FOR ROLLING BANJO TYPE AXLE HOUSINGS

Filed Nov. 23, 1936 4 Sheets-Sheet 1

Fig. 1.



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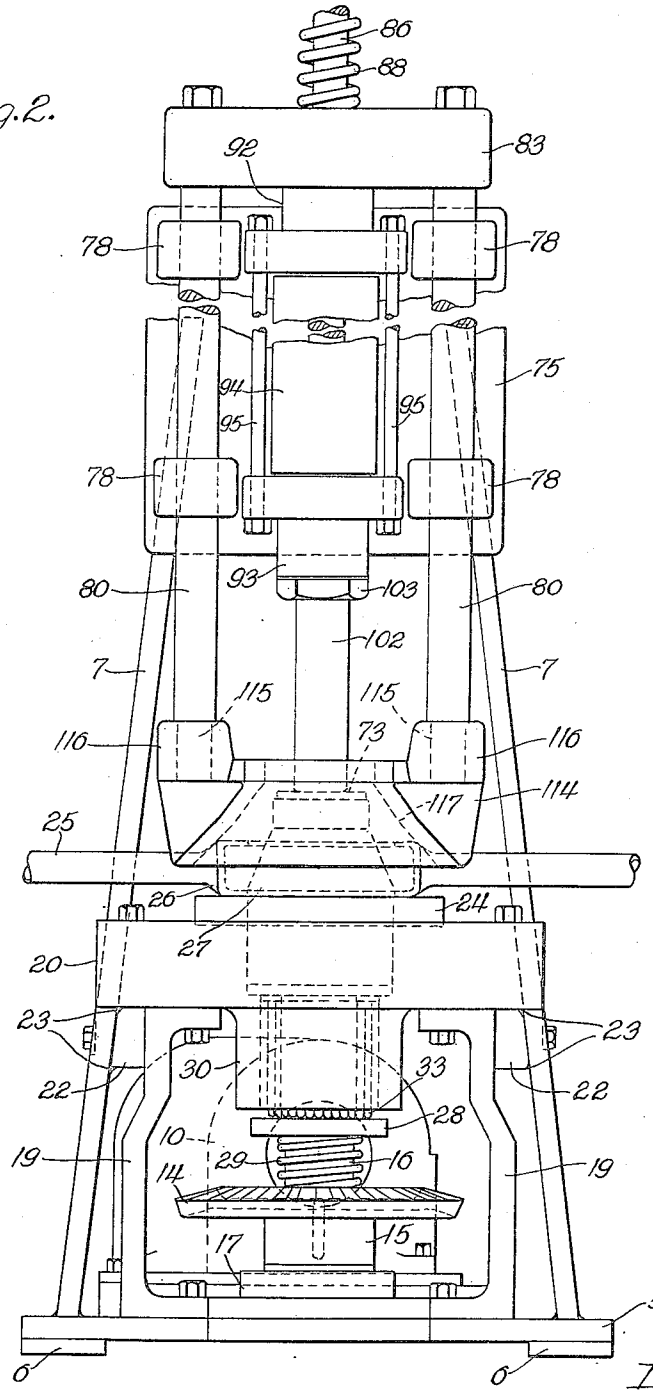
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METHOD OF AND MEANS FOR ROLLING BANJO TYPE AXLE HOUSINGS

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Fig. 2.



