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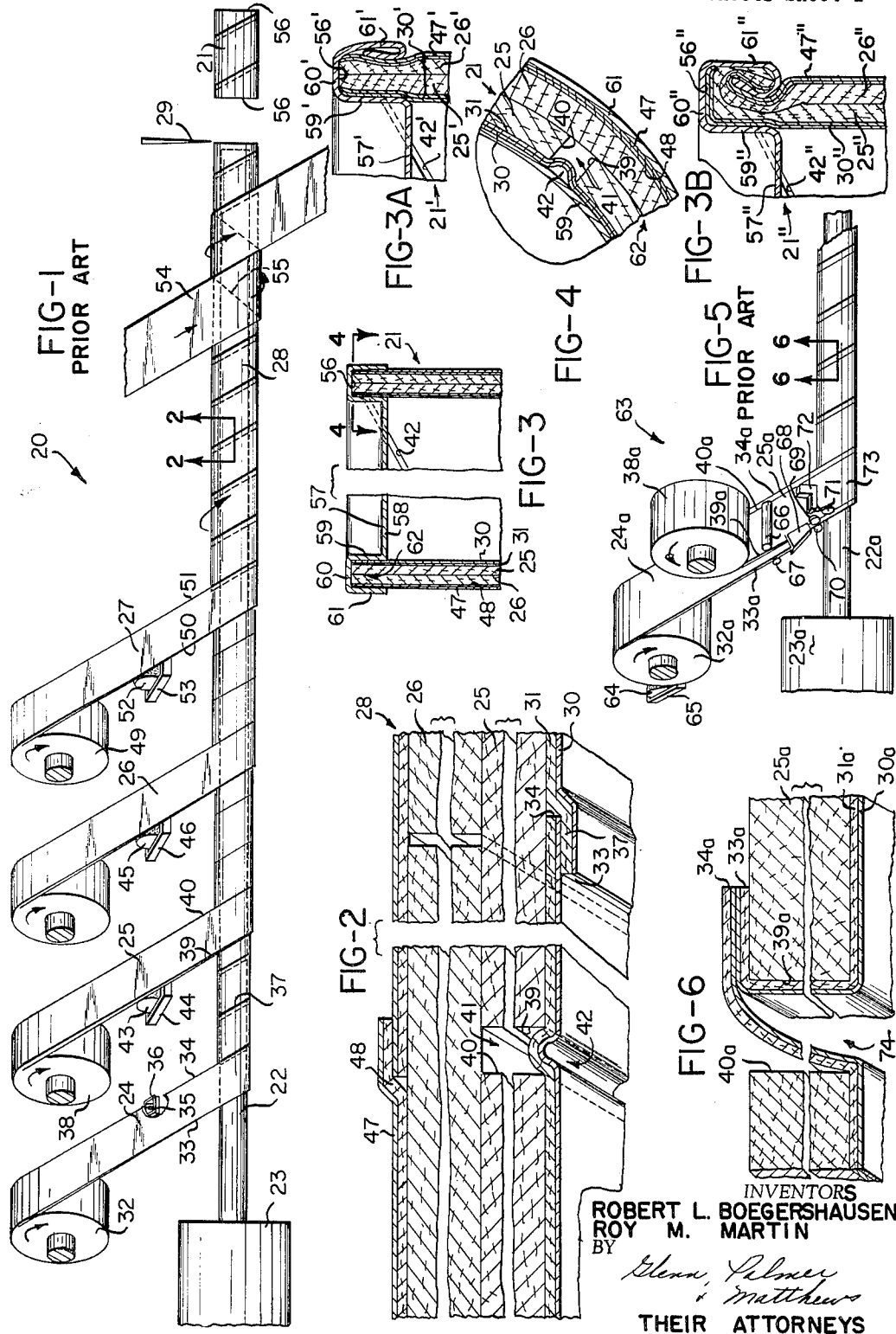
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HELICALLY WOUND TUBULAR MEMBER

