Nov. 5, 1940. W. A. RINGLER 2,220,122

COLLAPSIBLE BOX

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Fig. 1

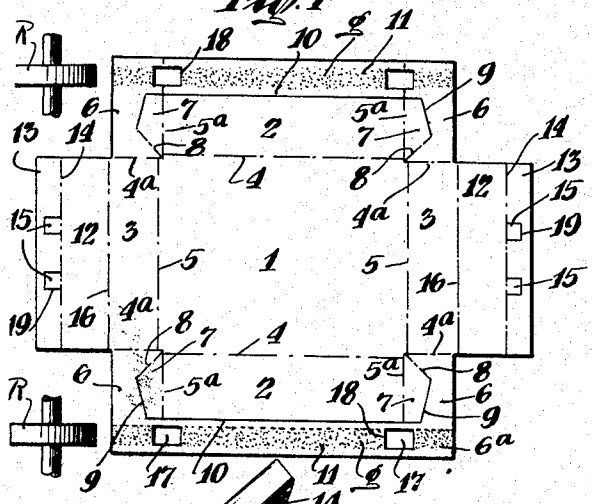


Fig. 4

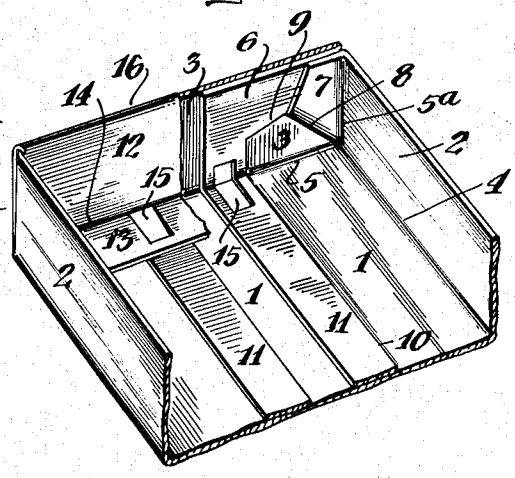


Fig. 3

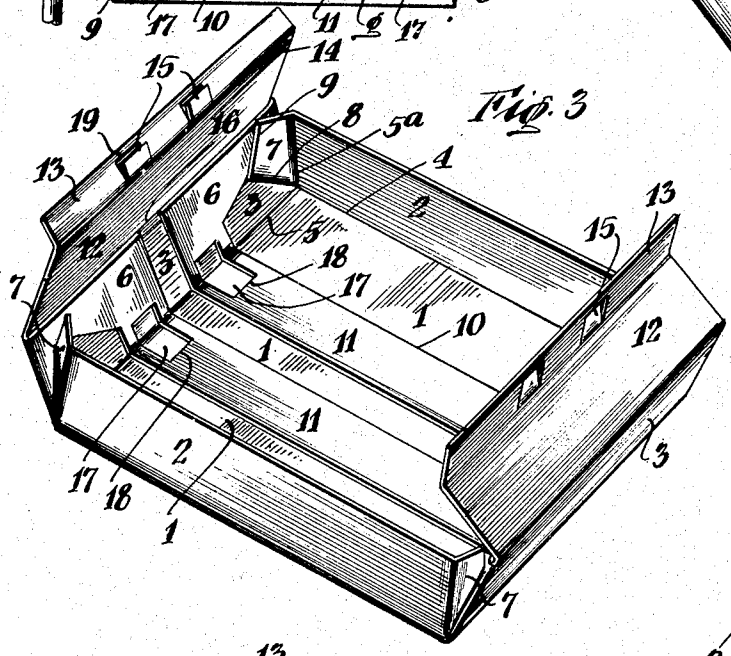


Fig. 5

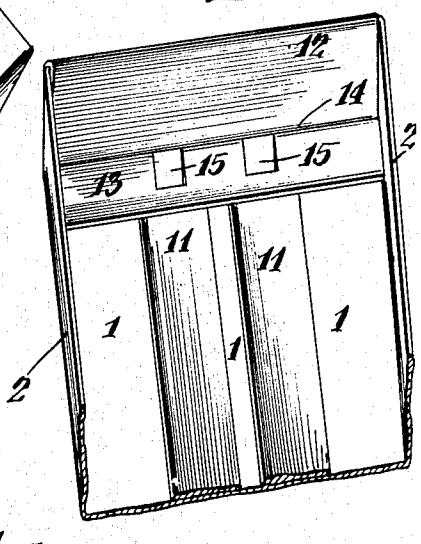
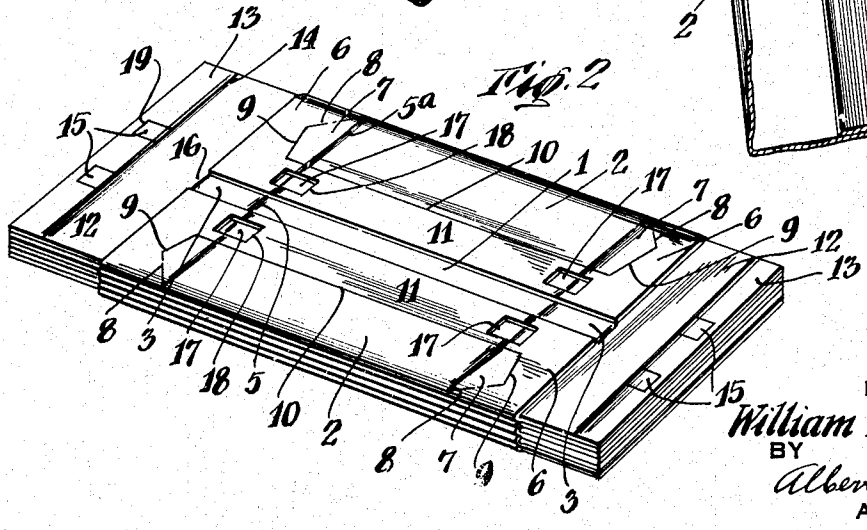


