

(No Model.)

3 Sheets—Sheet 1.

D. A. RITCHIE.

MACHINE FOR MAKING METAL TUBING.

No. 328,974.

Patented Oct. 27, 1885.

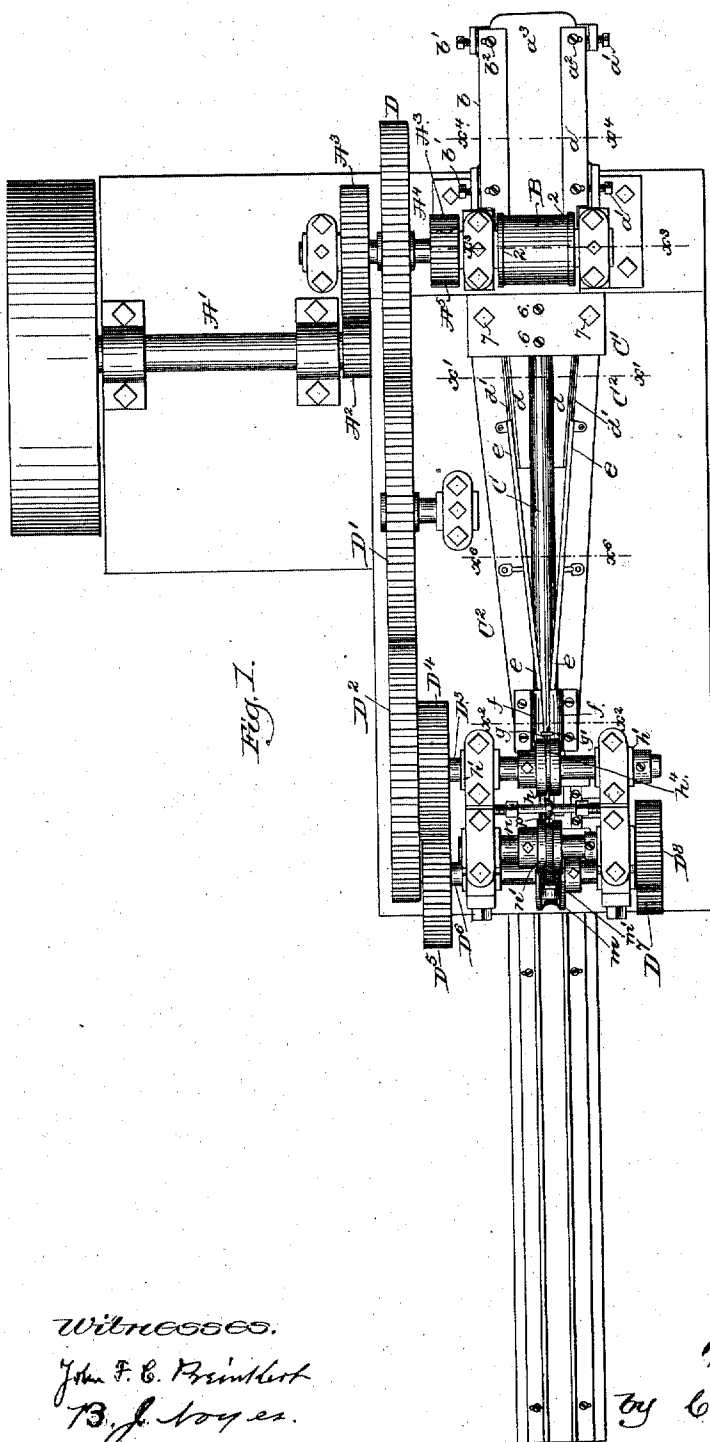


Fig. 1.

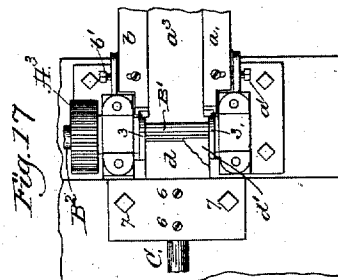


Fig. 17.

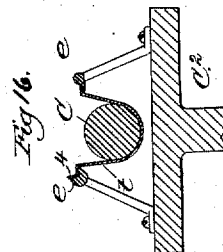


Fig. 16.

Witnesses.

John F. C. Brinkert
B. J. Hayes.

Inventor,
David A. Ritchie
by Crosby Gregory attys.

(No Model.)

