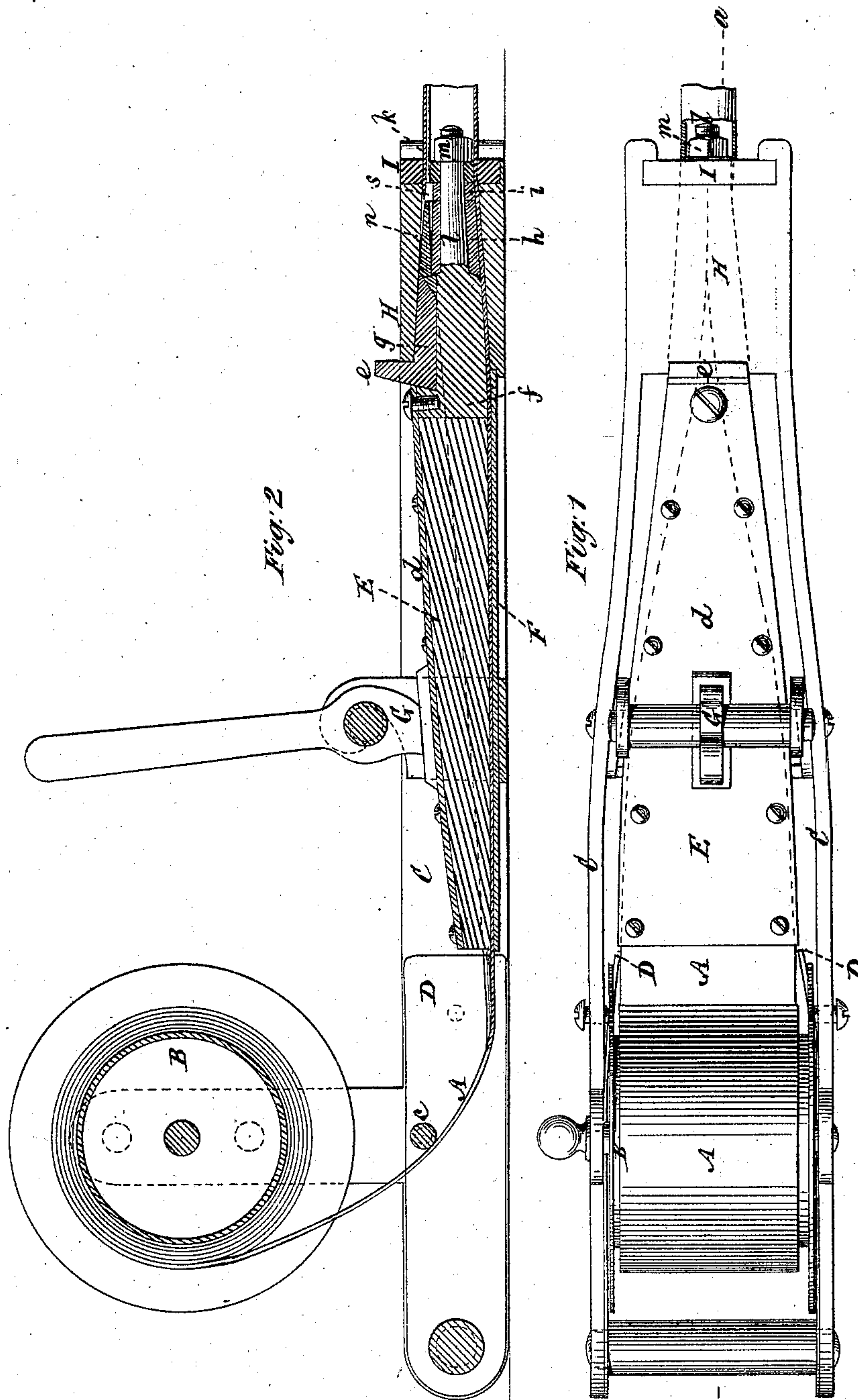


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Manufacture of Sheet Metal Tubing.

No. 137,992.

Patented April 15, 1873.



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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN THE MANUFACTURE OF SHEET-METAL TUBING.

Specification forming part of Letters Patent No. 137,992, dated April 15, 1873; application filed March 1, 1873.

*To all whom it may concern:*

Be it known that I, SAMUEL RUSSELL WILMOT, of Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain Improvements in the Manufacture of Metal Tubing, of which the following is a specification:

This invention generally consists in an organized system of devices, including guides, formers, and dies, whereby on draft, as distinguished from thrust, being applied to a strip of sheet metal the latter is bent into tubular form and its edges turned to constitute a locked seam, and such seam not only closed, but firmly compacted or compressed in every direction in common with the whole circumferential portion of the tube, both inside and out, by the drawing of the tube, as the seam is closed, through a finishing-die, thus producing a die-drawn locked-seam tube, which is smooth externally and internally, and may be made of greater length and thinner or lighter and stronger than any locked-seam tube heretofore produced by means of rolls.