Fig. 2



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Fig. 6

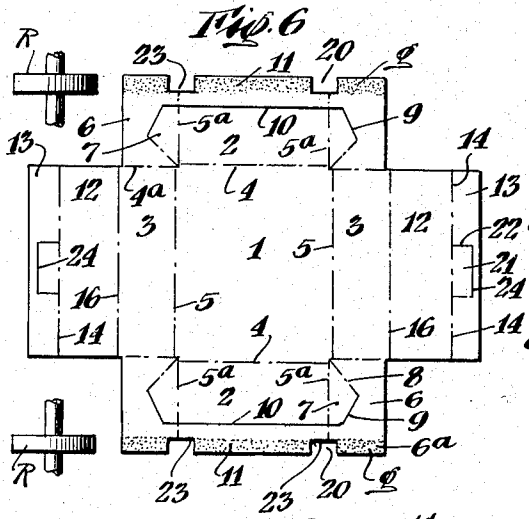


Fig. 8

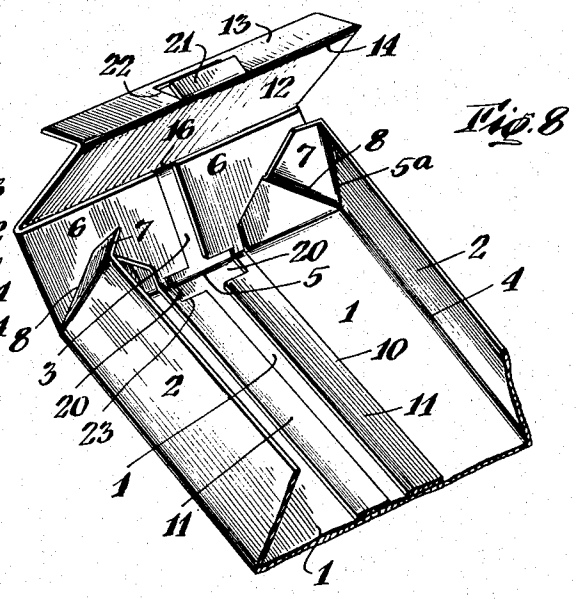


Fig. 9

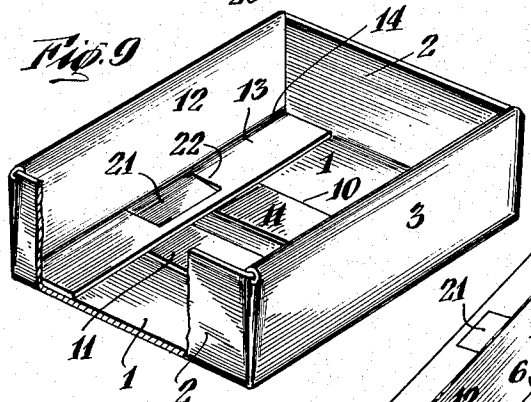


Fig. 7

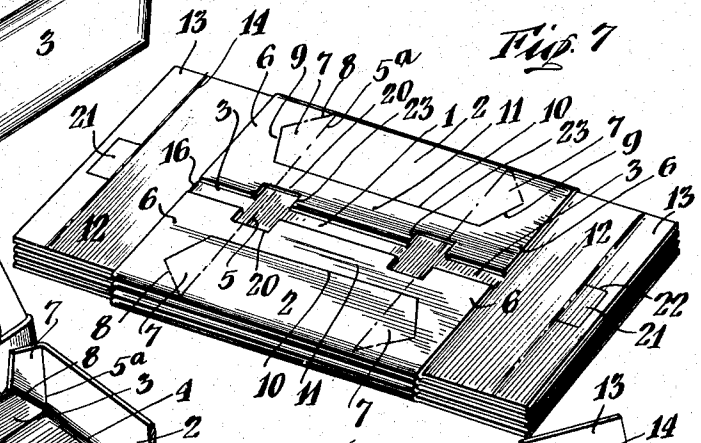


Fig. 10

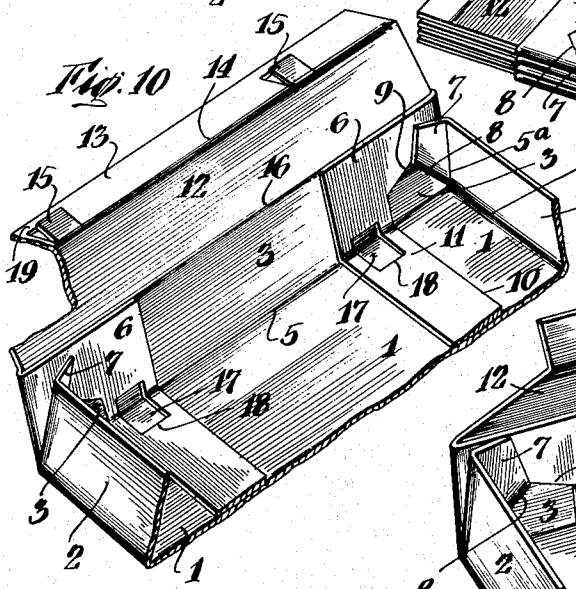
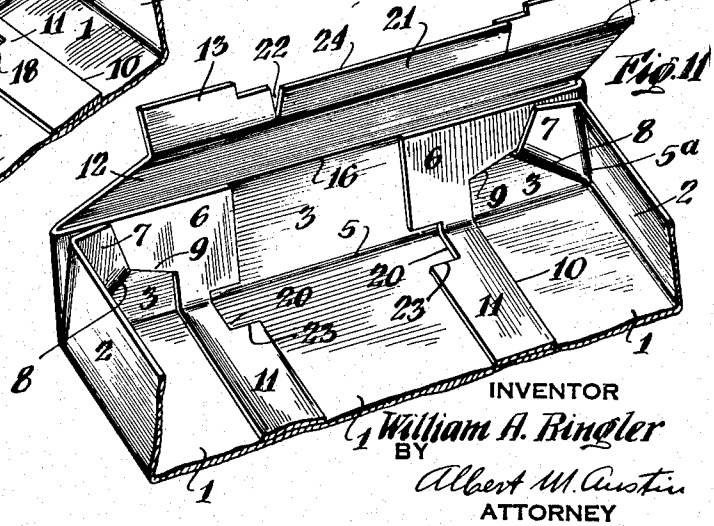