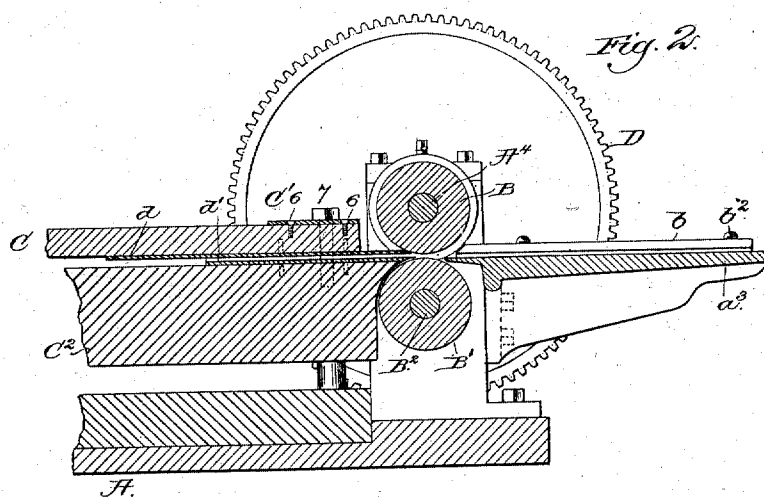
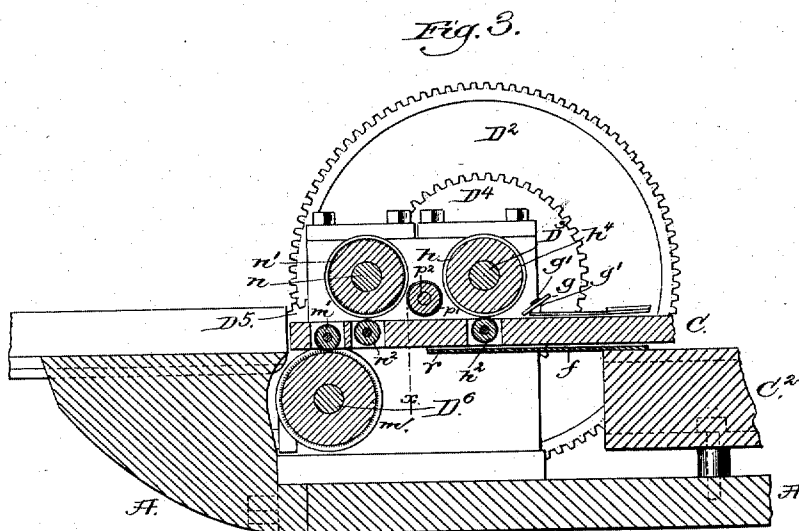
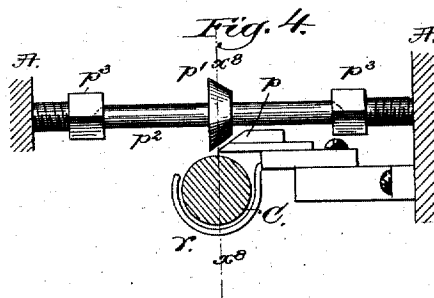
3 Sheets—Sheet 2.

D. A. RITCHIE.

MACHINE FOR MAKING METAL TUBING.

No. 328,974.

Patented Oct. 27, 1885.



Witnesses,
John F. L. Prindle
B. J. Toyless

Inventor,
David A. Ritchie
by Crosby & Gregory attys.

(No Model.)

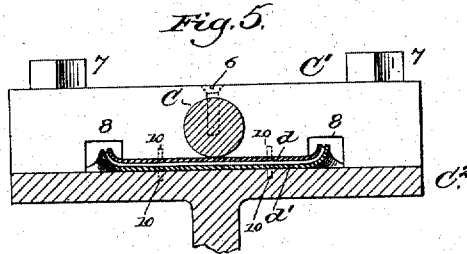
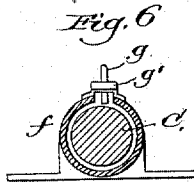
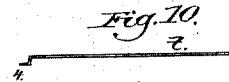
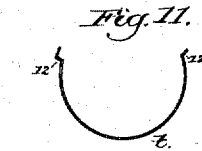
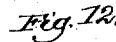
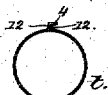
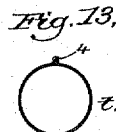
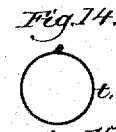
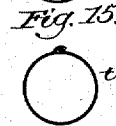
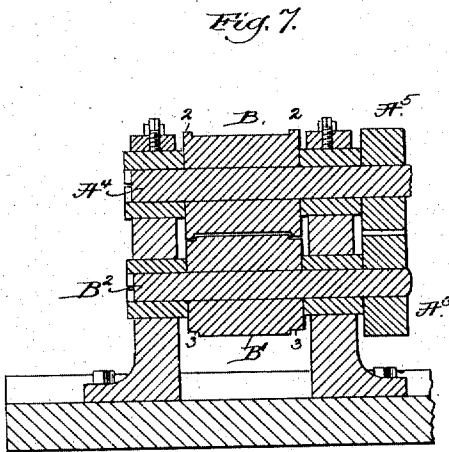
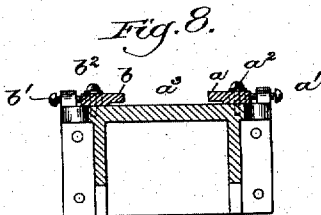
3 Sheets—Sheet 3.

