July 28, 1931. W. R. HUME 1,816,534

SHAPING THE MEETING EDGES OF CURVED BLANKS IN THE MANUFACTURE OF SHEET METAL PIPES AND THE LIKE

Filed June 6. 1928 4 Sheets-Sheet 1

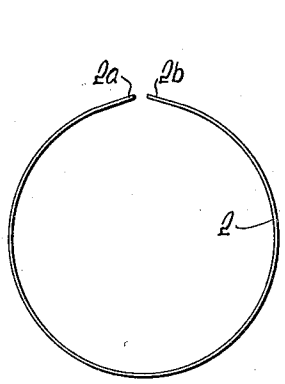


Fig. 1.

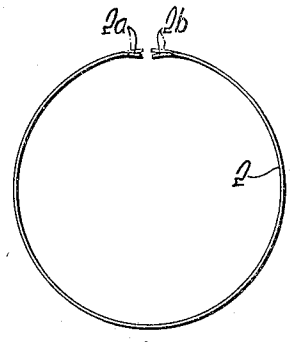


Fig. 2.

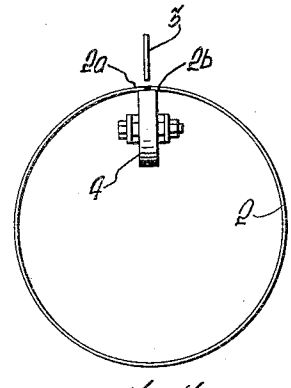


Fig. 3.

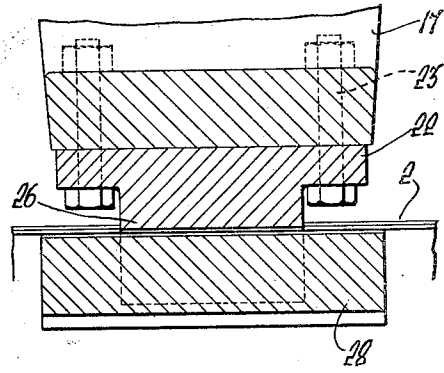


Fig. 4.

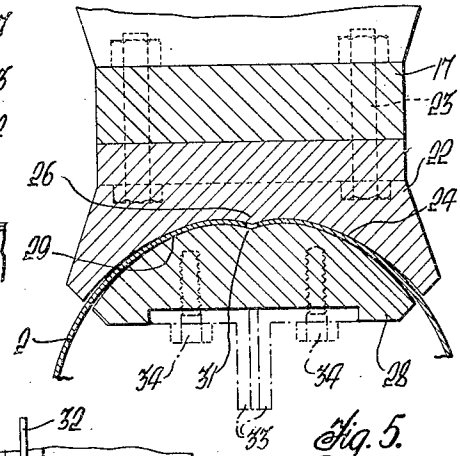


Fig. 5.

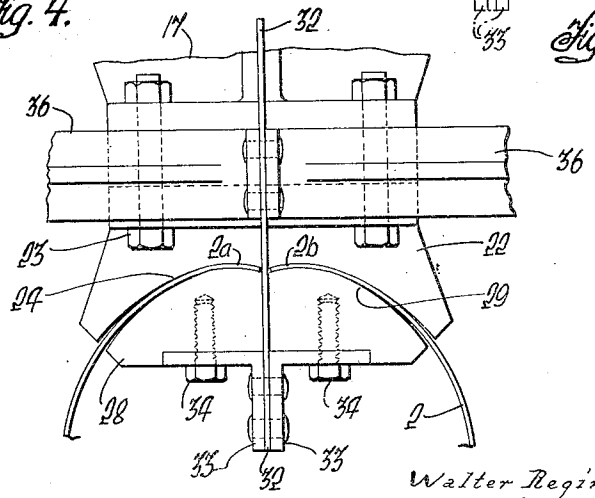


Fig. 6.

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SHAPING THE MEETING EDGES OF CURVED BLANKS IN THE MANUFACTURE OF SHEET METAL PIPES AND THE LIKE

