March 4, 1969 P. J. WOOD 3,430,413

ROTARY LOCKING MECHANISM FOR WRAPPER-TYPE CARTONS

Filed Oct. 24, 1966 Sheet 1 of 2

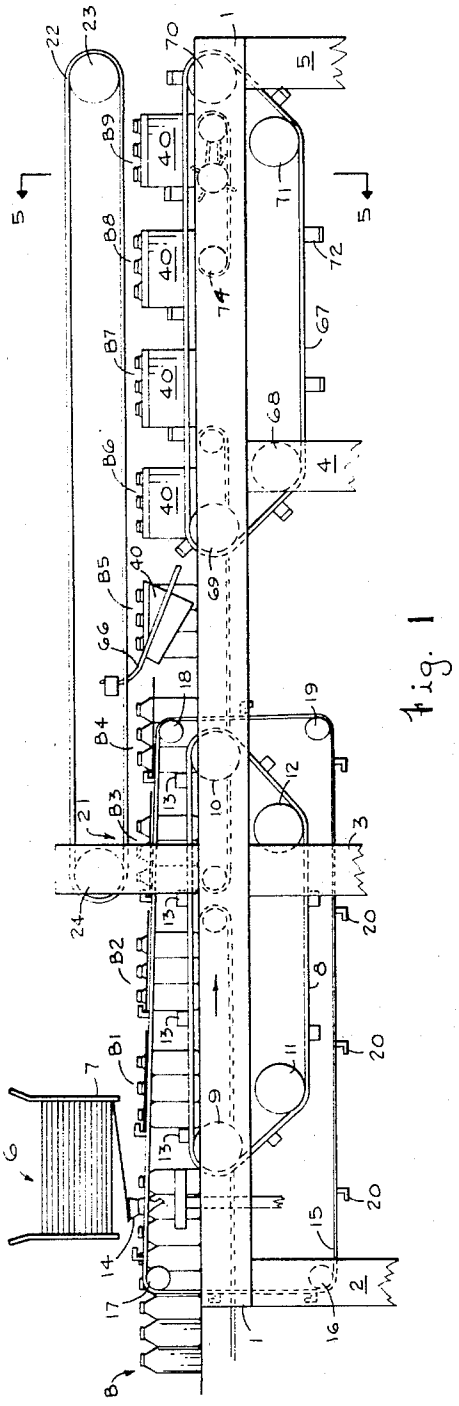

Fig. 1

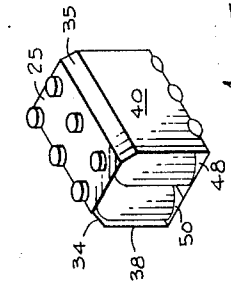

Fig. 3

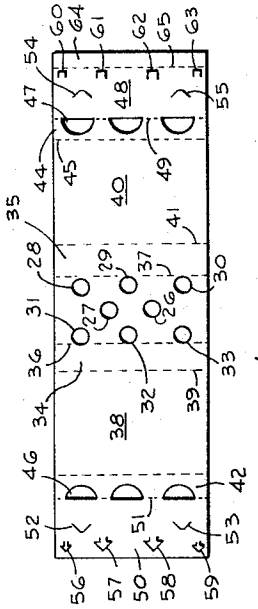

Fig. 2

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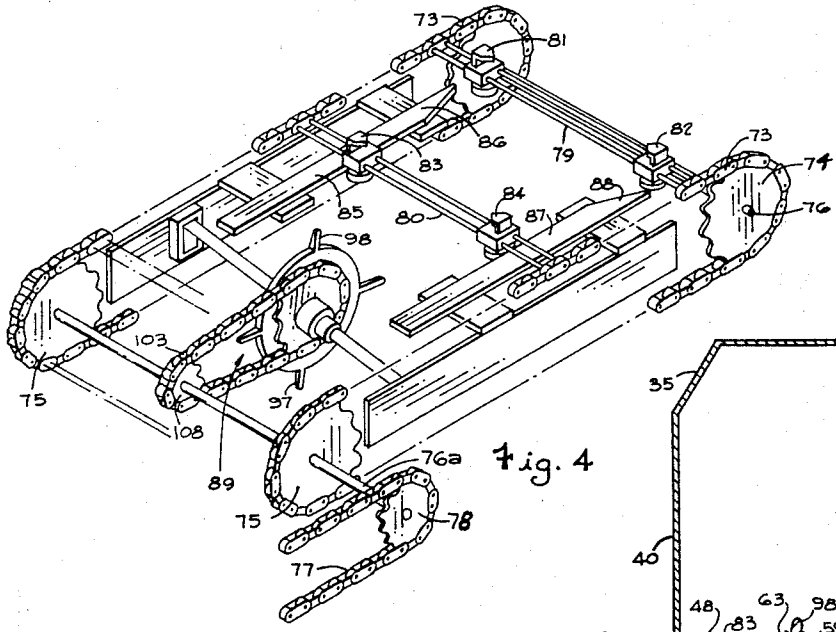

