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- (71) Applicant: AUTOMATED PACKAGING SYSTEMS,
INC. [US/US]; 10175 Philipp Parkway, Streetsboro, OH
44241 (US).
- (72) Inventor: WEHRMANN, Rick, Steven; 6100 Stow Road,
Hudson, OH 44236 (US).
- (74) Agent: SMITH, Kenneth, J.; Calfee, Halter & Griswold
LLP, The Calfee Building, 1405 East Sixth St., Cleveland,
OH 44114 (US).

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(54) Title: ON-DEMAND INFLATABLE PACKAGING

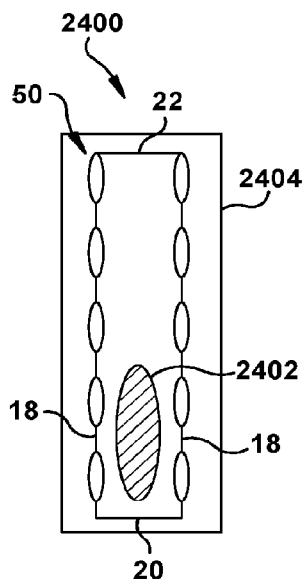


Fig. 24e

(57) Abstract: In a method of making packages, a web of preformed inflatable bags is moved along a path of travel. The preformed inflatable bags include two inflatable panels, and each inflatable panel includes a first ply and a second ply that are sealed together to form an inflation pattern. Each of the preformed inflatable bags are inflated and sealed across the seals of the inflation pattern. A product is deposited into each of the preformed inflatable bags, either before or after the inflation and/or sealing. Each of the preformed inflatable bags and contained product are loaded into a non-inflatable bag.

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ON-DEMAND INFLATABLE PACKAGING

CROSS-REFERENCE TO RELATED APPLICATION

[001] This application claims the benefit of United States Provisional Patent Application Serial No. 62/270,205, entitled ON-DEMAND INFLATABLE PACKAGING and filed, December 21, 2015, which incorporated herein by reference in its entirety.

BACKGROUND

[002] Bubble wrap is a widely-used packaging material. One known use of bubble wrap is as a cushioning material, for example, wrapped around a product or within a larger package, such as within corrugate, a bag, or paper. For example, cushioning material is used within the inside of a paper skin as a padded envelope.

[003] A typical padded envelope includes cushioning material formed by a vacuum process. After the two layers of plastic are laminated or sealed together, a small amount of air is trapped within each bubble to create a cushioning characteristic.

[004] Conventionally, a padded envelope is manufactured at assembly site. At the assembly site, the cushioning material is formed and attached to the paper skin. The envelope may be shipped to a point of retail sale, or a product may be packed within the padded envelope at a packing site. In either example, the padded envelopes are shipped in a final size and volume, i.e., with the inflation pattern fully inflated.

SUMMARY

[005] The present application describes a method of making packages. In an exemplary embodiment, a method of making packages may include moving a web of preformed inflatable bags along a path of travel. The preformed inflatable bags include two inflatable panels, and each inflatable panel includes a first ply and a second ply that are sealed together to form an inflation pattern. The method may include inflating each of the preformed inflatable

bags, sealing each of the preformed inflatable bags across the seals of the inflation pattern, depositing at least one product into each of the preformed inflatable bags, and loading each of the preformed inflatable bags and contained product into a non-inflatable bag.

[006] Further features and advantages of the invention will become apparent from the following detailed description made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[007] Features and advantages of the general inventive concepts will become apparent from the following detailed description made with reference to the accompanying drawings.

[008] Figure 1 is a perspective view of an exemplary embodiment of an inflatable packaging web;

[009] Figure 2 is a sectional view of the packaging web of Figure 1, shown along the line 2-2 of Figure 1;

[010] Figure 2A is a view similar to the view of Figure 2, where the packaging web has two inflation channels;

[011] Figure 3 is a side view of another exemplary embodiment of an inflatable packaging web, showing a pouch in an inflated condition;

[012] Figure 3A is a side view of the inflatable packaging web of Figure 2A, showing a pouch in an inflated condition;

[013] Figure 4 is a side view of the pouch of Figure 3, showing the pouch in a closed position;

[014] Figure 5 is a top view of sequential assembly stages of a method to make an exemplary embodiment of an inflatable packaging web;

[015] Figure 6a is a sectional view of another exemplary embodiment of an inflatable packaging web, showing a pouch in an inflated condition;

[016] Figure 6b is a sectional view of the pouch of Figure 6a, showing the pouch in a sealed condition;

[017] Figure 6C is a sectional view an inflatable packaging web that is similar to the Figure 6a embodiment, except the inflatable packaging web includes two inflation channels, showing a pouch in an inflated condition;

[018] Figure 6D is a sectional view of the pouch of Figure 6C, showing the pouch in a sealed condition;

[019] Figure 7 is a front view of the pouch of Figure 6b, showing bar code data and indicia imprinted on the pouch;

[020] Figure 8a is a front view of another exemplary embodiment of an inflatable packaging web;

[021] Figure 8b is a sectional view of the inflatable packaging web of Figure 8a, shown along the line 8b-8b of Figure 8a;

[022] Figure 8c is a sectional view of the inflatable packaging web of Figure 8a, shown along the line 8c-8c of Figure 8a;

[023] Figure 8D is a front view of another exemplary embodiment of an inflatable packaging web;

[024] Figure 8E is a sectional view of the inflatable packaging web of Figure 8D, shown along the line 8E-8E of Figure 8D;

[025] Figure 8F is a sectional view of the inflatable packaging web of Figure 8a, shown along the line 8F-8F of Figure 8D;

[026] Figure 9 is a sectional view of the inflatable packaging web of Figure 8a, showing a pouch in an inflated condition;

[027] Figure 9A is a sectional view of the inflatable packaging web of Figure 8D, showing a pouch in an inflated condition;

[028] Figure 10 is a sectional view of the pouch of Figure 9, showing the pouch in an inflated condition with the panel sealed;

[029] Figure 10A is a sectional view of the pouch of Figure 9A, showing the pouch in an inflated condition with the panel sealed;

[030] Figure 11a is a sectional view of another exemplary embodiment of an inflatable packaging web, showing a pouch in an inflated condition with the panel sealed and with the skin closed;

[031] Figure 11b is a front view of the pouch of Figure 11a, showing bar code data and indicia imprinted on the pouch;

[032] Figure 12 is a front view of another exemplary embodiment of an inflatable

packaging web;

[033] Figure 13 is a sectional view of the inflatable packaging web of Figure 12, shown along the line 13-13 of Figure 12;

[034] Figure 14 is a sectional view of the inflatable packaging web of Figure 12, shown along the line 14-14 of Figure 12;

[035] Figure 15 is a sectional view of the inflatable packaging web of Figure 13, showing the sealed skin in a slit condition;

[036] Figure 16 is a sectional view of the inflatable packaging web of Figure 13, showing the sealed skin in a slit condition and the skin flaps folded open;

[037] Figure 17 is a sectional view of the inflatable packaging web of Figure 13, showing a product inserted inside;

[038] Figure 18 is a sectional view of the inflatable packaging web of Figure 17, showing a the web in an inflated condition;

[039] Figure 19 is a sectional view of the inflatable packaging web of Figure 18, showing a the web in an inflated condition and the panel sealed;

[040] Figure 20 is a sectional view of the inflatable packaging web of Figure 19, showing the skin flaps closed;

[041] Figure 21a is a front perspective view of a packaging machine, showing exemplary machinery for forming and packaging a padded package from an inflatable packaging web;

[042] Figure 21b is a top view of a packaging machine of Figure 21a;

[043] Figure 22 is a schematic view of a process of forming inflatable cushioning material;

[044] Figure 23 is a top view of a web of inflatable cushioning material being produced by the process of Figure 22;

[045] Figures 24a-24e illustrate an exemplary method of moving a web of inflatable bags along a path of travel to make packages;

[046] Figures 25a-25e illustrate another exemplary method of moving a web of inflatable bags along a path of travel to make packages;

[047] Figure 26 illustrates an exemplary packaging machine used to load an

inflated bag and product into a non-inflatable bag;

[048] Figures 27A-27C illustrate another exemplary packaging machine used to load an inflated bag and product into a non-inflatable bag;

[049] Figures 28A-28E illustrate an exemplary method of moving a web of inflatable bags along a path of travel to make packages; and

[050] Figures 29A-29E illustrate another exemplary method of moving a web of inflatable bags along a path of travel to make packages.

DETAILED DESCRIPTION

[051] This Detailed Description merely describes exemplary embodiments in accordance with the general inventive concepts and is not intended to limit the scope of the invention or the claims in any way. Indeed, the invention as described by the claims is broader than and unlimited by the exemplary embodiments set forth herein, and the terms used in the claims have their full ordinary meaning.

[052] The general inventive concepts will now be described with occasional reference to the exemplary embodiments of the invention. This general inventive concept may, however, be embodied in 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 general inventive concepts to those skilled in the art.

[053] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art encompassing the general inventive concepts. The terminology set forth in this detailed description is for describing particular embodiments only and is not intended to be limiting of the general inventive concepts. As used in this detailed description and the appended claims, the singular forms “a,” “an,” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[054] Unless otherwise indicated, all numbers expressing quantities of ingredients, properties such as molecular weight, reaction conditions, percentages and so forth as used in the specification and claims are to be understood as being modified in all instances by the term

“about.” Accordingly, unless otherwise indicated, the numerical properties set forth in the specification and claims are approximations that may vary depending on the suitable properties sought to be obtained in embodiments of the present invention. Notwithstanding that the numerical ranges and parameters setting forth the broad scope of the general inventive concepts are approximations, the numerical values set forth in the specific examples are reported as precisely as possible. Any numerical values, however, inherently contain certain errors necessarily resulting from error found in their respective measurements.

[055] When discussing the invention, a final packaging product is discussed. For exemplary purposes, a padded mailer envelope is discussed. However, it should be apparent to one with ordinary skill in the art, that the invention may be practiced with other packaging products, such as for example, paper or plastic bags, paper or plastic mailers, corrugate mailers, and other known packaging offerings in which the inside of the package may be lined with a cushioning material.

[056] The invention is directed to a method of producing on-demand inflatable packaging. The packaging would include a web of preformed pouches being defined by side edges and two panels. At least one panel has an inflation pattern and an outer skin may be attached to the outside of the web, or an outside surface of the panels may be smooth to act as an outer skin. The packaging would be inflatable at a later time for assembly of a padded envelope, either with or without a product being deposited in the preformed pouch, and the product being deposited before or after the preformed pouch is inflated.

[057] The inventive assembly of the on-demand inflatable packaging allows the inflating of the padded envelope to be delayed, such as for example, until the end-user of the envelope deposits a product into the pouch. After the web is inflated, the padded envelope is separated from the web. This method allows more padded envelopes, in a non-inflated condition, to be shipped having a specific volume and weight, as compared to inflated padded envelopes. Also, a final user of the padded envelopes, such as a packer of a product, may produce only the amount of inflated padded envelopes needed for a certain packaging run, and thus enjoy the efficiencies of just-in-time production and reduction of envelope inventory.

[058] In one embodiment of the invention, a method converts a web of preformed pouches to on-demand inflatable packaging. The pouches are defined by side edges, two panels, and at least one panel having an inflation pattern. The method includes moving the web along a

path of travel, attaching an outer skin to the outside of the web, and packaging the web into a non-inflated and stored configuration. The web may be at least partially deflated and flattened before packaging. At the same or another location, the method may include moving the web along a path of travel, inflating each of the preformed pouches, and sealing each of the preformed pouches to form a cushioning material. In this condition, the two panels of each pouch are positioned to define an open end of the pouch and a closed end of the pouch.

[059] After the cushioning material is formed, the method may include closing each of the preformed pouches, sealing the outer skin in a closed position around each of the preformed pouches, and separating the web into a plurality of padded envelopes. The preformed pouches may be closed before the outer skin is closed, or the preformed pouches and the outer skin may be closed at the same time. The outer skin may be attached to the web by heat sealing, during the edge line perforation process, or any known technique. In one embodiment, the outer skin is attached to the web at edge lines of the preformed pouches and unattached at areas between the edge lines of the preformed pouches. In another embodiment, the outer skin is attached to the web at areas between the edge lines of the preformed pouches.

[060] In another embodiment, at least one product is deposited into each of a plurality of the preformed pouches. This embodiment includes inflating each of the preformed pouches, either before or after the product is deposited, sealing each of the preformed pouches to form a cushioning material, closing each of the preformed pouches, sealing the outer skin in a closed position around each of the plurality of the preformed pouches, and separating the web into a plurality of padded envelopes. The preformed pouches may be closed before the outer skin is closed, or the preformed pouches and the outer skin may be closed at the same time.

[061] In another embodiment, a method of assembly for on-demand inflatable packaging includes an intermediate sealing of the outer skin, and after a time in storage, separating the outer skin. The method includes moving the web along a path of travel, attaching an outer skin to the outside of the web, sealing the outer skin in a closed position on the outside of the web, and packaging the web into a non-inflated and stored configuration. In this stored configuration, an amount of on-demand inflatable packaging, transferrable into a given number of envelopes, is storable in a smaller volume than the same number of fully inflated envelopes.

[062] The method may further include moving the web along a web of travel, separating the outer skin open to thereby open the preformed pouches for inflation, and inflating

the preformed pouches. After inflation, the preformed pouches are sealed to form a cushioning material. The method may further include sealing the outer skin in a closed position on the outside of the web and separating the web into a plurality of padded envelopes, or depositing at least one product into each of a plurality of the preformed pouches, sealing the outer skin in a closed position on the outside of the web, and separating the web into a plurality of padded envelopes.

[063] When the intermediate sealed skin is separated to an open position, the sealed skin may form flaps on either side of the preformed pouch opening. Further, the method may include forming sealable flaps on either side of the preformed pouches after cutting the outer skin open to thereby open the preformed pouches for inflation forms sealable flaps, pulling the sealable flaps open in opposing directions, and depositing at least one product into each of a plurality of the preformed pouches.

[064] After depositing, the method may include closing each of the preformed pouches, sealing the outer skin in a closed position around each of the preformed pouches, and cutting the web into a plurality of padded envelopes. The preformed pouches may be closed before the outer skin is closed, or the preformed pouches and the outer skin may be closed at the same time.

[065] Another embodiment of the invention is a method of making packages with a preformed inflatable bag without an outer skin and with a non-inflatable bag. In this embodiment, a web of preformed inflatable bags move along a path of travel. The preformed inflatable bags include two inflatable panels, and each inflatable panel includes a first ply and a second ply that are sealed together to form an inflation pattern. The method includes inflating each of the preformed inflatable bags, sealing each of the preformed inflatable bags across the seals of the inflation pattern, depositing at least one product into each of the preformed inflatable bags, and loading each of the preformed inflatable bags and contained product into a non-inflatable bag. In one embodiment, the product is deposited into the preformed inflatable bag after the preformed inflatable bag is inflated and sealed. In another embodiment, the product is deposited into the preformed inflatable bag prior to the preformed inflatable bag being inflated and sealed.

[066] Another embodiment of the invention is preformed and inflatable pouches for manufacture into a plurality of padded envelopes. The pouches include a web of pouches being

defined by side edges, two panels, and at least one panel having an inflation pattern, an outer skin attached to the outside of the web. The web is packaged into a non-inflated and stored configuration.

[067] The outer skin may be attached to the web at edge lines of each pouch and unattached at areas between the edge lines of the pouches, or the outer skin may be attached to the web at areas between the edge lines of the pouches. In the non-inflated and stored configuration, the outer skin may be sealed in a closed position on the outside of the web with the two panels of each pouch open to define an open end and a closed end.

[068] The web of preformed pouches may be of a variety of forms in the practice of the invention. The web may be an inflatable cushioning material designed to be inflated initially, flattened, and re-inflated at a later time by an end user and used as a wrapping material. An exemplary material is FASTWRAP™, manufactured and marketed by Automated Packaging Systems of Streetsboro, Ohio, and described in US Patent No. 6,423,166, which is incorporated herein by reference in its entirety. The end user inflates this material on-demand and inflates only the amount of wrapping material that is required at that time. A method of producing the preformed pouches is discussed herein.

[069] The outer skin may be made of any thin material of suitable strength. Exemplary materials for the outer skin include paper and plastic and the material may be printable. For example, a plastic skin may be imprinted with indicia, such as for example, trademark information, product measurements, instructions, and bar coding data. The outer skin remains sufficiently smooth after all manufacturing steps, such as for example, initial inflation, flattening, and re-inflation, so that the bar coding is readable by a scanner.

[070] The outer skin may be sealed on all four sides around the perimeter of the preformed pouch. If the end user of the on-demand inflatable packaging produces packaging as an end product, such as for example, padded mailing envelopes, the outer skin may be sealed on only three sides around the perimeter of the envelope to allow for depositing of a product. The open side may include user sealable features, such as for example, a removable strip which temporarily protects an adhesive strip.

[071] Referring now to the drawings, Figures 1 and 2 illustrate an exemplary embodiment of an inflatable packaging web 10. An exemplary web is made of one or more layers of plastic film. The packaging web 10 includes a string of side connected inflatable

pouches or bags 12. A single pouch 12 is shown in Figure 1, but the web 10 includes an indeterminate length of inflatable pouches or bags 12. Each inflatable pouch is connected to one another at side edges 14. The exemplary side edges shown include lines of perforations 16 to facilitate separation of the finished product. Each pouch 12 includes at least one inflatable panel 18. The inflatable panel can take a wide variety of different forms. In exemplary embodiments, the panels 18 may be at least partially inflated, at least partially flattened, and then fully inflated. The panels may be made from the web disclosed in US Patent No. D596,031 or the web disclosed in US Patent No. 6,423,166, each of which are incorporated herein by reference in their entirety.

[072] An exemplary web of on-demand inflatable packaging includes two or more inflatable bags. Each inflatable bag 12 includes two inflatable panels 18, and each inflatable panel includes a first ply 17 and a second ply 19. The first ply 17 and second ply 19 of each panel 18 may be sealed together to form an inflation pattern. One or both of the panels 18 include an inflation pattern 512 (see Figure 5). One (See Figure 2) or both (See Figure 2A) of the panels 18 include an inflation channel 30. The inflation channel allows the preformed inflatable bag to be inflated by a nozzle inserted into the channel 30.

[073] In the illustrated embodiment in Figure 2, only one inflation channel 30 is included and the two panels of the inflatable bag are in fluid communication, such that inflation of one of the panels inflates the other panel. For example, in the illustrated embodiment passages 32 connect the air pockets 34 (see Figure 3) at the bottoms of the panels to one another such that inflation through the inflation channel 30 causes inflation of both panels. The inflation channel 30 may be as described by any one or more of US Patent Nos. 6,423,166; 8,357,439; D646,972, 8,038,348, each of which are incorporated herein by reference in their entirety.