Fig. 11



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Fig. 12

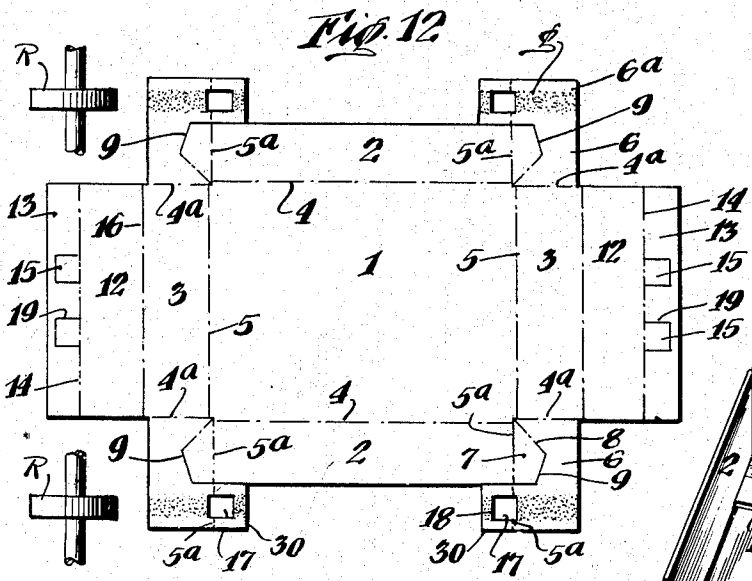


Fig. 15

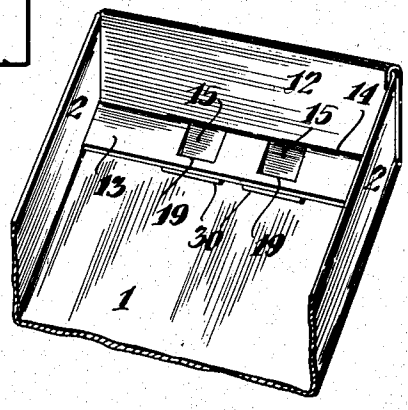


Fig. 13

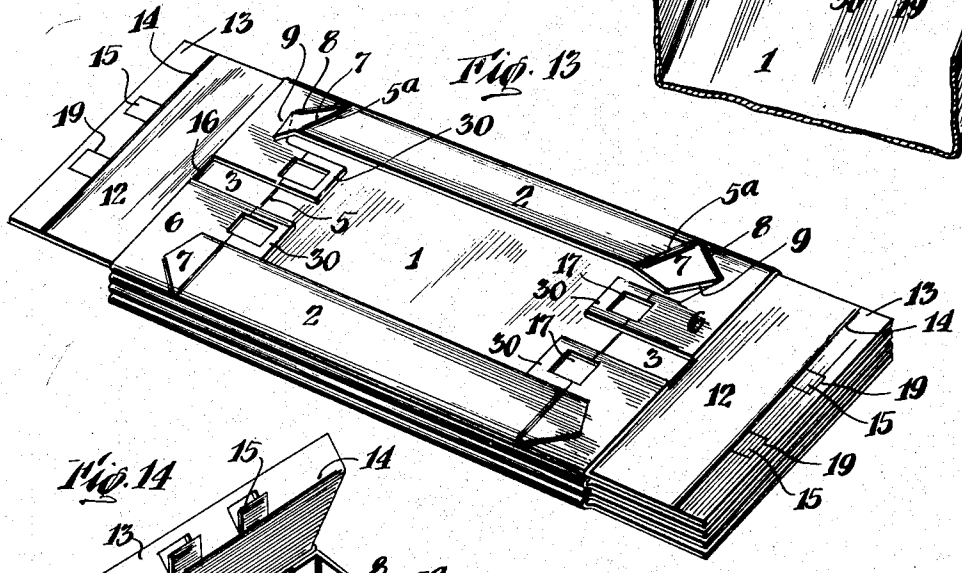
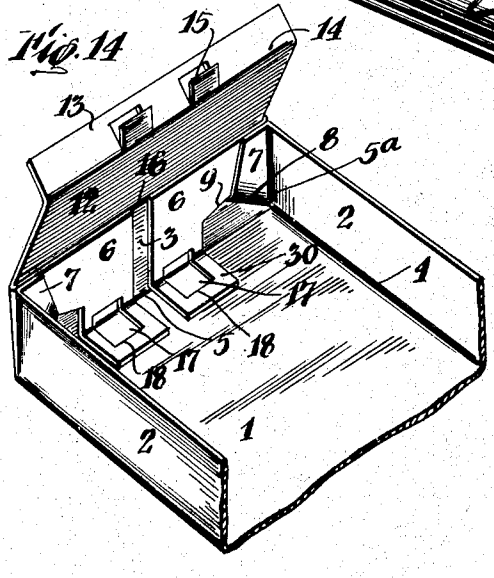


Fig. 14



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COLLAPSIBLE BOX

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Fig. 16

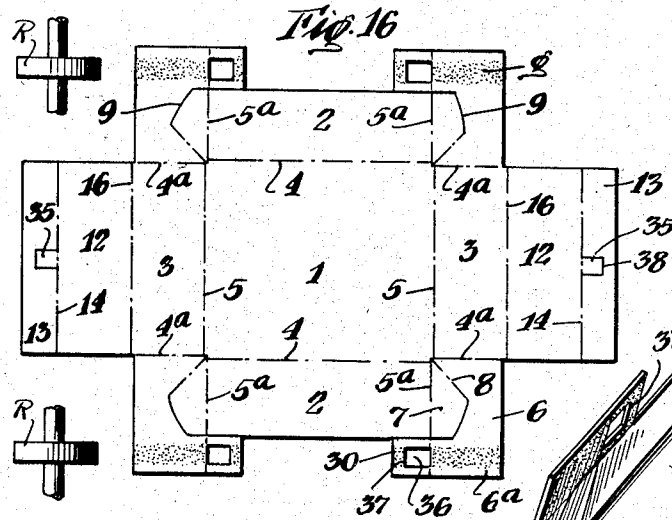


Fig. 17

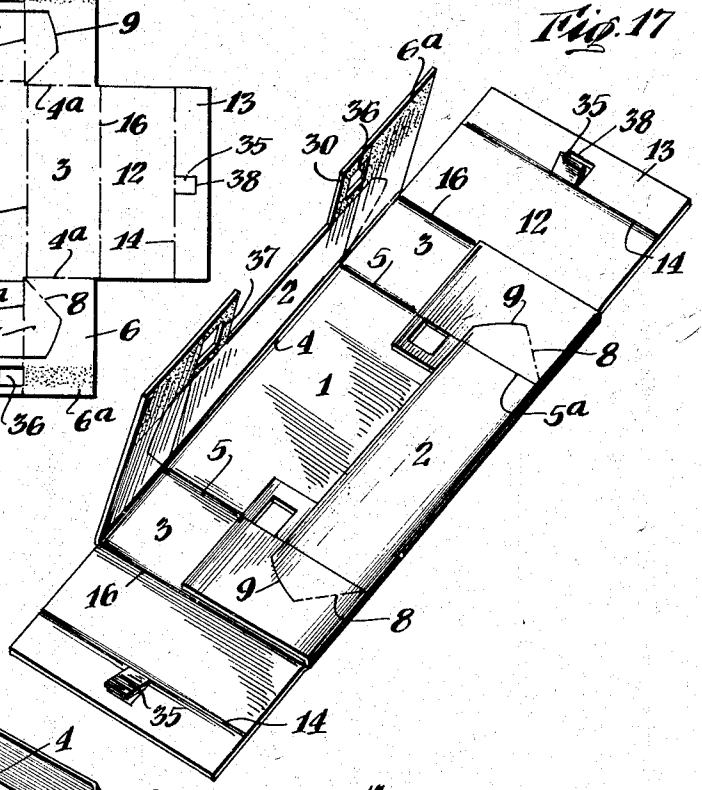


Fig. 18

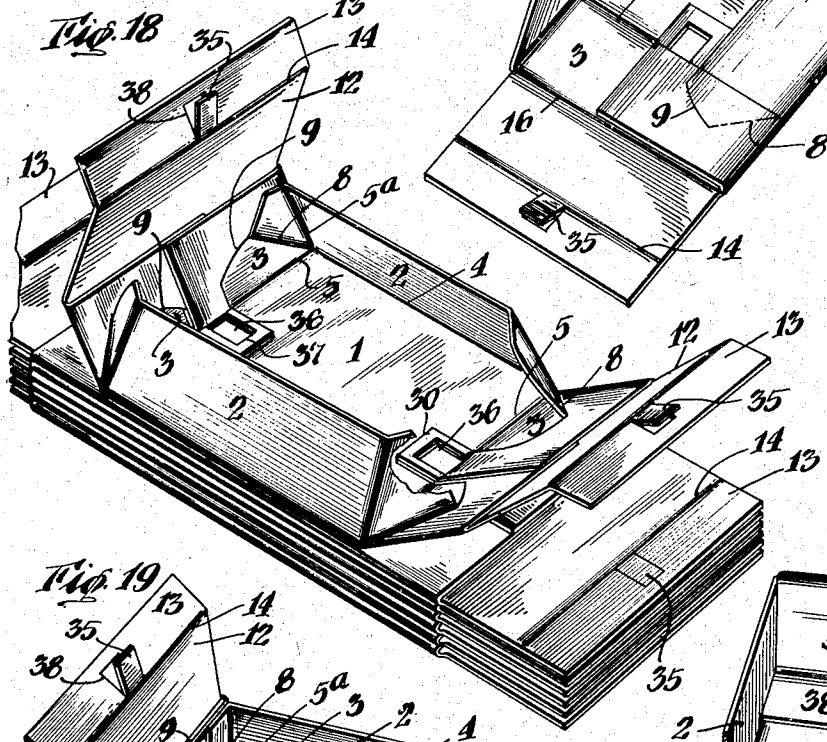


Fig. 19

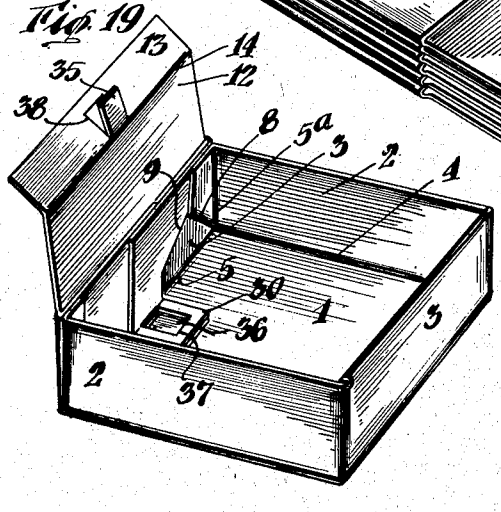
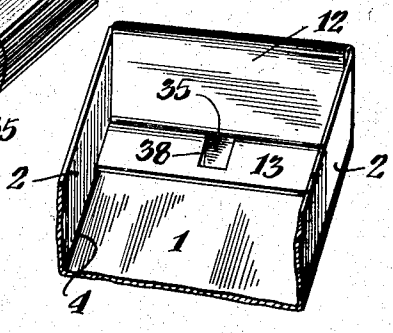