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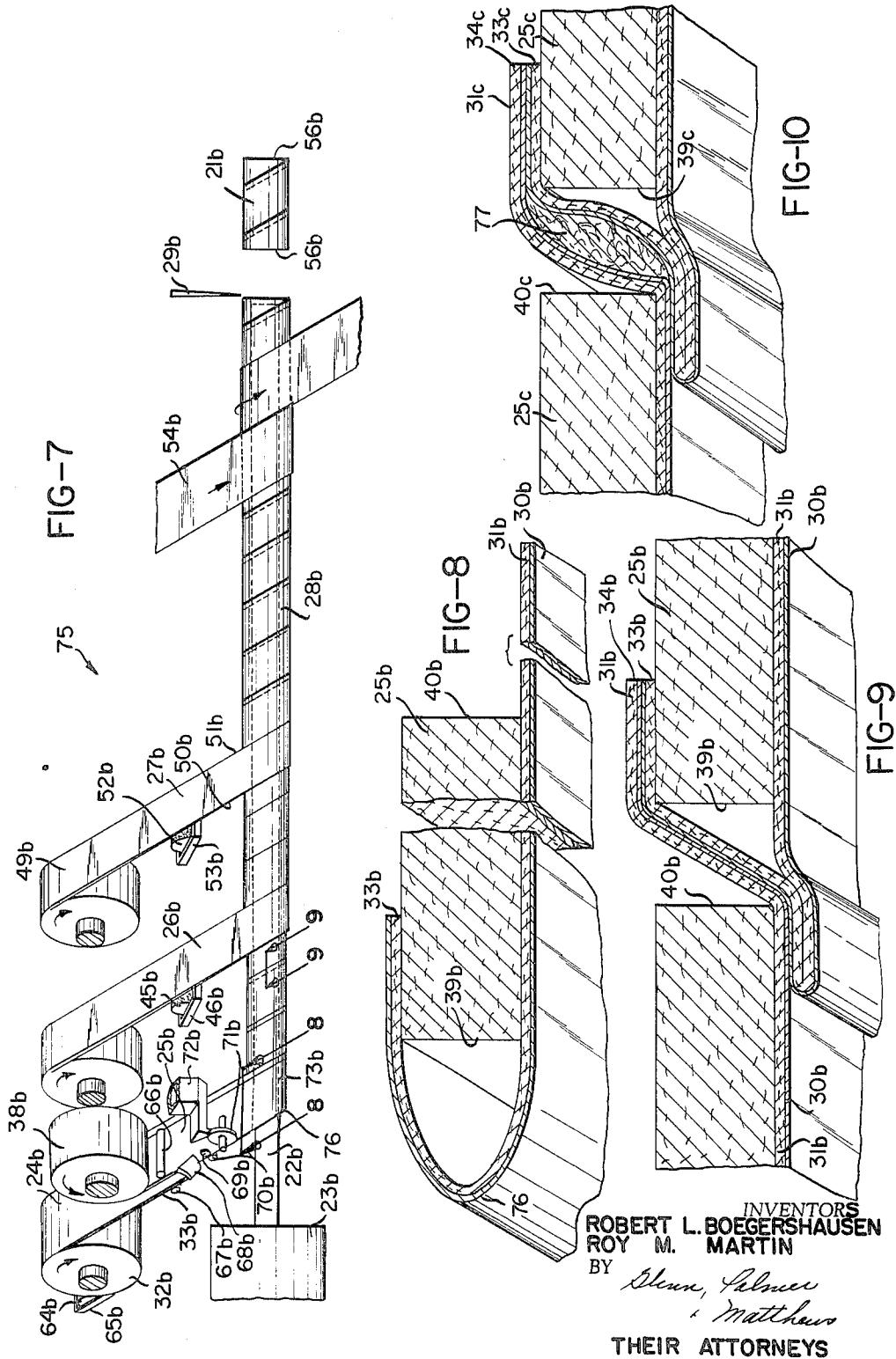
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HELICALLY WOUND TUBULAR MEMBER

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This invention relates to improved helically wound tubular members, such as composite container bodies or the like.

Heretofore, a problem has existed in the helically wound composite container art because the liner of each prior known helically wound container body provides a capillary action at the end closures of the container body in such a manner that moisture from a moisture bearing product disposed in such a container cannot only seep out of the end closure thereof but also wick into the container body material causing adverse deterioration thereof.

However, according to the teachings of this invention, such capillary action at the end closures of such composite containers is substantially eliminated whereby the containers of this invention are readily adapted to package moisture bearing products and the like.

