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(54) Title: BAG WITH TAMPER EVIDENCING CLOSURE

(57) Abstract: A closure has at least one channel portion adapted to receive an interlocking profile portion. The channel has at least one window permitting visual inspection of a profile interlocked therein. At least one profile is disposed for interlocking with the channel and includes a stem joined to the closure and one or more latching projections formed by a frangible connection to the stem, wherein one or more projections are adapted to cooperatively interlock with the channel portion of the closure, thereby sealing the closure. In one closure, a tamper evident structure is included in the form of a slider having a shaver to engage in shaving contact with interlocking closure members when passed along the closure in a direction opposite to the closing direction. The various closure members can include different colors. The closures can be used on bag structures.

BAG WITH TAMPER EVIDENCING CLOSURE

This application is being filed as a PCT International Patent Application on 25 May 2005, in the name of Reynolds Consumer Products, Inc., a U.S. national corporation, applicant for the designation of all countries except the U.S. and Catherine E. Kettner, Steven E. Gradl, Michael E. Schreiter, Timothy James May, Greg W. Melchoir and Chad A. Hendricks; all U.S. citizens, applicants for the designation of the U.S. only, and claims priority to U.S. Application Serial No. 60/685,229, filed 26 May 2005.

Field of Invention

The invention pertains to a closure for a flexible package. More particularly, the invention pertains to a closure having tamper-inhibiting features which include indication that attempts have been made to open the closure putting a viewer on notice of potential unauthorized access of the contents of a package to which the closure is attached.

Reported Developments

Security bags, for example, those used to transport instruments of value, for example, currency, comprise a method of sealing the bag which inhibits unauthorized opening of the bag and unauthorized access to the contents of the bag. Such security bags are described in each of U.S. Patent Nos. 5,908,243 to Hanning, 5,631,068 to Smith, 5,620,256 to Makrauer, 5,407,277 to Burke, 5,352,041 to Fullerton et al., 5,350,238 to Bolton, 5,318,364 and 5,108,194 each to Raden, 4,491,196 to Edelman et al.,4,838,708 to Holcomb, and 4,653,113 to Taylor. To inhibit unauthorized opening and provide an indication that unauthorized access may have occurred tamper-inhibiting / tamper-indicating closures utilized in previous security bags have employed adhesives, for example, as described in U.S. Patent Nos. 5,108,194 to Raden, 4,491,196 to Edelman et al., and 4,838,708 to Holcomb, and/or selectively die-cut or selectively imprinted portions, for example, as described in U.S. Patent Nos. 5,631,068 to Smith, 5,620,256 to

Makrauer, 5,350,238 to Bolton, and 5,318,364 to Raden. Unfortunately, these chemical/mechanical systems can be defeated, for example, by the application of environmental conditions not typically experienced within their in-use environment, for example, exposure to extremes of heat or cold. Moreover, prior mechanical systems, for example selectively die-cut interlayers, are subject to being defeated by mechanical manipulation and/or do not leave readily apparent evidence of tampering. When defeated, these systems do not provide ready confirmation of unauthorized opening or attempted opening of the security package. Accordingly, previous security bag closures do not provide the desired level of tamper-deterrence. What is needed is a system of sealing a package containing valuables that provides a readily ascertainable indication of unauthorized opening. What is needed moreover is a tamper-indicating closure which has a high degree of reliability that the tamper-evidencing features are actuated when an unauthorized attempt is made to access the contents of the package.

These and other shortcomings are addressed by the closure of the present invention. The present invention provides a closure comprising interlocking elements which provide a seal. Additionally, at least one of the interlocking elements is adapted to fail when a force which is less than that sufficient to disengage the interlocked closure elements is applied to the sealed closure, thereby providing visual indication that the closure has been opened.

In one embodiment the present invention provides a closure which requires an implement, for example, a slider, to effect the initial sealing of the package to which it is attached, permitting the provision of a closure which provides a high closing force. In one embodiment, after utilizing a slider to seal the closure, the slider is removed from the sealed package. The slider track is adapted to impede reattachment of the slider after removal. In one embodiment the slider is adapted to cover the closure completely and after initially sealing the closure, remain in place, covering the closure. In this embodiment the covering slider is adapted to be unremovable without triggering an indicator of the removal attempt, providing the closure with alternate or additional tamper deterrence

Summary of the Invention

In one embodiment the present development provides a closure which has at least one channel portion adapted to receive an interlocking profile portion, and at least one oppositely positioned profile comprising:

i) a stem joining the interlocking portion of the profile to a flange of the closure;

ii) one or more latching projections joined by a frangible connection to the stem, wherein said one or more projections are adapted to cooperatively interlock with at least a portion of said channel, thereby sealing said closure,

wherein said frangible connection of said profile is selected to fail at an applied force which is less than sufficient to disengaged the interlocked channel and profile, thereby severing said latching projections from said profile

In one embodiment, the channel portion of the inventive closure is provided with a window which permits viewing of the interlocked latching projection of the profile, and accordingly, viewing the severed latching projection of the profile after an attempt has been made to access the contents of a package sealed by the closure, thus providing a visual indication of the attempted access. In one embodiment the interlocking portions of the latching projection and the channel are each provided with distinctive coloration which provides visual confirmation of their interlocked state, and serves to highlight a severed condition of the interlocking profile portion of the closure.

In one embodiment the closure profile has latching projections having a cross-sectional shape selected from the group consisting of: (1) a latching projection having a wing shape for example, that illustrated in Figure 1; (2) a latching projection having the arrowhead shape, for example, that illustrated in Figure 2; (3) a "C"-shaped latching projection, for example, that illustrated in Figure 3; and (4) a latching projection having a double arrowhead shape, for example, that illustrated in Figure 4, and wherein said channel has a cross-sectional shape selected to interlock with said latching projection(s).

In one embodiment, the frangible area of the connection between the one or more latching projections joined to the stem of the profile is provided by a die-cut groove penetrating the material comprising the profile. In one embodiment the interlocking profile is segmented. In one segmented embodiment, the profile comprises a series of evenly-spaced features with gaps interspersing each of the profile features. In one embodiment the features are regularly spaced. In one segmented embodiment the regularly spaced features are "button-shaped" when viewed in plan view.

In one embodiment the inventive closure comprises:

a) at least one channel portion adapted to receive an interlocking profile portion, said channel being characterized by having a window which permits visual inspection of a profile interlocked therein;

(b) at least one profile disposed for interlocking with said channel, said profile comprising:

i) a stem joined to the closure;

ii) one or more latching projections joined by a frangible connection to the stem, wherein said one or more projections are adapted to cooperatively interlock with said channel portion of said closure, thereby sealing said closure,

wherein said frangible connection of said profile is selected to fail at an applied force which is less than sufficient to disengaged the interlocked channel and profile, thereby severing said latching projections from said profile, and wherein said channel is joined to one leaf of a self-supporting bi-fold strip and said profile is joined to the other leaf of said bi-fold strip in a location such that folding said strip along the bi-fold line permits interlock of said channel and said profile.

In one embodiment, the bi-fold strip is joined to one wall of a bag opening and is disposed to capture both walls of said bag opening between said interlocked channel and profile. In one embodiment, the profile on the bi-fold strip is segmented. In one embodiment the opposite walls of the bag to which the bi-fold strip is joined have at least one pair of registered openings through which a portion of the segmented profile pass prior to

interlocking with the opposite channel. In one embodiment the profile comprises a regularly spaced series of profile segments, each of which passes through a pair of registered openings in the opposite walls of the bag opening to which the bi-fold closure is attached prior to interlocking with the opposite channel.

