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(54) Dunnage bag with anti-dilatation features and method for making same.

(57) A dunnage bag and method for making the bag are disclosed in which the bag casing has a plurality of outwardly extending end flaps (253a,253b) and a plurality of outwardly extending corner flaps (270a,270b) on each side of the end flaps (253a,253b). The end flaps are folded over at each end of the casing and secured to the opposite wall. The corner flaps (270a,270b) are folded inwardly and tucked inside the opposite wall to provide a support at each bladder corner to prevent dilatation of the bladder (232) during and after inflation.

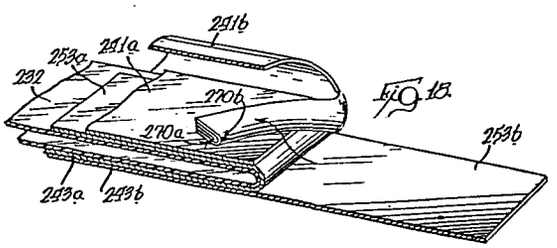

Fig. 15

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DESCRIPTION

DUNNAGE BAG WITH ANTI-DILATATION FEATURES AND METHOD FOR MAKING SAME

Technical Field

The present invention relates to dunnage bags, and more particularly, to inflatable dunnage bags.

Background of the Invention

Conventional inflatable, disposable dunnage bags have a gastight bladder, typically constructed from polyethylene, that is surrounded by an outer protective and supportive shroud or casing consisting of one or more plies of material, usually paper.

Such dunnage bags are used in cargo or freight carriers where it is customary to fill the spaces between the cargo or between the cargo and the walls of the freight carrier to prevent the cargo from shifting and damaging either the cargo itself and/or the walls of the freight carrier. The dunnage bags are placed between the cargo in a deflated condition and are subsequently inflated with a gas (usually air) to a certain design pressure, usually between two and six pounds per square inch gauge, depending upon the size and wall structure of the particular bag.

During inflation of the dunnage bag, the bladder inside the casing is subjected to various forces associated with the gas inflation process. Portions of the bladder, if not suitably supported, may be excessively stressed and may fail.

Typically, the dunnage bag bladder is disposed within the multi-ply casing with the corners of the bladder adjacent the corners of the casing. Also, the plies or sheets forming the casing typically have end flaps which are folded over the

ends of the bladder and secured in the folded over position to the casing wall. The end flaps may be as wide as the casing, slightly wider than the casing, or slightly narrower than the casing.

Typical of recent end closure designs for dunnage bags are those described in the U.S. patents to Ludlow, No. 3,365,116; to Hollis, No. 3,556,318; to Evans, No. Re. 27,787; to Shaw, No. 3,808,981; to Baxter, No. 3,955,690; and to Robbins, No. 4,136,788. The end closures illustrated in all of these patents involve the use of end flaps on the plies or sheets of one wall of the casing which are folded over the end of the casing and then placed between certain plies of the opposite wall of the casing. Some or all of these folded end flaps are then secured to each other and/or adjacent plies of the wall into which they have been inserted.

Discovery and Analysis of Technical Problems

The inventors of the instant invention have discovered that it is desirable to ensure that the folded over end flaps provide adequate support for the end of the bladder. Further, they have found it desirable to ensure that the bladder itself is properly positioned in the bag with the exterior surface of the bladder contacting, or sufficiently close to, the folded over end flaps so that, when the bladder is inflated, sufficient support will be provided for the bladder to prevent the imposition of excessive stresses.

It is believed that during commercial fabrication of dunnage bags, proper placement of the bladder relative to the encasing sheets may not always be effected. If there is excessive space between the deflated bladder and the inside surfaces of either or both casing ends, then the bladder,

during inflation, will expand into the space. This dilatation of the bladder may cause the bladder to burst.

In view of the inventors' discovery of the above-discussed problem of bladder dilatation, it would be desirable to provide a dunnage bag end fold structure having an interior support surface more closely resembling the contour of the bladder in the bag or, at least, providing more support for the bladder and reducing the tendency of the bladder to dilatate.

Further, it would be desirable to provide a casing in which the position of the inserted bladder could be visually checked even after an end flap has been folded over the casing end.

In providing an improved dunnage bag structure to better support the dunnage bag bladder, it would also be desirable if that structure could be fabricated from a continuous length of casing in a relatively simple manner without requiring excessive fabrication steps and in a manner that would avoid the production of waste casing material.

Summary of the Invention

According to one aspect of the invention, a multi-ply dunnage bag comprising an inflatable bladder encased within a plurality of protective reinforcing sheets is provided with end flaps on each sheet at at least one end of the bag. A pair of separate corner flaps are also provided at the bag end on each sheet which permit the position of the bladder, when inserted into the casing, to be observed during folding of the end flaps. The corner flaps are folded together inwardly from the bag side edge and positioned directly or indirectly above the bladder so as to support a corner of the bladder during and after inflation.

To form the casing for an individual bag, a desired leading length is severed, with a plurality of cuts, from a continuously formed casing tube. Specifically, the front walls of all of the sheets forming the casing tube front wall are cut along a straight line segment substantially perpendicular to the casing side edges and, similarly, all of the back walls of the sheets forming the back wall of the casing tube are cut along a parallel straight line segment substantially perpendicular to the casing side edges. In the preferred embodiment, the two parallel cuts are then joined at each end by simultaneously cutting through the front and back walls of the casing with two T-shaped cuts, one of the T-shaped cuts being made at one side edge of the casing and the other of the T-shaped cuts being made at the opposite side of the casing so as to sever the leading length of the casing tube from the trailing length of the casing tube and to define the above-described end flap and corner flap structure.

The novel structure is especially effective with multi-ply, disposable dunnage bags having paper reinforcing sheets. However, the structure would also function advantageously with single-ply dunnage bags and with reusable dunnage bags.

Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and of one embodiment thereof, from the claims, and from the accompanying drawings.

Brief Description of the Drawings

In the accompanying drawings forming part of the specification, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a perspective view of a known type of conventional, single ply dunnage bag casing;

Figure 2 is a greatly enlarged, fragmentary, partial cross-sectional view of the side of an inflated dunnage bag incorporating the dunnage bag casing illustrated in Figure 1;

Figure 3 is a fragmentary, plan view taken generally along the plane 3-3 in Figure 2;

Figure 4 is a schematic diagram illustrating a method for fabricating the casing tubing used to form the individual dunnage bag casing illustrated in Figure 1;

Figure 5 is a schematic diagram illustrating the end flap cutting configuration of the individual dunnage bag casing of Figure 1;

Figure 6 is a perspective view of a novel, single ply dunnage bag casing;

Figure 7 is a schematic diagram illustrating the formation of a casing tubing from which the single dunnage bag casing illustrated in Figure 6 is ultimately fabricated;

Figure 8 is a schematic diagram, similar to Figure 7, but illustrating the bottom wall of the casing tubing;

Figure 9 is a schematic diagram, similar to Figure 7, but illustrating an additional fabrication step;

Figure 10 is a table showing the sequence for cutting the casing tubing of Figure 7 to form the dunnage bag casing illustrated in Figure 6;

Figure 11 is a schematic diagram similar, to Figure 7, but illustrating the fabrication of a twoply casing tubing from two reinforcing sheets;

Figure 12 is a fragmentary, plan view of one end of the completed, two-ply dunnage bag casing illustrated as being fabricated in Figure 11, but with a deflated bladder positioned within the casing;

Figure 13 is an enlarged, fragmentary, cross-sectional view taken generally along the plane 13-13 in Figure 12;

Figure 14 is a fragmentary, perspective view of the partially fabricated dunnage bag structure of Figure 12, but with portions of the structure cut away to better illustrate the interior arrangement;

Figure 15 is a view similar to Figure 14 but showing the end flap of the innermost casing sheet folded over on top of the bladder;

Figure 16 is an enlarged, cross-sectional view of the folded structure of Figure 15 showing the end flap of the innermost casing sheet adhesively secured to the wall of the innermost casing sheet;

Figure 17 is a view similar to Figure 15 but showing the corner flap structure of the dunnage bag casing being squeezed together and moved inwardly toward the main portion of the dunnage bag casing;

Figure 18 is a view similar to Figure 17 but showing the corner flap structure moved into the dunnage bag casing open end;

Figure 19 is a fragmentary, plan view of the partially completed dunnage bag structure illustrated in Figure 18;

Figure 20 is a view similar to Figure 18 but showing the end flap of the outermost casing sheet folded over and tucked into the dunnage bag casing end;

Figure 21 is a fragmentary, cross-sectional view of the dunnage bag structure illustrated in Figure 20 but with the outermost casing sheet secured in place with adhesive on top of the folded end flap of the outermost ply; and

Figure 22 is a fragmentary, cross-sectional view of the end of a dunnage bag showing another form

of construction wherein the end of the inflatable bladder is folded over within the casing.

The various views of the figures are shown with greatly enlarged sheet cross sections to better illustrate the casing structure and fold configuration.

Description of the Preferred Embodiment

This invention is susceptible of embodiment in many different forms. There is shown in the drawings and will herein be described preferred embodiments of the invention. It should be understood, however, that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiments illustrated.

The precise shapes and sizes of the structures and components herein described are not essential to the invention unless otherwise indicated. Unless otherwise indicated, the particular shapes and relative sizes are shown to best illustrate the principles of the invention.

For ease of description, the dunnage bag will be described in a generally horizontal position and terms such as front or top, back or bottom, upper, lower, horizontal, etc., will be used with reference to this position. It will be understood, however, that the dunnage bag may be manufactured, stored, transported, used and sold in an orientation other than the position described.