Accordingly, it is an object of this invention to provide an improved helically wound tubular member or the like having one or more of the novel features of this invention as set forth above or hereinafter shown or described.

Other objects, uses and advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIGURE 1 is a schematic view illustrating one prior method and apparatus for making prior known container bodies or the like.

FIGURE 2 is an enlarged, fragmentary, cross-sectional view taken on line 2-2 of FIGURE 1.

FIGURE 3 is a fragmentary cross-sectional view illustrating the adverse effect of the prior art container of FIGURE 1.

FIGURE 3A is a view similar to FIGURE 3 and illustrates another embodiment of the end closure means of the prior art.

FIGURE 3B is a view similar to FIGURE 3 and illustrates still another embodiment of the end closure means of the prior art.

FIGURE 4 is an enlarged, fragmentary, cross-sectional view taken on line 4-4 of FIGURE 3.

FIGURE 5 is a view similar to FIGURE 1 illustrating another prior art method and apparatus.

FIGURE 6 is an enlarged, fragmentary, cross-sectional view taken on line 6-6 of FIGURE 5.

FIGURE 7 is a view similar to FIGURE 1 and illustrates the method and apparatus of this invention for making the improved tubular member of this invention.

FIGURE 8 is an enlarged, fragmentary, cross-sectional view taken on line 8-8 of FIGURE 7.

FIGURE 9 is also an enlarged, fragmentary, cross-sectional view taken on line 9-9 of FIGURE 7.

FIGURE 10 is a view similar to FIGURE 9 and illustrates another embodiment of this invention.

While the various features of this invention are hereinafter described as being particularly adaptable for making tubular members for composite containers, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide tubular members for other desired functions.

Therefore, this invention is not to be limited to only the embodiments illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

In order to fully understand the important advance-

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ments provided for the container art by the teachings of this invention, it is deemed necessary to fully point out the prior art structure and method of making the same in order to fully illustrate how this invention overcomes adverse effects produced by the prior art containers.

Referring now to FIGURE 1, a prior art method and apparatus is generally indicated by the reference numeral 20 and is utilized to continuously make helically wound tubular members 21 to be subsequently utilized as container bodies.

As illustrated in FIGURE 1, a cylindrical forming mandrel 22 is mounted in cantilevered fashion to a supporting means 23 and is adapted to have webs of material 24, 25, 26 and 27 serially and helically wound thereon to continuously produce container body stock 28 that is continuously rotated and axially advanced to the right on the mandrel 22 to be subsequently cut into individual tubular members 21 by a suitable cutting means 29 in a conventional manner.

For example, the first web of material 24 is preformed by laminating a strip of metallic foil 30, FIGURE 2, such as aluminum-containing metallic foil or the like, to a strip of paper backing material 31, the web of lining material 24 being angularly drawn onto the forming mandrel 22 from a free wheeling supply roll 32 and having the opposed edges 33 and 34 thereof disposed in overlapping relation as illustrated in FIGURE 2.

The overlapping edges 33 and 34 of adjacent convolutions of the helically wound lining material 24 can be secured together by applying a suitable adhesive to the under surface of the edge 34 by an applicator roller 35 receiving the adhesive from a reservoir 36.

Subsequently, the web of material 25 is helically wound onto the helically wound lining material 24 in such a manner that the strip of material 25 completely overlaps the spiral seam 37 defined by the overlapping edges 33 and 34 of the lining material 24.

The web of material 25 comprises a relatively thick paperboard material and is helically wound onto the mandrel 22 from a free wheeling supply roll 38 in such a manner that the opposed edges 39 and 40 thereof are disposed closely adjacent each other in non-overlapping relation.

While it is desired that the edges 39 and 40 of the web of material 25 be disposed in abutting relation, it has been found in actual practice that the spacing between the adjacent edges 39 and 40 of the helically wound strip of material 25 varies from 0 to $\frac{1}{32}$ of an inch or more.

This gap or void between the adjacent edges 39 and 40 of adjacent convolutions of the helically wound strip of paperboard material 25 is generally indicated by the reference numeral 41 in FIGURE 2 and has an adverse effect on the lining material 33 in a manner hereinafter described.

