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(54) **PACK OF UNFOLDED PLASTIC BAGS**

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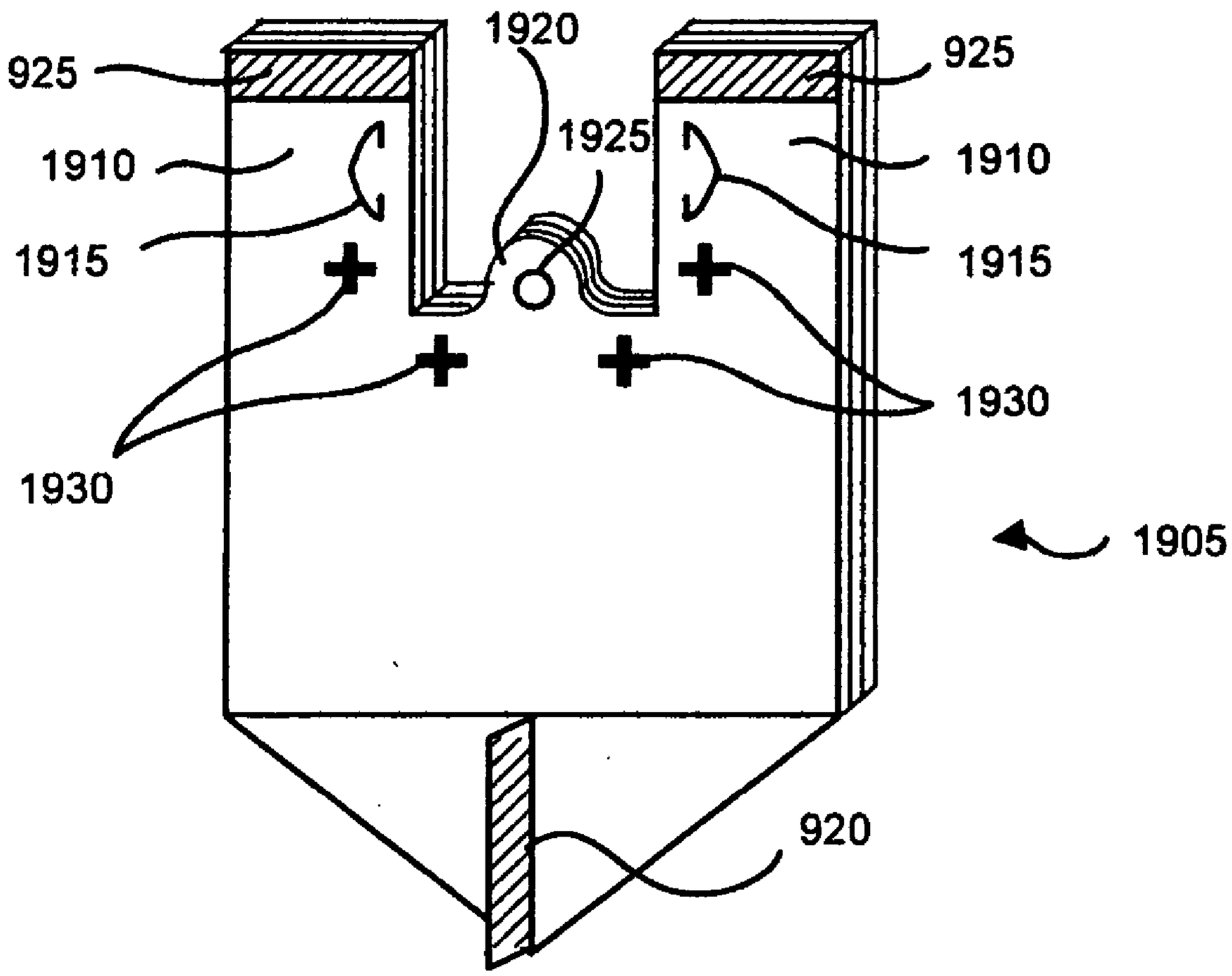
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(57) **ABSTRACT**

In an embodiment of the invention, a bottom seal of a plastic bag is strengthened by welding together 8 layers of plastic film. In one respect, an embodiment of the invention provides a bag pack that includes multiple T-shirt style plastic bags. The bag pack may be manufactured by folding a 4-layered structure into an 8-layered structure, welding a bottom edge, and then unfolding the 8-layered structure before stacking 4-layered bags into a bag pack.



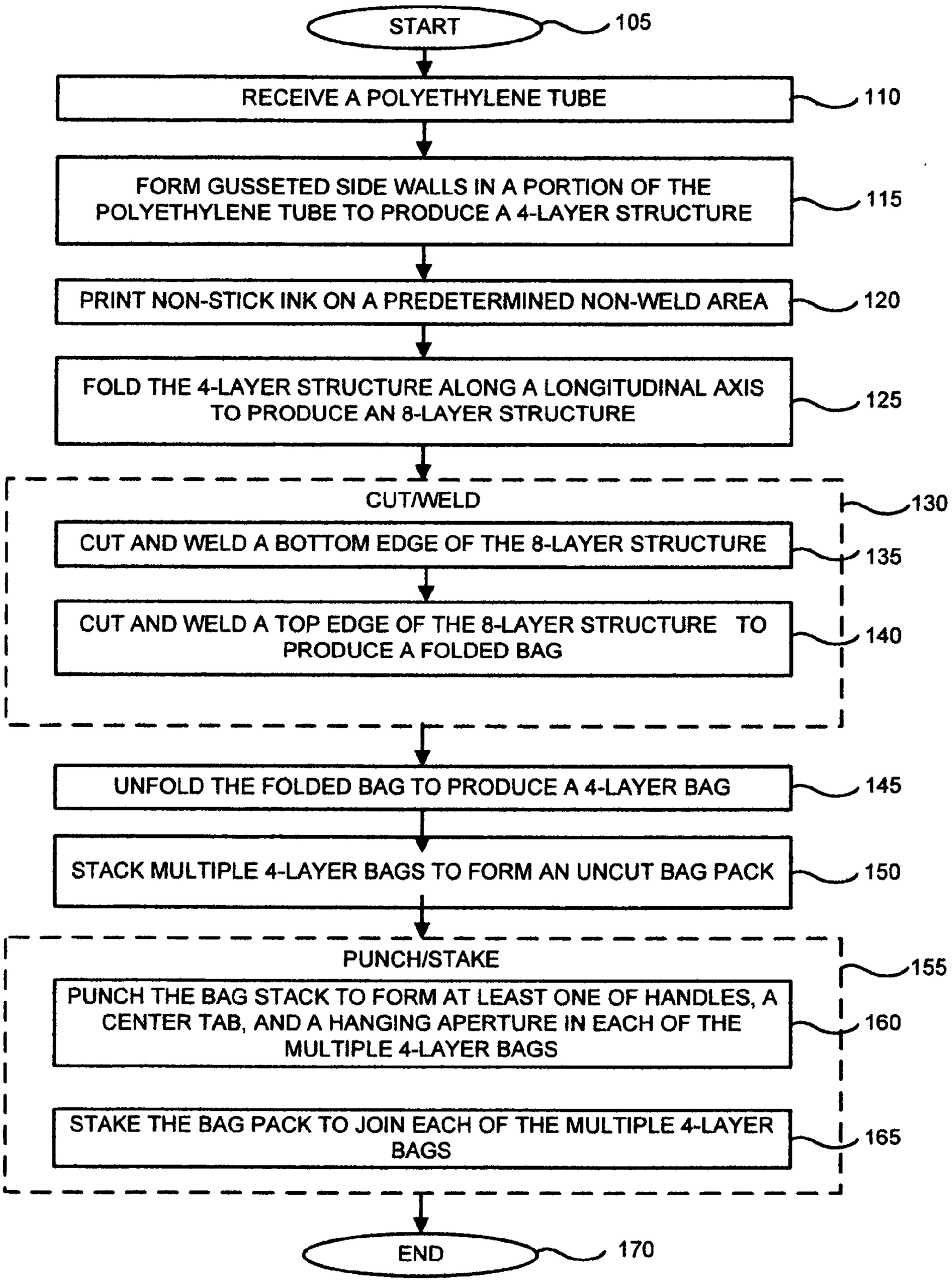
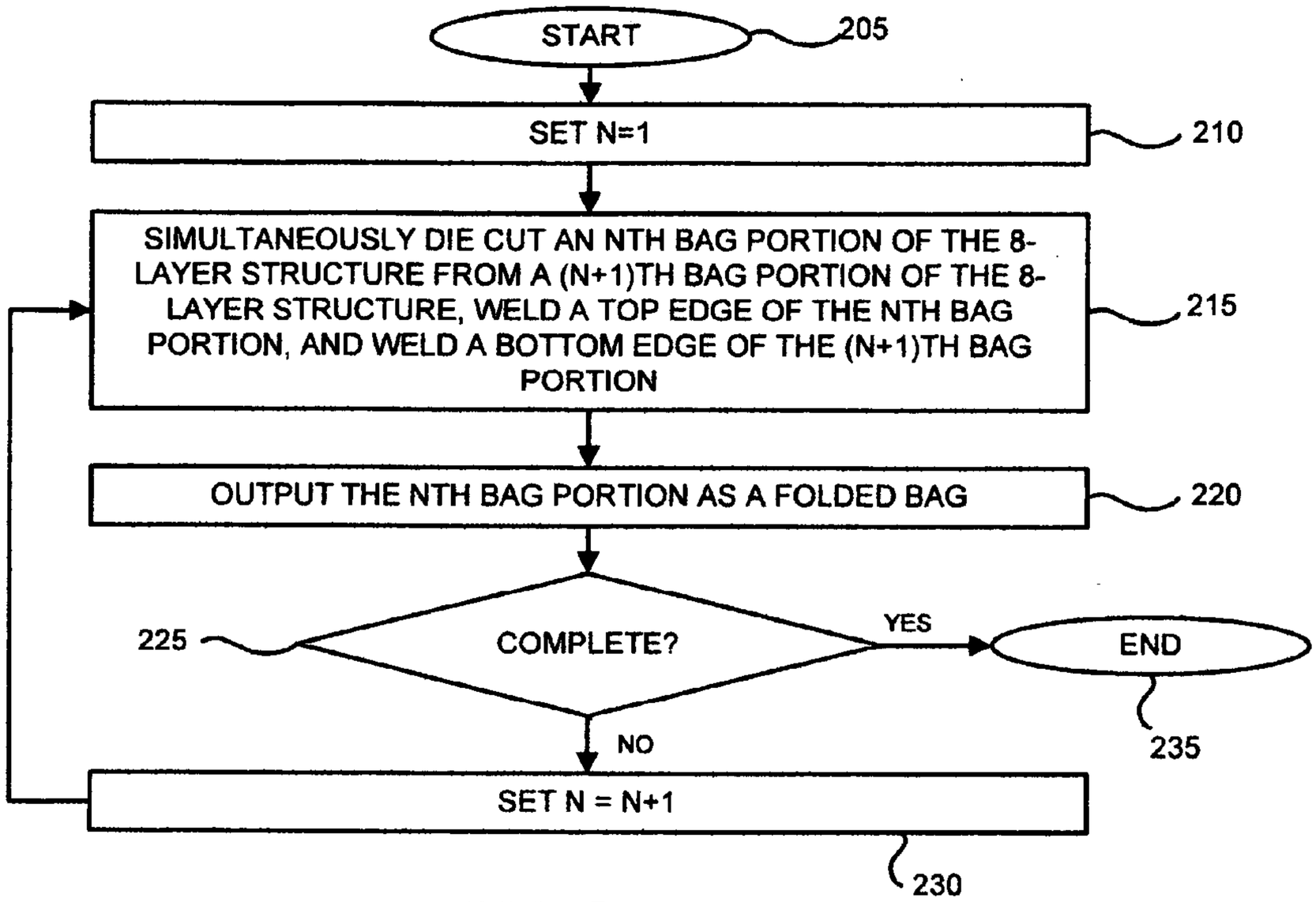
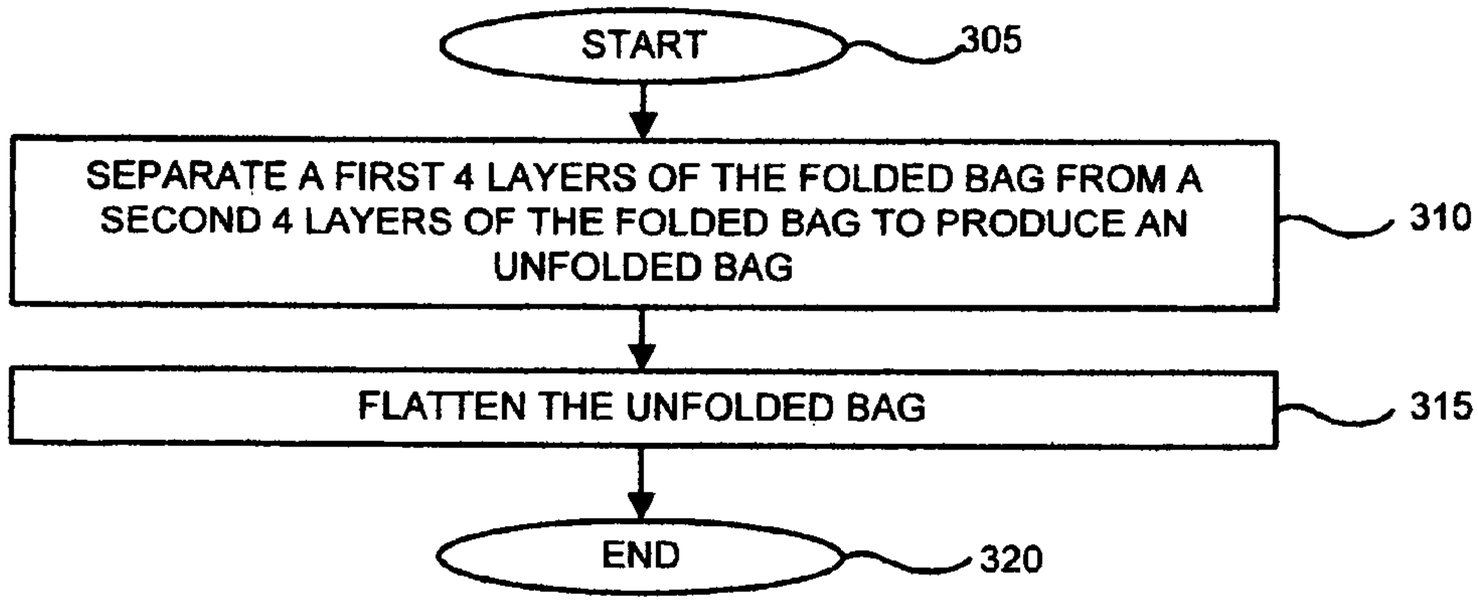

