

Oct. 24, 1939.

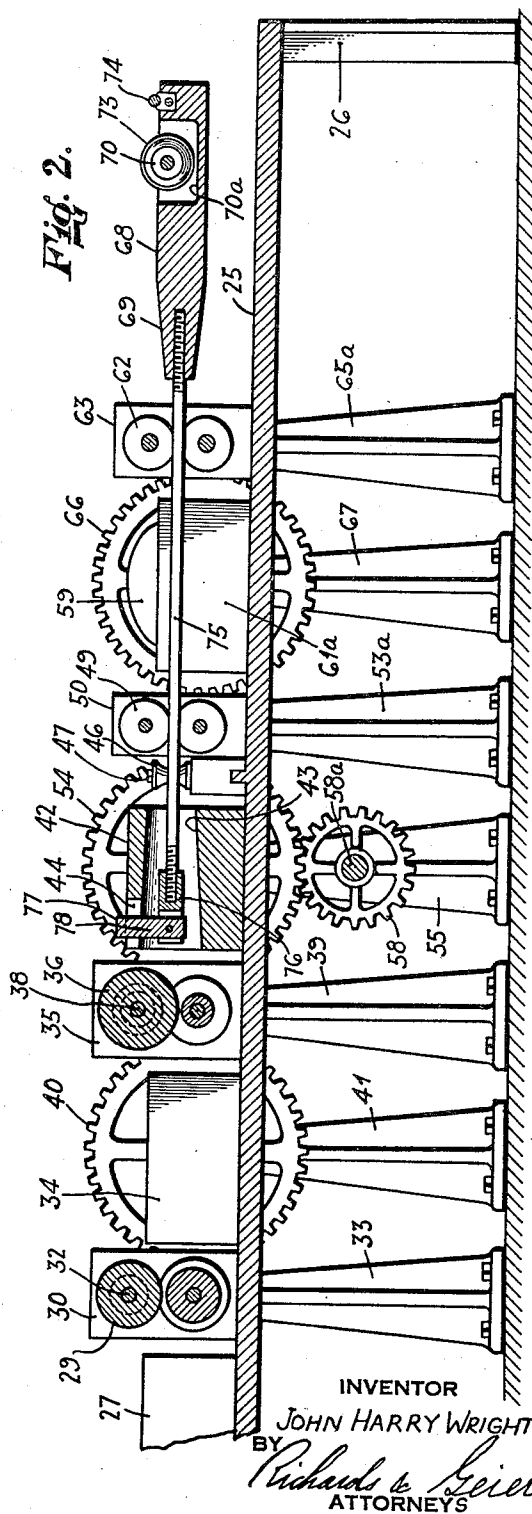
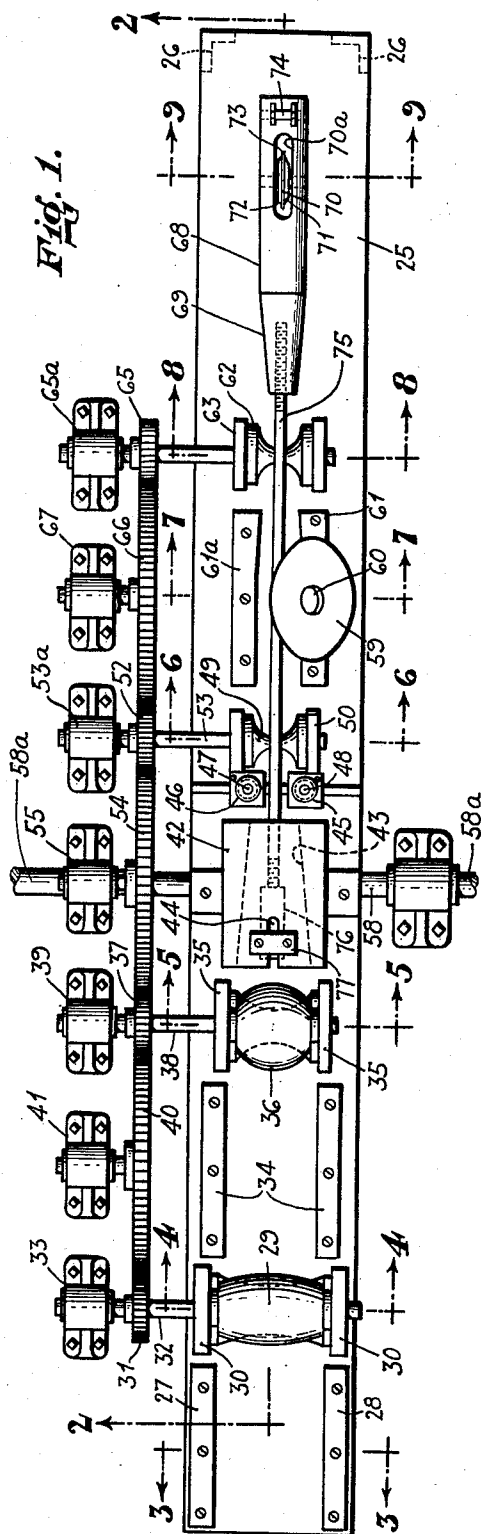
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2,177,545

APPARATUS FOR MAKING METAL TUBES

Filed Nov. 15, 1938

4 Sheets-Sheet 1



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Fig. 3.

