

May 1, 1951

R. M. BERGSTEIN
KNOCKED DOWN OR FOLDING STRUCTURE MADE FROM
ACETATE SHEETING OR THE LIKE

2,551,090

Filed Sept. 6, 1946

5 Sheets-Sheet 1

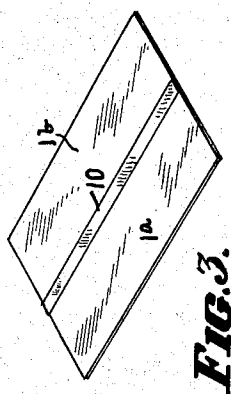


Fig. 3.

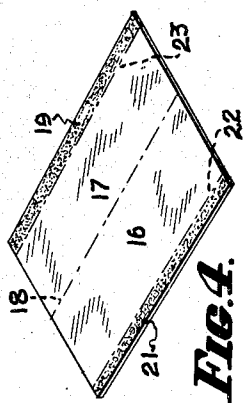


Fig. 4.

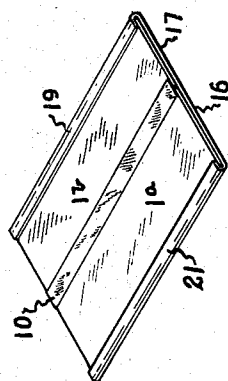


Fig. 5.

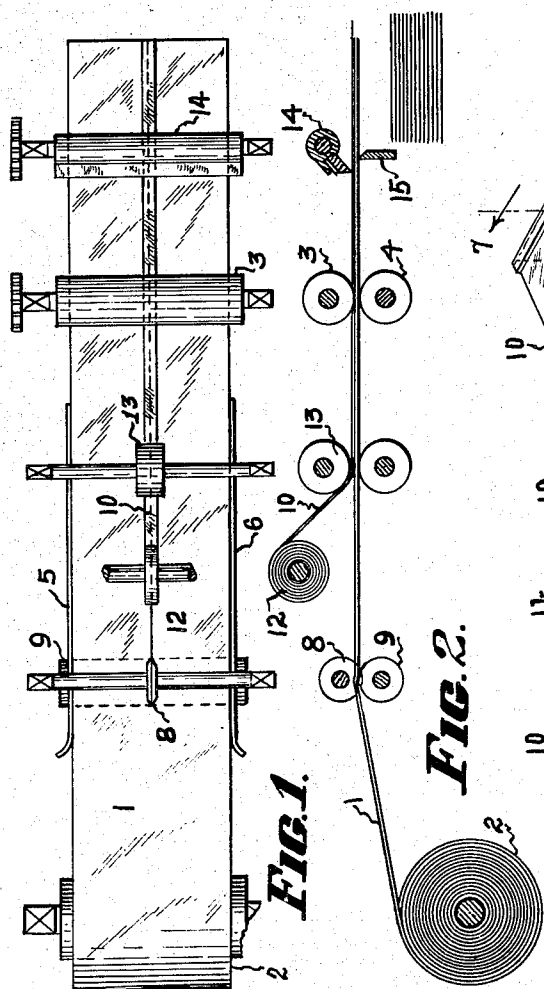


Fig. 1.

Fig. 2.

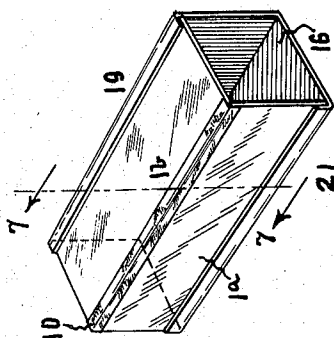


Fig. 6.

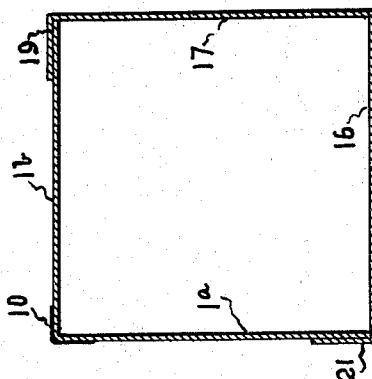


Fig. 7.