D. A. RITCHIE.

MACHINE FOR MAKING METAL TUBING.

No. 328,974.

Patented Oct. 27, 1885.



Witnesses.
John F. C. Printz
B. J. Noyes.

Inventor.
David A. Ritchie
by Crosby & Gregory attys.

UNITED STATES PATENT OFFICE.

DAVID A. RITCHIE, OF BOSTON, MASSACHUSETTS.

MACHINE FOR MAKING METAL TUBING.

SPECIFICATION forming part of Letters Patent No. 328,974, dated October 27, 1885.

Application filed April 3, 1885. Serial No. 161,134. (No model.)

To all whom it may concern:

Be it known that I, DAVID A. RITCHIE, of Boston, (Chelsea,) county of Suffolk, and State of Massachusetts, have invented an Improvement in Machines for Making Metal Tubing, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention has for its object the production of a simple machine by which to automatically and rapidly produce straight sheet-metal tubing of that class in which the locked seam is longitudinal with relation to the tubing.

Prior to my invention attempts have been made to produce this class of tubing automatically by means of a former called a "triplet," a sheet-metal strip having a bend defined at its longitudinal center being fed onto the former or triplet, having its axis inclined with relation to the feeding-rollers, the sheet metal first bent into gutter-form, with its sides of equal width, and fed upon the said former or triplet, being distorted or twisted by it, so as to make one part of the gutter of unequal width, thereby leaving one leg thereof, viewing the same in cross-section, longer than the other, in order that the longer side may be lapped or turned over and made to embrace the opposite or shorter side. In the class of machine referred to the flanged edges to cooperate together and form the lap were not bent until after the tube was bent closely about the former or triplet.

In accordance with my invention the rollers which feed the strip into the machine from the strip-receiving guide or feed-table form flanges at each edge thereof before the strip arrives in position to be brought together about a mandrel, the latter being arranged at right angles to the axis of the feed-rollers, so that the flanged strip folded about it may be fed over the mandrel in a straight line without distorting or twisting the strip, as heretofore. With the roller for flanging the strip at each edge, and with the mandrel, I have arranged a preliminary curving guide, which gradually curves the flanged strip longitudinally, and delivers its flanged portion upon helical or spiral guides, which support the flanged edges of the strip while it is fed through

the machine and is being gradually bent about the mandrel to form a tube, the strip of metal in practice being gradually curved and applied to the mandrel by the said preliminary curving guide and the helical or spiral guides. The flanges first produced in the strip leave at one edge an L-shaped and at its other edge a J-shaped flange, and consequently when the portions of the said flanged edges, which when first formed are substantially at right angles to the main body of the strip, are brought together a part of the J-shaped flange overlaps the L-shaped flange, and thereafter the outer margin of the J-shaped flange is, by a finger, to be described, turned downward about and to embrace the L-shaped flange, the flanges so placed together entering an annular groove in the first pair of pulling-rollers. As and after the lapped edges enter the groove in the large roller of the first pair of pulling-rollers the said larger roller, co-operating with the mandrel, brings the sheet metal into tubular form and gives it its tubular set, and also pinches the flanges together. After leaving the first pair of pulling rollers the folded and interlocked flanged edges are gradually bent over by flange-bending devices, so that as the interlocked and bent-over flanges arrive at the second pair of pulling-rollers the latter act on the flange so partially turned and also on the tube, thus completing the seam or joint in the tube.

My invention consists, essentially, in flanging-rollers and a mandrel having its axis at right angles to the axes of the flanging-rollers, combined with a preliminary curving-guide, which gradually curves and applies the plunger-tube to the mandrel, as will be described.

My invention also consists in the flanging-rollers, mandrel, preliminary curving-guide, and a pair of rollers—one located within and the other outside the mandrel—and flange-bending devices, substantially as will be hereinafter described, combined with pulling-rollers located both outside and inside the tube, the roller of the pair inside the tube being supported by the mandrel.

Other features of my invention will be pointed out in the claims at the end of this specification.