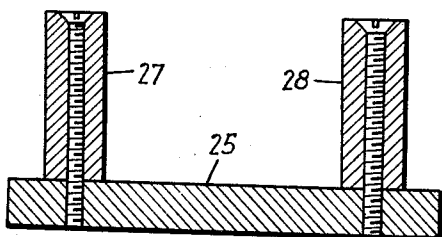


Fig. 3A.



Fig. 4.

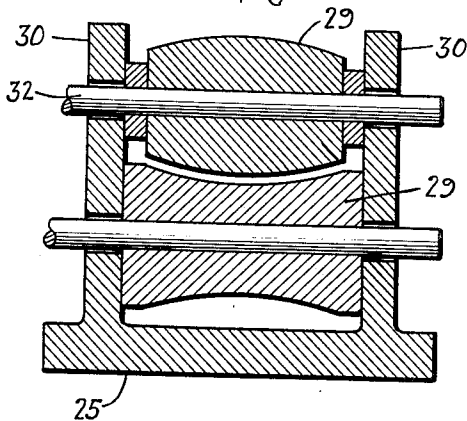


Fig. 4A.

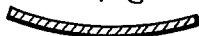


Fig. 5.

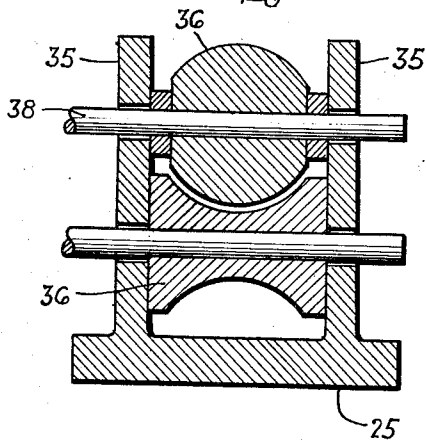


Fig. 5A.



Fig. 6.

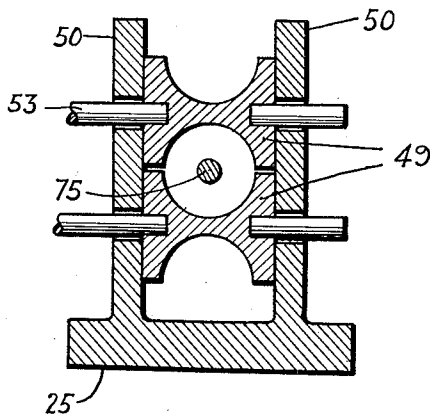
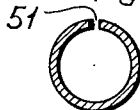


Fig. 6A.



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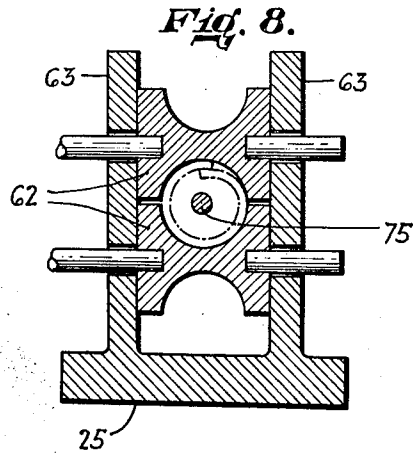
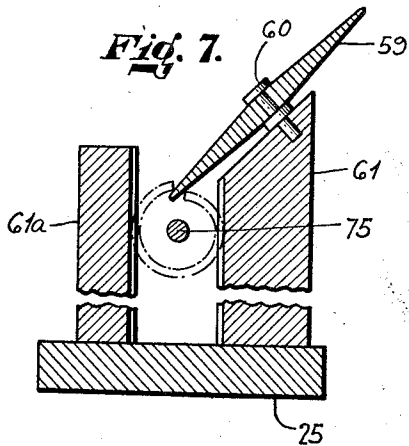


Fig. 7A.



Fig. 8A.

