Dec. 19, 1933. C. P. WELLMAN 1,939,744

RECEPTACLE

Filed Jan. 17, 1930 4 Sheets-Sheet 1

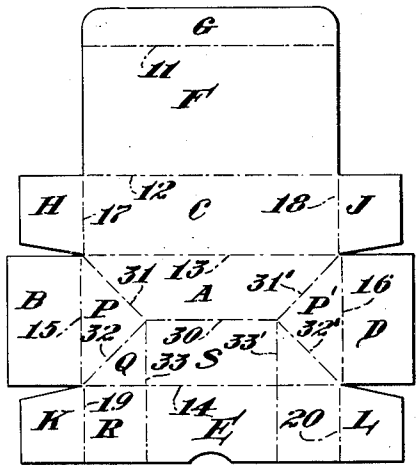


Fig. 1

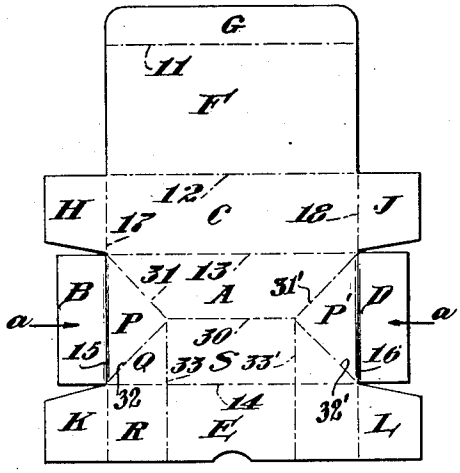


Fig. 2

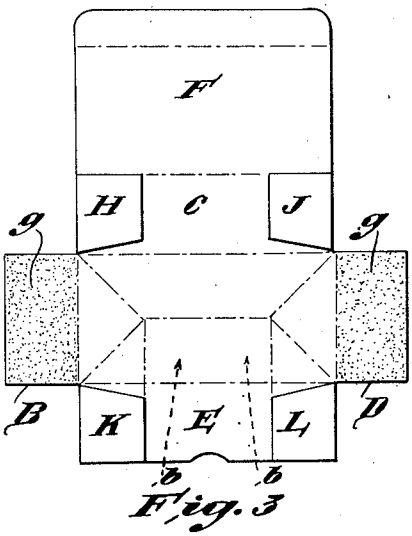


Fig. 3

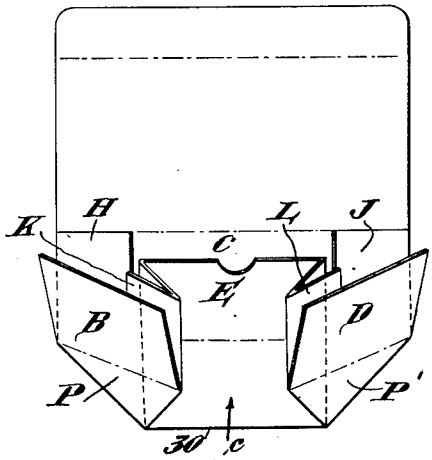


Fig. 4

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RECEPTACLE

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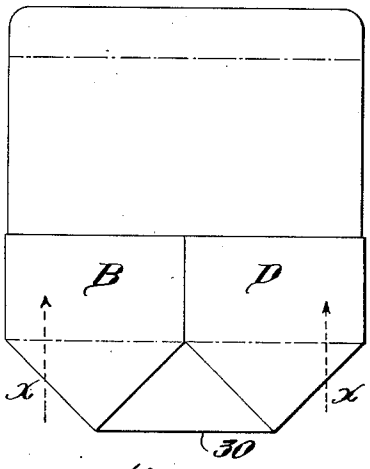


