Oct. 24, 1933. W. H. ENGELBERTZ 1,932,266

APPARATUS FOR MAKING SEAMLESS TUBULAR ARTICLES

Filed Aug. 3, 1931

FIG. 1.

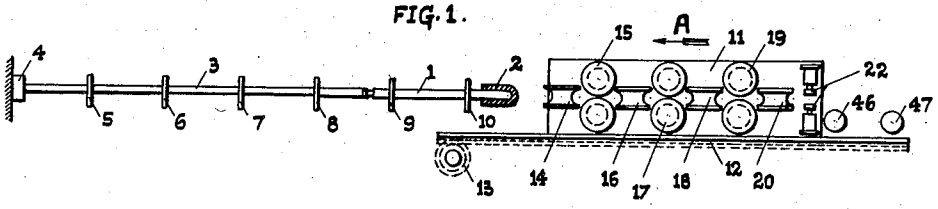


FIG. 2.

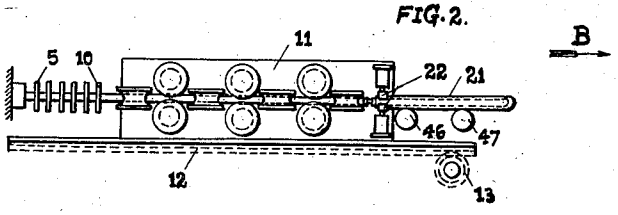


FIG. 3.

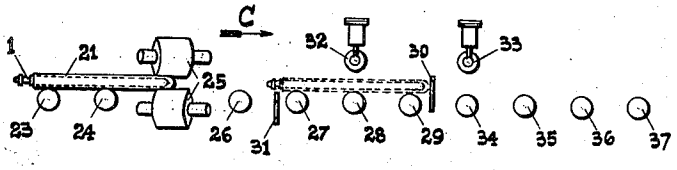
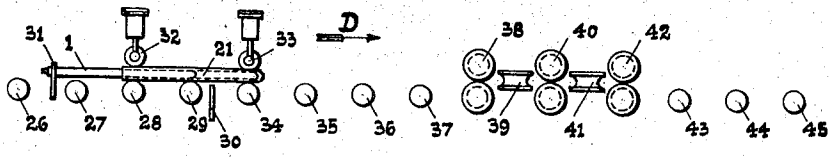


FIG. 4.



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APPARATUS FOR MAKING SEAMLESS TUBULAR ARTICLES

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5 Claims. (Cl. 80—12)

This invention relates to the manufacture of seamless metal tubes, or other seamless tubular articles. It is generally known that seamless metal tubes are produced from cup-shaped billets by the so-called pushbench apparatus, in which a heated cup-shaped billet is placed on the front end of a mandrel and forced through a set of ring-shaped dies with successively decreasing diameter. The costs of such a process are very high as the enormous axial stresses frequently upset the front end of the mandrel, which must be reshaped, and tear the bottom of the billet to be stretched, thus rendering the billet practically useless for this purpose. Moreover, a substantial wear of the dies caused by the sliding friction of the passing billet to be reduced in diameter, occurs in such a process and, therefore, these dies must frequently be exchanged. Furthermore, a very high stress is imposed on the material-fibers of the billet being forced through a succession of ring-shaped dies, thus making the use of low-grade material for the production of seamless tubes impossible.

The general object of the present invention is to provide a method and apparatus to eliminate the above mentioned set-backs of the pushbench process, thereby decreasing the high manufacturing costs of seamless tubes, and effecting manufacture of such goods in a more efficient, expeditious and economical manner.

All advantages comprehended by this invention will be specifically described hereinafter, and will be particularly pointed out in the appended claims. To enable those skilled in the art to readily comprehend and practice this invention, reference should be made to the accompanying drawing. I wish to have it understood that it is not my intention to confine or limit myself to any specific details of construction described or illustrated herein, since changes and alterations will readily suggest themselves to those skilled in this art without departing from the spirit and scope of the invention.

