J. M. WEBSTER.

METAL TUBE FORMING MACHINE.

APPLICATION FILED OCT. 17, 1908.

950,163.

Patented Feb. 22, 1910.

3 SHEETS—SHEET 1.

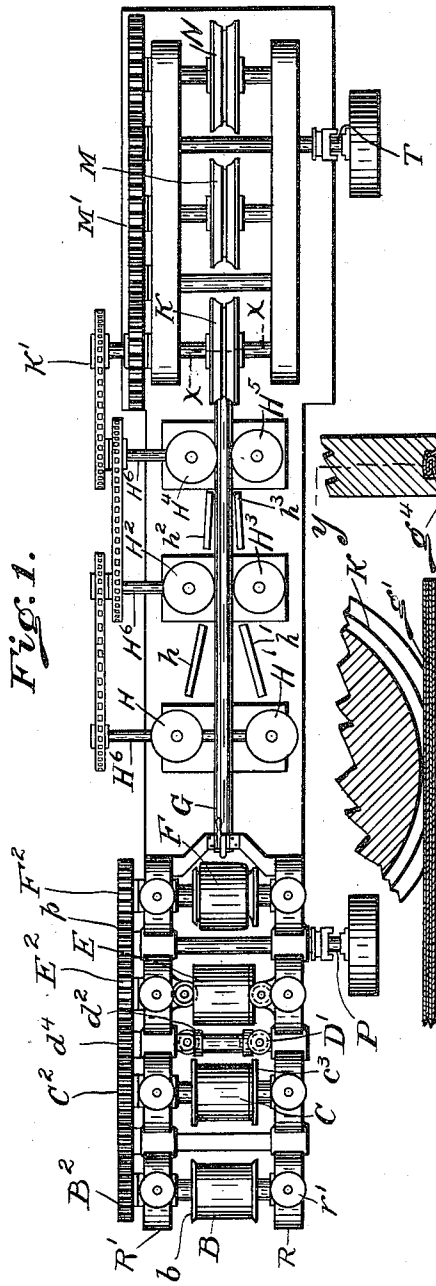

Fig. 1.

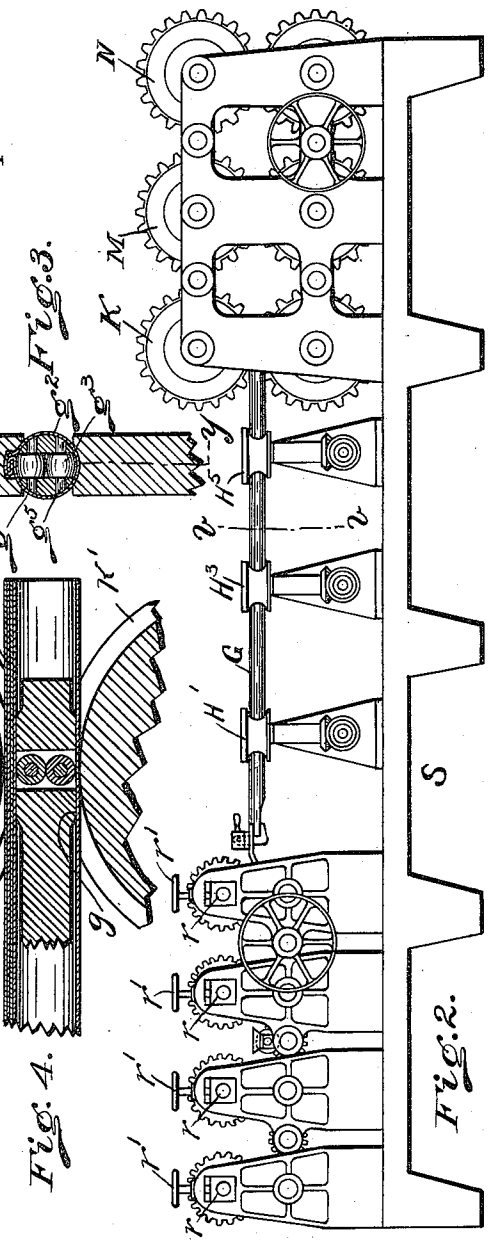

Fig. 2.

Fig. 3.

Fig. 4.