In one embodiment, the closures of the present invention comprise the opening of a flexible package. In one embodiment the flexible package is a bag. In one embodiment, the opening of the package comprises the closure which comprises a channel and a segmented profile defining a series of latching projections, wherein said projections are adapted to cooperatively interlock with at least a portion of said channel, thereby sealing said closure. In one embodiment the package comprises a bag having an opening to which the closure is attached, and wherein at least one portion of the segmented profile penetrates at least one pair of registered openings through the walls of said bag.

Brief Description of the Drawings

Figure 1A – Cross-sectional view of interlocking projections and channel of one closure embodiment

Figure 1B – Cross-sectional view of one embodiment of interlocked closure portions, attached security bag and slider.

Figure 1C – Transverse view of one embodiment of closure, slider, and attached bag illustrating single end stop.

Figure 2A – Cross-sectional view of one embodiment of the closure having an arrowhead-shaped interlocking projection and channel.

Figure 2B – Cross-sectional view of one embodiment of a frangible region employed with an arrowhead-shaped interlocking projection.

Figure 2C – Cross-sectional view of an interlocked arrowhead-shaped projection and channel affixed to bag opening.

Figure 3A – Cross-sectional view of an interlocked "C"-shaped interlocking projection and channel affixed to bag opening.

Figure 3B – Cross-sectional view of a "C"-shaped interlocking projection and channel employing alternative frangible regions.

Figure 4A – cross-sectional view of an interlocked "double arrowhead-shaped" projection and channel affixed to the opening of a bag.

Figure 4B – cross-sectional view of a "double arrowhead-shaped" projection and channel employing alternative frangible areas.

Figure 5A – Cross-sectional view of a bi-fold closure affixed to the opening of a bag in interlocked engagement.

Figure 5B – Cross-sectional view of a non-interlocked bi-fold closure affixed to the opening of a bag.

Figure 5 C – Overhead cross-sectional view of a segmented interlocking projection and channel.

Figure 5D – Plan longitudinal view of a segmented interlocking projection and channel with slider and end stop.

Figure 6 - Top plan view of an embodiment of a tamper-indent closure.

Figure 6A - Cross-sectional view of the closure of Figure 6, the cross-section being taken along the line A-A of Figure 6.

Figure 6B - Cross-sectional view of the closure of Figure 6, the cross-section being taken along the line B-B of Figure 6.

Detailed Description of Preferred Embodiments

It is believed that the closure of the present invention will be most beneficially employed when mounted on the opening of a security bag and used to seal access to the interior of the bag, for example, the opening of the plastic security bags described in any one of U.S. Patent Nos. 5,908,243 to Hanning, 5,631,068 to Smith, 5,620,256 to Makrauer, 5,407,277 to Burke, 5,352,041 to Fullerton et al., 5,350,238 to Bolton, 5,318,364 and 5,108,194 each to Raden, 5,491,196 to Edelman et al., 4,838,708 to Holcomb, 4,785,960 to Belisle, and 4,653,113 to Taylor, each of which is incorporated herein by reference.

The closure of the invention comprises several elements, including a pair of opposed interlocking portions, generally extending from a flange or formed sometimes from a base wall material, either of which is also described herein for convenience or a base material the interlocking of which seals the closure. The closure optionally employs a slider to assist interlocking the closure portions. Generally the slider is guided and supported by rails or other features appended to the flange material or base wall material, depending upon which is employed. The closure of the present invention incorporates into either the interlocking portions of the closure and/or the slider (if employed) at least one tamper-evidencing means. Next will be discussed the interlocking portions of the closure, thereafter, the slider, and finally, methods of preparing the closure.

THE INTERLOCKING PORTIONS

As mentioned above, the closure of the present invention comprises two interlocking portions which cooperate to close the opening of a package to which the closure is attached, for example, the opening of a security bag. With reference to Figure 1A, a cross-sectional profile of the interlocking portions of one closure embodiment is illustrated. The interlocking portions of the closure include a channel portion (10) and a profile portion (100) which has interlocking projections (101) and (102), which form the interlocking portion of the profile, is inserted into, and interlocks with the channel portion. The channel portion illustrated in Figure 1A comprises a viewing window (14) to which is affixed side walls (11) and (12). Affixed to the side walls is a second viewing window (13), which defines slot (15). Wall (12) and one face of window (13) also support seal area (16), attached thereto. Seal area (16) is used to attach the closure to one wall of a package. Profile (100) comprises stem portion (109) to which latching projections (101) and (102) are attached through frangible regions (103) and (104), respectively. Stem portion (109) is affixed to flange (110) which supports seal area (105) affixed also thereto. Seal area (105) is used to affix the closure to a wall of a package opposite to the package wall to which seal area (16) is affixed.

With reference to Figure 1B, the interlocking portion of profile (100) is interlocked with channel portion (10) by inserting the portion of the stem containing interlocking projections (101) and (102) into slot (15) until face portions (106) and (107) of latching projections (101) and (102) respectively engage faces (1) and (2), respectively of window (13). When engaged, the interlocked portions of the channel and profile can be verified by viewing through view windows (13) (between region "A-A") and (14) (between region "B-B"). In some embodiments, latching projections (101) and (102) are provided with a coloration, and the faces (1) and (2) of viewing window (13) can be provided with contrasting coloration such that when interlock between the profile and channel is complete, the latching portions (101) and (102) of the profile appear through viewing window (14) as a pair of colored parallel lines along the length of the closure. Such interlocking closure portions are described in further detail in each of U.S. Patent Nos. 5,356,222, 5,252,281, and 5,248,201, each of which is incorporated herein by reference in its entirety.

With further reference to Figure 1B, upon interlock, frangible regions (103) and (104) are subjected to stress. A force applied to the closure to disengage the profile from the channel will cause interlocking projections (101) and/or (102) to separate from stem (104) along the frangible region. This will cause the view of the interlocked profile through window (14) to change from a pair of parallel lines to a solid broad bar as the tension imparted to the interlocking projections upon interlock with the channel is release, forcing the severed interlocking projections against the inside face of viewing window (14). Stem (109) of profile (100) will not remain engaged along the length of slot (15). This will result in the view of the stem through view window (13) to no longer appear as a solid line. Accordingly, once the profile and channel are engaged, an attempt to disengage the two will result in severing of the interlocking projections of the profile, actuating the above-described visual indications that the closure was opened.

It is preferred if the dimensions of the various portions of the channel and profile are selected to require too much force to separate the parts to permit the slot from being enlarged sufficiently to permit disengage of the interlocked profile without severing the frangible regions and actuating the

visual tamper-indicating features of the closure or without rendering profound, and visually detectable, damage to the channel. It is preferred for frangible regions to be selected to fail under the application of insufficient force to disengage the interlocked closure portions.

With reference to Figure 1B and to Figure 1C, in general, the durometer rating and dimensions of the channel and profile will be selected such that the closure can not be conveniently sealed by utilizing digit pressure to press the profile and channel portions of the closure together. When higher pressure than can conveniently be supplied by finger pressure is required to interlock the closure parts, it is preferred to employ slider (17) to interlock the two. When a slider is employed, in general it is preferable to select a thickness for flange (110) which can accommodate a slider finger (111) of an extent sufficient to prevent the slider from being pried off of the flange or forced off of the flange during the stress of a sealing operation. Similarly, it is preferred to supply side wall (12) of sufficient dimension that face (3) accommodates slider finger (4) of sufficient extent to prevent the slider from being pried off or forced off of the side wall as well.

In some embodiments, the closure is affixed to a security bag (18), and is provided with an end stop (19). In an unused condition, the assembly is supplied with the slider positioned next to the end stop, which corresponds to a non-interlocked condition in the closure. As supplied, moving the slider in the direction indicated by arrow "C" in Figure 1C interlocks the channel and profile. In some embodiments no end stop is supplied opposite end stop (19), and upon sealing the closure, the user continues to slide the slider off of the closure and discards the slider. In general, slider (17) does not contain means to separate the interlocked closure portions, unlike conventional sliders which are adapted to alternately interlock and disengage the closure portions.

