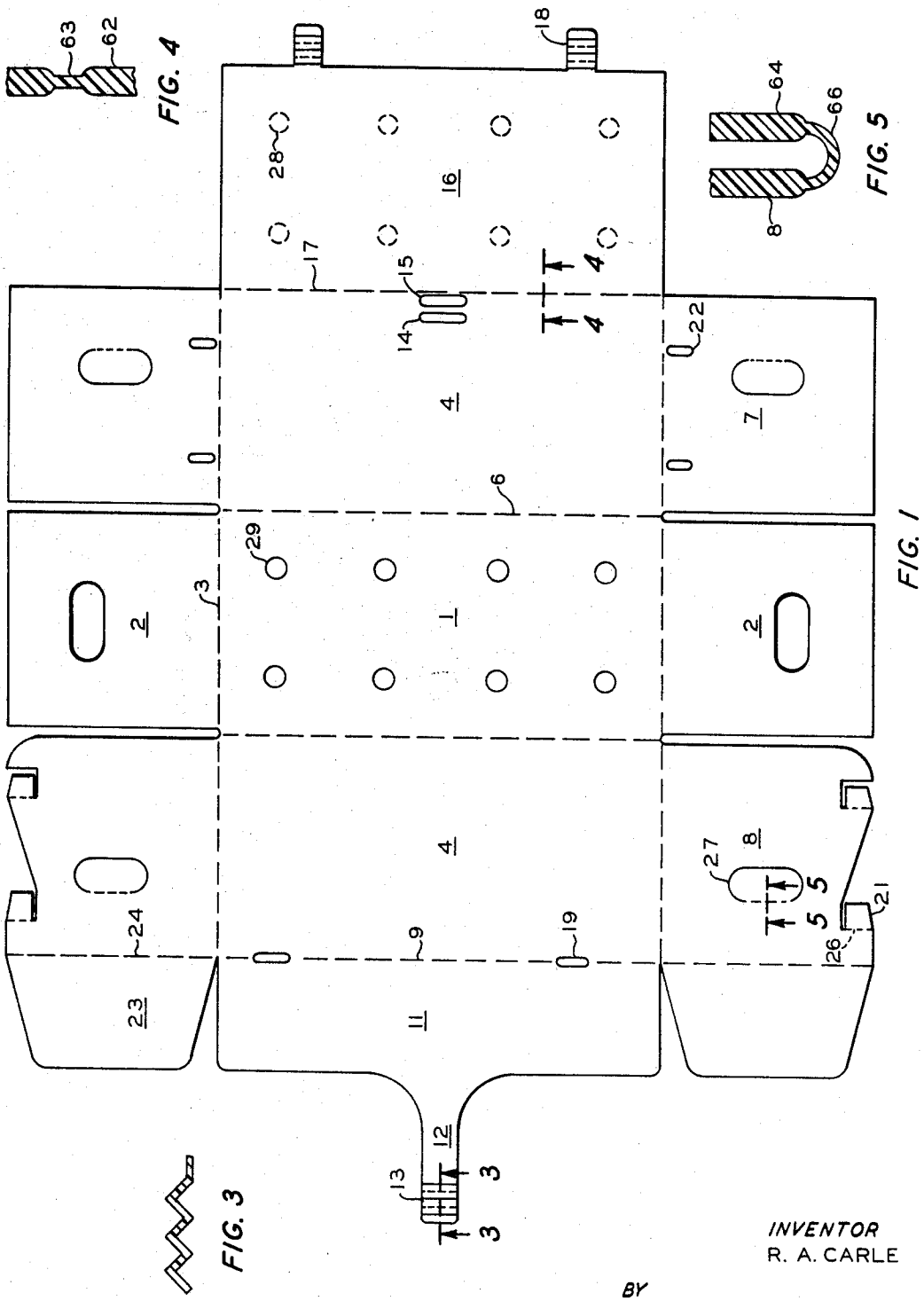
Nov. 5, 1968 R. A. CARLE 3,409,204

CARTON BLANK

Filed Aug. 1, 1966 2 Sheets-Sheet 1



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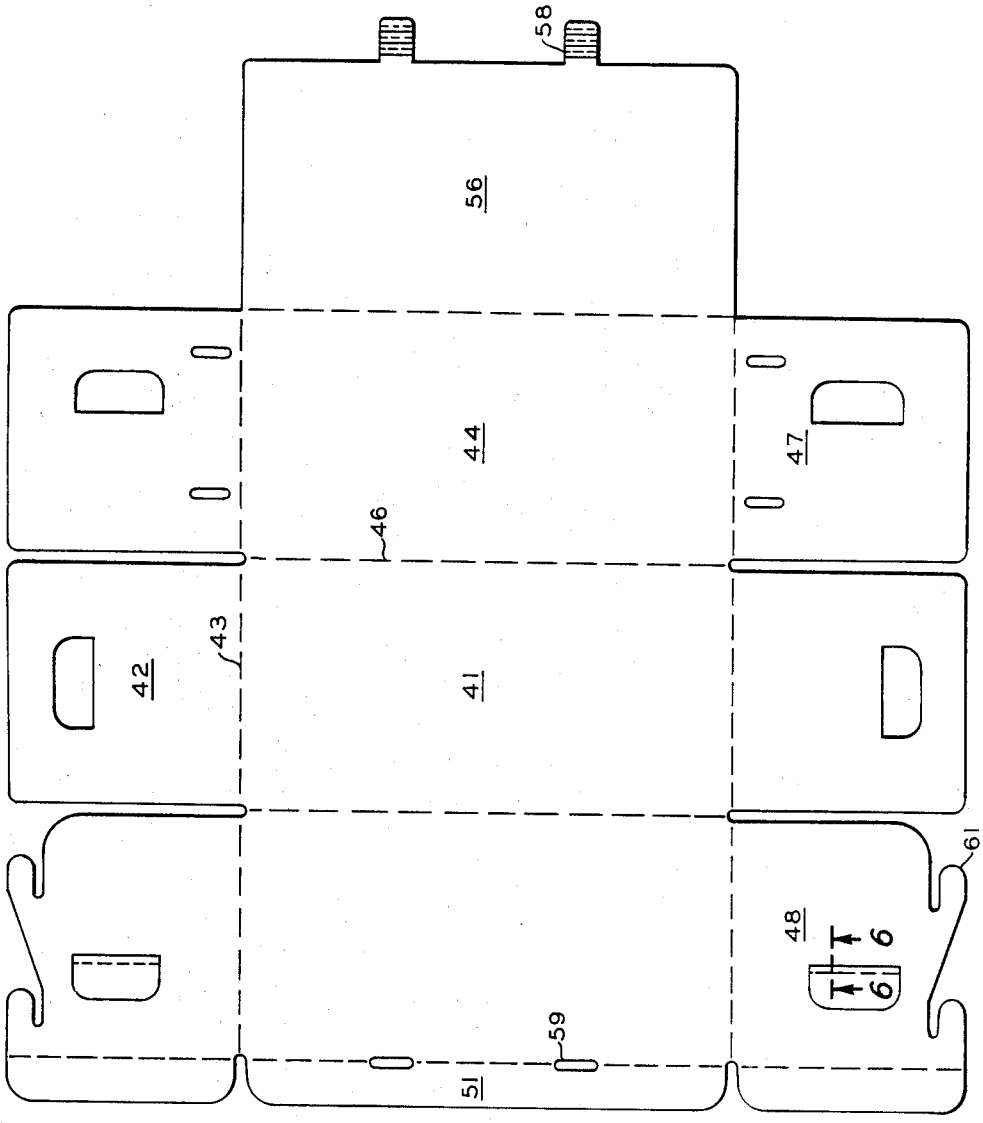


FIG. 2

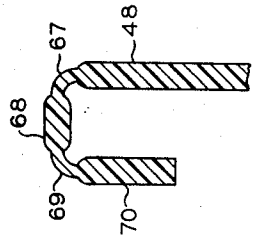


FIG. 6

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CARTON BLANK

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ABSTRACT OF THE DISCLOSURE

A carton blank formed from a single sheet of material adapted to be folded into a self-supporting box without the use of external fasteners comprises a bottom panel, side panels, interior, middle and exterior end panels, and a top panel provided with a tab for maintaining the top panel in closed position.

This invention relates to a blank suitable for folding into a box-like container. In one aspect, it relates to a blank of one-piece construction suitable for forming a carton. In another aspect, it relates to a blank which can be folded and interlocked to form a carton without the use of staples, glue, or other fastenings. In another aspect, it relates to a blank which can be folded to form a carton, used for carrying articles, and knocked down to a flat blank again a great plurality of times without damage to the blank. In still another aspect, it relates to a carton formed from a single blank of thermoplastic material. In still another aspect, it relates to a knocked-down crate suitable for repeated use in transporting perishable goods such as eggs.