In the accompanying drawing, which forms part of this specification, Figure 1 represents a plan of an apparatus or combination of devices embodying my invention, and Fig. 2 a longitudinal vertical section on the line  $a a$  of the same. Fig. 3 is a plan of the core or male former with attached devices for aiding in shaping, seaming, closing, and drawing or finishing the tube. Fig. 4 is a side view of the same; Fig. 5, a transverse section thereof on the line  $a^1 a^1$ , showing also the female former in relation therewith; Fig. 6, a transverse section on the line  $a^2 a^2$  of like parts; Fig. 7, a transverse section on the line  $a^3 a^3$ ; Fig. 8, a transverse section, upon a larger scale, on the line  $a^4 a^4$ ; and Fig. 9, a transverse section, upon the same scale as in Fig. 8, on the line  $a^5 a^5$ . Fig. 10 is a transverse section of the strip of sheet metal immediately previous to its entry beneath the core or male former, as indicated by the line  $b b$  in Fig. 3; Fig. 11, a transverse section of the same when partly bent as on reaching a position under the male core or former indicated by the line  $b^1 b^1$ ; Fig. 12, a transverse section thereof, showing the shape it assumes when reaching the line  $b^2 b^2$ ; Fig. 13, a transverse section thereof at the posi-

tion indicated by the line  $b^3 b^3$ ; Fig. 14, a transverse section at the position denoted by the line  $b^4 b^4$ ; Fig. 15, a transverse section at the position indicated by the line  $b^5 b^5$ ; and Fig. 16, a similar section to Fig. 15, but on a larger scale. Fig. 17 is an inverted plan of a tongue used to form the seam.

Similar letters of reference indicate corresponding parts.

A is a strip of sheet metal of any desired length, width, and thickness, according to the strength and size of the tubing to be made. This strip may either be brass, copper, steel, or any other suitable metal, and may be rolled upon a reel, B, for supply to the tube-forming devices, or be otherwise suitably fed. From the reel B the strip A of metal passes under a cross guide, bar, or roller,  $c$ , down within and along a trough, C, between adjustable side guides or wings D that serve to direct the strip to its proper position beneath the core or male former E, and between the latter and a correspondingly-shaped female former, F, subject to the action or pressure of a cam-lever or other suitable clamp, G, which, bearing down on the male former E, serves to pinch or keep the strip A from buckling or crinkling while being drawn through between the two formers. Said formers E and F are of tapering width, diminishing toward their forward ends, and the trough B may be of a corresponding taper. In addition to such construction of said formers, their contiguous surfaces, which bear upon the strip A, are of a gentle curvature at their rear ends, and a gradually-quickenning curvature toward their forward ends, to produce a gradual bend of the strip into a tubular or partly-circular form as it is drawn forward between the formers E and F.

The strip A is drawn forward and through the dies in front of the formers by first cutting a tongue or tapering extension on the front of the strip and passing it through in front of the apparatus, so that it may be readily taken hold of by a pair of power-pinchers or otherwise, and so form a handle or hold whereby to draw the remainder of the strip through the apparatus, such handle portion afterward being cut off as waste from the one end of the tube.



On the top of the male core or former E is a plate, *d*, the edges of which overlap the body or shaping portion of said former, as clearly shown in Figs. 5 and 6, and also lie over or overlap the upper edges of the female former F to guide the edges of the bent strip and insure the smooth and straight or steady draft of the strip between the formers to the dies free from any bruising or marring of the edges of the strip.

The male core or former E may be removable by sliding it backward on releasing the clamp G, and when in position is retained in place, together with its attachments, which enter the dies in front, and the same prevented from being drawn unduly forward on heavy draft being applied to the strip by a stop suitably applied at any desired point to said former E; as, for instance, by a lip or projection, *e*, on an attached front extension or section, arranged to enter a recess in the upper portion of the closing-die H. This closing-die H is of a closed circular form in its transverse section, but of a gradual taper in direction of its length, reducing in diameter forwardly—that is, in the direction the strip travels or is drawn. Arranged to fit concentrically within this die is a correspondingly-tapering forward extension of the core or male former E, which extension is preferably constructed in sections *f g h i*, the two latter sections, *h i*, as also an advance ring or mandrel, *k*, fitting as sleeves over a central shank, *l*, of the section *f*, and being retained in place by a nut, *m*, on the outer or forward end of said shank. The section *g* fits as a top or cover and virtually forms part of the section *f*, and has attached to it, by a dovetail-lock or otherwise, a tongue, *n*, which lies within a curved tapering groove, *o*, in the upper surface of the section *h*; but, for the most of its forward portion, is free from contact therewith to allow of the underlapping portion of the seam in the tubing as the latter is closed, passing under the tongue, the edges of the strip of which the tubing is composed having been previously bent to lock the one with the other by their travel along grooves *r r'* in the upper surface of the top *g*, and beneath a tapering upper part of said top or cover, and by their continued travel along or past the tongue *n*. This tongue forms a close fit on its upper surface with the interior of the die H, which sustains it against being strained or broken by the passing strip or partially formed tubing. The top *g* or upper part of the section *f* may also be similarly supported by the die H. The tongue *n* is grooved along its one side, in continuation of the groove *r*, in the piece *g*, subject to interruption by a jog or rise, *u*, which turns the one edge, *v*, Fig. 13, of the strip inward, while the other side of the tongue is made with an overhanging portion, *w*, at the root of the tongue. The section *i* has a groove, *s*, in its upper surface for the passage of the closed seam of the tubing out of the groove *o* through it, and the man-

drel *k* a slightly-reduced continuation, *s'*, of the groove *s* for similar accommodation of the seam within the finishing-die I, which latter may be slid vertically to its place down grooves in the forward end of the trough C.