[074] In the illustrated embodiment in Figure 2A, two inflation channels 30 are included and the two panels of the inflatable bag are optionally isolated in fluid communication, for example by an optional seal 33. For example, in the illustrated embodiment a seal or seals 33 isolate the air pockets 34 (see Figure 3A) at the bottoms of the panels such that deflation of one panel does not cause deflation of both panels. The inflation channel 30 may be as described by any one or more of US Patent Nos. 6,423,166; 8,357,439; D646,972, 8,038,348, each of which are incorporated herein by reference in their entirety.

[075] The web of preformed inflatable bags 12 may be inflated to produce

cushioning material. The inflatable bag 12 may be inflated and sealed in a first step to maintain the cushioning material, and then closed to create a closed inflated bag 50. For example, Figures 3 and 4 illustrate an inflatable bag 12 of the web in an inflated condition. The web 10 is inflated through the inflation channel 30 and sealed across seals 40 to form the inflated bags 50. The web 10 of inflatable bags can be inflated and sealed in a wide variety of different ways. For example, the web 10 can be inflated and sealed in any one of the manners disclosed by US Patent Nos. 8,357,439, 8,038,348, or 7,513,090, each of which are incorporated herein by reference in their entirety. As can be seen from Figure 3, the panels 18 of the inflated bag 50 are connected (either by sealing or folding) at the bottom of the pouch. Each panel 18 has a first ply 17 and a second ply 19. As can be seen from Figure 4, the panels 18 are sealed together at the side edges 14 to close the inflated pouch 50. Each inflatable bag 50 has an opening 42, and each panel 18 of each inflatable bag 50 has connectors 22. A product may be placed into the inflatable bags through opening 42, and the inflatable bag 50 may be closed using connectors 22.

[076] The web of inflatable bags 12 may be made from plastic film. An exemplary method for making the web 10 of inflatable bags 12 is illustrated in Figure 5. At a first position 510, two single layers of material are placed on top of one another. The single layers may be plastic and, as shown, have a width W_1 . An exemplary width may be 20 inches, but any width may be used to accommodate a desired pouch width. The two layers may be of any of the web materials identified in any of the patents and published applications which are incorporated herein by reference. One or both of the layers may include an inflation edge line of perforations 511 that is spaced apart from the edge 513. The perforations 513 are useable to separate the preformed bags 12 after final assembly. Alternatively, the inflation edge line of perforations could be in line with the edge 513 or omitted. Also at position 510, the two layers are sealed together according to the seal and inflation pattern 512. In the example illustrated by Figure 5, the seal pattern having a hexagon cell pattern and shown in Figure 1 is used. The layers are also sealed together at top and bottom ends as indicated by arrows 514, 516, respectively. A registration perforation 552 is used for registering the two labels prior to a folding operation. In another exemplary embodiment, the illustrated single layer of inflatable material formed at position 510 is replaced with material formed in accordance with US Patent No. 6,423,166.

[077] At position 520, the material formed at position 510 (or material formed as described in US Patent No. 6,423,166) is folded approximately in half on a fold line 551 to form

a bottom edge 20 of the bag 12. Cross seals 522 are formed through the four layers (two layers from the top set of layers and two layers from the bottom set of layers) to form the bags 12. Also at position 520, a trim line 553, for example, by hot knife, is added to remove excess material.

[078] The web may be inflated at the next portion 530 to create a web of inflated bags 50. A line of perforations 554 may be added at station 540 or any of the previous stations 510, 520, 530 to allow for separation after final inflation and sealing of the bags. Typically, the web 10 of inflatable bags 12 may be shipped to a site where items are packaged instead of inflating the bags at stations 530 or 540. At that site, the web 10 may be inflated after packaging of the product to form inflated bags 50. In the practice of the invention, the inflated bag 12 may alternatively be loaded with a product after the inflation and sealing that maintains inflation. The top of the pouch may be sealed after any product is loaded. Following position 530, position 540 represents a different location where the web 10 is inflated and sealed to maintain the inflation of the bags 12. The web 10 of inflatable bags 12 is packaging, for example, rolled up or folded into a box and shipped to the location where the bags are inflated and sealed. For example, the web 10 can be inflated and sealed to maintain inflation of the pouches in any one of the manners disclosed by US Patent Nos. 8,357,439, 8,038,348, 7,513,090 and Published Application No. 2009/029342.

[079] Another exemplary embodiment of a packaging web is shown in Figures 6a and 6b. The embodiment illustrated is similar to the embodiment illustrated by Figures 1 and 2. As illustrated, a separate outer skin is not used. In Figure 6a, the inflatable packaging web 700 has been formed by two layers, an outside layer 712 and an inside layer 714, to form an opening 710. The inside layer has a pattern of inflated cells 720 formed by a inflation process, as discussed herein. The outside layer 712 is relatively smooth and unaffected by the inflation process.

[080] In Figure 6b, the seals 40 are closed to maintain the inflation in the pouch. As discussed herein, the panels may be made from the web disclosed in US Patent No. D596,031 or the web disclosed in US Patent No. 6,423,166, each of which are incorporated herein by reference in their entirety.

[081] Another exemplary embodiment of a packaging web is shown in Figures 6C and 6C. The embodiment illustrated is similar to the embodiment illustrated by Figures and 6a and 6b, except the option of having inflation channels on both sides of the bag is illustrated. In

Figure 6D, the seals 40 on both sides of the bag are closed to maintain the inflation in the pouch.

[082] In Figure 7, only a single pouch of the packaging web 700 is shown. The pouch 730 is defined in part by side edges 724. As discussed, the outside layer 712 is relatively smooth and unaffected by the inflation process. The outside layer 712 includes imprinted information on the relatively smooth surface, such as for example, bar code date 654 and packaging indicia 652.

[083] In an embodiment, the web may include an outer skin separate from the inflation layers. The outer skin may be made of any thin material of suitable strength, such as for example, paper or plastic, and the material may be printable. The outer skin remains sufficiently smooth after all manufacturing steps, such as for example, initial inflation, flattening, and re-inflation, so that the bar coding is readable by a scanner. The outer skin may be sealed on all four sides around the perimeter of the preformed pouch. If the end user of the on-demand inflatable packaging produces packaging as an end product, such as for example, a padded mailer envelope, the outer skin may be sealed on only three sides around the perimeter of the envelope to allow for depositing of a product. The open side may include user sealable features, such as for example, a removable strip which temporarily protects an adhesive strip.

[084] An embodiment of the invention having an outer skin will now be discussed. The packaging web shown in Figures 8a-11b has an outer skin 612. Figure 8a is a top view of inflatable packaging web 610, a sectional view of the inflatable packaging web 610 is shown along the center of a pouch in Figure 8b, and a sectional view of the inflatable packaging web 610 is shown along the side edge of a pouch in Figure 8c.

[085] The embodiment illustrated in Figures 8a-8c is similar to the embodiment illustrated by Figures 6a and 6b, except the packaging web 610 includes an outside skin 612. The outside skin 612 may be provided around the entire web as shown or adhered to one or both of the panels 18. The packaging web 610 includes a string of side connected inflatable pouches 12 with the skin 612 disposed around the pouches 12. Each pouch 12 includes at least one inflatable panel 18. The inflatable panel can take a wide variety of different forms. In exemplary embodiments, the panels 18 are made from the web disclosed in US Patent No. D596,031 or the web disclosed in US Patent No. 6,423,166, each of which are incorporated herein by reference in their entirety. Each pouch 12 is formed by sealing a pair of panels 18 together along a bottom edge 20 and side edges 14 or by folding a larger panel in half along the

bottom edge and sealing the side edges together.

[086] Referring now to Figures 8b and 8c, sectional views of the packaging web of Figure 8a are shown. In the illustrated embodiment, outside skin 612 is only connected to the panels at the side edges 14, preferably by the seals 40. This structure may be the case when the skin 612 is disposed completely around the pouches 12 as shown, when the skin is connected to one side of the web, but not to the other, or when separate skins are attached to opposite sides of the web 610. By attaching the skin 610 to the web along the side edges 14, the skin will wrinkle less when the pouches are inflated, as compared to a skin that is attached to the entire surface(s) of the web 610. The skin 612 attached in this manner will not wrinkle significantly, if the web is made from a vacuum process as disclosed in US Patent No. 6,423,166. In another exemplary embodiment, the skin 612 is attached, adhered, or bonded to an entire surface or substantially all of the surface of the panels.

[087] One (Figures 8a-8c) or both (Figures 8D-8F) of the panels 18 include an inflation channel 30. In the Figure 8a-8c embodiment, only one inflation channel 30 is included and the two panels of the pouch are in fluid communication, such that inflation of one of the panels inflates the other panel. For example, in the illustrated embodiment in Figures 8a-8c, passages 32 connect the air pockets 34 at the bottoms of the panels to one another such that inflation through the inflation channel 30 causes inflation of both panels. In the Figure 8D-8F embodiment, two inflation channels 30 are included and a seal 33 isolates the two panels, such that deflation of one of the panels does not deflate the other panel. For example, in the illustrated embodiment in Figures 8D-8F, the seal 33 blocks the passages 32 connect the air pockets 34 at the bottoms of the panels to one another such that inflation through the inflation channel 30 causes inflation of both panels. The inflation channel(s) 30 may be as described by any one or more of US Patent Nos. 6,423,166; 8,357,439; D646,972, 8,038,348, each of which are incorporated herein by reference in their entirety.

[088] In the example illustrated by Figures 8D-8F, the inflation channel(s) 30 include a line of perforations 890. The line of perforations allows the inflation channels 30 to be broken apart without the use of a knife and removed from an inflation nozzle. In the example illustrated by Figures 8D-8F, the web 10 also includes cuts 892 that extend through all of the plies of the web 10 (through both panels 18 and through both skins 612). These cuts 892 allow the bags to be opened more easily and to a larger extent for filling with a product.

[089] An exemplary inflation of the web 610 is illustrated in Figures 9-11b. Referring now to Figure 9, the web 10 is inflated through the inflation channel 30. As shown in an inflated condition, the cushioning bubble pattern of the pouches is opened by inflation on the inward side of the pouch. Figure 10 illustrates that one of the panels is sealed across seals 40 to form and seal the inflated pouches 50 inside the skin 612. The inflatable web of pouches 610 can be inflated and sealed in a wide variety of different ways. For example, the web 10 can be inflated and sealed in any one of the manners disclosed by US Patent Nos. 8,357,439, 8,038,348, 7,513,090 and Published Application No. 2009/029342.

[090] Another exemplary inflation of a web 610 is illustrated in Figures 9A and 10A. In this embodiment, the web 10 is inflated through two inflation channels 30 as shown, or through a single inflation channel 10. As shown in an inflated condition, the cushioning bubble pattern of the pouches is opened by inflation on the inward side of the pouch. The arrows 1000 in Figure 10 illustrates that a single seal is formed across the inflated pouches 50 and the skins 612 to both seal the inflated pouches 50 and close the skins 612. This single seal can be accomplished in a wide variety of different ways. For example, the web 10 can be inflated and sealed in any one of the manners disclosed by US Patent Nos. 8,357,439, 8,038,348, 7,513,090 and Published Application No. 2009/029342.

[091] Referring to Figure 11a, in one exemplary embodiment, the skin 612 is longer on one side of the pouch to form a sealing flap 614. The inflated pouch 50 may be loaded with a product, either by a packer or a consumer, the sealing flap 614 is moved to a closed position on an opposing side of the pouch, and the sealing flap 614 is positioned to seal the package at an overlap position 616. Other sealing structure for the outer skin may be used in the practice of this invention, such as for example, two flaps on each side of the pouch of equal length that are joined together, such as for example, by a strip of adhesive on an inward side of at least one flap.

[092] The front view of one package of the web of Figure 11a is shown in Figure 11b. The package 650 includes an outer skin 612 and the sealing flap 614, which is positioned to seal the package at an overlap position 616. Bar code data 654 and product indicia 652 are imprinted onto the outer skin 612. The imprinted operation may take place before or after inflation of the web, and before or after depositing of product by a packer.

[093] Another exemplary embodiment of a packaging web is illustrated in Figures 12-20. The exemplary packaging web is similar to the embodiment illustrated by Figures 6-8,

except the outer skin is sealed to close the pouch before final inflation of the web. The web may be at least partially inflated before the outer skin is sealed. If so, the web may be partially flattened prior to sealing the outer skin.

[094] In the embodiment illustrated in Figures 12-14, a top edge of the skin 610 is connected to form an enclosed channel 1212, as shown in Figures 13 and 14. In Figure 13, the inflatable packaging web 1210 is shown along the middle of a pouch. In Figure 14, the inflatable packaging web 1210 is shown along the edge line 14 of the pouch. In a non-inflated and stored configuration, the entire web may be at least partially flatten.

[095] Depositing a product in the preformed pouches of the web will now be discussed. In the practice of this invention, a product may be deposited into the pouch by several different ways. For example, the product may be inserted into the open end of the pouch, either by manual or by automated techniques. The product can be inserted into the open end before the pouch is inflated and sealed. Alternatively, the product can be inserted into the pouch through the open end and the pouch is inflated and sealed. A packer may select one of these options, in view of the product size, weight, or other characteristics.

[096] The exemplary skin configuration of Figures 12-14 allows the packaging web 1210 to be opened, loaded, closed and sealed by a packaging machine, such as the packaging machine 1210 illustrated in Figures 21a and 21b. Examples of packaging machines that can be modified, or combined, to open, load, close, and seal the outer skin are described in US Patent Nos. 7,552,571; 6,170,238; 6,055,796; 5,996,319; 5,987,856; and 5,944,424, and US Publication No. 2012/0214658, each of which are incorporated herein by reference in their entirety. Other skin configurations may be used in the practice of this invention to load, close and seal a padded package by a packaging machine.

[097] In one exemplary embodiment, a bagging machine is used to load, close and seal a padded package by a packaging machine. In this example, the pouch is loaded with a product, and the outer skin is sealed. For example, the pouch, loaded with a product, may be placed in a mailing bag. In one exemplary embodiment, a pouch loaded with a product is placed in a bag and the bag is sealed with a bagging machine. For example, a pouch loaded with a product may be bagged using any one of the machines disclosed by US Patent No. 8,3076,617; 7,7552,257; 6,948,296; 6,742,317; 6,543,201; 6,055,796; 5,996,319; 5,987,856; 5,944,424 and 6,170,238, each of which are incorporated herein by reference in their entirety.

[0098] Another exemplary method of using an inflated packaging web to package a product will now be discussed. Figures 15-20 illustrate a method of forming an inflated/padded package 1500 from the web 1210 with the packaging machine. Referring to Figure 15, a top of the skin 610 is cut, slit, or otherwise separated. The machine makes the slit, cut, or other separation in the same manner as is disclosed in US Patent Nos. 7,552,571; 6,170,238; 6,055,796; 5,996,319; 5,987,856; or 5,944,424. Referring to Figure 16, top lips 1610 are formed and grabbed by belts 1612. The belts travel the same direction as the web and act to pull the web in the forward direction through the machinery. The belts 1612 may have the same form disclosed by US Patent Nos. 7,552,571; 6,170,238; 6,055,796; 5,996,319; 5,987,856; or 5,944,424. Referring to Figure 17, the belts 1612 pull the lips apart to open the pouch. A product 1710 is deposited into the pouch. The depositing of the product may be done by automated machinery or manually by hand.

[0099] Figures 18-20 illustrate an exemplary process for finishing the packaging of a product. Figure 19 is a sectional view showing the web 610 being inflated around a product 1710. The web may be inflated by an inflation nozzle 1810 into an inflation channel 30. After inflation, the web may be sealed by sealing the web at the seals 40 to maintain the inflation. Figure 20 illustrates the flaps 1610 of the outer skin in a sealed position. Once the web 610 reaches this condition, the individual packages may be separated from the web, such as for example, by separating at edge perforations.

[0100] Referring to an exemplary embodiment illustrated in Figures 21a and 21b, the packaging machine 2110 includes several stations. Each station performs one or more particular purposes as the web travels through each station. For example, the packaging machine 2110 includes a load station 2112, an inflation and sealing station 2114, and a skin sealing station 2116. It will be apparent to one skilled in the art that packaging machine 2110 is offered for exemplary purposes only, and that the invention may be practiced with other packaging machines, or with a combination of packaging machines and one or more manual assembly steps.

[0101] Referring to Figures 21a, a packaging web 1210 is moved along a path of travel toward a load station 2112. The load station is used to deposit automatically one or more pieces of product into each pouch of the web 1210. At the beginning of the load station, or upstream from it, the enclosed channel 1212 (see Figures 13-15) is cut open. At a separation point 2220, the flaps 1610 are engaged and pulled apart by belts, which also pull the web through

the machinery. The outsides of the web travels outward along an angled path 2202 prior to a loading point. The load station 2112 may correspond to a load station disclosed in US Patent Nos. 7,552,571; 6,170,238; 6,055,796; 5,996,319; 5,987,856; or 5,944,424.

[0102] The load station 2112 includes a length of travel in which the two panels are held apart a distance. In the length of travel, a loading cavity 2204 is created in between the panels of each pouch. As shown in Figures 21a and 21b, the product 1710 is deposited a direction D_1 into the loading cavity by load station 2112. As discussed herein, the loading may be by automated machinery or by a manual step. At the end of the loading station 2012, the sides of the panel are brought back together to be contiguous or relatively contiguous at a pre-sealing point 2206.

[0103] The web travels on to the next station to be inflated and sealed. In an exemplary embodiment, inflation and sealing components 2114 correspond to inflation and sealing components disclosed by US Patent Nos. 8,357,439, 8,038,348, 7,513,090 or Published Application No. 2009/029342 and are provided after the load station 2112. The web includes a channel for the pouches to be inflated. Referring specifically to Figures 18 and 21, the channel 30 is routed onto a pin which includes an inflation nozzle 1810. The pin and inflation nozzle 1810 slides into the channel as the web travels through the machinery and inflates the pouch around the product by a blower 2208. As shown in Figure 19, the pouch is then sealed along the seals 40 to maintain inflation of the pouch. This sealing may be performed by sealing belts that have the configuration of sealing belts disclosed by US Patent Nos. 7,552,571; 6,170,238; 6,055,796; 5,996,319; 5,987,856; or 5,944,424. In one exemplary embodiment, the pouches of the web are vacuum formed, such as for example, by using the material disclosed by US Patent No. 6,423,166.

