Sept. 9, 1947. H. L. JOHNSON 2,427,003

APPARATUS FOR FLANGING PIPES INWARDLY OR OUTWARDLY

Filed May 31, 1945 2 Sheets-Sheet 1

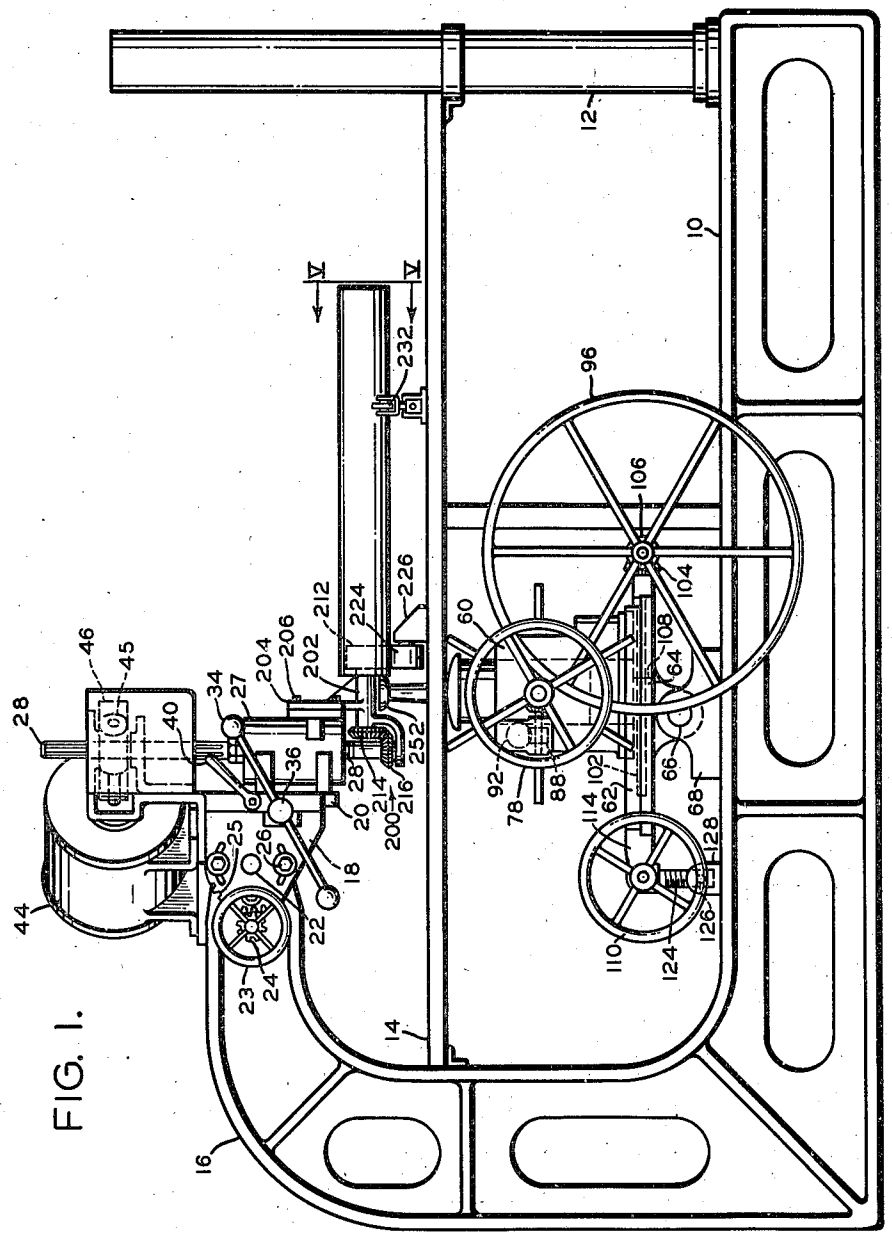


FIG. 1.

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FIG. 2.

