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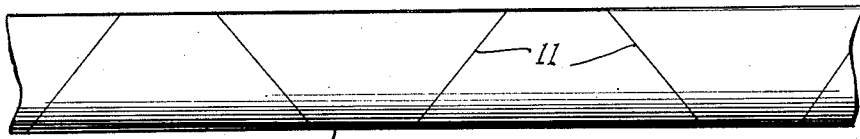
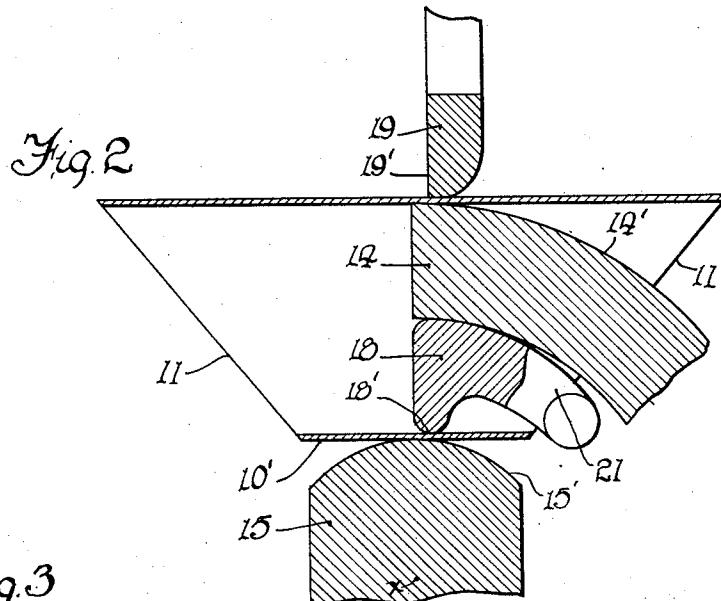
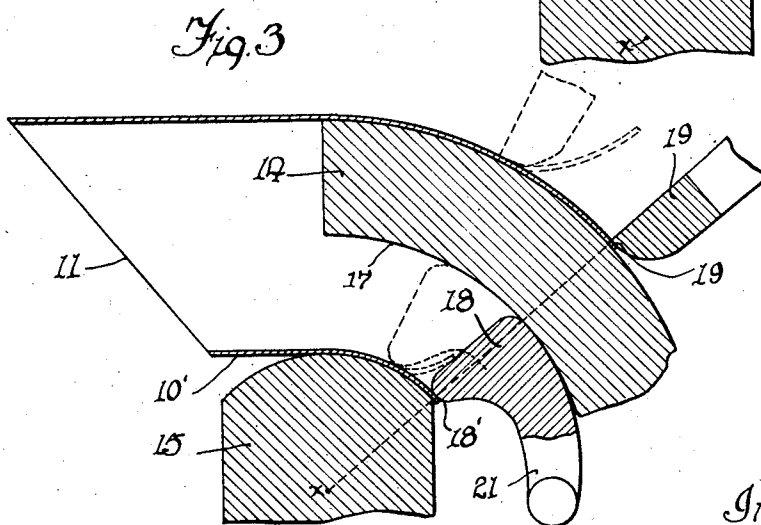
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METHOD OF AND MEANS FOR FORMING PIPE ELBOWS