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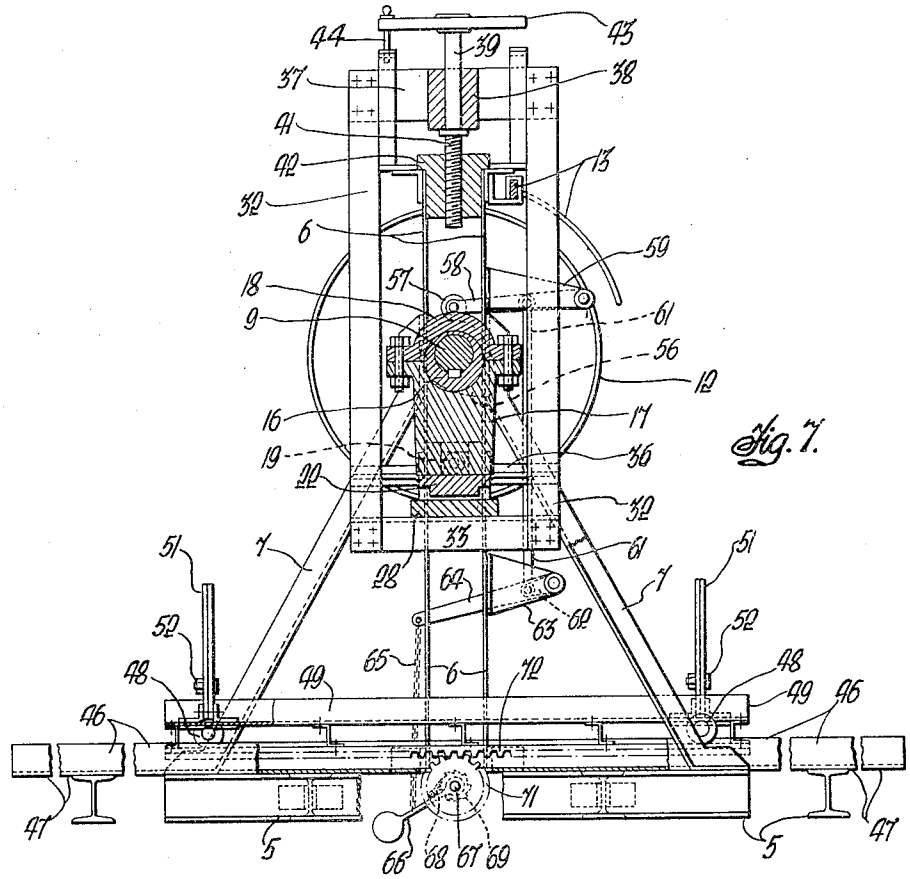


Fig. 7.

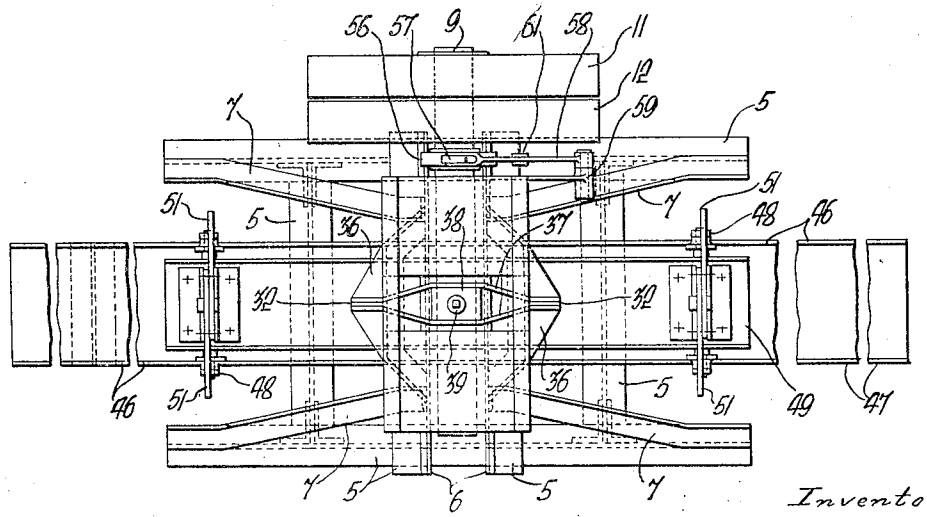


Fig. 8.

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SHAPING THE MEETING EDGES OF CURVED BLANKS IN THE MANUFACTURE OF SHEET METAL PIPES AND THE LIKE

Filed June 6, 1928 4 Sheets-Sheet 3

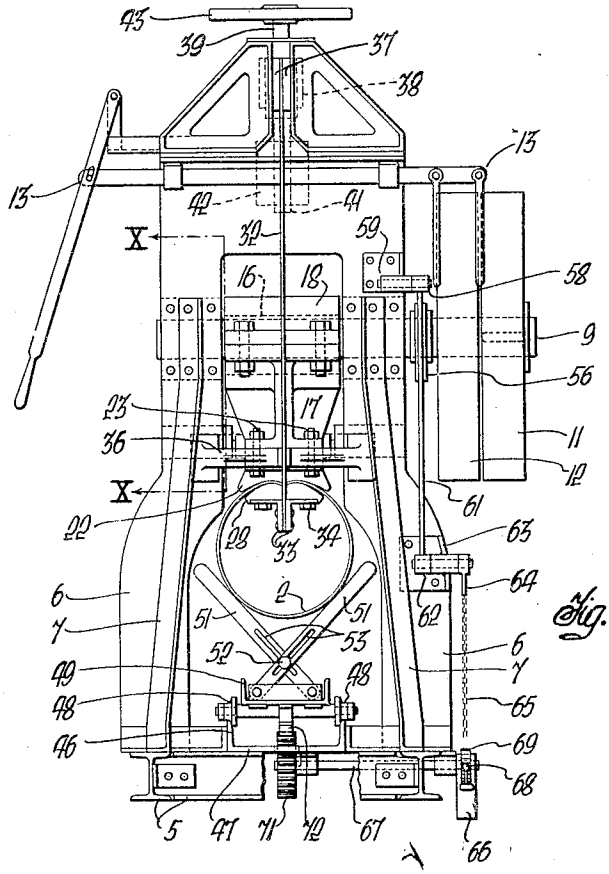


Fig. 9.

