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**(54) TAMPER EVIDENT SEAL AND TAPE**

ORIGINALITÄTS-KLEBEBAND UND VERSCHLUSS

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## Description

### Field of the Invention

[0001] This invention relates generally to tamper-evident closures and, more particularly, to a closure in the form of a tape or label that indicates a forced opening, cooling below a particular temperature, and/or heating above a particular temperature.

### Background of the Invention

[0002] Tamper-evident closures for containers such as bags, envelopes, packages, etc. and tamper-evident tapes and labels for use with bags, envelopes, and other packages have been available for several years. Generally, if these existing closures are forced open, the visual appearance of the closure changes so as to provide an indication that the contents of the container have been accessed. Containers fabricated having tamper-evident closures are commonly used in industries in which the contents of the containers must be maintained in tight security, for example, in the banking industry. In certain instances package manufacturers employ prefabricated closures in the form of a tape or label to provide a tamper-evident closure on their packaging. Tamper-evident closures in the form of tapes or labels are also often used by everyday consumers who want to ensure that their packages are securely sealed and will evidence tampering if it occurs.

[0003] One form of container commonly used in banking and other industries is a bag, pouch or envelope (generally referred to herein as a bag) formed of a plastic material such as polyethylene. WO-A-93 00269 describes a security bag having a tamper-evident indicator means which is disposed adjacent the bag opening on sealing of the bag and which is adapted to change color or state to provide a visible and durable indication of heating or cooling of the bag. GB 2 243 825A describes a tamper evident member for sealing a container comprising a sheet formed from two layers integrally secured to one another around the edges. One of the layers has a reactive substance printed or sprayed thereon which is reactive, on exposure to the atmosphere, so as to provide an indication that the container has been opened. The layers may be heat shrinkable thermoplastics material having different directions of shrinkage or different shrinkage rates.

[0004] The opening in this type of bag is commonly closed with a pressure-sensitive adhesive located on one side of the bag. To close the bag, a peelback strip covering the free side of the adhesive is removed, and the exposed surface of the adhesive is then pressed against the opposite side of the bag. Generally, if a bag of this type is later forced open, the pressure-sensitive adhesive and/or other parts of the bag will distort and break apart, so as to provide an indication that the bag has been opened, possibly without authorization. Clo-

5 sures for a bag of this type have been formed with layers in addition to the pressure-sensitive adhesive to provide a clearer indication of when the closure is forced open. For example, US-A-5,060,848 describes a tamper evident seal that uses a layer of nitrocellulose or acrylic ink that breaks apart in a selected pattern when the seal is forced open. The layer of ink is adhered to a polyester panel that is part of the seal. Before applying the ink the plastic panel is masked with a desired pattern of a silicon oil releasant material, which normally causes the ink to break apart in the masked pattern when the seal is forced open. Also, to ensure that the ink layer adheres to the silicon oil releasant material and polyester panel, a primer is applied over the silicon oil releasant, and the ink is then applied over the primer.

10 [0005] Unfortunately, bags of this type are generally expensive to manufacture, use hazardous materials, and are not easily recycled. For example, the polyester panel disclosed in US-A-5,060,848 is not easily recycled, and the primer required is hazardous. Furthermore, thieves have devised a scheme to gain access to the contents of bags of this type without detection. The scheme devised involves spraying a liquid refrigerant onto the adhesive to freeze the adhesive down to its glass transition temperature, generally at about -10°F. At this temperature, the adhesive becomes brittle and loses its adhesive qualities, i.e., tack. The thief is then able to open the bag and remove certain contents. The thief allows the adhesive to warm back to room temperature, at which point the adhesive regains its tack and then simply recloses the bag by applying pressure, all without any evidence of tampering.

15 [0006] Thieves have also devised a scheme to gain access to the contents of bags of this type without detection by heating the adhesive to a temperature at which the adhesive softens. The thief is then able to open the bag and remove certain contents. The thief can reseal the bag while the adhesive is still soft by applying pressure, all without any evidence of tampering.

20 [0007] Tamper-evident closures for plastic bags have been formed to combat the problem of refrigerant tampering. Such closures provide an indication that the bag was opened, whether or not a refrigerant is first applied. These closures include multiple adhesive and nonadhesive layers that have differing strengths so that when the closure is forced open, one or more of the layers is permanently altered, even if a refrigerant is first applied. For example, US-A-4,834,552 describes a tamper-evident seal for a plastic envelope. The tamper-evident seal comprises two paper layers and an adhesive layer. One of the paper layers is bonded to a closure flap on the back wall of the envelope, the other paper layer is bonded to the front wall of the envelope, and the adhesive layer is applied to the free side of one of the paper layers. To close the envelope, the closure flap is folded over the envelope opening, and the adhesive layer is pressed onto the paper layer that has a free side. The

adhesive seeps into the interstices of the paper layers to form a mechanical-type lock with the paper layers. The strength of this mechanical-type lock is apparently greater than the internal strength of the paper layers, even if a refrigerant is first applied, so that the paper layers break apart when the seal is forced open.

**[0008]** Unfortunately, closures such as the seal disclosed in US-A-4 834 552 have several shortcomings. These closures do not provide any evidence of refrigerant tampering unless the closure is actually forced open. Thus, if a thief begins to attempt to open a bag by applying a refrigerant, but his efforts are somehow thwarted before he is able to force the bag open, the thief's tampering will go undetected. Even if these closures are forced open, they do not always satisfactorily provide evidence of such tampering. Any delamination of one of the paper layers can only be detected by close inspection; the delamination is not bold and distinct as would be desired. Once the closure is forced open, it is possible to use additional adhesive/glue to reclose the closure, without any readily visible evidence that the closure was ever opened. In addition, these closures generally have high production costs. For example, in addition to an adhesive layer as is commonly used to close plastic bags, the closure described in US-A-4 834 552 requires two paper layers, which must both be bonded to the envelope during its production. Furthermore, the bag and closure taught by that patent is not readily recyclable.

**[0009]** To overcome these shortcomings in the existing technology, what is needed is a closure in the form of a taper or label that provides evidence of forced opening of a seal created by the tape or label regardless of whether a refrigerant is applied, and additionally, provides evidence of refrigerant tampering, regardless of whether the closure is actually opened. Further, closures which provide evidence of heat tampering are also needed. The tape or label should be easy to close, and the evidence of tampering provided should be readily visible, i.e., bold and distinct. Furthermore, the tape or label providing these features should also be relatively inexpensive and easy to recycle and include only nonhazardous materials. As explained in the following, the present invention provides a tape and label that can meet these criteria.

**[0010]** The present invention resides in a tamper evident seal and tape as defined in claims 1 and 2 hereof. It also resides in a method of forming a tamper evident seal for a bag and of making a tape for forming a tamper evident seal as defined in claims 24 and 25.

**[0011]** The invention enables the provision of a bag closure which displays evidence of refrigerant tampering. Hence, the bag closure is sensitive to being cooled below a particular "breakdown temperature," so that if a refrigerant is applied, the visual appearance of the closure permanently changes, regardless of whether the closure is opened. In one preferred embodiment of the invention, the closure includes an adhesive layer and a

delaminating layer that visibly delaminates when the closure is cooled below the breakdown temperature. The bag includes a back and front wall that are joined at their peripheral side and bottom edges. The opening of the bag is formed by the upper ends of the back and front walls, and the closure is located at this opening.

**[0012]** In accordance with further features of the invention, one surface of the delaminating layer is bonded to a closure flap formed at the upper end of the bag front wall. When the closure is closed, the opposite surface of the delaminating layer is adhered to one surface of the adhesive layer, and the opposite surface of the adhesive layer is adhered to the bag back wall. Further, in one preferred embodiment, the bag is formed so that one surface of the adhesive layer is adhered to the bag back wall and the opposite surface of the adhesive layer is covered with a peel-back strip. To close the closure, the peel-back strip is removed and the free surface of the adhesive layer is pressed against the delaminating layer.

**[0013]** In accordance with still further features of the invention, as the closure is cooled, e.g., with a refrigerant, the delaminating layer delaminates from the front wall prior to the adhesive layer losing its tack which occurs when the adhesive layer reaches its glass transition temperature. Thus, an indication of refrigerant tampering is provided before the refrigerant allows the closure to be easily opened. Furthermore, the delaminating layer delaminates regardless of whether the closure is actually opened, so that the closure provides evidence of the mere application of a refrigerant. Also, regardless of whether a refrigerant is first applied, the delaminating layer delaminates whenever the closure is opened, so as to provide an indication that the contents of the bag have been accessed.

**[0014]** In accordance with still further features of the invention, the delaminating layer comprises a layer of ink that is applied to the closure flap on the bag front wall. Furthermore, the adhesive layer comprises a pressure-sensitive adhesive and the closure flap comprises a plastic material. The closure flap, ink and pressure-sensitive adhesive are chosen so that when the temperature of the closure is above the glass transition temperature of the adhesive, the bond (i.e., affinity) between the ink layer and the adhesive layer is at least as strong as (and preferably stronger than) the bond between the ink layer and the closure flap. As a result, the ink layer delaminates when the closure is forced open. Also, the adhesive layer and the closure flap are chosen such that, when cooled, the closure flap and the adhesive layer shrink at different rates. As a result, the ink layer - which is sandwiched between the adhesive layer and closure flap - delaminates as the closure is cooled below the breakdown temperature. Preferably, both the ink and closure flap have contrasting colors so that delamination of the ink can be easily seen. Further, in one preferred embodiment, the closure flap comprises a polyethylene plastic and the ink is water based. In one pre-

ferred embodiment, the ink is in direct contact with the closure flap without any intervening primer or releasant, and the closure flap is not pretreated (e.g., by corona discharge).

[0015] In a second preferred embodiment of the invention, the previously described delaminating layer of the bag closure includes two layers of ink. A patterned layer of clear ink is applied directly to the closure flap without any intervening primer or releasant, or pretreating of the closure flap. For example, the clear ink can be applied in a pattern to form a series of "stop signs." After the pattern of clear ink is applied, the closure flap is treated, e.g., with a corona discharge process, so that the ink more readily adheres to the closure flap. Then a uniform layer of colored ink is applied over the patterned layer of clear ink and ink-free portions of the closure flap. When the closure flap is closed, the two ink layers are sandwiched between the adhesive and the closure flap, which is preferably a polyethylene plastic. If the closure flap is quickly "frozen" or forced open, the clear ink, and the colored ink positioned over the clear ink delaminates from the closure flap. The colored ink in between the clear ink pattern remains on the closure flap, so that the pattern of the clear ink appears.

[0016] In accordance with another feature of the present invention, a tamper evident tape or label formed similarly to the tamper-evident closure described above is provided. In one preferred embodiment, a polyethylene plastic layer is used to form the tape or label backing. A layer of ink is applied to the plastic layer, and a layer of pressure-sensitive adhesive is then applied over the ink. The tape or label is secured by pressing the adhesive layer onto the desired surface. As with the closures described above, if a thief or other unauthorized person applies a refrigerant to the tape and/or forces the tape open, the tape provides permanent evidence of such tampering by visible delamination of the ink layer.

[0017] In accordance with yet another embodiment of this invention, a bag closure that provides evidence of heat tampering is also provided. The bag closure is sensitive to being heated above a particular activation temperature, so that if heat is applied, the visual appearance of the closure permanently changes, regardless of whether the closure is opened.

[0018] In one preferred embodiment of the invention, the closure includes a thermally activatable or thermochromic ink layer that visibly changes when the closure is heated at or above the activation temperature of the ink. The thermally activatable ink layer can be applied uniformly or in a pattern, for example, so that upon activation, the ink forms a series of "stop signs." Alternatively, a uniform coating of a standard ink can be used to provide a background contrast, and a layer of the thermally activatable ink can be applied in a pattern, such as the above-referenced series of "stop signs" over the layer of standard ink. In this embodiment of the invention, when dry, the standard ink and the thermally activatable ink are the same color. However, if the closure is

heated to a temperature at or above the activation temperature of the thermally activatable ink layer, the thermally activatable ink visibly changes so as to form a series of contrasting "stop signs" against the standard ink layer. In a particularly advantageous embodiment of the invention, the thermally activatable ink layer is used in combination with any of the tamper evident closures described above.

[0019] As will be appreciated from the foregoing brief summary, this invention provides a tape or label that can be used as a bag closure that provides evidence of the mere application of a refrigerant, and/or the mere application of heat, regardless of whether the closure is actually forced open. Furthermore, if the closure is forced open, whether or not a refrigerant and/or heat is first applied, the tape or label provides a permanent indication that the closure was opened. As will be further appreciated from the foregoing brief summary, the tapes and labels and corresponding manufacturing process provided by this invention present a cost savings over existing tapes and labels since they include a minimal number of layers which are inexpensive to form. The materials used are inexpensive and nonhazardous. Furthermore, because the tape and labels are preferably formed of a polyethylene plastic, they are easily recycled.

#### Brief Description of the Drawings

#### [0020]

FIGURES 1A and 1B are pictorial views of a bag including a tamper-evident seal formed in accordance with the invention;

FIGURE 2A is a side cross-sectional view of the bag shown in FIGURES 1A and 1B, and FIGURE 2B is a side cross-sectional view of the bag with the seal closed;

FIGURE 3 is a front view of the bag illustrating the visual appearance of the seal when closed;

FIGURE 4A is a pictorial view of the seal illustrating how the seal visually distorts if the seal is forced open, and FIGURE 4B is a pictorial view illustrating how the visual distortion remains, even if the seal is reclosed;

FIGURE 5 is a front view of the bag illustrating the visual distortion of the seal that occurs when the seal is cooled below a particular temperature;

FIGURES 6A-6D are top views of a plastic strip formed in accordance with a further embodiment of the present invention, and FIGURE 6E is a side cross-sectional view of the plastic strip shown in FIGURES 6A-6D;

FIGURE 7 is a side cross-sectional view of a bag with a tamper-evident seal including the plastic strip shown in FIGURES 6A-6E in accordance with the invention;

FIGURE 8A is a front view of the bag shown in FIG-

FIGURE 7, illustrating the visual appearance of the seal when a portion of the seal is forced open;

FIGURE 8B is an end cross-sectional view of the seal in FIGURE 8A, illustrating the delamination of the portion of the seal that is forced open; and FIGURE 9A is a side cross-sectional view of a bag including a tamper-evident tape formed in accordance with a further aspect of the present invention, and FIGURE 9B is a side cross-sectional view of a bag with the tamper-evident tape sealing the bag closed;

FIGURE 10 is a pictorial view of a roll of tamper-evident tape formed in accordance with the present invention; and

FIGURE 11 is a side view of a section of a roll of tamper-evident tape formed in accordance with the present invention.

#### Detailed Description of the Preferred Embodiment

**[0021]** FIGURES 1A and 1B illustrate a bag 10 that incorporates a seal 12 formed at the opening 14 of bag 10. The bag includes a front wall 16 and a back wall 18 that are joined together at the bottom and side edges to form an enclosure having opening 14 at the upper ends of front wall 16 and back wall 18. Seal 12 is included to close opening 14 and to provide visual evidence of any forced opening of seal 12. Furthermore, seal 12 will visually distort if the opening of the bag is cooled below a particular "breakdown temperature," e.g., by the application of a refrigerant.

**[0022]** Seal 12 includes a plastic strip 20, a layer of ink 22, and a layer of adhesive 24. The bottom end of plastic strip 20 is attached to the inner surface of the upper end of front wall 16. Ink layer 22 is printed on the inner surface of plastic strip 20. While ink layer 22 is represented by a grid of lines in the figures, ink layer 22 is preferably a uniform layer of ink. As shown in FIGURES 1A and 1B, adhesive layer 24 is preferably applied to the inner surface of the upper end of back wall 18. The free surface of adhesive layer 24 is covered with a peel-back strip 26. To seal the opening of the bag closed, peel-back strip 26 is removed from adhesive layer 24, and plastic strip 20 is pressed onto adhesive layer 24, which is a pressure sensitive adhesive. Thus, when seal 12 is closed, ink layer 22 is sandwiched between adhesive layer 24 and plastic strip 20.

**[0023]** The location of the various layers of seal 12 can be seen more definitely in the side cross-sectional views in FIGURES 2A and 2B. Plastic strip 20 is attached at its lower end 28 to the inner surface of the upper end of front wall 16, and ink layer 22 is printed on the inner surface of plastic strip 20. Adhesive layer 24 is applied to the inner surface of the upper end of back wall 18, and the free surface of adhesive layer 24 is covered with peel-back strip 26. FIGURE 2B illustrates the alignment of seal 12 after peel-back strip 26 is removed and the seal is pressed closed. Plastic strip 20 is

pressed onto adhesive layer 24 so that ink layer 22 adheres to adhesive layer 24.

**[0024]** As shown in FIGURES 2A and 2B, adhesive layer 24 preferably extends approximately 5 mm (0.125 inch) below the bottom edge of plastic strip 20, so that when seal 12 is closed, a portion of adhesive layer 24 adheres directly to front wall 16. This helps prevent loose contents within the bag from partially opening seal 12 as the contents bump against the seal. Without a portion of adhesive layer 24 adhering to front wall 16, contents within the bag could falsely activate the tamper evidencing means of seal 12.

