

J. C. THEBERATH.
 APPARATUS FOR BENDING TUBES AND THE LIKE.
 APPLICATION FILED JAN. 28, 1918.

1,324,940.

Patented Dec. 16, 1919.

2 SHEETS—SHEET 1.

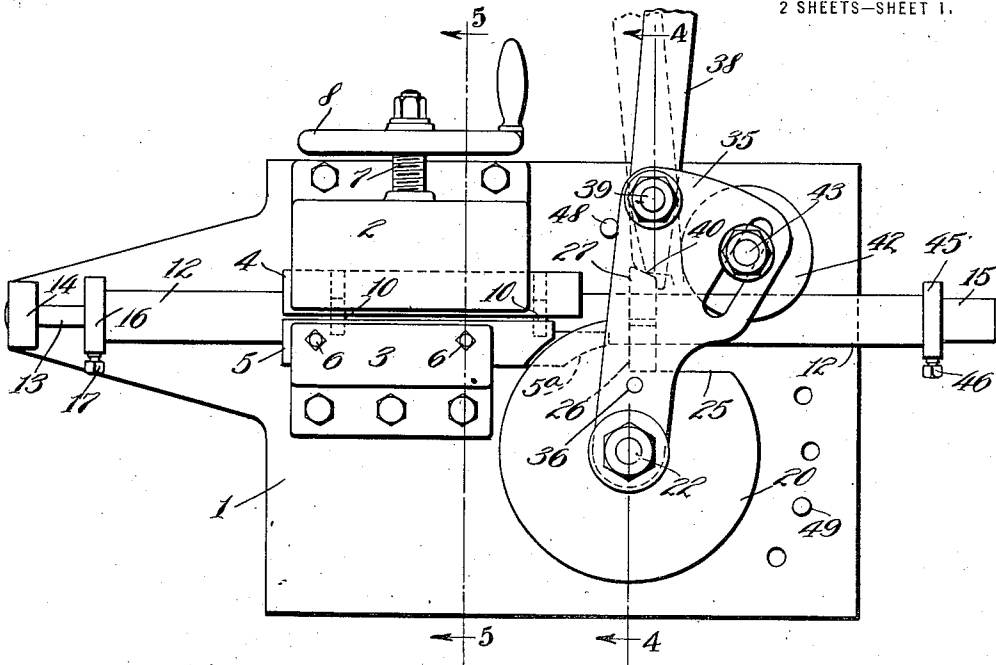


Fig. 1.

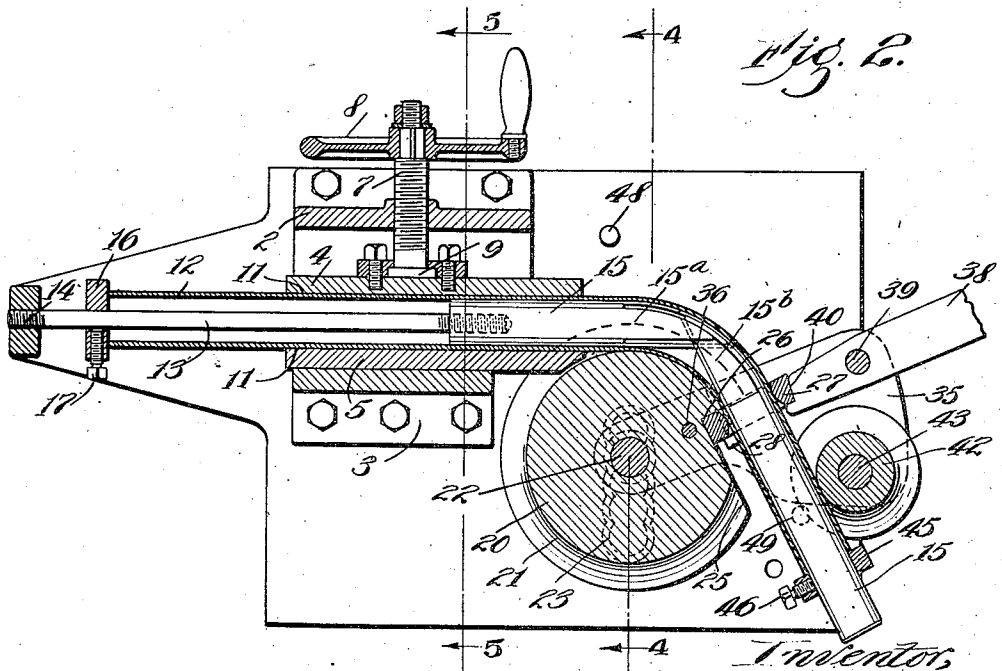


Fig. 2.