START
105
RECEIVE A POLYETHYLENE TUBE
110
FORM GUSSETED SIDE WALLS IN A PORTION OF THE POLYETHYLENE TUBE TO PRODUCE A 4-LAYER STRUCTURE
115
PRINT NON-STICK INK ON A PREDETERMINED NON-WELD AREA
120
FOLD THE 4-LAYER STRUCTURE ALONG A LONGITUDINAL AXIS TO PRODUCE AN 8-LAYER STRUCTURE
125
CUT/WELD
130
CUT AND WELD A BOTTOM EDGE OF THE 8-LAYER STRUCTURE
135
CUT AND WELD A TOP EDGE OF THE 8-LAYER STRUCTURE TO PRODUCE A FOLDED BAG
140
UNFOLD THE FOLDED BAG TO PRODUCE A 4-LAYER BAG
145
STACK MULTIPLE 4-LAYER BAGS TO FORM AN UNCUT BAG PACK
150
PUNCH/STAKE
155
PUNCH THE BAG STACK TO FORM AT LEAST ONE OF HANDLES, A CENTER TAB, AND A HANGING APERTURE IN EACH OF THE MULTIPLE 4-LAYER BAGS
160
STAKE THE BAG PACK TO JOIN EACH OF THE MULTIPLE 4-LAYER BAGS
165
END
170