Fig. 5

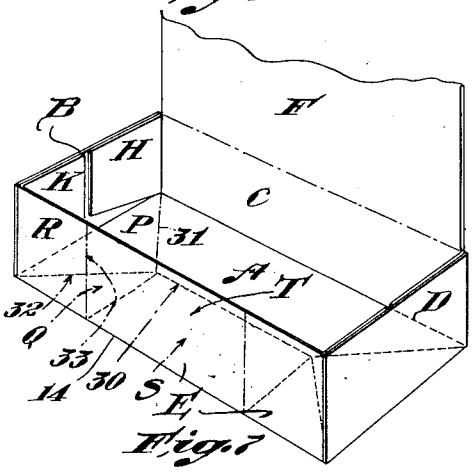


Fig. 7

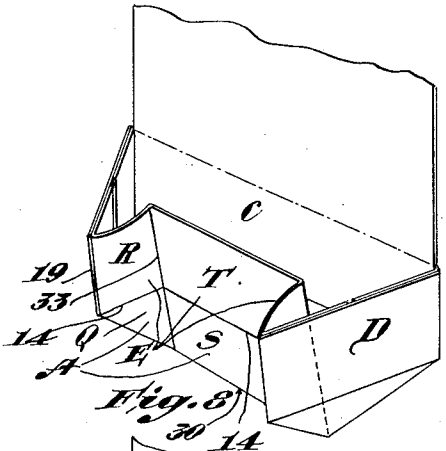


Fig. 8

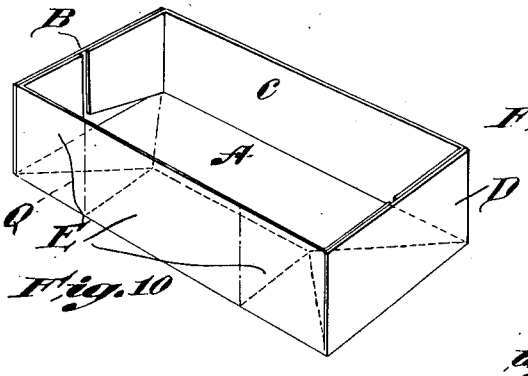


Fig. 10

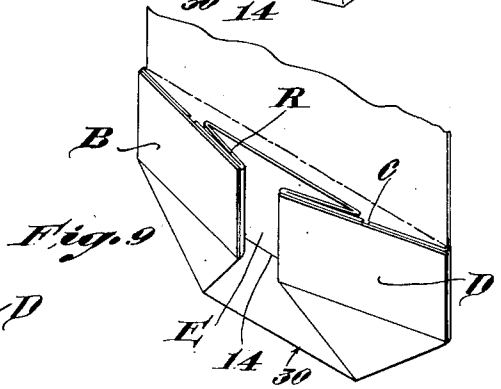


Fig. 9

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RECEPTACLE

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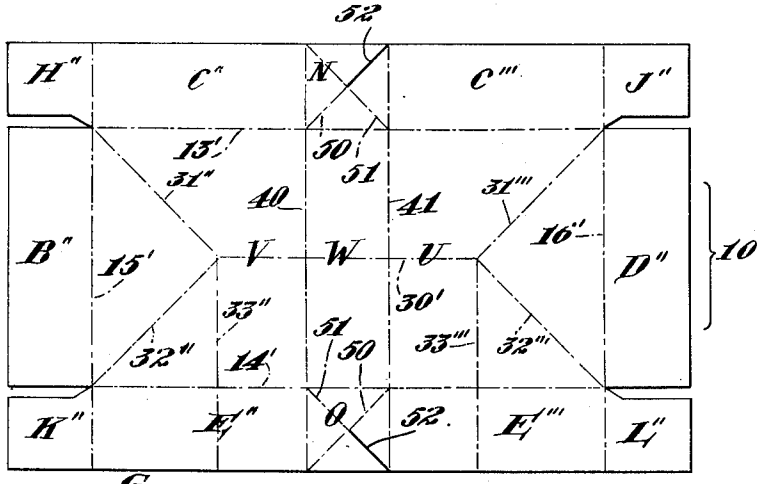


Fig. 11

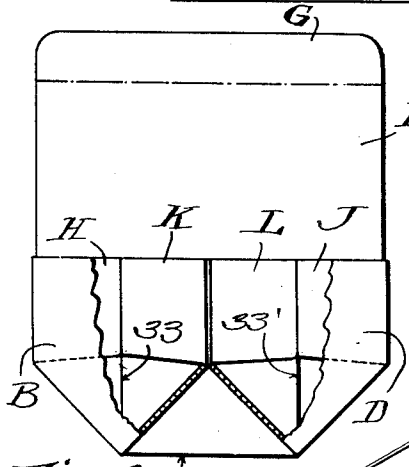


Fig. 6.