Witnesses

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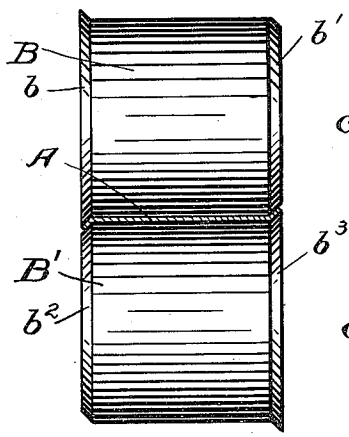


Fig. 5

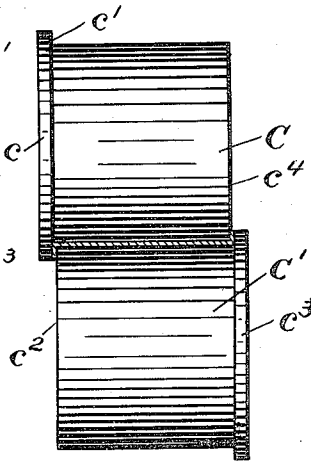


Fig. 6.

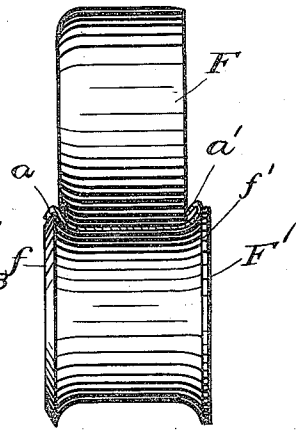
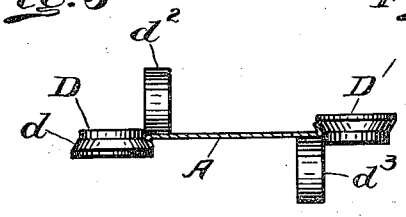


Fig. 9.



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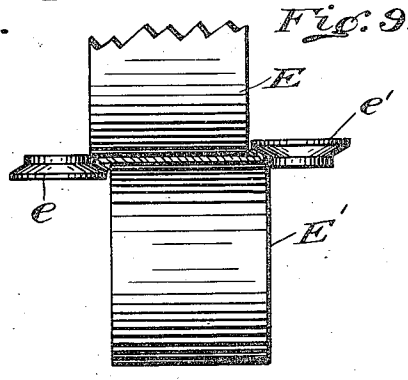

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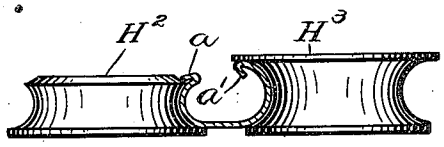

Fig. 11.

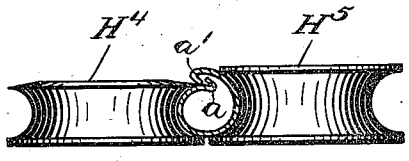

Fig. 12.

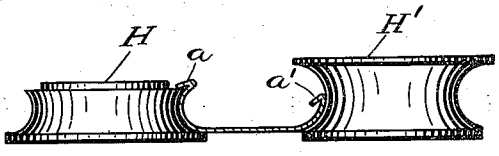

Fig. 10.

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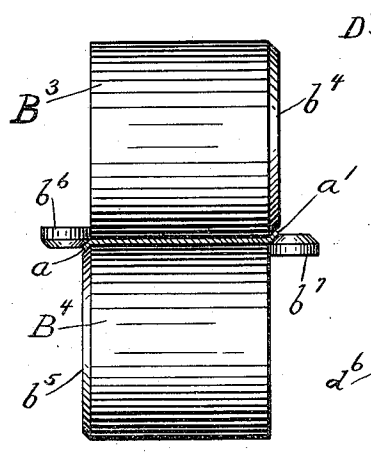

Fig. 13.

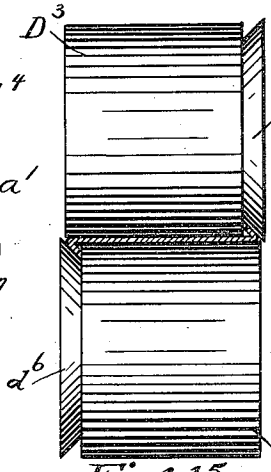

Fig. 15.

