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Zerfas et al.

(54) **FLEXIBLE PACKAGE HAVING AN AUTOMATIC CLOSURE FEATURE**

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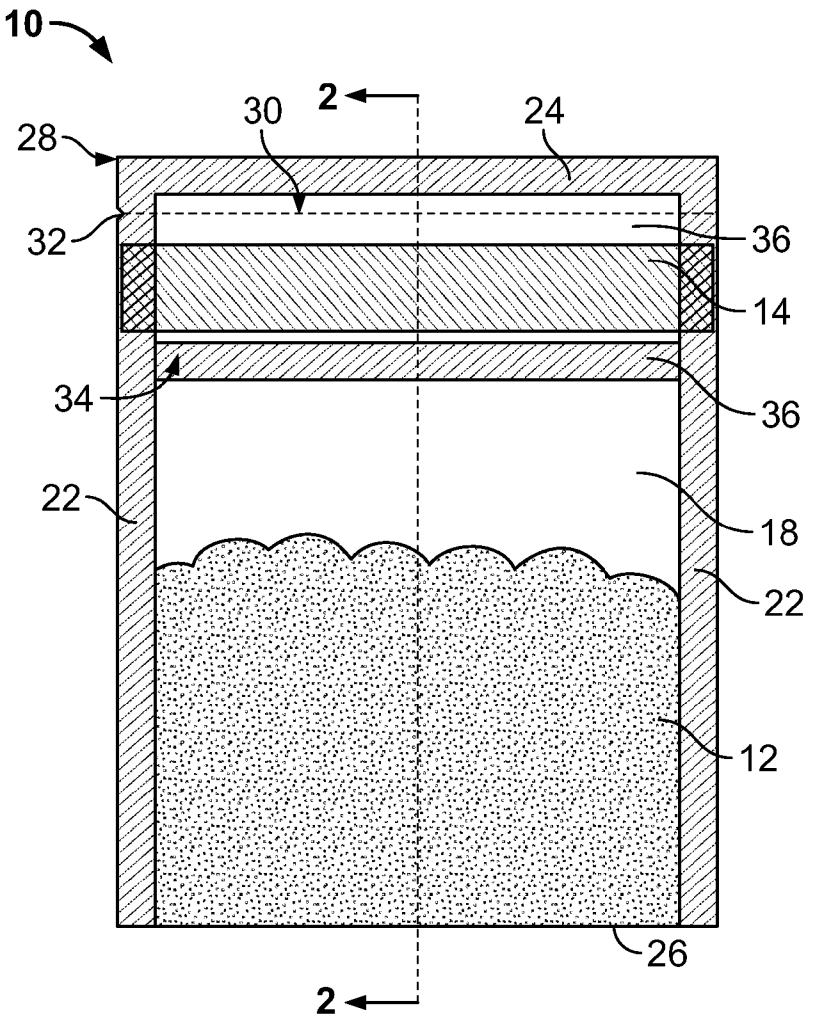
(57) **ABSTRACT**

A reclosable flexible package is suitable for retail sale of food products and is comprised of a film material. The reclosable flexible packages are suitable for mass production on high-speed form-fill-seal equipment. The flexible package includes a pair of semi-rigid strips attached to the walls of the flexible pouch and positioned parallel to the package opening. The semi-rigid strips are configured and arranged to nest together and bias toward one another. Upon opening of the package, the semi-rigid strips are moveable between a closed position and an open position. Further, the semi-rigid strips are configured such that they automatically reclose the package when the strips are released from the open position.



