

March 19, 1940.

G. SPATTA

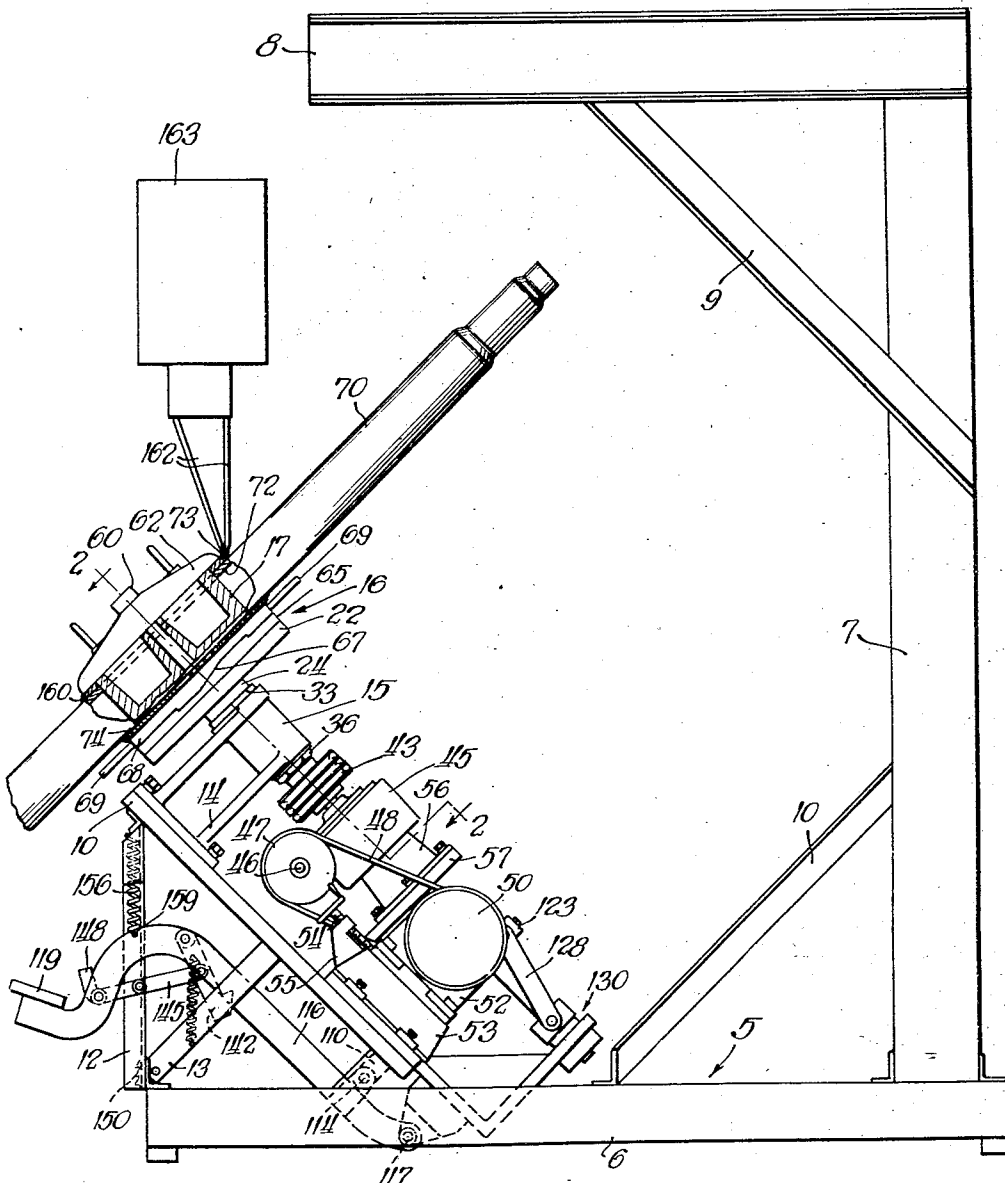
2,194,101

MEANS FOR REINFORCING BANJO TYPE AXLE HOUSINGS

Filed June 11, 1937

4 Sheets-Sheet 1

Fig. 1.



