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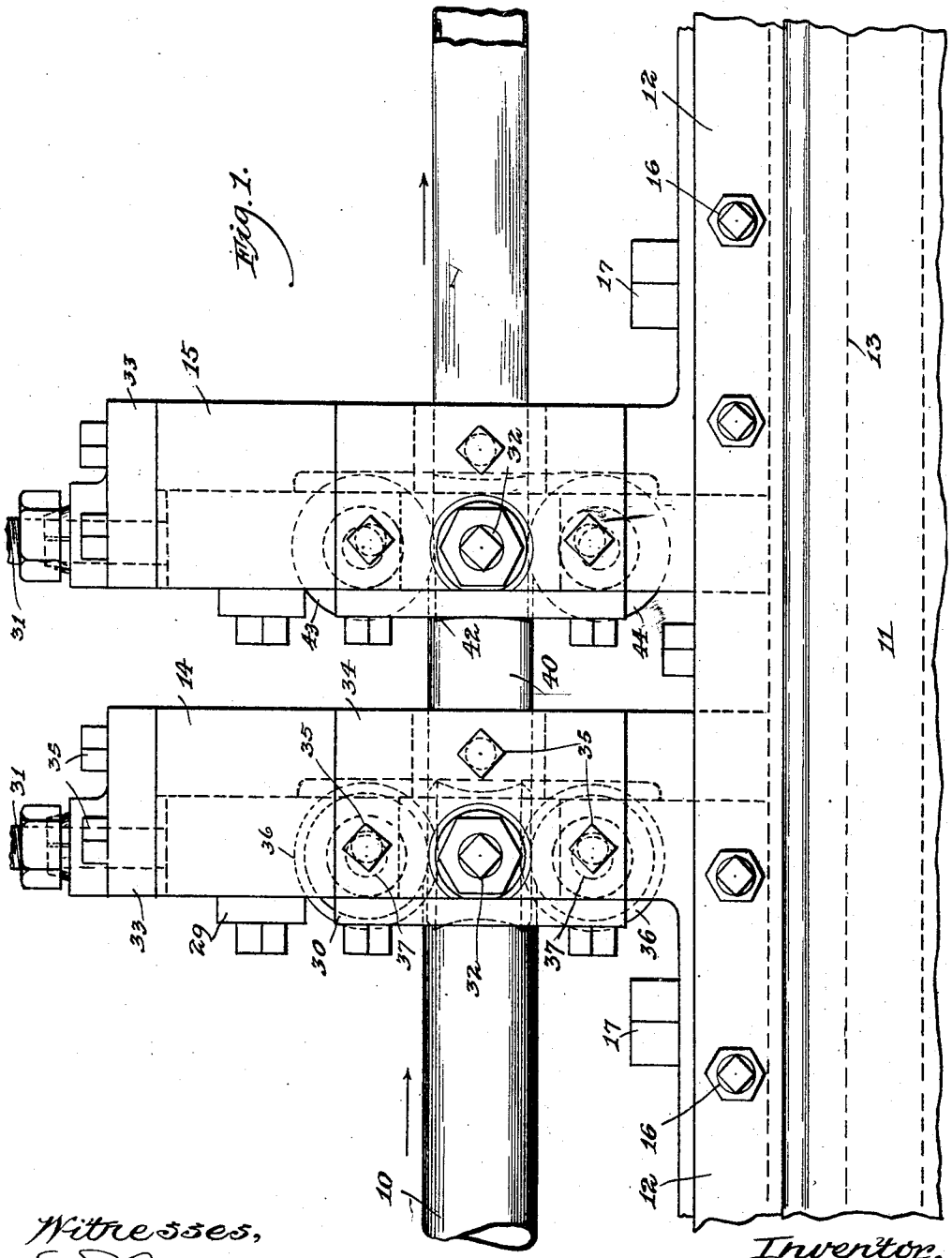
TUBE SQUARING APPARATUS.

APPLICATION FILED MAY 11, 1917.

1,308,945.

Patented July 8, 1919.