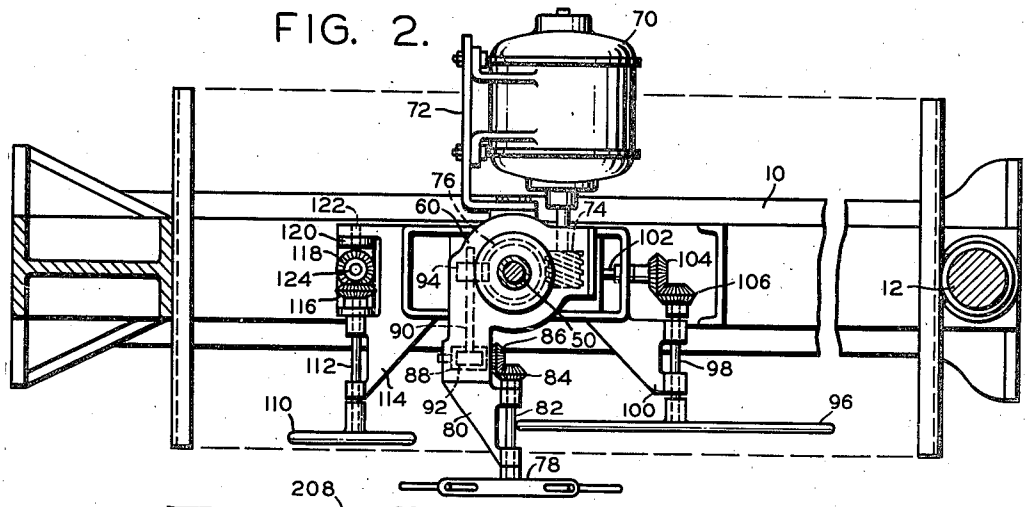


FIG. 3.

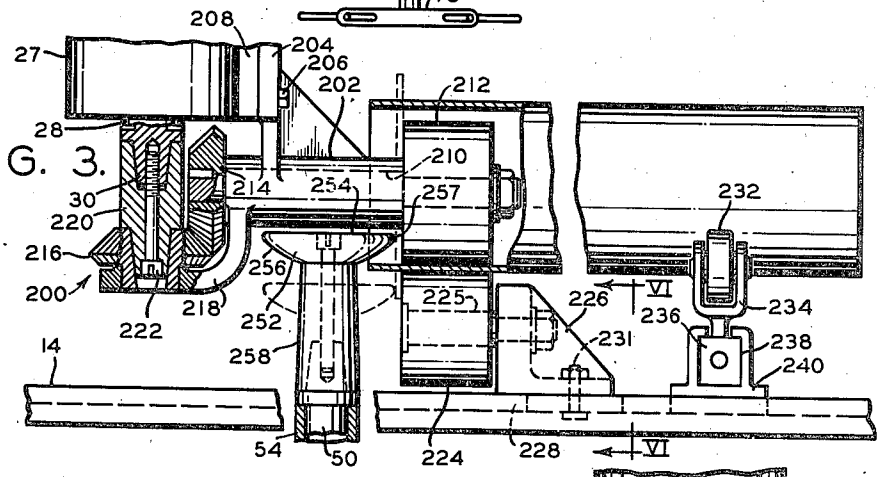


FIG. 4.

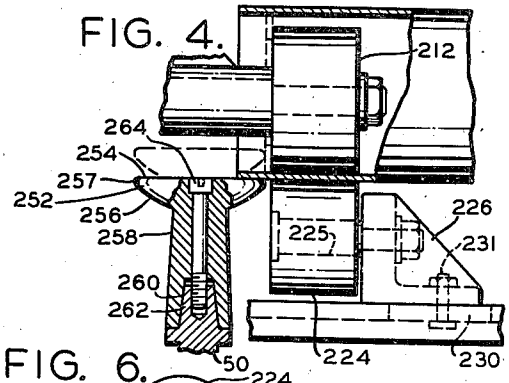


FIG. 5.