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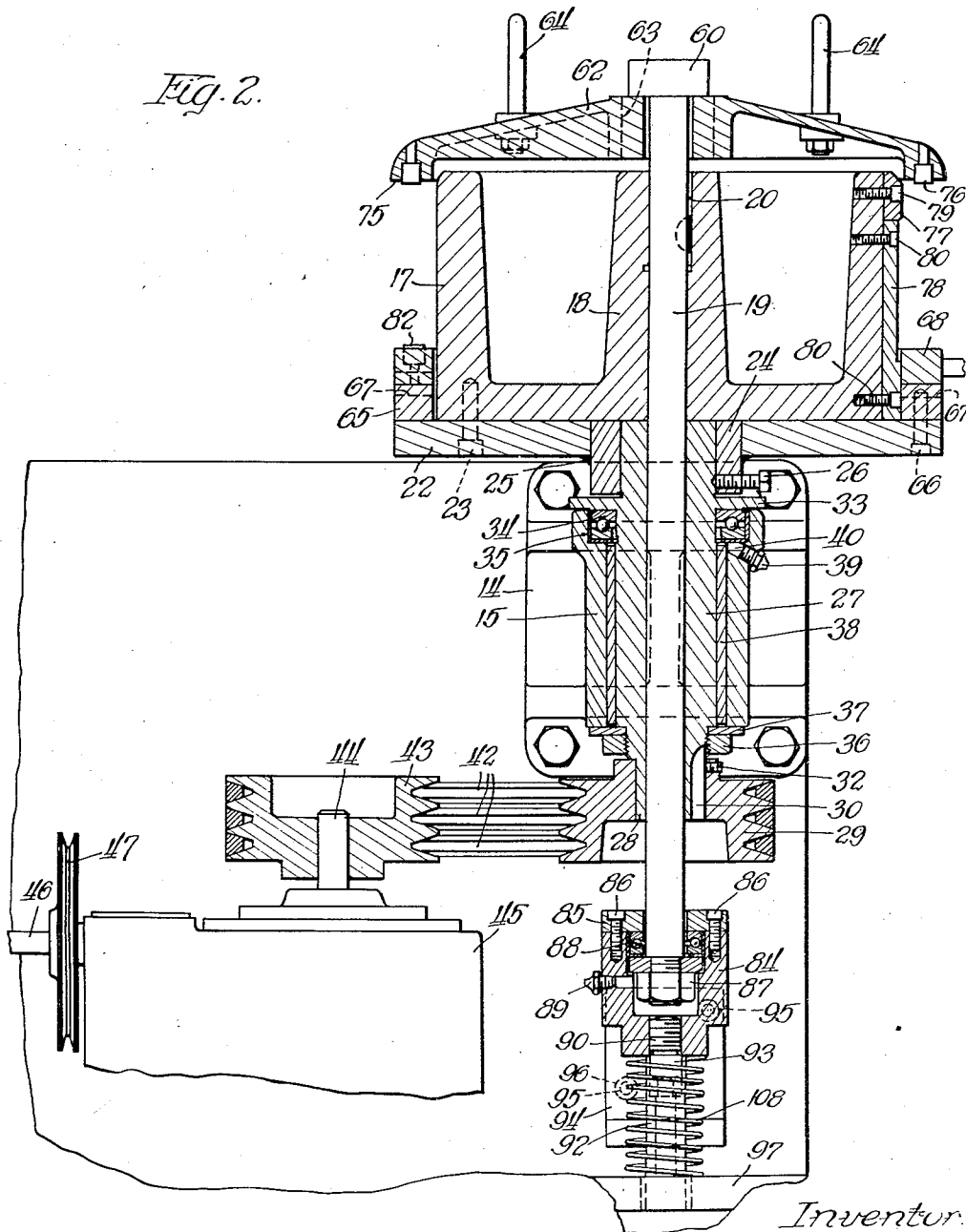
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MEANS FOR REINFORCING BANJO TYPE AXLE HOUSINGS

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4 Sheets-Sheet 2



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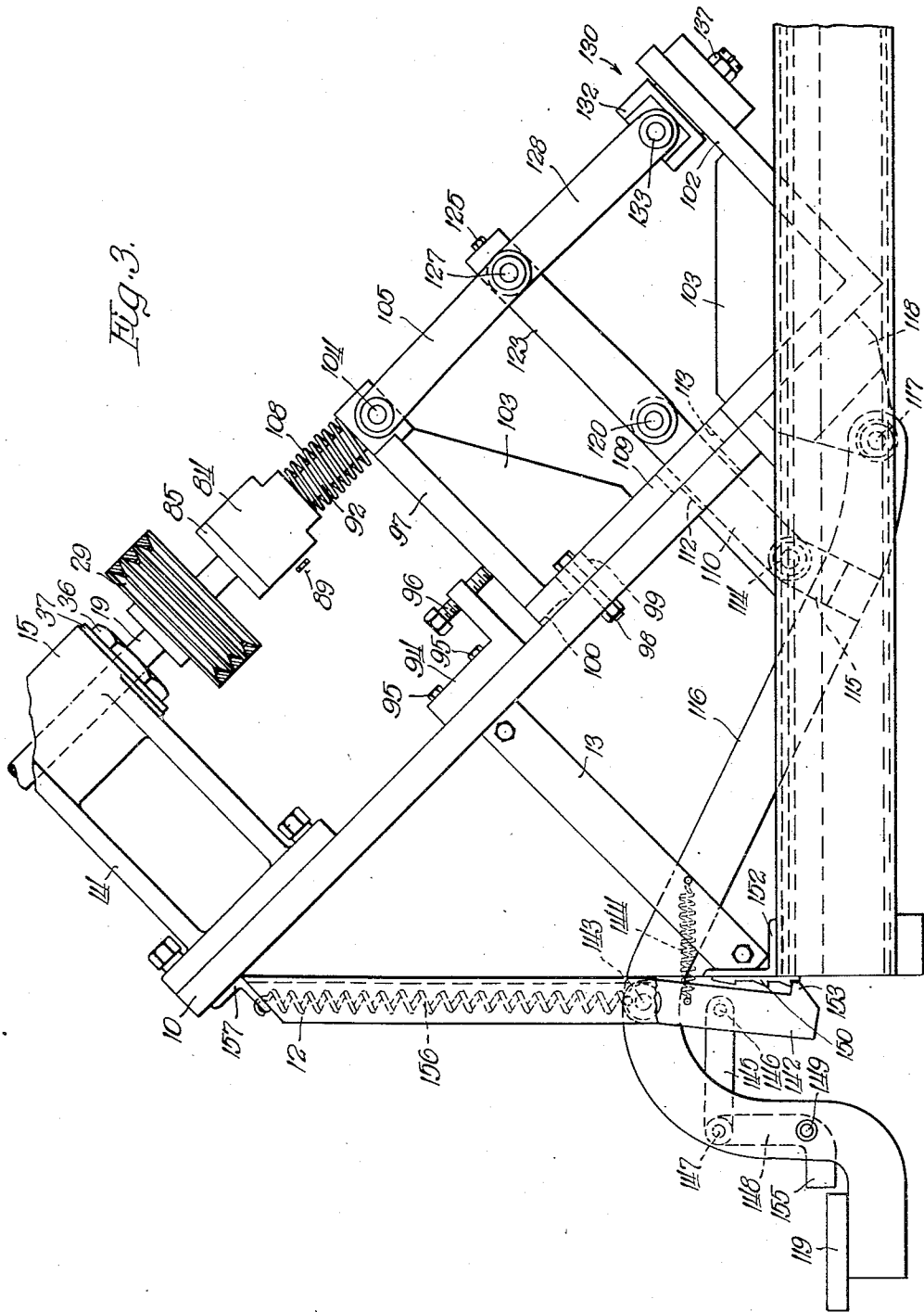
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MEANS FOR REINFORCING BANJO TYPE AXLE HOUSINGS