Fig. 20



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UNITED STATES PATENT OFFICE

2,220,122

COLLAPSIBLE BOX

William A. Ringler, Wayne, Pa., assignor to National Folding Box Company, New Haven, Conn., a corporation of New Jersey

Application November 8, 1937, Serial No. 173,274

12 Claims. (Cl. 229—34)

This invention relates to collapsible boxes and more particularly to a collapsible box formed from a single blank of paperboard material which can be manufactured at a high production rate and which is adapted to be shipped and stored in collapsed condition and thereafter may be manipulated into set-up position by the user as needed. This application is a continuation in part of my copending application Serial No. 110,587 filed November 13, 1936.

Collapsible boxes heretofore provided have been time-consuming and expensive to manufacture and assemble due to the fact that adhesive must be applied to limited areas of a prepared blank, which areas of adhesive can only be applied while the blank is held stationary in proper position under the adhesive-applying mechanism or otherwise moved in synchronism with the adhesive-applying mechanism. Time-consuming operations, requiring special and expensive equipment to manufacture the boxes, have thus been required.

Collapsible boxes as heretofore manufactured also have been weak in construction, often becoming badly deformed in use. This is due to the lack of proper bracing and reinforcement of the corners of the box and the bottom wall section of the box, resulting in outward bowing or flexing of the side and end walls and outward bowing and flexing of the bottom wall of the box when merchandise is packed therein. Collapsible boxes as heretofore manufactured also have a tendency to weave or twist when the box is handled with merchandise therein, due largely to the fact that the bottom wall of the box is formed of single-ply paperboard without adequate reinforcement.

An object of this invention is to provide a strong and sturdy box of the collapsible type which can be manufactured and assembled entirely by automatic machinery at a high production rate, and at a cost comparable to the cost of manufacture of the simplest assembled box.

Another object of this invention is to provide a collapsible box formed from a single blank of paperboard material, which can be shipped and stored in collapsed knockdown position, and thereafter quickly manipulated into strudy set-up position by the user as needed.

Another object of this invention is to provide a collapsible box formed from a single blank of paperboard material, the blank being adapted to be cut from large sheets or rolls of paperboard material substantially without waste, the cutting and scoring operation being performed entirely automatically by a cutting and scoring machine substantially without waste of material, and which thereafter can be glued and assembled in collapsed form by successive simple mechanical operations substantially with unlimited speed.

Another object of this invention is to provide an improved collapsible box which can be manufactured at high production speed and provided with adequate bottom-reinforcing means which rigidly resists twisting, weaving and deforming forces applied thereto.

Still another object of this invention is to provide a collapsible box provided with improved locking means for retaining the box in erect position, which are so constructed as to permit automatic locking thereof when the end wall flaps associated with the end wall sections of the box are inturned.

Other objects of this invention will become apparent as the disclosure proceeds.

Various other features and advantages of the invention will be apparent from the following particular description and from an inspection of the accompanying drawings.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which:

Fig. 1 is a face view of a prepared blank from which my improved collapsible box may be made;

Fig. 2 is a perspective view of a stack of assembled collapsed boxes ready for shipment or storage;

Fig. 3 is a perspective view of the collapsed box in the process of being erected into container form;

Fig. 4 is a fragmentary perspective view of the erected box, certain parts being broken away to illustrate certain features of the construction;

Fig. 5 is a fragmentary perspective view of the erected box ready to receive merchandise;

Fig. 6 is a face view of a prepared blank from which a collapsible box having modified locking means may be made;

Fig. 7 is a perspective view of a vertical stack of assembled collapsible boxes each formed from a blank as shown in Fig. 6;

Fig. 8 is a fragmentary perspective view of the collapsed box in the process of being erected into container forming position;

Fig. 9 is a perspective view of the erected box,

certain parts being broken away to more clearly illustrate the construction;

Fig. 10 is a fragmentary perspective view of a box formed from a blank of the type illustrated in Fig. 1 as it would appear when constructed to provide relatively shallow enclosing walls;

Fig. 11 is a fragmentary perspective view of a box formed from a blank of the type shown in Fig. 6, as it would appear when provided with relatively shallow enclosing walls;

Fig. 12 is a face view of a prepared blank from which a further modified form of collapsible box may be made;

Fig. 13 is a perspective view of a series of stacked collapsed boxes each formed from the blank shown in Fig. 12;

Fig. 14 is a fragmentary perspective view of the box formed from the blank shown in Fig. 12 in the process of erection from a collapsed position into container-forming position;

Fig. 15 is a fragmentary perspective view of the box formed from the blank shown in Fig. 12 as it appears when fully erected and ready to receive merchandise;

Fig. 16 is a face view of a blank from which a collapsible box of substantial depth with reference to its width and length can be made;

Fig. 17 is a perspective view of a box in the process of being assembled into collapsed form from the blank shown in Fig. 16;

Fig. 18 is a perspective view of a stack of collapsed boxes each formed from the blank shown in Fig. 16, the box on the top of the stack being shown in the process of erection into container-forming position;

Fig. 19 is a perspective view of the collapsed box as it appears at a further stage of erection; and

Fig. 20 is a fragmentary perspective view of a fully erected box formed from the blank shown in Fig. 16.

Similar reference characters refer to similar parts throughout the several views of the drawings and specification.

Referring more particularly to Figs. 1 to 5, inclusive, my improved collapsible box is formed from a prepared blank of paperboard material, as shown in Fig. 1, which when assembled at the box factory is collapsed and ready for shipment to the user in the form shown in Fig. 2. The collapsed box may be thereafter erected in container-forming position by the user and when so erected appears as shown in Fig. 5. Each of the blanks may be cut and scored on an automatic cutting and scoring machine from large sheets or rolls of paperboard material, the sheets or rolls having previously been lithographed or decorated, if desired. The blank pattern on the large sheets or rolls is so arranged as to permit the cutting and scoring of the separate blanks substantially without waste of paperboard material. The cutting and scoring of the separate blanks may be performed at a high production rate and in a single operation.

Each blank comprises a bottom wall section 1 having side wall sections 2 hinged to the bottom wall section along parallel extending score lines 4. End wall sections 3 extend from opposite ends of the bottom wall section 1 and are hinged thereto along the score lines 5. The adjacent ends of the side wall sections 2 and the end wall sections 3 are integrally connected by corner portions. Each corner portion comprises bellows-fold sections 6 and 7 defined by a diagonally extending score line 8 extending from the meeting point of the score lines 4 and 5 and extending diagonally outwardly into the corner portion, terminating at a point spaced from the free edge of the corner portions, as illustrated more particularly in Fig. 1. Each bellows-fold section 6 is hinged to the adjacent end of the end wall section 3 by a score line 4a which is slightly offset inwardly of the blank from the adjacent score line 4 to permit folding and erection of the blank into box form, as will be appreciated by those skilled in the art. The bellows-fold sections 7 are each hinged to the adjacent end of the side wall sections 2 along the score line 5a which is also slightly offset inwardly from the score line 5 to permit folding and erection of the box, as is evident to those skilled in the art.

