United States Patent [19]

Weldon

[11] **3,797,731**

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[54] **CARTON WITH IMPROVED HAND HOLES**

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[73] Assignee: **Owens-Illinois Inc.,** Toledo, Ohio

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[52] **U.S. Cl.** ..... **229/52 B,** 220/94 A

[51] **Int. Cl.** **B65d 5/46**

[58] **Field of Search** ..... 229/52 B, 52 BC, 33; 220/94 A, DIG. 2, DIG. 5

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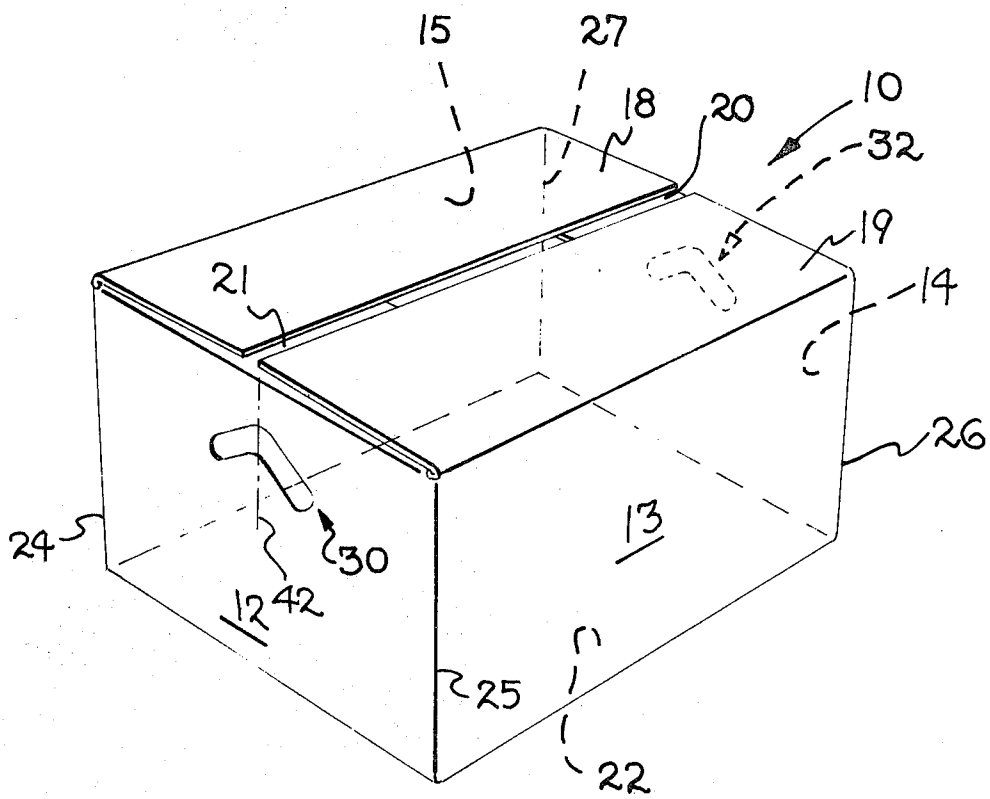
Assistant Examiner—Stephen Marcus
Attorney, Agent, or Firm—Steve M. McLary; E. J. Holler

[57] **ABSTRACT**

A carton with improved hand holes for facilitating lifting the carton, the hand holes being unusually resistant to tearing when the carton is lifted. In one aspect of the invention, the improved hand holes take the form of inverted V cutouts located on opposed sidewall panels of the carton. In another aspect of the invention, the improved hand holes take the form of at least one inclined, elongated, slot-shaped cutout located on each of two opposed sidewall panels of the carton. In both aspects of the invention, a longitudinal axis of the inclined cutout will intersect the plane of a bottom closure means for the carton at an acute angle measured between the extended longitudinal axis and the plane. Also in both aspects of the invention, the improvement in tear resistance results from distributing the lifting force as both a vertical and a horizontal load in the carton sidewall and from increasing the area of the carton over which the load or lifting force is distributed. Furthermore, in both aspects of the invention, the hand holes may be provided with flaps to keep them closed when not in use.