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4 Sheets-Sheet 3



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MEANS FOR REINFORCING BANJO TYPE AXLE HOUSINGS

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4 Sheets-Sheet 4

Fig. 5.

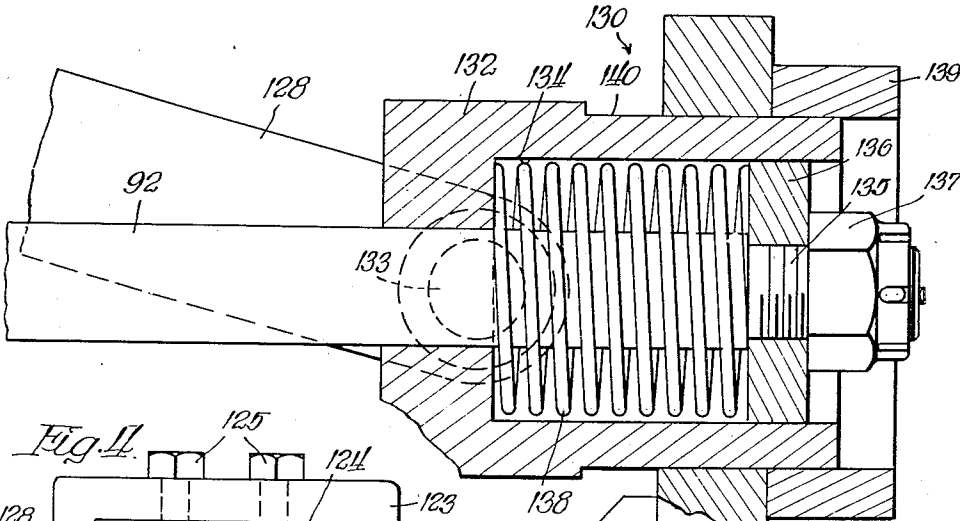


Fig. 11.

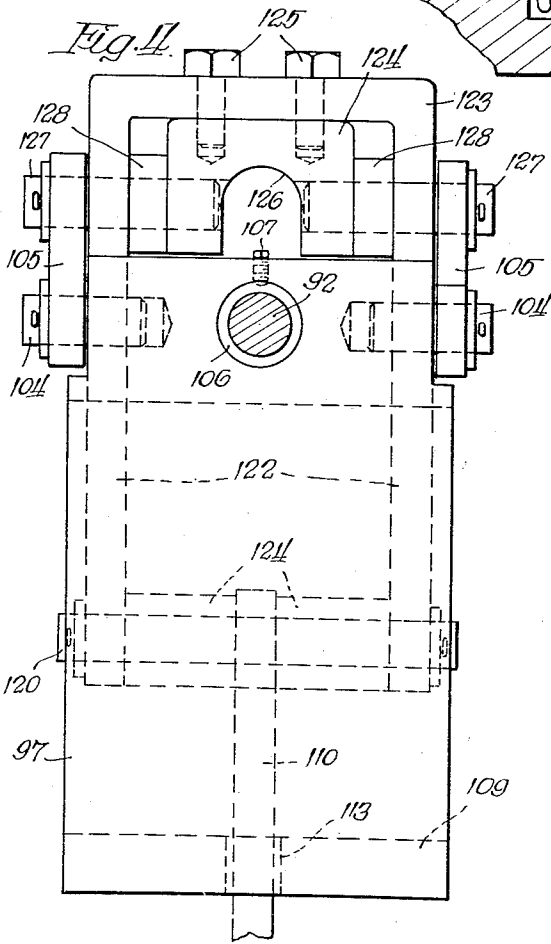
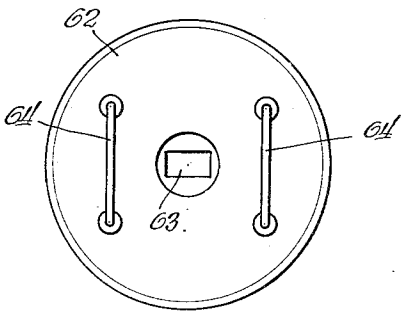


