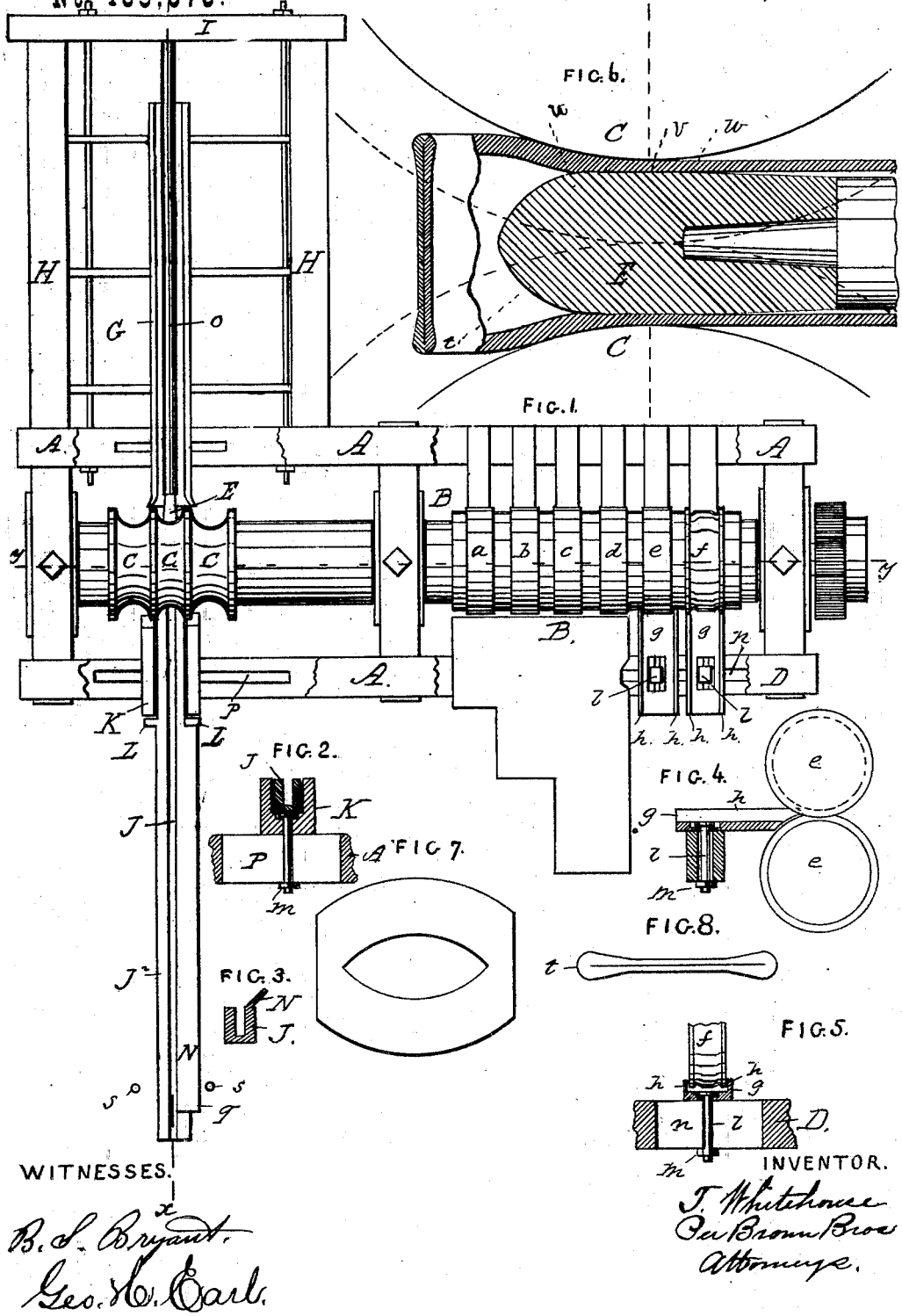
2 Sheets—Sheet 1.