8 Claims, 8 Drawing Figures



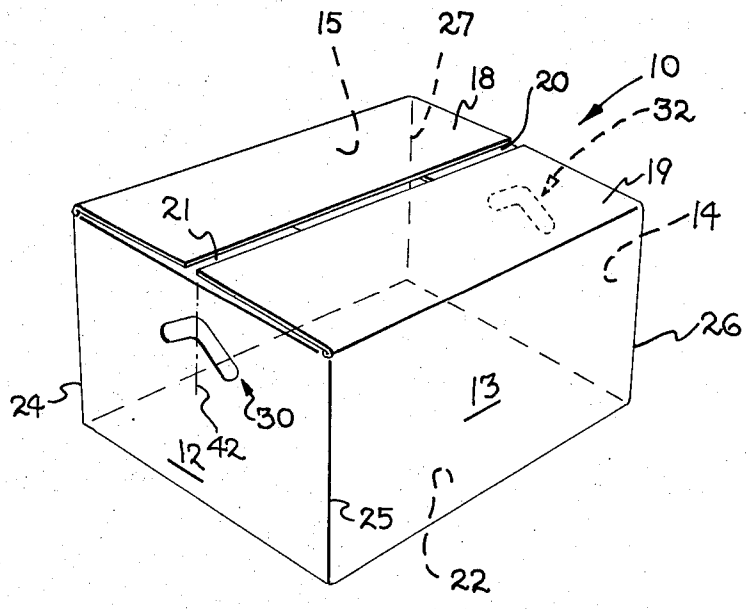


FIG. 1

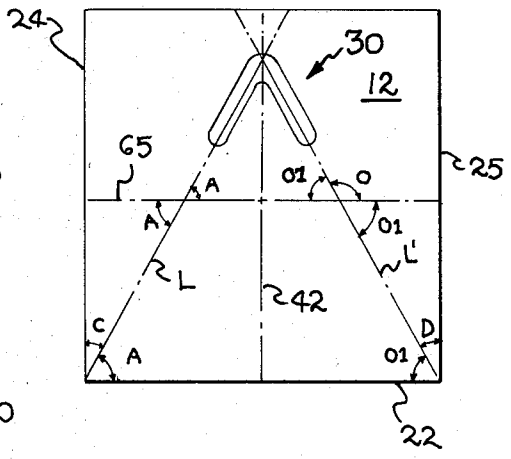
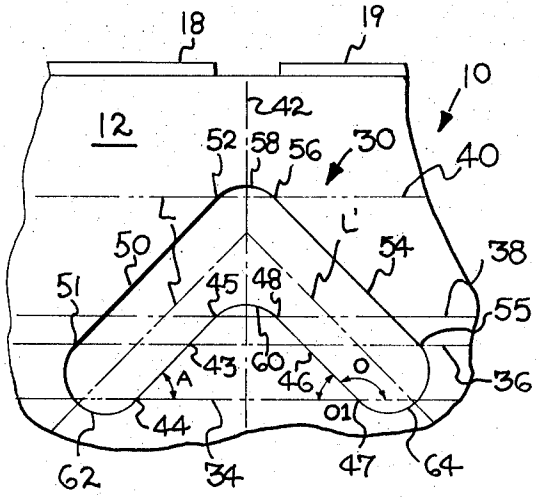