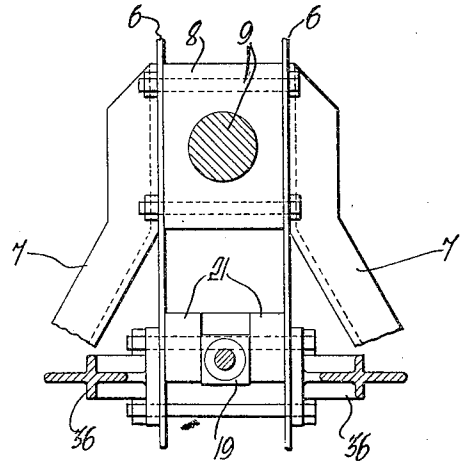


Fig. 10.

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SHAPING THE MEETING EDGES OF CURVED BLANKS IN THE MANUFACTURE OF SHEET METAL PIPES AND THE LIKE

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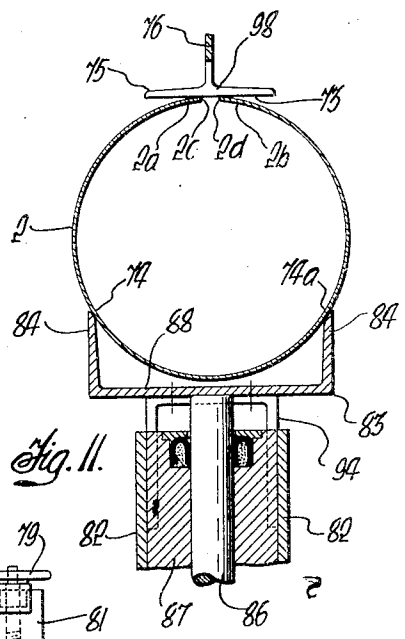


Fig. 11.

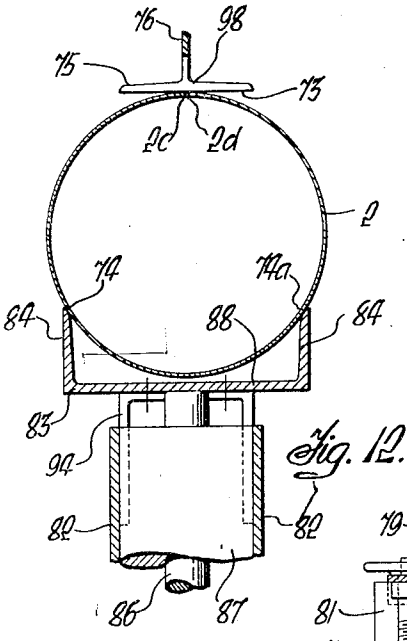


Fig. 12.

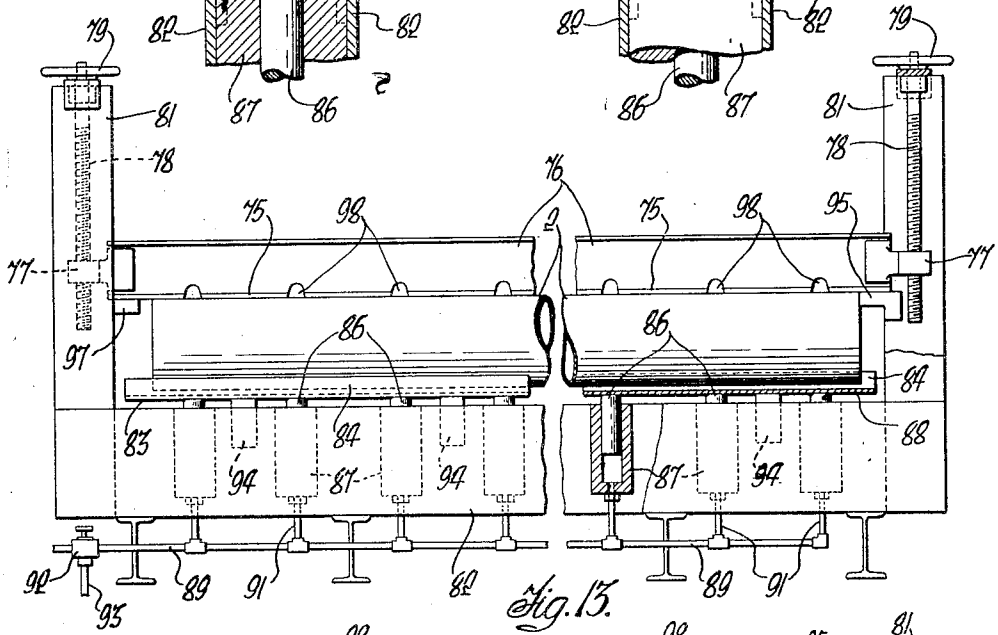


Fig. 13.