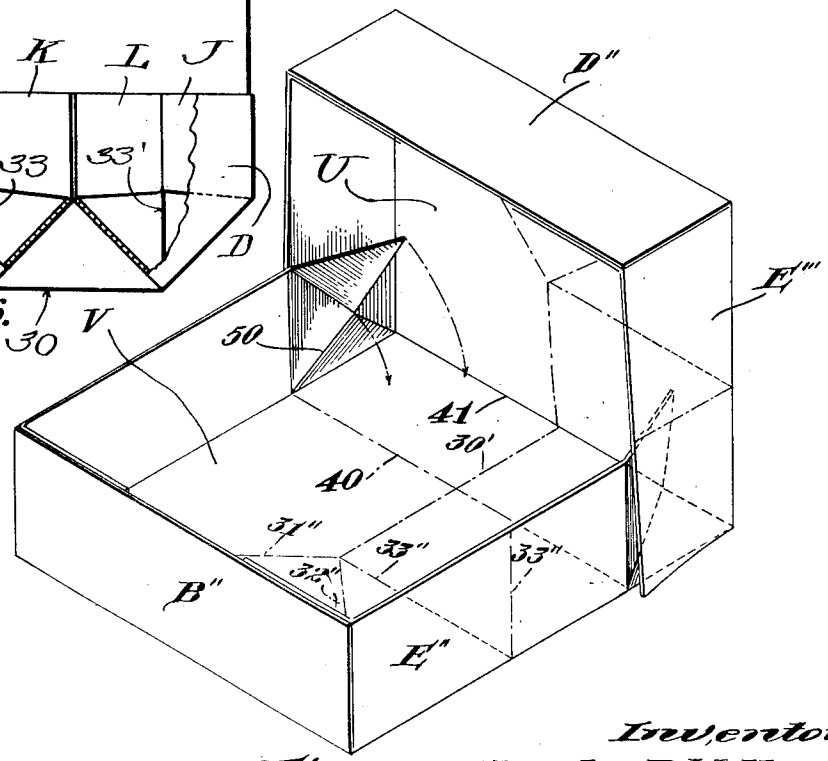


Fig. 13

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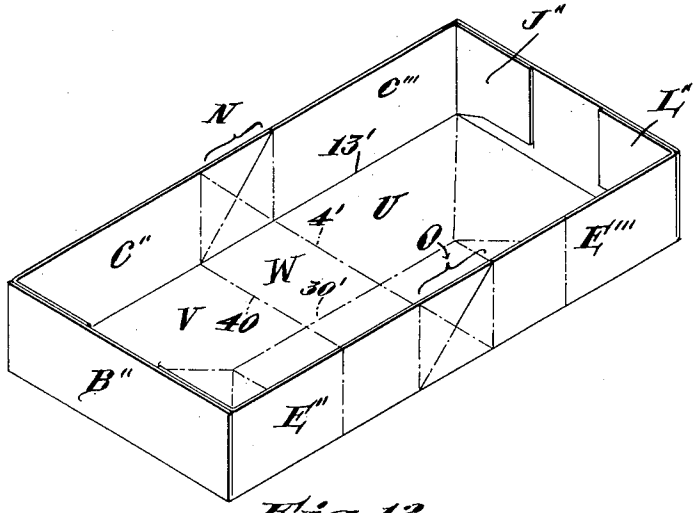


Fig. 12

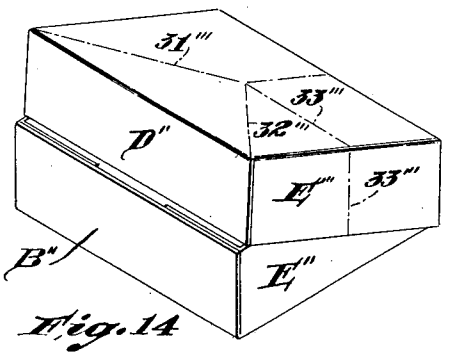


Fig. 14

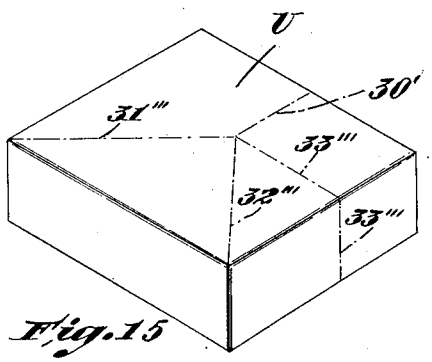


Fig. 15

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UNITED STATES PATENT OFFICE

1,939,744

RECEPTACLE

Charles Pomeroy Wellman, Medford, Mass.

Application January 17, 1930. Serial No. 421,474

5 Claims. (Cl. 229—41)

This invention relates to boxes, trays or cartons of any suitable material, usually paper or cardboard and to blanks capable of being formed into such receptacles, and to an art of making receptacles. When I refer to a "receptacle" in this specification, I do not exclude such receptacles as open-sided covers, trays, or caps, and I include receptacles having integral and receptacles having separable closures, except as otherwise specified.

One object of this invention is to provide folding receptacles which may be manufactured by automatic machinery in an improved manner and with greater facility than previous receptacles, and to these ends to provide receptacle-forming blanks adapted for such manufacture.

