

May 6, 1952

H. J. WALLACE
ROLLING MILL

2,595,910

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3 Sheets-Sheet 1

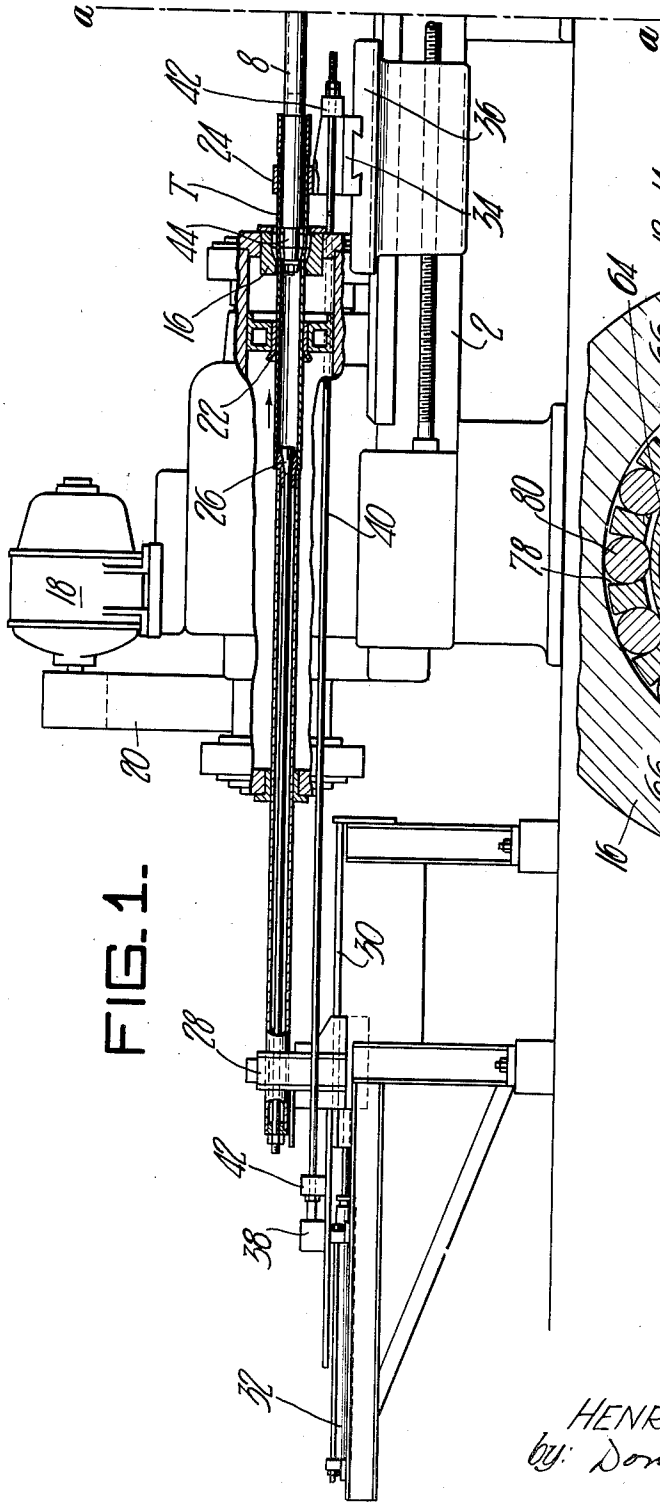


FIG. 1.

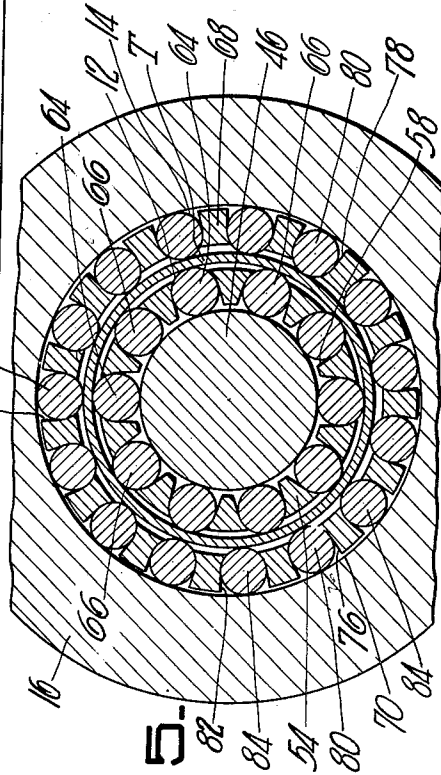


FIG. 5.