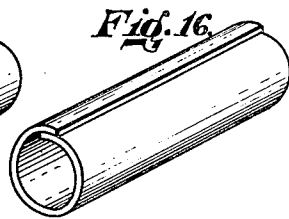
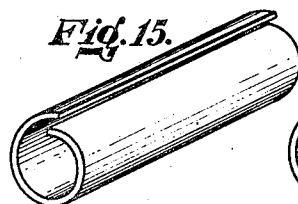
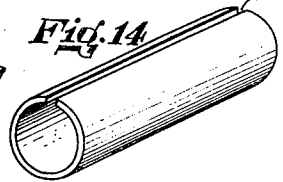
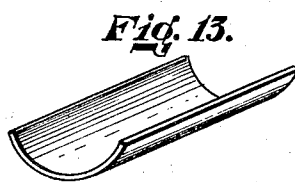
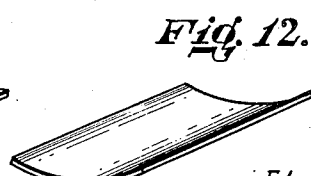
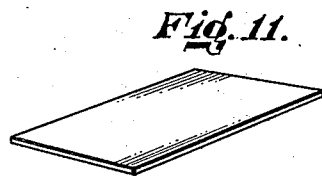
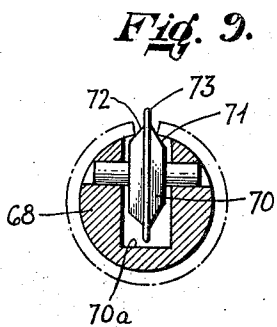
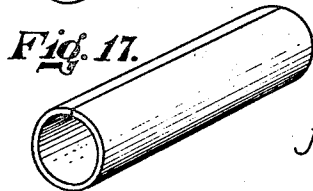


Fig. 10.



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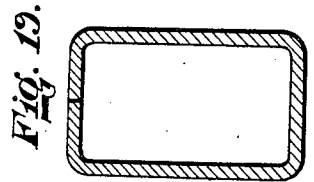
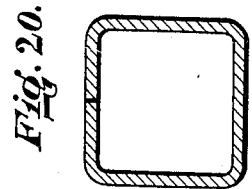
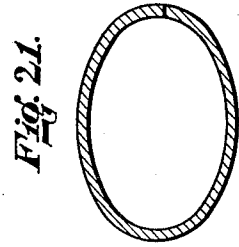
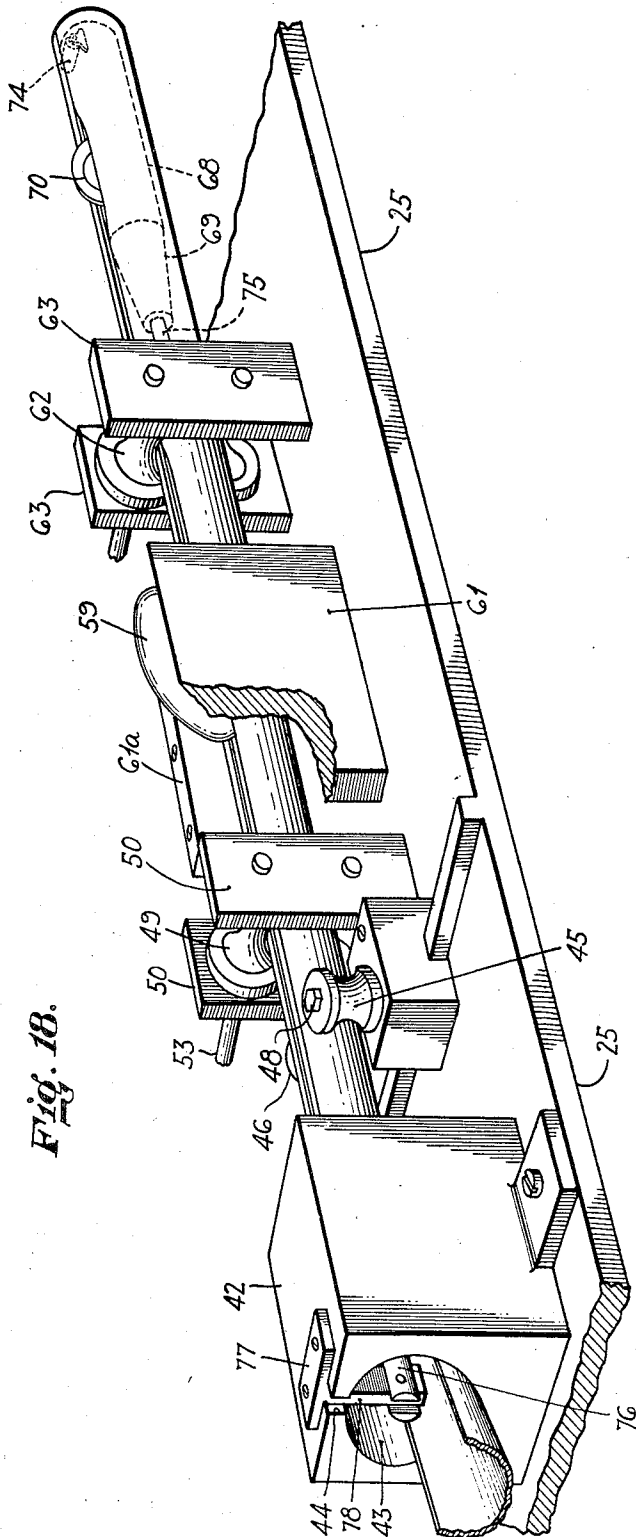
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APPARATUS FOR MAKING METAL TUBES

