(No Model.) 2 Sheets—Sheet 1.

J. A. CHARNOCK.

TUBE MAKING MACHINE.

No. 603,811. Patented May 10, 1898.

Fig. 1.

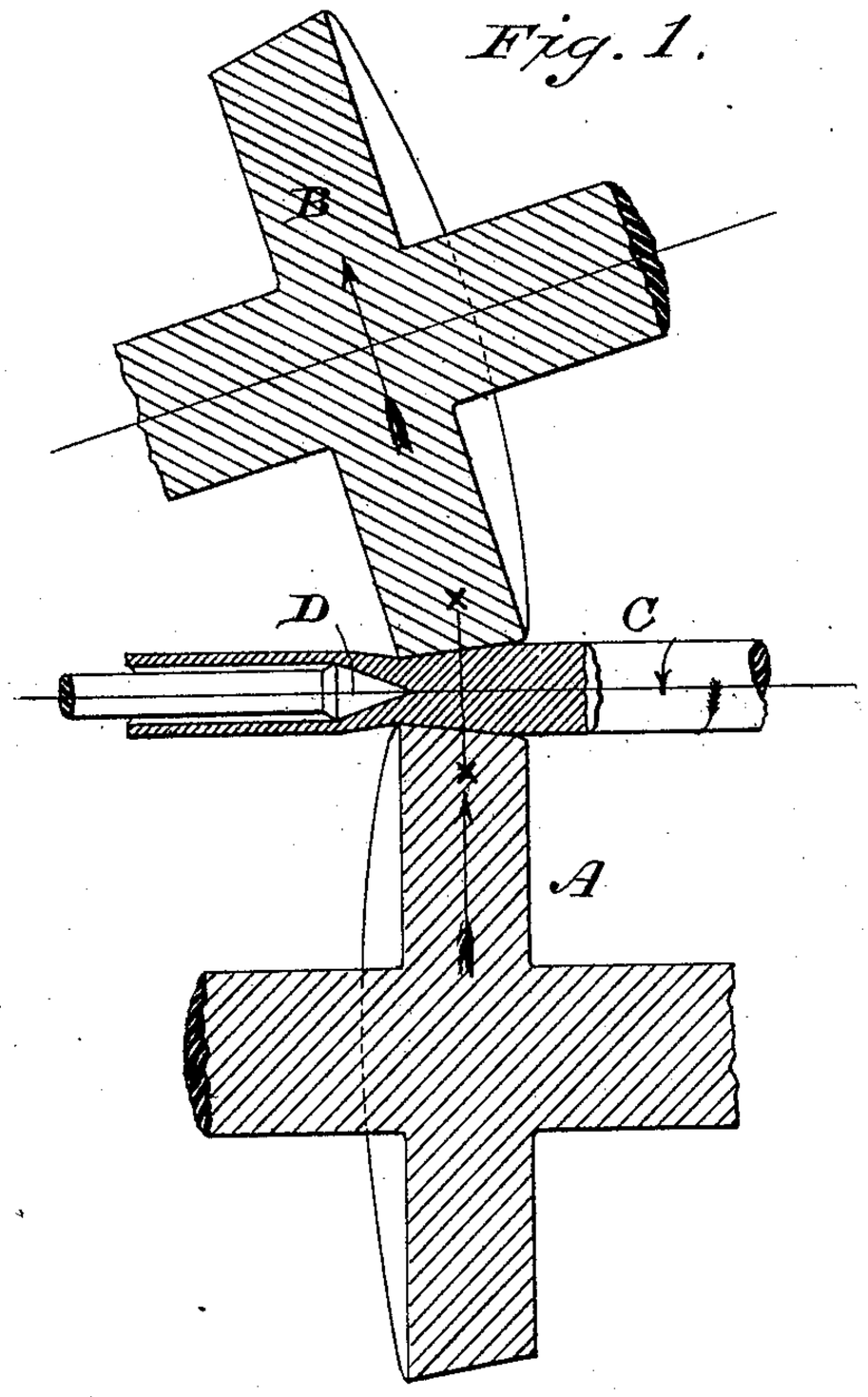


Fig. 3.

