April 28, 1953 C. E. RUTHERFORD 2,636,541

MACHINE AND METHOD FOR FORMING COLLAPSIBLE TUBING

Filed April 11, 1949 2 SHEETS—SHEET 1

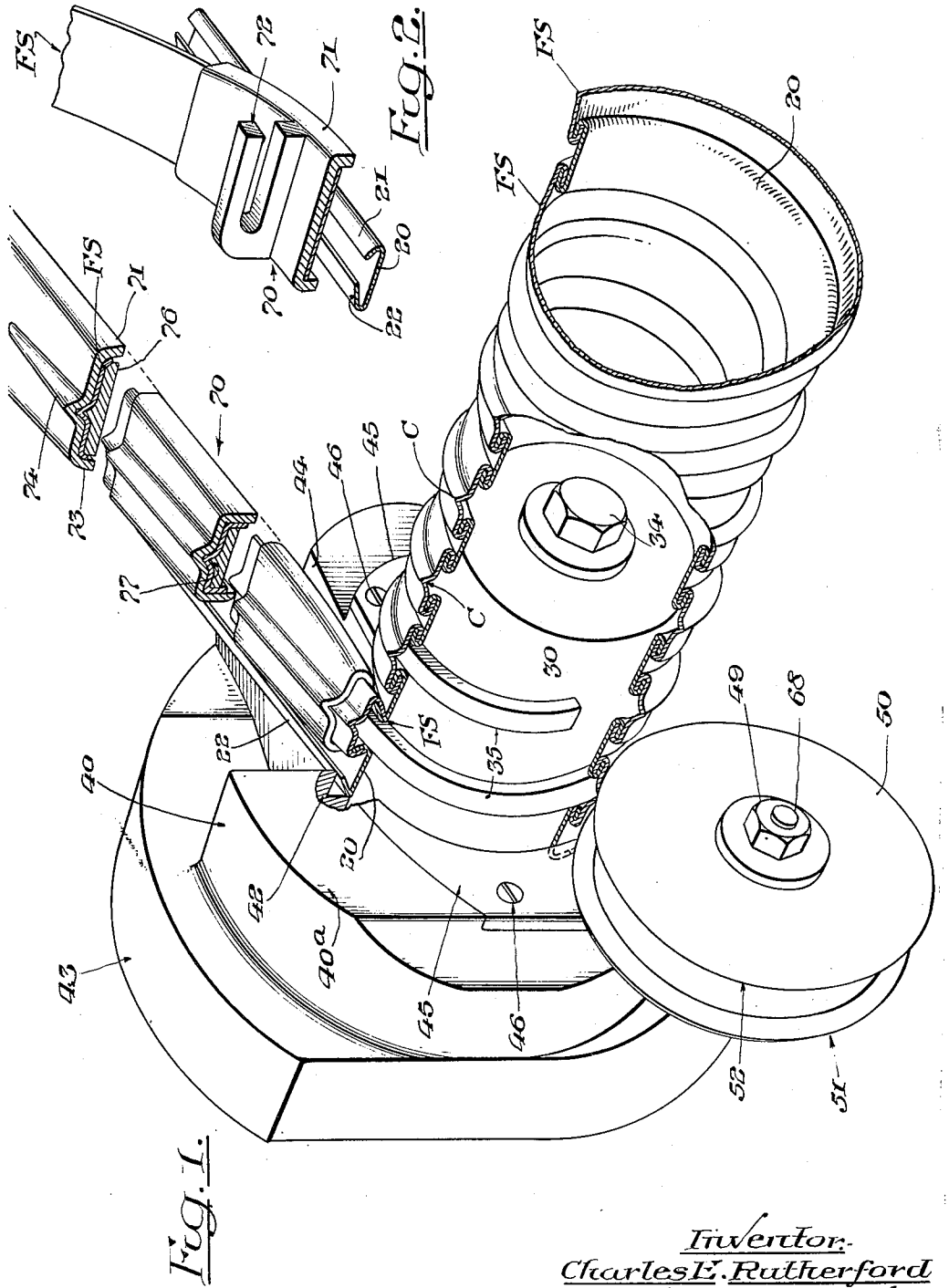


Fig. 2.