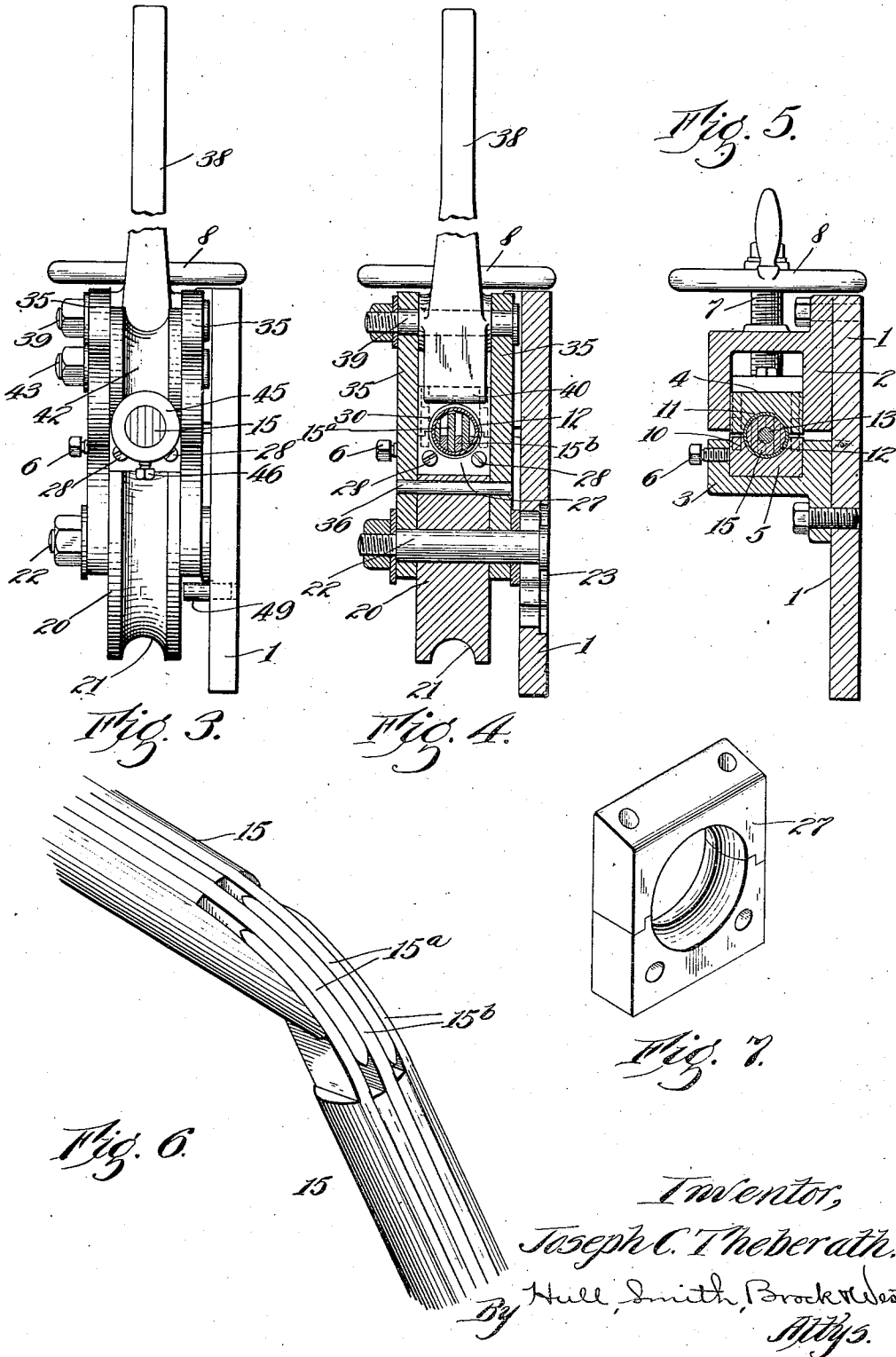
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 By Hull, Smith, Brock & West
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UNITED STATES PATENT OFFICE.

