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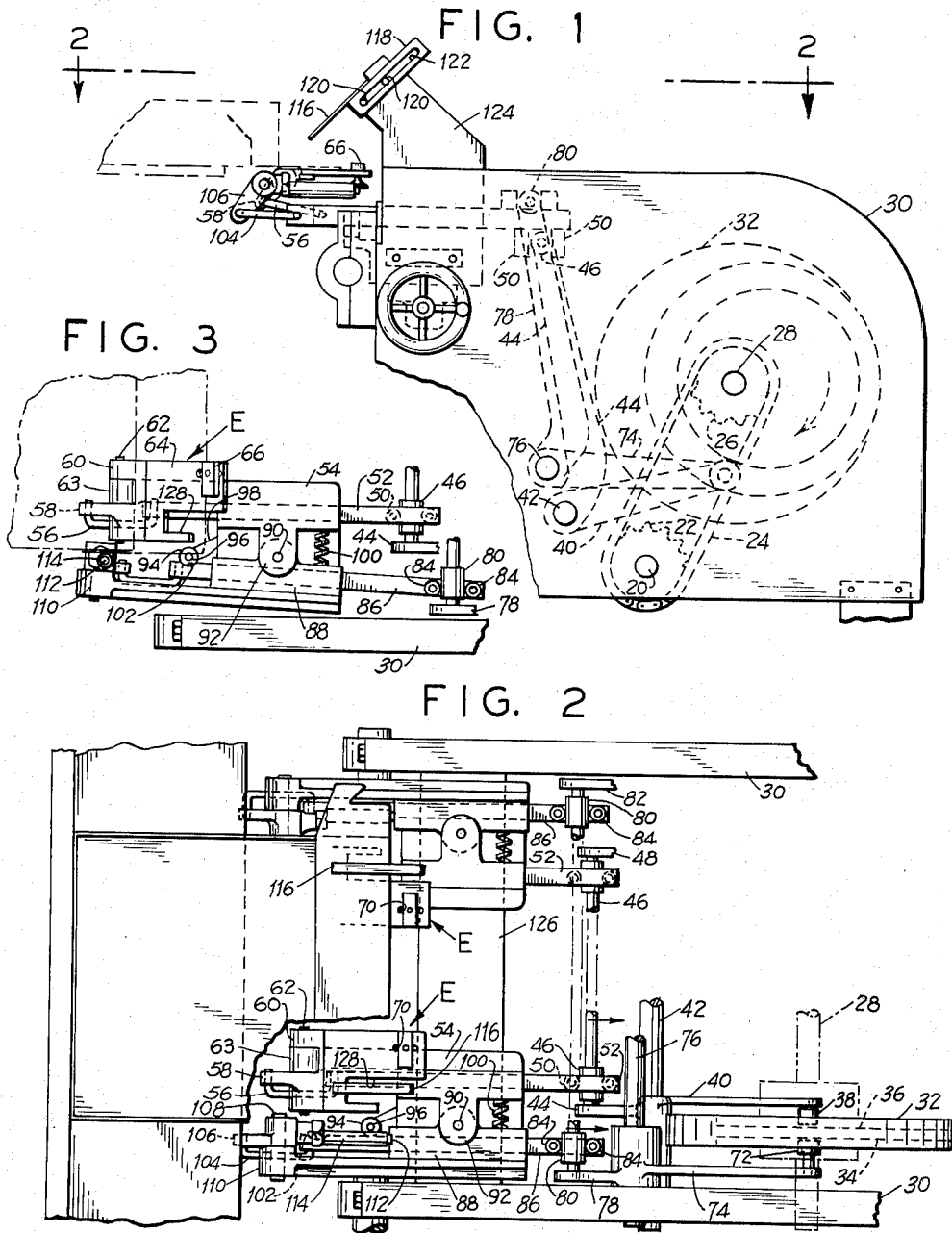
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3,234,859

