Nov. 23, 1948. H. L. JOHNSON 2,454,282

TUBE FORMING DEVICE

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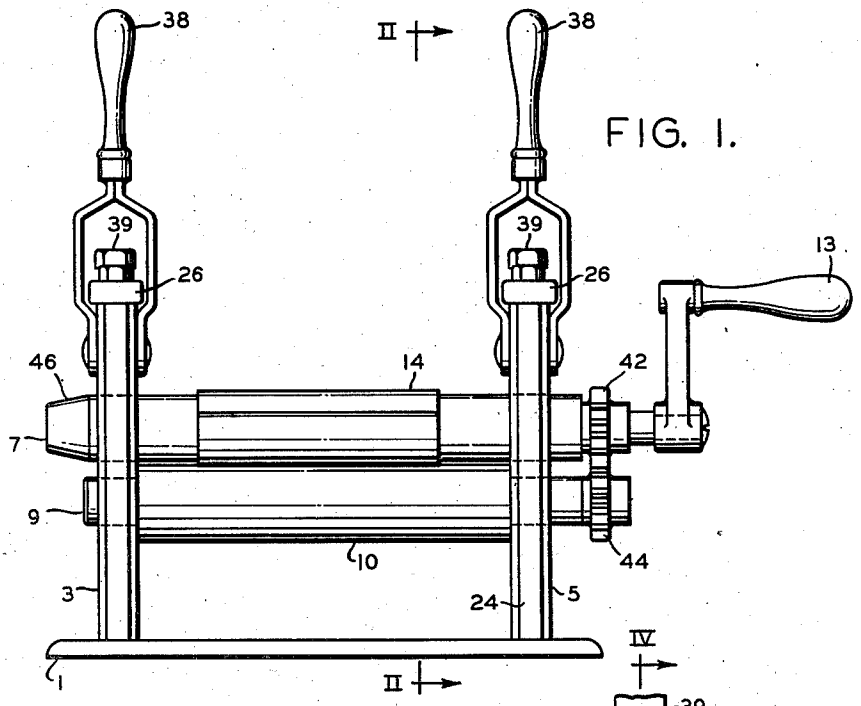


FIG. 1.

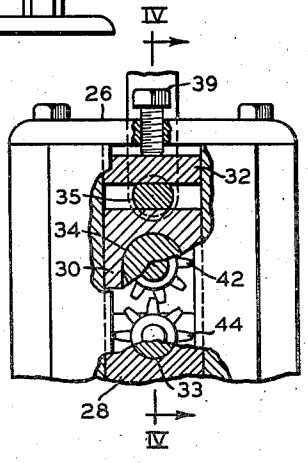


FIG. 3.

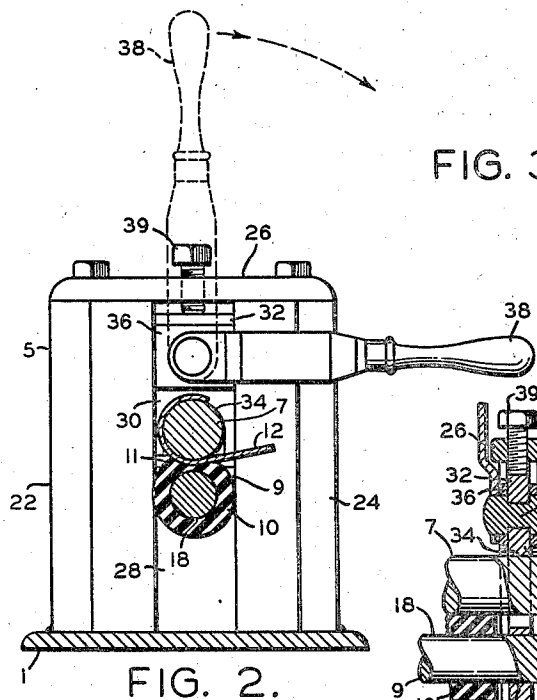


FIG. 2.

