

5

10

1

"IMPROVEMENTS IN SELF-LOCKING BOX"**15 Background of the Invention**

The present invention relates generally to boxes, and more specifically to boxes for storing, mailing, or shipping various articles.

20 Boxes for storing, mailing, or shipping goods have been known in the prior art. In their simplest embodiment, those boxes comprise several body panels forming the sides of the box, and a pair of end panels connected to one or more of the side panels to close the ends of the box. The end panels usually are secured to the side panels by adhesive tape or the like, to close the box. The end
25 panels may terminate with folded flap portions which are inserted beneath one of the body panels to provide a self-securing closure, but such conventional closures usually are less secure than taping shut the box panels. The conventional box may also feature a plurality of overlapping panels which are secured to each other by
30 means of adhesive to form integral end panels. U.S. Patent No. 3,512,823 is an example of such a box structure.

In order to provide a somewhat more secure closure mechanism, end panels of boxes have been provided with a tabbed portion along the distal edge thereof. These tabbed portions are
35 simply inserted through a mating slit of substantially the same length

located on a side panel of the box, the tab after insertion through the slit being glued to the exterior surface of the side panel. U.S. Patent Nos. 916,503 to Thompson and 4,752,028 to Ogura disclose such a structure.

5 In the alternative, such tabs have been provided with leading edges which are longer in dimension than the length of the mating slit so that the tab and side panel around the perimeter of the mating slit provide interlocking abutment surfaces, as shown in U.S. Patent Nos. 2,834,531 to Struble; 2,028,677 to Lupton; 1,530,644 to
10 Blandford; and 4,516,718 to Forbes, Jr. The end portions of such an elongated tab must be folded upon the center portion thereof to permit inserting the tab through the slit, whereupon the elasticity or "memory" of the corrugated board causes the end portions to revert towards their original portion, thereby providing the interlock.
15 However, the leading edge of the locking tabs taught by these box configurations either protrudes through the slit so that it is exposed outside the box or else only provides marginal interlocking structure. Therefore, the locking tabs may be easily unlocked from engagement with the slit of the box and the top panel removed
20 without leaving any visible evidence of tampering.

 Some box manufacturers, therefore, have resorted to a locking tab arrangement whereby the tab is affixed to a box panel so that the tab is inserted into the box through the slit, whereupon the reverted locking tab is inaccessible. The only means of opening the
25 box end panel, therefore, is to tear or sever the locking tab from where that tab joins the side panel of the box, thereby providing visible evidence of tampering. The profile of such panels may be rectangular (U.S. Patent Nos. 4,830,270 to Holmes; 3,949,931 to Hall; 1,470,141 to Bryson; 1,108,464 to Morey; and 636,806 to
30 Johnstone), crescent-shaped (U.S. Patent No. 3,451,535), or slightly tapered, although still with a flat leading edge (U.S. Patent No. 3,462,066 to Farquhar; and 4,471,902 to Skaggs). However, these tabs provide a completely straight leading edge when the end portions of the tab are folded onto the center portion thereof,
35 thereby making insertion through the narrow slit difficult.

Moreover, the double layered leading edge of the folded tab inevitably becomes slightly separated during the insertion stage, once again providing undesirable abutment between the tab and the slit prior to inserting the tab through the slit.

5 U.S. Patent No. 5,350,108, assigned to the owner of the present application, discloses an improved self-locking box. That patent describes a box having at least one panel secured to another panel by a locking tab and slot assembly, so that the secured panel cannot be opened without leaving visible evidence of tampering. To
10 accomplish that locking, the box of the '108 patent includes an end panel having a flap extending into the box. The slot is located in the flap. The locking tab is foldable to fit through the slot, and a terminal portion of the locking tab engages a surface on the interior of the box so as to prevent withdrawing the locking tab. However,
15 there remains at least some possibility that a box with the self-locking structure shown in the '108 patent could be nondestructively opened by a determined person who knew the internal construction of the box and had the time, the tools, and a measure of luck to defeat the lock structure.

20 Authorized opening of the boxes disclosed in the '108 patent and the '682 application takes place by cutting, tearing or otherwise separating the locking tab from the box panel forming that tab. Some persons have difficulty in manually tearing the locking tab, particularly in boxes fabricated of material having sufficient
25 strength to withstand shipping by parcel delivery services or other commercial services. Although the locking tabs of those boxes are defined by perforated or scored regions to facilitate folding the locking tabs as disclosed therein, the manual force required to break apart or otherwise separate such locking tabs, without using scissors
30 or some other implement as a makeshift tool, may impede the authorized opening of a box so equipped.