FIG. 3

FIG. 2



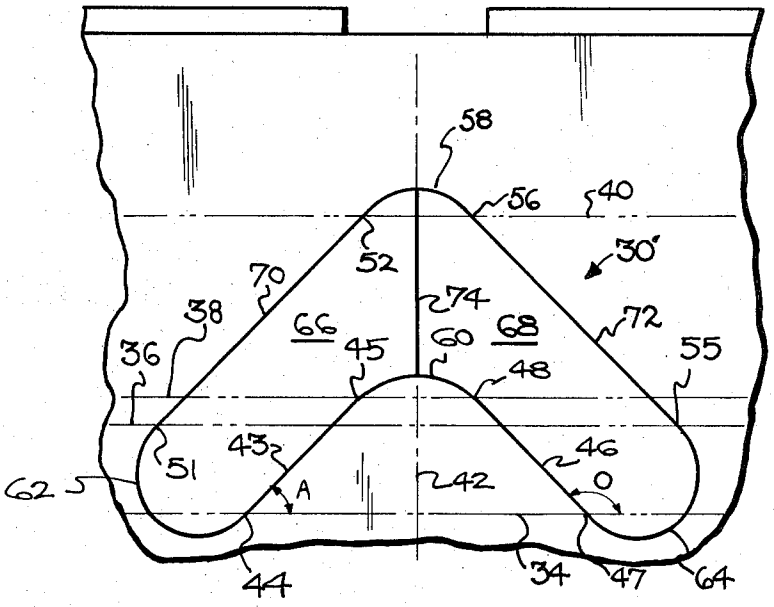

58
56
40
52
30'
70
74
38
66
68
72
36
45
60
55
48
43
46
51
62
A
42
O
44
34
47
64

FIG. 4

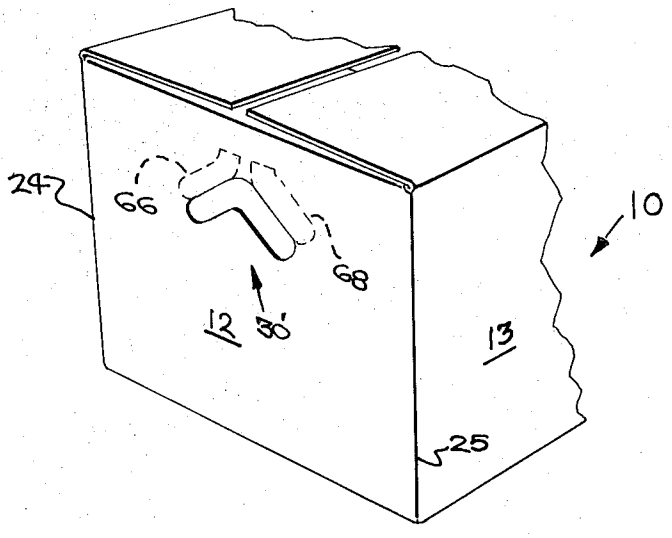

24
66
10
68
12
30'
13
25

FIG. 5

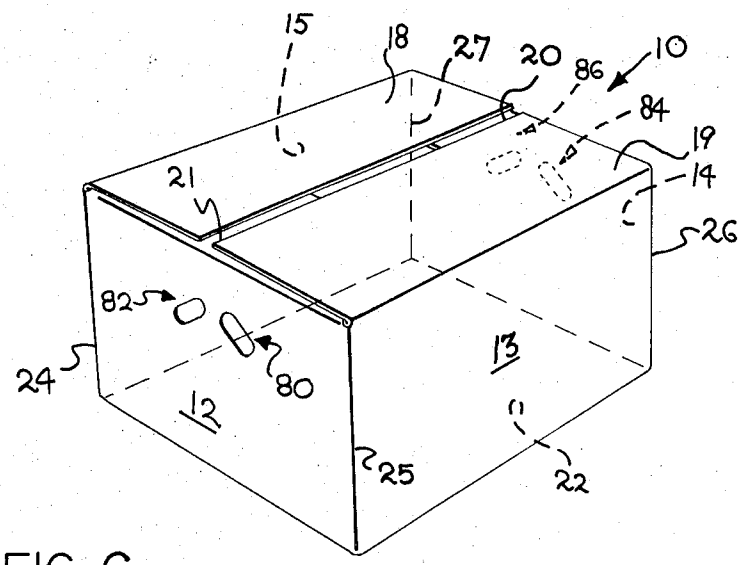


FIG. 6

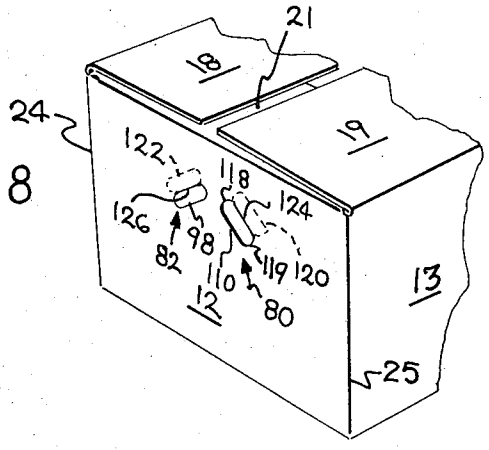
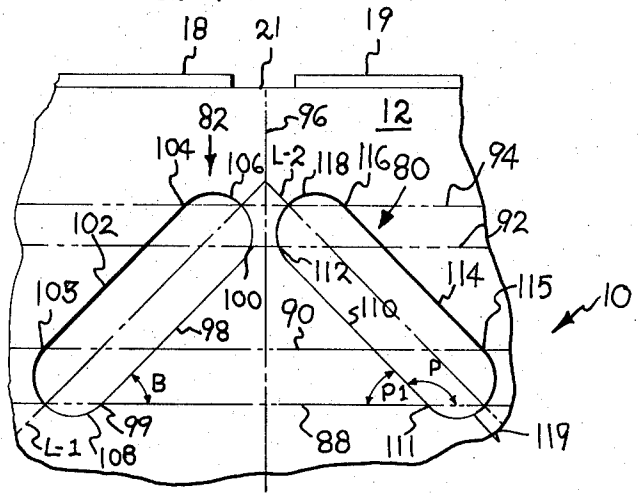


FIG. 8

FIG. 7



CARTON WITH IMPROVED HAND HOLES

BACKGROUND OF THE INVENTION

This invention generally relates to hand-transported shipping cartons. More particularly, this invention relates to cartons made of paperboard material. Most specifically, this invention relates to hand holes in such cartons for facilitating lifting the cartons.

The provision of hand holes in the sidewalls of cartons for facilitating lifting the cartons is old. However, one problem is most of the hand hole designs of the prior art was that such hand holes tended to tear out of the carton. This effect was particularly actue under high humidity conditions or when the carton was wet. This tendency to tear was generally a result of the lifting force being carried by a relatively small portion of the carton wall above the hand hole. The lifting force would normally be transmitted to the carton as a shear load at the edge of the hand hole, causing that portion of the carton immediately above the hand hole to be ripped out. In part, this action was due to orienting the hand hole substantially parallel to the top and bottom of the carton. U.S. Pat. No. 3,197,110 illustrates a typical hand hole of the prior art, with a reinforcing member to reduce tearing. U.S. Pat. No. 2,308,050 teaches yet another method of reinforcing a prior art hand hole. U.S. Pat. No. 3,464,619 teaches a specific hand hole configuration which is said to be tear resistant. I have devised a hand hole which is superior to any of the prior art hand holes in tear resistance by virtue of its distribution of the lifting load over a large area and in such directions as to avoid shearing forces.