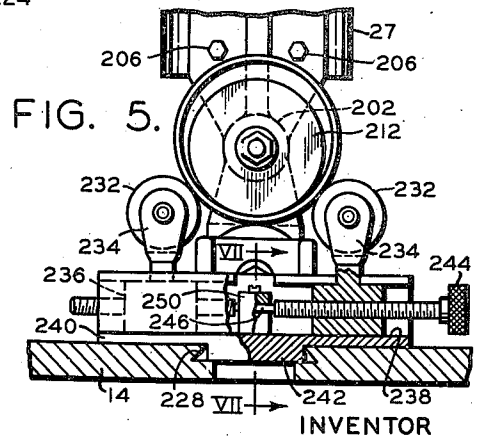


FIG. 6.

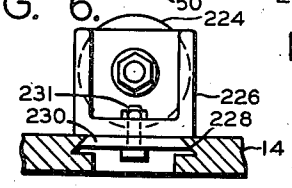
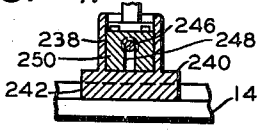


FIG. 7.



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APPARATUS FOR FLANGING PIPES INWARDLY OR OUTWARDLY

Herbert L. Johnson, Peabody, Mass.

Application May 31, 1945, Serial No. 596,937

5 Claims. (Cl. 153—29)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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This invention relates generally to sheet metal working machines and is illustrated herein as embodied in a machine for forming flanges on the ends of tubular elements such as pipes or cylinders for joining the latter with other pipes or cylinders or with plane members.

In U. S. Patent No. 2,370,666 granted to Herbert L. Johnson on March 6, 1945, and in his U. S. application for Letters Patent, Serial No. 582,098 filed on March 10, 1945, are disclosed machines for forming flanges on flat blanks. These machines, in their present form, are not particularly suited for use in forming flanges on the ends of long tubular elements because the general arrangement of the machines does not permit such elements to be presented properly to the operating tools.

It is an object of the present invention therefore, to provide in connection with a machine of the character disclosed in the above-mentioned application, a few simply constructed attachments adapted to be readily assembled on the machine and by means of which it is rendered capable of forming end flanges on cylinders in a smooth and efficient manner.

Another object of the invention is to provide a flanging mechanism of the above character which by the making of a few simple adjustments accommodates cylinders of different thicknesses of stock and of varying diameters and lengths.

A further object of the invention lies in the novel arrangement of certain of the parts whereby the machine may, at the will of the operator, be operated to form end flanges on cylinders in either inward or outward direction from the bodies thereof.

With the above and other objects and features in view, the invention will now be described with reference to the accompanying drawings which illustrate a preferred embodiment of the invention and will be pointed out in the claims.

In the drawings:

Fig. 1 is a view in front elevation of an illustrative machine embodying the invention and illustrating a cylinder in position for the flanging operation to be performed thereon,

Fig. 2 is a sectional plan view showing the operating means for the flanging tool,

Fig. 3 is a sectional front elevation illustrating the mounting and arrangement of the cylinder engaging rollers, the flanging tool and its initial position in relation to a cylinder when a flange is to be formed outwardly on its end,

Fig. 4 is a view similar to Fig. 3 but with the flanging tool shown in its initial position in relation to a cylinder when a flange is to be formed inwardly on its end,

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Fig. 5 is a detailed sectional view taken substantially on the line V—V of Fig. 1 and showing in end elevation an adjustable means for supporting the free end of a cylinder concentrically with its axis of rotation,

Fig. 6 is a sectional detail view taken on the line VI—VI of Fig. 3, and

Fig. 7 is a sectional detail view taken on the line VII—VII of Fig. 5.