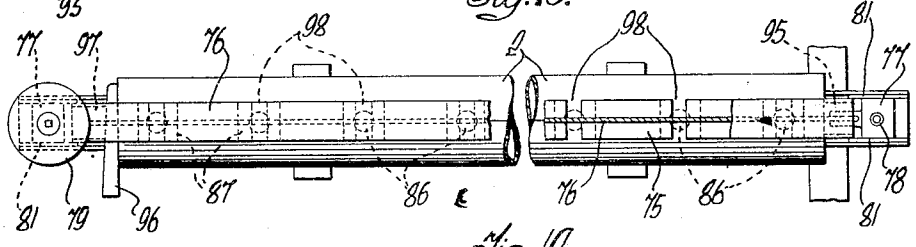


Fig. 14.

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Patented July 28, 1931 1,816,534

UNITED STATES PATENT OFFICE

WALTER REGINALD HUME, OF MELBOURNE, VICTORIA, AUSTRALIA

SHAPING THE MEETING EDGES OF CURVED BLANKS IN THE MANUFACTURE OF SHEET METAL PIPES AND THE LIKE

Application filed June 6, 1928, Serial No. 283,356, and in Australia June 27, 1927.

This invention relates to the manufacture of pipes and like hollow or tubular articles from metal sheets or plates which are first rolled or shaped in a bending machine or the like so as to form curved blanks the meeting edges of which are subsequently secured together. For instance, by welding, to thereby form the pipe or like article.

A difficulty hitherto experienced in the manufacture of sheet metal pipes and the like as above mentioned is that the meeting edge portions of the curved blanks after leaving the bending machine are somewhat flat thus forming a corresponding flat or distorted portion adjacent the seam or joint in the finished article.

The object of the present invention is to provide an improved method and means of treating the meeting edge portions of the curved blanks so that the resultant portion of the finished article is of proper arcuate formation.

The method in accordance with the invention consists primarily in bending the meeting edge portions of the sheet metal blank slightly inwards prior to the welding or uniting of said edges, the result being that the natural spring or resilience of the metal causes said inbent edges to assume, in the finished article, the correct arc of the adjacent portion of the metal tube.

Secondly, the method involves the bending of the meeting edges as above mentioned, progressively from end to end of the curved blanks.

The invention also contemplates bringing the meeting edges of the curved blank, after they have sprung from the inbent attitude into the required curvature, into closely abutted relationship and tack welding or similarly securing them together at longitudinal intervals prior to the final welding operation.

Any suitable apparatus may be employed in carrying out the above mentioned method but a preferred form of apparatus for the purpose will now be described.

Referring to the drawings which form part of this specification :—

Figure 1 is an end view of a pipe blank after it has been curved in a bending machine and showing the meeting edge portions of the blank slightly flattened.

Figure 2 is an end view of the curved blank after its meeting edge portions have been bent slightly inwards in accordance with this invention.

Figure 3 is an end view in which the meeting edge portions have assumed the required curvature and have been closely abutted so that they may be welded together to form a pipe of perfect cross-sectional shape.

Figure 4 is a sectional elevation of co-operating die members by which the meeting edges of a curved pipe blank may be bent inwardly, preparatory to welding operations.

Figure 5 is a cross sectional view of the co-operating die members.

Figure 6 is an end view of the co-operating die members and shows means for supporting the lower die member within a curved blank.

Figure 7 is a part sectional side elevation of a machine for carrying out the invention. Various parts are broken away or omitted for convenience of illustration.

Figure 8 is a plan view of the machine.

Figure 9 is an end view of the machine.

Figure 10 is an enlarged view taken approximately on the line X—X in Figure 9.

Figure 11 is a cross sectional view illustrating means for bringing the longitudinal edges of a blank against each other preparatory to uniting same.

Figure 12 is a view similar to Figure 11 but in which the longitudinal edges are shown in abutted relationship.

Figure 13 is a contracted side elevation of apparatus for closing the meeting edges of a curved blank and embodies the means shown in Figures 11 and 12.

Figure 14 is a plan of Figure 13.

