May 29, 1934. J. MAROTO 1,960,788

METHOD AND MEANS FOR FORMING PIPE ELBOWS

Original Filed Nov. 19, 1930 2 Sheets-Sheet 1

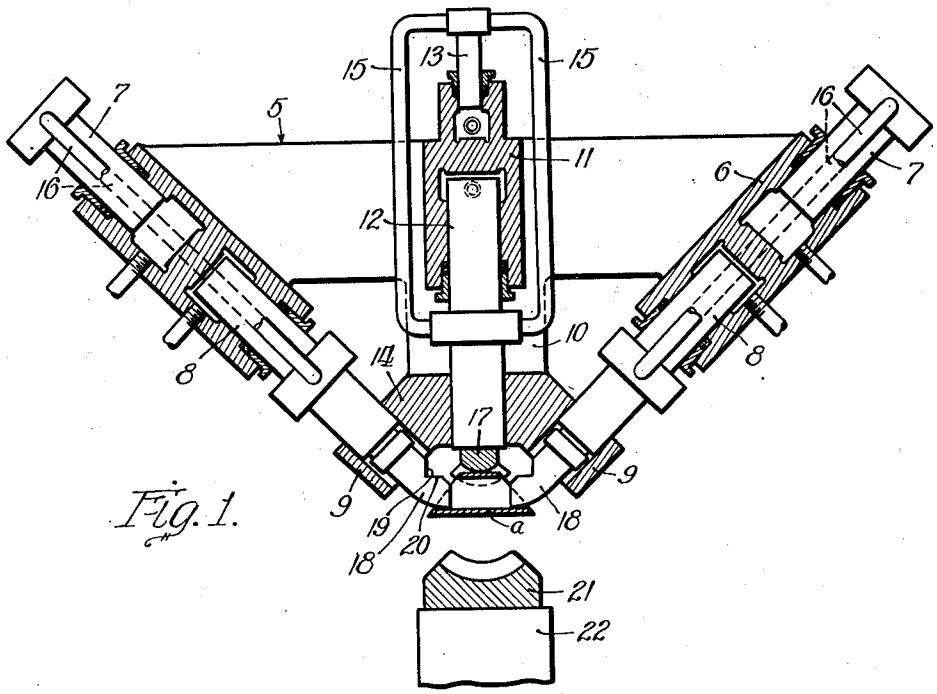



Fig. 1.

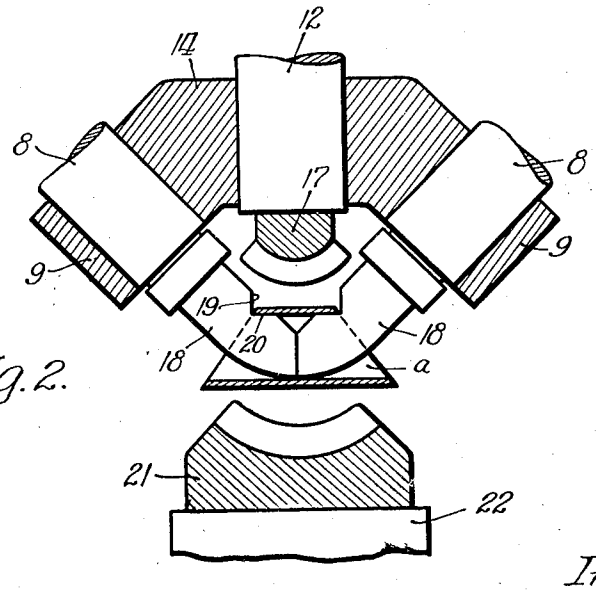



Fig. 2.

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Fig. 3.