[0104] In the illustrated embodiment, a skin sealing station 2116 is positioned after the inflation and sealing components 2114. Still referring to Figure 21a and 21b, the outer skin is sealed by sealing belts. The sealing is controlled by a heater temperature control 2210 and a heater position control 2212. The sealing belts may have the configuration of the sealing belts of US Patent Nos. 7,552,571; 6,170,238; 6,055,796; 5,996,319; 5,987,856; or 5,944,424.

[0105] In another exemplary embodiment, the sealing of the pouches and the sealing of the skins is accomplished with a single seal. For example, after inflation of the pouches a single sealer would seal across all four layers, i.e., the two layers at the end of the pouch and two

layers of the skins 1610, at the same time. In one exemplary embodiment, the skin sealing station 2116 corresponds to a closure and sealing station disclosed by US Patent Nos. 7,552,571; 6,170,238; 6,055,796; 5,996,319; 5,987,856; or 5,944,424.

[0106] A machine and method for producing inflatable material is illustrated in Figure 22. The method is useable for forming re-inflatable material that can be used to product cushioning material in any of the embodiments disclosed by this application. As discussed, the web of preformed pouches may be of a variety of forms in the practice of the invention. The web may be an inflatable cushioning material designed to be inflated at a later time by an end user. An exemplary material is described in US Patent No. 6,423,166. The end user inflates this material on-demand and inflates only the amount of wrapping material that is required at that time.

[0107] Still referring to Figure 22, a machine 800 is arranged to produce an inflatable cushioning material. The machine includes two adjacent wheels, a base wheel 712 rotating in a direction T_1 and a forming wheel 710 rotating in an opposite direction T_2 . Two individual layers of plastic film 700, 702 are pulled in a direction A_2 between the two wheels 710, 712. The forming wheel 710 has a patterned surface 714 to produce an inflatable pattern on the web 704. The base wheel 712 may have a smooth surface 716. The inflatable cushioning material may be stored in bulk amounts in a container 720 in non-inflated form until an end-user is ready to use the material. Another machine or series of machine can attached the outer skin and inflate the cushioning material in an amount desired.

[0108] A top view of the web 704 of inflatable cushioning material is shown in Figure 23. The web includes an inflation pattern 750 which includes a repetitive of individual cells 752 arranged in an alternating pattern. After an inflation process, such as by vacuum, the cells may have a distinguishable shape, such as for example, hexagonal. The patterned web may shrink in both longitudinal and lateral directions to form the inflated pattern. Any separate outer skin may be attached to the inflatable cushioning material at the edges only to minimize shrinkage or distortion.

[0109] Figures 24a-24e illustrate an exemplary method of using a web of inflatable bags 12 and non-inflatable bags 2404 to make packages 2400. Figure 24a shows an inflatable bag 12 in a non-inflated condition. The inflatable bag 12 may have any of the configurations disclosed herein. In an exemplary embodiment, the inflatable bags do not have an outer skin. In

the illustrated embodiment, the inflatable bag 12 has two panels 18, a bottom edge 20, and optional connection 22. Each panel has a first ply 17 and a second ply 19 that are sealed to form an inflation pattern. Figure 24b shows the inflatable bag 12 after it has been inflated and sealed, thereby forming inflated bag 50. Figure 24c illustrates the inflated bag 50 of Figure 24b after a product 2402 is deposited in inflated bag 50. Figure 24d shows the inflated bag 50 and product 2402 loaded into non-inflatable bag 2404, thereby forming the package 2400. Inflated bag 50 may be closed by forming the optional connection 22. The optional connection 22 can take a wide variety of different forms, examples include, but are not limited to adhesive, a heat seal, zip lock, tape or the like. Figure 24e illustrates the package 2400 after non-inflatable bag 2404 is closed with inflated bag 50 and product 2402 within the closed non-inflatable bag 2404.

[0110] Figure 25a-25e illustrate another exemplary method of using a web of inflatable bags 12 and non-inflatable bags 2404 to make packages 2400. Figure 25a shows an inflatable bag 12 in a non-inflated condition. The inflatable bag 12 may have any of the configurations disclosed herein. In an exemplary embodiment, the inflatable bags 12 do not have an outer skin. In the illustrated embodiment, the inflatable bag 12 has two panels 18, a bottom edge 20, and connectors 22. Each panel has a first ply 17 and a second ply 19. Figure 25b shows the inflatable bag 12 after a product 2402 is deposited into inflatable bag 12, which occurs prior to inflating inflatable bag 12. Figure 25c illustrates the inflatable bag 12 and product 2402 of Figure 25b after inflatable bag 12 is inflated and sealed, thereby forming inflated bag 50. Figure 25d shows inflated bag 50 and product 2402 loaded into non-inflatable bag 2404, thereby forming package 2400. Inflated bag 50 is optionally closed by optional connections 22. Figure 25e illustrates package 2400 after non-inflatable bag 2404 is closed with inflated bag 50 and product 2402 within the closed non-inflatable bag 2404.

[0111] The above-mentioned embodiments of methods of making packages 2400 are only exemplary. The methods shown in Figures 24a-24e and 25a-25e provide that the inflated bags 50 are closed by connections 22. However, it is not a requirement that inflatable bags 50 are closed. The inflated bags 50 may be open while in package 2400, which means that connections 22 are not required. Also, if inflated bag 50 includes connections 22, the connections 22 may take any form that closes inflated bag 50, such as an adhesive, a heat seal, a zip-lock connection, tape or the like.

[0112] The inflated bags 50 and product 2402 may be loaded into non-inflatable bags

2404 to form packages 2400 using a packaging machine 2600, 2700. Referring to the exemplary embodiment illustrated in Figure 26a, the packaging machine 2600 includes non-inflatable bags 2404 that travel through a load station 2610 and a sealing station 2620. It will be apparent to one skilled in the art that packaging machine 2610 is offered for exemplary purposes only, and that the invention may be practiced with other packaging machines, or with a combination of packaging machines and one or more manual assembly steps. Referring to Figure 26a, a web of non-inflatable bags 2404 is moved along a path of travel toward a load station 2610. At the load station 2610, the inflated bag 50 and product 2402 is automatically or manually deposited into non-inflatable bag 2404. At a separation point 2612, the sides of the non-inflatable bag 2404 are engaged and pulled apart by belts, which also pull the web of non-inflatable bags 2404 through the packaging machine. The outside of the web travels outward along an angled path 2614 prior to a loading point 2616. The load station 2610 may correspond to a load station disclosed in US Patent Nos. 7,552,571; 6,170,238; 6,055,796; 5,996,319; 5,987,856; or 5,944,424.

[0113] The load station 2610 includes a length of travel, along which the sides of the non-inflatable bags 2404 are held apart a distance. In this length of travel, a loading cavity 2616 is created in between the sides of each non-inflatable bag 2404. As shown in Figure 26a, the inflated bag 50 and product 2402 is deposited in a direction D_1 into the loading cavity 2616 of the opened non-inflatable bag 2404 at load station 2610. As discussed herein, the loading may be by automated machinery or by a manual step. At the end of the loading station 2610, the sides of the non-inflatable bag 2404 are brought back together to be contiguous or relatively contiguous at a pre-sealing point 2618.

[0114] The web of non-inflatable bags 2404 loaded with inflated bags 50 and product 2402 travels on to the next station 2620 to be sealed. In an exemplary embodiment, sealing components 2620 correspond to the sealing components disclosed by US Patent Nos. 8,357,439, 8,038,348, 7,513,090 or Published Application No. 2009/029342 and are provided after the load station 2610. As shown in Figures 24e and 25e, the non-inflatable bag 2404 is sealed. This sealing may be performed by sealing belts that have the configuration of sealing belts disclosed by US Patent Nos. 7,552,571; 6,170,238; 6,055,796; 5,996,319; 5,987,856; or 5,944,424.

[0115] Figures 27a-27c illustrates another exemplary embodiment of a packaging machine 2700 that may be used to load inflated bag 50 and product 2402 into non-inflatable bag 2404. A web 2702 of non-inflatable bags 2404 is loaded into packaging machine 2700. An

indexing mechanism 2701 moves the web 2702 along a path of travel. The indexing mechanism 2701 may take a wide variety of different forms. For example, any indexing mechanism that can be controlled to index the non-inflatable bags 2404 of the web 2702 may be used. In the exemplary embodiment shown in Figures 27a-27c, the indexing mechanism includes a pair of rollers 2704 that form a nip that engages web 2702. Packaging machine 2700 also includes an opening arrangement 2710 to create an opening 2716 in non-inflatable bag 2404. In an exemplary embodiment, the opening arrangement includes grippers 2712 that pull apart the sides of non-inflatable bag 2404. The opening arrangement 2710 may take a wide variety of different forms. For example, any opening arrangement that can be controlled to open the non-inflatable bags 2404 of web 2702 may be used. In another exemplary embodiment, a blower (not shown) may be used to create opening 2716. The above-mentioned embodiment for a packaging machine 2700 is only exemplary. The packaging machine 2700 may also have the configuration of any of the packaging machines disclosed by US Patent Nos. 8,307,617, 8,069,635, or 7,654,064 and US Publication Nos. 20120073246, 20100122512, or 20090064637, each of which are incorporated herein by reference in their entirety.

[0116] Referring to the exemplary embodiment provided in Figures 27a-27c, the grippers close non-inflatable bag 2404 after the inflated bag 50 and product 2402 are loaded into the non-inflatable bag 2404. However, if the opening arrangement 2710 does not include grippers 2712, the non-inflatable bag 2404 may be closed in another manner. For example, in certain exemplary embodiments, packaging machine 2700 may close the non-inflatable bag 2404 simply by closing the seal bar.

[0117] Still referring to the exemplary embodiment provided in Figures 27a-27c, the non-inflatable bag 2404 is sealed using sealing arrangement 2720. The non-inflatable bag may be sealed at the position located in Figures 27a-27c, or the grippers 2712 may release the non-inflatable bag 2404, and the non-inflatable bag 2404 may be indexed to another position for sealing. In one exemplary embodiment, the non-inflatable bag 2404 is sealed while the grippers 2712 is holding the non-inflatable bag 2404 closed. The sealing arrangement 2720 may take a wide variety of different forms. For example, any mechanism that applies heat to the non-inflatable bag 2404 to create a seal may be implemented. In the exemplary embodiment provided in Figures 27a-27c, the sealing arrangement 2720 includes a seal backing bar 2718 and a heating element 2716 that are selectively moved into and out of engagement. The non-

inflatable bag 2404 is sealed by clamping the non-inflatable bag between the seal backing bar 2718 and heating element 2716. In an exemplary embodiment, the seal backing bar 2718 has a rubber seal backing element 2717. The seal backing bar 2718 may be moved to the clamped position.

[0118] A controller (not shown) is in communication with the indexing mechanism 2701, the opening arrangement 2710, and the sealing arrangement 2720. The controller controls the indexing mechanism 2701, the opening arrangement 2710, and the sealing arrangement 2720 to convert the non-inflatable bags 2404 into packages 2400 holding inflated bag 50 and product 2402. A wide variety of controllers can be used and programmed to control the indexing mechanism 2701, the opening arrangement 2710, and the sealing arrangement 2720 as described herein. For example, the controller and controller algorithms described in U.S. Pat. No. 5,341,625 to Kramer can be modified to control the indexing mechanism 2701, the opening arrangement 2710, and the sealing arrangement 2720 to form packages 2400.

[0119] Referring to Figures 27a-27c, the web 2702 of non-inflatable bags 2404 is moved through packaging machine 2700 using indexing mechanism 2701. The indexing mechanism 2701 moves a non-inflatable bag 2404 of web 2702 into a position to be opened by opening arrangement 2710 to create opening 2716. Inflated bag 50 and product 2402 are loaded into the opened non-inflatable bag 2404. In an exemplary embodiment, grippers 2712 are used to create opening 2716, and grippers 2712 are used to close non-inflatable bag 2404. Once the non-inflatable bag is closed, sealing arrangement seals the non-inflatable bag to create package 2400.

[0120] Figures 28A- 28E are similar to Figures 24A-24e, except the panels of the web of inflatable bags 12 are separately inflatable and are optionally isolated from one another, so that if one panel deflates, the other panel remains inflated. Figure 28A shows an inflatable bag 12 in a non-inflated condition. The inflatable bag 12 may have any of the configurations disclosed herein. In an exemplary embodiment, the inflatable bags do not have an outer skin. In the illustrated embodiment, the inflatable bag 12 has two panels 18, a bottom edge 20, and optional connection 22. Each panel has a first ply 17 and a second ply 19 that are sealed to form an inflation pattern. Figure 28B shows the inflatable bag 12 after it has been inflated and sealed, thereby forming inflated bag 50. Figure 28C illustrates the inflated bag 50 of Figure 28B after a product 2402 is deposited in inflated bag 50. Figure 28D shows the inflated bag 50 and product

2402 loaded into non-inflatable bag 2404, thereby forming the package 2400. Inflated bag 50 may be closed by forming the optional connection 22. The optional connection 22 can take a wide variety of different forms, examples include, but are not limited to adhesive, a heat seal, zip lock, tape or the like. Figure 28E illustrates the package 2400 after non-inflatable bag 2404 is closed with inflated bag 50 and product 2402 within the closed non-inflatable bag 2404.

[0121] Figures 29A- 29E are similar to Figures 25A-25e, except the panels of the web of inflatable bags 12 are separately inflatable and are optionally isolated from one another, so that if one panel deflates, the other panel remains inflated. Figure 29A shows an inflatable bag 12 in a non-inflated condition. The inflatable bag 12 may have any of the configurations disclosed herein. In an exemplary embodiment, the inflatable bags 12 do not have an outer skin. In the illustrated embodiment, the inflatable bag 12 has two panels 18, a bottom edge 20, and connectors 22. Each panel has a first ply 17 and a second ply 19. Figure 29B shows the inflatable bag 12 after a product 2402 is deposited into inflatable bag 12, which occurs prior to inflating inflatable bag 12. Figure 29C illustrates the inflatable bag 12 and product 2402 of Figure 25b after inflatable bag 12 is inflated and sealed, thereby forming inflated bag 50. Figure 29D shows inflated bag 50 and product 2402 loaded into non-inflatable bag 2404, thereby forming package 2400. Inflated bag 50 is optionally closed by optional connections 22. Figure 29E illustrates package 2400 after non-inflatable bag 2404 is closed with inflated bag 50 and product 2402 within the closed non-inflatable bag 2404.

[0122] The above-mentioned embodiments of methods of making packages 2400 are only exemplary. The methods shown in Figures 28A-28E and 29A-29E provide that the inflated bags 50 are closed by connections 22. However, it is not a requirement that inflatable bags 50 are closed. The inflated bags 50 may be open while in package 2400, which means that connections 22 are not required. Also, if inflated bag 50 includes connections 22, the connections 22 may take any form that closes inflated bag 50, such as an adhesive, a heat seal, a zip-lock connection, tape or the like.

[0123] While various inventive aspects, concepts and features of the general inventive concepts are described and illustrated herein in the context of various exemplary embodiments, these various aspects, concepts and features may be used in many alternative embodiments, either individually or in various combinations and sub-combinations thereof. Unless expressly excluded herein all such combinations and sub-combinations are intended to be within the scope

of the general inventive concepts. Still further, while various alternative embodiments as to the various aspects, concepts and features of the inventions (such as alternative materials, structures, configurations, methods, circuits, devices and components, alternatives as to form, fit and function, and so on) may be described herein, such descriptions are not intended to be a complete or exhaustive list of available alternative embodiments, whether presently known or later developed. Those skilled in the art may readily adopt one or more of the inventive aspects, concepts or features into additional embodiments and uses within the scope of the general inventive concepts even if such embodiments are not expressly disclosed herein. Additionally, even though some features, concepts or aspects of the inventions may be described herein as being a preferred arrangement or method, such description is not intended to suggest that such feature is required or necessary unless expressly so stated. Still further, exemplary or representative values and ranges may be included to assist in understanding the present disclosure; however, such values and ranges are not to be construed in a limiting sense and are intended to be critical values or ranges only if so expressly stated. Moreover, while various aspects, features and concepts may be expressly identified herein as being inventive or forming part of an invention, such identification is not intended to be exclusive, but rather there may be inventive aspects, concepts and features that are fully described herein without being expressly identified as such or as part of a specific invention. Descriptions of exemplary methods or processes are not limited to inclusion of all steps as being required in all cases, nor is the order that the steps are presented to be construed as required or necessary unless expressly so stated.

CLAIMS

1. A method of making packages comprising:

moving a web of preformed inflatable bags along a path of travel, each preformed bag comprising two inflatable panels, each inflatable panel comprising a first ply and a second ply that are sealed together to form an inflation pattern;

inflating each of the preformed inflatable bags as the preformed inflatable bags move along the path of travel;

sealing each of the preformed inflatable bags across the seals of the inflation pattern;

depositing at least one product into each of the preformed inflatable bags; and

loading each of the preformed inflatable bags and contained product into a non-inflatable bag.

2. The method of claim 1 wherein each of the preformed inflatable bags and contained product are loaded into the non-inflatable bag by a packaging machine.

3. The method of claim 1 wherein the at least one product is deposited into the each of the preformed inflatable bags before the inflating the each of the preformed inflatable bags.

4. The method of claim 1 wherein the at least one product is deposited into the each of the preformed inflatable bags after the inflating the each of the preformed inflatable bags.

5. The method of claim 1 further comprising closing each of the preformed inflatable bags.

6. A method of making packages comprising:

moving a web of preformed inflatable bags along a path of travel, each preformed bag comprising two inflatable panels, each inflatable panel comprising a first ply and a second ply that are sealed together to form an inflation pattern;

inflating each of the preformed inflatable bags as the preformed inflatable bags moves along the path of travel;

sealing across seals of the inflation pattern to form sealed and inflated bags;

depositing at least one product into each of the sealed and inflated bags; and

loading each of the sealed and inflated bags and contained product into a non-inflatable bag.

7. The method of claim 6 wherein each of the sealed and inflated bags and contained product are loaded into the non-inflatable bag by a packaging machine.

8. The method of claim 6 further comprising closing each of the sealed and inflated bags.

9. A method of making packages comprising:

moving a web of inflatable preformed bag portions along a path of travel, each inflatable preformed bag portion comprising two inflatable panels separated by a bottom edge, each inflatable panel comprising a first ply and a second ply that are sealed together to form an inflation pattern;

folding each of the preformed bag portions at the bottom edge of the preformed bag as the web of inflatable preformed bag portions moves along the path of travel, thereby forming a web of inflatable bags;

inflating each of the inflatable bags as the web of inflatable preformed bag portions moves along the path of travel;

sealing each of the inflatable bags across the seals of the inflation pattern as the web of inflatable preformed bag portions moves along the path of travel;

depositing at least one product into each of the inflatable bags as the web of inflatable preformed bag portions moves along the path of travel;

separating each of the inflatable bags and contained product from the web of inflatable bags as the web of inflatable bag portions moves along the path of travel; and

loading each of the separated inflatable bags and contained product into a non-inflatable bag.