**[0025]** Preferably, back wall 18 includes a detachable identification tab 30 formed by perforating the upper end of back wall 18. As shown in FIGURES 1A and 1B, the perforations allow identification tab 30 to be easily removed. Preferably, identifying text or numbers are printed on identification tab 30 and matching identifying text or numbers are printed on either front wall 16 or back wall 18 of the bag. When the bag is sealed closed, identification tab 30 can be removed and used as a receipt.

**[0026]** After being closed, if seal 12 is forced open, the seal visually distorts. Plastic strip 20 is partially transparent so that ink layer 22 can be seen from the outer side of plastic strip 20 before seal 12 is closed, as shown in FIGURE 1A, and after seal 12 is closed, as shown in FIGURE 3, which is a front view of the bag with seal 12 closed. In particular, objects that are in direct contact with the inner surface of plastic strip 20 can be seen from the outer side of plastic strip 20. In contrast, if an object is positioned near the inner surface side of plastic strip 20, but not in direct contact with the inner surface of plastic strip 20, the object can barely be seen, if at all, from the outer side of plastic strip 20. Accordingly, when ink layer 22 is printed on the inner surface of plastic strip 20, the ink can be seen from the outer surface of plastic strip 20, as shown in FIGURE 1A and FIGURE 3. However, as illustrated in FIGURE 4A, if seal 12 is forced open, a substantial portion of the ink remains adhered to adhesive layer 24 and accordingly delaminates from plastic strip 20. When this occurs, the ink is no longer visible from the outer side of plastic strip 20.

**[0027]** If an attempt is made to re-close seal 12, the visual distortion of the ink is still visibly apparent, as illustrated in FIGURE 4B, because the ink does not re-adhere to plastic strip 20. The ink is printed onto plastic strip 20 while wet, i.e., in a liquid state. The ink then dries. Once dried, if the ink is delaminated from plastic strip 20, the ink no longer adheres to the inner surface of plastic strip 20. As a result, even when plastic strip 20 is re-pressed against adhesive layer 24, the ink remains sufficiently separated from plastic strip 20 so that the ink cannot be clearly seen through the outer side of plastic strip 20. In the illustration shown in FIGURES 4A and 4B, a portion 32 of seal 12 is forced open and then re-closed. As illustrated in FIGURE 4B, portion 32 that was

forced open is visibly distorted, in sharp contrast to the portion 34 of seal 12 that was not opened.

**[0028]** In order for ink layer 22 to delaminate from plastic strip 20 when the seal is forced open, it is necessary that the bond between the ink and plastic strip 20 be relatively weak i.e., weak relative to the bond between adhesive layer 24 and ink layer 22. Because the bond between the ink and plastic strip 20 is relatively weak, if adhesive layer 24 merely adhered to ink layer 22, the overall strength of seal 12 would be relatively weak. Adhesive layer 24 would simply release from plastic strip 20 whenever ink layer 22 delaminated from plastic strip 20. This could cause the seal to inadvertently open during handling and shipping of the bag, which would be highly undesirable. To avoid this potential problem, ink layer 22 is sufficiently thin so that there are voids in ink layer 22. As a result, when seal 12 is pressed closed, portions of adhesive layer 24 adhere to the inner surface of plastic strip 20 through the voids in the ink. The affinity between the adhesive and the plastic strip is sufficiently high so that the strength of seal 12 is acceptably strong. Thus, seal 12 generally does not open unless it is intentionally forced open by pulling plastic strip 20 away from back wall 18.

**[0029]** In addition to distorting when forced open, seal 12 is sensitive to cooling so that if the seal is cooled below a particular "breakdown temperature," e.g., -10°F, the seal visibly distorts in a manner similar to when the seal is forced open. In particular, as illustrated in FIGURE 5, when the seal is cooled below a breakdown temperature, ink layer 22 delaminates from plastic strip 20 so that the ink can no longer be clearly seen when viewing the outer side of plastic strip 20. The mechanism for the delamination of the ink is differential rates of shrinking of adhesive layer 24 and plastic strip 20. In particular, plastic strip 20 and adhesive layer 24 are chosen so that they shrink at different rates when cooled. In a preferred embodiment, the adhesive shrinks more and at a greater rate than plastic strip 20. Because the ink has a strong affinity to the adhesive, as the adhesive and the plastic strip shrink at different rates, ink layer 22, which is sandwiched between the plastic strip and the adhesive, is pulled away from the plastic strip. As a result, the ink is no longer clearly visible through the outer side of plastic strip 20.

**[0030]** The ability of seal 12 to provide visual evidence of cooling is important because a common technique used by thieves to gain access to plastic bags sealed with a pressure sensitive adhesive is to "freeze" the bag with a refrigerant, as previously described herein. Seals that combat this form of tampering have been introduced. However, as previously described herein, these prior art seals do not provide evidence of mere "freezing." Rather, the prior art seals simply provide evidence of a forced opening of the bag, whether or not the bag is first "frozen." In sharp contrast, seal 12 provided by the present invention provides a permanent visual indication if the seal is cooled below the breakdown tempera-

ture, regardless of whether or not the seal is actually forced open.

**[0031]** Furthermore, seal 12 provided by the present invention cannot be opened without ink layer 22 visibly delaminating, whether or not the seal is first "frozen." This is ensured by choosing a pressure sensitive adhesive for adhesive layer 24 that has a relatively low glass transition temperature. When a pressure sensitive adhesive is cooled to its glass transition temperature, the adhesive loses its adhesive properties, i.e., its adhesive tack. The adhesive is chosen so that its glass transition temperature is lower than the breakdown temperature of seal 12, at which temperature ink layer 22 delaminates from plastic strip 20. As a result, as the seal is progressively cooled, ink layer 22 at least partially delaminates from plastic strip 20 before the glass transition temperature of the pressure sensitive adhesive is reached. Thus, the ink delaminates before the seal is sufficiently "frozen" to allow the seal to be opened without any significant force.

**[0032]** It is important that the breakdown temperature of seal 12 be greater, i.e., at a higher temperature, than the glass transition temperature of the pressure sensitive adhesive, to ensure that the seal cannot be opened without detection. If, in contrast, the glass transition temperature is above the seal's breakdown temperature, a refrigerant could be used to cool the seal to the adhesive's glass transition temperature, at which point the adhesive would lose its adhesive tack and release from the upper end of back wall 18 and/or ink layer 22 and plastic strip 20. The bag could then be opened, and then after warming to room temperature be reclosed. As long as the temperature of the bag is kept above the breakdown temperature, no visual indication of tampering would exist.

**[0033]** Adhesive layer 24 and plastic strip 20 are also preferably chosen so that they expand at different relative rates when warmed, i.e., the plastic strip and adhesive layer have different thermal coefficients of expansion. In one preferred embodiment, the adhesive expands more and at a greater rate than plastic strip 20. As a result, if, after the seal is "frozen" below the breakdown temperature, a portion of ink layer 22 has not delaminated from plastic strip 20, the ink will further delaminate upon warming of seal 12. This further ensures that the delamination is sufficient to provide a significant visual indication of "freezing."

**[0034]** The embodiment of seal 12 shown in FIGURES 1 and 2 is one preferred embodiment of the invention. FIGURES 9A and 9B illustrate a second embodiment. The second embodiment includes many of the same component parts as the first preferred embodiment; accordingly, like components are referred to with the same reference numerals, except that the reference numerals are double primed. In the second embodiment, adhesive layer 24" is applied to the inner surface of ink layer 22" instead of to the inner surface of the back wall 18". The free surface of adhesive layer 24"

is covered with peel-back strip 26". The other structural aspects of seal 12" are the same as seal 12 in FIGURES 1 and 2. To close the seal, peel-back strip 26" is removed and the free surface of adhesive layer 24" is pressed against the inner surface of back wall 18". If the seal is forced open or "frozen," ink layer 22" visually delaminates, as described with respect to the first embodiment shown in FIGURES 1 and 2. While the second embodiment shown in FIGURES 9A and 9B is an alternative embodiment, the first embodiment shown in FIGURES 1 and 2 is preferred because adhesive 24 adheres more strongly to back wall 18 when applied hot, as described in more detail below, as opposed to adhesive layer 24" of the second embodiment that is pressed against back wall 18" to close seal 12".

**[0035]** While one preferred embodiment of a bag incorporating a seal formed in accordance with the present invention has been shown so far, various other bag structures can be formed. For example, with respect to FIGURE 2A, if front wall 16 is formed of the same material as plastic strip 20, front wall 16 can be extended to the same height as back wall 18. Plastic strip 20 would then be eliminated and ink layer 22 would be printed on the inner surface of the upper end of front wall 16. As a further alternative, front wall 16 could be extended beyond the height of back wall 18, so that a fold-over closure flap is formed by the upper end of front wall 16. Adhesive layer 24 would then be applied to the outer surface of back wall 18, and the closure flap would be folded over the opening of the bag onto the adhesive on the outer surface of back wall 18.

**[0036]** The seal provided by the present invention can be formed as a tape or label 40, as shown in FIGURES 10 and 11. The structure of tape 40 is essentially the same as the structure of seal 12" of the second embodiment shown in FIGURES 9A and 9B. Tape 40 includes a flexible, plastic backing 42, a layer of ink 44 printed on plastic backing 42, and a layer of adhesive 46 applied to the free surface of ink layer 44. Plastic backing 42 is analogous to plastic strip 20" in FIGURES 9A and 9B, and ink layer 44 is sandwiched between plastic backing 42 and adhesive layer 46. The free surface of adhesive layer 46 is covered with a peel-back strip 48. To apply tape 40 to an object, peel-back strip 48 is removed from a section of the tape then adhesive layer 48 is pressed onto the object to form a seal. As described with respect to bag 10 and 10", if tape 40 is forced off the object or if the tape is frozen below its breakdown temperature, ink layer 44 delaminates from plastic backing 42, to provide a visual indication of tampering.

**[0037]** Roll of tape 40 can be used in various applications to form seals on surfaces of containers such as bags and envelopes. For example, tape 40 could be used to seal an envelope. The tape could also be used to seal closed the opening of a bag as previously described herein. For example, bag 10 shown in FIGURE 2A could be formed without seal 12, so that the bag simply consists of back wall 18 and front wall 16.

Front wall 16 could be extended up beyond back wall 18, so that the upper end of front wall 16 forms a closure flap that can be folded over opening 14 onto the outer surface of back wall 18. The closure flap could then be secured onto back wall 18 with tape 40 by overlapping the tape over the closure flap and back wall 18. Alternatively, bag 10 shown in FIGURE 2A could be formed without seal 12 and then the upper portion of back wall 18 could be folded over the upper end of front wall 16 to contact the outer surface of front wall 16. The closure flap could then be secured onto front wall 16 with tape 40 by overlapping the tape over the closure flap and front wall 16.

**[0038]** In addition to providing a tape for forming seals on containers, tape 40 can be printed on, for example, on plastic backing 42 to provide a label or other type of indicating means.

**[0039]** The seal provided by the present invention is preferably constructed of relatively simple, inexpensive, and nonhazardous materials. The seal is preferably manufactured on a continuous line system, using conventional equipment including printers and handling machines. With respect to seal 12 shown in FIGURE 2A, plastic strip 20 is preferably formed of a high density polyethylene or other polyolefin such as polypropylene. Plastic strips 20 are preferably formed of polyethylene, as opposed to some other plastic such as polyester, so that the strips can be easily recycled. Preferably, plastic strip 20 is colored so as to contrast with the color of the ink of ink layer 22. For example, if the ink is blue, the plastic strip could be yellow. The plastic strip can be formed using an extrusion process as is commonly done in the plastics industry. Typically, to extrude polyethylene sheets, polyethylene pellets are melted and then extruded. To form colored plastic strips, color pigment, e.g., yellow pigment, is preferably added to the melted polyethylene, e.g., at a ratio of ten percent (10%) of the total mixture. In one preferred embodiment, the polyethylene sheets are formed of a thickness of approximately 0.06 mm (2.3 mils). The polyethylene sheets are cut into approximately 28.5 mm (1.125 inch) strips, and then cut to length, to form plastic strips 20.

**[0040]** The ink of ink layer 22 is preferably a water-based ink that has a Ph of 7.5 to 8.2, such as Universal Reflex Blue sold by CPI Inks, Inc. However, other inks such as a solvent-based ink could be used. The ink is printed on the inner surface of plastic strip 20. Actually, the ink is preferably printed on the polyethylene sheets before the sheets are cut to form plastic strips 20. The pattern of ink does not have to be very exact; in fact, in one preferred embodiment the ink is printed as a uniform layer. Thus, inexpensive printing techniques can be used. For example, a flexographic press that includes a photo polymer print roller can be used to print the ink even if a particular pattern is desired. The advantage of using a flexographic press is that the photo polymer roller for creating the print pattern is relatively inexpensive to manufacture. In contrast, a rotogravure

printer, which includes steel printing plates and is much more expensive, has generally been used to hold more exact registration and produce more precise characters on the walls of plastic bags.

[0041] As previously described herein, while the precision of the pattern of ink is not critical, the thickness of the ink layer is important. Ink layer 22 must be sufficiently thin so that there are microscopic voids in the ink through which adhesive layer 24 can migrate and therefore adhere to plastic strip 20. If ink layer 22 is too thick, adhesive layer 24 will not migrate through the ink layer and adhere to the inner surface of plastic strip 20. Instead, the adhesive layer will only adhere to ink layer 22, which would result in a seal that is too weak. It is also important that the ink have a relatively weak bond or adhesion to the inner surface of plastic strip 20, so that ink layer 22 delaminates from plastic strip 20 if the seal is forced open or "frozen."

[0042] The structure and manufacturing process of the seal embodiment shown in FIGURES 1 and 2 do not involve any pretreating, such as with a corona discharge or a silicon releasant, of the inner surface of plastic strip 20. That is, the ink is applied without any intervening adhesion promoting material or pretreating, and without any intervening adhesion suppression material. Accordingly, this embodiment of the seal is very inexpensive to manufacture. For example, with respect to FIGURE 2A, the inner surface of plastic strip 20 is not pretreated with a corona discharge process, because a relatively weak adhesion between the ink and plastic strip is desired. Furthermore, because a water-based ink is preferably used, which has a relatively weak adhesion with polyethylene, no releasants such as silicone are required.

[0043] With respect to FIGURE 2A, ink layer 22 is preferably printed onto the inner surface of plastic strip 20 in a single coat, which involves printing wet ink onto plastic strip 20. The single coat of ink is uniform, i.e., a flood coat. While it is important that ink layer 22 is sufficiently thin so that there are voids in ink layer 22, there is a lower limit on how thin the ink should be. If ink layer 22 is extremely thin, there will not be a sufficient visual color contrast in the seal when ink layer 22 delaminates from plastic strip 20. In one preferred embodiment, an appropriate ink thickness is obtained by using a water-based ink that has a viscosity reading of 20 to 30 seconds with a # 3 Zahn cup, and printing the ink on plastic strip 20 with a flexographic printer. After the wet ink is printed on plastic strip 20, the ink is thoroughly dried, for example, by using heat guns.

[0044] It is also possible to print a particular pattern of ink e.g., a grid pattern, onto plastic strip 20. For example, using a flexographic press, two coats of ink could be printed onto plastic strip 20. The first coat of ink would be a flood coat that is uniform, and the second coat of ink would be applied in a grid pattern over the flood coat.

[0045] Regardless of the ink pattern used, the bottom end of plastic strip 20 is preferably secured to the inner

surface of front wall 16 by a heat seal, e.g., a running heat sealer, as is commonly done to seal together plastic materials such as polyethylene. However, plastic strip 20 can also be attached in other ways, e.g., using an adhesive or glue. Plastic strip 20 is preferably secured to the inner surface, as opposed to the outer surface, of front wall 16 so that it is relatively easy to visually detect any slits or cuts made near plastic strip 20. While it is certainly possible to adhere plastic strip 20 to the outer surface of front wall 16, if this done, a slit, e.g., made using a razor blade, could be made under plastic strip 20 where plastic strip 20 is sealed to front wall 16. It would be difficult to visually detect such slits as the slits would be underneath the substantially opaque plastic strip 20.

[0046] As previously described, front wall 16 and back wall 18 are preferably formed of a plastic material, such as polyethylene. Common extrusion techniques can be used to form the back and front walls. The side edges of the back and front walls are preferably joined together by a heat seal. The bottom ends of the back and front walls are preferably formed of a single sheet of plastic that is folded to form the bottom end, as shown in FIGURE 2A. Alternatively, two separate sheets of plastic could be used to form the back and front walls, in which case, the bottom ends of the walls would be joined together with a heat seal. Because the walls of the bag and plastic strip 20 are all preferably formed of polyethylene, the bag is recyclable.

[0047] As previously described, adhesive layer 24 is applied to the inner surface of back wall 18, as shown in FIGURE 2A. The free surface of adhesive layer 24 is covered with peel-back strip 26. To close the seal 12, peel-back strip 26 is removed and the free surface of adhesive layer 24 is pressed against ink layer 22 as shown in FIGURES 2A and 2B. Preferably, no intervening materials are applied to the inner surface of back wall 18 or the inner surface of ink layer 22. As a result, when the seal is closed, adhesive layer 24 is in direct contact with the inner surface of back wall 18 and the inner surface of ink layer 22, as shown in FIGURES 2B.