Filed Oct. 31, 1921

2 Sheets-Sheet 1



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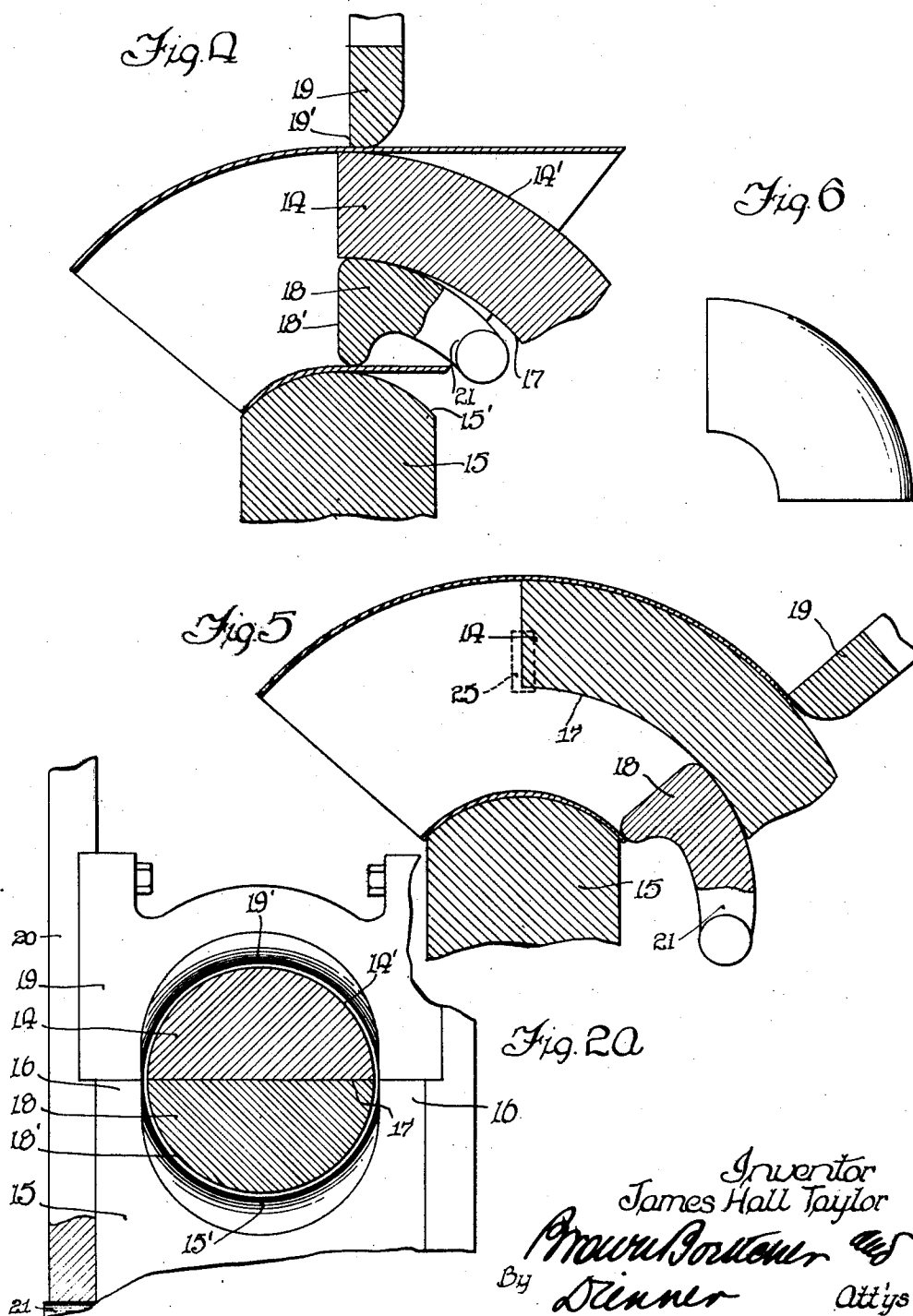
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE.

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METHOD OF AND MEANS FOR FORMING PIPE ELBOWS.

Application filed October 31, 1921. Serial No. 511,800.

The present invention pertains to a method of and means for forming pipe elbows. The invention proposes making pipe elbows out of sections of substantially straight tubing by drawing these sections over internal and external forming members with which cooperate internal and external pivoted dies. This particular method will be described in detail in the following description taken in connection with the accompanying drawings in which:—

Figure 1 illustrates the manner of cutting the straight stock tubing on diagonal planes so as to eliminate waste;

Fig. 2 illustrates the section of tubing in position between the forming members and dies, the latter being illustrated diagrammatically;

Fig. 2^a is an end elevational view of the forming members and dies, the internal horn and die being illustrated in section;

Fig. 3 shows the outer and inner dies revolved downwardly, illustrating the first curve completed;

Fig. 4 illustrates the next step in one manner of performing the process with the pipe section reversed to dispose the straight end over the horn and outer forming member;

Fig. 5 is a view similar to Fig. 3 illustrating the final step of rounding this straight end; and

Fig. 6 is an elevational view on a smaller scale of the completed elbow.

