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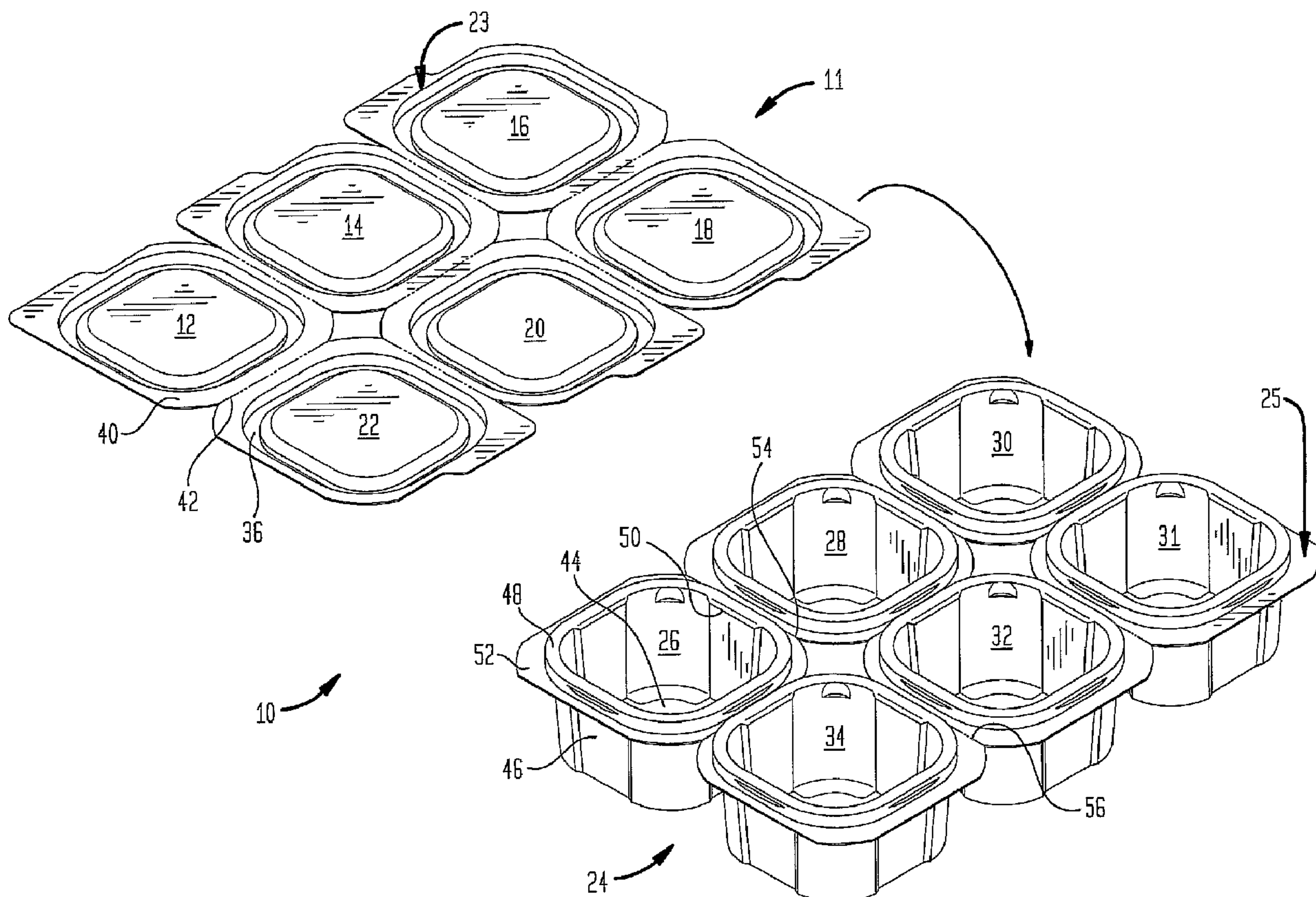
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(54) Title: SEPARABLE PORTION CONTAINERS



(57) Abrégé/Abstract:

A container ensemble (10) for food packaging comprising a substantially planar lid member (11) formed of a polymeric material which has a plurality of substantially planar lids which are integrally formed and separably joined to each other, each of the lids

(57) **Abrégé(suite)/Abstract(continued):**

including a sealing channel (36) around its perimeter and a skirt (40) extending outwardly therefrom. The lid member is provided with tearable portions (42) to facilitate separation. The other component of the ensemble is a cup member (24) formed of a polymeric material defining a plurality of cups which are integrally formed and also separably joined to each other, the cups including a bottom, a sidewall, and a brim (48) about an upper opening of each cup. Each cup has a skirt (52) extending outwardly from its brim provided with tearable portions (54, 56) to facilitate separation. The sealing channels (36) of the lids of the lid member are adapted to mate with the brims (48) of the cups to provide a plurality of separably joined sealed containers. The lids and cups or bases may be thermoformed from different compositions or sheet of different thicknesses and optionally include slip agents to avoid nesting lock.