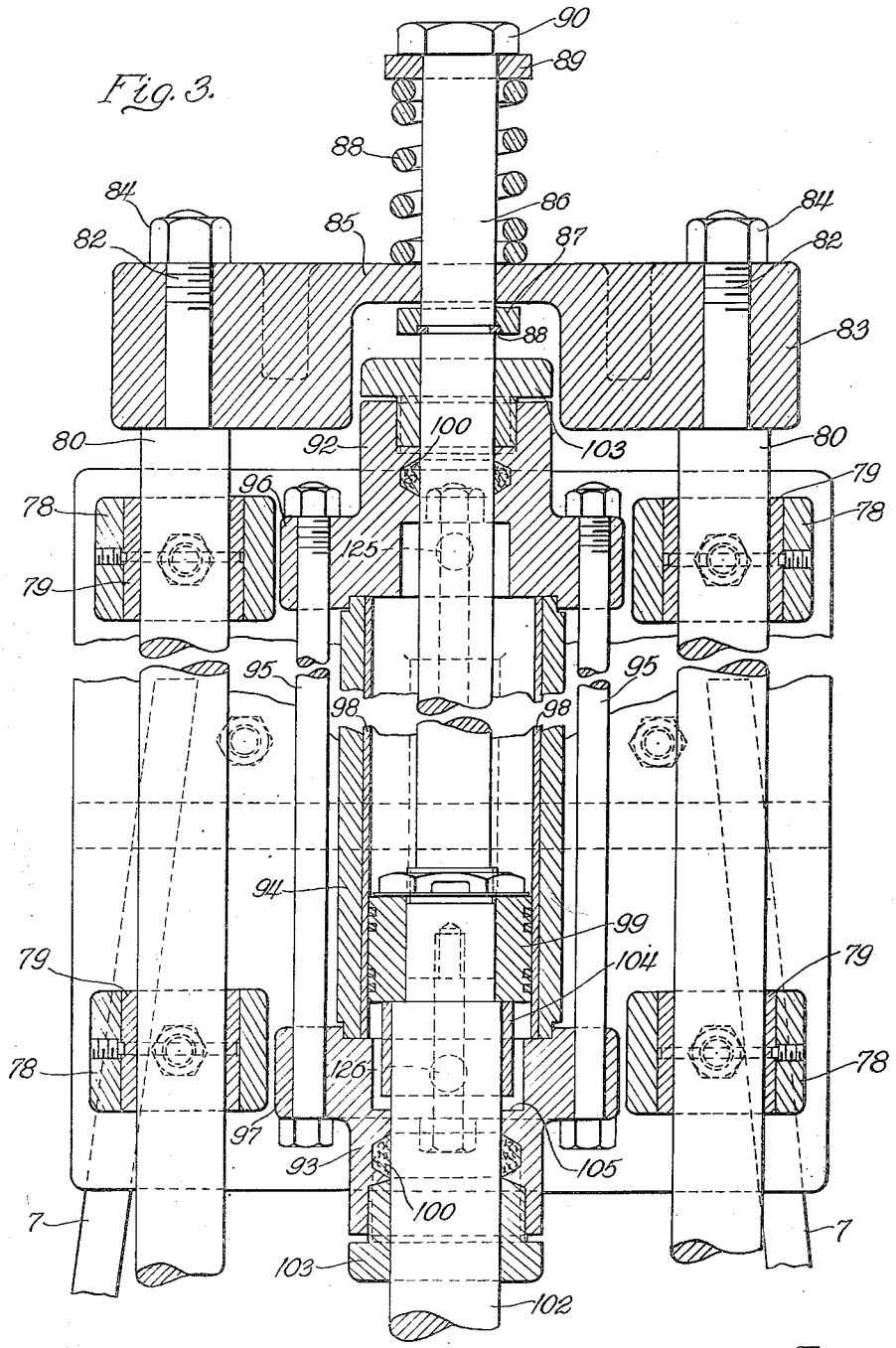
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METHOD OF AND MEANS FOR ROLLING BANJO TYPE AXLE HOUSINGS

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Fig. 3.



