No. 697,988. Patented Apr. 22, 1902.

L. D. DAVIS.

PIERCING AND SHAPING METALLIC INGOTS.

(Application filed May 3, 1899.)

(No Model.)

Fig. 1.

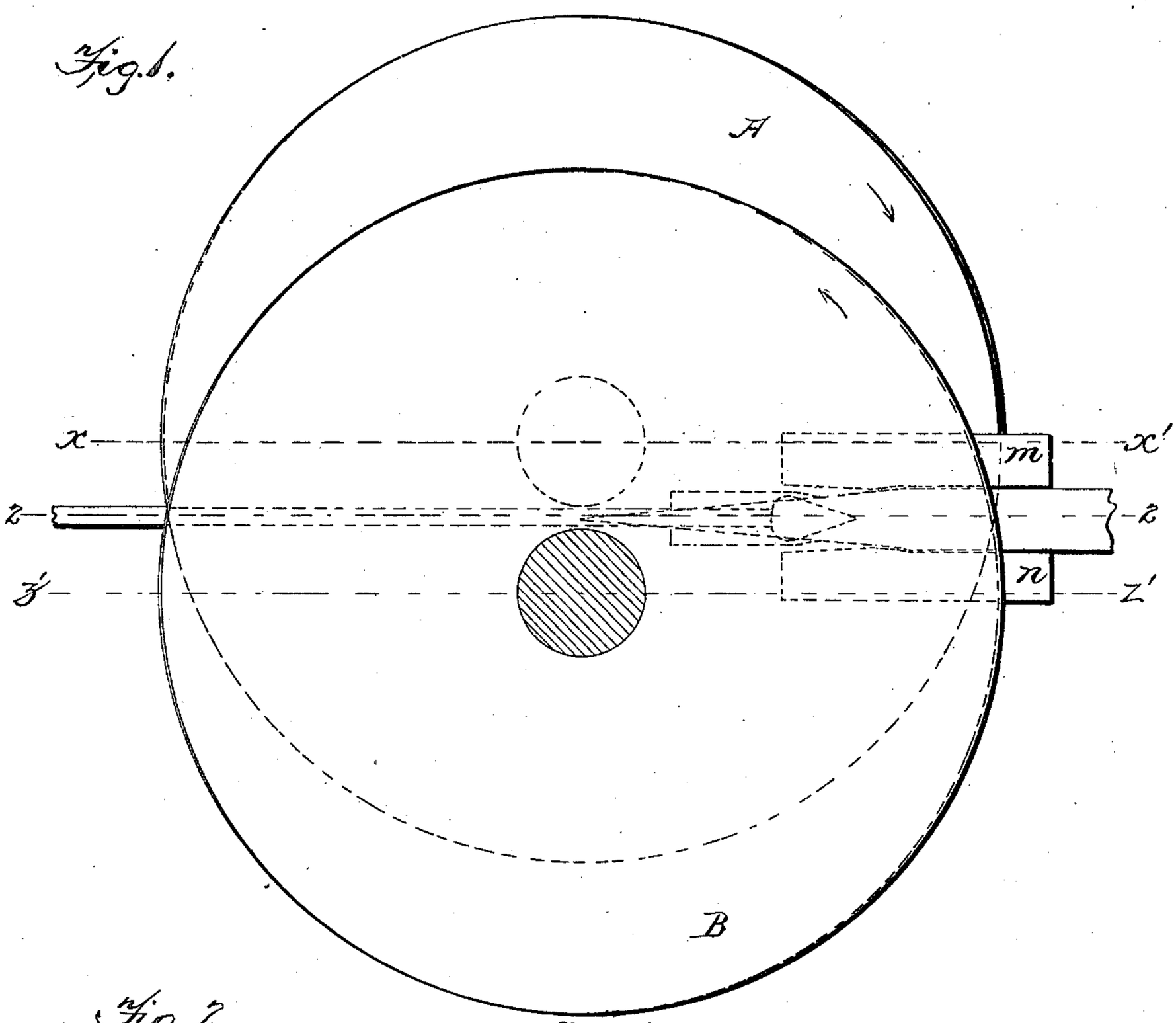


Fig. 2.