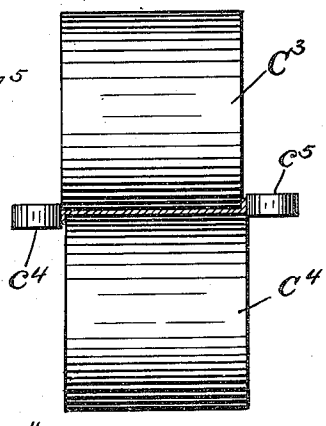

Fig. 14.

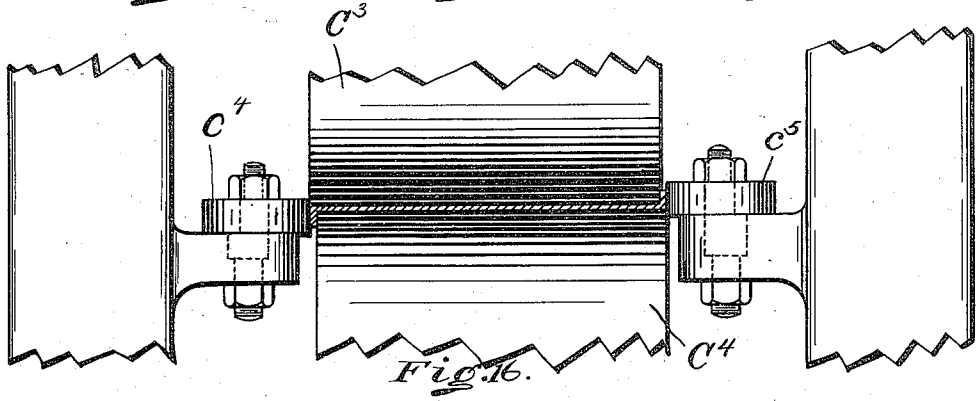

Fig. 16.

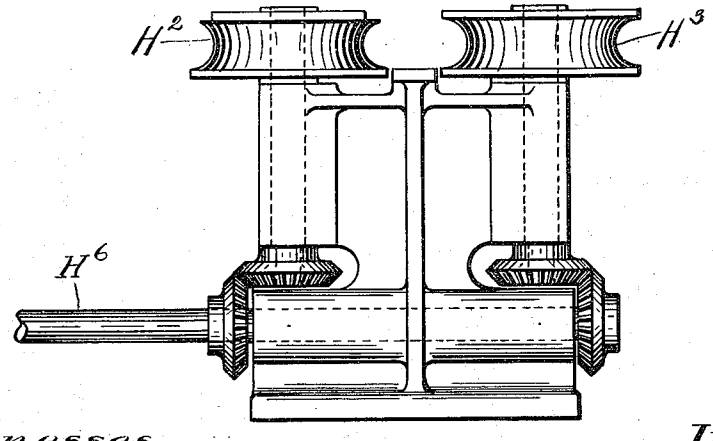

Fig. 17.

Witnesses

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UNITED STATES PATENT OFFICE.

JOHN M. WEBSTER, OF CINCINNATI, OHIO, ASSIGNOR TO THE O. P. SCHRIVER COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

METAL-TUBE-FORMING MACHINE.

950,163. Specification of Letters Patent. Patented Feb. 22, 1910.

Application filed October 17, 1908. Serial No. 458,198.

To all whom it may concern:

Be it known that I, JOHN M. WEBSTER, a citizen of the United States of America, and resident of Cincinnati, county of Hamilton, State of Ohio, have invented certain new and useful Improvements in Metal-Tube-Forming Machines, of which the following is a specification.