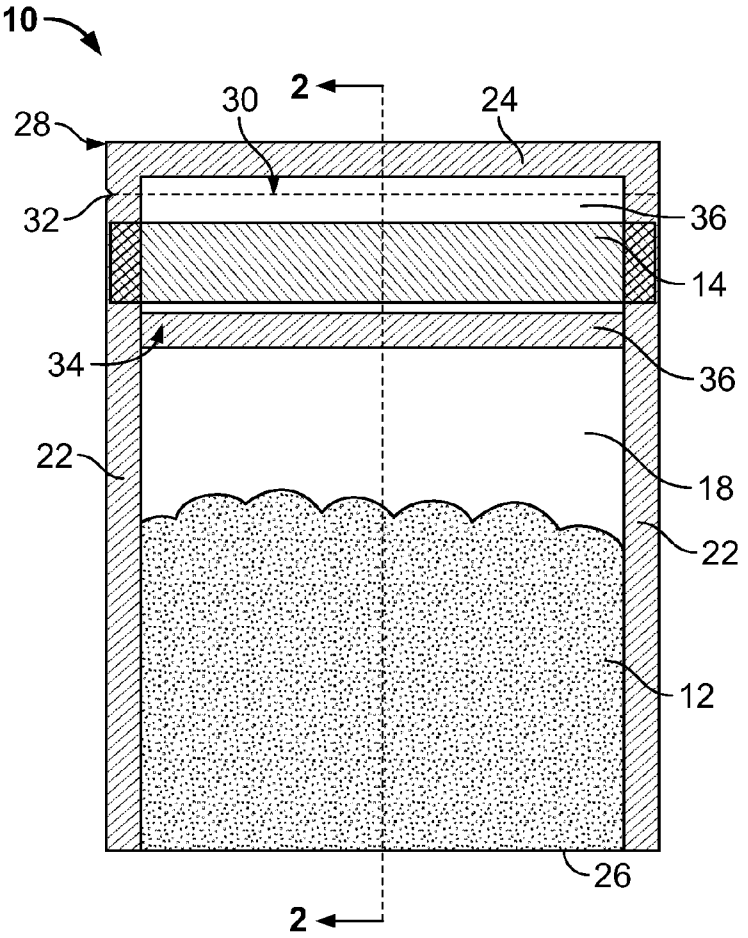


FIG. 1

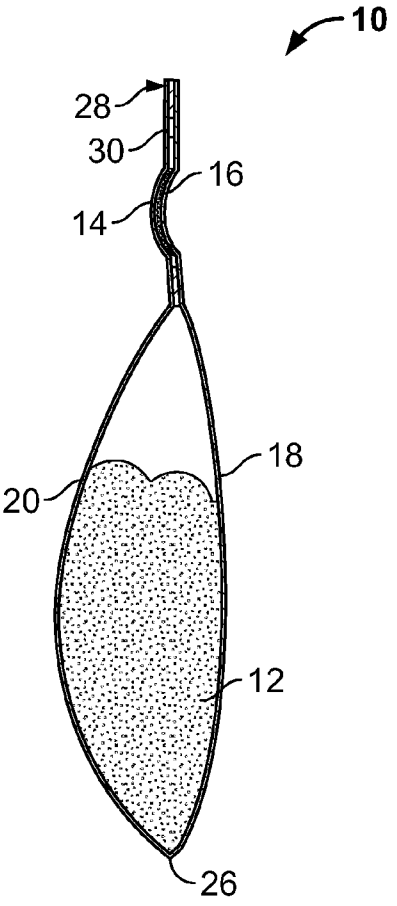


FIG. 2

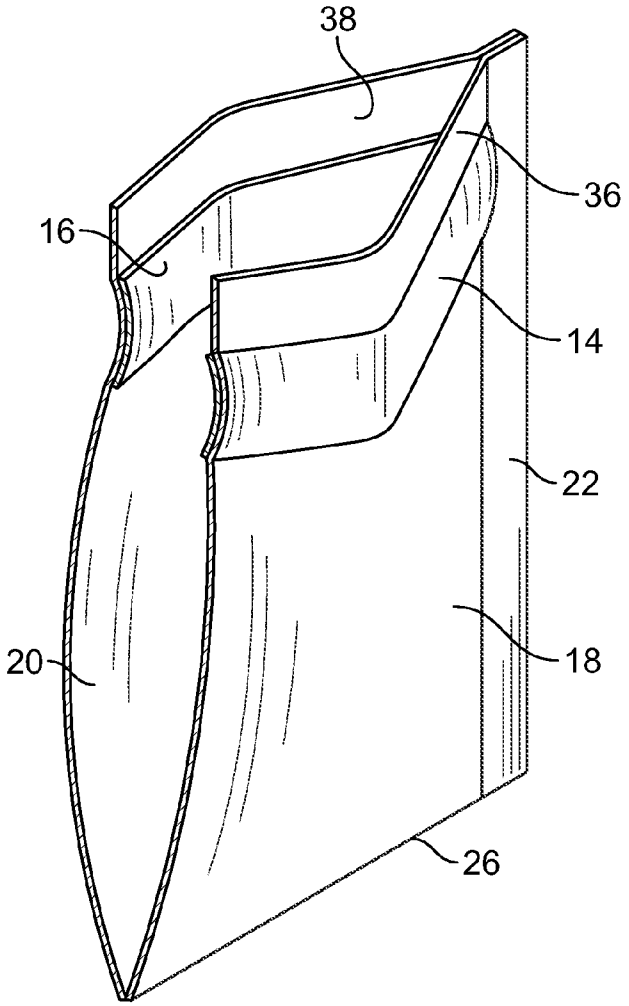


FIG. 3

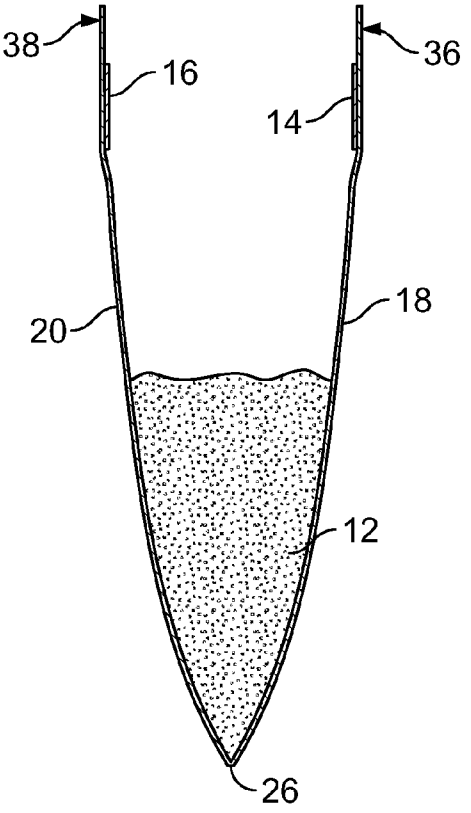


FIG. 4

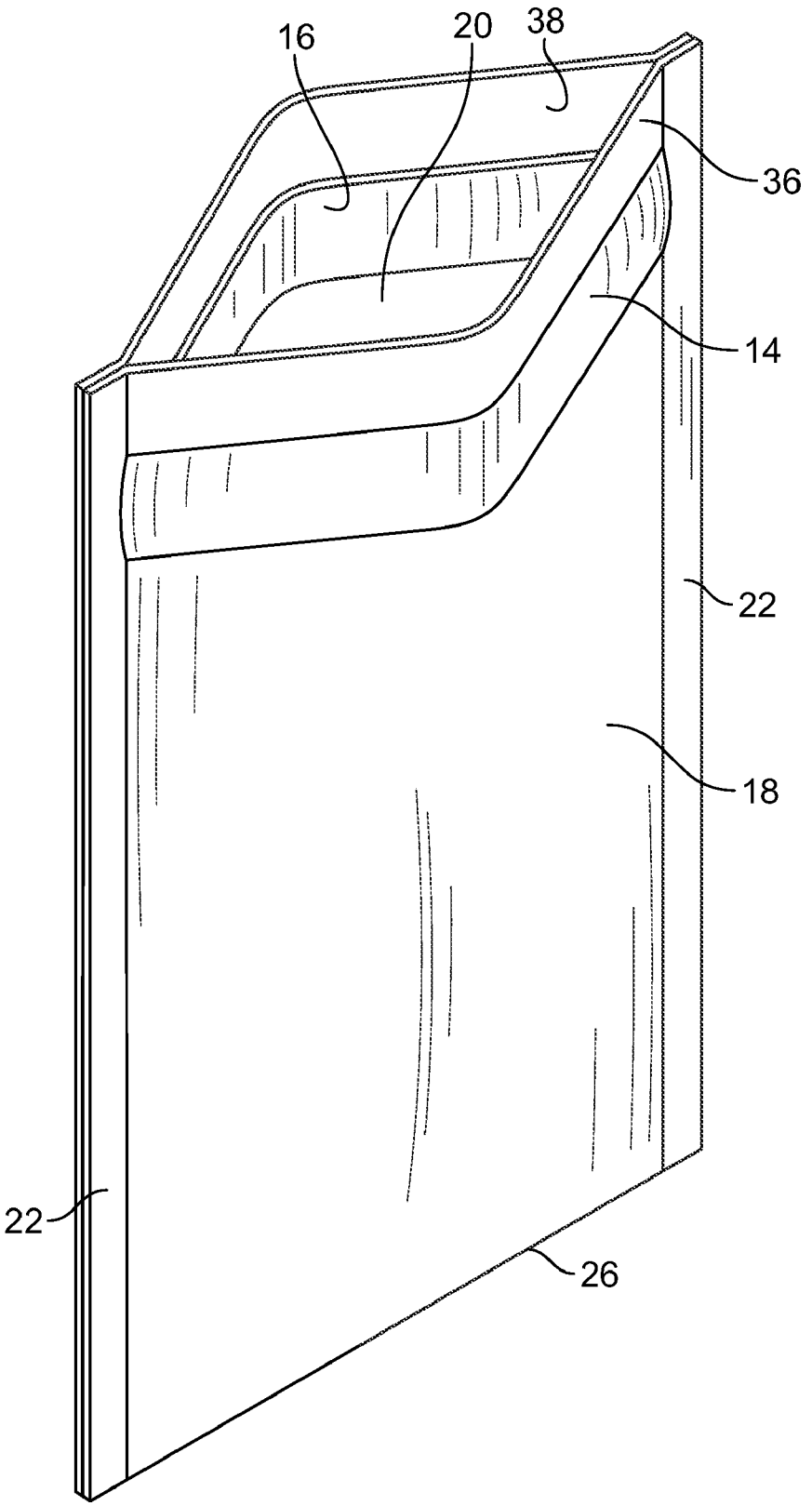
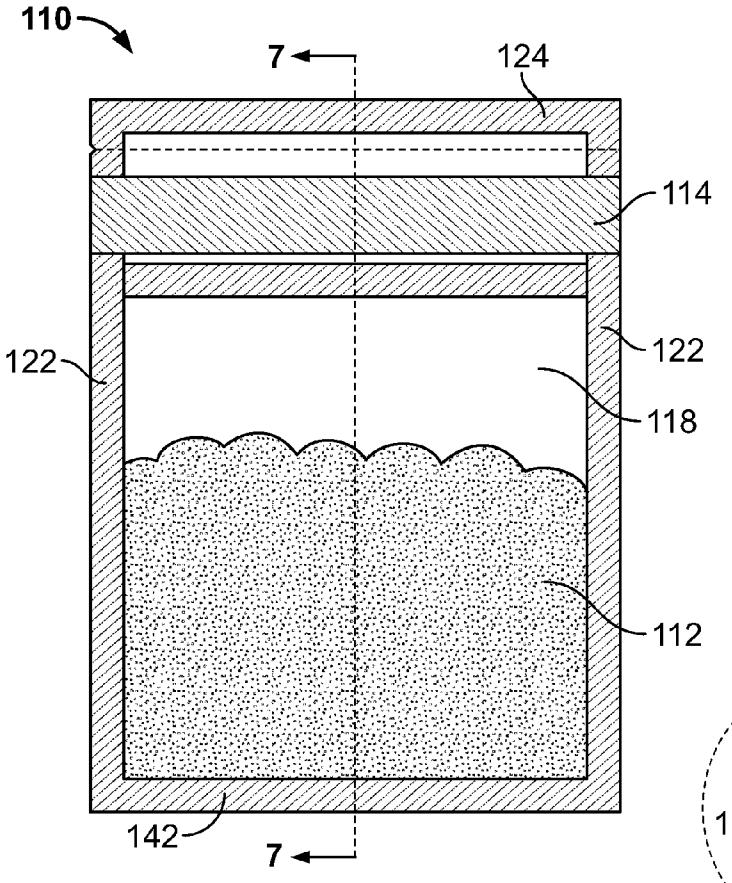


FIG. 5


110
7
124
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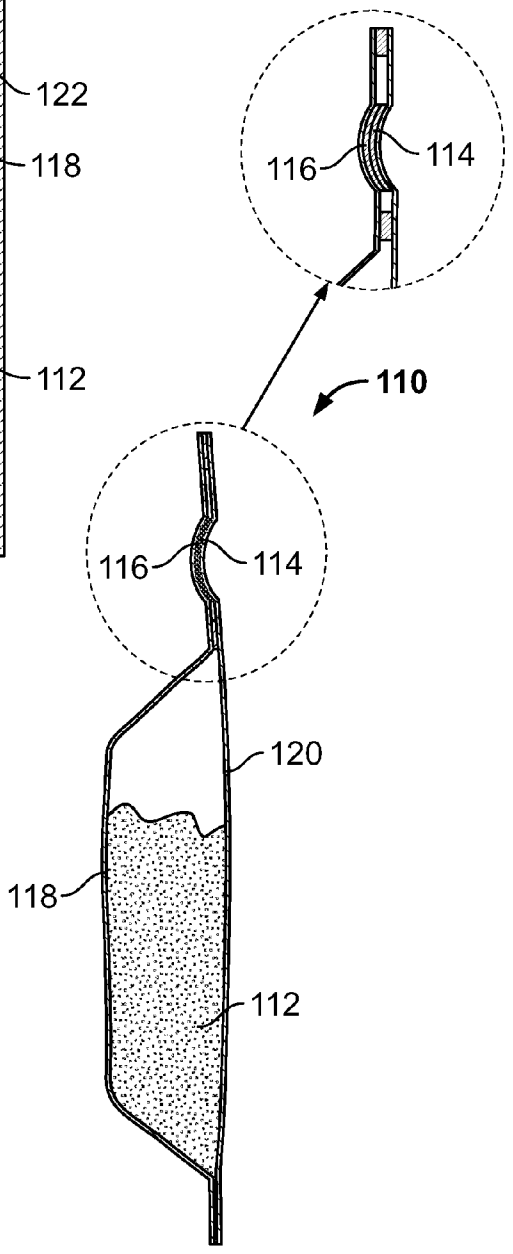
142
7

FIG. 6


116
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120
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112