Fig. 6.



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UNITED STATES PATENT OFFICE

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MEANS FOR REINFORCING BANJO TYPE
AXLE HOUSINGS

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Application June 11, 1937, Serial No. 147,655

7 Claims. (Cl. 113—99)

This invention relates to a means for reinforcing axle housings, and more particularly is directed to the securing of reinforcing rings to the flanges defining the differential housing
5 frame in a banjo type axle housing.

In forming axle housings of the banjo frame type, wherein a differential carrier is bolted to the front flange of the banjo frame, and a back cover plate is secured to the rear flange thereof,
10 it is necessary to provide an adequate thickness of metal in the flanges to insure positive support of the bolts therein. When axle housings of this type are formed from tubular blanks, such as described in my Reissue Patent No. 20,103 of
15 September 8, 1936, the expansion of the central portion of the blank to form the banjo results in a reduction in thickness of the wall sections which are folded radially inwardly to form the flanges, and it has been found necessary, in some
20 types of housings, to reinforce these flanges by securing suitable rings thereto.

The rings which are employed may preferably be formed from flat strip stock, rolled and welded as described in detail in my copending application,
25 Serial No. 112,247, filed November 23, 1936, and per se form no part of the present invention.

The primary object attained by the present invention is a simplified means for securing such rings to the flanges of a banjo type differential
30 frame of a rear axle housing. Broadly contemplated, the invention comprises supporting the housing for rotation about an inclined axis with the ring to be secured to the flange clamped in position thereon, and then rotating the ring and
35 housing whereby the welding electrode may remain stationary and the weld is formed about the defining surface of the ring by rotation of the housing.

In carrying out the invention I provide as a preferred form of the invention a supporting
40 stand having an inclined rotatable shaft carrying a supporting head upon which the banjo frame is mounted. The clamp for holding the ring in position on the flange of the frame is carried by a second shaft telescoping within the rotatable shaft and actuated through suitable
45 toggle mechanism for movement into clamping position. The welding equipment is supported above the head, and the inclination of the axis of rotation is such that a V-shaped cleft is presented by the annular surface of the ring and the flange whereby a highly effective annular
50 weld may be formed in this cleft during rotation of the head.

Another object of the present invention is to

provide a machine for effecting a substantially uniform weld securing the ring around its periphery to the banjo flange.

Still another object of the present invention is to produce a simplified rapid and economical
5 means for reinforcing the banjo flanges, which is semi-automatic in operation, whereby one operator may take care of a plurality of units at the same time.

Other objects and advantages of the present
10 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 method of operation of a
15 preferred form of the present invention.

In the drawings:

Figure 1 is a side elevational view with portions broken away, of one form of machine for carrying out the present invention;

Figure 2 is a sectional view taken substantially
20 on line 2—2 of Figure 1;

Figure 3 is an enlarged partial elevational view showing the details of the clamping mechanism;

Figure 4 is a plan view of the toggle supporting
25 mechanism;

Figure 5 is a sectional view taken through the lower end of the toggle mechanism; and

Figure 6 is a plan view of the clamping head.

Referring now in detail to the drawings, I provide a supporting stand indicated generally at
30 5 having the base portion 6, the vertically extending back portion 7 which supports an overhanging rail 8 suitably braced by means of the angle members 9 and 10. At the forward portion
35 of the stand there is provided the supporting frame plate 10 which is disposed at an angle with respect to the base 6, in a preferred embodiment of the invention this angle being 45°. The plate
40 10 is held in inclined position by means of the angle members 12 and 13.

At its upper end the plate 10 is provided with a normally extending journal 14 having the sleeve portion 15 spaced from the plate 10 and adapted to receive the supporting head structure
45 shown generally at 16.

This head structure comprises a drum-like cylindrical portion 17 having the central hub 18 which is suitably bored to receive the axially
50 movable shaft 19 therein, the hub 18 having the keyway 20 whereby the shaft 19 is keyed to the hub 18 for conjoint rotation therewith. At its lower face the drum or head 17 is provided with the base or wear plate 22 which is secured thereto by means of the screws 23. The plate 22 is
55

apertured at its central portion to receive the sleeve 24 which is welded or otherwise rigidly secured thereto as indicated at 25. A suitable set screw 26 is threaded into the lateral surface of the sleeve 24 to key the shaft 27 therein, this shaft seating at its upper end against the base of the head 17, and at its lower end having the reduced portion 28 forming a hub for a pulley 29 which is secured thereto by means of the key 30 and the set screw 32.

