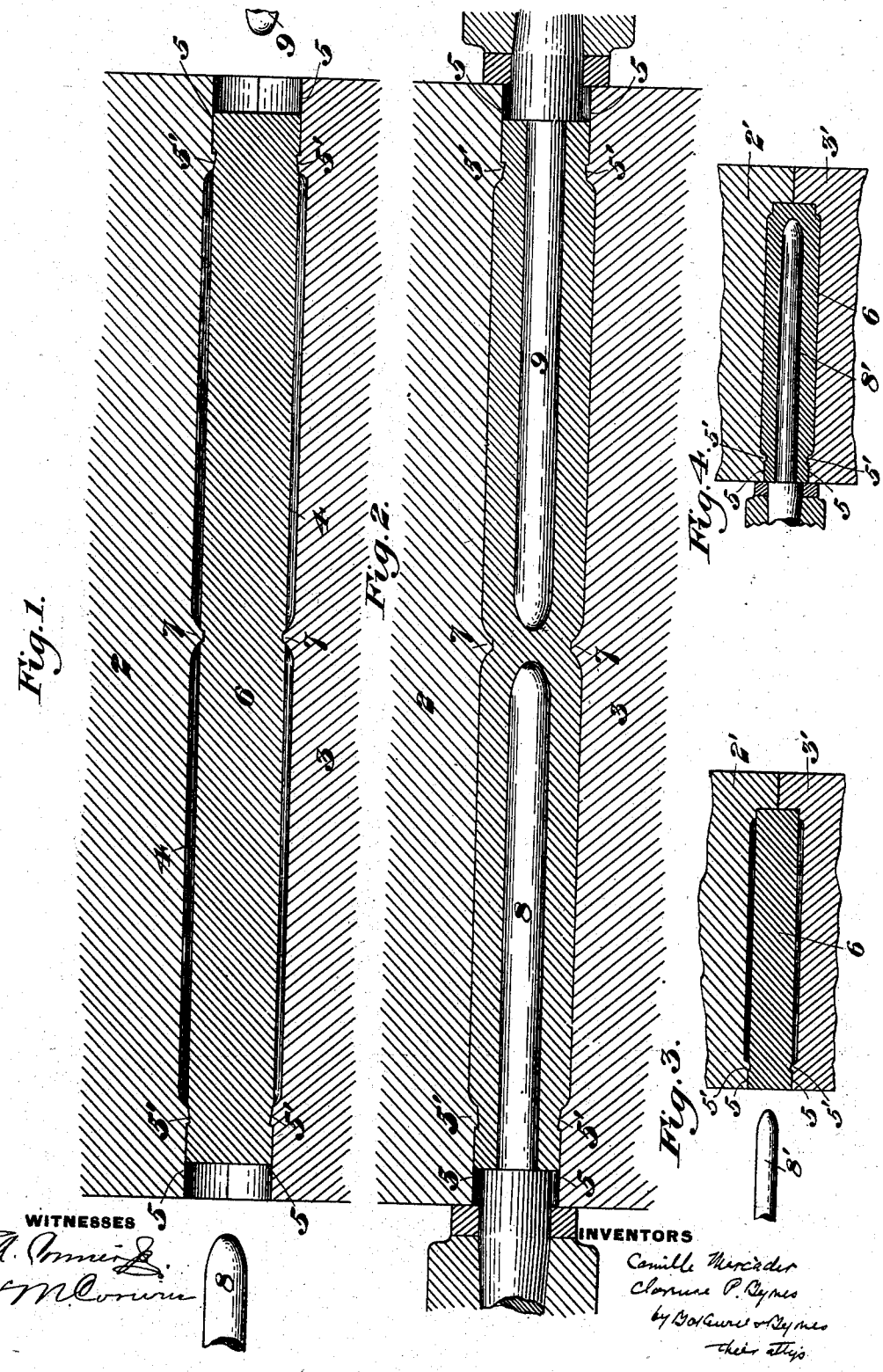
No. 717,886. PATENTED JAN. 6, 1903.

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METHOD OF MAKING SEAMLESS TUBES OR HOLLOW ARTICLES.

