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(54) Title: PACKAGING FOR PARTICULATE AND GRANULAR MATERIALS

(57) Abstract: The present invention provides a packaged cementitious product including a bag formed of a polymeric material. The bag has first and second sealed ends. The first end has a first tab extending therefrom defining at least one aperture therethrough so that the first tab defines a first handle. The second end has a second tab extending therefrom defining at least one aperture therethrough so that the second tab defines a second handle. A cementitious product is sealed within the bag, and wherein the first and second handles facilitate the handling of the packaged cementitious product.

PACKAGING FOR PARTICULATE AND GRANULAR MATERIALS

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to packaging and, more particularly, to packaging and methods for packaging for particulate and granular materials.

Description of Related Art

Particulate and granular materials are commonly packaged in bags, sacks or other packaging materials (collectively referred to herein as "bags") constructed of paper. As used herein, the term "particulate materials" refers to powdery materials that generate dust when disturbed, such as during packaging. For purposes of example only and not limitation, particulate materials can include cementitious materials, such as cement and concrete mixes, limestone, fly ash, bottom ash, powdered sugar, etc. As used herein, the term "granular materials" refers to materials that are composed of granules or grains, or have a grainy texture, and which may or may not generate dust when disturbed. For purposes of example only and not limitation, granular materials can include sand, pea gravel, sugar, salt, etc.

The conventional paper bags used to package particulate and granular materials are generally closed at one end either when the bag is made or prior to filling by folding the sides of the bag inwardly in an overlapping configuration and then securing the sides together using an adhesive. The bags are filled with the particulate or granular material through the open end of the bag, which is then closed by folding the sides of the bag inwardly in an overlapping configuration and then securing the sides together using an adhesive.

Conventional paper bags are structured to allow air to escape from the interior of the bags so that the bags can be compressed when the bags are stacked, such as on a pallet. However, conventional paper bags have several disadvantages. For example, in addition to allowing air to escape, conventional paper bags also can allow fine particles from the particulate or granular material inside the bag to escape, which can result in appreciable amounts of dust, particularly when storing the bags in an enclosed space such as a warehouse or inside a store. Conventional paper bags also are susceptible to rupturing or tearing if not handled properly, which can result in product spillage and waste. Conventional paper bags also allow moisture to permeate the bag, which will typically have an adverse effect on the particulate or granular material inside the bag. For example, where the bag is used to package cementitious material, moisture can lead to curing of the cementitious material inside the bag thereby rendering the product useless. This can be particularly problematic when storing or handling the bags outside where the bags can be exposed to rain, condensation or other wet ambient conditions. Conventional paper bags also can be difficult to load and unload manually when the bags are filled with particulate or granular material. For example, bags used to package cementitious material are typically offered in 29 lb, 44 lb, 50 lb, 60 lb and 80 lb bags, which are heavy and can be difficulty to carry.

Accordingly, there remains a need for packaging for particulate and granular material generally and cementitious materials in particular. The packaging should be capable of being filled and sealed using an automated filling machine and should allow the particulate or granular material to be stored so as to minimize leakage, spillage and exposure to moisture. The packaging should also be stackable when filled with particulate or granular material, such as on a pallet, and should also facilitate manual loading and unloading of the filled packaging.

SUMMARY OF THE INVENTION

The present invention provides package for particulate and granular material. According to one embodiment, the package includes a bag formed of a polymeric material. The bag has first and second ends. The first end of the bag is sealed and the second end of the bag is open. The first end of the bag has a first

tab extending therefrom defining at least one aperture therethrough so that the first tab defines a first handle. In one embodiment, the edge of the at least one aperture in the first tab is at least partially sealed. The second end of the bag is structured to be sealed after filling the bag with the particulate or granular material. The second end of the bag has an excess portion structured to be formed into a second tab defining at least one aperture therethrough upon sealing of the second end of the bag so as to define a second handle. In one embodiment, the bag has first and second sides, wherein at least a portion of the first side and/or the second side of the bag defines a textured surface.

The present invention provides package for cementitious material. According to one embodiment, the package includes a bag formed of a polymeric material. The bag has first and second ends. The first end of the bag is sealed and the second end of the bag is open. The first end of the bag has a first tab extending therefrom defining at least one aperture therethrough so that the first tab defines a first handle. In one embodiment, the edge of the at least one aperture in the first tab is at least partially sealed. The second end of the bag is structured to be sealed after filling the bag with the cementitious material. The second end of the bag has an excess portion structured to be formed into a second tab defining at least one aperture therethrough upon sealing of the second end of the bag so as to define a second handle. In one embodiment, the bag has first and second sides, wherein at least a portion of the first side and/or the second side of the bag defines a textured surface.

The present invention also provides a packaged product containing particulate or granular material. According to one embodiment, the packaged product includes a bag formed of a polymeric material. The bag has first and second sealed ends. The first sealed end has a first tab extending therefrom defining at least one aperture therethrough so that the first tab defines a first handle. The second sealed end has a second tab extending therefrom defining at least one aperture therethrough so that the second tab defines a second handle. In one embodiment, the edge of the at least one aperture in the first tab and/or second tab is at least partially sealed. A particulate or granular material is sealed within the bag, wherein the first and second handles facilitate the handling of the

packaged product. In one embodiment, the bag has first and second sides, wherein at least a portion of the first side and/or the second side of the bag defines a textured surface.

The present invention also provides a packaged cementitious product. According to one embodiment, the packaged cementitious product includes a bag formed of a polymeric material. The bag has first and second sealed ends. The first sealed end has a first tab extending therefrom defining at least one aperture therethrough so that the first tab defines a first handle. The second sealed end has a second tab extending therefrom defining at least one aperture therethrough so that the second tab defines a second handle. In one embodiment, the edge of the at least one aperture in the first tab and/or second tab is at least partially sealed. A cementitious product is sealed within the bag, wherein the first and second handles facilitate the handling of the packaged cementitious product. In one embodiment, the bag has first and second sides, wherein at least a portion of the first side and/or the second side of the bag defines a textured surface.

The present invention also provides a method for packaging particulate or granular material. According to one embodiment, the method includes providing a bag formed of a polymeric material, the bag having first and second ends. In one embodiment, the providing step includes forming the bag. The first end of the bag is sealed and the second end of the bag is open. The first end of the bag has a first tab extending therefrom defining at least one aperture therethrough so that the first tab defines a first handle. In one embodiment, the providing step includes heating a die and forming the at least one aperture through the first tab using the heated die. In one embodiment, the heating step comprises heating the die to between approximately 420° F to approximately 460° F. The bag is filled with a predetermined amount of particulate or granular material. The second end of the bag is sealed so as to form a second tab extending therefrom. At least one aperture is formed through the second tab so that the second tab defines a second handle. In one embodiment, the forming step comprises heating a die and forming the at least one aperture through the second tab using the heated die. In one embodiment, the heating step comprises heating the die to between approximately 420° F to approximately 460° F. In one embodiment, substantially all of the air is removed

from the interior of the bag. In one embodiment, the removing step comprises compressing the bag. In another embodiment, the removing step comprises evacuating air from the bag prior to the sealing step. In another embodiment, the filling step and the evacuating step are done concurrently. In yet another embodiment, a plurality of bags are stacked on a pallet. In still another embodiment, the plurality of bags are secured to the pallet.

The present invention also provides a method for packaging cementitious material. According to one embodiment, the method includes providing a bag formed of a polymeric material, the bag having first and second ends. In one embodiment, the providing step includes forming the bag. The first end of the bag is sealed and the second end of the bag is open. The first end of the bag has a first tab extending therefrom defining at least one aperture therethrough so that the first tab defines a first handle. In one embodiment, the providing step includes heating a die and forming the at least one aperture through the first tab using the heated die. In one embodiment, the heating step comprises heating the die to between approximately 420° F to approximately 460° F. The bag is filled with a predetermined amount of cementitious material. In one embodiment, the filling step includes filling the bag with approximately 29 lbs, 44 lbs, 50 lbs, 60 lbs or 80 lbs of cementitious material. The second end of the bag is sealed so as to form a second tab extending therefrom. At least one aperture is formed through the second tab so that the second tab defines a second handle. In one embodiment, the forming step comprises heating a die and forming the at least one aperture through the second tab using the heated die. In one embodiment, the heating step comprises heating the die to between approximately 420° F to approximately 460° F. In one embodiment, substantially all of the air is removed from the interior of the bag. In one embodiment, the removing step comprises compressing the bag. In another embodiment, the removing step comprises evacuating air from the bag prior to the sealing step. In another embodiment, the filling step and the evacuating step are done concurrently. In yet another embodiment, a plurality of bags are stacked on a pallet. In still another embodiment, the plurality of bags are secured to the pallet.

The present invention also provides an apparatus for forming handles in polymeric packaging for particulate and granular material. The apparatus includes a die structured to form at least one aperture in the packaging. The apparatus also includes at least one heating element structured to heat the die such that the die seals the edges of the at least one aperture. In one embodiment, the die comprises a forming portion and a backing member. In another embodiment, the at least one heating element is structured to heat the die to between approximately 420° F to approximately 460° F.