JOSEPH C. THEBERATH, OF LAKEWOOD, OHIO, ASSIGNOR TO THE STANDARD PARTS COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

APPARATUS FOR BENDING TUBES AND THE LIKE.

1,324,940.

Specification of Letters Patent.

Patented Dec. 16, 1919.

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To all whom it may concern:

Be it known that I, JOSEPH C. THEBERATH, a citizen of the United States, residing at Lakewood, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Apparatus for Bending Tubes and the like, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to apparatus for bending tubes and similar articles, the objects being to provide comparatively simple apparatus of this character that is convenient of use and readily adjustable to adapt it to the bending of tubes or the like of various sizes and on different radii; that imparts to the tube a smooth, even bend of the desired curvature without affecting, in any way, the circumferential contour of the tube; and to provide a sectional internal form or mandrel which effectively contributes to the attainment of this last result, and which may be easily placed within and removed from the tube.

To certain of the foregoing ends I employ a drawing die which fits the tube very accurately and is drawn in a curved course along the tube thereby to bend it, while confining it against distortion in a transverse direction; and this gives rise to a further purpose of the invention, that of making the drawing die of an expanding nature and providing means for contracting it, preferably constituting the same means as is subsequently used to move the die through its curved course, so that the die closing operation is made dependent upon the bending operation and is therefore rendered automatic.

These several objects are attained in the construction illustrated in the drawings accompanying and forming a part hereof, and wherein Figure 1 is an elevation of the apparatus, shown as containing a tube and with the drawing die contracted preparatory to bending the same; Fig. 2 is a section on the center-line of the tube in a plane parallel to that of Fig. 1, showing the parts at the completion of the bending operation; Fig. 3 is a right hand elevation of the apparatus; Figs. 4 and 5 are sections on the lines 4-4 and 5-5, respectively, of Fig. 1; Fig. 6 is a perspective view of the sectional mandrel;

and Fig. 7 is a similar view of the drawing die.

Describing the invention by the use of reference numerals, 1 is a bed plate whereon opposed holders 2 and 3 are permanently mounted to receive, respectively, the removable clamping jaws 4 and 5. The latter jaw may be secured within the holder 3 by set screws 6, while the jaw 4 is adapted to be vertically moved within the holder 2 by a screw 7, equipped at its outer end with a hand wheel 8 and having its inner end attached to the jaw by a connection of a swivel nature and designated 9 (Fig. 2). The jaws 4 and 5 are shown as retained in proper relation to each other by dowels 10, and their opposed faces are provided with grooves 11 for the reception of the tube 12. A bar 13, shown as anchored at 14 to the bed plate, extends between the jaws 4 and 5 and has attached to its end one section of a mandrel 15, hereinbefore referred to. A collar 16 is adjustable along the rod 13 and is adapted to be secured to the rod at any desired position by a set screw 17.

A form 20, shown as circular, and as having a circumferential groove 21, is of a radius equal to that of the bend that is to be imparted to the tube, and is mounted upon a stud 22 that may be attached to the bed plate in any one of a number of positions, indicated by the circular, stud-confining compartments of a slot 23. The form is cut away at 25 to produce a surface 26 against which a drawing die 27 may be secured, as by screws 28, in a substantially radial position with respect to the stud 22 or center whereon the form 20 rotates. The drawing die 27 is rendered expansible by being constructed of two parts divided on substantially the center line of the die opening, and guides are provided by dowels 30 for maintaining the two parts in proper relation to each other. A pair of plates 35 are arranged on opposite sides of the form 20 and die 27 and are pivoted upon the stud 22, these plates being shown as secured against rotation with respect to the form, by a pin 36 which passes through the form and plates. An operating handle 38 is pivoted at 39 between the plates 35 and beyond the outer end of the die 27, and its inner end is inclined, as shown at 40, for cooperation with the correspondingly inclined outer end of

the die, for a purpose which will be presently explained. A bending roller 42 is journaled upon an arbor 43, adjustably carried by the opposed plates 35, the roller 42 having a groove corresponding in concavity to that of the groove of form 20. The jaw 5 has an extension 5^a which projects well into the groove of the form 20 to thoroughly support the tube.