A bottom reinforcing section 11 is integrally connected to the bellows-fold sections 6 along each side of the blank and is hinged to the adjacent bellows-fold sections 6 by the score line 4a. The bottom reinforcing portion 11 is separated from the top edge of the adjacent side wall section 2 by a cut 10 which extends beyond the score lines 5a. Each end of the cut 10 is connected to the adjacent diagonally extending score line 8 by a cut 9, so that the bellows-fold section 7 is connected to the adjacent bellows-fold section 6 by diagonally extending score line 8 only.

A flap section 12 is hinged to each of the end wall sections 3 along the score line 16 and is adapted to be turned inwardly so as to overlie the inside face of the adjacent end wall section 3 when the box is erected. A foot section 13 is also hinged to each inturned flap 12 along the score line 14, and when the box is erected is adapted to overlie the inside face of bottom wall section 1 of the box. A pair of locking tabs 15 hinged along the score lines 14 to the inturned flaps 12 are cut out from each foot section 13 and adapted to cooperate with suitable locking apertures 17 provided in each of the bottom reinforcing sections 11.

When the blank has been cut and scored as above described and illustrated in Fig. 1, adhesive in continuous strip form is applied to the bottom reinforcing sections 11, and to the outer end portions of the adjacent bellows fold sections 6, each strip of adhesive being applied by a suitable adhesive-applying means, such as an adhesive-applying roller R. This adhesive may be applied at a high production rate by running each separate blank on a suitable belt or conveyor over or under the spaced adhesive-applying means R, so as to contact the inside face of the blank and apply the strips of adhesive *g* in a continuous strip across the bottom reinforcing sections 11 and the free end portions of the bellows fold sections 6, as clearly illustrated in Fig. 1. When adhesive *g* in strip form has been applied, the blank continues to move into contact with infolding devices or plows which operate to fold each of the side wall sections 2, the bellows-fold sections 6, and the bottom reinforcing sections 11 inwardly over the inside face of the bottom wall section 1 and the adjacent end wall sections 3, so as to produce an assembled collapsed box, as illustrated in Fig. 2. If desired, one or more pressure rollers may be provided which roll over the collapsed box so as to cause the bottom reinforcing portions 11 to strongly adhere to the inside face of the bottom wall section 1 and also to cause the outer end portions of the bellows fold section 6 to which adhesive *g* has been applied to adhere to the inside face of the end wall section 3. As thus assembled, it will be noted

that the side wall section 2 and the bellows-fold section 7 hinged thereto carry no adhesive and consequently are free to be manipulated thereafter into erect position to provide the erected box, as shown in Figs. 3, 4 and 5.

The adhesive applied in strip form and the infolding of the side wall sections 2, bellows-fold sections 6 and the bottom reinforcing sections 11, may be performed on well known strip gluing and folding machines at a production rate of 20,000 to 30,000 per hour, and requires no hand manipulation whatsoever. In collapsible boxes heretofore produced adhesive has been applied in spots or limited areas requiring complicated machinery or hand application, which in the most up-to-date devices permits the gluing and assembly of the blank at a rate of speed which is a small fraction only of the speed with which my improved box can be assembled.

This high speed of production can be accomplished when the box is made and assembled as herein described, because of the fact that the adhesive is applied to the blank in straight line strip form, which requires no hand or mechanical manipulation of the adhesive-applying devices to place them over the areas to be glued. The adhesive-applying devices such as the rollers R are adjusted in proper spaced relationship to properly apply the adhesive *g* in continuous strip form to the bottom reinforcing portions 11 and the outer end portions of the bellows fold sections 6 and the blank is guided under the adhesive-applying devices in such a manner as to apply the adhesive in strip form without requiring movement or manipulation of the adhesive-applying mechanism. The speed of production which can be obtained in the manufacture of collapsible boxes of the type herein described is almost unlimited. The infolding operations requires only simple mechanism and, since it can be performed by continuous operation upon successive rapidly advancing blanks, can be performed at an unusually high rate of production speed. The collapsed boxes are ejected from the machine in the form shown in Fig. 2 and can be vertically stacked one upon the other occupying a minimum of space during shipment and storage.

When the box is to be packed with merchandise, the merchandise manufacturer or user can quickly erect the box from its collapsed position into container form expeditiously and conveniently without special tools. In erecting the box the operator or user raises the end wall sections 3 into position substantially at right-angles to the bottom wall section 1, which operation causes the side wall sections 2 to be automatically raised at right-angles to the bottom wall section 1, and each bellows-fold section 7 to fold inwardly and lie against the adjacent bellows-fold section 6. The bottom reinforcing sections 11 remain adhered to the inside face of the bottom wall section 1. The operator then folds the flaps 12 inwardly so as to overlie the inside face of the adjacent end wall sections 3, the adjacent bellows-fold sections 6 and the adjacent bellows-fold sections 7, the foot portion 13 being positioned to overlie the bottom wall section 1 of the box. The tabs 15, hinged along the score line 14 are pressed into the corresponding openings 17 provided in the bottom reinforcing portions 11, so that the free edge 19 of the tab 15 will rest in abutment against the free edge 18 of the adjacent aperture 17. It will be noted that the tabs have a tendency to resiliently press down against the bottom wall 1 of the box, which tendency retains the free edge 19 thereof in locking abutment against the free edge 18 of the corresponding aperture 17. The box as thus assembled is ready to receive merchandise.

It will be noted that the bottom-reinforcing portions 11 serve to greatly strengthen the bottom construction of the box. Heretofore, collapsible boxes have been generally made with a bottom wall of single ply paperboard which is weak and has a tendency to twist or weave due to the fact that the bottom wall section is not properly braced. In my improved construction the bottom-reinforcing strips or sections 11 greatly increase the strength and rigidity of the bottom wall section, resisting any tendency of the box to twist, weave, or otherwise become deformed. The bottom reinforcing strips 11 comprise paperboard material which would otherwise be thrown away as waste, which portion normally thrown away is made use of in this invention to perform an important function. The locking tab-receiving apertures 17 may be cut into the bottom-reinforcing strips 11 without weakening the box construction. My improved cooperating locking apertures are provided without requiring any additional material and are so arranged and constructed that the tabs 15 will resiliently snap into the corresponding apertures 17 when the inturned flap 12 is pressed downwardly and interiorly against the adjacent inside face of the side wall section 3. A strong and sturdy box construction which can be manufactured at a high production rate, at low cost, which is economical to ship and store and can quickly be erected into box form when needed, is thus provided.

There is shown in Figs. 6 to 9, inclusive, a collapsible box generally similar in construction to that shown in Figs. 1 to 5, inclusive. The blank as shown in Fig. 6 is similar in general construction to the blank shown in Fig. 1, except for a slightly modified form of locking means. In the construction shown in Fig. 6, a pair of notches 20 is cut into each bottom wall reinforcing section 11 so that when the side wall sections 2, the bellows fold sections 6 and 7, and the bottom-reinforcing sections 11 are folded inwardly so as to overlie the bottom wall section 1 and the adjacent end wall section 3 of the box, a pair of cutouts or notches 20 will provide a recess adjacent the end wall section 3 to receive a locking tab 21 cut out from the foot portion 13, as shown more particularly in Figs. 8 and 9. The locking tab 21 is hinged to the adjacent end wall flap 12 along the score line 14 and is otherwise freed of the foot portion 13 by the surrounding cut 22.