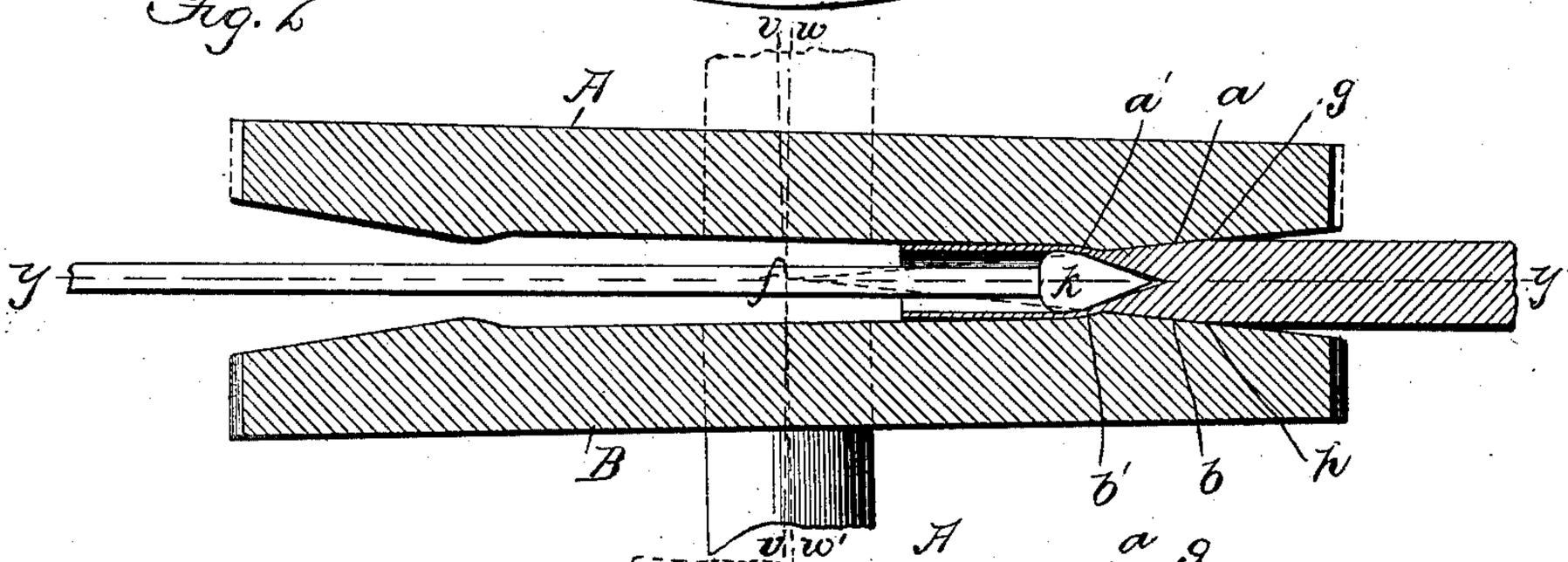
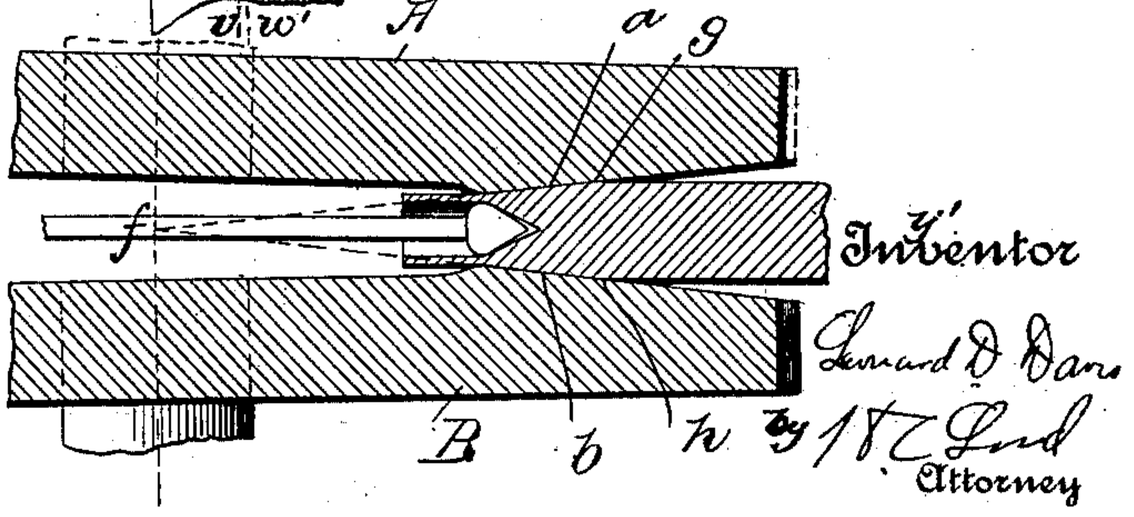


Fig. 3.



