Oct. 15, 1935. B. BANNISTER 2,017,386

APPARATUS FOR FORMING TUBULAR BLANKS

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Fig. 1.

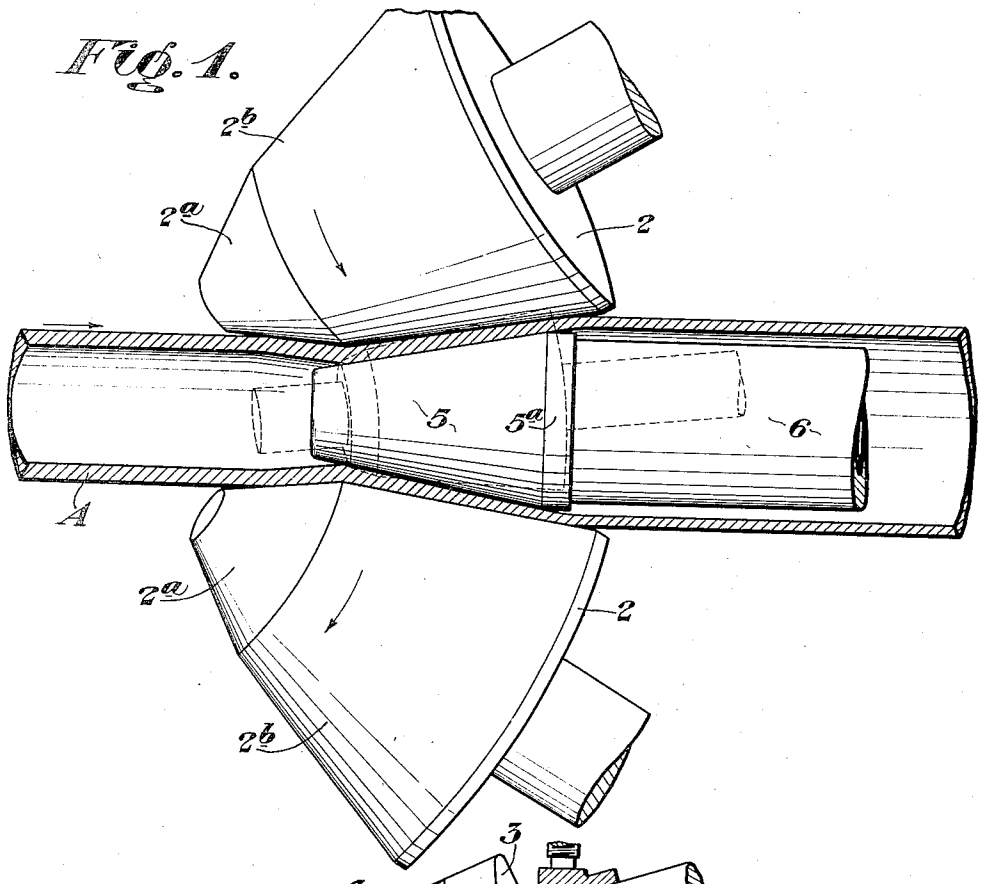
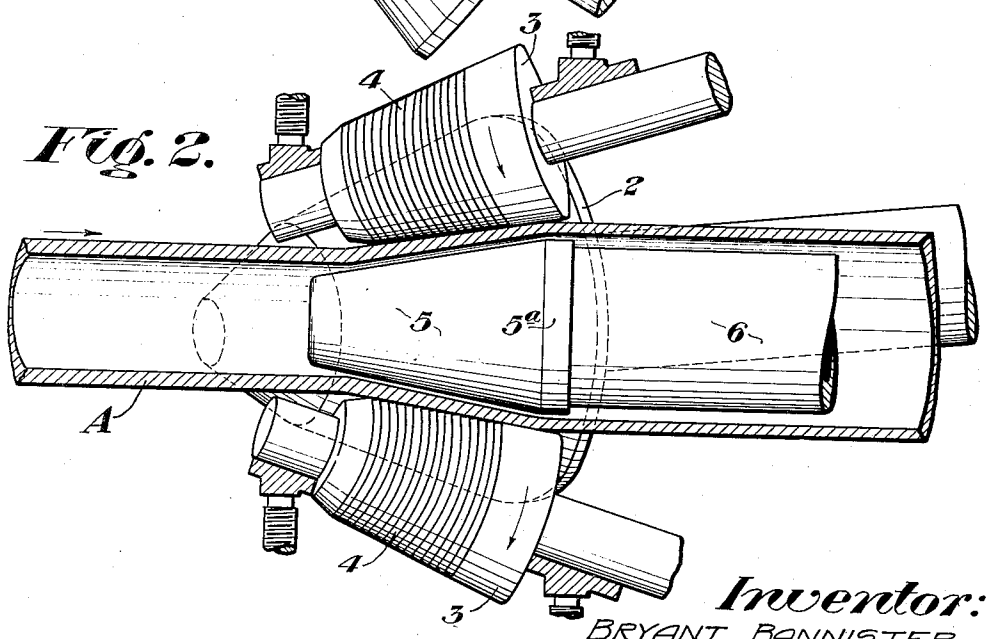