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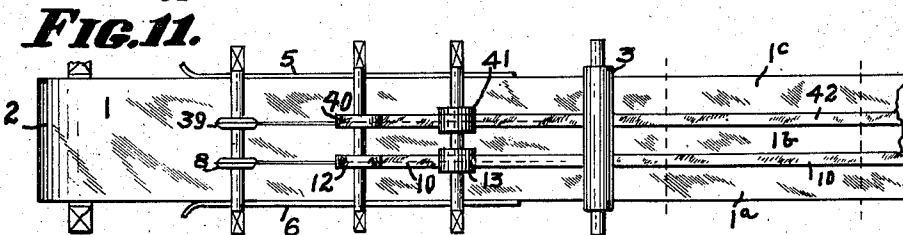
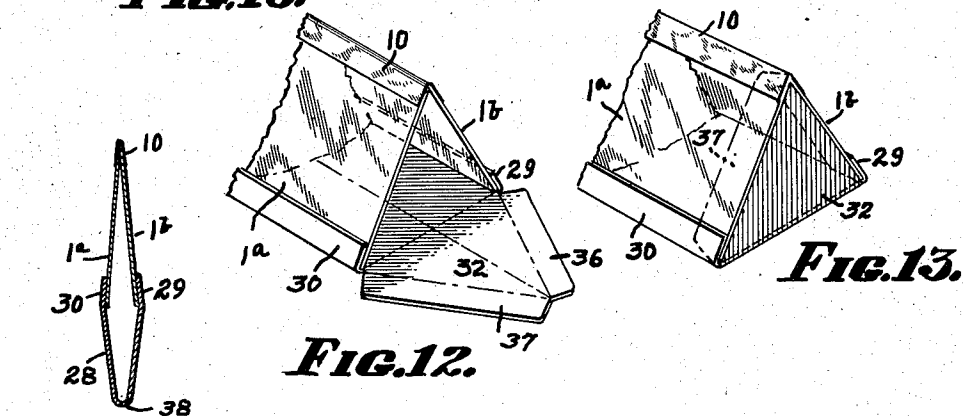
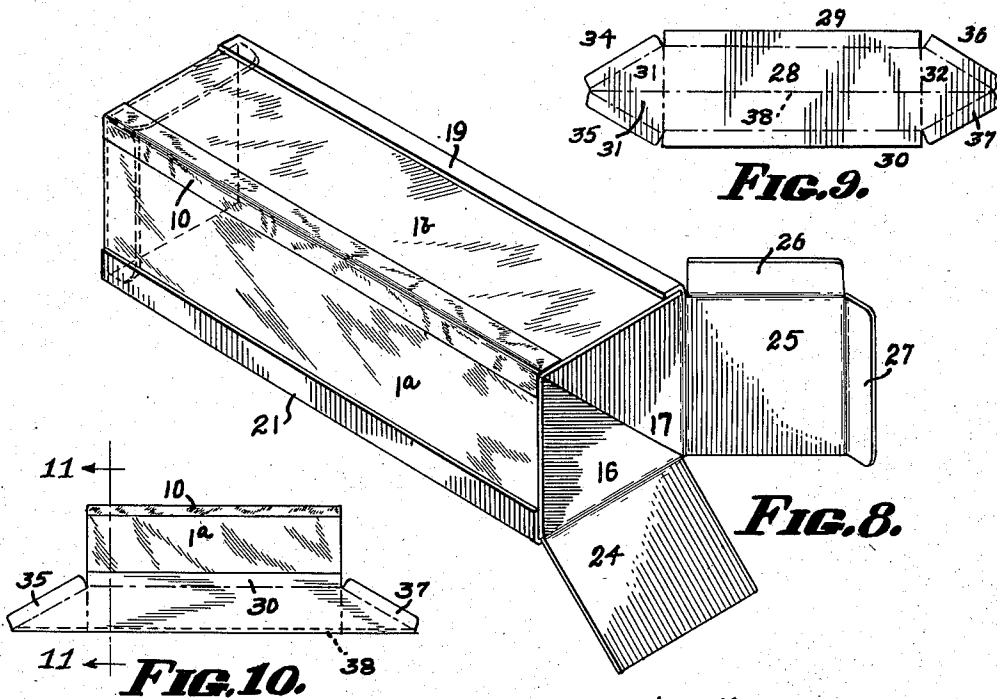


FIG. 14.

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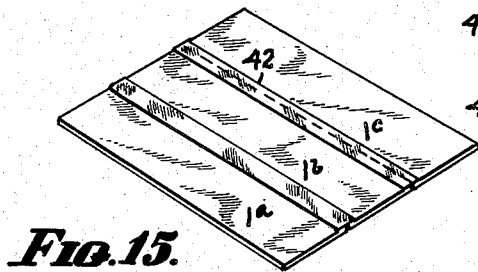


FIG. 15.

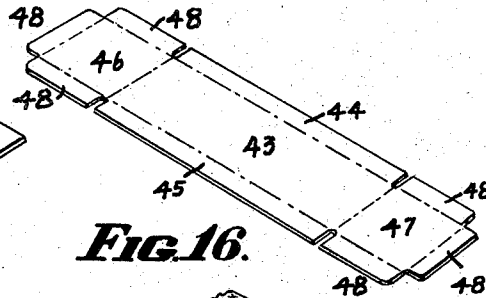


FIG. 16.

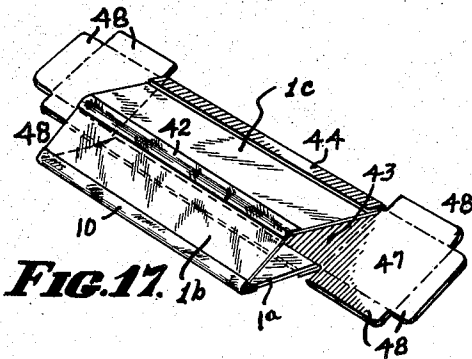


FIG. 17.

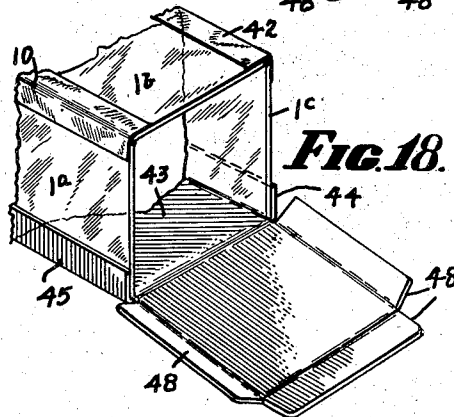


FIG. 18.