Summary of the Invention

35 Accordingly, it is an object of the present invention to provide an improved self-locking box.

4

It is another object of this invention to provide a self-locking box structure which can be easily and quickly assembled for containing an article of merchandise.

5 Still another object of the present invention is to provide a self-locking box structure having a locking tab insertable through a mating slit to lock the box closed but is not withdrawable without visible damage to the box.

10 It is yet another object of the present invention to provide a self-locking box that thwarts attempts to tamper with the locking tab of the box.

It is a further object of the present invention to provide a self-locking box having a locking tab that cannot be withdrawn from a mating slit in the box, once inserted through the slit.

15 Yet another object of the present invention is to provide such a box structure whereupon the assembled box cannot be opened without separating the locking tab from part of the box, thereby providing visible evidence of tampering.

20 The present invention also seeks to provide a self-locking box that is relatively easy to open in a predetermined manner.

Other objects of the invention, in addition to those set forth above, will become apparent to those skilled in the art from the following disclosure.

25 Stated in broad terms, a box according to the present invention has at least one end panel connected to a body panel for selectively closing a corresponding end of the box. That end panel has a flap extending on top of an open end of the box and there occupying a location adjacent a body panel of the box. A slit is located in the flap of the end panel, and a locking tab is connected to
30 the body panel adjacent the location occupied by the flap. The locking tab is selectably inserted through the slit when the box is closed, and a surface of the inserted locking tab abuts the interior of the box, preventing withdrawal of the locking tab. Structure on the locking tab defines an opening tab that separates the locking tab from

5

part of the box when the opening tab is pulled in a predetermined manner.

Stated in somewhat more detail, boxes according to the present invention have an end panel foldable to close an end of the box. The end panel has a flap extending to overlap an end of a body panel adjacent the open end of the box, when the end panel closes that open end. A slit is formed in the flap of the end panel and overlays an opening in the body panel of the box when the end panel is folded to close the box. The locking tab is connected to the body panel adjacent the overlapping location of the end flap. A first portion of the locking tab is foldable to lie alongside a second portion thereof, with the fold line forming a leading edge of the folded locking tab. That leading edge of the locking tab may be aligned with the slit in the end panel and inserted through the slit. The locking tab partially unfolds within the box, abutting the flap within the closed box and thereby locking the end panel in closed relation with the box. The locking tab includes at least one flange that engages a surface of the body panel as the locking tab is inserted through the slit, preventing withdrawal of the locking tab through the slit independently of the abutment between the partially-unfolded locking tab and the flap surface within the box. One or more diagonal lines or other regions of predetermined weakness extend on the locking tab and define, at least in part, the opening tab. The regions of predetermined weakness preferably are perforated lines formed in the locking tab. For example, two lines of perforations may extend from a common point midway across the locking tab, on diagonal paths toward opposite sides of the locking tab, intersecting other cut lines extending inwardly from those sides and at least in part defining a pair of opening tabs. Pulling each opening tab away from the locking tab separates the regions of predetermined weakness, thereby separating the locking tab without requiring a cutting tool.

Stated in further detail, part of the locking tab is formed in the body panel and is connected to that panel by a selectably separable region of predetermined weakness. In a preferred

6

embodiment, that selectively separable region comprises perforations along the fold line. The locking tab thus defines an open region in the second body panel when that locking tab is folded to enter the slit in the flap of the end panel. A flange is formed on at least one side of the locking tab, and preferably on both sides of the locking tab, and the flanges resiliently deform against confronting edges of the open region as the locking tab passes through the slit. That locking structure resiliently expands once the locking tab moves past the confronting edges, so as to engage the edges of the open region in the panel and further prevent withdrawing the locking tab from the slit.

The present box preferably includes a secondary end panel extending outwardly from the body panel and foldable to close the end of the box. The secondary end panel thus lies in substantially parallel relation to the end panel when the box is closed, so as to prevent a person from seeing inside the box by bending back the end panel from the end of the closed box.