The choice of materials used in fabricating the dunnage bag is dependent upon the particular application involved and other variables, as those skilled in the art will appreciate. The technique for producing the materials and many of the sub-assemblies used in the dunnage bag disclosed herein

are well known in the art and do not constitute, as such, any part of the present invention.

Present Dunnage Bag Structure

Figure 1 illustrates the exterior shroud or casing 30 used in some types of conventional dunnage bags. The casing 30 may be made from a single sheet or ply 31 of material as illustrated, or may include a plurality of sheets. For illustrative purposes, the casing 30 illustrated in Figure 1 is shown as comprising only one sheet or ply 31. It is to be understood that conventional dunnage bag casings 30 typically comprise between two and six such sheets or plies. Examples of conventional multi-ply dunnage bags fabricated from such casings 30 are described and illustrated in the U.S. Patent No. 3,365,116 and the U.S. Patent No. 4,136,788.

Typically, the protective reinforcing sheet or sheets 31 are made of Kraft paper or other suitable material and encase a bladder 32 (positioned within casing 30 in Figures 2 and 3). The bladder 32 is substantially airtight and is adapted to be inflated with a pressurized gas, such as air. To this end, the dunnage bag is provided with a conventional valve or inflation means (not illustrated) for permitting inflation of the bladder with pressurized gas from an exterior source of gas and for retaining the pressurized gas within the inflated bag. The bladder 32 is typically made by conventional techniques separately from the casing 30 and is subsequently inserted into the formed tubular casing 30.

Each casing ply or reinforcing sheet 31 typically has two parallel longitudinal edge portions 34 and 36. One of the longitudinal edge portions 36 of the sheet is overlapped with, and secured to, the

other longitudinal edge portion 34 of the sheet. The sheet 31 is substantially flat between the side margins and defines a front or top wall 41 and a back or bottom wall 43 between the side margins of the casing.

In both the single and multi-ply bags, the front wall 41 of each ply 31 terminates at one end to define one end of the bag front wall (the right-hand end of the casing in Figure 1). Similarly, at the other end of the bag (at the left-hand end of the casing in Figure 1), the back wall 43 of each ply 31 terminates to define the other end of the bag back wall.

As best illustrated in Figure 1, the back wall 43 of each casing sheet 31 extends beyond the ends of the bag front walls 41 to form an end flap 53. Similarly, the front wall 41 of each casing sheet 31 extends beyond the ends of back walls 43 at the other end of the casing to form an end flap 51. The end flaps may have the same width as the casing or may be slightly wider or slightly narrower.

Typically the inflatable bladder 32 is placed in a deflated condition within the casing 30 after the casing is formed. In conventional disposable dunnage bags having an exterior casing 30, the inflatable bladder 32 has a generally rectangular shape when deflated. The two opposite ends of the rectangular bladder are positioned adjacent the ends of the dunnage bag casing. One end of the bladder is positioned adjacent the end of the front wall 41 of the bag and the other end of the bladder 32 is positioned adjacent the end of the rear wall 43 of the bag. The end flaps 51 and 53 are then folded over the opened ends of the casing and secured in a folded configuration to the opposite wall of the bag.

There are a variety of ways in which the end flaps of casings may be folded and positioned relative to the sheet or sheets in the opposite wall of the bag. Examples of such end flap fold configurations are illustrated in the above-discussed U.S. Patent Nos. 3,365,116 and 4,136,788. In a multi-ply bag, the end flaps may be interleaved between the sheets of the opposite wall of the bag. The end flaps may be arranged in one or more nested groups of flaps and these nested groups may then be separately interleaved between the sheets of the opposite wall of the casing. One or more of the end flaps may be positioned on the outside of the outermost sheet of the opposite wall of the bag and one or more of the end flaps may be positioned inwardly of the innermost sheet of the opposite wall of the casing. Further, the folded over end flaps may be glued or secured by other means at their locations in the opposite wall of the casing. On the other hand, some of the folded over end flaps may not be directly secured, but rather, may be held by frictional engagement within the opposite wall of the casing.

The present invention contemplates an improvement in the support of the bladder within the dunnage bag casing and this improvement may be applied to a multi-wall casing having end flaps folded in a variety of conventional configurations or fold sequences. The improvement is described in detail hereinafter. However, it is instructive to first consider a conventional method for fabricating the present dunnage bag casing.

Fabrication of Present Dunnage Bag Casing

Figures 4 and 5 schematically illustrate a typical method of fabricating the conventional casing

30. One or more continuous reinforcing sheets are pulled from rolls 60 as illustrated in Figure 4. For purposes of more clearly illustrating the method, Figure 4 shows the use of just one roll 60 for forming the casing 30 having just one ply or reinforcing sheet 31. The fabrication of an improved multi-ply bag will be described hereinafter.

The roll 60 is mounted on a generally horizontally disposed axle or shaft 62 to permit the roll to rotate as the sheet is drawn off (toward the left as viewed in Figure 4).

The continuous sheet from the roll 60 is pulled through a guide assembly schematically illustrated by reference numerals 64. The guides 64 are of a suitable conventional design adapted to deflect the opposed side edge portions of the sheet into the overlapping tubular configuration.

A suitable length of the sheet 31 is drawn through the guides 64 to provide the tubular casing 30 of the desired length. The sheet 31 is secured together along the two parallel longitudinal edge portions with adhesive or other suitable material. After the longitudinal seam has been secured, the casing 30 is severed from the continuous sheet 31 as indicated by CUT A in Figure 4.

The end flaps are formed by removing a piece from a wall of the casing at each end as illustrated schematically in Figure 5. Specifically, a piece D_1 is severed from the back or bottom wall of the casing 30 at one end of the bag and, at the other end of the casing, a piece D_2 is severed from the opposite or top wall of the casing. The pieces D_1 and D_2 are discarded.

Removal of piece D_1 thus defines the end flap 51 and removal of piece D_2 thus defines the

end flap 53. The bladder may then be inserted into the casing 30 and the end flaps 51 and 53 may then be folded over and secured to the opposite wall of the casing in a suitable manner.

Problems With Present Dunnage Bag

It is seen that the conventional fabrication of the dunnage bag casing illustrated in Figure 5 results in the production of two waste pieces, piece D_1 which is severed to form end flap 51, and piece D_2 which is severed to form end flap 53.

A method has been proposed for fabricating a dunnage bag casing in a manner that avoids production of such waste pieces of casing. According to the teachings of the present invention, a novel dunnage bag can now be formed from such a casing as will be explained in detail hereinafter.

Further, the inventors of the present invention have found that it is desirable to ensure that the end of the bladder 32 adjacent the folded over end flap(s) is sufficiently supported during and after inflation. If the end flap 53 (Figure 2) is not folded tightly enough over the end of the bladder 32, an undesirable amount of space may exist between the end of the bladder 32 and the inner surface of the end flap 53. Further, at the corners of the bag (indicated by arrow 50 in Figure 3), the bladder 32 may remain unsupported by either the flap 53 or the adjacent portions of the casing 30. This lack of support may be aggravated during inflation of the bag when the pressure of the bladder on the casing tends to stretch or expand the casing to some degree, thus enlarging the unsupported region at corner 50. The inventors of the present invention believe that it is advantageous to be able to visually check that the end of the bladder is still properly positioned after

one or more end flaps have been folded at the casing end.

The inventors of the present invention have found that improper or insufficient support in one or more of the areas along the end of the bag, and especially in the corner region 50, can lead to dilatation of the bag or can cause some other phenomenon which ultimately leads to the bursting of the bladder. The exact mechanisms or phenomena which cause or contribute to the bursting of the bladder is not necessarily fully understood, and there is no intent herein to be bound by any theory or by any explanation.

Nevertheless, it has been found that the teachings of the present invention substantially reduce, if not eliminate altogether, the problems of dunnage bag bladder bursting caused by a lack of proper support of the bladder at the ends of the dunnage bag. A casing structure that can be folded in a novel configuration to provide proper bladder corner support, and that permits bladder inspection during the folding of one or more end flaps, will next be described in detail.

Improved Single Ply Casing Structure

Figure 6 illustrates a novel dunnage bag casing 130. The casing 130 is illustrated as being formed from only a single reinforcing ply or sheet 131 to more clearly show the novel structure. It is to be understood that commercially produced dunnage bags typically have one or more of such sheets 131 that are assembled in superimposed registration to provide a single-ply or multi-ply casing. Typical multi-ply casings have between 2 and 6 plies.

The casing 130 has a tubular configuration and is adapted to receive therein a conventional

inflatable bladder. The casing reinforcing sheet 131 has two parallel longitudinal edge portions 134 and 136. The sheet 131 is folded substantially flat along parallel fold lines to define side margins of the bag with the sheet being substantially flat between the side margin fold lines and defining a front or top wall T and a back or bottom wall B. The longitudinal edge portion 136 is overlapped with, and secured to, the other longitudinal edge portion 134.

If a plurality of sheets 131 were provided to form a multi-wall casing, each of the front or top walls T would together define the front or top wall T of the casing while each of the back or bottom walls B of the sheets would together define the back or bottom wall B of the casing.

The conventional bladder (not illustrated in Figure 6) has a generally rectangular configuration defining four corners and is adapted to be disposed within the formed casing 130 with two corners of the bladder located at one end of the casing and with the other two bladder corners located at the other end of the casing.