The operation of the apparatus is as follows: As the strip A is drawn between the formers E F and out through the dies H I, it, on reaching the position shown by dotted line *b<sup>1</sup>* in Fig. 3, is curved, as represented in Fig. 11, and on reaching the dotted line *b<sup>2</sup>* is further bent, as in Fig. 12. After this, and when the strip passes within the die H, which gradually causes the edges of the strip to approach and give to the strip its required tubular shape, said edges pass within the grooves *r r'* and along the grooved and recessed sides of the tongue *n*, and, on reaching the position represented by dotted line, *b<sup>3</sup>*, are bent as represented in Fig. 13, the one edge, *v*, being bent inward by its passage over the jog *u*, while the other edge is shaped, as represented in Fig. 13, by its passage under the wing *w* of the tongue *n*. The further passage of the strip to the position represented by dotted line, *b<sup>4</sup>*, causes the edge *v* to be further slightly hooked or bent by the combined action of the die H and the groove in the side of the tongue *n*, while the other edge of the strip, by its passage under the forward portion of said tongue, and transversely within as well as along the groove *o*, is bent by said parts in combination with the tapering die H, to pass under and into engaging position with the first-mentioned edge, as represented in Fig. 14. As said strip A further moves toward the front and narrower or closing end of the die H, the engagement or hooking together of the two edges is completed by the action of the forward portion of the groove *o* and surrounding portion of the die on the edge which passed under the tongue, so that when the seam enters the groove *s* in the section *i* the same is closed by the die H. The seam having been thus closed or locked, the strip assumes the shape of a locked seamed tube, as represented in Figs. 15 and 16, but is not yet materially drawn or finished. To complete it or make of it a perfect die-drawn locked-seam tube, the closed tube, as it leaves the tapering die H and tapering core-sections *f h* and *i*, is drawn through the finishing cylindrical die I and around the cylindrical mandrel or core *k*, having the groove *s'* in it for accommodation of the seam. This produces a drawing action on the tube, and compresses or compacts the seam, not only as regards its faces or above and below, but edgewise, or in every direction, and simultaneously compacts or compresses the whole body of the tube circumferentially, both inside and out, as it passes through or from out of the die *i*.

If preferred, the strip A may be introduced to the apparatus in a partly-curved form instead of in a flat shape. Likewise the formers, dies, and accompanying devices may be constructed to produce a fluted tube, also, if desired, to throw the seam outward instead of



inward without departing from the principle that distinguishes my invention from other devices heretofore used to produce a locked-seam tube.

In some cases the drawing-die I and its core *k* may be omitted and the locked seam produced by the closing-die H, and its core be hermetically sealed by brazing or not, according to circumstances or other purposes for which the tubes are required.

What is here claimed, and desired to be secured by Letters Patent, is—

1. As an improvement in the art of manufacturing tubing of sheet-metal strips or skelps with interlocked joint or seam, the method of condensing and consolidating the joint or seam, and also the metal of the tube proper, by drawing the same through a die or dies that impinge against, compress, consolidate, and draw upon, all the exposed surfaces of the joint or seam, and of the tube itself, substantially as described.

2. An improved machine, constructed substantially as described, of formers, guides, and dies, organized, so that as a strip of metal is drawn therethrough or between the same, to bend said strip into a tubular form, to turn its edges to interlock one with another, to close the seam thus produced, and to die-draw such locked-seam tube by pressure applied in every direction both to the seam and body of the tube circumferentially, inside and out.

3. The combination of the male former E and its overhanging plate or portion *d* with the female former F, and the tapering circular closing die H with its tapering core or extension of the male former E, essentially as herein set forth.

4. The combination with the tapering die H of the tapering section or portion *f*, having grooves *r r'* arranged to converge in a forwardly direction, substantially as specified.

5. The grooved tongue *n*, wing *w*, and jog *u*, in combination with the groove *o* in the section or portion *h* of the core, and the closing die H, essentially as described.

6. The combination, with the elements recited in the last preceding clause of claim, of the drawing-die I and its grooved core *k*, substantially as specified.

7. The sectionally-constructed core or core extension, composed of detachable sections *f g h i* and *k*, arranged in relation with each other and with the dies H I, essentially as described.

8. The detachable male former E, with its attached core or forward extension, in combination with a stop, *e*, arranged to resist the draft on said former E relatively to the tapering die H, substantially as specified.

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Witnesses:

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