Fig. 4

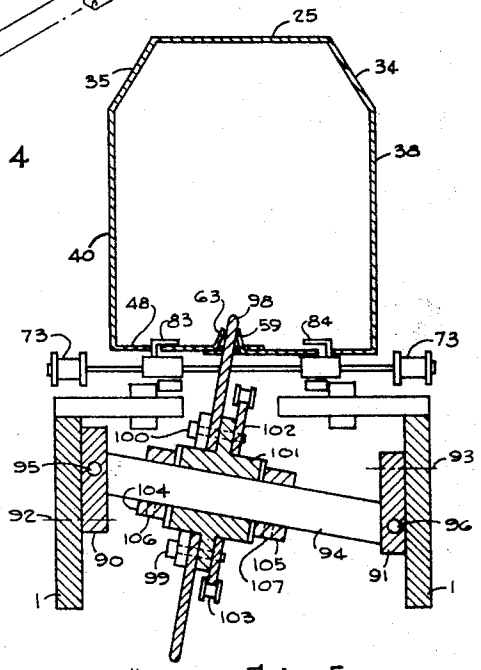

Fig. 5

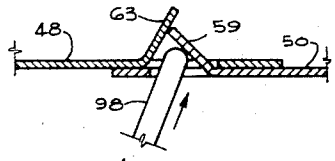

Fig. 6

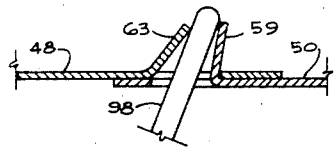

Fig. 7

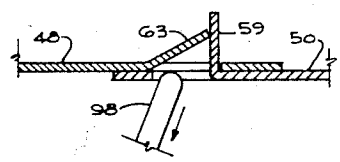

Fig. 8

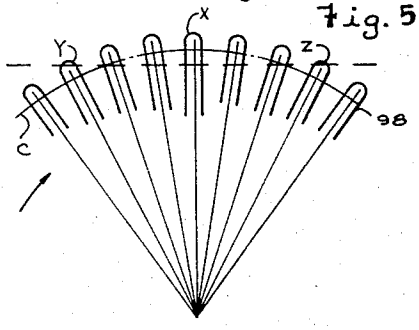

Fig. 9

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ROTARY LOCKING MECHANISM FOR WRAPPER-TYPE CARTONS

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U.S. Cl. 53—48 10 Claims
Int. Cl. B65b *11/10, 7/04, 5/06*

ABSTRACT OF THE DISCLOSURE

For driving a locking tab formed in a lap panel of a wrapper-type blank through an opening defined by a retaining tab disposed in a contacting lap panel and in coincidential and aligned relationship to the locking tab a rotary element having a radial tab engaging element is synchronized with movement of the blank so that rotation of the rotary element engages the locking tab at the right instant to perform a locking operation, the rotary element being rotatable about an axis which is disposed at an angle to the planes of the lap panels in which the locking and retaining tabs are formed so that when a locking operation is performed the retaining tab is disposed in a tilted, locking relationship to the locking tab upon the withdrawal of the radial tab engaging element.

This invention relates to rotary type locking mechanisms for wraparound cartons and more particularly to a locking mechanism for interlocking a locking tab in one panel with a retaining tab in another panel, the two panels being disposed in flat face contacting relation with the locking and retaining tabs initially disposed in coincidence with respect to each other.

United States Patent 2,841,279 discloses a carrier of the wraparound type in which locking tabs of the arrowhead type are disposed within openings defined by retaining tabs. Briefly stated the retaining tab is arranged with its free end in abutting relationship to the locking tab so that the locking tab is held at a substantial angle with respect to the two panels which are interlocked by the tab. By this means security of the lock is substantially enhanced.