The illustrated machine comprises a base 10 (Fig. 1), of welded H-beam construction, to one end of which is fixed a pedestal 12 adapted to support one end of a table 14. The other end of the table is fixed to an arm 16, integral with the base 10, and arranged to extend above and centrally over the left-hand end of the table. A bracket 18, having a slide-way in which a slide 20 may be adjusted vertically, is mounted for angular adjustment on a pivot 22 fixed to the arm 16. This angular adjustment is made by turning a handwheel 23 which drives a gear 24 arranged to mesh with a gear segment 25 formed in the bracket 18. The handwheel and gear 24 are fixed to a shaft rotatably mounted in the arm 16. Upon completing the adjustment of the bracket 18, it is clamped in position by setting up bolts 26 which pass through arcuate slots in the bracket and are threaded into the arm 16. For the purposes of the present invention bracket 18 is adjusted to the position shown in Fig. 1 and is left in such position.

Fixed to the slide 20 (Fig. 1) is a housing 27, in which a shaft 28 is mounted to rotate. The lower end of shaft 28 (Fig. 3) has the form of a truncated pyramid as indicated at 30. The shaft and housing 27 are arranged to be raised and lowered with respect to table 14 by a lever 34 carried by a shaft 36, the latter being mounted to rotate in the bracket 18. A pinion (not shown) fixed to shaft 36 is arranged to mesh with a rack (not shown) cut in the slide 20, the latter thus being moved heightwise when the lever 34 is operated. The slide 20 may be locked to the bracket 18 by setting up a clamp 40 having a shank threaded in the bracket 18, and adapted to bear against the slide 20.

An electric motor 44 mounted on the top of the bracket 18 drives the shaft 28 through connections comprising a worm 45 fixed to the motor shaft 28 and meshing with a worm gear 46. The gear 46 and the shaft 28 are splined to provide a driving connection therebetween, regardless of

the adjustment of the slide 20 heightwise of the table.

The foregoing parts are identical in operation and construction with those shown and described in the aforementioned application Serial No. 582,098.

In the present invention the lower end 30 (Fig. 3) of shaft 28 accommodates the mounting of one of the attachments that adapts the machine to turn end flanges upon cylinders, the attachment being indicated generally at 200. The attachment 200 comprises a horizontally disposed bearing 202 that is mounted to the right of shaft 28 by an upstanding arm 204 secured by bolts 206 to a flat plate 208 on the lower end of housing 27. A stub shaft 210 mounted in the bearing 202 has fixed on its rightwardly projecting end a horizontally disposed roller 212. A beveled gear 214 fixed on the opposite end of the shaft 204 meshes with a companion gear 216 journaled in a depending arm 218 formed integral with the bearing 202. The gear 216 is interconnected with the lower, squared end of a vertically disposed stub shaft 220. The upper end of shaft 220 is provided with a socket that engages the lower end 30 of shaft 28, and a screw 222 passing through the stub shaft and threaded into the shaft 28 completes the connections necessary for mounting the attachment 200 on the machine. Through the foregoing connections, rotation of shaft 28 drives the shaft 210 and rotates the roller 212.

A second attachment for adapting the machine for cylinder end flanging operations comprises another horizontally disposed roller 224 that is adjustable lengthwise of the table 14 into vertical alignment with the driven roller 212. The roller 224 is rotatably mounted on the left end of a shaft 225 that is secured in a bracket 226 and projects from an opposite direction toward the shaft 210. The bracket 226 is mounted for sliding movement above a dovetailed way 228 that extends lengthwise of the table 14 and centrally thereof. A block 230 (Fig. 6) slidable in the way is connected to the bracket 226 by a bolt and nut 231 by means of which the roller 224 may be locked in its vertically adjusted position.

The arrangement of the rollers, as just described, permits of the free, easy, and unobstructed introduction of an end of a cylinder wall therebetween as clearly illustrated in the drawings. In mounting the cylinder, it is placed lengthwise of and above the table 14 with its internal and external surfaces lying between the vertically aligned rollers 212 and 224, respectively, and with its left end spaced beyond the left end faces of rollers an amount corresponding substantially in width with the width of the flange to be formed.

