

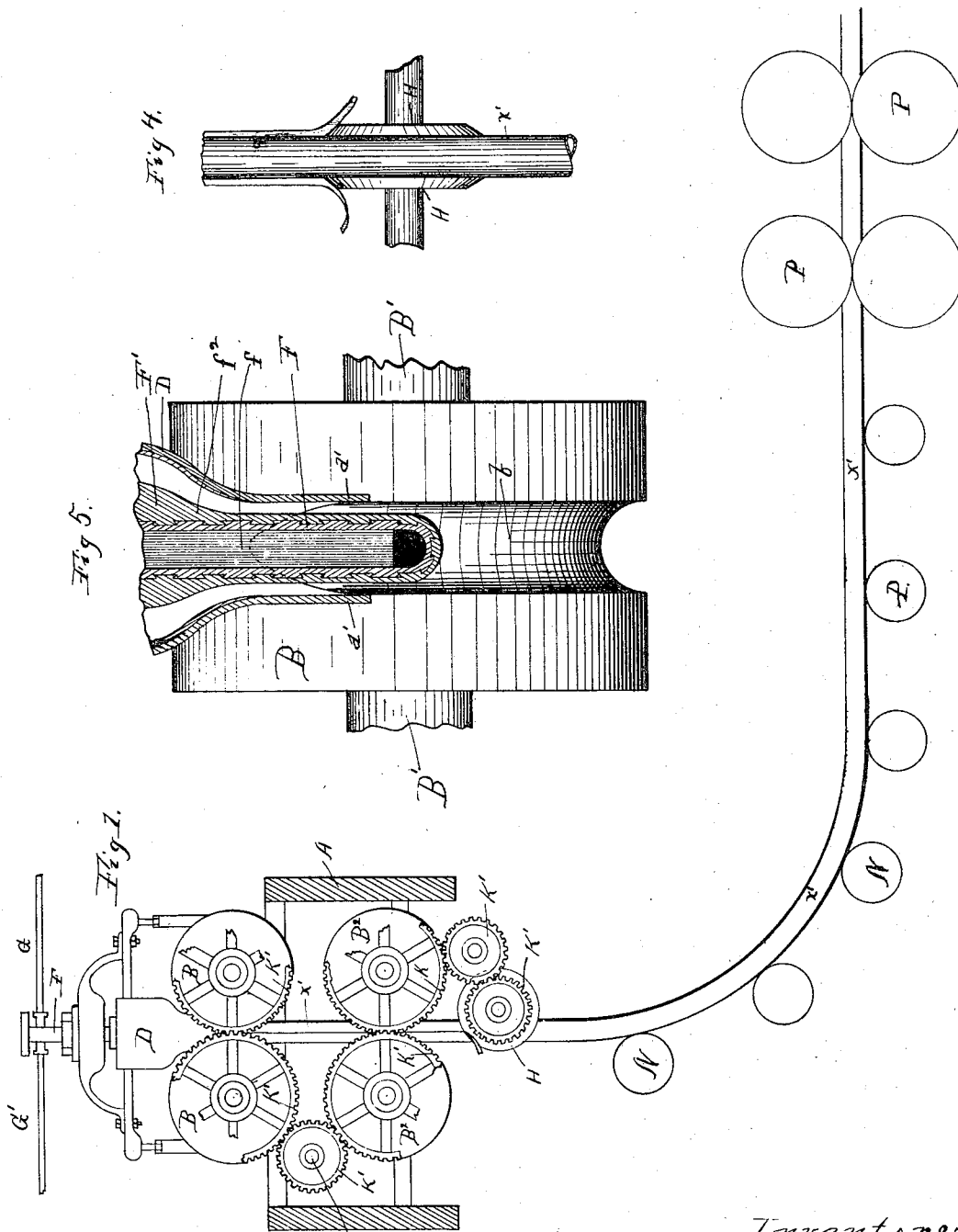
(No Model.)

3 Sheets—Sheet 1.

E. NORTON & E. ADCOCK.
ART OF MAKING METAL TUBING.

No. 441,375.

Patented Nov. 25, 1890.



Witnesses:
Mack A. Giffin.
Law. C. Curtis.

