April 12, 1927. 1,624,804

T. T. ROBINSON

TUBE BENDING MACHINE

Filed July 3, 1924 2 Sheets-Sheet 1

Fig. 1.

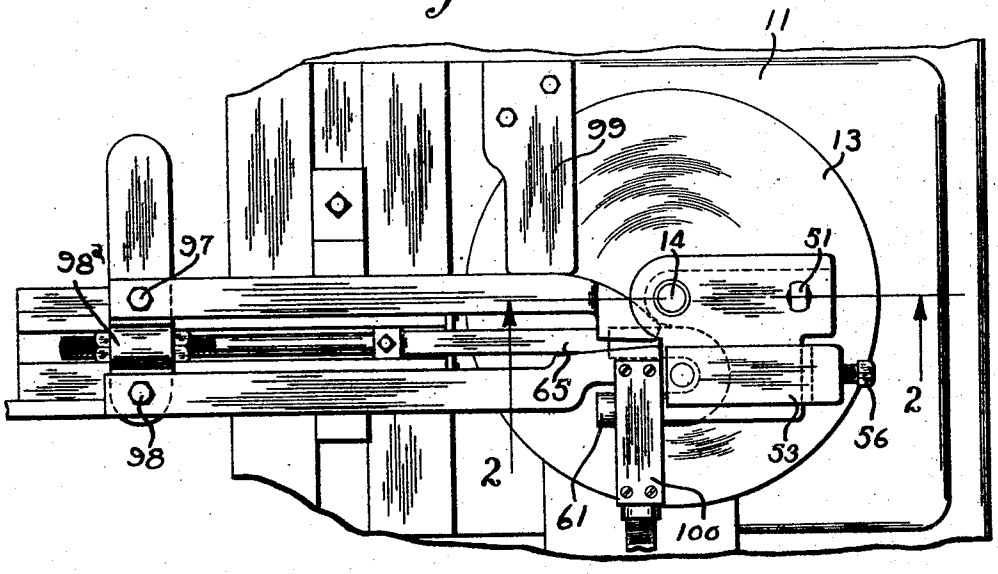
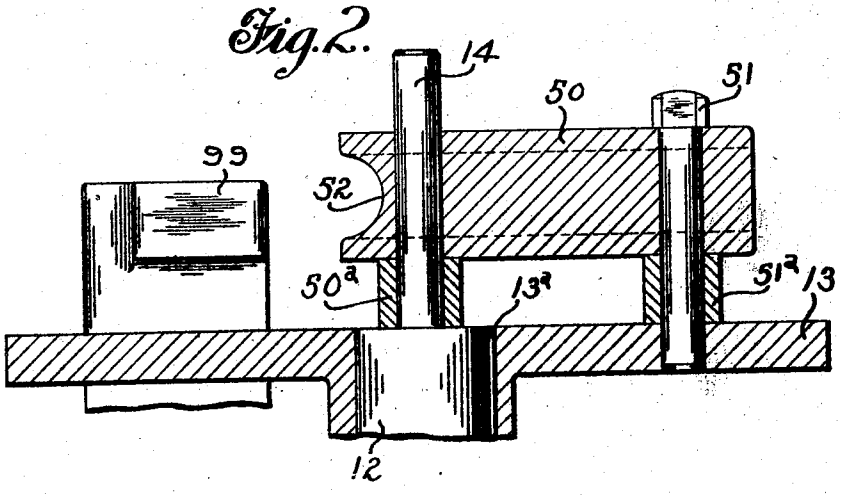


Fig. 2.