Accordingly, there has been provided packaging and associated packaging methods for particulate and granular material generally and cementitious materials in particular. The packaging is capable of being formed, filled and sealed using an automated forming, filling and sealing machine and allows the particulate or granular material to be stored so as to minimize leakage, spillage and exposure to moisture. The packaging is stackable when filled with the particulate or granular material, such as on a pallet, and also facilitates manual loading and unloading of the filled packaging.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other advantages and features of the invention, and the manner in which the same are accomplished, will become more readily apparent upon consideration of the following detail description of the invention taken in conjunction with the accompanying drawings, which illustrate preferred and exemplary embodiments and which are not necessarily drawn to scale, wherein:

Figure 1 is a perspective view illustrating a packaged product, according to one embodiment of the present invention;

Figure 2 is a perspective view illustrating a package for particulate and granular material, according to one embodiment of the present invention;

Figures 3 and 4 are perspective views illustrating the opening and filling of the package for particulate and granular material of Figure 2, respectively, according to one embodiment of the present invention;

Figure 5 is a perspective view illustrating the evacuation of air from the package for particulate and granular material of Figure 4, according to one embodiment of the present invention;

Figure 6 is a perspective view illustrating the filled package of particulate and granular material of Figure 5 after sealing the second end, according to one embodiment of the present invention;

Figure 7 is a perspective view illustrating the apertures formed in the tab extending from the second end of the filled package of Figure 6, according to one embodiment of the present invention;

Figures 8-13 are partial perspective views illustrating various configurations of the first and/or second handle, according to embodiments of the present invention;

Figure 14 is a partial perspective view illustrating the textured surface of one side of the package of Figure 1, according to one embodiment of the present invention;

Figure 15 is a block diagram illustrating a method for packaging a cementitious material, according to one embodiment of the present invention;

Figures 16 and 17 are partial perspective views illustrating the formation of the first and/or second handle, according to one embodiment of the present invention;

Figures 18A and 18B are partial perspective views illustrating a heated die used to form the first and/or second handle, according to one embodiment of the present invention; and

Figures 18C, 18D, and 18E are perspective, plan, and side views, respectively, illustrating a rim on the raised portion of the forming portion of the die, according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the invention are shown. This invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and

complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

Referring to Figure 1, there is illustrated a packaged product **10** of particulate or granular material, according to one embodiment of the present invention. The packaged product **10** includes a bag **12** formed of a polymeric material. The type of polymeric material and thickness of the material can vary depending on the type and weight of the particulate or granular material to be packaged. According to one embodiment, packaged cementitious products **10** are typically distributed in 29 lb, 44 lb, 50 lb, 60 lb, 80 lb, and 90 lb sizes, although other sizes can be provided. The polymeric material can include, but is not limited to, a blend of linear low density polyethylene, which provides elasticity to the bag, and high density polyethylene, which provides puncture resistance, and metallocenes, which provides strength. For example, according to one embodiment the bag **12** is formed of a blend of high density polyethylene, linear low density polyethylene, and metallocenes having a thickness of approximately 3 mil to 6 mil and, preferably, approximately 4 mil to 5 mil, and more preferably, approximately 5 mil. In one embodiment, all or portions of the polymeric material of the bag **12** are substantially transparent. In other embodiments, all or portions of the polymeric material of the bag **12** are translucent or opaque. For example, all or portions of the polymeric material of the bag **12** can be colored based upon or to denote the strength or composition of the particulate or granular material inside the bag to provide visual differentiation between different products **10** so that purchasers can easily identify the different products. In other embodiments, one or more colors can be printed on the bag **12**, such as by screen printing, as can information relating to the contents of the bag and/or the producer of the bag (such as trademarks, etc.).

As illustrated in Figure 1, the bag **12** has a first sealed end **14** and a second sealed end **16**. The first and second sealed ends **14, 16** can be formed using a variety of techniques, as is known in the art. For example, the first and second sealed ends **14, 16** can be formed by applying energy, such as heat or irradiation, to one or both sides of the bag **12** at the first and second ends so as to fuse the sides of the bag together. This energy can be applied using a manual or automated filling

machine. For example, a relatively thin Teflon coated bar can be heated and pressed against one side of the bag to fuse the sides together. The first sealed end **14** has a first tab **18** extending therefrom defining at least one aperture **20** therethrough so that the first tab defines a first handle **22**. Similarly, the second sealed end **16** has a second tab **24** extending therefrom defining at least one aperture **26** therethrough so that the second tab defines a second handle **28**. While not required, as illustrated in Figure 1, the ends of the first and second tabs **18, 24** can be fused at the distal edges of the tabs by applying energy, such as heat or irradiation, to the ends of the tabs to further strength the tabs.

As illustrated in Figures 8-13, which are provided for purposes of example only and not limitation, the number of apertures **20, 26** and configuration of the apertures of the first and second handles **22, 28** can vary depending on the strength and thickness of the polymeric material and the weight of the particulate or granular material to be packaged within the bag **12**. The first and second tabs **18, 24** preferably will include a plurality of apertures **20, 26**, as illustrated in the exemplary embodiments shown in Figures 8-11 and 13, or an elongate aperture, as illustrated in exemplary embodiment shown in Figure 12, as this will facilitate handling the bags **12** manually since multiple fingers can be inserted into the corresponding apertures **20, 26**. For polymeric materials having lower strengths, the number of apertures **20, 26** formed in the first and second tabs **18, 24** can be reduced so as not to compromise the strength of the corresponding tab **18, 24**. Preferably, the apertures **20, 26** are configured so as to minimize sharp corners or notches along the edges **25** to thereby minimize potential stress concentrations along the edges of the apertures. For bags **12** packaging larger or heavy loads of material, the apertures **20, 26** can be located a predetermined distance from the sealed ends **14, 16** of the bag and the distal end of the corresponding tab **18, 24** to further strengthen the handles **22, 28**. For example, according to one embodiment, the apertures **20, 26** can be located approximately 6 mm to 10 mm from the sealed ends **14, 16** of the bag and the distal end of the corresponding tab **18, 24**.

In forming the apertures **20, 26**, the excess material **21** within the apertures can be removed entirely or, as illustrated in Figure 1, a small section of material **21a** can remain after forming the apertures that connects the excess material to the

corresponding first or second tabs **18, 24**. According to the embodiment illustrated in Figure 1, when the bag **12** is lifted or picked up, the person lifting the bag inserts their finger(s) into the corresponding apertures **20, 26** thereby pushing the excess material **21** through the aperture.

As discussed more fully below, the apertures **20, 26** in the first and second tabs **18, 24** can be formed using a heated die such that the edges **25** of the apertures are at least partially sealed. In one embodiment, the die can include a rim so that the seal at the edges **25** of the apertures **20, 26** extends beyond the edges a predetermined distance. It has been found that using a heated die to at least partially seal the edges **25** of the apertures **20, 26** strengthens the material around the apertures and increases the tear resistance of the material and, thus, strengthens the first and second handles **22, 28** of the bag **12**. Advantageously, the first and second handles **22, 28** of the bag **12** of the present invention do not require any further reinforcement, such as the application of reinforcing tape, in order to support the material stored in the bag. In addition, apertures **20, 26** having sealed edges **25** have the further benefit of containing any material that may escape into the first or second tabs **18, 24** due to a ruptured or defective first or second sealed end **14, 16**, respectively, thus further minimizing product spillage.

As illustrated in Figures 1, the bag **12** includes first and second sides **32a, 32b**. According to one embodiment of the present invention, as illustrated in Figures 1 and 14, at least a portion of at least one of the first and second sides **32a, 32b** defines a textured surface **34**, which creates friction between the corresponding bag **12** and an adjacent bag or surface. The friction created by the textured surface **34** prevents shifting of the bag during transport or storage thereby enabling the bags **12** to be stacked, such as on a pallet (not shown), for purposes of shipping the packaged product **10** in bulk. The types of textured surfaces **34**, as well as the configuration and the number of areas of textured surface (for example, Figure 1 illustrates two parallel areas of textured surface having a linear configuration) can vary provided sufficient friction is created between the corresponding bag **12** and an adjacent bag or surface to prevent shifting of the bag during transport or storage. As illustrated in Figure 14, the textured surface **34** comprises a plurality of protuberances or raised members. In other embodiments

(not shown), the textured surface **34** can comprise a plurality of recessed surfaces or dimples. Other types of textured surface **34** can be provided as well. In one embodiment, at least a portion of both the first and second sides **32a**, **32b** defines a textured surface **34**.

As illustrated in Figure 2, the bag **12** can also include first and second gusseted sides **33a**, **33b**. Alternatively, the bag **12** can also be a non-gusseted bag. In one embodiment (not shown), the gusseted sides **33a**, **33b** can include perforations to allow air to escape from the bag **12**, such as during filling of the bag with cementitious material, when using a bag flattener, and/or when stacking the bag for storage or shipping. The perforations can be formed using a variety of cutting techniques. In one embodiment, the perforations are formed using heated needles (also known as "microperfing") or a laser. In another embodiment (not shown), the gusseted bag **12** can include K seals at the corners of the first and second sealed ends **14**, **16**, as is known in the art, to provide the packaged product **10** with a generally rectangular or square configuration.

Referring to Figure 2, there is illustrated a package **36** for particulate and granular materials, according to one embodiment of the present invention, that is used to form the product **10**. The package **36** includes a bag **42** formed of a polymeric material, as discussed above. The bag **42** can be formed using a variety of techniques, such as mono-extrusion or co-extrusion. The bag **42** has a first sealed end **44** and a second end **46**. The first sealed end **44** is formed as discussed above and includes a first tab **48** extending therefrom defining at least one aperture **50** therethrough so that the first tab defines a first handle **52**. The second end **46** of the bag **42** is open so that the bag can be filled with the particulate or granular material. As discussed above, the first and second sides **62a**, **b** of the bag **42** can be provided with a textured surface **64**. In addition, the bag **42** can also include first and second gusseted sides **63a**, **63b**.

According to one embodiment, the product **10** is formed from the package **36** in several steps, as illustrated in Figures 3-7. Referring to Figures 3 and 4, the bag **42** is filled with a predetermined amount or weight of particulate or granular material **60**. Figure 3 illustrates the second end **46** of the bag **42** being opened using suction cups **41**. Figure 4 illustrates the bag **42** being filled with a chute **43**

as the edges of the edges of the second end **46** of the bag are secured against the chute with clamps **45**. In one embodiment, as illustrated in Figure 5, once the bag **42** is filled with material **60** the air inside the bag can be substantially removed by evacuating the bag using a vacuum or other suction device **47** so as to compress the bag around the material inside the bag. Alternatively, in another embodiment (not shown), the air inside the bag **42** can be substantially removed using a bag flattener after the packaged product **10** is formed. In one embodiment, as illustrated in Figure 5, the inside edges of the second end **46** of the bag **42** preferably are cleaned prior to forming the second handle **58** using air and/or a cleaning device **49**, which moves from side to side to dislodge any particles located on the inside edges. Figures 3-5 are provided for purposes of illustration only and not limitation, as the machinery or process used to fill the bag **42**, clean the inside edges of the second end **46** of the bag **42**, or evacuate air from inside the bag can vary depending on the type of particulate or granular material, the weight of the product **10** being made, the dimensions of the bag, etc.

As illustrated in Figure 6 and as discussed above, once the inside edges of the second end **46** of the bag **42** are cleaned, the second end **46** of the bag is sealed to thereby form a second sealed end **66** and a second tab **54**. In this regard, and as illustrated in Figure 2, the second end **46** of the bag **42** has an excess portion **51** structured to be formed into the second tab **54**. While not required, as illustrated in Figure 6, the first and second tabs **48, 54** can also be sealed at the distal edges of the tabs, as discussed above, to form a double seal to further strengthen the tabs. As illustrated in Figure 7, at least one aperture **56** can be formed in the second tab **54** (such as by cutting or die stamping the second tab) so as to define a second handle **58**.