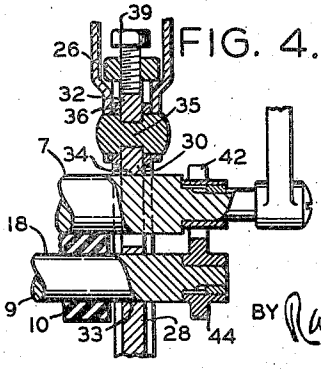


FIG. 4.

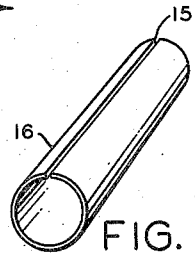


FIG. 5.

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TUBE FORMING DEVICE

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1 Claim. (Cl. 153—61)

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

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This invention relates to devices for forming tubes and is illustrated herein as embodied in a device for forming metal tubes of small diameter from flat sheet material.

Metal tubes of small diameter are often required in a metal working shop. However, it is uneconomical to keep a large supply of all sizes always on hand. Moreover, certain sizes and shapes of tubes often cannot be secured in the markets. Therefore, it is desirable to have readily available a small, inexpensive machine for making tubes of small diameter from flat sheet material.

Sheet metal pipes or tubes are commonly rolled into circular form from flat stock by passing the stock through a machine having three rolls, the upper roll being arranged to bend the stock into a groove between the lower rolls. The work is removed from a machine of this type by separating its edges sufficiently to allow the upper roll of the machine to pass between them as the work is lifted off the machine. As the diameter of small tubes or pipes made in this type of machine approaches the diameter of the upper roll, the tube cannot be removed from the machine in the manner described above without being distorted. Therefore, the ordinary type of three roll machine is not suitable for producing tubes of small diameter.

In view of the foregoing, it is a principal object of this invention to provide an inexpensive device for quickly and simply forming tubes of small diameters.

To this end, the invention contemplates the provision of a rigid roll of as small a diameter as that of the required tube in combination with an elastic roll in which a piece of sheet material disposed between the rolls is embedded as a result of the rolls being pressed together. Accordingly, the reaction of the elastic roll on being deformed by the pressure of the rigid roll, bends the sheet material progressively into conformity to the rigid roll as the rolls are rotated.

A further object of the invention is to make provision for the removal of finished work from a machine of this type without distorting it. This object is attained in the illustrated device by mounting the rigid roll, about which the tube is formed, in bearings from which the roll can be withdrawn axially. Thus, as the roll is removed from the device, the tube is slid axially off the roll without distorting its cross sectional shape in the least.

In order to enable the device to produce tubes of many diameters, the invention provides in

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accordance with another feature thereof, means for varying the penetration of the rigid roll into the elastic roll whereby the extent to which the sheet material is made to conform to the rigid roll is controlled.

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 claim.

Fig. 1 is a side elevational view of a tube forming device constructed in accordance with this invention showing a completed tube in place on the rigid roll and showing the rolls in released position.

Fig. 2 is an end elevational view, partly cut away and in section, of the device illustrated in Fig. 1, showing the rolls in position for forming a tube, the section being taken along the line II—II of Fig. 1.

Fig. 3 is a partial and elevational view of the device illustrated in Fig. 1, partly broken away.

Fig. 4 is a sectional view, the section being taken along the line IV—IV of Fig. 3.

Fig. 5 is a perspective view showing a tube formed by the device.

As illustrated in Figs. 1 and 2, the device includes a base 1 to which a pair of supports 3 and 5 are attached. The supports carry two rolls 7 and 9 which are rotatably mounted one above the other, parallel to each other, and to the base 1.

The upper roll 7 is made of suitable rigid material and acts as a form around which tubes are pressed. The lower roll 9 acts to press flat sheet material around the upper roll and is constructed with an elastic outer covering 10 (Figs. 2 and 4). When the rolls are forced together the rigid roll 7 becomes embedded in the elastic covering which thereby is deformed to follow the contour of the rigid roll 7, as shown at 11 in Fig. 2.