FIG. 1



130

FIG. 2



145

FIG. 3

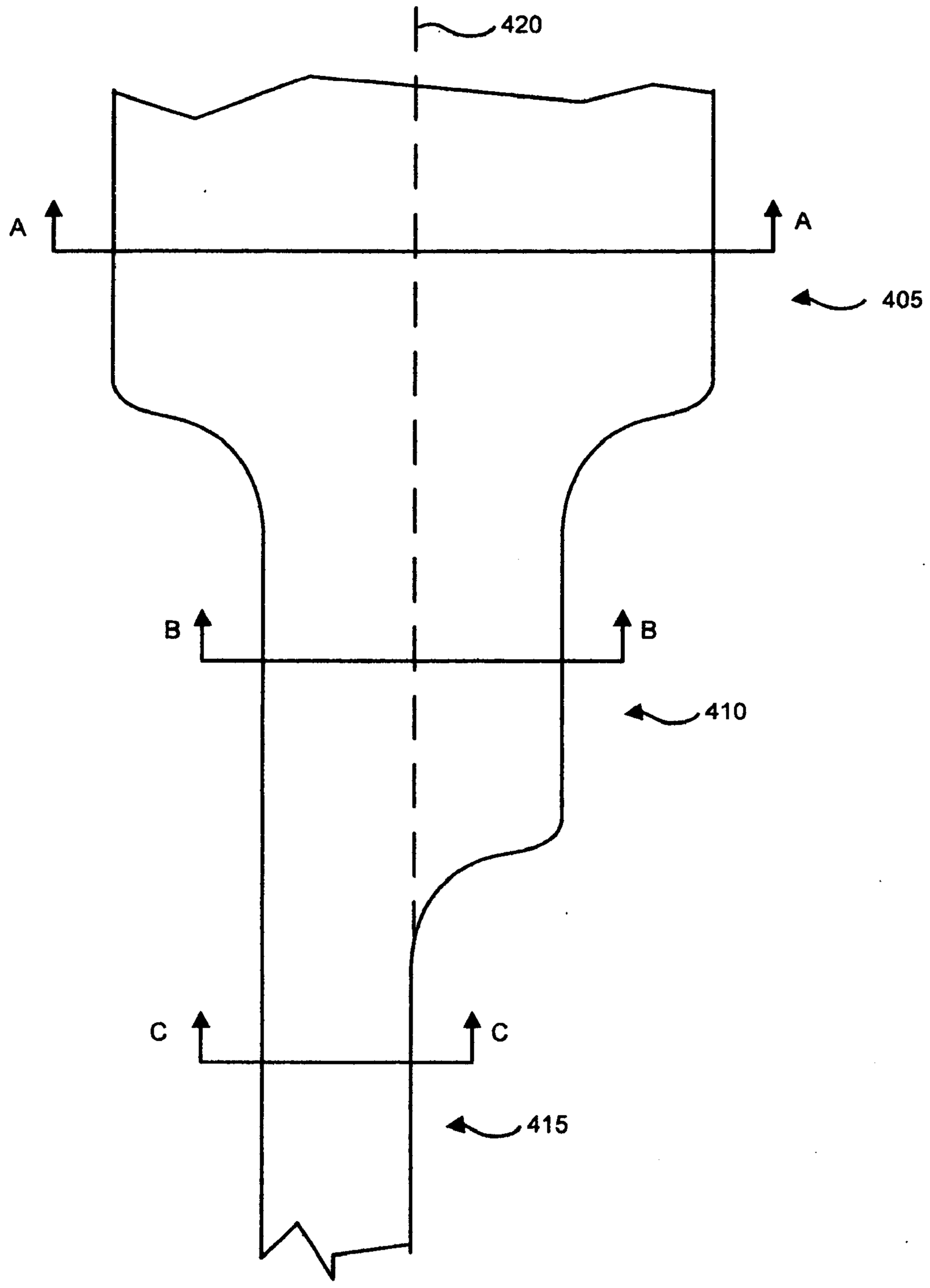


FIG. 4



FIG. 5

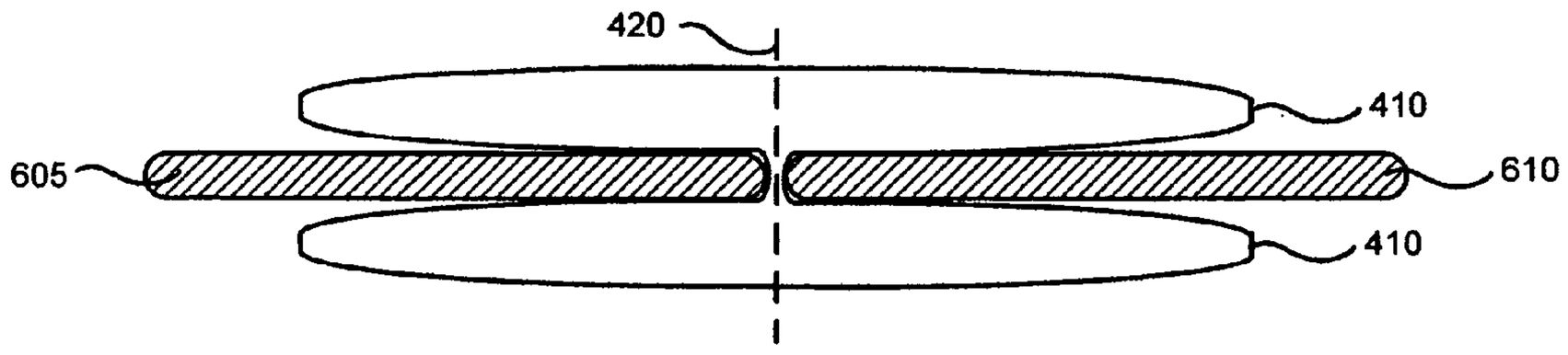


FIG. 6

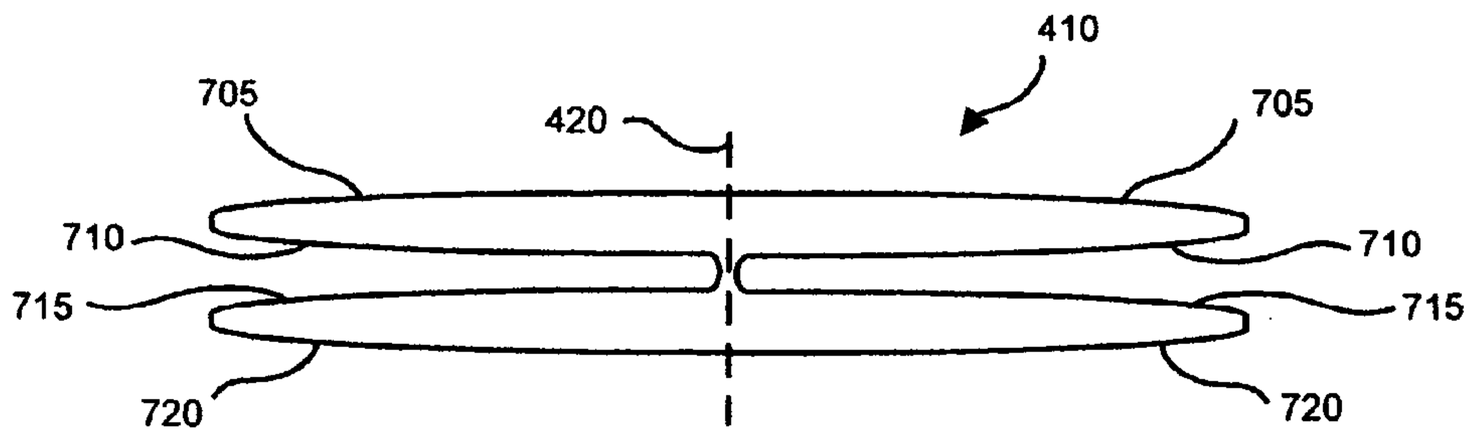


FIG. 7

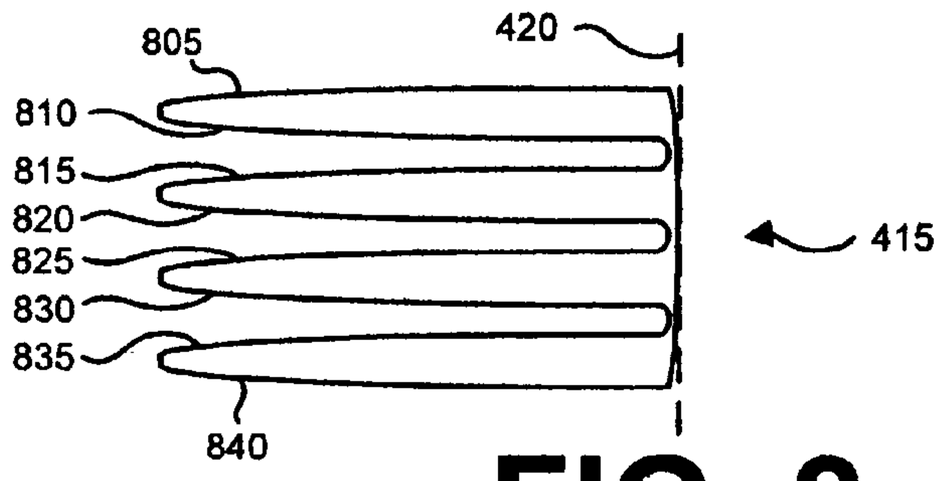


FIG. 8

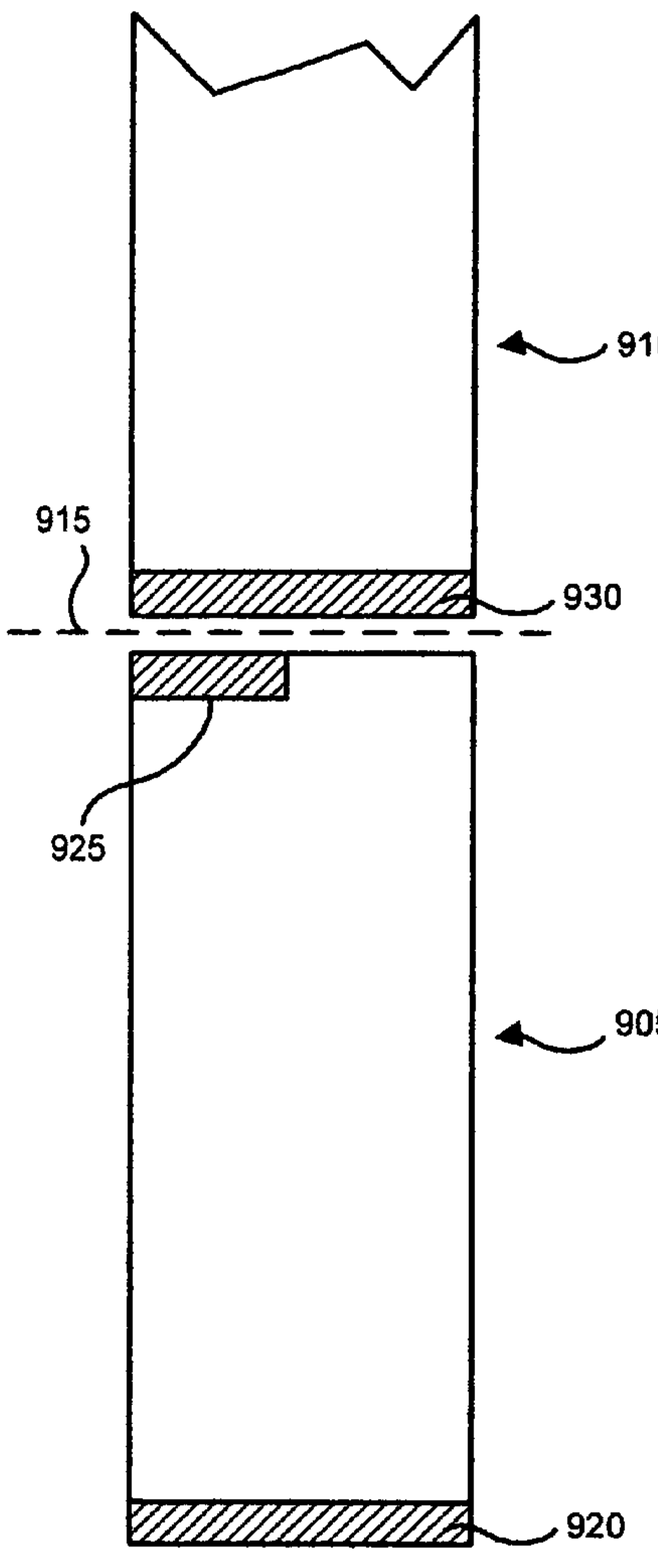

910
915
930
925
905
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FIG. 9

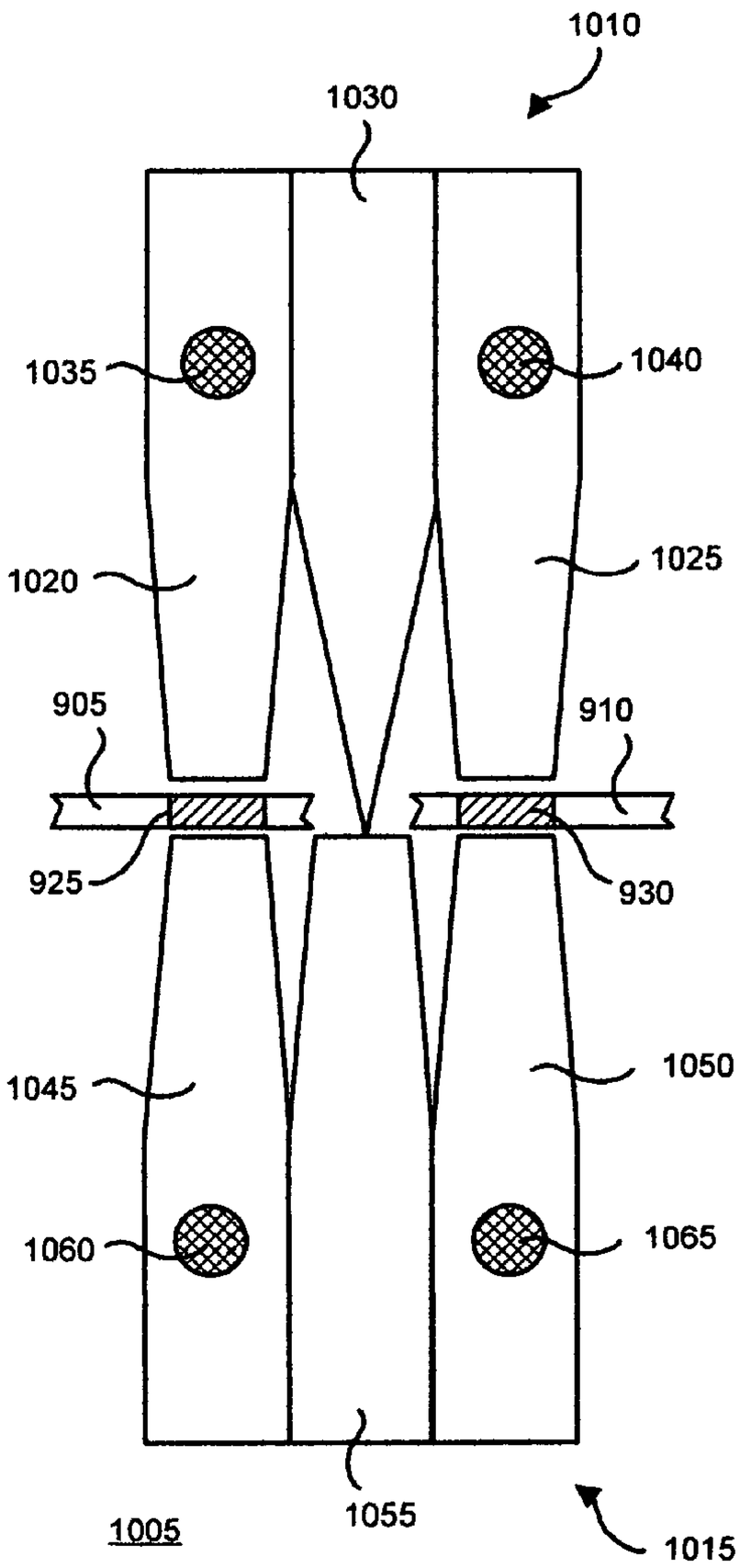

1010
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1005
1055
1015

FIG. 10

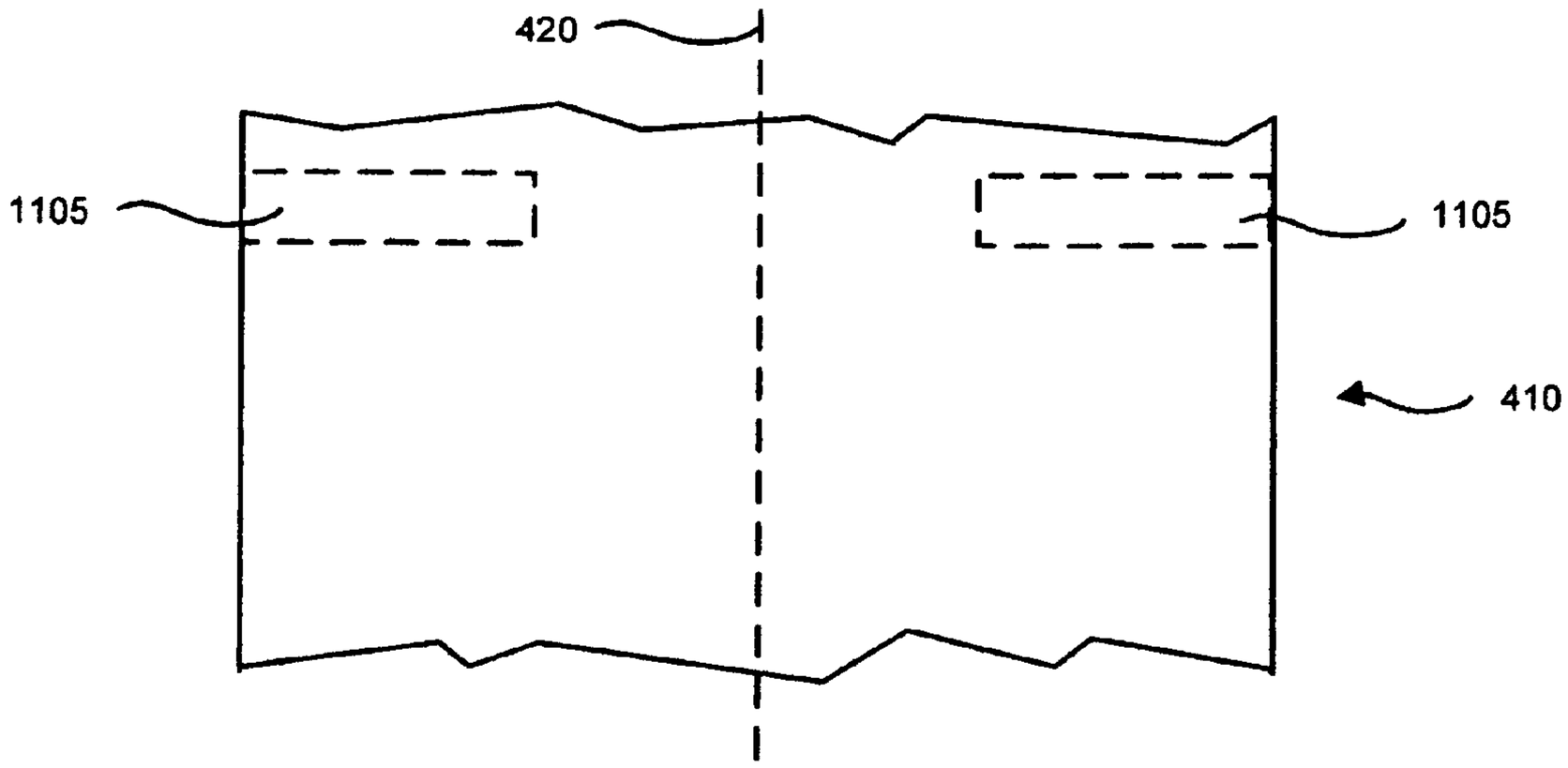

420
1105
1105
410

FIG. 11

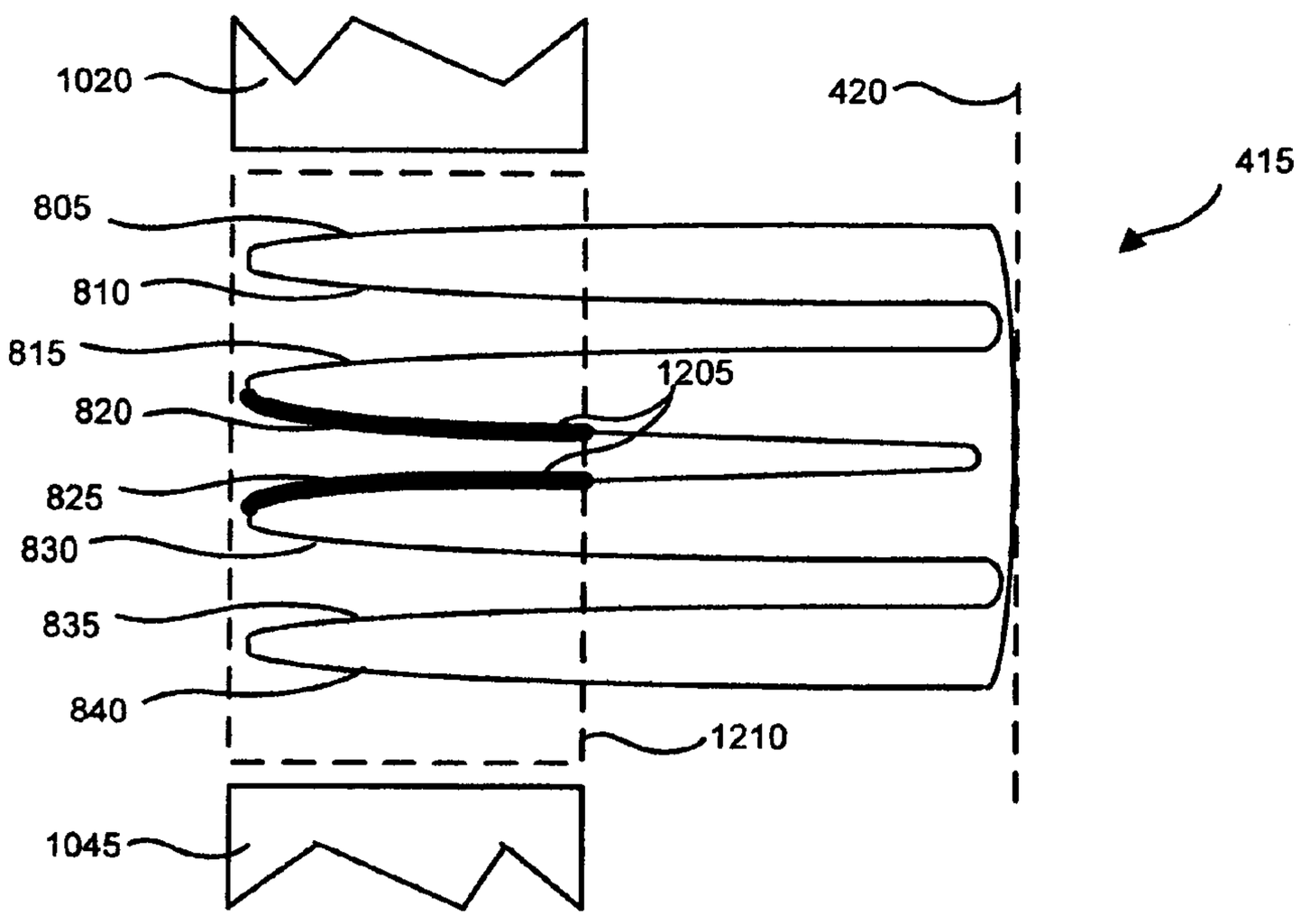

1020
420
415
805
810
815
1205
820
825
830
835
840
1210
1045

FIG. 12

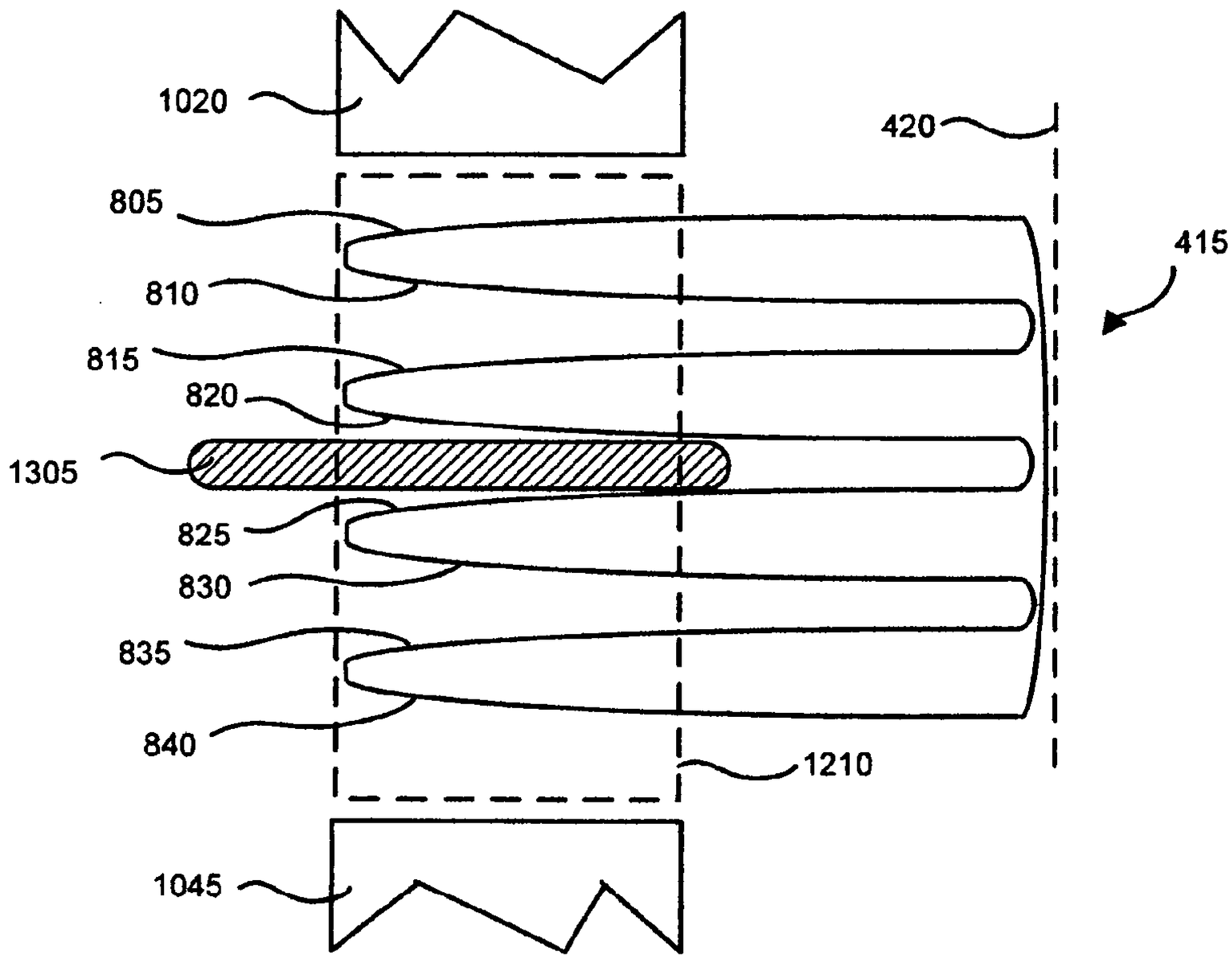


FIG. 13

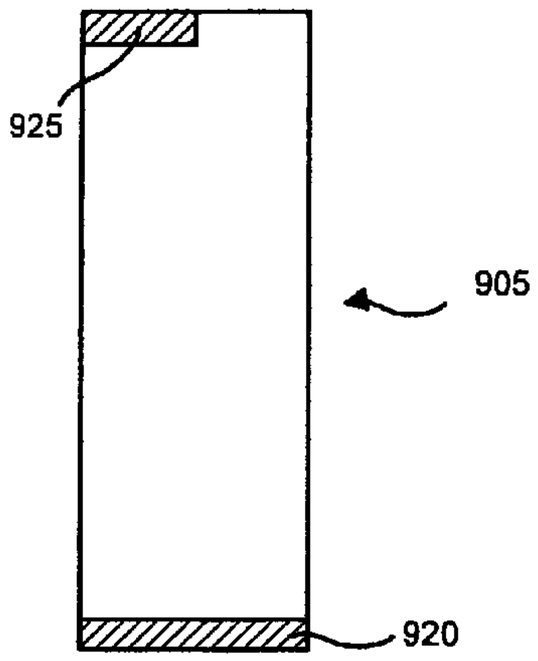


FIG. 14

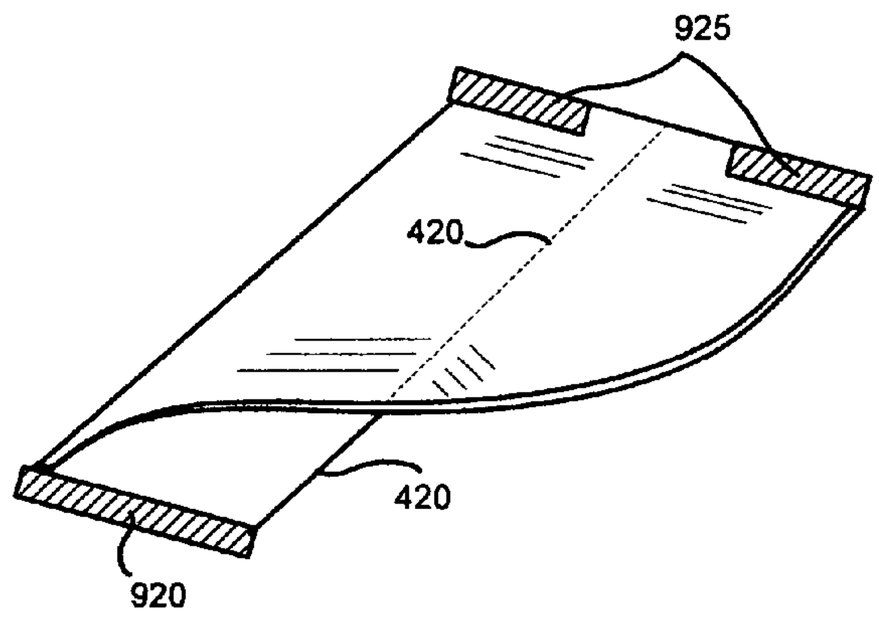


FIG. 15

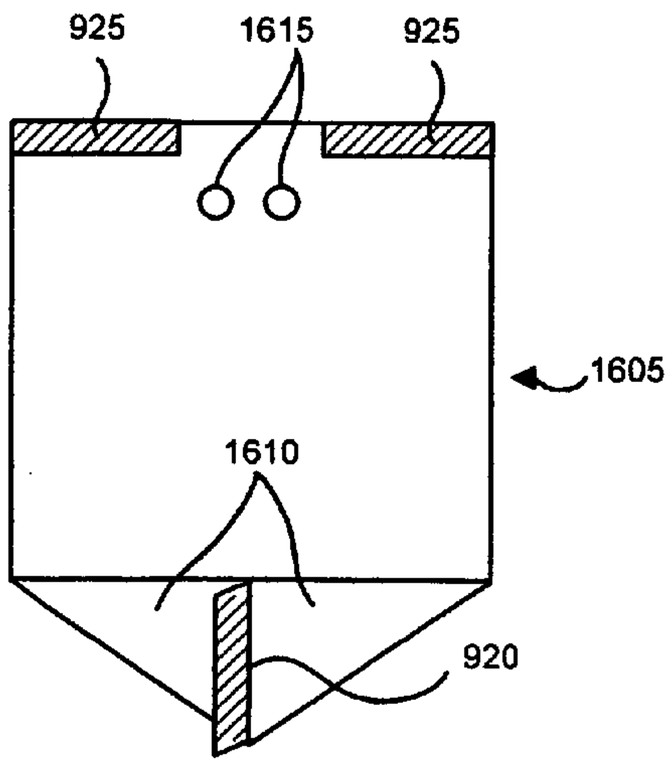


FIG. 16

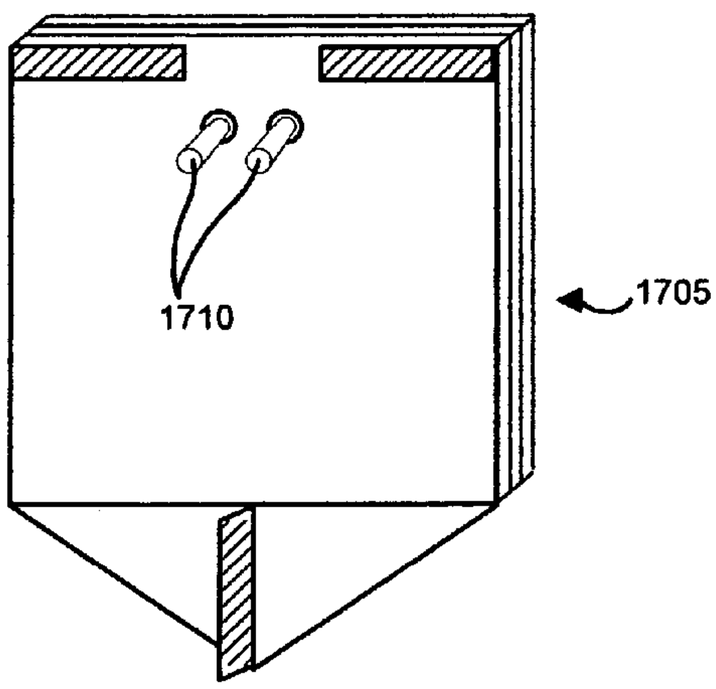


FIG. 17

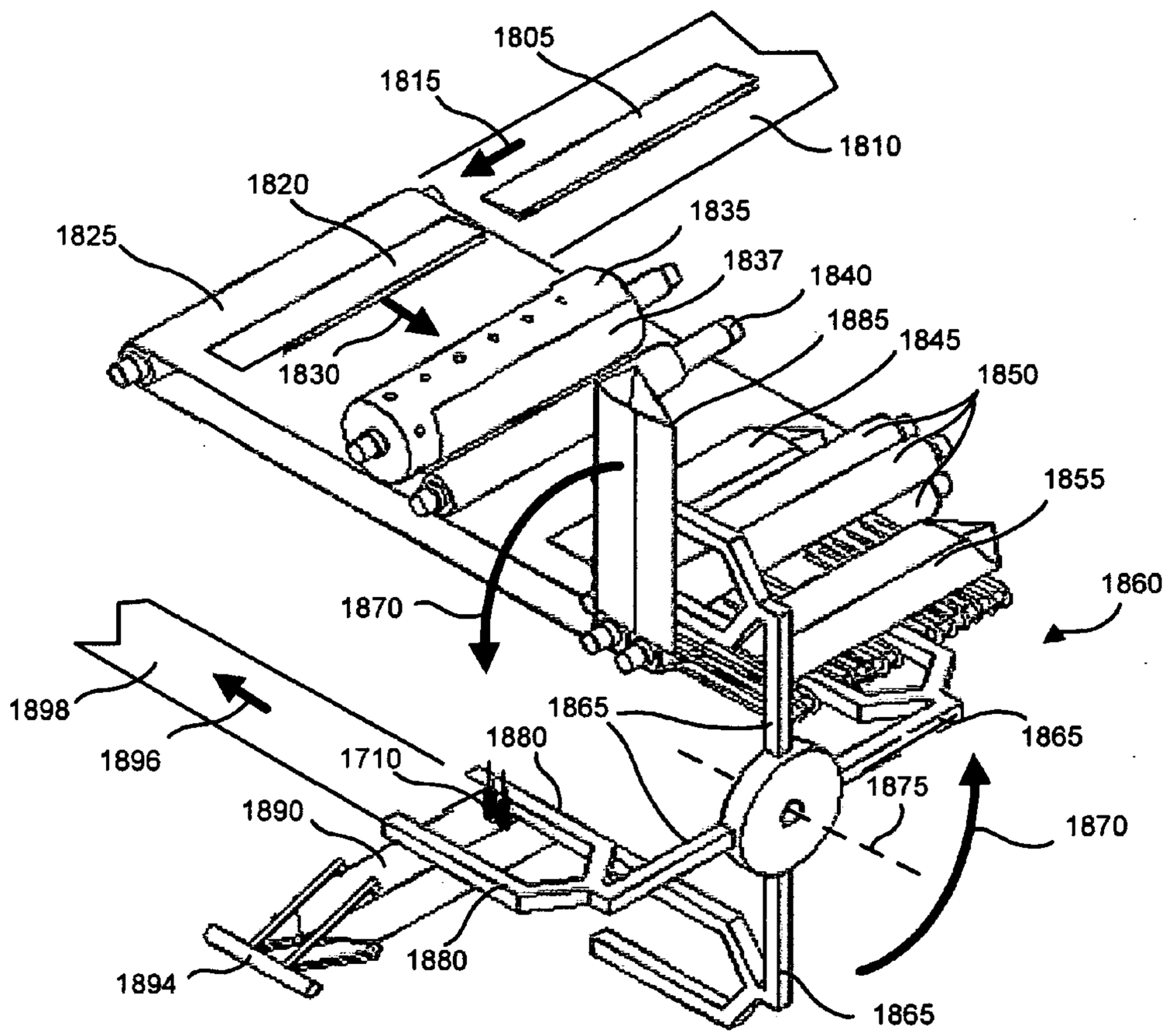

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FIG. 18

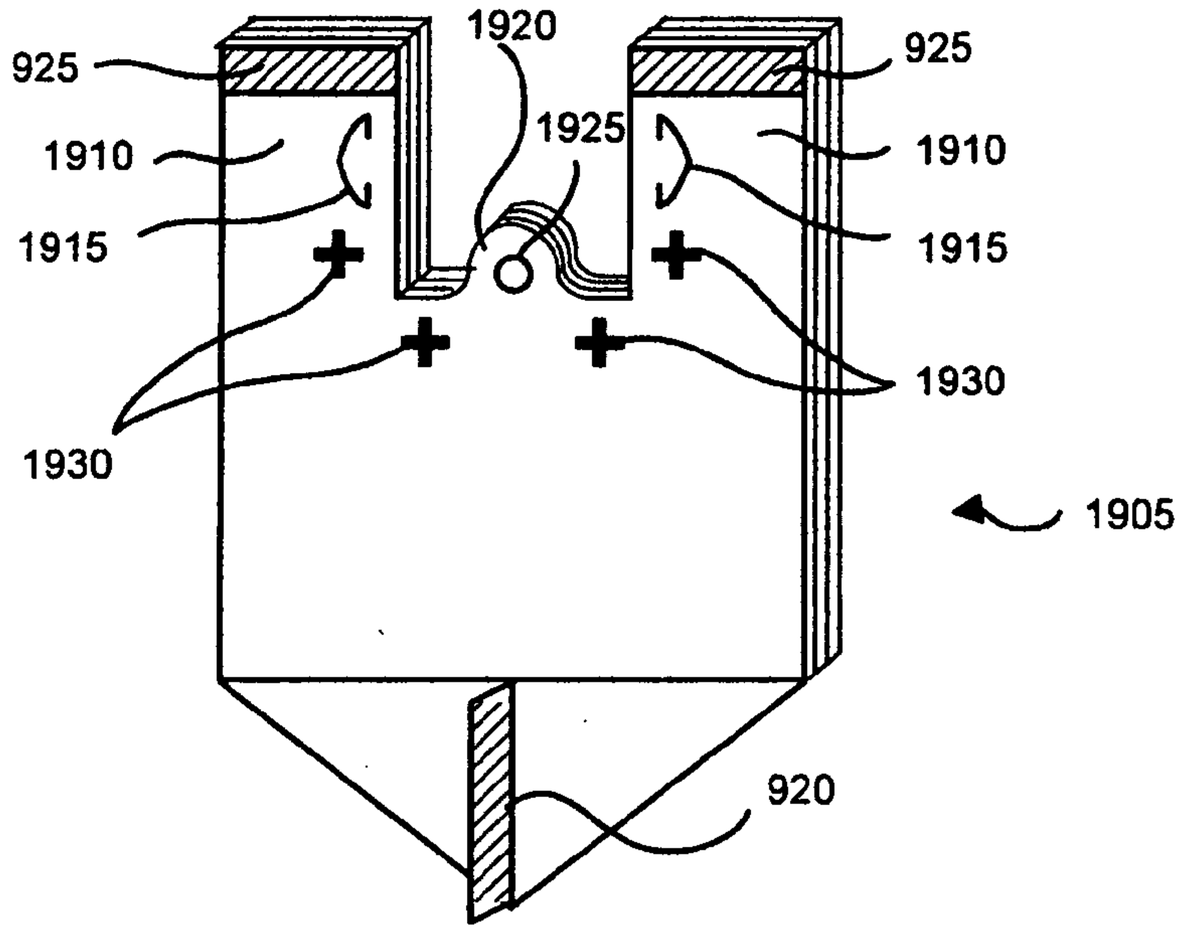

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FIG. 19

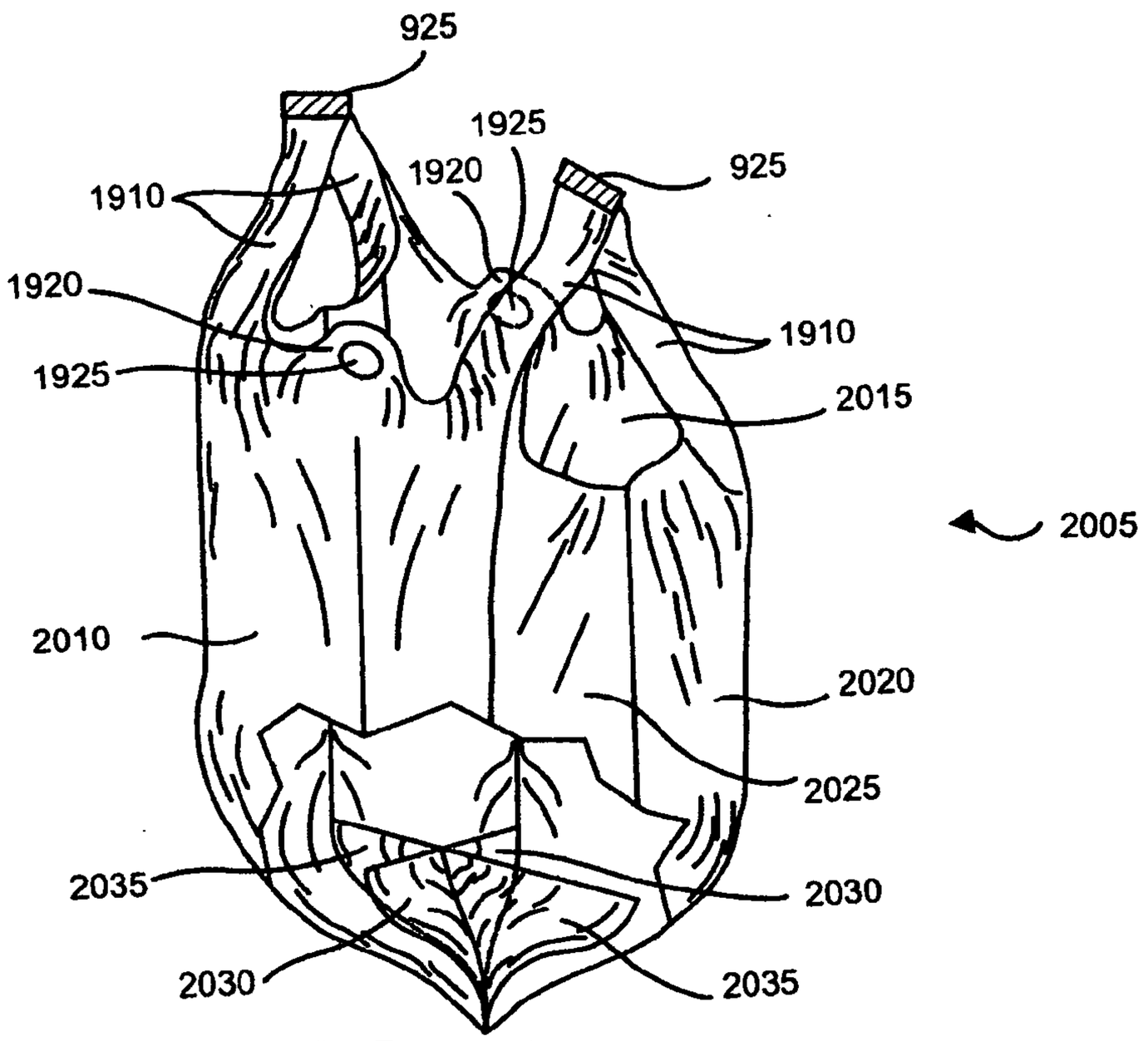

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FIG. 20

PACK OF UNFOLDED PLASTIC BAGS

BACKGROUND

[0001] 1. Field of the Invention

[0002] The invention relates generally to plastic bags, and more particularly, but without limitation, to a pack of polyethylene T-shirt style bags having relatively thin walls.

[0003] 2. Description of the Related Art

[0004] Plastic bags are used in a variety of applications, including bagging groceries and/or other items at a retail point of sale. A common plastic bag for such applications has a pair of carrying handles that extend from the top of the bag body on opposite sides of the bag opening. Such bags are often referred to as T-shirt or vest bags because the handles loosely resemble the short sleeves of a T-shirt or shoulder straps of a vest. T-shirt bags are typically manufactured and distributed in bag packs that are configured to cooperate with a standard retailer dispensing rack.

[0005] Plastic bags can be a significant overhead cost for a retailer. It would therefore be desirable to decrease the manufacturing cost of such bags. One way to reduce the cost of a plastic bag is to reduce the thickness of its walls, thereby reducing the plastic content. A problem with such an approach, however, is that thinner walls generally translate to decreased load strength. A method for manufacturing thinner-walled bags without sacrificing load strength is needed. Preferably, the resulting bag packs would also be configured such that individual bags can be fully supported by the dispensing rack while being filled with goods.