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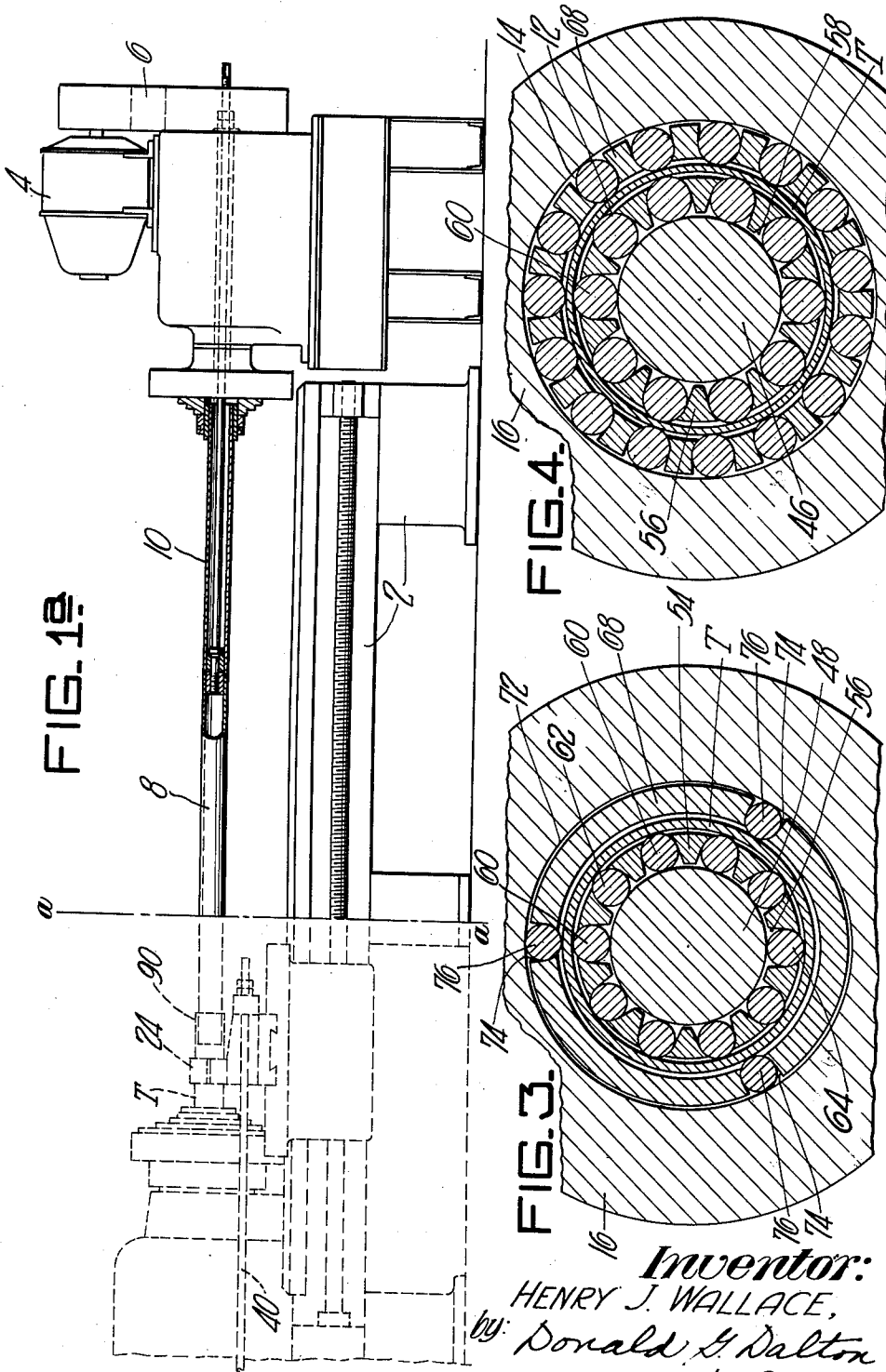
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3 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,595,910

ROLLING MILL

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2 Claims. (Cl. 80-12)

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This invention relates to a rolling mill and more particularly to such a mill for removing eccentricity from seamless tubing. The manufacture of seamless tubes is such that the wall thickness throughout the periphery of the tube varies and it is impossible to completely eliminate this eccentricity by any mill or method now in use. This residual eccentricity results in a tube which does not have maximum strength for its weight. Other disadvantages of the eccentricity in tubes is well known to those skilled in the art and it is therefore a problem which many have attempted to solve without success.

