April 8, 1952 W. E. REJESKI 2,592,335

COLLAPSIBLE TUBING

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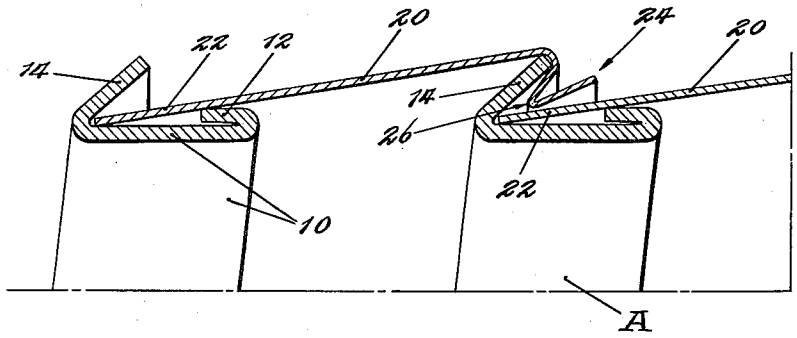


Fig. 1.

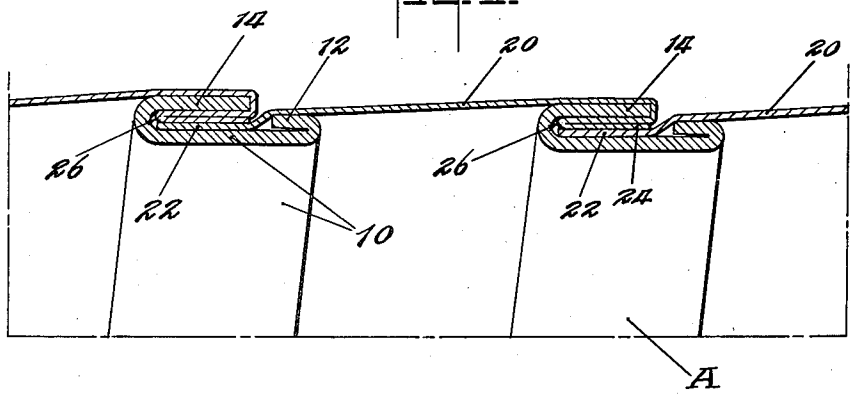


Fig. 2.

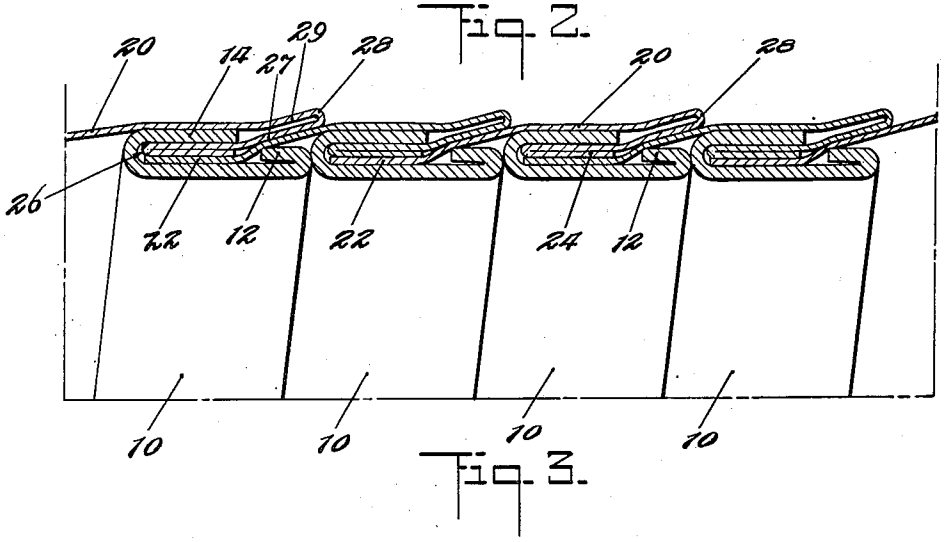


Fig. 3.

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Fig. 4.