Fig. 1.

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Fig. 3.

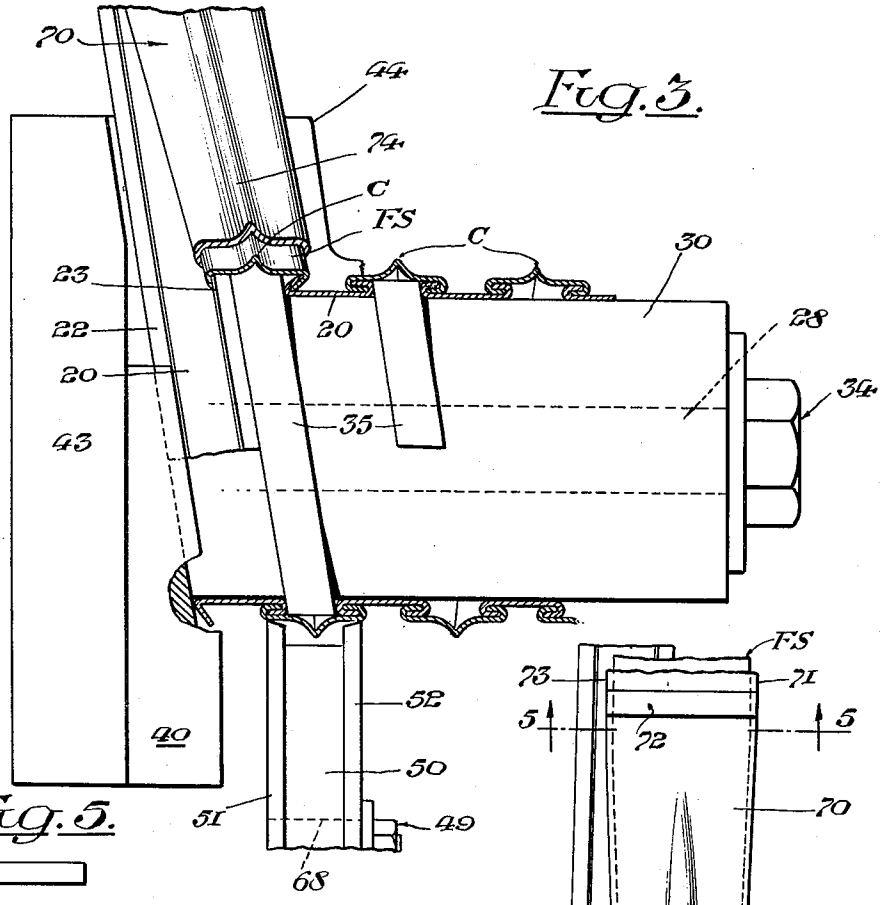


Fig. 5.

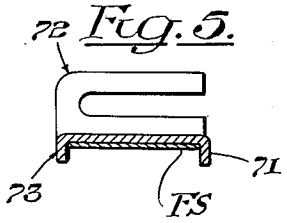


Fig. 6.

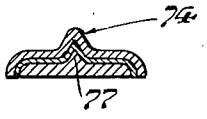


Fig. 8.

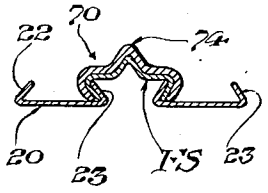


Fig. 7.

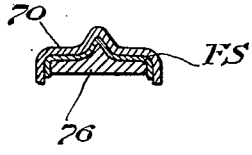
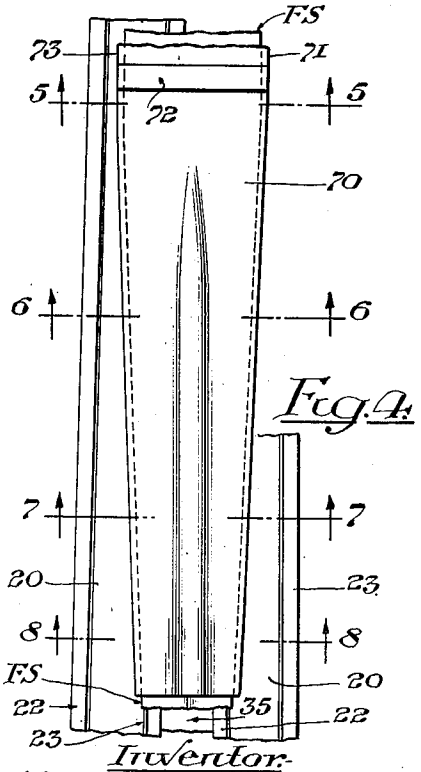


Fig. 4.