SUMMARY OF THE INVENTION

[0006] Embodiments of the invention seek to overcome one or more of the shortcomings described above. In an embodiment of the invention, a bottom seal of a plastic T-shirt style bag is strengthened by welding together 8 layers of plastic film. Multiple bags can be included in a bag pack. In one respect, an embodiment of the invention provides a bag pack including a plurality of plastic T-shirt style bags. Each of the plurality of plastic T-shirt style bags may include: a body at least partially open on a top end, the body having exactly four layers, the four layers being a front layer, a rear layer, and two gusset layers, each of the two gusset layers being disposed between the front layer and the rear layer; a first handle and a second handle coupled to a top end of the body, a mouth being defined on the top end between the first handle and the second handle; and a first internal rib and a second internal rib coupled to the four layers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The invention will be more fully understood from the detailed description below and the accompanying drawings, wherein:

[0008] FIG. **1** is a flow diagram of a bag manufacturing process, according to an embodiment of the invention;

[0009] FIG. **2** is a flow diagram of a cutting and welding process, according to an embodiment of the invention;

[0010] FIG. **3** is a flow diagram of an unfolding process, according to an embodiment of the invention;

[0011] FIG. **4** is a plan view of a formed plastic material, according to an embodiment of the invention;

[0012] FIG. **5** is a cross-sectional view of a tubular portion along plane A-A in FIG. **4**, according to an embodiment of the invention;

[0013] FIG. **6** is a cross-sectional view of a gusset forming tool, according to an embodiment of the invention;

[0014] FIG. **7** is a cross-sectional view of a gusseted portion along plane B-B in FIG. **4**, according to an embodiment of the invention;

[0015] FIG. **8** is a cross-sectional view of a folded portion along plane C-C in FIG. **4**, according to an embodiment of the invention;

[0016] FIG. **9** is a plan view of a folded bag, according to an embodiment of the invention;