The roller 212 is raised or lowered to the correct height for this purpose and conformably to the thickness of the cylinder wall by the lever 34 and is finally adjusted so that there is provided a sufficient frictional engagement of the wall between the two rollers to cause the cylinder to rotate when the roller 212 is driven by the shaft 30.

The cylinder is supported at its opposite, unengaged end for rotative movement by a pair of bearings 232. The bearings 232 (Fig. 5) are arranged to be jointly adjusted into tangential contact with the periphery of the cylinder below its horizontal center and on the opposite sides of its vertical center. The bearings are rotatably supported between upstanding bifurcated arms 234 formed on oppositely disposed followers 236 slidable in a channel 238 formed in a bar 240 extending transversely of the table 14. The bar 240 is guided for longitudinal movement along the table by a depending projection 242 slidably seated within the way 228. The means for adjusting the bearings 232 inwardly and outwardly from the cylinder comprises a screw 244 having a reduced central portion 246 engaged within a slot 248 (see also Fig. 7) in a block 250 secured centrally within channel 238 to the bar 240. The left and right ends of the screw are oppositely threaded within the followers 236 whereby rotation of the screw in one direction moves the bearings 232 toward each other and rotation of the screw in an opposite direction moves the bearings away from each other. Thus the bearings may be adjusted to accommodate cylinders of varying diameters and, into proper position with respect thereto, to insure concentric rotation of the unengaged end of the cylinder. In this manner, the rotative feed movement imparted to the cylinder by the rollers 212 and 224 is kept smooth and uniform throughout the flanging operation and the possibility of strain upon the engaged end of the cylinder is precluded.

The flanging tool 252 (Fig. 4) of the present invention comprises a circular body that is formed with an upper flat face 254 and a lower face 256 of convex contour, and with the peripheries of these faces merging in a common round 257. Centrally of the lower face 256 there is formed a depending shank 258 having a tapered square socket 260 internally formed therein. The socket is adapted to fit securely over a correspondingly formed end 262 of a shaft 50. The shaft 50 is rendered receptive to the mounting of the tool 252, just described. A screw 264 passing through the tool 252 and threaded into the shaft 50 secures the tool in operative position on the shaft.

The mechanism for rotating tool 252 and shaft 50 and for adjusting it laterally and vertically with respect to the end of the cylinder is identical in construction and operation with that disclosed in the above-mentioned application and will be described herein only insofar as it pertains to the present invention.

The shaft 50 is mounted to rotate on bearings within a sleeve 54 (Fig. 3), the sleeve being arranged to slide vertically in a housing 60 (Figs. 1 and 2). The housing 60 is arranged to slide lengthwise of the machine in a slideway 62 on a carriage 64, and the latter is arranged to tilt in a vertical plane about a shaft 66, carried by a boss 68 fixed to the frame 10.

The flanging tool 252 is driven in rotation by an electric motor 70 (Fig. 2) which is mounted on a bracket 72 fixed to the housing 60. A driving connection between the motor and the flanging tool is provided by a worm 74, fixed to the motor shaft, and a worm gear 76 splined to the shaft 50, the gear being rotatably mounted in the housing 60. The flanging tool 252 is raised or lowered by turning a handwheel 78, which is rotatably mounted in a bracket 80, fixed to the housing 60. The handwheel 78 is fixed to a shaft 82 which carries a gear 84 arranged to mesh with another gear 86, formed on the right-hand end of a worm 88. The worm 88 and the gear 86 are mounted to rotate in the housing 60. A shaft 90, also mounted to rotate in the housing 60, has on one end a worm gear 92, arranged to mesh with the worm 88. On the other end of the shaft 90 is fixed a pinion 94 which meshes with a rack (not shown) cut in the side of the

sleeve 54. Thus, by means of the connections above described, when the handwheel 78 is turned, the sleeve 54 and the flanging tool 252 may be raised or lowered as desired.