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UNITED STATES PATENT OFFICE

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MACHINE AND METHOD FOR FORMING COLLAPSIBLE TUBING

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Application April 11, 1949, Serial No. 86,635

13 Claims. (Cl. 154—7)

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This invention relates to collapsible tubing formed of two elements and also to methods and machines for making such tubing.

It is an object of this invention to provide an improved form of two element collapsible tubing in which the flexible element is made and assembled so that it tends to fold outwardly when the tubing is collapsed, thus not to impede the flow of air or fluid through the tubing.

Another object of this invention to provide a method for forming the improved tubing.

Another object of the invention is to provide an improved machine for forming the new tubing.

Another object is to provide improvements and attachments adaptable to known collapsible tubing machines for producing the new tubing.

Other objects and advantages of the invention will become apparent as it is described in connection with the accompanying drawings.

In the drawings:

Fig. 1 is a fragmentary perspective view partly in section of the portion of the machine which embodies the invention for making the improved tubing;

Fig. 2 is an extension of Fig. 1 illustrating the entrance of the fabric guide;

Fig. 3 is a plan view partly broken away and partly in section of the machine shown in Fig. 1;

Fig. 4 is a plan view of the fabric guide showing its relation to the first and second convolutions of the spiralled channelled metal member;

Figs. 5–8 are transverse section views of the fabric guide, taken along lines 5—5 to 8—8 of Fig. 4.

This invention is an improvement on tubing, machine and method disclosed in the application of A. E. Chernack, S. N. 705,539, filed October 23, 1946, for "Method and Machine for Forming Tubing," now Patent No. 2,539,814.

Referring to the drawings a strip of thin sheet metal 20 which preferably is formed by any suitable means into channel shape by having its opposite edges bent into acute angles to form flanges 21 and 22 is fed to a rotating mandrel (designated generally by 30) and to a rotary pinching or pressure roll (designated generally by numeral 50) and being guided in an advancing spiral path by a guideway 42 in a guide block 40, as will hereinafter be more particularly described.

The cylindrical mandrel 30 is formed on a rotating shaft 28 extending through the guide block 40. The mandrel 30 also extends through the guide block 40 and is held in place on the rotating shaft 28 by means of a key (not shown) and bolt 34 so as to rotate with the shaft 28.

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The guide block 40 is a machined casting mounted upon a stationary casting 43 which may in turn be mounted upon a suitable machine frame, not shown. The guide block 40 has a spiral guideway 42 rectangular in cross section cut into its vertical face around and adjacent the mandrel 30 to receive the trailing edge 22 of the preformed channel strip 20. The pitch of the guideway depends upon the desired advance of the channel strip 20. Secured to the guideblock 40 and substantially co-extensive with the vertical surface 40a thereof, is a guide or cam plate 45, also curved to a spiral shape and positioned so as to engage the body portion of the metallic strip. The guide plate 45 cooperates with the spiral guideway 42 in forming the metal strip into a spiral of the desired pitch by bending the metal strip to closely fit the curvature of the mandrel. The guide or cam plate 45 may be secured to the guide block 40 by means of screws such as 46.

To guide the opposite side of the channel strip 20, a spiral guiding member or rib 35 is affixed at one end by a screw upon an extension 44 of the guide block 40, the surface of the extension being horizontal and substantially tangential to the top of the mandrel 30. The guide rib 35 winds about one and one-quarter turns around the mandrel and terminates at that point. Its terminal end is not attached to the mandrel. The mandrel rotates within the guide rib 35.