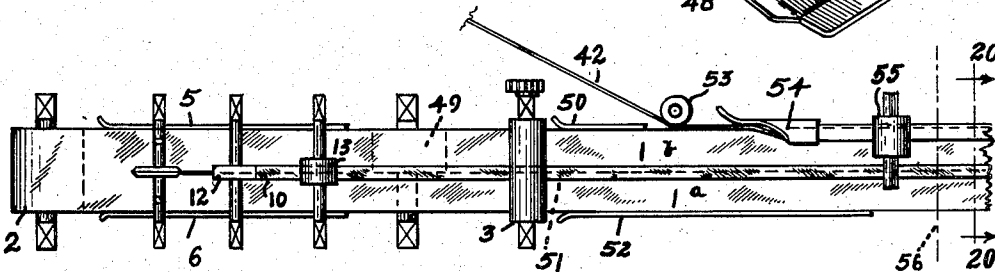


FIG. 19.

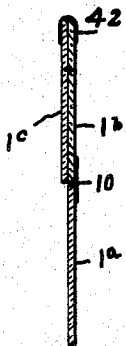


FIG. 20.

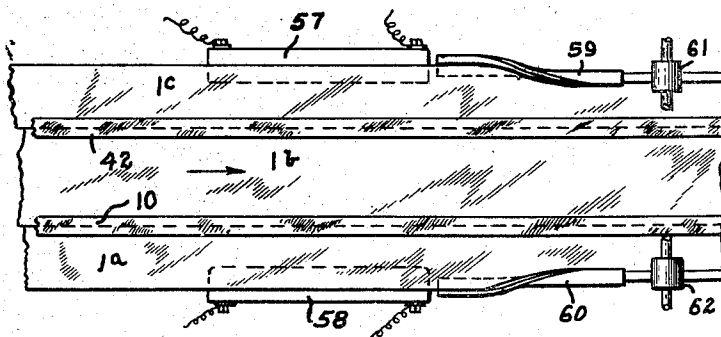


FIG. 21.

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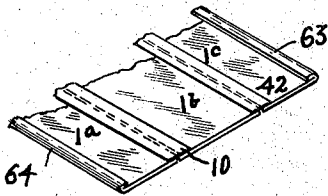


FIG. 22.

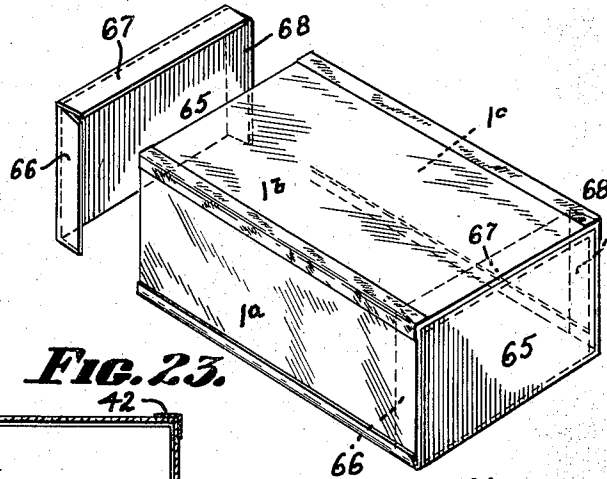


FIG. 23.

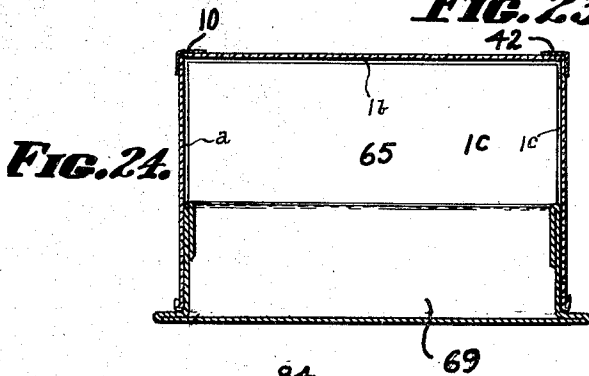


FIG. 24.

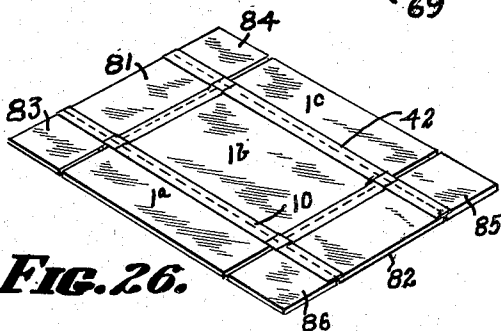


FIG. 26.

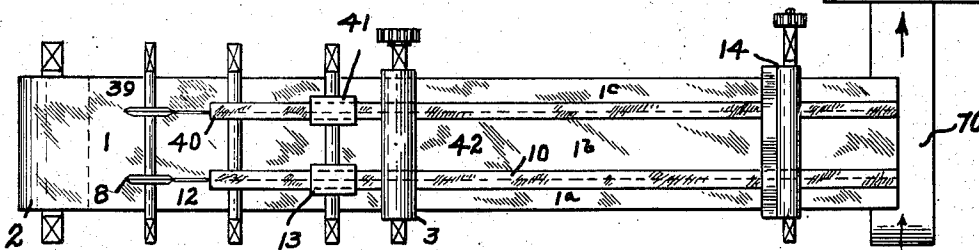


FIG. 25.