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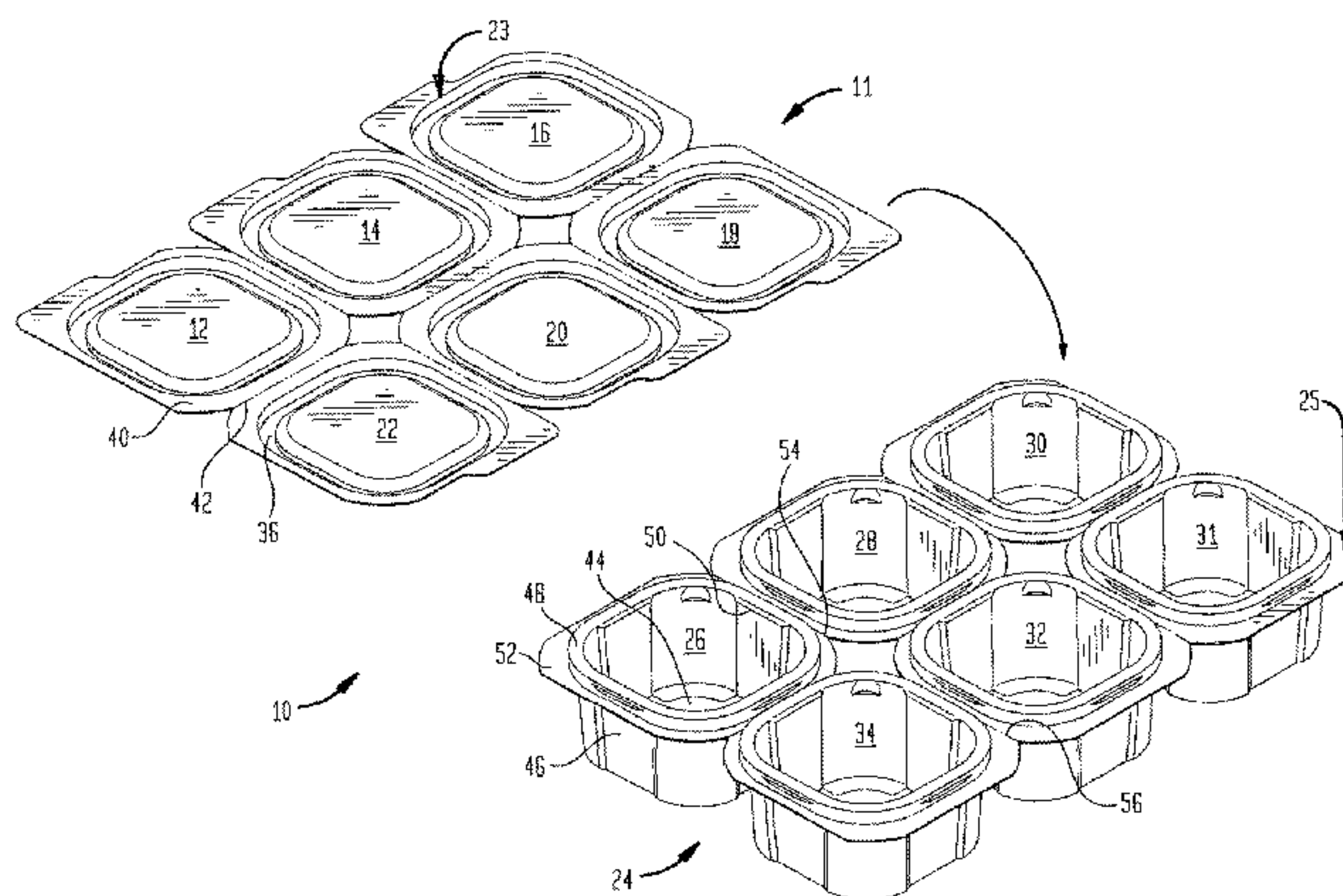
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(54) Title: SEPARABLE PORTION CONTAINERS