Figure 1, discussed above, illustrated a "wing-shaped" interlocking projection on the profile and a suitable channel with which it could interlock. With reference to Figure 2A, there is illustrated a cross-sectional view of another embodiment of the closure of the invention, an "arrow-head" shaped interlocking projection (201) on the profile (200) and a suitable channel (20) with which it can interlock. As illustrated in Figure 2A, channel (20)

comprises view window (24) to which is affixed walls (21) and (22). Depending from the free end of wall (21) and (22) are walls (23) and (26) which define slot (25). Wall (26) contains also a portion extending beyond wall 22 to which seal area 216 is affixed. With further reference to Figure 2A, profile (200) comprises arrowhead-shaped interlocking projection (201) affixed to stem (209) via frangible region (203). Stem (209) in turn is affixed to flange (210). Attached to flange (210) also is seal area (205). As illustrated also in Figure 2A, frangible region (203) can be provided by making a single die cut into stem (209) adjacent to interlocking projection (201) on the face of the stem proximal to sealing area (205). Alternatively, as illustrated in Figure 2B, frangible region (203) can be provided by making a pair of parallel die cuts one on each of the faces of stem (209) distal and proximal to sealing area (205). It will be appreciated that the "arrowhead" interlocking projection (201) illustrated in Figure 2A is less flexible than the "wing-shaped" interlocking projections (101) and (102) illustrated in profile (100) of Figure 1A. Accordingly, with reference to Figure 2A, walls (23) and (26) which define slot (25) in channel (20) have a cross-section of a thickness selected to provide suitable flexibility to permit interlocking projection (201) to be inserted a sufficient distance into slot (25) to permit faces (206) and (207) of interlocking projection (201) to engage faces (241) and (242), respectively of channel (20). In some embodiments, walls (241) and (242) are angled such that when engaged with interlocking projection (201) they are under tension. With reference to Figure 2C, this tension severs to exert a force directing interlocking projection (201) into the channel in the direction indicated by arrow "c". With further reference to Figure 2C, this force insures not only a tight seal along opening (250) of attached bag (253), but supplies force to impinge interlocking projection 201 against the inside surface of view window (24) should frangible region (203) be ruptured. As described above for the closure illustrated in Figure 1, the interacting portions of the channel and profile can be supplied with contrasting colored material to provide visual indication of interlock and rupture of the frangible region of the closure, giving in the latter event a visual indication of an unauthorized attempt to open the closure.

As illustrated in Figure 2C, some embodiments will employ a slider (217) to facilitate interlocking the channel and profile of the illustrated closure. As with the closure illustrated in Figures 1A through 1 C, it is preferred if wall thickness in the flange and channel portions which support the seal areas (205 and 216 respectively) are selected to be of sufficient thickness to accommodate slider fingers (252 and 251, respectively) having sufficient extent to prevent the slider from being pried off or forced off in use. As mentioned above for the embodiment illustrated in Figure 1, it is contemplated that some embodiments will employ a slider which is removed and discarded after it has been employed to initially seal the closure.

Figures 3A and 3B illustrate a cross-section of a profile having a "C"-shaped interlocking projection and a channel adapted for interlocking with the profile. Figure 3B illustrates the separated profile (300) and channel (30). Profile (300) contains "C"-shaped interlocking projection (301), affixed to stem (309) via a frangible region created by die-cuts 302 and 303. Stem (309) is affixed to flange (310) which has affixed to it also sealing region (305). The "C"-shaped interlocking projection (301) contains interdigitating fingers (306) and (307). Channel (30) comprises window section (34), side walls (31) and (32) from which depend L-shaped walls (33) and (36) respectively. L-shaped wall (36) extends beyond sidewall (32), and has affixed to it sealing area (316). L-shaped walls (33) and (36) define slot (35) and profile locking members (341) and (342). Channel (30) may optionally contain frangible areas (362) and (363) as an alternative to, or in addition to, one or more frangible areas on the profile. These optional frangible areas can be created by providing a die cut into the inside of the junction between side wall (31) and L-shaped wall (33) (illustrated as frangible region 362) and/or a die cut into the inside of the junction between side wall (32) and L-shaped wall (36) illustrated as frangible region 363. In this manner, the channel will fail along the frangible region provided by the die cut if it is subjected to prying, or other forces, in an attempt to disengage a profile engaged with the channel without rupturing the frangible region of the profile. Accordingly, such die-cut regions serve to provide readily identifiable visible evidence that an attempt has been made to defeat the tamper evidencing features of the closure. In general, a die cut can be placed

along a feature of the profile or channel in any location in which it is desirable to create a region which will fail if the feature is subjected to stress. From this description it will be appreciated that many variations on the placement of die-cuts can be worked to provide frangible regions which evidence tampering and be within the scope of the invention.

To interlock the profile and channel, interlocking projection (301) of profile (300) is inserted into channel (30) through slot (35) until profile interdigitating member (306) resides between channel sidewall (31) and locking member (341), and profile interdigitating member (307) resides between channel sidewall (32) and locking member (342). As illustrated in Figure 3A, when the profile and channel are interlocked in this manner, the opening of a bag attached to the sealing areas of the profile and channel is securely closed without placing the interlocking channel and profile parts under stress. However, the interdigitated portions of the channel and profile concentrate stress on these frangible regions if an attempt is made to extract the profile from interlock with the channel. This stress concentration occurs whether the frangible region is placed between the stem and the interlocking projections of the profile, in the inside junction between the side walls and the L-shaped walls of the channel, or both.

Figure 3A illustrates also that a frangible region can be introduced into the junction between the interlocking projection and the stem along the long axis of the stem (302A and 303A) or across the long axis of the stem, as illustrated by, frangible region (302) and (303) in Figure 3 B. As mentioned above with the other illustrated embodiments, in some embodiments aspects of the closure dimensions and materials will be selected which make it impractical to interlock the profile and channel using digit pressure. Accordingly, slider (317) can be employed to interlock the closure part. Conveniently, the closure can be disposed such that it is guided along the closure utilizing slider finger (351) along sidewall (32) of the channel (30), and slider finger (352) along the bottom of flange (310). As mentioned for the examples illustrated above, the interlocking portions of the profile and channel (30) can have complimentary coloration so that interlock can be visually confirmed by viewing the interlocked portions through window (34).

In addition, any unauthorized manipulation of the closure which severs the closure portions at the frangible regions will be visible through window (34).

Figure 4 A illustrates in cross-section a channel containing an arrowhead-shaped central interlocking projection (43) interlocked with a profile comprising double arrowhead-shaped interlocking projections (44). As illustrated, the channel contains locking members (401), (402), (403), and (404) which interlock with interdigitating members (411), (412), (413), and (414) on the interlocking projections of the profile. In the embodiment illustrated, channel (40) contains a window through which each interlocking projection of the profile can be viewed (windows 41 and 42). In like manner, the profile contains a viewing window (422) through which central interlocking projection (43) can be viewed when interlocked with the profile. Illustrated also in Figure 4A are frangible regions provided by die cuts (431), (432),(433), (434) and (435), which provide regions of failure in the interlocking members of both the channel and the profile. As illustrated in Figure 4B, these regions can alternatively be provided by placing corresponding die cuts in each side of the stem connecting the double arrowhead-shaped interlocking projections of the profile to the flange(432a and 432b), (434a and 434b), and in the stem of the central interlocking projection connecting the central interlocking projection to the channel (433a and 433b). As for the other examples described above, in some embodiments a slider (431) will be employed to interlock the channel and profile.