Intermediate its ends, the shaft 27 is provided with the radial flange 33 which forms a thrust surface for the upper race of a bearing assembly 34 carried within the recessed portion 35 of the upper flared end of the journal sleeve 15. The thrust bearing 34 is retained within the recess 35 by means of the nut 36 threaded over the lower end of the shaft 27 against the thrust washer 37 which bears against the lower end of the journal sleeve 15. This is adapted to draw the flange 33 downwardly against the upper race of the bearing 34, and holds the assembly in position. A suitable bushing sleeve 38 is disposed between the intermediate lateral surface of the shaft 27 and the inner surface of the journal sleeve 15 to accommodate relative rotative movement therebetween. In order to provide proper lubrication for the bearing 34 and bushing 38, I provide the lubricant fitting 39 which threads into the journal sleeve 15 and communicates with the passage 40 leading to the bearing assembly.

The pulley 29 is of the multiple V-belt type, and is adapted to be driven by means of the belt 42 from a corresponding pulley 43 carried upon the output shaft 44 of a gear reduction mechanism shown generally at 45. The speed reduction gearing 45 has its input shaft 46 provided with a pulley 47 which is connected by means of the belt 48 to the drive pulley of an electric motor or similar power device 50 which is suitably supported by means of the frame 52 upon a supporting block 53 secured to the inclined plate 16. In order to provide for proper tensioning of the belt 48, the frame 52 is mounted for adjustable movement toward and away from the gear mechanism 45, and its position is accurately determined by means of the adjusting spindle 54 carried by the bracket 55 of the support block 53 which engages the base of the supporting frame 52 to locate the relative position of this frame with respect to the axis of the shaft 46.

The gear mechanism itself, indicated at 45, is preferably mounted upon a supporting pedestal 56 carried by the angle plate 57, and can be moved laterally with respect to the axis of the shaft 27 in order to vary the tension on the belt 42 between the pulleys 29 and 43. This lateral movement is also imparted to the supporting block 53 for the motor frame 52 in order to maintain the alignment between the pulley 47 and the drive pulley of the motor.

Considering now the shaft 19 which is adapted to have relative axial movement with respect to the shaft 27 and head 17, this shaft is provided at its upper end with a rectangular shaped head portion 60 which projects laterally on opposite sides of the shaft. A suitable clamp head 62 shown in detail in Figure 6 and shown in section in Figure 2 is provided at its center with a rectangular opening 63 whereby it may be turned to fit over the head 60 and may be moved downwardly below the under surface of this head. Suitable U-shaped handles 64 are secured to the head 62 to facilitate its movement over the head 60. After the head has been positioned below

the surface of the head portion 60 of the shaft 19, the clamp head 62 is rotated through a quarter of a revolution to dispose the slot 63 in a direction crosswise of the head portion 60, thereby holding the clamp head 62 against displacement outwardly of the end of the shaft 19.

The plate 22 is of a diameter such that it projects radially outwardly upon the cylindrical surface of the head 17, and upon this surface the plate 22 is adapted to support a first cam ring 55 which is suitably secured thereto by means of the cap screws 56. The ring 55, as shown in detail in Figure 1, is provided with cam surfaces 57 which cooperate with corresponding cam surfaces on the upper rotatable cam ring 58 carried thereby. The cam ring 58 is provided with opposite extending handle or actuating arms 59 whereby it may be rotated relative to the cam ring 55 to a position where the cam surfaces 57 are in alignment, and the cam ring 58 is therefore disposed in its lowermost position. Upon rotation of the ring 58, the cam surfaces raise this ring upwardly from the ring 57 a distance corresponding substantially to the thickness of the reinforcing ring which is to be secured to the flange of the banjo opening. Thus, the structure is adapted for use in welding the rings to the two opposite flanges of the banjo.

Considering Figure 1 again, an axle housing is shown generally at 70 and is provided with the banjo flange portions 72 which fit about the external surface of the head 17 and are centered thereby. Each of the flanges 72 is adapted to receive on its outer face a reinforcing ring 73 which, upon completion of the reinforcing operation, is welded to the flange 72 as indicated at 74. During the first ring welding operation there is no ring provided on the surface of the flange which is in engagement with the upper cam ring 58. The ring 58 is therefore rotated to move it axially away from the ring 55 a distance corresponding to the thickness of the reinforcing ring so that the clamping head 62 will have the same relative position as when a ring is provided on both flanges.