BOX CLOSING MECHANISM AND METHOD OF CLOSING

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2 Sheets-Sheet 1



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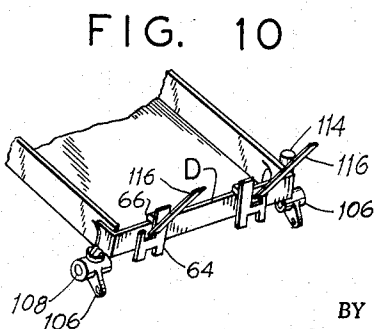
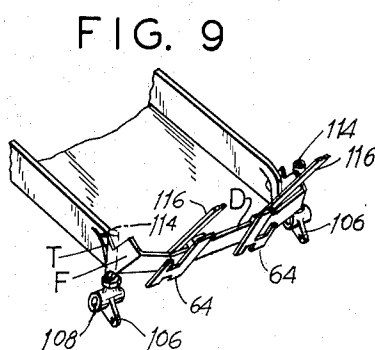
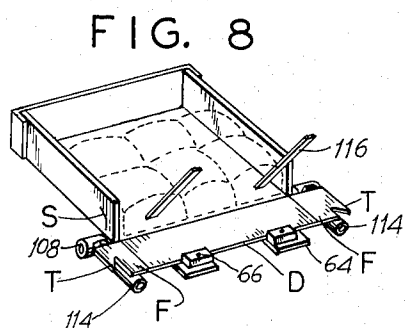
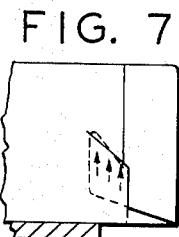
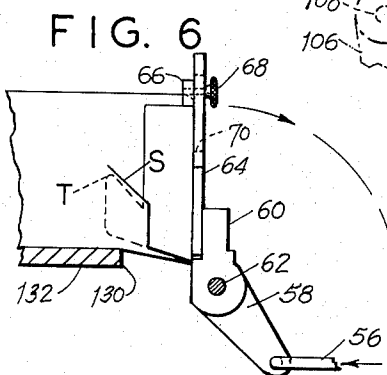
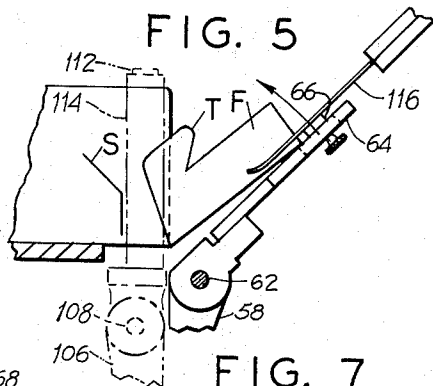
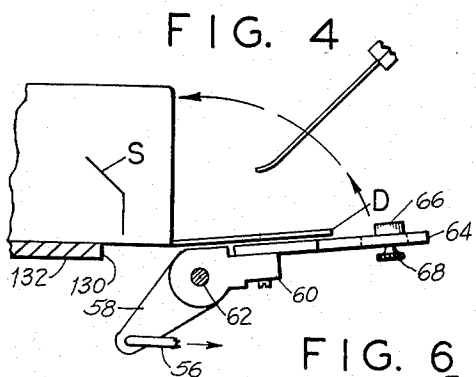
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BOX CLOSING MECHANISM AND METHOD OF CLOSING

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2 Sheets-Sheet 2



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3,234,859  
**BOX CLOSING MECHANISM AND METHOD  
 OF CLOSING**

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 8 Claims. (Cl. 93-49)

This invention relates generally to a package closing machine and more particularly to a machine for setting up and automatically securing any unerected side of a box to other sides thereof that have been previously raised and secured together.

This invention relates to improvements in the method of and apparatus for erecting cartons, and especially of the type of carton disclosed in Dunn Patent 3,120,730. In a machine such as shown in that patent a pair of upwardly facing locking tabs forming an integral part of the end flaps on the fourth unerected side of the carton are moved into registry with locking slots or slits formed in the adjacent previously erected side walls of the carton as the fourth side is moved to its fully erected position. However, with a Dunn carton it has been found that under some conditions there would be a clearance, say of one-sixteenth of an inch between the locking tab and its locking slot. This would allow the fourth side of the carton to rotate about its hinge with the bottom panel thereof during handling of filled cartons even though it was latched by the locking tabs to the side walls of the carton. This back and forth action of the fourth side of the carton can cause the tabs to become unlatched so that the carton will spill its contents and loss occur, which is a disadvantage.