[0048] In the preferred embodiment, adhesive layer 24 is formed of a pressure sensitive adhesive that is rubber-based, has a relatively high liquid tactifier content, and is applied as a hot melt using an extrusion process. The adhesive must have a low glass transition temperature and simultaneously a relatively high internal cohesive strength. As previously described, it is important that the adhesive have a glass transition temperature that is below the breakdown temperature of the seal. Preferably, the adhesive has a glass transition temperature that is below -10°F. In addition to the requirement that the glass transition temperature be below -10°F, the adhesive preferably has the following characteristics: 180° peel strength of 7.9 lbs. (±0.4 lbs.) on steel; viscosity of 10,500 cps at 300°F, 3,900 cps at 325°F, 2,000 cps at 350°F; a melting point of 181°F; a SAFT reading of 500gm/sq. in. at 143°F; and an application temperature

of 300-325°F. In one preferred embodiment, the adhesive is clear so that ink layer 22 can be seen through back wall 18 and adhesive layer 24 when seal 12 is closed. Various adhesive compositions exist in the prior art. Based upon the preceding characteristics, an appropriate pressure-sensitive adhesive can be readily composed. Most likely, the basic ingredients of the adhesive include a rubber base of synthetic block polymers with a liquid tactifier added to provide the specified viscosity. An adhesive having the preceding characteristics can be manufactured by various adhesive producers, including Swift Adhesives Co. and Ecomelt, Inc.

[0049] To apply the adhesive, the adhesive is melted and extruded onto the inner surface of back wall 18. Peel-back strip 26 is then placed over the free surface of the adhesive. In one preferred embodiment, the peel-back strip is formed of high density polyethylene, and the surface of the peel-back strip that is in contact with the adhesive is coated with silicon so that the peel-back strip easily releases from the adhesive. When the adhesive cools, a pressure sensitive adhesive is formed.

[0050] While the materials and manufacturing process were described in the context of a bag incorporating a seal as provided by the present invention, it will be readily appreciated that the materials and manufacturing process of tape 40 shown in FIGURES 10 and 11 are basically the same. In particular, tape 40 is formed of the same materials as in the same process as seal 12" shown in FIGURES 9A and 9B.

[0051] FIGURES 6A-E illustrate an alternative ink composition/pattern and manufacturing process for plastic strips 20 and 20" shown in FIGURES 2A and 9A. A seal incorporating the plastic strip 20' shown in FIGURES 6A-E has the benefits of being more difficult to force open and providing a more visible indication of a forced opening than the previously described embodiments. The drawback of the embodiment shown in FIGURES 6A-E is that the resulting seal does not evidence refrigerant tampering as effectively as the previously described embodiments. The ink/plastic strip embodiment shown in the top views in FIGURES 6A-D and the side cross-sectional view in FIGURE 6E includes a plastic strip 20', a patterned layer of clear ink 60 (e.g., ink extender), and a uniform layer of colored ink 62. Plastic strip 20' is preferably formed of a high density polyethylene, as previously described plastic strip 20. Preferably, plastic strip 20' is colored, e.g., yellow.

[0052] Patterned layer of clear ink 60 is printed, e.g., using a flexographic press, onto an untreated surface of plastic strip 20'. Clear ink 60 should have a weak affinity to untreated polyethylene and should be able to withstand a corona discharge process as described in the following. Preferably, ink 60 is a water-based ink as previously described, except that ink 60 contains no pigment so that the ink is clear. For example, colorless, water-based ink extender manufactured by CPI Inks, Inc. sold under the name Universal Flex Extender can be used. However, a solvent-based ink extender could

also be used. Ink 60 is printed in a selected pattern, so that the majority of the surface of plastic strip 20' is free of clear ink 60. As shown in FIGURE 6B, in one preferred embodiment, clear ink 60 is printed as a series of "stop signs."

[0053] After clear ink 60 is applied and dried, e.g., using a heat gun, the surface of plastic strip 20' on which clear ink 60 is applied is treated with a corona discharge process to roughen and increase the surface energy of plastic strip 20', as illustrated pictorially by line dashes 64. In one preferred embodiment, a corona discharge treater set to a strength of approximately 43 to 50 dynes is used. The corona discharge process is used so that colored ink 62 adheres well to plastic strip 20'. In particular, after plastic strip 20' is subjected to a corona discharge, colored ink 62 is printed as a uniform layer over plastic strip 20', so as to cover the entire surface of plastic strip 20'. In place of using a corona discharge process, the plastic strip 20' could be subjected to plasma treatment, chemical treatment, or flame treatment.

[0054] FIGURE 7 is a side cross-sectional view of a bag 10' incorporating plastic strip 20' to form a seal 12'. When seal 12' is closed, colored ink layer 62 is sandwiched between adhesive layer 24 and plastic strip 20'. Because plastic strip 20' is subjected to a corona discharge process before the application of colored ink 62, colored ink 62 forms a strong adhesion with those portions of plastic strip 20' not covered with clear ink 60. As a result, if an attempt is made to force open seal 12', colored ink 62 will not delaminate from plastic strip 20', except along the pattern where clear ink 60 was applied, as shown in FIGURE 8B. Colored ink 62 does not delaminate from plastic strip 20' because colored ink 62 adheres more strongly to the treated portions of plastic strip 20' than to adhesive 24. However, because clear ink 60 was applied to the untreated surface of plastic strip 20', clear ink 60 does not adhere very well to plastic strip 20'. As a result, colored ink 62 and clear ink 60 delaminate from plastic strip 20' along the pattern of clear ink 60 when an attempt is made to force the seal open.

[0055] Colored ink 62 is chosen to have a color that contrasts with the color of plastic strip 20'. In one preferred embodiment, plastic strip 20' is yellow and colored ink 62 is blue. Preferably, colored ink 62 is water-based, as is the case for previously described ink layer 22. Because the color of colored ink 62 contrasts with the color of plastic strip 20', the pattern in which clear ink 60 was applied boldly appears when an attempt is made to force open the seal. For example, as indicated in FIGURE 8A, when a portion 66 of seal 12' is forced open, the "stop sign" pattern appears, whereas an untampered portion 68 of seal 12' appears uniformly opaque. The delamination of colored ink 62 and clear ink 60 in portion 66 of seal 12' is shown in FIGURE 8B, which is an end cross-sectional view of portion 66 shown in FIGURE 8A.

**[0056]** Because colored ink 62 adheres much more strongly to treated plastic strip 20' than ink layer 22 previously described with reference to FIGURE 2A, seal 12' illustrated in FIGURE 8 is much more difficult to open. After being closed, if seal 12' is quickly "frozen" with a refrigerant, some "stop signs" will appear as a result of clear ink 60 delaminating from plastic strip 20' due to the differential shrink rates between plastic strip 20' and adhesive 24'. However, because colored ink 62 adheres strongly to the majority of the surface of plastic strip 20', colored ink 62 provides structural support that prevents the differential shrink rates from delaminating clear ink 60 as readily as ink layer 22 in the previously described embodiments.

**[0057]** Other than the differences specifically described hereinabove, the manufacturing process and materials of seal 12' are the same as for previously described seal 12 and 12" shown in FIGURES 2A and 9A. For example, both clear ink 60 and colored ink 62 are preferably water-based with a viscosity reading of 20 to 30 seconds with a #3 Zahn cup, and the inks are preferably applied using a flexographic printer.

**[0058]** In accordance with yet another embodiment of this invention, a bag closure that provides evidence of heat tampering is also provided. The bag closure is sensitive to being heated above a particular activation temperature, so that if heat is applied, the visual appearance of the closure permanently changes, regardless of whether the closure is opened.

**[0059]** As discussed above, in addition to the use of refrigerant cooling, thieves also use heating to tamper with bag closures. Typically, the adhesive layer of a bag closure can be heated using, for example, a hair dryer or other heating device. The adhesive is softened and the bag can then be opened.

**[0060]** To indicate tampering by heat, a "heat activatable," or "thermochromic," ink layer is used in the closure of the invention. As used herein, the term "heat activatable" or "thermochromic" ink refers to inks which, upon the application of heat, exhibit a visible, permanent color change.

**[0061]** Any of the types of thermochromic inks known in the art can be used. In the present invention, it is particularly advantageous to use a thermochromic ink which permanently visually changes when heated to a temperature of at least about 140°F, more preferably at least about 150°F, or higher. This activation temperature range is desirable because typically the adhesives described above for use with the closures of the invention soften sufficiently at a temperature between about 140°F and about 180°F to enable a person to open the closure. A particularly preferred ink is available from Midwest Coatings Inc. of St. Louis, Missouri, and is described in more detail below.

**[0062]** As will be appreciated by the skilled artisan, the time required to effect the color change can vary as heating conditions vary, i.e., the activation temperature of the ink system used, the temperature applied to the

seal, how long heat is applied, and the like. For example, when the seal is heated to a temperature at the lower end of a range of thermochromic ink activation temperatures, the visible color change can take place more slowly than when higher activating temperatures are used.

**[0063]** The thermochromic ink can be used in the tamper-evident closures of the invention in various ways. For example, in one preferred embodiment, the thermochromic ink is applied to an outer surface of plastic strip 20, on a surface opposite ink layer 22. The plastic layer 20 is printed using standard techniques, as described above, for example, using a flexographic press including a photo polymer roller printed. The thermochromic ink can be printed onto the outer surface of plastic strip 20 before or after the ink layer 22 is printed thereon. Further, the thermochromic ink layer can be applied as a substantially uniform coating on a surface of the plastic strip 20, or applied in a pattern, for example, so that upon activation, the ink forms a series of "stop signs." The thermochromic ink is then dried using conventional equipment, such as heat guns. Of course, the thermochromic ink is dried at a temperature below its activation temperature.

**[0064]** When dry, the thermochromic ink is a specific color. However, when heated to its activation temperature, dye compounds in the thermochromic ink can undergo a chemical reaction. As the dye compounds react, the color of the dye compounds changes, which results in a change in the color of the ink. In the example given below, the thermochromic ink initially appears white, similar to a standard white ink which is not thermally activatable. Once activated, the thermochromic ink turns from white to a reddish-purple color. The present invention is not, however, limited to this particular color format. The thermochromic ink can provide a permanent visual indication if the seal is heated at or above the activation temperature, regardless of whether or not the seal is actually forced open.

**[0065]** Alternatively, a standard, non-thermochromic ink, such as a conventional alcohol based ink, can be applied in a uniform coating to the outer surface of plastic strip 20 to provide a background contrast against which the color change is clearly visible. A layer of thermochromic ink is then applied in a pattern, such as the above-referenced series of "stop signs" over the layer of standard ink. Preferably, the standard, non-thermochromic ink and the thermochromic ink are the same color initially, such as white. If the closure is subsequently heated, the thermochromic ink visibly changes so as to form a series of contrasting reddish "stop signs" against the standard ink layer. Preferably, an industry standard water based clear overcoat layer is applied over at least a portion of the strip to protect the thermochromic ink from scuffing.

**[0066]** Preferably, as described above, the thermochromic ink layer is used in combination with seal 12, i.e., which includes an ink layer 22, and in which the

plastic strip 20 and the adhesive layer 24 exhibit differential shrinking and expansion rates. It will be apparent, however, that the thermochromic ink layer can be used for security purposes with various other seals which include an adhesive bonding layer and a plastic strip as a support for the thermochromic ink layer which do not include ink layer 22. In this embodiment of the invention, the thermochromic ink layer can be printed on either the inner or outer surface of a plastic strip. The free surface of the adhesive layer can be covered with a peel-back strip. As described above, to seal the closure, the peel-back strip is removed from the adhesive layer, and the plastic strip is pressed onto adhesive layer. Further, the thermochromic ink layer can be used without regard to specific differential shrinking rates of the plastic support strip and the adhesive layer upon cooling, or differential expansion rates thereof upon warming.

**[0067]** Further, the thermochromic ink layer can also be provided as a component of a seal in the form of a tape or label 40, as shown in FIGURES 10 and 11. The structure of tape 40 which includes the thermochromic ink layer is essentially the same as described above.

**[0068]** An exemplary thermochromic ink formulation is as follows. First, Solution "A" is prepared as follows. A carrier for the dye compounds is prepared by mixing 85% water and 15% polyvinyl alcohol (PVOH). This mixture can be strained, for example, using a 25 micron filter. A mixture is then prepared with the following: 60% PVOH; 39.6% of a conventional leuco dye (well known in the industry); 0.1% Nopko-W dispersing agent (industry standard); 0.1% Surfionol TG wetting agent (industry standard); and 0.2% defoamer (industry standard).

**[0069]** Solution "B" is then prepared by first formulating a carrier as described above including 85% water and 15% PVOH. A mixture is then prepared comprising: 60% PVOH; 39.6% bisphenol-A activator; 0.1% Nopko-W dispersing agent (industry standard); 0.1% Surfionol TG wetting agent (industry standard); and 0.2% defoamer (industry standard).

**[0070]** The final formulation is prepared by mixing 1 part Solution "A" to 4 parts Solution "B". Although not wishing to be bound by any explanation of the invention, it is believed that when the ink is heated, the bisphenol A activator can initiate a chemical reaction within the structure of the leuco dye compound, thus altering its structure and producing a color change.

**[0071]** This particular formulation has an activation temperature of about 155°F. The ink is initially white when dry and changes color to a bright red or reddish purple when heated to its activation temperature or higher to provide a permanent visible color change. This, as noted above, is particularly advantageous for use with adhesives having a softening point between about 140°F and 180°F.

**[0072]** However, this formulation is subject to various modifications. For example, higher or lower percentages of each of the formulation components can be used, and/or higher or lower "A" to "B" ratios, and the

like. Further, thermochromic dye compounds and thermochromic dye compound activators, other than leuco dyes and bisphenol A, respectively, can also be used in accordance with this aspect of the invention. In addition, polyvinyl alcohol is a preferred carrier because its use can provide a desired degree of flexibility to the ink layer, which is particularly advantageous in continuous in-line application to plastic substrates. However, other carriers can also be used.

**[0073]** As will be appreciated by the skilled artisan, preferably the particle size of the ink formulation is sufficiently small to provide smooth consistent application of the ink to a substrate surface. Further, it is preferred that the thermochromic ink formulation not be cut or mixed with other inks or solutions, and that the equipment used to produce the seals of the invention is clean.

### Claims

1. A tamper evident seal (12,12') comprising an adhesive layer (24,24') adhered to a surface, a support (20,20') to which portions of the adhesive layer are adhered when said seal is applied, and indicating means (22,60,62) disposed on the support so as to be between the adhesive layer and the support, when the seal is applied, for producing an indication of tampering with the seal, characterised in that

the indicating means comprises a delaminating layer (22,60) adhered to the support (20,20') and having an initial adhesion to said support, the delaminating layer (22,60,62) has a greater adhesion for the adhesive layer (24,24') than said initial adhesion and the adhesive layer has a greater adhesion for the support and to said surface than said initial adhesion, whereby the delaminating layer delaminates from the support, before the adhesive layer separates from the support, so as to provide a permanent visual indication of such delamination, and the adhesive layer (24,24') and support (20,20') have different rates of shrinkage, when cooled, to produce delamination of the delaminating layer (22,60,62) and provide a permanent visual indication of tampering with the seal, by cooling below a breakdown temperature, when said seal is applied, whereby if a refrigerant is applied to said seal to cool the seal below the breakdown temperature, at least an indication of the mere application of the refrigerant is provided regardless of whether the seal is opened.

2. A tamper evident seal or tape (12",40) comprising an adhesive layer (24",46) for adhering to a surface when said seal or tape is applied to the surface, a support (20",42) for the adhesive layer, and indicating means (22",44) disposed between the adhesive

layer and the support for producing an indication of tampering with the seal or tape, portions of the adhesive layer being adhered to the support, characterised in that

the indicating means comprises a delaminating layer (22",44) adhered to the support (20",42) and the adhesive layer (24",46) and having an initial adhesion to said support, the delaminating layer (22",44) has a greater adhesion to the adhesive layer (24",46) than said initial adhesion and the adhesive layer has a greater adhesion to the support (20",42) and for the surface of the object than said initial adhesion whereby the delaminating layer delaminates from the support before the adhesive layer separates from the support to provide a permanent visual indication of such delamination, and the adhesive layer (22",44) and support (20",42) have different rates of shrinkage, when cooled, to produce delamination of said delaminating layer (22",44) and provide a permanent visual indication of tampering with the seal or tape, by cooling below a breakdown temperature, when said seal or tape is applied to the object, whereby if a refrigerant is applied to said seal or tape to cool the same below the breakdown temperature, at least an indication of the mere application of the refrigerant is provided regardless of whether said seal or tape is opened or removed.

3. The seal or tape (12,12',12",40) of claim 1 or 2, wherein the adhesive layer (24,24',24",46) has adhesive tack and a glass transition temperature at which said adhesive layer loses said adhesive tack, and wherein the adhesive layer and the delaminating layer (22,60,62,22',22",44) are selected so that said breakdown temperature is above said glass transition temperature.
4. The seal or tape (12,12",40) of claim 1, 2 or 3, wherein the adhesive layer (24,24',24",46) and the support (20,20',20",42) are selected to have different relative rates of expansion when warmed so that, upon warming after being cooled below said breakdown temperature, the adhesive layer and the support expand at different rates causing the delaminating layer (22,60,62,22",44) to visibly distort.
5. The seal or tape of any preceding claim, wherein the support is a plastic strip (20,20',20",42) and the delaminating layer is an ink layer (22,60,62,22",44).
6. The seal or tape of any preceding claim, wherein the delaminating layer is an ink layer (22,22",44) which is sufficiently thin so that there are voids in

the ink layer through which the adhesive layer (24,24",46) adheres or can adhere to the portions of the support (20,20",42).

