

Jan. 11, 1938.

C. E. GRUBER ET AL

2,105,243

BOX

Original Filed May 23, 1935

Fig. 1.

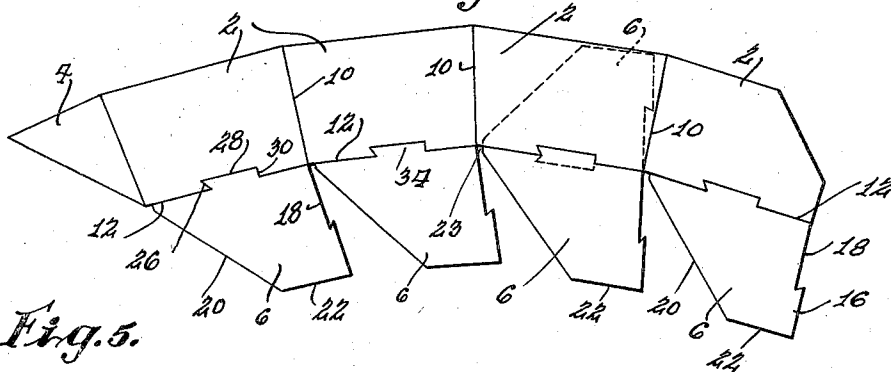


Fig. 5.

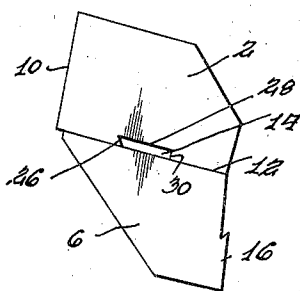


Fig. 2.

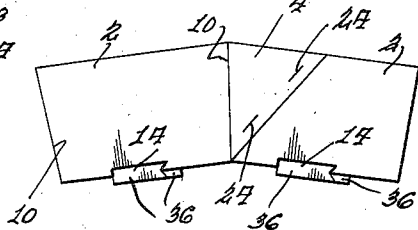


Fig. 6.

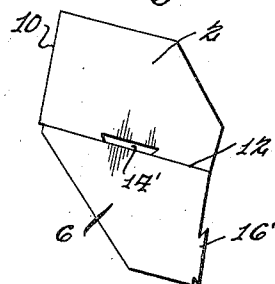


Fig. 3.

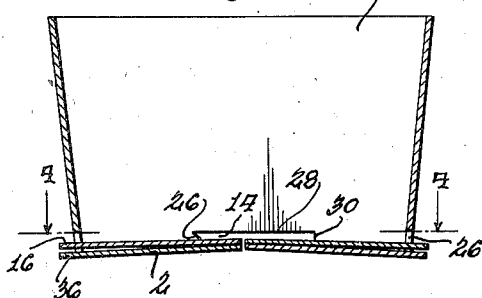
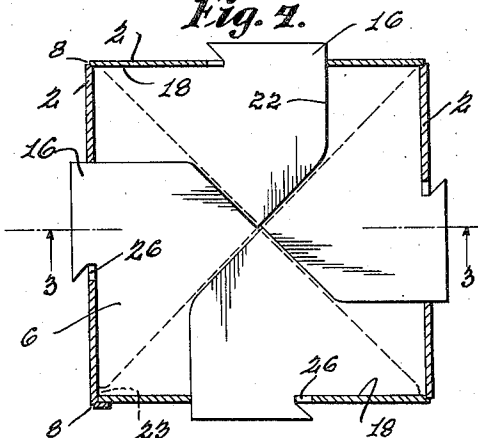


Fig. 4.



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UNITED STATES PATENT OFFICE

2,105,243

BOX

Clarence E. Gruber and William F. Gruber,
French Lick, Ind.Application May 23, 1935, Serial No. 23,114
Renewed June 11, 1937

27 Claims. (Cl. 229—16)

This invention primarily relates to a box which has its parts folded together in collapsed condition for shipment and storage and which is adapted to be set up readily and simply from its collapsed condition into its condition of use by unfolding and interlocking its parts.