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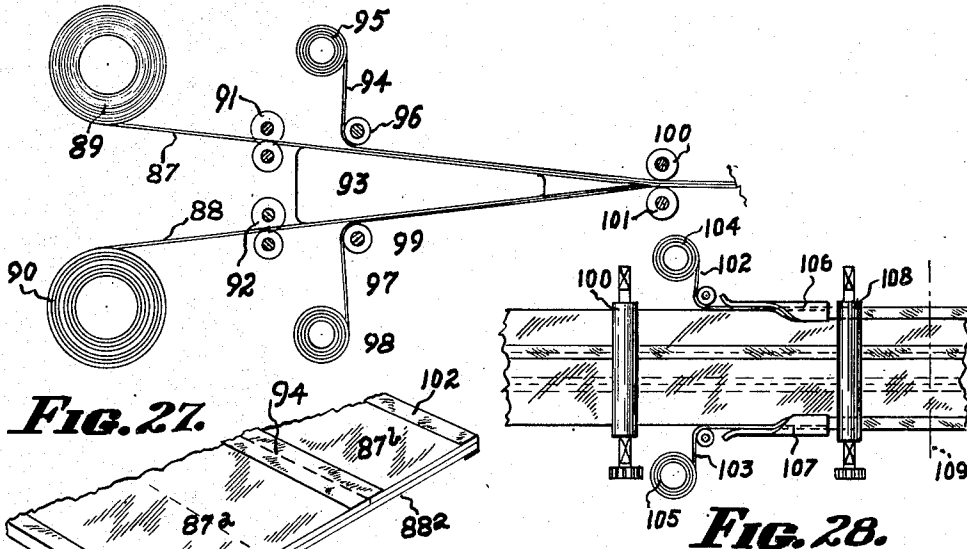


Fig. 27.

Fig. 28.

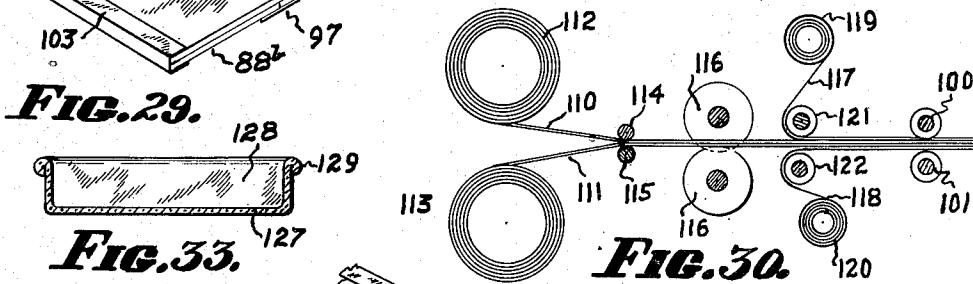


Fig. 29.

Fig. 30.

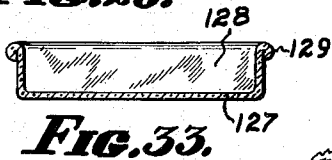


Fig. 31.

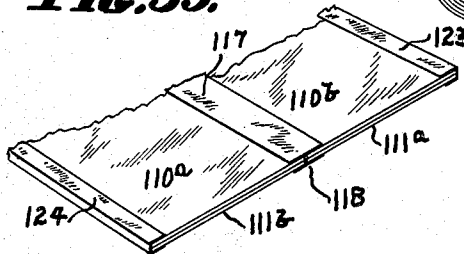


Fig. 32.

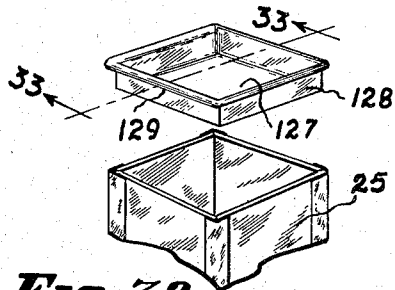


Fig. 33.

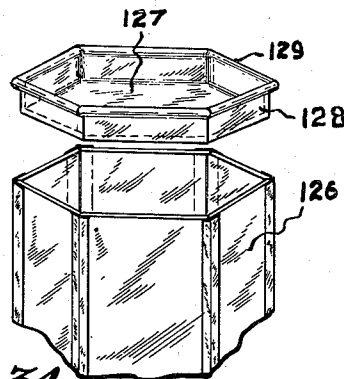


Fig. 34.

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UNITED STATES PATENT OFFICE

2,551,090

KNOCKED DOWN OR FOLDING STRUCTURE
MADE FROM ACETATE SHEETING OR THE
LIKERobert Morris Bergstein, Cincinnati, Ohio, as-
signor to Robert Morris Bergstein and Frank
David Bergstein, trustees

Application September 6, 1946, Serial No. 695,143

3 Claims. (Cl. 229-41)

1

Transparent sheet materials made from cellulose acetate and a wide variety of other thermoplastic substances have long been found desirable for the manufacture of containers for the protection, display and merchandising of various articles of commerce. The sheeting made from such substances is usually transparent, but may be made in a variety of colors and either transparent or opaque. The sheeting is relatively stiff and rigid, but may readily be bent, formed, drawn, or molded upon the application of a suitable degree of heat. The specific composition of the thermoplastic is not a limitation on this invention, and I shall hereinafter refer to all of the kinds of relatively stiff and rigid sheet materials as set forth above by the term "sheeting."