At one end of the casing, the top wall T of sheet 131 terminates while at least a portion of the back or bottom wall B of the sheet 131 extends beyond the wall T to form an end flap F_2. Similarly, at the other end of the casing 130, the bottom wall B of sheet 131 terminates while at least a portion of the front or top wall T of the sheet 131 extends beyond the end of the bag back or bottom wall B to form an end flap F_1.

If a plurality of such sheets were provided for a multi-ply casing, all of the front walls of the sheets would terminate in substantial registry to define one end of the casing front or top wall and

all of the back walls of the sheets would terminate in substantial registry to define one end of the casing back wall. In such a multi-ply casing, the end flaps of the sheets are in registry at each end of the bag.

In the single ply casing illustrated in Figure 6, or in a multi-ply casing, each sheet 131 has a pair of separate corner flaps 170 at each end of the bag. Each flap 170 extends from each sheet 131 beyond the corner of the casing 130 (and beyond the corner of the bladder that is ultimately inserted in the casing). The corner flaps comprising the pair of corner flaps 170 at one end of the bag on each sheet are disposed at opposite lateral margins of the end flap F_1 or F_2 of the sheet. Each corner flap 170 includes an extension 174 of the sheet top wall T and an opposed extension 176 of the sheet bottom wall B. Both extensions 174 and 176 integrally merge together along one of the bag side margins to form the corner flap. In a multi-ply casing, the corner flaps at each corner of the bag are registered in a nested configuration.

The corner flaps 170 are adapted to be folded in a certain manner, as will be explained in detail hereinafter, to provide a unique support for the corners of the bladder after the bladder is inserted into the casing 130.

Fabrication of Improved
Single Ply Casing Structure

Figures 7-10 illustrate a novel method for fabricating the novel dunnage bag casing structure illustrated in Figure 6 and described above. The figures illustrate the formation of the single ply casing 130 from a single sheet 131 drawn from a roll 160 that is rotatably mounted on the axle or shaft 162.

As with the conventional method for fabricating a conventional dunnage bag casing, suitable guides 164 (schematically illustrated only in Figure 7) are provided to form the sheet 131 into the tubular structure having overlapping parallel longitudinal edge portions which are secured together with adhesive or other suitable means.

After a suitable length of the sheet 131 has been drawn from the roll 160, and formed into the tubular casing configuration of the desired length, a series of cuts is made in the walls of the casing. Figure 7 shows that the left-hand end of casing 130 has been formed, during a preceding step, with a flap F_1. A first cut C_1 is then made in the front or top wall T of the bag at a selected distance from the end of the flap F_1 so as to define the desired length of the top wall T of the casing 130.

The cut C_1 is made through only the top wall T and not through the bottom wall B of the casing. To this end, a separator means or an anvil 180 may be provided in the interior of the tubular casing 130 to prevent accidental severance of the underlying bottom wall B. The cut C_1 may be made by any suitable means. However, preferably the cut C_1 is made with a device having a blade extending the length of the cut C_1 and which is forced into the top wall T of the casing 130 to make the cut C_1. Preferably, the cut C_1 extends generally transversely of the casing 130 and is substantially perpendicular or normal to the side margins or edges of the casing 130. However, the cut C_1 does not extend all the way to each side edge. The cut C_1 terminates short of each side edge to leave an unsevered portion of the casing material between each end of the cut C_1 and an adjacent side edge of the

casing. As illustrated in the table entitled "CUT SEQUENCE" in Figure 10, the cut C_1 is made in the top or front wall T as a first step in the cut sequence.

Figure 8 illustrates the casing 130 as viewed from the back or bottom wall B wherein the cut C_1 in the top wall T appears in dashed line. A cut C_2, similar to cut C_1, is made in the bottom wall B. Cut C_2 is spaced from cut C_1 and extends only through the bottom wall B and not through the front or top wall T. In Figure 7, cut C_2 is shown in the bottom wall B in dashed line. Cut C_2 is similar to cut C_1 in that it is oriented generally normal or perpendicular to the side edges of the casing 130 and does not extend completely to the side edges of the casing 130. Cut C_2 is substantially parallel to cut C_1 and the length of C_2 is preferably equal to the length of cut C_1.

Cut C_2 in the back or bottom wall B may be made by any suitable means. However, preferably, the cut C_2 is made by a device having a blade with a length equal to the length of the cut C_2. The device is moved against the back or bottom wall B to sever the bottom wall B. To prevent severance of the top wall T, a suitable anvil 180 may be inserted in the interior of the tubular casing 130.

Both the cut C_1 and C_2 may be made simultaneously if desired. This is illustrated in the table in Figure 10 wherein the first step of the cut sequence includes making both the cuts C_1 and C_2.

Figure 9 illustrates the next step in the sequence of fabricating the casing 130. Specifically, a T-shaped cut C_3 is made entirely through both the top wall T and the bottom wall B.

Cut C_3 has a cut portion 190 extending generally parallel to the casing side edges and connecting ends of cuts C_1 and C_2. Cut C_3 has another cut portion 192 generally perpendicular to the casing side edges and bisecting the cut segment 190 and extending to the dunnage bag side margin or edge.

Similarly, on the other side of the casing, a cut C_4 is made through both the top wall T and the back wall B of the bag. Cut$_4$ is oppositely oriented, but otherwise identical to cut C_3 in that it has a first portion 190 extending generally parallel to the casing side edges between an end of the cut C_1 and an end of the cut C_2. A cut portion 192 bisects the portion 190 and extends to the adjacent side edge of the casing.

The portions 190 and 192 of the cuts C_3 and C_4 thus define the corner flaps of the casing, such as corner flaps 170 of the completed casing 130 illustrated in Figure 6. The folding of such corner flaps 170 to support the bladder corners will be described in detail hereinafter with reference to a two-ply casing.

As illustrated in the table entitled "CUT SEQUENCE" in Figure 10, the cut C_3 and the cut C_4 may be made substantially simultaneously as the second step of the cutting sequence. On the other hand, the cuts C_3 and C_4 may be made separately. In order to make the cuts C_3 and C_4 entirely through the front and back walls of the bag, either anvil 180 (illustrated in Figure 7) must be removed or the casing 130 must be moved relative to the anvil 180 so as to move the area of the casing between cuts C_1 and C_2 away from the anvil 180.

As a result of making the cuts C_1, C_2, C_3 and C_4, the end flap F_2 is formed in the

bottom wall B of the casing 130. Of course, the cut configuration that defines the end flap F_2 in the bottom wall B also defines an overlying flap in the top wall T of that portion of sheet 131 extending to the right of the casing 130 toward the roll 160. Thus, it is seen that the cuts effectively form two ends of adjacent casings simultaneously without the production of any waste pieces of material that must be discarded.

Although the cut portions 192 are illustrated as bisecting the cut portions 190 of cut C_3 and cut C_4, it is to be realized that the bisection of cut portions 190 is not necessary to provide a workable structure. If the cut portion 190 is not bisected by the cut portion 192, the corner flap 170 formed at one end of the bag will necessarily be longer than the corner flap 170 formed at the other end of the bag. However, so long as each corner flap 170 has an adequate length (adequate to be folded around the bladder corner as will be explained hereinafter in detail), the resulting casing structure will function in accordance with the teachings of the present invention.

Preferably, the blade of the cutting device is serrated or saw-toothed to form a serrated edge on the sheet along the cut. It has been found that such a configuration prevents, or greatly reduces the possibility of, cuts to the fingers and hands of dunnage bag assembling personnel when the sheets consist of heavy paper. Further, it has been found that the paper reinforcing sheets having a serrated edge do not cut into the types of plastic bladders that are typically used in dunnage bags. Thus, the probability of accidentally damaging a bladder during insertion of the bladder into the dunnage bag casing

is greatly reduced when paper sheets of the dunnage bag casing are provided with serrated edges.

Fabrication of Improved Multi-Ply Casing and Assembly of Dunnage Bag With Unfolded Bladder

Figure 11 schematically illustrates the fabrication and assembly of a preferred embodiment of a two-ply dunnage bag in accordance with the present invention. The casing 230 is fabricated from a first or innermost sheet 231a and a second or outermost sheet 231b. Sheet 231a is taken from a roll 260a which is rotatably supported on a shaft 262a. Similarly, the outermost sheet 231b is taken from a roll 260b supported on a shaft 262b. Suitable guides 264 are provided for forming the sheets into the tubular configuration. The overlapping longitudinal edge portions are sequentially secured together starting with the innermost ply and progressing to the outermost ply. The desired length of formed casing 230 is separated from the trailing portion of the sheets 231a and 231b by means of cuts C_1, C_2, C_3 and C_4 as described above in great detail with reference to the single ply casing 130 illustrated in Figures 6-9. This avoids the production of waste pieces of casing.

After the casing 230 is formed, a bladder 232 is inserted into the interior of a casing as illustrated in Figures 12-14. The bladder 232 lies above the bottom wall of the casing wherein the bottom wall comprises the bottom wall 243a of the innermost sheet and the bottom wall 243b of the outermost sheet. The top wall of the casing comprises the top wall 241a of the innermost sheet and the top wall 241b of the outermost sheet. The bladder 232 lies immediately below the top wall 241a

of the innermost sheet. The bladder 232 lies immediately below the top wall 241a of the innermost sheet.