After the ring has been welded to one of the flanges, the housing 70 is reversed in position on the head 17 and the cam ring 58 is rotated to move it downwardly to accommodate the additional thickness introduced by the position of the ring which has been welded as indicated at 74. The second ring 73 is then placed on the upper flange 72 and the clamping head 62 serves to hold this ring in position during the welding operation. For this purpose, the head 62 is provided with a peripheral radial flange portion 75 having the wear plugs 76 positioned therein for engaging the outer surface of the ring to be welded. The head 17 is provided with wear plates 77 and guide plates 78 which are secured by means of the screws 79 and 80 to the lateral surface of the head, and which serve to guide the banjo over the head and to center it in position with respect to the head. These plates are preferably carried in recessed portions of the head, and project only slightly beyond the lateral cylindrical surface of the head 17. If desired, the upper cam ring 58 may also be provided with wear plugs 82 for supporting the lower flange of the banjo when the first ring is to be welded and for engaging the welded ring disposed thereagainst while the second ring is being welded to the second flange of the banjo.

The lower end of the shaft 19 terminates within the bearing housing 84 which has the top plate

85 secured thereto by means of the screws 86. A suitable headed nut 87 threads over the lower end of the shaft 19 and bears against the lower race of a thrust bearing assembly 88 carried within a recessed portion of the housing 84. The upper race of the bearing assembly is confined by the top plate 85 and thus a thrust bearing assembly is provided which permits relative rotation of the shaft 19, but prevents any substantial relative movement between the shaft 19 and the housing 84. A suitable lubricant fitting 89 is provided for introducing lubricant to the bearing assembly 88 within the housing. Threaded into the lower end of the housing 84 is the stud portion 90 of a shaft member 92 which has its upper end adjacent the stud portion 90 flatted as indicated at 93 to facilitate threading the same into the housing 84. Disposed upon the plate 10 rearwardly of the housing 84 is an angle plate member 94 which is secured to the plate 10 by means of the cap bolts 95 and which has the adjusting screw 96 carried by the normally extending angle portion thereof.

This screw bears against the upper face of a U-shaped plate assembly 97 which is mounted for vertically adjusting movement on the plate 10. This adjustable movement is provided by the clamping bolts 98 extending through the assembly 97 and through the supporting plate 10, and which engage in elongated slots 99 formed on the back portion of the assembly 97. A plurality of such adjusting means is provided, and the plate assembly 97 is held in vertically aligned position by means of keyways 100 cooperating with suitable guide means carried by the surface of the plate 10.

The plate assembly 97 is of generally U-shaped form having the leg portions 97 and 102 extending normal to the surface of the plate 10 and reinforced by suitable angle plates 103. At its outer end the plate 97 is provided with a slightly reduced portion into which are threaded the stud members 104 which carry the spaced toggle links 105 thereon, these links being mounted for pivotal movement about the studs 104 at one end. The forward portion of the plate 97 is also provided with an opening adapted to receive the bushing member 106 which serves as a guide for the shaft 92 extending therethrough, and which is suitably held in position by the set screw 107.

Suitable spring means 108 is biased between the upper surface of the plate 97 and the lower face of the bearing housing 84. The base portion 109 of the plate assembly between the plates 98 and 102 and the supporting plate 10 is suitably apertured to receive the link 110, the plate 10 having the aperture or rectangular slot 112 formed therein while the plate 109 has the elongated slot 113 formed therein, which accommodates the adjusting movement of the plate assembly with respect to the plate 10. This link at its lower end is pivotally connected by the pin 114 to a pair of plate members 115 welded or otherwise secured to the lever 116 forming a portion of the treadle operating mechanism. The lever 116 is pivoted at one end by the pin 117 to a suitable supporting bracket 118 carried by the supporting stand and held in fixed position. The opposite end of the lever 116 extends outwardly between the laterally spaced supporting angles 12 and at its outer end is provided with the treadle portion 119 adapted to be operated by the foot of the operator.

At its opposite end the link 110 is connected to a cross pin 120 which extends transversely be-

low the plate 97 and which is adapted to receive the opposite ends 122 of a U-shaped clevis member indicated generally at 123. Suitable spacing sleeves 124 are provided between the ends 122 and the link 110 to center the link with respect to the ends of the clevis.

At its opposite end the clevis member is adapted to carry a block 124 secured thereto by means of the bolts 125 which is provided with a substantially U-shaped portion 126 adapted to clear the shaft 92 when the clevis member 123 is moved downwardly normal to the axis of the shaft 92. Extending through the clevis member 123 and through the opposite end of the links 105 are suitable stud members 127 which are threaded into opposite sides of the block 124. These stud members form pivotal supports for the lower ends of the links 105 and also form pivotal support for the upper ends of the links 128 which are disposed between the opposite surfaces of the block 124 and the arms of the clevis member. The links 128 extend downwardly to a suitable lost motion cushioning means disposed on the outer end of the plate 102 and indicated generally at 130, being pivotally connected to opposite sides of the block member 132 by means of studs 133.

The block member 132 is provided with an axially extending recess 134 within which is received the lower end of the shaft 92. The shaft 92 is provided at its lower end with a threaded stud portion 135 adapted to receive the thrust washer 136 secured in position thereon by the castellated nut 137 threaded over the end of the shaft. A suitable spring 138 is biased between the base of the recess 134 and the adjacent face of the washer 136 about the shaft 92 and normally urges the shaft 92 downwardly, or considered in another manner, urges the block 132 upwardly away from the lower end of the shaft. The plate 102 is provided with an extending sleeve block 139 which is welded or otherwise secured to the bottom surface thereof, and which forms with the aperture in the plate 102 a cylindrical guide surface for the reduced portion 140 of the housing block 132, accommodating relative sliding movement of the block with respect to the plate 102.