In particular, it has been found that when the tubular container body stock 28 is formed in the manner illustrated in FIGURE 1, the lining material 24 tends to enter the gap 41 between the adjacent edges 39 and 40 of adjacent convolutions of the strip of material 25 to form an inwardly directed spiral groove 42 in the interior surface of the stock 28 throughout the length thereof, such spiral groove 42 producing an adverse effect in the completed container in the manner hereinafter described.

The strip of material 25 is adapted to be secured to the exterior surface of the helically wound lining material 24 by a suitable adhesive being placed on the under surface of the strip of material 25 by an applicator roller 43 receiving the adhesive from a reservoir 44.

Subsequently, one or more additional strips of paperboard material, such as strip 26, are helically wound on the first strip of paperboard material 25 in the manner

illustrated in FIGURES 1 and 2 to build up the body thickness and strength of the tubular stock 28, the strip of material 26 having the under surface thereof suitably coated by an adhesive applicator roll 45 receiving the adhesive from a reservoir 46.

After the desired thickness of the container body stock 28 has been provided by the paperboard material, a labeling or wrapping material 27 is helically wound onto the mandrel 22, the material 27 normally comprising a strip of metallic foil 47 laminated to a strip of paper backing material 48 in the manner illustrated in FIGURE 2.

The strip of wrapping material 27 is drawn from a free wheeling supply roll 49 onto the mandrel 22 and has the opposed edges 50 and 51 thereof disposed in overlapping relation as illustrated in FIGURE 2, the under surface of the strip of material 27 receiving a suitable adhesive from an applicator roller 52 receiving the adhesive from a reservoir 53.

In order to continuously draw the strips of material 24-27 onto the mandrel 22 to continuously form the container body stock 28, the container body stock 28 is continuously rotated and axially advanced to the right on the mandrel 22 in any suitable manner.

For example, a continuous crossed belt 54 can be provided and the same has a section 55 thereof looped around the container body stock 28 whereby continuous movement of the crossed belt 54 in the direction indicated by the arrows in FIGURE 1 causes the container body stock 28 to be continuously rotated and axially advanced to the right on the mandrel 22.

Therefore, it can be seen that as the container body stock 28 is axially advanced to the right on the mandrel 22, the cutting means 29 can cut the same into individual container bodies 21.

Each container body 21 is adapted to have the opposed opened ends 56 thereof closed by suitable metal end closures 57 in the manner illustrated in FIGURE 3.

In particular, each end closure 57 has a central circular portion 58 adapted to be telescopically received in the end 56 of the container body 21 and has a vertical flange 59 integrally interconnected to an outwardly extending horizontal flange 60 which terminates in a downwardly extending peripheral flange 61, the flanges 59-60 defining an annular channel 62 to receive the end 56 of the container body 21.

After the end closure 57 has been disposed in the position illustrated in FIGURE 3, the flanges 61 and 59 thereof of the end closure 57 are pinched toward each other to effectively seal the end closure 57 to the container body 21.

However, it has been found that the spiral channel 42 formed in the lining material 24 of the completed container extends from one opposed end 56 thereof to the other opposed end 56 in such a manner that the same defines a capillary tube when covered by the flanges 59 of the end closures 57 in the manner illustrated in FIGURES 3 and 4.

Thus, should the finished container have a moisture bearing product disposed therein, the moisture or liquid in the product is drawn by capillary action through the channel 42 in the lining material 24 at the end closures 57 toward the horizontal flange 60 thereof whereby not only can such moisture or liquid leak out of the end closures 57 but the same is also adapted to wick onto the raw edges of paperboard strips 25 and 26 of the container having raw edges thereof disposed at the horizontal flanges 60 of the end closures 57 whereby the moisture wicking into the paperboard material 25 and 26 causes adverse deterioration of the container body 21 by not only adversely affecting the adhesive thereof but also causing swelling and softening of the container body 21 so that the same can be easily ruptured or the like.

While this adverse capillary action has been described

in connection with the end closure structure illustrated in FIGURE 3, it is to be understood that such adverse capillary action is also provided in other types of known end closure structure.

For example, reference is made to FIGURE 3A wherein another prior known end closure structure is disclosed and parts thereof similar to parts of FIGURE 3 are indicated by like reference numerals followed by a prime mark.

