

[54] **METHOD FOR MANUFACTURE OF SEAMLESS TUBE**
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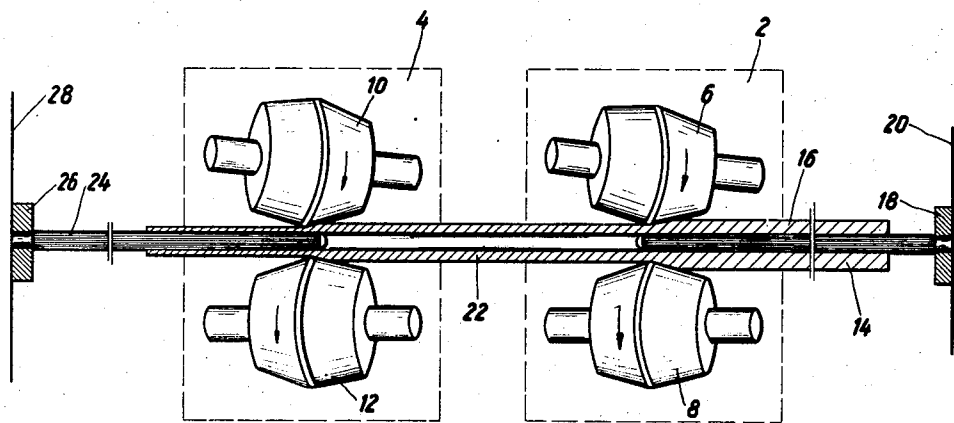
[56] **References Cited**
UNITED STATES PATENTS
401,143 4/1889 Flagler.....72/97

401,144	4/1889	Flagler.....	72/97
1,077,013	10/1913	Stiefel.....	72/97
2,528,651	11/1950	Gross.....	72/97
1,826,360	10/1931	Mazurie.....	72/97
1,088,650	2/1914	Brinkman.....	72/96
1,499,535	7/1924	Katzenmeyer.....	72/98
3,503,238	3/1970	Marcovitch.....	72/96

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[57] **ABSTRACT**
A method of manufacturing seamless tubing from a tubular bloom is provided in which the bloom is reduced on a mandrel or like rod in a first skew rolling mill inserted into the bloom, and the tube issuing from the first skew mill is immediately rolled in a continuous manner on a mandrel or like rod in a second skew mill directly contiguous to the first skew mill.