(57) Abstract: A container ensemble (10) for food packaging comprising a substantially planar lid member (11) formed of a polymeric material which has a plurality of substantially planar lids which are integrally formed and separably joined to each other, each of the lids including a sealing channel (36) around its perimeter and a skirt (40) extending outwardly therefrom. The lid member is provided with tearable portions (42) to facilitate separation. The other component of the ensemble is a cup member (24) formed of a polymeric material defining a plurality of cups which are integrally formed and also separably joined to each other, the cups including a bottom, a sidewall, and a brim (48) about an upper opening of each cup. Each cup has a skirt (52) extending outwardly from its brim provided with tearable portions (54, 56) to facilitate separation. The sealing channels (36) of the lids of the lid member are adapted to mate with the brims (48) of the cups to provide a plurality of separably joined sealed containers. The lids and cups or bases may be thermoformed from different compositions or sheet of different thicknesses and optionally include slip agents to avoid nesting lock.

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SEPARABLE PORTION CONTAINERS5 Technical Field

 The present invention relates to disposable containers with lids for packaging fresh foods for distribution. Particularly preferred embodiments inclusive of 2, 4 and 6 ounce containers for sauces and condiments are thermoformed on complimentary sheets which may be joined in sealing
10 engagement to each other and thereafter separated to supply individual portions.

Background

 Plastic containers with lids such as disposable plastic containers are well known. There is disclosed in United States Patent No. 5,702,017 to *Goncalves* a
15 combination of a row of containers and a strip of caps, each of the containers and caps being respectively joined by breakable links allowing the joined strip of caps to be placed on necks of the joined row of containers by a translational movement

parallel to the axes of the containers. *See generally* United States Patent No. 6,629,834 to *Cargile et al.*; United States Patent No. 5,531,349 to *Wojcik et al.*; United States Patent No. 4,215,797 to *Chen*; as well as French patents 2 763 314 of *Apri* and 1 278 149 of *Goiffon*, all of which disclose various container
5 configurations.

Disposable articles are used as food containers as is seen, for example, in United States Patent No. 5,012,971 to *Cozzi et al.* In the '971 patent there is disclosed a compartmented container of the "clam shell" class suitable for
10 containing food. The container or package in one embodiment includes a first or bottom compartment and a second or top compartment that is hinged to the first compartment. There is disclosed in United States Patent No. 4,798,133 to *Johnson* a package and container for eggs. The container defines a plurality of compartments each of a configuration to hold an egg captive, each portion of the
15 container defining a respective single compartment being connected with the remainder along lines of weakening, perforation or the like.

Containers arranged in arrays with breakable or tearable portions between them are seen in a number of references. In this respect, German Patent DE 100
20 12 364 of *von der Worth* discloses separable egg cartons arranged in a planar array. *See also* DE 100 12 364; FR 2 763 314; and FR 1 278 149.

There is disclosed in United States Patent No. 6,000,535 to *Berk et al.* disposable mixing wells. Wells are formed as a unitary sheet of individual mixing
25 wells arranged in rows and columns. The boundary between each mixing well is scored, perforated or otherwise made to allow individual pieces to be removed from the sheet. Preferably, the mixing wells may be pressure formed rather than being vacuum formed.

30 There is disclosed in United States Patent No. 5,904,263 to *St. Pierre et al.* a multi-container package with individually removable containers. The package

includes several individually sealed containers which are easily separable from one another by weakened zones between adjacent containers. Each container includes a tab portion over which the peel tab of the lid extends. Dimples in either the peel tab or tab portion facilitate their separation. Several multi-container
5 packages are manufactured as a unit using a die and conventional heat sealing process and then are separated from one another by transverse cuts.

United States Patent No. 5,409,127 to *Stratford et al.* is directed to a multi-pack container assembly. The multi-pack assembly includes a plurality of
10 containers and webs joining the containers, each web configured to include an area of reduced structural integrity for tearing a plurality of frangible ribs interconnecting adjacent containers and traversing the tearing area.