According to another embodiment of the present invention (not shown), the evacuation of the air from the bag **42** can occur concurrently with the step of filling the bag with the material **60**. For example, one or more probes can be inserted into the interior of the bag **42** and can evacuate the air from the bag as the bag is filled with material **60**. Thereafter, the second end **46** of the bag **42** can be sealed, as discussed above.

In one embodiment, the package **36** is preformed. In another embodiment, the package **36** is formed from a roll of tubular film material (not shown). According to this embodiment, the first end of the bag is sealed to thereby form a first sealed end **44** and a first tab **48**. At least one aperture **50** can be formed in the first tab **48** (such as by cutting or die stamping the second tab) so as to define a first handle **52**. In one embodiment, the apertures **50** are formed in the first tab **48** and then the first end of the bag is sealed to form the first sealed end **44**. The package **36** can be cut from the roll of tubular film material prior to, concurrently with, or after forming the first sealed end **44**.

Referring to Figures 16-17, there is illustrated an apparatus **80** used to form the apertures **50, 56** in the first and second tabs **48, 54**, respectively, according to one embodiment of the present invention. The apparatus **80** includes a die **82** and at least one heating element **84**. The die **82** can include a forming portion **86** (as illustrated in Figures 18A and 18B) and a backing member **88**. As illustrated in Figures 16 and 17, the apparatus **80** can include a housing **90** structured to receive the forming portion **86** of the die **82**. In one embodiment, a hydraulic or pneumatic cylinder (not shown) seated within the housing **90** is used to move the forming portion **86** of the die **82** toward the backing member **88** when forming the apertures **50, 56** in the first and second tabs **48, 54**. As illustrated in Figure 17, the apparatus **80** can include a pair of clamps **92** to secure the bag **42** when forming the apertures **50, 56** in the first and second tabs **48, 54**.

Referring to Figures 18A and 18B, the forming portion **86** of the die **82** can include a plate or block **94** having a first side **94a** and a second side **94b**. The first side **94a** includes a raised portion **96** configured to form the apertures **50, 56** in the first and second tabs **48, 54** thereby forming the first and second handles **22, 28**. In one embodiment, the second side **94b** defines one or more apertures **98** structured to receive a corresponding heating element **84**. The heating element or elements **84** can comprise an electrical resistance heater, such as the FIREROD® brand of heaters distributed by Watlow Electric Manufacturing Company of St. Louis, Missouri. In other embodiments, other types of heating elements **84** can be used, including induction coils, convection heaters, lasers, etc. In one embodiment, the

heating element **84** is structured to heat the forming portion **86** of the die **82** to between approximately 420° F to approximately 460° F.

Referring to Figures 18C, 18D, and 18E, in one embodiment the raised portion **96** includes a rim **100** along the circumference of at least a portion of the distal end of the raised portion. The rim **100** can be around the entire circumference of the raised portion **96**, but preferably is present around at least a portion of the circumference of the raised portion that faces away from the excess material **21**. The rim **100** is structured to increase the heated surface area that contacts the first and second tabs **48**, **54** to thereby enlarge the seal formed about the edges of the apertures **50**, **56** in the first and second tabs so as to improve the tear resistance of the apertures.

The heated die **82** can be used to form the first and second handles **22**, **28** of the bag **12** of the present invention or, in another embodiment (not shown), the heated die **82** can also be used to form packaging having a single handle by forming one or more apertures in a tab, as discussed above. It has been determined that using a heated die **82** to at least partially seal the edges of the apertures forming the handles strengthens the material around the apertures and increases the tear resistance of the material and, thus, provides a more robust handle. Advantageously, handles formed using the heated die **82** of the present invention do not require any further reinforcement, such as the application of reinforcing tape, in order to support the material stored in the bag **12**. In addition, handle apertures having sealed edges have the further benefit of containing any material that may escape into the corresponding tab due to a ruptured or defective sealed end, respectively, thus further minimizing product spillage.

The present invention also provides a method of packaging particulate and granular material generally and cementitious materials in particular. According to one embodiment, as illustrated in Figure 13, the method includes providing a bag formed of a polymeric material, the bag having first and second ends. See Block **71**. The first end of the bag is sealed and the second end of the bag is open. The first end of the bag has a first tab extending therefrom defining at least one aperture therethrough so that the first tab defines a first handle. In one embodiment, the providing step includes forming the bag. See Block **70**. The bag is filled with a

predetermined amount of cementitious material. See Block **72**. In one embodiment, the filling step includes filling the bag with approximately 60 lbs of cementitious material. See Block **73**. In another embodiment, the filling step includes filling the bag with approximately 80 lbs of cementitious material. See Block **74**. Substantially all of the air can be removed from the interior of the bag. See Block **75**. The second end of the bag is sealed so as to form a second tab extending therefrom. See Block **76**. At least one aperture is formed through the second tab so that the second tab defines a second handle. See Block **77**. In one embodiment, a plurality of bags are stacked on a pallet. See Block **78**. In another embodiment, the plurality of bags are secured to the pallet. See Block **79**.

Advantageously, the packaging of the present invention is capable of being filled and sealed using an automated filling machine. This feature is particularly important in connection with particulate materials (such as cementitious materials), which are notoriously difficult to package using automated packaging machinery since the dust can inhibit the machinery from forming a proper seal. The packaging also allows the particulate or granular material to be stored so as to minimize leakage, spillage and exposure to moisture. The packaging is stackable when filled with particulate or granular material, such as on a pallet, and also facilitates manual loading and unloading of the filled packaging.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

THAT WHICH IS CLAIMED:

1. A package for particulate and granular material, comprising:

a bag formed of a polymeric material, said bag having first and second ends, said first end being sealed and said second end being open, said first end having a first tab extending therefrom defining at least one aperture therethrough so that said first tab defines a first handle, said second end being structured to be sealed after filling said bag with the material, said second end having an excess portion structured to be formed into a second tab defining at least one aperture therethrough upon sealing of said second end so as to define a second handle.

2. A package for particulate and granular material according to Claim 1 wherein said bag has first and second sides, at least a portion of at least one of said first and second sides defines a textured surface.

3. A package for particulate and granular material according to Claim 1 wherein said polymeric material comprises a blend of high density polyethylene and linear low density polyethylene.

4. A package for particulate and granular material according to Claim 1 wherein said polymeric material has a thickness of approximately 4 to 6 mil.

5. A package for particulate and granular material according to Claim 1 wherein said first tab defines a plurality of apertures therethrough.

6. A package for particulate and granular material according to Claim 1 wherein the edge of said at least one aperture in said first tab is at least partially sealed.

7. A package for cementitious material, comprising:

a bag formed of a polymeric material, said bag having first and second ends, said first end being sealed and said second end being open, said first end having a first tab extending therefrom defining at least one aperture therethrough so that said first tab defines a first handle, said second end being structured to be sealed after filling said bag with the cementitious material, said second end having an excess portion structured to be formed into a second tab defining at least one aperture therethrough upon sealing of said second end so as to define a second handle.

8. A package for cementitious material according to Claim 7 wherein said bag has first and second sides, at least a portion of at least one of said first and second sides defines a textured surface.

9. A package for cementitious material according to Claim 7 wherein said polymeric material comprises a blend of high density polyethylene and linear low density polyethylene.

10. A package for cementitious material according to Claim 7 wherein said polymeric material has a thickness of approximately 4 to 6 mil.

11. A package for cementitious material according to Claim 7 wherein said first tab defines a plurality of apertures therethrough.

12. A package for cementitious material according to Claim 7 wherein the edge of said at least one aperture in said first tab is at least partially sealed.

13. A packaged cementitious product, comprising:

a bag formed of a polymeric material, said bag having first and second sealed ends, said first sealed end having a first tab extending therefrom defining at least one aperture therethrough so that said first tab defines a first handle, said

second sealed end having a second tab extending therefrom defining at least one aperture therethrough so that said second tab defines a second handle; and

a cementitious product sealed within said bag, wherein said first and second handles facilitate the handling of the packaged cementitious product.

14. A packaged cementitious product according to Claim 13 wherein said bag has first and second sides, at least a portion of at least one of said first and second sides defines a textured surface.

15. A packaged cementitious product according to Claim 13 wherein said polymeric material comprises a blend of high density polyethylene and linear low density polyethylene.

16. A packaged cementitious product according to Claim 13 wherein said polymeric material has a thickness of approximately 4 to 6 mil.

17. A packaged cementitious product according to Claim 13 wherein at least one of said first and second tabs define a plurality of apertures therethrough.

18. A packaged cementitious product according to Claim 13 wherein the edges of said at least one apertures in said first and second tabs are at least partially sealed.

19. A method for packaging cementitious material, comprising:

providing a bag formed of a polymeric material, the bag having first and second ends, the first end of the bag being sealed and the second end of the bag being open, the first end of the bag having a first tab extending therefrom defining at least one aperture therethrough so that the first tab defines a first handle;

filling the bag with a predetermined amount of cementitious material;

sealing the second end of the bag so as to form a second tab extending therefrom; and

forming at least one aperture through the second tab so that the second tab defines a second handle.

20. A method for packaging cementitious material according to Claim 19 wherein said providing step comprises forming the bag.

21. A method for packaging cementitious material according to Claim 19 wherein said providing step comprises heating a die and forming at least one aperture through the first tab using the heated die.

22. A method for packaging cementitious material according to Claim 21 wherein said heating step comprises heating the die to between approximately 420° F to approximately 460° F.

23. A method for packaging cementitious material according to Claim 19 wherein the bag has first and second sides, at least a portion of at least one of the first and second sides defines a textured surface.

24. A method for packaging cementitious material according to Claim 19 wherein said polymeric material comprises a blend of high density polyethylene and linear low density polyethylene.

25. A method for packaging cementitious material according to Claim 19 wherein said polymeric material has a thickness of about 4 to 6 mil.

26. A method for packaging cementitious material according to Claim 19 wherein said first tab defines a plurality of apertures therethrough.

27. A method for packaging cementitious material according to Claim 19 wherein said forming step comprises forming a plurality of apertures through the second tab.

28. A method for packaging cementitious material according to Claim 19 wherein said forming step comprises heating a die and forming the at least one aperture through the second tab using the heated die.

29. A method for packaging cementitious material according to Claim 28 wherein said heating step comprises heating the die to between approximately 420° F to approximately 460° F.

30. A method for packaging cementitious material according to Claim 19 wherein said filling step comprises filling the bag with one of approximately 29 lbs, 44 lbs, 50 lbs, 60 lbs, or 80 lbs of cementitious material.