T. WHITEHOUSE.

MACHINES FOR FORMING TUBES OF CAST INGOTS.

No. 185,378. Patented Dec. 12, 1876.



WITNESSES.

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2 Sheets—Sheet 2.

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FIG. 9.

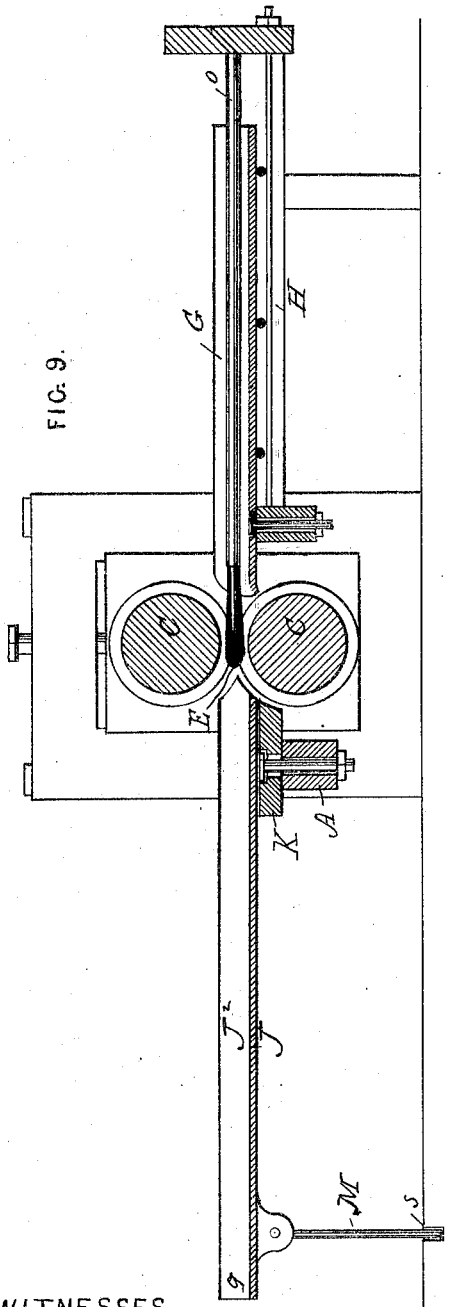
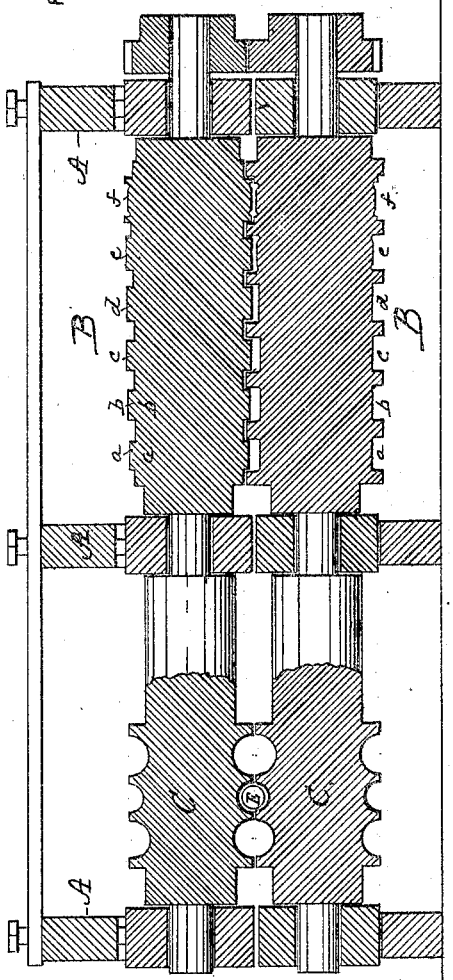


FIG. 10.



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UNITED STATES PATENT OFFICE.

THOMAS WHITEHOUSE, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO AMERICAN TUBE WORKS, OF SAME PLACE.