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4 Sheets-Sheet 4



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APPARATUS FOR MAKING METAL TUBES

John Harry Wright, Irvington, N. J.

Application November 15, 1938, Serial No. 240,457

3 Claims. (Cl. 153—32)

This invention relates to apparatus for and the method of forming sheet metal into hollow bodies, or tubes of various sizes and shapes.

In the past, such tubes were made with seams formed by overlapping and folding the edges of the sheet metal in order to form a tight seam, or by welding the edges of the seam together, or by means of a swedging apparatus which tapped the sides of the tube until the edges of the sheet metal were brought together. These tubes were expensive to make, both in time and material, and in the case of the tube formed by swedging apparatus, did not have a tight seam.

An object of my invention is to provide an improved method of manufacturing a metal tube from sheet metal so as to form a tight seam along said tube in a simple and effective manner.

Another object of my invention is to provide apparatus upon which a metal tube may be formed from a piece of sheet metal, said tube having a tight seam.

A further object of my invention is to provide an apparatus upon which a metal tube may be formed from a piece of sheet metal the tube being bent into a tube of lesser diameter in such a manner that the longitudinal edges of the seam overlap and then spread so that the longitudinal edges of the seam will snap together as the tube passes from the spreading means by virtue of the spring created along the side of the tube adjacent the seam.

In accomplishing the above objects, it has been found most satisfactory, according to one embodiment of the present invention, to provide breaking down rollers and finishing rollers which are driven by means of motor to form a flat sheet of sheet metal into a tube having a longitudinal seam, the edges of which are slightly spaced apart.

A spreading plate is then provided for raising one edge of said longitudinal seam above the other in order that the same may be fed between overlapping rollers having a space of lesser diameter than the tube as it leaves the finishing rollers in order that the same may be bent into a tube of lesser diameter, having one edge of the longitudinal seam overlapping the other.

A spreading means having a body of a diameter slightly larger than the inside diameter of the finished tube is mounted longitudinally forward of the overlapping rollers. The end adjacent said overlapping rollers is tapered, the small diameter of which engages the inside surface of the tube as it passes from the overlapping rollers. A wheel having bevelled edges is mounted

in the body of said spreading means in such a manner that the periphery of the wheel engages the edges of the longitudinal seam in order to insure the spreading apart of the longitudinal edges of the seam.

The spreading means merely spreads but does not bend the tube in order that the longitudinal edges of the same may snap together, as the tube passes from the spreading means.

Other objects and advantages inherent in the invention will become apparent as the specification proceeds and when taken in conjunction with the accompanying drawings.

Figure 1 is a plan view of the apparatus of my invention.

Figure 2 is a longitudinal sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a sectional view on the line 3—3 of Figure 1 showing the gauge plates which guide the sheet metal as it enters the machine.

Figure 3A is a cross-section of the sheet metal as it enters the machine.

Figure 4 is a sectional view on the line 4—4 of Figure 1 showing the first set of breaking down rollers through which the sheet metal passes, after entering the machine.

Figure 4A is a cross-section of the sheet metal after it passes through the first set of breaking down rollers.

Figure 5 is a section taken on the line 5—5 of Figure 1 showing the second set of breaking down rollers, through which the sheet metal passes.

Figure 5A is a cross-section of the sheet metal after it has passed through the second set of breaking down rollers.

Figure 6 is a cross-sectional view taken on the line 6—6 of Figure 1 showing the finishing rollers.

Figure 6A is a cross-section of the sheet metal after passing through the finishing rollers.

Figure 7 is a sectional view taken on the line 7—7 of Figure 1 showing a cross-section of means for spreading and raising one edge of the sheet metal forming a tube.

Figure 7A is a cross-sectional view of the tube after passing the means for raising an edge of the tube.

Figure 8 is a sectional view taken on the line 8—8 of Figure 1 showing the overlapping rollers.

Figure 8A is a cross-sectional view of the tube after passing through said overlapping rollers.