APPLICATION FILED JULY 14, 1902.

NO MODEL. 2 SHEETS—SHEET 1.



THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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Fig. 5.

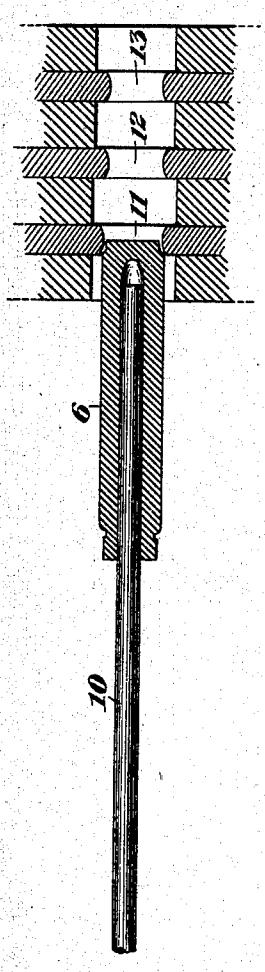


Fig. 7.

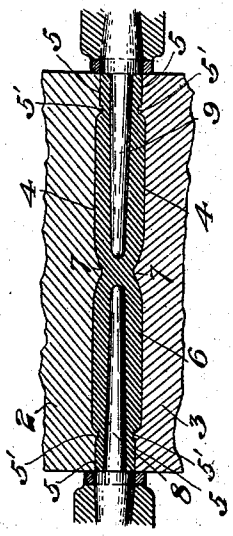
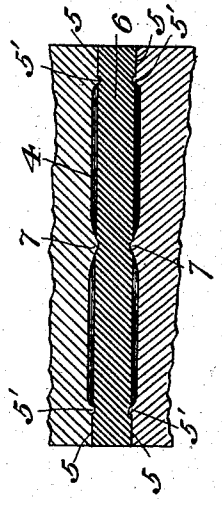


Fig. 6.



WITNESSES

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UNITED STATES PATENT OFFICE.

CAMILLE MERCÀDER AND CLARENCE P. BYRNES, OF PITTSBURG, PENNSYLVANIA.

METHOD OF MAKING SEAMLESS TUBES OR HOLLOW ARTICLES.

SPECIFICATION forming part of Letters Patent No. 717,886, dated January 6, 1903.

Application filed July 14, 1902. Serial No. 115,414. (No model.)

To all whom it may concern:

Be it known that we, CAMILLE MERCÀDER and CLARENCE P. BYRNES, of Pittsburg, Allegheny county, Pennsylvania, have invented a new and useful Method of Making Seamless Tubes or Hollow Articles, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a partial sectional side elevation illustrating the step of piercing a billet. Fig. 2 is a similar view showing the piercing operation as completed. Figs. 3 and 4 are views similar to Figs. 1 and 2, respectively, showing a modified form. Fig. 5 is a sectional side elevation showing the drawing of the pierced billet; and Figs. 6 and 7 are views similar to Figs. 1 and 2, showing the method of forming projectiles under our method.

Our invention relates to the method of making seamless tubing and seamless hollow articles, and is designed to afford a new and improved method by which an improved product may be obtained rapidly and at comparatively small cost.

Heretofore in piercing billets for the manufacture of seamless tubes, &c., two methods have been attempted, in one of which a billet of angular cross-section has been expanded within a cylindrical mold-cavity by a piercing-mandrel, while in the second a heated billet is forced forwardly over a stationary mandrel. In the first method difficulties have arisen owing to the compressing of the billet endwise when the mandrel is forced into it. Moreover, owing to the angular section there is an unequal lateral pressure upon the metal which gives a non-uniform quality of metal in the product. A further difficulty with this method lies in the fact that it is not practicable to remove the scale from an angular billet. In the second method the metal is compelled to flow against the punch, thus giving a large amount of friction and requiring excessive power. In both of these methods the metal is allowed to flow freely in one or more directions, and hence the resulting pierced billet is not compressed and densified.

Our method overcomes these difficulties and gives a compressed and densified hollow billet of uniform quality throughout and also of more uniform chemical composition than formerly.