In accordance with the novel method and apparatus embodied in the invention, the carton is so designed that when the fourth side has been disposed in its fully erected state, its locking tabs are secured against loosening and failure of the carton cannot occur. The relationship between the slits or slots in the side walls and the locking tabs on the end flaps of the fourth side of the carton is such that it is necessary to deflect a portion of the bottom of the carton in order to allow the locking tabs to be located below the locking slits or slots in the side walls of the carton for insertion and engagement therewith. When this pressure is removed the elastic resilience of the box causes the flaps to move upwardly which forces the locking tabs against the locking walls of the slits or slots. The inherent resilience of the carton maintains a locking force between the tabs and slots which prevents any substantial movement of the flaps. Thus my novel method insures against unlocking of the flaps and an extremely rigid carton results.

The invention embodies a novel carton or box having a bottom panel, side walls, a rear or third wall and a fourth or front wall. Each of the side walls is provided with an elongated vertical slit extending substantially parallel with the front edge thereof, and spaced inwardly therefrom. An angular elongated complementary slit connects with and extends upwardly from the top of the first-named slit and is of such length and so disposed that a locking tab formed on the end flaps of the fourth wall can be inserted into its adjacent slit in a side wall. This is done when a portion of the bottom panel is deflected downwardly such that the angularly inclined portion of the locking tab can be inserted into the angular slit in the side wall. The greater angularity of the top of the locking tab insures its firm, yet resilient locking engagement in the slit in the side wall.

It is an object of the invention to provide a novel carton or box having means for insuring a firm yet resilient

coaction between the locking tabs on the end flaps of the fourth wall or side of the carton and the slits in the front ends of the side walls thereof.

It is an object of the invention to provide a novel method of and apparatus for securing end locking flaps on one side of a carton in locking relationship with adjacent sides such that unlocking of tabs on the end locking flaps is practically eliminated.

It is a further object of the invention to provide a novel method of and machine for erecting the fourth side of a carton in such manner that the fourth side when in erected condition is held by its locking tabs against substantial movement under all normal conditions of handling and its locking tabs will not become unlatched from the slits with which they engage in the adjacent sides of the carton.

With these and other objects not specifically mentioned in view, the invention consists in certain combinations and constructions which will be described fully hereinafter, and then set forth in the claims hereunto appended.

In the accompanying drawings which form a part of this specification, and in which like characters of reference indicate the same or like parts:

FIGURE 1 is a side elevation of the carton erecting machine embodying the invention,

FIGURE 2 is a plan view of the same, taken on line 2-2 of FIGURE 1,

FIGURE 3 is a partial plan view of one pair of carton erecting members illustrated in advanced position,

FIGURES 4, 5, 6 and 7 are partial side elevations illustrating the progressive movements of the erecting mechanism in erecting the fourth side of a carton,

FIGURES 8, 9 and 10 are isometric plan views illustrating progressive movements incident to the erecting and securing the fourth side of a carton in its erected state.

The present invention is readily adapted for use in a machine of the type disclosed in Dunn Patent 3,120,730 granted February 11, 1964. In the following description reference is made to that patent and only so much is disclosed herein as is necessary to a full understanding of the invention.

Referring to FIGURE 1 of the drawings the machine is driven from main drive shaft 20 which in turn is continuously rotated by a suitable means of power, such as a motor (not shown). As shown in FIGURE 2 the mechanism for erecting the fourth side of the carton and effecting the insertion of the locking tabs on the end flaps thereof into their respective slits or slots are designated generally E. There are two such mechanisms, one being provided for each end of the carton. Since the construction of each unit E is the same except that one is reversed with respect to the other, only one is described hereinbelow in detail.