31. A method for packaging cementitious material according to Claim 19 further comprising removing substantially all of the air from the interior of the bag.

32. A method for packaging cementitious material according to Claim 31 wherein said removing step comprises compressing the bag subsequent to said forming step.

33. A method for packaging cementitious material according to Claim 31 wherein said removing step comprises evacuating air from the bag prior to said sealing step.

34. A method for packaging cementitious material according to Claim 33 wherein said filling step and said evacuating step are done concurrently.

35. A method for packaging cementitious material according to Claim 19 further comprising stacking a plurality of the bags on a pallet.

36. A method for packaging cementitious material according to Claim 35 further comprising securing the stacked bags to the pallet.

37. An apparatus for forming handles in polymeric packaging for particulate and granular material, comprising:

a die structured to form at least one aperture in the packaging; and

at least one heating element structured to heat said die such that said die seals the edges of the at least one aperture.

38. An apparatus for forming handles in polymeric packaging for particulate and granular material according to Claim 37 wherein said at least one heating element is structured to heat said die to between approximately 420° F to approximately 460° F.

39. An apparatus for forming handles in polymeric packaging for particulate and granular material according to Claim 37 wherein said die comprises a forming portion and a backing member.

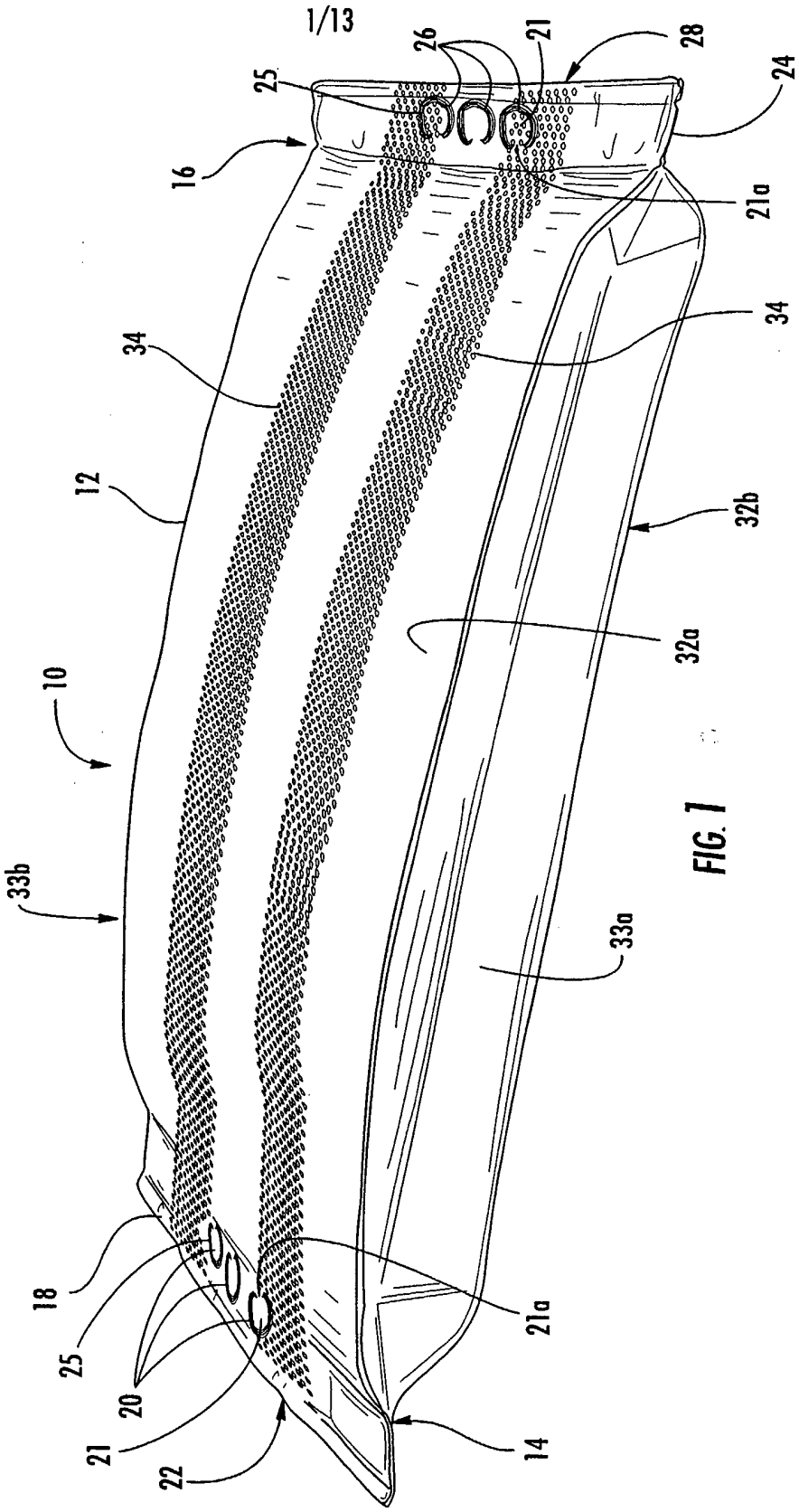

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FIG. 1

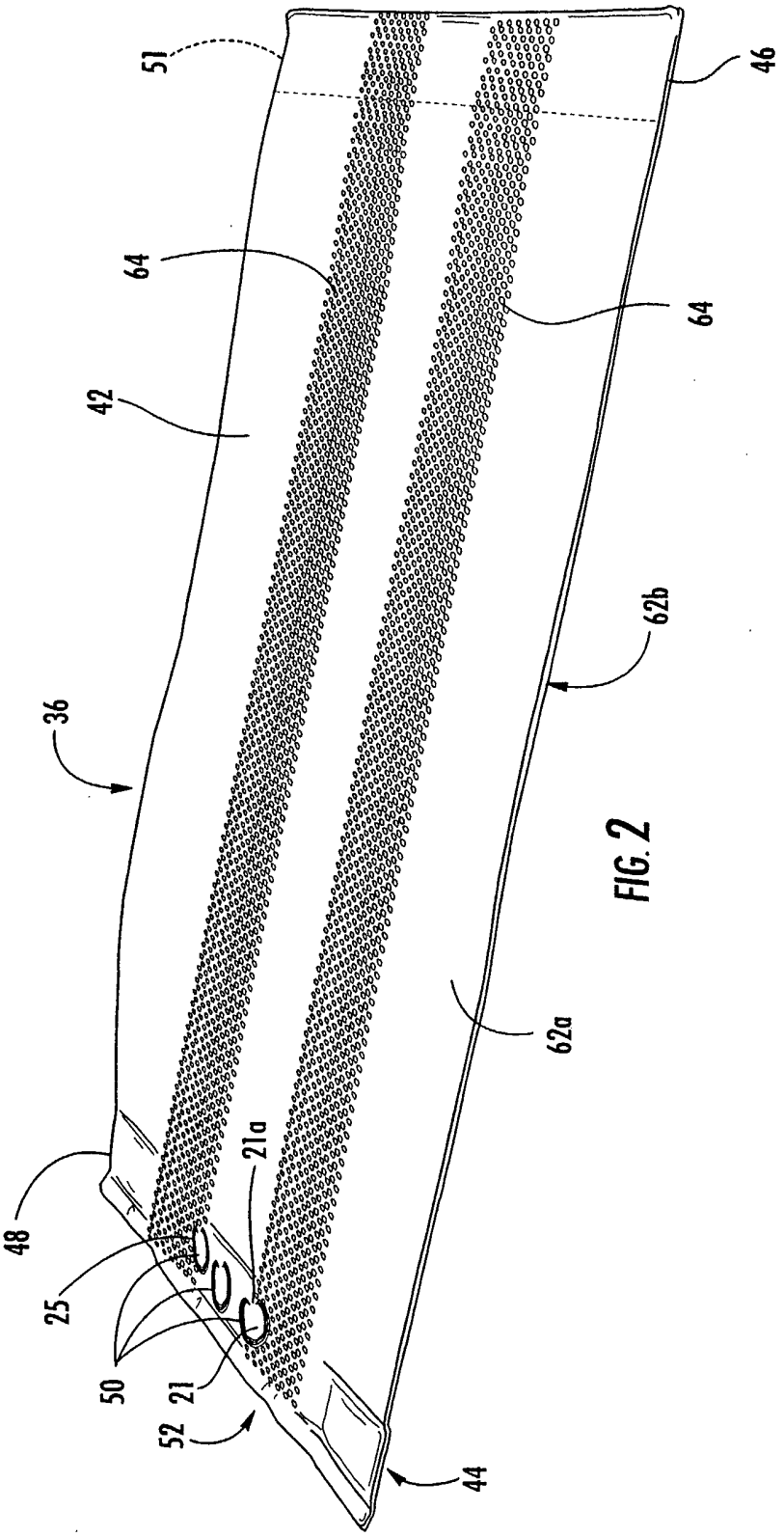


FIG. 2