Seamless tubes, or other tubular articles to be manufactured according to the invention are preferably made from square or round billets, previously heated and shaped to cup-like form, that is, a hollow body with bottom at one end. One of these cup-shaped billets is placed on the front end of a mandrel and, thereafter, is formed to a tube of desired cross-section by forcing a number of non-driven roll sets, generally mounted upon a common frame, over the billet on said mandrel which is held stationary during the forming process. Each of said roll sets includes two or more rolls, and the successive roll sets show a decrease in the size of their roll grooves to gradually shape and form the cup-like billet to approximately the desired outside diameter of the tube to be made.

The shaped tube hugs tightly to the mandrel and, therefore, the mandrel and tube are jointly conveyed to any suitable means adapted to slightly expand the diameter of the tube on the mandrel, for instance, a reeling machine of old and well known design, in which a pair of cross rolls increase the tube diameter slightly and, simultaneously, equalize the tube wall. Suitable means then strip the tube from the mandrel while the latter is held stationary, whereupon the tube may be conveyed to cooperating roll sets which reduce and true its diameter.

The accompanying drawing shows one preferred embodiment of the invention in somewhat diagrammatical form in which—Fig. 1 is a view of a part of the apparatus, showing the mandrel in a stationary position and the shiftable frame mounting sets of rolls, advancing toward the mandrel to form and roll the billet, placed on the front end of said mandrel, into a tube. Fig. 2 is a view of the same parts of the apparatus disclosed in Fig. 1, the shiftable frame mounting the sets of rolls being advanced, and said rolls after having passed over the billet and shaped the same into a tube. Fig. 3 shows the mandrel and the tube, clinging thereto, passing the cross rolls of a reeling machine and, in dotted lines, the mandrel and tube being stopped in their advance after passing the cross rolls. Fig. 4 shows the separation of mandrel and tube in progress, and cooperating roll sets which may reduce and true the tube.

The stationary mandrel 1, supporting on its front end the cup-shaped billet 2, is provided with an extension or mandrel holder 3 which, in turn, has at its rear end a stationary abutment 4. The slidable guides 5 to 10, inclusive, serve to support the mandrel in proper position, and to avoid bending of the mandrel and its extension when shiftable frame 11, driven by rack 12 over pinion 13, supporting sets of non-driven rolls 14 to 20, inclusive, is advanced in direction of arrow A (Fig. 1) to shape and roll billet 2 to a tube 21, shown in Fig. 2.

The use of slidable guides 5 to 10, to support the mandrel and its holder, constitutes only an example of how said mandrel and its extension can be prevented from bending. Therefore, any suitable means may be employed to serve this purpose, in accordance with the invention.

To perform the tube-forming operation, any desired number of roll sets may be used, and the roll grooves of the succeeding sets should be of decreasing cross section so that the outside diameter of billet 2 is gradually decreased when the rolls pass over it. The rolls in the successive sets are so arranged that the parts of billet 2 between the circumferentially contacting points of the roll-grooves are covered by the grooves of the succeeding rolls. The mandrel 1 remains stationary, while billet 2 is rolled over said mandrel into a tube of desired wall thickness and length, and is held against backward motion by the mandrel shaft or holder 3 which, in turn, is held stationary by the abutment 4.

Upon termination of the rolling operation, frame 11 with roll sets 14 to 20, inclusive, is shifted back to its initial position by reversing the drive of rack 12, thereby shifting mandrel 1 with adhering tube 21, supported by rollers 46 and 47, in direction of arrow B (Fig. 2) by means of grippers 22, attached to frame 11. The mandrel and tube will be released by said grippers when reaching the conveying rollers 23 and 24, located at the inlet-side of cross rolls 25 of a reeling machine. Said cross rolls then grip tube 21 with mandrel 1 and, while slightly expanding the tube diameter, equalize the tube wall.

After the reeling operation, tube 21, with mandrel 1 still inside, is conveyed in the direction of arrow C (Fig. 3) until it reaches rollers 26 to 29, inclusive, where the advancement of the tube is temporarily checked by stop 30 until the mandrel is engaged, that is, arrested by stop 31. Said stops are connected by suitable means (not shown on the drawing) to operate alternately, that is, while stop 30 is lowered stop 31 is raised, and vice versa. By the lowering of stop 30, as shown in Fig. 4, the rollers 32 and 33 are pressed downward upon tube 21, thereby cooperating with the driven rollers 28 and 34 to strip tube 21 off mandrel 1.