Figure 1 is a plan view of a tube-forming machine embodying my invention; Fig. 2, an

enlarged central vertical section taken through the feeding and flanging rollers, the strip-receiving guide or feed-table, part of the preliminary curving-guide, and part of the bed of the machine; Fig. 3, a similar detail taken through the pulling-rollers and mandrel at the delivery end of the machine, the line of section being shown at $x^3 x^3$, Fig. 4; Fig. 4, a sectional detail in the line x , Fig. 3, showing the mandrel, curving-guide, and the conical disk of the flange-bending devices; Fig. 5, an enlarged section in line $x' x'$, Fig. 1; Fig. 6, a similar section in the line $x^2 x^2$; Fig. 7, a section in the line $x^3 x^3$, Fig. 1; Fig. 8, a section in the line $x^4 x^4$. Figs. 9 to 15, inclusive, show the different shapes assumed by the sheet-metal strip as it is made into a tube on my improved machine. Fig. 16 is a section in the line $x^6 x^6$, Fig. 1. Fig. 17 is a partial top view of the receiving end of the machine with the upper one of the feeding-rollers removed, the uppermost-plate of the preliminary curving-guide being broken out to show the lower plate under it.

25 The frame-work A, of proper shape to support the working parts, has suitable bearings for the different shafts, to be described. The driving-shaft A', driven by a belt or otherwise in usual manner, has a pinion, A², that engages a gear, A³, on the shaft A⁴, on which is secured the upper roller, B, of the pair of feeding and flanging rollers B B', the latter roller being fast on the shaft B², provided with the pinion B³, that is engaged and rotated by the pinion A⁵ on the shaft A⁴ of the feed-roller B.

The end of the upper feed roller, B, is provided with annular flanges 2 2, and the end of the lower feed-roller with annular grooves 3 3, the part of the under roll between its grooves entering and almost filling the space left in the upper roller between its flanges, so that the strip of metal t , entering between the said rolls in the condition Fig. 9, is flanged or bent at its edges, as shown at Fig. 10, wherein it will be seen that one flange is L-shaped and the other J-shaped, the latter being so shaped owing to the position of the edge-guides $a b$, made adjustable by the adjusting-screws $a' b'$, and held in place by the set-screws $a^2 b^2$ in suitable slots in the said edge-guides. These edge-guides and the plate a^3 constitute the receiving guide or feed-table, and by adjusting the said guides laterally the edge of the strip of sheet metal to be formed into a tube may be made to lap more or less at either end of the main part of the under roller, any excess of overlapping beyond the depth of the annular groove cut in the roller B' appearing in the J-shaped flange or in that part of the same marked 4 in Fig. 10.

The mandrel C, a long rod or bar in cross-section the same as that desired for the tube to be made, and herein shown as round, but which might be rectangular if that sort of tube or pipe were needed, is attached at one end by screws 6 6 to a cross-head, C', attached by

bolts 7 7 to the bed C², supported upon and secured by suitable bolts to the frame-work. The cross-head C (see Fig. 5) is provided with two grooves or spaces, 8 8, into which enter the edges of the upper or crown plate, d , of the preliminary curving-guide, composed of the said crown-plate and a bottom plate, d' , having its edges turned up to follow the transverse curve of and also the taper of the crown-plate d . The crown plate d will be attached by suitable screws to the under side of the under portion or plate of the cross-head, and the bottom plate, d' , to the upper side of the bed by screws 10, as shown in Fig. 5. The lower side of the crown-plate d and the upper side of the bottom plate, d' , are so shaped and adjusted with relation each to the other as to leave a narrow curved passage, such as to gradually curve upward the flanged strip.

On the bed C², and just in front of the bottom plate, d' , are placed helical or spiral guides e , gradually rising above and carrying the strip of metal about the mandrel into the position designated by Fig. 12, bringing the parts 12 12 of the strip face to face, and delivering the said parts so placed together into a delivery-guide, f , it being at or forming part of the helical or spiral guides, the delivery-guide f nearly surrounding the mandrel, the narrow slot at its upper side bringing the two parts 12 12 closely together and holding them so while the steel finger g , held by the small yoke or stand g' , acts upon the part 4 (see Fig. 12) and bends it down about the L-shaped flange, as in Fig. 13.

The shaft A⁴ has fast on it a toothed gear, D, that through an intermediate, D', engages and drives the gear D², fast on the shaft D³, carrying the roller h , the said shaft being supported in boxes h' in uprights of the frame-work.