The selectively separable region connecting the locking tab to the box panel provides a further safeguard against undetected opening of the closed box. The separation strength of that region is chosen so that the locking tab will become separated from the box if subjected to force, whether applied manually or by a tool used in an attempt to gain nonobvious entry to the box.

25 Brief Description of the Drawings

Fig. 1 is a plan view showing a box blank for producing a box according to a preferred embodiment of the present invention.

Fig. 2, 2b, 2c, and 2d are fragmentary pictorial views showing a box assembled from the blank of Fig. 1 and illustrating progressive stages of closing and locking an end panel of the box.

Fig. 3 shows the box partially broken away for illustrative purposes.

Fig. 4 is a fragmentary interior view of the closed box in Fig. 2d, showing the locking tab separated to permit opening the box.

Detailed Description of Preferred Embodiment

Turning first to Fig. 1, there is shown generally at 15 a box blank die-cut or otherwise formed from a suitable material such as corrugated board or the like. The box blank 15 includes a number of distinct panels defined by the several score lines 16a ... 16h formed in the board while forming the blank, in a manner known to those skilled in the art. The distinct panels include the bottom panel 17 flanked by a pair of side panels 18 and 19 across the respective lengthwise score lines 16g and 16h, and a top panel 20 contiguous to the side panel 19 across the score line 16a. A glue flap 21 adjoins the opposite side of the side panel 18, across the score line 16b at one edge of that side panel. The box blank 15 may be fabricated from any corrugated or noncorrugated paperboard, or from nonpaper material suitable for box production.

Adjoining the ends of the bottom panel 17 and separated therefrom by the two score lines 16c are the two end panels 24 and 25. A pair of corner flaps 26 flank the end panel 24, separated therefrom by the cut lines 27 perpendicular to the score line 16c and defining the sides of that end panel. Each corner flap 26 further is defined by the score lines 16c', comprising an extension of the score line 16c and also defining ends of the side panels 18 and 19. A second pair of corner flaps 26 likewise flank the end panel 25 at the opposite end of the box blank 15.

Separate flaps 29 and 30 are formed at the terminal ends of the end panels 24 and 25. The flaps 29 and 30 preferably extend the width of the respective end panels 24 and 25 to provide the most effective closure of the box, as will become apparent. The score lines 16e along the end panels 24 and 25, parallel to the respective score lines 16c defining the end panels, define the respective flaps 29 and 30. Elongated slits 31 and 32 are formed in the respective flaps 29 and 30, paralleling the longitudinal dimension of those flaps. The slits 31 and 32 preferably are formed as cuts through the material of the box blank 15 without removing any significant amount of that material, and so the slits have minimal width.

8

The box blank 15 also includes a pair of secondary end panels 75 foldably connected to opposite ends of the top panel 20 by the score lines 16f comprising an extension of the score lines 16c in the bottom panel 17 and 16c' in the side panels 18 and 19. The secondary end panels 75 are substantially rectangular and have approximately the same size as the end panels 24 in the preferred embodiment. One end 77 of each secondary end panel 75 lies adjacent a corner flap 26, and an elongated cut 76 along the confronting side of each corner flap from the adjacent secondary end panels. The width of each cut 76 extends slightly into the end 77 of the secondary end panel 75 to provide clearance for folding the corner flap 26 at a right angle to the secondary end panel, as becomes evident below.

Turning now to Fig. 2, the box 32 shown in that figure is assembled from the box blank 15 by folding the box blank along the score lines 16a, 16b, 16g, and 16h so that the bottom panel 17, side panels 18 and 19, and top panel 20 bear an orthogonal three-dimensional relation to each other as shown in that figure. The top panel 20 overlays and is adhesively attached to the glue flap 21 to maintain the assembled configuration of the box 32. The details of fabricating box blanks from corrugated board or other materials, and producing boxes from such blanks, are well known to those skilled in the art and need not be repeated herein.

A central portion of each secondary end panel 75 is cut away to define an open space 35. One part of a locking tab 38 is located in the open space 35, with the remaining part of the locking tab extending into the adjacent end of the top panel 20. The score line 16f, forming an extension of the score line 16c and 16c', joins the secondary end panel 75 to the top panel 20 and defines a fold line along which the secondary end panel can fold relative to the top panel. The score line 16f thus also defines the forward edge 36 of the top panel 20.