While, by reason of the readily formable characteristics of sheeting and the fact that joints may readily be made between parts by the use of applied adhesives or applied solvents, or sometimes by fusion, highly attractive and useful containers may be made of sheeting, these containers have hitherto been very expensive and by consequence have not attained the degree of general use warranted by the nature of the containers. Not only is it costly in labor and equipment to make such containers, by methods involving heating and forming, but also, only set up or erected containers can be made in this fashion. Consequently, the user of such containers must install expensive equipment for their manufacture, or else the containers must be shipped by the manufacturer to the user in set up form at very high shipping costs per container.

The principles of the construction of knocked down or collapsed paperboard containers have hitherto not been applicable to containers made of sheeting. This is for the reason that, while sheeting may be readily bent or folded when heated, it acquires a permanent set in the folded condition, and if containers are made in this way, they cannot thereafter be collapsed or knocked down. If made in an initially collapsed condition, they cannot thereafter be erected. In a copending application, Serial No. 609,091, filed August 6, 1945, and entitled Cartons and Method of Making Them, now Patent No. 2,529,128, dated November 7, 1950, I have taught the manufacture of cartons in which a plurality of walls are of paperboard, but in which one wall comprises sheeting as a structural element of the carton. These structures may be made in the knocked down form and may be erected by the user; but it is characteristic of them that all fold lines lie in scored paperboard sections. The cartons, while

2

highly useful for many purposes, suffer from this limitation, and do not have the same appearance value as do containers having a plurality of contiguous wall sections formed uninterruptedly of sheeting.

It is a principal object of this invention to provide novel structures and means and methods of making them wherein the ideal of a container having a plurality of contiguous walls of sheeting is realized, the container, nevertheless, being collapsible and erectable. It is an object of this invention to provide ways whereby containers made of sheeting can be manufactured in the knocked down form rapidly and economically by techniques comparable in cost and speed to those hitherto employed for making knocked down paperboard cartons and containers.

It is an object of this invention to provide means and a method for making flexible or hinged joints between contiguous panels of sheeting in structures in the classes referred to, while preserving the essential appearance of structures having contiguous walls made entirely of sheeting.

These and other objects of the invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, I accomplish in those structures, by the use of those mechanisms and in the practice of those procedures of which I shall now set forth certain exemplary embodiments.

Reference is made to the accompanying drawings, wherein:

Figure 1 is a diagrammatic plan view of an apparatus for forming a two-panel hinged or articulated structure of sheeting.

Figure 2 is a side elevation thereof.

Figure 3 is a perspective view of the articulated structure.

Figure 4 is a perspective view showing a paperboard blank prepared for union with the structure.

Figure 5 is a perspective view showing the articulated structure joined to a paperboard blank.

Figure 6 is a perspective view showing the erected tubular body.

Figure 7 is a sectional view taken along the line 7-7 of Figure 6.

Figure 8 is a similar view showing, however, a paperboard blank equipped with end closure members.

Figure 9 is a plan view of a paperboard blank for a container which is triangular in cross section.

Figure 10 is a plan view of the collapsed tubular structure.

Figure 11 is a sectional view thereof taken along the line 11—11 of Figure 10.

Figures 12 and 13 are respectively partial perspective views of the erected container, with the end open, and with the end closed.

Figure 14 is a diagrammatic plan view of an apparatus useful for forming a three-panel articulated structure.

Figure 15 is a perspective view of the three-panel structure itself.

Figure 16 is a perspective view of a paperboard blank with which the structure of Figure 15 may be associated.

Figure 17 is a perspective view of a partially collapsed structure illustrating the assembly of the parts.

Figure 18 is a partial perspective view of the erected structure ready for end closure.

Figure 19 is a diagrammatic plan view of a mechanism operating in another fashion to form a three-panel articulated structure.

Figure 20 is a sectional view of such a structure taken along the line 20—20 of Figure 19.

Figure 21 is a semi-diagrammatic plan view of a mechanism which may be employed to bead edge portions of articulated panel structures.

Figure 22 is a partial perspective view of a three-panel articulated structure with beaded edges.

Figure 23 is a perspective view of a box top member incorporating a three-panel articulated structure of the type of Figure 22.

Figure 24 is a sectional view thereof of a two piece container showing a top member similar to that of 23, and a bottom member of paperboard.

Figure 25 is a plan view of a right angle machine for forming five-panel blanks of sheeting.

Figure 26 illustrates such a blank in perspective.

Figure 27 is a diagrammatic elevational view of a machine for forming closed tubular structures, all of the enclosing body walls of which are of sheeting.

Figure 28 is a diagrammatic plan view of a further section of the same machine.

Figure 29 is a partial perspective view of a four-sided collapsed tubular structure made of sheeting.

Figure 30 is a diagrammatic side elevation of a machine for forming tubular bodies of sheeting, where the panels are articulated, and where the cross section of the erected tubular structure is a regular polygon.