Figure 9 is a sectional view taken on the line 9—9 of Figure 1 showing the finishing plug.

Figure 10 is a cross-sectional view of the finished tube after it passes from the finishing plug.

Figure 11 is a perspective view showing a piece of sheet metal as it enters the apparatus.

Figure 12 is a perspective view showing the piece of sheet metal after it passes through the first set of breaking down rollers.

Figure 13 is a perspective view of the piece of sheet metal after it passes through the second set of breaking down rollers.

Figure 14 is a perspective view of the piece of sheet metal after it passes through the finishing rollers.

Figure 15 is a perspective view of the piece of sheet metal after it passes the edge raising means.

Figure 16 is a perspective view of the sheet metal after passing through the overlapping rollers.

Figure 17 is a perspective view of the completed tube after passing from the finishing plug.

Figure 18 is a perspective view of the part of the apparatus showing the sheet metal passing therethrough from the time it leaves the last breaking down roller until the completed tube is formed.

Figures 19, 20, 21 and 22 are cross-sectional views of various shaped hollowed bodies which might be formed by the method and apparatus of my invention.

Like numerals refer to like parts throughout the several views.

The apparatus of the present invention consists of a bed plate 25 supported on legs 26. Mounted upon the bed plate 25 are the various supports for the several forming rollers and dies.

The various rollers and dies are mounted longitudinally along the surface of the bed plate 25 so that sheet metal may be fed into one end of the apparatus and is formed into a hollow metal body or a tube as it progresses through the various stages.

At one end of the machine are gauge plates 27 and 28 through which the sheet metal to be formed into a tube is fed. Adjacent the plates are a set of breaking-down rollers 29, shown in cross section in Figure 4, mounted in the supports 30, which rollers form the sheet metal strip so that the same is substantially semi-circular in cross-section as shown in Figure 4A.

The rollers 29 are driven through a gear 31 mounted on the shaft 32 which is further supported by a pillow block 33. Guide plates 34 are mounted on the bed plate 25 to engage the sides of the sheet metal strip as it passes from the breaking-down rollers 29.

Mounted in supports 35 formed integrally with the bed plate 25 are another set of breaking-down rollers 36 which are shaped to form the sheet metal strip substantially U-shaped, as shown in Figure 5A, the rollers 36 being shown in cross-section in Figure 7. The breaking-down rollers 36 are driven by means of a gear 37 mounted on the shaft 38 which is supported in the support 39.

An idler gear 40 is supported in the support 41, said idler gear being positioned to mesh with gears 31 and 37.

Mounted on the bed plate 25 longitudinally forward of the breaking-down rollers 36 is a chuck 42 having a round funnel-shaped passage 43 therethrough, the diameter of the passage being larger at its opening adjacent the breaking-down rollers 36 the same becoming progressively smaller to the opposite opening. A longitudinal slot 44 is formed in the top of the chuck 42 adjacent the end nearest the breaking-down rollers 36.

Guide rollers 45 and 46 are rotatably mounted on shafts 47 and 48 the axes of which are perpendicular to the axis of the breaking-down rollers. The surface of the rollers 45 and 46 are grooved in order to engage the sides of the partially formed tube as it passes from the chuck 42. The shafts 47 and 48 are mounted in blocks which are slidably mounted on the bed plate 25 in order that the roller may accommodate different sized tubes.

Finishing rollers 49 mounted in supports 50 on the bed plate 25 are positioned longitudinally forward of the guide rollers 45 and 46. The finishing rollers are adapted to form the sheet metal into a tube circular in shape but having an opening 51, as shown in Figure 6A, extending longitudinally thereof. The finishing rollers 49 are shown in cross-section in Figure 6. The finishing rollers 49 are driven by a gear 52 mounted on the shaft 53 which is mounted in pillow block 53A.

The gear 52 is adapted to enmesh with an idler gear 54 mounted in a pillow block 55, the idler gear 54 in turn being adapted to engage the gear 58.

The idler gear 54 is driven through a gear 58 mounted below the same on the main drive shaft 58A, which is driven by any suitable motor not shown.

Positioned longitudinally forward of the finishing rollers 49 is a spreading plate 59, one edge of which is adapted to extend diagonally into the opening 51 in the metal tube, the spreading plate raising one edge of the metal tube and bending the other edge downwardly as shown in Figures 7 and 7A of the drawings.

The spreading plate 59 is preferably, as shown in the drawings, circularly shaped and is pivotally mounted on a pin 60 which is fastened in a support 61 on the bed plate 25. The plate 59 is substantially thin at the periphery, being made progressively thick to the center of the same. It is understood, of course, that the spreading plate 59 may be made rectangular or square in shape and mounted diagonally on the guide plate 61 so that an edge of said plate would engage the opening 51 of the tube raising one edge of the tube and lowering the other.