More particularly, the invention relates to a box having four connected relatively foldable side walls, to the lower edges of which are foldably connected flaps which in the collapsed condition of the box lie against the inner surfaces of the side walls and which in the set-up condition of the box lie in overlapped relation and are interlocked with one another and are also interlocked with the side walls. The interlocking of the flaps with one another and with the side walls takes place as the flaps are swung down into the box to form its bottom during the setting up of the box, each flap being provided with an extension or tongue which extends outwardly from a lateral edge of the flap and which is adapted to enter a slot near the lower edge of a side wall other than that to which the flap is foldably connected. This interlocking of tongues and slots firmly supports an edge of each flap other than the foldably connected edge and thus strengthens the overlapped bottom flaps. The invention also relates particularly to the interlocking of the flaps with the walls.

In a preferred embodiment of the invention, the tongues and slots are formed so that they resist the stresses which are exerted by the weight of the contents of the box on its bottom and in the planes of the flaps and which tends to separate the flaps from the side walls. This desirable result is attained by making the outer portions of the tongues wider than the base portions thereof and wider than the lower parts of the slots with which these outer portions interlock when stresses are exerted in the planes of the flaps. In order to facilitate the engagement of the tongues and slots, and in order to avoid the necessity of deforming the tongues, the upper parts of the slots are made as wide as, or slightly wider than, the outer portions of the tongues, which consequently readily enter the slots as the flaps are forced downwardly in setting up the box in condition for use.

An object of the invention is the manufacture of a box from a single blank so as to entail a minimum waste of material. This is accomplished by forming the flaps of substantially less width, between the foldably connected edge of each flap and its opposite edge, than the corresponding width of the box bottom. For maximum effec-

tiveness the tongues are provided on the flaps at portions remote from the foldably connected edges and preferably close to the edges respectively opposite thereto. In the illustrated form of the invention, the interlocking tongues and slots are situated somewhat more than half way from the foldably connected flap edges to the bottom edges respectively opposite thereto.

The principal features of this invention are particularly applicable to boxes of rectangular cross-sectional shape, and more especially to boxes of square cross-sectional shape. In its broader aspects, however, the invention may be applied to boxes of other shapes. Certain features of the invention are also applicable to the top or cover structure of boxes having tops or covers formed of flaps.

A further object of the invention is the provision of means for interlocking a wall of a box, such as the bottom, to another wall of the box, such as a side wall. Preferably, this means is such that the interlocking becomes more effective as either interlocked wall is subjected to pressure from the contents of the box. The form of this means illustrated in the drawing comprises a tongue on one wall and a slot in the other wall, the tongue and slot having interengaged sloping edges.

Other and further objects of the invention will become apparent from the following disclosure and from the claims.

The invention is illustrated in the accompanying drawing, in which like characters indicate like parts and in which:—

Fig. 1 is a plan view of the box blank.

Fig. 2 is a plan view of the box in collapsed condition.

Fig. 3 is a transverse sectional view of the box when set up for use, the section being in the vertical plane indicated by line 3—3 of Fig. 4 and the view being in the direction indicated by the arrows.

Fig. 4 is a transverse sectional view of the box when set up for use, the section being in the horizontal plane indicated by line 4—4 of Fig. 3 and the view being in the direction indicated by the arrows.

Fig. 5 is a fragmentary view, similar to the right portion of Fig. 1, but showing a somewhat different way of forming the slots in the side walls.

Fig. 6 is a fragmentary view, similar to the right portion of Fig. 1, but illustrating another suitable form of tongue and slot.

Preferably, the box is made from a single blank, as shown in Fig. 1. This blank comprises side

walls 2, a side overlapping portion 4, and flaps 6 which when the box is set up form a wall substantially perpendicular to the side walls. In the box shown in the drawing, this wall is the bottom of the box. Score line 8, shown in Fig. 4, are provided at lateral edges 10 of side walls 2 to facilitate folding of the side walls relative to one another; other score lines are similarly provided at the bottom edges 12 of the side walls to facilitate folding of the flaps relative to their adjacent side walls. The side walls preferably have downwardly converging walls, after the manner common in berry boxes, in order to make the cross-sectional size at the upper part of the box larger than at the bottom, advantage of this construction being taken to attain one of the objects of this invention as will appear hereinafter. Near their lower edges, side walls 2 are provided with slots 14 which are adapted to be engaged by tongues or extensions 16 extending from lateral edges 18 of the flaps when the box is set up in condition for use.