In Figure 1 a curved pipe blank is shown with its meeting edged portion $2a$, $2b$, slightly flattened due to the normal operation of the roller bending machine by which the blank has been curved. Figure 2 depicts the edge portions $2a$, $2b$, in unbroken lines bent inwardly in accordance as shown in broken lines with this invention, from which position said edge portion, owing to the resilience thereof, spring outwards into the desired

curvature as shown in broken lines. In Figure 3 the edge portions 2*a*, 2*b*, are shown closely abutted so that they may be welded together by an electrode 3 and will thus assure the correct arc or curvature in the finished article. The numeral 4 indicates a backing member—or bearer which may engage the under side of the work immediately beneath the electrodes. Prior to the actual welding together of the meeting edge portions 2*a*, 2*b*, the meeting edges of the blank 2 may be closely abutted and tack welded as will be more fully described hereinafter.

Apparatus for carrying out the invention includes a suitable base 5 from which upstands a framework which may comprise metal plates 6 secured to and upstanding from the base and standards 7 for bracing the plates. A shaft 9 is supported in bearings 8 (Figure 10) to extend transversely of the framework and is fitted with fast and loose pulleys 11, 12, having suitable belt shifting gear 13 associated therewith as seen in Figures 7 and 9.

Mounted on the shaft 9 where it extends across an opening in the framework is an eccentric 16 around which is fitted a vertically reciprocating ram or presser head 17, preferably having a detachable cap 18 to facilitate assembly. The ram 17 may carry adjacent its lower end guide blocks 19 adapted to slide in vertical guides 21 formed in or attached to the main framework.

An upper or outer die block 22 may be attached by bolts 23 to the lower end of the ram 17. As seen more clearly in Figures 5 and 6 the underneath face 24 of the die block 22 is of concave formation and is provided with a central depending ridge or projection 26 of approximately V shape in cross-section, the sides of the projection being curved to the point of the V.

Disposed beneath the outer die is a lower or inner die block 28 the upper face 29 of which is of convex formation and is provided with a central groove or recess 31 which, in cross-sectional shape, corresponds substantially to the ridge or project on 26 of the outer die, the recess 31 being situated immediately beneath said projection as shown more clearly in Figure 5.

The inner die 28 is preferably carried by a vertically adjustable frame comprising a pair of relatively thin vertical legs 32 capable of passing freely between the meeting edge portions 2*a*, 2*b*, of the blank 2, the legs 32 being spanned at their lower ends by angle pieces 33 which are disposed within the blank 2 being treated as indicated in Figures 6 and 9. The inner die may be attached to these angle pieces by bolts or screws 34. The legs 32 may be braced immediately above the blank 2 by suitable bracing members or stiffeners 36 secured to the main framework.

At their upper ends the legs 32 may be secured to a pair of arms 37 which are spaced apart centrally of their length to accommodate a bearing 38 for a rod 39. The screwed lower end portion 41 of the rod operates within a vertically screwed socket member 42 suitably secured to the upper part of the main framework above the cross shaft 9. By turning a handwheel 43 at the upper end of the rod 39 the entire frame carrying the inner die 28 may be adjusted vertically to bring the latter into the desired position. The frame may be locked in position by passing a pin 44 through the hand-wheel 43 and into an adjacent part of the main framework.

On the base 6 is a track comprising a pair of rails 46 which may consist of the upstanding flanges of a channel section girder 47 laid upon the base. Running upon this track are the wheels 48 of a work supporting carriage 49, the direction of travel of which is lengthwise of the die blocks 22, 28.

The carriage is provided adjacent its ends with work holders each of which may comprise a pair of crossed arms 51, pivoted at their lower ends to the carriage, and adapted to receive between them the curved blank 2 as indicated in Figure 9. The arms 51 may be adjusted to accommodate work of different sizes and held in the desired adjusted positions by a bolt 52 or the like passed through slots 53 in the arms of the crossing point of the latter.

In operation the curved blank 2 is placed upon the work holders 51 with the meeting edges 2*a*, 2*b*, of the blank disposed immediately above the lower die block 28 and at opposite sides of the groove or recess 31 thereof, the legs 32 supporting the inner die passing through the gap between the meeting edges of the blanks. The vertically reciprocating ram or presser head 17 is then brought into operation so that the outer die 22 is forced downwardly against the meeting edge portions of the blank with the result that said edges are pressed downwardly between the ridge 26 of the upper die block and thus turned slightly downwards and inwards as indicated. When the meeting edge portions of the blank are relieved of pressure they spring outwardly and assume the required curvature as before mentioned. The pressing operation is carried out progressively from end to end of the blank, the work carriage 49 being intermittently advanced between the successive pressing operation. By adjusting the inner die 28 in relation to the outer die 22 and by adjustment of the work holding devices on the carriage 49, the apparatus may deal with pipe blanks of different diameters and thicknesses. The die blocks 22, 28, may also be interchanged to suit blanks of different sizes.