Mounted longitudinally forward of the spreading plate 59 are overlapping rollers 62 which, in turn, are mounted in supports 63 in the bed plate 25. The space 64 formed between the rollers 59 by the grooves about the circumference of said rollers is of lesser diameter than the outside diameter of the tube as it passes from the finishing rollers 49.

The metal passes between the guide plate 61, which also acts as a support for the spreading plate 59, and the gauge plate 61A which plates are spaced apart a sufficient distance to contact either side of the metal tube as it passes from the finishing rollers. The end of the gauge plates 61 and 61A are tapered toward each other so that the sides of the metal tube passing therethrough will be pressed together in order that the tube will fit into the space 64 between the overlapping roller.

Since one edge of the opening 51 in the tube has been spread above the other edge by the spreading plate 59, the overlapping rollers 62 will bend the sides of the metal tube inwardly one edge of the opening overlapping the other, as shown in cross-section in Figure 8A.

The overlapping rollers 62, therefore, bend the metal into a tube of lesser diameter than the tube formed by the finishing rollers 48, said tube,

however, having one edge of the longitudinal seam overlapping the other.

The overlapping rollers 62 are driven by means of a gear 65 mounted in pillow block 65A, through an idler gear 66 mounted at 67, the gear 66 being, in turn, driven by the gear 52.

Mounted in a manner to engage the inside of the tube as it passes from the overlapping rollers, is a finishing plug 68. The plug 68 has an outside diameter which is slightly larger than the inside diameter of the finished metal tube, the body being tapered on the end 69 nearest the overlapping rollers so the smallest diameter at the end of the plug is slightly less than the inside diameter of the metal tube as it passes from the overlapping rollers 62.

As the metal tube passes from the overlapping rollers 62, the end of the plug 69 engages the inside of the tube and, as the tube moves over the tapered surface of the plug, the tube is gradually spread until it reaches the desired size.

A wheel 70 is rotatably mounted in a recess 70A within the body of said plug, a portion of the circumference of the same extending above the surface of the plug 68. The wheel 70 has a bevel about its periphery, one side 71 thereof being bevelled at a greater angle than the other side 72. A knife-like projection 73 is formed about the circumference of the wheel 70.

The wheel 70 acts as a guide to the metal tube and separates the edges of the metal tube along the seam by means of the projection 73 and the bevels 71 and 72. Since the bevel 71 is at a greater angle than the bevel 72 an edge of the seam is slightly raised in order that one edge of the seam may be brought into approximate alignment with the other.

A roller 74 is rotatably mounted in the plug 68 and is adapted to engage the inside diameter of the metal tube adjacent the seam in order that both sides of the seam will be in exact alignment.

The plug 68 acts to spread the metal tube after it leaves the overlapping rollers 62 and does not in any way bend the metal, so that the spring action produced in overlapping the tube and then spreading it will tend to snap the edges of the seam together as the tube passes from the plug 68.

The plug 68 is mounted on the apparatus by means of a rod 75 which is screw threaded and adapted to engage the end 69 of the plug. The rod 75 extends longitudinally along the machine and is screw threaded at its opposite end to engage a slotted fitting 76 which is pivotally mounted on a T-shaped fitting 77 so that the vertical arm 78 of said fitting extends through the slot. The T-shaped fitting is fastened in the longitudinal slot 44 in the chuck 42.

The rod 75, in this manner, will extend through the central portion of the metal tube being formed and will allow the plug a vertical movement in accordance with any up and down movement of the metal tubing.

Different shaped hollow metal bodies having a tight seam, as shown in Figures 19 to 22 inclusive, may be formed by the method and apparatus of my invention by merely changing the size and shape of the breaking-down and finishing rollers, and spreading the edges of the seam of such a metal body apart so that the same may be overlapped and then spread apart by a plug of the desired size and shape so that spring is created in the metal body which will snap the edges of the seam together as it passes from the plug.

In the operation of the apparatus of my in-

vention power is applied to a motor which, in turn, revolves the shaft 58a driving the gear 58 which turns the idler gear 54. The idler gear 54, which is enmeshed with the gear 57 which drives the breaking-down rollers 36, and the gear 52 which drives the finishing rollers 49, is turned in an anti-clockwise direction, which drives the gears 37 and 52 in a clockwise direction. The gear 52 is enmeshed with an idler gear 61 which is enmeshed with the gear 65 which drives the overlapping roller 62 in a clockwise direction. The gear 37 is enmeshed with an idler gear 40, in turn, is enmeshed with the gear 31 so as to drive the breaking-down rollers 29 in a clockwise direction.