SUMMARY OF THE INVENTION

My invention is an improvement in a carton wherein two pairs of opposed sidewall panels are hingedly connected along substantially vertical foldable connections to form a tubular configuration, and wherein the tubular configuration is provided with a bottom closure means, the improvement comprising the following: elongated, inclined hand hole means in each of a pair of opposed sidewall panels for facilitating lifting the carton, the inclined hand hole means being located intermediate the height and width of the sidewall panels above the center of mass of any load carried by the container, an extension of a longitudinal axis of the inclined hand hole means intersecting the plane of said bottom closure means at an acute angle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a carton illustrating one embodiment of the hand hole of the present invention;

FIG. 2 is an enlarged elevational view of a portion of one sidewall panel of the carton of FIG. 1 showing the hand hole of the present invention in more detail;

FIG. 3 is a schematic view of one sidewall panel of the carton of FIG. 1 illustrating the angular relationship of the hand hole of the present invention to the carton;

FIG. 4 is a view of a hand hole similar to that shown in FIG. 2 illustrating the hand hole of the present invention with the addition of closing flaps in place;

FIG. 5 is a perspective view showing the hand hole configuration of FIG. 4 with the flaps in the open position;

FIG. 6 is a perspective view of a carton illustrating a further embodiment of the hand hole of the present invention;

FIG. 7 is an enlarged elevational view of a portion of one sidewall panel of the carton of FIG. 6 showing the hand hole of the present invention in more detail; and

FIG. 8 is a perspective view similar to FIG. 6, illustrating the hand hole of FIG. 7 with closing flaps in the open position.

DETAILED DESCRIPTION OF THE DRAWINGS

The carton 10 illustrated in FIG. 1 is of conventional double-faced corrugated paperboard construction, and has two pairs of opposed sidewall panels 12 and 14 and 13 and 15. A top closure is provided for the carton 10 with conventional overlapping closure flaps 18, 19, 20 and 21. A closed carton is formed by the addition of a bottom closure means 22. The sidewall panels 12 through 15 are hinged together along foldable connections 24, 25, 26 and 27, to allow the sidewall panels 12 through 15 to be folded and joined by the usual "manufacturer's joint" into the tubular configuration of the carton 10. FIG. 1 illustrates that in two of the opposed sidewall panels 12 and 14, inverted V shaped hand hole cutouts 30 and 32 are provided. It should be realized that the configuration of the carton 10 shown in FIG. 1 is an essentially rectangular one, thus leading to the advantageous placement of the hand hole cutouts 30 and 32 on the shorter opposed sidewall panels 12 and 14. In a square carton, however, the sidewall panels on which the hand hole cutouts are placed is not critical and may be placed on any of the two pairs of opposed sidewall panels. In addition, if the configuration of the carton or the contents to be placed in the carton would dictate such, the hand hole cutouts 30 and 32 could be placed on the longer opposed sidewall panel pair 13 and 15 shown in FIG. 1. In the following description, it should be understood that the two hand holes 30 and 32 are substantially identical, so it is believed that the detailed description of one will suffice for both.

FIG. 2 shows the hand hole 30, on an enlarged scale, in the sidewall panel 12 of the carton 10. In order to properly define the hand hole 30, it is first necessary to lay out imaginary construction or base lines. A first base line 34 is constructed substantially perpendicular to the foldable connections 25 and 24 between the sidewall panel 12 and the sidewall panels 13 and 15. The position of the first base line 34 relative to the length of the foldable connection 25 may be variable depending upon the exact configuration of the carton 10 and the anticipated contents of the carton 10. That is, the relative position of the hand hole 30 may be shifted up and down with respect to the vertical height of the sidewall panel 12. However, it is sufficient to say that the first base line 34 is located intermediate the height of the foldable connections 24 and 25. Generally, the base line 34 will be located above the center of mass of the anticipated contents of the carton 10. As a specific example, in one case where the foldable connections 24 through 27 were all approximately 10 inches in length, the first base line 34 was located approximately centrally of the foldable connection length; that is, at a distance 5 inches from the connection of the sidewall panel 12 to the top closing flap 21. It should be recognized that the first base line 34, and all subsequent base lines to be defined, will be con-

structed perpendicular to the foldable connections 24 and 25 only in the case illustrated in FIG. 1; that is, when the foldable connections 24 and 25 are substantially vertical in their normal operational orientation. In the most general case, for example when the carton 10 assumes the shape of a truncated pyramid, the base lines will all be parallel to the plane of the bottom closure means 22. In its normal operational position, the bottom closure means 22 defines a substantially horizontal flat plane. This situation holds true regardless of the shape of the rest of the carton, even in the illustrated situation where the foldable connections 24 and 25 are substantially vertical.