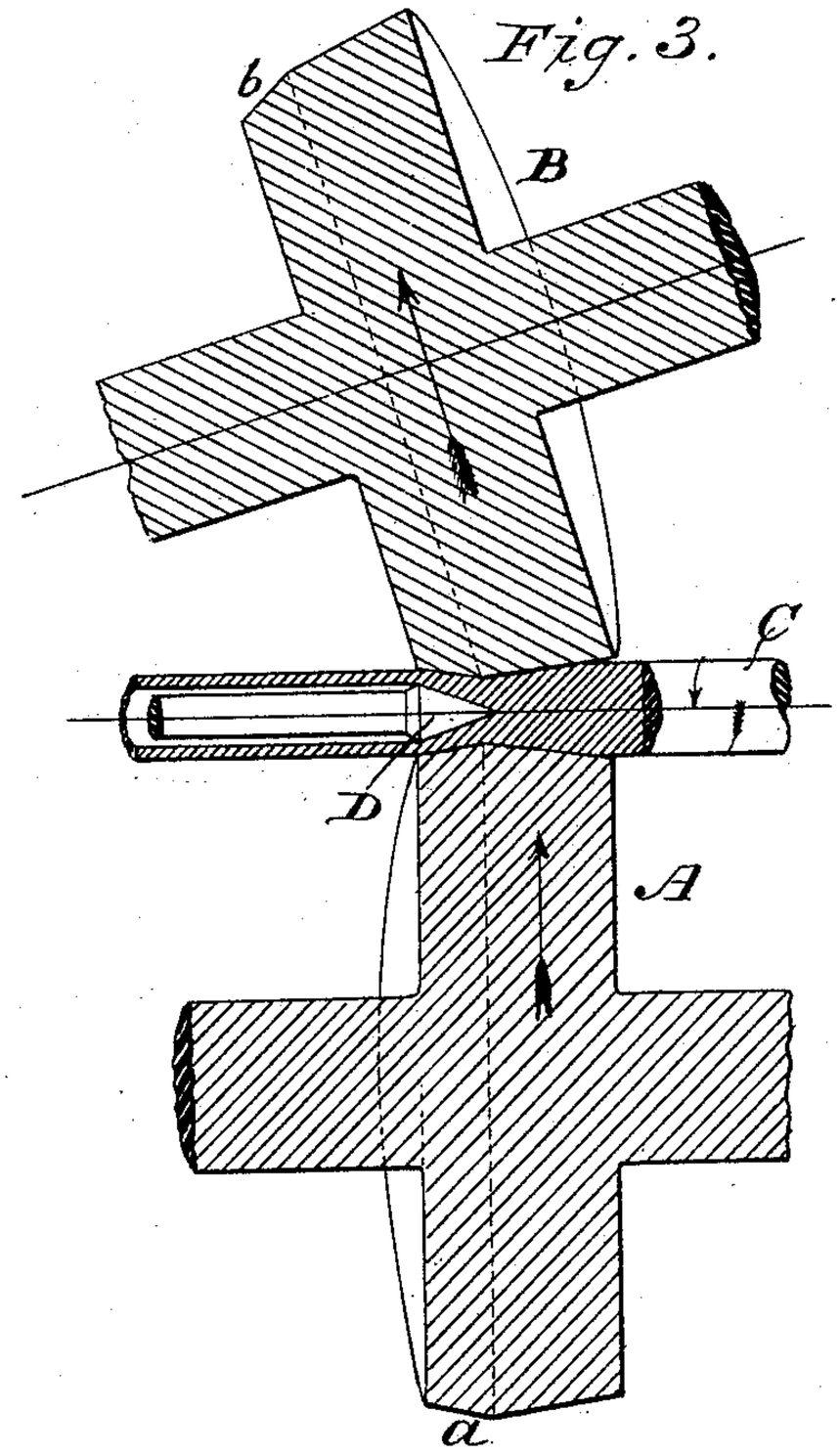


Fig. 2.