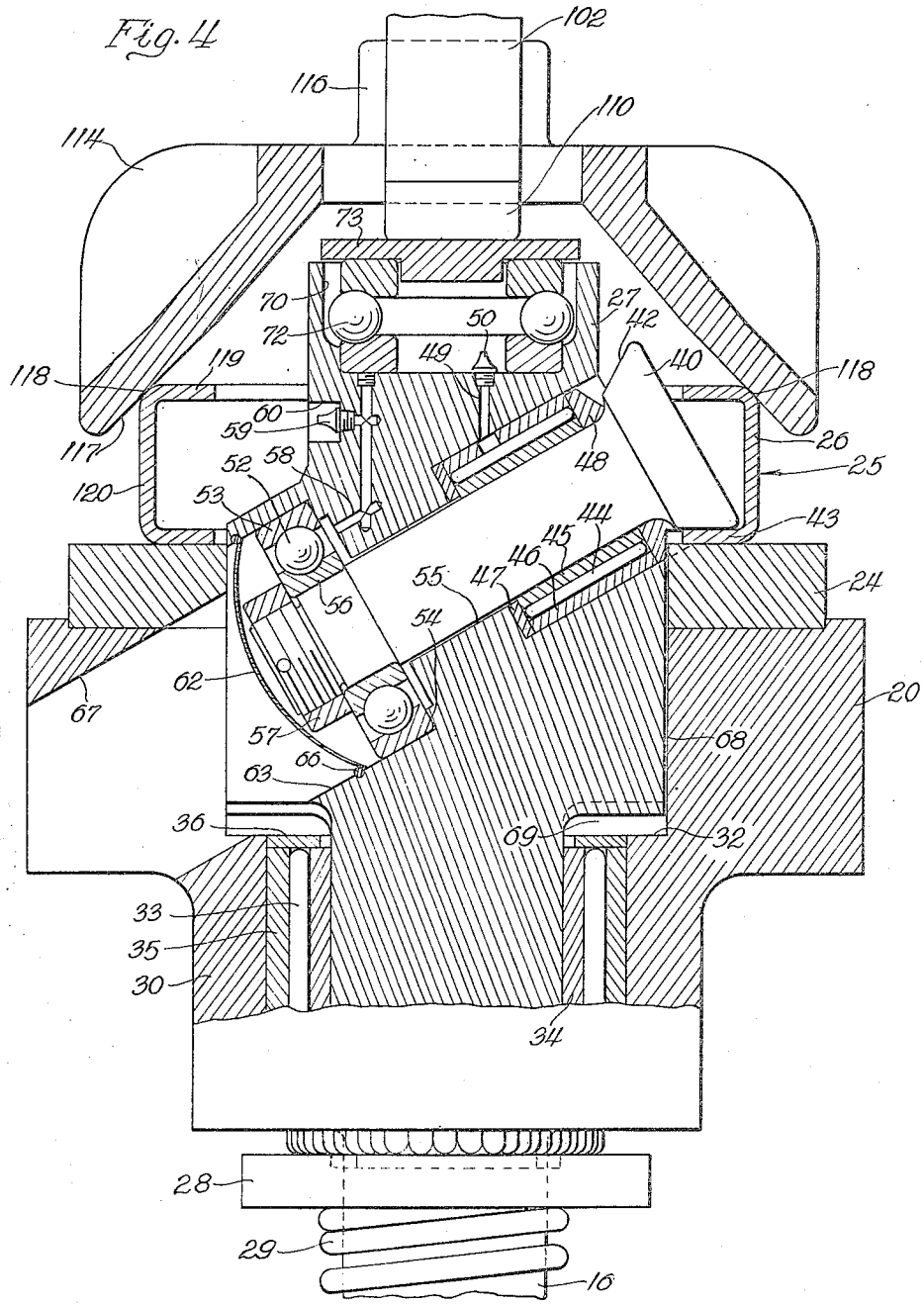
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METHOD OF AND MEANS FOR ROLLING BANJO TYPE AXLE HOUSINGS

Filed Nov. 23, 1936 4 Sheets-Sheet 4

Fig. 4



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UNITED STATES PATENT OFFICE

2,160,179

METHOD OF AND MEANS FOR ROLLING BANJO TYPE AXLE HOUSINGS

George Spatta, Buchanan, Mich., assignor to Clark Equipment Company, Buchanan, Mich., a corporation of Michigan

Application November 23, 1936, Serial No. 112,248

10 Claims. (Cl. 153—54)

This invention relates to a method of and means for rolling banjo type axle housings, and more particularly is directed to the method of and means for straightening flanges such as those which define the central banjo opening of a housing of this type in order to true these flanges and roll them into accurate parallelism.