The work carriage 49 may be advanced either by hand or automatically. A suitable means of automatically advancing the carriage between successive pressing operations

may comprise a cam 56 mounted on the cross shaft 9, and contacting with a roller 57 carried at the free end of a lever 58 pivoted at its other end to a bracket 59 on the main framework. A connecting rod 61 may extend between this lever 58 and a second lever 62 pivoted to a bracket 63 on the framework. From the free end of a third lever 64, also pivoted to the bracket 63, a rod, chain or flexible line 65 may extend to a weighted arm 66 mounted to swing about a spindle 67 which may extend transversely beneath the main framework. This arm may carry a pawl 68 adapted to engage the teeth of a ratchet wheel 69 fixed on the spindle which may also be fitted with a toothed pinion 71 meshing with a toothed rack 72 attached to and extending longitudinally beneath the work carriage 49.

As the outer die 22 is raised from the work the foregoing mechanism automatically advances the carriage so as to bring another portion of the work into position for the next pressing operation, the legs 32 of the inner die supporting frame preventing circumferential or sideward disalignment of the meeting edge portions of the blank relative to the dies 22, 28, during advances of the carriage 49.

Provision may be made for varying the amount of travel of the work carriage for each action of the cam operated feeding mechanism. For instance the lower end of the flexible line 65 may be attached at various positions along the weighted arm 66.

After the meeting edge portions of the blank have been so treated for the whole of their lengths, the blank is removed and the meeting edges, which at this stage are spaced apart, are closely abutted and tack welded or suitably held together, at longitudinally spaced intervals preparatory to the welding together of the meeting edges along the entire lengths thereof. In order to close the blank or bring the meeting edges 2*c*, 2*d*, thereof into closely abutted relationship, the meeting edge portions 2*a*, 2*b*, are adapted to bear against a stop face or abutment 73 (as indicated in Figures 11 to 14) whilst pressure, acting towards said stop face, is applied simultaneously to the external surface of the blank at two zones or points 74, 74*a*, (Figures 11 and 12) which, in endwise viewing of the blank, are preferably spaced equi-distant from the gap between said meeting edges, 2*c*, 2*d*, and from each other. By thus applying pressure to the blank the meeting edge portions 2*a*, 2*b*, are caused to slide inwardly so that the meeting edges 2*c*, 2*d*, are brought and held against each other as in Figure 12, without in any way distorting the curvature of the blank which is thus of perfect circular form, in cross section. Whilst the meeting edges are held together as aforesaid they are tack welded at suitably spaced intervals, or otherwise temporarily secured together, so that the cylindrical blank may be removed for final welding along the line of the joint.

The stop face or abutment may be constituted by a horizontal flange 75, of a stop member 76 adapted to extend longitudinally above the blank being treated and to be held stationary during operations. This stop member may have secured thereto at its ends nuts 77 through which extend screws 78 fitted at their upper ends with hand wheels 79 whereby the screws may be operated to raise or lower the nuts and the stop member according to the diameter of the blank to be operated upon. The nuts 77 may be prevented from rotating by being fitted closely within pairs of upstanding plates 81 suitably supported at each end of a framework 82.

The means for applying pressure to the blank includes a presser member 83 of substantially channel shape in cross section which is arranged with its side flanges 84 projecting upwards so that the curved blank, with its meeting edge portions 2*a*, 2*b*, uppermost, may rest upon the upper edges of said flanges 84. The presser, which preferably extends longitudinally for the entire length of the blank, may be forced upwardly by a plurality of rams 86 operating in vertical cylinders 87 from the open upper ends of which the rams are projected by fluid pressure. The rams bear at their upper ends against the under surface of the horizontal flange or base 88 of the channel shaped presser 83, and preferably mid-way of the width thereof. The ram cylinders 87 may be suitably attached to the framework 82 at appropriate longitudinally spaced intervals, and fluid under pressure may be led to the cylinders by a main service pipe 89 and a number of branch service pipes 91 (Figure 13) a suitable valve 92 may be provided whereby the fluid may be discharged from said cylinders by way of an exhaust pipe 93.

The presser 83 may have one or more guide members 94 secured to and depending therefrom and adapted to slide within opposite plates of the main framework 82. Presser members 83 of different widths may be employed according to the diameter of the blank to be treated, so that in all cases the blank will be subjected to external pressure at three points or zones spaced approximately equidistantly around the circumference thereof, the pressure applied at two of said points acting in a counter direction to the pressure at the third point or zone which is disposed adjacent the meeting edge portions of the blank.

To ensure that the end edges of the blank are perfectly true, that is to say, that they are perfectly square, with or at right angles to the length of the blank, one end edge of the blank may bear against a stop member 95 (Figures 13 and 14) whilst a wedge 96 may

be driven between the other end edge and an inclined face of another stop member 97 as indicated in Figure 14, said stop members being disposed in alignment with the meeting edge portions 2*a*, 2*b*, of the blank.