10. The method of claim 9 wherein each of the preformed inflatable bags and contained product are loaded into the non-inflatable bag by a packaging machine.

11. The method of claim 9 wherein the at least one product is deposited into the each of the preformed inflatable bags before the inflating the each of the preformed inflatable bags.

12. The method of claim 9 wherein the at least one product is deposited into the each of the preformed inflatable bags after the inflating the each of the preformed inflatable bags.

13. The method of claim 9 further comprising closing each of the preformed inflatable bags.

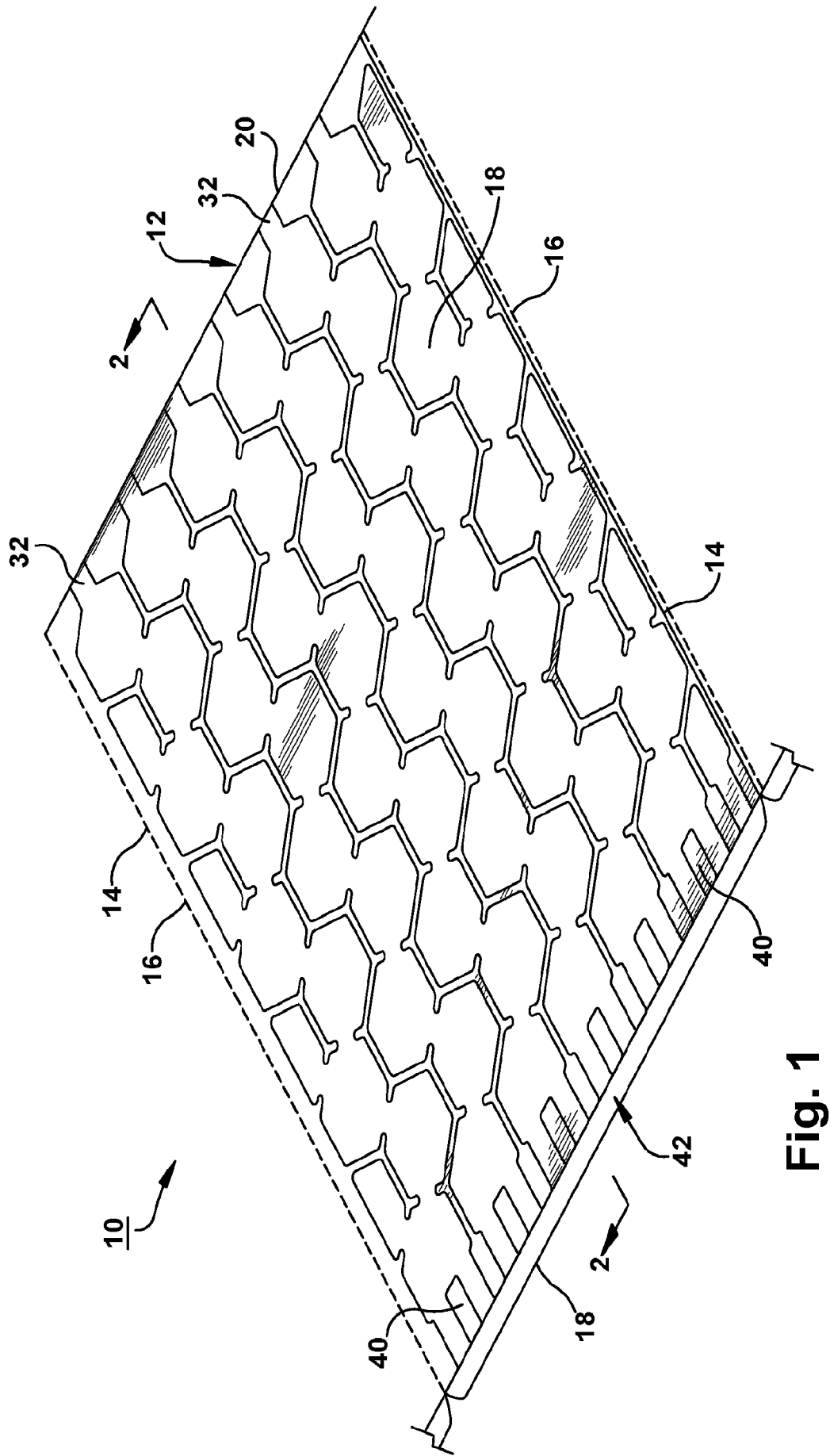
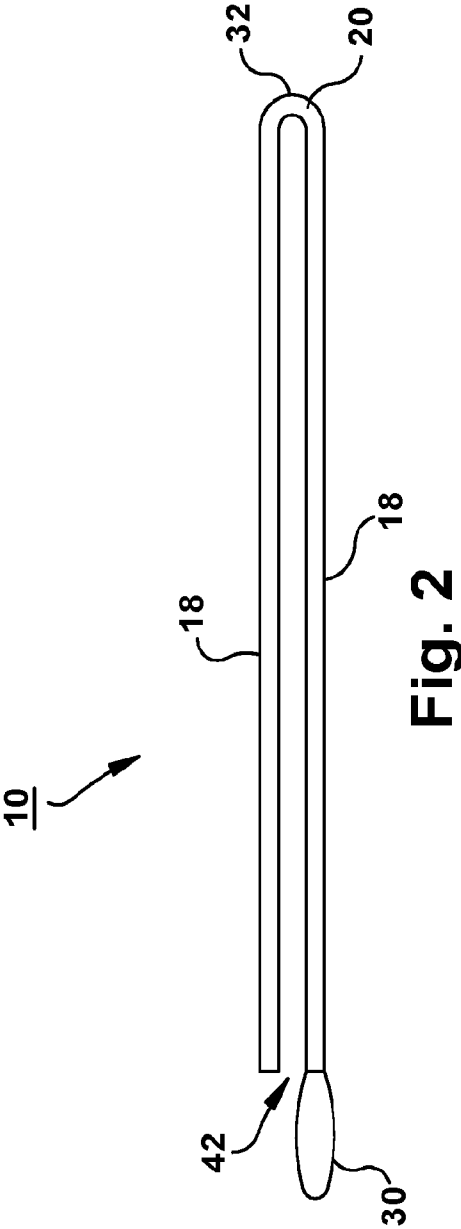
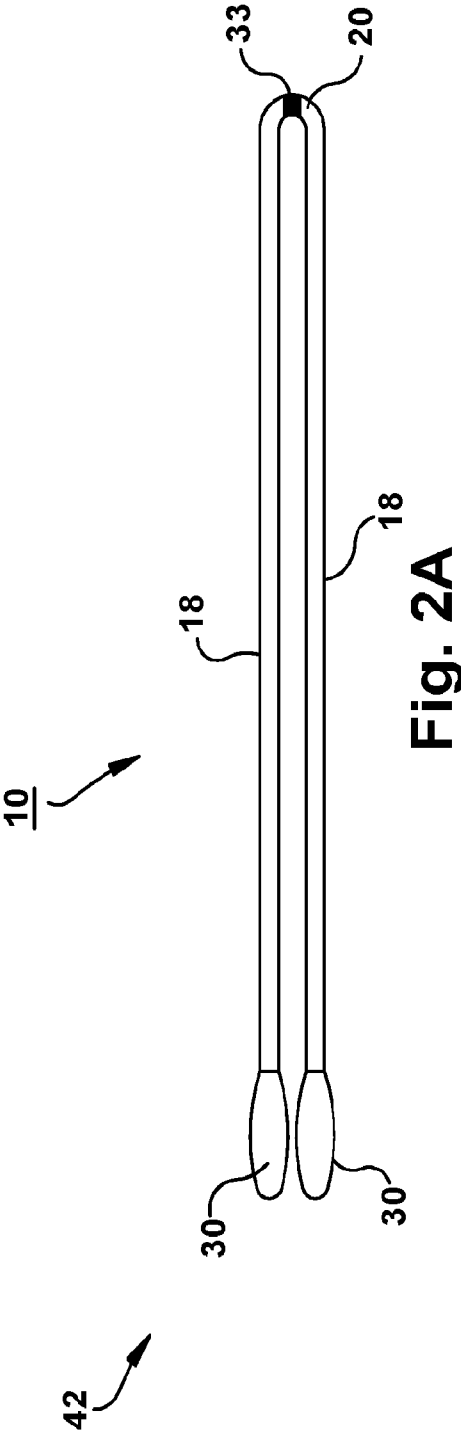