[0017] FIG. **10** is an elevation view of a die set, according to an embodiment of the invention;

[0018] FIG. **11** is a plan view of a gusseted portion, according to an embodiment of the invention;

[0019] FIG. **12** is an elevation view of a folded bag portion in alignment with the die set, according to an embodiment of the invention;

[0020] FIG. **13** is an elevation view of a folded bag portion in alignment with the die set, according to an embodiment of the invention;

[0021] FIG. **14** is a plan view of a folded bag portion, according to an embodiment of the invention;

[0022] FIG. **15** is a perspective view of a partially-unfolded bag, according to an embodiment of the invention;

[0023] FIG. **16** is a plan view of an unfolded and uncut bag, according to an embodiment of the invention;

[0024] FIG. **17** is a perspective view of a stack of unfolded and uncut bags, according to an embodiment of the invention;

[0025] FIG. **18** is a perspective view of a bag-forming apparatus, according to an embodiment of the invention;

[0026] FIG. **19** is a perspective view of a bag pack, according to an embodiment of the invention; and

[0027] FIG. **20** is a perspective view of an opened bag, according to an embodiment of the invention.

DETAILED DESCRIPTION

[0028] The invention will now be described more fully with reference to FIGS. **1-20**, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. In the drawings, reference designators may be duplicated for the same or similar features. The figures are not drawn to scale; some features are exaggerated for clarity.

[0029] FIG. **1** is a flow diagram of a bag manufacturing process, according to an embodiment of the invention. The illustrated process begins in step **105**, and receives a polyethylene tube in step **110**. Blow molding and other methods for forming plastic tubes with desired wall thicknesses and diameter are known in the art. In embodiments of the invention, the wall thickness of the tube received in step **110** is substantially uniform at approx. 9 to 10 um. Such a dimension is relatively thin compared to a film thickness of approx. 14 to 15 um that is more typical of conventional grocery-sized T-shirt style plastic bags.