The sectional mandrel 15 is shown in perspective in Fig. 6, and the adjacent ends of the sections 15^a and 15^b thereof comprise series of interengaging tongues. The sections may be conveniently formed of laminations that are secured together by any suitable means, the alternate laminations of each section extending, at one end, a material distance beyond the others, thereby to form the aforesaid tongues. On one side, the tongues are curved to define an arc described from the center of the form 20 when the sections of the mandrel are swung into the angular relation to each other which corresponds to the angular relation between the ends of the tube after it has been given the desired bend. A collar 45 is adapted to be secured, by a set screw 46, to the section 15^b of the mandrel, to determine the extent to which it may be inserted into the tube, and in operative relation to the other section. A stop 48, carried by the bed plate, limits the movement of the plates 35 in one direction, and a stop 49, which may be set at various positions upon the bed plate, arrests movement of the plates in the other direction.

In considering the operation of the apparatus it will be assumed that the jaws 4 and 5 have been separated through the instrumentality of the hand wheel 8, and that the operating handle has been swung to its extreme left hand position (indicated in dot-and-dash lines in Fig. 1) with the plates 35 in the position determined by the stop pin 48. The tube 12 may now be inserted past the roller 42, through the die 27, between the jaws 4 and 5, and over the mandrel section 15^a until the end of the tube engages and is stopped by the collar 16. The adjustment of this collar determines the point at which the tube is to be bent. The hand wheel 8 may now be rotated to drive the screw 7 inward and move the jaw 4 into clamping relation with the jaw 5, with the tube firmly held between them. The mandrel section 15^b is now inserted in the outer end of the tube a distance dependent upon the location of its collar 45 which is so arranged as to bring the interengaging fingers of the mandrel sections into proper relation as hereinbefore explained. The ends of the fingers of each section are tapered to facilitate entrance between the fingers of the other.

The initial movement of the lever 38 toward the right will cause its inner end to

operate upon the outer member of the die 27 and can said member inward so as to contract the die to normal size. Further movement of the handle 38 in the same direction will carry with it the plates 35, the roller 42 and the form 20, as well as the drawing die 27, with the result that the tube will be bent to an extent dependent upon the location of the adjustable pin 49. With the tube so bent, the mandrel section 15^b may be withdrawn from the end of the tube and the parts controlled by the handle 38 returned to their former position, after which the jaws may be separated, and the tube withdrawn.

To adapt the apparatus to the bending of tubes of other sizes, it is obvious that jaws, forms, and bending rollers, having grooves corresponding in radii to those of the tubes that are to be bent, may be substituted for the present ones; and to obtain bends of different radii, forms of corresponding sizes are employed, and the stud 22 and arbor 43 adjusted accordingly. The angularity of the bend is determined by the position of the stop 49; and the curvature of the mandrel joint depends upon this angle and the radius of the bend.

Having thus described my invention what I claim is:—

1. In combination, holding means for a tube or the like, a circular drawing die extending around the tube, and means for moving said die in an arcuate course with respect to the holding means.

2. In combination, holding means for a tube or the like, an expansible circular drawing die extending around the tube, and means for contracting the die and moving it in an arcuate course with respect to the holding means.

3. In combination, holding means for a tube or the like, an expansible drawing die movable in an arcuate course with respect to said means, and a member for moving said die, said die and member having coöperating parts through which the die is contracted by the initial movement of the member.

4. In combination, holding means for a tube or the like, a movable form, a circular drawing die carried by the form and extending around the tube, and means for moving the form.

5. In combination, holding means for an article such as a tube or the like, a form supported in operative relation thereto, a drawing die extending completely around the article and movable to bend the article about the form, and means for so moving the die.

6. In combination, holding means for an article such as a tube or the like, a form movably supported in operative relation thereto, a drawing die carried by the form and extending completely around the article,

a member movable with the form, and a roller carried by the member for initiating the bending of the article.

7. In combination, holding means for an article such as a tube or the like, a form movably supported in operative relation thereto, an expansible drawing die carried by the form, a frame movable with the form, and a lever pivoted to the frame for moving the same and having a portion for coöperation with the die for contracting it.

8. In combination, a bed plate, holding means for an article such as a tube or the like supported by the bed plate, pivot means adapted to be carried by the bed plate at different distances from the holding means,

a form rotatably and detachably supported by said pivot means whereby forms of various radii may be employed, a member for rotating said form, and means carried by said member for bending an article about the form and adjustable toward and from the pivot means.

9. A mandrel comprising sections having longitudinally lapped fingers designed to present an uninterrupted or continuously curved supporting surface when said sections bear a given angular relation to each other.

In testimony whereof, I hereunto affix my signature.

JOSEPH C. THEBERATH.