7. The seal or tape (12",40) of claim 5 or 6, wherein the ink layer (22",44) has first and second surfaces, said first surface of said ink layer is in direct contact with and adhered to one surface of said plastic strip (20",42) without any intervening adhesion promoting material, without any adhesion promoting pre-treating of said one surface of said plastic strip, and without any intervening adhesion suppression material, and said adhesive layer (24",46) has first and second surfaces, said first surface of said adhesive layer being in direct contact with and adhered to said second surface of said ink layer.
8. The seal or tape of claim 5, wherein the plastic strip is a polyolefin strip (20') having a surface treated with an adhesion promoting process except at selected untreated areas defining a selected pattern on said surface of said polyolefin strip, so that said surface of said polyolefin strip has treated areas and said untreated areas, said ink layer (62) is over said treated areas and said untreated areas of said polyolefin strip, said ink layer (62) being in direct contact with said treated areas and having an adhesion to said treated areas that is strong relative to an adhesion of said ink layer to said untreated areas, whereby if said seal or tape is removed said ink layer delaminates from said polyolefin strip at said untreated regions, so that said selected pattern is visible, thereby providing evidence of tampering.
9. The seal or tape of claim 8, wherein said adhesion promoting process comprises a corona discharge process.
10. The seal or tape of claim 8, or 9, including a masking layer (60) adhered directly to said surface of the polyolefin strip (20') in said selected pattern so as to define said untreated areas, said masking layer (60) having an adhesion with said untreated areas that is weak relative to the adhesion of the ink layer (62) to said treated areas and the ink layer is over said masking layer and in direct contact therewith, so that said masking layer is sandwiched between the ink layer and said untreated areas of said polyolefin strip.
11. The seal or tape of claim 10, wherein the masking layer (60) is a water-based ink extender.
12. The seal or tape of claim 8, 9 10 or 11, wherein the polyolefin strip (20') is coloured to have a colour that contrasts with the colour of the ink layer (62), thereby increasing the ease with which the delami-

nation of said ink layer can be seen.

13. The seal or tape of claim 1 or 2, wherein the support is a flexible plastic strip (20,20',20",42) having a first rate of thermal contraction or expansion, the delaminating layer (22,60,62,22",44) is adhered to portions of one surface of the plastic strip with said initial adhesion and is separable from the plastic strip upon said initial adhesion being overcome to give a visual indication of such separation and thereafter has no adhesive affinity for the plastic strip, wherein the adhesive layer (24,24',24",46) is applied to said one surface of the plastic strip and to the delaminating layer, said adhesive layer having an adhesive tack above a glass transition temperature at or below which the adhesive layer loses its adhesive tack and being adhered to the delaminating layer and to portions of the plastic strip other than said portions to which the delaminating layer is initially adhered, said adhesive layer having a second rate of thermal contraction or expansion different from said first rate of contraction or expansion of the plastic strip, and wherein the plastic strip, delaminating layer and adhesive layer are responsive to cooling substantially below ambient temperature but above the glass transition temperature of the adhesive layer to cause the delaminating layer to separate from the plastic strip by differential rates of contraction or expansion whether or not the adhesive layer separates from the plastic strip or the surface.
14. The seal or tape of claim 13, wherein the delaminating layer is an ink layer (22,22",44) and the plastic strip (20,,20",42) is coloured to have a colour that contrasts with the colour of the ink layer, thereby increasing the ease with which delamination of the ink layer can be seen.
15. The seal or tape of any preceding claim, wherein the delaminating layer is a water based ink layer (22,60,22",44).
16. The seal or tape of any preceding claim, wherein the support (20,20',20",42) comprises polyethylene.
17. The seal or tape of any preceding claim, wherein support (20,20',20",42) includes printing.
18. The seal or tape of any preceding claim, including a thermally activatable layer adjacent a surface of the support (20,20',20",42) opposite the delaminating layer (22,60,62,22",44) for providing a permanent indication of tampering with said seal or tape by heating same at or above an activation temperature of said thermally activatable layer, whereby if heat is applied to the seal or tape to heat same at or above said activation temperature in an attempt to open said seal or tape without detection, an indication of the application of heat is provided regardless of whether the seal is opened.
19. The seal or tape of claim 18, wherein said thermally activatable layer comprises a thermally activatable ink layer which provides a permanent indication of tampering with the seal or tape when same is heated at or above an activation temperature of said thermally activatable ink layer by changing colour at said activation temperature.
20. The seal or tape of claim 18, wherein the thermally activatable layer comprises a masking ink layer adhered directly to the outer surface of the support (20,20',20",42) and a thermally activatable ink layer substantially the same colour as said masking ink layer adjacent the masking ink layer so that said masking ink layer is sandwiched between said support and said thermally activatable ink layer, and wherein the thermally activatable ink layer provides a permanent indication of tampering with said seal or tape when same is heated at or above an activation temperature of said thermally activatable ink layer by changing colour at said activation temperature to provide a thermally activatable ink layer which has a colour that contrasts with the colour of the masking ink layer, thereby increasing the ease with which heating of said ink layer can be detected.
21. A tamper-evident bag (10,10',10") including the seal or tape of any preceding claim 1 to 6, and a back wall (18,18',18") having an upper end, a bottom end, and two sides, said back wall having the surface to which the adhesive layer is adhered or can be adhered, and a front wall (16,16',16") having an upper end, a bottom end, and two sides, said front wall including said support (20,20',20"), and wherein the bottom ends and the sides of said back and front walls are joined together to form an enclosure having an opening (14,14") at the upper ends of said back and front walls.
22. The tamper-evident bag (10,10') of claim 21, wherein the back wall (18,18') is formed of polyethylene, the adhesive layer (24,24') is in direct contact with and adhered to the upper end of said back wall, and is covered with a peel-back strip (26,26'), which is removable to enable said adhesive layer to be pressed directly onto the ink layer (22,62')
23. The tamper-evident bag of claim 21 or 22, including a thermally activatable layer adjacent a surface of the support (20,20',20",) opposite the delaminating layer (22,22",60,62) for providing a permanent indication of tampering with said seal or tape by heating same at or above an activation temperature of

said thermally activatable layer means, whereby if heat is applied to said seal or tape to heat same at or above said activation temperature in an attempt to open or remove it without detection, an indication of the application of heat is provided regardless of whether the bag is opened.

24. A method of forming a tamper-evident seal for a bag (10,10',10") which comprises opposed front (16,16',16") and back (18,18',18") walls having bottom ends and two sides joined together to form an enclosure having an opening (14) at the upper ends of the walls, an adhesive layer (24,24',24") for sealing the opening and indicating means (22,22',60,62") cooperating with the adhesive layer for producing an indication of tampering with the seal, characterised by the steps of producing, on an untreated plastics strip (20,20',20") at the upper end of the front wall of the bag, a delaminating layer (22,22',60,62") which delaminates from the plastics strip both upon opening of the seal and cooling of the seal below a breakdown temperature, regardless of whether the seal is opened, to provide a permanent visual indication of tampering, said delaminating layer being produced by applying a layer (22,22',60,62") of wet ink onto the untreated plastics strip and drying said layer of wet ink, applying a layer (24,24',24") of heat melt adhesive on to the ink layer or the upper end of the back wall (18,18'), and applying a peel-back strip (26,26',26") over the adhesive layer, said ink layer having a greater adhesion for the adhesive layer than for the plastics strip, and the adhesive layer and plastics strip having different rates of shrinkage, when cooled.
25. A method of making a tape (40) for forming a tamper-evident seal characterised by the steps of producing, on an untreated plastics strip (42), a delaminating layer (44) which delaminates from the plastics strip both upon opening of the seal and cooling of the seal below a breakdown temperature, regardless of whether the seal is opened, to provide a permanent indication of tampering, said delaminating layer being produced by applying a layer (44) of wet ink on to the untreated plastics strip, and drying said layer of wet ink, and applying a layer (46) of hot melt adhesive on to the layer of dried ink (44), said ink layer having a greater adhesion for the adhesive layer than for the plastics strip, and said adhesive layer and plastics strip having different rates of shrinkage, when cooled.
26. The method of claim 24 or 25, wherein the layer (22,22',44) of wet ink is a flood coat of ink that is uniform and said flood coat of ink is applied sufficiently thin so that there are voids in the ink layer through which the adhesive layer can adhere to the

untreated plastic strip (20,20",42).

27. The method of claim 24 or 25, including the step of exposing first areas of a surface of the plastic strip (20') to an adhesion promoting process, second areas of said surface of the plastic strip not being exposed to said adhesion promoting process, and said second areas defining a selected pattern prior to the wet ink applying step, and disposing said ink layer (62) in direct contact with said first areas of said plastic strip during said wet ink applying step.
28. The method of claim 27, including the step of applying a masking layer (60) onto the surface of the plastic strip (20') in said selected pattern prior to said step of exposing said strip to an adhesion promoting process, so as to prevent said second areas of the plastic strip from being exposed to said adhesion promoting process.
29. The method of claim 27 or 28, wherein said adhesion promoting process comprises a corona discharge process.
30. The method of claim 28 or 29, wherein the ink layer (62) is in direct contact with the masking layer (60) at said second areas of said strip (20'), so that said masking layer is sandwiched between the strip and the ink layer.
31. The method of claim 28, 29 or 30, wherein the masking layer (60) is a water-based ink extender.
32. The method of any of claims 24 to 31, wherein the ink layer (22,22",60,44) is a water-based ink.
33. The method of any of claims 24 to 32, wherein the plastic strip is a polyolefin strip (20,20',20",42).
34. The method of any of claims 24 to 33, wherein the plastic or polyolefin strip (20,20',20",42) comprises polyethylene.
35. The method of any of claims 24 to 34, wherein the front wall (16,16',16") of the bag (10,10',10") is plastic and the plastic strip (20,20',20") having the ink layer (24,24',24") applied thereto, is attached to the bag (10,10',10") by heat sealing the plastic strip to the upper end of the front wall.
36. The method of any of claims 24 to 35, including the steps of applying a layer of wet thermally activatable ink directly onto the untreated strip (20,20',20",42) on a surface opposite the first ink layer, and drying said layer of wet thermally activatable ink.
37. The method of claim 36, including the step of apply-

ing a layer of wet masking ink directly onto the untreated plastic or polyolefin strip (20,20',20",42) on a surface opposite the first ink layer and drying said layer of wet masking ink prior to applying the wet thermally activatable ink so that said masking ink layer is sandwiched between the strip and the thermally activatable ink layer, said masking ink layer and said thermally activatable ink layer having substantially the same color when dry.

## Patentansprüche

1. Eingriffsnachweisverschluß (12, 12'), umfassend eine auf einer Oberfläche haftende Haftschrift (24, 24'), eine Unterlage (20, 20'), auf die Abschnitte der Haftschrift geklebt werden, wenn der genannte Verschluß aufgebracht wird, und ein Anzeigemittel (22, 60, 62), das so auf der Unterlage angeordnet ist, daß es sich zwischen der Haftschrift und der Unterlage befindet, wenn der Verschluß aufgebracht wird, um eine Anzeige für einen Eingriff in den Verschluß zu geben, dadurch gekennzeichnet, daß

das Anzeigemittel eine Delaminierungsschicht (22, 60) umfaßt, die an der Unterlage (20, 20') haftet und eine Anfangshaftfähigkeit an der Unterlage hat,

die Delaminierungsschicht (22, 60, 62) eine stärkere Haftfähigkeit für die Haftschrift (24, 24') hat als die genannte Anfangshaftfähigkeit und die Haftschrift eine stärkere Haftfähigkeit für die Unterlage und an der genannten Oberfläche hat als die genannte Anfangshaftfähigkeit, so daß die Delaminierungsschicht von der Unterlage abblättert, bevor sich die Haftschrift von der Unterlage löst, so daß eine dauerhafte visuelle Anzeige für eine solche Delaminierung entsteht,

die Haftschrift (24, 24') und die Unterlage (20, 20') beim Kühlen unterschiedliche Schrumpfraten haben, um ein Delaminieren der Delaminierungsschicht (22, 60, 62) zu erzeugen und eine dauerhafte visuelle Anzeige für einen durch Abkühlen auf eine Temperatur unterhalb einer Versagenstemperatur, wenn der genannte Verschluß aufgebracht ist, erfolgten Eingriff in den Verschluß bereitzustellen, so daß, wenn ein Kühlmittel auf den genannten Verschluß aufgebracht wird, um diesen auf eine Temperatur unterhalb der Versagenstemperatur abzukühlen, wenigstens eine Anzeige für das reine Aufbringen des Kühlmittels gegeben wird, unabhängig davon, ob der Verschluß geöffnet wurde oder nicht.

2. Eingriffsnachweisverschluß oder -band (12", 40), umfassend eine Haftschrift (24", 46), die auf einer

Oberfläche haftet, wenn der genannte Verschluß oder das genannte Band auf die Oberfläche aufgebracht wird, eine Unterlage (20", 42) für die Haftschrift, und ein Anzeigemittel (22", 44), das zwischen der Haftschrift und der Unterlage angeordnet ist, um eine Anzeige für einen Eingriff in den Verschluß oder das Band zu geben, wobei Abschnitte der Haftschrift auf die Unterlage geklebt werden, dadurch gekennzeichnet, daß

das Anzeigemittel eine Delaminierungsschicht (22", 44) umfaßt, die an der Unterlage (20", 42) und der Haftschrift (24", 46) haftet und eine Anfangshaftfähigkeit an der genannten Unterlage hat,

die Delaminierungsschicht (22", 44) eine stärkere Haftfähigkeit an der Haftschrift (24", 46) hat als die genannte Anfangshaftfähigkeit und die Haftschrift eine stärkere Haftfähigkeit an der Unterlage (20", 42) und für die Oberfläche des Objektes hat als die genannte Anfangshaftfähigkeit, so daß die Delaminierungsschicht von der Unterlage abblättert, bevor sich die Haftschrift von der Unterlage löst, so daß eine dauerhafte visuelle Anzeige einer solchen Delaminierung entsteht,

die Haftschrift (22", 44) und die Unterlage (20", 42) beim Kühlen unterschiedliche Schrumpfraten haben, um ein Abblättern der genannten Delaminierungsschicht (22", 44) zu erzeugen und eine dauerhafte visuelle Anzeige für einen durch Abkühlen auf eine Temperatur unterhalb einer Versagenstemperatur, wenn der genannte Verschluß oder das genannte Band auf das Objekt aufgebracht ist, erfolgten Eingriff in den Verschluß oder das Band bereitzustellen, so daß, wenn ein Kühlmittel auf den genannten Verschluß oder das genannte Band aufgebracht wird, um diesen/dieses auf eine Temperatur unterhalb der Versagenstemperatur abzukühlen, wenigstens eine Anzeige für das reine Aufbringen des Kühlmittels gegeben wird, unabhängig davon, ob der genannte Verschluß oder das genannte Band geöffnet oder entfernt wurde.

3. Verschluß oder Band (12, 12', 12", 40) nach Anspruch 1 oder 2, bei dem die Haftschrift (24, 24', 24", 46) eine Klebrigkeit und eine Glasübergangstemperatur aufweist, bei der die genannte Haftschrift die genannte Klebrigkeit verliert, und wobei die Haftschrift und die Delaminierungsschicht (22, 60, 62, 22', 22", 44) so gewählt werden, daß die genannte Versagenstemperatur oberhalb der genannten Glasübergangstemperatur liegt.