Inventors:
Edwin Norton;
Edmund Adcock;
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their Attorneys.

No Model.

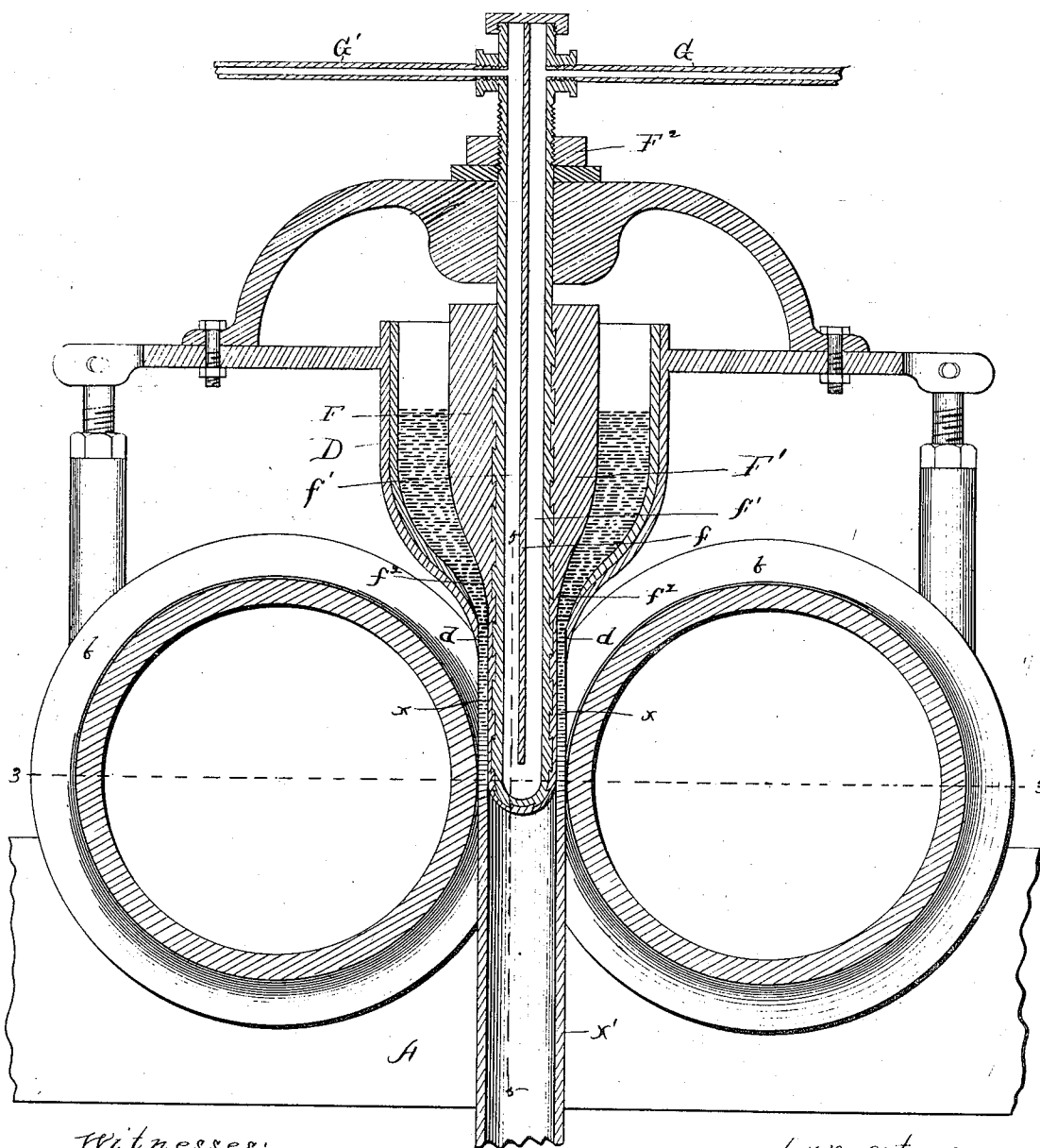
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3 Sheets—Sheet 2

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Fig 2.