Another object is to provide a folding receptacle which will tend to stay open when opened. Folding receptacles capable of being collapsed from a fully formed state (or opened from a collapsed state), necessarily have fold lines or lines of increased flexibility and one of the objects of this invention is to dispose such fold lines as are utilized in the new receptacles in such a way as to be least detrimental to rigidity of the assembled and opened structure.

Another object is to provide a folding receptacle of which one of the walls capable of serving as the bottom is capable of being folded in such a way that a load within the receptacle will tend to hold the receptacle in its open state. A further object is to provide a receptacle having a wall capable of being folded so disposed that a force tending to compress the receptacle will serve to hold the receptacle open.

Another object is to provide a folding receptacle which may be opened from a collapsed to an erected state by a simple operation and to provide a receptacle capable of collapse and also capable of closure with a structure by which collapse is resisted during and after closure.

Another object is to provide a method or art of making folding boxes according to which a folding box is made from a blank in the first instance as a collapsed receptacle, i. e. without the necessity of first forming an open receptacle and then collapsing it, and in which affixing parts by gluing, cementing, stapling or otherwise is facilitated by the order of making of and placing of folds of the receptacle material.

The invention will be explained in connection with the making and product of making of typical species only of the genus comprising the invention as shown in the accompanying drawings, in which:

Fig. 1 shows in elevation a blank capable of being folded and fastened to form a receptacle and closure;

Figs. 2, 3, 4 show the blank of Fig. 1 at various stages of one method of forming a folding receptacle from a blank of this character;

Fig. 5 shows in elevation a completed receptacle folded or collapsed in one way, and serves as a diagram to show a preferred mode of applying pressure to glue laps of the receptacle during manufacture;

Fig. 6 is an elevation similar to Fig. 5 partly broken away to show the position of internal parts during assembly and in a collapsed state;

Fig. 7 is a perspective view of the receptacle of Figs. 1 to 6 when open;

Fig. 8 is a perspective view showing the receptacle partially collapsed;

Fig. 9 is a perspective view showing the receptacle almost completely collapsed;

Fig. 10 is a perspective view of a receptacle comprising an open tray and corresponding otherwise to Figs. 1 to 9;

Fig. 11 shows a modified form of the blank of Fig. 1 illustrating a further embodiment of my invention;

Fig. 12 is a perspective view of a receptacle in the form of a tray having one open face made from the blank of Fig. 11 and capable of being folded on itself to form a box and enclosing cover;

Fig. 13 is a perspective view of the receptacle of Fig. 12 partially closed;

Fig. 14 is a similar view of the receptacle of Figs. 12 and 13 more nearly closed; and

Fig. 15 is a similar view of the receptacle of Figs. 12 and 13 completely closed.

Referring to the drawings, the boxes shown and described illustrate characteristics of preferred embodiments of my invention, which may be realized in many other forms. In one aspect each of the embodiments illustrated and described constitutes the application of two several principles of my invention, my boxes shown being symmetrical, and each having a bottom (or any principal face) which is provided with folding creases of a symmetrical pattern for the purpose of enabling superposition and separation of other walls of the box during making (or shipment) and use respectively. In the preferred embodiments, corresponding creases at each end of the bottom cooperate in the folding and unfolding of the box; the creases at opposite ends of the bottom each perform definite functions with respect to the adjacent members

of the box; and the performance of these functions is not necessarily conditioned upon the provision of corresponding creases at the opposite end of the box. Hence in the broader aspects of my invention it is not essential that the folding creases at one end of the box be duplicated by corresponding creases at the opposite end.

The box of Figs. 1 to 9 for example forms a complete six-sided enclosure, while the construction of Fig. 10 comprises a five-sided tray differing from the box of Figs. 1 to 9 at least in the absence of a top. Numerous other modifications will be apparent in which a receptacle embodying the principles of my invention may differ from the box of Figs. 1 to 9 by the absence of one or more of the side or end walls, or the substitution for or addition to some of the walls shown of other desired closure members.

The blank shown in Fig. 1 may be comprised of a flat integral sheet of cardboard or other suitable material divided by lines of increased flexibility, for example scored, creased or otherwise more flexible fold lines 11, 12, 13, 14, 15 and 16 which define edges of the finished receptacle, into a principal folding section A, suitable for the bottom of the receptacle, side wall sections B, C, D and E joined to, preferably integral with, the principal folding section A, a cover section F and a suitable tuck-in flap G for the cover section.