It is an object of my invention to provide a rolling mill which will remove eccentricity from seamless tubes.

Another object is to provide a method of removing eccentricity from seamless tubing.

These and other objects will be more apparent after referring to the following specification and attached drawings, in which:

Figure 1 is an elevation of part of the rolling mill;

Figure 1^a is an elevation of the remaining part, the entire mill being shown by uniting Figures 1 and 1^a along line *a-a*;

Figure 2 is an enlarged view of the rolls with a tube in position for working;

Figure 3 is a sectional view taken along the line III—III of Figure 2;

Figure 4 is a sectional view taken on the line IV—IV of Figure 2; and

Figure 5 is a sectional view taken on the line V—V of Figure 2.

Referring more particularly to the drawings, the reference numeral 2 indicates the bed of a lathe on which the mill is mounted. At one end of the bed 2 is a motor 4 which, through suitable gearing 6, rotates the mandrel 8 over which the workpiece T passes. The mandrel is made in sections, section 10 being removable to allow the finished tube to be removed from the mandrel. Such mandrels are common so that the details thereof need not be set forth here. The forward end of the mandrel carries the internal working rolls 12 in a manner which will be explained hereinafter. Surrounding the outer periphery of the tube T and cooperating with the rolls 12 are the outer working rolls 14 which are mounted in a rotatable housing 16 as will be explained in detail later. The housing 16 is rotated from the motor 18 through suitable gearing 20. A tube support 22 for supporting the tube T is mounted on the inlet side of the rolls 12 and 14 and a tube clamp 24 is arranged on the exit side to prevent

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rotation of the finished tube. The end of the tube is supported by an internal gripper 26 which is carried by the carriage 28 which is moved on the slide 30 by means of a hydraulic motor 32. The clamp 24 is mounted on a carriage 34 which is moved to the desired position on guide 36 by means of a hydraulic motor 38. The motor 38 is connected to the carriage 34 by means of a tension rod 40 on each side of the head, the rods 40 being connected by cross bars 42. As best shown in Figure 2, the mandrel 8 has a reduced portion 44 at its forward end. The first part of this reduced portion is cylindrically shaped as shown at 46 and merges into a conical portion 48. The extreme outer portion 50 is further reduced in diameter and threaded to receive the nut 52 which holds a roller cage 54 in place on the reduced portion 44. The inner portion of the roller cage is shaped in the same manner as portion 44 and the outer surface is substantially parallel to the inner surface. The cage 54 is provided with a plurality of openings 56 which extend along the conical portion thereof and merges into openings 58 in the cylindrical portion thereof. Rollers 60 and 62 are received in alternate openings 56, roller 60 being somewhat longer than roller 62. Rollers 64 and 66 are received in openings 58. Rollers 64 which are somewhat shorter than rollers 66 abut against rollers 60 while rollers 66 abut against rollers 62. The rollers 60, 62, 64 and 66 bear against the mandrel surface 44 which forces them against the outer spherical portion of the openings 56 and 58 to hold them in place. The housing 16 is counter-bored to receive the roller cage 68, the counter-bore having a cylindrical surface 70 merging into a conical surface 72. The cage 68 has three openings 74 around its periphery to receive the rollers 76. The cylindrical portion of cage 68 has openings 78 which are in line with openings 74 and which contain rollers 80. The cage 68 also has openings 82 for receiving rollers 84 which are somewhat longer than rollers 80. The cage is held in place by means of a retaining member 86, which is fastened to housing 16 by means of cap screws 88.

The operation of the device is as follows:

A guide piece 90, which is machined to the uniform wall thickness desired in the finished tube, is placed over the mandrel 8 and between the inner and outer rolls in order to center the inner rolls with respect to the outer rolls. A tube T, which may be either hot or cold, is gripped internally by the gripper 26 and fed to the rolls 55 by supplying pressure fluid to hydraulic motor 32.