As illustrated in FIGURE 3A, the end closure 57' is substantially the same as the end closure 57 except that the peripheral flange 61' of the end closure 57' is reversely turned to define a bead that is pressed into the end 56' of the container body 21' to facilitate securement of the end closure 57' to the open end 56' of the container body 21'.

Similarly, the peripheral flange 61'' of the end closure 57'' in FIGURE 3B is reversely turned except that the reversely turned portion of the flange 61'' traps part of the end 56'' of the container body 21'' between the reversely turned portion and the remainder of the peripheral flange 61'' to facilitate securement of the end closure 57'' to the open end 56'' of the container body 21''.

However, as in the embodiment illustrated in FIGURE 3, the grooves 42' and 42'' in the lining material of the container bodies 21' and 21'' cooperate with the engaging surfaces of the end closures 57' and 57'' to provide the aforementioned adverse capillary action at the end closures 57' and 57'' regardless of the construction of the end closures.

Further, the raw edge 33 of the lining material 24 is exposed to the interior of the container 21 whereby the moisture in the moisture bearing product is adapted to wick into the raw edge 33 of the paper backing material 31 of the container body 21 and further wick into the paperboard material 25 and 26 thereof to provide the above adverse effects.

Attempts have been made to eliminate the wicking action that takes place at the raw edge 33 of the lining material 24 illustrated in FIGURE 2.

For example, another method and apparatus of the prior art is generally indicated by the reference numeral 63 in FIGURE 5 and parts thereof similar to the apparatus 20 are indicated by like reference numerals followed by the reference letter "a." The apparatus 63 comprises the forming mandrel 22a secured in cantilevered fashion to the supporting means 23a.

However, the strip of lining material 24a and first strip of paperboard material 25a are helically wound together onto the mandrel 22a as illustrated in FIGURE 6.

In particular, the strip of lining material 24a is fed onto the mandrel 22a from the free wheeling supply roll 32a and comprises a strip of metallic foil 30a laminated to a strip of paper backing material 31a in the manner previously described.

The paperboard material 25a is also fed from a free wheeling supply roll 38a in unison and in superimposed relation with the strip of lining material 24a. However, the opposed edges 39a and 40a of the strip of paperboard material 25a are respectively disposed inboard of the opposed edges 33a and 34a of the lining material 24a in the manner illustrated in FIGURE 5.

As the lining material 24a is drawn from the roll 32a, a suitable adhesive is applied to the paper backing surface 31a thereof by an applicator roller 64 receiving adhesive from a reservoir 65 whereby the strip of paperboard material 25a is secured to lining material 24a as the strips 24a and 25a pass between a pair of pinch rollers 66 and 67.

After the secured strips of material 24a and 25a pass through the pinch rollers 66 and 67, a suitable plow or folder 68 folds the edge 33a of the strip of lining material 24a completely and tightly around the edge 39a of the material 25a in the manner illustrated in FIGURE 6,

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such folded edge 33a being adhered in place by passing through a pair of pinch rollers 69 and 70.

Subsequently, the folded edge 33a of the strip of lining material 24a has a suitable hot melt wax or other adhesive applied to the upper surface thereof by an applicator roller 71 receiving the adhesive from a reservoir 72.

Thereafter, the completed web of material 73, formed in the above manner, is helically wound onto the mandrel 22a in the manner illustrated in FIGURE 6 whereby the adjacent edges 39a and 40a of the strip of material 25a are disposed in non-overlapping relation while the end edge 34a of the strip of material 24a is disposed on top of the edge 33a thereof and secured together by the adhesive applied by the applicator roll 71.

In this manner, it can be seen that the resulting structure illustrated in FIGURE 6 provides means whereby the lining material 24a has the foil sides of the edges 33a and 34a thereof secured together so that no wicking action can take place at the spiral seam 74 defined between the adjacent edges of adjacent convolutions of the helically wound strip of material 73.

However, the resulting structure illustrated in FIGURE 6 has a decided inwardly facing channel disposed at spiral seam 74 thereof whereby channel 74 provides the capillary action at the end closures 57 in the same manner as the spiral channel 42 of the container 21 previously described.

Therefore, while the structure illustrated in FIGURE 6 prevents the wicking action at a raw edge of the helically wound liner material, the same still provides the capillary action at the end closures 57 to produce the adverse wicking action into the paperboard material in the manner previously described.