10 Claims, 2 Drawing Figures



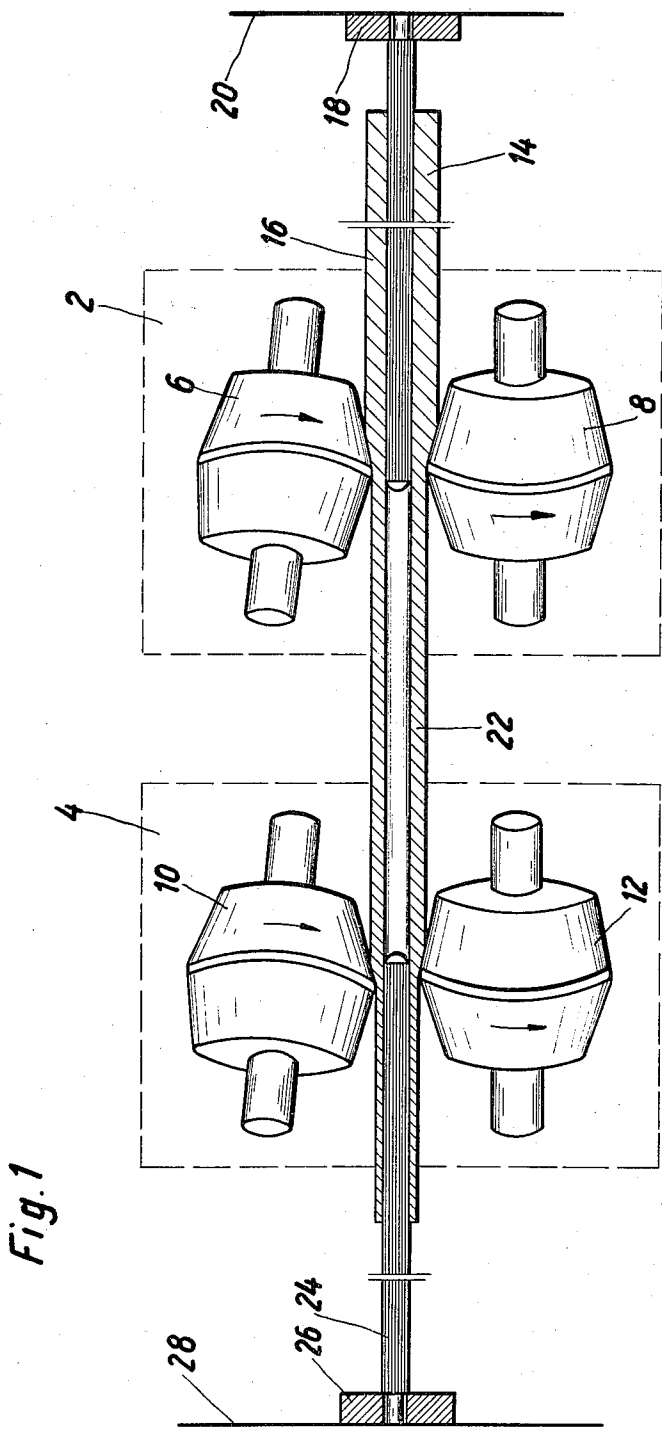


Fig. 1

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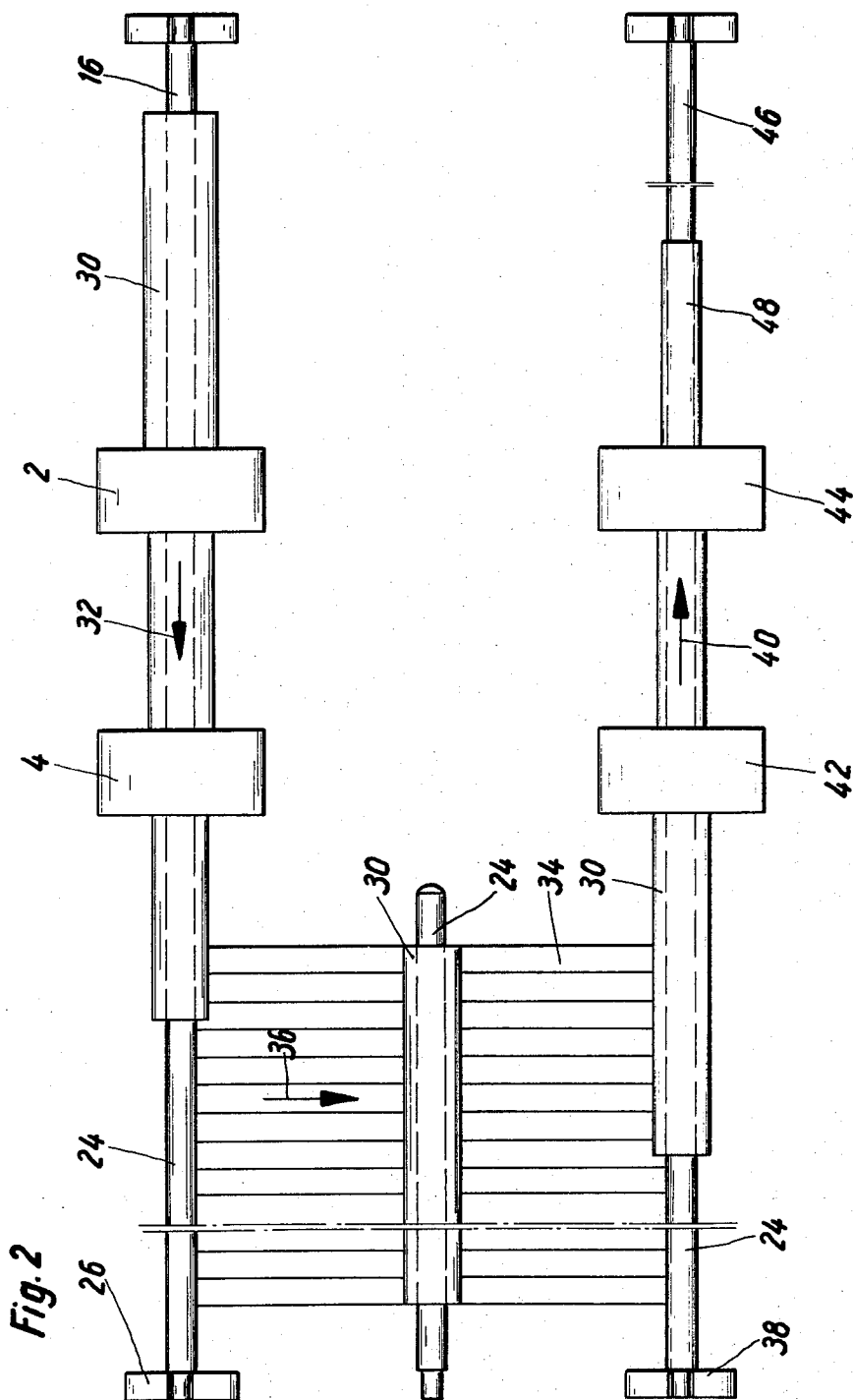