3 SHEETS—SHEET 1.



Witnesses,
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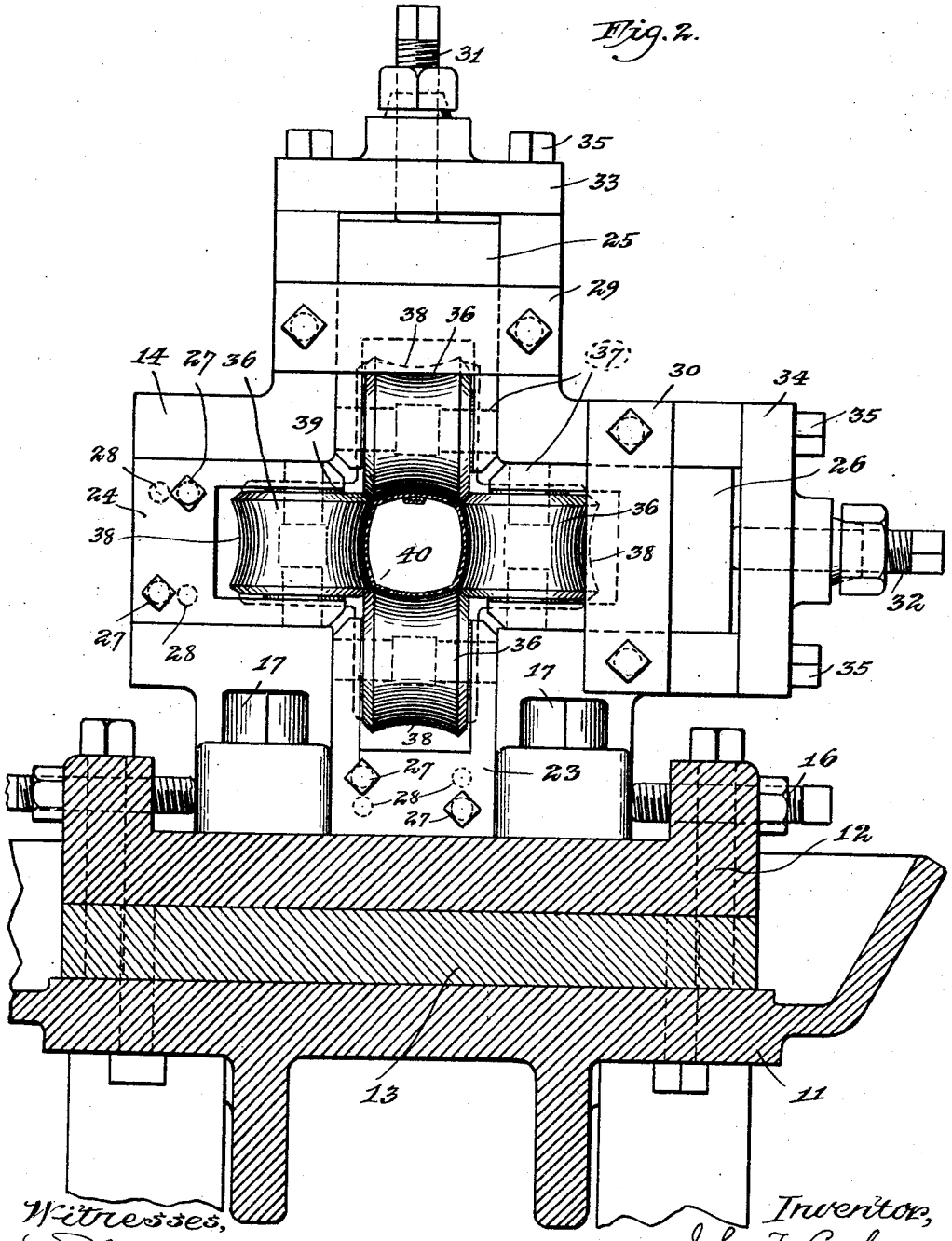
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