A second base line 36 is then constructed parallel to the first base line 34 spaced apart from the first base line 34 in the direction of the top closing flaps 18 through 21. In the specific example cited, the separation of the first base line 34 and the second base line 36 was approximately three-fourths of an inch. A third base line 38 is then constructed parallel to the second base line 36 and spaced apart from the second base line 36 in the direction of the top closing flaps 18 through 21. Again, in the specific example cited, the separation of the second base line and the third base line 38 was approximately one-fourth of an inch. Finally, a fourth base line 40 is constructed parallel to the third base line 38 and spaced apart from the third base line 38 in the direction of the top closing flaps 18 through 21. In the specific example, the separation of the third base line 38 and the fourth base line 40 was approximately 1½ inches. A final imaginary reference line is a hand hole bisector line 42 which is constructed perpendicular to the base lines 34, 36, 38 and 40. It will be noted that in FIG. 1, the hand hole bisector line 42 essentially bisects the sidewall panel 12 as well. However, the basic function of the hand hole bisector line 42 is to divide the hand hole 30 into two symmetric parts. The actual position of the hand hole bisector line 42 may vary with respect to the actual width of the sidewall panel 12 and need not necessarily bisect the sidewall panel 12 as well as the hand hole 30. With the reference lines so constructed, the hand hole 30 is developed as follows: a first cut line 43 extends between a lower terminus 44 on the first base line 34 to an upper terminus 45 on the third base line 38 at an actue angle A with respect to the first base line 34, with the slope of the first cut line 44 being toward the hand hole bisector line 42. The location of the lower terminus 44 of the first cut line 43 is at a position intermediate the length of the first base line 34 on one side of the hand hole bisector line 42. In the specific example previously cited, the distance from the lower terminus 44 of the first cut line 43 to the hand hole bisector line 42 was 1½ inches, and the angle A was 45°. The angle A may be between 40° and 60° and still function properly. A second cut line 46 connects the first base line 34 to the third base lines 38, extending from a lower terminus 47 on the first base line 34 on the opposite side of the hand hole bisector line 42 from the first cut line 43. The lower terminus 47 is spaced from the bisector line 42 a distance equal to the spacing of the lower terminus 44 from the bisector line 42. The second cut line 46 is angled toward the bisector line 42 at an obtuse angle O with respect to the first base line 34. The angle O and the angle A are supplementary. The second cut line 46 ends at an upper terminus 48 on the third base line 38. A third cut line 50 extends from a lower terminus 51 on the second base line 36 to an upper terminus 52 on the fourth base line 40 and is parallel to the first cut line 43. The lower terminus 51 is positioned at a greater distance from the hand hole bisector line 42 than the lower terminus 44 of the first cut line 43. In the specific example previously cited, the distance of the lower terminus 51 from the hand hole bisector line 42 was approximately 2¼ inches. A fourth cut line 54, parallel to the second cut line 46, extends from a lower terminus 55 on the second base line 36 to an upper terminus 56 on the fourth base line 40. The location of the lower terminus 55 on the second base line 36 is at a distance equal to the distance of the lower terminus 51 from the hand hole bisector line 42 on the opposite side of the hand hole bisector line 42. A first arcuate cut line 58 connects the upper terminus 52 with the upper terminus 56. A second arcuate cut line 60 connects the upper terminus 45 to the upper terminus 48. A third arcuate cut line 62 connects the lower terminus 51 with the lower terminus 44. Finally, a fourth arcuate cut line 64 connects the lower terminus 55 with the lower terminus 47. It may be seen that the combination of the cut lines 43, 46, 50, 54, 58, 60, 62 and 64 define a substantially inverted V shaped hand hole cutout in the sidewall panel 12. This defines the hand hole cutout 30 as shown in FIG. 1 and 2. The hand hole cutout 32 is defined and constructed in an identical manner on the sidewall panel 14 as shown in FIG. 1.

There are, of course, two longitudinal axes for the inverted V shaped hand hole 30, a longitudinal axis L being parallel to the first cut line 43, and a longitudinal axis L' being parallel to the second cut line 46. FIG. 3, in schematic form, illustrates the positioning of the hand hole 30 in the sidewall panel 12 with respect to the longitudinal axes L and L'. The position of the hand hole 30 shown in FIG. 3 is such that the longitudinal axes L and L' will cut the intersection of the foldable connections 24 and 25 with the bottom closure means 22. It should be understood that this is a unique position of the hand hole 30 and is chosen to illustrate the two more general situations. In general, the longitudinal axes L and L' will usually intersect the foldable connections 24 and 25 and, if extended even further, the plane of the bottom closure means 22. In some cases, the hand hole 30 will be positioned such that the longitudinal axes L and L' will intersect only the plane of the bottom closure means 22. To aid in the description of the angle of intersection, a reference line 65 has been constructed parallel to the first base line 34.

The angle O–1 must be equal to the angle A, since the angles O and A were defined as being supplementary. The angles formed by the intersection of the longitudinal axes L and L' with the reference line 65 must be the same as the angles shown in FIG. 2 formed by the intersection of the cut lines 43 and 46 with the first base line 34. This must be true as a result of the parallel relationships set up. Therefore, since the plane of the bottom closure means 22 is parallel to the first base line 34 and the reference line 65, the longitudinal axes L and L' must intersect the plane of the bottom closure means 22 at the acute angles A and O–1 as seen in FIG. 3. In addition, when the foldable connections 24 and 25 are perpendicular to the base line 34, the longitudinal axes L and L' will intersect the foldable connections 24 and 25 at the respective angles C and D which are equal and are the complements of the angles A and

O–1. Simple right triangle analysis with reference to FIG. 3 will show the truth of this statement.

Turning now to FIG. 4, a somewhat modified version of the hand hole 30, designated as 30', is shown. The major difference between the hand hole 30 and the hand hole 30' is the provision of two hand hole closing flaps 66 and 68. Those portions of the hand hole 30' shown in FIG. 4 which are identical with the same portions of the hand hole cutout 30 are designated with the same numbers as used in FIG. 2. It may be seen that the major difference is that the cut lines 50 and 54 have been replaced with score lines 70 and 72. These score lines 70 and 72 follow the identical geometric path as defined for the cut line 50 and 54, and it is believed that further explanation is not necessary. It will be noted that the score lines 70 and 72 still have upper termini 52 and 56 and lower termini 51 and 55. In addition, a fifth cut line 74 connects the first arcuate cut line 58 with the second arcuate cut line 60 following essentially the path of the hand hole bisector line 42. Thus, the hand hole closing flaps 66 and 68 are hinged to the sidewall panel 12 along the score lines 70 and 72 respectively. When a person's hand is pressed against either of the hand hole closing flaps 66 or 68, the flap 66 or 68 will pivot inwardly toward the interior of the carton 10 along the score line 70 or 72. In most situations, a person would insert his hand approximately centrally of the fifth cut line 74, thus pivoting both of the hand hole closing flaps 56 and 68 inwardly. This function may be seen in FIG. 5, where the hand hole closing flaps 66 and 68 are shown in dotted lines as they would be when pivoted into the interior of the carton 10.