Fig. 2

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METHOD FOR MANUFACTURE OF SEAMLESS TUBE

This invention relates to methods for manufacture of seamless tube and particularly to a method of manufacturing seamless tubing from a tubular bloom in a skew rolling mill with the aid of a mandrel rod or a stopper rod.

Although nowadays welded tubes can be manufactured in a relatively simple manner with a welding factor of about unity (the welding factor is the ratio of the strength of the weld to strength of the parent metal) there are specific fields of application wherein seamless tubing is used exclusively, particularly when the tubes are to be used at high pressures and temperatures. There are many methods of manufacturing seamless tubes. By means of the Mannesmann process, solid ingots have a hole formed therein in a skew-rolling mill and are rolled on a mandrel. A large number of rolling mills operating on different principles are known for rolling out pre-hollowed ingots or hollow-cast ingots. However, some of the conventional methods of manufacturing tubing are still relatively expensive and some of them have a low output and can produce only relatively short lengths of tubing, the longest tubes (of about 30 meters in length) being produced by the Pilger rolling line.

A feature of the present invention is to provide a method for manufacturing seamless tubes from tubular blooms, by which method long lengths of tubing can be manufactured economically and with a high output.

In accordance with the invention, the bloom is rolled in a first skew-rolling mill on a mandrel rod or stopper rod previously inserted into the bloom, and the tube issuing from the first skew-rolling mill is simultaneously rolled onto a second mandrel rod or stopper rod in a continuous process in a second skew-rolling mill directly contiguous to the first skew-rolling mill.

In performing the process of the present invention, in which the rolled material passes through successive skew-rolling mills, the metal can be worked with greater deformation and a lower consumption of heat. In addition to improved economy, the tubes can be produced with a very uniform wall thickness.

Advantageously, the first and the second mandrel rod or stopper rod rotate at the same speed, thus preventing twisting of the tube between the two rolling mills. Furthermore, it is advantageous to operate with continuity of volume or slight tension between the first and the second skew-rolling mill, thus preventing the tube between the two rolling mills from being telescoped. The rotational speed of the second mandrel rod or stopper rod, and the tension between the first and the second skew-rolling mill, can be controlled automatically by varying the skew angle of the rollers and/or the speed of rotation of the second skew-rolling mill, the speed of rotation of the first mandrel rod or stopper rod and the axial movement of the rolled material between the two skew-rolling mills being used as reference values.

Any kind of hollow ingots which are cast by the continuous casting or centrifugal casting methods, or by inserting a central interior tube into a chill mould, or which are manufactured in a piercing press, can be further processed by the method of the present invention. When using tubular blooms which come from a piercing press or which have previously been expanded

by means of a mandrel, the expansion tool or the piercing tool may be left in the bloom and used in the first skew-rolling mill as a mandrel rod by which the bloom is reduced.

The process may be interrupted after the passage of the tube through the second skew-rolling mill. However, after the tube has passed through the second skew-rolling mill it is possible to guide the tube, together with the second mandrel located in the interior of the tube, into a further skew-rolling mill in which the tube is reduced on the mandrel rod and thereby further elongated and the wall thickness reduced. At the same time, the tube issuing from the third skew-rolling mill can, if required, be simultaneously rolled onto a further mandrel rod in a continuous process in a fourth skew-rolling mill immediately contiguous to the third skew-rolling mill.