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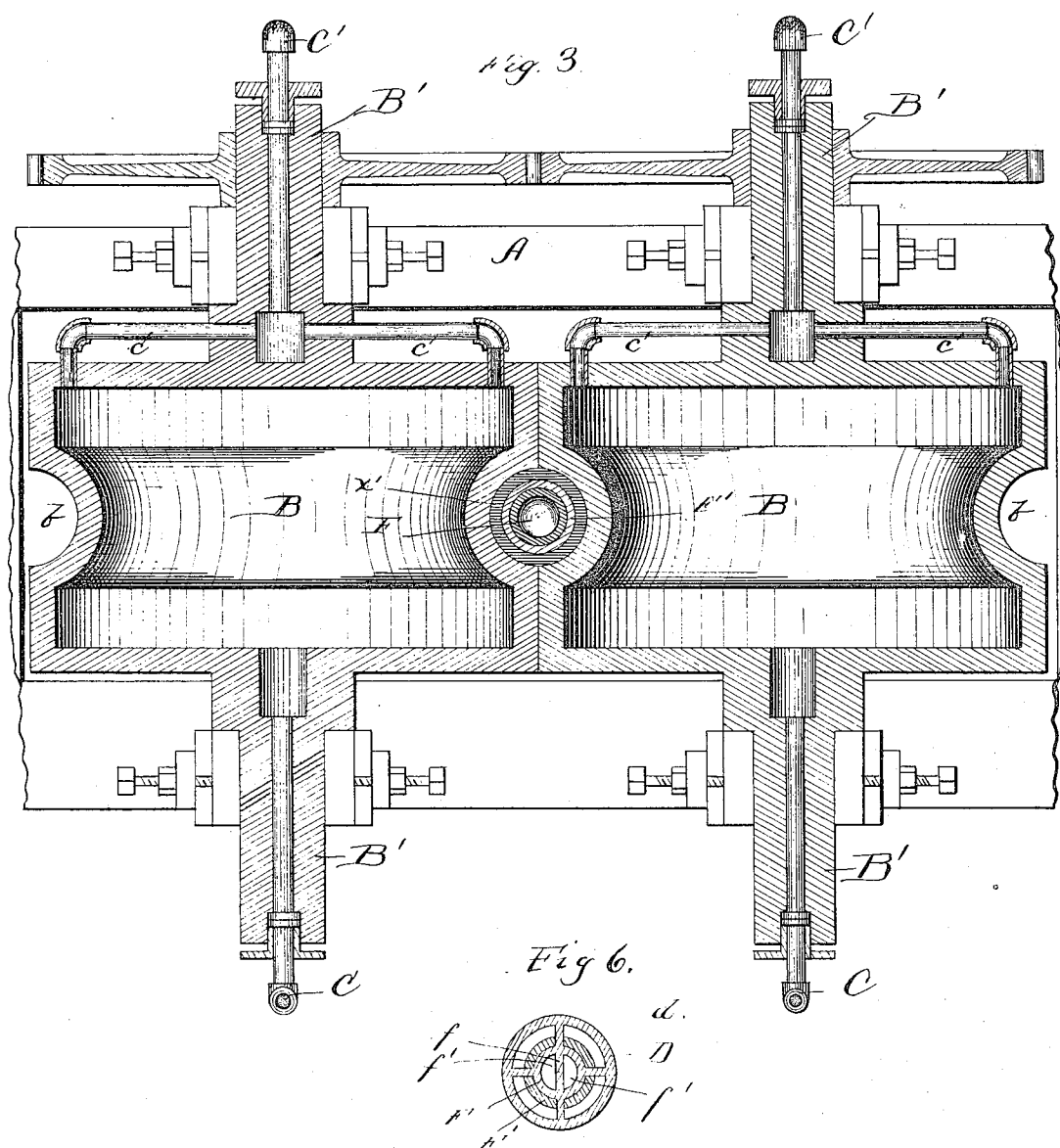
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E. NORTON & E. ADCOCK.
ART OF MAKING METAL TUBING.

No. 441,375.

Patented Nov. 25, 1890.



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UNITED STATES PATENT OFFICE.

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ART OF MAKING METAL TUBING.

SPECIFICATION forming part of Letters Patent No. 441,375, dated November 25, 1890.