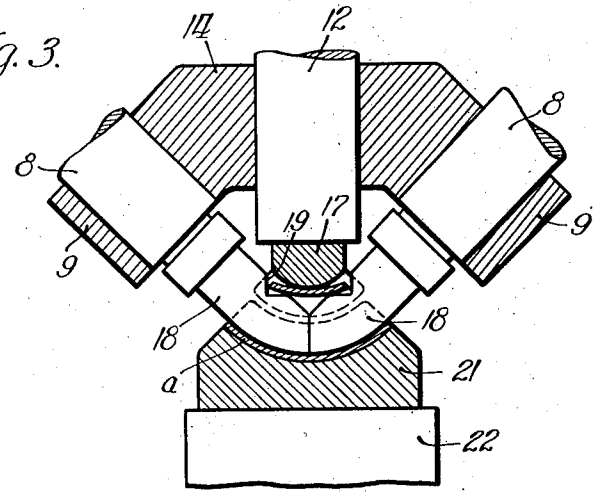
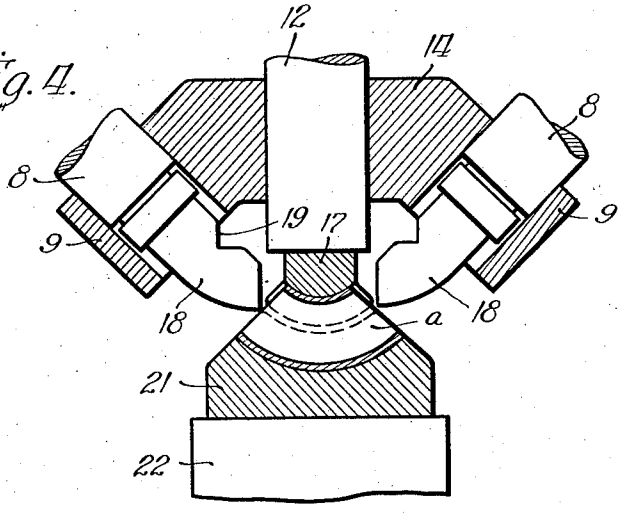



Fig. 4.




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# UNITED STATES PATENT OFFICE

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## METHOD AND MEANS FOR FORMING PIPE ELBOWS

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Original application November 19, 1930, Serial No. 496,615. Divided and this application January 16, 1933, Serial No. 652,001

3 Claims. (Cl. 153—33)

This invention relates to the manufacture of pipe elbows from wrought metal, and has to do more particularly with a method of and means for bending suitable lengths of tubing into desired final curvature to form therefrom the elbows.

One of the main objects of my invention is to provide an improved method whereby a length of tubing can be bent quickly into desired curvature so as to form an elbow without undesirable thinning of the tubing at the end portions, particularly at the inner side thereof. A further object is to provide improved means for bending the tubing, this means employing dies having rectilineal movement and so related and operated that the bending of the tubing is accomplished in a relatively short period of time, thus facilitating speed of operation with consequent reduction in cost. Further objects and advantages of my invention will appear from the detail description.

This application is a division of my co-pending application, Serial No. 496,615, for Method and means for forming pipe elbows, filed November 19, 1930.

In the drawings:—

Figure 1 is a sectional view through the exterior dies and the means for operating the interior dies, parts being shown in elevation, this view illustrating the first step of my method as practiced by the means illustrated;

Figure 2 is a sectional view on an enlarged scale through the exterior dies and the tubing and associated parts, parts being shown in elevation, illustrating the second step of my method;

Figure 3 is a view similar to Figure 2 illustrating the third step of my method;

Figure 4 is a view similar to Figure 2 illustrating the fourth or final step of my method.

In manufacturing elbows in accordance with my invention, I provide suitable lengths of tubing of proper diameter and of wrought metal, each length having its ends cut on converging diagonal planes. Such a length of tubing constitutes a blank, designated *a*, from which an elbow is formed. The shorter side of this tubing forms the inner side or shorter bend of the elbow, and is accordingly termed the inner side of the tubing for purposes of description. The longer side of the tubing forms the outer or longer bend of the elbow and, accordingly, is termed the outer side of the tubing.

In the means illustrated, I provide a suitable frame 5 of approximately T shape. A cylinder structure 6 is suitably supported at each end of the head of the frame, and oppositely acting pistons 7 and 8 operate in each of the cylinder structures. These pistons are oppositely inclined, the pistons 8 converging downwardly and inwardly of the frame. The inner end portions of pistons 8 operate in guide sleeves 9 at the lower end of stem 10 of frame 5. A cylinder structure 11 is provided at the upper portion of stem 10 and oppositely acting pistons 12 and 13 operate in the cylinder structure 11. Piston 12 is slidably mounted, at its lower portion, through a guide opening provided in a web element 14 connecting the sleeves 9. The pistons 12 and 13 are connected together by a suitable frame 15 and liquid under pressure is admitted to and exhausted from the cylinders of structure 11 for moving piston 12 either upwardly or downwardly, in a known manner. The pistons 7 and 8 are also connected by a suitable frame 16 and are operated by hydraulic pressure in the same manner as pistons 12 and 13.