The adhesive *g* is applied in strip form to the bottom reinforcing portions 11 and the outer ends of the bellows fold sections 6, as by means of rollers R or other convenient adhesive-applying devices, and the blank folded in the same manner as that heretofore described in connection with the formation of the box from the blank shown in Fig. 1. The assembled blanks are ejected from the machine in collapsed box form, as illustrated in Fig. 7, and may be vertically stacked for convenient storage and shipment.

When the manufacturer or user desires to pack his goods the box is erected by lifting the end wall sections 3 into a position substantially at right-angles to the bottom wall section 1, which operation causes the side wall sections 2 to be raised substantially at right-angles to the bottom wall section 1. The end wall flaps 12 are

then turned inwardly so as to overlie the adjacent end wall sections 3 and the bellows-fold sections 6 and 7, and when so positioned the foot sections 13 will overlie the bottom wall 1 of the box and each locking tab 21 will automatically snap into the recess formed by the adjacent notch cutouts 20. The locking tab 21 has a tendency to swing downwardly against the inside face of the bottom wall section 1 of the box so as to retain the free edge 24 thereof in locking abutment against the free edge 23 of the notched recesses 20, providing an assembled construction as illustrated in Fig. 9. In this construction it will be noted that the bottom wall of the box is also reinforced and strengthened by the bottom reinforcing strips 11, providing a box of great strength and rigidity.

It will be appreciated that my invention as herein disclosed is adapted to be applied to the manufacture of boxes of substantial depth as well as boxes of relatively shallow depth. In making a box of relatively shallow depth from a blank of the type shown in Fig. 1, it will be appreciated that all that is necessary is to space the locking tabs 15 cut out from the foot portions 13 the desired distance apart so that they will spring into the cooperating recesses 17 provided in the bottom reinforcing strips 11. In such a construction, as shown more particularly in Fig. 10, the bottom reinforcing strips 11 will merely be correspondingly spaced apart a greater distance than where a box of greater depth is provided. No material change in the principles of construction heretofore explained, is required.

A collapsible box formed from a blank of the type shown in Fig. 6 can also be made as shallow as desired. As shown more particularly in Fig. 11, such a shallow box would have the bottom reinforcing strips 11 spaced apart a greater distance and the locking tabs 21 would be of sufficient length to fit within the spaced notches 20 cut in the bottom reinforcing strips 11. The locking tab 21 may be of any convenient width, and if desired may be substantially the same width as the foot portion 13 with which it is associated, being cut therefrom by the cut lines 22. In this construction, also, the free edge 24 of each locking tab 21 will be held in abutment against the edges 23 of the adjacent notches 20 by the resilient tendency of the tab 21 to swing downwardly against the inside face of the bottom wall section 1.

It will be appreciated that the bottom reinforcing strips 11 are especially desirable where boxes having a bottom wall section 1 of substantial size are to be constructed. Relatively shallow boxes and particularly boxes having a bottom wall section 1 of substantial size are more inclined to warp or twist than a box having a bottom wall section 1 of relatively limited area. The bottom reinforcing strips 11 resist twisting or warping forces applied to the box and, in addition thereto, greatly strengthen the box so that goods of substantial weight may be packed therein without deforming or injuring the box.

In the event that the bottom reinforcing strips 11 be objectionable for any reason, I have provided an improved collapsible box which may be made on a strip gluing machine at a high production rate, with the bottom reinforcing strips eliminated. Such a box is shown in Fig. 15, which may be formed from a prepared blank of the type shown in Fig. 12. The blank shown in Fig. 12 is generally constructed similar to the blank shown in Fig. 1 comprising a bottom wall section 1, side wall sections 2 hinged thereto along the score lines 4, and end wall sections 3 hinged to the bottom wall section 1 along the score lines 5. Corner portions connect the adjacent ends of the side and end wall sections, each corner portion comprising a bellows-fold section 6 hinged to the adjacent end of the end wall section 3 along the score line 4a and bellows-fold section 7 hinged to the adjacent end of the side wall section 2 along the score line 5a. The bottom reinforcing strip 11 is eliminated and in place thereof integrally extending feet 30 hinged to the adjacent bellows-fold section 6 along the score lines 5a are provided. Each of the feet 30 is provided with a tab-receiving aperture 17, as clearly shown in Fig. 12.

In manufacturing this box, suitable adhesive-applying devices, such as adhesive rollers R, are provided to apply a strip of glue along the outer end of the bellows fold sections 6 and the feet 30, which may be performed on a strip gluer by continuous operation. The side wall sections 2, the bellows-fold sections 6 and the feet 30 are turned inwardly so as to overlie the bottom wall section 1 and the adjacent end wall section 3, which folding operation may be performed by turning-in plows or other devices. A roller associated with the continuous strip gluer and folding machine rolls over the collapsed box and presses the adhesive *g* applied to the outer portion of the bellows fold sections 6 to the inside face of the adjacent end wall section 3, and the adhesive *g* applied to the feet 30 into adhesive engagement with the inside face of the bottom wall section 1.

In erecting the box the end wall sections 3 are raised into a position substantially at right angles with the bottom wall section 1, which automatically causes the side wall sections 2 to be raised in like position. The operator then folds the flaps 12 inwardly so as to overlie the inside face of the bellows-fold sections 6 and 7, in which position the locking tabs 15 spring into locking engagement with the recess 17 provided in the feet 30. The free edges 19 of the locking tabs 15 abut against the free edges 18 of the apertures 17 so as to firmly retain the end flap sections 12 in seating position relative to the inside face of the adjacent end wall section 3. It will be noted by referring more particularly to Fig. 15, that the feet 30 are substantially concealed beneath the foot section 13 hinged to the end wall flap 12, so that the bottom wall section 1 presents a smooth inside surface except for the overlying foot sections 13.

It will be appreciated, however, that the feet 30 and the foot sections 13 may be entirely eliminated by providing other suitable means for retaining the end flaps 12 in box-assembled position, thus to provide a bottom section 1 which has a smooth bottom surface throughout. Such end flap locking means may provide abutments or projections extending from the ends of the end flaps 12, which frictionally grip or engage side wall sections 2. Where a foot section 13 is used the feet 30 may be concealed thereunder, so as to present a bottom section having a substantially smooth interior surface.

A collapsible box having substantial depth with relation to its width or length may be constructed from a blank as shown in Fig. 16. The blank shown in Fig. 16 is generally constructed similarly to the blank shown in Fig. 12 and heretofore described, comprising the side wall sections 2 hinged to the bottom wall section 1 along the score lines 4 and end wall sections 3 hinged to

the bottom wall section 1 along the score lines 5. Corner portions connect the adjacent ends of the side and end wall sections, each corner portion comprising a bellows-fold section 6 hinged to the adjacent ends of the end wall sections 3 along the score lines 4a, and bellows-fold sections 7 hinged to the adjacent ends of side wall sections 2 along the score lines 5a. Bottom reinforcing strips 11 may or may not be eliminated, as desired. If the bottom reinforcing strip is eliminated, feet 30 may be provided which are hinged to the adjacent bellows-fold sections 6 along the score lines 5a. Each of the feet 30 is provided with a tab-receiving aperture 36, as clearly shown in Fig. 16.