The stock wrought metal tubing designated 10 is cut into unit lengths on alternately inclined diagonal planes so as to leave the diagonal ends 11. Each section of tubing 10' is then inserted horizontally into the forming machine. The machine comprises inner and outer forming members consisting of an inner horn 14 which extends into the end of the pipe section and an outer form 15 which engages with the exterior of the pipe section at its bottom. These two forming members extend upwardly from a suitable support (not shown). The horn 14 has pivotal or other suitable movable connection with its support in order that it may be quickly and easily inserted into the end of the pipe section. The curving of the pipe section is performed upon the upper surfaces 14' and 15' of these two forming members, these surfaces as viewed from the side being curved substantially concentrically about a common center α . As viewed in the transverse plane represented in Fig. 2^a, both

of these forming members are curved to conform to their respective portions of the completed elbow. That is to say, the forming surface of the outer forming member 15 is concave and of semi-circular outline to embrace and shape the inner portion of the elbow. The horn 14, on the other hand, is convex and of semi-circular contour to shape the outer half of the elbow. The lateral walls 16 of the outer forming member 15 terminate substantially co-incident with the under surface 17 of the horn, this under surface corresponding substantially with the horizontal diametrical plane passing through the center of the pipe elbow.

Cooperating with the two forming members 14 and 15 are the two swinging dies 18 and 19. The die 18 extends into the interior of the pipe section and is formed with a convex die face 18' to agree with the concave curvature of the forming member 15. The outer die member 19 is adapted to form the exterior portion of the elbow and its die face 19' is given a concave curvature to correspond with the convex curvature of the horn 14. The two die members are arranged to follow the circular contours of their respective forming members, either through pivotal connections, by following curved guiding means, or in any other suitable manner. In Figure 2^a I have shown the outer die 19 as being mounted between parallel arms 20 which have pivotal connection with the machine on pivots 21 aligned on the pivotal center α . The inner die 18 has an extending arm 21 adapted to reach outside of the pipe section 10' for making connection with a suitable supporting member or frame adapted to draw the die over the form 15. The lower surface 17 of the horn 14 is concentric with the lower forming surface 15' and is intended to function as a bearing surface against which the top of the die 18 bears and is guided. This bearing contact insures the requisite pressure for drawing down the inner portion of the elbow. The two points of bearing contact between the die 18 and horn 14 may be arranged for adjustment or renewal by the provision of shims or the like.

The pipe section 10' is first inserted with the dies in the position shown in Fig. 2, the long edge of the diagonal end 11 being uppermost for shaping over the horn 14. The pipe section is only inserted halfway to dispose the center of the section substantially

at the forward edge of the horn 14. Any suitable clamping apparatus may be secured to the projecting end of the pipe section for holding it in place. The two dies are then swung downwardly around the circular contours of their respective forming members as shown in Fig. 3. The longitudinal curving of the pipe section is the result. The dotted line positions of the two dies are for the purpose of representing the forming action which takes place. The action of the outer die 19 is to compress or shrink the metal transversely and lengthen it longitudinally in drawing it over the horn 14. The action of the inner die is to stretch the metal in drawing it downwardly over the outer forming member 15. Owing to the fact that the curving of the tube is performed by drawing both the inner and outer circumferences, there is no bunching of the metal in the inner circumference, nor any thickening of the inner wall so often characteristic of other methods. The downward drawing of the metal in the operation of curving the inner wall of the blank tends to slightly reduce the sectional thickness of this wall from the central plane outwardly towards the ends of the blank. Prior methods of forming pipe elbows of relatively small radii have in the main been deficient or objectionable because of the buckling of the metal and other similar difficulties, preventing the commercial production of this type of elbow. My experience has proven the present method to be the only process which effectively takes care of excess metal and obviates these difficulties. The diagonal end 11 of each pipe section is preferably cut at such angle that the completion of the curving operation illustrated in Fig. 3 will leave the curved end of the pipe section substantially flush with a radial plane passing through the center x of the elbow. This minimizes or eliminates waste of material which would otherwise be involved in trimming or facing the end of the elbow.