After power has been applied to these gears and the rollers are set in motion a piece of sheet metal, which may be of any desired length or may be a continuous strip, is fed into the apparatus through the gauge plates 27 and 28, the distance between the gauge plates being the same as the width of the sheet metal. The sheet metal may be sheet brass, sheet iron, sheet aluminum, or like sheet metal.

The metal then passes through the breaking-down rollers 29 which shapes the surface of the same semi-circularly longitudinally, as shown in cross-section in Figure 4A and in perspective in Figure 12. Since the breaking-down rollers are driven in a clockwise direction, a forward longitudinal movement is imparted to the sheet metal.

From the breaking-down rollers 29, the metal passes between guide plates 34 which are spaced apart at a distance to engage the sides of the sheet metal passing therethrough. The sheet metal then passes through a second set of breaking-down rollers 36 which are formed in a manner to place a greater curve on the longitudinal surface of the sheet metal, as shown in cross section in Figure 5A and in perspective in Figure 15. A further forward movement is imparted to the sheet metal by the revolution of the breaking-down rollers 29 in a clockwise direction.

The sheet metal then passes through the funnel-shaped passage 43 in the chuck 42 which forms the sheet metal into a substantially round body.

Upon leaving the chuck 42 the sheet metal passes between guide rollers 45 and 46 which are adjustably mounted on the bed plate 25, so that the recessed surfaces thereof may be brought in contact with the outside circumference of various sized tubes and thereby guide the same. The sheet metal then passes through the finishing rollers 49 which forms the sheet metal into a circular tube, in the embodiment of the invention, as shown, having a longitudinal seam therein, the edges of the same being spaced apart as shown at 51 in Figure 6A, and as shown in perspective in Figure 14.

After passing through the finishing rollers 49, the edges of the longitudinal seam in the tube are spaced apart and a tight seam is not obtained.

Various means of obtaining a tight seam have been previously tried but I have devised a simple apparatus for obtaining a very tight longitudinal seam in a hollow metallic body form of sheet metal.

Mounted longitudinally forward of the finishing rollers 49 is a spreading plate 59. As the sheet metal tube passes from the finishing rollers 49, one edge of the spreading plate 59, which is so mounted as to extend diagonally into the opening 51, raises one edge of the longitudinal

seam in the sheet metal tube, as shown in the drawings in Figures 1 and 7. The spreading plate 59 is pivotally mounted so that the same will revolve as the sheet metal tube moves forward. The edge of the seam on the sheet metal tube must be raised by hand at the forward end in order that the same may engage the spreading plate 59 and may be held in a raised position by the same, as the sheet metal continues through the apparatus.

The spreading plate 59 revolves in order to decrease friction and wear between the edge of the seam and the spreading plate 59. However, a fixed plate may extend diagonally into the opening 51 of the seam in a sheet metal tube and serve the same purpose. The shape of the sheet metal tube immediately after it passes through the spreading operation is shown in cross section in Figure 7A and in perspective in Figure 15.

From the spreading plate 59, the metal tube passes into the overlapping rollers 62. The space 64 between the overlapping rollers is of lesser diameter than the tube as it passes the spreading plate 59.

The gauge plates 61 and 61a, since the ends adjacent the overlapping rollers 62 are tapered toward one another press the sides of the metal tube inwardly after the tube passes the spreading plate 59. The tube, therefore, will have a smaller diameter and may be fed into the space 64 between the overlapping rollers 62.

One edge of the tube is raised by the spreading plate 59 so that this raised edge will overlap the other edge as the tube passes through the overlapping rollers.

The overlapping rollers bend the metal into a tube of smaller diameter with an overlapped seam.

The overlapping rollers 62 are driven in a clockwise direction which imparts a forward movement to the tube. Figure 8A shows a cross section of the sheet metal tube after it passes from the overlapping rollers, the tube also being shown in perspective in Figure 16.

From the overlapping rollers 62 the tube is moved onto the tapered end 69 of the finishing plug 68, the outside circumference of said tapered end engaging the inside circumference of the tube. As the tube moves over the tapered end 69 of the plug, the tube is spread apart until the maximum circumference of the taper is reached. The maximum circumference of the taper is such as to take the overlap out of the tube. The knife-like projection 73 on the wheel 70 engages the edges of the sheet metal tube along the seam, the bevelled periphery of the wheel further spreading apart the edges of the same. The surface of the roller 74, which extends laterally across the plug 68 engages the inside circumference of the metal tube adjacent the seam, which will bring the edges of the seam level with one another in order that the same may be snapped together as the tube passes from the plug 68. The finished tube is shown in perspective in Figures 17 and in cross-section in Figure 10. The plug 68 has a slight vertical movement through its mounting, as previously described, in order that the same may adjust itself automatically to any up and down movement of the tube as it passes through the machine.