The flaps 6 are identical. Each flap has a base edge where it is foldably connected to a side wall at or near its bottom edge 12, oblique edge 20 which extends from near one end of the base edge at an acute angle from the base edge and which substantially coincides with the greater part of a diagonal line of the box bottom when the box is set up for use, the lateral edge 18 which extends from the other end of the base line at a slightly obtuse angle, and an edge 22 which is opposite to the base edge. The width of the flap between its base edge and edge 22 preferably is the same as the height of the side walls; this effects a saving of material in the making of the blank and, since the flaps do not extend above the sides of the boxes in their collapsed condition, also a saving of space in connection with their shipping and storage, when the width of the box is greater than its height, as in the case of a berry box. The tongue 16 is preferably formed on edge 18 near edge 22 in order to provide a support for the flap where it is needed most, namely, near free edge 22. The oblique edge 20 of the flap does not extend to the end of the base edge in order to provide a clearance space 23 which facilitates the folding of the side walls into the collapsed condition and the setting up of the box from the collapsed condition.

The blank shown in Fig. 1 may be conveniently folded into the collapsed condition of the box shown in Fig. 2 by first folding the flaps inwardly on their adjacent side walls and then folding the end side walls of the blank, together with the flaps folded thereon, on the intermediate side walls and flaps. In Fig. 1 a flap folded inwardly on its adjacent side wall is shown in broken lines. The side portion 4 is made to overlap the side wall at the other end of the blank and is fastened thereto in any suitable manner, as by staples 24. In this condition the box requires a minimum of space and hence may be economically shipped and stored.

The box may be set up into condition for use from its collapsed condition very readily without making use of any additional fastening means and without the use of tools. The collapsed box shown in Fig. 2 is grasped in both hands, with the fingers thrust upwardly between the side walls so as to hold the bottom flaps against the side walls while the two ends of the collapsed box are pushed toward one another until the box is approximately square in form. The flaps are

then released and will fall into correct seriatim overlapping position. When the flaps are forced down substantially into the plane of the bottom or into a plane perpendicular to the side walls, the parts adjoining the oblique edges of the flaps become interlocked where they overlap and provide a well supported bottom center portion. As the flaps are forced down into their final position to form the bottom, tongues 16 enter slots 14 since the upper parts of the slots are formed as wide as, or slightly wider than, the outer portions of the tongues and since the flaps urge the tongues outwardly in reacting against the compressive force exerted on the flaps by the downwardly converging side walls.

It is understood, of course, that the inward sloping of the side walls toward the bottom is sufficient to cause the side walls to exert such force on the flaps as will cause them to flex and that the tongues are sufficiently wide to effect a secure engagement with slots 14 and yet are not so wide as to impede seriously the entrance of the tongues into the slots. The slope of each side wall should be such that the upper edge of the wall extends outwardly beyond the vertical line passing through the outermost point on the tongue when the box is set up after engagement of the tongue in the slot in the side wall, in the case of a box of rectangular cross-section, in order that the tongue may fit within the lateral edges 10 of the side wall when the box is in the collapsed condition, as shown in broken lines in Fig. 1. It is also understood that the material of which the box is made possesses sufficient flexibility, stiffness and resilience to produce the compressive and reacting forces of the side walls and flaps, respectively, when the flaps are forced downwardly into the box. Cardboard which is commonly used in making boxes is a satisfactory material; other suitable materials, however, may also be employed.