Application filed June 6, 1889. Renewed May 14, 1890. Serial No. 351,736. (No model.)

To all whom it may concern:

Be it known that we, EDWIN NORTON, of Maywood, Cook county, Illinois, and EDMUND ADCOCK, of Chicago, Illinois, citizens of the United States, have invented a new and useful Improvement in the Art of Manufacturing Metal Tubing, of which the following is a specification.

Our invention relates to the manufacture of pipes or tubes of iron or steel or other metal or alloy. Heretofore such metal tubes have either been cast in a tubular mold or else formed by welding, brazing, or otherwise uniting the side edges of a strip formed to the desired shape. The cast pipe so produced is liable to be defective from imperfections in the casting, may be easily broken, and can only be produced in comparatively short lengths, and cannot be economically made of small diameter. The welded or brazed pipe produced by the old method can also only be made of comparatively short lengths, cannot be made economically of large sizes, and is frequently liable to part at the weld or joint.

The object of our invention is to provide a method or process by which seamless metal tubing may be made of a strong, homogeneous, and perfect character throughout, and whereby it may be rapidly and cheaply produced of any size or length desired.

To this end our invention consists in pouring or passing a tubular stream of molten metal in contact with continuously-moving chilling-surfaces, which surround the tubular stream on all sides and set and shape the tubular molten stream and convert it into a metal tube as it passes the continuously-moving chilling-surfaces.

It further consists in simultaneously compressing the tubular stream of molten metal against an internal support while it is in the molten or setting state to give the tube produced a strong, dense, and homogeneous structure and free it from blow-holes or imperfections which might otherwise arise from air or gas confined in the molten metal.

To enable our new process to be more readily understood and practiced, we have in the accompanying drawings, which form a part of this specification, illustrated one form

of apparatus which may be used in practicing our invention, the same being, as we believe, the best form now known to us for the purpose.

In the drawings, Figure 1 is a side elevation of the apparatus; Fig. 2, a partial central vertical longitudinal section. Fig. 3 is a horizontal section on line 3 3 of Fig. 2. Fig. 4 is a detail view of the shearing wheels or cutters. Fig. 5 is a partial vertical section on line 5 5 of Fig. 2. Fig. 6 shows a modified form of the annular orifice of the pouring nozzle or vessel.

In the drawings, A represents the frame of the machine, which may be of any suitable form to give the requisite strength and afford bearing for the different parts of the machine.

B B are a pair of revolving wheels or rolls having half-grooves *b b* in their peripheries conforming to the exterior shape of the tube desired to be produced. As shown in the drawings, the annular grooves *b* are semicircular in cross-section, as the machine is designed to produce a pipe or tube in the form of a hollow cylinder. The grooves *b* may, however, be made of any desired form, according to the form of the tube desired to be made. The rolls B are made hollow, and have hollow shafts B', through which water or other cooling-fluid is admitted into the rolls B from the supply-pipe C and discharged through the exit-pipe C'. The water entering at the center of the rolls flows out through the branch pipes *c*, which connect with the interior of the rolls near their periphery, so that the water will circulate to the periphery of the rolls.

D is a pouring vessel or bowl mounted directly above and between the rolls B B and having a discharge-orifice *d*, through which the stream of molten metal *x* flows directly down between and in contact with the walls of the groove *b* in the periphery of the rolls B. The stream of molten metal flows in a direction tangential to both rolls.

F is a core or mandrel conforming in cross-section to the bore of the tube designed to be produced. The purpose of the core or mandrel is to give the stream of molten metal as it issues from the vessel D a tubular or hol-

low shape. The lower end of this core or mandrel F may, preferably, project down to or beyond the meeting line of the rolls B B—that is to say, to the line joining the axes of the rolls. The core or mandrel F, in connection with the pouring-vessel D, thus serves to give the pouring-vessel an annular orifice d , so that the stream of molten metal issuing therefrom will be of a tubular shape.