4. Verschluß oder Band (12, 12", 40) nach Anspruch 1, 2 oder 3, bei dem die Haftschrift (24, 24', 24",

- 46) und die Unterlage (20, 20', 20", 42) so gewählt werden, daß sie beim Erwärmen unterschiedliche relative Ausdehnungsraten haben, so daß sich die Haftschrift und die Unterlage beim Erwärmen, nachdem sie auf eine Temperatur unterhalb der genannten Versagenstemperatur abgekühlt wurden, mit unterschiedlichen Geschwindigkeiten ausdehnen, so daß die Delaminierungsschicht (22, 60, 62, 22", 44) sichtbar verzogen wird.
5. Verschluß oder Band nach einem der vorherigen Ansprüche, bei dem die Unterlage ein Kunststoffstreifen (20, 20', 20", 42) und die Delaminierungsschicht eine Farbschicht (22, 60, 62, 22", 44) ist.
6. Verschluß oder Band nach einem der vorherigen Ansprüche, bei dem die Delaminierungsschicht eine Farbschicht (22, 22", 44) ist, die so dünn ist, daß die Farbschicht Leerstellen enthält, durch die die Haftschrift (24, 24", 46) an den Abschnitten der Unterlage (20, 20", 42) haftet oder haften kann.
7. Verschluß oder Band (12", 40) nach Anspruch 5 oder 6, bei dem die Farbschicht (22", 44) eine erste und eine zweite Fläche aufweist, wobei sich die genannte erste Fläche der genannten Farbschicht in direktem Kontakt mit einer Fläche des genannten Kunststoffstreifens (20", 42) befindet und ohne eingreifendes haftförderndes Material, ohne haftfördernde Vorbehandlung der genannten einen Fläche des genannten Kunststoffstreifens und ohne eingreifendes Haftunterdrückungsmaterial daran haftet, und wobei die genannte Haftschrift (24", 46) eine erste und eine zweite Fläche aufweist, wobei sich die genannte erste Fläche der genannten Haftschrift in direktem Kontakt mit der genannten zweiten Fläche der genannten Farbschicht befindet und an dieser haftet.
8. Verschluß oder Band nach Anspruch 5, bei dem der Kunststoffstreifen ein Polyolefinstreifen (20') mit einer Oberfläche ist, die mit einem Haftförderungsprozeß behandelt wurde, ausgenommen an gewählten unbehandelten Bereichen, die ein gewähltes Muster auf der genannten Oberfläche des genannten Polyolefinstreifens definieren, so daß die genannte Oberfläche des genannten Polyolefinstreifens behandelte Bereiche und die genannten unbehandelten Bereiche aufweist, wobei sich die genannte Farbschicht (62) über den genannten behandelten Bereichen und den genannten unbehandelten Bereichen des genannten Polyolefinstreifens befindet, wobei sich die genannte Farbschicht (62) in direktem Kontakt mit den genannten behandelten Bereichen befindet und eine Haftfähigkeit an den genannten behandelten Bereichen hat, die im Vergleich zu einer Haftfähigkeit der genannten Farbschicht an den genannten unbehandelten Bereichen stark ist, so daß, wenn der genannte Verschluß oder das genannte Band entfernt wird, die genannte Farbschicht von dem genannten Polyolefinstreifen an den genannten unbehandelten Regionen abblättert, so daß das genannte gewählte Muster sichtbar wird, wodurch ein Nachweis für einen Eingriff gegeben ist.
9. Verschluß oder Band nach Anspruch 8, bei dem der genannte Haftförderungsprozeß einen Glimmentladungsprozeß umfaßt.
10. Verschluß oder Band nach Anspruch 8 oder 9, einschließlich einer Maskierungsschicht (60), die unmittelbar an der genannten Oberfläche des Polyolefinstreifens (20') in dem genannten gewählten Muster haftet, um die genannten unbehandelten Bereiche zu definieren, wobei die genannte Maskierungsschicht (60) eine Haftfähigkeit mit den genannten unbehandelten Bereichen besitzt, die im Vergleich zur Haftfähigkeit der Farbschicht (62) an den genannten behandelten Bereichen schwach ist, und die Farbschicht sich über der genannten Maskierungsschicht und in direktem Kontakt damit befindet, so daß die genannte Maskierungsschicht zwischen der Farbschicht und den genannten unbehandelten Bereichen des genannten Polyolefinstreifens eingeschlossen ist.
11. Verschluß oder Band nach Anspruch 10, bei dem die Maskierungsschicht (60) ein auf Wasser basierender Farbextender ist.
12. Verschluß oder Band nach Anspruch 8, 9, 10 oder 11, bei dem der Polyolefinstreifen (20') mit einer Farbe gefärbt ist, die einen Kontrast zur Farbe der Farbschicht (62) bildet, so daß eine Delaminierung der genannten Farbschicht leichter erkennbar ist.
13. Verschluß oder Band nach Anspruch 1 oder 2, bei dem die Unterlage ein flexibler Kunststoffstreifen (20, 20', 20", 42) mit einer ersten Wärmezusammenzieh- oder -ausdehnungsrate ist, die Delaminierungsschicht (22, 60, 62, 22", 44) auf Abschnitte einer Oberfläche des Kunststoffstreifens mit der genannten Anfangshaftfähigkeit geklebt ist und von dem Kunststoffstreifen abgezogen werden kann, wenn die genannte Anfangshaftfähigkeit überwunden wird, so daß sich eine visuelle Anzeige eines solchen Abziehens ergibt, und danach keine Haftungsaffinität für den Kunststoffstreifen hat, wobei die Haftschrift (24, 24', 24", 46) auf die genannte Oberfläche des Kunststoffstreifens und auf die Delaminierungsschicht aufgebracht ist, wobei die genannte Haftschrift eine Klebrigkeit oberhalb einer Glasübergangstemperatur hat, bei der oder unterhalb derer die Haftschrift ihre Klebrigkeit ver-

- liert, und auf die Delaminierungsschicht und auf andere Abschnitte des Kunststoffstreifens geklebt ist als die genannten Abschnitte, auf die die Delaminierungsschicht anfänglich geklebt ist, wobei die genannte Haftschrift eine zweite Wärmezusammenzieh- oder -ausdehnungsrate hat, die sich von der genannten ersten Wärmezusammenzieh- oder -ausdehnungsrate des Kunststoffstreifens unterscheidet, und wobei der Kunststoffstreifen, die Delaminierungsschicht und die Haftschrift auf eine Abkühlung wesentlich unterhalb der Umgebungstemperatur, aber oberhalb der Glasübergangstemperatur der Haftschrift ansprechen, indem sich die Delaminierungsschicht von dem Kunststoffstreifen mit unterschiedlichen Zusammenzieh- oder Ausdehnungsraten löst, unabhängig davon, ob sich die Haftschrift von dem Kunststoffstreifen oder von der Oberfläche löst.
14. Verschluß oder Band nach Anspruch 13, bei dem die Delaminierungsschicht eine Farbschicht (22, 22", 44) und der Kunststoffstreifen (20, 20", 42) mit einer Farbe gefärbt ist, die einen Kontrast zur Farbe der Farbschicht bildet, so daß eine Delaminierung der Farbschicht leichter erkennbar ist.
15. Verschluß oder Band nach einem der vorherigen Ansprüche, bei dem die Delaminierungsschicht eine auf Wasser basierende Farbschicht (22, 60, 22", 44) ist.
16. Verschluß oder Band nach einem der vorherigen Ansprüche, bei dem die Unterlage (20, 20', 20", 42) Polyethylen umfaßt.
17. Verschluß oder Band nach einem der vorherigen Ansprüche, bei dem die Unterlage (20, 20', 20", 42) bedruckt ist.
18. Verschluß oder Band nach einem der vorherigen Ansprüche, mit einer thermisch aktivierbaren Schicht neben einer Fläche der Unterlage (20, 20', 20", 42) gegenüber der Delaminierungsschicht (22, 60, 62, 22", 44) zum Bereitstellen einer dauerhaften Anzeige für einen Eingriff in den genannten Verschluß oder das genannte Band durch Erwärmen desselben auf oder über eine Aktivierungstemperatur der genannten thermisch aktivierbaren Schicht, so daß, wenn der Verschluß oder das Band mit Wärme beaufschlagt wird, um ihn/es auf oder über die genannte Aktivierungstemperatur in dem Versuch zu erwärmen, den genannten Verschluß oder das genannte Band nachweislos zu öffnen, eine Anzeige für die Beaufschlagung von Wärme unabhängig davon gegeben wird, ob der Verschluß geöffnet wurde oder nicht.
19. Verschluß oder Band nach Anspruch 18, bei dem die genannte thermisch aktivierbare Schicht eine thermisch aktivierbare Farbschicht umfaßt, die eine dauerhafte Anzeige für einen Eingriff in den Verschluß oder das Band gibt, wenn dieser/dieses auf oder über eine Aktivierungstemperatur der genannten thermisch aktivierbaren Farbschicht erwärmt wird, da sich die Farbe bei der genannten Aktivierungstemperatur ändert.
20. Verschluß oder Band nach Anspruch 18, bei dem die thermisch aktivierbare Schicht eine Maskierungsfarbschicht, die unmittelbar auf die Außenfläche der Unterlage (20, 20', 20", 42) geklebt ist, und eine thermisch aktivierbare Farbschicht, die im wesentlichen dieselbe Farbe hat wie die genannte Maskierungsfarbschicht, neben der Maskierungsfarbschicht umfaßt, so daß die genannte Maskierungsfarbschicht zwischen der genannten Unterlage und der genannten thermisch aktivierbaren Farbschicht eingeschlossen ist, und wobei die thermisch aktivierbare Farbschicht eine dauerhafte Anzeige für einen Eingriff in den genannten Verschluß oder das genannte Band gibt, wenn dieser/dieses auf oder über eine Aktivierungstemperatur der genannten thermisch aktivierbaren Farbschicht erwärmt wird, da sich die Farbe bei der genannten Aktivierungstemperatur ändert, oder durch Vorsehen einer thermisch aktivierbaren Farbschicht, die eine Farbe hat, die einen Kontrast zur Farbe der Maskierungsfarbschicht bildet, so daß ein Erwärmen der genannten Farbschicht leichter erkennbar ist.
21. Eingriffsnachweisbeutel (10, 10', 10"), der folgendes aufweist: den Verschluß oder das Band nach einem der vorherigen Ansprüche 1 bis 6, eine Rückwand (18, 18', 18") mit einem oberen Ende, einem unteren Ende, und zwei Seiten, wobei die genannte Rückwand die Fläche aufweist, auf die die Haftschrift geklebt wird oder werden kann, und eine Frontwand (16, 16', 16") mit einem oberen Ende, einem unteren Ende, und zwei Seiten, wobei die genannte Frontwand die genannte Unterlage (20, 20', 20") aufweist und wobei die unteren Enden und die Seiten der genannten Rück- und Frontwand miteinander verbunden sind, so daß ein Gehäuse entsteht, das an den oberen Enden der genannten Rück- und Frontwand eine Öffnung (14, 14") aufweist.
22. Eingriffsnachweisbeutel (10, 10') nach Anspruch 21, bei dem die Rückwand (18, 18') aus Polyethylen gebildet ist, wobei sich die Haftschrift (24, 24') in direktem Kontakt mit dem oberen Ende der genannten Rückwand befindet und an dieser haftet und mit einem Abziehstreifen (26, 26') bedeckt ist, der entfernt werden kann, damit die genannte Haftschrift direkt auf die Farbschicht (22, 62') gedrückt

werden kann.

23. Eingriffsnachweisbeutel nach Anspruch 21 oder 22, mit einer thermisch aktivierbaren Schicht neben einer Fläche der Unterlage (20, 20', 20'') gegenüber der Delaminierungsschicht (22, 22'', 60, 62), um eine dauerhafte Anzeige für einen durch Erwärmen des Verschlusses oder des Bandes auf oder über eine Aktivierungstemperatur der genannten thermisch aktivierbaren Schicht erfolgten Eingriff in den genannten Verschuß oder das genannte Band zu geben, so daß, wenn der genannte Verschuß oder das genannte Band mit Wärme beaufschlagt wird, um ihn/es auf oder über die genannte Aktivierungstemperatur in einem Versuch zu erwärmen, ihn/es nachweislos zu öffnen oder zu entfernen, eine Anzeige für die Beaufschlagung von Wärme unabhängig davon gegeben wird, ob der Beutel geöffnet wurde oder nicht.
24. Verfahren zur Herstellung eines Eingriffsnachweisverschlusses für einen Beutel (10, 10', 10''), der folgendes umfaßt: gegenüberliegende Front- (16, 16', 16'') und Rückwände (18, 18', 18'') mit unteren Enden und Zwei Seiten, die miteinander verbunden sind, um ein Gehäuse mit einer Öffnung (14) an den oberen Enden der Wände zu bilden, eine Haftschiicht (24, 24', 24'') zum Verschließen der Öffnung, und ein Anzeigemittel (22, 22', 60, 62''), das mit der Haftschiicht zusammenwirkt, um eine Anzeige für einen Eingriff in den Verschuß zu erzeugen, gekennzeichnet durch die folgenden Schritte: Erzeugen einer Delaminierungsschicht (22, 22', 60, 62'') auf einem unbehandelten Kunststoffstreifen (20, 20', 20'') am oberen Ende der Frontwand des Beutels, wobei die Delaminierungsschicht von dem Kunststoffstreifen sowohl nach dem Öffnen des Verschlusses als auch nach dem Abkühlen des Verschlusses auf eine Temperatur unterhalb einer Versagenstemperatur abblättert, unabhängig davon, ob der Verschuß geöffnet wurde oder nicht, um eine dauerhafte visuelle Anzeige für einen Eingriff zu geben, wobei die genannte Delaminierungsschicht erzeugt wird, indem eine Schicht (22, 22', 60, 62'') aus nasser Farbe auf den unbehandelten Kunststoffstreifen aufgebracht und die genannte Schicht aus nasser Farbe getrocknet, eine Schicht (24, 24', 24'') aus Warmschmelzklebstoff auf die Farbschicht oder das obere Ende der Rückwand (18, 18') aufgebracht und ein Abziehstreifen (26, 26', 26'') auf die Haftschiicht aufgebracht wird, wobei die genannte Farbschicht eine stärkere Haftfähigkeit für die Haftschiicht hat als für den Kunststoffstreifen und die Haftschiicht und der Kunststoffstreifen beim Abkühlen unterschiedliche Schrumpfungsraten haben.

25. Verfahren zur Herstellung eines Bandes (40) zur

Bildung eines Eingriffsnachweisverschlusses, gekennzeichnet durch die folgenden Schritte: Erzeugen einer Delaminierungsschicht (44) auf einem unbehandelten Kunststoffstreifen (42), die sowohl nach dem Öffnen des Verschlusses als auch nach dem Abkühlen des Verschlusses auf eine Temperatur unterhalb einer Versagenstemperatur abblättert, unabhängig davon, ob der Verschuß geöffnet wurde oder nicht, um eine dauerhafte Anzeige für einen Eingriff zu geben, wobei die genannte Delaminierungsschicht erzeugt wird, indem eine Schicht (44) aus nasser Farbe auf den unbehandelten Kunststoffstreifen aufgebracht und die genannte Schicht aus nasser Farbe getrocknet und eine Schicht (46) aus Heißschmelzklebstoff auf die Schicht aus getrockneter Farbe (44) aufgebracht wird, wobei die genannte Farbschicht eine größere Haftfähigkeit für die Haftschiicht besitzt als für den Kunststoffstreifen und die genannte Haftschiicht und der Kunststoffstreifen beim Abkühlen unterschiedliche Schrumpfungsraten haben.

26. Verfahren nach Anspruch 24 oder 25, bei dem die Schicht (22, 22', 44) aus nasser Farbe ein Flutfarbüberzug ist, der gleichförmig ist, und der genannte Flutfarbüberzug ausreichend dünn aufgebracht wird, so daß Leerstellen in der Farbschicht vorhanden sind, durch die die Haftschiicht an dem unbehandelten Kunststoffstreifen (20, 20'', 42) haften kann.
27. Verfahren nach Anspruch 24 oder 25, das die folgenden Schritte enthält: Unterziehen erster Bereiche einer Oberfläche des Kunststoffstreifens (20') einem Haftförderungsprozeß, wobei zweite Bereiche der genannten Oberfläche des Kunststoffstreifens dem genannten Haftförderungsprozeß nicht unterzogen werden, und wobei die genannten zweiten Bereiche ein gewähltes Muster vor dem Schritt des Aufbringens nasser Farbe definieren, und Bringen der genannten Farbschicht (62) in direkten Kontakt mit den genannten ersten Bereichen des genannten Kunststoffstreifens während des genannten Schrittes des Aufbringens der nassen Farbe.
28. Verfahren nach Anspruch 27, mit dem folgenden Schritt: Aufbringen einer Maskierungsschicht (60) auf die Oberfläche des Kunststoffstreifens (20') in dem genannten gewählten Muster vor dem genannten Schritt des Unterziehens des genannten Streifens einem Haftförderungsprozeß, um zu verhindern, daß die genannten zweiten Bereiche des Kunststoffstreifens dem genannten Haftförderungsprozeß unterzogen werden.

29. Verfahren nach Anspruch 27 oder 28, bei dem der

genannte Haftförderungsprozeß einen Glimmentladungsprozeß umfaßt.