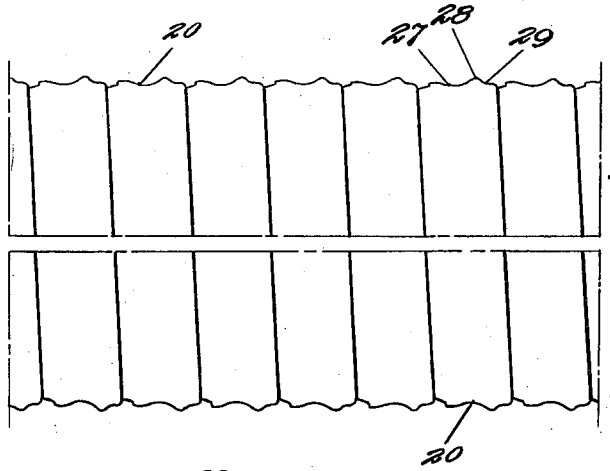


Fig. 9.

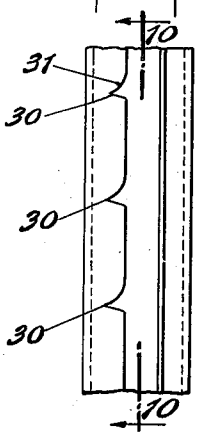


Fig. 5.

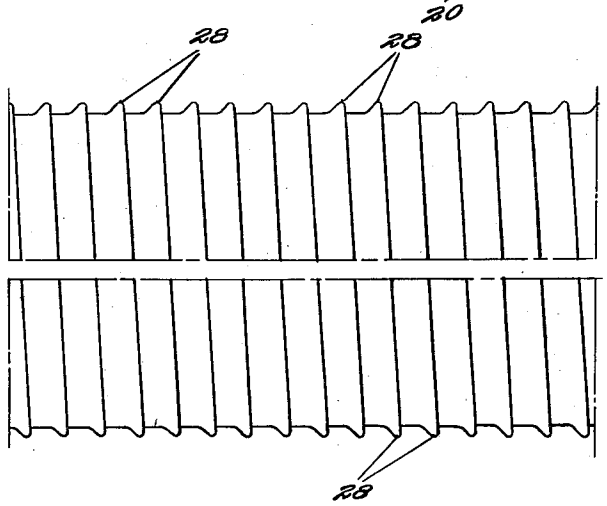


Fig. 10.

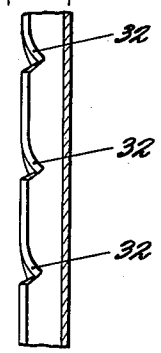


Fig. 6.

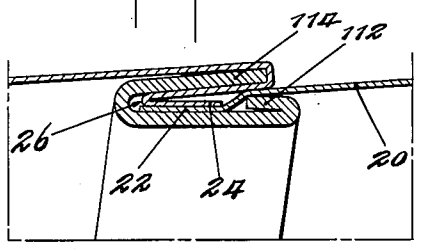


Fig. 7.

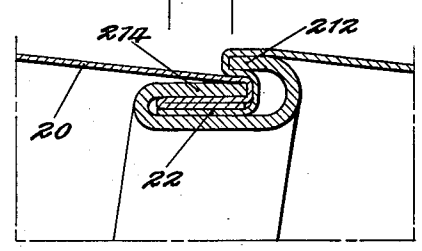
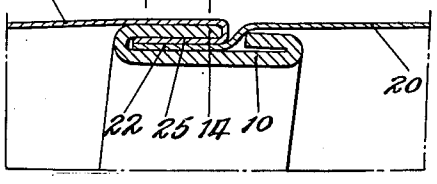


Fig. 8.



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COLLAPSIBLE TUBING

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Application February 24, 1949, Serial No. 78,135

14 Claims. (Cl. 138—51)

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This invention relates to improvements in collapsible tubing. More particularly the invention relates to collapsible tubing formed of two elements such as a strip of fabric or other flexible material and a spiral of strip metal whose edges are folded over and interlock or interengage with the strip of flexible material.

In the process of collapsing tubing of this sort as heretofore made, the fabric or flexible strip would fold or be thrown inwardly. This inward encroachment upon the area enclosed by the tube reduced the volume of fluid gas or air which the tube would pass because the free area for passage was reduced. Also the interior spiral caused by the inward fold of the fabric tended to create an interior surface in the tube which was less smooth and offered more surface resistance than desired for the flow of air or fluid through the tubing. These factors have proven commercially undesirable.