It will be noted that the spring 108 normally urges the bearing housing 84 upwardly which, in turn, exerts an upward pressure on the shaft 19. This produces a tension on the shaft 92 tending to move it upwardly against the pressure of spring 138 thereby tending to raise the block 132 and break the toggle knuckle at 127 to allow the toggle to collapse by outward movement of the clevis 123. This forces the clamping head 62 upwardly away from the supporting head 17 to release the clamping engagement between the head 62 and the ring 68.

In the operation of the structure as thus far described, the operator first places a banjo housing of the type shown in Figure 1 in centered position on the head 17 with the cam rings 65 and 68 disposed in cam position to decrease the axial distance between the head 62 and the upper surface of the cam ring 68. At this time, the head 62 is removed from the shaft 19 to allow the positioning of the housing as described. The operator then places a reinforcing ring of the type disclosed in my above referred to co-pending application on the upper banjo flange 72 and mounts the head 62 on the upper end of the shaft 19 in the manner previously described. In order to hold the clamping ring in position, the operator then must move the shaft 19 downwardly with

respect to the head 17 in order to move the clamping head 62 into engagement with the upper surface of the ring 73.

This movement is accomplished by stepping on the treadle 119 which swings the lever 116 about its pivot 117 and through the pin 114 pulls the link 110 rearwardly thereby pulling the clevis 123 toward the plate 10. This produces a downward thrust on the links 123 due to the fixed pivotal support of the links 105 on the outer end of the plate 97, thereby moving the block 132 downwardly, which in turn acts through spring 138 to pull the shaft 32 downwardly. This results in pulling the bearing housing 34 downwardly against the pressure of spring 103 and draws the shaft 19 and the clamping head against the ring 73. In order to hold the toggle linkage in this clamped position against the pressure of springs 103 and 133, I provide a suitable latch 142 pivotally supported as at 143 on the lever 116, and normally urged in one direction by the spring 114 connected between the latch and angle supporting member 13.

Midway between its ends, the pivoted latch 142 is connected to a link 145 by means of the pin 146, and the link 145 at its opposite end is pivotally connected by the pin 147 to one end of a bell crank member 148 pivotally supported as at 149 adjacent the treadle portion of the lever 116. As the operator pushes the treadle 119 downwardly, he also automatically breaks the toggle connection between the bell crank 148 and link 145 drawing the latch 142 outwardly and downwardly. This latch ratchets along the latch plate 150 secured to the front face of the transverse angle member 152, and when the head 62 has moved to fully clamped position, the latching dog 153 of the latch engages under a suitable detent on the latch plate 150. This holds the treadle member 116 in locked position against the pressure of springs 103 and 133 to hold the clamp head 62 firmly against the ring 73.

A lost motion connection is effected by the mechanism indicated generally at 130 so that variations in thickness of the ring and flange can be accommodated by this mechanism. This adjustability is also, to some extent, obtained by the provision of a number of detents on the latch plate 150.

Having latched the treadle member 116 in position to clamp the ring on the banjo flange, the operator then actuates the motor 50, which through the reduction gear 45 and the pulleys 43 and 29 slowly rotates the shaft 27 to cause rotation of the head 17. Through the key 20, the shaft 19 is also rotated, the thrust bearings 38 and 34 accommodating this rotating movement. An arc is then struck in the V-shaped cleft indicated at 160 in Figure 1, between the outer annular surface of the ring and the normally extending planar surface of the flange by means of the electrodes 182, and a suitable weld is thereby continuously formed in this cleft by the welding apparatus indicated generally at 163 and supported in fixed position by the overhanging rail 8. After the housing has been rotated through a complete revolution so that a continuous annular weld is produced in this V-shaped cleft, the operator steps upon the projecting portion 155 of the bell crank 148 thereby pulling the latch 142 outwardly from the latch plate 150 by means of the link 145 and releasing the treadle member for upward movement. This movement is assisted by the spring member 156 secured at one end to the angle member 157

adjacent the top of plate 10, and at its opposite end secured to the treadle member, as indicated at 159. The spring 156 thereby snaps the treadle member 116 upwardly about its pivot 117 moving the link 110 upwardly and thereby breaking the toggle connection at 127. This movement is also assisted by the spring 130 which tends to force the links 123 upwardly to assist in breaking the toggle joint. The springs 130 and 133 then become effective to raise the shaft 19 and release the clamping engagement between the head 62 and the ring 73.

The head 62 is then removed from the upper end of the shaft 19, and the housing is reversed in position on the head 17 with the welded ring disposed in engagement with the upper surface of the cam ring 63, the cam ring 63 at this time being rotated with respect to the ring 65 to decrease the axial distance between the upper surface of the ring 63 and the plate 22 to accommodate the increase in thickness of the work to be clamped due to the addition of one ring. A second ring 73 is then placed in position over the other flange of the banjo, and the head 62 is again engaged with the upper end of the shaft 19. Upon depression of the treadle member 116 the shaft 19 is pulled downwardly to move the head 62 into clamping engagement with the second ring 73, and is locked in position by the latch 142. The motor is then started, and as the head 17 rotates, a weld is formed in the V-shaped cleft securing the ring to the banjo in the manner previously described.