IMPROVEMENT IN MACHINES FOR FORMING TUBES OF CAST INGOTS.

Specification forming part of Letters Patent No. 185,278, dated December 12, 1876; application filed April 8, 1876.

To all whom it may concern:

Be it known that I, THOMAS WHITEHOUSE, of Boston, county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in the Manufacture of Metal Tubes, of which the following is a specification:

This invention relates to the manufacture of tubes from metal, such as brass, copper, &c., and under it the required tube is produced from a thick hollow casting or ingot, which is first closed, flattened, and lengthened by passing it between suitable rolls, and is then shaped in cross-section, as hereinafter described, by passing it between rolls of suitable shape therefor, and is afterward passed between rolls, each having a corresponding semicircular groove, and, as it passes between said grooved rolls, drawn over a bulb or mandrel head so shaped and located within the grooves of the two rolls as to open it—the said blank—into a cylindrical tube as it continues to pass onto the said bulb-head from the continued rotation of the said grooved rolls, all as hereinafter fully described.

For producing a metal tube in the manner above described, this invention consists in thickening up and rounding off both edges of the flattened and elongated metal blank, as hereinafter described, by passing it through rolls of suitable shape therefor, but, by preference, as hereinafter particularly described; and, also, it consists in the combination, with said shaping-rolls, of a guideway or box, constructed and arranged as hereinafter described, to hold the blank against spreading at its edges as it is acted upon by the shaping-rolls, all as will hereinafter fully appear.

This invention further consists in the location, within the opening of the circular groove of the grooved rolls, of a mandrel or bulb-head, for opening out the metal blank into a tube. This mandrel is suitably held from behind, and is unconfined or free at its front end, which is the end at which it receives the blank, to open it out into a tube, and it is adjusted to project to the front of the nip of the two rolls on the metal passing between them and over the mandrel. This mandrel, in its location and said front projection, as above stated, is of the same shape and size as it has within and just back of the nip, or, in other words, within and just back of the vertical plane of the axis of the two rolls, but at its said unconfined and free end it is made of a taper or pointed, all as will hereinafter more fully appear.

The pointed or tapered end of the mandrel opens out the closed blank as it is advanced by the rotation of the rolls, so that it can pass on to the said front projection of the mandrel, which is of the same shape and size as that of the mandrel within the nip of the rolls, and from thence into and beyond the nip of the rolls, and by having the mandrel of the same size and shape just back and in advance of the nip of the rolls as it is within said nip the metal blank has a support in advance and back of the nip of the rolls sufficient to prevent its being jammed or forced down over the receiving and pointed or bulb head of the mandrel and back of the nip of the rolls by the rolls as they revolve and draw the metal blank in and between them and over the mandrel, to open it out from a closed and flattened blank directly into a round shape corresponding to the round shape in cross-section of the mandrel at the nip of the rolls.

This advance support of the metal blank in its passage to the nip of the rolls prevents its block on the mandrel which, without such a support, would occur. The support back of the nip of the rolls secures a more perfect-shaped tube, as it holds the open metal tube from a sudden contraction as it escapes from the action and nip of the rolls, and, besides, it holds the metal the better to the nip of the rolls.

This invention further consists in the combination, with the semicircular grooved rolls and their opening mandrel or bulb, of a guideway and support for the metal blank as it passes to the grooved rolls; and, also, it consists in the arrangement of this guideway and support for being set up to and back from the grooved rolls, and also, in combination therewith, of arranging it so it can be adjusted and set for grooved rolls of varying sizes arranged side by side between common standards or supports.

The figures of the accompanying plate of drawings illustrate my invention.

In Plate 1, Figure 1 is a plan view, and Figs. 2, 3, 4, 5, 6, 7, and 8, views in detail, to be hereinafter more particularly referred to. In Plate 2, Fig. 9 is a vertical section along line *x x*, Fig. 1, Plate 1; and Fig. 10 a cross-vertical section along line *y y*, Fig. 9.