Therefore it is an object of the invention to provide an improved collapsible tubing construction in which the flexible strip element is "thrown" or folds outwardly as the tubing collapses or bends into curved shapes.

Another object of the invention is to provide tubing achieving the foregoing objective which will at the same time require less metal in the metal spiral element of the tubing.

Another object is to provide means on the metal element to more securely hold the edges of the flexible element.

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

In the drawings:

Fig. 1 is a fragmentary sectional view of a portion of tubing in the process of formation embodying the principles of this invention;

Fig. 2 is a fragmentary longitudinal sectional view of two convolutions of collapsible tubing embodying the invention;

Fig. 3 is a view similar to Fig. 2 but with the tubing collapsed;

Fig. 4 is an elevation view of expanded collapsible tubing embodying the invention;

Fig. 5 is a view similar to Fig. 4 but with the tubing collapsed;

Fig. 6 is a fragmentary sectional view of one convolution of flexible tubing embodying an alternate form of the invention;

Fig. 7 is a fragmentary sectional view of a convolution of collapsible tubing embodying another alternate form of the invention;

Fig. 8 is a fragmentary sectional view of a portion of a convolution similar to the form of Figs. 1–3 but with the advance edge of the fabric not folded double;

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Fig. 9 is a fragmentary plan view of the metal strip element of the tubing;

Fig. 10 is a longitudinal section view of the metal strip element of the tubing taken along line 10—10 of Fig. 9.

Referring to the drawings, the tubing shown in Figs. 1–3 comprises a metallic spiral 10 formed of thin strip metal having its edges folded or reversely bent outwardly. The forward edge 12 (i. e., the right edge in Figs. 1–3) is folded more shortly, or in other words, farther from the center line of the strip than the trailing edge 14 (i. e., the left edge in Figs. 1–3).

The flexible element of the tube may be a strip 20 of treated or untreated fabric or any other flexible material suited to the requirements of usage. One edge 22 of the flexible strip 20 is inserted under the longer folded edge portion 14 during the formation of the tubing and prior to that edge portion 14 being bent all the way down. The other edge portion 24 of the flexible strip 20 is folded or reversely bent outwardly upon itself and then the folded edge 26 is tucked under the longer edge portion 14 of the preceding convolution A of the metal spiral as shown in Fig. 1. After this the longer edge portion 14 of the metal spiral is bent down tight upon both the edge portions 22 and 26 of the flexible strip to firmly grip them and frictionally hold them.

The shorter folded edge 12 of the metal spiral 10 tends to lock the flexible strip in place. To accomplish that objective the spacing between the extremities of the folded edges 12 and 14 is made small. Hence, should the edges of the flexible strip tend to pull out from under the edge 14 of the metal spiral, the flexible strip would tend to jam between and be held by the edges 12 and 14.

When constructed in the foregoing manner the flexible or fabric portion of the tubing, when the tubing collapses, will move outwardly and fold as indicated at 28 in Figs. 3 and 5 thus presenting a relatively smooth interior surface within the tubing.

To insure the outward folding, the folded portion is pinched during the formation of the tubing, the pinching being done while the metal convolutions of the tube are close together. While these convolutions are together there is an excess of fabric which folds over as at 28 and is pinched between a crimping roll (not shown) and a mandrel (not shown). In winding the fabric on the metal spiral it is desirable not to have the fabric under tension.

When the tubing is expanded the pinched part shows up as a ridge or line (28 in Figs. 4 and 5). In collapsing the tube from the position of Fig. 4 the part 27 of the fabric which follows the pinch 28 (i. e. at its left) moves over the part 29 of the fabric which is in advance of

the pinch (i. e. at its right). In other words, both parts 27 and 29 move to the right but part 27 turns upside down and moves over the part 29; and part 29 moves towards the next convolution.

In Fig. 6 an alternate form is shown wherein the edges of the fabric or flexible element are folded and tucked under the longer edge 114, as in the previously-described form. However, the leg 114 is longer than the edge 14 in the previous form and when bent down it overlaps the shorter edge 112 which is or may be about the same as the edge 12.

In Fig. 7 a third form is illustrated wherein the longer edge 214 may be of the same extent as 14 in Figs. 1–3; or it may be longer as in Fig. 6. But the longer edge 214 is bent down as in Figs. 1–3 to frictionally hold and firmly grip the edges of the fabric or flexible material between it and the body 210 of the metal spiral.