However, according to the teachings of this invention, not only can the wicking action that takes place at the raw edge 33 of the lining material 24 of FIGURE 2 be eliminated, but also the wicking action at the spiral channel 42 or spiral channel 74 of the embodiments illustrated in FIGURES 2 and 6 can be eliminated.

In particular, one embodiment of the method and apparatus of this invention is generally indicated by the reference numeral 75 in FIGURE 7 and parts thereof similar to the structure illustrated in FIGURES 1 and 5 are indicated by like reference numerals followed by the reference letter "b."

As illustrated in FIGURE 7, the container body stock 28b is formed on the mandrel 22b in substantially the same manner that the container body stock is formed on the mandrel 22a illustrated in FIGURE 5 except for the following important distinction.

In particular, as the stripes of lining material 24b and paperboard material 25b are passed through the folding plow 68b, the folding plow 68b is so constructed and arranged that the same folds the edge 33b of the strip of lining material 24b against the top surface of the strip of paperboard material 25b in such a manner that the strip of lining material 24b provides a large loop 76 that is considerably spaced from the adjacent end edge 39b of the strip of paperboard material 25b.

This loop 76 provides important structure in forming the container bodies 21b of this invention.

In particular, after the resulting web of material 73b passes through the pinch rollers 69b and 70b and has the hot melt adhesive applied to the exposed surface of the end edge 33b of the lining material 24b by the applicator roller 71b, the web of material 73b is so helically wound onto the mandrel 22b that the loop 76 of the lining material 24b is subsequently flattened in the manner illustrated in FIGURE 9 by the adjacent convolution of the web of material 73b whereby the loop 76 overlaps the inside surface of the adjacent convolution of the web of material 73b while the end edge 34b of the lining material 24b overlaps the outside surface of the adjacent convolution of the web of material 73b in the manner illustrated in FIGURE 9 and is secured to the end

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edge 33b of the lining material 24b to provide the foil-to-foil seal of the liner 24b.

In this manner, it can be seen that no raw edges of the paper backing material 31b of the lining material 24b is exposed to the interior of the resulting container body whereby no wicking action can take place at the overlapping seam of the lining material 24b.

Further, and most important, the crushed loop 76 of the lining material 24b completely closes off the space or void between the adjacent edges 39b and 40b of the strip of material 25b to prevent any capillary action at the end closures of the resulting container.

It has been found that when helically wound tubular container is formed in the manner illustrated in FIGURE 7, the resulting container body 21b will not have the adverse capillary action at the end closures thereof even though the end closures are formed in the same manner as illustrated in FIGURE 3 because no inwardly facing channel is provided at the variable spacing between the adjacent ends 39b and 40b of the first strip of paperboard material 25b as is provided by the channel 42 in FIGURE 2 and the spiral seam 74 in the prior art structure of FIGURE 6.

Therefore, it can be seen that not only has an improved tubular member been provided by this invention, but also an improved method and apparatus of making the same or the like has been provided by this invention.

After the strips of material 24b and 25b have been helically wound on the forming mandrel 22b in the above manner, the strips of material 26b and 27b can be helically wound thereon to complete the container body stock 28b in the manner previously described for the container body stock 28.

If desired, the applicator roller 71b of this invention can be so constructed and arranged that the same not only applies the hot melt wax adhesive to the surface of the end edge 33b that is in superimposed relation on the end edge 39b of the strip of material 25b, but also the applicator roll 71b can deposit an excess amount of adhesive on part of the loop 76 of the web of material 73b to produce the structure illustrated in FIGURE 10, the structure illustrated in FIGURE 10 being indicated by the like reference numerals followed by the reference letter "c."

As illustrated in FIGURE 10, the excess adhesive or wax 77 is collected between the loop 76c and the end edge 34c of the lining material 24c to tend to fill the void between the adjacent edges 39c and 40c of the strip of paperboard material 25c to further tend to eliminate any attempt of the lining material 24b to form an inwardly facing spiral channel at the variable gap between the adjacent end edges 39c and 40c of the paperboard material 25c.

Further, by filling the void between the adjacent edges 39c and 40c of the strip of paperboard material 25c with the adhesive or wax 77, not only is a better seal provided at the spiral seam of the web of material, but also the compressive strength of the resulting container is improved.