30. Verfahren nach Anspruch 28 oder 29, bei dem die Farbschicht (62) in den genannten zweiten Bereich des genannten Streifens (20') in direktem Kontakt mit der Maskierungsschicht (60) ist, so daß die genannte Maskierungsschicht zwischen dem Streifen und der Farbschicht eingeschlossen ist. 5
31. Verfahren nach Anspruch 28, 29 oder 30, bei dem die Maskierungsschicht (60) ein auf Wasser basierender Farbextender ist. 10
32. Verfahren nach einem der Ansprüche 24 bis 31, bei dem die Farbschicht (22, 22", 60, 44) eine auf Wasser basierende Farbe ist. 15
33. Verfahren nach einem der Ansprüche 24 bis 32, bei dem der Kunststoffstreifen ein Polyolefinstreifen (20, 20', 20", 42) ist. 20
34. Verfahren nach einem der Ansprüche 24 bis 33, bei dem der Kunststoff- oder Polyolefinstreifen (20, 20', 20", 42) Polyethylen umfaßt. 25
35. Verfahren nach einem der Ansprüche 24 bis 34, bei dem die Frontwand (16, 16', 16") des Beutels (10, 10', 10") aus Kunststoff besteht und der Kunststoffstreifen (20, 20', 20") mit der darauf aufgebracht Farbschicht (24, 24', 24") an dem Beutel (10, 10', 10") durch Heißsiegeln des Kunststoffstreifens auf das obere Ende der Frontwand befestigt wird. 30
36. Verfahren nach einem der Ansprüche 24 bis 35, das die folgenden Schritte enthält: Aufbringen einer Schicht aus nasser, thermisch aktivierbarer Farbe unmittelbar auf den unbehandelten Streifen (20, 20', 20", 42) auf eine Oberfläche gegenüber der ersten Farbschicht, und Trocknen der genannten Schicht aus nasser, thermisch aktivierbarer Farbe. 35 40
37. Verfahren nach Anspruch 36, das die folgenden Schritte enthält: Aufbringen einer Schicht aus nasser Maskierungsfarbe unmittelbar auf den unbehandelten Kunststoff- oder Polyolefinstreifen (20, 20', 20", 42) auf einer Oberfläche gegenüber der ersten Farbschicht und Trocknen der genannten Schicht aus nasser Maskierungsfarbe vor dem Aufbringen der nassen, thermisch aktivierbaren Farbe, so daß die genannte Maskierungsfarbschicht zwischen dem Streifen und der thermisch aktivierbaren Farbschicht eingeschlossen ist, wobei die genannte Maskierungsfarbschicht und die genannte thermisch aktivierbare Farbschicht im trockenen Zustand im wesentlichen dieselbe Farbe haben. 45 50 55

## Revendications

1. Une fermeture apportant la preuve de l'ouverture frauduleuse (12,12') comportant une couche adhésive (24,24') collée à une surface, un support (20,20') sur lequel des portions de la couche adhésive collent lorsque ledit dispositif est appliqué, et des moyens d'indication (22,60,62) disposés sur le support de manière à se trouver entre la couche adhésive et le support, quand la fermeture est appliquée, pour produire une indication/preuve de l'ouverture frauduleuse de la fermeture, caractérisée en ce que :

les moyens indicateurs comportent une couche de délamination (22,60) collée au support (20,20') et ayant une adhésion initiale audit support,

la couche de délamination (22,60,62) adhère davantage à la couche adhésive (24,24') que ladite adhésion initiale et la couche adhésive adhère davantage au support et à ladite surface que ladite adhésion initiale ; par conséquent, la couche de délamination se délamine du support avant que la couche adhésive se sépare du support, de manière à fournir une indication visuelle permanente d'une telle délamination,

et la couche adhésive (24,24') et le support (20,20') ont des vitesses de retrait différentes, lorsque refroidis, pour produire une délamination de la couche de délamination (22,60,62) et pour fournir une indication visuelle permanente d'une ouverture frauduleuse de la fermeture, en refroidissant jusqu'au dessous d'une température de rupture, lorsque ladite fermeture est appliquée ; par conséquent, si un agent réfrigérant est appliqué à ladite fermeture pour la refroidir jusqu'au dessous de la température de rupture, ceci fournit au moins une indication de la simple application du réfrigérant, que la fermeture soit ou non ouverte.

2. Une fermeture ou bande (12",40) apportant la preuve de l'ouverture frauduleuse, comportant une couche adhésive (24",46) pour adhérer à une surface quand ladite fermeture ou bande est appliquée à la surface, un support (20",42) pour la couche adhésive, et des moyens indicateurs (22",44) disposés entre la couche adhésive et le support pour produire une indication d'une ouverture frauduleuse au niveau de la fermeture ou bande, des portions de la couche adhésive étant collées au support, caractérisé en ce que

les moyens indicateurs comportent une couche de délamination (22",44) collée au support (20",42) et à la couche adhésive (24",46) et

adhérant initialement audit support, la couche de délamination (22",44) adhère davantage à la couche adhésive (24",46) que ladite adhésion initiale et la couche adhésive adhère davantage au support (20",42) et à la surface de l'objet que ladite adhésion initiale ; par conséquent, la couche de délamination se délamine du support avant que la couche adhésive se sépare du support pour fournir une indication visuelle permanente d'une telle délamination, et la couche adhésive (22",44) et le support (20",42) ont différentes vitesses de retrait, lorsque refroidis, pour produire une délamination de ladite couche de délamination (22",44) et offrir une indication visuelle permanente d'une ouverture frauduleuse au niveau de la fermeture ou bande, en refroidissant au-dessous d'une température de rupture, quand ladite fermeture ou bande est appliquée à l'objet ; par conséquent, si un réfrigérant est appliqué à ladite fermeture ou bande pour la refroidir au-dessous de la température de rupture, au moins une indication de la simple application du réfrigérant est fournie, que ladite fermeture ou bande soit ouverte ou enlevée.

3. La fermeture ou bande (12,12',12",40) de la revendication 1 ou 2, dans laquelle la couche adhésive (24,24',24",46) a une pégosité et une température de transition vitreuse à laquelle la couche adhésive perd ladite pégosité, et dans laquelle la couche adhésive et la couche de délamination (22,60,62,22',22",44) sont sélectionnées de façon telle que ladite température de rupture est supérieure à ladite température de transition vitreuse.
4. La fermeture ou bande (12,12",40) de la revendication 1, 2 ou 3, dans laquelle la couche adhésive (24,24',24",46) et le support (20,20',20",42) sont sélectionnés pour avoir des vitesses relatives de dilatation différentes lorsque chauffés de façon telle que, s'ils sont chauffés après avoir été refroidis au-dessous de ladite température de rupture, la couche adhésive et le support se dilatent à des vitesses différentes, ce qui fait déformer visiblement la couche de délamination (22,60,62,22",44).
5. La fermeture ou bande de l'une quelconque des revendications précédentes, dans laquelle le support est un ruban en plastique (20,20',20",42) et la couche de délamination est une couche d'encre (22,60,62,22",44).
6. La fermeture ou bande de l'une quelconque des revendications précédentes, dans laquelle la couche de délamination est une couche d'encre (22,22",44) qui est suffisamment mince pour qu'il y

ait des vides dans la couche d'encre, vides à travers lesquels la couche adhésive (24,24",46) adhère ou peut adhérer aux portions du support (20,20",42).

7. La fermeture ou bande (12",40) de la revendication 5 ou 6, dans laquelle la couche d'encre (22",44) a une première et une seconde surfaces, ladite première surface de ladite couche d'encre est en contact direct avec et collée à une surface dudit ruban en plastique (20",42) sans aucune matière intermédiaire favorisant l'adhésion, sans aucun prétraitement favorisant l'adhésion de ladite première surface dudit ruban en plastique, et sans matière intermédiaire de suppression d'adhésion, et ladite couche adhésive (24",46) a une première surface et une seconde surface, ladite première surface de ladite couche adhésive étant en contact direct avec une seconde surface de ladite couche d'encre à laquelle elle est collée.
8. La fermeture ou bande de la revendication 5, dans laquelle le ruban en plastique est un ruban en polyoléfine (20') ayant une surface traitée par un procédé qui favorise l'adhésion, sauf sur certaines surfaces et non traitées qui définissent un motif sélectionné sur ladite surface du ruban de polyoléfine, de façon telle que ladite surface du ruban de polyoléfine possède des surfaces traitées et lesdites surfaces non traitées, ladite couche d'encre (62) est au-dessus desdites surfaces traitées et desdites surfaces non traitées dudit ruban de polyoléfine, ladite couche d'encre (62) étant en contact direct avec lesdites surfaces traitées et ayant une adhésion auxdites surfaces traitées qui est puissante relativement à une adhésion de ladite couche d'encre auxdites surfaces non traitées, de façon telle que, si ladite fermeture ou bande est retirée, ladite couche d'encre se délamine dudit ruban de polyoléfine dans lesdites régions non traitées, de manière telle que ledit motif sélectionné est visible, ce qui apporte la preuve d'une ouverture frauduleuse.
9. La fermeture ou bande de la revendication 8, dans laquelle ledit procédé qui favorise l'adhésion comporte un procédé à décharge corona.
10. La fermeture ou bande de la revendication 8 ou 9, incluant une couche de masquage (60) directement collée sur ladite surface du ruban en polyoléfine (20') selon ledit motif sélectionné de manière à définir lesdites surfaces non traitées, ladite couche de masquage (60) ayant une adhésion avec lesdites faces non traitées qui est faible relativement à l'adhésion de la couche d'encre (62) auxdites surfaces traitées et ladite couche d'encre est au-dessus de ladite couche de masquage et en contact direct

avec elle, de façon telle que ladite couche de masquage est prise en sandwich entre la couche d'encre et lesdites surfaces non traitées dudit ruban de polyoléfine.

11. La fermeture ou bande de la revendication 10, dans laquelle la couche de masquage (60) est un produit d'allongement d'encre à base d'eau.

12. La fermeture ou bande de la revendication 8, 9, 10 ou 11, dans laquelle le ruban de polyoléfine (20') est coloré avec une couleur qui contraste avec la couleur de la couche d'encre (62), accroissant ainsi la facilité avec laquelle peut être vue la délamination de ladite couche d'encre.

13. La fermeture ou bande de la revendication 1 ou 2, dans laquelle le support est un ruban en plastique souple (20,20',20'',42) ayant une première vitesse de contraction ou de dilatation thermique, la couche de délamination (22,60,62,22'',44) est collée aux portions d'une surface du ruban en plastique avec ladite adhésion initiale et est séparable du ruban en plastique lorsque ladite adhésion initiale est surmontée pour fournir une indication visuelle d'une telle séparation et, par la suite, n'a aucune affinité adhésive pour le ruban en plastique, la couche adhésive (24,24',24'',46) étant appliquée à l'une desdites surfaces du ruban en plastique et la couche de délamination, ladite couche adhésive ayant une pégosité qui excède une température de transition vitreuse égale à laquelle ou au-dessous de laquelle la couche adhésive perd sa pégosité et étant collée à la couche de délamination et à des portions du ruban en plastique autres que lesdites portions auxquelles la couche de délamination est initialement collée, ladite couche adhésive ayant une seconde vitesse de contraction ou de dilatation thermique qui diffère de ladite première vitesse de contraction ou de dilatation du ruban en plastique, et dans laquelle le ruban en plastique, la couche de délamination et la couche adhésive réagissent à un refroidissement substantiellement inférieur à la température ambiante mais excédant la température de transition vitreuse de la couche adhésive, pour faire séparer la couche de délamination du ruban en plastique du fait des vitesses différentielles de contraction ou de dilatation, que la couche adhésive se sépare ou non du ruban en plastique ou de la surface.

14. La fermeture ou bande de la revendication 13, dans laquelle la couche de délamination est une couche d'encre (22,22'',44) et le ruban en plastique (20,20'',42) est coloré avec une couleur qui contraste avec celle de la couche d'encre, accroissant ainsi la facilité avec laquelle il est possible de voir la délamination de la couche d'encre.

15. La fermeture ou bande de l'une quelconque des revendications précédentes, dans laquelle la couche de délamination est une couche d'encre à base d'eau (22,60,22'',44).

16. La fermeture ou bande de l'une quelconque des revendications précédentes, dans laquelle le support (20,20',20'',42) comporte du polyéthylène.

17. La fermeture ou bande de l'une quelconque des revendications précédentes, dans laquelle le support (20,20',20'',42) inclut une impression.

18. La fermeture ou bande de l'une quelconque des revendications précédentes, incluant une couche thermiquement activable adjacente à la surface du support (20,20',20'',42) qui fait face à la couche de délamination (22,60,62,22'',44) pour fournir une indication permanente de l'ouverture frauduleuse de ladite fermeture ou bande en chauffant celle-ci à une température d'activation de ladite couche thermique activable ou à une température supérieure de façon telle que, si de la chaleur est appliquée à la fermeture ou bande pour chauffer celle-ci à la température d'activation précitée ou à une température supérieure pour tenter d'ouvrir ladite fermeture ou bande sans détection, une indication de l'application de chaleur est produite, que la fermeture soit ouverte ou non.

19. La fermeture ou bande de la revendication 18, dans laquelle ladite couche thermiquement activable comporte une couche d'encre thermiquement activable qui fournit une indication permanente d'une ouverture frauduleuse de la fermeture ou bande quand celle-ci est chauffée à une température égale ou supérieure à une température d'activation de ladite couche d'encre thermiquement activable en changeant de couleur à ladite température d'activation.

20. La fermeture ou bande de la revendication 18, dans laquelle la couche thermiquement activable comporte une couche d'encre de masquage collée directement à la surface extérieure du support (20,20',20'',42) et une couche d'encre thermique activable d'une couleur essentiellement identique à ladite couche d'encre de masquage adjacente à la couche d'encre de masquage de façon telle que ladite couche d'encre de masquage est prise en sandwich entre ledit support et ladite couche d'encre thermiquement activable ; et dans laquelle la couche d'encre thermiquement activable offre une indication permanente de l'ouverture frauduleuse de ladite fermeture ou bande quand celle-ci est chauffée à une température d'activation égale ou supérieure à celle de la couche d'encre thermiquement activable en changeant de couleur à ladite

température d'activation à produire une couche d'encre thermiquement activable dont la couleur contraste avec la couleur de la couche d'encre de masquage, augmentant ainsi la facilité de détection d'un chauffage de ladite couche d'encre.

21. Un sac apportant la preuve d'une ouverture frauduleuse (10,10',10") incluant la fermeture ou bande de l'une quelconque des revendications précédentes 1 à 6, et une paroi postérieure (18,18',18") ayant une extrémité supérieure, un extrémité inférieure et deux côtés, ladite paroi postérieure ayant la surface à laquelle la couche adhésive est collée ou peut être collée, et une paroi antérieure (16,16',16") ayant une extrémité supérieure, une extrémité inférieure et deux côtés, ladite paroi antérieure incluant ledit support (20,20',20"), et dans laquelle les extrémités inférieures et les côtés desdites parois postérieure et antérieure sont joints ensemble pour former une enceinte ayant une ouverture (14,14") aux extrémités supérieures desdites paroi postérieure et antérieure.
22. Le sac apportant la preuve d'une ouverture frauduleuse (10,10') de la revendication 21, dans lequel la paroi postérieure (18,18') est formée en polyéthylène, la couche adhésive (24,24') est en contact direct avec et collée à l'extrémité supérieure de ladite paroi postérieure, et est couverte d'un ruban détachable (26,26') qui peut être détaché pour permettre de presser directement ladite couche adhésive sur la couche d'encre (22,62').
23. Le sac apportant la preuve d'une ouverture frauduleuse de la revendication 21 ou 22, qui inclut une couche thermiquement activable adjacente à une surface du support (20,20',20") face à la couche de délamination (22,22',60,62) pour fournir une indication permanente de l'ouverture frauduleuse de ladite fermeture ou bande, en chauffant celle-ci à une température égale ou supérieure à la température d'activation de ladite couche thermiquement activable de façon telle que, si de la chaleur est appliquée à ladite fermeture ou bande pour la chauffer à une température égale ou supérieure à ladite température d'activation pour tenter de l'ouvrir ou de l'enlever sans détection, une indication de l'application de chaleur est fournie, que le sac soit ou non ouvert.
24. Une méthode de formation d'une fermeture apportant la preuve d'une ouverture frauduleuse pour un sac (10,10',10") qui comporte des parois antérieure (16,16',16") et postérieure (18,18',18") opposées ayant des extrémités inférieures et deux côtés joints ensemble pour former une enceinte ayant une ouverture (14) aux extrémités supérieures des parois, une couche adhésive (24,24',24") pour fer-

mer l'ouverture et des moyens indicateurs (22,22',60,62") coopérant avec la couche adhésive pour produire une indication d'ouverture frauduleuse de la fermeture, caractérisée par les étapes de production, sur un ruban en plastique non traité (20,20',20") à l'extrémité supérieure de la paroi antérieure du sac, d'une couche de délamination (22,22',60,62") qui se délamine du ruban en plastique tant à l'ouverture de la fermeture qu'au refroidissement de la fermeture en deçà d'une température de rupture, que la fermeture soit ou non ouverte, pour fournir une indication visuelle permanente de l'ouverture frauduleuse, ladite couche de délamination étant produite par application d'une couche (22,22',60,62") d'encre mouillée sur le ruban en plastique non traité et en séchant ladite couche d'encre mouillée, en appliquant une couche (24,24',24") d'une colle thermofondante sur la couche d'encre ou sur l'extrémité supérieure de la paroi postérieure (18,18') et en appliquant un ruban détachable (26,26',26") au-dessus de la couche adhésive, ladite couche d'encre adhérant mieux à la couche adhésive qu'au ruban en plastique, et la couche adhésive et le ruban en plastique ayant des vitesses différentes de retrait au refroidissement.