Box-like containers are generally supplied to manufacturers and packagers as flat blanks which can be assembled at the point of use. Generally, this assembly requires the use of glue, staples, or other fastening devices, although blanks which interlock without fastening devices are also known. A blank which can be interlocked without the use of external fastening devices or tools has the obvious advantage of being capable of being assembled at any point in the field where tools or fastening devices may not be readily available. Furthermore, boxes which are held together by interlocking parts rather than external fasteners can generally be knocked down to a completely flat blank after use. This is a distinct advantage for reusable containers which are shipped to the user flat, assembled and packed by him, and shipped to the consignee of the goods who can remove the articles and return the carton to the supplier in a completely knocked-down, flat condition. When such reuse is contemplated, one-piece construction of the carton is extremely desirable.

It is therefore an object of this invention to provide a blank suitable for folding into a container without external fasteners. It is a further object of this invention to provide a reusable container which can be readily knocked down to a completely flat blank. It is a further object of this invention to provide a sturdy container suitable for a great number of reuses. It is a further object of this invention to provide a reusable egg carton.

Other aspects, objects and the several advantages of this this invention are apparent to one skilled in the art from a study of this disclosure, drawings and the appended claims.

According to the invention, I provide a blank of a single piece of material, having integrally formed hinges, which folds and interlocks to form a carton by means of co-acting tabs and slots, and which requires no external fasteners. In a preferred embodiment, the carton is formed of synthetic thermoplastic material.

The novel features of my invention can be readily seen by reference to the appended drawings. FIGURE 1 is a plan view of one embodiment of the blank of my invention. FIGURE 2 is a plan view of a different embodiment. FIGURE 3 is a cross-section view of the tabs provided on the blank. FIGURE 4 is a cross-section of an integral hinge formed when a thermoplastic material is used in the blank of my invention. FIGURE 5 is a cross-sectional view of a hand hole provided on the blank of thermoplastic material. FIGURE 6 is a cross-section of a modified hand hole provided on my carton.

Referring now to FIGURE 1, the blank of my invention has a bottom panel **1**. Interior end panels **2** are attached to bottom panel **1** along longitudinal fold line **3**. Side panels **4** are attached to bottom panel **1** along transverse fold lines **6**. One of side panels **4** has attached thereto along longitudinal fold lines middle end panels **7**. The other of side panels **4** has attached thereto along longitudinal fold lines exterior end panels **8**. In a preferred embodiment, end panels **2**, **7** and **8** are all provided with hand holes, as will be discussed more fully below.

Attached to one of side panels **4** along a transverse fold line **9** is an inner top panel **11**. In this embodiment, inner top panel **11** is provided with an extension **12** forming a tab **13**. Upon assembly of the box, tab **13** will fit through slots **14** and **15** on the side panel opposite the one to which the interior top panel is attached, thus holding the inner top panel in position over the contents of the assembled container. Oppositely disposed from inner top panel **11** is outer top panel **16**, which is attached along longitudinal fold line **17** to side panel **4**. This outer top panel is provided with at least one tab **18** which, upon assembly of the carton, will be inserted into an oppositely disposed slot **19**. In the embodiment shown, slot **19** is disposed on transverse fold line **9**. However, this slot could be disposed either entirely on inner top panel **11**, or on the side panel opposite the one to which the outer top panel is attached.

Exterior end panels **8** are provided with at least one tab **21**. Upon assembly of the carton, tab **21** will be inserted into slot **22** on middle end panel **7**. If desired, corresponding slots could be supplied in interior end panel **2**, in which case tab **21** would be inserted through the slots on both the interior and middle end panels, locking the three panels together.

In the embodiment shown in FIGURE 1, exterior end panels **8** are provided with subpanels **23** joined along transverse fold lines **24**. These subpanels are optional, but aid in keeping dust and water from entering the assembled carton around the top edges, Upon assembly, subpanels **23** would be folded over the contents before inner top panel **11** is folded down and locked into position.

In order to aid in the interlocking of the carton parts, tabs **13** and **18** are conveniently corrugated, as is shown in FIGURE 3. The corrugations make an angle of approximately 45° with the horizontal. The size of the corrugations will depend upon the size of the container. In the case of a container designed to hold from 24 to 30 dozen eggs, it has been found that corrugations of approximately ¼ inch distance between peak and valley are satisfactory.

Tabs **21** can either be corrugated, or can be provided with transverse fold line **26** to allow the tab to be securely interlocked in slot **22**.