After the fabrication of the novel casing 230 by the novel method described above, the casing may be used to make a dunnage bag that is preferably of the type having the novel bladder corner support structure. To this end, a bladder 232 is inserted into the interior of a casing as illustrated in Figures 12-14. The bladder 232 lies above the bottom wall of the casing wherein the bottom wall comprises the bottom wall 243a of the innermost sheet and the bottom wall 243b of the outermost sheet. The top wall of the casing comprises the top wall 241a of the innermost sheet and the top wall 241b of the outermost sheet. The bladder 232 lies immediately below the top wall 241a of the innermost sheet.

The end of the bladder 232 preferably projects slightly beyond the ends of the top walls 241a and 241b of the reinforcing sheets as best illustrated in Figures 12 and 13. A portion of the bottom wall 243a of the innermost sheet extends beyond the casing front wall and beyond the end of the bladder 232 to form an end flap 253a. Similarly, a portion of the bottom wall 243b of the outermost sheet extends beyond the casing front wall and beyond the end of the bladder 232 to form an end flap 253b.

As best illustrated in Figure 14, the innermost sheet has a corner flap 270a and the outermost sheet has a corner flap 270b. As best illustrated in Figure 12, a corner flap is provided on each sheet at each side of the bag at opposite lateral margins of the end flap on the sheet. Corner flap 270a on the innermost sheet includes a portion 274a which is an extension of the top wall 241a of

the innermost sheet. Corner flap 270a also includes a portion 276a which is an extension of the bottom wall 243a of the innermost sheet. The portions 274a and 276a are integrally merged together along the bag side edge to form the corner flap 270a.

The corner flap 270b of the outermost sheet has a structure identical to that of the corner flap of the innermost sheet. Specifically, the corner flap 270b includes a portion 274b which is an extension of the top wall 241b of the outermost sheet and includes a portion 276b which is an extension of the bottom wall 243b of the outermost sheet. The portion 274b and the opposed portion 276b are integrally merged together along the bag side edge to form the corner flap 270b. The corner flap 270a and the corner flap 270b are nested together.

As illustrated in Figure 12, each end flap 253a and 253b has a length 2L which is twice the length L of the corner flaps 270a and 270b. However, other configurations would function satisfactorily. In fact, the end flaps 253a and 253b may even be shorter than the corner flaps 270a and 270b.

After the bladder 232 has been properly positioned within the casing 230 as illustrated in Figure 14, one or more of the end flaps are then folded over the end of the bag and positioned as desired to form a portion of the dunnage bag end closure. Figure 15 shows the innermost end flap 253a being folded over the bladder end and beneath the front or top wall 241a of the innermost sheet. In Figure 15, the top walls 241a and 241b are illustrated as being spaced apart by an exaggerated amount in order to best show the structure. The end flap 253a may be held in the folded over position by a suitable mechanism, such as by frictional engagement, or by the use of an adhesive 256.

As illustrated in Figure 15, the adhesive 256 preferably does not extend completely across the surface of the folded over end flap 253a. This is to prevent the possibility that some adhesive may accidentally contact the bladder 232. If the bladder 232 becomes accidentally adhesively secured to one or more of the flaps or walls of the sheets comprising the casing, the bladder may rip during inflation since it would be prevented from expanding and moving relative to the casing at the point of adhesive securement.

Although Figures 15 and 16 illustrate the innermost sheet end flap 253a being folded over and positioned directly on top of the bladder 232, it is to be realized that the end flap 253a may be folded over and positioned beneath the bladder or between the top wall 241a of the innermost sheet and the top wall 241b of the outermost sheet. Also, in a casing having more than two plies, the end flap of the innermost ply may be folded over and inserted between the top walls of sheets other than the innermost two sheets.

Owing to the outwardly projecting corner flaps on either side of the end flaps, the end flaps are necessarily narrower than the casing and bladder. Thus, when the end flap on the innermost sheet is folded over the bladder, the corner of the bladder can still be visually inspected. Thus, the novel corner flap structure permits a visual check of the bladder location even after the first flap has been folded.

After the end flap 253a has been folded over and secured to the top wall of the casing, the corner flaps 270a and 270b of the casing 230 may be arranged in a novel configuration to provide a suitable

support for the corner of the bladder 232 as best illustrated in Figures 17-19. In Figures 17, 18 and 20, the front or top wall 241b of the outermost sheet of the casing is shown spaced from the underlying portions of the bag by an exaggerated amount to better illustrate the structure.

With reference to Figure 17, it is seen that the top wall extensions 274a and 274b forming part of the nested corner flaps are superposed in substantial registry upon the opposed bottom wall extensions 276a and 276b forming part of the same nested corner flaps. This is essentially effected by pressing the corner flaps together in the direction indicated by the oppositely directed arrows 263. Next, as illustrated in Figure 17, the nested and compressed corner flaps are moved inwardly, in the direction of arrow 280 toward the open end of the casing. As best illustrated in Figure 18, the corner flaps are then tucked in position between the top wall 241a of the innermost sheet and the top wall 241b of the outermost sheet. Preferably, the corner flaps are tucked into the bag at an angle of not more than 45° with respect to the bag end.

As can be seen from studying the Figures 15-18, superposition of the extensions 274a, 274b, 276a and 276b in substantial registry and subsequent movement of those extensions together into a wall of the bag provides a supporting structure around the projecting corner of the bladder 232. The corner of the bladder positively nests within the bend region of the corner flap. This is to be compared with the conventional end closure configuration illustrated for the dunnage bag in Figure 3 wherein the corner of the bladder 32 can project from the side of the dunnage bag adjacent the folded over end flaps during

and after inflation. In contrast, the nested support structure provided by the corner flaps in accordance with the teachings of the present invention prevents the dilatation of the bladder beyond the corner of the dunnage bag. This prevents or substantially reduces the possibility of the bladder bursting during inflation.

The end closure of the dunnage bag may be completed by folding the remaining end flap 253b upwardly as indicated by arrow 282 and then tucking the end flap 253b beneath the front or top wall 241b of the outermost sheet.

The end flap 253a of the outermost sheet is disposed directly over and on top of the tucked corner flap so as to hold the corner flaps down against the underlying top wall 241a of the innermost sheet. The top wall 241b of the outermost sheet may be secured, as with adhesive 284 (Figure 21), to the folded over end flap 253a.

The corner flaps 270a and 270b are illustrated as being pressed together and folded inwardly between the top wall 241a of the innermost sheet and the end flap 253a of the outermost sheet. It is to be realized that the corner flaps may instead be folded and tucked between sheets in the bottom wall of the bag rather than the top wall of the bag. However, it has been found that better support of the bladder corners is provided when the corner flaps are tucked in the same casing wall with the end flaps. Also, it is to be realized that in multi-ply bags, the casing end flaps may be folded over separately, or in groups, and tucked between the sheets of the opposite wall in a variety of configurations and combinations.

The corner flap structure for reinforcing the bladder corner in accordance with the teachings of the present invention may be used with a great number of different end flap fold configurations. The two-ply casing and end flap fold configuration illustrated in Figures 12-21 is merely illustrative of one way in which the novel corner flap structure may be employed. Having been taught that bladder bursting can be caused by insufficient support of the bladder corners, and having been taught how the bladder corners may be supported by the novel, folded corner flap structure according to the teachings of the present invention, it will then be apparent to one having skill in the art that the corner flaps may be folded and disposed within a wall of the casing in a variety of different ways, subject, of course, to any inherent limitations of the particular end flap fold configuration being used.

Assembly of Improved Multi-Ply Dunnage Bag With Folded Bladder

The casing 230 of Figures 12-21 is illustrated again in Figure 22, but with the bladder 232 replaced by a different type of bladder 233. The different bladder 233 is of the conventional thermoplastic type which has a pair of opposed walls 234 and 235 which are heat sealed at each end, as by heat seal 236. An end portion of the bladder, indicated by bracket 237, is folded over at one end of the bag. Preferably, the portion 237 is folded over together with the innermost sheet end flap 253b. The folded over configuration of the bladder end provides a smoother contour of the bladder adjacent the folded end flaps of the casing.

When the bladder is folded over as at 237, the bladder, being generally rectangular when

deflated, still defines four corners with a pair of corners being oriented at each end of the casing. The corners of the bladder will, of course, then comprise a double thickness of the bladder. Nevertheless, the novel dunnage bag casing corner flap structure will provide the desired support for the double thickness bladder corners to prevent dilatation of the bladder during inflation.

From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the true spirit and scope of the novel concept of the invention. It is to be understood that no limitation with respect to the specific structures and methods illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

WHAT IS CLAIMED IS:

1. A dunnage bag having a substantially gastight inflatable bladder (32) encased within at least one protective reinforcing sheet (31,131), said sheet (31,131) defining a front and a back wall (41,43), said front and back wall (41,43) of said sheet (31,131) comprising at least one ply (31) of a front and back wall (41,43), respectively, of the dunnage bag; said dunnage bag having a folded closure at one end of the bag wherein the back wall (43) of the sheet (31,131) has an end flap (51) folded over the bladder end and secured to the front wall (41) of the bag; said dunnage bag characterized in that an improved construction is provided that comprises:
a pair of separate corner flaps (170) at said one end of the bag on said sheet (131); each said corner flap (170) extending from said sheet (131) beyond a corner of the bladder; each said corner flap (170) of the pair of corner flaps at said one bag end on said sheet (131) disposed at opposite lateral margins of the end flap (F_1;F_2) of the sheet (131); each said corner flap (170) including an extension (174) of the sheet front wall (T) and an opposed extension (176) of the sheet back wall (B) that are both integrally merged together along one of the bag side margins to form the corner flap (170); said front wall extension (174) forming part of the corner flap (170) at each side margin of the bag being superposed in substantial registry upon the opposed back wall extension (176) forming part of the same corner flap (170); the corner flap (170) at each side margin of the bag being folded inwardly from the bag side margin and positioned directly or

indirectly adjacent said bladder in a wall of said dunnage bag to thereby support a bladder corner during and after inflation of the bladder.