In order to insert a strip FS of cloth or fabric or other limp flexible material i. e. lacking stiffness, fabric guide means is provided comprising an upper guide member 70 and a lower guide member 76. The guide means is fixedly positioned above the mandrel by supporting bracket 72 which may be attached to a fixed part (not shown) of the machine. The upper member 70 of the cloth guide is generally of inverted channel form converging at its exit end portion over the top of the mandrel as will be described. It may also be curved upwardly toward the entrance end. At the entrance end it has side flanges 71, 73 substantially perpendicular to the roof of the guide and extending downwardly. As the upper guide member proceeds toward the exit end it converges and the flanges are bent inwardly towards each other into acute angles or curved reversely toward the mandrel so as to tuck the fabric under the forward edge of the first convolution of the metal strip and under the trailing edge of the second convolution. The tucking in of the fabric strip FS under the forward edge of the first convolution occurs at about the

point or just prior to the point where the metal strip enters the spiral guideway **42** of the guide block **40**.

In order to form an outwardly extending ridge or crimp in the center of the fabric strip FS the upper cloth guide member **70** is fluted or provided with a progressively-deepening downwardly-faced groove **74**, the guide being formed into an upwardly and outwardly pressed ridge for that purpose and being greatest at the exit of the guide. The groove starts at a point near the entrance of the upper cloth guide on the center line thereof and progressively grows deeper.

Cooperating with the upper fabric guide **70** is a lower fabric guide member **76** formed as a strip of metal dimensioned to fit within the upper fabric guide **70** and having its top surface complementary to the inner surface of the upper guide. Thus a rib or ridge **77** on the upper surface of the lower guide **76** presses the fabric into the groove **74** of the top guide **70** forming a crease or upwardly pointed crimp C along the center line of the fabric strip FS as it moves along and issues from the guides. The lower guide **76** may terminate short of the end of the upper guide member **70** and may also be short of the entrance end.

With the cloth inserted under the forward edge or flange of the first convolution and under the trailing edge or flange of the second convolution, the mandrel rotates these elements of the tubing to present them to a pressure or pinching roll **50**. The pinching roll **50** is mounted upon a rotary shaft **68** and held thereon by a nut **49**. The shaft **68** is parallel to the axis of the mandrel.

The driving means for the mandrel and the mounting and driving means for the pinching roll are omitted from the drawing for clearness. Those features being known to those skilled in the art and per se not being part of the invention, need not be illustrated. Preferably the shaft upon which the pinching roll is mounted is pressed by spring pressure in a known manner (not herein illustrated) so as to cause the pinching roll to press against the tubing with the desired pressure as the roll acts upon the tubing.

The pinching roll is provided with pinching flanges **51**, **52** extending from opposite sides of the roll beyond the periphery of the roll, the flanges being spaced so as to straddle the guide rib **35**. The flange **51** presses upon the fabric overlying the forward edge of the first convolution of the metal strip and the flange **52** presses upon the fabric overlying the trailing edge of the second convolution of the metal strip so that both of these edges are pressed down simultaneously to frictionally and securely hold the edges of the fabric strip FS under these flanges. The peripheral surfaces of the flanges **51**, **52** may and preferably do incline slightly inwardly as shown in Fig. 3.

During the formation of the tubing this crease **77** in the fabric is untouched since it passes between the flanges **51**, **52** of the pinching roll while the side edges of the fabric strip are secured beneath the edges of the metal channel strip. As a result of the formation of the crimp in the tubing the fabric tends to move outwardly as the tube is collapsed. In this way the inward moving of the fabric as in prior collapsible tubing is avoided.

Tubing made according to this invention is claimed in my co-pending application Serial No. 193,250 filed October 31, 1950 which is a division hereof.

From the foregoing it may be observed that I have provided apparatus and means for forming collapsible tubing wherein the tubing is formed by the pressure of a single pinching or pressure roll and also the tubing is formed so as to cause the fabric to tend to move upwardly as the tubing is collapsed. It will be apparent to those skilled in the art that other means for making crease or crimp in the fabric may be employed and other means for bending the edges of the metallic strip upon the edges of the fabric strip may be used. Therefore I do not limit the invention to the specific embodiment illustrated in the drawings.