End panels **2**, **7**, and **8** can be provided with hand holes which come into registration when the blank is assembled into a carton. Although the hand holes can be completely cut out, it is preferred that the material cut from exterior end panel **8** be only partially severed, and remain attached to the end panel along fold line **27**. After the three hand holes have been brought into registration, this dependent material can be folded up inside of end panels **2** and **7**, thus holding the three end panels together. If desired, material cut from the hand hole in middle end panel **7** can also be only partially severed so that there

are two thickness of materal folded up inside interior end panel **2** when the carton is assembled.

If desired, raised buttons **28** can be provided on the top of outer top panel **16**, and corresponding holes **29** cut in bottom panel **1** to allow interlocking of a plurality of cartons when they are stacked one upon another. Alternately, the outer surfaces of bottom panel **1** and outer top panel **16** can be somewhat roughened or knurled to minimize slippage when the cartons are stacked on top of each other.

A modification of the blank of my invention is shown in FIGURE 2. In this modification, bottom panel **41** has attached thereto interior end panels **42** along longitudinal fold lines **43**. Side panels **44** are attached to bottom panel **41** along transverse fold lines **46**. Middle end panels **47** are attached to one of side panels **44**, and exterior end panels **48** are attached to the other side panel **44**. In this embodiment, inner top panel **51** is abbreviated, and contains no means for interlocking with the opposite side panel, as is the case in the embodiment shown in FIGURE 1.

Outer top panel **56** is provided with corrugated tabs **58**, which are adapted for insertion into slots **59**.

As shown in this embodiment, the material cut from the hand hole in exterior end panel **48** can remain partially attached to the end panel along the bottom edge of the hand hole, as well as along the top edge, as shown in the previous embodiment.

A slightly different configuration of exterior end panel tabs **61** is shown in this modification than is shown in FIGURE 1, but it is mechanically equivalent to the embodiment of FIGURE 1 in this respect.

The carton of my invention can be manufactured from any material which has sufficient rigidity to be formed into a self-supporting carton of the size desired. The carton can thus be of cardboard, coated cardboard, metal, or plastic. When the blank is formed of cardboard, metal, or other non-resilient material, the various transverse and longitudinal fold lines illustrated on the drawings will generally be formed by creasing the material as is known in the art.

In a preferred embodiment, the carton of my invention is made of a synthetic thermoplastic material. Because of their strength and toughness, cartons made of thermoplastic materials have been shown to be capable of making more than 100 round trips, whereas cardboard cartons are suitable for only about 10 trips. Furthermore, the thermoplastic cartons can be washed if they become soiled. They can be sterilized if desired. Furthermore, when the perishable goods are shipped under refrigeration, cartons made of thermoplastic material will not be weakened because of the dampness inherent in the refrigeration process, as will cardboard cartons.

Any synthetic plastic material can be used to form the blank of my invention, provided it has sufficient flexibility to form a hinge structure, as will be discussed below, and has sufficient rigidity to provide a self-supporting box. Impact polystyrene, plasticized polyvinylchloride containing small amounts of filler, and polyolefins have been proven satisfactory. The preferred pastics are polymers and copolymers of ethylene, propylene and butene. The materials which are currently most preferred are polypropylene and high density polyethylene (0.95–0.96 density). The polymer can contain pigments, anti-oxidants, ultra-violet light stabilizers, destatisizing agents, and the like.

In one embodiment, a strong, light-weight carton is made by forming the blank from a foamed plastic material. Foamed polyethylene or foamed polypropylene are satisfactory, as is foamed semi-flexible polyurethane. Laminates can also be used in the process of my invention, including a sandwich-type construction having solid skin and a foam core.

The sheet stock for the blank is formed by any known means. In the case of thermoplastics, extrusion is ordinarily used, although calendering is also possible. The blank is normally die cut from sheet stock on either a flat or cylindrical die.

The thickness of the material will be dependent upon the size of the carton, and the weight which it is designed to carry. For cartons suitable for transporting 24 or 30 dozen eggs, the blank can be cut from sheet material of 1/16 inch thickness. For cartons of this size, no center divider is needed, as is needed in cardboard cartons of equivalent size. When foamed sheet stock is used, the thickness of the material may have to be increased in order to gain additional strength.

When the blank is made of thermoplastic material, the various transverse and longitudinal fold lines which have been discussed in connection with the drawings will comprise integral cold formed hinge structure. These integral hinges are formed by cold rolling the thermoplastic along a line in order to thin out the material. As some orientation of the material generally takes place in this thinning, the hinge structure is quite strong. The hinges will generally be formed at the same time that the blank is die cut from sheet stock.

FIGURE 4 shows a cross-section of a hinge structure. As seen in this drawing, the walls of the carton **62** are thinned down at the hinge **63** to a thickness of approximately 25 percent of their original thickness. As a matter of hinge design, the width of the hinge is generally approximately equal to the thickness of the material.