United States Patent No. 4,875,620 to *Lane, Sr.* discloses a fluted product
15 cup. The cup, suitable for food packaging is formed from a resilient material and has an integral body having a product reservoir and a lip. The product reservoir includes a flat bottom wall and a continuous sidewall integrally joined together about a smooth curve. The sidewall extends upwardly from the bottom wall to join the lip. The joint between the lip and the sidewall continuously surrounds and
20 defines an opening through the lip to the interior of the reservoir. The lip extends in a plane outwardly from this opening completely around the periphery of this opening. The bottom wall is essentially circular in shape and the opening is essentially a square shape. First, second, third and fourth fluted areas are located in the sidewall at the corners of the squarish shaped opening at the top of the
25 containers. Each of the fluted areas are shaped essentially as a conical surface generated from a cone which is truncated by a plane about a parabolic intersection of the plane with the cone. These containers may be formed in an array as can be seen in the patent.

30 With respect to containers which may be separated, the following references are also of interest: French Patent No. 1,392,947 to *Skandinavisk*;

German Patent No. DE 26 53 906 to *Gizeh-Werk* and British Provisional Specification No. 649,541 to *Stephenson*.

It is seen in United States Patent No. 5,722,553 to *Hovatter* an integral
5 assembly of microcentrifuge strip tubes having independently tethered caps and angularly related seal caps.

Food containers having sealing features are likewise well known. In this respect, ridges and cooperating grooves are used in many such containers. See
10 United States Patent No. 5,377,860 to *Littlejohn et al.*

While the container art is plentiful, there remain largely unresolved issues with respect to lidded containers for food which are low in cost. In accordance with the invention there are a variety of packaging options as well as superior
15 sealing characteristics, even at low product weight. Sealing is especially a problem with respect to containers having straight brim segments. Simply making a "tighter" fit between the lid and its associated container or receptacle is ineffective since the increase in the required capping force will crush the container, leading to product failure in too many instances as well as associated
20 spillage.

Existing containers, especially relatively small containers, are difficult to individually fill and seal, making the process prohibitively time consuming or requiring equipment and skills not generally available at homes, catering
25 establishments and restaurants.

A still further drawback of existing containers, especially lightweight containers, is nesting lock which makes it difficult to separate a cup or lid from a nested stack thereof when the product is needed.

Summary of Invention

The present invention is directed to food containers which are easily filled and sealed while the containers are connected to one another and then separated into individual containers containing a serving. Preferably the lids and cups form
5 substantially continuous seals between them so that the containers are substantially liquid proof; it being understood that the seal, while highly effective, especially when viewed in light of the low cost nature of the articles, is of course less than perfect where the seal formed might allow a few drops of moisture to penetrate when a sealed container is partially filled with water and shaken; but
10 compression, effort and/or agitation is required to remove more than a few drops of liquid. The containers are thus especially suitable for liquid or semi-liquid sauces, condiments, dressings, side dishes and so forth that are prepared and fresh-packaged shortly before consumption.

15 There is provided in accordance with the invention a container ensemble for food packaging including: (a) a substantially planar lid array member formed of a polymeric material defining a plurality of substantially planar lids which are integrally formed and separably joined to each other, each of the lids including a sealing channel around its perimeter and a skirt extending outwardly therefrom
20 provided with tearable portions to facilitate separation; (b) a cup array member formed of a polymeric material defining a plurality of cups which are integrally formed and separably joined to each other, each of the cups including a bottom, a sidewall, a brim about an upper opening of each cup and a skirt extending outwardly from its brim, wherein the skirts of each cup include tearable portions
25 to facilitate separation; (c) the sealing channels of the lids of the lid member being adapted to mate with the brims of the cups to provide a plurality of separably joined sealed containers when the lid member and cup member are joined in sealing engagement; the ensemble being thereby adapted for sequentially: receiving serving portions of food in a plurality of cups; lidding the cups to
30 provide sealed containers containing individual portions; separating the sealed containers; and distributing the packaged portions. The container ensemble is

further characterized by at least one attribute selected from (i) or (ii) or (iii), wherein attribute (i) is that the lid array member is formed from a different composition than the cup array member; attribute (ii) is that the lid array member and the cup array member are thermoformed from sheets of thermoplastic material of different thickness; and attribute (iii) is that at least one of the lid array member or the cup array member includes a slip agent to alleviate nesting lock.

One preferred way of practicing the invention is producing lids and cups separately. Separate production removes the limitations inherent in producing the lids and cups simultaneously from a common sheet of material. Product cost reduction is accomplished in some preferred embodiments by thickness reduction in the lid while maintaining product performance attributes, through higher thickness, in the base or cup. For example, 2-oz., 4-oz., and 6-oz. products may have base (cup) sheet thickness in the range of 20-22 mils (thousandth of an inch) and lid sheet thickness in the range of 12.5-15 mils. Producing lids and cups with different sheet thickness (and/or different materials) offers the ability to optimize the design of the scoring and perforations necessary to enable the lids or cups to be separated easily. This in turn means that the tooling required to effect the scoring and perforations can be optimized for the thickness and/or type of material used for the lids and cups.