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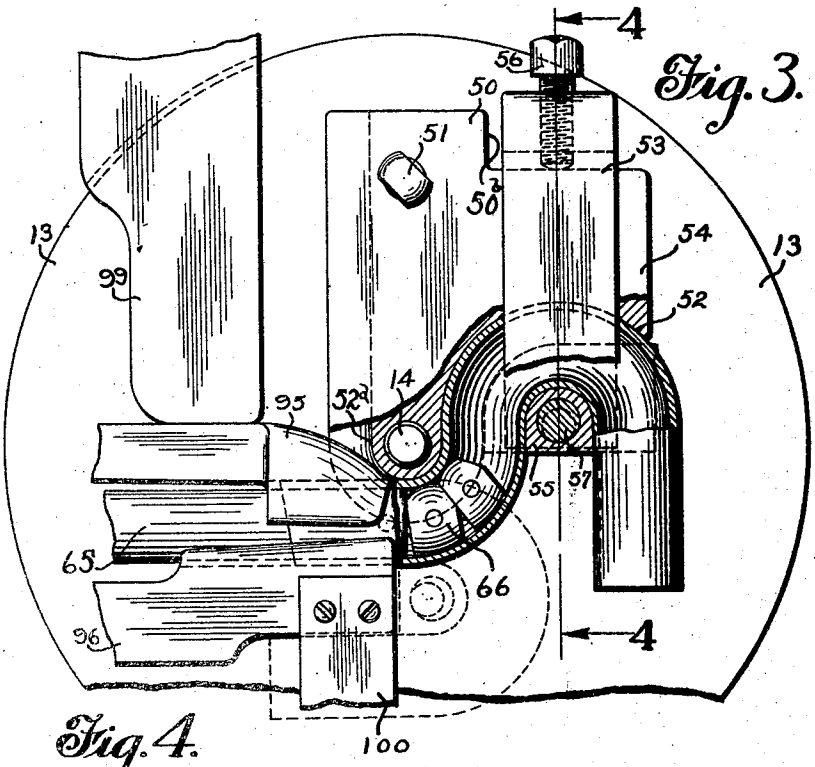
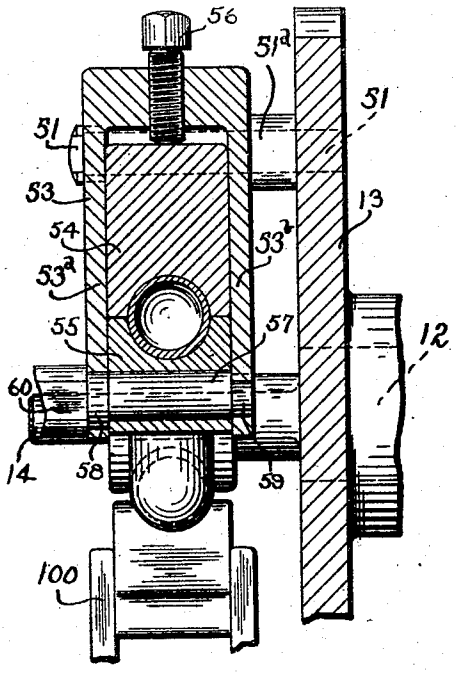


Fig. 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

THOMAS T. ROBINSON, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR TO BRIDGEPORT BRASS COMPANY, OF BRIDGEPORT, CONNECTICUT.

TUBE-BENDING MACHINE.

Application filed July 3, 1924. Serial No. 723,972.

This invention relates to machines or apparatus for bending or curving pipes or tubes, and while the principles of the invention are capable of broad application and may be used in connection with machines for bending tubes of various kinds, the particular machine illustrated in the drawing is especially well adapted for the bending to curvilinear form, of pipes or tubes, such as drawn brass tubing. The device is particularly well adapted for operating upon smooth or polished tubing in such a manner that the bending operation does not distort or wrinkle the metal of the tube to a harmful degree, and is particularly designed for bending tubes adapted to be used in connection with plumbing traps and the like.

One object of my invention is the provision of a device of this character with which a tube may be reversely bent into a form commonly referred to as a half-S tube and used in connection with plumbing traps.

Another object of my invention is the provision of a bending or forming attachment for machines of this character which will properly hold the tube and support the walls thereof during the bending operation, so that harmful distortion of the walls of the tube will be prevented.

A still further object of the invention is the provision in connection with an attachment for properly holding the tube during the bending operation, of an improved clamping device for securely clamping the tube in place during the bending process.

A still further object of the invention is the provision of a bending arbor or attachment designed to receive and hold a bent tube so that a further bending operation may be performed thereon.

To these and other ends the invention consists in the novel features and combination of parts to be hereinafter described and claimed.

In the accompanying drawings:

Fig. 1 is a fragmentary top plan view of a tube bending machine, embodying my improvements;

Fig. 2 is a sectional view on line 2—2 of Fig. 1;

Fig. 3 is an enlarged top plan view of the bending table and arbor, the parts being shown in the position assumed at the completion of the bending of a half-S tube, and, Fig. 4 is a sectional view on line 4—4 of Fig. 3.