Drive shaft 20 carries a sprocket 22 which through a chain 24 drives sprocket 26 mounted on cam shaft 28 supported at each end in suitable bearings provided in the main frame 30 of the machine. Secured to one end of the cam shaft 28 is a double faced cam 32 which has a cam track 34 on one side and a cam track 36 on the other (FIGURE 2). Cam track 36 is tracked by cam follower 38 pivotally mounted on the free end of cam lever 40 secured to transverse shaft 42 rotatably supported at each end in suitable bearings in machine frame 30. A folding plate actuating arm 44 extends upwardly from the hub of cam lever 40. This arm, at its upper free end carries one end of a horizontal transverse rod 46. The other end of rod 46 is supported by the free end of another arm 48 which is identical to arm 44 and also mounted on transverse shaft 42. Transverse rod 46, adjacent to arm 44, is positioned between and engaged by a pair of spaced vertical rollers 50 pivotally secured to the rear end and on the underside of a bar 52 which is slidably supported

in a stationary bracket 54. The front end of slide bar 52 is connected by link 56 to the lower free end of an arm 58 integral with and projecting from a folding plate supporting bracket 60 pivotally mounted on stud shaft 62 held by a suitable bearing lug 63 which is integral with and extends from stationary bracket 54. Secured to the top face of supporting bracket 60 is a folding or erecting plate 64. This plate at its upper portion carries an adjustably mounted transversely extending pressure bar 66, the position of which can be varied by means of thumb screw 68 extending through elongated slot 70 in erecting plate 64.

It will be apparent that the clockwise rotation of cam 32, as viewed in FIGURE 1, through cam lever 40, arm 44 and transverse rod 46 results in the horizontal rearward motion of slide bar 52. This movement of slide bar 52 causes erecting plate 64 on bracket 60 to turn in a counterclockwise direction, as viewed in FIGURES 1, 4, 5 and 6, from its down or substantially horizontal position to an upright vertical position thereby effecting the erection of the fourth side of the carton, the folding of the end tabs of said fourth side and the inserting and locking of said tabs in the previously erected upright adjacent side walls of the carton. This phase of the erecting and locking operation will be described hereinafter.

As mentioned heretofore, cam 32 is provided with two cam tracks. Track 34 is engaged by cam follower 72 pivotally carried by the free end of cam lever 74 mounted on a horizontal transverse shaft 76 supported at each end in suitable bearings in frame 30 of the machine. Extending upwardly from the hub of cam lever 74 is a folding roller actuating arm 78 which at its upper free end carries one end of a horizontal transverse rod 80. The other end of rod 80 is supported by the free end of another arm 82 which is identically the same as arm 78 and also mounted on the same transverse shaft 76. Transverse rod 80 adjacent arm 78 is engaged by a pair of spaced vertical rollers 84 which are pivotally secured to the rear end of the upper side of bar 86 which is slidably supported in guide bracket 88. This bracket is pivotally mounted on a vertical stud shaft 90 supported by forked bearing lug 92 integral with and extending from side of the stationary bracket 54 (FIGURES 2 and 3). A roller 94 mounted on stud 96 in lug 98 formed integrally with and extending outwardly from bracket 54 engages one side of slide bar 86. A compression spring 100 is located between bracket 54 and pivotally mounted guide bracket 88. The purpose and function of spring 100 is described hereinafter. The front end of the side edge of slide bar 86 which engages with roller 94 is provided with an indentation or notch 102. The front end of the slide bar 86 is connected by link 104 to an arm 106 which is pivotally supported by a stud 108 held by a suitable bearing lug 110 which is integral with and extends from the pivotally mounted guide bracket 88. Secured adjustably to the hub of arm 106 is a stud shaft 112 which pivotally supports an end flap folding roller 114. As shown in FIGURES 1, 2, 3, 8, 9 and 10 each flap folding roller 114 is rotatably supported on a pin projection at right angles from the hub of arm 106.

Referring to FIGURE 1, it will be appreciated that the clockwise rotation of cam 32, through cam lever 74, arm 78 and transverse rod 80 will cause slide bar 86 to have a horizontal rearward motion which causes folding roller 114 to move from its horizontal position shown in FIGURE 1, in a counterclockwise direction to its vertical operative position. Each end flap folding roller 114 is arranged to operate in conjunction with an angularly mounted leaf spring 116. As shown in FIGURES 1 and 5, each leaf spring 116 extends downwardly into the path of movement of the fourth side of the carton to be erected as a result of the upward swinging movement of the erector plates 64. Each leaf

spring 116 is secured to an adjustable slide member 118 manually operable to move the slide on screws 120 which engage with a slot 122 formed in the slide member which is supported by a suitable stationary bracket 124 fixed on a cross member 126 of the frame of the machine.