In the drawings, A A represent standards or supports, carrying at one end the grooved rolls for rolling and shaping the hollow metal ingot or blank before opening it into a tube, and at the other end a series of semicircular grooved rolls, with the bulb or mandrel-head, by which the blank, rolled and shaped in the first grooved rolls, is opened into a tube

The grooved rolls B have a series of grooves, *a*, *b*, *c*, *d*, *e*, and *f*, and by the grooves *a*, *b*, *c*, and *d* of the series the hollow ingot or blank is closed, flattened, and lengthened, and by the grooves *e* and *f* the then flattened and lengthened blank is shaped by the first grooves, *e*, upon one side, and by the second grooves, *f*, upon the other side.

The opening-rolls C are shown in a series of different sizes for different sized tubes, and these different sizes are side by side between a common pair of standards.

For each pair of grooves *e* and *f* of the grooved rolls B there is a guide box or way, *g*, with upright sides *h*, that are at a distance apart equal to the width of the blank to be shaped by the grooves, and the width between the sides *h* is a little less—say, about one-eighth inch—than the width of the grooves in relation to which the guide-box is arranged.

The sides *h* of each guide-box extend to the periphery of the rolls, and at their end toward the rolls they are shaped, as shown, to correspond substantially with the periphery of the rolls, and to set as closely as possible, without contact with the rolls, to the "bite" or nip of the rolls.

These guide-boxes *g g* rest on a suitably-located beam of the standards A A, and they are secured to each beam D by a headed screw-bolt, *l*, and nut *m*. The head of the bolt *l* is counter-sunk in the guideway, and and the guideway is slotted so that by loosing the screw-nut *m* the guideway can be set up to and away from the shaping-rolls when desired; and the slot *n* of the supporting-beam D, through which the screw-bolt passes, allows the guideway to be adjusted in the length of the beam as may be desired, and, as is obvious, by simply turning up the nut *m*, the guide-box *g* can be rigidly fastened in position.

E, a cylindrical bulb or mandrel-head. This bulb or mandrel-head lies between and in the grooves of a set of the circular-grooved rolls C. At the back of the grooved rolls the mandrel-stem *o* lies in a trough, G, supported in a suitable frame-work, H, and it backs against a head-board, I, suitably braced from the main standards A A, leaving its front end free and unconfined. The bulb or mandrel-head projects to the front or receiving side of the grooved rolls C C from the nip of the rolls, which is in the vertical plane of the axis of the rolls. This projection *u* of the mandrel is of the same size and shape as that of the mandrel at the nipping-plane *v* of the rolls, and its length is such—say, one-half an inch—as to support the metal blank which is being drawn through the rolls over the mandrel, against the compression of the rolls in front of the nip of the rolls, and thereby prevent a jamming or setting of the blank over the front end E of the mandrel, which would occur were the mandrel not so extended and projected forward between the nip of the rolls and the front end E. The mandrel just back (as at *w*) of the nip of the roller C is of a similar size and shape to that at the nip, and beyond this the head tapers.

It is important to preserve this uniformity between the size and shape of the mandrel at and back of the nip, for the reasons which have before been given.

The front end E, beyond the front projection *u* of the mandrel is of a pointed or conical or other suitable taper or shape, as shown in the drawings. This taper of said front or head E secures the gradual opening out of the blank from its closed and flattened condition, and also gradually prepares and opens it out for passing on and over the mandrel projection *u* and from thence into and out of the nipping-plane *v* of the rolls, and thus a closed blank is opened from its flattened condition directly out into a round tube at one operation or rolling.

J is a guideway for receiving the blank to be opened by the grooved rolls C and mandrel E. This guideway is along the length of a beam, J^2, and the beam is supported at the outer end *q* upon a hinged post, and at its inner end in a box, K, which is adapted by a slot, *p*, in frame-beam A, and screw bolt and nut, to be slid along and adjusted on the beam and then fastened against displacement, so that the same guide-box may be used for any pair of a series of grooved rolls, C, arranged between the common support.