Fig. 2.



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Fig. 3.

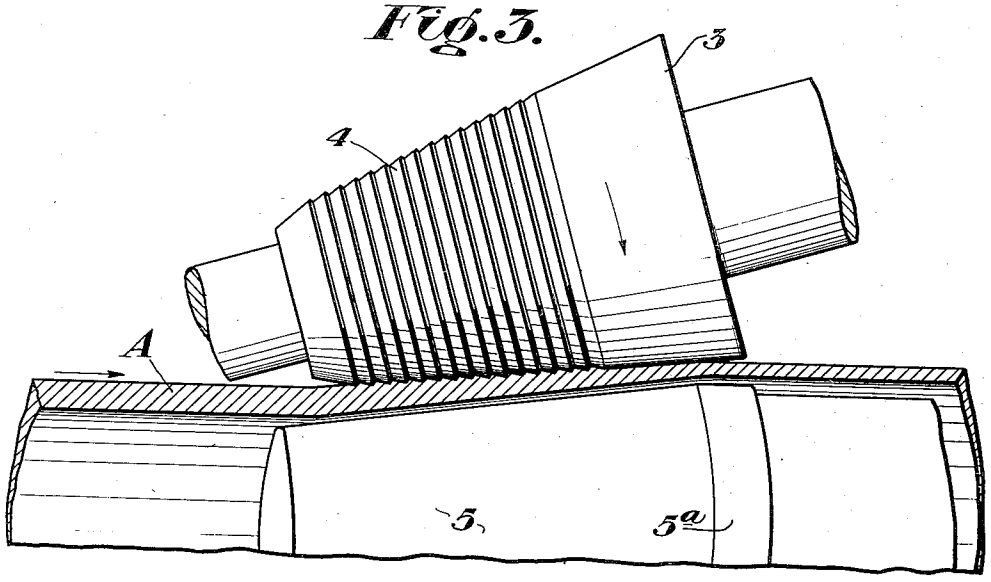
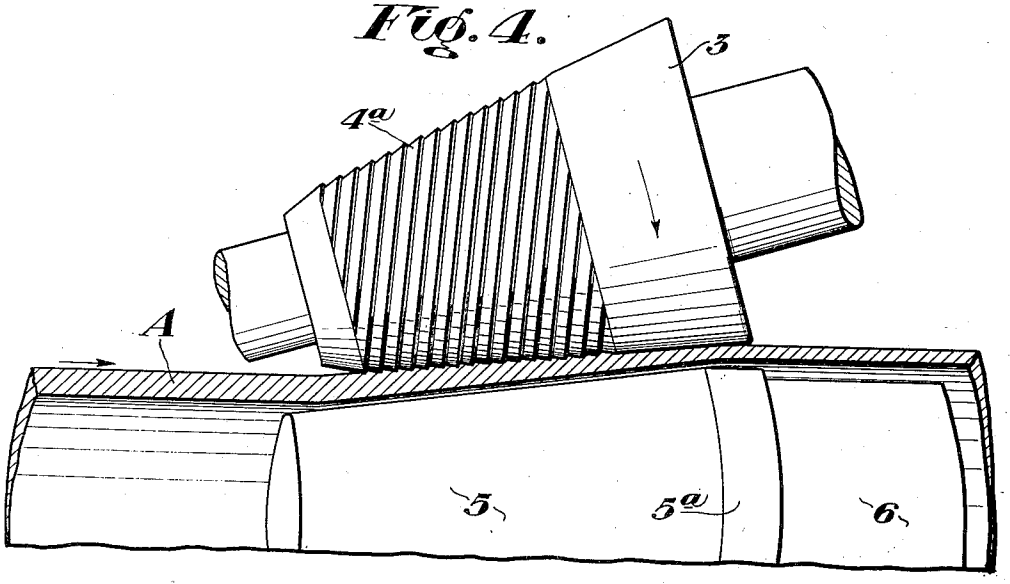


Fig. 4.