Likewise, the present invention enables a wide range of color options which provides product variety and better utility in many applications where color coding or optical clarity is desired. Clear lids and cups, produced as known in the art through use of clarifying chemicals and/or nucleating agents, can be made and used in combination with each other, with any translucent or opaque materials, and in any color combination. Clear or translucent material can be tinted and then the lids and cups mixed or matched in a package. For example, in a package the lids may be tinted green and the cups tinted blue or both the lids and cups tinted blue. The combinations and colors of tints can be from any part of the color spectrum as long as the colorants are suitable for use in food contact articles.

Multilayer material, similar to that used in multilayer cold cups, having different colors on each side may be used with a variety of lids to differentiate the product. Different opaque color cups and lids may be mixed or matched with each other or with clear or translucent tinted lids or cups.

5

Product options are further provided by the use of different polymer materials for the cup and lid. If limited heat tolerance is required then a polypropylene (PP) cup may be matched with a PP lid. In cases where environmental stress crack resistance is required, combinations of cups and lids made from polyethylene terephthalate (PET) could be provided. For higher heat tolerance, the lid and cup could be crystal PET (CPET) or a CPET cup and a PP lid. Other materials may be mixed and matched depending on the required performance and cost criteria. The materials may be polystyrene, polyactic acid, or any other suitable material. In particular, a PP material filled with one or more mineral fillers might advantageously be used. In applications requiring good performance during microwave use, mica-filled PP materials may be used. These materials offer excellent microwave performance and heat-resistance, and can be produced in a variety of colors, including a non-carbon-containing black color that is particularly suitable for foodservice applications

20

The same or different chemical agents may be applied to or incorporated into separately produced cups and lids. For example, denesting agents may be used to ensure individual units can be removed easily from a stack of units. In the present invention, the type of denesting agents, the concentration of such agents and how the agents are applied can be varied depending on the manufacturing methods used for the cup and lid, the materials chosen for the cup and lid, and the specific denesting requirements in a stack of cups or lids depending on the structural design, surface roughness, etc. of the cup or lid. Commonly used internal denesting agents include fatty acids, fatty acid esters, and fatty amides that bloom to the surface of the plastic, which are typically added to the plastic during manufacture or compounding. In these cases, the lid and cup may have a

30

different chemical composition. Alternatively, an aqueous silicone treatment may be topically applied to a surface of the lid or cup during or after manufacture. These or other denesting agents could be used individually or in combination to effect the appropriate denesting characteristics in a stack of lids and a stack of
5 cups. Other chemical optional components could include: antifogging agents, clarifiers, impact modifiers, light stabilizers or processing aids which facilitate efficient manufacture or enhance the processability or functionality of the plastic.

Producing the lids and cups separately offers the opportunity to optimize
10 the packaging design and minimize the storage/transport volume (i.e. the "cube") required.

These and other features of the invention will become apparent from the discussion which follows.

15

Brief Description of Drawings

The invention is described in detail below with reference to the drawings, wherein like numerals designate similar parts and wherein:

20 **Figure 1** is an exploded view in perspective of a thermoformed container/lid ensemble constructed in accordance with the present invention wherein the lids are thermoformed from one sheet of thermoplastic resin and the cups are thermoformed from another sheet of thermoplastic resin;

25 **Figure 2** is a view in elevation of an individual cup of the present invention provided with a medial sealing bead about the four (4) straight portions of its brim;

Figure 3 is a top view of an individual cup of the present invention
30 provided with medial sealing beads;

Figure 4 is an enlarged schematic view illustrating the profile of the medial sealing bead;

Figure 5 is an exploded schematic view of a portion of a single container
5 in profile illustrating alternate locations of medial sealing beads;

Figure 6 is a top plan view of a stack of nested lid array members;

Figure 7 is a view in elevation of a stack of nested lid array members;
10

Figure 8 is a plan view of a stack of nested cup array members;

Figure 9 is a view in elevation of a stack of nested cup array members;
and
15

Figure 10 is a view in perspective of an integrally thermoformed container/lid ensemble constructed in accordance with a still further embodiment of the present invention.