What is claimed is:

1. In a machine for forming collapsible two-element tubing from a strip of limp material and a metal strip preformed into channel shape and having its edges bent to form flanges, a rotating mandrel, means to guide said channel strip around the mandrel in a spiral path, means to insert the edges of the limp strip under different flanges of adjacent convolutions of the metal strip simultaneously, and means to bend down the flanges simultaneously onto the inserted limp strip edges to secure them to the metal strip and to connect adjacent convolutions of the metal strip.

2. In a machine for forming collapsible two-element tubing from a strip of limp material and a metal strip preformed into channel shape and having its edges bent to form flanges, a rotating mandrel, means to guide said channel strip around the mandrel in a spiral path and to space one convolution from another, means to insert the trailing edges of the limp strip under the forward flange of one convolution of the metal strip and the forward edge of the limp strip under the trailing flange of a spaced adjacent convolution of the metal strip simultaneously, and means to bend down the flanges simultaneously onto the inserted limp strip edges to secure them to the metal strip and to connect adjacent convolutions of the metal strip.

3. A machine as claimed in claim 1 wherein the bending means comprises a pressure roller having peripheral radially extending flanges simultaneously engaging the flanges of the metal strip.

4. A machine as claimed in claim 2 wherein the bending means comprises a pressure roller having peripheral radially-extending flanges simultaneously engaging the flanges of the metal strip.

5. In a machine for forming collapsible two-element tubing from a strip of limp material and a metal strip preformed into channel shape by having its edges bent to form flanges, means to secure the edges of the limp strip under the edges of the metal strip to form continuous tubing, means to feed the limp strip to the channel-form metal strip, and means associated with said feeding means to crease the limp strip longitudinally and outwardly of the tubing, said creasing means comprising stationary top and bottom guide members between which the limp strip passes, said members having complementary formations causing a crease to be formed in the limp strip as it passes between said guide members to cause the limp strip to fold outwardly when the tubing collapses.

6. A machine as claimed in claim 5 wherein said creasing means comprises a top guide mem-

ber and a bottom guide member between which the flexible strip passes, said members having complementary formations causing the crease to be formed in the flexible strip as it passes between said guide members, and wherein said top guide member has its edges bent to guide the edges of the limp strip and insert them under the flanges of the metal strip.

7. A machine as claimed in claim 5 wherein the top guide member has a longitudinal groove progressively deepening toward the exit end, and the bottom guide member is formed complementary to the top guide member to cause the longitudinal outward crease in the limp strip as it passes between the guide members.

8. A machine as claimed in claim 5 wherein said top guide member has its edges bent to guide the edges of the limp strip and insert them under the flanges of the metal strip.

9. A machine as claimed in claim 5 wherein said top guide member has depending side portions inclined towards each other at the exit end to guide the edges of the limp strip and insert them under the flanges of the metal strip.

10. A machine as claimed in claim 9 wherein the top guide member has a longitudinal groove progressively deepening toward the exit end, and the bottom guide member is formed complementary to the top guide member to cause a longitudinal crease in the limp strip as it passes between the guide members.

11. The method of making collapsible tubing comprising forming a spiralled convolution from a preformed strip of metal having its edges bent to form flanges, forming a longitudinal crease in a limp strip prior to its presentation to the metal strip, forming two convolutions of said metal strip and spacing them apart, inserting the trailing edge of a limp strip under the forward flange of one convolution of the metal strip and

simultaneously inserting the forward edge of the limp strip under the trailing flange of an adjacent convolution of the metal strip and bending down said flanges to secure together the metal and limp strips.

12. The method of making collapsible tubing comprising forming a spiralled convolution from a preformed strip of metal having its edges bent to form flanges, forming a longitudinal crease in a limp strip prior to its presentation to the metal strip, forming two convolutions of said metal strip and spacing them apart, inserting the trailing edge of a limp strip under the forward flange of one convolution of the metal strip and simultaneously inserting the forward edge of the limp strip under the trailing flange of an adjacent convolution of the metal strip, and simultaneously bending down said flanges to secure the metal and limp strips in adjacent convolutions.

13. A machine as claimed in claim 2 having means associated with said inserting means to crease the limp strip longitudinally and outwardly to cause the limp strip to fold outwardly when the tubing collapses.

C. E. RUTHERFORD.

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