[0030] The process forms gusseted side walls in the polyethylene tube in step **115**. In embodiments of the invention, the gussets meet substantially in the center of the tube (as illustrated in FIG. **7**). The plastic material is thus formed such that there are generally 4 plastic layers from front to back: a front layer, 2 gusset layers, and a back layer. Accordingly, the result of gusseting step **115** may alternatively be referred to herein as a gusseted portion, a 4-layered portion, a 4-layered structure, or with similar language.

[0031] In step **120**, the process prints a non-stick ink on a predetermined non-weld area. The non-stick ink applied in step **120** may be or include, for example, a mold-release agent such as silicone, paraffin, and/or a fluorocarbon. The purpose of the non-stick ink is to selectively prevent a plastic weld. Embodiments of printing step **120** are further described with reference to FIGS. **11** and **12**.

[0032] The process then folds the 4-layered structure along a longitudinal axis to produce an **8**-layered structure in step **125**. Because of the folding step used, the resulting structure is also referred to herein as a folded portion. Embodiments of the folded portion are illustrated in FIGS. **8**, **12** and **13**, and are further described below.

[0033] Next, the process advances to cutting and welding step **130**. In the illustrated embodiment, cutting and welding step **130** includes first cutting and welding a bottom edge of the 8-layer structure in step **135**, and then cutting and welding a top edge of the 8-layer structure to produce a folded bag in step **140**. A folded bag is distinguished from a folded portion in that the former is welded on at least one edge.

[0034] The cutting processes in steps **135** and **140** may be or include, for example, die cutting, laser cutting, water-jet cutting, or other cutting processes, according to design choice. The welding processes in steps **135** and **140** may be or include, for example, heat sealing, hot gas welding, contact welding, laser welding, solvent welding, or other suitable method. As used herein, contact welding is a process that joins two or more plastic components by pinching them together between heated tips.

[0035] Subsequent to step **130**, the process unfolds the folded bag to produce a 4-layered bag in step **145**. The 4-layered bag may also be referred to herein as an unfolded bag. The process then stacks multiple 4-layered bags to form an uncut bag pack in step **150**. The result of step **150** is called an uncut bag pack because features such as handles and hanging apertures have not yet been formed.