In order to strengthen the bottom of the box further and to render the interlocking of the flaps more effective, slots 14 and tongues 16 are formed so that they interlock in reacting to and in resisting stresses in the planes of the flaps. When the box is put into use, the weight of the contents exerts pressure downwardly on the bottom and tends to push the central portion of the bottom downwardly, thus tending to disengage the flaps and to overcome their interlocking by exerting stresses which act in the planes of the flaps. The interlocking of the flaps and side walls by means of slots 14 and tongues 16 not only resists downward pressure of the weight but also resists these stresses in the planes of the flaps and hence renders more effective the interlocking of the flaps near the center of the bottom. The interlocking of the flaps and side walls thus resists stresses in the planes of both the flaps and side walls, the downward pressure of the weight of the contents near the side walls of a filled box being exerted on the interlocking parts substantially in the planes of the side walls and the pressure of the weight of the contents at the central portion of the box causing stresses in the planes of the flaps. This interlocking of the flaps and side walls also resists upward pressure which may be exerted on the bottom of a filled box in handling. If the upward pressure is exerted on the bottom of a filled box, such pressure as is exerted at or near the center of the bottom causes stresses in the planes of the flaps and these stresses are resisted by the interlocking surfaces in the same manner as

when downward pressure is exerted at the center of the bottom, while such upward pressure as is exerted near the edges of the bottom will be resisted by the portions of the flaps at and near the folding lines between the flaps and their respectively connected side walls and thus no harmful upward movement and disengagement of the tongues relative to the slots results, it being noted that the weight of the contents near the side walls tends to hold the tongues down. Hence upward pressure exerted on the bottom of a filled box tends to maintain the interlocking of the flaps with the side walls and spilling or crushing of the contents is consequently avoided.

This interlocking of the side walls and flaps is preferably attained by making the outer portions of the tongues of greater width than the lower parts of the slots and by making the base portions of the tongues of the same width as, or of less width than, the lower parts of the slots, so that the base portions of the tongues fit in the lower parts of the slots and so that the lateral edges or ends of the lower parts of the slots engage and interlock with the outer portions of the tongues when stresses are exerted in the planes of the flaps. In effect, this construction provides the flaps with hook means which enter the slots in the side walls when the box is set up and which engage and interlock with the edges or ends of the slots when pressure is exerted downwardly on the box bottom. This construction is such that, the greater the pressure exerted on the bottom, as by contents of the box, the more firmly do the hooked ends of the tongues engage the lower parts of the lateral edges or ends of the slots. A further advantage of this construction is that the locking as such is effective, not only in the planes of the flaps or in the plane of the bottom, as explained heretofore, but also in the planes of the side walls since, after the tongues and slots are hooked together in setting up the box, unfolding of the box is prevented even if side overlapping portion 4 should not be fastened to, or should become loosened from, the side wall which it overlaps and to which it is normally secured, as by staples 24. In fact, the box may be adequately maintained in effective condition for use by employing only the upper staple 24, which is required to overcome the flexibility inherent to some extent in the material of which the box is made, since the lower part of the box is securely held together by this preferred construction and interlocking of the side walls and bottom flaps and since stress on the staple fastening is consequently slight. Thus, this preferred tongue-and-slot construction materially aids in holding the box in firm set-up condition, particularly under pressure which, except for this construction, would deform the box and damage its contents or would cause the bottom to collapse. It is noted that other interlocking means may be employed to effect the same purpose and it is to be understood that the illustrated tongue-and-slot means is only a preferred interlocking means.

In the form of the invention illustrated in Figs. 1 to 5, the interlocking between each tongue and its associated slot occurs only at the end of the tongue nearer the base edge of the flap. This interlocking is more effective than the interlocking at the other end of the tongue since the stress in the plane of the flap tends to pull the tongue away from its cooperating slot and toward the base of the flap as well as perpendicularly from the slot. Since the interlocking occurs only at one end of the tongue and slot, obviously the

tongue will more readily enter the slot than if the interlocking occurs at both ends of the tongue and slot.

In Fig. 6, by way of example, there is illustrated another form of interlocking tongue and slot. In this form tongue 16' will engage and interlock with both ends of slot 14'. The resulting interlocking is more effective than that obtained only at one end of the slot; on the other hand, the tongue does not as readily enter the slot as in the form shown in Figs. 1 to 5.

