July 10, 1945. W. KASTEN 2,380,111

HELICALLY-WOUND BODY

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Fig. 1.

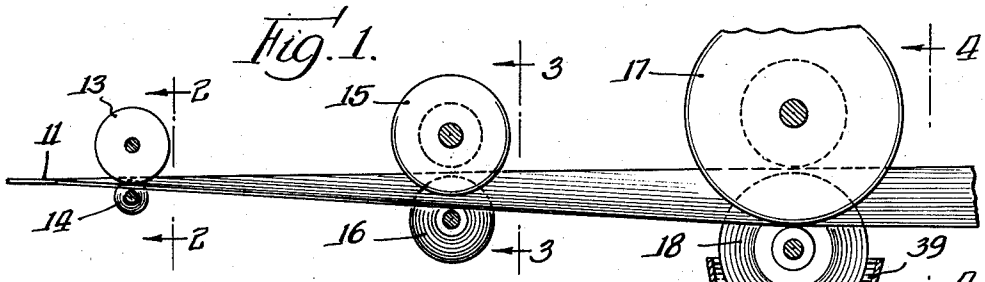


Fig. 2.

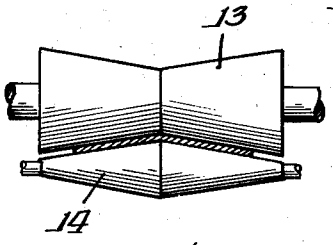


Fig. 3.

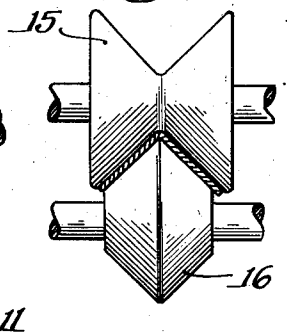


Fig. 4.

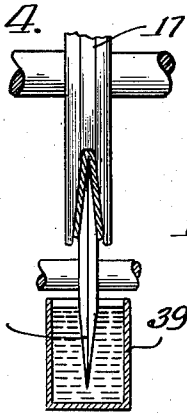


Fig. 7.



Fig. 5.

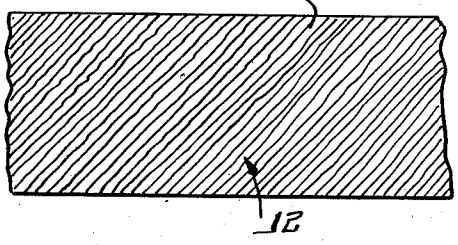


Fig. 6.

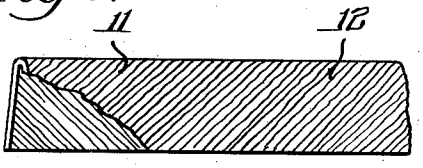


Fig. 8.

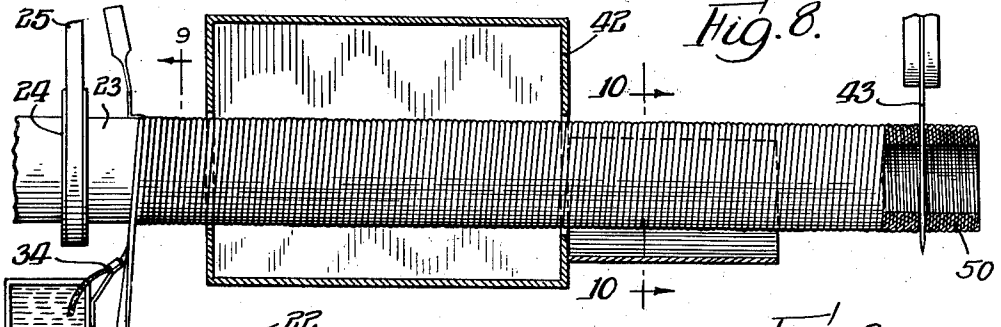
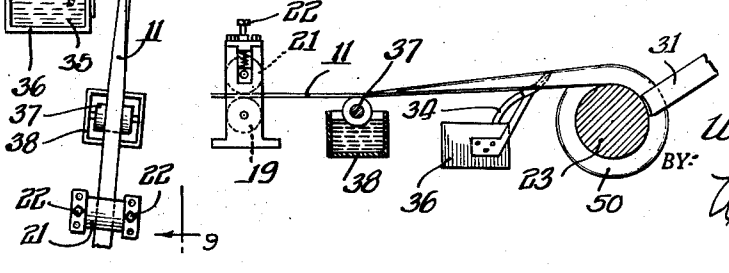


Fig. 9.



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HELICALLY-WOUND BODY

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Fig. 11.