Through bending the tube in the overlapping roller 62, so that the same is of lesser diameter than the diameter desired in the finished tube, and then spreading the same by means of the finishing plug 68, a spring action in the metal

of the tube is created along the back, or the portion diametrically opposite the seam, so that as the tube passes from the plug 68, the body of which is slightly larger in circumference than the inside circumference of the finished tube, the edges of the same will be snapped together, forming a very tight longitudinal seam.

It will be understood, of course, that by varying the shape of the breaking-down rollers, the finishing rollers, the over-lapping rollers and the plug, different shaped hollow sheet metal bodies may be formed by the method of my invention, various shapes being shown in Figures 19 to 22 inclusive.

It is not my intention to limit this invention to the precise construction shown, but rather to cover all equivalent structures as defined by the scope of the following claims.

I claim:

1. In tube forming apparatus, the combination of means for progressively bending a strip of sheet metal into tubular form having a longitudinal seam therein, means rotatably mounted on said apparatus the periphery of the same being adapted to extend into and raise one edge of said longitudinal seam, laterally disposed bending rollers having a space of lesser diameter than said tube therebetween through which said sheet metal tube passes thereby overlapping the edges of said longitudinal seam, spreading means longitudinally disposed having a body of slightly greater diameter than the inside diameter of the metal tube to be formed, one end of said means being tapered to engage the inside surface of said tube as it passes from said bending rollers, means for mounting said spreading means extending through said tube one end of which is attached to the tapered end of said spreading means and the other end being pivotally fastened to said tube forming apparatus at a point before the tube is formed, a wheel rotatably mounted in said body having bevelled edges on the opposite sides of the periphery thereof, one of said bevelled edges being formed at a greater angle than the other, said bevelled edges forming a thin projection about the circumference of the wheel in the center of the surface of said periphery, said thin projection and said bevelled edges being adapted to engage and spread apart the opposite edges of said longitudinal seam, and aligning means mounted in said body to align the edges of said seam so that said edges of the longitudinal seam of said tube will spring together as said tube passes from said spreading means.

2. In tube forming apparatus, the combination of means for progressively bending a strip of sheet metal into tubular form having a longitudinal seam therein, means rotatably mounted on said apparatus the periphery of the same being adapted to extend into and raise one edge of said longitudinal seam, laterally disposed bending rollers having a space of lesser diameter than said tube therebetween through which said sheet metal tube passes, thereby overlapping the edges of said longitudinal seam, and spreading means longitudinally disposed having a body of slightly greater diameter than the inside diameter of the metal tube to be formed, one end of said means being tapered to engage the inside surface of said tube as it passes from said bending rollers, means for mounting said spreading means extending through said tube one end of which is attached to the tapered end of said spreading means and the other end being pivotally fastened to said

5 tube forming apparatus at a point before the
tube is formed, a wheel rotatably mounted in
said body having bevelled edges on the opposite
sides of the periphery thereof, one of said be-
velled edges being formed at a greater angle than
10 the other, said bevelled edges forming a thin pro-
jection about the circumference of the wheel in
the center of the surface of said periphery, said
thin projection and said bevelled edges being
adapted to engage and spread apart the opposite
15 edges of said longitudinal seam.

3. In tube forming apparatus, the combination
of means for progressively bending a strip of sheet
metal into tubular form having a longitudinal
seam therein, means adapted to extend into said
15 longitudinal seam and raise one edge of said
seam outwardly and above the other edge, later-
ally disposed bending rollers having a space of
lesser diameter than said tube therebetween
through which said sheet metal tube passes,
20 thereby overlapping the edges of said longi-
tudinal seam, and spreading means longitudinally
disposed having a body of slightly greater diam-
eter than the inside diameter of the metal tube

to be formed, one end of said means being
tapered to engage the inside surface of said tube
as it passes from said bending rollers, means
for mounting said spreading means extending
through said tube one end of which is attached
5 to the tapered end of said spreading means and
the other end being pivotally fastened to said
tube forming apparatus at a point before the
tube is formed, a wheel rotatably mounted in said
body having bevelled edges on the opposite sides
10 of the periphery thereof, one of said bevelled
edges being formed at a greater angle than the
other, said bevelled edges forming a thin pro-
jection about the circumference of the wheel
in the center of the surface of said periphery,
15 said thin projection and said bevelled edges being
adapted to engage and spread apart the opposite
edges of said longitudinal seam, and aligning
means mounted in said body to align the edges
of said seam so that said edges of the longi-
20 tudinal seam of said tube will spring together
as said tube passes from said spreading means.

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