J. MERRITT & W. A. SAWYER.

PROCESS OF BENDING TUBING.

APPLICATION FILED AUG. 12, 1911.

1,217,101. Patented Feb. 20, 1917.

Fig. 1.

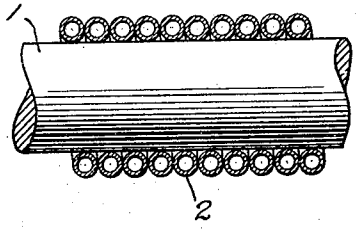


Fig. 2.

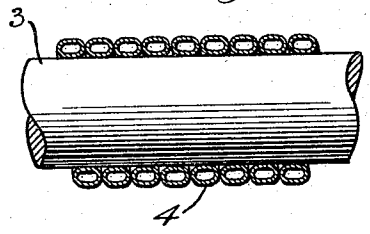


Fig. 3.

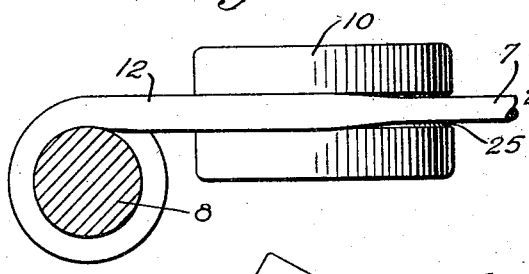


Fig. 4.

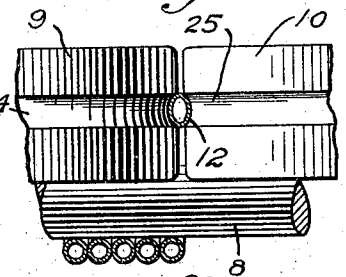


Fig. 5.

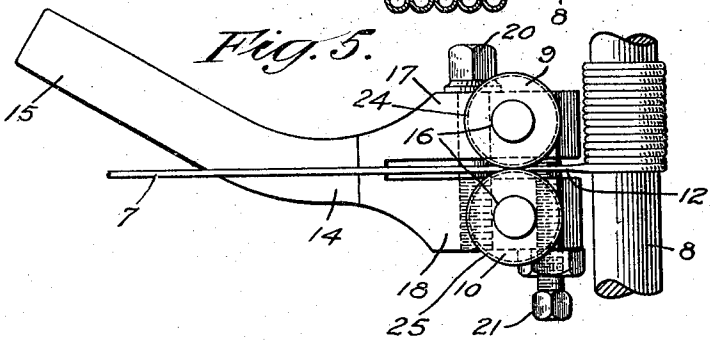
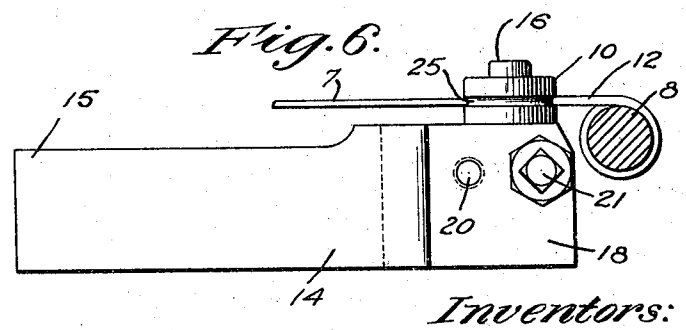


Fig. 6.



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UNITED STATES PATENT OFFICE.

JOSEPH MERRITT, OF HARTFORD, AND WILLIAM A. SAWYER, OF WEST HARTFORD, CONNECTICUT, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO THE HARTFORD LOCK RING COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF CONNECTICUT.

PROCESS OF BENDING TUBING.

1,217,101. Specification of Letters Patent. Patented Feb. 20, 1917.

Application filed August 12, 1911. Serial No. 643,663.

To all whom it may concern:

Be it known that we, JOSEPH MERRITT and WILLIAM A. SAWYER, citizens of the United States, residing at Hartford and West Hartford, respectively, in the county of Hartford and State of Connecticut, have invented new and useful Improvements in Processes of Bending Tubing, of which the following is a specification.

This invention is an improved process of bending or coiling tubing, whereby the tendency of the bending or coiling action to flatten or otherwise deform the cross-section of the tube by the winding action is compensated or counteracted.