The locking tab 38 has three distinct segments, starting with a shank 39 located in the top panel 20 and defined by a perforation line 40 in the top panel parallel to the score line 16f and

set inwardly from that score line. The two parallel cut lines 41, perpendicular to the perforation line 40 and extending outwardly from that line to intersect the fold line 16f defining an end 36 of the top panel 20, further define the shank 39. The perforation line 40 preferably is formed by perforations extending across the width of the locking tab 38. The perforation line 40 defines a hinge that allows the shank 39 of the locking tab 38 to bend relative to the plane of the top panel 20.

Joining the shank 39 of the locking tab 38 is the central panel 44 defined by the fold line 45 scored parallel to the perforation line 40 and inset from the score line 16f (and from the forward edge 36 of the top panel 20) by a lesser distance than the perforation line 40. The fold line 45 preferably is a cut at 45a along each end of its length. The use of a partially cut fold line 45, instead of an ordinary perforated fold line, to join the central panel 44 to the shank 39 is preferred because the central panel and the shank will undergo bending at an acute angle during the locking procedure as explained below.

The shank 39 also has at least one perforation 95 intersecting the respective cut lines 41 and located on an imaginary line between the perforation line 30 and the fold line 45. The perforations 95, although aligned parallel to the perforation line 40 and fold line 45, are not intended to define a perforated fold line for folding the shank. However, the perforations 95 do impart a region of structural weakness to the shank 40 between the perforation line 40 and fold line 45.

Two additional perforated lines 42a and 42b, together having the appearance of an inverted V, are formed on the shank 39 of the locking tab. Those additional perforated lines assist in unlocking the box in a predetermined manner after the box is locked, as described below. One end of the perforated line joins the fold line 45 at a first point spaced inwardly from one cut line 41; that point preferably is at the inner end of the terminal perforation forming the fold line and interlocking the one cut line. The perforated line 42a extends on a generally diagonal path from the

10

first point to a terminal point 43 midway on the length of the imaginary line of the perforation 95. The perforated line 42b likewise has one end joining the fold line 45 spaced inwardly from the other end of the fold line, preferably at the end of the terminal perforation forming that other end. The perforated line 42b extends on a generally diagonal path mirroring the path of the perforated line 42a, and ends at the terminal point 43. The perforation 95, the terminal perforation of the fold line 45, and the diagonally-extending perforation lines 42a and 42b, thus cooperate to define the opening tabs T extending a short distance across the width of the locking-tab shank 39 from both sides of that shank.

The central panel 44 extends outwardly from the fold line 45 and beyond the forward edge 36 of the top panel 20 to join the front panel 46 across the partially-perforated score line 47, parallel to the fold line 45 and the perforation line 40. The front panel 46 thus is foldable relative to the central panel 44. A V-shaped notch 48 is cut into each side of the central panel 44 and the front panel 46, the apex of each notch aligned with corresponding ends of the score line 47 separating the front panel from the central panel. The central panel 44 and front panel 46 together form a locking panel 50 (Fig. 1) of the locking tab 38, and the notches 48 help guide the locking panel into the slit 31 of the flap 29 in a manner to be described. As best seen in Fig. 1, the sides 51 of the front panel 46 are flared outwardly toward the terminal end 49 of the front panel, instead of being perpendicular to the terminal end. This outward flare of the sides 51, together with the notches 48 formed between the central and front panels, help assist the locking panel 50 in entering the slit 31 of the flap 29, as described below.

Each locking tab 38 is formed in the box blank 15 by the perforation line 40 and the cut lines 41 in the top panel 20 as mentioned above, and by additional cuts in the secondary end panels 75. The terminal end 49 of the front panel 46 is formed by a cut line parallel to the terminal edge 80 of the secondary end panel, and spaced inwardly a distance from that terminal edge. A strip 82 of the secondary end panel 75, between the terminal end 49 of the

locking tab 38 and the terminal end 80 of the secondary end panel itself, thus bridges the open space 35 between the two end portions 81 of the secondary end panel. That bridging strip 82 ensures that the secondary end panel 75 remains a unitary element foldable on the score line 16f. The regions between the notches 48 on each side of the locking tab 38, and the confronting sides 85 of the open space 35 in the secondary end panel 75, are cut out as the box blank 15 is produced and remain as open spaces in the secondary end panel.