In the formation of banjo type housings such as described in my Reissue Patent No. 20,103, issued September 8, 1936, after the spreading operation which forms the banjo frame portion of the housing, it becomes necessary to true up the flanges which extend radially inwardly and define the central opening into which the differential assembly is inserted. These flanges must extend at right angles to the axis of the opening and must be disposed in accurate spaced parallel planes.

The present invention contemplates, broadly, a novel method of clamping and straightening these flanges by means of which the flanges are rolled into spaced parallel planes. In carrying out this feature of the invention it is necessary to insure that the axle housing be accurately centered on the machine and be held in fixed position during the rolling operation to insure proper alinement of the rolling mechanism and proper straightening of the flanges. This is preferably accomplished by means of a hydraulic clamping mechanism which engages and centers the banjo portion of the housing to hold the same in fixed position during the operation of the rolling mechanism.

Another object of the present invention is the provision of a fixture which provides a simplified arrangement for supporting the work during the rolling operation and which can be readily operated by an unskilled laborer.

While the invention is described and illustrated in connection with banjo type axle housings, it will be obvious to those skilled in the art that the invention may be applied to any rolling or straightening operation upon annular radially extending flanges.

Other objects and advantages of the present invention will appear more fully from the following detailed description which, taken in conjunction with the accompanying drawings will disclose to those skilled in the art the particular construction and operation of a preferred form of the present invention.

In the drawings:

Figure 1 is a side elevational view with portions broken away showing the assembled machine in position for the rolling operation;

Figure 2 is a front elevational view of the machine shown in Figure 1;

Figure 3 is a sectional view taken substantially on line 3—3 of Figure 1 showing the hydraulic actuating mechanism for the clamping members; and

Figure 4 is a sectional view through the clamping and rolling portions of the mechanism.

Referring now in detail to the drawings, the machine preferably comprises a base 5 having leg plates 6 welded or otherwise suitably secured to the under surface thereof, and having converging side plate members 7 extending upwardly from opposite sides of the base 5 and terminating in a vertically extending supporting plate 9 welded or otherwise suitably secured transversely across the upper ends of the plates 7.

Mounted on the base 5 between the plates 7 is a standard type of electric motor 10, which is rigidly secured in position on the base and which has the shaft 12 provided with the pinion gear 13. This gear 13 has meshing engagement with a bevel gear 14 having a hub portion 15 having axial sliding keyed engagement to the shaft 16, which shaft at its lower end is supported in a thrust bearing assembly, indicated generally at 17. A suitable guard 18 is provided across the front of the machine to protect the operator from the gear 14. Mounted on the base 5, forwardly of the plates 7 are the frame members 19, preferably bolted to the base in any suitable manner and which, at their upper ends, suitably support a table member 20 mounted thereon and fixed to support blocks 22 welded as at 23 to the side plates 7.

Mounted in a recessed portion of the upper surface of the table 20 is an anvil 24 which is secured to the table 20 by means of countersunk cap screws extending into the table. The anvil 24 is adapted to provide a support for an axlie housing indicated at 25, which housing has been subjected to a spreading operation, forming a central banjo portion 26 which fits about the rotating head 27 extending centrally through the table 20 and anvil 24.

The shaft 16 and head 27 are preferably formed integral, the shaft 16 also being provided with an annular collar 28 locked thereto and forming an upper stop for a compression spring 29 which encircles the shaft 16 and is biased at its lower end about the hub of the gear 14. The compression spring normally acts to raise the collar 28 into abutting engagement with the lower end of the socket portion 30 depending from the under surface of the table 20. This socket

portion 30, as indicated in detail in Figure 4, is provided with a counterbored recess 32 receiving the head portion 27 of the upper end of the shaft 16. The collar 28 is held in fixed position on the shaft 16 by means of a suitable locking ring preferably in the form of a split washer. The shaft 16 is mounted for vertical sliding movement within the table 20 and anvil 24 by means of the roller bearing members 33 carried between inner and outer races 34 and 35, respectively, of a bearing assembly disposed between the shaft 16 and the socket portion 30 of the table 20. This bearing assembly is preferably closed at its upper end by a dust washer 36.