Furthermore, after the first pass of the rolled material through the first and second skew-rolling mills, it is possible to adjust the two skew-rolling mills to a smaller diameter and to roll back the rolled material along the same path but in a reverse direction, or to guide the rolled material through the twin a plurality of times in the same direction after corresponding roller adjustment. Thus, only a single mandrel rod of appropriate length is required on which the tube is rolled out in one or a plurality of passes.

In order to increase the deformation the second skew-rolling mill may comprise a three-roller stand.

The method of the present invention is not limited solely to shoulder drawing-roller mills. It is also possible, for example, to connect tube expansion mills in tandem according to the given conditions, in order to manufacture thin-walled tubes of larger diameter.

Finally, the raw material may be in the form of a solid ingot which has a hole formed therein in the first skew-rolling mill and which is rolled over a stopper whose rod extends through the second skew-rolling mill. The tube issuing from the first skew-rolling mill may then be rolled on the stopper rod or further elongated in the second skew-rolling mill which directly follows the first skew-rolling mill.

When the bloom is reduced on a single mandrel rod, more than two skew-rolling mills may be connected in tandem if required, each set of rollers being controlled by the reference parameters of the tube issuing from the preceding stand.

The invention is further described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a partially sectioned, diagrammatic plan view of a device for carrying out the process of the invention, and

FIG. 2 is a diagrammatic plan view of a device having four rolling stands for carrying out the process of the invention.

Referring to FIG. 1 of the drawings, a rolling mill for carrying out the method of the invention comprises two skew-rolling mills 2 and 4 which are arranged one behind the other a short distance apart and in which respective skew rollers 6, 8 and 10, 12 are journaled. Alternatively, stands having three skew rollers offset by 120° relatively to one another may be used instead of the two-roller frames illustrated in the drawing.

The tubular bloom 14, which may be manufactured by any desired process, is reduced in the first skew-rolling mill 2 on a mandrel 16 which is rotatably mounted on a support 20 by means of a bearing 18.

The tube 22 which is reduced on the mandrel 16 and which issues from the first skew-rolling mill 2 subsequently runs directly between the rollers 10 and 12 of the second skew-rolling mill 4 where it is rolled onto a second mandrel 24 the free end of which faces the free end of the first mandrel 16 and is located in the region of the pair of skew-rollers 10, 12. In the same manner as the first mandrel 16, the second mandrel 24 is rotatably mounted on a support 28 by means of a bearing 26.

The rollers 6 and 8 of the first skew-rolling mill 2 may be set at a fixed angle of skew and may be driven at a constant speed, while the angle of skew of the rollers 10 and 12 of the second skew-rolling mill 4 is adjustable to correspond to the speed of rotation of the rolled material or of the first mandrel 16 and to the advance of the tube 22 issuing from the first skew-rolling mill 2, and the speed of rotation of the rollers 10 and 12 is variable. To obtain optimum results, the rollers 10 and 12 of the second skew-rolling mill should impart to the rolled material the same rotational speed as the rollers 6 and 8 of the first skew-rolling mill 2. Furthermore, the rollers 10 and 12 of the second skew-rolling mill 4 must be controlled such that an adequate quantity of rolled material is conveyed through the gap between the rollers in order to prevent accumulation of material or buckling of the tube 22 between the two skew-rolling mills. Since it is probably difficult to obtain equal $Q \times v$ (volume per unit length times velocity) in the two skew-rolling mills, it is advantageous to operate with tension in the region between the two skew-rolling mills 2 and 4.

The roller control device (not illustrated in the drawings) for varying the skew position of the rollers and the speed of rotation of the rollers of the second skew-rolling mill operates automatically, the speed of rotation of the first mandrel rod 16 and the axial movement of the tube 22 between the two skew-rolling mills 2 and 4 being fed into the control device as reference parameters by means of appropriate sensing devices.

If the rollers of the two skew-rolling mills 2 and 4 are appropriately adjustable and can be driven in opposite directions or can be oppositely inclined, the rolled material can be passed once again through the two skew-rolling mills in the opposite direction after the first pass and after the rollers have been appropriately adjusted, the first mandrel rod 16 having to be replaced by a mandrel rod of correspondingly greater length. Furthermore, it would be possible, after appropriate adjustment of the rollers, to guide the rolled material a second time and even a third time in the same direction through the two rolling mills after appropriate interchange of the mandrels.