This invention is capable of application to many uses, in connection with the bending or coiling of tubing of different shapes, sizes, and material. The embodiment of the invention selected for particular illustration and description herein is one in which tubing of circular cross-section is wound in spiral form upon a cylindrical member, although obviously the invention may be adapted to other cross-sections of tubing and other forms of bends or coils.

Figure 1 of the drawings is a side view of a mandrel having thereon a coil of tubing shown in cross-section, which is circular in form. Fig. 2 is a similar view, illustrating the flattening or deforming action upon the tubing, of the ordinary methods or processes employed for coiling thereon tubing which is initially of the circular cross-section shown in Fig. 1. Fig. 3 is an end view, partly in cross-section, and Fig. 4 a front view, illustrating this improved process as applied to the winding of tubing upon a mandrel to the form illustrated in Fig. 1, free from the distortions of the tube illustrated in Fig. 2. Fig. 5 is a plan view and Fig. 6 an end view partly in section showing in reduced scale an arrangement of simple apparatus suitable for carrying out our improved process.

In attempting to bend tubing in any direction out of the straight form, the tendency is to deform the cross-section thereof by closing toward each other those portions of the tubing which are on the inner and outer surfaces of the bend or coil, as illustrated in Fig. 2.

This tendency to flatten the tubing is increased or diminished according to the degree of tension necessary to bend or coil the wire closely to the desired form, which in turn depends upon the size of the tube, the thickness of its wall, and the flexibility and ductility of the metal of which it is made, all of which must be taken into account in adapting the present invention to the various uses of which it is susceptible.

In the embodiment selected for specific illustration of this invention, the mandrel 1 of Fig. 1 has wound upon it a helical coil of tubing 2, which in this figure is shown to be circular in cross-section, as a result of our improved process of winding, illustrated in Figs. 3 to 6 inclusive; while the mandrel 3 of Fig. 2 has wound upon it a coil of tubing 4, the cross-section of which is distorted by flattening the inner and outer surfaces of the bends to oval form, as is liable to be the case when coiled by prior known methods or processes.

This tendency to flatten or deform the tubing by the bending or coiling operation is by this invention compensated for or counteracted by suitably shaping the cross-section of the tubing previous to the bending or coiling operation.

This preparatory shaping may be done either in connection with or after the manufacture of the tube by passing it through suitable dies or rolls which impart to it a cross-section of a character and extent suited for reduction to the desired cross-section by the subsequent bending or coiling operation. But for better illustration of the complete process, the preliminary shaping is herein shown as being done concurrently with the bending or coiling operation.

The tubing 7 which is herein shown to be initially of the circular form shown in Fig. 1 is coiled upon a mandrel 8, to which the tube passes between rolls 9 and 10, which are shaped and adjusted so as to deform the tube from its original circular form at 7 to the elongated oval cross-section shown at 12 in Figs. 3 and 4, this elongation of the cross-section being in the general plane or direction of the subsequent bend made around the mandrel. As the tube is wound upon the mandrel it is held back with a suitable tension by means of the rolls 9 and 10, or by passing the tube through suitable frictional hold-back devices applied to the tube before it reaches the rolls, and not shown herein.

The operation of bending the tube around the mandrel under suitable tension serves to restore the tube to its initial circular form, or to any other form which may be desired.

The rolls 9 and 10 herein shown to be employed for compressing the sides of the tube to make the desired compensating elongation in its cross-section, are herein shown to be mounted in a holder 14 having a shank or stock 15, which is adapted to be held in the tool post of an ordinary lathe. Obviously, however, the form of this holder may be modified in many ways to adapt it for attachment to various types of machines which might be employed for this purpose. The rolls are mounted on studs 16 which are held in the two arms 17 and 18 of the holder, which are herein shown to be separated by a slot, which permits the arms to be drawn toward each other by means of the screw 20, or separated farther from each other by means of the screw 21; so as to correspondingly adjust the rolls to or from each other to obtain the desired preliminary compression and deformation of the tube, as it passes between them to the mandrel 8. These rolls are shown to be provided with grooves 24 and 25, forming between them the oval outline shown at 12, which is hereto assumed to be desirable for obtaining the deformation desired in this particular illustration. Obviously, however, the form of groove may be changed, and in some instances perhaps omitted altogether, according to the character of the material to be operated upon, or other requirements of the work to be accomplished.