[0036] The process then advances to punching/staking step **155**. As illustrated in FIG. **1**, step **155** may include performing steps **160** and **165**, but not necessarily in any particular order. In the illustrated embodiment, step **160** includes punching (or die cutting) the bag pack to form at least one of handles, a center tab, and a hanging aperture in each of the multiple 4-layered bags. Step **165** may include staking the bag pack to at least temporarily join adjacent bags in the bag stack with an interference fit. Such staking facilitates loading bags at a dispensing rack because the back panel of a first bag in the bag pack is temporarily secured to the front panel of a second bag in the bag pack at the first bag is being loaded with goods. A friction pin resulting from staking step **165** typically includes a rounded head.

[0037] The process terminates in step **170**.

[0038] One advantage of the process illustrated in FIG. **1** is that it produces bags with very strong 8-layer bottom welds. Another advantage is that the bags are unfolded prior to stacking. A bag pack with unfolded bags means that each handle of a T-shirt style bag can be supported on a separate hanger of a dispensing rack.

[0039] Variations to the process illustrated in FIG. **1** are possible. For example, in alternative embodiments, the receiving step **110** could include receiving a nylon tube or another plastic tube other than polyethylene. The gusseting step **115** could include forming less than full gussets (i.e., gussets that do not substantially meet in the center), so that the resulting structure is not a uniformly 4-layered structure. In alternative embodiments, the printing step **120** could be performed prior to the gusseting step **115**. Moreover, in an embodiment where a separator is used (described with reference to FIG. **6**), the printing step **120** can be eliminated. The sequence of cutting and welding in steps **135** and **140** could be reordered and recombined as appropriate. In embodiments of the invention that are described with reference to FIG. **16**, a punching step may be added prior to, or during, stacking step **150** to form stacking alignment holes. The punching/staking step **155** could execute steps **160** and **165** in any sequence, or in parallel, according to design choice. Instead of, or in combination with staking step **165**, the process could include a pinning step to provide a releasable bond between layers and bags in a bag pack. A pinning operation differs from staking step **165** in that the pinning geometry typically includes two orthogonal lines (e.g., an "x" shape) rather than a round head.

[0040] FIG. **2** is a flow diagram of a cutting and welding process, according to an embodiment of the invention. The illustrated process is an inline embodiment of the cutting/welding step **130**. The process begins in step **205**, and sets N equal to 1 in step **210**. Then, in step **215**, the process simultaneously die cuts an Nth bag portion of the 8-layer structure from a (N+1)th bag portion of the 8-layer structure, welds a top edge of the Nth bag portion, and welds a bottom edge of the (N+1)th bag portion. Next, the process outputs the top-welded Nth bag portion as a folded bag in step **220**. The process then advances to conditional step **225** to determine whether the cutting and welding process **130** is complete. Where the result of conditional step **225** is not satisfied, the process advances to step **230** to set N equal to N+1. Subsequent to step **230**, the process returns to step **215**. The process thus performs step **215** twice for each fully-welded folded bag. Where the result of conditional step **225** is satisfied, the process terminates in step **235**.

[0041] The process flow illustrated in FIG. **2** accommodates a high-speed in-line manufacturing process by simultaneously performing one separation cut and two welds. The process illustrated in FIG. **2** can be more fully understood with reference to FIGS. **9** and **10** below. Alternative processes that weld a single edge at a time can also be used.

[0042] FIG. **3** is a flow diagram of an unfolding process, according to an embodiment of the invention. The illustrated process is an embodiment of unfolding step **145**. The process in FIG. **3** begins in step **305**. Next, the process separates a first 4 layers of the folded bag from a second 4 layers of the folded bag to produce an unfolded bag in step **310**. Then, the process flattens the unfolded bag in step **315**. The unfolding process terminates in step **320**. Embodiments of unfolding step **145** are further described below with reference to FIGS. **15** and **18**.

[0043] FIG. **4** is a plan view of a formed plastic material, according to an embodiment of the invention. FIG. **4** illustrates the progression of formed plastic film in a bag manufacturing process. In sequence, FIG. **4** shows a tubular portion **405**, a gusseted or 4-layered portion **410**, and a folded or 8-layered portion **415**. The tubular portion **405** may be as received in step **110**. The gusseted or 4-layered portion **410** may be as formed by step **115**. The folded or 8-layered portion **415** may be as output from step **125**. Cross-sectional views of these same features are provided in FIGS. **5**, **7**, and **8**.

[0044] FIG. **5** is a cross-sectional view of the tubular portion **405** along plane A-A in FIG. **4**, according to an embodi-

ment of the invention. The tubular portion **405** may be, for example, several inches or several feet in diameter, according to application demands.

[0045] FIG. **6** is a cross-sectional view of a gusset forming tool, according to an embodiment of the invention; FIG. **7** is a cross-sectional view of the gusseted portion **410** along plane B-B in FIG. **4**, according to an embodiment of the invention. As shown in FIG. **6**, the tubular portion **405** may be deformed using gusset forming tools **605** and **610**. In the illustrated embodiment, the gusseting tools **605** and **610** substantially meet along a center line **420** of the 4-layered portion **410**. The gusseting tools **605** and **610** may be, for instance, constructed of wood or other thermal insulator. The resulting structure of the 4-layered portion **410** is shown in FIG. **7**. As illustrated therein, except at the center line **420**, the 4-layered portion **410** includes a first, second, third, and fourth layer **705**, **710**, **715**, and **720**, respectively. Layers **710** and **715** are the gusset layers.

[0046] FIG. **8** is a cross-sectional view of the folded portion **415** along plane C-C in FIG. **4**, according to an embodiment of the invention. The 8-layered portion **415** is formed by folding the 4-layered portion **410** onto itself. The center line **420** is the fold line. The resulting 8-layered structure **415** includes first, second, third, fourth, fifth, sixth, seventh, and eighth layers **805**, **810**, **815**, **820**, **825**, **830**, **835**, and **840**, respectively.

[0047] FIG. **9** is a plan view of a folded bag, according to an embodiment of the invention. A first folded bag **905** is substantially rectangular and includes an 8-layered bottom weld **920** and a top weld **925**. As described below, the top weld **925** may include two 4-layered welds. A second folded bag **910** includes an 8-layered bottom weld **930**.

[0048] In an embodiment of the invention, the configuration illustrated in FIG. **9** is the result of two passes of cutting/welding step **130**. For example, on a first pass of the cutting/welding step **130**, the bottom weld **920** may be formed. On a second pass of the cutting/welding step **130**, the process may separate the first folded bag **905** from the second folded bag **910** along a cut line **915** and also produce the top weld **925** and the bottom weld **930**.

[0049] Variations to the configuration illustrated in FIG. **9** are possible. For example, in an alternative embodiment, the top weld **925** could extend across the entire top edge of the first folded bag **905**.

[0050] FIG. **10** is an elevation view of a die set, according to an embodiment of the invention. The illustrated die set **1005** is configured to perform the cutting/welding step **130**. The die set **1005** may include an upper die **1010** and a lower die **1015**. The upper die **1010** may include heating tips **1020** and **1025**, and a blade **1030**. The heating tips **1020** and **1025** may include tubular heaters **1035** and **1040**, respectively. The bottom die **1015** may include heater tips **1045** and **1050**, and plate **1055**. The heater tips **1045** and **1050** may include tubular heaters **1060** and **1065**, respectively.

[0051] In operation, the tubular heaters **1035**, **1040**, **1060**, and **1065** heat the corresponding heater tips **1020**, **1025**, **1045**, and **1050**. The heater tips **1020** and **1045** may cooperate to contact weld the 8-layer folded bag **905** at the top weld area **925**. Likewise, the heater tips **1025** and **1050** cooperate to form a contact weld at the bottom weld **930** of the folded bag **910**. Simultaneously, the blade **1030** may cooperate with the plate **1055** to separate the folded bag **905** from the folded bag **910**.

[0052] Although not illustrated in FIG. **10**, it should be appreciated that the geometries of the heater tips may vary according to the target weld areas. For instance, with reference to FIGS. **9** and **10**, the heater tips **1025** and **1050** could be substantially longer in one dimension than heater tips **1020** and **1045**, since the bottom weld **930** is longer than the top weld **925**. In addition, instead of tubular heaters **1035**, **1040**, **1060**, and **1065**, cartridge heaters or other heat sources could be used to heat the heater tips **1020**, **1025**, **1045**, and/or **1050**.

[0053] FIG. **11** is a plan view of a gusseted portion **410**, according to an embodiment of the invention. As illustrated therein, a gusseted or 4-layered portion **410** may include printing areas **1105**. The printing areas **1105** may be associated with the printing step **120**. The location of the printing areas **1105** may correspond to a future top weld area **925**.

[0054] FIG. **12** is an elevation view of a folded portion **415** in alignment with the die set **1005**, according to an embodiment of the invention. As shown therein, layers **820** and **825** of the 8-layered portion **415** include non-stick ink **1205**. The location of the non-stick ink **1205** on layers **820** and **825** correspond to a top weld area **1210**. The top weld area **1210** is a side view of top weld area **925**.

[0055] During a contract weld operation, for example cutting/welding step **130**, heater tips **1020** and **1045** draw toward each other, applying heat and pressure to each layer of the folded portion **415** at the weld area **1210**. The non-stick ink **1205** prevents welding between layers **820** and **825**. The result of the weld operation will thus be two 4-layered welds. A first 4-layered weld includes layers **805**, **810**, **815**, and **820**; a second 4-layered weld includes layers **825**, **830**, **835**, and **840**.

[0056] An alternative method may be used to prevent a weld between layers **820** and **825**. FIG. **13** is an elevation view of a folded portion **415** in alignment with the die set **1005**, according to an embodiment of the invention. A shown therein, a separator **1305** may be inserted between layers **820** and **825** during cutting/welding step **130**. The separator **1305** provides a temporary physical barrier. The separator **1305** may be or include, for example, a metallic component having an anti-stick coating. For instance, the separator **1305** could be Teflon-coated steel. The separator **1305** can be considered part of the die set **1005** since at least two of the heater tips, for example heater tips **1020** and **1045**, are configured to cooperate with the separator **1305**.

[0057] During a contract weld operation, for example cutting/welding step **130**, heater tips **1025** and **1050** draw toward each other, applying heat and pressure to each layer of the folded portion **415** at the weld area **1210**. The separator **1305** prevents welding between layers **820** and **825**. The result of the weld operation will thus be two 4-layered welds. A first 4-layered weld includes layers **805**, **810**, **815**, and **820**; a second 4-layered weld includes layers **825**, **830**, **835**, and **840**.

[0058] The lack of a weld between layers **820** and **825** facilitates the unfolding step **145**, which is further described with reference to FIGS. **14-16** below.

[0059] FIG. **14** is a plan view of a folded bag portion, according to an embodiment of the invention. FIG. **15** is a perspective view of a partially-unfolded bag, according to an embodiment of the invention. FIG. **16** is a plan view of an unfolded and uncut bag, according to an embodiment of the invention.

[0060] FIGS. **14**, **15**, and **16** illustrate structures that may be associated with the unfolding step **145**. Unfolding step **145** may receive an unfolded bag **905** and produce a partially unfolded bag as illustrated in FIG. **15** (e.g., in separating step **310**). Unfolding step **145** would not be possible if layers **820** and **825** were welded to each other at the top weld **925**. Unfolding step **145** also may include flattening the partially unfolded bag to produce the unfolded and uncut bag **1605**

illustrated in FIG. **16** (e.g., in flattening step **315**). The unfolded and uncut bag **1605** may thus include a flattened portion **1610**.