The pipe section is now withdrawn from the machine and the dies returned to their upright positions, whereupon the other end of the pipe section is inserted between the dies and forming members, as shown in Fig. 4. The dies are then rotated for repeating the previous drawing operation on this end of the pipe section. This latter step is illustrated in Fig. 5. According to this manner of performing the process the pipe section 10' is in each instance inserted in the machine to dispose its central transverse plane substantially coincident with the end of the horn 14, whereby each operation of the dies 18 and 19 shapes one-half of the elbow. Both ends of the pipe section may be curved simultaneously if desired. The performance of such double curving operation merely requires a duplication of the

forming and die members for the other end. The outer forming member 15 has forming surfaces 15' on both sides of its central plane. A duplicate die 18 would be arranged for cooperation with the left hand forming surface 15'. Similarly, a duplicate horn 14 would be inserted into the left hand end of the pipe section and a duplicate die 19 would be arranged to cooperate with this horn. The simultaneous actuation of both sets of dies in opposite directions would substantially neutralize any stresses tending to move the pipe section. However, it is advisable to provide lateral clamping members 25 to engage the sides of the pipe.

The completed elbow is illustrated in Fig. 6, it being noted that this elbow is substantially a right angle elbow. It will be obvious that elbows of greater or lesser angular length may be produced by cutting the pipe section 10' of corresponding length.

I claim as new and desire to secure by Letters Patent:—

1. The process of making elbows which comprises taking a section of wrought steel tubing having an oblique end, engaging the long side which defines an acute angle with the oblique end over an internal horn, and the short side which defines an obtuse angle with the oblique end over an external form, moving an external die down over the long side of the oblique end to shrink the metal over said internal horn, and moving an internal die in engagement with the short side of said oblique end to stretch the metal over the external form.

2. The method of curving tubing which comprises disposing said tubing over an internal horn and adjacent an external form, said horn and form having substantially concentric curvatures moving an internal die along said external form to shape the tubing thereto, and moving an external die along said internal horn to shape the tubing thereto.

3. The method of forming elbows which comprises disposing a section of tubing over a curved internal horn and adjacent an external form, and then moving internal and external dies substantially parallel with the faces of said internal horn and said external form to shape the tubing thereto.

4. The method of curving tubing which comprises disposing said tubing over an internal horn and adjacent an external form, said horn and form having concentrically curved faces, and then moving internal and external dies concentrically with said curved faces to shape the tubing thereto.

5. The method of producing pipe elbows from substantially straight tubing which comprises cutting said tubing into sections on alternately inclined planes, disposing each section in association with a forming member engaging exteriorly with said tub-

ing and a forming horn extending interiorly into said tubing, said forming member and said horn having concentrically curved forming surfaces, and moving co-operating dies concentrically with said curved surfaces for shaping the inner and outer portions of said tubing thereto.

6. The method of producing elbows which comprises disposing a section of wrought steel tubing adjacent an external curved form and with an internal curved form projecting into the end of the tubing, moving an internal die substantially concentrically with said external form to draw or stretch the metal of the inner circumferential wall of said tubing down upon said external form, and moving an external die substantially concentrically of said internal form to shrink the metal in the outer circumferential wall of said tubing down over said internal form.

7. In a tube shaping device, a stationary curved horn adapted to project inside of the tubing, a curved form outside of the tubing, and die members moving concentrically with the curved faces of said horn and outer form for shaping the tubing thereto.

8. In a tube shaping device of the class described, the combination of an outer form having a concave forming surface curved longitudinally of the section of tubing to be shaped thereby, a horn adapted to project into said section of tubing, said horn having a convex forming surface curved longitudi-

nally of the tubing, an inner die rotatable within said section of tubing concentrically with the longitudinal curvature of said outer form, said inner die having a convex die face co-operating with the concave surface of said outer form and an outer die rotatable concentrically of the longitudinal curvature of said horn, said outer die having a concave die face co-operating with the convex curvature of said horn.

9. In a forming machine for making pipe elbows, an internal horn of substantially semi-circular convex section adapted for insertion into one end of the pipe, an external form of substantially semi-circular concave section adapted for engaging with the exterior of said pipe, an external die for drawing the outer circumference of the elbow over the internal horn, and an internal die for drawing the inner circumference of the elbow over the external form.

10. In a tube shaping device, a horn adapted for insertion into the tubing, said horn being of semi-circular contour on its outer surface, means for shaping one portion of the tubing over said horn, a form, and a die co-operating therewith, said die being movable within the tubing for shaping another portion thereof, said die having bearing cooperation with said horn.

In witness whereof, I hereunto subscribe my name this 28th day of October, 1921.

JAMES HALL TAYLOR.