Figure 5 A illustrates in cross-section a closure comprising non-interlocked channel (50) and profile comprising a segmented interlocking projection (500). Figure 5B illustrates in cross-section interlocked channel (50) and segmented interlocking projection (500). As illustrated in Figure 5A, sidewalls 551 and 552 of package (550) to which the closure is attached contain at least one pair of openings in registration (553) and 554) through which interlocking projection (500) and stem (501) pass prior to interlocking with channel (50). Stem (501) contains also frangible region (502), which is ruptured upon application of a force directed at disengaging interlocking projection (500) from channel (50). With reference to Figure 5B, channel (50) contains window (51), which provides a clear area (between region A-

A) through which the interlocked profile and channel can be viewed. With reference to Figure 5C, in one embodiment the segmented profile is provided as a series of regularly spaced "buttons" (561a to 561f) that when interlocked with the channel appear as a series of regularly spaced shapes through window (51). As with the other embodiments illustrated above, attempts to separate the interlocked channel and segmented profile results in separation of the interlocking projections (500) from stem (502) with the result that the "buttons" no longer appear regularly "spaced" through window (50), providing visual indication of the unauthorized attempt to open the closure.

Figure 5D illustrates an overhead cross-sectional view of the "button-shaped" interlocking projections of the segmented profile illustrated in plan view in Figure 5C.

With further reference to Figure 5A, the segmented closure, and any of the other closures of the invention, can be supplied as a two part closure with the channel and profile fastened to separate flange portions, in the manner typical for interlocking closure strips, or joined to a bi-fold flange. A bi-fold flange can be provided either by mounting or molding the channel and closure on separate flanges and joining them at a common edge or by mounting or molding the channel and closure on a common base material and die-forming or die-cutting a folding line positioned to bring the profile and channel into interlocking registration when the base material is folded along the folding line. The fold line, or joining line in such bi-fold arrangements can be parallel to the long axis of the closure or perpendicular to it. Illustrated in Figure 5A and 5B is a base material with a bi-fold line (573) parallel to the long axis of the closure. Accordingly bi-fold closure (570) comprises leaf (571) onto which is mounted (or into which is molded) channel (50), leaf (572), onto which is mounted (or into which is molded) stem (501) and interlocking projection (500), and folding line (573), which is positioned to bring channel (50) and interlocking projection (500) into interlocking orientation when leaf (571) and (572) are folded together along folding line (573). When a bi-fold closure is employed, only one side of the base material (to which a sealing area can be affixed) need be fastened to the opening of a package opening. As illustrated in Figure 5A, in such an arrangement, flange (52) is attached to side wall (551) of bag (550), at a

location that places slot (53) of channel (50) in register with opening (553) in sidewall (551) of bag (550). To seal the package, leaf (572) is folded to bring interlocking projection (500) into register with channel slot (53) and bag wall opening (554). Applying the necessary pressure to the aligned part passes interlocking projection (500) through bag wall openings (554) and (553) and interlocks it within channel (50).

In general, when a bifold strip is employed, it will be made from a plastic which is stiffer than the bag material. When a bifold strip is employed, it is preferred to employ dimensions and design for the strip and/or materials having properties which provide a bi-fold strip that is self supporting. In some embodiments the bi-fold strip will be of a construction and made from materials which provide a rigid bi-fold strip.

The segmented profile can be provided by specifically molding a shaped profile, or it can be provided by milling or die-cutting away unwanted portions of a conventionally extruded continuous profile. In either manner, a profile can be provided which has everything from small gaps milled into it which can be used in conjunction with more or less rectangular holes, to "button-shaped" features which can be employed with round holes, for example, the mushroom-shaped profiles illustrated in Figures 5A to 5D. It will be appreciated that other arrangements of discontinuous profile shapes and bag-wall openings can be employed with equal effect.

As with the other embodiments discussed above, in some embodiments a slider will be necessary to provide the force required to interlock the interlocking portions of the closure. With reference to Figure 5B, slider (580) can be employed which utilizes a '"keyway" shaped channel as a guide. With reference to Figure 5C, in some embodiments the closure is provided with end stop (590) adjacent to closure (580), when the closure is in the unsealed state. End stop (590) maintains the closure on the unsealed container. After filling, the slider is operated in the direction indicated by arrow "C", interlocking the interlocking parts of the closure. After the closure is sealed, the slider is moved further along direction "C" and removed from the sealed package and discarded.

The material and dimensions of the interlocking portions of the closure are preferably selected to provide a closure which seals a package

opening to require a force of at least about 5 pounds to separate the interlocked portions of the closure, more preferably at least about 8 pounds, more preferably at least about 10 pounds, and more preferably at least about 15 pounds.

Preferably, the frangible regions are provided by strategic die cutting of the closure profile and/or channel interlocking portions. It will be appreciated that other methods such as selective perforation and the provision of weaker materials in frangible areas can be utilized. Preferably, frangible areas are selected to fail when a force is applied to the sealed closure which is less than sufficient to separate the interlocked portions of the closure.

Preferably, the physical properties of the materials from which the closure is constructed are selected to be sufficiently stiff to resist prying of the interlocking portions of the closure to disengage the interlocked portions without extensive, readily detectable damage to the closure portions subjected to prying, or activating the tamper-evidencing features of the closure. Materials of construction and methods are discussed in more detail below. Preferably, materials of construction of the inventive closure are selected to resist defeat through softening of the materials to permit mechanical manipulation to open the closure without activating the tamper evident features of the closure.

TAMPER-EVIDENCING SLIDER

In some embodiments the closure may comprise a conventional interlocking closure (one that does not employ frangible regions) with a slider which contains tamper-evidencing features. One example of this is slider (600) illustrated in Figure 6. Slider (600) is preferably selected to have a length (along section "A-A") which exceeds that of the closure over which it is operated. With reference to the cross-section along section "A-A" of Figure 6, the slider contains sealed end (601), which acts to encase the closure over which the slider is operated when the closure is in its sealed position. Moreover, the closure upon which slider (600) operates contains end stop (602), which serves to maintain slider (600) on the closure when it

is in the unsealed position (to the left as illustrated in Figure 6). Slider (600) contains also shaving means (603) for shaving off a portion of closure profile (604) if, after being operated in the direction indicated by arrow "E" to seal the closure, it is operated in the direct indicated by arrow "F" in an attempt to access the closure. The slider is also equipped with means (606) to divert the shavings (609) removed from profile (604) by shaving means (603) into chamber (608). The presence of shavings in chamber (608) can be verified by viewing the chamber through viewing window (607) provided in slider top (610). In some embodiments, the profile of the closure is preferably provided with a coloration, the viewing chamber comprising a contrasting color so that the presence of shavings indicating an unauthorized attempt to access the closure will be readily apparent.

Although many means will be readily apparent for shaving a portion of the closure, one shaving means, illustrated in Figure 6, comprises a sharpened projection resembling a plane blade molded into the underside of the slider contiguous with one wall of chamber (608). A more flexible L-shaped portion (606) fastened only to top wall (610) of slider (600) can be employed to divert shavings from the blade into chamber (608). Based on this description, other arrangements will be appreciated. While for some applications, the use of the above-described tamper-indicating slider alone may be adequate, other applications may use the slider in conjunction with one or more of the tamper-indicating closure described above.

METHOD OF MAKING CLOSURES OF THE INVENTION

Preferably, the closure of the present invention is made from a plastic material adapted for permanent attachment to a security bag to which it is attached. Preferably, the closure is fashioned from materials which resists prying, softening by heating, and embrittling upon freezing. One example of suitable material is polypropylene. Closures prepared from polypropylene are described in copending U.S. Patent Application No. 10/726,731 (the '731 application) filed December 2, 2003. The '731 application also describes methods of preparing closures utilizing these materials. The disclosure of the '731 application is incorporated herein in its entirety by reference and

each of the above-mentioned U.S. Patent Nos. 5,356,222, 5,252,281, and 5,248,201 are each incorporated herein by reference for their teaching in these matters.