In carrying out our method a mold-cavity is formed by a plurality of clamping-dies having mating recesses. The mold or forming cavity is provided with portions of reduced diameter, which when the dies are forced together engage and grip portions of the heated cylindrical blank to prevent its endwise compression during piercing. The piercing-mandrels, of which we prefer to use two, are forced in simultaneously from opposite ends to approximately the center of the blank, which is thus pierced and expanded to fill the mold-cavity. The punches preferably enter through the clamped end portions and force the displaced metal in these portions forwardly into the mold-cavity. The metal is prevented from flowing freely in any direction and is forced sidewise by the punches and compressed during the latter portion of the stroke. By slightly tapering the punches from the base toward the point a very high compression can be exerted upon the metal, and by changing the proportion of the cubical contents of the punches relatively to that of the annular space between the blank and the mold-cavity the amount of this compressing action can be regulated whether the tapered form of punch is used or not. If substantially no compression is desired, the punches may be proportioned so that their cubical contents are the same as or slightly less than that of the annular space. A hollow billet is thus produced having a portion or portions of smaller diameter than the expanded parts and with a central dividing-web between the holes. If a tube is to be formed, the billet may be cut in two at the center, leaving a part of the web to close the end of each half, and the two blanks may then be drawn over a mandrel in the ordinary manner or the central web may be cut out either with or without cutting the billet in half and the hollow blank or blanks then elongated by the well-known system of swaging-rolls or otherwise, as desired. If articles having closed ends, such as carbonic-acid bottles or projectiles, are to be formed, the billet may be severed

at the center, leaving the web portions to close the ends of the two blanks, which are then drawn or otherwise formed into final shape.

In the drawings, referring to Figs. 1 and 2, 2 represents an upper die and 3 a lower die, these dies having mating recesses which form a cylindrical mold-cavity 4. At the ends of this cavity the recesses are made shallower, as shown at 5, in order to grip the end portions of the cylindrical blank 6. These gripping portions are preferably provided with shallow ridge portions 5′, which will bite into the blank and firmly clamp it to prevent endwise compression. The projections may be arranged to give a diameter, say, of one-eighth of an inch less than that of the blank. At the center of the mold-cavity we preferably provide projections 7, forming an annular ring of general V shape which centers the middle portion of the blank and may also be used to grip it at this point. When the heated cylindrical blank has been treated to remove the scale after heating, as by the use of skew-rolls between which the heated blank is passed, it is inserted between the dies 2 and 3, one (or both) of which is then moved to clamp and center the blank in the mold-cavity, as shown in Fig. 1. The piercing-mandrels 8 and 9 are then forced in simultaneously from opposite ends through the end holes to or approximately to the center of the blank.

If the blanks are to be elongated by drawing, a sufficient distance is left between the ends, so that when the blank is cut in two at the center each half blank will be closed by the web portion. If the web is to be removed, the mandrels are preferably forced close together—say within a sixteenth of an inch of each other. The mandrels are then withdrawn and the pierced blank removed and cut in two at the center, and each half may then be transferred to a drawing apparatus and be drawn in the usual manner, as shown in Fig. 5. In this figure, 10 represents the plunger of a hydraulic cylinder, this plunger preferably having a flat end which will square up the inner conical end of the hole, and thus reduce the amount of scrap formed in cutting off the end after drawing. By this plunger the blank is forced through a series of dies, (shown diagrammatically at 11, 12, and 13,) thus forming a seamless tube by drawing the hollow billet. If desired, the web at the center of the double blank may be removed by a cylindrical cutting-tool and the blank elongated by swaging-rolls without cutting in two, or the blank may be cut in two and the web portions then removed before elongating.

The use of two plungers presents many advantages in that the tendency to push the metal endwise is neutralized and a billet of twice the ordinary length may be used, thus reducing the number of blanks, with a consequent saving in heating and handling. Our process may, however, be carried out by the use of a single mandrel. Thus in Figs. 3 and 4 we show the dies 2′ and 3′ as closed at one end, a single piercing-mandrel 8′ being employed. The blank formed by this method will be about one-half the length of that in its first form and will be closed at one end. This blank may be then removed and drawn in dies to the desired form or the end web removed and the blank elongated by swaging or otherwise as desired.