A principal object of this invention is to provide an improved locking mechanism for use in conjunction with locking and retaining tabs and which is both simple and inexpensive to manufacture and to use as well as to maintain.

Another object of this invention is the provision of a locking mechanism for use in conjunction with wraparound type cartons which is capable of operating at unusually high speeds due to the fact that it is a rotary type device.

Still another object of the invention is to provide a specially constructed rotary locking mechanism which is adapted for manipulating a locking and retaining tab in the necessary sequence so as to form a secure lock of this type.

The invention in one form as applied to a wrapper type interlocking mechanism comprises a rotary locking element on which one or more radially disposed tag engaging elements are mounted, the axis of rotation of the locking device being inclined at an angle with respect to the plane of the panels to be interlocked and in which the locking and retaining tabs are formed. The inclined relationship

of the axis of the rotary locking device constructed according to this invention is particularly well adapted for manipulating locking and retaining tabs which are arranged in coincidental relationship to each other in such manner that the locking tab is first engaged and driven through the opening defined by the associated retaining tab. Thereafter withdrawal of the radial tab engaging locking element is such that the retaining tab is released into abutting relationship with the locking tab before the locking tab is released. Thus by this means the locking tab is ordinarily folded through an angle of more than ninety degrees while the retaining tab is folded through an angle less than ninety degrees. Thus when the locking element is withdrawn the desired interlocking relationship is established with the retaining tab disposed in a bracing angular relationship to the locking tab.

For a better understanding of the invention, reference may be had to the following detailed description taken in conjunction with the accompanying drawings in which FIG. 1 is a side view of a high speed packaging machine to which this invention has been applied; FIG. 2 is a plan view of a blank of the type to which the machine and method of this invention are particularly applicable; FIG. 3 is a perspective view of the completed package utilizing the blank depicted in FIG. 2 and showing six primary packages such as capped bottles packaged therein; FIG. 4 is an enlarged perspective view of the opposite side of the right hand end of the machine shown in FIG. 1 and which embodies certain essential elements of the invention; FIG. 5 is a cross sectional view taken along the line 5—5 of FIG. 1; FIGS. 6, 7, and 8 are enlarged sectional views similar to a part of FIG. 5 which depict sequential stages of a locking operation according to the invention; and in which FIG. 9 is a schematic diagram showing the pitch circle chosen according to the invention and its relationship to elements of the invention.

With reference to FIG. 1, the numeral **1** designates a transverse frame structure supported on vertical pedestals designated by the numerals **2**, **3**, **4** and **5**. It will be understood that the pedestals **2–5** are mounted at their lower ends on a suitable base structure. A plurality of carrier blanks of the type shown in FIG. 2 and generally designated by the numeral **6** are disposed above the machine in a suitable hopper structure designated by the numeral **7**. Primary packages such as the bottles designated by the letter B in FIG. 1 are introduced on a continuous conveyor or otherwise to the left hand end of the machine and proceed toward the right to the formation of a completed package such as is depicted in FIG. 3. During movement through the machine the primary packages B are arranged in a series of groups designated in FIG. 1 at B1, B2, B3, B4, B5, B6, B7, B8 and B9.

For the purpose of moving the bottle groups such as B1–B9 from left to right, an endless conveyor **8** is mounted in known manner on rotatable elements **9**, **10**, **11** and **12** which are supported by suitable shafts affixed to the frame of the machine in known manner. Secured to the conveyor **8** is a series of plungers designated by the numeral **13**. As is apparent from FIG. 1 the plungers engage a package group and impart movement thereto toward the right, it being apparent that the conveyor **8** and the rotatable elements on which the conveyor is mounted and which are designated by numerals **9–12** all rotate in a clockwise direction.

In order to withdraw the lowermost one of the blanks from the hopper 7, a suitable reciprocable suction plunger 14 is arranged to engage and draw downwardly such a blank so as to dispose the blank atop the immediately adjacent article group.

Once the lowermost blank 6 is withdrawn from the hopper 7, it must be moved in synchronism with one of the article groups such as B1. To this end, an endless conveyor 15 is suitably mounted in known manner on rotatable elements 16, 17, 18 and 19 and moves in a clockwise direction. The blanks 6 are engaged along their trailing edges by suitable hooks mounted on conveyor 15 and designated by the numeral 20. Thus, as the article groups such as B1, B2, etc., move toward the right an associated blank such as 6 is moved atop each group by the action of conveyor 15 and its associated hooks 20 in a manner well known in the art.