Although the present invention closure is illustrated above affixed to a security bag and will find its broadest utility in conjunction with the provision of secure bags for packaging documents of value and currency, it will be appreciated that the present invention closure can also be employed with other flexible packaging materials to provide closure to other forms of flexible packaging and is not limited to use only with bags. In general, when used to seal the opening of a bag, the closure of the invention is attached proximal to the edge of the opening defined by the walls of the bag by a permanent means, for example, welding. In some embodiments it will be preferred to mold the closure portions directly from the web of material from which the bag walls are manufactured.

Having described the presently preferred embodiments, it is to be understood that the above is exemplary and is not meant to be limiting, moreover the invention may be otherwise embodied within the scope of the appended claims.

What is claimed is:

1. A closure comprising:
    a) at least one channel portion adapted to receive an interlocking profile portion, said channel being characterized by having at least one window which permits visual inspection of a profile interlocked therein;
    b) at least one profile disposed for interlocking with said channel, said profile comprising:
        i) a stem joined to the closure;
        ii) one or more latching projections joined by a frangible connection to the stem, wherein said one or more projections are adapted to cooperatively interlock with said channel portion of said closure, thereby sealing said closure,

    wherein said frangible connection of said profile is selected to fail at an applied force which is less than sufficient to disengaged the interlocked channel and profile, thereby severing said latching projections from said profile.

2. The closure of claim 1 wherein said channel is joined to one leaf of a self-supporting bifold strip, and said profile is joined to the other leaf of said bifold strip in a location such that folding said strip along the bifold line permits interlock of said channel and said profile.

3. The closure of claim 2 wherein said window portion of said self-supporting bifold strip is adapted to provide a guide supporting said slider.

4. The closure of claim 2 wherein said profile is a segmented profile.

5. The closure of claim 4 wherein the cross-sectional shape of the profile has a mushroom-shape.

6. The closure of claim 1 wherein said channel and said profile are formed on separate sheets of base material and subsequently joined together on at least one end.

7. The closure of any of claims 1 to 6 wherein said frangible region comprises at least one die cut into the material from which said profile is formed.

8. The closure of any of claims 1 to 7 in which each of said channel and said profile comprise a material having coloration.

9. The closure of claim 8 wherein each of said channel and said profile are selected to have a different hue, thereby providing visual indication of interlocked and tampered status.

10. The closure of any of claims 1 to 9 further characterized in that when interlocked, separation of the interlocked channel and profile requires an application of a force of at least about 10 pounds.

11. A bag comprising a closure of any one of claims 1-10; the bag including:

(a) opposing side walls; the closure being attached proximal to the edge of one of at least one of the side walls.

12. The bag of claim 11 wherein each said bag side wall contains therethrough at least one opening, in registration with an opening through the opposite wall, each said pair of registered openings being disposed such that when said profile and channel are mated at least one portion of said profile passes through at least on pair of registered openings.

13. The bag of any of claims 11 and 12 further comprising a slider.

14. The bag of claim 13 further including retaining structure oriented on an end of the closure, which when the slider is adjacent to said end, the closure is in a non-interlocked state; and an opposite end of the closure contains no construct to prevent the slider from being removed from the closure.

15. The bag of claim 14 wherein said retaining structure comprises a stop seal.

16. The bag of any of claims 11-15 wherein said closure has latching projections having a cross-sectional shape selected from the group consisting of: a latching projection having a wing shape; a latching projection having an arrowhead shape; a latching projection having a "C"-shape; and a latching projection having a double arrowhead shape, and wherein said channel has a cross-sectional shape selected to interlock with said latching projections.

17. A closure comprising an opposite pair of side wall members having proximal and distal faces, and a device for sealing said closure comprising:

a) at least one channel portion affixed to a proximal face of a first side wall member and adapted to receive an interlocking profile portion;

b) at least one profile affixed to a proximal face of a second side wall member disposed for interlocking with said channel, said profile comprising:

i) a stem joined to said proximal second side wall face;

ii) one or more latching projections joined to the stem, wherein said one or more projections are adapted to cooperatively interlock with said channel portion of said closure, thereby sealing said closure; and

c) a slider selected to have a length at least equal to the length of said closure interlocking channel and profile and adapted to cooperate with projecting portions of said distal faces of said opposite sidewall members of said closure, and which is characterized in being adapted to facilitate interlock of said channel and profile portions of said closure when passed along a closure having non-interlocked channel and profile portions, the slider comprising

1. a collection chamber disposed at the end of the slider which promotes interlock of said channel and profile;

2. a top window permitting visual inspection of said collection chamber;

3. a shaving and trap means proximal to said interlocking members of said closure and disposed such that said shaving means engages in sliding contact with said interlocking closure members when said slider is operated

along the closure in a direction promoting interlock of said channel and profile, and engages in shaving contact with said interlocking closure members when passed along the closure in the opposite direction;

4. an enclosed end opposite to the end of the slide containing said shaving means, said enclosed end abutting the closure when slider is operated to fully seal said closure; and

5. means to conduct shavings from interlocking closure parts removed by said shaving means from site of said shaving means contact into collection chamber;

wherein said closure further contains means to retain slider engagement with closure when slider is in a position corresponding to non-interlocked channel and profile portions.

18. The closure of claim 17 wherein said interlocking parts of closure have a coloration distinguishing them from the slider collection chamber.

19. The closure of claim 17 further characterized in that when interlocked, separation of the interlocked channel and profile requires an application of a force of at least about 15 pounds.