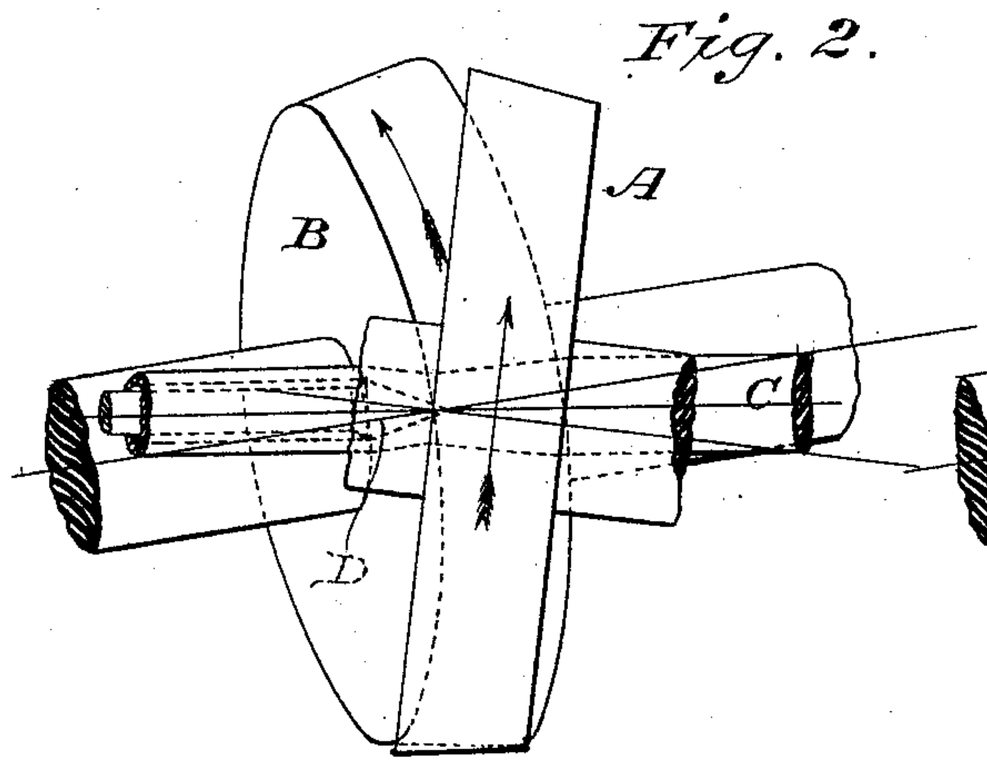
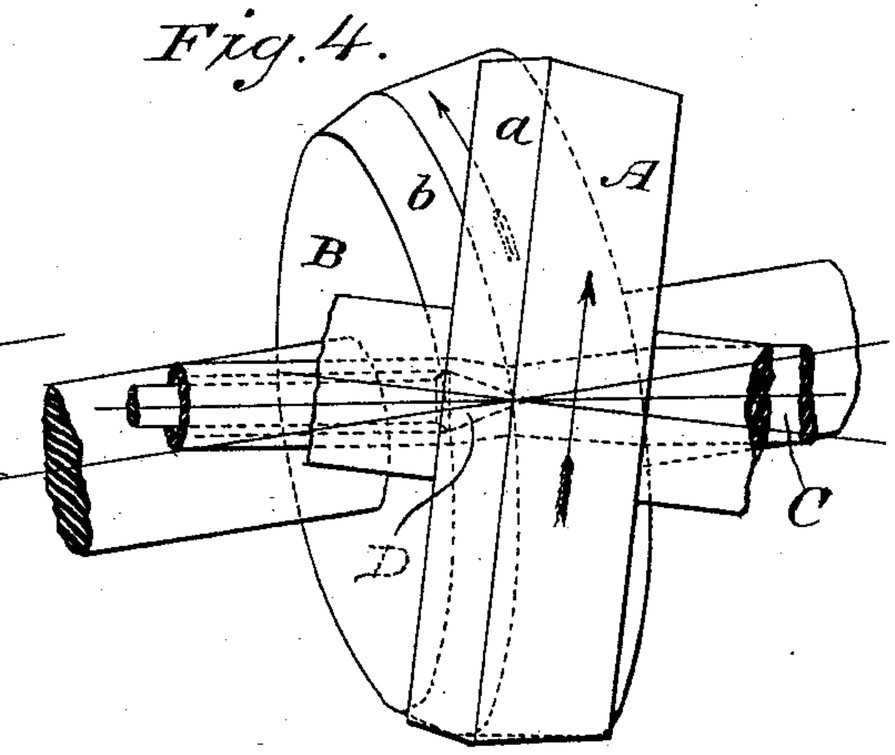


Fig. 4.