Once the particular wrapper 6 is properly oriented with respect to its associated article group such for example B3, suitable hold down mechanism serves to maintain the wrapper securely atop its associated group. Such mechanism is designated in FIG. 1 by the numeral 21 and simply comprises an endless conveyor 22 mounted on rotatable elements 23 and 24 which of course are mounted on shafts journaled in suitable bearings, the shaft for rotatable element 24 being journaled on frame element 3 while the shaft for rotatable element 23 is appropriately journaled on the boom 21.

The blank depicted in FIG. 2 comprises a top panel 25 having finger gripping apertures 26 and 27 and a plurality of apertures 28, 29, 30, 31, 32 and 33 for receiving the necks of the packaged primary articles. Of course, it may be desirable to utilize a top panel 25 which overlies the crowns of the packaged bottles in which event the apertures 28–33 of course would not be used. Sloping panels 34 and 35 are foldably adjoined respectively to the side edges 36 and 37 of the top panel 25 and conform generally with the shoulders of the packaged bottles. Side wall 38 is foldably joined to sloping panel 34 along a fold line 39 while a similar side wall 40 is foldably joined to sloping panel 35 along a fold line 41. Another sloping panel 42 is foldably joined to the bottom edge of side wall 38 along fold line 43 and a similar sloping panel 44 is foldably joined to the bottom edge of side wall 40 along fold line 45. Formed in each of the sloping panels is a plurality of apertures 46 and 47 formed respectively in the sloping panels 42 and 44. These apertures are for receiving the lower portions of the packaged items to aid in securing the bottles as a unitary group. The bottom of the wrapper is a composite wall structure comprising the lap panel 48 foldably joined to sloping panel 44 along a fold line 49 together with a similar lap panel 50 foldably joined to sloping panel 42 along a fold line 51. The wrapper is tightened in known manner by suitable machine elements which enter the tightening apertures 52 and 53 in panel 50 and suitable opposed machine elements disposed in tightening apertures 54 and 55 formed in lap panel 48.

The wrapper is secured about the article group by locking elements 56, 57, 58 and 59 formed in lap panel 50 which are driven by machine elements through the openings defined by retaining tabs 60, 61, 62 and 63 formed in lap panel 48. A medial separator panel designated by the numeral 64 is foldably joined to lap panel 48 along a fold line 65. When the package is complete, panel 64 occupies a medial position in the carrier as depicted for example in FIG. 2.

Once a particular article group such as that designated at B4 is appropriately assembled and moved toward the right by plungers 13 and with an associated wrapper such as 6 disposed atop the bottle group, the bottle group is then in condition for subsequent package forming operations. Thus, as is designated at B5, suitable folding structure which may take the form of a guide or plow 66 or which might take some other known form, engages a side panel such as 40 and initiates the downward folding thereof. Such folding is substantially complete when the bottle group arrives at the position depicted at B6. Of course, the subsequent folding operations are effected by mechanism not shown and simply effect inward folding of lap panels such as are designated at 48 and 50 and suitable apparatus is employed to tighten the wrapper. Locking of the wrapper is effected according to this invention by driving the locking tabs 56–59 through the respective apertures defined by retaining tabs 60–63, the medial panel 64 being vertically disposed upon completion of the formation of the package.

The endless conveyor 67 is mounted for clockwise rotation on rotatable elements 68, 69, 70 and 71 which are mounted on suitable shafts supported by bearings which in turn are mounted on the frame of the machine. Suitable plungers are arranged on each side of the machine and are mounted on the conveyor 67. These plungers are designated generally in FIG. 1 by the numeral 72 and serve to move the packages toward the right in known manner.

For the purpose of tightening the wrapper about its associated group of primary packages B and as shown in FIG. 4, a pair of endless chains 73 are mounted for rotation on sprockets 74 and 75 rotatable about shafts 76 and 76*a* which in turn are journaled in suitable bearings mounted on frame 1 of the machine. Sprockets 74 and 75 are driven by an endless chain 77 which cooperates with a sprocket 78 mounted on shaft 76*a*.