The flanging tool may be adjusted lengthwise of the machine into a position adjacent to the left end faces of rollers 212—224 by turning another handwheel 96, which is carried by a shaft 98. The shaft 98 is rotatably mounted on a bracket 100 fixed to the carriage 64. A threaded shaft 102 rotatably mounted on the carriage 64 has fixed to its right-hand end a gear 104 adapted to mesh with another gear 106, the latter being fixed to the shaft 98. The shaft 102 is threaded into a plate 108 which is secured to the base of the housing 60 and accordingly, when the shaft 102 is rotated, the housing 60 is moved lengthwise of the machine in the slideway 62.

Angular adjustment of the flanging tool 252 laterally of the left end faces of rollers 212—224 is not necessary in the present invention beyond positioning the shaft 50 and the axis of rotation of the tool 252 at a direct right angle to these faces as illustrated in the drawing. This right angular positioning of the shaft is accomplished by turning a handwheel 110 fixed to a shaft 112 rotatably mounted in a bracket 114, extending from the left end of the carriage 64. A gear 116, fixed to the shaft 112, is arranged to mesh with another gear 118, which is mounted to rotate on a yoke 120, the latter being pivoted at 122 to the bracket 114. The gear 118 is internally threaded to receive a screw 124 (Fig. 4) which is pivoted at 126 to a boss 128 fixed to the frame 10. It is now apparent that by turning the handwheel 110, the gear 118 may be moved up or down the screw 124, and a corresponding tilting movement imparted to the carriage 64 to bring the shaft 50 and tool 252 into a right angular relation with respect to the left end faces of the rollers 212 and 224.

It is noted that ample clearance is provided between the left end face of the roller 212 and the depending arm 218 of the bearing 202 to freely admit the tool 252 for vertical movement and permit of its lateral adjustment therebetween. Tools similar to the tool 252 but having larger diameters for turning flanges of greater widths may be readily used by providing an attachment 200 having a correspondingly elongated bearing 202 for accommodating the increased diameter of the tool.

The adjustment and operation of the machine will now be described with reference to the forming of a flange on an end margin of a cylinder, it being assumed first that the flange is to be formed outwardly from the body of the cylinder.

With the rollers 212 and 224 adjusted in vertical alignment and approximately into the proper position for receiving the cylinder wall therebetween, the tool 252 is adjusted by handwheels 96 and 78 horizontally and vertically, respectively, to a position where its flat face 264 lies adjacent to the bearing 202 and the round 257 of the tool is spaced laterally from the left end face of roller 212 by an amount substantially equal to the thickness of the wall of the cylinder upon which a flange is to be turned as shown in Fig. 3. The cylinder wall is then inserted between the rollers 212 and 224 and beneath the convex face 256 in the manner hereinbefore described, i. e., with its left end spaced beyond the left end faces of the rollers by an amount substantially equal to the desired width of the flange to be formed whereupon the roller 212 is brought into frictional engagement with the internal surface of the cylinder wall by turning lever 34. The rollers are locked in adjusted position by the clamp 40 and bolt and nut connections 231. The bearings 232 are now adjusted lengthwise of the table 14 in way 228 into a position for supporting the free end of the cylinder and are moved inwardly into supporting contact with the cylinder by screw 244.

Assuming now that the motors 70 and 44 are operating, the cylinder will be fed rotatively by the frictional engagement thereof between rollers 212—224. During this rotary movement the handwheel 78 is operated to lower the rotating flanging tool 252 and bring its convex face 256 into contact with the inner surface of the end of the cylinder, which, as illustrated in Fig. 3, progressively bends the marginal end portion outwardly against the left end face of the roller 224, as suggested by the dotted lines in this figure. The convex contour of the face 256 permits this lowering movement to be carried out without interference between the tool and the cylinder by providing a surface that contacts the cylinder end at but a single point during the downward traverse of the tool.