In the construction shown there are two erector plates 64 which are the same in construction and operation as mentioned hereinabove. If desired, a single plate could be used, but experience has shown that the two plates function to produce very satisfactory results. Each erector plate 64 is provided with a suitable cut-out or opening 128 which permits it to swing upwardly past leaf spring 116 during the fourth side erecting operation.

Cam tracks 34 and 36 in cam 32 are so formed that the movement of the flap folding roller 114 is slightly behind that of the erecting plate 64 at the initial stages of the erecting operation. However, roller 114 overtakes plate 64 at about the time when the free ends of leaf spring 116 engage the interior face of the fourth side of the carton. This causes each of the rollers 114 to engage with its adjacent end flap F on the fourth side of the carton and fold it upwardly, as indicated in FIGURE 9 about a pre-scored line in order to position the locking tabs T of the end flaps for insertion into a precut slit or slot S provided in the adjacent erected side walls of the carton.

During the continued upward movement of the fourth side of the carton by the erecting plate 64, the leaf spring 116 simply raises and slides over the top edge D of the fourth carton side. Due to the indentation 102 in the front end of the side edge of the slide bar 86 which transmits the oscillating motion to folding roller 114, the latter, shortly before reaching its upright and vertical position, is moved sideways (FIGURE 3) or inwardly towards and into engagement with the raised side of the carton and thus by the slight squeezing action opens the slit S to assure easy and positive entry of the locking tab T of the end flap F into slit S, as illustrated in FIGURE 9. Due to the location of stud shaft 72 which is the pivot of bracket 60 which carries erecting plate 64, pressure bar 66 on plate 64 engages the top edge of the fourth side of the carton shortly before plate 64 reaches its final upright position and gradually pushes the fourth side of the carton downwardly so that when reaching its final upright position the fourth side of the carton is vertically lower than the rest of the carton sides with the portion of the bottom panel of the carton adjacent the just erected fourth side also deflected downwardly from the front edge 130 of the conveyor plate 132, as illustrated in FIGURE 6. This down pressing of the fourth side of the carton while being erected permits the locking tabs T to enter easily in slits S and also assures a positive resilient locking of the tabs T with the side wall of the carton after the pressure bar 66 disengages from the top edge of the erected fourth side thereof. Thus, when this pressure is released, due to its resiliency, the downwardly deflected portion of the bottom panel is permitted to spring up again so that the top edge of the fourth side lines up with the top edges of the three other sides of the carton. The uplift also brings the top edge of the locking tab T past the top slit and thus prevents any possible disengagement of the locking tab from the slit and any accidental opening of the carton. If desired, the pressure bar 66 carried by each of the two pressure plates 64 may be replaced by a single long bar, not shown, with its ends adjustably secured to the two spaced pressure plates. This arrangement would permit the pressure applied to the top edge of the fourth side of the carton during erecting operation to be distributed over the entire length of said fourth side instead of only short distances adjacent the ends of the carton.

As shown herein for illustrative purposes only the angularity of the angular slit in the side wall of a carton can

range between say 40°-50° from the horizontal while the angularity of the top portion of tab T may range between 45°-55°. These figures are merely illustrative since the idea is to insure that the angularity of the top portion of tab T is always somewhat greater than the angularity of the inclined slit in the side wall of a carton into which tab T is inserted in locking relationship.