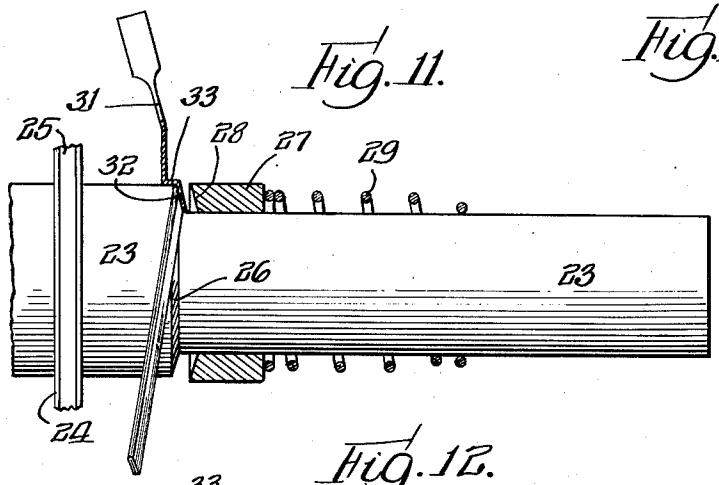


Fig. 10.

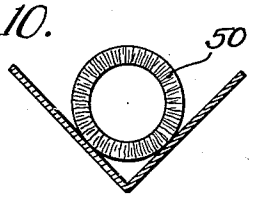


Fig. 12.

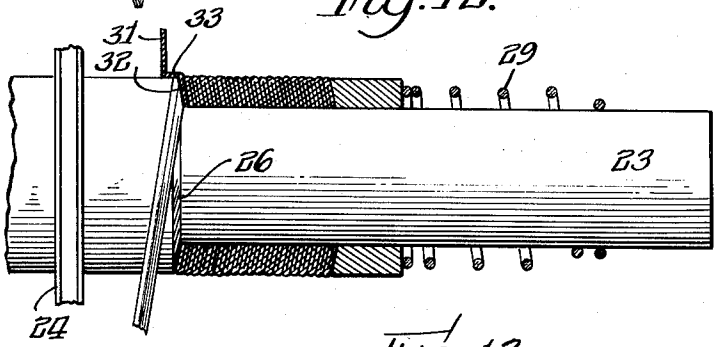


Fig. 13.

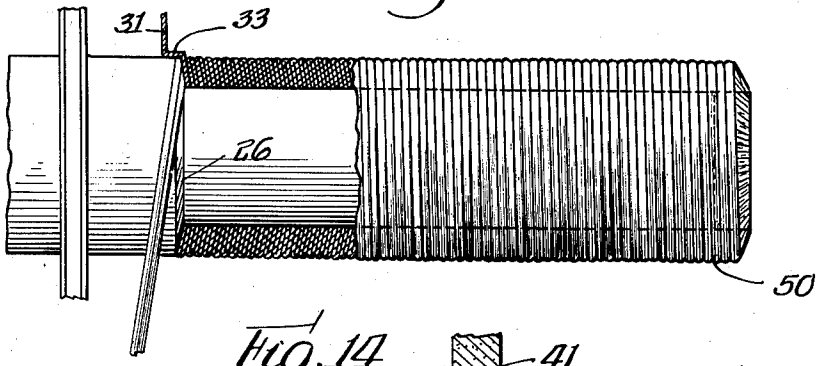
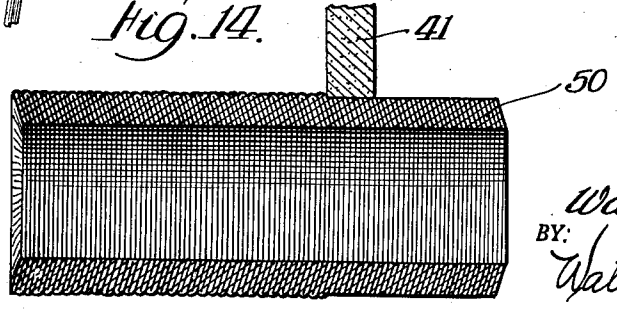


Fig. 14.



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UNITED STATES PATENT OFFICE

2,380,111

HELICALLY WOUND BODY

Walter Kasten, Franklin, Mich., assignor to Ralph L. Skinner, Detroit, Mich.

Application June 19, 1943, Serial No. 491,433

4 Claims. (Cl. 138—73)

The present invention concerns the production of hollow members or bodies, made of convolutely-wound or coiled bands, strips or ribbons, which may be satisfactorily used in various relations, such as edge-filtration filters, tubes, conduits, distributors, etc.

A main or leading aim of the invention is to provide such bodies which are novel and which have several outstanding advantages, among which may be mentioned simplicity, effectiveness, and economy, as well as other structural and functional benefits.