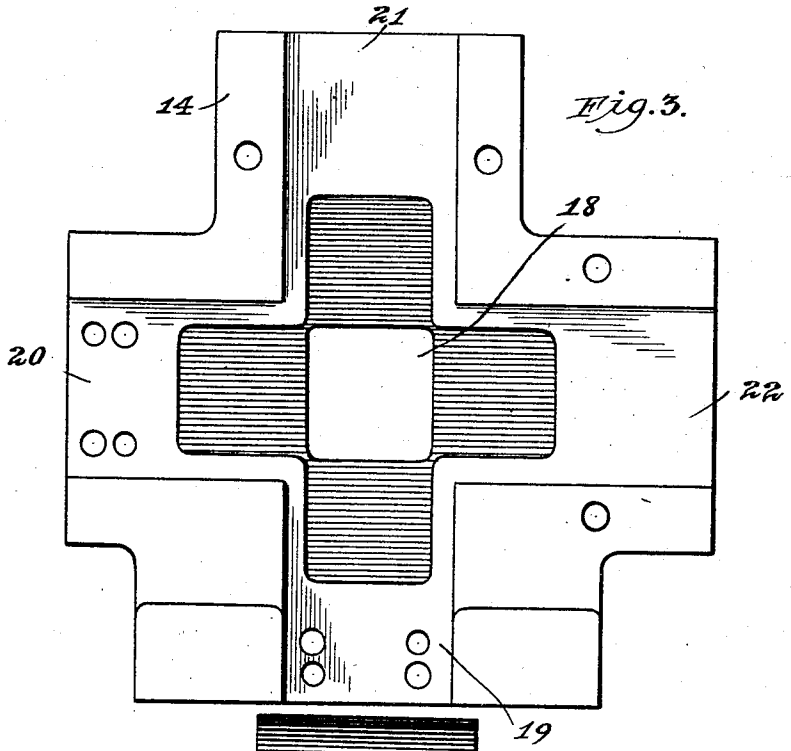


Fig. 3.

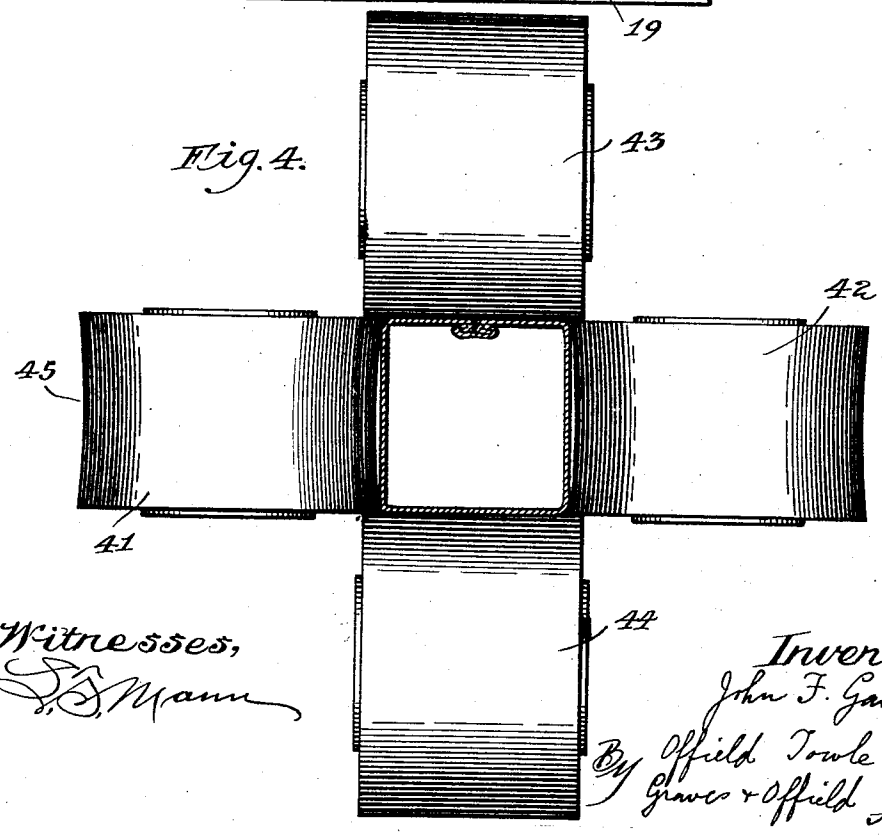


Fig. 4.