Carried in an angularly extending position in the head 27 is a roller and arbor member 40, the roller portion being provided with a beveled head having the tapered surface 42 adapted to have rolling engagement with the internal surface of the banjo side flange 43. The arbor portion of the member 40 is supported adjacent the head 42 by means of the roller bearings 44 carried between the inner and outer races 45 and 46 of the bearing assembly, and held in position at their lower ends by the thrust washer 47, and at the outer ends by the washer 48 which encircles the arbor immediately adjacent the flared head portion. Lubricant is admitted to this bearing assembly through the lubricant channel 49 provided with a lubricant fitting 50 of standard type.

At its lower end the roller is mounted within a ball bearing assembly 52, the outer race 53 of which is held against a shoulder 54 formed in a counterbored portion of the angularly extending passageway 55 in which the roller 40 extends, and the inner race 56 is clamped in position by the nut 57 carried at the reduced end of the member 40. Lubricant for this bearing assembly is supplied through this passageway 58, communicating with the lubricant fitting 59 extending upwardly through a recessed portion 60 of the lateral periphery of the head 27. A cover disc 62 is sprung into position over the lower end of the member 40 within the counterbored portion 63 of the passageway 55, and is held in position by the snap ring 66 snapped into an annular groove formed in this passageway. This prevents any of the flakes or scale from the housing getting into the bearing assembly and, if any of such flakes do fall into the passageway 63, they can be discharged through the angularly extending passageway 67 formed in the anvil 24 and table 20. Preferably, the portion 68 of the head 27, which is cylindrical in shape and rotates within the counterboard opening 32 of the table 20, is cut away adjacent its lower portion, as indicated at 69, to provide clearance with respect to the shoulder 32 so that upon vertical movement of the shaft 16 no binding of the head 27 within the anvil or table is effected.

The upper end of the head 27 is axially recessed as indicated at 70 to receive the thrust bearing assembly 72, forming a support for the cap member or thrust washer 73 which is rotatably mounted on the upper end of the head 27 over the recess 70 and is supported for rotation by the bearing 72.

Mounted on the supporting plate 9 carried at the upper ends of the plates 7 is a cylinder casting 75, which is secured to the plate 20 by means of the cap screw 76, and suitable interlocking tongue and groove engagement indicated at 77 which alines the casting 75 in fixed position with respect to the plate 9.

The casting 75 includes vertically spaced bracket portions 78 disposed adjacent opposite sides of the cylinder and having suitable bushings 79 disposed therein for guiding the banjo holder bars 80 for reciprocatory movement within the brackets 78. At their upper ends, the bars 80 are provided with reduced stud portions 82 adapted to carry the banjo pressure head 83 which is secured thereto by means of the nuts 84, and which has a central web portion 85 encircling the upper end of the piston rod 86. A stop ring 87 is mounted on the rod 86 by means of the split washer 88 to limit movements of the pressure head 83 with respect to the rod 86 in one direction. A compression spring 88 encircles the upper end of the rod 86 and is biased between the web portion 85 and a collar 89 disposed beneath the lock nut 90 threaded over the upper end of the rod 86. Thus, upon downward movement of the rod 86, the compression of the spring 88 causes the pressure head 83 to move downwardly causing simultaneous downward movement of the rods 80.

Disposed between opposite pairs of the brackets 78 are the piston stuffing boxes 92 and 93 at opposite ends of the cylinder 94 carried by the casting 75. The boxes are clamped over opposite ends of the cylinder by means of the tie bolts 95 tensioned between flanges 96 and 97 of the stuffing boxes by means of nuts secured to opposite ends of the bolts 95. The cylinder 94 is provided with an internal cylinder sleeve 98 forming a smooth cylinder within which the piston 99 is adapted to reciprocate.