Figure 31 is a partial perspective of a four-panel tubular structure of this type.

Figure 32 is a partial perspective of an erected tubular structure and an end closure member.

Figure 33 is a sectional view of a V end closure taken along the line 33—33 of Figure 32.

Figure 34 is a partial perspective view of a container comprising a hexagonal tubular body formed of sheeting, and an appropriate end closure therefore.

In the practice of my invention, I form articulated panel structures from sheeting in a continuous fashion, by machine, and at relatively high speeds. Since it is not possible to score sheeting and achieve a flexible hinged joint along lines of articulation as is done with boxboard, I have found that the desired result may be obtained by forming panels separately and then articulating them together by means of a thin film of suitable substance, cemented to the pan-

els, of substantially lesser thickness than the panels themselves, and of sufficient flexibility to form the desired line of articulation on which the structure may be rapidly folded or bent. Preferably, the strip of material by means of which I articulate adjacent panels of sheeting to each other is one of the thin amorphous and flexible films such as are employed for forming flexible wrappings. Films of cellulosic derivatives such as, for example, "cellophane" are excellent for the purpose. The films may, if desired, be of the same substance as the sheeting itself, only thin enough to possess the required bendability in conjunction with the relatively stiffer panels. Thus, I may use strips of thin cellulose acetate film with relatively thick acetate sheeting. The films or strips are preferably transparent in character. They may be adhered to edge portions of the panel in various ways, as for example, by the use of solvents capable of softening both the film and the sheeting, or by the use of cements (solvent-type, thermoplastic or both) and capable of adhering both to the film and to the sheeting. I prefer to use solvents or cements which themselves form transparent unions. A convenient mode of attaching the strips of film to the panels of sheeting is by the use of film strips precoated with pressure sensitive adhesive. Thus, a material similar to that known in the trade as "Scotch tape" on a transparent cellulose base is suitable for my purpose and has the advantage that satisfactory adhesion can be brought about by pressure alone, while the application of solvents or adhesives on machine together with the control of viscosity by temperature are not required.

When these conditions are met, a joint between adjacent panels along which the structure may be bent or folded is readily produced; and the joint is not visually obtrusive. A joint formed in this fashion by means of a transparent film between transparent panels of sheeting gives the general effect of a corner or angle formed by bending the sheeting itself, and the film even though lying on the outside of a structure is not particularly noticeable at a little distance. In structures where the sheeting is highly colored or opaque, its color shows through the transparent film employed for hinging panels together and the joint is even less apparent.

In the practice of my invention, panel structures are formed without the necessity of assembling and articulating separate panels. I accomplish this by withdrawing the sheeting from a roll or other effective continuous supply and slitting it into sections in the machine of a width desired for the width of the novel panels. Immediately after the slitting operation, the film is applied over the lines of cut. Thereafter, I sever the sheeting into articulated panel structures of the desired length by cutting the composite in transverse directions.

Referring to Figures 1 and 2, I have shown a supply of sheeting 1 being withdrawn from a roll 2. As the sheeting is pulled through a machine by means of pinch rolls 3 and 4, and while its position is being maintained by side guides 5 and 6, I slit it by means of a rotary knife 8 operating against an anvil roll 9. A narrow strip of film 10, such for example as the Scotch tape mentioned above, is withdrawn from a roll 12 and is brought and pressed into contact with the sheeting 1 over the line of cut thereon, by means of a pressure roll 13, or a pressure roll combination,

Thereafter, during the further travel of the sheeting, I cut it apart into structures of a desired panel length by fly knife combination 14, 15. The result is the structure shown in Figure 3 and consisting of two panels of sheeting, 1a and 1b articulated together by means of the film 10.

In Figure 4, I have shown a paperboard blank comprising main walls 16 and 17 articulated together along a score line 18. Glue tabs 19 and 21 are formed at the sides of the structure, articulated to the walls 16 and 17 along score lines 22 and 23. A suitable adhesive may be applied to the glue flaps as indicated in shading; the structure of Figure 3 may be deposited on the blank of Figure 4 and the glue flaps bent over to contact with and become adhered to the side edges of the sheeting panels. The resultant tubed structure is shown in Figure 5.

The tubing operation as well as tubing operations hereinafter described for assembling panel structures of boxboard or paperboard and panel structures of sheeting, may be accomplished on the usual paperboard carton folding and gluing equipment to which is added means for associating the paperboard and sheeting structures. However, when tubular boxes without end enclosures, as illustrated in Figures 5, 6, and 7, are desired, it is possible continuously to score a supply of boxboard, associate it with the slitted and articulated sheeting web 1, bend over and adhesively secure the side edges of the paperboard and then simultaneously cut the paperboard and sheeting to length by means of the fly knife 14, 15.

The tubular structure thus far described is illustrated in erected form in perspective and in section in Figures 6 and 7. It will be observed that one has two contiguous walls of sheeting and two contiguous walls of paperboard, but that the contents of such a structure will be effectively displayed through the contiguous walls 1a and 1b if of transparent sheeting.

A tubular body such as that shown in Figure 6 will normally be employed with end closures. These may be separate elements; but the paperboard blank of Figure 4 may have end closures integrally formed therewith. For example as in Figure 8, I may provide wall 16 with closure flaps 24 at its ends, while wall 17 carries closure flaps 25, the latter being provided with tuck flaps 26 and 27. The tuck flaps may merely be inserted within the tubular body, but they also may be adhered to the sheeting panels 1a and 1b through an application of suitable cement.