The machine which I have selected to illustrate and describe is provided with a main frame or supporting base, shown in a fragmentary way at 11. Extending vertically through this supporting base and projecting therefrom at its upper end, is a shaft 12 rotatably mounted in the base and designed to be turned by suitable means (not shown) usually employed in machines of this character. Secured to the upper end of this shaft by means of a key 13^a is a forming disk or table 13 which is designed to rotate with the shaft. The shaft 12 is provided at its upper end with a projecting pin 14, and mounted upon this pin is the bending or forming arbor 50. This arbor is spaced from the forming table by a collar 50^a surrounding the pin 14 and disposed between the upper end of the shaft 12 and the arbor.

In order that the forming arbor may rotate with the table it is secured thereto by means of a pin 51, which passes through the arbor and into the table 13 at a point spaced from the pin 14, and surrounding this pin above the table is a sleeve 51^a substantially equal in length to the sleeve 50^a which surrounds the pin 14.

The forming arbor 50 is of special form in the case illustrated, so that it may be employed to bend a U-shaped tube into a form commonly referred to as a half-S tube. This arbor is relatively broad and upon its base which receives the tube is provided with a tube receiving groove or seat 52, substantially semi-circular in cross section and in the shape of a part of the letter S in contour. This shape is perhaps best shown in Fig. 3 wherein it may be noted that the groove is adapted to fit around and receive the U-shaped bend in the tube. The groove 52 is also extended around the end and upon one side of the forming arbor, as shown at 52^a, the groove adjacent the pin 14 being curved in a direction opposite to that at the other side of the arbor.

At one side the forming arbor is extended both forwardly and rearwardly so as to provide at the front face, an offset portion, in which the tube receiving groove 52 is formed in order that this groove may have the contour desired in the bent tube. At the rear

side of the arbor this extension forms the shoulder 50b, and about the shorter side is positioned a U-shaped clamp 53 of special form designed to hold the tube tightly within its seat or groove 52. The clamp is provided with legs 53a and 53b which embrace the shorter or offset portion 54 of the arbor and lie closely upon opposite sides thereof. A block 55 is mounted between the legs of the clamp, and upon one side, this block is substantially of U-shape form to fit in the U bend in the tube upon the side opposite the forming arbor, to securely clamp the tube in position as shown in Fig. 4. A set screw 56 is mounted in a threaded opening in the web portion of the clamp and a pin 57 is inserted through an opening in the block 55, the pin being provided with eccentrically formed journal portions 58 and 59 rotatable in openings in the legs 53a and 53b of the clamp. This pin is provided with a projecting end or thumb turn 60, and it will be apparent that when the pin is rotated the part 57 will be moved eccentrically with respect to the axis of the journals 58 and 59 and the block 55 will thereby be drawn up snugly into the bend of the tube. The set screw may then be turned to draw the tube closely into its groove or seat 52, the screw bearing against the end of the arbor to bring about such action.

The particularly novel form of clamp above described is especially efficient for use in clamping a previously formed U-shaped tube to a forming arbor 50. The construction of the clamp of this invention is especially adapted to decrease the amount of time necessary in the operation of the machine, by allowing rapid engagement and disengagement of the parts. It is obvious from the disclosure that it is only necessary to slightly loosen the set screw 56 and then to withdraw the pin 57 from the arms 53a and 53b and the block 55 by a movement upwardly in a direction away from the table 13, in order to disengage the parts. The block 55 may then be removed from its position within the bend of the previously formed tube and from between the arms 53a and 53b of the clamp member 53. The reverse action will securely clamp another previously bent U-shaped tube into operative position. The tube is placed in position within the seat or groove 52 and the block 55 is slipped into the bend in the tube and between the arms of the clamp 53, being locked in place by insertion of the pin 57. The set screw 56 is then tightened and the parts are in position for the machine to produce the subsequent bend. The portions 58 and 59 of the pin 57 which are eccentric to the portion thereof which passes through the block 55, causes the clamp to be adjustable so that the tube may be properly positioned within the seat or groove 52 before the set screw 56 is tightened. The block 55 being within the bend of the tube and contacting with substantially the entire interior periphery of the bend, positions the clamp relatively to the bend in the tube so as to equalize the clamping strain at this portion. The tube when clamped, therefore, is especially well supported against distortion because of the form of the groove 52 and the corresponding seat or groove which is formed in the block 55. These grooves cooperate when the tube is in clamped position to substantially surround the tube at the bend thereof.