The stuffing boxes 92 and 93 are each provided with axially extending recesses adapted to receive packing 100 compressed about the lateral surface of the piston rod 86 and the piston rod 102 by means of the packing gland nuts 103 threaded into these recesses. A stop collar 104 is positioned about the lower piston rod 102 to limit its downward movement within the recessed portion 105 of the lower stuffing box 93. The rods 86 and 102 are connected to the piston 99 in any usual or desired manner, and are rigidly secured together for conjoint movement. The lower end of the rod 102 is provided with a head portion 110 which is adapted to engage the thrust washer 73 carried by the rotating head 27 to move the head 27 and shaft 16 downwardly to engage the surface 42 of the arbor 40 on the internal surface of the banjo flange 43.

The bars 80 are adapted to carry at their lower end a banjo holder member 114, each of the bars being provided with a threaded portion 115 engaged in integral sockets 116 formed in the upper portion of the member 114, whereby the member 114 has conjoint movement with the rods 80. Disposed in the lower end of the member 114 is the banjo clamping portion 117 which extends at a substantially 45 degree angle, and which is arcuate in shape to engage opposite corresponding arcuate surfaces of the banjo for clamping the same in centered position about the head 27. This portion engages the corners 118 of the junction between the upper banjo flange 119 and the web portion 120 of the banjo, thus exerting a downward and centering pressure on the banjo 26 to hold the same in fixed position during the rolling operation with respect to the center of shaft 16.

Considering now the operation of the mechanism thus far described, the spring 29 normally raises the shaft 16 and head 27 to dispose the arbor 40 out of engagement with the lower flange

43 of the banjo as the banjo is initially set in position on the anvil 24. Pressure is then admitted through a suitable port indicated at 125 in Figure 3 to the upper end of the cylinder 94, moving the piston 99 downwardly and producing corresponding downward movement of the rods 86 and 102. This causes the cross head 83 to move downwardly under the pressure of spring 88 producing downward movement of rods 80 and corresponding clamping movement of the pressure head 114 about the banjo 26. In centering the banjo with respect to the head 27, the spring 88 provides a cushioning means so that excessive pressure which would tend to distort or damage the banjo is not produced.

At the same time, the downward movement of the rod 102 produces engagement of the head 110 on the thrust washer 73 to move the rotating head 27 downwardly with respect to the anvil 24, moving the arbor 40 into engagement with the internal surface of the banjo flange 43. Since the shaft 16 is being rotated through the geared connection from the gear 14 through pinion 13 to the motor, the surface 42 of the roller 40 rolls about the internal surface of the banjo flange 43 and flattens this flange downwardly on the surface of the anvil 24, smoothing the flange and disposing it in a single plane coplanar with the upper surface of the anvil 24.

When the rolling operation has been completed, the port 125 of the cylinder 94 is opened to exhaust, and fluid under pressure is admitted through a suitable port, such as indicated at 126, at the lower end of the cylinder, moving the piston 99 upwardly. This releases the pressure of spring 88 and simultaneously causes engagement of the stop collar 87 with the under surface of the web portion 85 of the cross head 83 drawing the rods 80 upwardly, and thereby raising the pressure head 114 from engagement with the corners 118 of the banjo. At the same time, the rod 102 is moved upwardly releasing the pressure on the thrust washer 73 and allowing the compression spring 29 to move the head 27 and shaft 16 upwardly, thereby disengaging the roller 40 from the banjo flange 43.

This allows the housing to be removed from the anvil 24 and reversed in position with the straightened flange 43 disposed above the flange 119. The same cycle of operation is then repeated to provide for straightening of the flange 119. Since both of the flanges are straightened with respect to the same planar surface, it is obvious that both flanges will be disposed in parallel planes and thus a uniformly flanged banjo section is provided.

It is obvious that various changes can be made in the construction and design of various parts, and the particular manner of providing for movement of these parts can also be varied within the scope of the present invention. I therefore do not intend to be limited to the exact details shown and described, but only insofar as defined by the scope and spirit of the appended claims.

I claim:

1. The method of straightening a radially inwardly extending flange of a channel shaped hoop section which comprises supporting the flange on a planar supporting surface, resiliently engaging the upper periphery of said section for centering said flange in non-rotative position and then producing a rolling pressure on the upper face thereof to force said flange into planar contact with said supporting surface.