FIG. 7

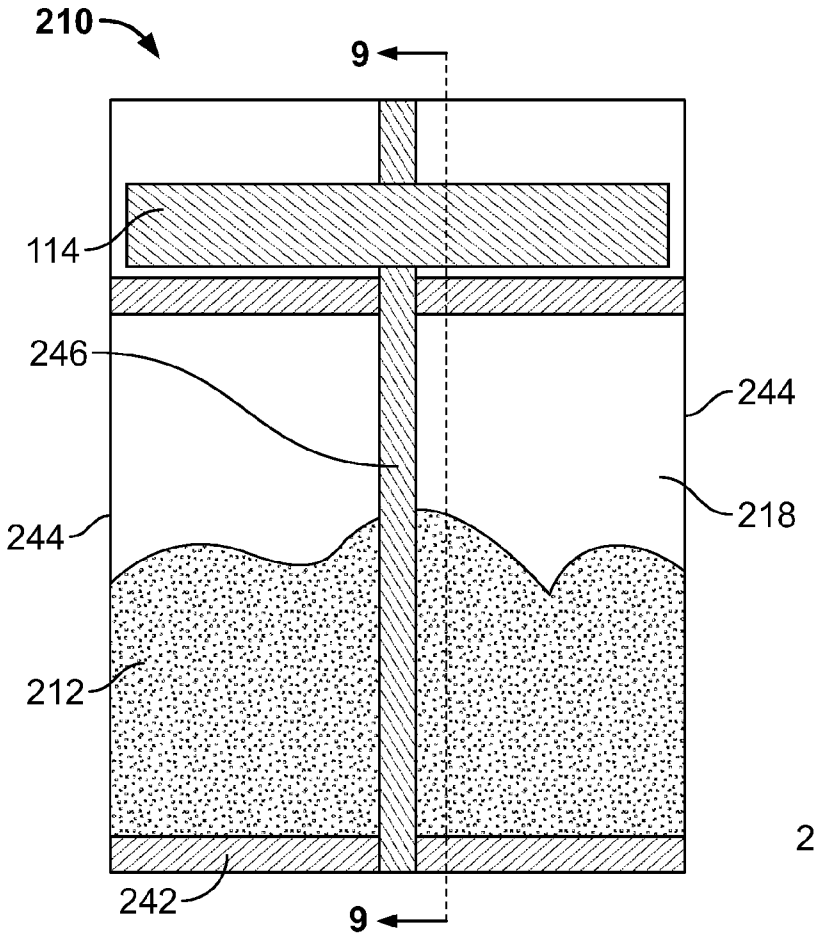

FIG. 8

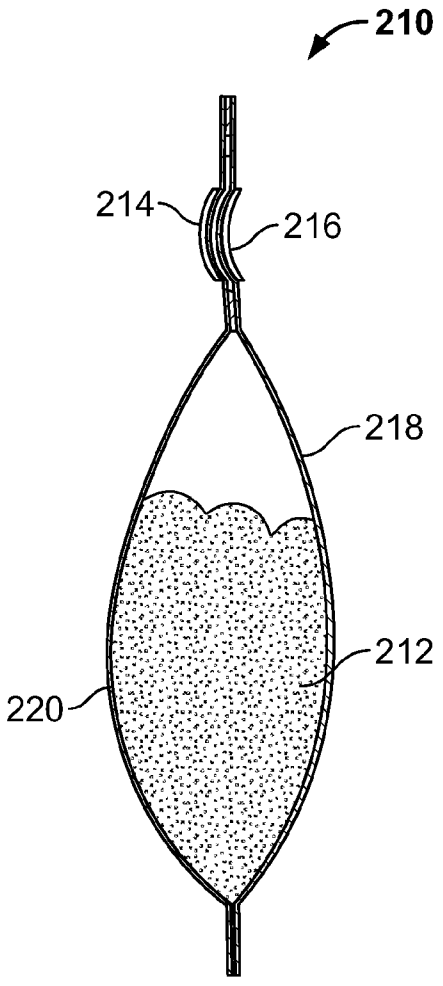

FIG. 9

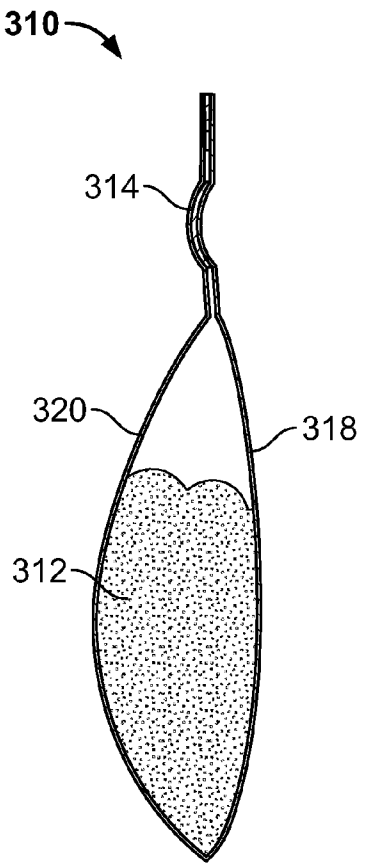

FIG. 10

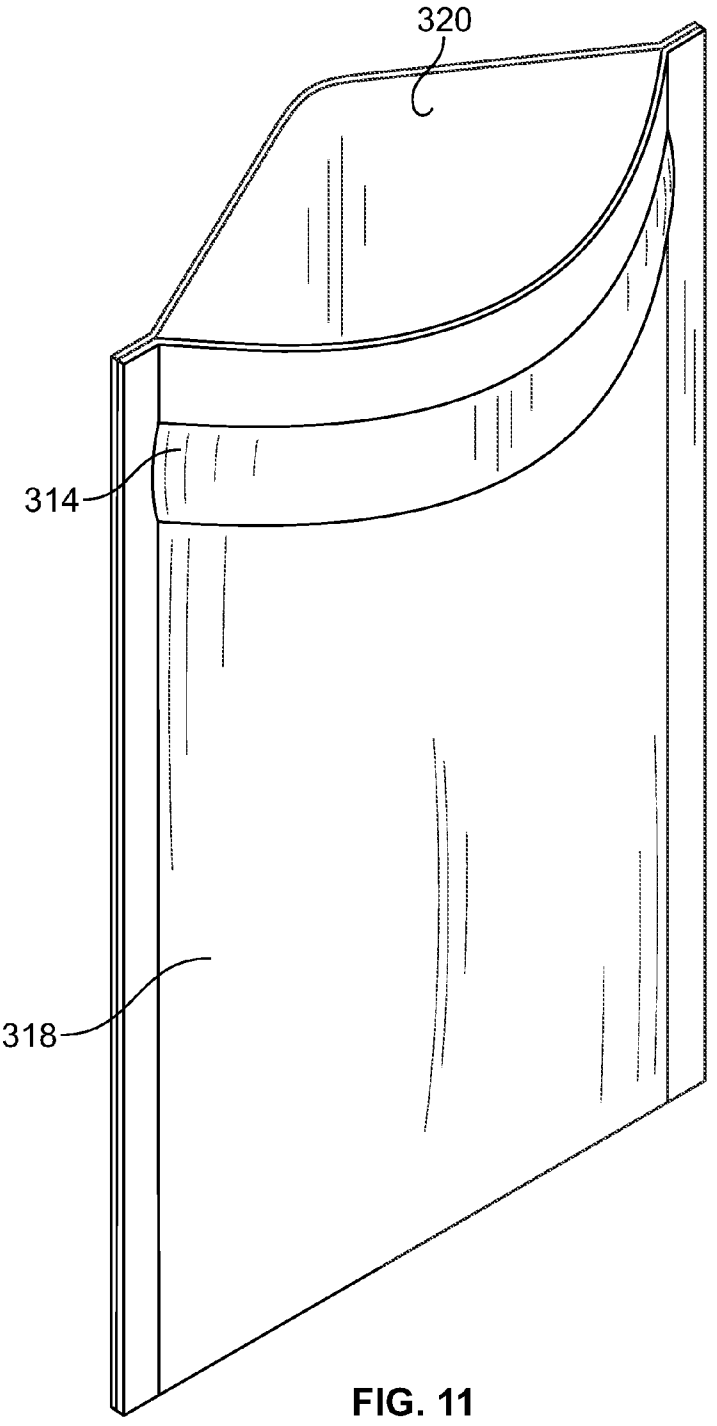

FIG. 11

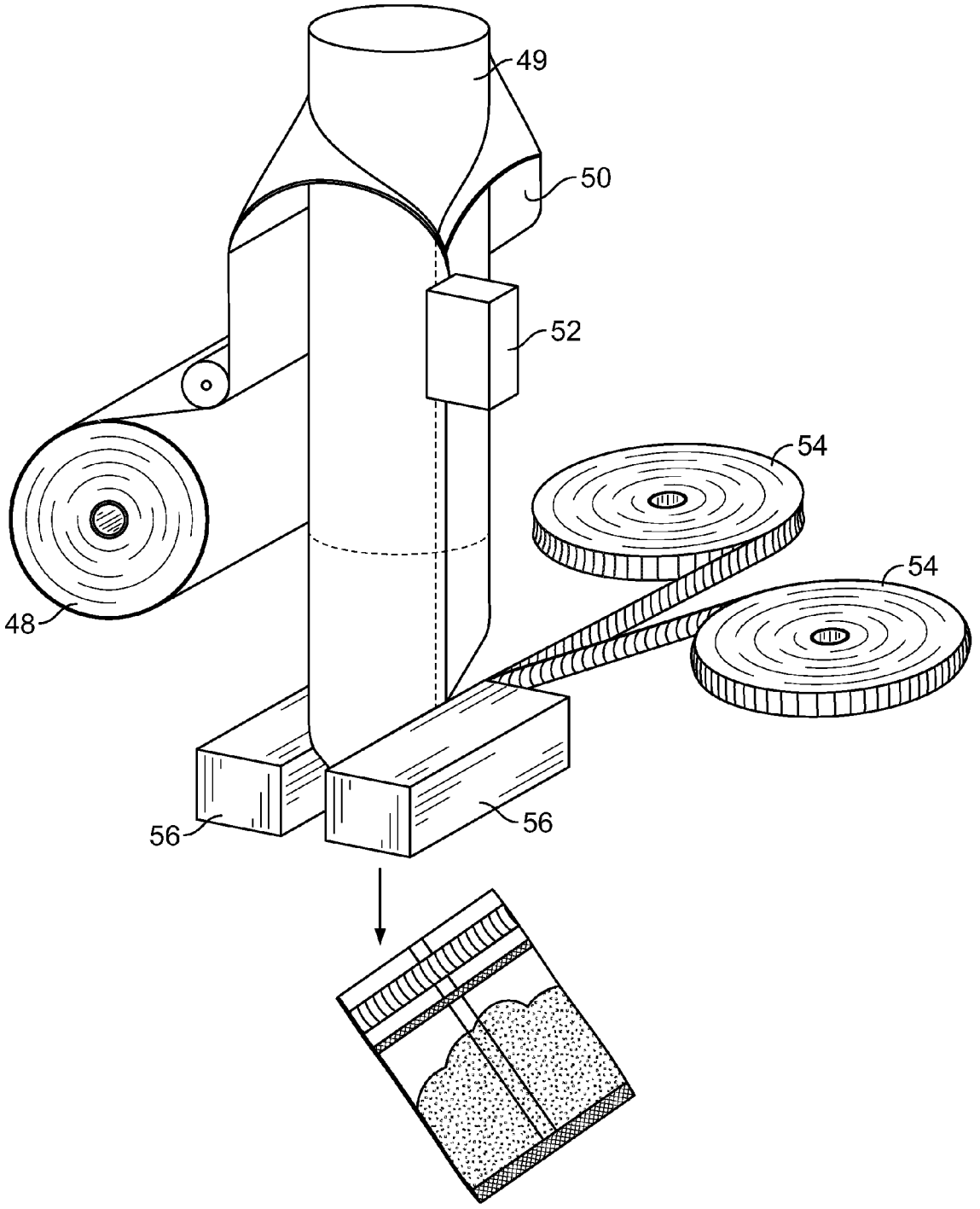

FIG. 12

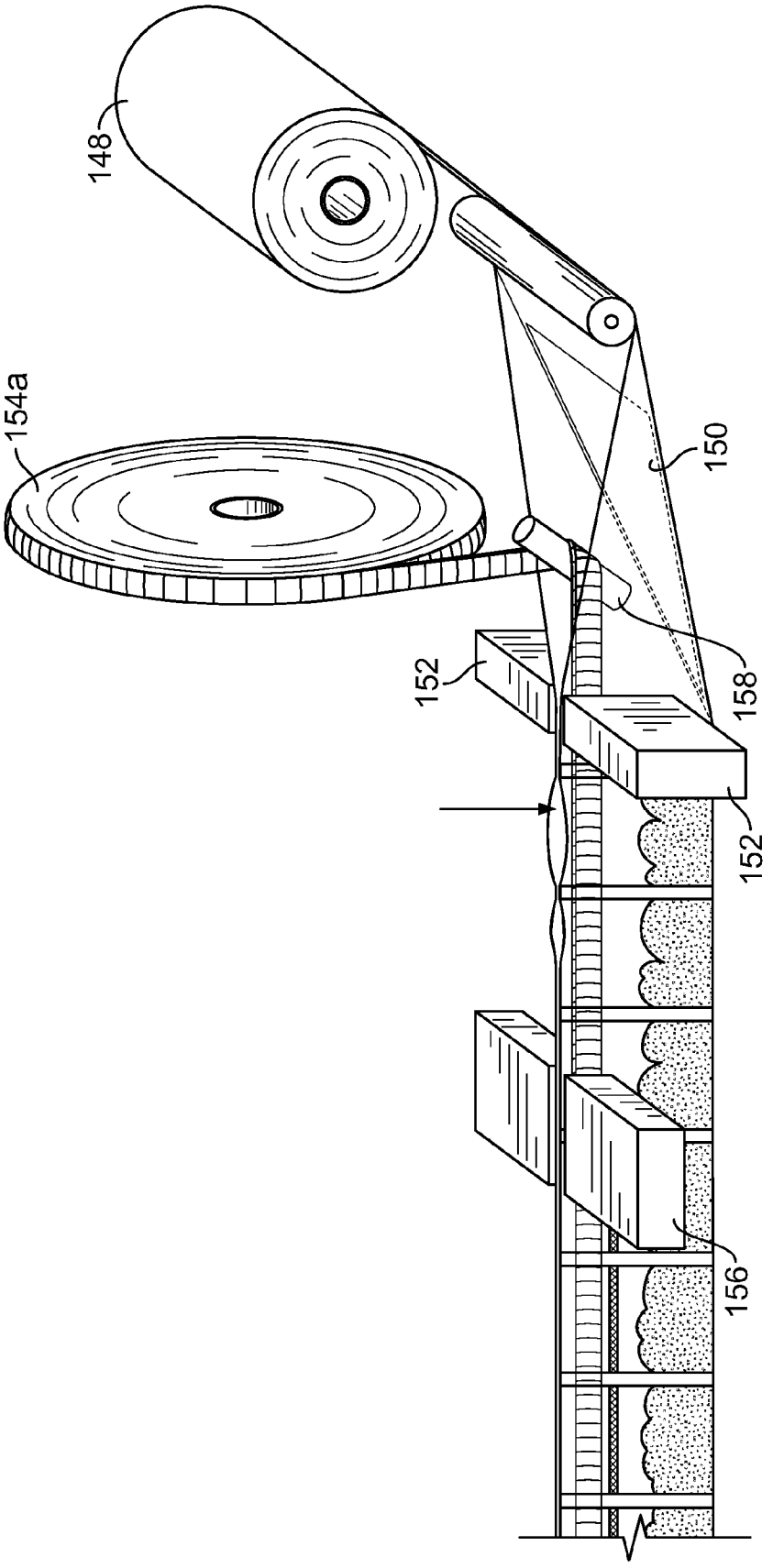

FIG. 13A

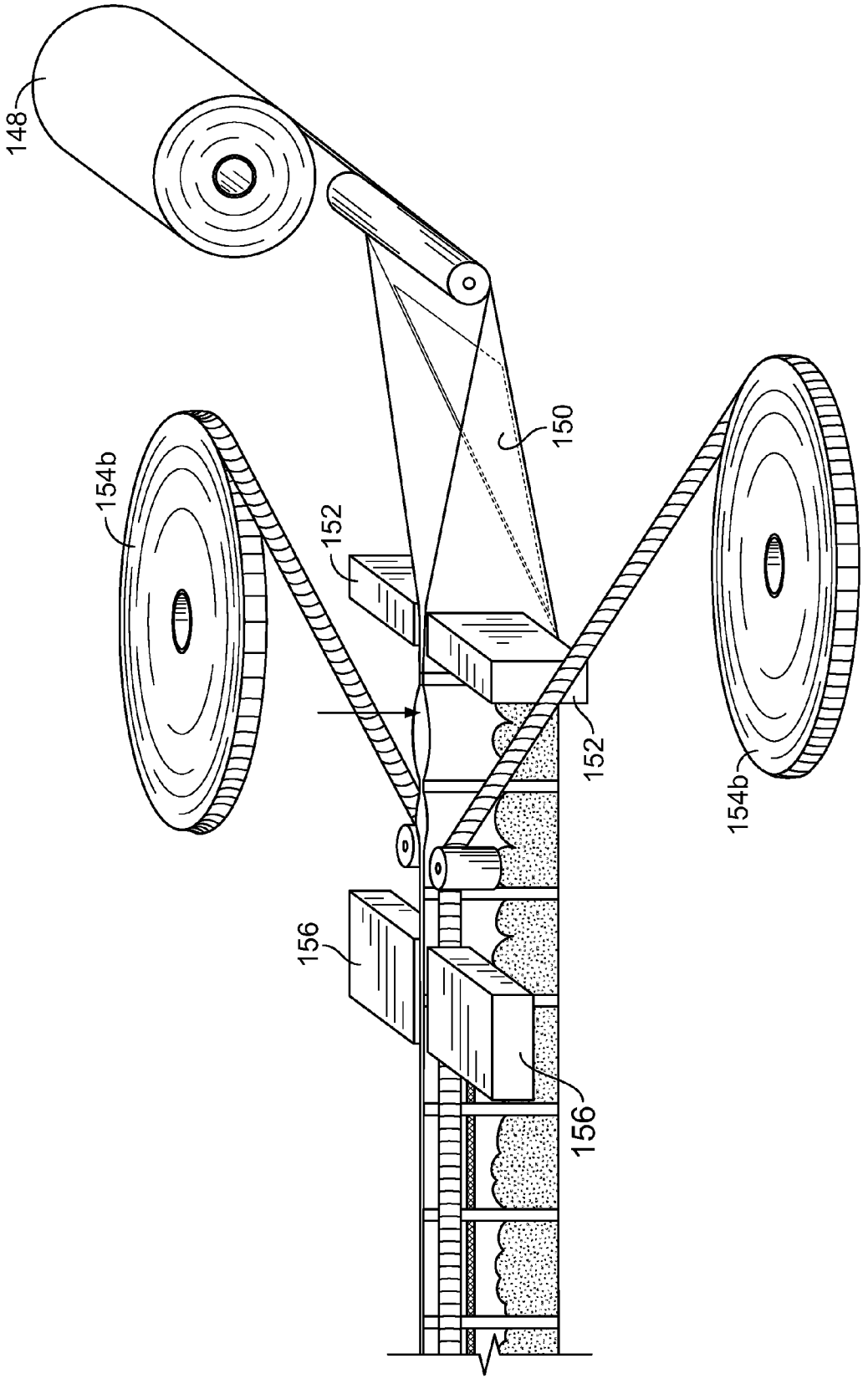

FIG. 13B

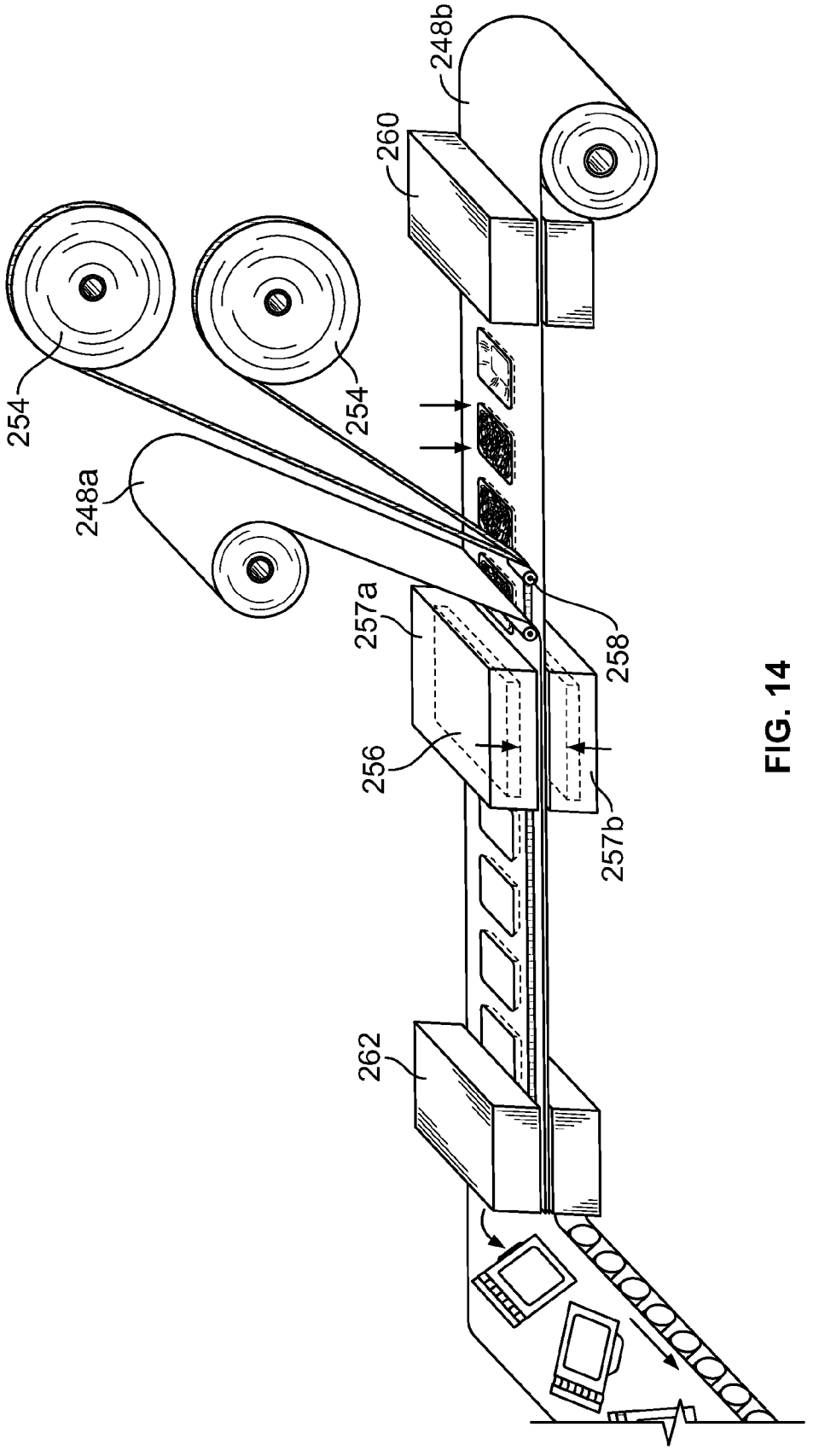

FIG. 14

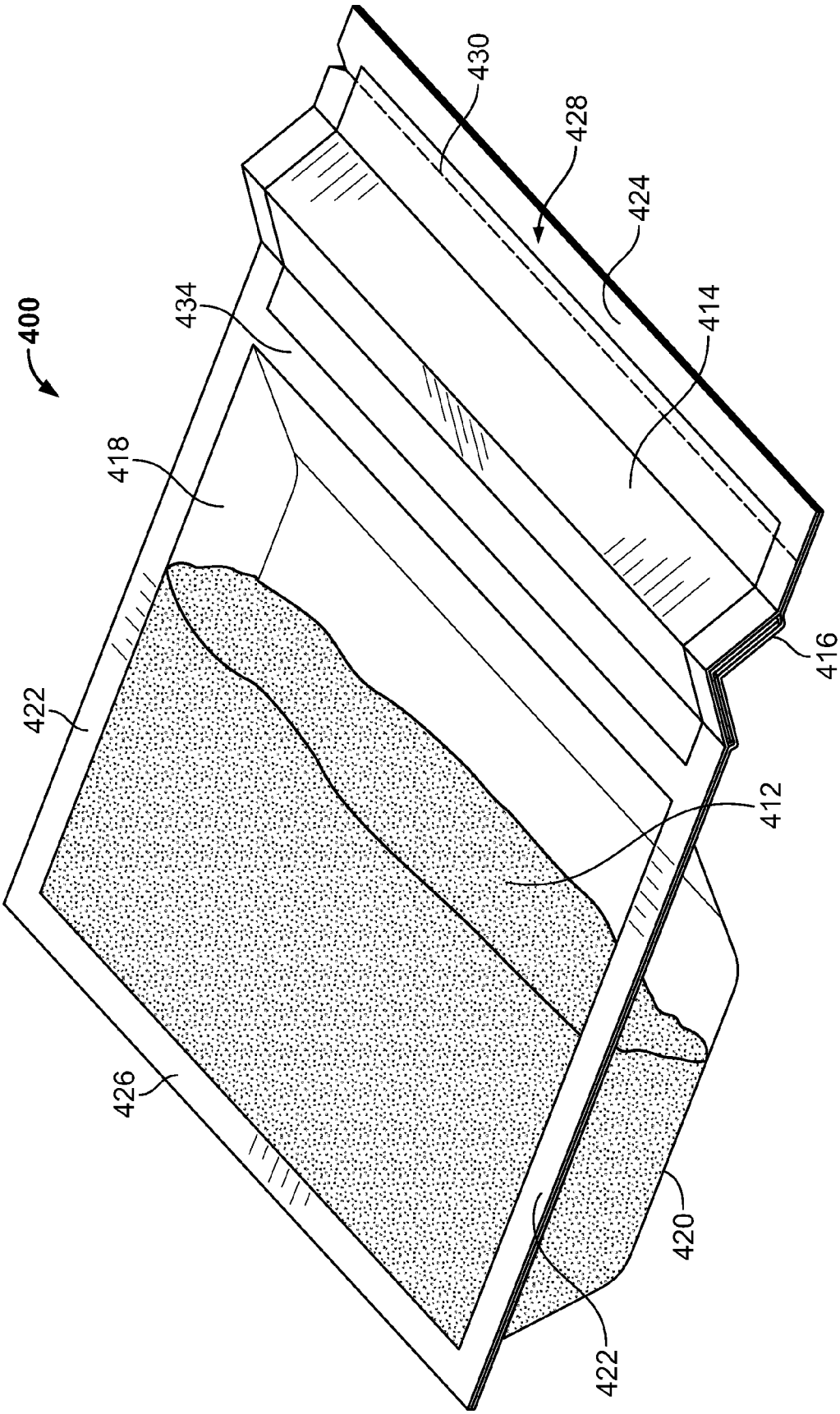

FIG. 15

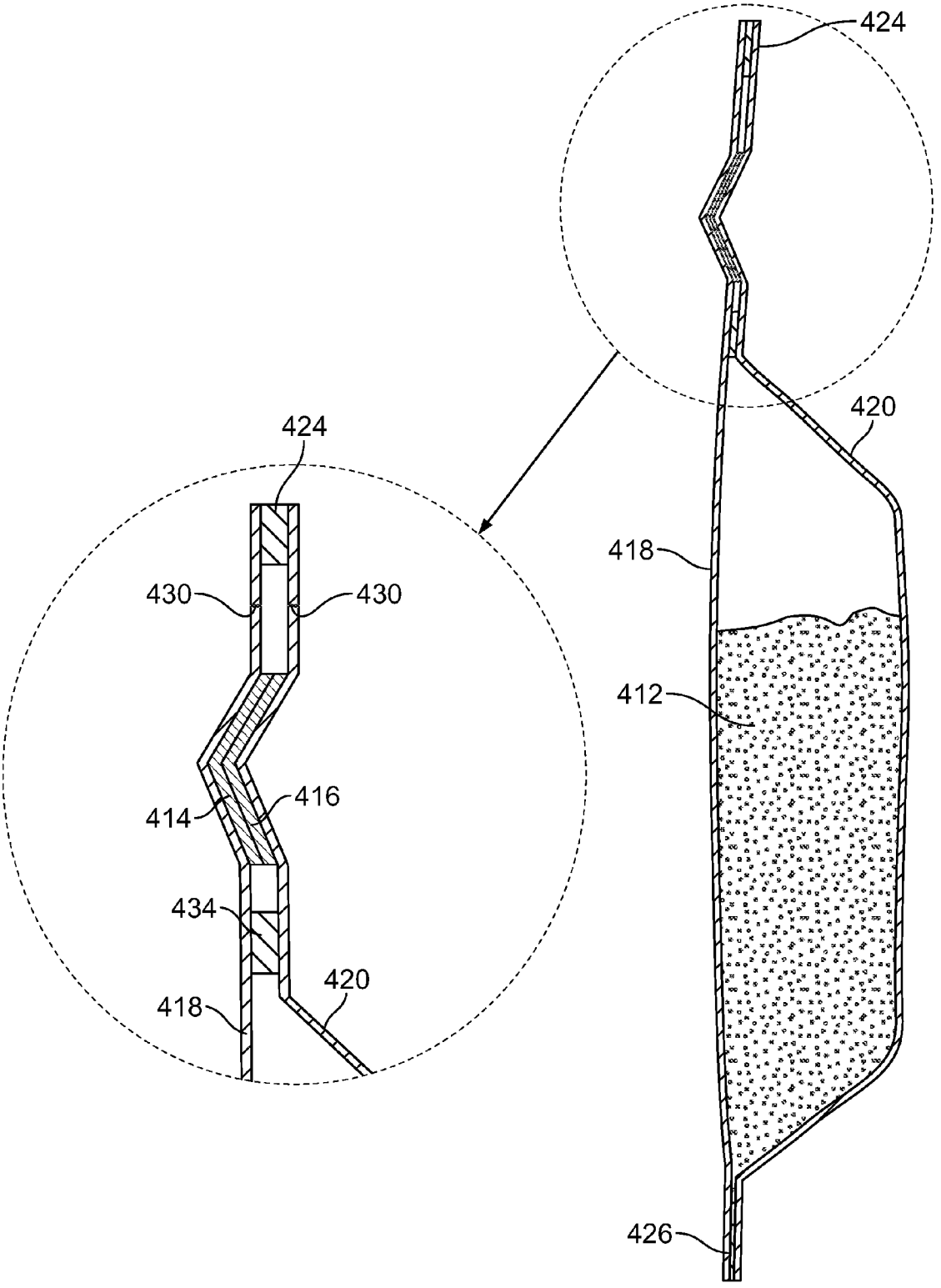

FIG. 16

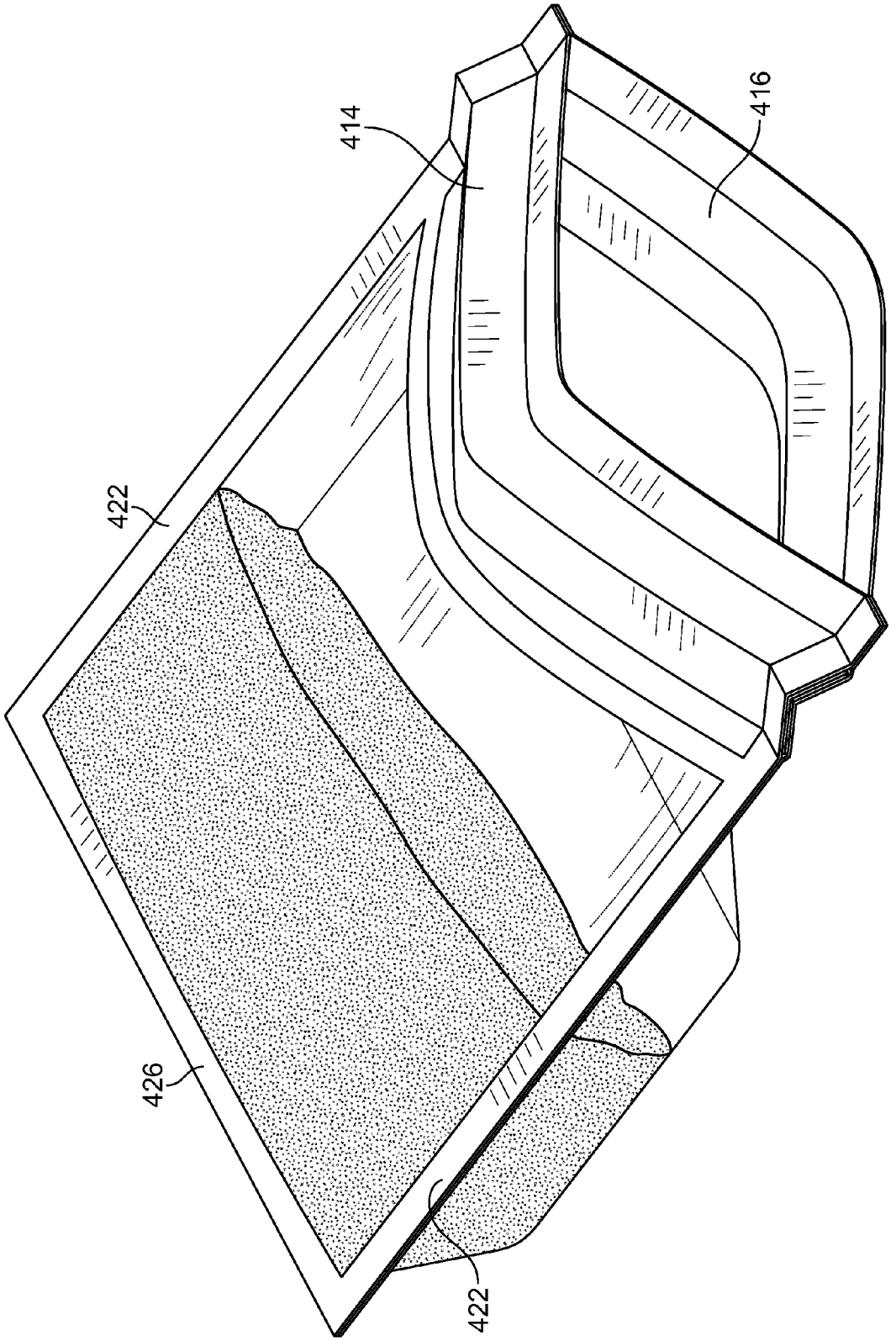

FIG. 17

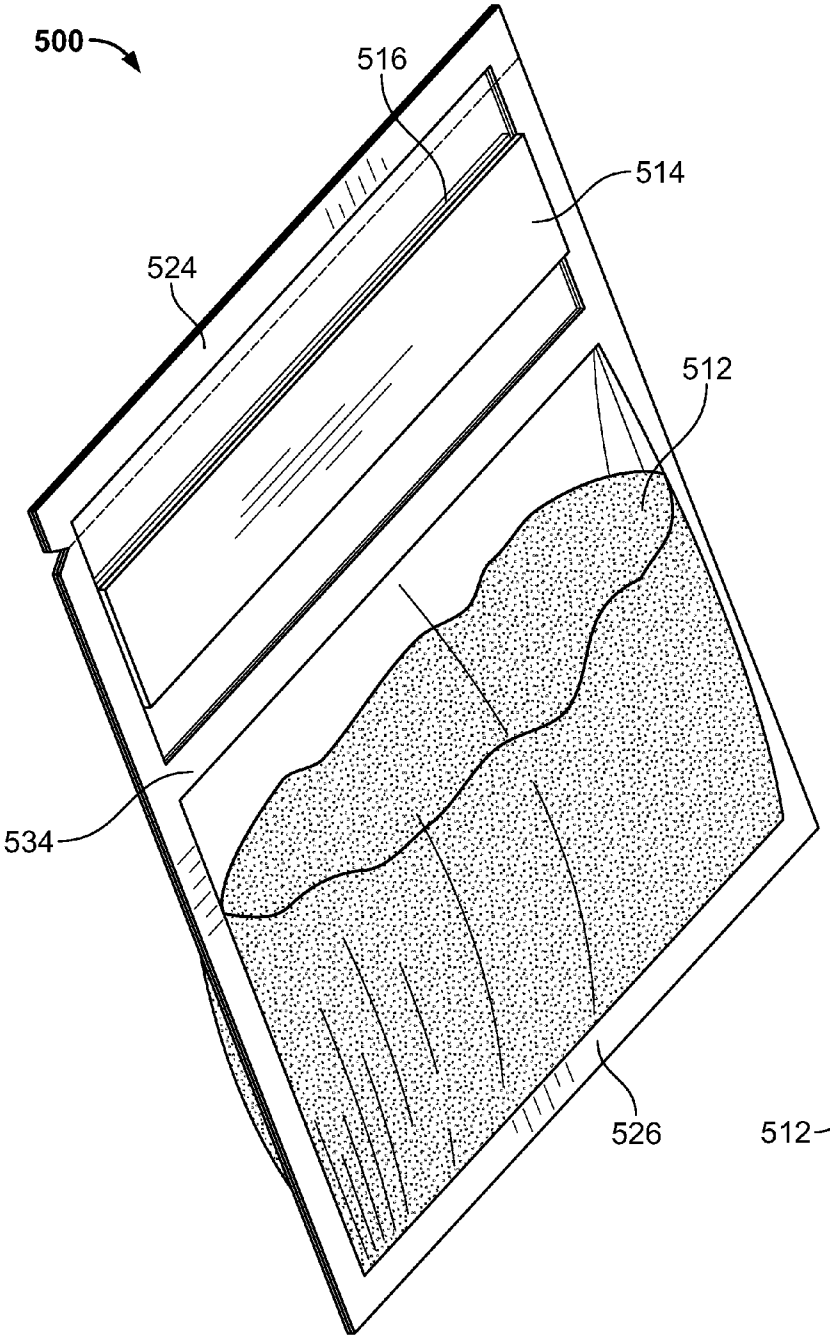

FIG. 18

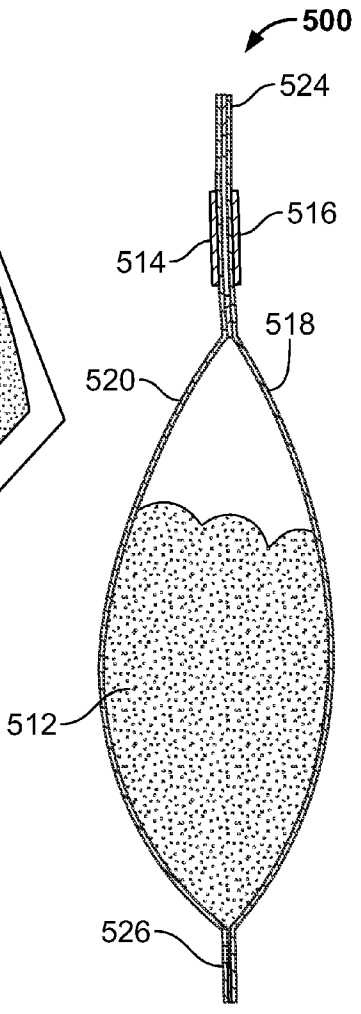

FIG. 19

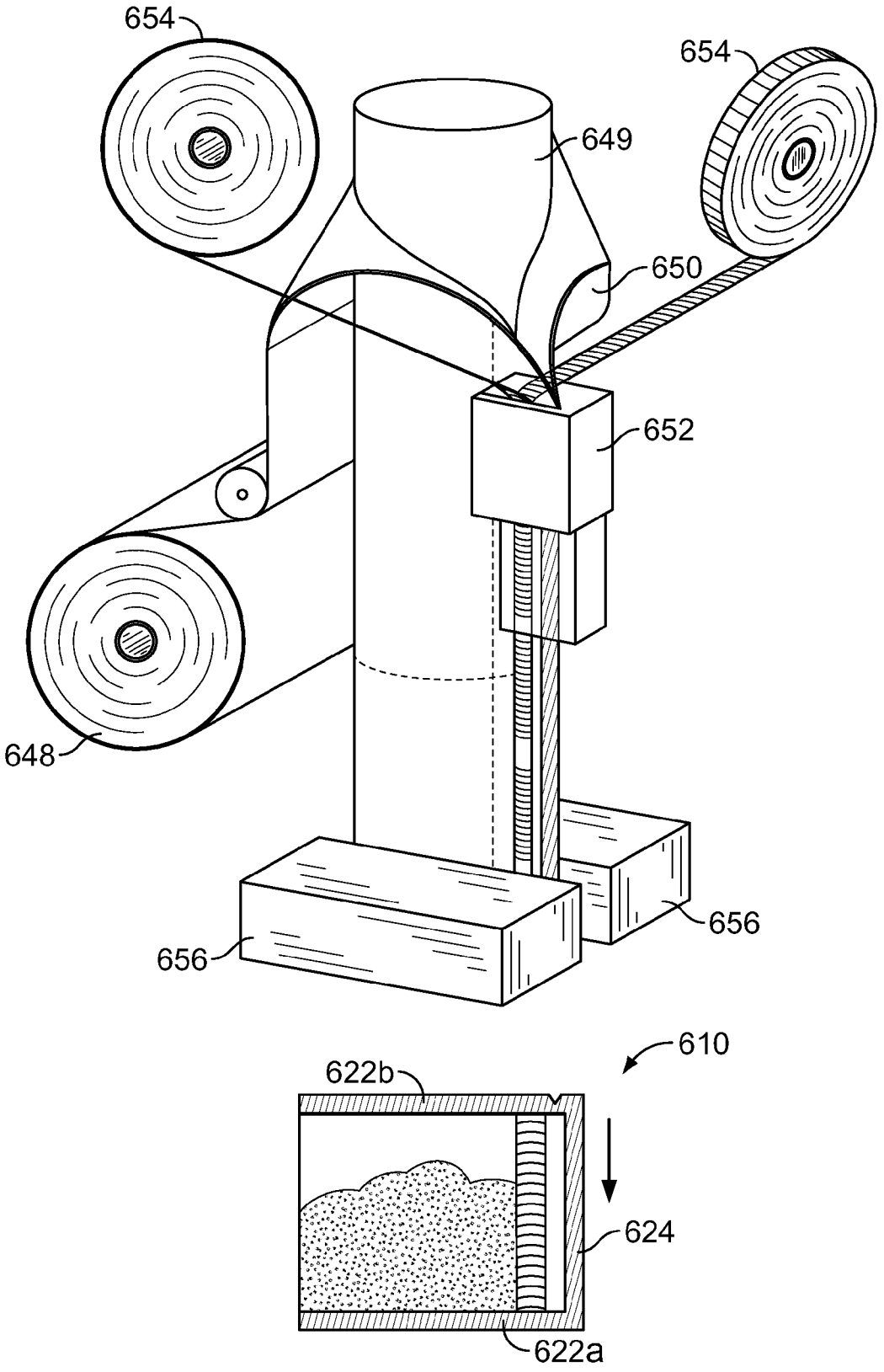

FIG. 20

FLEXIBLE PACKAGE HAVING AN AUTOMATIC CLOSURE FEATURE

RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional application No. 61/047,695, filed Apr. 24, 2008, which is incorporated by reference in its entirety herein. This application is a continuation-in-part of U.S. patent application Ser. No. 12/247,903, filed Oct. 8, 2008, and is a Continuation-in-Part of U.S. patent application Ser. No. 12/347,374, filed Dec. 31, 2008, both of which claim the benefit of U.S. Provisional Application No. 61/047,695, and all of which are incorporated by reference in their entirety herein.

TECHNICAL FIELD

[0002] This invention relates generally to packaging, and more particularly to a disposable food packaging comprising a pouch made of a film material with an automatic closure feature.

BACKGROUND