One feature of the invention involves the helical winding of an initially longitudinally-folded strip or ribbon of suitable material, such as paper or the like, on a revolving mandrel or form, so that a double-thickness of such band or strip is thus convolutely coiled thereon after which such double-thickness may be reduced to single-thickness of the strip.

Various other novel features will become apparent from the following detailed description, illustrated more or less diagrammatically in the accompanying drawings, forming a part of this specification, and to which reference should be had.

In the drawings:

Figure 1 illustrates the lengthwise folding of such band or tape;

Figure 2 is a cross-section on line 2—2 of Figure 1;

Figure 3 is a similar cross-section on line 3—3 of Figure 1;

Figure 4 is an analogous transverse section on line 4—4 of Figure 1;

Figure 5 is a face view of a short section of such strip or band;

Figure 6 shows a portion of the ribbon after such folding or bending;

Figure 7 presents a cross-section through the folded ribbon in its completed form;

Figure 8 portrays the winding of the folded ribbon on the revolving form, such figure including a heat-treating appliance as well as means for severing the completed body into parts or units;

Figure 9 is a transverse section on line 9—9 of Figure 8 on a smaller scale;

Figure 10 is a cross-section on line 10—10 of Figure 8;

Figures 11, 12 and 13 illustrate various steps in the winding operation and Figure 14 shows the grinding off or removal of the outer portion of the wound body.

In carrying out one desirable or preferred mode of practicing the novel invention of this application, a strip, ribbon, band or tape of suitable material, such as crepe-paper 11 (Figure 5), having oblique, substantially-parallel rugosities 12 or shallow alternating ribs and valleys on both of its opposite faces, disposed preferably at about 70°–80° to the lengthwise dimension of the strip, is preliminarily passed through three pairs of power-actuated rollers 13–14, 15–16 and 17–18 to fold the paper gradually progressively along its middle longitudinal line, as illustrated in Figures 1, 2, 3 and 4, such doubling of the paper on itself as presented in Figure 6, causing the rugosities or ribs of the two contiguous lengthwise parts to cross one another at from about 20° to 40°, thus assuring that the ribs of either part will not become nested in the valleys of the other part, this being true also of the ribs and valleys of two, adjacent, contacting convolutions of the strip after it is wound.

Such folded strip or band, with its two inner surfaces in contact with one another (Figure 7), is fed between a pair of rubber-surfaced, restraining pressure-rollers 19, 21, the pressure of which on the strip may be adjusted by screws 22 acting on the bearings of the upper roller 21.

From such restraining or retarding rollers, the folded paper-strip passes to the rotary form or mandrel 23 revolved on its axis by a pulley-and-belt drive 24, 25, or by any other appropriate means, such mandrel having an annular, sloping shoulder 26 against which the strip bears with its folded-edge disposed outermost.

This mandrel is equipped with a collar or sleeve 27 free to turn and slide on the smaller-diameter section of the mandrel and it has a sloping end surface 28 facing and parallel to the shoulder 26, the collar being initially pressed toward the shoulder by a coiled-spring 29 encircling the mandrel and having a suitable friction engagement therewith.

A thin, stationary, metal, blade separator or guide 31 (Figure 11) has a terminal part 32 between the sloping surface of such shoulder and adjacent, companion, inclined surface of the sleeve or collar, and an intermediate portion 33 just above, or beyond, and close to, the shoulder.

Assuming that the forward end of the folded crepe-paper ribbon has been fed between the shoulder 26 and the part 32 of the blade and beneath the portion 33 of the latter, such portions of the blade guide the longitudinally-folded paper-strip between themselves and the shoulder, and the part 33 prevents the forcing out of the strip beyond the outer periphery of the shoulder.

Rotation of the mandrel now has a tendency

to carry the paper-strip around and elongates the same in graduated degree transversely of the strip by reducing the crepe at the outer bend, this action naturally rolling the strip around the mandrel, in this way progressively forming a tube, similar to a closed coiled spring, the convolutions of which are produced by the duplex strip of paper.

As will be readily understood, the spring-pressed collar or sleeve, by reason of the frictional engagement of its spring with the mandrel, holds the convolutions pressed together, and, after a suitable length of the tube has been thus formed, the spring and collar are manually removed from the mandrel, the action of the collar from then on being replaced or superceded by the friction of the tube itself on the mandrel.

Inasmuch as there is a predetermined amount of tension applied to the paper-strip by the resilient-rollers 19 and 21 which causes elongation of part of the strip by the rotation of the mandrel, the amount of which depends upon the angle which the face of the strip describes with the axis of the finished tube and the distance from such axis, a certain small amount of slippage takes place between the sloping shoulder of the mandrel and the strip, the indicated restraining action or tension on the strip causing the thus formed-tube to rotate at a slower speed than that of the mandrel.