Tightening elements or rods 79 and 80 are secured at their ends to the chains 73. Slidably mounted on rods 79 and 80 are tightening elements 81, 82, 83, and 84. The elements 81 and 83 engage a fixed cam 85 having a beveled cam entry surface 86. Tightening elements 82 and 84 engage fixed cam 87 having beveled entry surface 88. Thus as the tightening elements 83 and 84, 81 and 82 move from right to left as shown in FIG. 4 they engage the cams 85 and 87 and are moved inwardly toward each other, it being apparent that carton tightening element 83 moves inwardly toward carton tightening element 84 which likewise moves inwardly toward its fellow tightening element 83. Of course tightening elements such as 81 and 83 enter tightening apertures such as 54 and 55 while machine tightening elements such as 82 and 84 enter tightening apertures such as 52 and 53.

In order to interlock the lap panels 48 and 50 by driving the locking tabs 56–59 inclusive into and through the apertures defined by retaining tabs 60–63 respectively, the mechanism shown best in FIGS. 4–8, inclusive, and generally designated by the numeral 89 is employed according to this invention. The mechanism 89 comprises a pair of adjustably mounted shoe blocks 90 and 91 which are affixed by set screws 92 and 93 to the frame elements 1. These blocks 90 and 91 may be adjusted vertically and horizontally within limits. Secured to the shoe blocks 90 and 91 is an inclined shaft or support axis 94 which is secured by pins 95 and 96 to the blocks 90 and 91 respectively. Preferably the shaft 94 is inclined at an angle of about ten degrees from horizontal.

The rotary device constructed according to this invention may comprise one or more radially disposed tab engaging elements 97 and 98 mounted by bolts 99 and 100 respectively to rotatable hub 101 to which is affixed a sprocket 102 which cooperates with a flexible driving chain 103. Hub 101 is held in the desired position on fixed shaft 94 by a pair of collars 104 and 105 which are affixed to shaft 94 by any suitable means such as by set screws 106 and 107.

Operating movement which is synchronized with the other movable elements of the machine is imparted to chain 103 by a sprocket 108 which is affixed to and rotatable with the shaft 76*a*.

It will be understood that lap panel 50 ordinarily is disposed exterior to lap panel 48 and that the locking tabs such as 59 are disposed in general coincidence with their associated retaining tabs such as 63.

As is shown in FIG. 6 the radial tab engaging element **98** is in the process of driving the locking tab **59** through the opening defined by retaining tab **63**. As the operation progresses the radial locking element **98** moves to an extreme position as depicted in FIG. 7. In this position the locking tab **59** has been folded through an angle greater than ninety degrees as is apparent in FIG. 7. At the same time retaining tab **63** has been folded out of the plane of lap panel **48** through an angle substantially less than 90 degrees. Thus when the radial tab engaging element **98** is withdrawn from its extreme position depicted in FIG. 7 to its initial position, the locking tab **59** by virtue of its inherent resilience is disposed substantially vertically and the retaining tab **63** is arranged with its free end in abutting relationship to the locking tab **59**. Stated otherwise, the operation of radial tab engaging element **98** is accomplished according to this invention by the expedient of tilting shaft **94** at an angle to the planes of the lap panels **48** and **50** as is clearly shown in FIGS. 5, 6, 7 and 8. Thus according to the invention, there is no opportunity for the retaining tab such as **63** and the locking tab such as **59** to lie flat against each other and the panels **48** and **50** so that security of the locking arrangement is greatly enhanced.

Of course the rotary locking element generally designated at **89** must move in synchronism with movement of the carton and its associated primary packages. As is shown in FIG. 9 schematically, tab engaging element such as **98** is assumed to be rotating in a clockwise direction about the axis of shaft **94** and preferably is moving from left to right at the speed of the associated carton when the locking element **98** is disposed vertically as is designated at X. Of course when the tab engaging element **98** occupies a position to the left of X for example as it enters the apertures defined by locking tabs such as **59** and retaining tabs such as **63** the condition designated at Y obtains. Of course at this point the linear component of velocity of movement of the radial tab engaging element **98** from left to right is slightly less than the left to right movement of the tab engaging element when it occupies the position X. Of course to a lesser degree the same condition obtains when element **98** is disposed at one of the two positions shown in FIG. 9 and which are located between position X and Y. Likewise at position Z the element **98** is being withdrawn from the apertures defined by retaining tabs **63** and locking tab **59** and the carton is moving from left to right at a speed somewhat faster than the left to right component of movement of element **98**. Of course position intermediate those depicted at X and Z are to a lesser degree characterized by a movement which is somewhat less in velocity than is the velocity of the carton from left to right.