Fig. 1





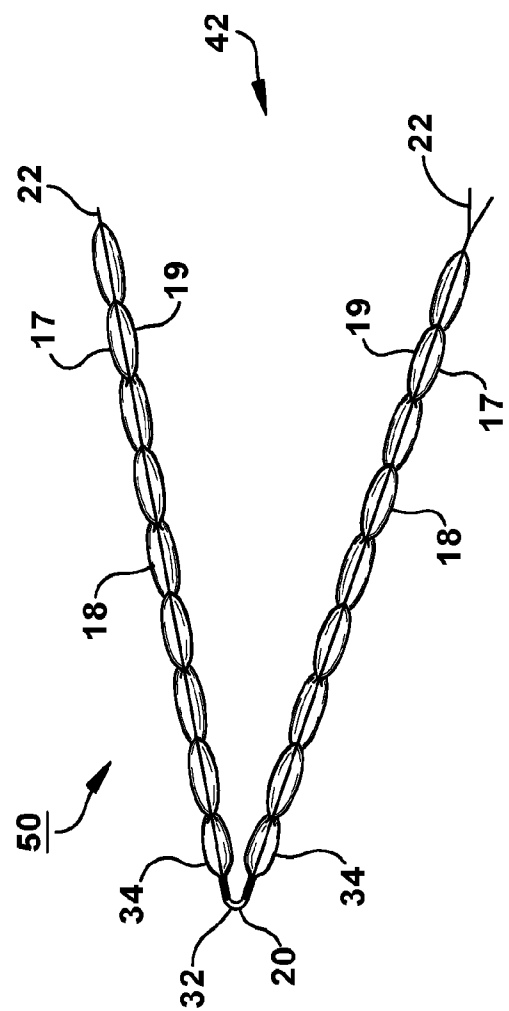


Fig. 3

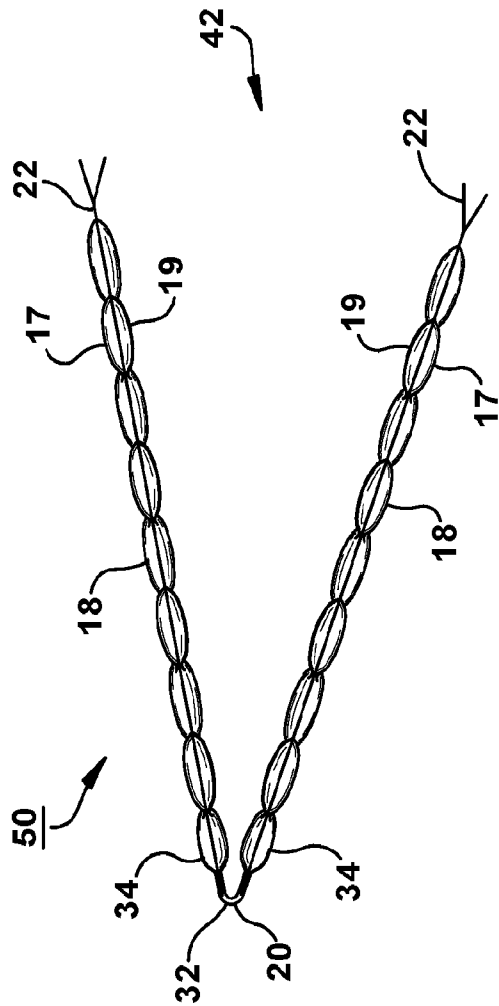


Fig. 3A

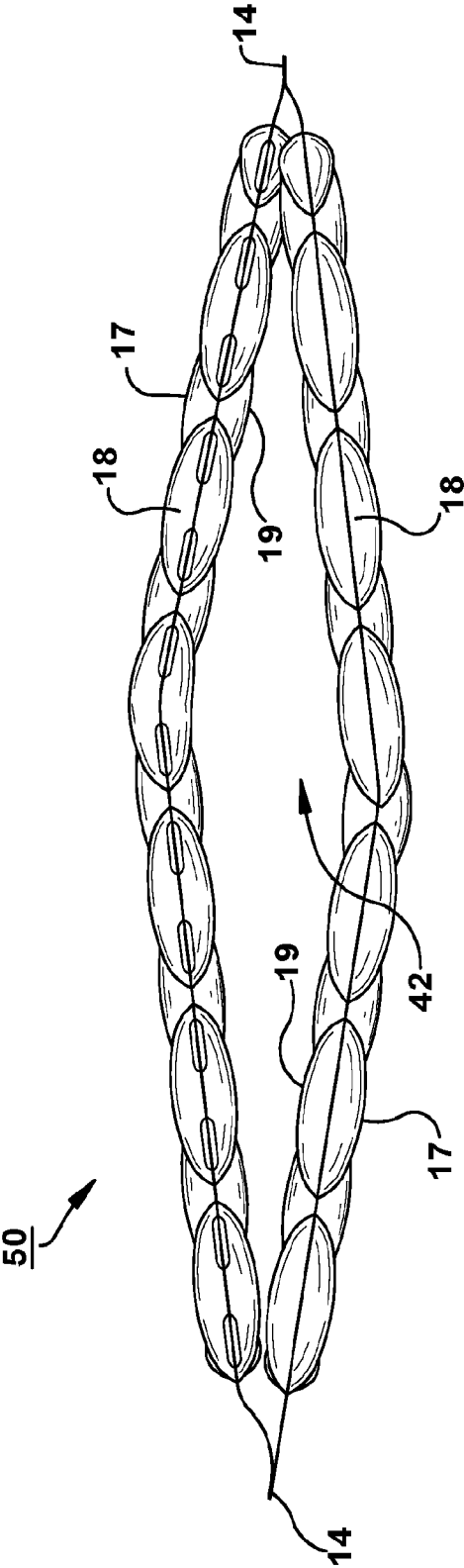


Fig. 4

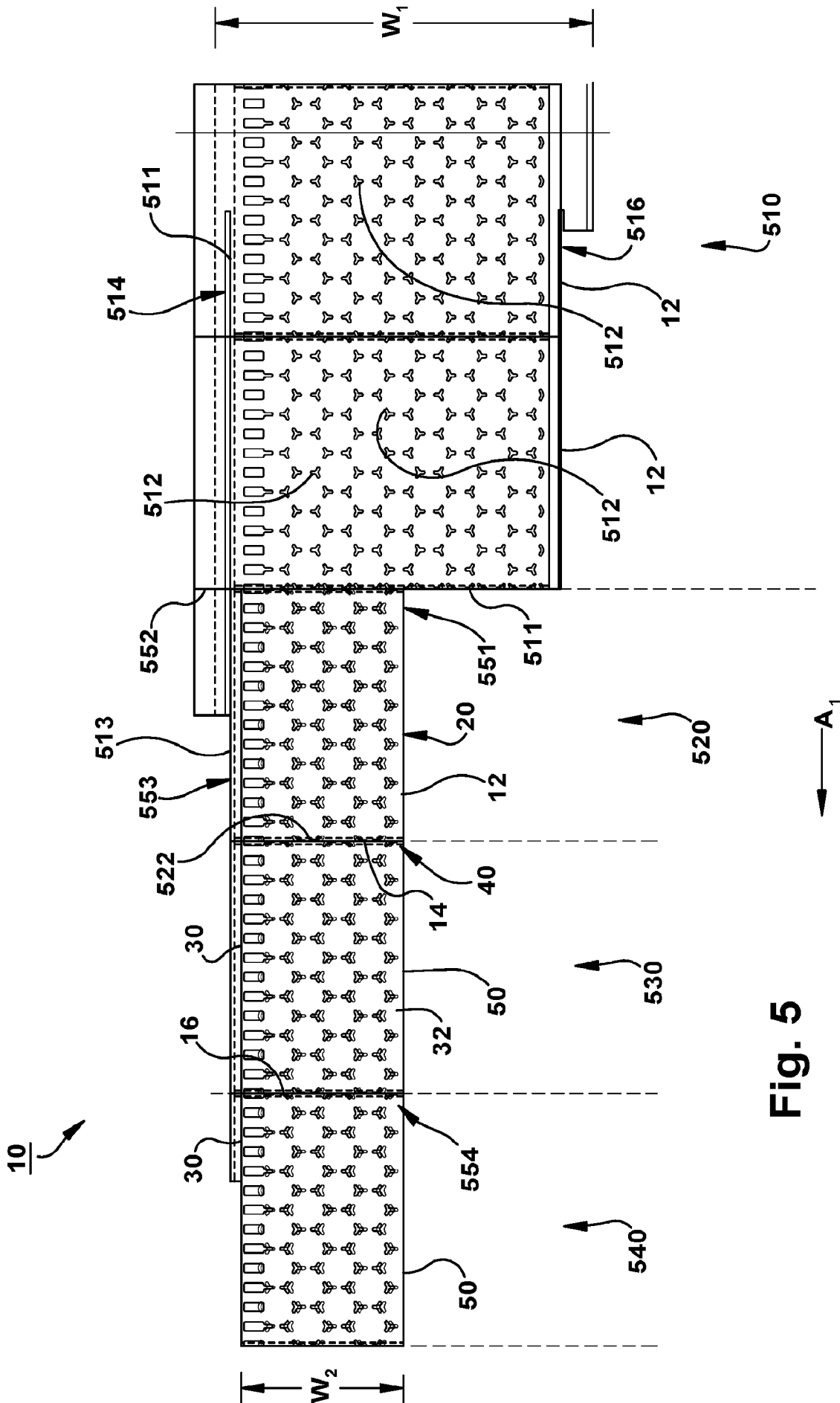


Fig. 5

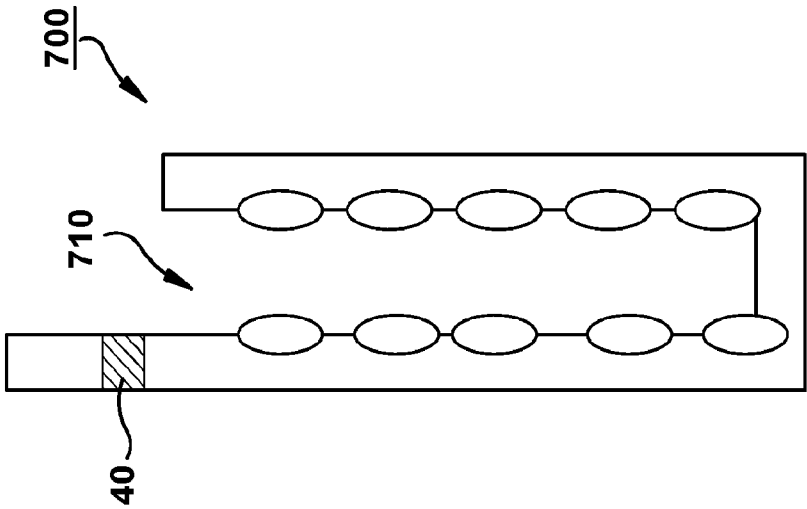


Fig. 6b

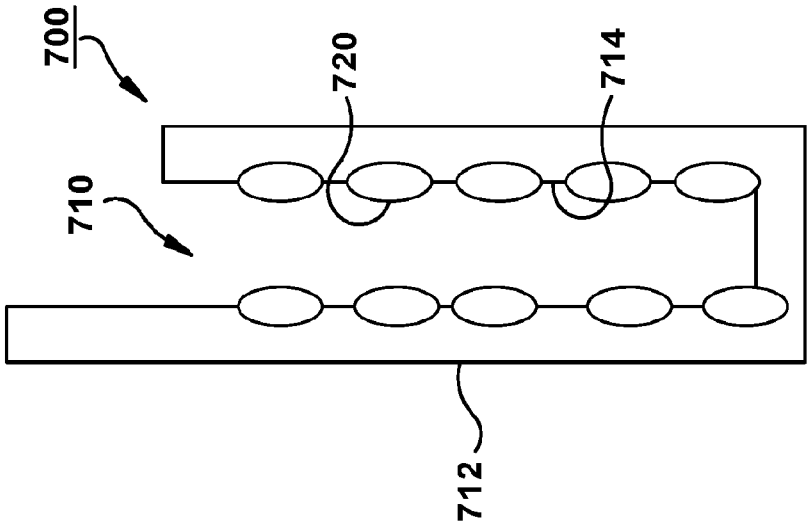


Fig. 6a

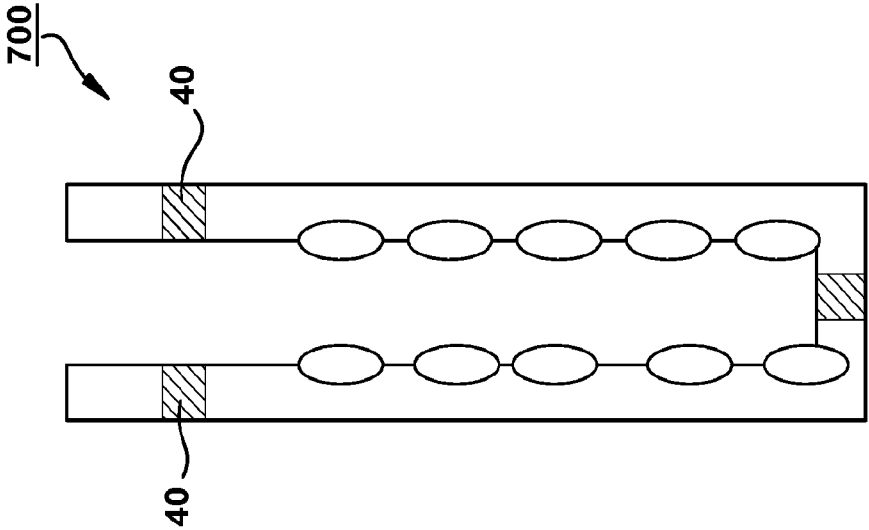


Fig. 6d

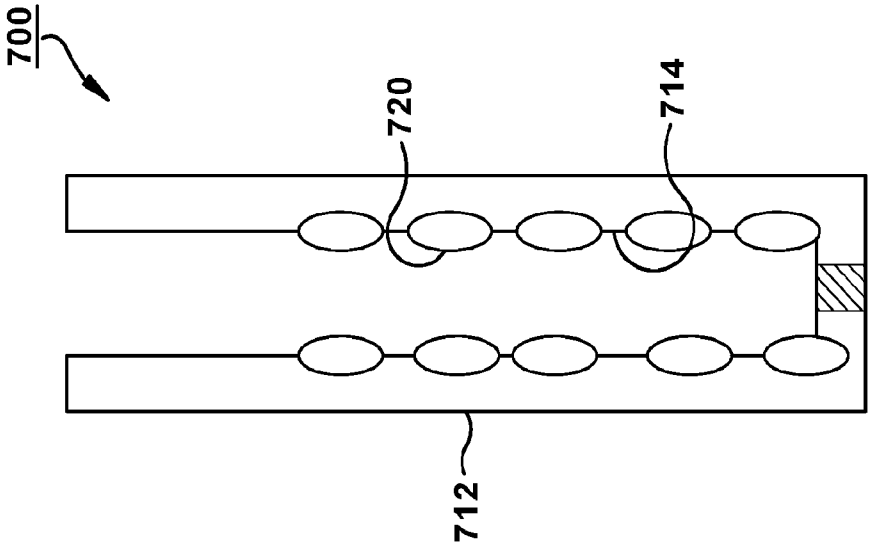
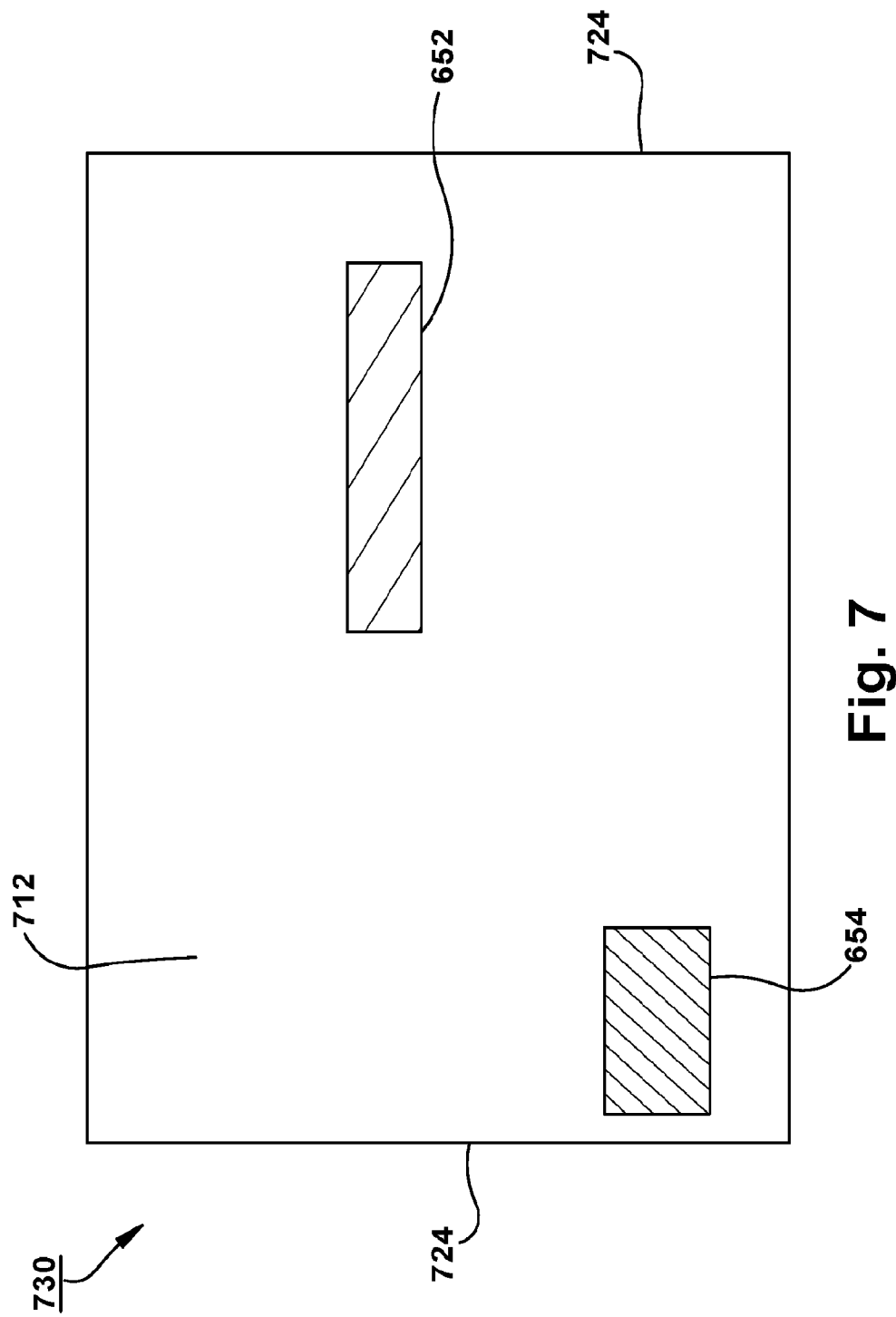