Another aspect of the same invention may be seen in FIG. 6. The carton 10 shown in FIG. 6 is identical to the carton 10 shown in FIG. 1, and it is believed that the description previously given of this carton is sufficient and the numbers therefore are transferred from FIG. 1 to FIG. 6 for identical structures. In FIG. 6, the inverted V hand hole 30 of FIG. 1 has been revised such that the legs of the V have been separated to form two separate inclined, elongated slot hand holes 80 and 82 in the sidewall panel 12. In addition, shown in dotted lines; there are two further inclined, elongated slot hand holes 84 and 86 shown in the opposed sidewall panel 14. It should be apparent that while the most efficient operation may be achieved by using all four of the hand holes shown in FIG. 6, any opposed pair of hand holes such as 80 and 84 or 82 and 86 would still lead to a satisfactory structure. However, the utilization of the opposed pairs of hand holes would require that the carton 10 be picked up from one side or the other, and thus for convenience and utility, it is preferred that all four of the hand holes 80, 82, 84 and 86 be utilized in the carton 10. The hand hole pair 80 and 82 are substantially identical to the hand hole pair 84 and 86, and therefore the following discussion will be limited to only the hand hole pair 80 and 82, since the description of the two hand holes 80 and 82 may readily be applied to the hand hole pair 84 and 86.

FIG. 7 shows the hand holes 80 and 82 on an enlarged scale in the sidewall panel 12 of the carton 10. As a preliminary note, it may be seen that the ends of the hand holes 80 and 82 are of a substantially circular or arcuate configuration. However, the ends could be of a more linear shape and still lead to proper operation of the hand holes. The major structural function of the hand holes 80 and 82 is achieved by the inclination of the hand holes 80 and 82 with respect to the sidewall panel 12. Thus, the configuration of the ends of the hand holes 80 and 82 is not critical except that the circular shape is preferred to reduce the possibility of tearing the hand hole at this point and to allow a person carrying the carton 10 to insert his hand in a more natural position. In order to more properly define the hand holes 80 and 82, it is again necessary to lay out imaginary construction or base lines. A first base line 88 is constructed substantially perpendicular to the foldable connections 25 and 24 between the sidewall panel 12 and the respective sidewall panels 13 and 15. The position of the first base line 88 relative to the length of the foldable connection 25 may be variable depending upon the exact configuration of the carton 10 and the contents of the carton 10. That is, the relative position of the hand holes 80 and 82 may be shifted up and down with respect to the vertical height of the sidewall panel 12. However, it is sufficient to say that the first base line 88 is located intermediate the height of the foldable connections 24 and 25. Generally, the base line 88 will be located above the center mass of any anticipated contents of the carton 10. As a specific example, in one case where the foldable connections 24 through 27 were all approximately 10 inches in length, the first base line 88 was located approximately centrally of the foldable connection length; that is, at a distance 5 inches from the connection of the sidewall panel 12 to the top closing flap 21. It should be recognized that the first base line 88, and all subsequent base lines to be defined, will be constructed perependicular to the foldable connections 24 and 25 only in the case illustrated in FIG. 7; that is, when the foldable connections 24 and 25 are substantially vertical in their normal operational orientation. In the most general case, for example when the carton 10 assumes the shape of a truncated pyramid, the base line will all be parallel to the plane of the bottom closure means 22. In its normal operational position, the bottom closure means 22 defines a substantially horizontal flat plane. This situation holds true regardless of the shape of the rest of the carton, even in the illustrated situation where the foldable connections 24 and 25 are substantially vertical. A second base line 90 is constructed parallel to the first base line 88 spaced apart from the first base line 88 in the direction of the top closing flaps 18 through 21. In the specific example cited, the separation of the first base line 88 and the second base line 90 was approximately three-fourths of an inch. A third base line 92 is constructed parallel to the second base line 90 and spaced apart from the second base line 90 in the direction of the top closing flaps 18 through 21. In the specific example cited, the separation of the second base line 90 from the third base line 92 was approximately one inch. Finally, a fourth base line 94 is constructed parallel to the third base line 92 and spaced apart from the third base line 92 in the direction of the top closing flaps 18 through 21. In the specific example, the separation of the third base line 92 and the fourth base line 94 was approximately three-fourths of an inch. A final imaginary reference line is a vertical axis line 96 which is constructed perpendicular to the base lines 88, 90, 92 and 94. In most situations, the vertical axis 96 will bisect the sidewall panel 12. However, the basic function, in this situation, of the vertical axis 96 is to allow a description of the two hand holes 80 and 82 and their positions relative to one another. With the reference