In order to effect a suitable compromise whereby the optimum conditions are achieved, a pitch circle C is chosen which when the element **98** occupies position X, the linear or tangential velocity of a point on pitch circle C is equal to the left to right speed of movement of the carbon. Thus portions of element **98** which are disposed outwardly from the pitch circle C and more remote from the center of rotation of the rotatable element **94** move slightly faster than the portions of element **98** which are on the pitch circle C. Similarly parts of element **98** which are located inside the pitch circle C and which are nevertheless disposed above the lap panels **48** and **50** move at slightly less velocity than the point on element **98** which coincides with pitch circle C. Thus by locating the pitch circle C approximately midway between the path of travel of the lap panels **48** and **50** and the outermost extremity of the element **98**, a desirable compromise is reached whereby an optimum condition of registry is obtained between element **98** and the associated openings in the two panels.

While a particular embodiment of the invention has been shown and described, the invention is not limited thereto and it is intended in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows.

I claim:

1. A locking mechanism for driving a locking tab formed in one panel through an opening defined by a retaining tab in another panel disposed in flat face contacting relation to said one panel said tabs being aligned and the free end of said retaining tab being initially adjacent the base of said locking tab, said mechanism comprising means for moving said panels along a predetermined path, and a rotary element having a radial tab engaging element arranged to engage said locking tab and to drive it against said retaining tab and through the opening defined by said retaining tab, said rotary element being mounted for rotation about an axis which is angularly disposed to the planes of said panels so that said radial tab engaging element forces said locking tab to swing through a substantial angle and past said retaining tab while causing said retaining tab to swing through an angle of less magnitude during a locking operation thereby to insure that said locking tab is braced at an angle to said panels by said retaining tab when said radial element is withdrawn from engagement with said tabs.

2. A locking mechanism according to claim **1** wherein said tab engaging element causes said locking tab to swing through an angle in excess of ninety degrees and wherein said tab engaging element causes said retaining tab to swing through an angle less than ninety degrees.

3. A locking mechanism according to claim **1** wherein said rotary element is immediately adjacent said locking tab with said retaining tab initially being on the opposite side of said locking tab from said rotary element and wherein the axis of rotation of said rotary element is tilted toward the free end of said locking tab and away from the base thereof.

4. A locking mechanism according to claim **2** wherein said panels are movable along a path which is transverse to said tabs and wherein said tab engaging element rotates in synchronism with and in the same general direction as the direction of movement of said panels during a locking operation.

5. A locking mechanism according to claim **1** wherein the angle at which the axis of said rotary element is disposed with respect to the planes of said panels is approximately ten degrees.

6. A locking mechanism according to claim **1** wherein the pitch circle point on said radial tab engaging element at which the instantaneous velocity is substantially equal to the velocity of said tabs and panels is spaced from the extremity of said tab engaging element by a distance approximately equal to one-half the total penetration of said extremity through the openings in said panels which are defined by said tabs.

7. A locking mechanism according to claim **1** wherein a plurality of sets of locking and retaining tabs are aligned for movement in following relation with one set of tabs behind another and wherein a plurality of radial tab engaging elements are mounted on said rotary element for sequential engagement with said sets of tabs the path of movement of said tab engaging elements defining ellipses when viewed in directions parallel and normal to the planes of said panels.

8. A locking mechanism according to claim **7** wherein the major axes of said elipse are equal and wherein the minor axis of the elipse as viewed in a direction parallel to the planes of said panels is greater than that viewed in a direction normal thereto.

9. A locking mechanism for driving a locking tab formed in one panel through an opening defined by a retaining tab in another panel disposed in flat face contacting relation to said one panel said tabs being aligned and the free end of said retaining tab being initially adjacent the base of said locking tab, said mechanism comprising means for moving said panels along a pre-

determined path, and a rotary element having a radial tab engaging element angularly arranged to engage said locking tab and to drive it against said retaining tab and through the opening defined by said retaining tab, the pitch circle point on said radial tab engaging element at which the instantaneous velocity is substantially equal to the velocity of said tabs and panels being spaced from the extremity of said tab engaging element by a distance approximately equal to one-half the total penetration of said extremity through the openings in said panels which are defined by said tabs.

10. A mechanism according to claim **1** wherein said

axis of said rotary element is aligned with said locking and retaining tabs.

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U.S. Cl. X.R.

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