In forming hinge structures for the depending material at the hand holes, the hinge is required to make a 180° bend, rather than just a 90° bend, as is shown in FIGURE 5, which is taken along section **5—5** of FIGURE 1. The hinge is therefore made of double width. FIGURE 5 shows exterior end panel **8** having dependent material **64** cut from the hand hole joined thereto by double hinge width **66**. In assembled position, the upper edges of hand holes on end panels **2** and **7** will fit between outer wall **8** and material **64**.

An alternate hinge arrangement for the hand hole area is shown in FIGURE 6. In this modification, two hinges are formed with a space between them, rather than forming a single double width hinge. This type of hand hole arrangement has been used in conjunction with the blank shown in FIGURE 2, and is the currently preferred embodiment. In this drawing, exterior end wall **48** is attached through hinge **67** to web **68**. Attached to web **68** is a second hinge **69**, attaching flap **70**.

As has been indicated, the cartons formed according to this invention have found utility for shipping of eggs. A carton suitable for holding 24 dozen eggs is 12 x 24 x 11 3/16 inches, and one for transporting 30 dozen eggs is 12 x 24 x 12 3/4 inches. Since the cartons can be readily cleaned, are not adversely affected by dampness or refrigeration, and can be knocked down completely flat for return trips, they have been extremely successful in transporting eggs from the chicken farm to the processer. Cartons which have been most successful in this application have been made from a homopolymer of ethylene having a density of 0.960 and a melt index of 0.1, and sold under the Trademark Marlex 6001. The cartons are also expected to find utility in transporting poultry and other perishable goods, as well as other articles such as bottled or canned drinks.

If desired, the cartons of this invention can be provided with random holes cut in all sides of the cartons both for ventilation and for lightening of the cartons.

Reasonable variation and modification are possible within the scope of the foregoing disclosure, the drawings and the appended claims to the invention, the essence of which is a one-piece blank suitable for folding into a carton and interlocking by means of tabs and slots to form a rigid container without use of external fasteners.

I claim:

1. A blank formed from a single sheet of material

adapted to be folded into a self-supporting box without use of external fastener comprising:

(a) a bottom panel

(b) interior end panels attached to each end of said bottom panel along longitudinal fold lines;

(c) side panels attached to said bottom panel along transverse fold lines;

(d) middle end panels attached to one of said side panels along longitudinal fold lines;

(e) at least one transversely disposed slot in each said middle end panel adjacent said side panel;

(f) exterior end panels attached to the other of said side panels along longitudinal fold lines;

(g) at least one tab on each said exterior end panel remote from said other side panel and adapted for insertion into said slot in said middle end panel;

(h) an inner top panel attached to one of said side panels along a transverse fold line;

(i) an outer top panel attached along a transverse fold line to the side panel opposite the one to which said inner top panel is attached; and

(j) at least one tab on the edge of said outer top panel opposite the transverse fold line attaching said outer top panel to said side panel, said tab adapted for insertion into a slot provided whereby said outer top panel is maintained in covering relation to the assembled box.

2. The blank of claim **1** wherein said inner top panel has an extension forming a tab adapted for insertion into a slot provided on the side panel opposite that to which said inner top panel is attached.

3. The blank of claim **1** wherein said slot provided for insertion of the tab on said outer top panel is on said inner top panel.

4. The blank of claim **1** wherein said slot provided for insertion of the tab on said outer top panel is on the side panel opposite that to which the said outer top panel is attached.

5. The blank of claim **1** wherein said slot provided for insertion of the tab on said outer top panel is on the fold line joining said inner top panel to the side panel.

6. The blank of claim **1** wherein said tabs are corrugated.

7. The blank of claim **1** wherein said exterior end panels have subpanels joined thereto along transverse fold lines, said subpanels adapted to fold at least partially over the contents of the assembled box inside of said interior top panel.

8. The blank of claim **1** wherein said material is thermoplastic and said fold lines comprise integrally formed hinges.

9. The blank of claim **8** wherein said thermoplastic is selected from impact polystyrene, polyvinylchloride, and polymers and copolymers of ethylene, propylene, and butene.

10. The blank of claim **8** wherein said thermoplastic is foamed.

11. The blank of claim **1** wherein said interior, middle and exterior end panels have hand holes formed therein, the exterior end panels having a flap of material dependent from one edge of its hand hole, said flap adapted to fold over the corresponding edges of the hand holes in said interior and said middle panels.

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