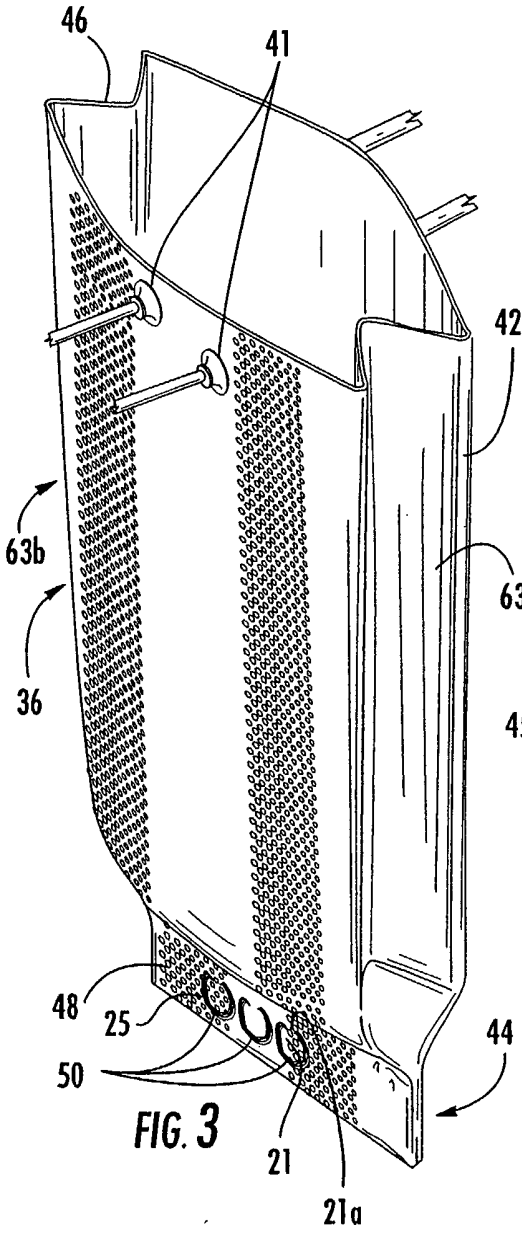

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FIG. 3

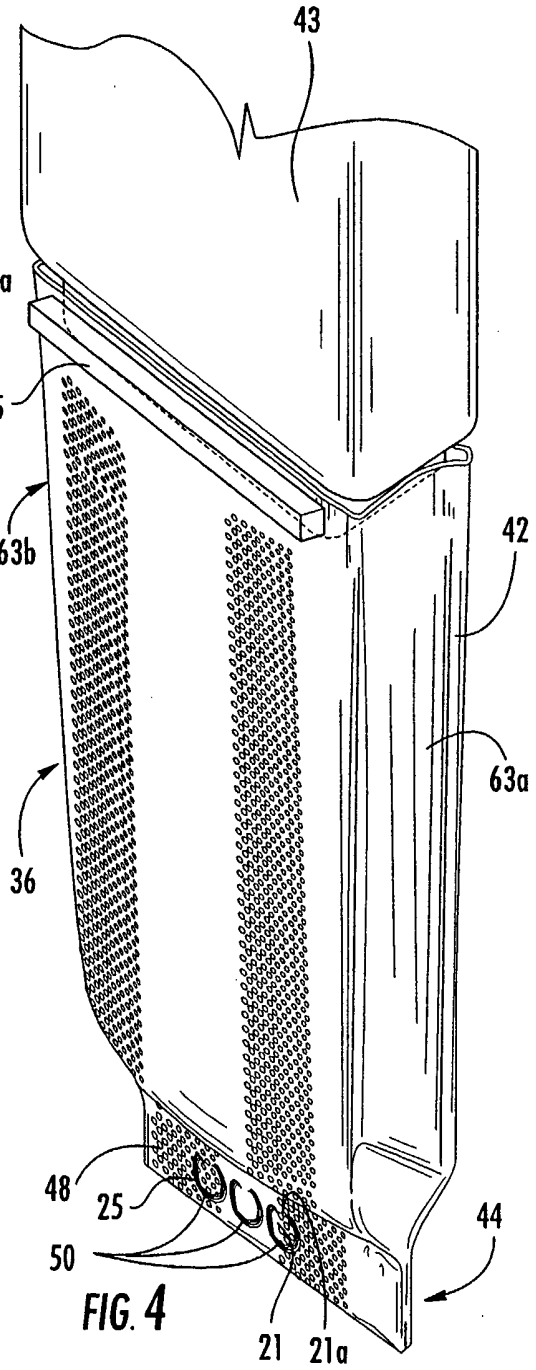

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FIG. 4

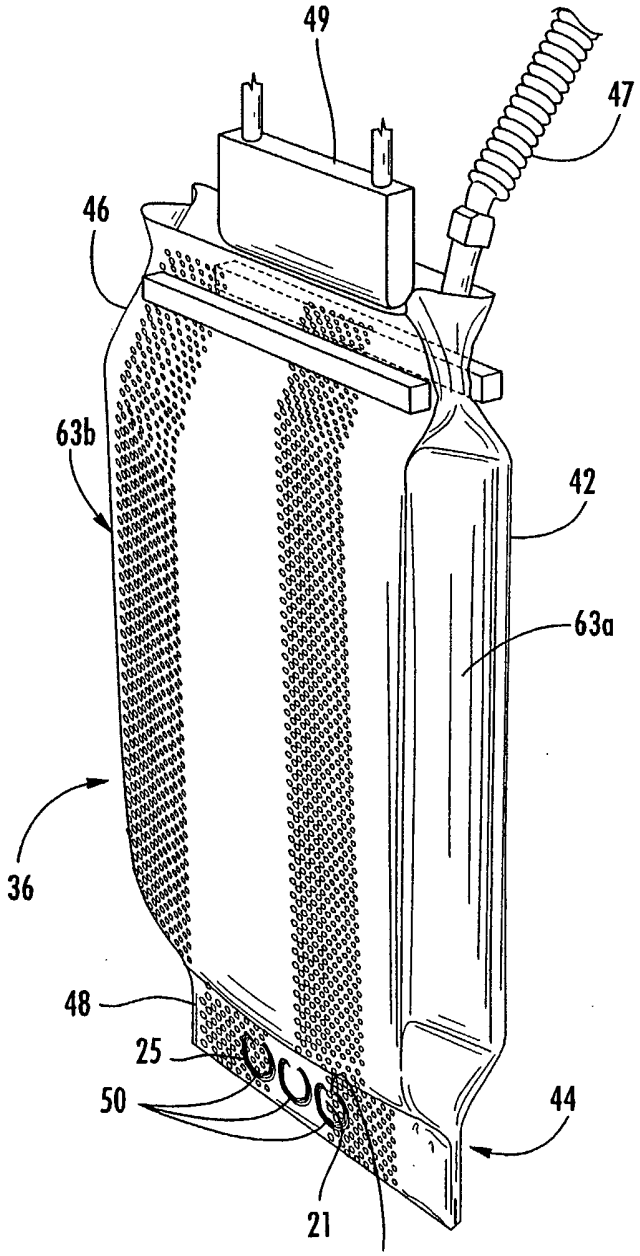


FIG. 5

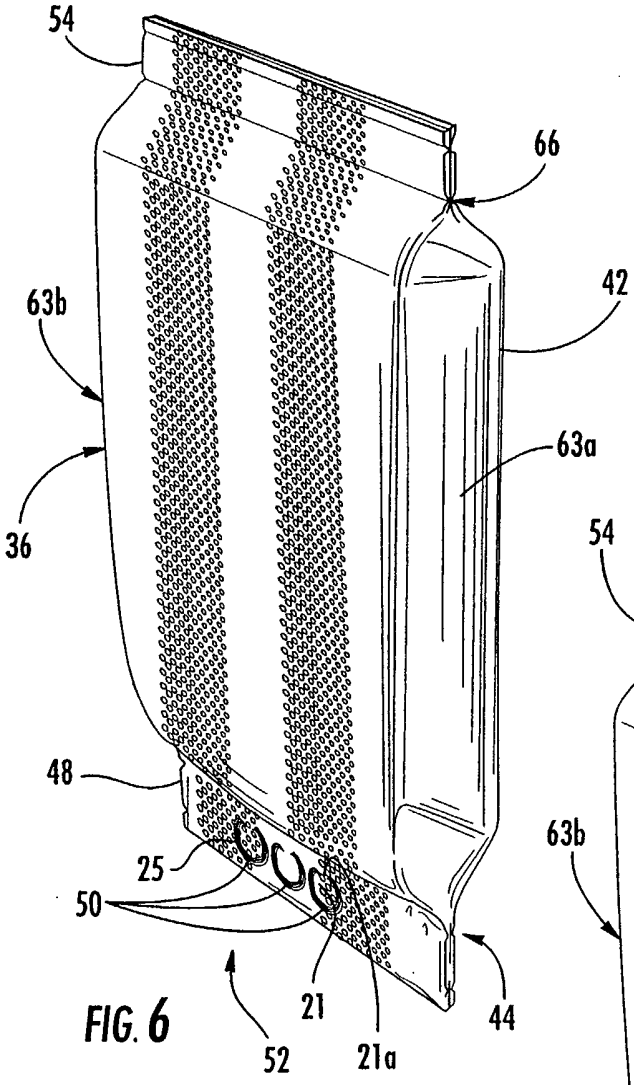

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FIG. 6

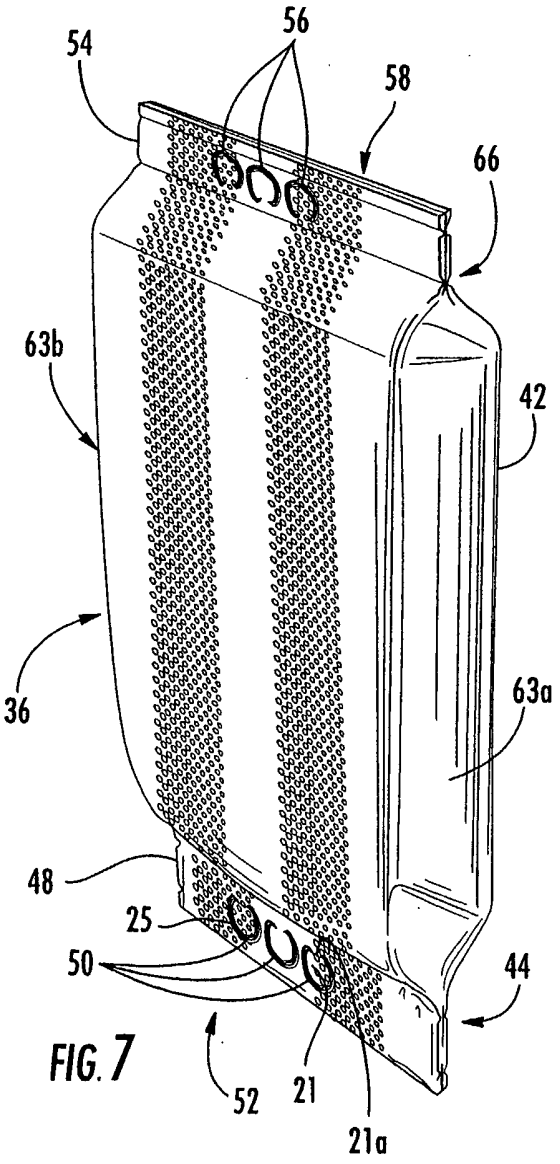

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FIG. 7

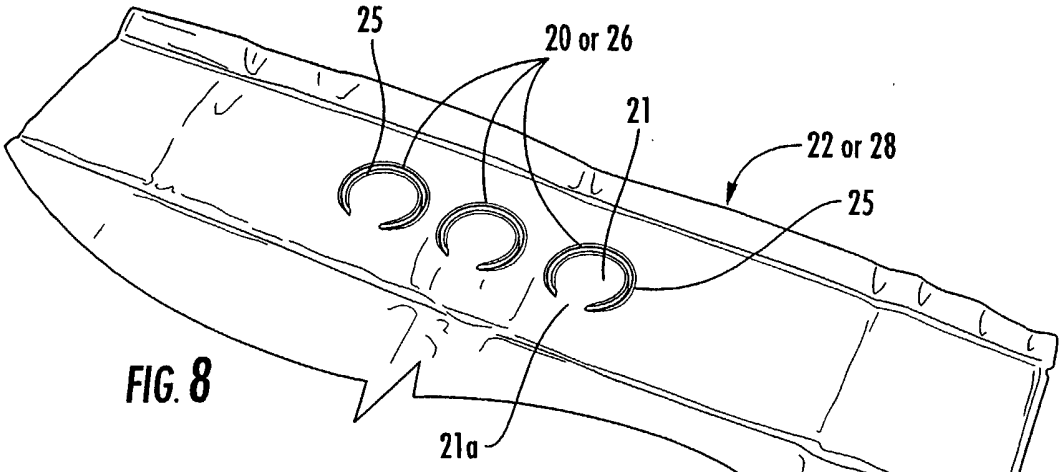


FIG. 8

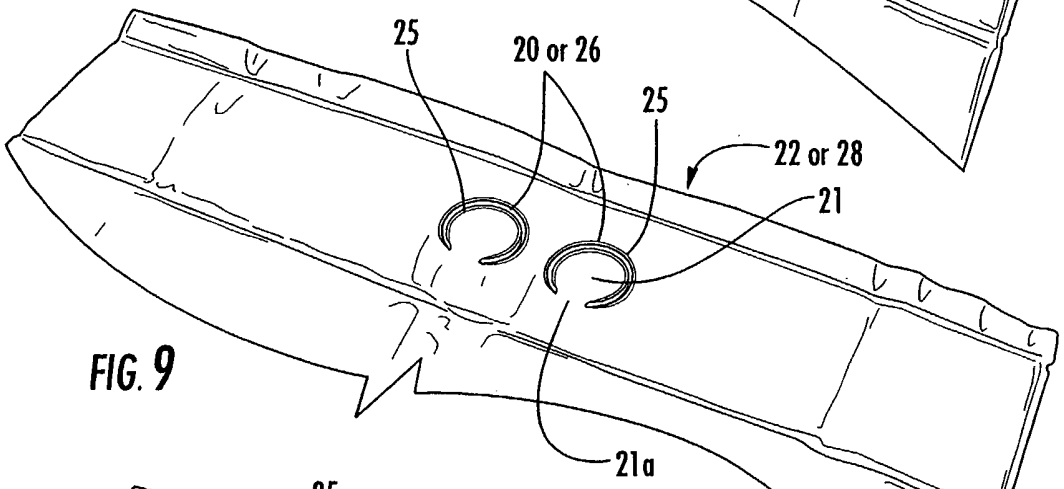


FIG. 9

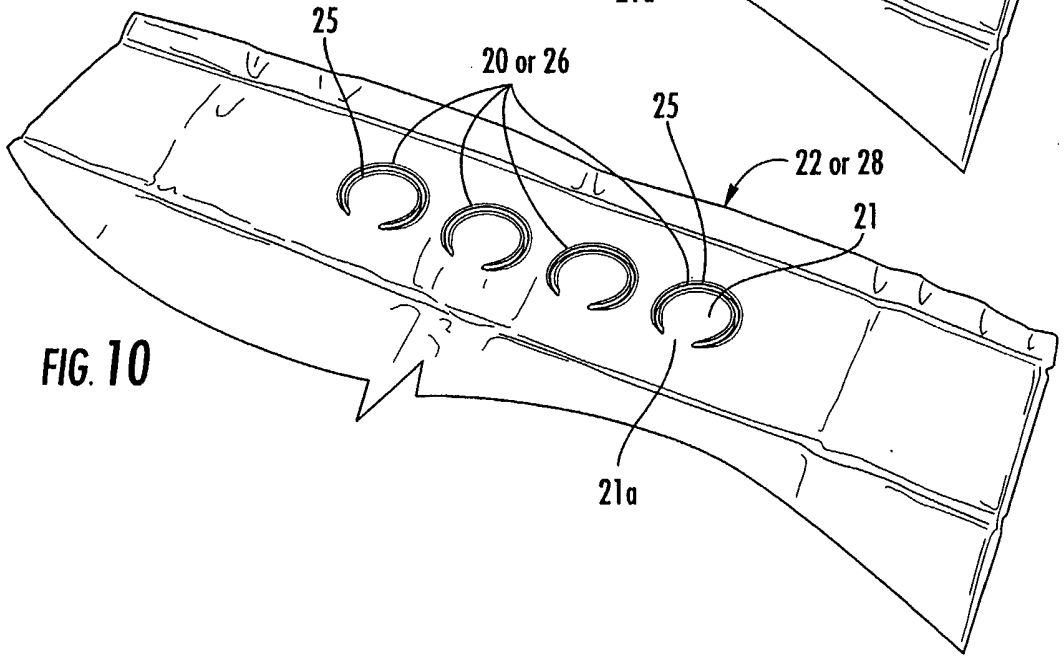


FIG. 10

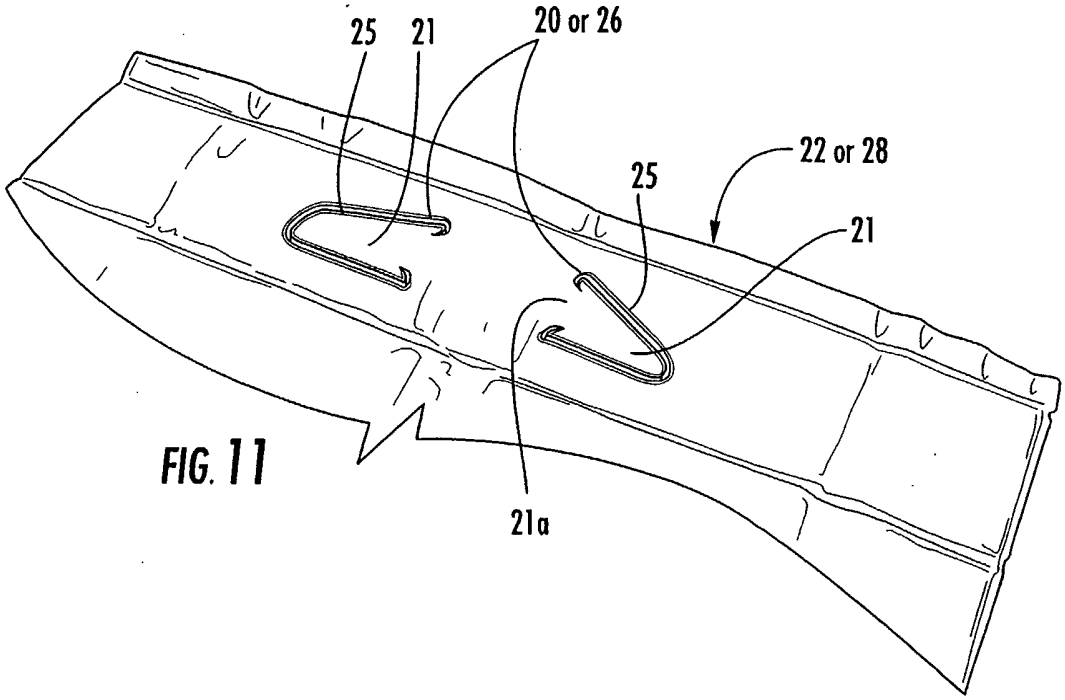


FIG. 11

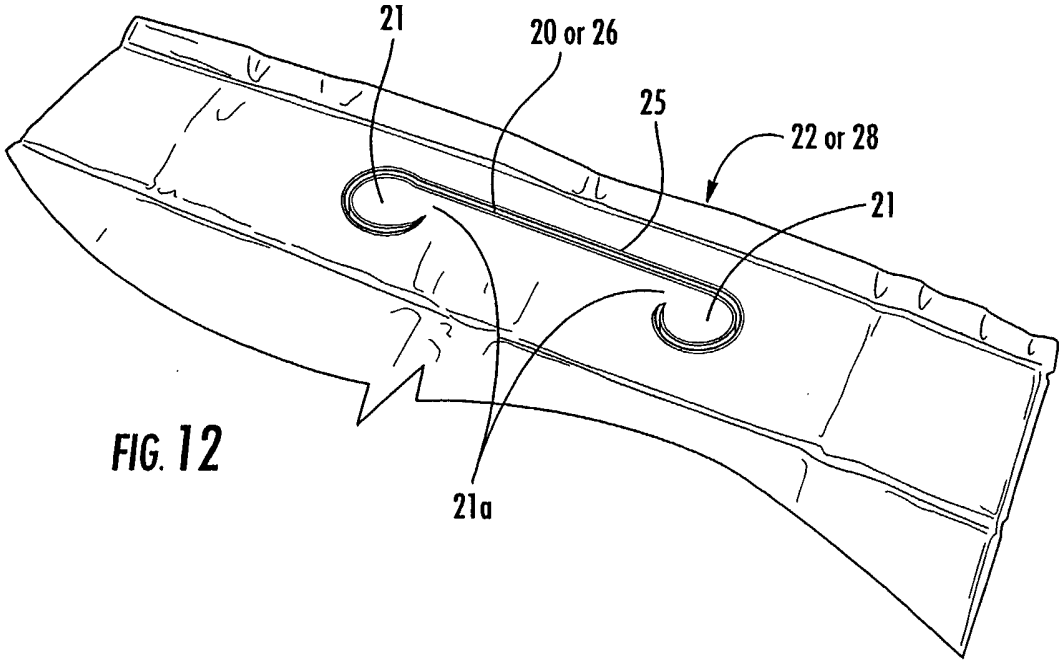


FIG. 12

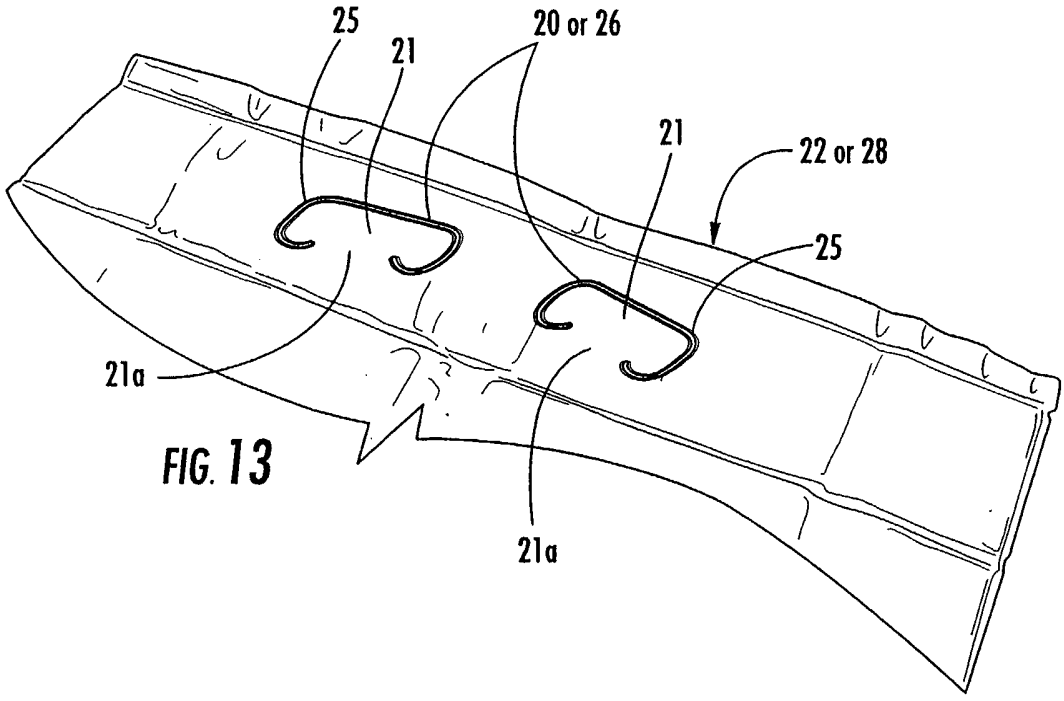


FIG. 13

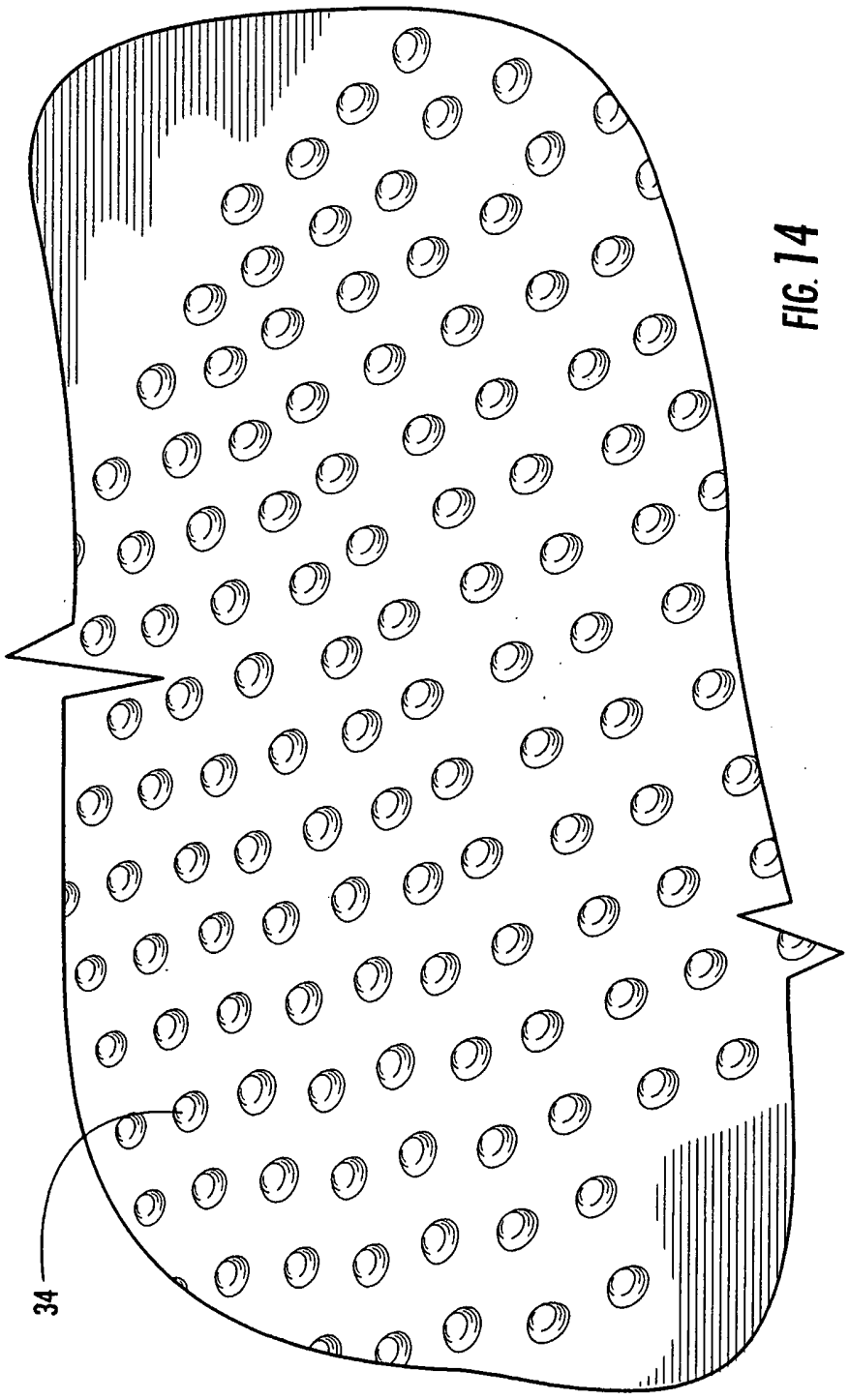


FIG. 14

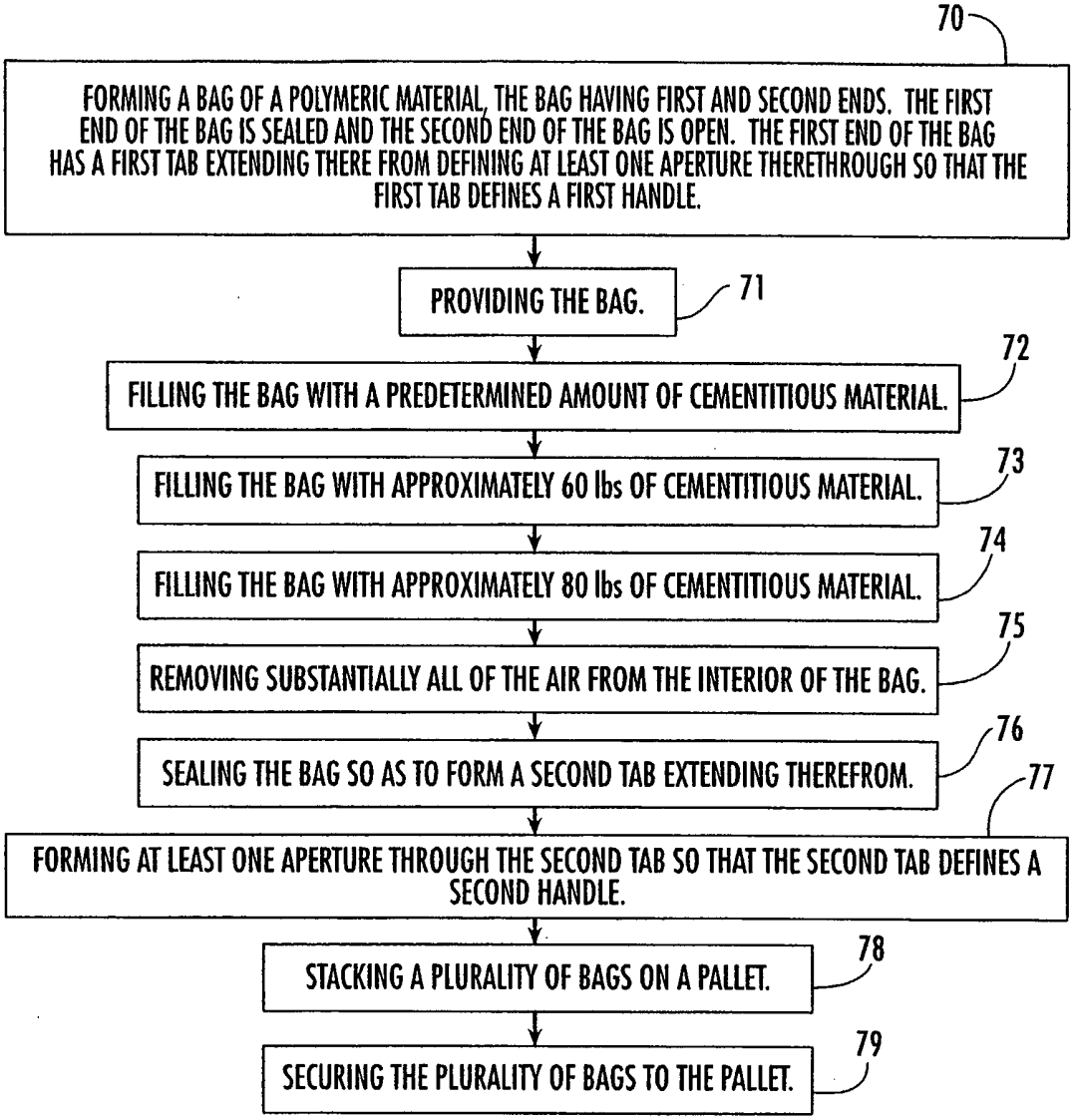