Witnesses.

N. P. Smith.

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(No Model.) 2 Sheets—Sheet 2.

J. A. CHARNOCK.

TUBE MAKING MACHINE.

No. 603,811. Patented May 10, 1898.

Fig. 6.

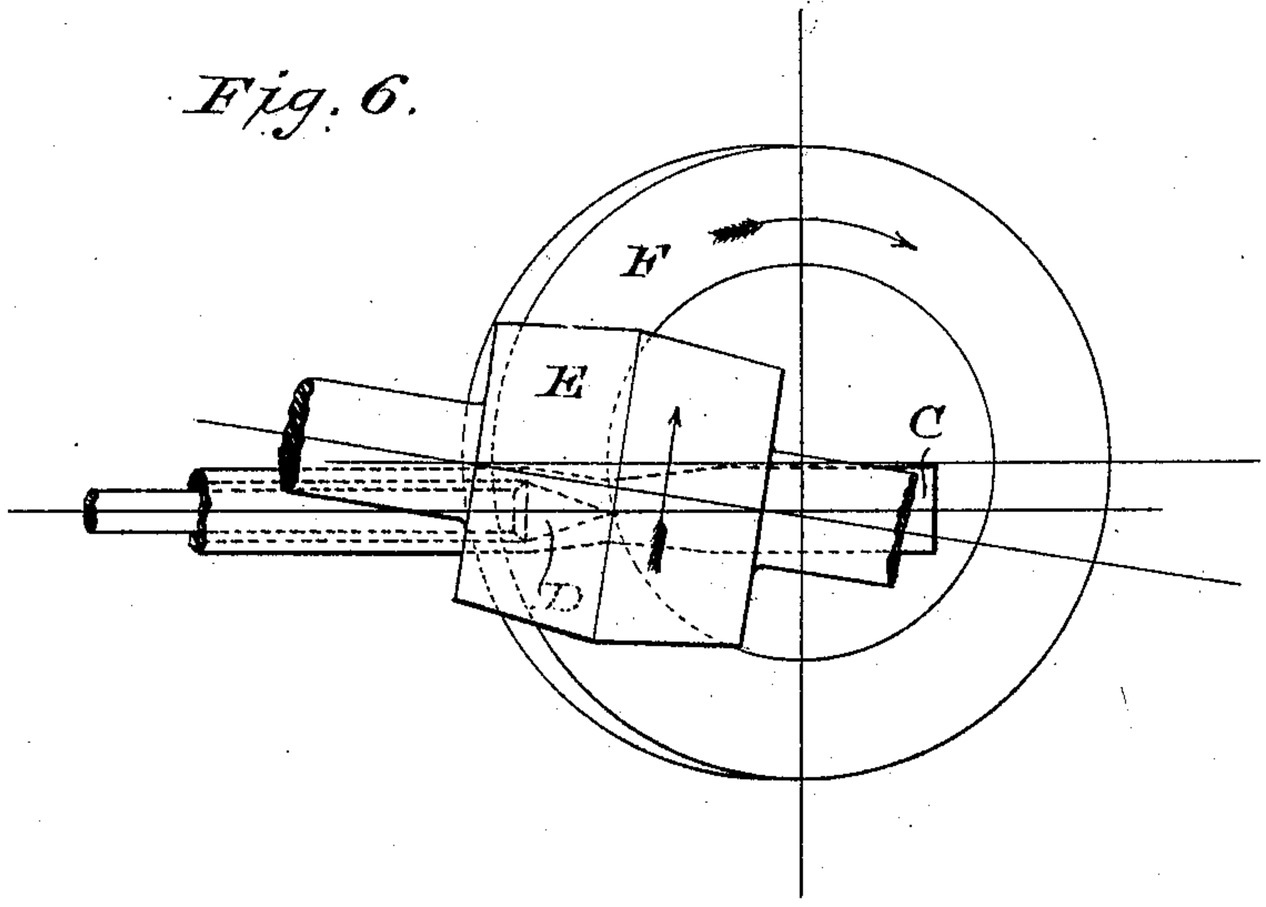
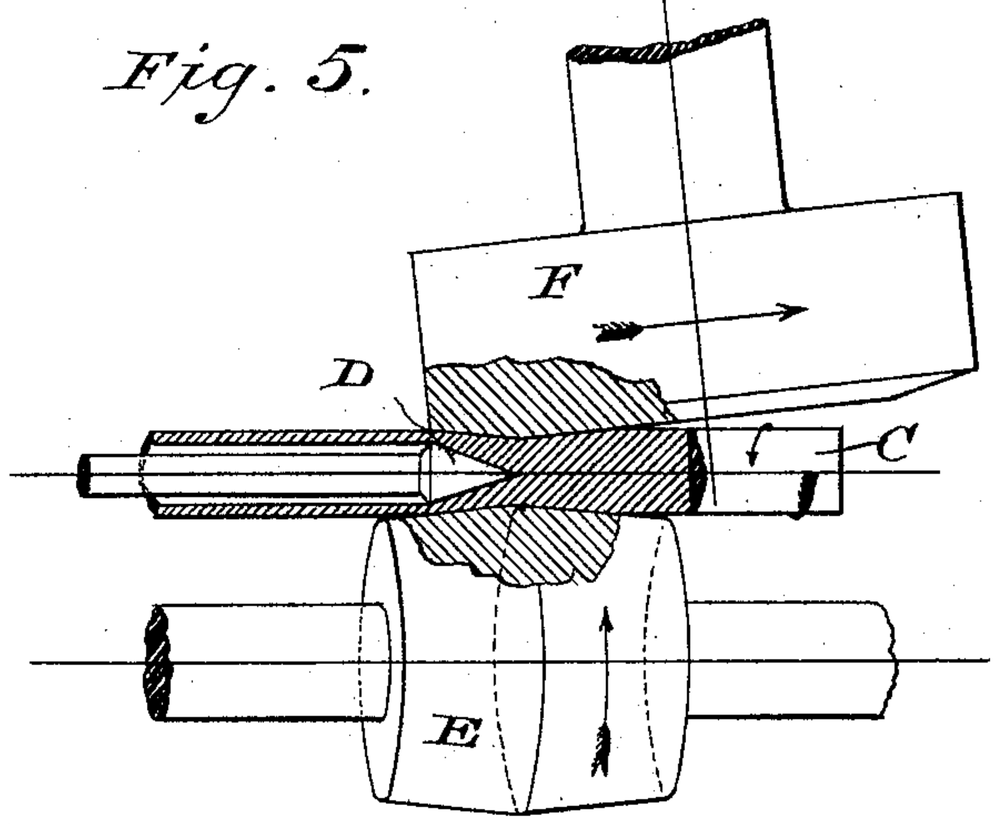