After the presser 83 has been raised to an extent sufficient to cause the meeting edges 2*c*, 2*d*, to be abutted, and whilst the presser remains in such raised attitude the meeting edges are tack welded. To permit access to be had to said meeting edges so that tack welding operations may be carried out, the horizontal flange 74 and, if desired, the adjacent portion of the stop member 76 may have gaps or recesses 98 formed therein at suitably spaced intervals. Subsequently the edges may be welded continuously along their length.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. A method of treating the meeting edge portions of curved sheet metal blanks in the manufacture of pipes and like hollow bodies, consisting in pressing or bending said edge portions of a curved blank slightly inwards prior to uniting said edge portions so that they may spring outwardly to assume the desired curvature upon release of such pressure, and subsequently pressing said edge portions against a stop face or abutment whereby they are held in coinciding arcuate formation with the meeting edges abutting against each other preparatory to being welded along the line of said edges.

2. A method of treating the meeting edge portions of curved sheet metal blanks in the manufacture of pipes and like hollow bodies, consisting in pressing or bending said edge portions of a curved blank slightly inwards prior to uniting said edge portions so that they may spring outwardly to assume the desired curvature upon release of such pressure, subsequently pressing said edge portions against a stop face or abutment whereby they are held in coinciding arcuate formation with the meeting edges abutting against each other preparatory to being welded along the line of said edges, and temporarily uniting said edges of the blank whilst they are thus held in abutted relationship.

3. An improved method of manufacturing pipes and like hollow bodies from sheet metal blanks, which consists in rolling a blank into substantially tubular form, pressing the longitudinal meeting edge portions of the blank slightly inwards so that upon relaxation of such pressure the edge portions will spring outwardly and assume the desired curvature with a gap between their edges, subsequently subjecting the blank to external pressure at three points or zones spaced approximately equidistant around the circumference thereof, the pressure applied at two of said points acting in a counter direction to the pressure at the third point which is disposed adjacent the longitudinal meeting edges of the blank so that said edges are forced into and held in abutted relationship, tacking or spot welding said abutted edges together at longitudinal intervals, and subsequently welding said edges together continuously along their length.

4. Apparatus for treating curved sheet metal blanks in the manufacture of pipes and other hollow bodies, comprising co-operating upper or outer and lower or inner die members, said outer die member having a concave working face provided with a central longitudinally extending ridge or projection approximately in shape to an obtuse angled V, adapted to contact with the outer surfaces of the longitudinal meeting edge portions of a blank, said inner die member having a convex working face provided with a groove or recess which conforms approximately in disposition and contour to said ridge and is adapted to contact with the inner surfaces of said meeting edge portions, and means for forcing said die members towards one another whereby said meeting edge portions of the blank are bent slightly inwards.

5. Apparatus for treating curved sheet metal blanks in the manufacture of pipes and other hollow bodies, comprising co-operating upper or outer and lower or inner die members, said outer die member having a concave working face provided with a central longitudinally extending ridge or projection approximating in shape to an obtuse angled V, adapted to contact with the outer surfaces of the longitudinal meeting edge portions of a substantially tubular blank, said inner die member having a convex working face provided with a groove or recess which conforms approximately in disposition and contour to said ridge adapted to contact with the inner surfaces of said meeting edge portions, and means for forcing said outer die member against the outer surfaces of said meeting edge portions, said inner die member being stationarily mounted so as to pass within the blank.

6. Apparatus for treating curved sheet metal blanks in the manufacture of pipes and other hollow bodies, comprising co-operating upper or outer and lower or inner die members, said outer die member having a concave working face provided with a central longitudinally extending ridge or projection approximating in shape to an obtuse angled V, adapted to contact with the outer surfaces of the longitudinal meeting edge portions of a curved blank, said inner die member having a convex working face provided with a groove or recess which conforms approximately in disposition and contour to said ridge adapted to contact with the inner surfaces of said meeting edge portions,

means for reciprocating said outer die member towards and from the inner die member, and a support for the blank adapted to be advanced longitudinally at intervals when said outer die member is out of contact with the blank.

7. Apparatus for treating curved sheet metal blanks in the manufacture of pipes and other hollow bodies, comprising co-operating upper or outer and lower or inner die members, said outer die member having a concave working face provided with a central longitudinally extending ridge or projection approximately in shape to an obtuse angled V, adapted to contact with the outer surfaces of the longitudinal meeting edge portions of a blank, said inner die member having a convex working face provided with a groove or recess which conforms approximately in disposition and contour to said ridge and is adapted to contact with the inner surfaces of said meeting edge portions, means for forcing said die members towards one another, whereby the longitudinal edge portions of the blank are bent slightly inwards, and means for automatically and intermittently advancing the blank between successive pressing operations of said dies.