When a tube is to be made in the device, the rolls 7 and 9 are forced together by a mechanism associated with supports 3 and 5, which will be described in detail below. A piece of flat sheet material 12 (Fig. 2) is fed between the rolls, and the rolls are revolved by turning a handle 13 (Fig. 1) attached to the rigid roll 7. The elastic roll 9 forces the sheet against the rigid roll 7 to bend the sheet into conformity to the contour of the roll. When the tube 14 has been rolled to a cylindrical shape, the pressure on the rolls is released, the rigid roll 7 is removed from between the supports 3 and 5, and the tube 14 is slipped off the small end of the rigid roll 7. At this stage

the tube is in the condition shown in Fig. 5 having a seam 15 and a body portion 16. The seam can be soldered or welded or otherwise sealed to form a fininshed tube.

The device which has been described generally above will now be described in greater detail.

The elastic roll 9 can be and preferably is made as shown in Figs. 2 and 4 with a rigid core 18 of steel or iron or other appropriate rigid material around which is fitted the outer covering 10 of rubber or other suitable elastic material. The core 18 serves to support the elastic covering and prevent the roll 9 from springing and spreading in its central portion when the rigid roll 7 is forced into the elastic covering 10 of the roll 9. The rigid roll 7 is made of steel or iron or other suitable rigid material. The outer surface of the rigid roll is machined to the shape desired for the finished tube and serves as a form about which the tubes are pressed.

The supports 3 and 5 are similar in construction. Therefore, only the right-hand support 5 will be described in detail.

Two uprights 22 and 24 (Fig. 2) form, with a cross piece 26, a framework for the support 5. The uprights 22 and 24 are grooved on their inner surfaces slidably to receive bearings 28 and 30 and a stop 32 and are held together at their upper ends by the cross piece 26. The lower ends of the uprights are fixed to the base 1.

The bearings 28 and 30 and the stop 32 are mounted between the uprights, and the bearing 30 and the stop 32 slide in the grooves in the inner surfaces of the uprights. The bearing 28 is stationary, and a circular opening 33 (Figs. 3 and 4) in the upper part thereof receives and supports the elastic roll 9. The elastic covering 10 of the roll 7 is cut away to expose the core 18 where it comes into contact with the bearing 28, and the ends of the rigid core 18 form journals which ride in the bearing 28, as shown in Fig. 4, and in a similar bearing associated with the left-hand support 3.

The roll 9 can rotate but does not move vertically. The form roll 7, on the other hand, can be moved up and down in the supports and also can be withdrawn axially from the device. The lower portion of the movable bearing 30 is cut away to form a semi-circular surface 34 (Fig. 3) which fits around the rigid roll 7. The surface 34 is cut away to a semi-circular shape in order that the rigid roll 7 can quickly and easily be removed from or inserted in the bearing 30 when being removed from or placed in the device.

Downward pressure is exerted on the roll 7 through the bearing 30 by the action of a cam 35. The upper surface of the cam bears on the stop 32 and the lower surface on the bearing 30. A strap 36 (Fig. 4) runs between the uprights 22 and 24 and carries the cam 35. A handle 38 is attached to the cam, and the cam is turned with the aid of this handle. When the handle is turned up, the rolls are free as shown in Figs. 1 and 3 and the rigid roll 7 can be removed from the device. When the handle is turned down, the cam operates to force the rolls together as shown in Fig. 2 embedding the rigid roll 7 in the elastic roll 9.

The amount of penetration of the rigid roll into the elastic roll can be adjusted by means of a set screw 39 (Fig. 3), which is threaded into the crosspiece 26. By turning the set screw 39 the stop 32 can be lowered or allowed to rise, whereby any desired amount of pressure between the rolls can be obtained.

The rolls are turned by means of the handle 13 which is firmly attached to the roll 7 and, through meshing gears 42 and 44 (Figs. 1 and 3) attached to the rolls 7 and 9, drives the roll 9 as well as the roll 7. The gears 42 and 44 are constructed with long teeth so that they mesh both when the rolls are in released position and when pressed together.

The upper roll 7 is readily removable axially from the device. When the cam operating handles 38 are raised and pressure on the rolls is released, the roll 7 can be removed with the aid of the handle 13. Moreover, the left-hand end of the roll 7 has a taper 46 (Fig. 1) which guides the roll into the bearing 30 when it is being replaced in the machine.