In the embodiment illustrated in FIG. 2, two parallel rolling lines are provided, wherein the rolling line located at the top of the Figure may be identical to the rolling line illustrated in FIG. 1. The rolled material 30 then runs through the skew-rolling mills 2 and 4 in the direction of the arrow 32, and is reduced in the first skew-rolling mill 2 by the mandrel 16 and is rolled onto the second mandrel 24 in the second skew-rolling mill 4.

When the rolling operation in the first rolling line has been completed and all the rolled material has been rolled onto the second mandrel 24, the mandrel 24 is released from its bearing 26 and, together with the tube 30, is introduced into the second rolling line in the direction of the arrow 36 by means of a transfer device 34. In the second rolling line, the end of the mandrel is again rotatably mounted on a stand by means of a bearing 38 and, in the same manner as the first rolling line, the tube 30 is guided in the direction of the arrow 40 through a third skew-rolling mill 42 and at the same time through a fourth skew-rolling mill 44 located directly behind the latter, the tube being reduced in the third skew-rolling mill 42 on the second mandrel 24 and rolled on a further mandrel 46 in the fourth skew-rolling mill 44. In this case, the wall thickness of the tube 30 is consequently reduced to a final thickness 48 in four passes. Thus, lengths of tube are obtainable which far exceed the lengths of seamless tube which can be manufactured by other methods.

In the foregoing specification I have described certain preferred practices and embodiments of my invention, however, it will be understood that this invention may be otherwise embodied.

I claim:

1. A method of manufacturing seamless tubing from a bloom comprising the steps of reducing the bloom to a first tube on one of a first mandrel rod and stopper rod inserted into the bloom in a first skew-rolling mill, transferring the end of the tube issuing from the first skew-rolling mill directly to one of a second mandrel rod and stopper rod coaxial with and separately spaced from said first mandrel and stopper rod and rotating at the same speed whereby the bloom and first tube are simultaneously rolled over a major portion of their length in a continuous process on said first and second mandrel rods and stopper rods in said first skew mill and in a second skew-rolling mill directly contiguous to the first skew-rolling mill and acting on the first tube on said one of a second mandrel rod and stopper rod to form said first tube into a second tube continuously and simultaneously with said first tube.

2. A method as claimed in claim 1 in which the tube is subjected to tension between the first skew-rolling mill and the second skew-rolling mill.

3. A method as claimed in claim 1 in which the speed of rotation of the second mandrel rod or stopper rod and the tension in the tube between the first skew-rolling mill and the second skew-rolling mill are automatically controlled by varying one of the oblique setting of the rollers and the speed of rotation of the second skew-rolling mill in accordance with the speed of rotation of one of the first mandrel rod and stopper rod, and the axial movement of the rolled material between the two skew-rolling mills.

4. A method as claimed in claim 1 wherein the bloom is formed on an elongated piercing tool in a piercing press, and the piercing tool is left in the bloom after the piercing operation to serve as a mandrel rod in the first skew-rolling mill.

5. A method as claimed in claim 1 in which the tube, together with the second mandrel rod located in the interior of the tube, is transferred from the second skew-rolling mill to a third skew-rolling mill in which the tube is reduced on the second mandrel rod.

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- 6. A method as claimed in claim 5 in which the tube coming from the third skew-rolling mill is simultaneously rolled on a further mandrel rod in a fourth skew-rolling mill directly contiguous to the third skew-rolling mill.
- 7. A method as claimed in claim 1 in which, after the first pass of the rolled material through the rolling line, the two skew-rolling mills are set to a smaller diameter and the rolled material is rolled back along the same path but in a reverse direction.
- 8. A method as claimed in claim 1 in which the rolled

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- material is guided several times through the rolling line in the same direction with appropriate adjustment of the rollers between passes.
- 9. A method as claimed in claim 1 in which a solid ingot is formed into a hollow bloom in the first skew-rolling mill about the free end of a mandrel rod extending through the second skew-rolling mill.
 - 10. A method as claimed in claim 1 in which the second skew-rolling mill comprises a three-roller stand.

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