Then the released tube, after its ends have been cut off by a hot-saw or other suitable means (not shown on the drawing), while advancing in the direction of arrow D (Fig. 4) over conveying rollers 35, 36 and 37, may pass the roll sets 38 to 42, inclusive, in order to be reduced or trued to the desired diameter. Any suitable number of roll sets may be employed for this purpose, and each roll set may comprise at least two or more rolls. Tube 21 may be reheated, if desired, before passing said roll sets. The tube thus finished then is received by rollers 43, 44, 45.

What I claim is:

1. Apparatus for making seamless tubular articles from cup-shaped billets, comprising a mandrel adapted to support at its front end a cup-shaped billet, means to hold said mandrel against longitudinal motion in backward direction, longitudinally shiftable elongating means adapted to roll said billet upon said mandrel into a tube by forcing said elongating means over said billet, means to slightly expand the diameter of said tube on said mandrel, means to separate said mandrel from said tube by advancing said tube while holding said mandrel stationary, and rolling means in line with, and receiving said tube from, said separating means, to further reduce and true said tube.

2. Apparatus for forming seamless tubing from cup-shaped billets, comprising a mandrel adapted to support at its forward end a cup-shaped billet, means to hold said mandrel at its rear end against longitudinal backward motion, a longitudinally shiftable frame supporting sets of cooperating rolls adapted to roll said billet into a tube by shifting said frame toward and over said mandrel, means, bearing on said frame, to advance said mandrel and tube in forward direction by moving back said frame to its initial position, means to slightly expand the diameter of said tube, means to separate said mandrel from said tube by advancing said tube while holding said mandrel stationary, and cooperating rolls to further shape and true said tube.

3. Apparatus for rolling seamless tubes from cup-like billets, comprising a mandrel adapted to support at its front end a cup-like billet, a stationary mandrel-holder supported by an abutment at its rear end, preventing said mandrel from longitudinal backward motion, shiftable means to support said mandrel and mandrel-holder and to prevent said mandrel and mandrel-holder from bending, a frame supporting sets of cooperating rolls shiftable to force said rolls over said billet to form said billet into a tube over said mandrel, said frame having means thereon to advance said mandrel and tube in a forward direction while the frame is returning to its initial position, means to slightly expand the diameter of said tube on said mandrel, shiftable holding means to stop the motion of said mandrel, and positive means to advance the tube while said mandrel is arrested by said holding means, thus separating said mandrel and tube.

4. Apparatus for forming seamless tubular articles from cup-shaped billets, comprising a mandrel adapted to support at its front end a cup-shaped billet, means to prevent backward motion of said mandrel, longitudinally shiftable rolling means to form a tube from said billet on said mandrel while forcing said rolling means over said billet and mandrel, means operated by the return of said rolling means to its initial position to advance said mandrel and tube to a conveyor, means at the end of said conveyor to slightly expand the diameter of said tube on said mandrel, means to further advance said tube and arrest said mandrel, and cooperating rolls to further shape said tube to the desired size.

5. Apparatus for forming seamless tubular articles from cup-shaped billets, comprising a mandrel adapted to support at its front end a cup-shaped billet, means to hold said mandrel against backward motion, longitudinally shiftable rolling means adapted to roll said billet upon said mandrel into a tube, means operated by the return of said rolling means to its initial position to advance said mandrel and tube in a forward direction to a conveyer, means at the end of said conveyor to slightly expand the diameter of said tube on said mandrel, means to convey said tube and said mandrel to a separating device including separate stops adapted to stop the forward motion of said tube and mandrel and grip the rear end of said mandrel, cooperating conveying means to advance said tube while said mandrel is held stationary, thus separating said mandrel from said tube, and cooperating rolls to further reduce and true the diameter of said tube, all of said working steps being performed without reheating said billet or said tube.

WILLIAM H. ENGELBERTZ.