[0003] Flexible film packages are well known in the art and typically comprise disposable pouches commercially produced on high-speed form-fill-seal machines from rolls of plastic film material. The flexible film packages have cavities within which pluralities of contents, such as food products, are stored. Consumers often consume only a portion of the package's contents. A package reclosability feature allows the user to discharge a portion of the contents through the package opening and then seal the opening to reclose the flexible package.

[0004] Numerous reclosable flexible packages are well known in the art. By one approach, reclosable flexible packages have press-to-close zipper closures. Press-to-close zippers require alignment of two profiles located on opposing package walls to interlock the closure and reclose the package. This alignment may be cumbersome and/or time consuming for consumers, especially younger or older consumers who may have limited manual dexterity. In addition, if a particulate food product, like shredded cheese or bread crumbs, is stored within the flexible package, the particulate may interfere with the alignment of the zipper profiles, which often have narrow channels or tracks.

[0005] In another approach, the reclosable flexible packages include a slider zipper closure. The slider closures on these flexible packages assist with the alignment of the two profiles located on the package walls; however, these slider closures require additional plastic material and manufacturing that come with additional costs. While the sliders allow the users to more easily align the package wall profiles, the slider closures create a slight opening between the slider and the side seal when the package is in the closed configuration. Further, the zipper slider remains on the slider tracks when the package is in the open position and the slider extends into the opening, thereby slightly reducing the size of the pouch opening.

[0006] In addition, typical recloseable flexible packages do not automatically reclose themselves. These reclosable flexible packages typically require affirmative manual action to reclose. Thus, the user must remember to close the package and accurately press-to-seal the closure or pull the zipper slider to the closed configuration between each usage. Further, if one of these reclosable flexible packages is inadvertently dropped, while open, the contents may be permitted to spill out. The consumer must remember or have sufficient time to reclose the package to avoid possible spilling or spoilage of the package contents.

SUMMARY

[0007] The package described herein comprises a flexible pouch made of film material and a pair of semi-rigid strips attached to the walls of the flexible pouch positioned such that the semi-rigid strips align and bias toward one another. Upon removal of the top portion, the semi-rigid strips are moveable between a closed position and an open position. Further, the semi-rigid strips are configured such that they automatically reclose the package when the strips are released from the open position. The strips may extend along the entire width of the flexible pouch or may extend between the side seals of the pouch.