When, as shown in Fig. 7, the receptacle is open, sides B, C, D, and E are preferably each perpendicular to the principal folding section A. In order to retain sides B, C, D, and E in this angular position when the receptacle is open, connecting sections, for example glue laps, are provided for connecting adjacent sides. I prefer to have these connecting sections constitute integral hinged or foldable extensions of sides C and E adjacent but extending beyond the corners of the principal folding section A. Referring to Fig. 1 such connecting sections H, J, K and L, are provided and are flexibly joined to side sections of the blank by the provision of suitable integral scores or fold lines 17, 18, 19 and 20 of the blank material, these fold lines also defining edges of the finished receptacle.

The principal folding section A of my receptacle is adapted to be collapsed in such a manner as to superpose three of the sides, in the present embodiment, sides B, D, and E, upon a fourth side, in the present embodiment, side C, to form a collapsed completely formed receptacle.

In order to render the principal folding section of the receptacle collapsible in this manner, I provide it with a longitudinal line of increased flexibility 30, preferably in the form of a score or fold line, along which it may be folded upon itself. Fold line 30 and cooperating fold lines permit this wall when folded to be projected downwardly below the side walls, as shown in Fig. 5 and Fig. 6.

In order to permit side B to be folded over into superposed relation to side C without being detached from either side C or bottom A, I impart to the principal folding section increased flexibility in a diagonal direction, for example by providing a diagonal line of increased flexibility 31 extending from corner of the principal folding section adjacent sides B and C to fold line 30. To render that portion of the principal folding section which is adjacent side section B foldable with respect to the portion of the principal folding section adjacent side section E, I impart to the principal folding section increased flexibility diagonally from the corner adjacent these side sections, for example by providing a diagonal line of increased flexibility 32. Lines 31 and 32 define a triangular area at the end of the principal folding section A, designated in the drawings by the reference character P. In collapsing the receptacle this triangular area P partakes of a swinging movement which carries it into a superposed position with respect to the two remaining trapezoidal portions of the principal folding section and into approximately the same plane as the end wall B of the receptacle.

To permit the triangular member P to fold over in this manner, the principal folding section of the receptacle is provided with a line of increased flexibility 33 extending from the junction of lines 31 and 32 with line 30 to the edge of the principal folding section, substantially at right angles to line 30. This line of increased flexibility 33 defines with lines 32 and 14 a triangular area designated by the reference character Q, adapted to fold over upon the remainder of the principal folding section. When a front side section E forms a part of the receptacle, line 33 may intersect the edge line, and be continued in prolongation across this side section E, thus defining with the edge line 19 a rectangular area designated R, Fig. 8, adapted to fold over upon the remainder of the side section, as shown in Fig. 9 and permit side section E to be superposed on side section C.

When, as illustrated in the accompanying drawings, a side section D corresponding to side wall B forms a part of the receptacle, a pattern of creases 31', 32' and 33' symmetrically corresponding to the creases 31, 32 and 33 may be provided at the opposite end of the principal folding section of the receptacle, and since these creases function in the same manner as creases 31, 32 and 33, no further description of them is believed necessary.

The creases described above enable the receptacle to be collapsed from an open position, as shown in Fig. 7 to the position shown in Fig. 5 by the steps apparent from Figs. 8 and 9.

I am able to form my collapsed receptacle from the blank of Fig. 1 without first forming an open receptacle. Starting with the blank of Fig. 1, I preferably bend down sides B and D as shown in Fig. 2 by acting downwardly on them at the point indicated by the arrows *a*, Fig. 2 to get them out of the way of instruments acting upwardly on the laps or connecting sections H, J, K and L. I next fold glue laps H, J, K and L inward upon their adjacent side walls and return the sides B and D to positions approximating their original positions, and apply glue thereto as shown at *g*, Fig. 3. I then fold the blank from the form of Fig. 3 into a collapsed receptacle as shown in Figs. 5 and 6, the blank passing through the stage diagrammatically illustrated in Fig. 4. This folding operation may be performed by the application of force to the principal folding section A of the receptacle in the region indicated by the arrows *b* in Fig. 3 and arrow *c* in Fig. 4. In this operation the principal folding section A of the blank is folded upon itself on line 30, opposite side sections E and C are superposed in parallel relation, and intermediate side sections B and D are superposed upon side sections E and C, upon which glue laps H and K, J and L may lie, if desired, with their ends in adjacent or abutting relation. Side sections B and D are engaged

by the glue laps and are thus affixed in hinged relation to the side walls E and C. To insure a strong joint between the glue laps and the sections affixed thereto, pressure may be aplied to the collapsed receptacle over the glue laps. As indicated in Fig. 5, this pressure may be a rolling pressure acting on the assembled collapsed box in the direction of the arrows *x*.