In Fig. 7 the short edge 212 is bent over on top of the longer edge with the layers of flexible material between the shorter and the longer edges. In this form the pull of the flexible material is always indirect or, in other words, around an edge of the spiral, thus tending further to inhibit or prevent pulling out of the fabric edges from the metal spiral.

It is not essential to double over the forward edge (as at 26, Figs. 1–3, 6 and 7) when inserting that edge under the flange 14. Insertion of a single thickness will suffice, as illustrated at 25 in Fig. 8.

In some cases it may be advisable to provide means to more securely hold the fabric edges under the flange 14. For that purpose I provide a series of serrations 30 in the edge of the flange 14. Each serration is made by cutting diagonally inwardly from the edge in backward direction and then bending down the back side 31 of the cut to form a sharp-edged tooth 32 which is obliquely inclined inwardly of the tube. These teeth bite into the flexible material or fabric under the flange 14 and thus securely hold the material. Often in bending the serrated metal edge a crack will occur in the flange at every other notch, running to the joint of the flange and the body of the strip. These cracks relieve the tension in the flange of the strip.

In all forms of the invention the collapsing of the tubing is facilitated by both edges of the flexible material lying in the same direction. Furthermore, because the flexible material moves outwardly upon collapse of the tubing, the tubing may be collapsed to a shorter length than in the prior collapsible tubing wherein the flexible material could move inwardly and thus occupy some of the space between the convolutions of the metallic spiral.

The tubing described herein can be made rapidly by the machine and process claimed in my copending application Serial No. 80,675, filed March 10, 1949, and issued concurrently herewith.

Many modifications of the invention will occur to those skilled in the art and therefore I do not limit the invention to the embodiments shown.

What is claimed is:

1. Collapsible tubing comprising a strip of metal wound into a spiral, an edge of said spiral being folded over outwardly, a strip of flexible material having one edge inserted under said folded edge of one convolution of said spiral, the other edge of said flexible strip being inserted under the same edge of the adjacent convolution of said spiral, said folded spiral edge being bent down to frictionally hold the edges of the flexible strip.

2. Collapsible tubing as claimed in claim 1 wherein both edges of the spiral are folded over outwardly.

3. Collapsible tubing as claimed in claim 2 wherein the folded edge of the spiral under which the flexible strip is held extends toward and close to and cooperates with the other edge tending to lock the edges of the flexible strip in place.

4. Collapsible tubing as claimed in claim 1 wherein one of the edges of the flexible strip is doubled over upon itself beneath said folded edge of the metallic spiral.

5. Collapsible tubing as claimed in claim 4 wherein both edges of the metallic spiral are folded outwardly.

6. Collapsible tubing as claimed in claim 5 wherein the folded edge of the spiral under which the flexible strip is held extends toward and cooperates with the other edge tending to lock the edges of the flexible strip in place.

7. Collapsible tubing as claimed in claim 1 wherein both edges of the metallic spiral are folded outwardly and the edge under which the flexible strip is inserted partially overlies the other edge of the spiral and is bent down thereon so as to hold the flexible strip between said other edge and itself.

8. Collapsible tubing as claimed in claim 7 wherein one of the edges of the flexible strip is doubled over on itself beneath the edge of the metallic spiral.

9. Collapsible tubing as claimed in claim 1 wherein the other edge of the metallic spiral is also folded over outwardly and overlies the edge of the spiral under which the flexible strip is held, thereby to hold the flexible strip between said two folded-over edges of the spiral.

10. Collapsible tubing as claimed in claim 9 wherein one of the edges of the flexible strip is doubled over on itself beneath the edge of the metallic spiral.

11. Collapsible tubing as claimed in claim 1 having means formed on the edge of spiral biting into the flexible strip.

12. Collapsible tubing as claimed in claim 1 having diagonal cuts in the edge of the spiral adjacent to which teeth are bent down into engagement with the flexible strip at spaced points along said edge of the spiral.

13. Collapsible tubing as claimed in claim 1 wherein the flexible strip is pinched to form an outwardly-extending ridge which causes the flexible strip material to fold outside the convolutions of the metal strip when the tubing collapses.

14. Collapsible tubing as claimed in claim 13 having means formed on the edge of the spiral biting into the flexible strip.

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