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Fig. 5.

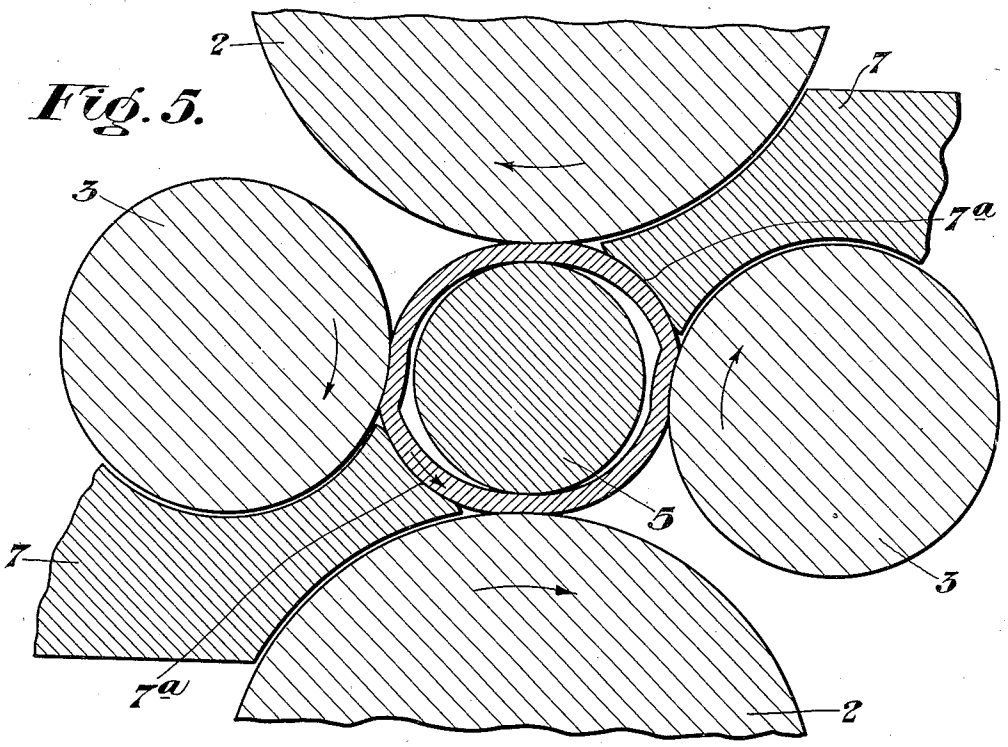
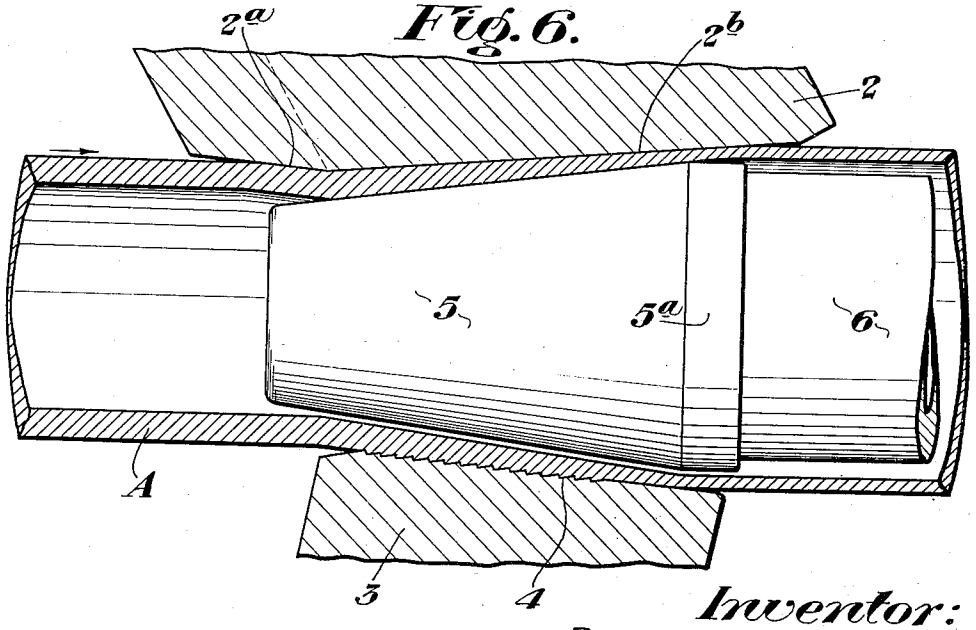