All of the operations involved in manufacturing a flat collapsed receptacle from a blank may be performed by the operations indicated, which are of such simplicity as to be suitable for making by automatic machinery; this order of operations is such that the receptacle (starting as a flat blank) may be moved very rapidly past, and in contacting relation to plow, folding and pressure members which react upon the various elements of the box to move them to their folded positions. The application of adhesive at *g* is facilitated by the isolation of the sections B and D laterally of the line of relative motion between the blank and the instruments acting upon it; the entire operation is thus suitable to be performed during continuous rapid relative movement in one direction between the blank and the making instruments.

A tray, such as shown in Fig. 10, may be formed from a blank having the characteristics of the blank of Fig. 1, by the omission of the top section F and tuck-in flap G, and made by the same steps. Such a tray is in itself capable of well known uses, as well as capable of combination with many different complementary laps, trays, covers or boxes to form a closed receptacle. Sides B, C and D are shown as having no fold lines within their borders, and both when collapsed and when open these sides of the tray are flat. Hence the tray is amply provided with sides which are well adapted to carry attached closure members. The top section F of the box of Figs. 1 to 9 is one example only of a closure member of the kind with which a tray such as that of Fig. 10 may be equipped by extension of or attachment to its side or end walls.

Receptacles hereinbefore explained by way of example are each provided with four side sections or walls, each attached to the principal folding section and to neighboring side sections, and have together only two collapsing scores or fold lines in the side sections, exclusive of the fold lines in the principal section and at the receptacle corners. The tendency of scored and folded material of the blank to resume its original plane on release is exerted in a direction everywhere effective to hold the receptacle open, rather than to close it, and weight of received contents emphasizes this effect. A load within the box need not contact with the sides of the box in order to assist in preventing collapsing, since merely retaining the bottom flat will have this effect.

The two collapsing fold lines 33, 33′ in the side wall E of the receptacle are parallel, and since this side wall is connected to the principal folding section and to its neighboring side sections, the receptacle when open is free from tendency to collapse, the side sections being positively held by the principal folding section against collapse. This makes this receptacle convenient to receive contents, since it stays open. The rigidity of may receptacle is due in part to the location of the two collapsing creases 33, 33′ in the same side wall, since this leaves three other side walls which do not fold during collapse and need not be traversed by collapsing creases. The receptacle when empty may readily be collapsed by positive pressure inward on the edge defined by sections E and A.

When the receptacle is opened from the collapsed form of Fig. 5 into the open form of Fig. 7 the central fold line 30 in the bottom of the receptacle is slightly lower than the lower side edges of the receptacle. Accordingly a force applied to the bottom of the box in a direction tending to compress the receptacle, for example the compressive force of a pile of boxes exerted upon one of the boxes of the pile, will tend to flatten the bottom of the box and render the structure more rigid.

The ridigity of my improved receptacle may be attributed in part to the appreciable distortion incident to displacing the various elements from the open position to intermediate partly-collapsed positions. Referring to Fig. 7, in which the receptacle is in its open position, the principal folding section A is flat, hence triangular portion Q forms a prolongation in approximately the same plane of a rectangular portion S. Likewise rectangular portion R forms a prolongation in approximately the same plane of rectangular portion T, Fig. 7, of the side section E. In this position, these portions exercise a toggle action tending to retain the receptacle against collapse. On the other hand, in the partly collapsed position of Fig. 8 the relations of these portions are interchanged, and each of the side portions R and T forms a prolongation in approximately the same plane of the adjacent bottom portions Q and S respectively. In springing the box from the open position to partially collapsed positions such as that of Fig. 8, a distortion in the nature of a flexing of portions of the box is produced. Referring to Fig. 8, for example, the fold line 33 is somewhat twisted with respect to fold line 19, and hence it appears that portions R and Q, among others, are stressed in collapsing the receptacle. The fact that a stress is set up in certain portions of the receptacle in partially collapsing it is believed to constitute a distinct advantage, since collapse is thus resisted and the receptacle when opened tends to remain fully opened. When the receptacle is in certain partially collapsed positions, it tends to spring into its fully opened position. This feature is of assistance in securing complete opening of the box. This tendency is of utility in filling the box, particularly by automatic machinery, since no mechanism is required to hold the receptacle open during this operation.

A receptacle in the collapsed position of Fig. 5 or the partially collapsed positions of Figs. 8 and 9, may be moved into contact with a table or other surface so that the folded edge defined by the line 30 is struck by the table. The force imparted to the receptacle at line 30 is transmitted to the various flexibly related sections, and causes them to spring into the open position of Fig. 7. The receptacle may thus be opened for filling by a very simple operation. This operation does not necessitate manual or mechanical spreading apart the walls of the box since the walls automatically spring into the open position when the collapsed receptacle is struck at line 30.