In the drawings I have shown a machine designed to operate upon a pipe which has first been bent into U-shaped form as shown at 61 in Fig. 3. The free end of this pipe, as shown, is slightly longer than the fixed end which receives a mandrel 65 and is secured against movement during the bending operation. To the end of the mandrel which enters the tube a series of balls 66 may be secured, which are pivoted to each other and to the mandrel to permit relative movement between the parts when the tube is bent. To hold the wall of this end of the tube against the mandrel, inner and outer swiping blocks 95 and 96 are pivoted at 97 and 98 to a mandrel carrier 98a, the swiping block 95 being shaped at its free end to enter the groove 52a in the forming arbor and to bear against the tube wall closely adjacent the arbor. This block is held in position against the tube and kept free from contact with the bending arbor by the holding block 99. Likewise, a holding block 100 is provided to bear against the swiping block 96 and force it firmly against the wall of the tube.

The operation of my machine is as follows:

With the forming table in the position shown in Fig. 1, a tube which has previously been bent into U-shaped form is securely clamped in the seat or groove 52 by means of the block 55 and pin 57, and the set screw 56. The mandrel 65 is then moved forwardly and inserted in the fixed or shorter end of the tube. The swiping blocks are secured firmly against the tube wall by means of the holding blocks 99 and 100. The bending operation is then begun by slowly rotating the shaft 12 and forming table 13. By reason of the connections of the forming arbor with the table, the arbor is rotated about the pin 14 and the tube will, of course be carried with the arbor forming a bend adjacent the outer ends of the swiping blocks. The forming arbor at the point where the bend takes place adjacent the pin 14 is formed in the shape desired for the inside of the bend. The balls 66 which enter the tube adjacent the bend prevent deformation of the tube walls at this point, so that the tube

wall is properly supported at this point as well as supported by the wall of the groove 52 and the block 55, and the bending operation takes place smoothly and evenly without wrinkling the tube to a harmful degree.

While I have shown and described a preferred embodiment of my invention, it will be understood that it is not to be limited to all the details shown, but is capable of modification and variation within the spirit of the invention and within the scope of the appended claims.

What I claim is:

1. In a tube bending machine, a bending arbor having a tube receiving groove and means to hold a tube in said groove comprising a block adapted to bear against the tube wall, a clamp to embrace the arbor, tube and block, and an eccentrically mounted pin passing through the block and adapted to urge the latter against the tube.

2. In a tube bending machine, a bending arbor provided with a tube receiving groove, and means to hold a tube in said groove including a pressing block and an eccentrically mounted pin passing through said block and adapted for rotation to urge said block against the tube.

3. In a tube bending machine, a bending arbor having a tube receiving groove, and means to hold a bent tube in said groove, comprising a block to set into the bend of the tube and means to draw the block toward the arbor, comprising a clamp, and a pin eccentrically mounted on the clamp, and passing through said block.

4. In a tube bending machine, a bending arbor having a tube receiving groove, and means to hold a bent tube in said groove, comprising a block to set into the bend of the tube and means to draw the block toward the arbor, comprising a clamp, and a pin eccentrically mounted on the clamp, and passing through said block, and means to move said clamp relatively to the arbor to hold the tube tightly in position.

5. In a tube bending machine, a bending arbor having a tube receiving groove contoured to receive a bent tube, a clamp having parts embracing the arbor, and being adjustable relatively to the arbor, a block adapted to be received in the bend of the tube, and means for adjusting said block relatively to the clamp.

6. In a tube bending machine, a bending arbor having a tube receiving groove contoured to receive a bent tube, a clamp having parts embracing the arbor, and being adjustable relatively to the arbor, a block adapted to be received in the bend of the tube, and eccentrically mounted means for adjusting said block relatively to the clamp.

7. In a tube bending machine, a bending arbor having a tube receiving groove contoured to receive a bent tube, a clamp having parts embracing the arbor, and being adjustable relatively to the arbor, a block adapted to be received in the bend of the tube, an eccentrically mounted pin upon which said block is rotatably mounted to adjust the latter relatively to the clamp.

In witness whereof, I have hereunto set my hand this 1st day of July, 1924.

THOMAS T. ROBINSON.