When a flange is to be formed inwardly on the end of a cylinder the adjustments of the cylinder between the rollers 212 and 224 follows substantially the same procedure as above described. The tool 252 however, in this instance, is positioned at the beginning of the operation with its flat surface 254 beneath the marginal end portion defined by the lateral positioning of the cylinder between the rollers as shown in Fig. 4. Assuming the motors 70 and 74 are operating, the handwheel 78 is turned to raise the tool and bring the flat surface 254 into contact with the outer surface of the cylinder, which, as illustrated in Fig. 4, progressively bends the marginal end portion inwardly against the left end face of roller 212 as suggested by the dotted lines of Fig. 4.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalty thereon or therefor.

Having described my invention, what is claimed as novel and desired to be protected by Letters Patent of the United States is:

1. In a machine for flanging the ends of cylinders, said machine comprising a pair of rollers, a rotating flanging tool, driving means for one of said rollers, means for projectively supporting said roller in a direction away from said driving means, means for projectively supporting the other of said rollers in a direction toward said driving means, means for adjusting said rollers relatively to each other into aligned engagement with the opposite surfaces of a cylinder wall disposed therebetween, the end of said cylinder being spaced from the end faces of said rollers nearest said driving means, a support for said tool, means for adjusting said support longitudinally of the cylinder into position between said driving means and said end faces, and means for moving said tool transversely of said end faces to bend said spaced end portion against one or the other of said end faces.

2. In a machine for flanging the ends of cylinders, said machine comprising a pair of rollers, a rotating flanging tool, driving means for one of said rollers, means for projectively supporting said roller in a direction away from said driving means, means for projectively supporting the

other of said rollers in a direction toward said driving means, means for adjusting said rollers relatively to each other into aligned engagement with the opposite surfaces of a cylinder wall disposed therebetween, the end of said cylinder being spaced from the end faces of said rollers nearest said driving means, a support for said tool, means for adjusting said support longitudinally of the cylinder into position between said driving means and said end faces, means for moving said tool transversely of said end faces to bend said spaced end portion against one or the other of said end faces, and means for supporting the cylinder at its free end concentrically with its axis of rotation.

3. A machine for flanging the end of a cylinder, said machine comprising a pair of rotating rollers, a rotating flanging tool, means supporting said rollers from opposite end faces thereof in a position receptive to the free and easy insertion of the wall of a cylinder between said rollers and with a marginal end portion of the cylinder extending beyond the end faces of the rollers, said supporting means being adjustable to move the rollers relatively to each other into aligned engagement with the opposed surfaces of said wall to define said end portion and impart feeding movement to the cylinder, and means for moving said tool transversely of said end portion to bend said portion against either of the end faces of said rollers that lie adjacent to said end portion.

4. A machine for forming end flanges on cylinders, said machine comprising a pair of rotating rollers, oppositely extending supports for said rollers, said supports being adjustable to position said rollers relatively to each other for freely receiving the wall of a cylinder inserted therebetween and being also adjustable to move the rollers to a position where they alignedly and oppositely engage the internal and external surfaces of said wall to impart feeding movement to the cylinder, said cylinder being adjusted between the rollers to a position defining a marginal end portion beyond the end faces of said rollers, a rotating flanging tool formed with oppositely disposed convex and flat faces, means for adjusting the tool so that its convex face overlies the internal surface of said marginal end portion or so that its flat face underlies the external surface of said marginal portion, said tool adjusting means being operative to move the tool transversely of said portion from either of said positions toward the other.

5. In a flanging machine, in combination, a pair of rollers, a flanging tool, means for driving one of said rollers to impart feed movement to a cylinder disposed with its circumferential wall engaged between said driven roller and the other of said rollers, means for adjusting said other roller longitudinally of the cylinder into alignment with said driven roller, said wall being positioned between the rollers with a portion of one of its ends extending marginally beyond the end surfaces of the rollers, means for adjusting said tool to a position adjacent said end surfaces either above or below the axis of engagement of said wall, means for rotating said tool, and means for operating said adjusting means during the feed movement of the cylinder to move said tool in opposite directions transversely of said marginal end portion whereby said portion may be bent against the end surface of said driven roller or against the end surface of said other roller.

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