The object of my invention is a machine for making metal tubes rapidly, without marring the metal, and by means of which a tube with a strong and inconspicuous joint is made. This object is attained by the means described in the specification and illustrated in the accompanying drawings, in which,

Figure 1 is a plan view of a machine embodying my invention. Fig. 2 is a side elevation of the same. Fig. 3 is a detail sectional view taken upon line *x*—*x* of Fig. 1. Fig. 4 is a detail sectional view taken upon line *y*—*y* of Fig. 3. Figs. 5, 6, 7 and 8 are detail views of the rollers for inturning the edges of the metal strips. Figs. 9, 10, 11 and 12 are detail views of the rollers for curving the strip into a tube. In each of the views, 5 through 12, a cross-section of the metal in the course of formation, is given. Figs. 13, 14 and 15 are modified forms of rollers for inturning the edge of the metal strip. Fig. 16 is a detail elevation upon a somewhat enlarged scale of the rollers shown in Fig. 14. Fig. 17 is a vertical sectional view taken upon line *v*—*v* of Fig. 2, looking toward the left.

A description will be given first of the rollers, in the order in which they operate upon the sheet metal strips, A, and then reference will be made to the mechanism by which the rollers are actuated.

In Fig. 1 the end of the machine into which the strip of metal is fed, is at the left. The receiving rollers, B, B′, have their axes in the same vertical plane; the roller, B, having upon one end an angular flange, b, and upon the other end a bevel, b', while the roller, B′, has a bevel, b^2, which is the converse of the flange, b, and an angular flange, b^3, which is the converse of the bevel, b'. By the flanges and bevels of these rollers, one edge of the strip is given an initial bend downward at an obtuse angle, and the other edge is given a similar bend upward. The second rolls, C, C′, of the machine have their axes in the same vertical plane. The roller, C, has a flange, c, whose actuating face, c', is at a right angle to the periphery of the roller and is of a size to project over the end, c^3, of the roller, C′. The roller, C′, has a flange, c^3, similar to the flange, c', and which projects over the edge of the face, c^4, of the roller, C. By the flanges of these rollers, the edges of the strip previously turned at an obtuse angle by the rollers, B, B′, are inturned at a right angle to the body of the strip. The downturned edge of the strip then comes in contact with a small wheel, D, which has a beveled face, d, which turns the downturned edge of the strip inward at an acute angle. The edge of the strip is held in contact with the wheel, D, by a vertical pinion, d^2. At the same time the opposite edge of the strip comes in contact with the roller, D′, which is the reverse of the roller, D, and, co-acting with which is a pinion, d^3. From the wheels, D, D′, the strip, A, passes between rollers, E, E′, which are positioned so that one end of roller, E, projects beyond the corresponding end of the roller, E′, and the other end of roller, E′, projects beyond the corresponding end of the roller, E, a distance equal to the width of the inturned flanges of the strip. Co-acting with the edge of the roller, E, a beveled wheel, e, turns the downturned edge of the strip inward at its most acute angle, and co-acting with the roller, E′, a beveled wheel, e', turns the upward edge of the strip inward at its most acute angle.

The strip is now ready to be curved, an operation, the successive steps of which are illustrated in Figs. 9 through 12. The initial curve is imparted to the strip by means of rollers, F, F′. The surface of the roller, F′, is concave and the surface of the roller, F, is made convex to correspond to this concavity. The roller, F′, terminates beyond the ends of the roller, F, at one end in a beveled flange, f, to fit into the downturned edge of the strip and at the other end in a

flange, f', between which and the adjacent end of the roller, F, the inturned edge is accommodated. The strip thence passes beneath a central longitudinal mandrel, G, upon opposite sides of which rollers, H, H', H^2, H^3, H^4, and H^5, are journaled upon vertical axes. The set, H^2, H^3 is located nearer the mandrel than the set, H, H'; and the set, H^4, H^5, is located nearest to the mandrel. The rollers, H, H^2 and H^4, with which the edge of the strip having the downturned flange comes in contact, are made with a more abrupt curve in their surfaces than the rollers, H', H^3, and H^4, so that the downturned flange, a, of the strip is made to take under the upturned flange, a', of the strip so as to cause the flange, a, to stand within the flange, a', as shown in Fig. 12. Between the sets, H, H' and H^2, H^3, and H^4, H^5, there are arranged converging guide blocks h, h', h^2, h^3, for contacting the underside of the strip, A.