L are stops on the guide-beam, to limit the throw toward the grooved rolls, and *s* holes to receive the hinged post M in the varied positions of the guideway, as adjusted, so as to have the outer end of the guideway always properly supported.

In the manufacture of tubes with a machine of the construction herein described, I first cast a short tube or ingot of a cross-section, such as shown in Fig. 7, and then wash the inside of the tube with salt and water, which prevents the inner surfaces from adhering together when afterward closed by rolling. I now heat the ingot to a red heat, and pass it, first, between the first grooves *a*, then, turning it over, between the second grooves, *b*, then, again turning it over, between the third grooves, *c*, and then, again turning it over, between the fourth grooves *d*. By this series of

grooves the blank shown in Fig. 7 is flattened and lengthened, and is left in a straight strip, which I then pass between the grooves *e*, by which one side or face of the strip is rounded at its edges and there thickened, as at *t*, Fig. 8, and then, being turned over, is passed between the grooves *f*, by which its other side or face is similarly shaped, at the same time presenting the shape given to the blank by the grooves. In both of these last rollings the strip is guided to the rolls by the guide-boxes *g*.

The herein-described projection and fit of the sides *h* of the guide-boxes to the rolls, in connection with the greater width of the grooves, compared with the width between said sides *h*, holds the metal blank as it passes to the compressing-grooves from spreading at its edges to such an extent that when it enters into the grooves of the rolls its edges will project beyond each side of the grooves between the roll, and thus, obviously, no fin or rib can be made at the edges of the blank, as the blank is wholly within the shaping-groove of the upper and lower rolls. This protection against a spread of the blank is secured, practically, for the whole length of the blank, although, it is true, for a short distance, the end of the blank last entering the grooves has its edges unprotected by the sides *h*, for the reason that there is, necessarily, an uncovered or exposed space between the sides *h* and the grooves; but this space, under my construction of the sides *h* to fit the peripheries of the rolls, is necessarily small. The formation of fins or ribs on the blank because of it, as above stated, is in fact of no practical account or consequence in the manufacture of metal tubes under this improvement.

In all the rolling above described the metal should be at the proper heat. The blank, thus being properly rolled and shaped, is again heated to a red heat, and, being partially opened at one end, is now laid edgewise in the guide-beam, and then the beam set up to the grooved rolls, at the same time forcing the partially-opened end of the blank on the mandrel-head or bulb, over which the blank is then drawn from the rotation of the rolls, and made into a tube of the diameter of the straight portion of the mandrel. The sides of the guideway J hold the blank firmly against the action of the drawing and grooved rolls. An inclined shelf, N, fixed along one side of the grooved guideway, directs the blank into the groove of the way.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In the manufacture of tubing from hollow cast ingots, such as herein described and shown, the particular construction of mandrels for opening out, and over which to draw, said ingots, and the location of it in relation to the bite of the rolls, as specified.

2. The combination of the grooved rolls C, mandrel or bulb head E, and guideway J, the latter being constructed to guide and hold the metal blank as it is opened on the mandrel E, and being arranged to be slid forward and back as to the rolls C, all substantially as described, for the purpose specified.

3. The guideway J for rolls C and its guide-box *g*, secured by screw-bolt to the slotted beam, in combination with the hinged outer leg or support *q*, all arranged together for operating and setting the guideway J, substantially as described.

4. In the manufacture of metal tubes from hollow ingots, thickening and rounding both edges of the flattened and elongated blank by passing it between rolls having shaping-grooves, substantially such as herein described.

5. A guide-box, *g*, for shaping-roll grooves *e* and *f*, which has sides *h*, constructed to fit the periphery of the rolls to receive between them the metal blank to be shaped, in combination with either groove *e* or *f*, having a width greater than the space between the box sides *h*, all substantially as described, for the purpose specified.

THOMAS WHITEHOUSE.

Witnesses:
EDWIN W. BROWN,
GEO. H. EARL.