An upper die 17 is suitably mounted upon the lower end of piston 12, and horn dies 18 are mounted upon the inner ends of pistons 8. Each of these dies 18 is provided, at the inner side thereof, with a transverse notch 19 forming a rounded shoulder 20 adjacent the inner end of the die. A lower die 21 is suitably mounted upon a hydraulic ram or piston 22.

Die 17 is provided with a trough-like depression defining a forming surface, this depression being of approximately semi-circular cross-section and being curved lengthwise to conform to the desired final curvature of the inner side of the elbow. Since this die is employed to form the inner side of the elbow, I term it the inner exterior die.

The lower die 21 is provided in its upper face with a trough-like depression of approximately semi-circular cross-section and defining a forming surface for shaping the outer bend of the elbow. Accordingly, I term this die 21 the outer exterior die. The horn dies 18 have rectilineal movement toward and away from each other, and each is of circular cross-section and tapers toward its inner end. The inner end of die 18 is flat and parallel to the direction of relative movement of dies 17 and 21, and the lower portions of these dies are curved to conform to the forming surface of die 21. When dies 18 are fully projected, they are in endwise contact and define, at their lower portions, a continuous curved surface corresponding to the desired curvature of the outer side of the elbow, as in Fig. 2. This curved surface, provided by the lower portions of dies 18,

conforms to and cooperates with the forming surface of die 21 for accurately shaping the outer side or bend of the elbow to the desired final curvature.

The blank *a* is disposed between dies 18 with its shorter side in contact with the lower face of die 17, as in Figure 1, and dies 18 are then projected into the blank with their inner ends in contact, as in Figure 2. The blank is then supported by dies 18, in spaced relation to dies 17 and 21, the ends of the blank, at the shorter or inner side thereof, resting upon the shoulders 20. With the blank thus supported, dies 17 and 21 are moved toward each other into full closed position. Die 21 coacts with the horn dies 18 to shape the outer side of the blank to the desired final curvature. Die 17 bends the central portion of the inner side of the blank outwardly so as to impart a substantially uniform longitudinal curvature thereto, as in Figure 3, which illustrates the relative positions of the parts when dies 17 and 21 are fully closed. Dies 18 are then withdrawn from the blank and, due to the disposition of shoulders 20 and the rectilineal movement imparted to dies 18, serve to shape the inner side of the blank accurately about the forming surface of die 17, thus completing the elbow as in Figure 4.

What I claim is:—

1. In means for curving a length of tubing, in combination, an inner exterior die and an opposed outer exterior die, said dies having relative rectilineal movement toward and away from each other, and oppositely inclined horn dies at opposite sides of and operating between the exterior dies, said horn dies having rectilineal movement toward and away from each other and converging toward the outer die, the horn dies having their outer sides curved lengthwise and being adapted for insertion into a length of tubing disposed between the exterior dies and through the ends of the tubing, said horn dies being provided at their inner sides with elements disposed to shape the inner side of the tubing about said inner die as the horn dies are withdrawn from the tubing with the exterior dies closed.

2. In means for curving a length of tubing, in combination, an inner exterior die and an opposed outer exterior die, said dies having relative rectilineal movement toward and away from each other, and oppositely inclined horn dies at opposite sides of and operating between the exterior dies, said horn dies having rectilineal movement toward and away from each other and converging toward the outer die, the horn dies having their outer sides curved lengthwise and being adapted for insertion into a length of tubing disposed between the exterior dies and through the ends of the tubing, said horn dies being provided at their inner sides with substantially L-shaped notches defining elements disposed to shape the inner side of the tubing about said inner die as the horn dies are withdrawn from the tubing with the exterior dies closed.

3. The method of curving a length of tubing, which comprises supporting the tubing upon two converging horn dies operable between two opposed exterior dies, subjecting the tubing to transverse pressure between the exterior dies in the closing thereof and shaping one side of the tubing to final curvature over the horn dies and between the latter and one of the exterior dies, and withdrawing the horn dies from between the exterior dies by rectilineal movement while the latter remain closed and shaping the other side of the tubing to final curvature over the other exterior die by the horn dies in the withdrawing movement of the latter.

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