Fig. 5 illustrates a method of forming the slot different from that of Figs. 1 to 4. In the form of slot shown in Figs. 1 to 4, the slot 14 is formed by making in side wall 2 the lateral sloping cut 26, the upper cut 28, and the lateral vertical cut 30; in this form the side wall portion between cuts 26, 28, 30 forms a tab 36 extending beyond the base edge of the flap when the flap is folded out of the plane of the side wall, as in Figs. 2 and 3. In the form of Fig. 5, and also in that of Fig. 6, the bottom cut 32 is made so as to remove completely from the blank the material between the cuts, and hence there is no tab extending from the flap.

Other suitable forms of tongue-and-slot construction are readily suggested by the forms illustrated above. Also, other interlocking devices may be employed which effect the same results as the tongue-and-slot form of interlocking means. Other features of our invention may also be modified in ways which become evident from this disclosure; for example, our invention is illustrated in connection with a box having four side walls and four flaps forming a bottom wall, but it is obvious that our invention is applicable to boxes having a larger or smaller number of walls and flaps and that the flaps may form a wall other than a bottom wall. Our invention, therefore, is not limited by the foregoing disclosure and is defined by the following claims.

We claim:

1. A collapsible box, comprising foldably connected side walls, a wall substantially perpendicular to the side walls and including flaps which are foldably connected to the side walls and which overlap one another, and means interlocking respectively adjacent side walls and flaps other than the foldably connected side walls and flaps, said means being adapted to resist stresses in the planes of the flaps.

2. A collapsible box, comprising foldably connected side walls and a bottom formed of flaps foldably connected to the side walls, respectively adjacent side walls and flaps, other than the foldably connected side walls and flaps, having interengaging and interlocking means which are adapted to resist stresses in the planes of the flaps.

3. A box of the class described, comprising foldably connected side walls and a bottom formed of flaps foldably connected to the side walls, said side walls having slots near their lower edges, and said flaps overlapping one another and having tongues which engage and interlock with said slots in such manner as to resist stresses in the planes of the flaps.

4. A box of the class described, comprising foldably connected side walls, a bottom including flaps foldably connected to the side walls, and means interlocking respectively adjacent side walls and flaps, said means becoming effective when the flaps are forced down substantially into the plane of the bottom.

5. A box of the class described, comprising

foldably connected side walls and a bottom including flaps foldably connected to the side walls, said flaps being interlocked with one another, said side walls having slots near their lower edges, and each of said flaps having a tongue which engages and locks with a slot in a side wall other than the side wall to which the flap is foldably connected.

6. A box of the class described, comprising foldably connected side walls and a bottom formed of flaps overlapping and interlocked with one another, each flap being foldably connected at one edge to a side wall and having a tongue extending from an edge next to its foldably connected edge, the outer portion of the tongue being wider than its base portion, each side wall having near its lower edge a slot engaged by and interlocked with one of the tongues, the upper part of said slot being substantially of the same width as the tongue outer portion, and the lower part of said slot being substantially of the same width as the tongue base portion, whereby stresses in the planes of the flaps are resisted.

7. A box according to claim 6, in which the tongue on each flap extends across and beyond the line which is parallel to the foldably connected edge of the flap and which passes through the center of the bottom.

8. A box according to claim 5, said box being of rectangular form in horizontal cross-section, and each side wall sloping inwardly toward the bottom to an extent such that the upper edge of the side wall extends outwardly beyond the vertical line passing through the outermost point on the tongue which is interlocked with and which extends through the slot in the side wall.

9. In a collapsible box having foldably connected walls each of which is substantially perpendicular to one or more of its adjacent walls when the box is in its set-up condition and a plurality of flaps each of which is foldably connected to one of said walls, means for interlocking each of said flaps with a wall other than the wall with which it is directly and foldably connected when the box is in its set-up condition, said means being effective in the planes of the interlocked walls and flaps.

10. A collapsible box comprising connected relatively foldable side walls, flaps each of which is foldably connected at one edge to a side wall and each of which is foldable on the inner surface of its foldably connected side wall when the box is in collapsed condition, said flaps being interlocked with one another and forming a wall substantially perpendicular to the side walls when the box is in set-up condition, and means interlocking each flap with a side wall other than its foldably connected side wall when the box is in set-up condition.