It may be desirable to enclose the operating parts of the supporting mechanism within a hood to protect the same from any hot metal droppings from the welding electrodes, but such protection is an obvious mechanical expedient and need not be described in detail.

It is therefore believed apparent that I have provided a method of securing these reinforcing rings to the banjo flanges which insures accurate positioning of the rings on the flanges and maintenance of this position during rotation of the banjo past a fixed point, whereby a continuous annular weld may be produced. The inclination of the axis of rotation is desirable since it opens up the V-shaped cleft so that the weld may be formed directly therein, the two surfaces defining the cleft extending at angles of 45° with respect to vertical. Thus the welding apparatus may be fixed in position, and the rotation of the housing may be so controlled that a continuous weld of the desired strength can be uniformly produced about the annular surface of the ring.

I do not intend to be limited to the exact details of the particular apparatus disclosed herein as illustrating a preferred embodiment for carrying out the present invention, since various changes and modifications may be made therein. The invention is therefore to be limited only as defined by the scope and spirit of the appended claims.

I claim:

1. Apparatus for securing reinforcing rings to the banjo flanges of an axle housing comprising a stand having a rotatable head about which the banjo flange is centered, a shaft extending through said head and axially movable relatively thereto, a head portion on the upper end of the shaft, clamping means having a slotted center adapted to fit over said head portion and then rotated to lock the same on the shaft above and overlying the periphery of said head, and means engaging the lower end of said shaft for moving

said shaft axially to move said clamping means into axial pressure engagement with a reinforcing ring on the flange of a housing centered on said head.

2. In combination, a supporting stand, a rotatable supporting head provided with an annular flange portion, cam rings supported on said flange portion, one of said rings being rotatable on the cam surface of the other ring to vary its position axially of said head, a shaft extending through and keyed to said head and movable relative thereto, means pivotally mounted on said stand beneath said head including a treadle operated mechanism engaging the lower end of said shaft for moving said shaft in one direction, spring means normally urging said shaft in the opposite direction, a clamp detachably supported at the end of said shaft above said head, and locking means carried by said treadle mechanism for holding said clamp and shaft in fixed axial position relative to said head to produce axial clamping pressure on work disposed about said head between said upper cam ring and said clamp.

3. In combination, a supporting stand, a head having a cylindrical drum-like portion and a lower work supporting radially projecting flange, means for rotatably supporting said head in inclined position on the stand, a shaft extending entirely through said head and having toggle operating means at the lower end beneath the head including a treadle pivoted to said stand for moving said shaft axially downwardly through said head, a lost motion connection in said toggle-operated means, a clamp head detachably secured to the upper end of said shaft above the first-named head axially clamping the work between said flange and said clamp head about said head portion, and means relatively movable with respect to said flange for varying the axial distance between said clamp head and said work supporting flange.

4. Apparatus for securing reinforcing rings to the opposite banjo flanges of an axle housing, comprising a stand, axially reciprocable shaft, a centering drum mounted intermediate the ends of said shaft and having a radial flange at the lower end thereof, a pair of superposed cam rings on said flange surrounding said drum, said rings being relatively movable to vary the axial distance

from the opposite end of said drum to said rings by an amount equal to the thickness of one of said reinforcing rings, a clamp head supported at the upper end of said shaft for conjoint rotation with said drum, and manually operable means in said stand below said drum for engaging the lower end of said shaft for moving said shaft axially to shift said head axially toward said drum to clamp the banjo of the housing about said drum between said head and the uppermost cam ring.

5. In apparatus for securing reinforcing rings to the opposite flanges of a banjo frame of an axle housing, a stand, a rotatable shaft normally urged into one axial position in said stand, means for moving said shaft axially, a drum mounted in fixed axial position on said stand intermediate the ends of said shaft and keyed for conjoint rotation with said shaft, means projecting radially from the lower edge of said drum for supporting said banjo frame thereabout including cam means for varying the axial relation of said frame relative to said drum a distance equal to the thickness of one of said rings, a clamp head having a center slot, and means at the upper end of said shaft above said drum adapted to pass through said slot and then be rotated to overhang the sides thereof for securing said clamp head thereto to clamp a ring to the upper flange of said frame under axial pressure upon axial movement of said shaft.

6. In a stand of the class described having a work supporting head and a shaft extending through and keyed thereto and axially movable relatively thereto, resilient means below said head normally urging said shaft axially in one direction, a treadle pivotally mounted on said stand, a pair of toggle members having a knuckle joint and having a connection at one end to the stand and at the opposite end to said shaft adjacent the base of the stand, and means connecting the knuckle joint to said treadle for straightening the toggle to move said shaft axially of the head against said resilient means.

7. The stand of claim 6 further characterized in the provision of a spring compensated lost-motion connection between the shaft and said opposite end of said toggle members.

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