The width of the shank 39 between the two cut lines 41 is somewhat less than the corresponding width of the central panel 44 commencing at the fold line 16f and the forward edge 36 of the top panel 20. Those different widths produce the separate flanges 86 on each side of the central panel 44 comprising the locking tab 38. These flanges 86 are contiguous with the forward edge 36 of the end panel 20 and with the fold line 16f defining that forward edge. The purpose of the flanges 86 is discussed below.

After the box 32 is assembled as shown in Fig. 2a, that box may be closed and locked as described with reference to Figs. 2b and 2c. The corner flaps 26 first are turned inwardly 90° around the fold lines 16c' to extend across the open end 34 of the box. The secondary end panel 75 then is folded downwardly along the fold line 16f to the position shown in Fig. 2b to cover the corner flaps and the remainder of the open end 34. The locking tab 38 becomes separated from the plane of the secondary end panel 75 as that latter element is folded downwardly. The locking tab 38 may now be turned upwardly around the perforated line 40 to expose an open space 37 in the top panel 20, as shown in Fig. 2b, which is contiguous to the open space 35 in the secondary end panel 75. Next, the end panel 24 is folded upwardly around the score line 16c as shown by the arrow 56 to cover the end 34 of the box 32. The end panel 24 in this position is parallel to the secondary end panel 75 and located immediately in front of that secondary end panel. In this position, the flap 29 of the end panel extends over the forward edge 36 of the top panel 20 and overlaps a forward portion of that top panel, as seen in Fig. 2c.

12

When the end panel 24 is fully closed as shown in Fig. 2c, the flap 29 substantially covers the previously-exposed open space 35 in the top panel 20. The locking tab 38 may now be folded back on itself as shown in Fig. 2c, by folding the shank 39 rearwardly at the perforated line 40. The arrow 60 in Fig. 2c represents that movement. At the same time, the central panel 44 may be folded downwardly along the perforated line 45 to assume a nearly vertical attitude with respect to the top panel 20 and the flap 29. The front panel 46 in this position is folded back along the score line 47 adjoining the central panel 44, so that the outer surfaces of the locking panel 50 comprised by the front panel and central panel move toward each other as shown in Fig. 2c. This desired folding movement of the front panel 46 is shown by the arrow 63, Fig. 2c. The front panel 46 and central panel 44 of the locking tab 38 thus are folded accordion-fashion into closely-abutting contact with each other, although for illustrative purposes those panels are shown in Fig. 2c with greater separation.

With the locking tab 38 thus folded so that the shank 39 is angled upwardly from the top panel 20 and the central panel 44 and front panel 46 folded accordion-fashion to contact each other, the perforated line 47 is substantially aligned above the slit 31 in the flap 29 of the end panel 24. The notches 48 on both sides of the locking panel 50 now overlies each other to define the beveled corners 64 at each end of the folded score line 47. By exerting downward force on the top of the now-folded locking panel, as shown by the arrow 67, Fig. 2c, the folded locking panel enters the slit 31 as the shank 39 of the locking tab 38 returns toward a position closely overlaying the end flap 29 and substantially parallel therewith, Fig. 2d. The flared sides 51 of the front panel 46 also assist in guiding the locking panel 50 downwardly through the slit 31.

The distance between the perforated line 45 and the perforated line 47 across the locking tab 38 is marginally greater than the corresponding distance between the perforated line 47 and the terminal end 49 of the front panel 46. This difference makes the

13

length of the front panel 46 (measured in a direction parallel to the cut lines 41) marginally less than that of the central panel 44. As a result, the terminal end 49 of the front panel 46 becomes located a short distance below the perforated line 45 when the front panel is folded in the direction 46 illustrated in Fig. 2c to lie alongside the central panel 44. Thus, the terminal end 49 of the front panel 46 becomes pushed completely through the slit 31 when the locking panel 50 is pushed to the fully-engaged position shown in Fig. 2d, where the shank 39 is substantially parallel with the top panel 20 of the box. When the terminal end 49 of the front panel 46 thus clears the underside of the slit 31, the resiliency of the hinge provided by the perforated line 47 pivots the front panel 46 forwardly toward the end panel 24. The terminal end 49 of the front panel thus moves out of registry with the slit 31 and becomes lodged in the corner on the inner side of the fold line 16e where the flap 29 joins the end panel. This lodgement of the terminal end 49 thus captures the locking tab 38 on the inside of the box 32, securing the end panel 24 over the end of the box as seen in Fig. 2d and Fig. 3. It is now impossible to withdraw the front panel 46 from the slit 31, or to otherwise to disengage the locking tab 38 from the remainder of the box, without cutting or tearing some visible portion of the locking tab or otherwise mutilating part of the box such that tampering with the box becomes evident to an observer.