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FORMING A BAG OF A POLYMERIC MATERIAL, THE BAG HAVING FIRST AND SECOND ENDS. THE FIRST END OF THE BAG IS SEALED AND THE SECOND END OF THE BAG IS OPEN. THE FIRST END OF THE BAG HAS A FIRST TAB EXTENDING THERE FROM DEFINING AT LEAST ONE APERTURE THERETHROUGH SO THAT THE FIRST TAB DEFINES A FIRST HANDLE.
PROVIDING THE BAG.
71
FILLING THE BAG WITH A PREDETERMINED AMOUNT OF CEMENTITIOUS MATERIAL.
72
FILLING THE BAG WITH APPROXIMATELY 60 lbs OF CEMENTITIOUS MATERIAL.
73
FILLING THE BAG WITH APPROXIMATELY 80 lbs OF CEMENTITIOUS MATERIAL.
74
REMOVING SUBSTANTIALLY ALL OF THE AIR FROM THE INTERIOR OF THE BAG.
75
SEALING THE BAG SO AS TO FORM A SECOND TAB EXTENDING THEREFROM.
76
FORMING AT LEAST ONE APERTURE THROUGH THE SECOND TAB SO THAT THE SECOND TAB DEFINES A SECOND HANDLE.
77
STACKING A PLURALITY OF BAGS ON A PALLET.
78
SECURING THE PLURALITY OF BAGS TO THE PALLET.
79