20. A bag having an opening comprising the closure of any of claims 17-19.

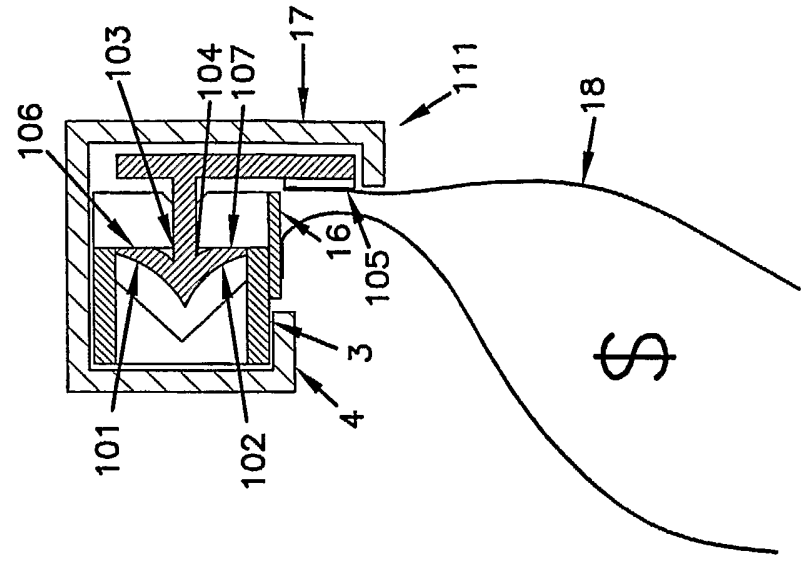


FIG.1B

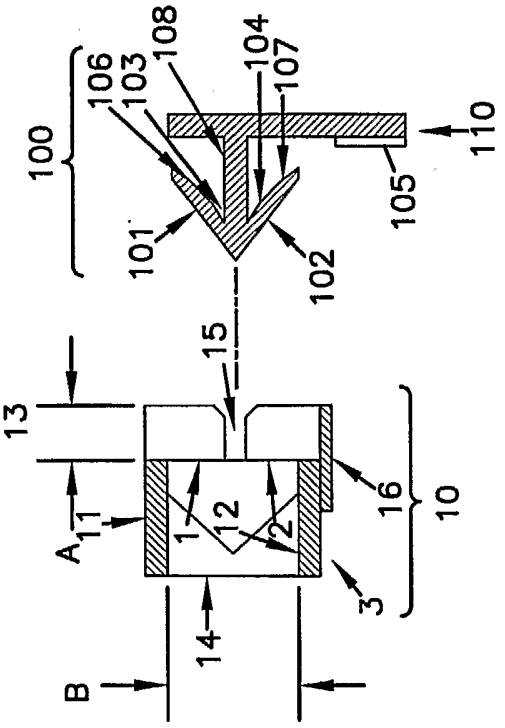


FIG.1A

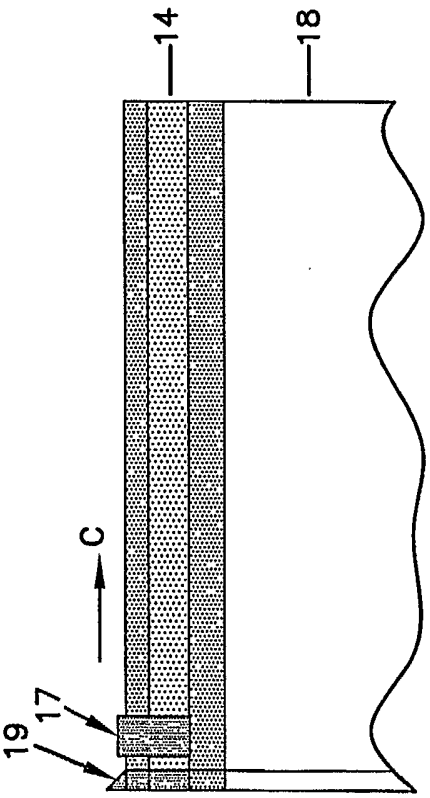


FIG.1C

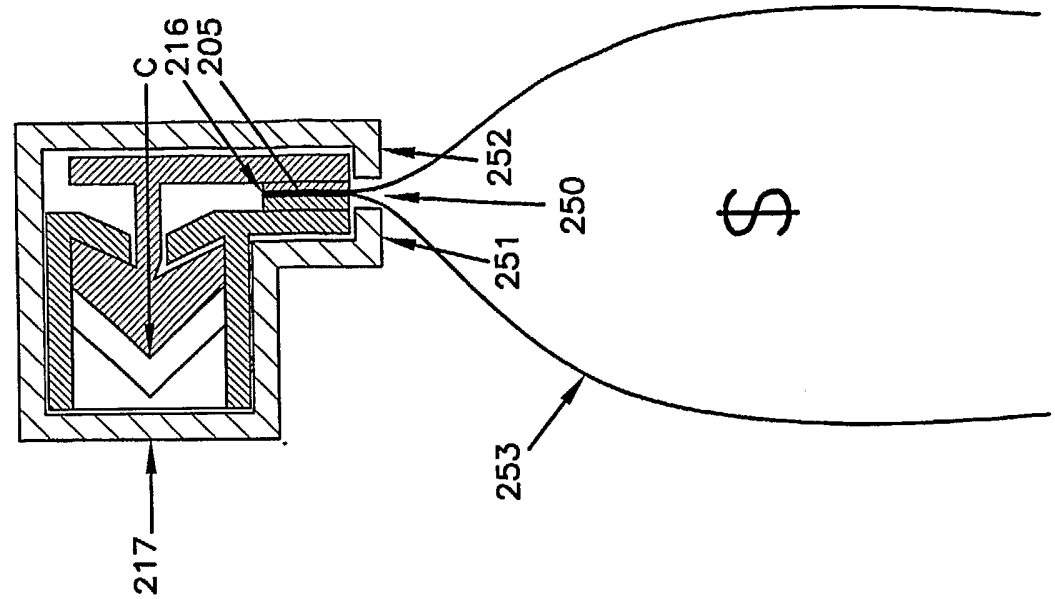


FIG.2B

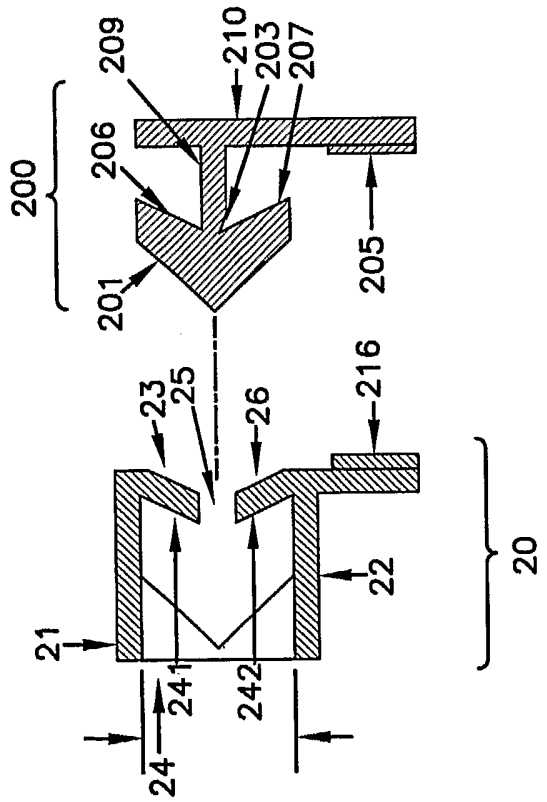


FIG.2A

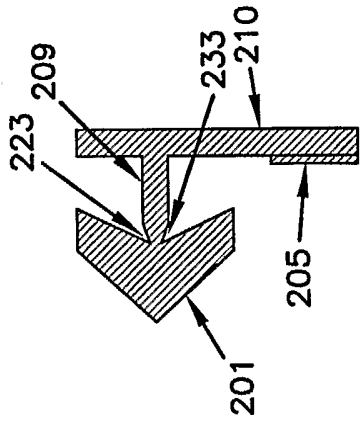


FIG.2C

FIG.3A

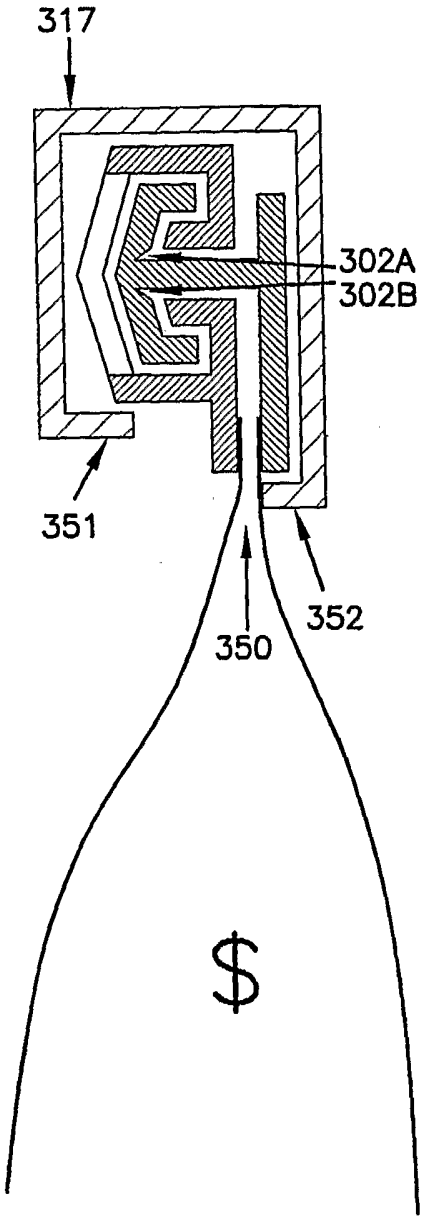

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302B
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350
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FIG.3B