With the box 32 closed, the combined presence of the corner flaps 26, the secondary end panel 75, and the end panel 24 juxtaposed with each other across the end of the box effectively prevents anyone from prying or bending back the end panel in an attempt to see the contents of the box. The shank 39 of the locking tab 38 extends from the perforated line 40 to the slit 31 in the flap 29, and keeps the end panel 24 secured in place across the end of the box. Even if a person somehow manages to bend that end panel somewhat back from the end of the box, by deforming the end panel, the secondary end panel 75 remains in place blocking visual and physical access to the interior of the box.

Because the slit 31 in the flap 29 is longer than the widths of the central panel 44 and the front panel 46 making up the locking panel 50, that locking panel passes through the slit without interference with the flanges 86 at each end of the central panel.

5 The accordion-folded central panel 44 and front panel 46 make a tight fit while being pushed downwardly through the slit 31, but that slit preferably is long enough to permit the flap portions on either side of the slit to temporarily deform or deflect as the locking panel 50 moves through the slit.

10 Although the flanges 86 on the central panel 44 can pass through the slit 31 without interfering with the ends of that slit, the lateral extent of those flanges is greater than the corresponding width of the open space 37 remaining in the top panel 20 when the shank 39 is turned upwardly from the plane of the top panel. Figs. 1
15 and 3 best show this relationship between the width of the shank 39 between the parallel cut lines and the greater lateral extent of the flanges 86 that extend outwardly adjacent to the shank 39. Because the flanges 86 extend beyond the sides 85 (defined by the cut lines 41) of the open space remaining under the shank 39 is turned
20 upwardly, those flanges resiliently and deformably pass over the sides as the locking tab 38 is pressed downwardly through the slit 31 to lock the box closed. The leading edge 89, Fig. 2, of each flange 86 preferably is curved or angled outwardly from the score line 47 to the flange, to assist the flanges in moving past the interfering sides
25 85 of the open space. Once those flanges have moved past the sides, each flange resiliently expands to its original size and engages the underside of the top panel 20, effectively securing the locking tab 38 in place within the box 32 and preventing any nondestructive withdrawal of that locking tab.

30 The flanges 86 on the central panel 44 provide an additional measure of security for the locked box. If a person attempts to jimmy open the folded locking panel 50 by inserting a blade or other thin tool through the slit 31 of the locked box, either
35 of two results is likely to occur. The first likelihood is that the person probing with the thin tool will tear apart the perforated line

47, thereby separating the central panel 44 from the front panel 46 of the locking tab 38. If that separation takes place, the terminal end 49 of the front panel 46 no longer remains engaging the inside corner formed by the fold line 16e. However, the flanges 86 on the
5 central panel 44 continue to engage the underside of the top panel 20 at the sides 85 of the open space 37, between the cut lines 41, so that the locking tab 38 continues to hold the flap 29 secured over the end of the box as shown in Fig. 2d.

The second possible result of probing with a thin tool is
10 that the person actually may succeed in unfolding the locking panel 50 without rupturing the perforated line 47. This possibility is unlikely, particularly in boxes according to the present invention and fabricated from relatively stiff material such as corrugated board. Nonetheless, if unauthorized probing does succeed in moving the
15 front panel 46 downwardly within the locked box without rupturing the perforated line 47, the flanges 86 of the central panel 44 again remain in place engaging the top panel 20 at the sides 85 of the open space. This engagement prevents withdrawing the locking tab from the box, so that the box remains closed and locked.

The perforated line 40 securing the locking tab 38 to the
20 top panel 20 provides still another measure of security. That perforated line 40 is constructed to provide a predetermined amount of weakness to the hinge or fold line joining the locking tab 38 to the front panel. This predetermined amount of weakness does not
25 rupture or tear during normal operation of the locking tab, namely, turning the locking tab upwardly from the plane of the front panel 20 to begin locking the box, and the other normal manipulations of the locking tab as previously described. However, both the
30 perforated line 40 connecting the shank 39 to the front panel, and the perforated line 47 connecting the central panel 44 to the shank, are designed to tear apart, separating the respective elements of the locking tab, in response to applied force exceeding a predetermined amount, especially a tearing force applied to an end of either perforated line.