To protect the core F from injury by the heat of the molten metal, we make, or prefer to make, the core hollow and provide it with a central web f , dividing it into two compartments or passages $f' f'$, so that water, air, or other cooling fluid may be forced entirely through it from the supply-pipe G and out through the discharge-pipe G'. To prevent the hollow core F from injury from the heat of the molten metal in the bowl D, as well as to prevent the chilling of the molten metal therein by the mandrel, we surround or coat the mandrel F with a refractory envelope or casing F'. This may be made of any suitable material known to those skilled in the art, according to the particular kind of metal of which the metal tube is being manufactured. The portion f^2 of the core F adjacent to the orifice d in the vessel D should be made of a tapering or conical form, so that by raising or lowering the core F the size or capacity of the annular orifice d may be regulated or entirely closed. The threaded nut F² serves to raise or lower the core F.

A second pair of rolls B² B² may be employed directly below the rolls B B, the same being of a similar construction, to further chill or cool the metal tube as it issues and further roll and compress it. The rolls B B, as well as the rolls B² B², revolve in the same direction that the stream of metal flows and, preferably at an equal surface speed with the velocity of the issuing stream of molten metal, so that the molten metal will not dam up between the rolls.

A pair of cutters H H, preferably rotary cutters, though stationary ones may be used, serve to remove any fin which may be left or produced on the metal tube at the meeting point of the rolls. The rolls B B and B² B², as well as the rotary cutters H H, are driven from the driving-shaft K through suitable connecting-gearing K'. As the tube issues from the rolls B B B² B² it is curved from a vertical to a horizontal direction by a suitable guide N, consisting, preferably, of a series of rolls arranged in a curve. As the tube issues in a horizontal direction, it is carried by a conveyer P, consisting, preferably, of a series of rolls, some of which may be used to straighten or further roll the tube.

As the tubular stream of molten metal flows or passes between the chilling-rolls B B the stream of molten metal is shaped and set and compressed against the core or mandrel F and converted into a metal tube of sound strong perfect and homogeneous character, having the qualities of forged or

compressed metal, and a tube may be made in this way very rapidly and cheaply and of any length or size desired.

The vessel D is furnished with guides or wings d' corresponding to the curvature of the rolls B B and extending down to near the meeting line of the rolls, as indicated in Fig. 5, and which fit said rolls snugly and serve to direct the molten metal in the channel formed by the annular grooves $b b$, and thus to prevent the formation of fins or webs upon the tube x' at the meeting line of the rolls B B.

By our process metal tubes may be made of any desired shape or cross-section, whether smooth or corrugated, round or square, and with a round or other form of bore by simply changing the form of the grooves $b b$ of the core F and pouring-orifice d of the vessel D, or by changing the shape of one or more of these parts, as may be necessary, to produce the particular outline of tube desired.

The annular or ring-shaped orifice d of the vessel D may of course be circular, as shown in the drawings, or of other form, according as the tube is to be made, cylindrical, square, or other form. It should also be understood that the annular orifice d need not necessarily be a complete ring or annulus; but it may be divided by webs or bridges, as the molten metal will reunite into a tubular stream after passing such web or bridges, which break or divide the annular orifice into two or more segments. This form of the annular orifice is indicated at Fig. 6.

We claim—

1. The process of making metal tubing, consisting in pouring or passing a tubular stream of molten metal in contact with continuously-moving chilling-surfaces, substantially as specified.
2. The process of making seamless metal tubing, consisting in pouring a tubular stream of molten metal in contact with continuously-moving chilling-surfaces traveling in the direction of the moving stream of molten metal and at an equal or greater surface speed than the velocity of the flowing stream to prevent the molten metal from collecting or damming up between the chilling-surfaces, substantially as specified.
3. The process of making metal tubing, consisting in pouring a tubular stream of molten metal in contact with continuously-moving chilling-surfaces which surround the tubular stream on all sides and simultaneously compressing the metal while in a liquid or setting state against an internal support, and thereby converting the tubular molten stream into a metal tube as it passes the continuously-moving chilling-surfaces, substantially as specified.
4. The process of making continuous metal tubing, consisting in passing a tubular stream of molten metal in contact with continuously-revolving chilling-rolls surrounding the

tubular metal stream, substantially as specified.

5 5. The process of making continuous metal tubing, consisting in passing a tubular metal stream in contact with continuously-revolving chilling-rolls and with an interior mandrel, and then further rolling and compressing the tube as it issues from such chilling-

rolls and while still at a high temperature, substantially as specified.

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