Accordingly, not only does this invention provide an improved helically wound tubular member or the like, but also this invention provides an improved method and apparatus for forming such a tubular member or the like.

While the various novel features of this invention have been described in connection with a lining material comprising a lamination of a sheet of metallic foil and a sheet of paper backing material, it is to be understood that this invention can also be utilized with other types of lining material because the other types of lining material will also provide the adverse capillary action at the end closures of the container bodies when such lining material is utilized in the manner set forth in the prior art methods of FIGURES 1 and 5.

For example, such lining material can comprise just

a plain sheet of metallic foil, a sheet of plastic material, plastic coated paper and the like.

Therefore, the term "lining material" or the like utilized in the appended claims is intended to cover any desired lining material and is not to be limited to a foil-paper lamination. Even in the specific recitation of the foil-paper lamination, the particular claim is intended to cover all equivalents thereof.

While the form of the invention now preferred has been disclosed as required by the statutes, other forms may be used, all coming within the scope of the claims which follow.

What is claimed is:

1. A tubular member comprising a helically wound web of material including a first strip of helically wound material having opposed sides and having opposed end edges disposed adjacent each other, and a second strip of material disposed against the inner surface of said first strip of material and having opposed end edges, one of said end edges of said second strip of material being disposed against the outer side of said first strip of material in such a manner that said second strip of material forms a loop that is spaced from the adjacent end edge of said first strip of material, said loop overlapping the inside surface of the adjacent convolution of said web of material.

2. A tubular member as set forth in claim 1 wherein other webs of material are helically wound on said first-named web of material.

3. A tubular member comprising a helically wound web of material including a first strip of helically wound material having opposed sides and having opposed end edges disposed adjacent each other, and a second strip of material secured to the inner surface of said first strip of material and having opposed end edges, one of said end edges of said second strip of material being secured to the outer side of said first strip of material in such a manner that said second strip of material forms a loop that is spaced from the adjacent end edge of said first strip of material, said loop overlapping the inside surface of the adjacent convolution of said web of material.

4. A tubular member as set forth in claim 3 wherein said first strip of material comprises paperboard.

5. A tubular member as set forth in claim 3 wherein said second strip of material comprises a lamination of metallic foil and paper backing.

6. A tubular member as set forth in claim 5 wherein said paper backing of said second strip of material is secured to said first strip of material whereby said metallic foil forms the interior surface of said tubular member.

7. A tubular member comprising a helically wound web of material including a first strip of helically wound material having opposed sides and having opposed end edges disposed adjacent each other, and a second strip of material secured to the inner surface of said first strip

of material and having opposed end edges, one of said end edges of said second strip of material being secured to the outer side of said first strip of material in such a manner that said second strip of material forms a loop that is spaced from the adjacent end edge of said first strip of material, said loop overlapping the inside surface of the adjacent convolution of said web of material, the other end edge of said second strip of material being spaced outwardly from the adjacent end edge of said first strip of material and overlapping the outside surface of the adjacent convolution of said web of material.

8. A tubular member as set forth in claim 7 wherein said other end edge of said second strip of material is secured to said one end edge thereof.

9. A tubular member as set forth in claim 8 wherein said second strip of material comprises a lamination of metallic foil and paper backing and wherein said securement between said end edge of said second strip of material provides foil-to-foil securement.

10. A tubular member comprising a helically wound web of material including a first strip of helically wound material having opposed sides and having opposed end edges disposed adjacent each other, and a second strip of material secured to the inner surface of said first strip of material and having opposed end edges, one of said end edges of said second strip of material being secured to the other side of said first strip of material in such a manner that said second strip of material forms a loop that is spaced from the adjacent end edge of said first strip of material, said loop overlapping the inside surface of the adjacent convolution of said web of material, the other end edge of said second strip of material being spaced outwardly from the adjacent end edge of said first strip of material and overlapping the outside surface of the adjacent convolution of said web of material, and means disposed between said loop and said other end edge of said second strip of material to tend to fill the void between the adjacent end edges of said first strip of material.

11. A tubular member as set forth in claim 10 wherein said means comprises wax.

12. A tubular member as set forth in claim 10 wherein said means comprises an adhesive.

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