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UNITED STATES PATENT OFFICE.

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TUBE-SQUARING APPARATUS.

1,308,945. Specification of Letters Patent. Patented July 8, 1919.

Application filed May 11, 1917. Serial No. 168,023.

To all whom it may concern:

Be it known that I, JOHN F. GAIL, a citizen of the United States, residing at Kenosha, in the county of Kenosha and State of Wisconsin, have invented certain new and useful Improvements in Tube-Squaring Apparatus, of which the following is a specification.

My invention relates to improvements in tube-squaring apparatus and is of particular service in changing the cross sectional shape of a tube from a circle to that of a rectangle, square, or other shape having one or more flat sides. The invention is of especial value in treating tubes in which the area of the tube cross section is quite large compared with the thickness of the wall of the tube.

For convenience, I adopt the expression "squaring" as describing the purpose of my invention when applied to round tubes, although of course cross sections other than square may be produced by my invention or a modification thereof. The term "round" similarly is intended to include any shape possessed by the unformed tubing, round or otherwise. Also, as a preferred embodiment of my invention and as a specific application thereof I shall describe the invention applied to the producing of a square tube from a round tube having a longitudinal welded lock seam, similar to the class of tube disclosed in U. S. patent to Gail & Rudd No. 1,172,699, issued February 22, 1916.

Before my invention, it had been considered impossible to "square" a thin-walled metallic tube while cold and without the aid of a mandrel, or some form of internal shoe maintained stationary in the tube in the forming zone and against which the walls of the tube are tightly engaged or pressed by the forming apparatus. Such a mandrel or internal die is usually employed in conjunction with a set of rolls which squeeze the walls of the tube into engagement with the mandrel, the function of the latter being to establish or preserve the shape of the tube while it is being formed or broken down by the rolls. It will be manifest that such a mandrel as I have described must be made with considerable accuracy, in addition to which, great difficulty is experienced in properly holding it in the correct location in the forming zone so as to coöperate properly with the forming rolls. Also, owing to the fact that the tube slides over the mandrel and is subjected to great pressure while sliding over the mandrel, the latter wears rapidly, loses its shape quickly, and causes trouble in various other ways.

So far as I am aware, such "squaring" operation has never been successfully accomplished with the ordinary set of rolls, without the aid of a mandrel, for the reason that the use of the ordinary rolls in forming the tube without the aid of a mandrel, results in the production of a concave-sided tube instead of a tube having perfectly flat sides. Such a concave-sided tube is of course wholly unfitted for commercial use, where appearance is a factor. One of the principal objects of my invention is the elimination of the mandrel.

Broadly stated, my invention consists in passing the tube through a set of forming devices which are so organized that the actual flattening of the tube, or any portion of it, is not attempted or effected until the tube has been subjected to a considerable initial forming operation. This principle of operation may readily be carried out by passing the tube through one or more sets of roughing-out or breaking-down rolls before the shaping of the tube is finally completed by a set of final or finishing rolls, the shape of the roughing rolls being concave so as to prevent the formation of flat surfaces on the tube before it reaches the finishing stage of the process.

In the drawings, which illustrate one form of apparatus for carrying out the invention—

Figure 1 is a side view of the tube-forming apparatus;

Fig. 2 is an end elevation of the same looking from the left of Fig. 1;

Fig. 3 is an end elevation of a roll housing casting; and

Fig. 4 is an end view showing the relation of the finishing rolls to the completed tubing.

In the drawings, 10 represents the raw or unformed tubing before it enters the apparatus. The means for propelling the tube through the rolls is not shown, as it does not form a part of this invention, it being sufficient to say that any well known means for forcing or pulling the tube through the apparatus may readily be utilized. I have obtained excellent results by simply pulling the tube through the rolls, which are not positively driven, but may simply revolve

at will, due to their friction with the walls of the tube.