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN A. CHARNOCK, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE SHELBY STEEL TUBE COMPANY, OF PITTSBURG, PENNSYLVANIA.

TUBE-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 603,811, dated May 10, 1898.

Application filed April 5, 1897. Serial No. 630,732. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. CHARNOCK, a subject of the Queen of Great Britain, residing at Cleveland, county of Cuyahoga, and State of Ohio, have invented certain new and useful Improvements in Mechanism for Making Tubes from Metallic Ingots or Blanks in a Heated State, of which the following is a specification, that will enable those skilled in the art to which my invention pertains to make and use the same.

My invention relates to improvements in mechanism for making tubes from metallic ingots or billets. Its objects are to pierce metallic ingots or blanks in a heated state and to roll or draw them out into tubular form without subjecting them to torsional strain or materially disturbing the longitudinal arrangement of the fibers of the metal; and the mechanism for accomplishing these objects consists of a pair of specially constructed and arranged rolls working in conjunction with a mandrel located in the pass between the rolls, by means of which the heated blank or billet may be pierced and drawn at one operation. In this operation a blank or billet is passed between the adjacent faces of the two rolls, which impart to it a rotary motion and at the same time a longitudinal motion, which forces it against and over the conical piercing-mandrel lying in the path of the axis of the blank, the arrangement of the working surfaces of the rolls being such that a practically uniform speed of rotation is imparted to each and every portion of the blank or billet lying between and being acted upon by them, thus producing a drawing action upon the blank that does not materially alter the longitudinal arrangement of the fibers in the blank or in the final product thereof during any changes wrought in its diameter or form.

The accompanying drawings show approximately the shapes and relative positions of the rolls and the piercing-mandrel of the mechanism which I employ in the practice of my invention, no attempt, however, being made to represent the framework or housings which support the rolls and mandrel or the gearing for imparting motion to the several parts, or, in fact, other portions of a fully-organized machine, such general features forming no part of the invention herein claimed and their construction and application being well understood by those familiar with the art to which my invention pertains. I do not mean, however, to confine myself to the exact proportions and shapes shown, as these may be varied to a considerable extent to suit different conditions and the relative positions of the parts changed within certain limits without departing from the spirit of my invention as set forth in the claims at the end of this specification.

Figure 1 is a plan view, partly in section, of a pair of my rolls with a piercing-mandrel, the point of which lies between the working surfaces of the rolls at the exit side of the pass, and a blank or billet engaged by the rolls and undergoing the process of being pierced by the mandrel. Fig. 2 is a side elevation of the same, showing the axial inclination of the rolls, relatively to the axis of the pass, necessary to impart endwise motion to the billet. Fig. 3 is a plan view of a modification of my rolls, showing them extended so as to act upon that portion of the billet which is being opened and enlarged by the conical part of the mandrel lying between them. Fig. 4 is a side elevation of the same. Fig. 5 shows a modification in which one of the working surfaces is arranged on the flat side of one of the rolls instead of on the periphery thereof. Fig. 6 is a side elevation of the same.

In the practice of my invention rolls A and B, revolving in the same direction, are so shaped and located relatively to each other as to form between their adjacent peripheral surfaces a pass through which a heated billet or blank C is drawn and thence forced upon the point of a mandrel D, which pierces its center and converts it from a solid into a tubular form. It will be observed that these rolls are tapering in shape, each being in the form of a frustum of a cone, the roller A having its smallest diameter at the entrance side of the pass and its largest diameter at the exit side of the pass, while the roller B has its largest diameter at the entrance side of the pass and its smallest diameter at the exit

side of the pass. By this disposition of the parts the larger diameter of the roll B is opposed to the smaller diameter of the roll A at one end of the pass, while at the other end of the pass the smaller diameter of the roll B is opposed to the larger diameter of the roll A. As a result of this the speed of rotation imparted to the billet C by the rolls at all points through the pass is equal to the mean speed of rotation of the two rolls at the line $x\,x$, where their diameters are equal. At all other points in the pass at either side of the line $x\,x$ the greater speed of the larger diameter of one roll is neutralized by the lesser speed of the smaller diameter of the roll opposed to it. The speed of rotation therefore imparted by the rolls to all parts of the billet lying in the pass and gripped by them is uniform. Consequently no twist or material alteration of the longitudinal arrangement of the fibers of the billet is produced.

As shown in Fig. 2, the axes of the rolls are set at such angles as will produce a forward feed of the billet, as well as its rotation by the rolls, in a manner well understood to those familiar with the art. The rolls are also so disposed that the sides of the pass gradually converge as they approach the exit end, so that the pass is narrower at that point than at the entrance end. This insures a constant and continuing grip of the rolls on the billet that causes it to move endwise with considerable force while it is being rotated. The point of the mandrel D is suitably located at or near the exit side of the pass and directly in the axial line of the path of the billet, so that as the latter is rotated and fed endwise by the revolving rolls it encounters this point of the mandrel, and being pierced thereby slips up over the head of the mandrel and passes off in tubular form.