The collapsing lines explained above may advantageously be used in cooperation with closing fold lines on the principal folding section, the collapsing fold lines retaining one or more parts of the receptacle rigid during closure, and the closing fold lines preferably serving to prevent col-

lapse of the receptacle along the collapsing fold lines during closure. An embodiment of my invention exemplifying such use is shown in Figs. 11 to 15. The blank 10 of Fig. 11 is similar in many respects to that of Fig. 1, having the cut corner flaps H'', J'', K'', L'', and side wall sections C'', C''', E'', E''', and end wall portions B'' and D''. A pattern of collapsing fold lines 30'', 31'', 32'' and 33'' similar to that of the blank of Fig. 1 is preferably provided, and as explained in connection with the blank of Fig. 1, the pattern of collapsing fold lines is preferably symmetrical, corresponding fold lines being provided at each end of the blank. Accordingly fold lines 31''', 32''' and 33''' are shown at the right-hand side of the blank of Fig. 11. This blank may be formed into a collapsed receptacle, and opened into an open-sided tray in the same manner as the blank of Fig. 1, and the tray thus formed, Fig. 12, exhibits features of rigidity and resistance to collapse as explained above.

In order to enable the tray formed from this blank to be closed into a covered receptacle, preferably by telescoping one longitudinal half of it on the other, I provide transverse closing fold lines 40 and 41 which divide the principal folding section set off by lines 13', 14', 15', 16' of the blank and tray into a top or cover section U, bottom section V, and side wall section W of a closed receptacle. The longitudinal side wall sections of the blank and tray are likewise divided preferably in prolongation of these top, bottom and side wall sections into conjoined outer side wall sections C''' and E''', inner side wall sections C'' and E'', and intermediate opposite joint-closing sections N and O. By the provision of a closing fold line which intersects a collapsing fold line 30', the receptacle is prevented from collapsing on its collapsing fold lines during or after closure.

Although the joint-closing sections N and O may be of any suitable construction, for example simple flaps, or may even be omitted by cutting away the blank, I prefer, in order to obtain tight closure of the box, that each of these joint-closing sections be joined integrally to each of its adjacent side wall sections, as well as to the end section W. Preferably I render these joint-closing sections flexible to permit telescoping of the side walls of the box by the provision of diagonal fold lines 50 and 51 and a slit 52 which have a common junction adjacent the center of the joint-closing section. The slit preferably extends inwardly of the section from the outer corner adjacent the outer side wall section, while the fold lines preferably converge outwardly from the inner corners of the joint-closing section. Further to increase the flexibility of the section, fold line 51 may extend completely across the section from one corner to the other, as shown, but this is not essential.

In using the embodiment of the invention shown in Figs. 11 to 15, the blank may be assembled into a collapsed receptacle in the manner of the previously described embodiments, and may be opened into the tray of Fig. 12. This tray, after filling may be closed by being telescoped into the closed receptacle of Fig. 15, passing through the partially closed positions illustrated in Figs. 13 and 14.

Before, during and after closure the collapsing fold lines insure the retention of the side and end wall sections in their erected positions at an angle of substantially 90 degrees, to their adjacent top and bottom sections U and V. The opposite portions of the tray may thus be telescoped without the necessity of holding the side and end wall sections against collapse. The resistance of the tray to collapsing is increased when it is even slightly folded along one or both of the closing fold lines 40, 41, since folding on these lines serves to flatten each of the bottom, side and cover sections V, W and U, and prevents collapse along the intersecting collapsing fold lines. However, the receptacle may readily be intentionally collapsed from its open state.

It will be observed that in each of the completed and closed forms of these commercial boxes, cartons or receptacles the top, if any, and the four side walls are integral sections, of the full area of the sides, of the same face of the cardboard, which enables these faces to be coated, painted or decorated, a qualification so important in a carton for merchandise as to be necessary in a package of value to the merchant. Only one of the side walls (E, Fig. 1) is necessarily scored, and that vertically, which does not interfere with decoration. The glue-laps necessary to the continuity of the four side walls are interior, and the overlapped edges are at the corners of the solid defined by the tray, carton or box. The mode of assembly described in connection with Figs. 2 to 6 insures effective conjoining of the necessary glued joints in one rapid operation without subjecting the box or carton to any stresses which might fatigue the cardboard at critical fold-lines in respect to the durability of the box or tray after assembly; this assembly is predetermined by the lines of fold of the blank, and independent of any operations requiring more than the application of glue or other adhesive, and directed pressure. So far as I am aware it has not heretofore been possible to assemble a six-sided receptacle in one operation without the use of complicated mechanism.