Beneath the tube 10 and alined therewith is a rigid casting or base 11 formed as a part of, or as an attachment to, the draw bench, and upon the plane upper surface of the said casting 11 is supported a channel-shaped longitudinal casting or base 12. The correct height of the apparatus supported by the casting 12 is maintained by a flat insert plate 13, in conjunction with which shims or similar devices may be employed when it is desired to change the height of the axis of the tube-forming apparatus. The upper surface of the web of the channel-shaped casting 12 slidably supports a pair of cast housings 14 and 15, the housing 14 being illustrated in Fig. 3, lateral adjustment transversely of the axis of the tube being effected by means of the set screws 16 passing through the flanges of the channel member 12. When the roll housings 14 and 15 have been located in the correct lateral position by means of the set screws 16, they may be clamped in said position by the cap screw 17. The housing 14, in which the breakdown or roughing rolls are mounted, is somewhat crucifiorm in elevation and is apertured, as shown at 18, in order to admit the tube. In line with said tube opening 18 there are planed or milled a set of four recesses or guideways 19, 20, 21 and 22 which receive the roller blocks 23, 24, 25 and 26. The roller blocks 23 and 24 are immovably secured in position in the housing 14 by means of square-headed cap screws 27 in conjunction with dowels 28, the latter being for the purpose of repairing or renewing the rolls without destroying the adjustment of the apparatus. The other roller blocks 25 and 26 are arranged to slide in the guideways 21 and 22, plates 29 and 30 serving to prevent displacement of the blocks out of the guideways. Endwise movement of adjustment of the roller blocks 25 and 26 is effected by means of set screw arrangements 31 and 32 supported by end plates 33 and 34 secured over the outer ends of the said guideways 21 and 22 by means of cap screws 35.

Each of the roughing rolls 36, which are identical with each other, is rotatably supported on a roller pin or arbor 37 extending between the bifurcated inner ends of each of the roller blocks. As shown, the shape of the periphery of each of the roughing rolls 36 is quite concave, as at 38, and the edges of the rolls are mitered, as shown at 39, so that their edges may, if desired, be forced tightly together and into engagement with each other. The axes of all of the roughing rolls preferably lie in the same transverse plane at right-angles to the axis of the tube. The cross-sectional shape of the broken down or roughed-out portion 40 of the round tubing as it leaves the roughing-out rolls, is shown in Fig. 2.

The squaring of the tube is completed by the finishing rolls 41, 42, 43, and 44, which are supported in the finishing roll housing 15 in a manner similar to that in which the roughing rolls are supported in the roughing roll housing 14. The finishing rolls comprise a pair of what may be termed "side rolls" 41 and 42, and a pair of "top and bottom" rolls 43 and 44, the latter pair of rolls having faces considerably wider than the faces of the side rolls 41 and 42, the edges of which enter the space between the top and bottom rolls 43 and 44, as indicated in Fig. 4. In order to get good results in squaring certain classes of tubing, the finishing rolls may be made with a very slight concave curvature, for instance, as shown at 45. However, I have found that with certain sizes of tubes and wall thicknesses, perfectly flat finishing rolls will suffice, particularly if an intermediate set of slightly concave rolls be inserted between the finishing rolls and the first set of roughing rolls.

The embodiment herein disclosed is of course merely illustrative of one application of my invention, which is not limited to the particular details of the process and apparatus described. The scope of the invention is to be determined by reference to the appended claim.

I claim—

Apparatus for cold squaring thin-wall round metallic tubing, comprising a set of four concave roughing idler rolls, all arranged substantially in the same transverse plane and arranged so that the propulsion of the tube between said rolls will result in the formation of two pairs of opposed longitudinal zones of a flatter curvature than that of the original tube, and a set of four substantially flat finishing idler rolls having their axes located substantially in the same transverse plane and substantially parallel with the axes of the first set of idler rolls.

JOHN F. GAIL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."