When the device is to be operated, the rigid roll 7 is placed in the machine and the handles 38 are pushed down to force the roll 7 into the elastic cover 10 of the roll 9 as shown at 11 in Fig. 2. The penetration of the rigid roll into the elastic roll is adjusted with the set screw 39. A piece of flat sheet material 12, from which a tube is to be formed, is introduced between the rolls. Then the handle 13 is turned, and a feed movement is imparted to the sheet forcing the sheet to be embedded in the elastic covering and bent into conformity to the rigid roll.

When a tube is desired which closely conforms in size to the rigid roll, the set screw 39 is tightened to force the stop 32 downward, thus increasing the penetration of the rigid roll into the elastic roll, and, as the rolls are rotated, the sheet is bent to conform closely to the outer contour of the rigid roll 7 forming a tube of cross section only slightly greater than that of the rigid roll 7. On the other hand, if a tube of greater cross section is desired, the set screw 39 is loosened, thus lessening the pressure between the rolls, and a tube is formed of cross section somewhat greater than that of the rigid roll 7.

When a tube has been rolled into shape, the handles 38 are raised to release the pressure between the rolls. The upper roll is moved axially to the right in Fig. 1, and the tube then engages right hand bearing block 30 which causes the tube to slide off the tapered end of the roll and the tube is ready to be finished. At this point, the tube is in the form shown in Fig. 5 and has a seam 15. The seam can be sealed in any appropriate manner to complete the tube.

This invention has been illustrated with reference to the manufacture of tubes having a circular cross section. However, it can be adapted readily to produce tubes of different cross sections by employing form rollers of different shapes, for example, form rolls of oval, elliptical, or other cross section.

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

What is claimed is:

A tube forming device comprising, in combination, a horizontal base, a first guideway extending vertically upward from said base, said first guideway comprising two U-shaped channels disposed in a spaced apart relationship and a spacing member secured at opposite ends thereof to the upper end of each of said channels, a second guideway extending vertically upward from said base at a position remote from said first guideway, said second guideway comprising two U-shaped channels disposed in a spaced apart

relationship and a spacing member secured at opposite ends thereof to the upper end of said channels, a first and second bearing block disposed within said first and second guideways, respectively, and supported on said base, said bearing blocks each comprising a substantially rectangular block formed with a cylindrical bearing surface at the upper end thereof, a first roll having a rigid core journalled in said cylindrical bearing surfaces in said first and second bearing blocks, said first roll having a yieldable covering surrounding said core and extending axially of that portion of said first roll intermediate said guideways, a second rigid roll disposed with the axis thereof parallel to the axis of said first roll and normally resting on the upper surface of said first roll, a third and a fourth bearing block slideably mounted within said first and said second guideways, respectively, each of said third and fourth bearing blocks being formed with a U-shaped bearing surface in the lower end thereof, said bearing surfaces in said third and fourth bearing blocks being adapted to engage a portion of the upper surface of said second roll and to maintain said second roll in said normally parallel relationship with said first roll, first and second stop members slideably positioned in said first and second guideways, respectively, and disposed above said third and fourth bearing blocks, first and second screw means extending downwardly through said spacing members in said first and second guideways, respectively, and adapted to limit the upward movement of said first and second stop members, respectively, a first cam member disposed intermediate said first stop member and said third bearing block,

a second cam member disposed intermediate said second stop member and said fourth bearing member, means actuatable to move said first and second cam members, respectively, from a position permitting minimum spacing between said first stop member and said third bearing block and said second stop member and said fourth bearing block to a second position requiring greater spacing between said first and second stop members and said third and fourth bearing members, respectively, said third and fourth bearing blocks being adapted to permit removal of said second roll from said device without disassembling said device when said first and second cam members are in said first position, said cam members being adapted upon movement into said second position to force said second roll into the yieldable covering of said first roll, a first gear secured to one end of said core of said first roll, a second gear secured to one end of said second roll and adapted to engage said first gear when said cams are in said second position, and a crank member secured to one of said rolls and adapted to provide means of rotating the roll to which it is attached.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,421,354	Littell	June 27, 1922
1,486,975	Lindgren	Mar. 18, 1924
1,930,562	Krueger	Oct. 17, 1933