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PIERCING AND SHAPING METALLIC INGOTS.

SPECIFICATION forming part of Letters Patent No. 697,988, dated April 22, 1902.

Application filed May 3, 1899. Serial No. 715,394. (No model.)

To all whom it may concern:

Be it known that I, LEONARD D. DAVIS, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented certain new and useful Improvements in Machines for Piercing and Shaping Metallic Ingots; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to mills for rolling seamless tubes from metallic ingots and billets. Mills of this character have heretofore been devised in which specially-constructed acting disks or rolls are employed in connection with a mandrel located between the working portions of the disk-faces and adapted to serve as an anvil; but in all prior mills the fibers of the metal are subjected to more or less of a twisting action incident to the form and relative arrangement of the disks and the direction of the pass.

The main object of my invention is to produce tubes without subjecting the metal to such torsional or distortive strains and yet attain this object by means of specially-formed disks arranged in a new relation to each other and to a piercing-mandrel, whereby a perfectly uniform speed of rotation is given to all portions of the billet which are in contact with the opposed working faces of the disks.

As diagonally-acting rolls for producing seamless tubes are well known in the art, it is deemed sufficient only to indicate the general form and relative positions of the essential parts of the mechanism which are comprehended in the present invention.

To enable others skilled in the art to make and use my invention, I will describe the same in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of the mill. Fig. 2 is a horizontal section of the line 2 2, Fig. 1; and Fig. 3 is a horizontal sectional view of a modification thereof.

The disks A and B are provided with the opposing contacting surfaces a and b, respectively. The axes of the disks lie in the horizontal planes $x\ x'$ and $z\ z'$ and converging vertical planes $v\ v'$ and $w\ w'$, which intersect each other and the axis $y\ y'$ of the pass at a point f. This point f is approximately the apex of a cone $f\ g\ h$, in which the lines of contact of the faces $a\ b$ of the disks with the billet lie. The location of this point f is determined by the inclination of the disk-shafts, the angle of the convergence of the contacting faces of the disks and the distance between the horizontal planes $x\ x'\ z\ z'$. In order that the billet may be made to move through the pass by the action of the working surfaces upon it, the disks are arranged eccentrically to each other, and the distance between the planes $x\ x'$ and $z\ z'$ determines the amount of axial feed upon the billet, this feed being increased as the distance between these planes is increased.

The shape of the faces $a\ b$ of the disks (viewed upon the radial line of said disks) should be such relatively to the inclination of the disk-shafts as to bring the lines of contact of the billet with the surfaces a and b of the opposing disks approximately into the lines $f\,g$ and $f\,h$ of the cone of rotation $f\ g\ h$, as stated. Under these conditions it will be seen that the speed of rotation of the disks at all points of contact with the billet passing between them will bear exactly the same ratio to the diameters of the passing billet at such points, so that there will be no twisting of the metal, as inevitably exists where these conditions are not secured. In order to secure this result, it is necessary that the disks be comparatively large and the working surfaces thereof as short as is practical in order to secure the necessary gripping and reducing action on the billet. For instance, it has been found that a pair of disks wherein the distance from the focal point f to the working surfaces $a\ b$ is approximately six feet will pierce billets without twisting the metal; but this is merely stated by way of illustration, as the dimensions of the disks may vary between rather wide limits. The length of the working surface, while comparatively small, is a variable quantity, a longer working surface being necessary in piercing or expanding a large billet than is necessary with a small billet; but in either case the working surface will be made as short as is practical in order to secure the necessary gripping and reducing action on the billet. The mandrel k is supported in any suitable manner in the line of the pass, which, as indicated, is toward the intersection of the converging vertical planes $v\ v'$ and $w\ w'$, the disks rotating as indicated by

the arrows. Suitable blocks *m n* may be used to guide the billet as it is passed between the working surfaces of the disks. As the metal is delivered at the narrowest point of the pass practically without twist it is in condition to stand some enlargement, if desired, through the action of the mandrel, as shown at Figs. 1 and 2. In case this is desired the disks may be shaped at this point so as to form the working surfaces *a' b'*, against which the metal may be forced by the mandrel and the tube thus spread and finished. The inclination of the axes of the disks when viewed in a horizontal plane should be such as to allow the enlarged tube to pass out at the rear of the disks. In the construction shown in Fig. 3 the mandrel is arranged and is of a size to utilize only the working surfaces *a b*. This produces a smaller tube, but one without twist.