Fig. 6.



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UNITED STATES PATENT OFFICE

2,017,386

APPARATUS FOR FORMING TUBULAR BLANKS

Bryant Bannister, Mount Lebanon, Pa.

Application September 21, 1933, Serial No. 690,475

1 Claim. (Cl. 80—13)

This invention relates to the manufacture of seamless pipes and tubes, and more particularly to apparatus for expanding the diameter of a previously pierced billet and substantially reducing its wall thickness.

In my co-pending application, entitled Apparatus for expanding and elongating tubular workpieces, Serial No. 660,717, filed March 14, 1933, a very substantial expansion is effected, together with a great reduction in wall thickness. In order to effectively limit the distortion or ovality of the work-piece being processed, the usual stationary guiding members are superseded by power actuated guide rolls having their axes of rotation at substantial right angles to the center line of the mill, and act to divert successive increments of the metal of the work-piece from its natural tangential flow into a longitudinal direction. While the surface presented by the power driven guide rolls effectively guides and assists the work-piece longitudinally through the pass in such manner as to reduce rotational friction, which would occur if antiquated stationary guiding members were employed, they still impose considerable resistance to rotation of the work-piece which it is desirable to eliminate, particularly when tubes of thin walls are being processed.

In a second copending application, entitled Method and apparatus for forming tubular blanks, Serial No. 670,345, filed May 10, 1933, novel extraneous assisting forces are disclosed for assisting both rotational and longitudinal travel of a work-piece through a "piercing" operation. These extraneous forces comprise a pair of substantially cylindrical power actuated feed rolls which are disposed intermediate the metal working rolls with a slight angle of inclination to the center line of the mill. The longitudinal feeding tendency resulting from the cross-setting of these power actuated feed rolls is greater than the forward feeding tendency of the metal working rolls with equal surface speeds, thus tending to divert metal longitudinally and preventing excessive bulging or ovality and at the same time assisting rotation of the work-piece.

One object of the present invention is the provision of a novel apparatus for expanding the diameter and reducing the wall thickness of previously pierced billets while diverting successive increments of metal of the work-piece from tangential flow into a longitudinal direction in such manner as to positively assist both longitudinal and rotational direction thereof.

Another object is the provision of novel means for controlling the perimeter of a tubular work-piece and obtaining an extremely orderly movement of the metal while effecting very substantial changes in diameter and wall thickness.

These and further objects will be apparent after referring to the drawings, in which:

Figure 1 is a plan of the apparatus of the invention with one of the extraneous assisting forces removed, and showing the work-piece in section.

Figure 2 is a side elevation with one metal work roll removed.

Figure 3 is a fragmentary elevation of one of the extraneous assisting forces of the invention shown together with an expanding plug and a work-piece in section.

Figure 4 is a view similar to Figure 3 of a modified form of an extraneous assisting force.

Figure 5 is a sectional end elevation of the novel metal working pass of the invention taken relatively adjacent the outlet end thereof.

Figure 6 is a composite view disclosing the relation of one metal working roll to one of the feed rolls, in a plane substantially 90 degrees from its true position in the mill.

Referring more particularly to the drawings, the numeral 2 designates a pair of cone-shaped metal working rolls of conventional design. The metal working rolls, when taken together, provide relatively narrow converging surfaces 2^a and elongated diverging surfaces 2^b.