According to this invention the relative proportions of the constituent elements of the blanks and receptacles are capable of extensive modification to fit particular requirements without departing from the invention; the invention is not limited to receptacles and blanks comprising all of the elements described, since it will be apparent that novel sub-combinations of elements disclosed herein are of utility in the art.

While, for simplicity I have referred to "collapsing" fold lines, it is contemplated that these "collapsing" fold lines may be utilized primarily to facilitate the forming and opening of receptacles, these lines of increased flexibility permitting a collapsed receptacle to be erected or opened, and likewise, if desired, recollapsed.

The preferred method of making the receptacle herein described is claimed in my copending divisional application Serial No. 585,550, filed January 8, 1932.

I claim:

1. Receptacle collapsed by being folded in one direction and closed by being folded in another direction comprising a principal folding section and conjoined side walls, said principal folding section having collapsing fold lines comprising a longitudinal fold line and diagonal fold lines extending from the four corners of said section to said longitudinal fold line, and having two closing fold lines thereon which define therebetween a portion of the principal folding section adapted to constitute one face of the closed receptacle, said closing fold lines intersecting said longitudinal collapsing fold line, whereby upon partial closure of the receptacle collapse thereof is prevented.

2. Collapsed receptacle comprising an integral sheet of foldable material having fold-lines of increased flexibility defining a rectangular principal folding section and four side wall sections each of full size sufficient to close completely a face of an erected receptacle formed from the collapsed receptacle, three of the four side wall sections being superposed on the fourth side wall section and the principal folding section being projected outwardly from said side walls in a folded state, and having a folded exterior edge connected to the four corners of said section by diagonal fold lines of increased flexibility, one of said side wall sections being folded upon itself in two places and each of the two adjoining side wall sections being undivided and free from fold lines within its wall-closing area and overlying another side wall section and also a folded-over part of the one twice-folded side-wall section, and four connecting sections comprising integral extensions of sections of the blank and fastened to each of the said overlying unfolded side wall sections, in face-to-face relation with said side wall sections, the sizes of said connecting sections being such that the two connecting sections fastened to a side wall section do not overlap each other but lie in the same plane, whereby the collapsed receptacle is of minimum thickness.

3. Collapsible receptacle comprising four integral side wall sections each of full size sufficient to close substantially completely a face of the receptacle, and a principal folding section of a size sufficient to close completely a fifth face of the receptacle, the principal folding section including a longitudinal fold line, diagonal fold lines extending from corners of the said section to common junctions with said longitudinal line and two transverse fold lines each extending from one of said junctions to an edge of said principal folding section, and from thence, in prolongation, across a side-wall section, two opposite ones of the side wall sections being free from fold lines or creases within their margins, and four connecting sections constituting integral extensions of other sections of the receptacle, pairs of said connecting sections being fastened to said opposite uncreased side wall sections to fasten the receptacle walls together, the fold lines of the receptacle permitting the receptacle to be collapsed with the four side wall sections lying within an area equal to that of one of the side walls, and the principal folding section projected below said side wall sections, and the said connecting sections being of such sizes that the two connecting sections of each pair do not overlap, either in the open or collapsed states of the receptacle.

4. A receptacle formed in a substantially flat state comprising four side wall sections, a bottom folded on a longitudinal line, on four diagonal lines and on two transverse lines extending from the junctions of said diagonal lines with the longitudinal line, the four side wall sections being collapsed into an area not substantially exceeding that of one side wall, by folding on vertical corner lines and on lines extending in prolongation of said two transverse lines, the said folded bottom being projected outwardly from the side wall sections, and being demarked from two opposite side wall sections by score lines upon which the receptacle material has not been folded, whereby upon opening the receptacle said score lines define bottom edges unweakened by previous repeated bending and demarking the initially folded bottom from the longitudinal side walls.

5. A receptacle formed in a substantially flat state comprising four side wall sections, a bottom folded on a longitudinal line, on four diagonal lines and on two transverse lines extending from the junctions of said diagonal lines with the longitudinal line, three of the side wall sections being superposed on the fourth side wall section by folding on vertical corner lines and by twice folding one side wall on two lines extending in prolongation of said two transverse lines, the said folded bottom being projected outwardly from the side wall sections, and being demarked from the twice-folded side wall by a score line upon which the receptacle material has not been folded, whereby upon opening the receptacle said score line defines a bottom edge unweakened by previous repeated bending and demarking the initially folded bottom from the initially twice-folded side wall.

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