25. Une méthode de fabrication d'une bande (40) pour former une fermeture apportant la preuve d'une ouverture frauduleuse caractérisée par les étapes de production, sur un ruban en plastique non traité (42), d'une couche de délamination (44) qui se délamine du ruban en plastique tant à l'ouverture de la fermeture qu'au refroidissement de la fermeture au-dessous d'une température de rupture, que la fermeture soit ou non ouverte, pour fournir une indication permanente de l'ouverture frauduleuse, ladite couche de délamination étant produite par application d'une couche (44) d'encre mouillée sur le ruban en plastique non traité, et par séchage de ladite couche d'encre mouillée, puis par application d'une couche (46) d'adhésif thermofondant sur la couche d'encre sèche (44), ladite couche d'encre adhérant mieux à la couche adhésive qu'au ruban en plastique, et ladite couche adhésive et le ruban en plastique ayant des vitesses différentes de retrait au refroidissement.
26. La méthode de la revendication 24 ou 25, selon laquelle la couche (22,22',44) d'encre mouillée est un enrobage d'encre au trempé qui est uniforme et ledit enrobage d'encre au trempé est appliqué en une couche suffisamment mince pour qu'il existe, dans la couche d'encre, des vides à travers lesquels la couche adhésive peut coller au ruban en plastique non traité (20,20",42).
27. La méthode de la revendication 24 ou 25, qui inclut l'étape d'exposition de premières régions d'une sur-

- face du ruban en plastique (20') à un procédé qui favorise l'adhésion, des secondes régions de ladite surface du ruban en plastique n'étant pas exposées audit procédé qui favorise l'adhésion, et lesdites secondes régions définissant un motif sélectionné avant l'étape d'application de l'encre mouillée, et agencement de ladite couche d'encre (62) en contact direct avec lesdites premières régions dudit ruban en plastique pendant ladite étape d'application de l'encre mouillée. 5
28. La méthode de la revendication 27, qui inclut l'étape d'application d'une couche de masquage (60) sur la surface du ruban en plastique (20') selon ledit motif sélectionné avant ladite étape d'exposition dudit ruban à un procédé qui favorise l'adhésion, de façon telle à empêcher l'exposition desdites secondes régions du ruban en plastique audit procédé qui favorise l'adhésion. 15
29. La méthode de la revendication 27 ou 28, selon laquelle ledit procédé qui favorise l'adhésion comporte un procédé à décharge corona. 20
30. La méthode de la revendication 28 ou 29, selon laquelle la couche d'encre (62) est en contact direct avec la couche de masquage (60) au niveau desdites secondes régions dudit ruban (20'), de façon telle que ladite couche de masquage se trouve prise en sandwich entre le ruban et la couche d'encre. 25 30
31. La méthode de la revendication 28, 29 ou 30, selon laquelle la couche de masquage (60) est un agent d'allongement d'encre à base d'eau. 35
32. La méthode de l'une quelconque des revendications 24 à 31, selon laquelle la couche d'encre (22,22'',60,44) est une encre à base d'eau. 40
33. La méthode de l'une quelconque des revendications 24 à 32, selon laquelle le ruban en plastique est un ruban en polyoléfine (20,20',20'',42). 45
34. La méthode de l'une quelconque des revendications 24 à 33, selon laquelle le ruban en plastique ou en polyoléfine (20,20',20'',42) comporte du polyéthylène. 50
35. La méthode de l'une quelconque des revendications 24 à 34, selon laquelle la paroi antérieure (16,16',16'') du sac (10,10',10'') est en plastique et le ruban en plastique (20,20',20'') sur lequel est appliquée la couche d'encre (24,24',24'') est attaché au sac (10,10',10'') par thermoscellement du ruban en plastique sur l'extrémité supérieure de la paroi antérieure. 55
36. La méthode de l'une quelconque des revendications 24 à 35, qui inclut les étapes d'application directe d'une couche d'encre mouillée thermiquement activable sur le ruban non traité (20,20',20'',42) sur une surface qui est opposée à la première couche d'encre, et de séchage de ladite couche d'encre mouillée thermiquement activable.
37. La méthode de la revendication 36, qui inclut l'étape d'application directe d'une couche d'encre de masquage mouillée sur le ruban en plastique ou en polyoléfine non traité (20,20',20'',42) sur une surface qui est opposée à la première couche d'encre et de séchage de ladite couche d'encre de masquage mouillée avant l'application de l'encre mouillée thermiquement activable, de façon telle que ladite couche d'encre de masquage est prise en sandwich entre le ruban et la couche d'encre thermiquement activable, ladite couche d'encre de masquage et ladite couche d'encre thermiquement activable ayant essentiellement une couleur identique lorsqu'elles sont sèches.

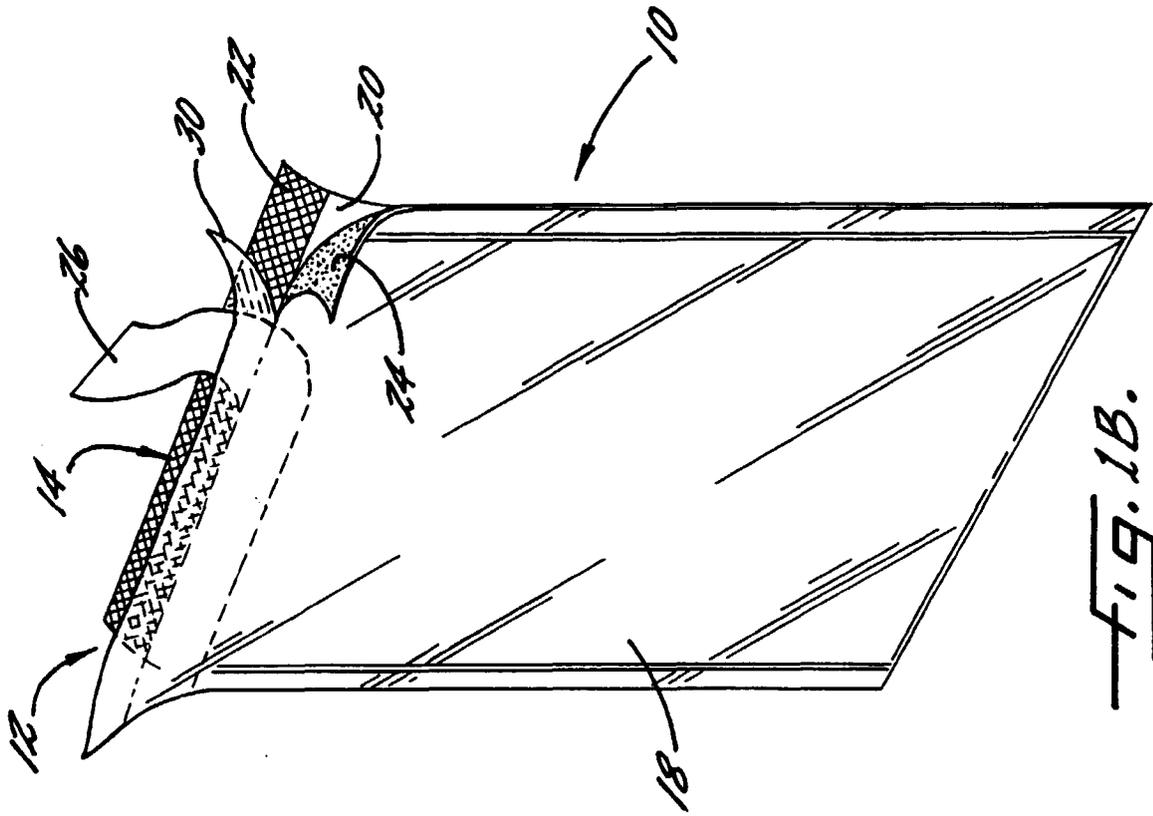


FIG. 1B.

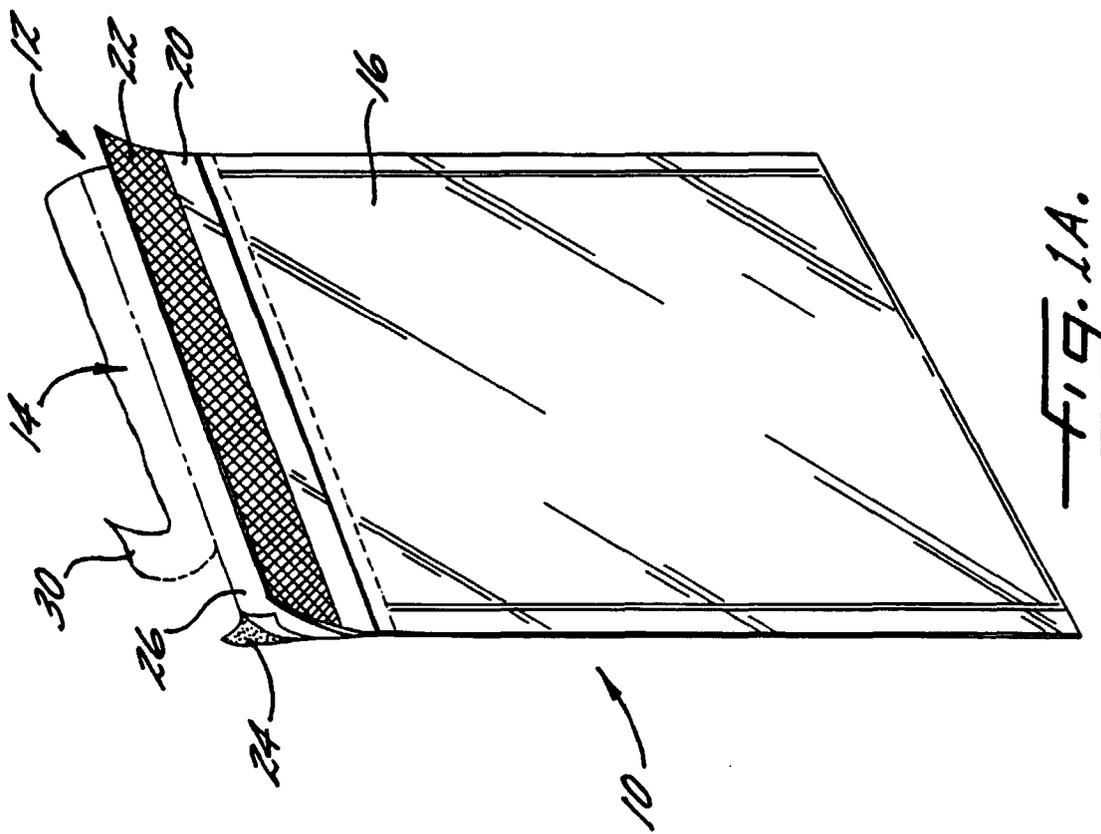


FIG. 1A.

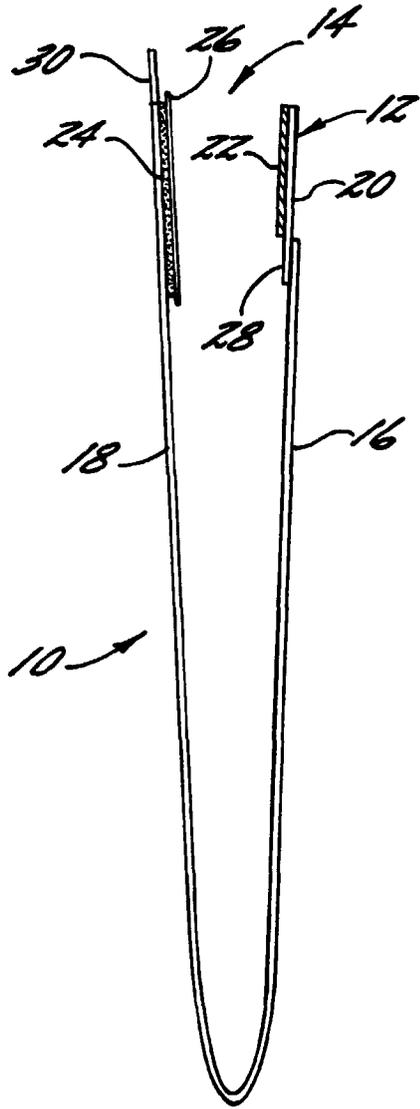


FIG. 2A.

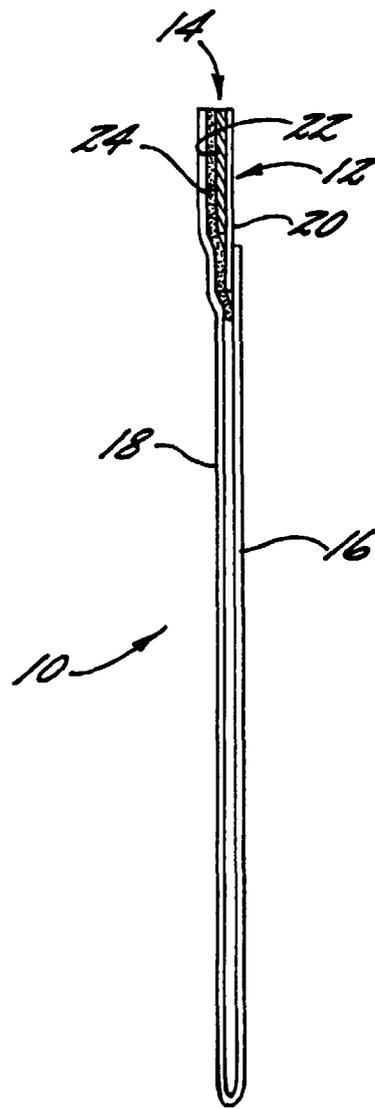


FIG. 2B.

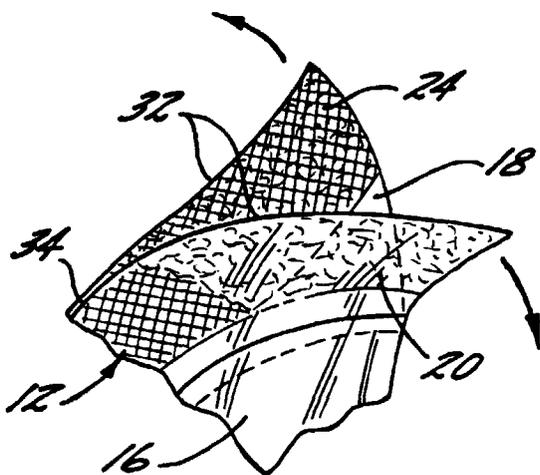


FIG. 4A.

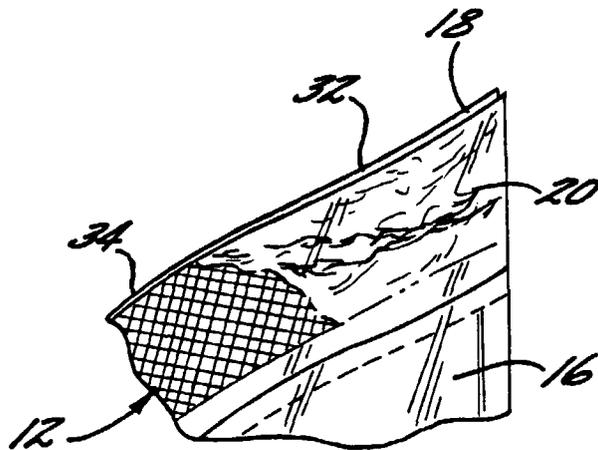


FIG. 4B.

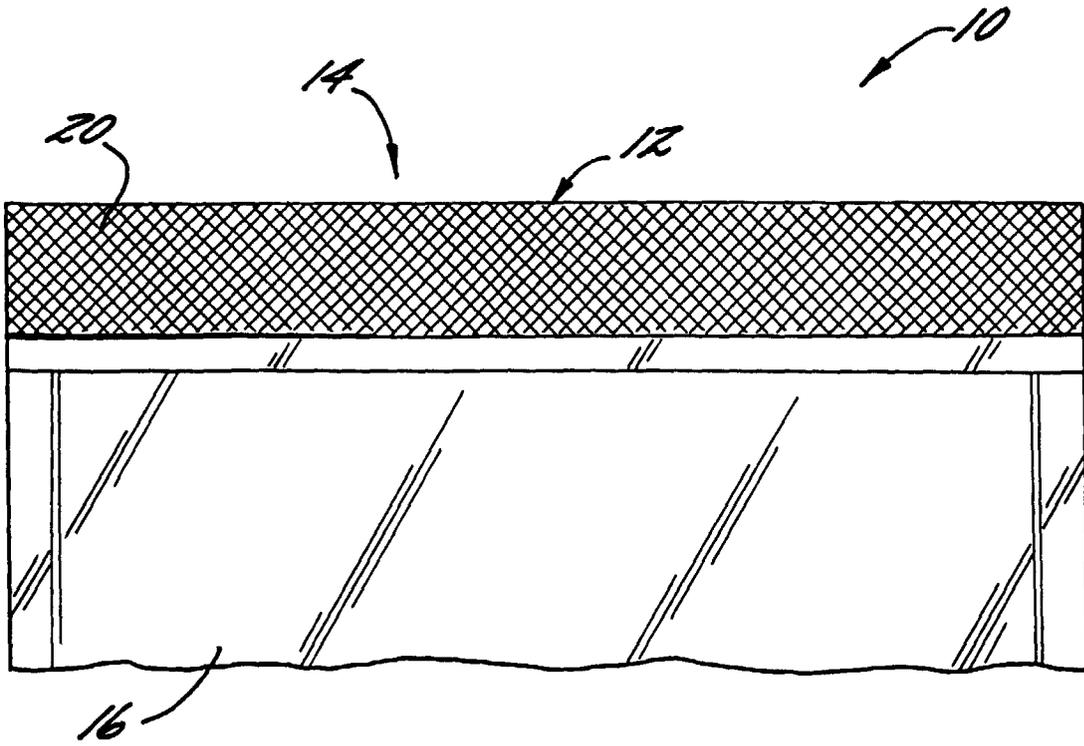


FIG. 3.