[0061] The unfolded and uncut bag **1605** may further include stacking alignment holes **1615**. The stacking alignment holes **1615** may be added before or during the stacking step **150**. For instance, in one embodiment, there is a punching step in the 8-layer structure before the unfolding step **145**. In this case, a single punch that is offset from the center line **420** will define the two stacking alignment holes **1615** when the folded bag is later unfolded. In an alternative embodiment, there is a punching step after the unfolding step **145** and before the stacking step **150** to form the stacking alignment holes **1645**. In yet another embodiment, the alignment holes **1615** are formed during the stacking step **150**, for example when a wicketer places an unfolded and uncut bag onto a stack of bags.

[0062] FIG. **17** is a perspective view of a pack of unfolded and uncut bags **1705**, according to an embodiment of the invention. FIG. **17** illustrates the result of stacking step **150**. The stacking alignment pins **1710** are configured to cooperate with the stacking alignment holes **1615**. In an embodiment where the stacking alignment holes **1615** are formed during the stacking step **150**, each of the stacking alignment pins **1710** may include a pointed tip that is configured to puncture a stacking alignment hole **1615** into each unfolded and uncut bag **1605** as it is added to the pack of unfolded and uncut bags **1705**. The pack of unfolded and uncut bags **1705** may include any predetermined number of unfolded and uncut bags **1605**. For instance, there may be 50 unfolded and uncut bags **1605** in each pack of unfolded and uncut bags **1705**.

[0063] FIG. **18** is a perspective view of a bag-forming apparatus, according to an embodiment of the invention. The illustrated apparatus may be used to perform the unfolding and stacking steps **145** and **150**, respectively.

[0064] As shown in FIG. **18**, the apparatus may include an incoming conveyer **1810** that is configured to carry a folded bag **1805** in a first direction **1815**. The apparatus may further include a conveyer **1825** that is configured to carry a folded bag **1820** in a second direction **1830**. The conveyors **1810** and/or **1825** may utilize vacuum and/or static electricity to secure bags during processing and transport. A vacuum roller **1835** is configured to at least partially unfold the incoming folded bag **1820**. In operation, the top four layers **1837** of an incoming folded bag are drawn to the vacuum roller **1835** while the bottom four layers (not shown) of the incoming folded bag remain secured to the conveyor **1825**. As the conveyor **1825** advances the bag, the roller **1840** guides the top four layers **1837** to the conveyor **1825** to produce the unfolded bag **1845**. In the illustrated embodiment, the roller **1840** has a smaller diameter than the vacuum roller **1835**. One or more rollers **1850** flatten the unfolded bag **1845** to form the unfolded and uncut bag **1855**. As shown, the rollers **1850** may be disposed on both a top side and a bottom side of a bag during flattening. The unfolded and uncut bag **1855** may have the same or similar configuration that is illustrated in FIG. **16**.

[0065] The apparatus illustrated in FIG. **18** includes a wicketer **1860**. The wicketer **1860** may include four wicket arms **1865**. Each of the four wicket arms **1865** may include two end effectors **1880**. Each of the end effectors may include vacuum holes to secure the unfolded and uncut bags during stacking step **150**. The wicketer **1860** is configured such that the wicket arms rotate in a rotational direction **1870** about a rotational axis **1875**. In operation, the wicketer **1865** transports an unfolded and uncut bag such that it progresses through the positions illustrated by uncut and unfolded bags **1855**, **1885**, and **1890**. At the output side of the wicketer **1860**, a stack of bags is formed on top of the unfolded and uncut bag **1890** with the aid of the alignment pins **1710** and the gripper **1894**. Once a predetermined number of unfolded and uncut bags have been formed into a stack at the location of the bag **1890**, a completed pack of unfolded and uncut bags may be output in the third direction **1896** on conveyor **1898**.

[0066] Variations to the apparatus illustrated in FIG. **18** are possible. For example, the configuration of the conveyors **1810**, **1825**, and **1898** may be altered, according to design choice. In embodiments of the invention, the rotational speed of the vacuum roller **1835** may be intentionally mismatched with respect to the linear speed of the conveyor **1825**. In addition, the relative size of the vacuum roller **1835** and the roller **1840** could be varied. More or fewer flattening rollers **1850** may be used. Also, alternative wicketers **1860** may include fewer or more than four wicketer arms **1865**. In an alternative embodiment, a stacking module other than a wicketer **1860** could be used to form a stack of unfolded and uncut bags.

[0067] Functional components described elsewhere could be operationally coupled to the bag unfolding and stacking apparatus illustrated in FIG. **18**. For instance, in embodiments of the invention, a cutting/welding module (not shown) that includes the die set **1005** could be coupled to the conveyor **1810**. Moreover, a stacking alignment hole punching module (not shown) may interface with the conveyors **1810** or **1825**, the stacking alignment hole punching module being configured to form the stacking alignment holes **1615** that are discussed above with reference to FIGS. **1** and **16**. Consistent with the description above, the stacking alignment hole punching module could alternatively be disposed, for example, before or after the vacuum roller **1835**, or even after the flattening rollers **1850**. Furthermore, a bag pack punching/staking module (not shown), or, alternatively, a bag pack punching/pinning module (not shown), may be operationally coupled to the conveyor **1898** to perform punching/staking step **155** or a variation thereof.

[0068] FIG. **19** is a perspective view of a bag pack, according to an embodiment of the invention. A bag pack **1905** may be output from the punching and staking step **155**, or a variation thereof. As illustrated in FIG. **19**, the bag pack **1905** may include handles **1910**, and each of the handles **1910** may include a slit **1915** that is configured to suspend the t-shirt style bag pack **1905** from a rod or other hanging feature of a dispensing rack (not shown). Each of the bags in bag pack **1905** may further include a center tab **1920** having an aperture **1925** to also facilitate the suspension of the bag pack **1905** from the dispensing rack. The bag pack **1905** may also include one or more pinning points **1930** to lightly couple adjacent layers and bags in the bag pack **1905**.

[0069] Alternatives to the configuration illustrated in FIG. **19** are possible. For example, the shape of the mouth formed between the handles **1910** may be varied, according to design choice. In addition, the quantity and shape of the aperture **1925** in each of the bags of the bag pack **1905** may be varied according to application needs. Moreover, there could be more than a single center tab **1920** in each of the bags. Further, the center tab **1920** could include one or more frangible features that are configured to fail when a bag is dispensed from the bag stack **1905** such that the center tab **1920** is retained with the bag rather than the dispensing rack. Staking points that have rounded geometries could be used together with, or instead of, the pinning points **1930** to provide releasable bonding between layers and bags within the bag pack **1905**.

[0070] FIG. **20** is a perspective view of an opened bag, according to an embodiment of the invention. A bag **2005**

may be one of many bags from a bag pack **1905**. As shown therein, a bag **2005** may include a front side **2010**, a back side **2015**, and gusseted sides. For example, a right side of the bag **2005** includes gusseted sides **2020** and **2025**.

[0071] Each of the handles **1910** include 4 layers that are joined at the top seal **925**. For example, a front portion of the right handle **1910** includes an extension of the front layer **2010** and an extension of the gusseted side **2025**; a rear portion of the right handle **1910** includes an extension of the rear layer **2015** and an extension of the gusseted side **2020**.

[0072] As shown in a cutaway section, an inside bottom portion of the bag **2005** includes ribs **2030** and **2035**. Each of the ribs **2030** and **2035** may be substantially triangular in shape. The ribs **2030** and **2035** intersect each other substantially at right angles.

[0073] Bag **2005** could also include slits **1915** and/or pinning points **1930**. Moreover, one or more of the alternative configurations described above with reference to FIG. **19** may also apply to the bag **2005** that is illustrated in FIG. **20**.

[0074] It will be apparent to those skilled in the art that modifications and variations can be made without deviating from the spirit or scope of the invention. For example, alternative features described herein could be combined in ways not explicitly illustrated or disclosed. Thus, it is intended that the present invention cover any such modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

I claim:

1. A bag pack including a plurality of plastic T-shirt style bags, each of the plurality of plastic T-shirt style bags comprising:

a body at least partially open on a top end, the body having substantially four layers, the four layers being a front layer, a rear layer, and two gusset layers, each of the two gusset layers being disposed between the front layer and the rear layer;

a first handle and a second handle coupled to a top end of the body, a mouth being defined on the top end between the first handle and the second handle; and

a first internal rib and a second internal rib coupled to the four layers.

2. The bag pack of claim **1**, wherein each of the first and second internal ribs are substantially triangular in shape, the first internal rib intersecting the second internal rib, a plane of the first internal rib being substantially orthogonal to a plane of the second internal rib when each of the plurality of T-shirt style bags is removed from the bag pack and opened.

3. The bag pack of claim **1**, further comprising a center tab disposed on the mouth of each of the plurality of plastic T-shirt style bags.

4. The bag pack of claim **3**, further comprising a hanging aperture disposed in the center tab, the hanging aperture configured to receive a first hanging portion of a dispensing rack.

5. The bag pack of claim **2**, wherein the center tab includes a frangible portion, the frangible portion configured to tear when a bag is dispensed from a dispensing rack such that the center tab is retained with the plastic T-shirt style bag rather than the dispensing rack.

6. The bag pack of claim **1**, further comprising a first slit in the first handle and a second slit in the second handle, the first slit and the second slit configured to receive a first and second handing portion of a dispensing rack, respectively.

7. The bag pack of claim **1**, wherein a weld at a bottom of the body includes 8 layers of plastic film.

8. A bag pack, the bag pack formed by a process comprising:

forming a plurality of gusseted side walls in a polyethylene tube to produce a gusseted portion, each of the plurality of gusseted side walls substantially meeting in a center of the polyethylene tube, the gusseted portion being a 4-layered structure;

folding the gusseted portion along a longitudinal axis to produce a folded portion, the folded portion being an 8-layered structure;

welding a bottom edge of the folded portion to produce a bottom weld;

cutting the folded portion to separate a folded bag from the folded portion, the folded bag including the bottom weld, the folded bag having 8 layers;

welding at least a portion of a top edge of the folded bag;

at least partially unfolding the folded bag to produce an unfolded bag; and

stacking the unfolded bag onto another unfolded bag to produce a pack of uncut bags.

9. The bag pack of claim **8**, wherein welding the bottom edge is a contact welding process.

10. The bag pack of claim **8**, wherein cutting and welding at least the portion of the top edge are performed simultaneously.

11. The bag pack of claim **8**, wherein welding at least the portion of the top edge of the folded bag includes preventing a weld between two middle layers of the 8 layers.

12. The bag pack of claim **11**, wherein preventing the weld between the two middle layers of the **8** layers includes inserting a separator between the two middle layers.

13. The bag pack of claim **11**, wherein the separator is a metallic component having an anti-stick coating.

14. The bag pack of claim **13**, wherein the separator is Teflon-coated steel.

15. The bag pack of claim **11**, further comprising, before the folding, applying a non-stick ink to a predefined portion of a top surface of the gusseted portion.

16. The bag pack of claim **15**, wherein the non-stick ink includes a mold release agent.

17. The bag pack of claim **8**, wherein at least partially unfolding the folded bag includes flattening the unfolded bag.

18. The bag pack of claim **8**, further comprising forming at least one alignment hole prior to the stacking.

19. The bag pack of claim **18**, wherein forming the at least one alignment hole includes punching the at least one alignment hole in the folded bag.

20. The bag pack of claim **18**, wherein forming the at least one alignment hole includes punching the at least one alignment hole in the unfolded bag.

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