FIG. 15

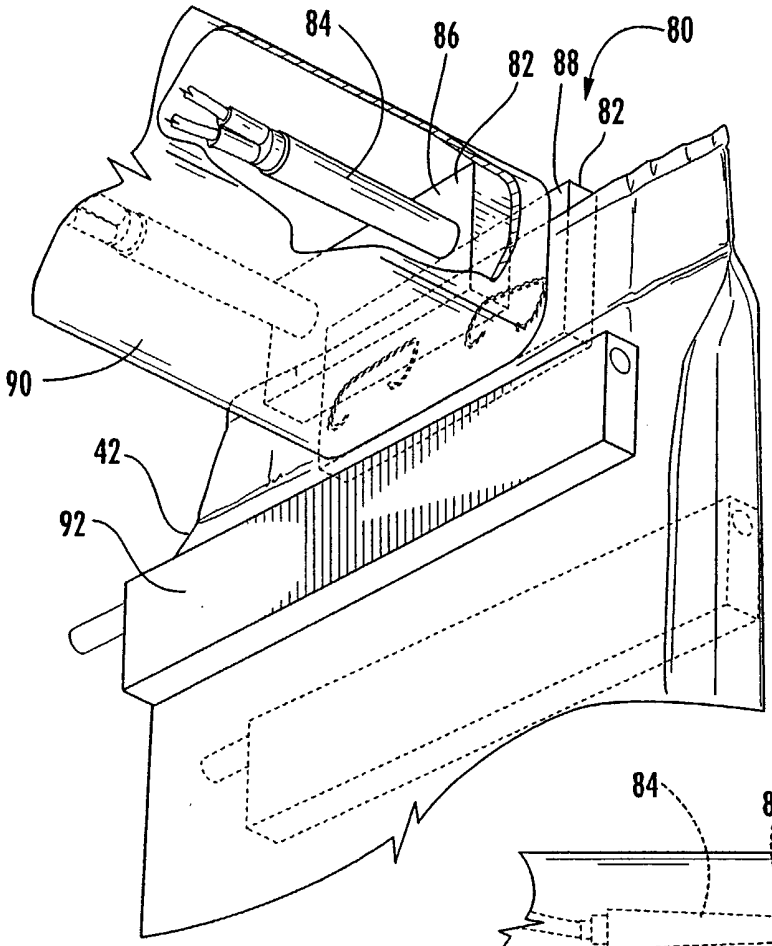


FIG. 16

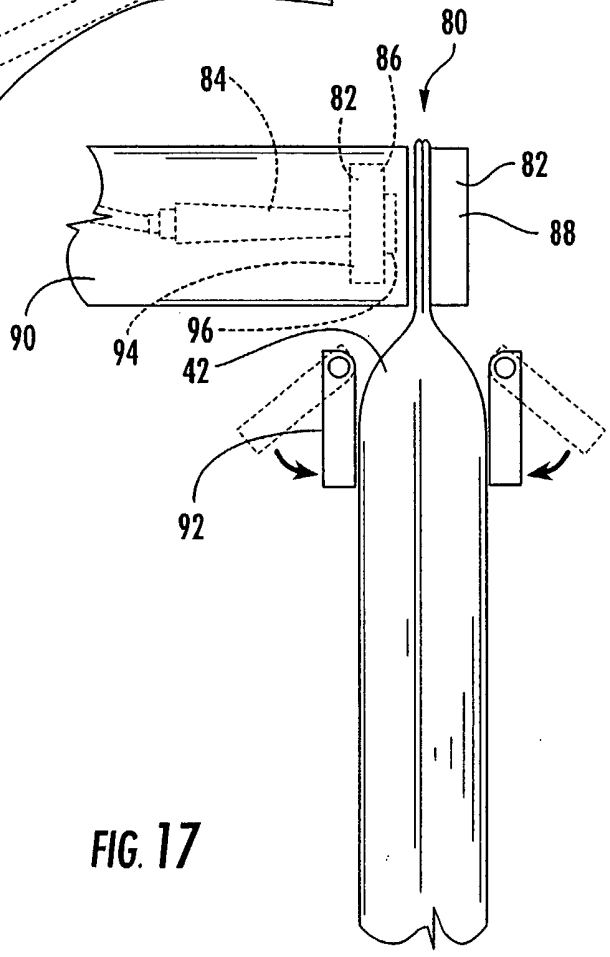


FIG. 17

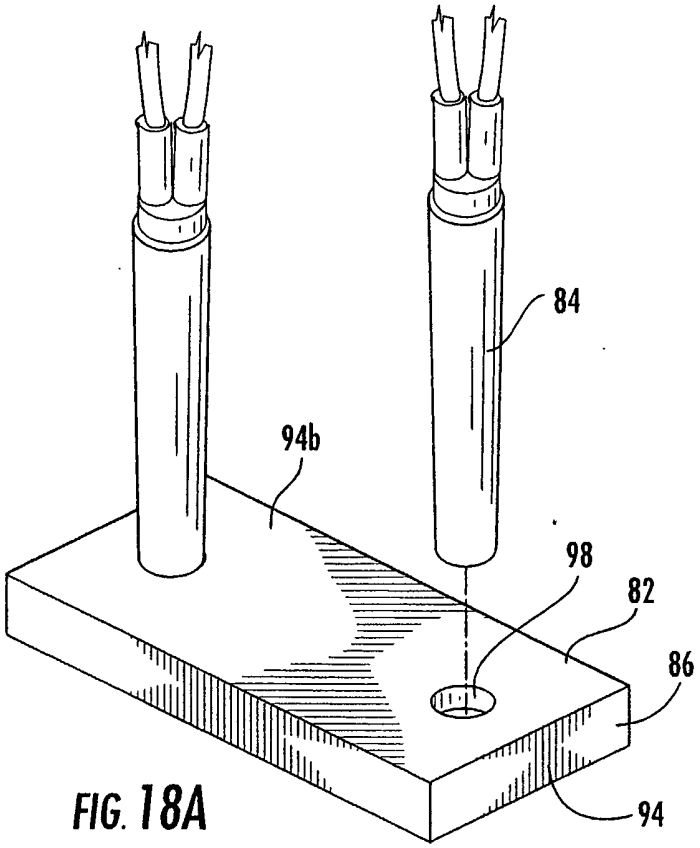


FIG. 18A

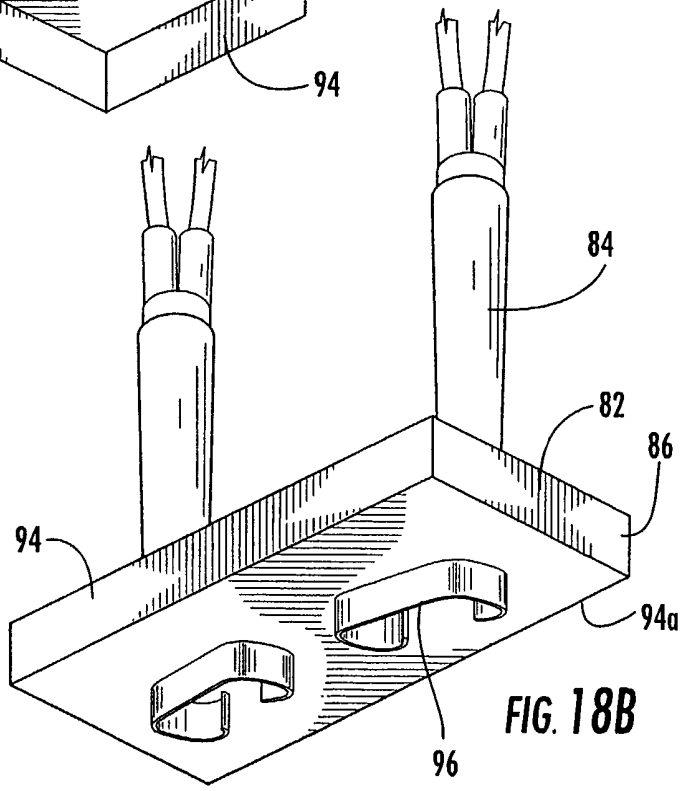


FIG. 18B

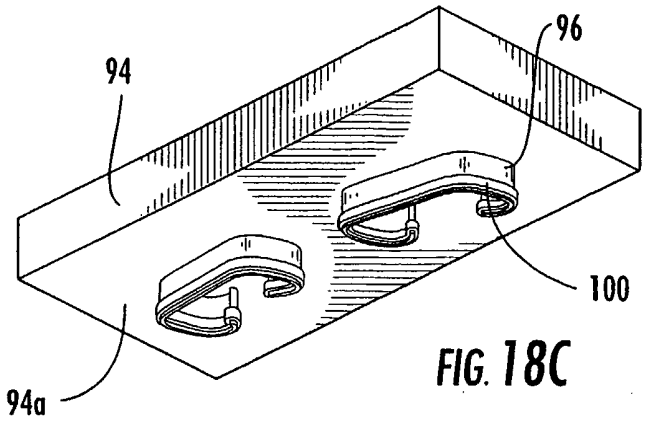


FIG. 18C

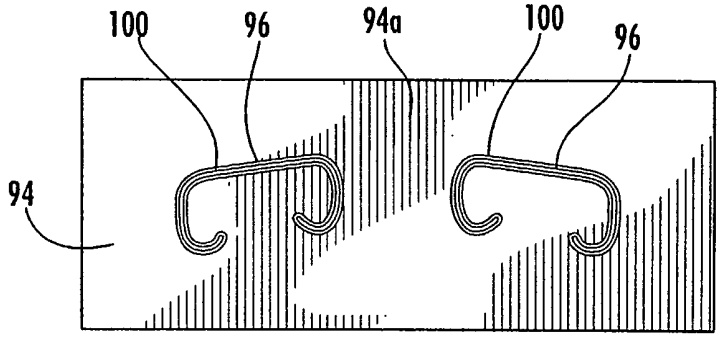


FIG. 18D

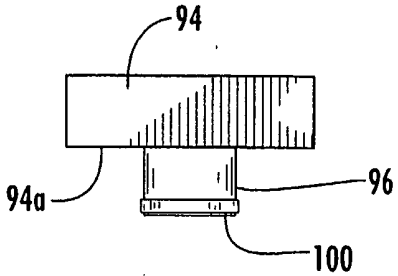


FIG. 18E