16

The selective separability of the perforated lines 40 and 47 make it virtually impossible to tamper with the locking tab without rupturing some part of that locking tab, thereby leaving irreparable evidence of tampering with the locked box. For example, if a person attempts to open the box by sliding a thin blade into the slit 31 of the flap 29 of the closed box to withdraw or dislodge the locking panel 50 from the slit, that prying movement exerts a tearing force on the perforation lines 45 and 47. At least one of those perforation lines will rip apart in response to force less than the amount that could forcibly pull the flanges 86 upwardly past their engagement with the edges on the top panel 20. The tampering person has opened the box, but has done so in a destructive manner providing clear evidence of tampering with the locked box. The selective separability of the perforated lines 40 and 47 also provides the added advantage of making it easier for an authorized person to open the locked box. The perforations 95 on the shank 39 of the locking tab 38 provide further protection from undetected tampering, because those perforations also may tear in response to lifting or tearing forces applied to the locking tab.

The locked box is intentionally opened by cutting the locking tab 38 or otherwise separating the locking tab from the remainder of the box, permitting opening the end panel 24 for access to the interior of the box. The opening tabs T defined in the shank 39 of the locking tab provide a predetermined and convenient way to separate the locking tab without resorting to a knife, scissors, or other improvised cutting tool. By grasping either opening tab T between a thumb and forefinger of one hand, a person can apply upward force to the opening tab while holding the box stationary with the other hand. That upward force tears the locking tab along the line of predetermined structural weakness defined by the respective perforation line 42a or 42b, and some tearing also may occur beyond the inner end of the perforation line 95 partially defining the opening tab T. Pulling up each opening tab T thus separates the shank 39 across half its width, so that the shank becomes separated from the remainder 105 of the locking tab as

illustrated in Fig. 5. That remainder 105 drops into the interior of the box, releasing the end panel for access into the box.

Although the disclosed embodiment uses a single locking tab and complementary slot located midway across each end, boxes according to the present invention alternatively can have more than one locking tab spaced from the sides of the top panel. In that alternative construction, each locking tab selectively engages a separate slot formed in a flap of the end panel. Two separate locking tabs, for example, permit two-point locking of the end panel and may provide greater locking integrity for pizza boxes or the like that have a relatively flat profile or are of noncorrugated or other less-durable material. That alternate arrangement of locking tabs at each end panel also laterally spaces the paired locking tabs from the midpoints of the end panels, so that each locking tab is less likely to interfere with the contents close to the midpoint of the box. Locking tabs according to the present invention also may be located on box panels other than the end panels as defined herein.

It will be understood that the foregoing relates only to a preferred embodiment of the present invention and that numerous changes and modifications therein may be made without departing from the spirit and scope of the invention as defined in the following claims.



18

Claims

1. A box that is lockable when closed, the box comprising:
- 5 a plurality of body panels interconnected to form a box;
- an end panel connected to a first said body panel to selectively close an end of the box, and having a flap extending to overlap an end of a second said body panel when the end panel closes
- 10 the end of the box;
- a slit located in the flap of the end panel;
- an open region in the end of the second body panel and substantially covered by the flap when overlapping the second body panel, so as to position the slit overlaying the open region;
- 15 a locking tab connected to the second body panel adjacent the overlapping location occupied by the flap;
- said locking tab having a fold line defining a locking panel for insertion in the slit;
- the locking panel having a central portion and a
- 20 fold line defining a terminal portion selectably foldable to lie alongside the central portion with the fold line thereby forming a leading edge of the folded locking panel;
- the locking panel with the terminal portion so folded being aligned for insertion by the leading edge through the
- 25 slit and the open region into the box whereat the terminal portion partially unfolds to abut the end panel, thereby locking the end panel to the second body panel to form a closed box; and
- a flange positioned on the locking tab to engage a surface of the second body panel adjacent the open region as the
- 30 locking panel is inserted through the slit and prevent withdrawing the central portion from the open region after the end panel is locked to the second body panel to close the box.
2. The box as in Claim 1, wherein the locking tab is
- 35 connected to the second body panel by a selectably separable region



19

of predetermined weakness allowing the locking tab to separate from the body panel in response to attempting to withdraw the locking tab from the slit after the end panel is locked, so that the attempted withdrawal becomes evident.