[0008] To commercially produce the self-closing flexible package having the semi-rigid strips, high-speed form-fill-seal equipment having a vertical or horizontal configuration may be employed. In one embodiment, cavities are formed out of film material in an in-line operation such that the strips may be added to the inside or outside surfaces of the film material. The semi-rigid strips may be secured to the front and back panels by heat sealing or adhesive bonding.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The above needs are at least partially met through provision of the flexible pouch having an automatic closure feature described in the following detailed description, particularly when studied in conjunction with the drawings, wherein:

[0010] FIG. **1** comprises a front elevational view of a flexible package as configured in accordance with various embodiments of the invention;

[0011] FIG. **2** comprises a cross sectional view of the flexible package of FIG. **1** along line **2-2**;

[0012] FIG. **3** comprises an isometric cross sectional view of the flexible package of FIG. **1** in the open configuration;

[0013] FIG. **4** comprises a cross sectional view of the flexible package of FIG. **1** in the open configuration;

[0014] FIG. **5** comprises a perspective view of the flexible package of FIG. **1** in the open configuration;

[0015] FIG. **6** comprises a front elevational view of another embodiment of a flexible package;

[0016] FIG. **7** comprises a cross sectional view of the flexible package of FIG. **6** along line **7-7**;

[0017] FIG. **8** comprises a rear elevational view of another embodiment of a flexible package;

[0018] FIG. **9** comprises a cross sectional view of the flexible package of FIG. **8** along line **9-9**;

[0019] FIG. **10** comprises a cross sectional view of another embodiment of a flexible package;

[0020] FIG. **11** comprises a perspective view of the flexible package of FIG. **10** in the open configuration;

[0021] FIG. **12** comprises a partial perspective view illustrating an apparatus as configured in accordance with an embodiment of the invention;

[0022] FIG. **13**A comprises a partial perspective view illustrating an apparatus configured in accordance with an embodiment of the invention;

[0023] FIG. **13**B comprises a partial perspective view illustrating an apparatus as configured in accordance with an embodiment of the invention;

[0024] FIG. **14** comprises a partial perspective view illustrating an apparatus as configured in accordance with an embodiment of the invention;

[0025] FIG. **15** comprises a perspective view of a of another embodiment of a flexible package;

[0026] FIG. **16** comprises a cross sectional view of the flexible package of FIG. **15**;

[0027] FIG. **17** comprises a perspective view of the flexible package of FIG. **15** in the open configuration;

[0028] FIG. **18** comprises a perspective view of another embodiment of a flexible package;

[0029] FIG. **19** comprises a cross sectional view of the flexible package of FIG. **18**; and

[0030] FIG. **20** comprises a partial perspective view illustrating an apparatus as configured in accordance with an embodiment of the invention.

[0031] Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions and/or relative positioning of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of various embodiments of the present invention. Also, common but well-understood elements that are useful or necessary in a commercially feasible embodiment are often not depicted in order to facilitate a less obstructed view of these various embodiments of the present invention. It will further be appreciated that certain actions and/or steps may be described or depicted in a particular order of occurrence while those skilled in the art will understand that such specificity with respect to sequence is not actually required. It will also be understood that the terms and expressions used herein have the ordinary technical meaning as is accorded to such terms and expressions by persons skilled in the technical field as set forth above except where different specific meanings have otherwise been set forth herein.

DETAILED DESCRIPTION

[0032] Generally speaking, pursuant to these various embodiments, a flexible package or pouch with an automatic closure feature is illustrated in FIGS. **1-11**. The flexible pouch **10**, as shown in FIGS. **1-5**, may be used for packaging food products **12**, such as particulate food products including shredded cheese, cereal, and trail mix, to note but a few. The flexible pouch **10** has a pair of curved semi-rigid strips **14**, **16** that run parallel to the pouch opening. The curved, semi-rigid strips **14**, **16** are configured and arranged to nest together and bias toward one another. The first and second semi-rigid strips **14**, **16** are secured to the opposed front and back panels **18**, **20** of the flexible pouch **10** and the biasing of the strips **14**, **16** biases the panels **18**, **20** to the closed configuration. The flexible pouch **10** may be comprised of a flexible film material that is formed using high-speed form-fill-seal equipment. The flexible pouch may have a variety of seals, folds, and other features as determined by a variety of considerations, such as the products stored in the pouch and the method of manufacturing the pouch, to note but a few.

[0033] In one illustrative embodiment, as depicted in FIG. **1**, the flexible pouch **10** includes front and back panels **18**, **20** that have a side seals **22**, a top seal **24**, and a bottom fold **26**. To facilitate access to the product, the flexible pouch **10** includes a removable top portion **28**. A distance below the removable top portion **28**, the front and back panels **18**, **20** have curved semi-rigid strips **14**, **16** located thereon. Upon removal of the top portion, the curved semi-rigid strips **14**, **16** are movable between an open position permitting dispensing of the food product and a closed position that limits or prevents egress of the food product.

[0034] As shown in FIG. **1**, the side seals **22** extend along the outside edges of the panels **18**, **20** to create the pouch **10**. The side seals **22**, top seal **24** and similar seals discussed herein may be conventional heat-seals. Such conventional heat seals may be created by reciprocating heat sealing bars or other suitable sealing apparatus and are well known to those skilled in the art.

[0035] In addition, the flexible pouch **10** includes an area of weakness **30** that assist the user with separating the removable top portion **28** from the flexible pouch **10**. The area of weakness **30** may be a mechanical or laser score line. This line may be linear or non-linear. If the area of weakness is non-linear, the flange at the top of the package (discussed below) may not extend entirely across the package width. In addition to a laser score line, the area of weakness **30** may include perforations. The score line or perforations may be extended along the entire width of the flexible pouch 1O. Instead, or in addition to a score line, the area of weakness **30** may include a tear initiation feature **32** along only a portion of the pouch, such as, for example, a small V-notch or slit on one edge of the package. For example, as shown in FIG. **1**, the area of weakness **30** may include a tear initiation feature **32** aligned with a score line.

[0036] Where the flexible pouch **10** is used for food products **12**, a hermetic seal **34** is desirable to ensure product freshness. The hermetic seal **34** may have a pealably openable characteristic. In the illustrative embodiment of FIG. **1**, the pealable hermetic seal **34** is positioned below the curved semi-rigid strips **14**, **16**. In another embodiment, the hermetic seal **34** may be created by the top seal **24** if the area of weakness **30** takes the form of a score line as opposed to perforations, which would interfere with the hermetic seal **34** created by the top seal **24**. In addition, the flexible pouch **10** may have a tamper evidence feature.

[0037] Below the area of weakness **30**, the front and back panels **18**, **20** each have a curved semi-rigid strip **14**, **16** secured thereon. The curved semi-rigid strips **14**, **16** have a slight arc and are positioned on the panels **18**, **20** such that the curved strips nest tightly together. More particularly, the curvature of the first curved semi-rigid strip **14** aligns in the same direction as the curvature of the second curved semi-rigid strip **16** as illustrated in FIG. **2**. The radius of curvature of the curved semi-rigid strips **14**, **16** may be larger or smaller than that illustrated in FIG. **2**.

[0038] The curved semi-rigid strips **14**, **16** may have a variety of dimensions. For example, the strips **14**, **16** may have a radius of curvature from 0.125 to 6.0 inches, a thickness of 0.007 to 0.050 inches, a height of 0.125 to 2.5 inches, and a length of 0.75 to 20 inches. In one illustrative embodiment, the curved semi-rigid strips **14**, **16** are about 1.25 inches in height, 5.75 inches in length, with a radius of curvature of 1.25 inches, and a thickness of about 0.015 inches. Depending on the dimensions and features of the flexible pouch **10**, the curved semi-rigid strips **14**, **16** may extend the entire width of the package, as shown in FIG. **1**, or may extend in between the side seals **22** such that the strips **14**, **16** terminate at the inside margin of the side seal **22**. Other embodiments

are contemplated, such as, for example, an embodiment having curved semi-rigid strips **14**, **16** that terminate in the middle of the side seals **22**.

[0039] As suggested, the curved semi-rigid strips **14**, **16** bias toward one another to automatically close the flexible pouch **10** upon release from the open position. The curved semi-rigid strips **14**, **16** are in their stable resting configuration when they are extended to their full length. When the curved semi-rigid strips **14**, **16** are separated and moved to a fully open position, as shown in FIGS. **3** and **4**, lengthwise tension is induced in the strips **14**, **16** such that when the strips are released from that position, they automatically move to the fully extended position which brings the strips **14**, **16** together tightly and closes the flexible pouch **10**. Further, in addition to the curved semi-rigid strips **14**, **16** imparting an automatic closure feature to the flexible pouch **10**, the strips **14**, **16** create an audible snap when the flexible package recloses. The audible snap assures the consumer that the package is securely closed and the unused portion of the contents will remain fresh.

[0040] As shown in FIG. **1**, the curved semi-rigid strips **14**, **16** are positioned parallel to the opening created at the top of the pouch **10** upon the removal of the top portion **28**. In addition, the curved semi-rigid strips **14**, **16** are positioned a distance form the area of weakness **30**. In one embodiment, the strips **14**, **16** are positioned about 0.75 inches from the top film edge. This distance may vary and a desired distance may be between 0.125 and 2.0 inches.

[0041] The curved semi-rigid strips **14**, **16** may be comprised of a variety of materials including a relatively heat resistant polymer such as polyethylene terephthalate (PET), high impact polystyrene (HIPS), polypropylene (PP), high density polyethylene (HDPE), another of a variety of relatively stiff polymers, or a thin strip of resilient metal such as a thin strip of steel. The curved semi-rigid strips **14**, **16** may be secured to the panels **18**, **20** in a variety of manners such as, for example, by heat sealing or adhesive bonding. Further, the strips **14**, **16** may be attached to the inside or outside surfaces of the panels **18**, **20**. By one approach, the first and second curved semi rigid strips **14**, **16** have an external heat seal layer compatible with a sealant on the respective front and back panels **18**, **20**.

[0042] The semi-rigid spring-loaded strips **14**, **16** may be produced in a variety of manners such as by stamping, injection molding, thermoforming, extrusion, or by a combination of two or more of these processes. For example, the strips may be stretched and rapidly quenched after profile extrusion. In addition, the curved semi-rigid strips **14**, **16** may be produced either as separate elements, pairs, or as a continuous ribbon of strip material wound onto a reel. In one embodiment, the curved semi-rigid strips **14**, **16** may be brought to the line in pre-cut strips. In another manufacturing process, the curved semi-rigid strips **14**, **16** may be formed in-line. For example, in one embodiment, the material from which the curved semi-rigid strips **14**, **16** is formed is wound on a reel in a flat form such that the curvature of the semi-rigid strips **14**, **16** is imparted by a forming process such as a thermoforming tool when the material is unwound from the reel.

[0043] Turning now to FIGS. **3** and **5**, the flexible pouch **10** is illustrated in the open configuration. Above the curved semi-rigid strips **14**, **16** and below the area of weakness **30**, a portion of film material extends, which comprises the panel flanges **36**, **38**. Thus, when the removable portion **28** has been separated from the flexible pouch **10**, the panel flanges **36**, **38** extend above the curved semi-rigid strips **14**, **16** and may be grasped by the user. In one illustrative embodiment, the strips **14**, **16** are positioned between 0.5 and 1.0 inches from the top edge of the film material. Thus, in one illustrative embodiment, the panel flanges **36**, **38** may be between 0.25 and 0.8 inches in height. Such panel flanges **36**, **38** provide loose film for easy grasping, which assists with the opening of the pouch **10**.

[0044] To open the flexible pouch **10**, the user may manually grasp and pull the front and back panel flanges **36**, **38** apart from one another. Pulling the panel flanges **36**, **38** with a mild force causes the package to move to a fully open configuration. Once opened, the flexible pouch **10** may be held in the fully open configuration by applying longitudinal compression to the sides of the flexible pouch **10** where the curved semi-rigid strips **14**, **16** terminate. Continuous application of such longitudinal compression retains the flexible pouch **10** in the fully open configuration, as shown in FIGS. **3-5**. The fully open configuration allows significant access to the food products stored within the flexible pouch **10**. In one embodiment the flexible package is sized to allow one-hand manual application of the longitudinal compression.

[0045] Upon release of the longitudinal compression, the spring-tension of the curved semi-rigid strips **14**, **16** causes them to snap back to the closed position thereby automatically closing pouch **10**. As mentioned, the closing action may be rapid and accompanied by an audible snap sound. After returning to the closed position, the matching curvature of the curved semi-rigid strips **14**, **16** is forced tightly together creating a secure closure at the top of the flexible pouch **10**.

[0046] Turning now to FIGS. **6** and **7**, there is illustrate another embodiment of a flexible pouch. In this and subsequent embodiments, similar flexible pouches are illustrated having slightly different features. For convenience, features of the various embodiments that correspond to features already discussed with respect to previously discussed embodiments are identified using the same reference numeral in combination with a prefix (such as '1') to distinguish the different embodiment. For example, flexible pouch **110** corresponds to previously described flexible pouch **10**.