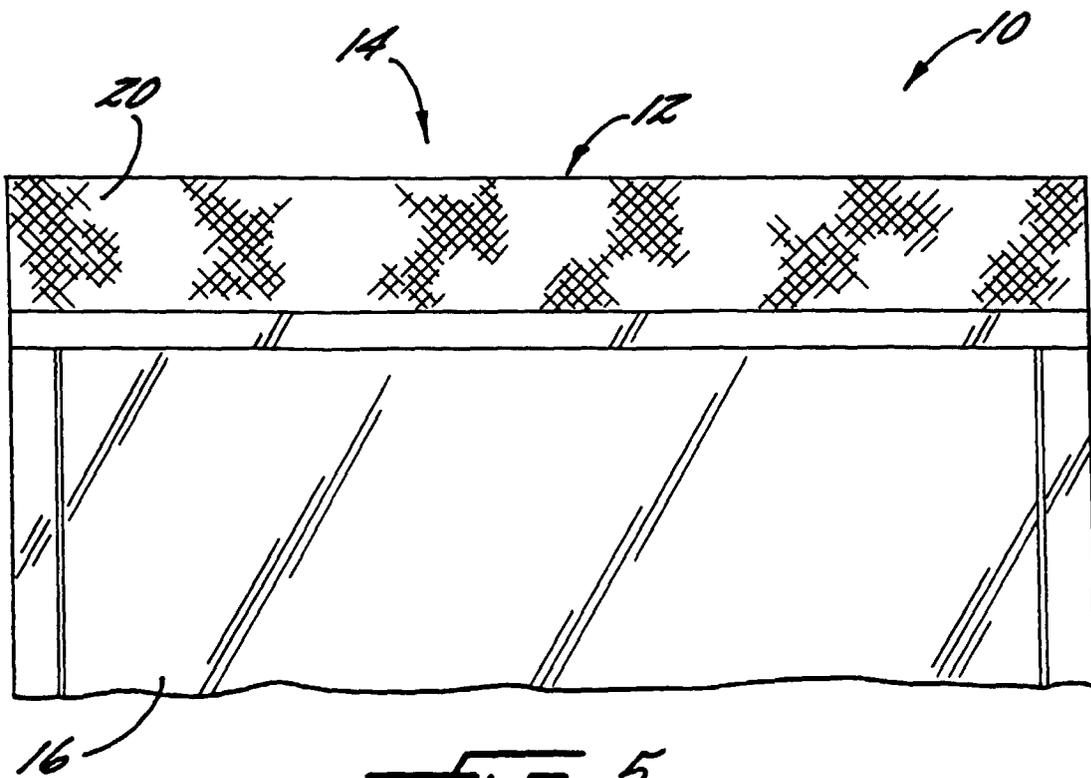


FIG. 5.

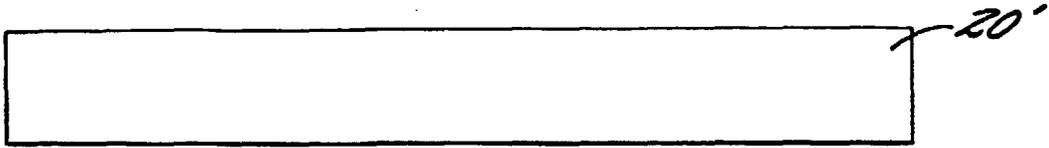


FIG. 6A.

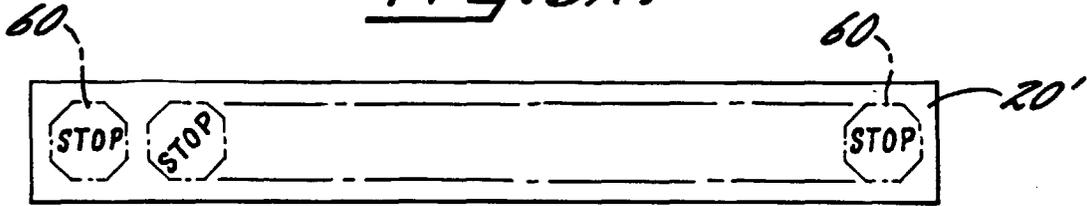


FIG. 6B.

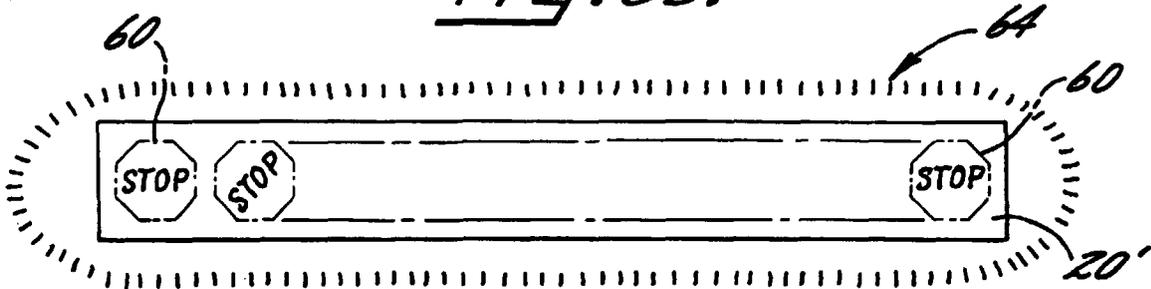


FIG. 6C.

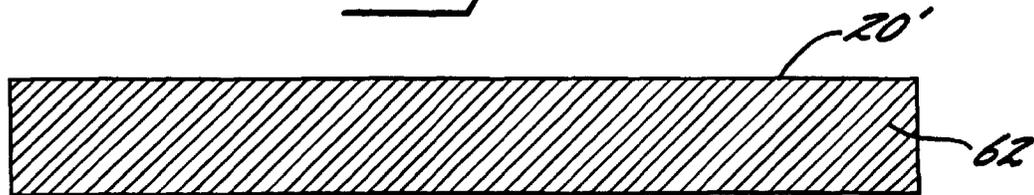


FIG. 6D.

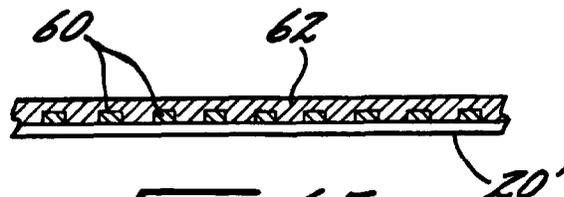


FIG. 6E.

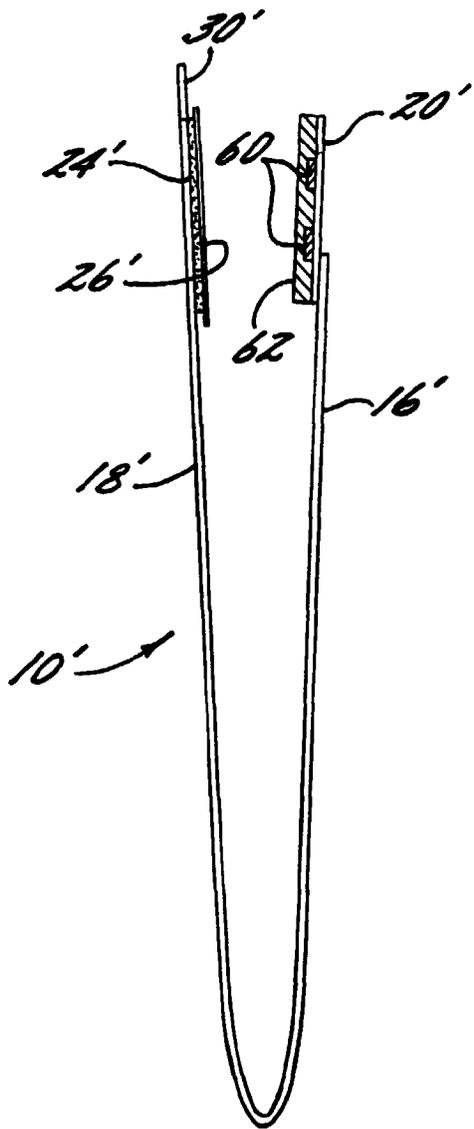


FIG. 7.

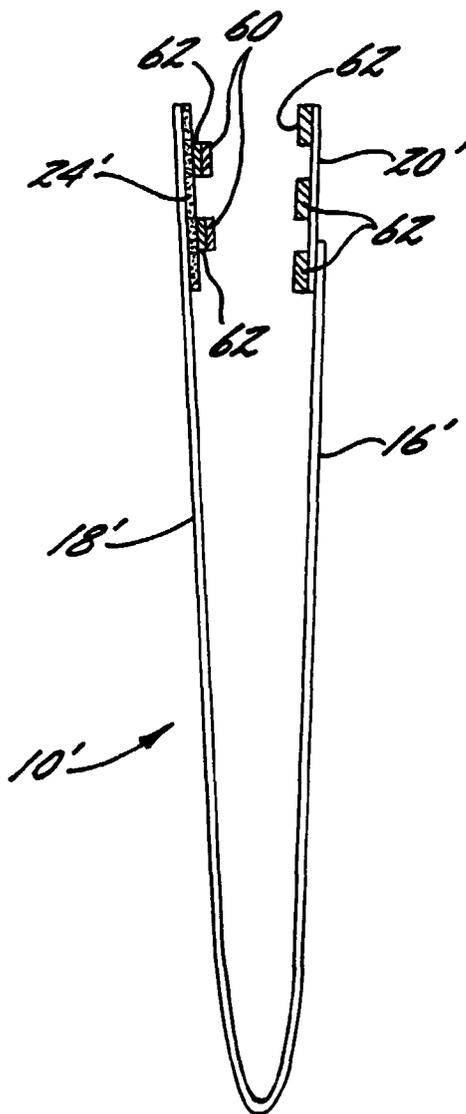


FIG. 8B.

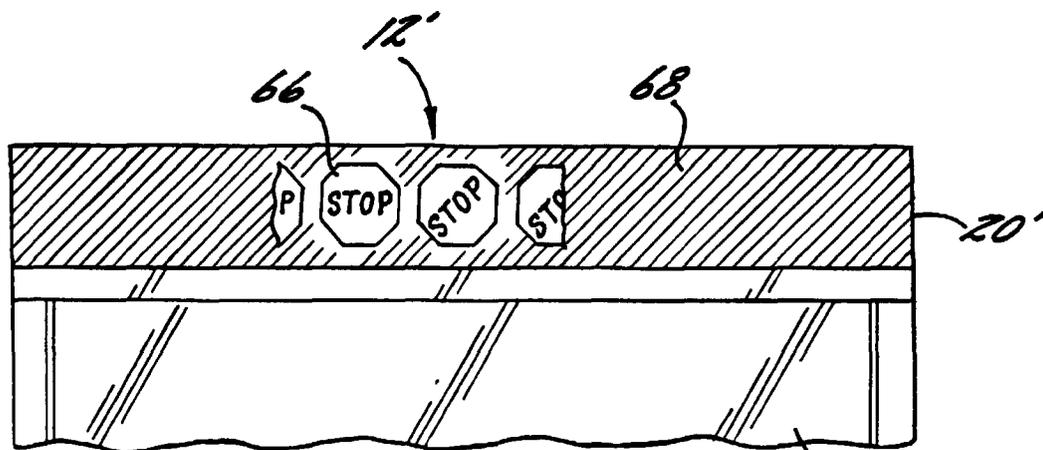


FIG. 8A.

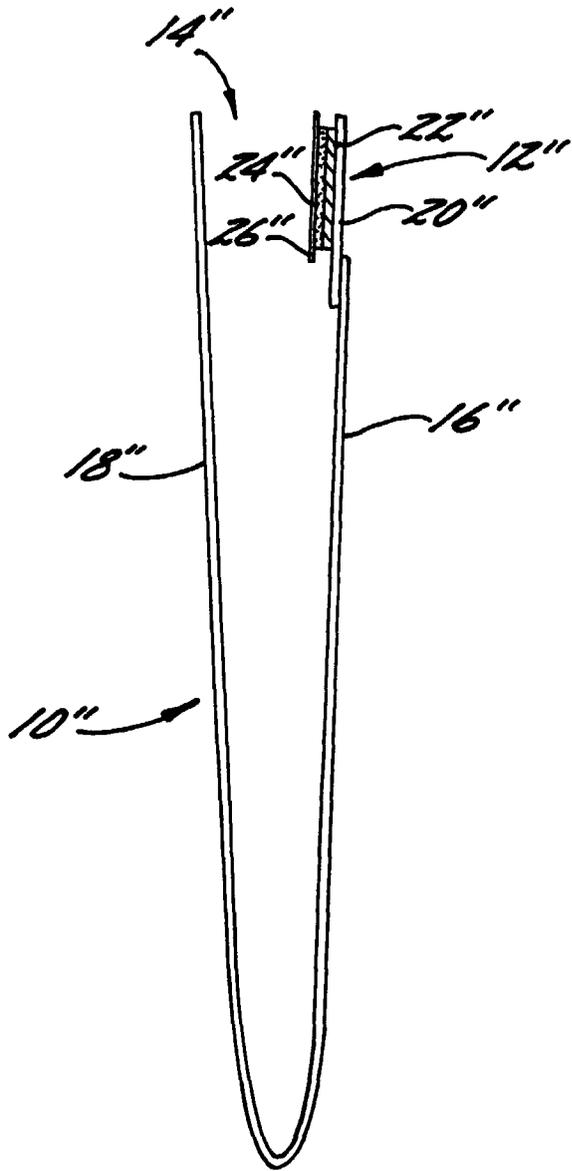


FIG. 9A.

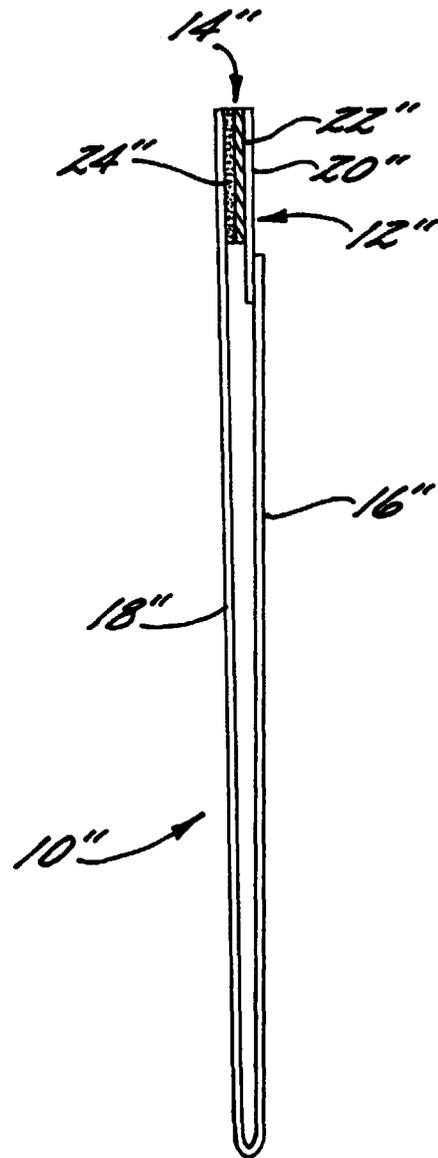


FIG. 9B.

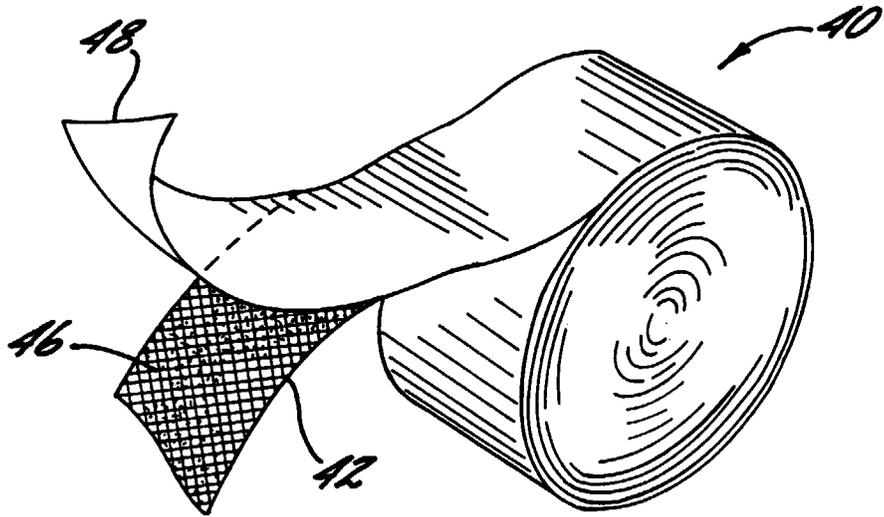


FIG. 10.

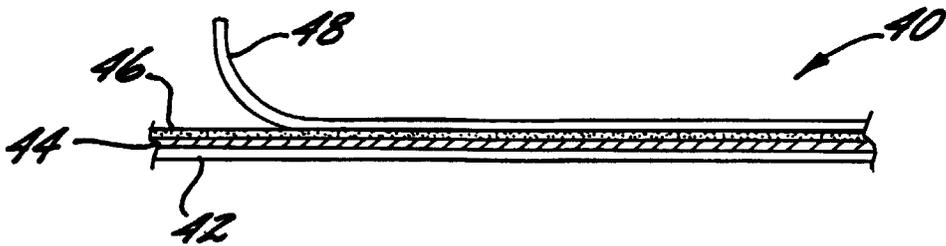


FIG. 11.