5

3. The box as in Claim 2, wherein:

the locking tab has at least one additional region of predetermined weakness spaced from the connection to the second body panel and operative to separate in response to force applied onto the locked end panel.

10

4. The box as in Claim 1, further comprising:

a secondary end panel extending outwardly from the second body panel and foldable to close the end of the box, so as to prevent a person from looking inside the box by pulling the end panel back from the end of the box.

15

5. The box as in Claim 1, wherein the slit is longer

20

than the width of the open region overlaid by the slit so that the folded locking panel can pass through the slit without engaging the flange on an end of the slit, when the locking panel is inserted through the slit into the open region.

6. The box as in Claim 1, further comprising:

25

a region of predetermined weakness formed in the end panel and disposed substantially perpendicular to the slit located in the flap of the end panel so that the end panel can tear along the region of weakness therein; in response to a pulling force exerted on the flap at one side of the slit,

30

whereby the locked box is openable.

7. The box as in Claim 4, wherein:

the secondary end panel is foldably connected to the end of the second body panel;



20

the locking tab is formed in one part in the second body panel and in another part in the secondary end panel;

the locking tab is connected to the second body panel along a fold line so that the locking tab becomes deflected
5 outwardly from the second body panel to reveal the open region formerly occupied by the locking tab; and

the flange extends outwardly from a side of the locking tab beyond the open region and thus extends beyond an edge of the second body panel defining the open region, so that the flange
10 deformably passes beyond the edge and is there operative to prevent withdrawing the locking tab from the open region.

8. The box as in Claim 1, further comprising:

means formed in the locking tab and defining an
15 opening tab extending at least partially across the locking tab so that the pull tab when grasped and pulled in a direction across the locking tab, separated the locking panel from the remainder of the locking tab,

thereby unlocking the end panel to permit opening
20 the box.

9. The box as in Claim 8, wherein:

the means comprises a first region of predetermined weakness extending from a first point on the
25 fold line to a terminus longitudinally spaced from the fold line;

a second region of predetermined weakness extending from a second point on the fold line to the terminus;
and

an opening tab defined in part by the first and
30 second regions, and by a weakened region extending from an edge of the locking tab part-way along a line substantially coextensive with the terminus of the first and second regions, so that grasping and pulling outwardly the pull tabs separates
35 the first and second regions from the locking tab,



21

thereby separating in a predetermined manner the locking tab from the remainder of the box.

8. A one-piece blank for producing a box that is tamper-evident, the blank comprising:
- two pairs of alternately disposed rectangular body and side panels connected on mutually parallel fold lines;
 - a pair of end panels, each end panel connected to one such body panel on mutually parallel second fold lines orthogonal to the first-mentioned fold lines;
 - at least one such end panel having a flap extending from an edge opposite to the connection to the one body panel and foldable relative to the one end panel along a fold line parallel to the second fold lines;
 - a slit located in the flap;
 - an open region in the other body panel and defined by edges on that other body panel, the open region being substantially covered by the flap of a box produced by the blank when the flap overlaps the other body panel to position the slit overlaying the open region;
 - a locking tab bendably connected, by a third fold line parallel to the second fold lines, to the other body panel;
 - the locking tab comprising a shank portion terminating in a locking panel having a central portion, and a front panel extending from a forward edge of the central portion and connected thereto by a tab fold line parallel to the third fold line;
 - the locking tab being located relative to the flap extending from the one end panel so that with the front panel folded upon the central portion to form a leading edge of the locking tab along the tab fold line and the folded locking tab inserted through the slit of the box produced from the blank, the front panel returns to a position inside the box such that a portion of the front panel abuts a surface of the flap and the end panel connected thereto, so that the one end panel of the box is locked to a body panel of the box to which the one end panel is not connected and cannot be withdrawn



22

without severing the locking tab or otherwise producing visible evidence of tampering; and

- 5 a flange extending outwardly from a side of the locking tab to engage an edge of the open region as the locking panel is inserted through the slit so as to prevent withdrawing the locking tab from the open region after the end panel is locked to the second other body panel to close the box.