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In a particular example, the outer rollers are driven in a clockwise direction, as shown in Figures 3, 4 and 5, at a speed of 150 R. P. M. and the mandrel is rotated in a counterclockwise direction at a speed of 150 R. P. M. As the tube passes through the rolls it is expanded in the conical portion of the pass and finished to the desired concentric shape in the cylindrical portion. If three or more rolls are mounted on the mandrel in the expanding part of the roll pass, the expanding action of the rolls will put the wall of the tube in tension circumferentially, but not to such an extent so as to cause the metal to flow. While in tension, that portion of the tube being worked, which is in excess of the theoretical minimum of the unprocessed tube, is subjected to additional rolling action. The combination of these forces causes the metal to flow circumferentially at the heavy wall and not at the light wall as would be the case from expanding action only. With the speed set forth and with the number of rollers shown, there will be 4350 swaging impacts per minute on the tube. The finished tube as it leaves the rolls forces the guide piece therefrom over the mandrel and thereafter the centering of the inner rolls with respect to the outer rolls is accomplished by means of the finished tube. The inner and outer rolls are peripherally skewed in opposite direction in order to feed the finished tube from the rolls. After the tube T passes entirely through the rolls, section 10 of mandrel 8 is separated from the rest of the mandrel and the tube removed therefrom. It will be understood that the number of rolls may be varied and that they need not be skewed.

While one embodiment of my invention has been shown and described, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. A rolling mill for removing eccentricity from a tube comprising a rotary mandrel, a set of short rolls mounted around the periphery of said mandrel with their axes arranged in a substantially conical pattern, a set of long rolls mounted around the periphery of said mandrel adjacent said first set of rolls with their axis arranged in a substantially cylindrical pattern, a rotary housing surrounding said mandrel, a set of short rolls mounted in said housing and surrounding the first set of short rolls with their axes inclined in the same general direction as the first set to form a conical pass at the feed end of said rolling mill, a second set of long rolls mounted in said housing and surrounding the first set of long mandrel rolls with their axes substantially parallel to the axes thereof to form a substantially cylindrical pass at the exit end of said rolling mill, means for feeding a tube to the rolls, means for rotating the housing in one direction, and means for rotating the mandrel in the direction opposite to the housing, said cylindrical portion of said roll pass being adapted to receive a tubular guide piece having the uniform wall thickness desired in the finished tube to thereby center the rolls on the mandrel with respect to the rolls in the housing at the

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beginning of the rolling operation, the end of the finished tube forcing the guide piece from the roll pass with the finished portion of the tube thereafter keeping the mandrel centered, said cylindrical portion of the pass being of such greater length than said conical portion that the area of the finished tube in the cylindrical portion will resist the transverse force applied by the rolling operation in the conical pass caused by the eccentricity of the workpiece.

2. A rolling mill for removing eccentricity from a tube comprising a rotary mandrel, a set of short rolls mounted around the periphery of said mandrel with their axes arranged in a substantially conical pattern, a set of long rolls mounted around the periphery of said mandrel adjacent said first set of rolls with their axes arranged in a substantially cylindrical pattern, a rotary housing surrounding said mandrel, a set of short rolls mounted in said housing and surrounding the first set of short rolls with their axes inclined in the same general direction as the first set to form a conical pass at the feed end of said rolling mill, a second set of long rolls mounted in said housing and surrounding the first set of long mandrel rolls with their axes substantially parallel to the axes thereof to form a substantially cylindrical pass at the exit end of said rolling mill, means for feeding a tube to the rolls, means for rotating the housing in one direction, and means for rotating the mandrel in the direction opposite to the housing, said cylindrical portion of said roll pass being adapted to receive a tubular guide piece having the uniform wall thickness desired in the finished tube to thereby center the rolls on the mandrel with respect to the rolls in the housing at the beginning of the rolling operation, the end of the finished tube forcing the guide piece from the roll pass with the finished portion of the tube thereafter keeping the mandrel centered, the number of rolls and the length thereof in said cylindrical portion of the pass having such greater tube engaging area than the rolls of said conical portion that the area of the finished tube in the cylindrical portion will resist the transverse force applied by the rolling operation in the conical pass caused by the eccentricity of the workpiece and thereby maintain the mandrel centered.

HENRY J. WALLACE.

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