20 Detailed Description

The invention is described in detail below with reference to several embodiments. Modifications of those embodiments within the spirit and scope of the present invention, set forth in the appended claims, will be readily apparent to those of skill in the art. As will become apparent from the discussion which
25 follows and the appended drawings, products of the invention may be thermoformed from thermoplastic sheet, such as a multilayer thermoplastic sheet. The lids and cups may be made separately or the lid member may be integrally fabricated with the cup member such as when the lid member and the cup member are formed from a single sheet of thermoplastic material. In these embodiments,
30 an array of cups is adjacent an array of matching lids and thermoplastic material therebetween forms a hinge about which the lids may be pivoted in order to seal

their matching cups. The sheet material may be a coextruded sheet having distinct regions of different composition and the lid member is formed of a first composition and the cup member is formed of a second composition. The different compositions may be of different color or the first composition and the second composition may be of different optical clarity. Materials and techniques for coextrusion are seen in the following patents and publications: United States Patent No. 6,598,738 to *Weaver* entitled "Multiple Property Container Carrier"; United States Patent No. 6,561,783 of *Hsu* entitled "Extruding Machine for Making Multi-Color Mesh Belts"; United States Patent Application Publication No. US 2003/0203177 A1 of *Cramer* entitled "Apparatus and Method for Co-Extruding Multi Color Plastics"; and United States Patent Application Publication No. US 2003/0203176 A1 also of *Cramer* entitled "Apparatus and Method for Co-Extruding Multi Color Plastics".

15 In many preferred embodiments, the lid member and cup member are fabricated as separate components and in such cases the lid member and cup member may be thermoformed from thermoplastic sheet of different caliper. Particularly preferred is where the lid member is thermoformed from thermoplastic sheet having a caliper less than that of the thermoplastic sheet from which the cup member is thermoformed, for example, the lid member may be thermoformed from thermoplastic sheet having a caliper at least about 25% less than that of the thermoplastic sheet from which the cup member is thermoformed. In another aspect of the invention wherein the lids and cups are fabricated separately, the lid member and cup member are thermoformed from thermoplastic sheet of different composition, for instance, wherein the lid and cup members are of different colors, different optical clarities, or where one member has a slip agent and one does not or when the cups and lids have different slip agents to alleviate nesting lock. Slip agents include internal slip agents melt-blended with the polymeric material during manufacture such as fatty acids, fatty acid esters and fatty acid amides. Exemplary materials include oleamides and erucamides. Alternatively, an external slip agent may be applied after or during formation of

the lids and cups. Suitable external slip agents include silicones or powders having a mean particle size between about 1 and about 10 microns. Slip agents including powders, fatty acid esters and the like are described in the following patents: United States Patent No. 6,291,026 of *Hanson et al.* entitled "Method for
5 Forming a Mold-Release Coating" and United States Patent No. 5,415,791 of *Chou et al.* entitled "Lubricating Composition and the Sliding Member Comprising the Composition".

One preferred construction is wherein at least one of the lid or cup
10 members is provided with a micronodular surface and is formed from a composition comprising a polypropylene matrix polymer, mica and optionally calcium carbonate. A black pigmented polypropylene/mica composition may be pigmented black with a pigment including black iron oxide and a green phthalocyanine dye. Such materials are described in the following patents and co-
15 pending application: United States Patent No. 6,700,106 of *Cochran II et al.* entitled Disposable, Microwaveable Containers Having Suitable Food Contact Compatible Olfactory Properties And Process For Their Manufacture" (Attorney Docket No. 2081-BA; FJ-98-5BA); United States Patent No. 6,670,592 of *McCarthy et al.* entitled "Thermoformed Polypropylene Mineral-Filled
20 Microwaveable Containers Having Food Contact Compatible Olfactory Properties and Process for Their Manufacture" (Attorney Docket No. 2081-1B; FJ-99-6B); United States Patent No. 6,459,075 to *McCarthy et al.* entitled "Thermoformed Polypropylene Mineral-Filled Microwaveable Containers Having Food Contact Compatible Olfactory Properties and Process for Their Manufacture" (Attorney
25 Docket No. 2081-1; FJ-99-6); United States Patent No. 6,420,689 of *Cochran II et al.* entitled "Disposable, Microwaveable Containers Having Suitable Food Contact Compatible Olfactory Properties And Process For Their Manufacture" (Attorney Docket No. 2081-B; FJ-98-5B); United States Patent No. 6,403,936 of *Cochran II et al.* entitled "Disposable, Microwaveable Containers Having Suitable Food
30 Contact Compatible Olfactory Properties And Process For Their Manufacture" (Attorney Docket No. 2081-C; FJ-98-5C); United States Patent No. 6,255,636 of