2. The dunnage bag in accordance with claim 1 in which said bladder (232) is encased within a plurality of said reinforcing sheets (231a, 231b), each said sheet defining a front and a back wall (241a, 241b; 243a, 243b), said front and back walls of all of the sheets (231a, 231b) together comprising a front and back wall, respectively, of the dunnage bag; said dunnage bag having a folded closure at one end of the bag wherein each back wall of each sheet has an end flap (253a,253b) and wherein at least some of the end flaps (253a,253b) are folded over the bladder (232) end and tucked separately or in groups beneath one or more of the front walls (241a, 241b) of the sheets (231a, 231b); said dunnage bag further characterized in that an improved construction is provided that comprises:
a pair of separate corner flaps (270a, 270b) at said one end of the bag on each said sheet; each said corner flap (270a, 270b) extending from each said sheet beyond a corner of the bladder (232), each corner flap of the pair of corner flaps (270a,270b) at said one bag end on each said sheet disposed at opposite lateral margins of the end flap (253a, 253b) of the sheet; each said corner flap (270a, 270b) including an extension (274a;274b) of the sheet front wall (241a, 241b) and an opposed extension (276a, 276b)of the sheet back wall (243a, 243b) that are both integrally merged together along one of the bag side margins to form the corner flap (270a,270b);

each said corner flap (270a,270b) on each side sheet being nested against the corner flap of an adjacent sheet; all of said front wall extensions (274a, 274b) forming part of the nested corner flaps at one side margin of the bag being superposed in substantial registry upon the opposed back wall extensions (276a, 276b) forming part of the same nested corner flaps; all of said nested corner flaps (270a, 270b) at the one side margin of the bag being folded together inwardly from the bag side margin and positioned directly or indirectly adjacent said bladder (232) in a wall of said dunnage bag to thereby support a bladder corner during and after inflation of the bladder.

3. The dunnage bag in accordance with claim 2 further characterized in that the end flap (253a) on the innermost sheet adjacent the bladder (232) is folded over directly on top of the bladder (232) and tucked beneath all of the front walls (241a, 241b) of said sheets and in that all of said nested corner flaps (270a, 270b) at one bag side margin are folded together inwardly from the bag side margin and positioned directly on top of the front wall (241a) of the innermost sheet.

4. The dunnage bag in accordance with claim 2 further characterized in that the end flaps (253a, 253b) of at least some of said sheets are interleaved with the front walls (241a, 241b) of some of said sheets.

5. The dunnage bag in accordance with claim 2 characterized in that an end portion (237) of said bladder (233) is folded over to provide a folded bladder configuration having a generally rectangular shape when deflated and presenting double thickness corners defined at the bladder fold line (237), said double thickness corners at the bladder fold line being positioned to be supported during and after inflation by said inwardly folded corner flaps (270a, 270b).

6. The method of forming a dunnage bag casing (130) wherein at least one encasing sheet (131) is provided with two parallel longitudinal edge portions (134,136) and is folded substantially flat along parallel fold lines to define side margins of a casing tube and to lie substantially flat between the side margin fold lines for defining a front and a back wall (T,B) in said sheet (131) between the fold lines; wherein one longitudinal edge portion (136) of said sheet (131) is overlapped with, and secured to, the other longitudinal edge portion (134) of the sheet (131); and wherein at least one end of the casing (130) is defined by severing the casing (131) from a trailing portion of said casing tube; said method characterized with the improvement comprising the steps of making the following cuts in any sequence at said one end:

making a first cut (C_1) through, and partially across, the front wall (T) of said sheet (131) between the side margins of the casing tube (130);

making a second cut (C_2) through, and partially across, the back wall (B) of said sheet (131) between the side margins of the casing tube (130), and spaced from, the first cut (C_1);

making a third cut (C_3) completely through both said front and back walls (T,B) of said sheet (131) and terminating at one end of the first cut (C_1) and at one end of the second cut (C_2);
making a fourth cut (C_4) completely through both said front and back walls (T,B) of said sheet (131) and terminating at the other end of said first cut (C_1) and at the other end of said second cut (C_2);
making a fifth cut (C_5) completely through said sheet front and back walls (T,B) and extending from one of the two side margins to said third cut (C_3); and
making a sixth cut (C_6) completely through said sheet front and back walls (T,B) and extending from the other of the two side margins to said fourth cut (C_4).

7. The method in accordance with claim 6 including making said first and second cuts (C_1,C_2) in substantially parallal straight line segments substantially normal to the side margins of the casing tube (130).

8. The method in accordance with claim 6 including making said third and fourth cuts (C_3, C_4) in substantially straight line segments parallel to the side margins of the casing tube (130).

9. The method in accordance with claim 6 including making said fifth and sixth cuts along line segments generally normal to the side margins of the casing tube.

10. The method in accordance with claim 6 including making said third through sixth cuts substantially simultaneously after making said first and second cuts sequentially.

11. A dunnage bag casing for surrounding an inflatable bladder (232,233) and having at least one encasing sheet (131); said sheet having two parallel longitudinal edge portions (134,136) and being folded substantially along parallel fold lines to define side margins of the casing and to lie substantially flat between said side margin fold lines for defining a front and a back wall (T,B) between the fold lines; one (136) of the longitudinal edge portions of the sheet being overlapped with, and secured to, the other longitudinal edge portion (134) of the sheet (131); the front wall (T) of said sheet (131) terminating to define one end of the casing; at least a portion of the back wall of said sheet extending beyond said one end of the casing to form an end flap (F_1,F_2); said dunnage bag casing characterized with an improved construction comprising: two corner flaps (170) disposed at said sheet (131) one end at opposite lateral margins of the end flap (F_1, F_2); each said corner flap (170) including an extension (174) of the sheet front wall (T) and an opposed extension (176) of the sheet back wall (B) that integrally merge together along one of said casing side margins to form said corner flap (170) whereby, when a bladder is disposed within the casing (130), and an end flap (F_1, F_2) is folded over the bladder and secured to the front wall of the sheet, the position of the bladder corners may be visually inspected adjacent said corner flaps (170).