Fig. 6c



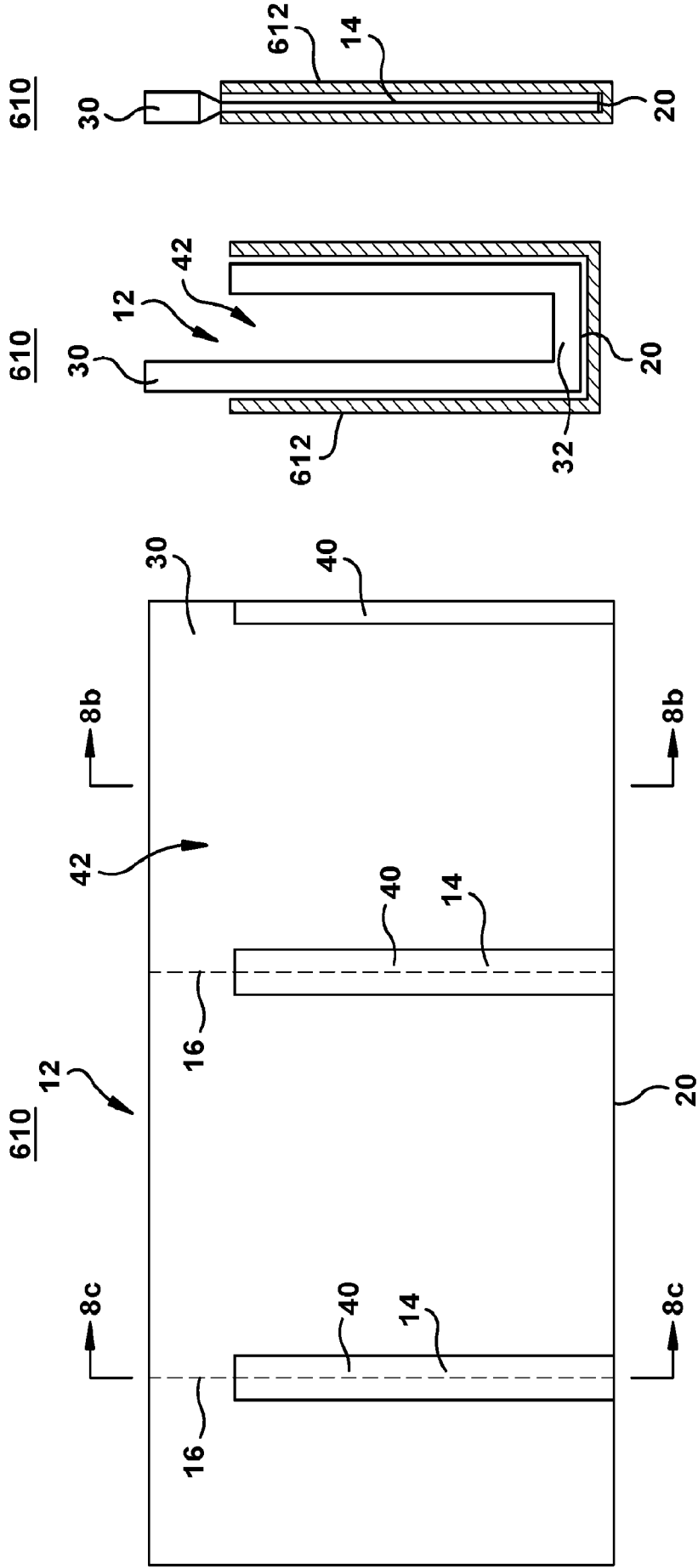


Fig. 8a

Fig. 8b

Fig. 8c

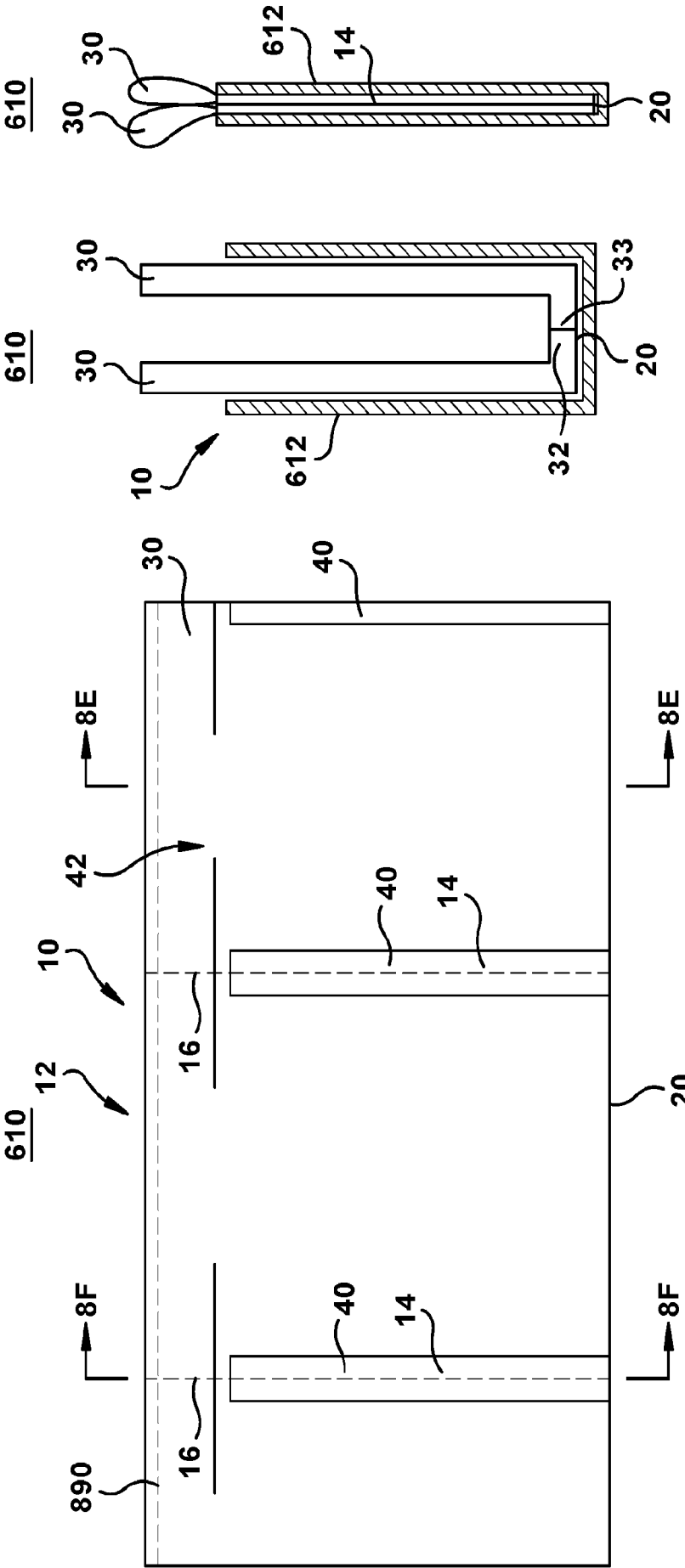


Fig. 8e

Fig. 8d

Fig. 8f

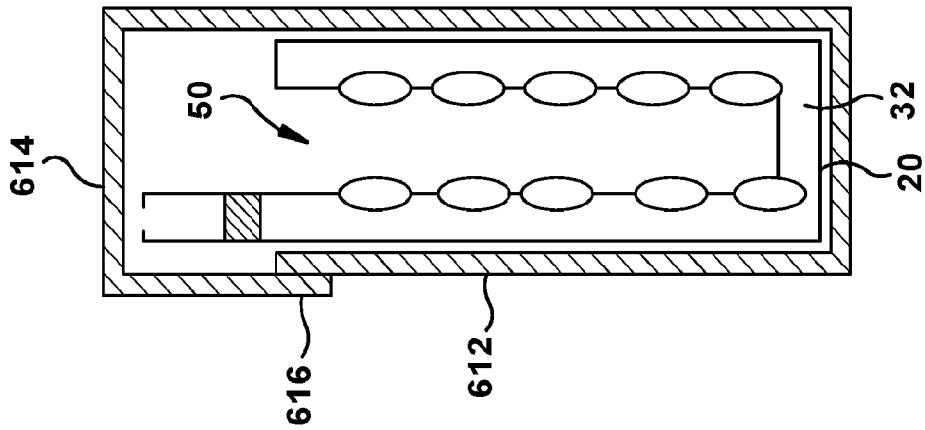


Fig. 11a

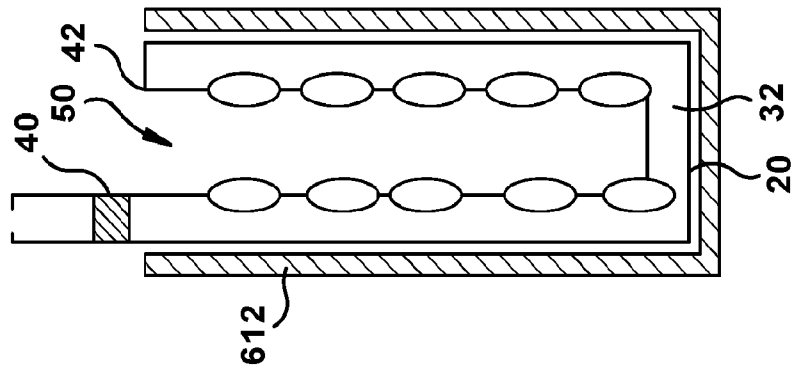


Fig. 10

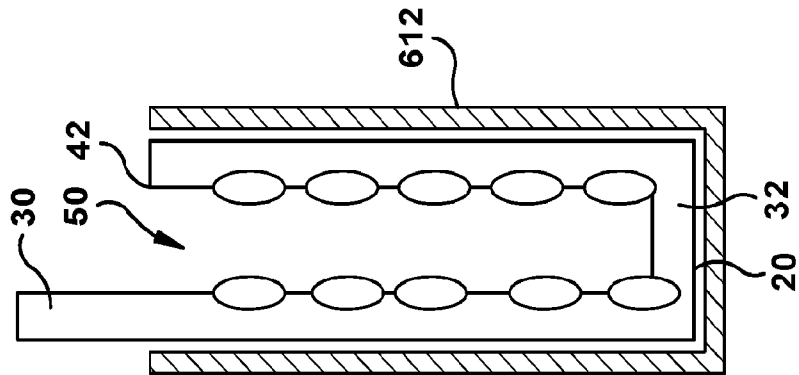


Fig. 9

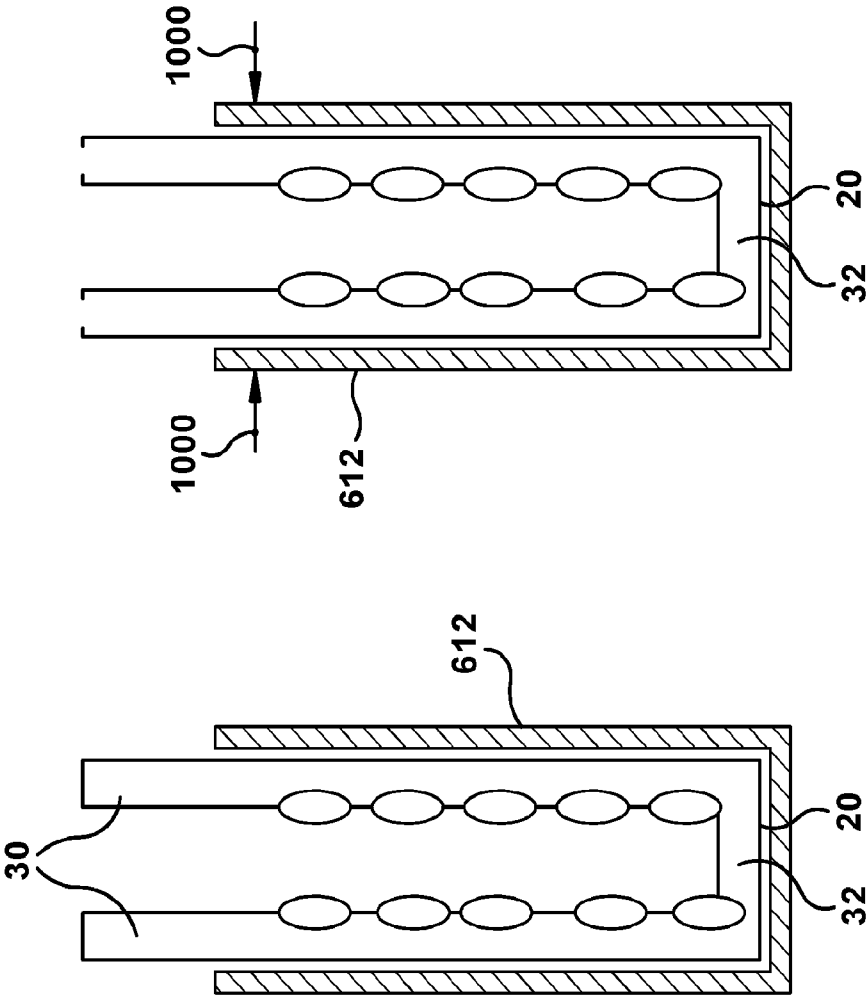
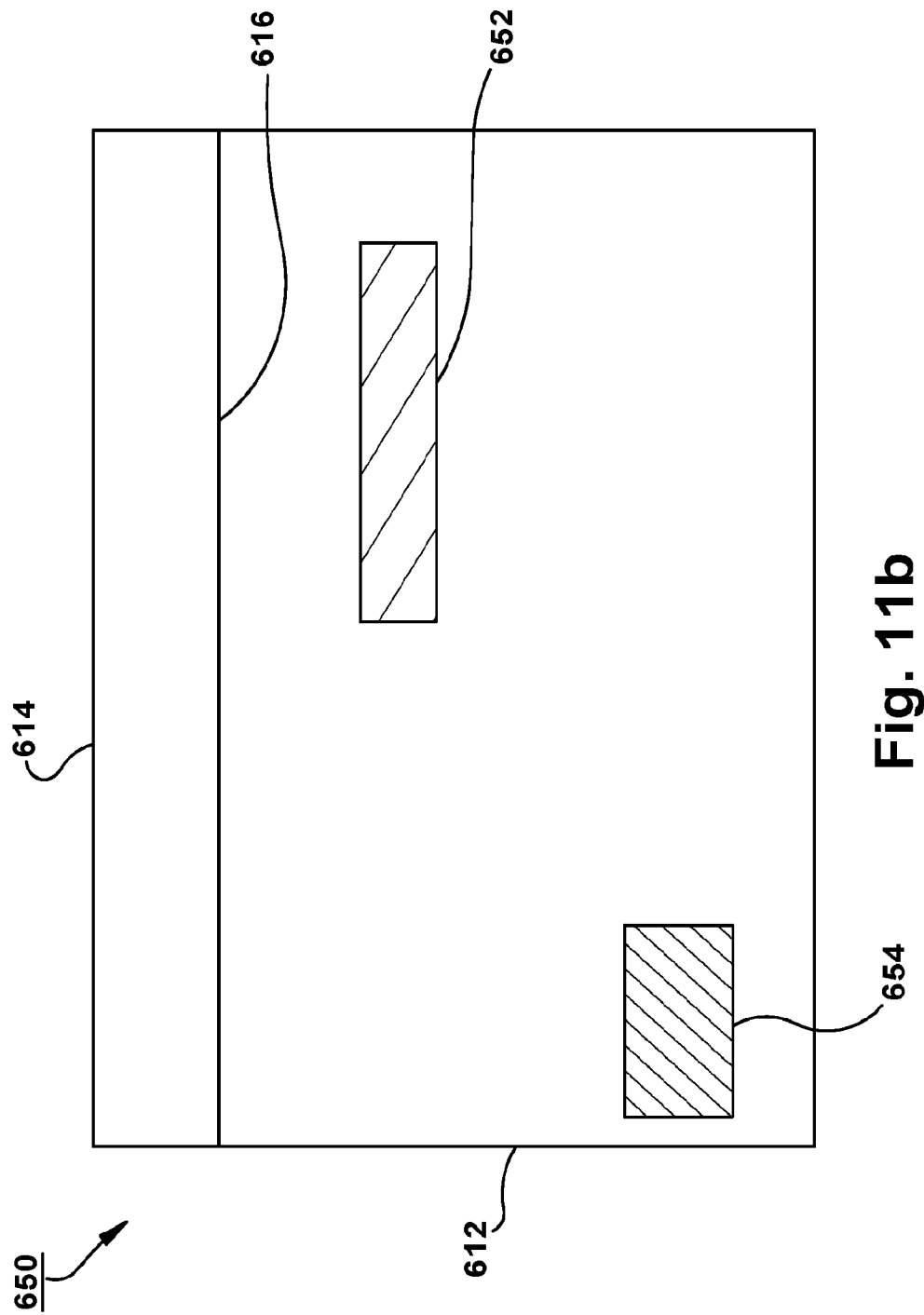