Cochran II et al. entitled "Disposable, Microwaveable Containers Having Suitable Food Contact Compatible Olfactory Properties And Process For Their Manufacture" (Attorney Docket No. 2081-A; FJ-98-5A); United States Patent No. 6,211,501 of *McCarthy et al.* entitled "Thermoformed Polypropylene Mineral-Filled Microwaveable Containers Having Food Contact Compatible Olfactory Properties and Process for Their Manufacture" (Attorney Docket No. 2081-1; FJ-99-6); United States Patent No. 6,211,500 of *McCarthy et al.* entitled Thermoformed Polypropylene Mineral-Filled Microwaveable Containers Having Food Contact Compatible Olfactory Properties and Process for Their Manufacture" (Attorney Docket No. 2081-1; FJ-99-6); and United States Patent Application Publication No. US 2003-0190443 A1 of *McCarthy* entitled "Thermoformed Food Containers With Colorfast High Color Density Black Pigment" (Attorney Docket No. 2372; GP-01-20).

As noted above, the containers of the present invention may be fabricated in a variety of ways, such as wherein the plurality of separably joined cups are arranged in an N x M array, and/or wherein the plurality of separably joined lids are arranged in an N x M array, N and M being independently selected integers from 1 to 6. Typically, the cups and lids are separably joined by tearable portions that are perforated or scored. The containers have any suitable size, such as a fill volume of from about 1 to about 8 fluid ounces, with 2, 4, or 6 fluid ounces fill volume being somewhat typical. Suitable compositions for the lid member or the cup member are thermoplastic compositions including polystyrene polymer compositions. Polystyrene compositions may include high impact polystyrene, rubberized polystyrene, oriented polystyrene and the like. Alternatively, the containers may be made of polyolefins, e.g. polyethylene or polypropylene or the containers may be made from a composition containing thermoplastic polyester, for example, polyethylene terephthalate.

Perhaps most preferably, the brims of the cups have profiles which are U-shaped and the lids are provided with corresponding U-shaped channels

configured so that the lids and cups cooperate to form substantially continuous seals around the opening of the cups when the lid member and cup member are joined together in sealing engagement. A particularly preferred embodiment is wherein the brims of the cups are further provided with: (a) a plurality of rounded
5 corner brim portions; (b) a plurality of lateral brim walls extending between the rounded brim corner portions, the walls being configured such that the surfaces are substantially linear along a direction between adjacent brim corners interconnected thereby; and (c) a plurality of medial sealing beads disposed on an outer surface of the lateral brim walls, the sealing beads being characterized in
10 that: (i) the medial sealing beads project outwardly from the outer surfaces of their respective lateral walls a maximum distance at a central portion thereof between and distal to adjacent corners with lesser projections away from their lateral walls at their end portions proximate adjacent corners; and (ii) the medial sealing beads extend over the major portion of the length of the lateral wall between adjacent
15 corners upon which they are disposed. In this construction it is most preferred that the plurality of medial sealing beads extends over substantially the entire distance between rounded corners.

Another aspect of the invention is a system for food packaging comprising
20 an ensemble of: a) a nested stack of substantially planar lid array members formed of a polymeric material each defining a plurality of substantially planar lids which are integrally formed and separably joined to each other, each of the lids including a sealing channel around its perimeter and a skirt extending outwardly therefrom provided with tearable portions to facilitate separation, wherein the sealing
25 channel defines a top recess on each lid; b) a nested stack of cup array members formed of a polymeric material each member defining a plurality of cups which are integrally formed and separably joined to each other, the cups including a bottom, a sidewall, a brim about an upper opening of each cup and a skirt extending outwardly from its brim, wherein the skirts of each cup include tearable
30 portions to facilitate separation, wherein further the bottom of each cup is configured to fit with the top recess of a lid such that an assembled lid/cup

ensemble of sealed containers is securely stackable; c) the sealing channels of each lid of the lid members being adapted to mate with the brims of the cups of a cup member to provide a plurality of separably joined sealed containers when a lid member and cup member are joined in sealing engagement; an assembled lid/cup
5 ensemble of sealed containers being thereby adapted for sequentially: (i) receiving serving portions of food in a plurality of cups; (ii) lidding the cups to provide sealed containers containing individual portions; (iii) separating the sealed containers; and (iv) distributing the packaged portions; d) the container ensemble being further characterized by at least one attribute selected from (i) or (ii) or (iii),
10 wherein attribute (i) is that the lid array member is formed from a different composition than the cup array member; attribute (ii) is that the lid array member and the cup array member are thermoformed from sheets of thermoplastic material of different thickness; and attribute (iii) is that at least one of the lid array member or the cup array member includes a slip agent to alleviate nesting lock.