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Fig. 1. PRESENT STRUCTURE

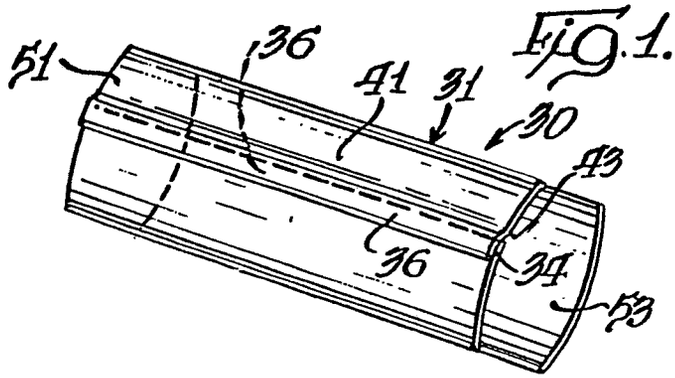


Fig. 2. PRESENT STRUCTURE

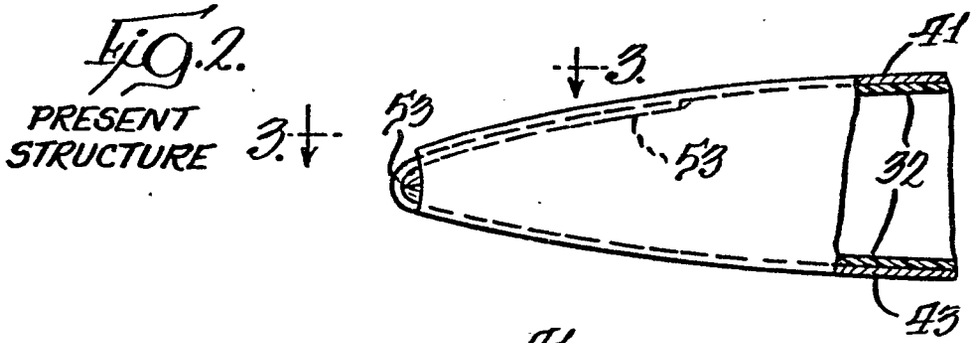


Fig. 3. PRESENT STRUCTURE

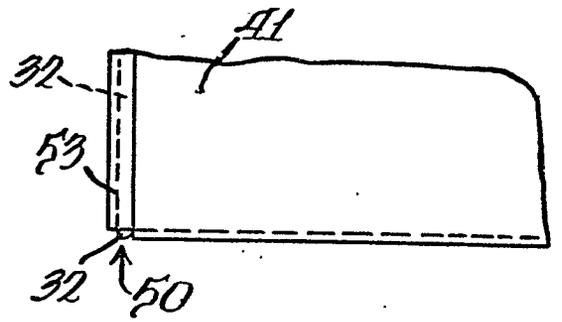


Fig. 4. PRESENT STRUCTURE

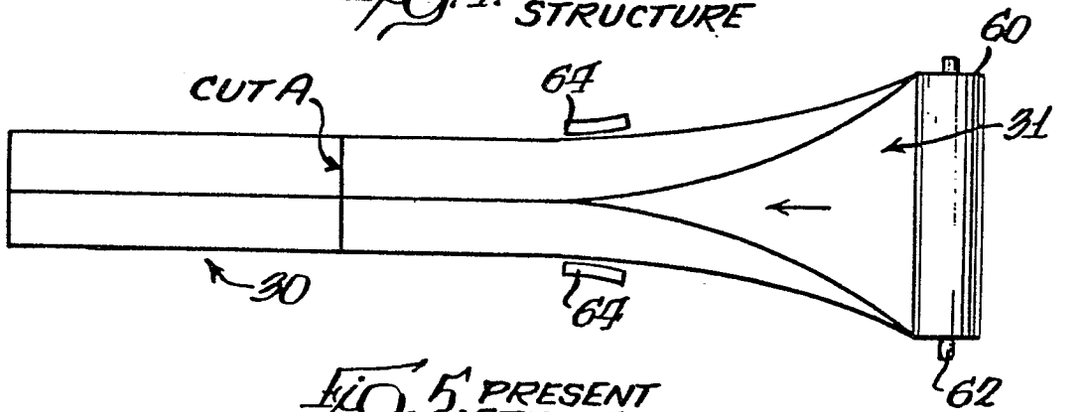


Fig. 5. PRESENT STRUCTURE

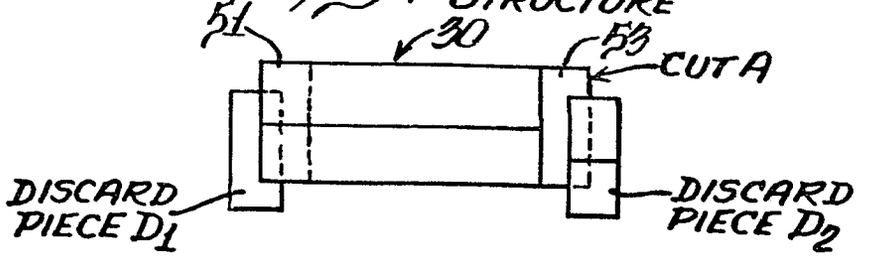


Fig.6.

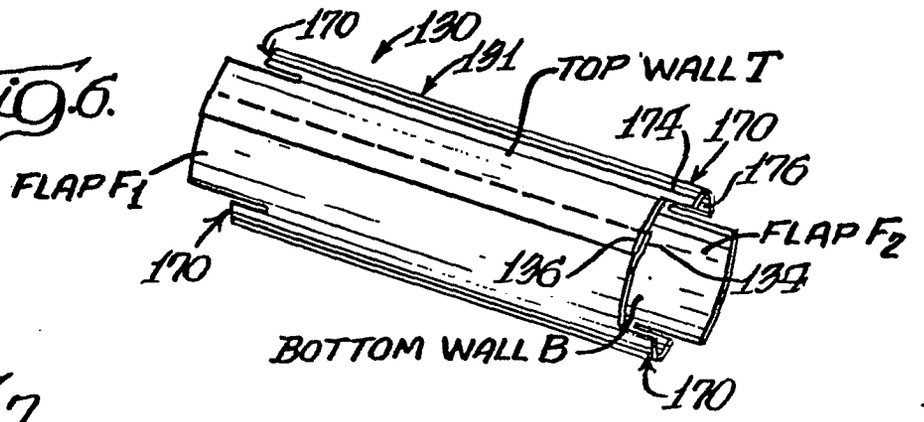
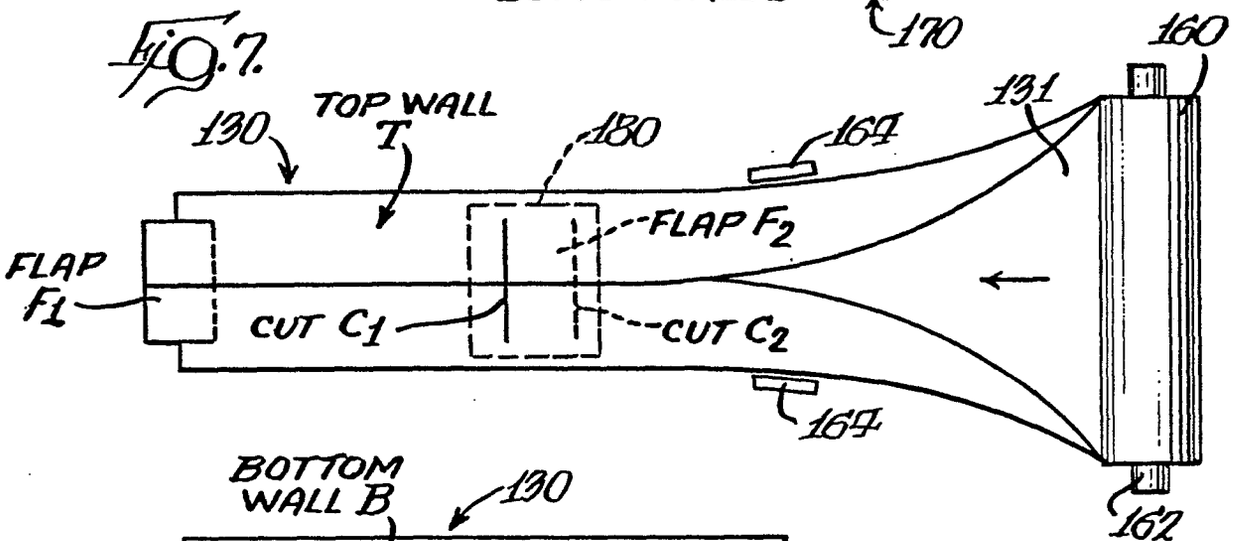


Fig.7.



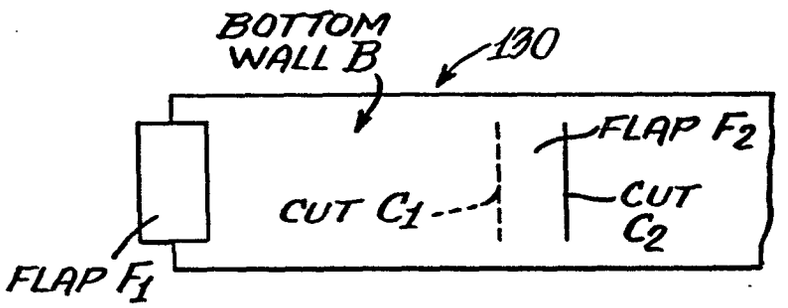


Fig.8.

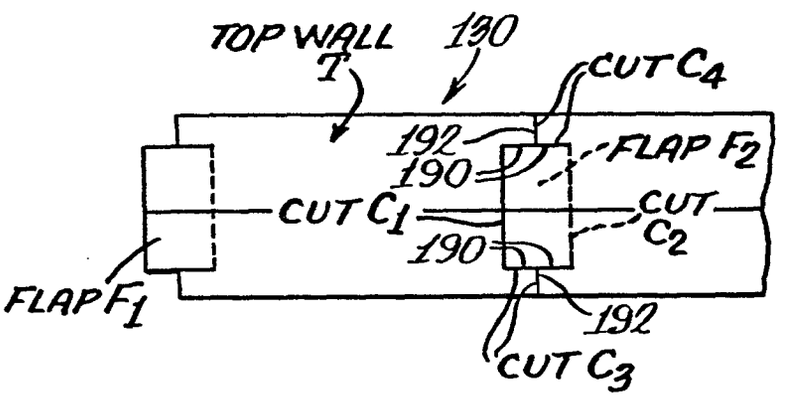


Fig.9.

Fig.10.

CUT SEQUENCE				
STEP	1		2	
CUT	C_1	C_2	C_3	C_4
WALL CUT	T ONLY	B ONLY	T AND B	T AND B

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Fig. 11.

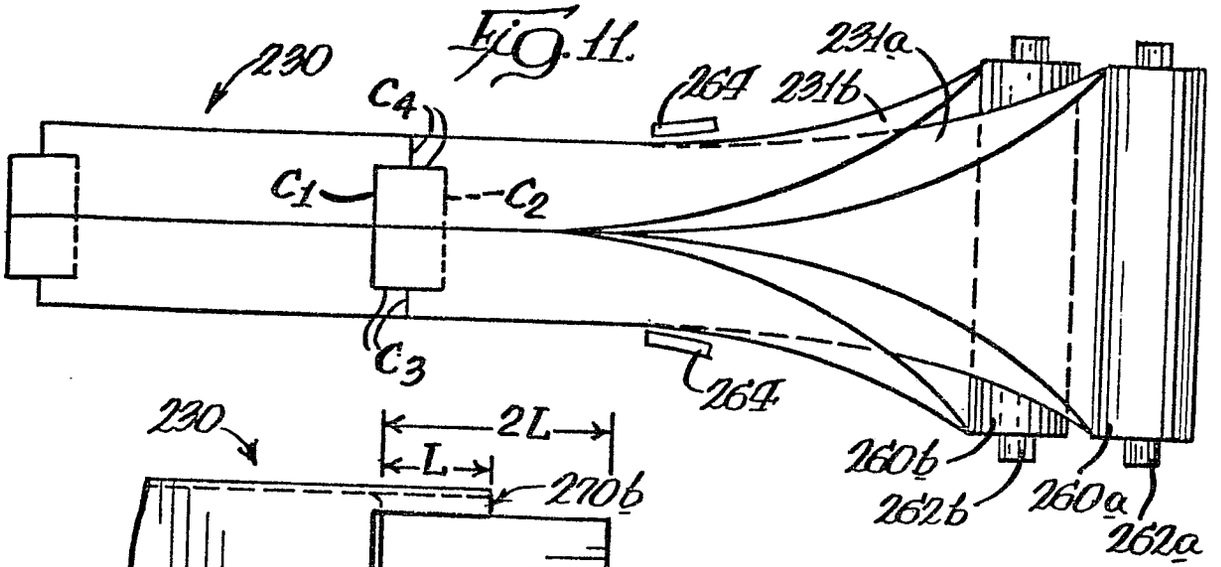


Fig. 12.