I have not herein described specifically the means for producing the proper-shaped disks for operating as described, as a detailed description of the method for producing such disks is described in my former patent, granted June 20, 1899, No. 627,455, in which the construction herein claimed is shown as an alternative construction.

What I claim, and desire to secure by Letters Patent, is—

1. A rolling mechanism comprising two opposed disks or rolls having their axes arranged in different planes *x x'* and *z z'*, respectively, and also in intersecting planes *v v'* and *w w'*, the contact portions of the opposing faces of said disks or rolls converging toward their axes, the convergence and the shape of said opposing faces being such that the decreasing diameter of the billet between them compensates for the decreasing speed of said faces toward the axes of the disks or rolls, whereby every point in the surface of the billet has the same speed of rotation about the axis of the billet and twisting of the billet by the action of said contact-faces is wholly avoided.

2. A rolling mechanism comprising two opposed disks or rolls having their axes arranged in different planes *x x'* and *z z'*, respectively, and also in intersecting planes *v v'* and *w w'*, the contact portions of the opposing faces of said disks or rolls converging toward their axes, the convergence and the shape of said opposing faces being such that the decreasing diameter of the billet between them compensates for the decreasing speed of said faces toward the axes of the disks or rolls, whereby every point in the surface of the billet has the same speed of rotation about the axis of the billet and twisting of the billet by the action of said contact-faces is wholly avoided, and a mandrel located in the line of the pass and between the contacting faces of the disks.

3. A rolling mechanism comprising two opposed disks or rolls having their axes arranged in different planes *x x'* and *z z'*, respectively, and also in intersecting planes *v v'* and *w w'*, the contact portions of the opposing faces of said disks or rolls converging toward their axes, the convergence and the shape of said opposing faces being such that the decreasing diameter of the billet between them compensates for the decreasing speed of said faces toward the axes of the disks or rolls, whereby every point in the surface of the billet has the same speed of rotation about the axes of the billet and twisting of the billet by the action of said contact-faces is wholly avoided, said contact-faces rotating in opposite directions toward said axes, whereby the direction of the pass is from the outer contacting portions of the disk toward such axes.

4. A rolling mechanism comprising two opposed disks or rolls having their axes arranged in different planes *x x'* and *z z'*, respectively, and also in intersecting planes *v v'* and *w w'*, the contact portions of said disks or rolls converging toward their axes, the convergence and the shape of said opposing faces being such that the decreasing diameter of the billet between them compensates for the decreasing speed of said faces toward the axes of the disks or rolls, whereby every point in the surface of the billet has the same speed of rotation about the axes of the billet and twisting of the billet by the action of said contact-faces is wholly avoided, said contact-faces rotating in opposite directions toward said axes, whereby the direction of the pass is from the outer contacting portions of the disks toward said axes, and a mandrel located in the line of the pass and between the contacting faces of the disks and pointing away from the axes of the rolls.

5. A rolling mechanism comprising two opposing disks or rolls having their axes arranged in different planes *x x'* and *z z'*, respectively, and also intersecting planes *v v'* and *w w'*, the contacting portions of said disks or rolls converging toward the axes, the convergence and the shape of said opposing faces being such that the decreasing diameter of the billet between them compensates for the decreasing speed of said faces toward the axes of the disks or rolls, whereby every point in the surface of the billet has the same speed of rotation about the axis of the billet and twisting of the billet by the action of said contact-faces is wholly avoided, said contact-faces rotating in opposite directions toward said axes, whereby the direction of the pass is from the outer contacting portions of the disks toward said axes, said disks also provided with the spreading faces *a' b'*, leading from the narrowest point in the pass toward the center of the disks, in combination with an enlarging mandrel located in the pass between the surfaces *a' b'* and pointing away from the axes of the rolls.

In testimony whereof I affix my signature in presence of two witnesses.

LEONARD D. DAVIS.

Witnesses:
M. BURY,
J. F. LYNCH.