What is claimed is:

1. A machine for setting up the unerected fourth side of a four-sided box having integrally with said side a bottom panel to which said side is hinged and having the other three sides erected and secured one to the next and to said bottom panel, said fourth side having flaps respectively hinged to the extremities thereof, erected side ends respectively adjacent said flaps each having an opened tab receiving slit at a position spaced inwardly from the extremity thereof, each said flap having a locking tab insertable into the associated tab receiving slit to lock the associated sides in upstanding relation with respect to said bottom panel, comprising a fourth side erecting station to which a box is moved for the erection of said fourth side in a generally horizontal path of travel with three sides erected and said fourth side positioned in generally coplanar relationship with the bottom panel of said box and said means for supporting said bottom of said box and said erected sides against substantial vertical movement at said station, fourth side erecting mechanism located at said station, including means for folding said fourth side upwardly about its bottom panel hinge, means on said folding means for engaging the top edge of said fourth side prior to its movement to fully erected position and exerting a downward pressure on said fourth side causing the portion of said bottom panel adjacent said fourth side bottom panel hinge to be deflected downwardly, means for folding said flaps inwardly and directing the locking tabs thereon into their respective tab receiving slits in the adjacent previously erected sides of said box, and means for releasing said pressure on said fourth side whereby said bottom panel returns to its normal horizontal position and said tabs become locked in said slits in said adjacent side walls.

2. The machine defined in claim 1 wherein said fourth side folding means comprise at least one pivotally mounted plate, and wherein said means for causing said portion of said bottom panel of said box to be deflected downwardly comprises a transversely extending bar carried by said plate.

3. The machine defined in claim 1 wherein said means for erecting said fourth side comprise hinged folding members, and means adjustably mounted on said members positioned to engage the top edge of said fourth side of said box during the movement of said members in erecting said fourth side.

4. The invention defined in claim 2 wherein said flap folding means include a pair of pivotally mounted rollers engaging the end flaps of said fourth side and means for operating said rollers to fold said flaps and guide the locking tabs thereon into said slits in said adjacent box sides while said pressure bar maintains said portion of said bottom panel of said box in a deflected state.

5. The method of erecting the fourth side of a box having end flaps and locking tabs and inserting said locking tabs in firmly locked relationship in slits in the adjacent erected side of said box comprising supporting said box with its bottom panel and the unfolded fourth side disposed in common with a portion of said bottom panel of said box adjacent the hinge line of said fourth side ex-

tending beyond said support, folding said end flaps inwardly and folding said fourth side upwardly, applying pressure to said fourth side during its upward movement and thereby causing said portion of said bottom panel to flex downwardly, from a substantially horizontal plane, and while said portion of said bottom panel is so deflected inserting said tabs into said slits, and then releasing said pressure on said erected fourth flap whereby said bottom panel portion returns to its original planar position and said tabs lock firmly in said slits.

6. The method defined in claim 5 wherein the pressure applied to said fourth side is directed against the free longitudinal edge thereof, concurrently with the upward movement of said fourth side to its erected position.

7. The method of erecting the fourth side of a box having end flaps and locking tabs which engage in the adjacent box sides in slits erected to hold said fourth side in erected condition, comprising supporting said box with its bottom and unfolded fourth side hinged thereto in coplanar relationship with a portion of said bottom disposed for deflection relative to the remainder thereof, folding said end flaps of said fourth side inwardly and moving said fourth side upwardly towards erected position, deflecting said portion of said box out of its normal planar position during a part of the upward movement of said fourth side to its erected position, maintaining said portion of said box bottom in its deflected condition, inserting said tabs of said flaps into said slits in said adjacent erected sides and then releasing said deflected portion of said box bottom for resilient free movement to its initial planar position and thereby firmly locking said tabs in said slits against loosening.

8. The method of erecting the fourth side of a box having end flaps and locking tabs which engage in slits in the adjacent erected box sides and hold said fourth side in erected condition, comprising supporting said box with its bottom and unfolded fourth side hinged thereto in coplanar relationship with a portion of said box bottom adjacent said fourth side unsupported relative to the remainder of said box bottom, folding said end flaps on said fourth side inwardly and concurrently for a portion of its movement to its erected state moving said fourth side to its erected position, engaging the outer free edge of said fourth side during a portion of its movement to said erected position and applying pressure thereto to cause said unsupported portion of said box bottom to deflect out of its normal planar position, engaging said tabs in said slits and releasing the pressure on said fourth side so that said deflected portion can move back to its initial planar position and cause said tabs to lock firmly in said slits.

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