The interlocking of the flanges, a, a', and the closing of the seam formed by them, is accomplished by the following means: The mandrel, G, terminates between the compression rollers, K, K', in a tapered enlargement, g, of a diameter equal to the internal diameter of the tube to be formed. In vertical alinement with the points at which the compression rollers, K, K', contact the tubing, mandrel, G, has a vertical bore, g', within which friction rollers, g^2, g^3, are journaled upon transverse pins, g^4, g^5. The rollers, g^2, g^3, are shaped to conform to the contour of the inside of the tube. Between the roller, g^2, and the compression wheel, K, the seam formed by the interlocking flanges, a, a', is flattened and compressed. The rollers prevent the metal's being drawn, or marred, by the action of the mandrel and the compression rollers. The tube is then guided and fed to the end of the machine by sets of rollers, M, and N.

I will now give a brief description of the means of mounting the rollers and the wheels, and of imparting rotation to them.

The spindles of rollers, B', C', E', and F', are journaled in the sides, R, R', of the base, S, of the machine. The spindles of the rollers, B, C, E, and F, are mounted in adjustable blocks, r, in the sides, R, R', of the machine and the blocks may be adjusted by means of hand-wheels, r', as illustrated in Fig. 2. The rollers, D, D', are mounted upon vertical axes terminating in their lower ends in beveled wheels which engage bevel wheels upon a transverse shaft in a manner similar to the shafts of the rollers, H^2, H^3. such as illustrated in Fig. 17. The transverse shaft which actuates the rollers, D, D', terminates in a gear wheel, d^4. The shafts of the rollers, B, B', C, C', E, E' and F, F', terminate in intermeshing gear wheels, B^2, C^2, E^2, and F^2, to which rotation is imparted from the main shaft, P, by a gear wheel, p. The means of mounting and rotating the rollers, H, through H^5, is illustrated in Fig. 17, each roller being mounted upon a vertical shaft, terminating at its lower end in a beveled pinion which meshes into one of the beveled pinions upon one of the transverse shafts, H^6, which terminate in suitable gear wheels which are coupled by sprocket chains, and connected by means of intermeshing gear wheels upon the ends of the shafts, K' and M', with the driving shaft, T.

In Figs. 13 through 16 I have illustrated modified forms of rollers for inturning the edge of the strip, prior to its passing to the wheels which curve the strip. In Fig. 13, horizontal rollers, B^3, B^4, have their ends, b^4, b^5, both co-acting with vertically mounted wheels, b^6, b^7, to give the obtuse bending to the opposite edges of the strip. The horizontal rollers, C^3, C^4, co-act with vertically mounted wheels, c^4, c^5, to give the right-angled bend to the edges of the strip. Then rollers D^3, D^4, with acute grooves, d^5, d^6, give the acute bend to the edges of the strip. In Fig. 16 a means of mounting the rollers C^4, C^5, upon the frame is illustrated and a similar means of mounting the rollers, b^6, b^7, may be used.

What I claim is:

1. In a machine for forming a strip of metal into a tube the combination of a set of opposing rollers with beveled ends, the ends of said rollers being adapted to coact with each other to turn one edge of the strip of metal downward at an obtuse angle and the other edge upward at an obtuse angle, a second set of opposed rollers whose ends are adapted to turn the obtuse angled edges of the strip inward at right angles, and a third set of opposed rollers adapted to turn the right-angled edges of the strip inward at an acute angle, curving rollers, and a mandrel for curving the strip and causing the inturned edges of the strip to interlock and wheels adapted to compress the seam formed by the interlocking edges of the strip.

2. In a machine for forming a strip of metal into a tube, progressive sets of rollers for turning one edge of the strip downward and the other edge upward first at an obtuse and then progressively to an acute angle, a longitudinal mandrel, rollers with concave peripheries and mounted upon opposite sides of the mandrel and adapted to curve the downward edge within the upturned edge of the strip, and a roller for compressing the seam formed by the interlocking edges.

3. In a machine for forming a strip of metal into a tube, progressive sets of rollers for turning one edge of the strip downward and the other edge upward first at an obtuse and then progressively to an acute angle, a

longitudinal mandrel, rollers with concave peripheries and mounted upon opposite sides of the mandrel, the rollers upon the side adjacent to the downturned edge of the strip having a sharper curve in their peripheries than the opposed rollers, and adapted to curve said edge within the upturned edge of the strip, and a roller for compressing the seam formed by the interlocking edges.

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E. F. HAPPENSACK.