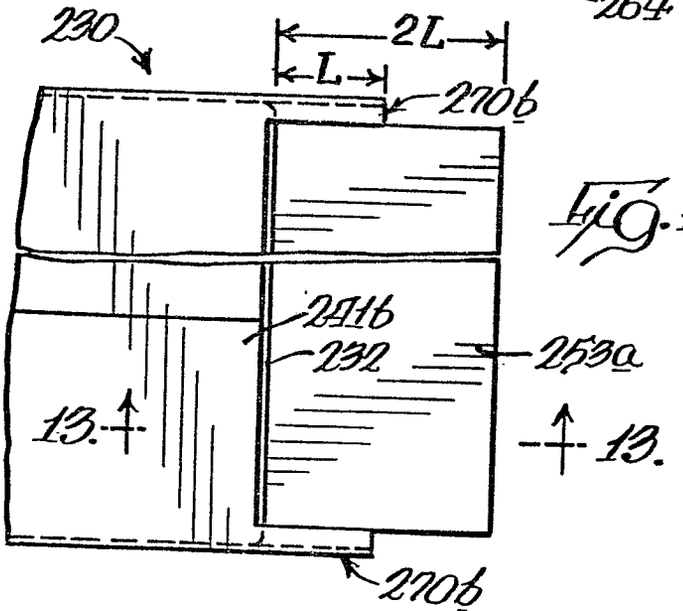


Fig. 13.

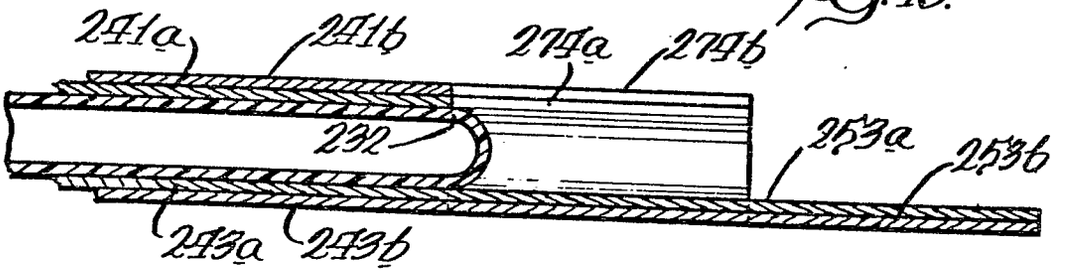
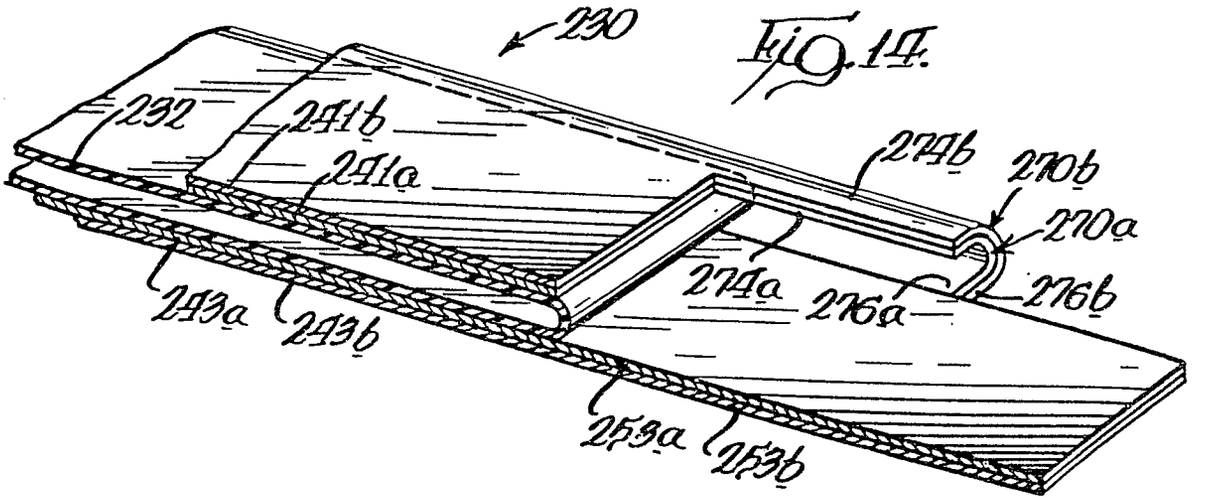


Fig. 14.



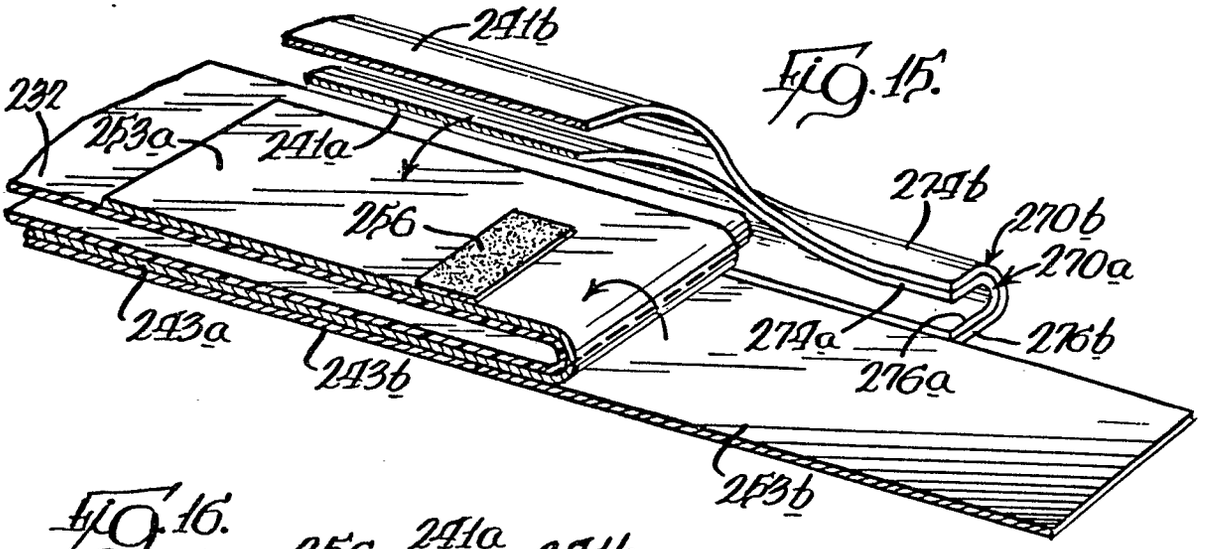


Fig. 15.

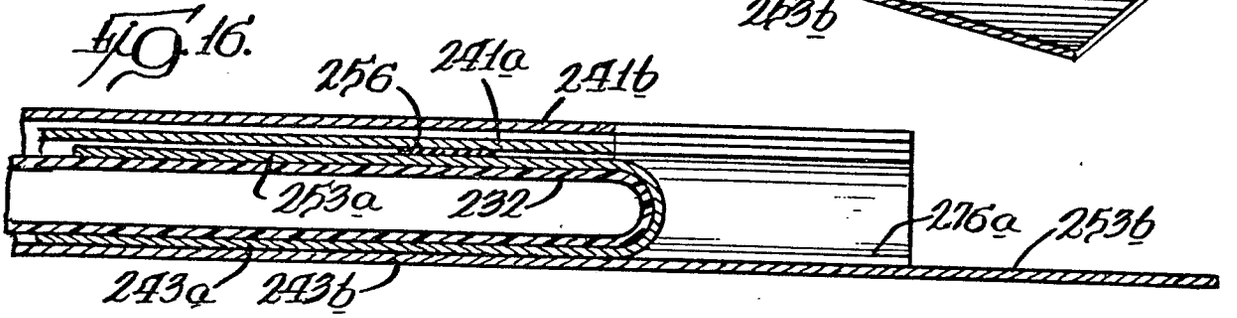


Fig. 16.

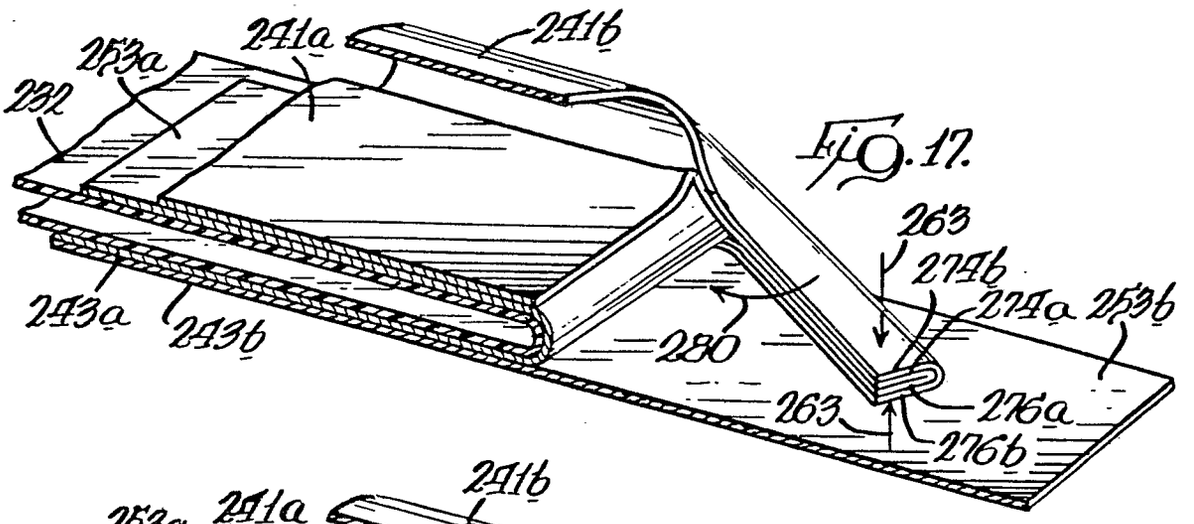


Fig. 17.