lines so constructed, the hand holes **80** and **82** may be described as follows: the hand hole **82** has a first cut line **98** which extends from a lower terminus **99** on the first base line **88** to an upper terminus **100** on the third base line **92** at an acute angle B with respect to the first base line **88**, with the slope of the first cut line **98** being toward the vertical axis **96**. The location of the lower terminus **99** of the first cut line **98** is at a position intermediate the length of the first base line **88** on one side of the vertical axis **96**. In the specific example cited, the distance from the lower terminus **99** to the vertical axis **96** was approximately 2 inches, and the angle B was 45°. The angle B may vary between 40° and 60° and still function properly. A second cut line **102** extends from a lower terminus **103** on the second base line to an upper terminus **104** on the fourth base line **94**. The second cut line **102** is parallel to the first cut line **98**, and the lower terminus **103** is positioned on the second base line **90** a distance from the vertical axis **96** greater than the distance of the lower terminus **99** from the vertical axis **96** and on the same side of the vertical **96** as the lower terminus **99**. In the specific example given, the distance of the lower terminus **103** to the vertical axis **96** was approximately 2¾ inches. A first arcuate cut line **106** connects the upper terminus **100** to the upper terminus **104**. A second arcuate cut line **108** connects the lower terminus **103** to the lower terminus **99**. Thus, the hand hole **82** is completely defined and is, in general terms, an elongated slot inclined at an acute angle with respect to the connection **24** between the sidewall panel **12** and the sidewall panel **15**. It should be readily apparent from FIG. **7** that the hand hole **80** is substantially identical to the hand hole **82**, the major difference being that the hand hole **80** is located on the opposite side of the vertical axis **96** from the hand hole **82** and is inclined at a different angle than the hand hole **82**. The hand hole **80** may be defined as follows: A third cut line **110** extends from a lower terminus **111** on the first base line **88** to an upper terminus **112** on the third base line **92**. The lower terminus **111** is positioned on the first base line **88** a distance from the vertical axis **96** equal to the distance of the lower terminus **99** from the vertical axis **96** on the opposite side of the vertical axis **96** from the lower terminus **99**. The third cut line **110** is sloped toward the vertical axis **96** at an obtuse angle P with respect to the first base line **88**. The obtuse angle P and the acute angle B are supplementary. A fourth cut line **114** extends parallel to the third cut line **110** from a lower terminus **115** located on the second base line **90** to an upper terminus **116** located on the fourth base line **94**. The lower terminus **115** is located the same distance from the vertical axis **96** as is the lower terminus **103**, and is located on the opposite side of the vertical axis **96** from the lower terminus **103**. A third arcuate cut line **118** connects the upper terminus **112** to the upper terminus **116**. A fourth arcuate cut line **119** connects the lower terminus **115** with the lower terminus **111**, thereby completely defining an elongated slot hand hole **80**.

The longitudinal axis of the hand hole **82** is indicated by the line L–1, which is, of course, parallel to the first cut line **98**. The longitudinal axis of the hand hole **80** is designated as the line L–2, the longitudinal axis L–2 being parallel to the cut line **110**. The angle P–1 shown in FIG. **7** is equal to the angle B, since the angles B and P are supplementary. It is believed that the explanation of the intersections of the longitudinal axes L and L' given with reference to FIG. **3** may be readily applied to the longitudinal axes L–1 and L–2. This is the case, since the angle A may be equal to the angle B, and the angle O–1 may be equal to the angle P–1. Thus, the axes L–1 and L–2 will both intersect the plane of the bottom closure means **22** at acute angles, the acute angles being the angles B and P–1. In addition, if the foldable connections **24** and **25** are substantially vertical, the longitudinal axes L–1 and L–2 can intersect the foldable connections **24** and **25** at acute angles which are the complementary of the angles B and P–1.

A may be seen in FIG. **8**, hand hole closing flaps, such as those designated as **120** and **122**, may be provided for the hand holes **80** and **82** if desired. This is very readily accomplished by replacing the cut lines **102** and **114** with score lines **124** and **126**. In this situation, the absence of the cut lines **102** and **114** allow the rest of the cutout portion of the hand holes **80** and **82** to be hinged about the score lines **124** and **126**. The hand hole closing flaps **122** and **124** thus would normally be in position to close the hand holes **82** and **80** when they are not in use. A person wishing to pick up the carton would press his hand against the hand hole closing flap **122** or **124** and push it inwardly, pivoting the hand hole closing flap **122** or **124** about the score line **124** or **126**. Of course, it should be obvious that hand hole closing flaps may also be provided in the same manner for the hand holes **84** and **86**.