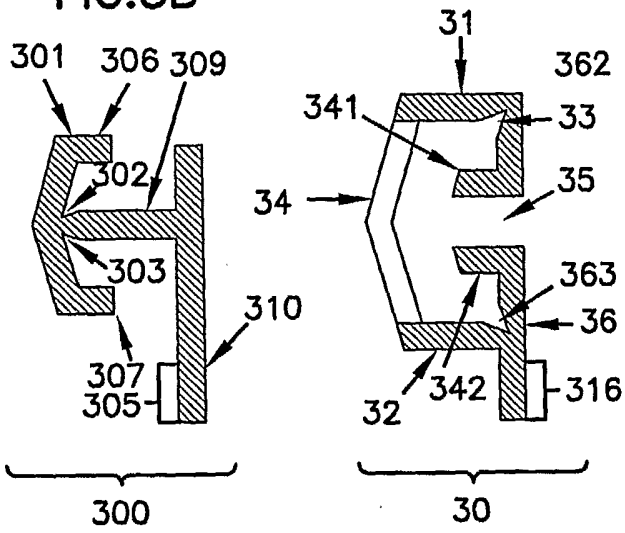

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FIG.4A

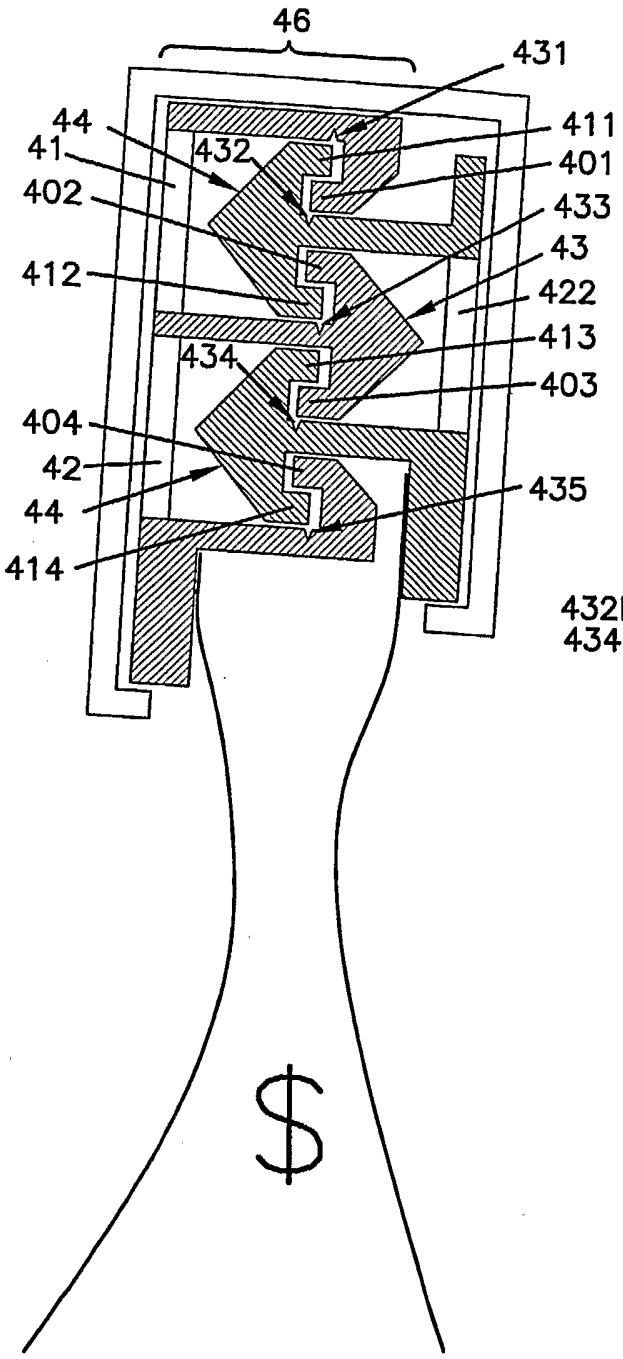

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FIG.4B

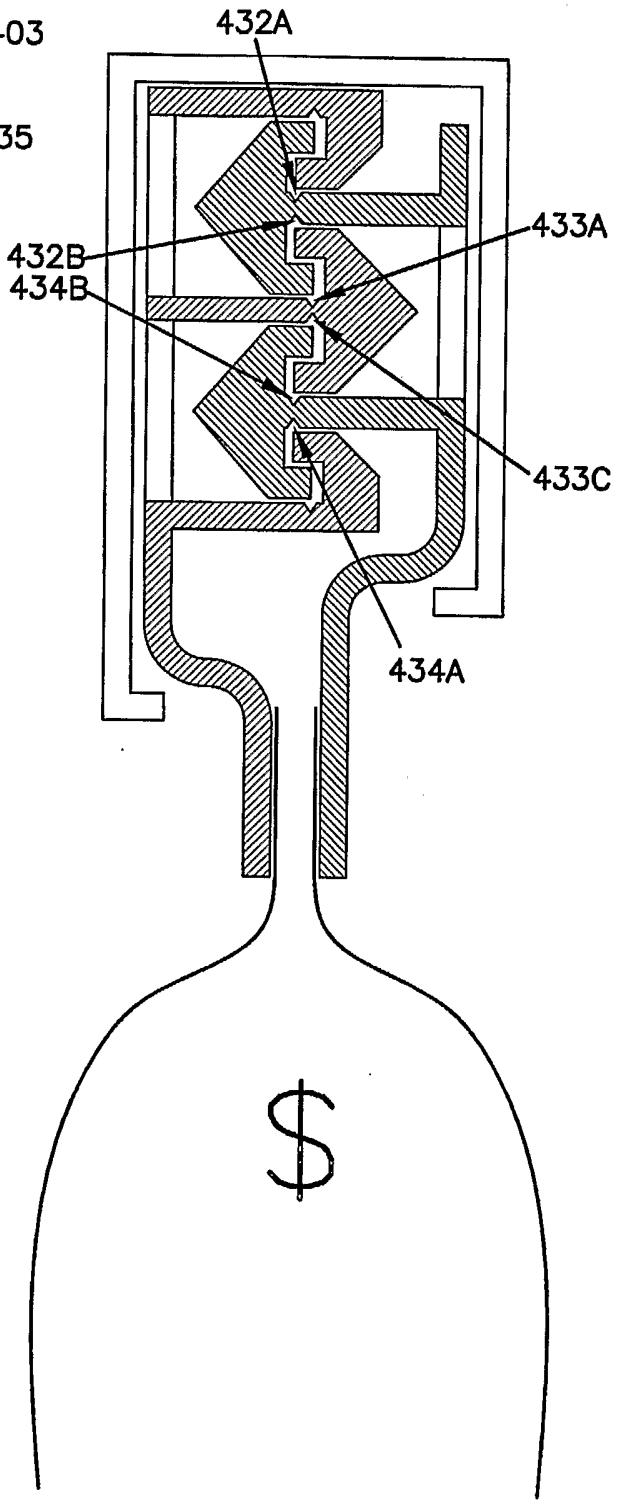

432A
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434B
433C
434A
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FIG.5D