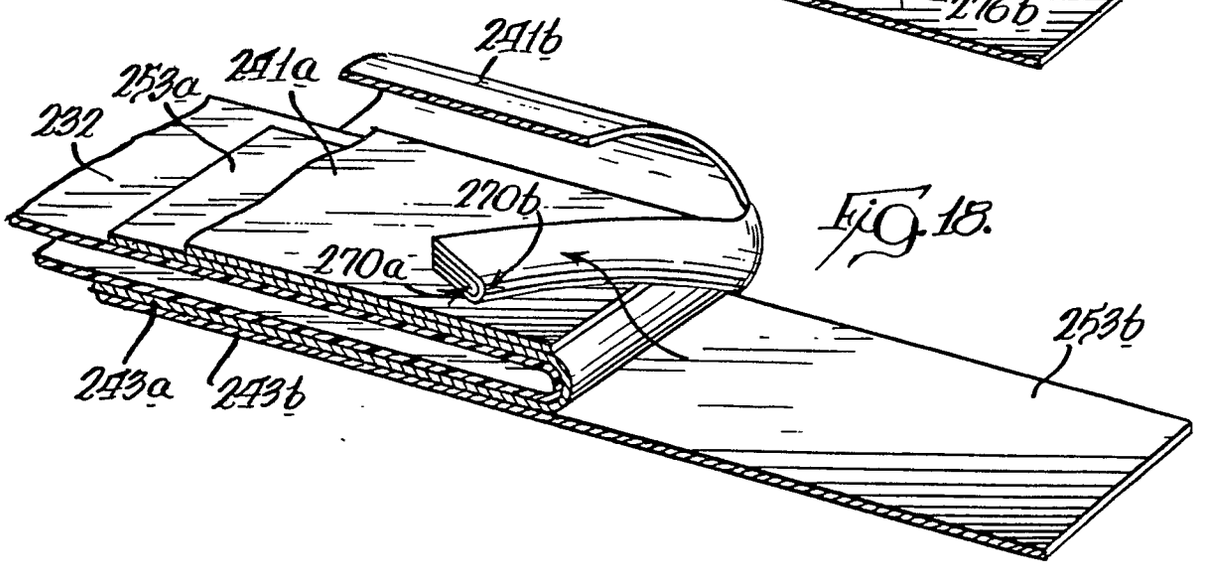


Fig. 18.

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Fig. 19.

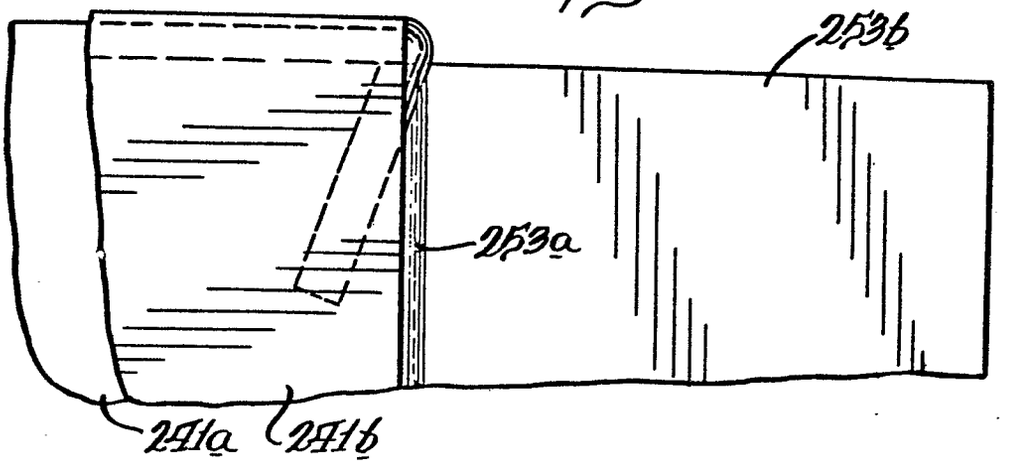


Fig. 20.

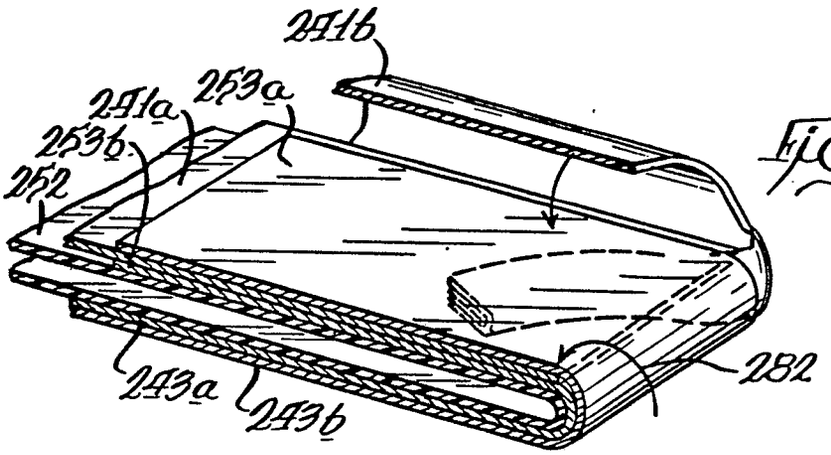


Fig. 21.

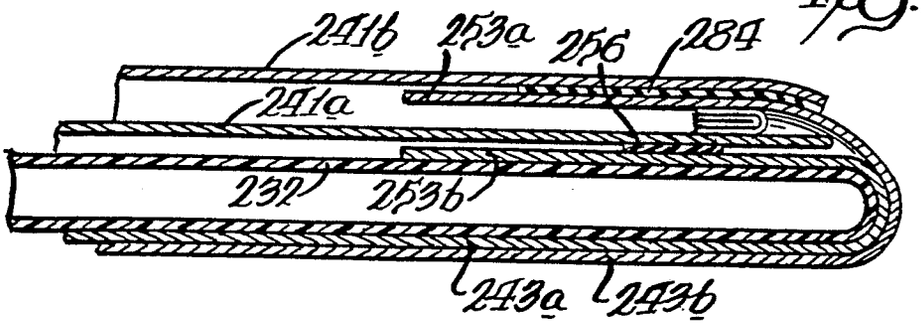
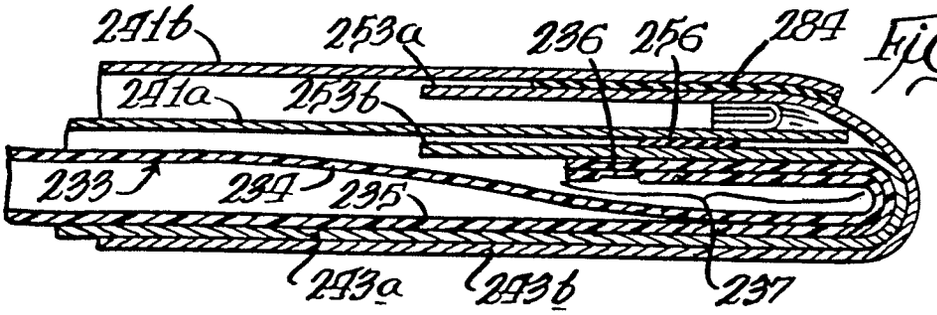


Fig. 22.



European Patent Office

EUROPEAN SEARCH REPORT

0056653
Application number
EP 82100368.8

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
D,A	US - A - 4 136 788 (ROBBINS) * Claims *	1-4
X	* Fig. 3-5 *	5
D,A	US - A - 3 556 318 (HOLLIS) * Claims 1-3 *	1-4
X	* Fig. 3 *	5
D,A	US - A - 3 365 116 (LUDLOW) * Claims *	1-4
D,A	US - E - 27 787 (EVANS) * Claims *	1-4
D,A	US - A - 3 808 981 (SHAW)	1-5
D,A	US - A - 3 955 690 (BAXTER)	1-5
A	DE - B - 1 511 034 (WINDMÖLLER) * Fig. 1,6-7; columns 7,8 *	6-8
A	US - A - 2 892 580 (WILLIAMS) * Fig. 2-5; columns 2,3 *	6-8

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

B 65 D 30/26
B 65 G 1/14
B 31 B 23/14

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

B 65 D 81/00
B 65 D 30/00
B 65 D 33/00
B 31 B 23/00
B 65 G 1/00
B 60 P 7/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same category
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: earlier patent document, but published on, or after the filing date
D: document cited in the application
L: document cited for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	22-04-1982	CZUBA

EPO Form 1503.1 06.78