We claim as our invention:—

1. In processes of bending tubing, the herein described method of compensating for the tendency to deform the tube in the bending operation, which consists in shaping the tube with a counter deformation of its cross section in advance of and in the general direction of the intended bending operation, and then bending it in the said direction.

2. In processes of bending tubing, the method of counteracting the tendency to flatten the tube while bending it longitudinally, which consists in shaping the tube with a counter flattening of the tube substantially at right angles with the direction in which the bending tends to flatten it, and then bending the tube longitudinally in the general direction of the said counter flattening.

3. In processes of producing a bent tube having a circular cross-section, the method of compensating for the described flattening of the tube, due to bending it longitudinally, which consists in forming a tube with elliptical cross-section and then bending the tube longitudinally in a direction lengthwise of the ellipse.

4. The process of producing a bent tube of a desired cross-section, which consists in bending a tube of more elliptical section longitudinally of the tube and lengthwise of the said more elliptical section.

5. The process of producing a bent tube of a desired cross-section, which consists in providing a tube having a cross-section more extended in one direction than the desired cross-section, and bending it longitudinally of the tube and in the general direction of the said more extended cross-section.

6. The process of producing a coiled tube of circular cross-section, which consists in coiling tubing of elliptical section in a direction longitudinally of the tube and lengthwise of the ellipse described by its cross-section.

7. The process of producing a bent tube of circular cross-section, which consists in bending the tube longitudinally and compressing the sides of the tube in advance of the said bending to extend its cross-section in the direction in which it is subsequently bent.

8. The process of producing bent tubing, which consists in flattening the tubing to extend its cross-section in one direction, and then bending the tubing in the same direction.

9. The process of producing coiled tubing, which consists in winding it in the desired coil, and compressing the opposite sides of the tube in advance of the winding to extend its cross-section in the general plane in which the tube is subsequently bent in the coiling operation.

10. The process of producing coiled tubing, which consists in compressing the opposite sides of the tubing, and coiling it approximately in the general plane toward which its sides are compressed.

11. In processes of producing coiled tubing of a desired cross-section, the method of pressing together the opposite sides of the tube to extend its cross-section in the direction of the subsequent coiling, and in advance of the coiling operation, and then coiling the tubing.

12. The process of producing coiled tubing, which consists in winding the tubing in a spiral coil and compressing the sides of the tubing in advance of the winding operation, to elongate its cross-section in the general direction of the spiral coils.

13. The process of coiling tubing into helical form, which consists in flattening the tube upon its opposite sides to elongate its cross-section in the general direction of the spiral of the intended helical bands, and then coiling the tube into the desired helical form by bending the tube longitudinally in the direction of its elongated cross-section.

14. The process of producing coiled tubing, which consists in winding tubing upon a mandrel, and deforming the cross-section

of the tube before reaching the mandrel in a direction and to a sufficient extent to compensate for the deformation due to the winding action around the mandrel.

15. The process of producing coiled tubing, which consists in winding the tubing in a spiral coil, compressing the sides of the tubing in advance of the winding operation, to elongate its cross-section in the general direction of the spiral bends, and holding back the tubing against the coiling operation with suitable tension for reducing the elongated cross-section to the desired cross-section as the tubing is bent into the coiled form.

16. The process of producing a bent tube of circular cross-section, which consists in bending a tube of elliptical cross-section in the plane of the major axis of the elliptical cross-section.

17. The process of producing bent tubing, which consists in flattening the tubing to extend its cross section in one direction, and bending the tubing longitudinally in the direction of its extended cross-section.

18. The process of producing a bent tube of a desired cross-section, which consists in progressively distending its cross-section in one plane, flowing the distention along the tube, and in bending the distended portion in the same plane, the bend following and reducing the distention progressively along the tube.

19. The process of producing bent tubing which consists in feeding the tubing longitudinally, progressively distending the cross-section of the tubing in opposite directions, and coincidently bending the tubing approximately in one of the said directions, flowing the said distention and the said bends one after the other along the tubing.

20. The process of producing continuous coiled tubing which consists in feeding the tubing longitudinally, progressively distending the cross-section of the tubing in opposite directions, and coincidently coiling the distended tubing in one of the said directions, flowing the said distentions and said coils one after the other along the tubing.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses this 11 day of August, 1911.

JOSEPH MERRITT.
WILLIAM A. SAWYER.

Witnesses:
CHARLOTTE S. HULL,
CAROLINE M. BRECKLE.

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