In manufacturing this box, adhesive-applying devices, such as the adhesive rollers R, are provided to apply a strip of glue or adhesive along the outer ends of bellows-fold sections 6 and the feet 30, which may be performed on a strip gluer by continuous operation. The side wall sections 2, the bellows-fold sections 6 and the feet 30 are turned inwardly so as to overlie the bottom wall section 1 and the adjacent end wall sections 3, which folding operation may be performed by turn-in plows or other devices. Where the total depth of the side wall sections 2 and the end wall sections 3 is substantially one-half the width of the bottom wall section 1, the bellows-fold sections 6 and the feet 30 may be made to overlap, as shown more particularly in Figs. 17, 18 and 19. The amount of the overlap is not material and with a construction as here shown, the box having side and end wall sections of a depth substantially approaching half the total width of the box may be made. It will be appreciated that, if desired, the feet 30 may be eliminated and other means used to secure the inturned end wall flaps 12 in position against the overlapping inside faces of the adjacent bellows-fold sections 6.

In the construction shown in Figs. 16 to 20, inclusive, the outer end portions of the bellows-fold sections along one side of the blank are first folded inwardly and the adhesive coating applied to bellows-fold sections 6 secured thereon to the adjacent end wall sections 3. The opposite side wall section 2 is then folded inwardly, as illustrated in Fig. 17, so that the outer end portions of the respective bellows-fold sections 6 overlie and are adhesively secured to the adjacent outer end portions of the bellows-fold sections 6 previously infolded. This folding operation can be performed on an automatic strip gluer and folding machine by means of plows or other turn-in devices arranged in staggered relationship. It will also be appreciated that the glue strip may be applied only to the outer end portions of the bellows-fold sections 6 along one side of the blank only, which bellows-fold sections are superimposed over and adhesively secured to the inturned outer end portions of the bellows-fold sections along the opposite side of the blank. As thus constructed, the bellows-fold sections 6 are not directly secured to the inside face of the adjacent end wall sections 3.

The glued and assembled collapsed box may be erected for use by the user in the same manner as described in connection with the assembly of the boxes heretofore described. As shown more particularly in Figs. 18 and 19, such erection operation comprises the raising of the end wall sections 3 in a position substantially at right-angles to bottom wall section 1, which raises the side wall sections 2 and the bellows-fold sections 7 associated therewith in raised position. The end wall flaps 12 are then folded inwardly so as to lie against the inside face of bellows-fold sections 6. If a foot section 13 is provided it is positioned to overlie the bottom wall 1 of the box and the locking tab 35 associated therewith will automatically spring into the superimposed apertures 36 in the feet 30 in such a manner that the free edge 38 of the locking tab 35 will lock and abut against the free edge 37 of the adjacent apertures 36. It will be also appreciated that feet 30 may be provided along one side edge of the blank only, the feet 30 along the other side edge of the blank being cut off along the score lines 5a. In such a construction only one paperboard layer 30 underlies the adjacent foot section 13, which permits the foot section 13 to lie more closely against the inside face of the bottom wall section 1. It will be also appreciated that, if desired, a bottom reinforcing strip may connect the bellows-fold sections 6 along one side edge of the blank, being hinged thereto along the score lines 5a in the manner illustrated in the blanks shown in Figs. 1 and 6. These blanks are ejected from the strip gluer and folding machine in collapsed form and may be vertically stacked as illustrated in Fig. 18, occupying a minimum of space during shipment and storage.

In constructing the blanks as illustrated in Figs. 1, 6, 12 and 16, the score lines 4a which define the end wall sections 3 from the bellows-fold sections 6 are inset and slightly out of line with respect to the score lines 4, so that proper erection of the box can be achieved. In the same manner the score lines 5a which define the side wall sections 2 from the bellows-fold sections 7 and the bottom reinforcing strips 11 (as shown in Figs. 1 and 6), or the feet 30 (shown in Figs. 16 and 17) from the adjacent bellows-fold sections 6, are also slightly inset and slightly out of line with respect to the score lines 5 so as to permit easy erection of the box without undue stretching of the paperboard. The score lines 5a which define the bellows-fold sections 7 and the bottom reinforcing strip 11 (as shown in Figs. 1 and 6) or the feet 30 (as shown in Figs. 12 and 16) comprise, however, substantially a continuous straight score line.

It will be understood that while the vertical wall sections 2 have been designated "side wall sections" and the vertical wall sections 3 have been designated "end wall sections", these descriptive words are merely used to facilitate exemplification of the construction. All comprise vertical box walls, and it will be understood that their relative length is unimportant and that the designations "side wall sections" and "end wall sections" are not to be interpreted in a limited sense to define a particular vertical box wall only.

It is now seen that I have provided an improved collapsible box formed from a blank which can be cut and scored on an automatic cutting and scoring machine from large sheets or rolls of paperboard material, the sheets or rolls having previously been lithographed or decorated, if desired. Such cutting and scoring operations can be performed at a high production rate. The prepared blanks are then fed in rapid succession into a strip gluing and infolding machine upon a moving belt or conveyor where the side edges of the blank come into contact with strip glue-applying devices, such as rollers, brushes, or other means. It is important to note that a strip of glue applied along one side edge of the blank or a strip of glue applied along both side edges of the blank, is in the form of a

straight line strip, whether bottom reinforcing strips 11, shown in Figs. 1 and 6, are used or are not used. The outer end portions 6a of the bellows-fold sections 6 come into contact with the strip glue-applying mechanism to receive an adhesive coating which permits these parts to be secured either to the inside face of the adjacent end wall sections 3, as shown in Figs. 2, 7 and 13, or to be secured to each other in superposed relationship, as shown in Fig. 18. This infolding operation may be performed on the same machine which applies the glue strips, by means of infolding mechanism or plows which infold the side wall sections 2 and the bellows-fold sections 6 and associated bottom reinforcing strips 11 or feet 30 substantially simultaneously, as shown in Figs. 2, 7 and 13, or alternately as shown in Fig. 17. The glued blanks move into contact with the plows or infolding mechanism in rapid succession and there is substantially no limit to the speed with which this operation can be performed. The final operation performed with this machine comprises the application of pressure by means of a roller to the top face of the collapsed box so as to firmly press the bottom reinforcing strips 11 or the feet 30 into adhesive contact with the inside face of the bottom wall section 1 and the outer end portions 6a of the bellows-fold sections 6 into adhesive contact with the inside face of the adjacent end wall sections 3, or in the case of the construction shown in Fig. 18, to press the outer end portion of the bellows-fold sections 6 which have received adhesive to the underlying outer end portion 6a of bellows-fold sections 6 infolded from the other side edge of the box. The collapsed boxes are ejected from the machine in rapid succession and may be arranged to fall in a vertical stack, where they can be quickly picked up and packed into suitable boxes or cartons for shipment to the user.

My improved collapsible box constructed as above described can be manufactured at a rate comparable to the speed of manufacture of the simplest type of box and substantially at no greater cost. Heretofore, collapsed boxes have been considerably more expensive to manufacture than the usual form of simple box, due to the fact that the adhesive must be applied to limited defined areas only. One form of spot gluing machine in common use requires that the blanks be moved under spot gluing devices and the blanks held stationary until the spots of glue can be applied. Another form of spot gluing machine now in use is provided with spot glue-applying contact points arranged around a wheel or roller and the blank then must be moved under the glue points in exact synchronism with the rotation of the wheel, which operation, as is evident, must be done with extreme care and at low speeds so that the glue spots will be exactly applied to the proper areas only. Such mechanism also requires many moving parts which is cumbersome in construction and operation. The box-forming blanks as herein described can be cut from large sheets or rolls of paperboard substantially without waste of material, and when assembled provides a box construction of great strength and rigidity. The bottom reinforcing strips 11 are formed from parts usually thrown away as waste and provide a means for reinforcing the bottom wall section of the box which is generally the weakest part of collapsible box constructions as heretofore made.