[0047] As shown in FIG. **6**, flexible pouch **110** includes side seals **122**, a top seal **124** and a bottom seal **142**. This embodiment may be produced out of two rolls of film material that are heat sealed together. In this example, the curved semi-rigid strips **114**, **116** extend to the outside edges of the side seals **122**. As shown in FIG. **7**, the flexible pouch **100** comprises a front panel **120** that is generally vertical and a back panel **118** within which a bulge is created to accommodate a plurality of food product **112**.

[0048] Turning now to FIGS. **8** and **9**, there is illustrated another embodiment of a flexible pouch **210**. The flexible pouch **210** includes a bottom seal **242**, side folds **244**, and a lap or fin seal **246** along the back of the flexible pouch **210**. The fin seal **246**, like side seals **22**, may be conventional heat seals. As shown in the illustrative embodiment of FIG. **9**, the curved semi-rigid strips **214**, **216** are secured to the outside surfaces of the front and back panels **218**, **220**.

[0049] In yet another illustrative embodiment, depicted in FIGS. **10** and **11**, a flexible pouch **310** is illustrated. The flexible pouch **310** is similar to the flexible pouch **10** described above except that flexible pouch **310** has only one curved semi-rigid strip **314** secured to one of either the front or back panels **318**, **320**. Such an embodiment functions similarly to the previously discussed embodiments, except

that the closure may not be as air-tight as the previous embodiments but the flexible pouch **310** uses less strip material and thus has a cost savings.

[0050] As mentioned above, the method of manufacturing the flexible pouches may affect the particular seals, folds, and various other features of particular flexible pouches. A variety of manufacturing methods are available to commercially produce the flexible pouches and a few examples will be discussed herein and illustrated in FIGS. **12-14**. The flexible pouches may be made in a high-speed form-fill-seal (FFS) operation that produces up to 800 packages per minute. The FFS operation may be on a vertical FFS machines as illustrated in FIG. **12** or also may be on a horizontal FFS machine as illustrated in FIGS. **13**A and **13**B or on a horizontal thermoform-fill-seal (HTFFS) machine as shown in FIG. **14**. The curved semi-rigid strips may also be secured to the pouches in a variety manners, such as by heat sealing or adhesive bonding via an add-on equipment module designed to work in harmony with the pouch-making machines of the FFS operation.

[0051] In one illustrative embodiment shown in FIG. **12**, the flexible pouches are made in a vertical FFS or bagging line. A series of flexible pouches is formed from a roll of film **48**, such that the front and back panels of the film material define a cavity. By one approach, a web of the rolled film material is fed over a folding shoulder **50** such as a forming collar and mandrel to provide it with a tubular shape. Opposite longitudinal edges of the film are brought together around the fill tube **49**. The longitudinal edges are sealed, such as by a seal tool **52** to form a fin seal, or overlapped to form a lap seal. In one illustrative embodiment, the curved semi-rigid strips are wound on reels **54**. The strips are brought into alignment with a reciprocating seal tool **56** for attachment to the walls of the flexible pouch. A bottom seal for the pouch is also formed by the reciprocating sealing tool **56**, which may include a pair of reciprocating sealing bars. The reciprocating sealing bars are heat sealing bars maintained at a desired temperature to apply heat and pressure to the front and rear walls. Further, the heat seal bars are brought together on opposite sides of the tubular web so that heat is conductively transferred to the film from both sides while pressure is applied. The sealing bars may be used in an intermittent or continuous operation. In an intermittent operation, the film is stopped while the sealing bars engage the film. In a continuous operation, the sealing bars may move vertically at the machine speed as they engage the film. During operation, sealing tool **56** attaches the curved semi-rigid strips and creates a top seal in a lower pouch and creates a bottom seal in an upper pouch at roughly the same time. In addition, sealing tool **56** may contain a reciprocating knife which acts to separate the bottom pouch from the upper pouch. Once the operation is complete and the upper pouch has been filled with food product, the upper pouch advances downward and becomes the bottom pouch to which curved semi-rigid strips are attached. In addition to attaching the strips and sealing the pouches, the sealing tool **56** may also be used to impart the curvature to the curved semi-rigid strips and/or to create the area of weakness. By one approach, the sealing tool **56** has a cutting device associated therewith to create a perforation across the top of the package or a notch at the edge of the package to aid in tear initiation. By another approach, the area of weakness in the pouch is not perforated at the package line but is pre-scored (mechanically or with a laser) at the film manufacturer.

[0052] As mentioned, the strips are attached to flexible pouches such that the curvature of the first curved semi-rigid strip aligns with the curvature of the second curved semi-rigid strip. The strips may be attached to the vertical FFS pouch in a variety of manners, e.g., hot melt adhesive, pressure sensitive adhesive, and heat sealing, to note but a few options. As mentioned above, the curved semi-rigid strips may be applied to the outside surfaces of the walls. In one vertical FFS process, the curved semi-rigid strips have an external heal seal layer compatible with a sealant on the outside surface of the package walls. In one such vertical FFS operation, the curved semi-rigid strips are secured to the front and back panels in a direction perpendicular to the machine direction on the outside surface of the panels.

[0053] After a bottom seal is formed in the flexible pouch, the partially formed flexible pouch is then filled with food product, which is introduced into the pouch via the fill tube **49**. In one embodiment, an area of weakness is formed in the flexible pouches to define a removable top portion. By one approach, a notch, score line, or other feature to facilitate removal of the top portion of the package may then be formed near the top of the pouch. A hermetic seal may also be created in the disposable pouch. The sealing tool **56** may perform a variety of functions simultaneously, including: creating the bottom seal of the pouch that is about to be filled with product; attaching the semi-rigid strips to the upper portion of the front and back panels and creating a peelable heat seal just below the strips on the pouch that was just filled; and having a reciprocating knife or cutting tool which separates the pouch that was just filled from the following one which is about to be filled. The reciprocating cutting tool may also create an area of weakness such as a perforation across the top of the package or a notch at the package edge. By another approach, the area of weakness in the pouch is not perforated at the package line but is pre-scored (mechanically or with a laser) at the film manufacturer such that the scored area of weakness is built into the film as it arrives from the manufacturer. If such an approach is taken, the film should be positioned on the packaging machine via optical registration so that the previously imparted score line is in the correct position when the flexible pouch is formed.

[0054] There are a variety of alternative steps to those described in this vertical FFS operation. Also, high speed techniques may be employed instead of application of heat and pressure by heat seal bars as described above. For example, RF energy, ultrasonic energy or other techniques may be employed.

[0055] In another example, shown in FIG. **13**A, flexible pouches are manufactured in a horizontal FFS or a flow-form wrapper. Like the vertical process described above, a series of flexible pouches is formed and the film material defines a cavity having front and back panels. FIG. **13**A illustrates a single roll of film **148** being folded at a folding apparatus **150** and then sealed with a sealing die **152** to form pouch cavities in series with one another. After the film is formed into cavities, the cavities are filled with food product. The strip-alignment roller **158** is set at an angle to cause the strips to turn after unwinding and to be redirected so that they are aligned in the proper orientation for attachment to the flexible pouches. As shown in FIG. **13**A, a double roll of strips **154***a* is located on the reel. As the strips are positioned and sealed to the pouches and the pouches are advanced in the machine direction, the strips are continuously unwound from the roll **154***a* and advanced in the machine direction along with the pouches. As

the double layer of continuous strips **154***a* is unwound, the strips are dispensed from the roll and positioned between the two front and back panels of the film material. In this embodiment, the strips are sealed to the inside surface of the front and back panels. As shown in FIG. **13**A, the seal bars **156** seal the flexible pouch and strips from both sides of the pouch. By one approach, having the strips on the inside of the pouch material makes the sealing process easier because the sealing bars **156** are configured to transfer heat through the pouch material, which is thinner than the semi-rigid strips. Whereas, the strips may be of a thicker material and thus, may require more, heat, pressure, or time, to be affected by the heat seal process. The sealing bars **156** may also create an area of weakness in the package such as by a cutting device associated therewith. By another approach, a separate mechanical or laser score tool (not shown) may be employed in-line to create the score line in the formed packages. By yet another approach, the area of weakness such as the score line is already formed in the film when the film arrives from the manufacturer.

[0056] In another embodiment such as that shown in FIG. **13**B, the flexible pouches are made in a horizontal FFS or a flow-wrapper line similar to the example shown in FIG. **13**A. A series of flexible pouches is formed from a single roll of film **148** that is folded at a folding apparatus **150**, such as a folding plow as shown in FIG. **13**B, and then sealed with a sealing die **152** to form pouch cavities in series with one another. After the film is formed into cavities, the cavities are filled with food product. In the illustrative embodiment of FIG. **13**B, the horizontal FFS process has two separate reels **154***b* with curved semi-rigid strips, instead of the single roll of double layer strips **154***a* shown in FIG. **13**A. A continuous ribbon of curved semi-rigid material is dispensed to the line from the reel and then secured to the pouch cavities at sealing die **156**. It is also contemplated that pre-cut strips may be brought in-line and secured to the flexible film pouches. The sealing die **156** also imparts a top seal to the flexible pouch and may also create a peelable seal, if desired. The filled cavities are then separated from one another, such as by a reciprocating knife, not shown.

[0057] In yet another embodiment, illustrated in FIG. **14**, the flexible pouches are made on horizontal thermoform-fill-seal equipment (TFFS). As shown, such a process may employ two rolls of film material **248***a*, **248***b*. A series of product cavities are thermoformed from a flexible plastic bottom film **248***b*, which can then be filled with a food product. The forming of the bottom film **248***b* occurs at thermoforming station **260**. After the lower cavities are filled with a product, the curved semi-rigid strips are introduced at the proper position between the top and bottom films. The strips may arrive to the in-line process pre-cut or on a continuous reel of semi-rigid spring strip material that may or may not require further forming processing. In the illustrative embodiment of FIG. **14**, the curved semi-rigid strips are positioned on two reels **254**, mated together with one another at strip roller guide **258**, and brought in series to be attached to the flexible pouch.

[0058] After alignment of the curved semi-rigid strips and the top and bottom films, the films and the semi-rigid strips enter a sealing station **256**. This sealing station **256** is generally contained within a vacuum chamber, especially when the food product requires low oxygen vacuum packaging or modified atmosphere packaging. Within the sealing station **256** are an upper moveable heated seal bar **257***a* and an unheated moveable lower seal support die **257***b*, which act together to apply heat and pressure to the upper and/or lower films, accomplishing all of the necessary heat seals to define the final package (such as the package shown in FIGS. **6** and **7**) including the side seals, the top and bottom seals, the peelable seal below the semi-rigid strips, as well as sealing the curved semi-rigid strips to the top and bottom films.

[0059] Upon leaving the sealing station **256**, the formed flexible pouches move in series to a trim station **262** where the pouches are separated from one another. The trim station **262** may also create the area of weakness in the pouches such as by a cutting device. Alternatively, a separate mechanical or laser score tool (not shown) may be employed in-line to create the score line in the film as it is unwound from the roll, prior to forming the packages. By another approach, the area of weakness is already formed in the film when the film arrives from the manufacturer. However, if pre-scored film is employed it should be registered on the packaging machine so that the scored line is in the correct position once the pouches have been formed.

[0060] By one horizontal TFFS process, the strips are sealed between the top film **248***a* and the bottom film **248***b* such that they are attached to the inside surfaces of the bottom film and the top film. More particularly, the film may have a heat sealable layer on the inside surface which seals to the resin material of the semi-rigid strips. In yet another embodiment, the strips have an external heat seal layer compatible with a sealant on the inside surface of the film.

[0061] The film material or substrate of the flexible pouch may be formed as a polymeric sheet of various plastic polymers, copolymers, co-extrusions and/or laminations. Further, the film material may be a monolayer polymeric film or a multilayer laminate comprising an outer layer of durable material and one or more inner barrier layers and sealant layers. The multilayer combination may be comprised of polyolefin such as polyethylene (high, medium, low, linear low, and/or ultra low density polymers including metallocene), polypropylene (non-oriented, oriented, and/or biaxially oriented); polybutylene; ethylene vinyl acetate (EVA); polyamides (non-oriented, oriented, and/or biaxially oriented) such as nylon; polyethylene terephthalate (non-oriented, oriented, and/or biaxially oriented); polyvinyl chloride; ethylene vinyl alcohol (EVOH); polyvinylidene chloride (PVDC); polyvinyl alcohol (PVOH); polystyrene; or combinations thereof. In addition, adhesive tie layers may also be used.

[0062] In addition to the curved, semi-rigid strips **14**, **16** described above, it is also contemplated that the semi-rigid strips may have alternative cross-sectional configurations. For example, an illustrative embodiment in FIG. **15** includes a flexible package **400** having a pair of semi-rigid strips **414**, **416** with a slight fold therein such that the strips have a crease, angle, or v-shape imparted thereto. The partially folded semi-rigid strips **414**, **416** extend nearly the entire width of the package and are parallel to the pouch opening. The partially folded, semi-rigid strips **414**, **416**, like previous strips, have matching profiles and are configured to automatically close the package **400** once the partially folded, semi-rigid strips **414**, **416** are released from an open position. More particularly, once released from the open position, the strips and associated panels **418**, **420** are forced tightly together creating a secure closure at the top of the flexible pouch **400**.