The novel extraneous assisting forces of the invention comprise a pair of substantially cone-shaped power actuated feed rolls 3 which are disposed intermediate the metal working rolls 2 and in a manner somewhat similar to the latter. These power actuated feed rolls 3 provide contact surfaces which continually diverge from the center line of the mill and are provided with annular grooves 4 which enable them to more effectively grip the metal of a work-piece being processed by the metal working rolls, and are driven in such manner that their surfaces rotate at a speed at least equal to the surface speed of the metal working rolls, which is, of course, substantially greater than that of the longitudinal travel of the work-piece.

The feed rolls 3 are "canted" or given a slight angle of inclination horizontally with respect to their axes, resulting in a longitudinal feeding tendency which is at least equal to the forward feeding tendency of the metal working rolls 2 with equal surface speeds, and may, of course, be increased by either increasing the angle of the feed rolls or their surface speeds.

A mandrel or expansion plug 5 is supported on a bar 6 and positioned within the tubular blank or work-piece, which is indicated at A, during the processing operation, and is provided with a rearward cylindrical portion 5a to preclude the possibility of its making contact with the work-piece as it leaves the outlet end of the mill.

Referring to Figure 5 of the drawings, a pair of small stationary guiding members 7 are profiled to permit of close proximity of the metal working rolls 2 and the feed rolls 3 and are disposed to permit a small contact area 7a to limit the lateral bulging of the work-piece A, particularly as the forward and rearward ends thereof are passing under the rolls.

In operation, the tubular blank or work-piece A is introduced into the converging section of the metal working pass, which is defined by the converging surfaces 2a of the metal working rolls where its horizontal diameter is slightly reduced immediately prior to the contact of the work-piece with the mandrel 5. As the work-piece A contacts with the mandrel and is reduced in wall thickness between the diverging surfaces 2b of the metal working rolls a substantial expansion in the diameter of the same will be effected, together with an accompanying reduction in wall thickness, due to the relative positions of the various working surfaces.

Immediately the work-piece enters this section of the pass or shortly thereafter, it will come into contact with the corrugations or annular grooves 4 of the metal working rolls 3 which will serve to divert successive increments of metal thereof from a natural tangential flow into a longitudinal direction, which is accompanied by a positive assistance to both rotational and longitudinal travel, excessive distortion or ovality being limited to a minimum.

As the work-piece A progresses into that section of the pass defined by the rearward portions of the metal working rolls 2, the rearward smooth or uncorrugated portions of the feed rolls 3 and the rearward portion of the mandrel 5, the wall of the work-piece is brought to a uniform thickness while still in contact with the feed rolls 3. Immediately the work-piece reaches the last contact areas of the feed rolls 3 it will be "rounded up" between the very extreme rearward portions of the metal working rolls 2. The work-piece may be subsequently "reeled", if desired.

Referring to Figure 4 of the drawings, there is disclosed a modified form of feed roll 3 which is shown as having threads, or helical corrugations 4a on its contact surface in order to accomplish a greater tendency to rotate the work-piece than would be the case were the rings annular, as in Figures 2 and 3. In this form of the invention, even though the axes of the feed rolls 3 are disposed parallel in a vertical plane to the center line of the mill, a very decided rotational and longitudinal feeding tendency will be obtained by increasing the surface speed of the feed rolls proportionately to that of the work-piece. The angle of the threads or helical corrugations 4a is regulated to govern the magnitude of the rotational and longitudinal assisting effect desired. It will be understood, of course, that the processing of the work-piece is in all respects similar to that previously described.

While I have shown and described several specific embodiments of my invention, it will be understood that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of my invention, as defined in the following claim.

I claim:

In an apparatus for expanding a tubular metal work-piece the combination of a conical mandrel, conical reducing rolls disposed in cooperative relation with the mandrel to form a pass and cause the blank to bulge laterally away from the mandrel and to move the metal of the blank helically, said reducing rolls having their wall-reducing portions materially longer than their individual remaining portions and substantially divergent with respect to each other, and blank feeding means including blank-engaging cross-feed rolls located in the pass with their axes lengthwise thereof, said feed rolls being conical and presenting portions extending lengthwise of the pass for contact with the blank longitudinally thereof to limit bulging of the blank and to apply extraneous feeding forces to the blank for assisting both the longitudinal and peripheral components of the movement of the metal, said feed rolls being peripherally grooved for furthering the longitudinal component and having their contact surfaces spaced a materially greater distance from the longitudinal center line of the pass than the corresponding surfaces of said reducing rolls.

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