Figures 9 to 13, inclusive, show the formation of a container which is triangular in cross section, and in which only the base portion and the end closures are of paperboard. A paperboard blank is provided comprising a bottom panel 28 having lateral glue flaps 29 and 30. Triangular end closures 31 and 32 are articulated to the ends of the bottom panel. These end closures are provided with tuck flaps 34, 35, 36, and 37. The bottom panel and the triangular end closures are transversely by a medial fold line or score 38. The paperboard blank is bent on this medial score line; and a two-panel sheeting structure, such as illustrated in Figure 3, is bent along its line of articulation. The two are associated together in a tubing operation as will be clear from Figures 10 and 11. The result is a knocked down structure which may be shipped to the user in flat form. The user will erect, pack and close the structure as will be clear from Figures 12 and 13.

The principles outlined above for the formation of articulated panel structures of sheeting, are applicable to the formation of structures containing as many articulated panels as may be desired. In Figure 14, I have shown a machine in which like parts have been given like index numerals, but in which there is a second slitting knife 39, a second roll of film substance 40, and a second pressure roll 41. The result of the operation of these machine elements is the division of the web 1 of sheeting into three articulated panels 1a, 1b and 1c, the articulation between the last two of these panels being formed by the film strip 42.

A paperboard blank comprising a bottom panel 43, glue flaps 44 and 45, end closures 46 and 47, and tuck flaps 48, all in articulation, as shown in the Figure 16, may be prepared for use with the three-panel structure of Figure 16. If this structure be first bent along the line of articulation formed by the film strip 10, it may then be associated with the paperboard blank of Figure 16 as a knocked down structure. The glue flap 45 is adhered to the free edge of panel 1a, while the glue flap 44 is bent over and adhered to the free edge of panel 1c, as diagrammatically illustrated in Figure 17. The erected structure is shown in Figure 18.

A variant method of making three-panel articulated structures is shown in Figure 19. The web of sheeting 1 is slit and articulated as in Figure 1; but a strip of the sheeting from a roll 49 is led upwardly to overlie the portion 1b. Using additional side guides 50, 51 and 52 to maintain the positions of the elements, I may lead in my film strip 42 from the side and, bringing it against the edges of sheeting portions 1b and 1c by means of a roll 53, I may form it about the edges of panel portions 1b and 1c by a forming device 54, thereafter pressing the structure by a pressure roll 55 which will operate against a lower pressure roll (not shown). In Figure 19, the dotted line 56 is indicative of the position of a fly knife or the like. The resultant articulated structure is illustrated in section in Figure 20 and differs from the structure in Figure 15 only in that the panel 1c is folded back against the panel 1b, and the structure is in condition for joining to a blank such as that shown in Figure 16 in the way described above.

The principles of my invention are not confined to the manufacture of one piece knocked down boxes, but may be applied to the manufacture of two piece boxes and similar structures employing a plurality of contiguous panels of sheeting articulated together. In two piece boxes where, for example, a lid portion is made of or comprises the panels of sheeting, free edges of the panels may form free edges of the structure, and in this event it may be desired that the edges be rolled or beaded. Edge rolling or beading may readily be carried on continuously as a part of the continuous operations which I have described above. In Figure 21, a three-panel structure designated by like index numerals has been produced as described in connection with Figure 14. In a continuation of the machine, but ahead of the fly knife, I subject the side edges of the structure to edge heating means 57 and 58 followed by suitable turning means curved forming devices 59 and 60 or other suitable means operating to turn over these edges. Pressing roll combinations 61 and 62 follow the formers to complete the fold. The resultant articulated panel structure after having been severed by the fly knife, is shown

in Figure 22, the rolled edges being indicated at 63 and 64. Such a structure is well adapted for the formation of a box top as shown in Figure 23. Here I may make use of end pieces comprising end panels 65 and attachment flaps 66, 67, and 68. The parts of the lid may be shipped separately and in knocked down or collapsed condition. The end pieces may be of boxboard or other substance. The box user will assemble the lid structure by adhering the attachment flanges 66, 67, and 68, respectively, to the panels 1a, 1b, and 1c. This may be accomplished without mechanism, even, if desired, without any mandrel or positioning means.

Figure 24 illustrates a box structure employing the lid of Figure 23 and a bottom element 69 of flanged type and with side and end walls of substantially less depth than the side and end walls of the lid or box top. Such bottom members are known in the carton art in various forms and may be set up by the user from blanks or may be made in the form of knocked down but erectable structures.