Fig. 10a

Fig. 9a



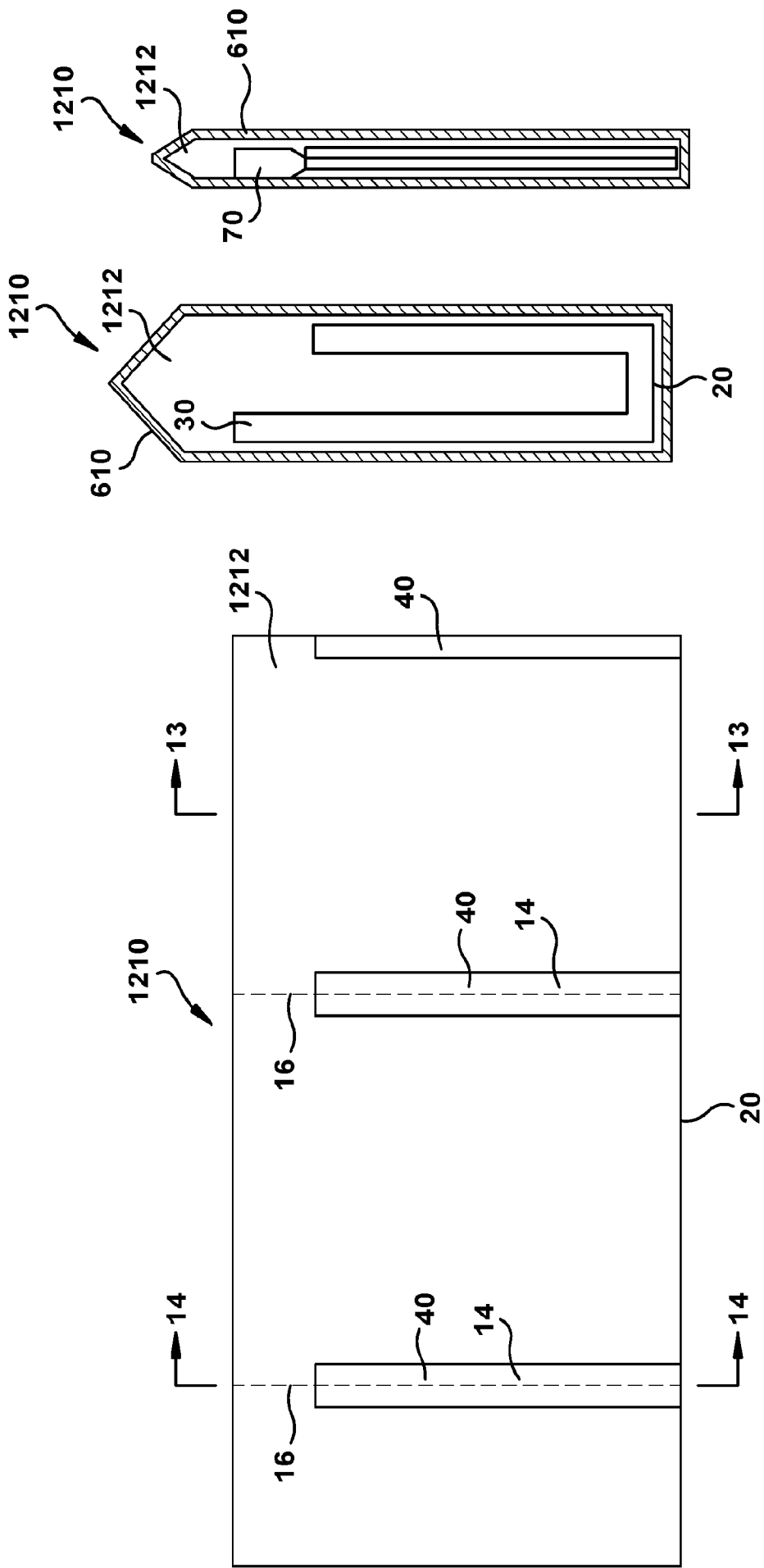


Fig. 13

Fig. 12

Fig. 14

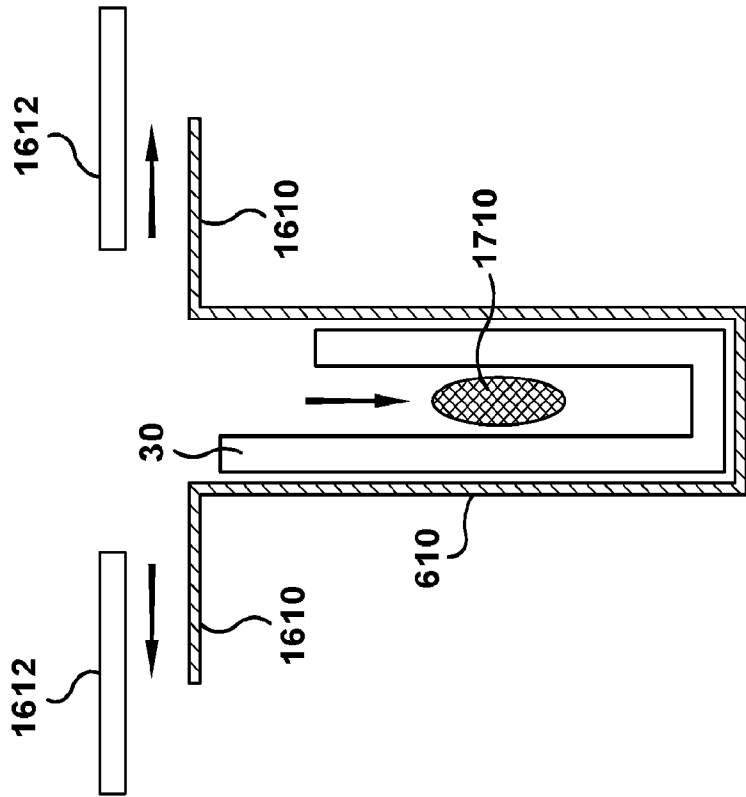


Fig. 15

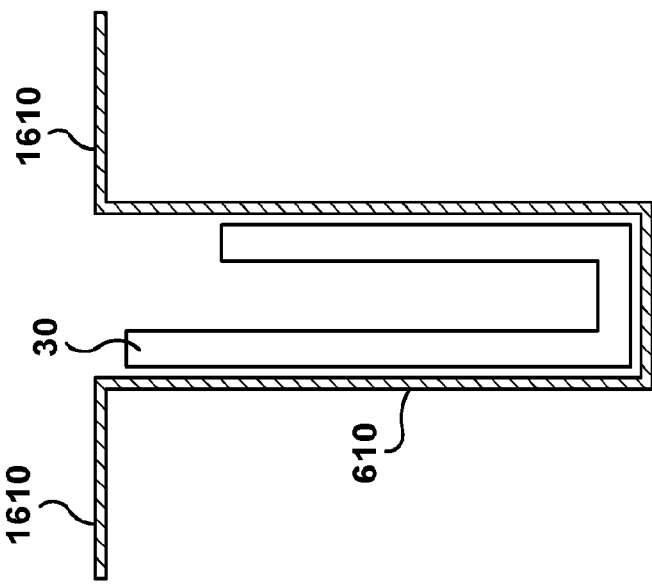


Fig. 16

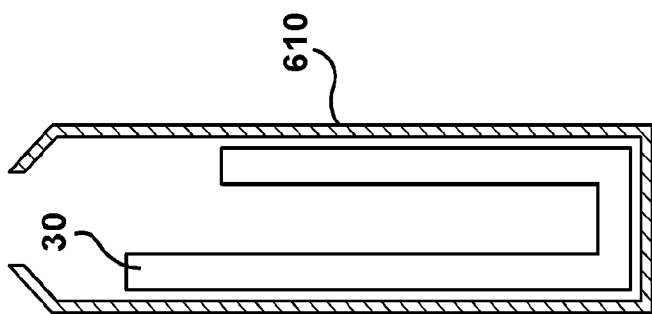


Fig. 17

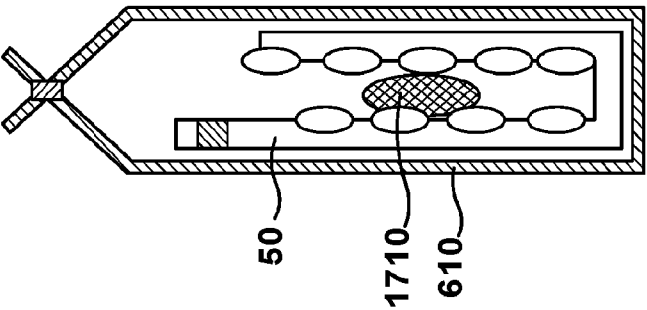


Fig. 20

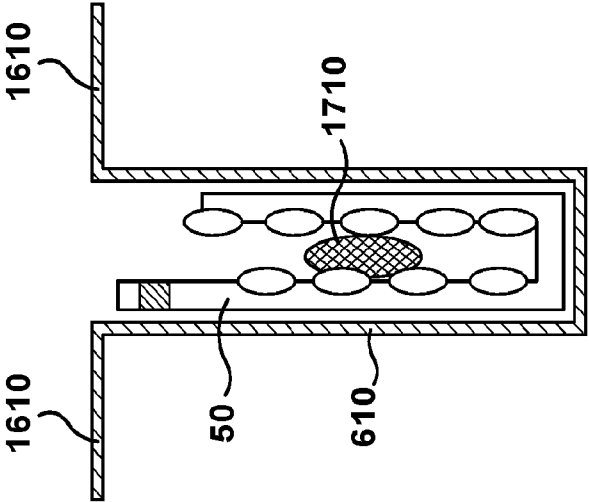


Fig. 19

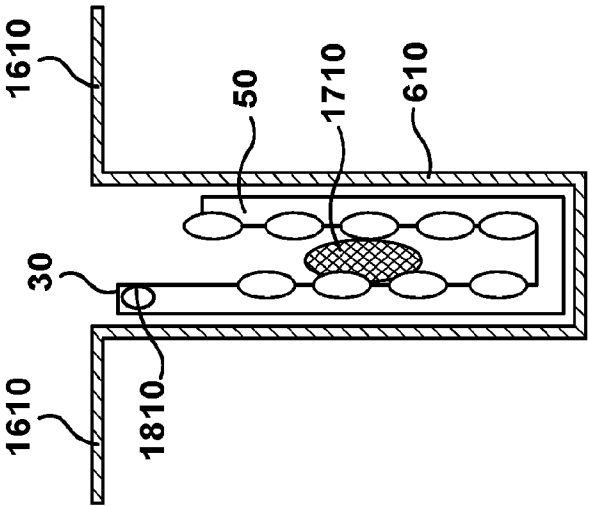


Fig. 18

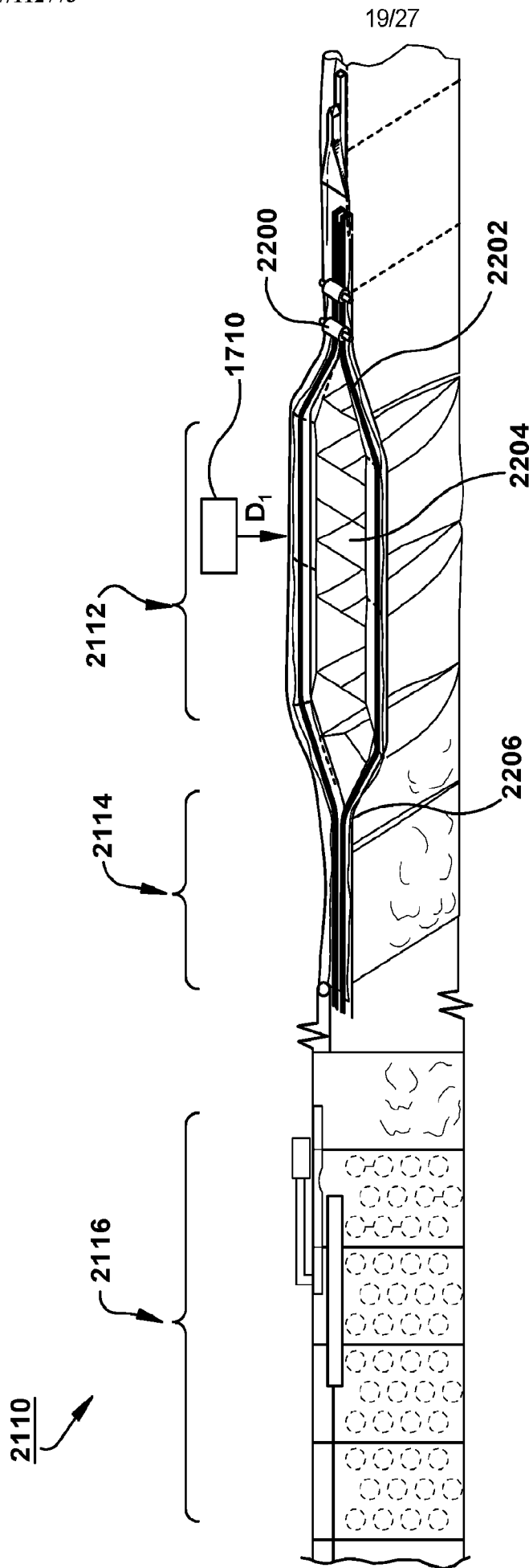


Fig. 21a

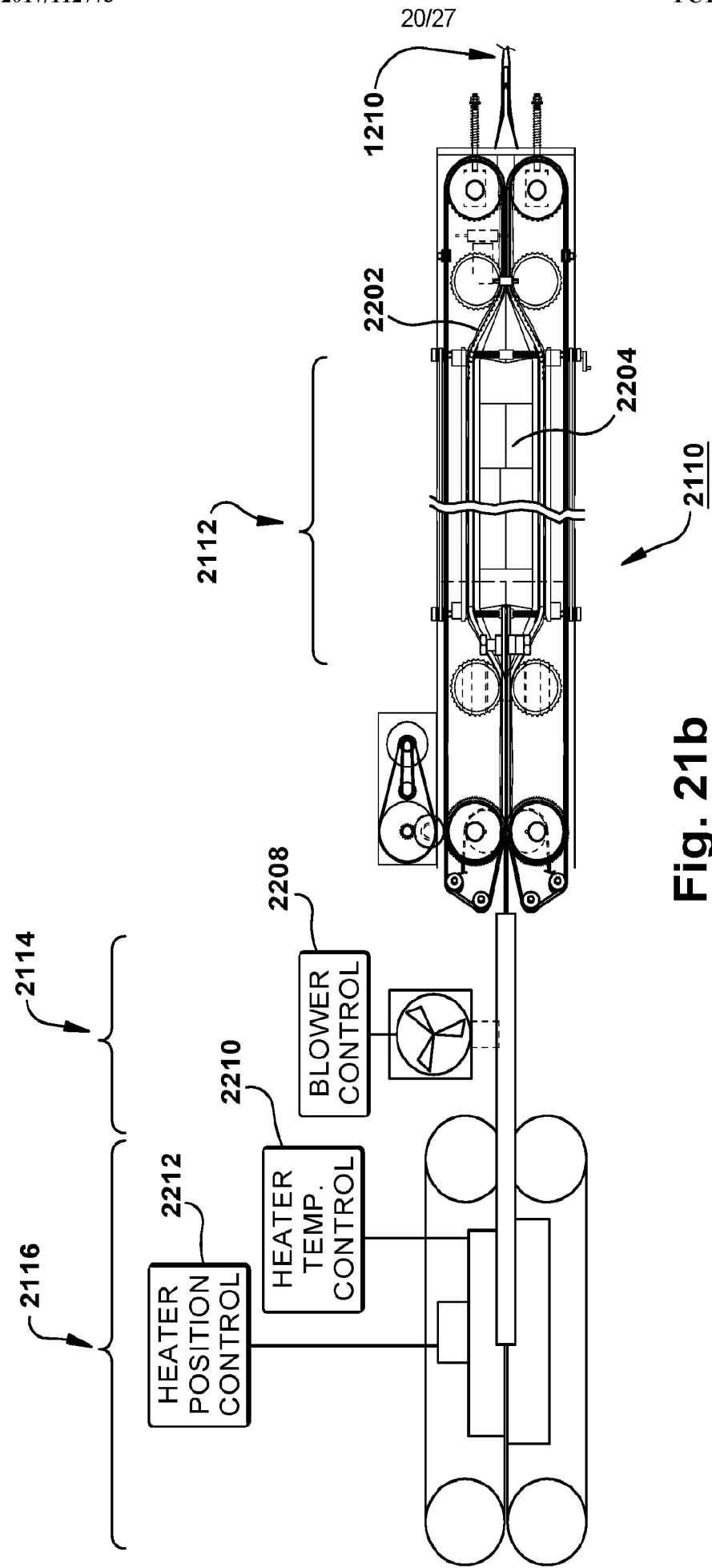
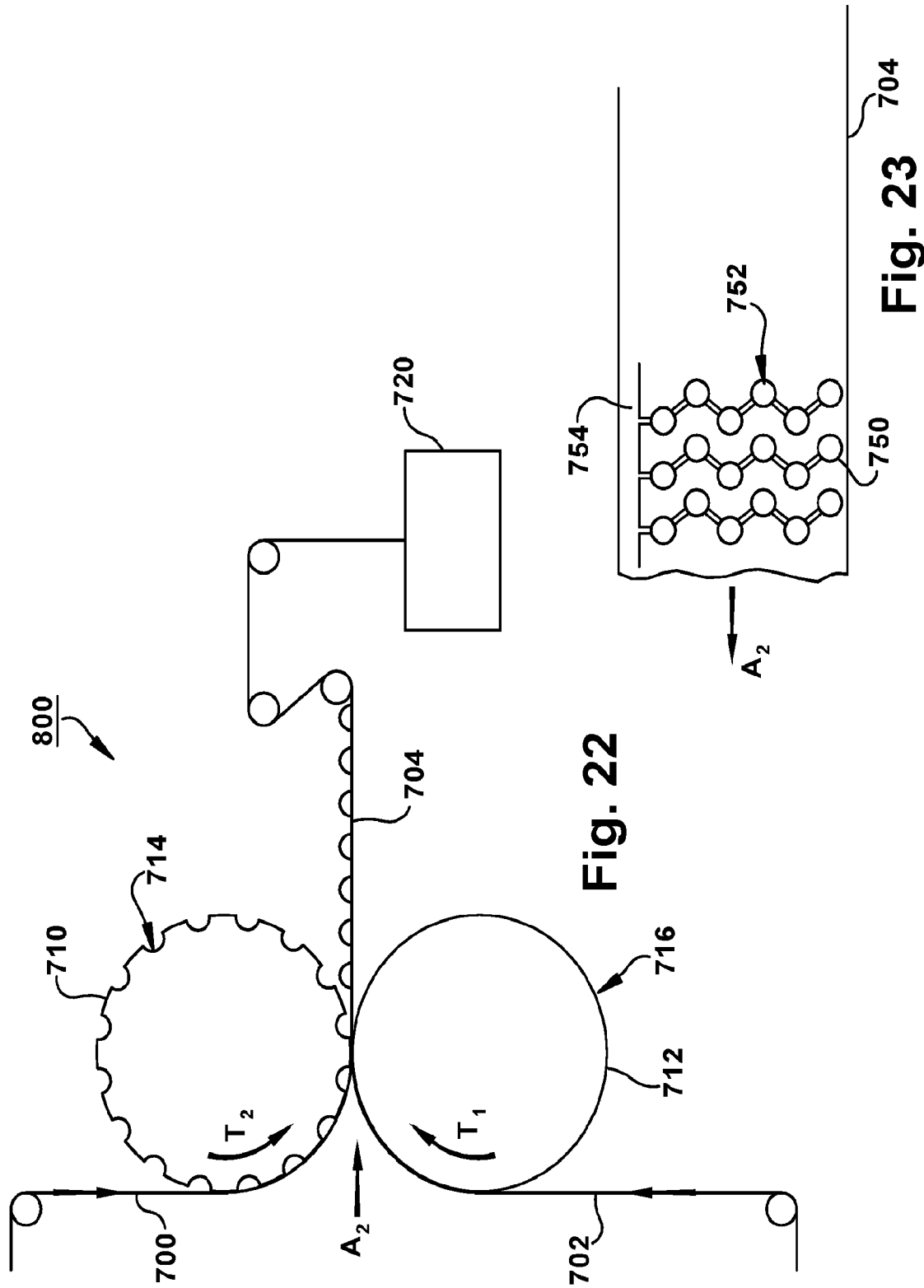


Fig. 21b



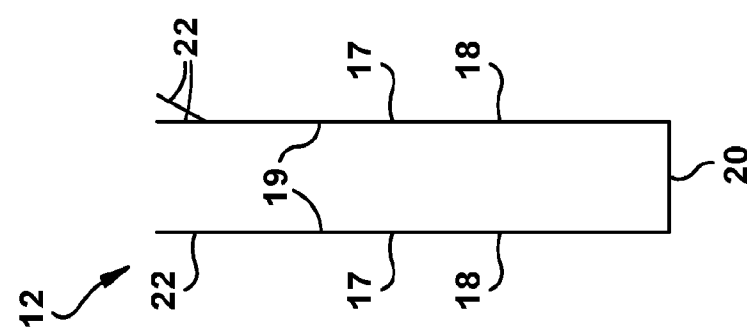


Fig. 24a

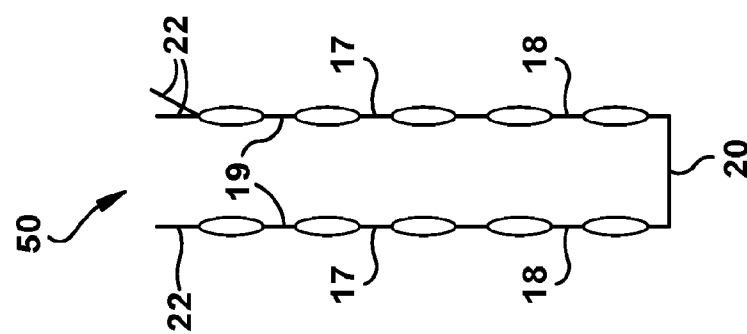


Fig. 24b

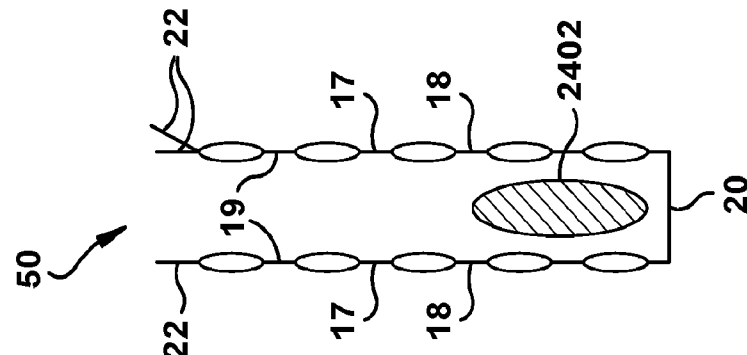


Fig. 24c

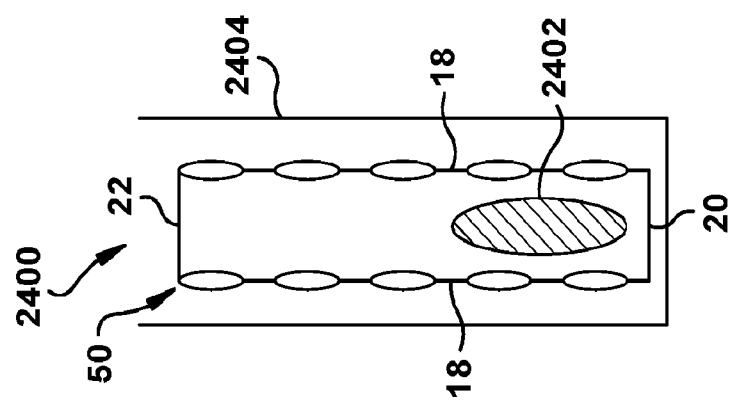


Fig. 24d

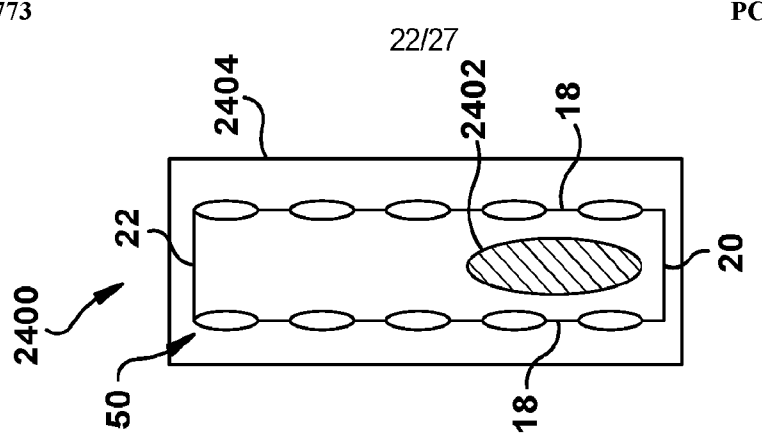
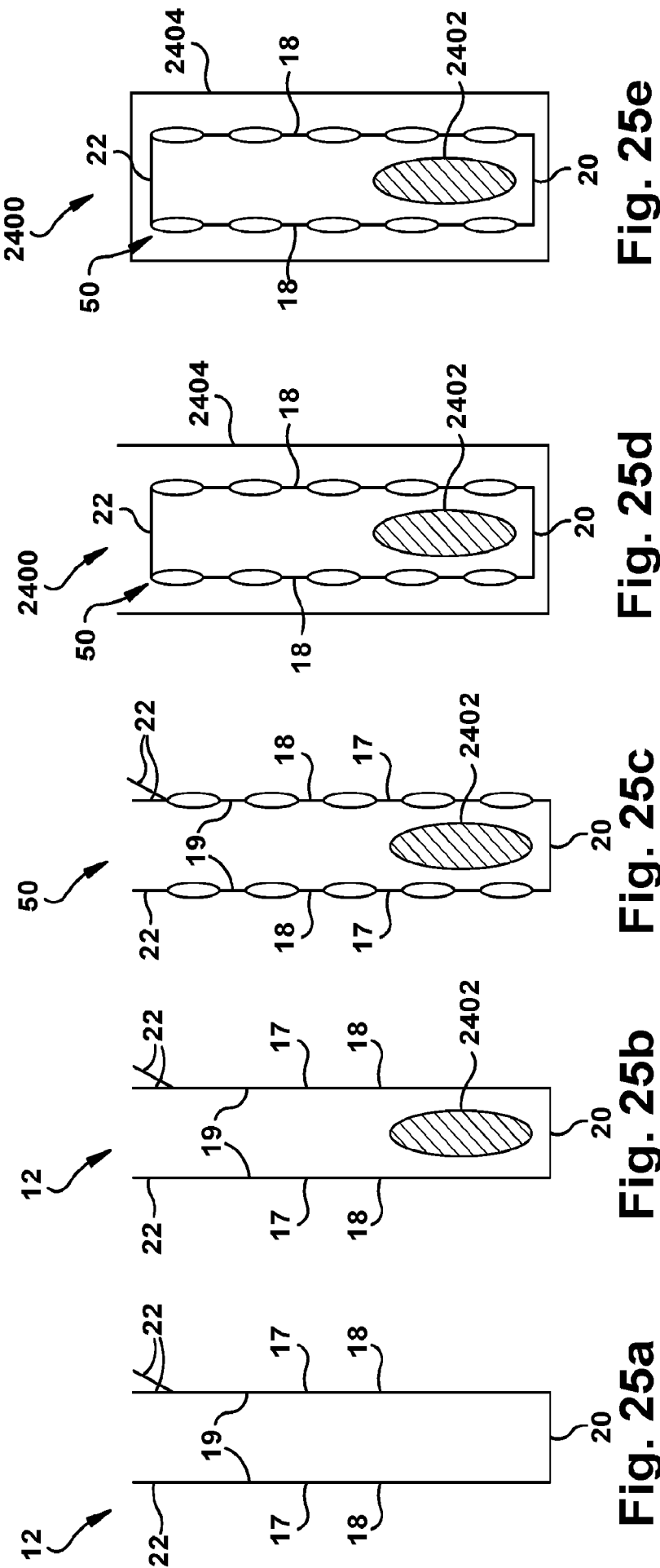