The hand hole configurations shown in FIGS. **1** and **6** both have a common purpose. This purpose is to provide an inclined hand hole means in a pair of opposed sidewall panels for facilitating lifting the carton, wherein an extension of a longitudinal axis of the inclined hand hole means will intersect the bottom closure means **22** at an acute angle. The reason for doing this is to provide a hand hole which is superior in strength to any of the hand holes of the prior art. There are two basic factors about the inclined hand hole design which make it stronger than prior art hand holes which are set with their longitudinal axes substantially perpendicular to the foldable sidewall connections. The first of these factors is that the lifting force is distributed along the corrugated paperboard sidewall panel at an acute angle, 45° in the specific example given, rather than being carried vertically by the sidewall panel. This allows a distribution of the lifting force in both the vertical and the horizontal direction throughout the structure of the sidewall panel and therefore does not require the vertical section to carry the entire load. In addition, it may readily be appreciated that in a conventional hand hole cutout which has its longitudinal axis substantially perpendicular to the foldable connections, the hand of a person lifting the carton is at substantially the same vertical distance from the top of the carton during the entire lifting process. This results in a relatively small vertical section of the carton above the hand hole supporting the entire load while the carton is lifted. However, the inclined hand hole design allows more material to be above the lifting portion of a person's hand during the time that the carton is carried. This feature may readily be appreciated by reference to FIGS. **2** and **7**. A person lifting the carton using either of these hand hole configurations would insert his hand such that the hand rested along substantially the entire cut line **50** or **54** or the cut line **102** or **114**. It may be seen, thus, that the lower

portion of the hand would be a considerable vertical distance below the upper portion of the carton **10**. This, as was pointed out previously, is in contrast to the normal hand hole, where the hand of a person lifting the carton is at substantially the same vertical distance from the top of the carton at all times. The hand hole design of the present invention thus requires a person to pick up the carton **10** by placing his fingers along one of the inclined edges, for example the cut lines **50, 54, 102** and **114**.

There are currently no standard test procedures for testing hand holes in cartons such that an absolute comparison may be made of this improved hand hole configuration with those of the prior art. However, several empirical tests have been made. In one test, the end panel of a box carrying approximately **55** pounds was wet thoroughly with a solution of soap and water. A carton which had a conventional hand hole cutout was lifted by the hand holes and shaken. The hand holes tore out of the carton immediately. A carton having the inverted V hand hole **30** of the present invention was tested in a similar manner and the inverted V hand hole **30** successfully carried the load while being shaken. Similarly, a carton having the inclined hand holes **80** and **82** was tested, and the hand hole survived the test successfully. As a final test, hand holes of the improved configuration were sent for field testing to areas of the country in which high humidity conditions had led to frequent failures of hand holes of conventional design. The improved hand holes of the present invention passed the field test successfully and were accepted for general use in these areas, where, in the past, hand holes had not been found acceptable for use.

It may be appreciated that the inclined edges such as the cut lines **50, 54, 102** and **114** may assume a curved or arcuate configuration rather than the linear form illustrated. In such a case, the arcuate lifting edge will have two end points similar, for example, to the upper terminus **52** and lower terminus **51** of the cut line **50** shown in FIG. **2**. An extension of a straight line connecting the two end points will intersect the plane of the bottom closure means **22** at the previously discussed acute angle.

What I claim is:

1. In a carton wherein two pairs of opposed sidewall panels are hingedly connected along substantially vertical foldable connections to form a tubular configuration, and wherein said tubular configuration is provided with a substantially horizontally disposed bottom closure means, the improvement which comprises: elongated inclined hand hole means in each of a pair of opposed sidewall panels, said inclined hand hole means being located intermediate the height and width of said sidewall panels, said inclined hand hole means comprising a pair of substantially inverted V shaped hand hole cutouts, one of said inverted V hand holes being located on each of said opposed sidewall panels, the extension of the longitudinal axis of each leg of said inverted V intersecting the plane of said bottom closure means at an acute angle.

2. The improvement of claim **1**, wherein said hand hole means further includes: two pairs of hand hole closing flaps, one pair for each of said pair of inverted V hand holes, each of said pair of closing flaps being of the same shape as said inverted V hand holes and hinged to said sidewall panel along score lines coincident with the edge of intersecting legs of said inverted V hand holes away from said bottom closure means.

3. The improvement of claim **1**, wherein said acute angle is between 40° and 60°.

4. The improvement of claim **3**, wherein said acute angle is 45°.

5. In a carton wherein two pairs of opposed sidewall panels are hingedly connected along substantially vertical foldable connections to form a tubular configuration, and wherein said tubular configuration is provided with a substantially horizontally disposed bottom closure means, the improvement which comprises: elongated inclined hand hole means in each of a pair of opposed sidewall panels, said inclined hand hole means being located intermediate the height and width of said sidewall panels, said inclined hand hole means comprising two pairs of substantially elongated slot-shaped hand hole cutouts, each elongated slot hand hole being defined by two substantially parallel, coextensive cut lines connected at their respective ends by continuous cut lines, one of said pair of slot-shaped hand holes being located on each of said opposed sidewall panels, each of said pairs of slot-shaped hand holes being placed on said opposed sidewall panels such that one of each pair is adjacent one of the foldable connections of said sidewall panel and the other of said pair is adjacent the other foldable connection of said sidewall panel, the extended longitudinal axes of all of said elongated slot-shaped hand holes intersecting the plane of said bottom closure means at an acute angle.

6. The improvement of claim **5**, wherein said hane hole means further includes: two pairs of hand hole closing flaps, one pair for each pair of said two pairs of elongated slot hand hole cutouts, each of said two pairs of closing flaps being of the same shape as said two pairs of elongated slot hand hole cutouts and hinged to said sidewall panels along a score line coincident with one of said parallel, coextensive cut lines.

7. The improvement of claim **5**, wherein said acute angle is between 40° and 60°.

8. The improvement of claim **7**, wherein said acute angle is 45°.

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