The inturned end wall flaps 12 are of such length as to fractionally abut the adjacent inside faces of the side wall sections 2, so as to provide a smooth and strong corner construction. As thus constructed, the inturned end wall flaps 12 function as a brace to give strength and rigidity to the side wall sections 2. The bellows-fold sections 6 are either adhesively secured to one another as shown in Fig. 18 or adhesively secured to the inside face of the adjacent end wall sections 3 to provide rigid tension means which prevent any outward bowing or outward collapse of the side wall sections 2. An unusually strong and rigid construction is thus provided which can be manufactured at low cost, and which can be made in any desired size or depth to best accommodate the merchandise to be packed therein.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. A collapsible box formed from a single blank of paperboard material including, a bottom wall, a side wall and opposed end walls hinged to said bottom wall, a corner portion hinged to and connecting the adjacent ends of said side wall and end walls, a score line extending diagonally into said corner portion dividing the corner portion into bellows-fold sections, and a bottom reinforcing strip free of the top edge of said side wall and connecting the opposed bellows-fold sections which are respectively hinged to the adjacent end walls.

2. A collapsible box formed from a single blank of paperboard material including, a bottom wall, opposed side walls and opposed end walls hinged to said bottom wall, a corner portion hinged to and connecting the adjacent ends of each of said side and end walls, a score line extending diagonally into each of said corner portions dividing said portions into bellows-fold sections, and a bottom reinforcing strip along each side of the box and connecting the adjacent bellows-fold sections which are hinged to the end walls, each bottom reinforcing strip being free of the top edge of the adjacent side wall.

3. A collapsible box formed from a single blank of paperboard material including, a bottom wall, opposed side walls and an end wall hinged to said bottom wall, a corner portion hinged to and connecting the adjacent ends of each of said side and end walls, a score line extending diagonally into each of said corner portions dividing said portions into bellows-fold sections, the bellows-fold sections which are hinged to said end wall each having an end portion extending beyond the top edge of the adjacent side wall section adhesively secured to the inside face of the adjacent end wall when the box is assembled, and an extension connection to one of said end wall portions which is adhesively secured to the inside face of the bottom wall of the box.

4. A collapsible box formed from a single blank of paperboard material including, a bottom wall, a side wall and opposed end walls hinged to said bottom wall, a corner portion hinged to and connecting the adjacent ends of each of said side and end walls, a score line extending diagonally into each of said corner portions dividing said portions into bellows-fold sections, the bellows-fold sections which are hinged to said end walls each having an end portion extending beyond the top edge of the adjacent side wall section and

adhesively secured to the inside face of the adjacent end wall when the box is assembled, and a bottom reinforcing strip connecting said end portions and adhesively secured to the bottom wall of the box.

5. A collapsible box formed from a single blank of paperboard material including, a bottom wall, a side wall and opposed end walls hinged to and connecting the adjacent ends of each of said side and end walls, a score line extending diagonally into each of said corner portions dividing said portions into bellows-fold sections, the bellows-fold sections which are hinged to said end walls each having an end portion extending beyond the top edge of the adjacent side wall section, a bottom reinforcing strip connecting said end portions and adhesively securing the bottom wall of the box, and an end flap hinged to each of said end walls folded inwardly to overlie the bellows-fold sections hinged to the adjacent end wall.

6. A collapsible box formed from a single blank of paperboard material including, a bottom wall, a side wall and end wall hinged to said bottom wall, a corner portion hinged to and connecting the adjacent ends of said side and end walls, a score line extending diagonally into said corner portion dividing said portion into bellows-fold sections, the bellows-fold section which is hinged to said end wall having an end portion extending beyond the top edge of the adjacent side wall section and a foot extending from said end portion adhesively secured to the inside face of the bottom wall of the box.

7. A collapsible box formed from a single blank of paperboard material including, a bottom wall, a side wall and an end wall hinged to said bottom wall, a corner portion hinged to and connecting the adjacent ends of said side and end walls, a score line extending diagonally across said corner portion dividing said portion into bellows-fold sections, the bellows-fold section which is hinged to said end wall having an end portion extending beyond the top edge of the adjacent side wall and overlying the inside face of the adjacent end wall when said box is assembled, a bottom portion extending inwardly from said end portion overlying the bottom wall of the box, an inwardly turned end wall flap, and means associated with said end wall flap operative to engage an element associated with said bottom portion to maintain the box in assembled erect position.

8. A paperboard blank adapted to form a collapsible box including, a bottom wall section, a side wall section and an end wall section hinged to said bottom wall section, a corner portion connecting the adjacent ends of said side and end wall sections, a score line extending diagonally into said corner portion to form a bellows-fold and dividing said corner portion into hinged bellows-fold sections one of which is hingedly connected to the side wall section and the other bellows-fold section being hingedly connected to the end wall section, an end portion extending from the bellows-fold section which is hinged to the end wall section, said end portion extending laterally beyond and outside of the outer side edge of said side wall section, a bottom portion extending from said end portion laterally beyond and outside of the outer side edge of said side wall section, and adhesive applied to said bottom portion and the part of said end portion which extends beyond the outer edge of said side wall section.

9. A paperboard blank adapted to form a collapsible box including, a bottom wall section, a side wall section, and end wall sections hinged to said bottom wall section, a corner portion hinged to and connecting the adjacent ends of each of said side and end wall sections, a score line extending diagonally into each of said corner portions to form bellows-folds and dividing each corner portion into hinged bellows-fold sections one of which is hingedly connected to the adjacent side wall section and the other bellows-fold section is hingedly connected to the adjacent end wall section, an end portion extending from each bellows-fold section which is hinged to an end wall section, said end portions extending laterally beyond and outside of the outer side edge of the adjacent side wall section, and a bottom reinforcing strip connecting said end portions free of and extending laterally beyond and outside of the outer side edge of said side wall section, and adhesive applied to said bottom reinforcing portion and to the part of said end portions which extend beyond the outer edge of said side wall section.

10. A paperboard blank adapted to form a collapsible box including, a bottom wall section, opposed side wall sections and opposed end wall sections hinged to said bottom wall sections, a corner portion hinged to and connecting the adjacent ends of each of said side and end wall sections, a score line extending diagonally into each of said corner portions to form bellows-fold sections and dividing each corner portion into hinged bellows-fold sections, one of which is hingedly connected to the adjacent side wall section and the other bellows-fold section is hingedly connected to the adjacent end wall section, and an end portion extending from each bellows-fold section hinged to an end wall section, said end portions extending laterally beyond and outside of the outer side edge of the adjacent side wall section, a bottom reinforcing strip extending along each side edge of the blank connecting the adjacent end portions, and adhesive applied to said bottom reinforcing portions and to the part of said end portions which extend beyond the outer edge of the adjacent side wall section.

11. A collapsible box formed from a single blank of paperboard material including, a bottom wall, a side wall and opposed end walls hinged to said bottom wall, a corner section hinged to the end of each of said end walls which are adjacent said side wall, and a bottom-reenforcing strip free of the top edge of said side wall and connecting the opposed corner sections which are respectively hinged to the adjacent end walls.

12. A collapsible box formed from a single blank of paperboard material including, a bottom wall, opposed side walls and opposed end walls hinged to said bottom wall, a corner section hinged to the ends of each of said end walls, and a bottom-reenforcing strip along each side of the box connecting the adjacent corner sections which are hinged to the end walls, said bottom-reenforcing strips being free of the top edge of said side walls.

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