To prevent undue heating at the shoulder portion of the mandrel due to the specified friction, produced by the above-mentioned speed-differential, which might have a detrimental effect on the strip, especially if the latter is impregnated with an agent causing it to tend to adhere to the shoulder, a small amount of a lubricant or other suitable product may be applied to the corresponding face of the strip or shoulder, or to both, and as an example, a properly-supported wick 34 partially immersed in a supply 35 of such a medium in a receptacle or container 36 is positioned to engage one face of the strip before it contacts with the shoulder.

Also, to release some of the pressure, the mandrel may be tapered in minor degree so that as the wound body is built up thereon, the friction of the spring on the mandrel is correspondingly reduced.

In order to adhere the duplex-convolutions of the helically-wound body together, an adhesive may be applied to the other face of the strip by a roller 37 to which the adhesive medium is supplied from a container 38 in any approved manner.

A wound body 50 of this character and of the desired length may be made and removed from the mandrel ready for use as a washer, bearing, conduit, etc.

If preferred to cement the turns or convolutions of the strip or ribbon together more completely, the longitudinal parallel sections of the strip may be affixed together or united before the winding on the mandrel by applying an appropriate adhesive to the roller 18, the latter receiving it from a supply tank 39 (Figure 4).

In some instances, particularly where the coiled body is to be used as a filter, and also in other cases, the wound body may have its outer portion only consisting of the longitudinally bent parts of the ribbon, turned or ground off by any appropriate means 41 as shown in Figure 14.

In making an edge-filtration filter by this method, it is preferable to impregnate the paper-strip thoroughly with a phenolic-resin or other appropriate material before the winding, and after such winding to pass the wound body, as it is formed, through a heater 42 maintained at a suitable temperature to polymerize the resin so as to render it unchangeable and unaffected by the fluid, gas or liquid, to be filtered or by any of its contaminating agents, and thereafter cut the elongated body into appropriate individual units by a rotary cutter or saw 43, the grinding off of the outer surface portion referred to above taking place either before or after such severance into parts.

In such a case, the polymerized resin may be used as the adhesive to bind or adhere the two parts of the ribbon together and the resulting duplex convolutions together.

In this connection it should be borne in mind that when crepe-paper, or its equivalent, is used as the helically-wound ribbon, its convolutions can be adhered together, without closing the spaces between such adhered layers and through which shallow gaps the fluid to be filtered or distributed passes, and such adhering means may be the impregnating-agent which makes such material stable against detrimental action thereon by the media with which it comes in contact, when acting as a filter, distributor, etc.

Instead of folding lengthwise an already-creped paper-strip, the creping may be performed by one or more of the three sets of folding-rollers and the depths of the valleys and the heights of the intervening ribs may be tapered or graduated so as to preliminarily curve the strip edgewise the desired amount to conform substantially to the curvature of the surface of the mandrel.

If preferred, to reduce the time taken for making a given length of tubular body of the type indicated, two or more of the duplex or folded strips arranged in parallel may be wound on the mandrel simultaneously or substantially so.

Those acquainted with this art will readily understand that the invention as presented in the appended claims is not necessarily restricted to the precise and exact details set forth and that modifications may be resorted to without departure from the heart and essence of the invention and without the loss or sacrifice of any of its substantial benefits and advantages.

I claim:

1. In a round hollow body composed of a helically-wound ribbon of uneven-surface material folded over along a longitudinal line with its two lengthwise sections in face-to-face contact with one another, the outer surfaces of such wound duplex ribbon being in register with, and in contact with, one another, and means adhering such outer surfaces together with passages between them, the convolutions of said folded ribbon being at an oblique angle to the axis of the body, the novel improvement being that said ribbon has substantially-parallel surface rugosities at an oblique angle to the lengthwise dimension of the ribbon, whereby the rugosities of said outer surfaces of the folded ribbon cross one another.

2. In a round hollow body composed of a helically-wound plurality of individual parallel registered uneven-surface ribbons adhered together in face-to-face contact with one another with passages between the ribbons, the novel improvement being that said ribbons are crepe-paper and that the rugosities of the contacting faces of the ribbons cross one another.

3. In a round hollow body composed of a heli-

cally-wound plurality of individual parallel registered uneven-surface ribbons adhered together, the novel improvement being that each said ribbon has substantially-parallel rugosities on both of its opposite surfaces and that the rugosities of the contacting surfaces of the ribbons cross one another.

4. In a round hollow body composed of a helically-wound plurality of individual parallel registered uneven-surface ribbons adhered together, the novel improvements being that said ribbons are impregnated with an agent which precludes detrimental effect on said ribbons of the medium or media with which the body is to come in contact in use, that said agent is said adhering means, that each said ribbon has substantially-parallel rugosities on both of its opposite surfaces, and that the rugosities of the contacting surfaces of the ribbons cross one another.

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