In forming projectiles either the single or double form of dies may be used. We show the double form in Figs. 6 and 7. In this case the central collar or projection 7 is preferably made deeper and is shaped so as to partially form the inner ends of the two halves to approximately the form of the head of a projectile. The piercing is carried out the same as before, and the two articles are then cut apart and the conical ends shaped to the desired form. In the single form the die-cavity could be formed to shape the point of the projectile during the piercing operation.

The advantages of our invention result from the piercing and expanding of a heated blank while it is gripped and centered by clamping-dies. The metal is prevented from being pushed endwise and is accurately centered, while the unequal diameters of the blank do not interfere with the following operations. In the preferred form a cylindrical blank is expanded within a cylindrical mold-cavity, and here the compression in expanding is equal in all parts, giving a uniform quality of metal throughout the blank. A much more uniform and solid block is thus obtained, especially where it is compressed against the walls of the cavity, than with previous methods, and the compression also tends to diffuse the chemical constituents, giving an even distribution of them and increasing the ductility. The amount of compression is easily regulated by varying the volumetric proportion of the plungers relatively to the annular space around the blank or by using a tapered mandrel, or both. As the metal cannot flow, it is expanded within the cavity and an accurate blank formed. Where the double form of blank is used, the cost of heating and handling the blanks is reduced.

The shape and size of the dies and their recesses, as well as that of the blank, may be varied widely. A cylindrical blank may be expanded within a mold-cavity of angular cross-section, thus giving a pierced billet having an angular cross-section. The length of the mandrel may be varied; but if steel is used its length should be less than twelve times its diameter, while if cast-iron is used its length should be less than five times its diameter.

Many other variations may be made in the apparatus and various mechanism may be used for transferring the blanks from the punching apparatus to the drawing or elongating apparatus and for the heating and

scale-removing devices without departing from our invention.

We claim—

1. The method of making pierced billets and similar articles, consisting in clamping a small end portion of the blank by forcing short side clamping-dies against said portion and then successively and continuously piercing the short clamped portion, and piercing and expanding the unclamped portion substantially throughout its length; substantially as described.

2. The method of forming pierced billets and similar articles, consisting in clamping a short end portion of a cylindrical blank by forcing short side clamping-dies against said portion, surrounding the unclamped cylindrical portion of the blank by a cylindrical mold of larger diameter, and then successively and continuously piercing the short clamped portion, and piercing and expanding the unclamped portion substantially throughout its length; substantially as described.

3. The method of making pierced billets and similar articles preparatory to further operations, consisting in clamping short end portions of a blank by forcing short lateral clamping-dies against said portions, and then simultaneously forcing punches inwardly from both ends of the blank to substantially its center to pierce the clamped portions and pierce and expand the unclamped portion substantially throughout its length; substantially as described.

4. The method of forming pierced billets and similar articles, consisting in clamping short end portions of a blank by forcing short lateral clamping-dies against said end portions, then simultaneously forcing punches inwardly from both ends of the blank to substantially its center to expand the unclamped portion, and then transversely severing the expanded billet, substantially as described.

5. The method of forming seamless tubing and similar articles, consisting in clamping short end portions of a cylindrical billet by forcing short clamping-dies sidewise against said end portions, surrounding the billet by a cylindrical mold-cavity of larger diameter and of approximately the same diameter throughout, simultaneously forcing punches from both ends to substantially the center of the blank to expand it within the mold-cavity, and then removing the pierced billet and elongating into final form; substantially as described.

6. The method of forming seamless tubing and similar articles, consisting in applying external lateral pressure to a short portion of a blank, piercing and expanding the blank simultaneously from opposite ends to near the center, and severing the blank at the center, leaving a web to close the end of each blank; substantially as described.

In testimony whereof we have hereunto set our hands.

CAMILLE MERCÄDER.
CLARENCE P. BYRNES.

Witnesses:
H. M. CORWIN,
L. A. CONNER, Jr.