8. Apparatus for treating curved sheet metal blanks in the manufacture of pipes and other hollow bodies, comprising co-operating upper or outer and lower or inner die members, said outer die member having a concave working face provided with a central longitudinally extending ridge or projection approximating in shape to an obtuse angled V, adapted to contact with the outer surfaces of the longitudinal meeting edge portions of a curved blank, said inner die member having a convex working face provided with a groove or recess which conforms approximately in disposition and contour to said ridge adapted to contact with the inner surfaces of said meeting edge portions, means for reciprocating said outer die member towards and from the inner die member, and a wheeled carriage adapted to support the blank under treatment, said carriage being operatively connected with the means for reciprocating the outer die whereby said carriage is automatically and intermittently advanced longitudinally with the blank between successive pressing actions of the dies.

9. Apparatus for treating curved sheet metal blanks in the manufacture of pipes and other hollow bodies, comprising co-operating upper or outer and lower or inner die members, said outer die member having a concave working face provided with a central longitudinally extending ridge or projection approximating in shape to an obtuse angled V adapted to contact with the outer surfaces of the longitudinal meeting edge portions of a blank, said inner die member having a convex working face provided with a groove or recess which conforms approximately in disposition and contour to said ridge adapted to contact with the inner surfaces of said meeting edge portions, means for reciprocating said outer die member towards and from the inner die member, a wheeled carriage adapted to support the blank under treatment, said carriage being operatively connected with the means for reciprocating the outer die whereby said carriage is automatically and intermittently advanced longitudinally with the blank between successive pressing actions of the dies, a toothed rack on said carriage, a pinion engaging said rack, and means operable by the outer die reciprocating means to turn said pinion at periods when the outer die is free of the blank.

10. Apparatus for treating curved sheet metal blanks in the manufacture of pipes and other hollow bodies, comprising co-operating upper or outer and lower or inner die members, said outer die member having a concave working face provided with a central longitudinally extending ridge or projection approximating in shape to an obtuse angled V adapted to contact with the outer surfaces of the longitudinal meeting edge portions of a blank, said inner die member having a convex working face provided with a groove or recess which conforms approximately in disposition and contour to said ridge adapted to contact with the inner surfaces of said meeting edge portions, means for reciprocating said outer die member towards and from the inner die member, a wheeled carriage adapted to support the blank under treatment, said carriage being operatively connected with the means for reciprocating the outer die whereby said carriage is automatically and intermittently advanced longitudinally with the blank between successive pressing actions of the dies, a toothed rack on said carriage, a pinion engaging said rack, and pawl and ratchet mechanism operatively connected with the outer die reciprocating means and adapted to turn said pinion in one direction only at periods when the outer die is free of the blank.

11. Apparatus for treating curved sheet metal blanks in the manufacture of pipes and other hollow bodies, comprising co-operating upper or outer and lower or inner die members, said outer die members having a concave working face provided with a central longitudinally extending ridge or projection approximating in shape to an obtuse angled V, adapted to contact with the outer surfaces of the longitudinal meeting edge portions of a curved blank, said inner die member having a convex working face provided with a groove or recess which conforms approximately in disposition and contour to said ridge and is adapted to contact with the inner surfaces of said meeting edge portions, means for forcing said die members towards

one another whereby the longitudinal edge portions of the blank are bent slightly inwards, and at least one relatively thin leg to support said inner die member which is adapted to pass through a gap between the meeting edges of the blank.

12. Apparatus for treating curved sheet metal blanks in the manufacture of pipes and other hollow bodies, comprising co-operating upper or outer and lower or inner die members, said outer die member having a concave working face provided with a central longitudinally extending ridge of projection approximating in shape to an obtuse angled V, adapted to contact with the outer surfaces of the longitudinal meeting edge portions of a blank, said inner die member having a convex working face provided with a groove or recess which conforms approximately in disposition and contour to said ridge and is adapted to contact with the inner surfaces of said meeting edge portions, means for forcing said die members towards one another whereby the longitudinal edge portions of the blank are bent slightly inwards, and means for adjusting said inner die member in relation to said outer die member.

13. Apparatus for treating curved sheet metal blanks in the manufacture of pipes and other hollow bodies, comprising co-operating upper or outer and lower or inner die members, said outer die member having a concave working face provided with a central longitudinally extending ridge or projection approximating in shape to an obtuse angled V, adapted to contact with the outer surfaces of the longitudinal meeting edge portions of a substantially tubular blank, said inner die member having a convex working face provided with a groove or recess which conforms approximately in disposition and contour to said ridge and is adapted to contact with the inner surfaces of said meeting edge portions of the blank, means for forcing said die members towards one another whereby said edge portions of the blank are bent slightly inwards, an adjustable frame, at least one relatively thin leg to support said inner die member, which forms a part of the adjustable frame and is adapted to pass through the gap between the meeting edges of the blank, a main framework carrying a screw threaded socket member, and an adjusting screw connected to said adjustable frame and operating in said socket member.

In testimony whereof I affix my signature.

WALTER REGINALD HUME.