By a carrying forward of the principles of my invention, it is readily possible to produce five-panel box structures similar to that illustrated in Figure 23, but with all panels formed of sheeting. In Figure 25 I have illustrated a right angle machine for this purpose. As in Figure 14, the sheeting 1 is withdrawn from a roll 2, slit by members 3 and 39 and taped as hereinabove described. Edge heading may be practiced or not, as desired. The treated structure is cut apart into desired panel lengths by the fly knife mechanism 14, and the severed elements are delivered to a conveyor 79 moving at right angles to the first portion of the machine. As the elements move along on the conveyor 70, they are gripped between that conveyor and an upper frictional member 71 in their central portions, while their lateral edge portions are gripped by upper and lower friction belts or their equivalents 72 and 73. Slitters 74 and 75 now cut the element in a direction transverse that of the first slits. Film strips 76 and 77 are withdrawn from rolls 78 and 79 and, by a timed tape applicator 80, are applied to the element to cover only those portions of the last mentioned slits lying between the first mentioned slits. The resultant articulated structure is shown in flat form in Figure 26 where it will be noted that at the end of panel 1b there are articulated end panel elements 81 and 82. Flap members 83, 84, 85, and 86 are articulated respectively to the ends of the end panels, but are free of any connection with side panels 1a and 1c. This structure may be shipped in the flat form illustrated and when received by the user will require only a simple erecting operation in which panels 1a, 81, 1c, and 82 are bent at right angles to the top panel 1b with the flaps 83 to 86 lying inside the side walls 1a and 1c and adhered thereto by an application of solvent or suitable cement. This provides an all-sheeting structure which may, if desired, be used together with a box bottom, such as 69. It will be evident, however, that a box bottom may be made from a structure similar to that shown in Figure 26, and similarly produced, but of slightly different dimensions, providing a two-piece, all-sheeting, telescopic box.

Again, in the practice of my invention, it is possible to produce various types of tubed structures in knocked down form, comprising articulated, enclosing body walls all of which are made of sheeting. In Figure 27, I have shown two pieces of sheeting 87 and 88 being withdrawn

simultaneously from rolls 89 and 90. These strips of sheeting are independently slit by slitting means indicated at 91 and 92. The slit strips pass respectively above and below an anvil member 93. Film material 94 from a roll 95 is applied over the slit formed by slitter 91 and is pressed against the sheeting strip 87 by a pressure roll 96 operating against the anvil. The slit, similarly a film material 97, forming roll 98 is applied upwardly against the slitted strip 88 by a pressure roll 99 operating against the anvil. The two slitted and articulated strips are then brought together beyond the anvil by pinch rolls 100 and 101. In a continuation of this machine as shown in Figure 28, the side edges of the composite are bound with film strips 102, 103, from rolls 104 and 105 by means of formers 106 and 107, and a pinch roll combination 108. Thereafter, the composite may be severed into panel length as by means of fly knife apparatus diagrammatically indicated at 109. One resultant structure is illustrated in Figure 29 as being a flattened tube comprising panels 87a, 87b, 88a, and 88b. The structure may be erected into a rectangular tubular body. The relative sizes of the several panels may be controlled by adjustment of the slitting means 91 and 92.

A somewhat similar form of apparatus may be employed in the manufacture of tubular, all-sheeting boxes of regular polygonal cross section. As in Figure 30, I may withdraw strips of sheeting 110 and 111 from rolls 112 and 113, bringing them together by pinch rolls 114, 115 and passing them through one or more slitting means 116 operating simultaneously to cut through both strips. Film material 117 and 118, withdrawn from rolls 119 and 120 may then be applied simultaneously along the slits from both sides by pressure rolls 121 and 122. A continuation of the machine will appear as in Figure 28, in which film material is applied to the side edges of the superposed treated strips. One structure so produced is shown in Figure 31 where the panels 110a and 110b, 111a and 111b are articulated together by film strips 117, 123, 118 and 124. This collapsed structure is erectable into the square tube shown in Figure 32 at 25 by using a plurality of slitting devices 116; tubes having a different number of enclosing body walls may be formed.

An hexagonal tube is shown at 126 in Figure 34.

Any desired type of end closure may be employed with tubular structures as just described. Such closures may be boxboard members, but they also may be relatively shallow, stamped or molded plastic members formed of the same sheeting as the enclosing body walls or from some other plastic. Such closures are shown in Figures 32, 33 and 34 as comprising end closure walls 127 of suitable shape and the desired plurality of upstanding side walls 128 responding to the number of enclosing body walls of the tubular structure. They may or may not have beaded or molded edges 129. Such closures may be used in frictional engagement with the erected tubular box, or they may be fastened in place by an application of solvent or cement. Because the end closure members are shallow in form, they take up little room in shipment and storage, while the tubular boxes are collapsible as has been set forth.

Thus, I am enabled to furnish cheaply all-sheeting boxes in a wide variety of attractive and ornamental shapes which can be shipped to

9

the user in collapsed condition and which require no machinery for erecting and closure.

Modifications may be made in my invention without departing from the spirit of it. Having thus described my invention in certain exemplary embodiments, what I claim as new and desire to secure by Letters Patent is:

1. A knock-down container having at least one element of paperboard, and another element constituted of a plurality of panels of transparent, plastic, non-scorable sheeting, all in articulation, the line of articulation between the paperboard element and a sheeting panel being formed by a score line in said paperboard demarking a flange secured to said sheeting panel, and the line of articulation between contiguous sheeting panels being formed by a strip of thin bendable substance adhered to marginal portions of said sheeting panels, and being substantially narrower than said panels.

2. The container claimed in claim 1, having a tubular body with articulated enclosing body walls, at least one of said body walls being formed from said paperboard element and at least two contiguous body walls being said panels of sheeting.

10

3. The structure claimed in claim 2, having end closure means for said tubular body formed from the said paperboard element thereof.

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