[0063] As with curved, semi-rigid strips **14**, **16**, the partially-folded semi-rigid strips **414**, **416** are configured and arranged to nest together and bias toward one another. The

first and second partially-folded, semi-rigid strips **414**, **416** are secured to the opposed front and back panels **418**, **420** of the flexible pouch **400** such that the profiles of the strips align in the same direction. Further, the biasing of the strips **414**, **416** biases the panels **418**, **420** to the closed configuration. The pouch **400** may be comprised of a thin, flexible film material such as that formed using high-speed form-fill-seal equipment previously discussed. While the package **400** includes a side seal **422**, a top seal **424**, and a bottom seal **426**, a variety of seals, folds, and other pouch features are contemplated for use with the partially-folded, semi-rigid strips **414**, **416**.

[0064] The pouch **400**, illustrated in FIG. **15**, includes an area of weakness **430** that facilitates removal of the top portion **428**. The area of weakness **430**, by one approach, is positioned a distance below the top seal **424** and a distance above the partially-folded, semi-rigid strips **414**, **416** such that a portion of the front and back panels **418**, **420** comprises a flange **436**, **438** that can be manually grasped and separated to open the package **400** once the top portion **428** has been removed. While flexible pouch **400** illustrates the partially-folded, semi-rigid strips **414**, **416** attached to inside surfaces of the front and back panels **418**, **420**, as shown in FIG. **16**, it is also contemplated that the strips **414**, **416** may be affixed to outside surfaces. To ensure freshness of the food product **412**, the flexible pouch **10** may include a hermetic seal. By one approach, the hermetic seal may include the top seal **424**. By another approach, the hermetic seal may include a pealable hermetic seal **434**.

[0065] Another illustrative flexible pouch **500**, shown in FIGS. **18** and **19**, includes planar semi-rigid strips **514**, **516**. By one approach, the planar semi-rigid strips **514**, **516** extend nearly the entire width of the package and are parallel to the pouch opening. As with previous strips, planar semi-rigid strips **514**, **516** bias toward one another such that the pouch automatically closes when the strips **514**, **516** and associated panels **518**, **520** are forced tightly together. The planar semi-rigid strips **514**, **516** have a flat profile and are secured to the front and back panels **518**, **520** such that the strips **514**, **516** generally overlap. Thus, like previous strips, planar strips **514**, **516** nest together by overlapping or having significant surface to surface contact. Additional configurations for the semi-rigid strips are contemplated. Further, the flexible pouch may have a variety of configurations with differing seals, folds, and various other features.

[0066] In addition to the variety of manufacturing methods discussed above, a number of alterations to the various methods disclosed are contemplated without changing the overall operation of the manufacturing method or the flexible packages produced. As mentioned, high-speed form-fill-seal (FFS) operations may produce significant quantities of flexible packages in a relatively short period of time. The various processes described above including the vertical manufacturing process of FIG. **12**, the horizontal manufacturing processes of FIGS. **13**A-**14**, and the strip attachment methods discussed herein may be modified or combined for particular manufacturing requirements or limitations. For example, a packaging system, shown in FIG. **20**, employs a vertical FFS or bagging line similar to that in FIG. **12** albeit with several modifications such that flexible packages are produced having a top seal and two side seals as shown produced in FIG. **13**A and **13**B. Further, the system of FIG. **20** aligns the semi-rigid strips in a direction parallel to machine direction or the movement of the series of pouches.

[0067] As shown in FIG. **20**, flexible pouches are formed from a roll of film **648**, such that the front and back panels of the film material define a cavity. By one approach, a web of rolled film material is fed over a folding shoulder **650** to provide the film with a tubular shape. Opposite longitudinal edges of the film **648** are brought together around the fill tube **649**. The longitudinal edges are sealed, such as by seal and attachment tool **652**. By one approach, the seal and attachment tool **652** forms a top seal that will span the width of the package opening in between side seals once the flexible package is formed. In addition, the seal and attachment tool **652** may also attach semi-rigid strips to the film **648**.

[0068] In one illustrative embodiment, the semi-rigid strips are wound on reels **654** and brought into alignment with the film at the seal and attachment tool **652** to be secured to the film. Attachment to the film may be accomplished by a variety of mechanisms. By one approach, heat sealing may be employed to secure the semi-rigid strips to the film. By another approach, an adhesive may be used, such as a hot melt adhesive or a pressure sensitive adhesive. The semi-rigid strips may have an external heat seal layer compatible with a sealant on the outside surface of the film comprising the package walls. While the material wound on the reels **654** may have a curvature or profile formed therein, by another approach, the profile or curvature of the semi-rigid strip may be created at the seal and attachment tool **652**. In the example of FIG. **20**, the semi-rigid strips, being wound on reels **654**, are secured to the film as the series of semi-rigid strips from the reels **654** advances in a direction parallel to the machine direction.

[0069] The seal and attachment tool **652** may also create an area of weakness or a tear initiation feature such as a notch. Alternatively, the area of weakness may be pre-scored in the film by the film manufacturer. In such a case, the film **648** may need to be loaded into the packaging system to ensure proper placement of the area of weakness in the flexible pouch. In addition to the tool **652**, the tear initiation feature may be created during other operations as discussed below.

[0070] As shown in FIG. **20**, side seals **622***a*, **622***b* of the flexible package **610** may be formed by a reciprocating seal tool **656**, which may include a pair of reciprocating sealing bars. By one approach, the reciprocating sealing bars are heat sealing bars maintained at a desired temperature to apply heat and pressure to the tubular web to create the flexible packages. In addition, the heat seal bars **656** illustrated in FIG. **20** are brought together on opposite sides of the tubular web so that heat is conductively transferred to the film from both sides while pressure is applied. The sealing bars may be used in an intermittent or continuous operation. In an intermittent operation, the film is stopped while the sealing bars engage the film. In a continuous operation, the sealing bars may move vertically at the machine speed as they engage the film. During operation, sealing tool **656** seals the side seal **622***b* of a lower pouch and creates another side seal **622***a* for another, upper pouch, at substantially the same time. Thus, as a lower flexible pouch is sealed at a second side seal **622***b*, thereby enclosing the food within the flexible package, an upper flexible pouch has a first side seal **622***a* created therein. After forming a side seal **622***a* into the upper flexible pouch, the upper flexible pouch may be filled with food and lowered to form the second side seal sealed **622***b* therein. In addition to forming side seals, sealing tool **656** may create a tear initia-

tion feature or tool **656** may contain a reciprocating knife that is configured to separate the bottom or lowered pouch from the upper pouch.

[0071] As mentioned, after the first side seal **622***a* has been created in the flexible pouch, the pouch may then be filled with product, which is introduced via the fill tube **649**. Either before or after the flexible pouch **610** has been filled with food, the pouch may advance downward to become the lower or bottom pouch, then, the second side seal **622***b* is created in the package thereby enclosing the food product in the flexible pouch **610**.

[0072] The sealing tools **652** and **656**, similar to sealing tools previously discussed, perform a variety of functions simultaneously or in quick succession. For example, sealing and attachment tool **652** can create a top seal of the pouch and attach the semi-rigid strips. In addition, tool **652** may also create a peelable heat seal just below the semi-rigid strips and may impart the curvature or formed profile of the semi-rigid strips. By one approach, seal tool **656** creates side seals on two different packages simultaneously and may also separate these packages. In addition, seal tool **656** may also include a cutting device to create a notch at the edge of the package to aid in tear initiation or may create an area of weakness in the film. The cutting device may also be used to separate the packages as mentioned via reciprocating knife.

[0073] Those skilled in the art will recognize that a wide variety of modifications, alterations, and combinations can be made with respect to the above described embodiments without departing from the spirit and scope of the invention, and that such modifications, alterations, and combinations are to be viewed as being within the ambit of the inventive concept.

We claim:

1. A method of mass producing a packaged food product in high-speed form-fill-seal equipment comprising:
- forming a series of disposable pouches having front and back panels made of film material, each of the disposable pouches defining a cavity therein;
- filling the cavity of the disposable pouches with a food product;
- hermetically sealing the disposable pouches;
- attaching a first semi-rigid strip to the front panel and a second semi-rigid strip to the back panel with each of the semi-rigid strips having a profile aligned with the profile of the adjacent semi-rigid strip such that the strips align, the first and second semi-rigid strips being biased toward one another; and
- separating the disposable pouches from one another.

2. The method of claim **1** further comprising forming a removable top portion in the disposable pouches defined by an area of weakness.

3. The method of claim **1** wherein the first and second semi-rigid strips are attached to inside surfaces of the front and the back panels.

4. The method of claim **1** wherein the first and second semi-rigid strips are attached to outside surfaces of the front and back panels.

5. The method of claim **1** wherein the first and second semi-rigid strips are pre-cut.

6. The method of claim **1** wherein strip material from which the first and second semi-rigid strips are produced dispensed from a reel.

7. The method of claim **6** wherein the strip material is wound on the reel in flat form such that the profile of the first and second semi-rigid strips is imparted by a thermal forming tool when the material is unwound from the reel.

8. The method of claim **1** wherein attaching the first and second semi-rigid strips comprises at least one of:
- heat sealing the first and second semi-rigid strips to the inside surface of the front and back panels;
- heat sealing the first and second semi-rigid strips to the outside surface of the front and back panels;
- adhesive bonding the first and second semi-rigid strips to the inside surface of the front and back panels;
- adhesive bonding the first and second semi-rigid strips to the outside surface of the front and back panels.

9. The method of claim **1** wherein heat sealing the first and second semi-rigid strips comprises having an external heat seal layer compatible on the first and second semi-rigid strips that is compatible with a sealant on the front and back panels.

10. The method of claim **1** wherein the first and second semi-rigid strips are attached in an orientation parallel to the machine direction.

11. The method of claim **1** wherein the first and second semi-rigid strips are attached in an orientation perpendicular to the machine direction via a strip applicator module configured and arranged to cut and heat-seal the first and second semi-rigid strips to the disposable pouch.

12. A method for mass producing a packaged food product in a horizontal thermoform-fill-seal equipment comprising:
- thermoforming a series product cavities from a thermoformable flexible plastic bottom film;
- filling the thermoformed series of product cavities;
- securing the first semi-rigid strip to the bottom film;
- securing the second semi-rigid strip to a flexible top film;
- heat sealing the flexible top film to the bottom film, the films defining a pouch wherein the first and second semi-rigid strips significantly overlap one another and the first and second semi-rigid strips have profiles that align in the same direction such that the strips nest together in a closed position.

13. The method of claim **12** wherein securing the first semi-rigid strip to the bottom film comprises heat sealing.

14. The method of claim **12** wherein securing the first semi-rigid strip to the bottom film comprises adhesive bonding.

15. The method of claim **12** wherein the first and second semi-rigid strips are attached to inside surfaces of the front and the back panels.

16. The method of claim **12** wherein the first and second semi-rigid strips are attached to outside surfaces of the front and the back panels.

17. The method of claim **12** wherein the first and second semi-rigid strips are pre-cut.

18. The method of claim **12** wherein strip material from which the first and second semi-rigid strips are dispensed from wound on a reel.

19. The method of claim **18** wherein the strip material is wound on the reel in flat form such that the profile of the first and second semi-rigid strips is imparted by a thermal forming tool when the material is unwound from the reel.

20. The method of claim **12** wherein the first and second semi-rigid strips are attached in an orientation parallel to the machine direction.

21. The method of claim **12** wherein the first and second semi-rigid strips are attached in an orientation perpendicular to the machine direction via a strip applicator module config-

ured and arranged to cut and heat-seal the first and second semi-rigid strips to the disposable pouch.

22. A method for mass producing a packaged food product in a vertical form-fill-seal equipment comprising:

forming a flexible plastic tube from a roll of flexible plastic film, the plastic tube having a sealed edge and having a pair of semi-rigid strips secured to the flexible film wherein the pair of semi-rigid strips significantly overlap one another once the semi-rigid strips are secured to the flexible film;

forming a first side seal in the plastic tube to create a flexible pouch from the flexible plastic tube;

filling the flexible pouch with a food product;

forming a second side seal in the flexible pouch to seal the food product within the flexible pouch; and

separating a filled flexible pouch from the plastic tube.

23. The method of claim **22** wherein the semi-rigid strips have formed profiles that align in the same direction such that the semi-rigid strips nest together when the flexible pouch is in a closed position.

24. The method of claim **22** wherein forming a flexible plastic tube from a roll of flexible plastic film further includes forming the flexible film over a forming collar to create the plastic tube.

25. The method of claim **22** wherein the plastic tube having a sealed edge and securing a pair of semi-rigid strips to the flexible film includes forming a top seal in the flexible film having a front and a back panels, the front and back panels each having one of the pair of semi-rigid strips attached thereto.

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