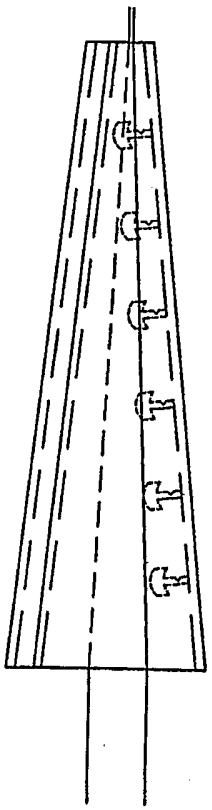


FIG.5C

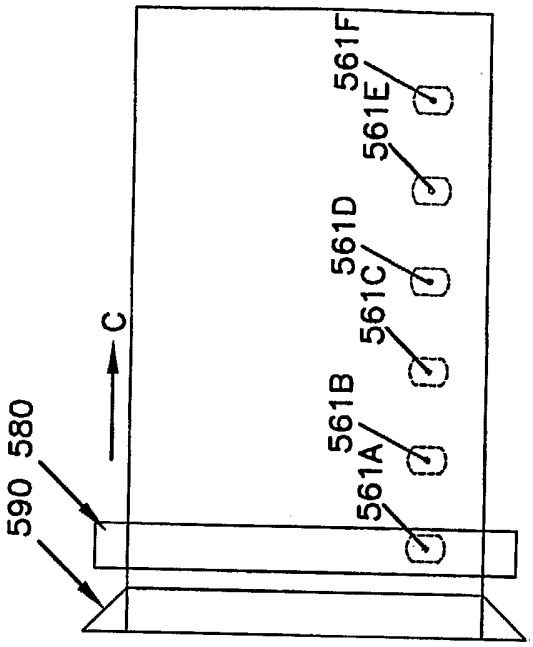


FIG.5A

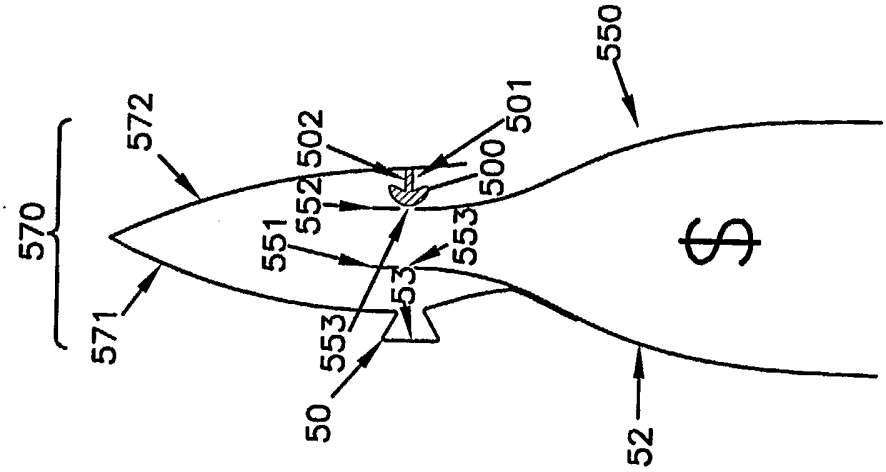
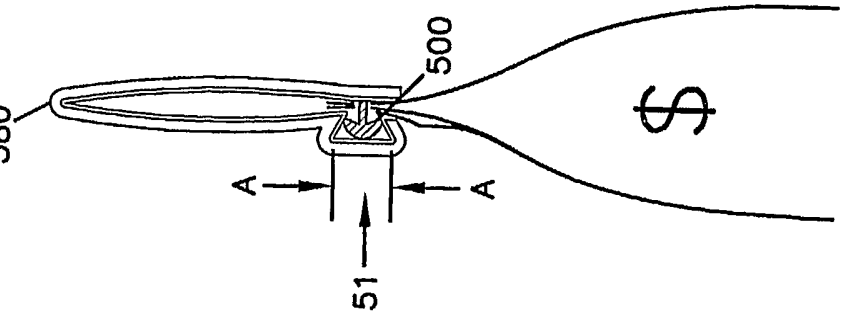


FIG.5B



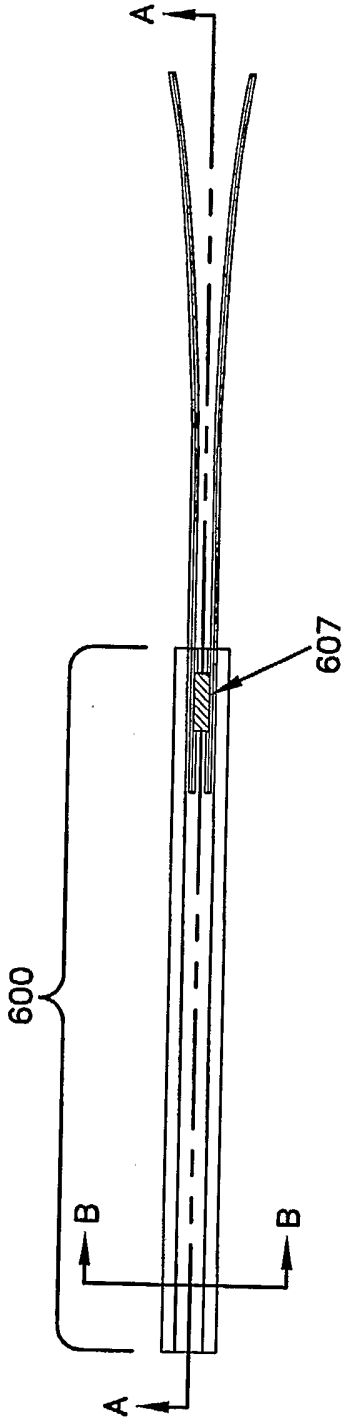


FIG.6

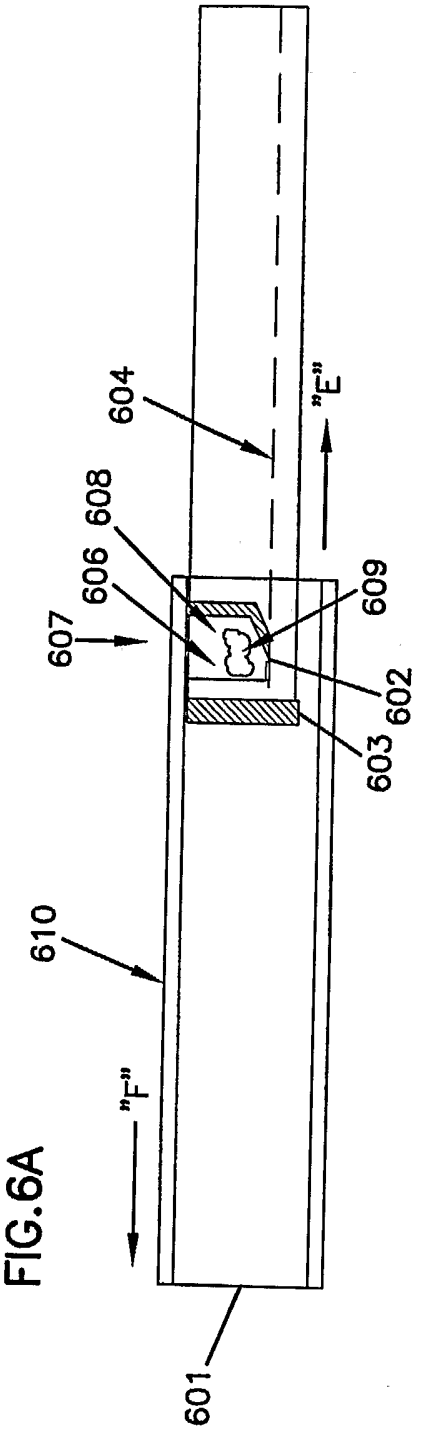


FIG.6A



FIG.6B