The shaft D³ has fast on it a gear, D⁴, that engages a gear, D⁵, on the shaft D⁶, carrying the roller m , the latter shaft having in turn an attached gear, D⁷, at its opposite end, that engages a gear, D⁸, on and rotates the shaft n , having on it the roller n' . The roller h is provided with a central annular groove, h^4 , in which the flanged edges, in the condition shown in Fig. 13, enter.

The mandrel C, near its delivery end, is recessed or slotted to receive the anti-friction rollers $h^2 n^2 m'$, each milled or scored at its surface to engage the interior of the tube surrounding the mandrel, and supported thereon by suitable journals or studs. The rollers $h^2 n^2 m'$ are located inside the tube, directly opposite the point where the rollers h , n' , and m , respectively, meet the tube on the mandrel, and co-operating each with one of the said rollers, as in Fig. 3, enable the rollers $h h^2$, $n n^2$, $m m'$ to serve as pulling-rollers, they acting in pairs, as indicated, the rollers h , n' , and m being rotated positively, the other rollers of the pairs rotating by reason of the friction of the tube or pipe against them. These rollers, inside the former, are very essential, and be-

ing milled they finely indent the pipe in the line of the seam, which tends to increase the closeness of the joint formed.

Behind the roller h , in the direction of the movement of the tube over the mandrel, I have placed the flange-bending devices p p' . The piece marked p is a sort of taper block or finger, to act against the part 4 close down in the right-angled bend of the L-shaped flange in the condition of the tube represented in Fig. 13, while the piece p' , made as a beveled roller or disk, acts against the opposite side of the locked flange and gradually turns it over, as in Fig. 14, in which condition the roller n' acts on the flange and compresses it between itself and the roller n^2 into the shape shown in Fig. 15.

The journal p^2 of the disk p is made adjustable by the fulcrum-screws p^3 p^3 . After this the pipe is pulled off the delivery end of the mandrel by the last set of pulling-rollers m m' . The rollers n' m are grooved annularly to receive the additional thickness of metal entering into the seam or joint, and are milled (see Fig. 1) to better engage the said seam or joint, and by slightly indenting it aid in making the seam or joint very close, and for many purposes sufficiently tight without the addition of solder.

The delivery-guide may be prolonged by the addition to it of a semicircular extension or rest, r .

The flanging-rollers B B' also serve as the main feeding-rollers; but it is obvious, instead of making the same identical pieces of metal perform both duties, that the flanged and reduced ends of the rollers B B' may be made in separate pieces held on the same shafts, A^4 and B^2 .

I claim—

1. The flanging and feeding rollers B B' , and the mandrel having its axis at right angles to the axis of the said rolls, combined with the preliminary curving-guide, the rollers acting to flange the edges of the strip preparatory to the action of the curving-guide to curving it longitudinally, substantially as described.

2. The flanging and feeding rollers B B' , and the mandrel having its axis at right angles to the axis of the said rolls, combined with the preliminary curving-guide and with the helical or spiral guides to receive and act upon the flanges of the strip of flanged metal to fold the same about the mandrel, substantially as described.

3. The mandrel and helical or spiral guide to fold the flanged tube about it, combined with the finger to turn the outer edge of the J-shaped flange of the strip down over the L-shaped edge thereof, substantially as described.

4. The mandrel and the helical or spiral guide to fold the flanged tube about it, combined with the finger to turn the outer edge of the J-shaped flange of the strip down over the L-shaped edge thereof, and with the rollers h h^2 , the former roller having an annular groove to receive the flanges after they have been caught together, while the latter roller supports the interior of the tube, substantially as described.

5. The mandrel, the guides to fold the flanged strip about the same longitudinally, and the rollers h h^2 , combined with flange-bending devices, substantially as described, to turn the locked flange over nearly upon the surface of the tube, substantially as set forth.

6. The mandrel, the guides to fold the flanged strip about the same longitudinally, and the rollers h h^2 , combined with flange-bending devices, substantially as described, to turn the locked flange over nearly upon the surface of the tube, and with a pair of milled pulling-rollers, one inside of, the other outside, the tube on the mandrel, to operate substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DAVID A. RITCHIE.

Witnesses:

G. W. GREGORY,
W. H. SIGSTON.

It is hereby certified that the residence of the patentee in Letters Patent No. 328,974, granted October 27, 1885, upon the application of David A. Ritchie, for an improvement in "Machines for Making Metal Tubing," was erroneously written and printed "Boston, Massachusetts," whereas said residence should have been written and printed *Chelsea, Massachusetts*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 24th day of November, A. D. 1885.

[SEAL.]

H. L. MULDROW,
Acting Secretary of the Interior.

Countersigned:

M. V. MONTGOMERY,
Commissioner of Patents.