Fig. 24e



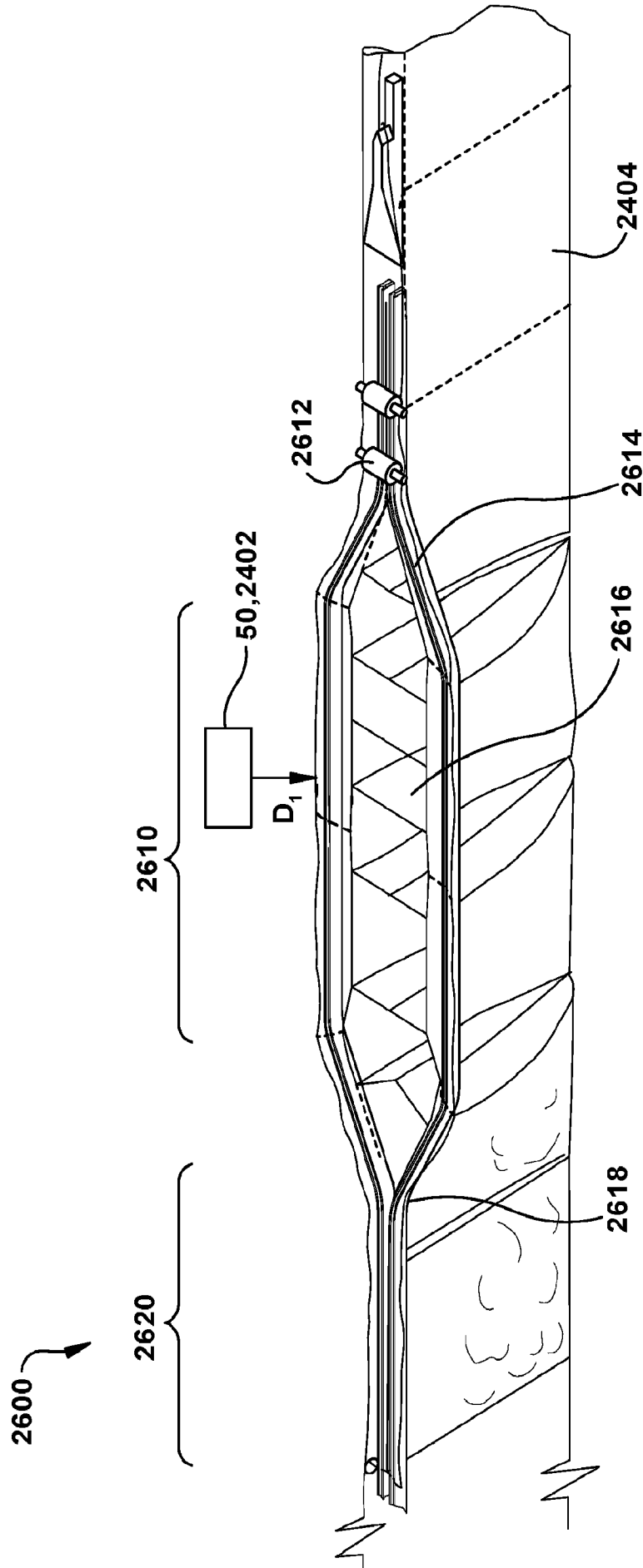


Fig. 26a

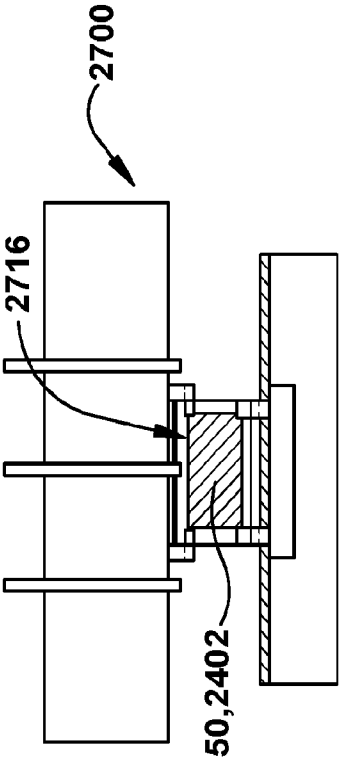


Fig. 27c

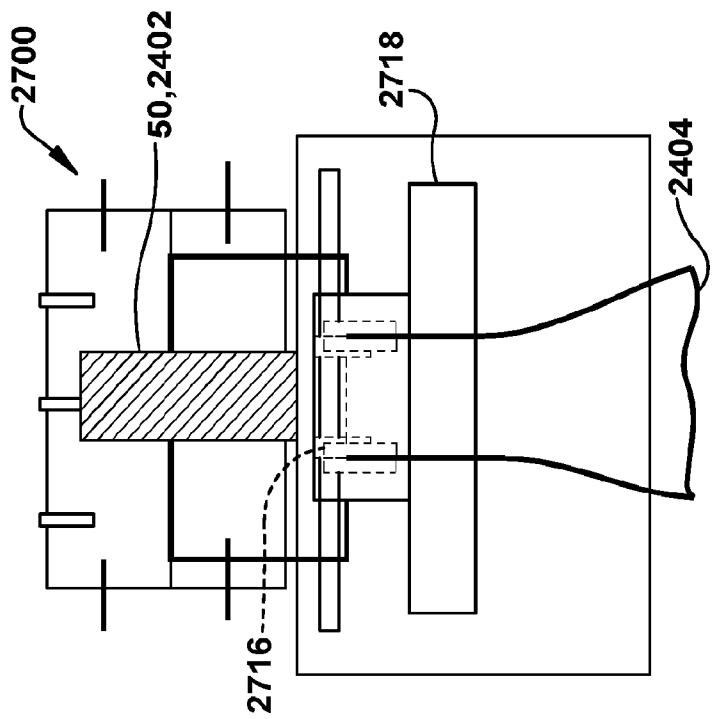


Fig. 27a

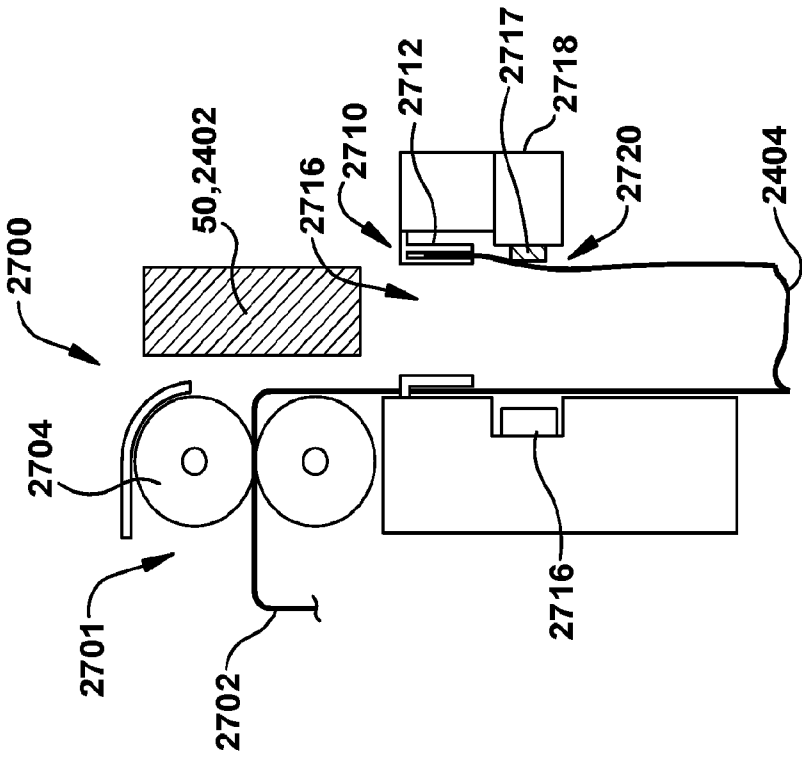


Fig. 27b

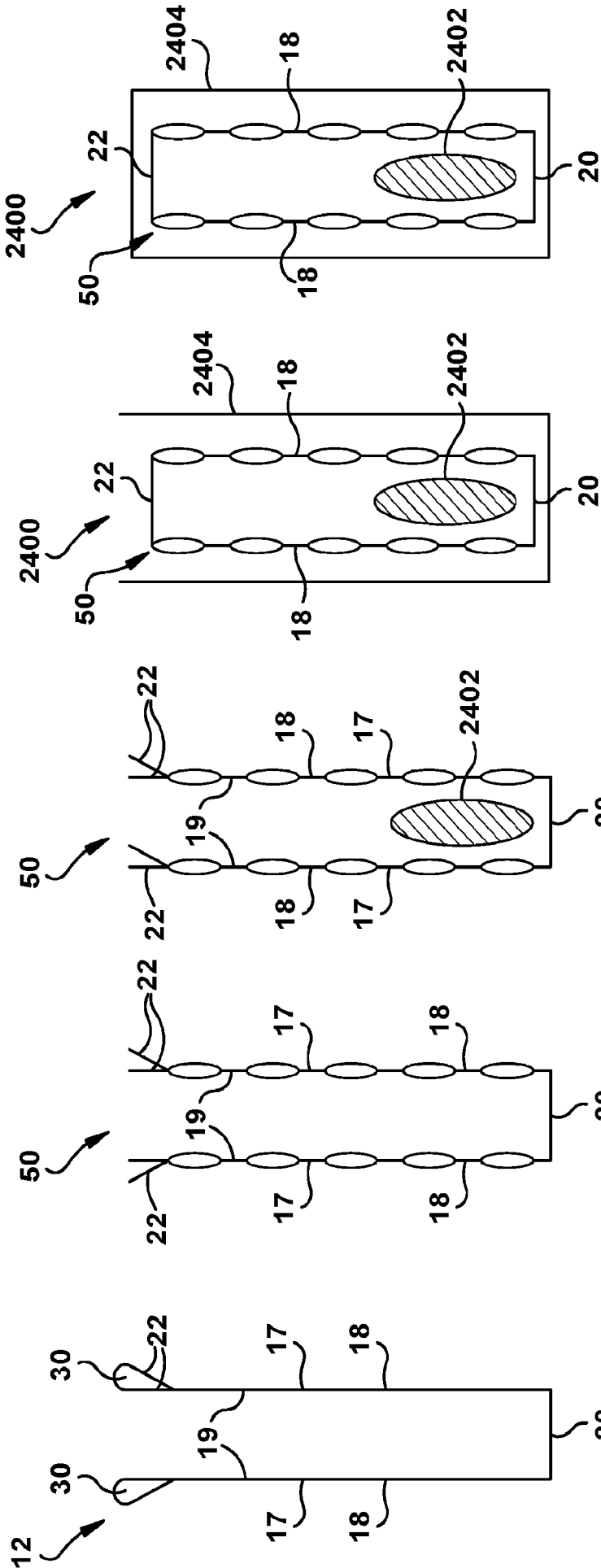


Fig. 28e

Fig. 28d

Fig. 28c

Fig. 28b

Fig. 28a

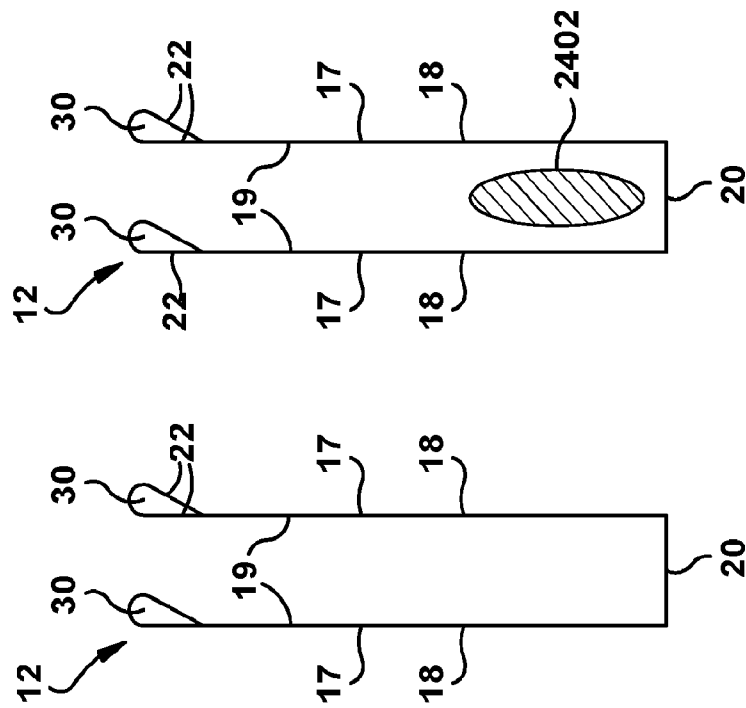


Fig. 29a

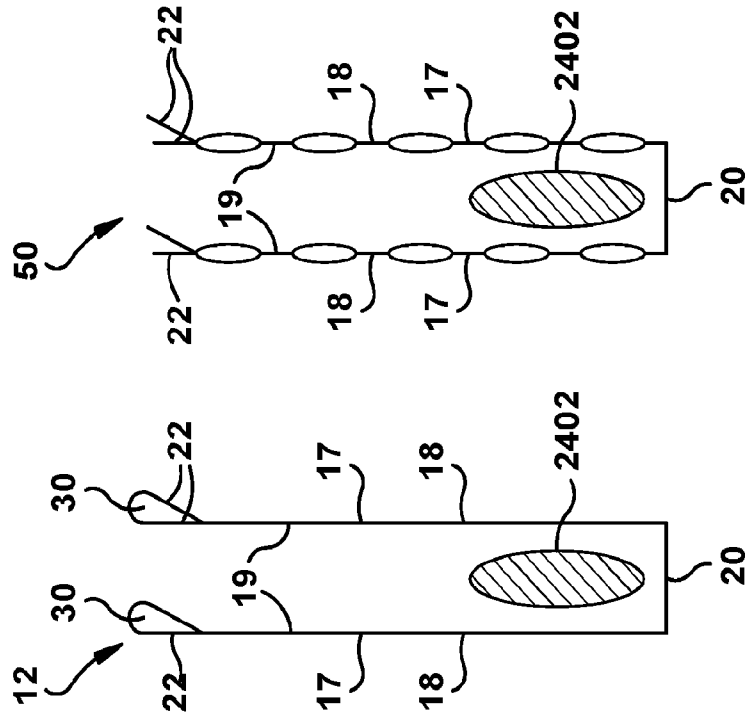


Fig. 29b

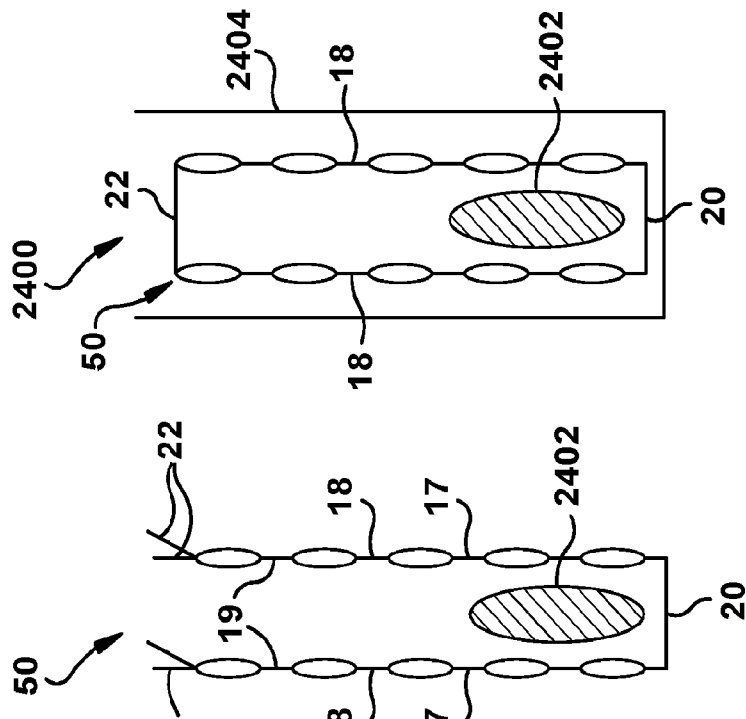


Fig. 29c

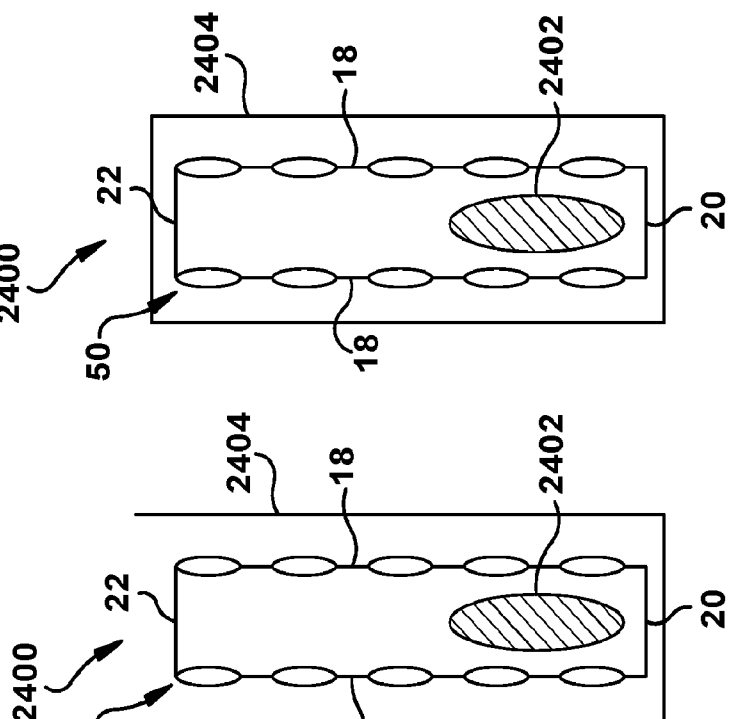


Fig. 29d

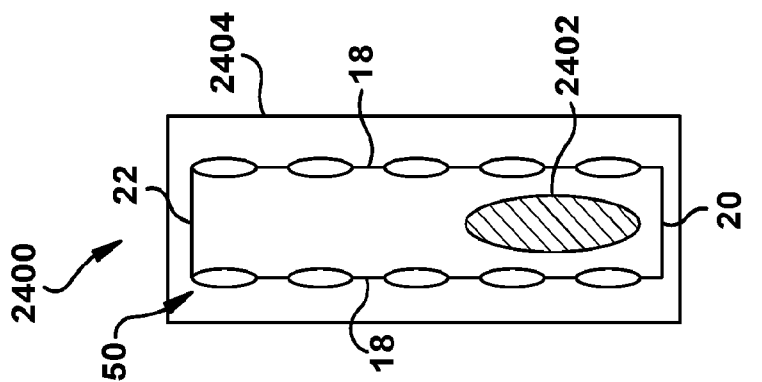


Fig. 29e

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/68025

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B65B 55/20 (2017.01)

CPC - B65B 55/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - B65B 55/20 (2017.01)

CPC - B65B 55/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

IPC(8) - B65B 31/00, 31/04, 43/00, 43/12, 43/26, 43/34, 43/36, 55/20 (2017.01)

CPC - B31D 5/0073; B65B 31/00, 31/04, 43/00, 43/12, 43/26, 43/34, 43/36, 55/20

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatBase; GOOGLE (PATENTS, SCHOLAR) Search Terms Used: inflate, cushion, bubble, wrap, package, envelope, bag

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/0260094 A1 (WEHRMANN) 18 September 2014 (18.09.2014) entire document	1-13
A	US 2004/0232031 A1 (NISHI et al) 25 November 2004 (25.11.2004) entire document	1-13
A	US 2004/0216429 A1 (TANAKA et al) 04 November 2004 (04.11.2004) entire document	1-13
A	US 5,743,070 A (LERNER et al) 28 April 1998 (28.04.1998) entire document	1-13
A	US 5,060,801 A (VILAS-BOAS) 29 October 1991 (29.10.1991) entire document	1-13

☐ Further documents are listed in the continuation of Box C.


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"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

23 February 2017

Date of mailing of the international search report

10 APR 2017

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-8300

Authorized officer:

Lee W. Young

PLI Helpdesk: 571-272-4300
PCT OSP: 571-272-7774