2. In a machine for straightening an inturned radial flange of a channel-shaped hoop section, an anvil adapted to support the section, a rotatable work engaging member reciprocably mounted in said anvil within said section and having a projecting roller for engaging said flange, means for pressing said member into rolling engagement with said flange, means for holding said work in centered position on said anvil during the straightening operation, and pressure actuated means common to both said last-named means for initially moving said centering means into position on the work and applying pressure thereto as said pressing means is moved into engagement with said flange, and subsequently producing additional pressure on said pressing means.

3. In a machine for straightening an inturned circular radially extending flange, an anvil having a surface supporting one face of said flange, a shaft reciprocally mounted in said anvil and having a laterally projecting work-engaging roller disposed above said anvil, means for rotating said shaft, centering means, and means for simultaneously actuating said centering means to center the work on the anvil and moving said shaft axially to press said roller into engagement with the opposite face of said flange, said last-named means including resilient means providing for relative movement of said shaft and said centering means.

4. A machine for straightening a circular radially extending flange comprising a frame, a supporting anvil for said flange, hydraulically actuated means carried by said frame above said anvil and operable to hold said flange in centered position on said flange, an axially movable rotatable shaft extending through said anvil and carrying a laterally projecting roller, means normally urging said roller away from said anvil, and means operable upon operation of said hydraulic means for moving said shaft axially to force said roller into pressure engagement with said flange.

5. A machine for straightening a circular radially extending flange comprising a frame, a supporting anvil for said flange, hydraulically actuated means carried by said frame above said anvil and operable to hold said flange in centered position on said anvil, an axially movable rotatable shaft extending through said anvil and carrying a laterally projecting roller, said roller moving in a circle upon rotation of said shaft and being mounted for independent axial rotation within said shaft about an axis extending angularly with respect to the axis of said shaft, and means operable upon operation of said hydraulic means after said flange is centered for moving said shaft axially to force said roller into pressure engagement with said flange.

6. In a machine of the class described, an anvil having a counterbored opening therethrough, a shaft extending through said opening and having an enlarged head portion within the counterbored opening and extending above said anvil, a thrust bearing in the top of said shaft, means disposed below said anvil for normally urging said shaft head outwardly of said anvil, means below said anvil for rotating said shaft, said head portion having an angularly extending passage therethrough opening above said anvil, a roller rotatably supported in said passage and having a laterally projecting roller surface, and non-rotatable means engaging and bearing for forcing said head portion downwardly toward said anvil to move said roller into engagement with work supported on said anvil about said opening.

7. In a machine of the class described having

an anvil and roller means rotatably mounted for movement adjacent said anvil to engage work disposed on said anvil, a pressure cylinder disposed above said anvil, a piston carried therein, means resiliently connected to and movable with said piston for centering work on said anvil with respect to said roller means, said last named means including means for pressing said roller means into working engagement with the work on said anvil upon further movement of said piston.

8. In a machine of the class described having an anvil, a rotatable shaft projecting centrally through said anvil and having laterally offset roller means, means normally urging said shaft and roller means away from the surface of said anvil, a pressure cylinder disposed above said anvil, a piston carried therein, means movable with said piston for centering work on said anvil with respect to said roller means, said last named means including means for pressing said roller means into working engagement with the work on said anvil.

9. A machine of the class described comprising an anvil for supporting the work, a rotatable shaft projecting through said anvil and carrying a laterally projecting roller, means normally urging said shaft and roller away from the work, pressure operated means including an aligning head for centering said work on said anvil with respect to said shaft and a pressure member for forcing said roller into engagement with the work on said anvil, means connecting said head and pressure member providing relative movement therebetween, and power operated means for rotating said shaft.

10. In a machine for straightening inturned flanges of a channel-shaped hoop section, a supporting frame, an anvil carried by the frame and adapted to support the work, a rotatable work-engaging member reciprocably mounted with respect to the anvil, mechanism movable toward the anvil including means for centering the work on the anvil, and means for then pressing the work-engaging member into engagement with one of said flanges, and a lost-motion connection between said centering means and said pressing means.

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