In Figs. 1 and 2 the rolls are shown with converging surfaces to gradually diminish the width of the pass toward its exit end to rotate and feed forward the billet against the point of the mandrel, which lies mainly outside of the space between the rolls. As a result of this the billet is forced upon and simply pierced by the mandrel, and no attempt is made to smooth or finish the tubular product either during or after the piercing operation. In Figs. 3 and 4, however, the rolls are shown with prolongations $a\,b$ on the exit side of the pass, which prolongations extend to or slightly beyond the head of the piercing-mandrel and are so shaped relatively to the head that they continue to act upon the billet as it is being pierced by said head, compacting the metal and finishing it both on its inner and outer sides, so that the tubular product leaves the head of the mandrel in a smooth and finished condition.

In Fig. 5 a disk-shaped roll is used in connection with another smaller roll. The mandrel is located in the pass between the rolls, and the arrangement is such as to produce substantially the same effect as the rolls herein described.

In the arrangement shown in Figs. 5 and 6 the axes of the two rolls are arranged nearly at right angles to each other, and the surfaces of the rolls are so shaped and relatively located as to produce between them a pass gradually diminishing in width from its entrance end to the point where it is intercepted by the piercing-mandrel, from which point it slightly increases in width at each side of the mandrel, so as to work upon and finish the tubular product in the same manner as the rolls shown in Figs. 3 and 4. The axis of the pass may be slightly above or below the plane of the axis of the disk-shaped roll, and the axis of the roll E may be inclined relatively thereto, as shown in Fig. 6, for the purpose of producing the endwise feed of the billet. The rolls revolve in directions shown by the arrows and impart to the billet gripped between them a rotary as well as an endwise movement.

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

1. A pair of rolls consisting of frustums of cones, arranged on opposite sides of a pass and revolving in the same direction, the larger diameter of each roll being opposed to the smaller diameter of the other roll substantially as set forth.

2. A pair of rolls consisting of frustums of cones arranged on opposite sides of a pass and revolving in the same direction, the larger diameter of each roll being opposed to the smaller diameter of the other roll, the rolls being so located that the pass between their opposed faces gradually diminishes in width toward its exit side as set forth.

3. A pair of rolls consisting of frustums of cones arranged on opposite sides of a pass and revolving in the same direction, the larger diameter of each roll being opposed to the smaller diameter of the other roll, the axes of the rolls being oppositely inclined relatively to the axis of the pass substantially as and for the purpose set forth.

4. A pair of rolls consisting of frustums of cones arranged on opposite sides of a pass and revolving in the same direction, the larger diameter of each roll being opposed to the smaller diameter of the other roll, the pass between the rolls gradually diminishing in width toward its exit end and the axes of the rolls being oppositely inclined relatively to the axis of the pass substantially as and for the purpose set forth.

5. The combination of a pair of rolls consisting of frustums of cones arranged on opposite sides of a pass and revolving in the same direction, the larger diameter of each roll being opposed to the smaller diameter of the other roll, the axes of the rolls being oppositely inclined relatively to the axis of the pass and the pass gradually diminishing in

width toward its exit side, a conical piercing-mandrel located in the axial line of the pass with its point at or near the exit side thereof, substantially as set forth.

6. The combination of a pair of rolls consisting of double frustums of cones arranged on opposite sides of a pass and revolving in the same direction, the entrance side of the pass being gradually diminished in width and bounded by sections of the rolls in which the larger diameter of each is opposed to the smaller diameter of the other, the exit side of the pass being gradually increased in width and bounded by prolongations of the rolls consisting of frustums of cones, a conical piercing-mandrel located in the exit side of the pass and in axial line therewith with its point at or near the narrowest part of the pass, with the axes of the rolls oppositely inclined relatively to the axis of the pass substantially as and for the purpose set forth.

7. A pair of rolls arranged on inclined axes and each having an inclined working surface with a pass between them, the larger diameter of the working surface on each roll being opposed to a smaller diameter of the working surface on the other roll, substantially as set forth.

In testimony whereof I affix my signature, in the presence of two witnesses, at Cleveland, Ohio, March 23, 1897.

JOHN A. CHARNOCK.

Witnesses:
JOSEPH KENDRICK,
WM. A. SKINKLE.