11. A collapsible box comprising foldably connected side walls, a bottom including flaps foldably connected to the side walls, said flaps being folded on the inner surfaces of the side walls in the collapsed condition of the box and being swung downwardly when the box is being set up into condition for use, and interengageable means on the flaps and side walls for interlocking the flaps with the side walls when the flaps are swung downwardly in setting up the box into condition for use.

12. A collapsible box comprising relatively foldable side walls, a bottom including flaps foldably connected to the side walls, said flaps being folded on the inner surfaces of the side walls in the collapsed condition of the box and being swung

downwardly when the box is being set up into condition for use, extensions on the flaps adapted to engage the side walls during downward movement of the flaps and thereby to resist such movement, and means on the side walls adapted to be engaged by and to interlock with said extensions when the flaps are forced substantially into the plane of the bottom.

13. A box according to claim 11, in which the interengageable means include a hook member on each flap and a slot formed in a side wall so as to be engaged by the hook member when the flap is swung downwardly.

14. A box according to claim 11, in which the flaps overlap and interlock with one another when swung downwardly in setting up the box into its condition for use.

15. A box according to claim 12, in which the flaps overlap and interlock with one another when swung downwardly in setting up the box into its condition for use.

16. A box according to claim 12, said box being square in horizontal cross-section and the side walls sloping inwardly toward the bottom.

17. A collapsible box comprising side walls, a bottom including flaps foldably connected to the side walls, each flap being foldably connected at one of its edges to a side wall, and means for connecting another edge of each flap to a side wall other than that to which it is foldably connected, said means being effective only in the set-up condition of the box.

18. A box according to claim 17, in which the flaps are interlocked with one another when the box is being set up.

19. A box according to claim 17, said box being square in horizontal cross-section, the side walls sloping inwardly toward the bottom, and said means including an extension on each flap such as to engage a side wall when the flap is swung toward the plane of the bottom and a slot in the side wall adapted to be engaged by the extension when the flap is swung substantially into the plane of the bottom.

20. A collapsible box comprising foldably connected side walls, a plurality of flaps each of which is foldably connected only to one of said side walls and each of which is positioned transversely of said side walls when the box is in its set-up condition, and means for interlocking each of said flaps with a side wall other than the side wall with which it is foldably connected, said means being effective in the plane of each flap and in the plane of the side wall interlocked therewith.

21. A collapsible box comprising foldably connected side walls, a transverse wall including flaps each of which is foldably connected to a side wall, and means interlocking side walls and flaps which are not foldably connected together, said means being effective in the planes of the side walls and of the flaps in such manner as to prevent unfolding of the side walls and unfastening of the flaps during normal use of the box.

22. In a collapsible box having two adjacent foldably connected side walls and a third wall which is foldably connected to one of said side walls and which is positioned transversely of said side walls when the box is in its set-up condition, means for interlocking said third wall with the other of said side walls, said means being constructed so as to become effective during the setting-up of the box.

23. A collapsible box comprising foldably connected side walls, a bottom wall having flaps

each of which is foldably connected only to one of said side walls, and means for interlocking each of said flaps with a side wall other than the side wall with which it is foldably connected, 5 said means being constructed so as to resist both upward and downward pressure on said bottom wall when the box is in its set-up condition.

24. A collapsible box comprising foldably connected side walls, a bottom including flaps each 10 of which is foldably connected to a side wall, and means interlocking side walls and flaps which are not foldably connected together, said bottom and said means being constructed so as to resist upward pressure on the bottom when 15 the box is in its set-up condition.

25. A collapsible box comprising foldably connected side walls, a bottom including flaps which are foldably connected to the side walls and which are so formed as to be interlocked during

the setting-up of the box to form the bottom, and means connecting flaps and side walls together so as to resist upward pressure on the bottom when the box is in its set-up condition.

26. A collapsible box comprising two adjacent 5 foldably connected side walls, a third wall which is foldably connected to one of said side walls and which is positioned transversely of said side walls when the box is in its set-up condition, 10 and means for mechanically interlocking said third wall with the other of said side walls.

27. A collapsible box comprising foldably connected side walls, a bottom including flaps each 15 of which is foldably connected at only one edge to a side wall, and means mechanically interlocking another edge of each flap to a side wall with which it is not foldably connected.

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