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Still further features and advantages will become apparent from the drawings and discussion which follows.

Referring to **Figure 1**, there is illustrated a container ensemble **10**
20 including a substantially planar lid array member **11** including lids **12, 14, 16, 18, 20** and **22** in a 2 x 3 arrangement formed from a first sheet **23** of thermoplastic material as well as a cup array member **24** including cups **26, 28, 30, 31, 32** and **34** formed from a second sheet **25** of thermoplastic material. Both the lid and cup members are conveniently formed from a sheet of thermoplastic material as is
25 well known in the art.

Each lid has a sealing channel such as channel **36** which is configured to cooperate with the corresponding brim cup to form a seal; that is channel **36** is configured to cooperate with brim **48** to form a sealed container which may be
30 separated from the others after sealing. The lids are separably joined to each other

by a skirt such as skirt **40** which has a scored or perforate tearable portion **42** so that the lids can be separated from one another.

Each cup of cup member **24** includes a bottom **44**, a sidewall **46** and a
5 brim **48** extending around an opening **50** of each cup. There is additionally provided a skirt **52** around each cup extending outwardly from its brim. The skirts include scored or perforate portions such as portions **54**, **56** so that the cups can be separated from each other.

10 The profiles of lid **22** and brim **48** of cup **26** are likewise seen in **Figure 5**. **Figure 5** has the same container shape as seen in **Figures 1-4** except that the sealing beads are shown at alternative locations, discussed further below.

As will be appreciated from **Figures 1** through **5**, each container includes a
15 cup or receptacle portion as well as an associated lid portion which may be joined together and sealed before separation. Each receptacle portion has a brim with a plurality of straight portions between rounded corners as will be particularly appreciated by reference to **Figures 2** and **3**.

20 **Figure 2** is a view in elevation of cup **26** of **Figure 1**, while **Figure 3** is a top plan view thereof. Cup **26** has a brim **48** provided with four linear segments **100**, **102**, **104**, and **106**. The linear segments are interconnected by rounded corners **108**, **110**, **112**, and **114**. Preferably the brim is U-shaped in profile as shown with generally flat (except for sealing beads) inner and outer sidewalls
25 which define a U-shape together with its top. Likewise, the channels are most preferably U-shaped with flat walls cooperating to form a seal with the substantially rectangular, U-shaped brim when the parts are engaged. Each of the linear segments **100**, **102**, **104** and **106** of the brim has a medial sealing bead, **116**, **118**, **120**, and **122** as shown extending substantially over the entire length, **L**, of
30 the linear segment and blending with the corners between the linear segments. Most preferably, the medial sealing beads are arched in shape as shown and flush

with the corner portions of the brim and are configured such that they generally progressively increase in projection from the walls of the brim as the distance from the adjacent corner portions increases. That is to say, the sealing beads project away from the brim a maximum distance at the center portion of the linear segment where they are disposed. This feature is perhaps best appreciated by reference to **Figures 2** and **4**. **Figure 4** is an enlarged schematic view in section along line 4-4 of **Figure 2**, that is, at the center point of linear segment **104**. Here the sealing bead **120** has its maximum projection indicated as **P**, away from surface **105** of brim segment **104** which may be about 8 mils (thousandths of an inch) or so for a 2- ounce container. It will be appreciated from the **Figures**, especially **Figure 3**, that the curvature of the sealing beads is very subtle, that is, the beads have a very large radius of curvature from end to end. In the embodiment shown in **Figures 1** through **4**, the bead is disposed at a height which is approximately two-thirds the height, **H**, of brim portion segment **104** above surround skirt **52**. Other positions of sealing beads are possible. That is to say, the sealing bead is located on wall surface **105** of brim portion segment **104** as shown in the diagram. The beads are in the same location on all straight segments of the brims on the containers shown in **Figure 1**, as will be appreciated from **Figures 2** and **3**, especially.

Each of the cups and lids has all of the features of cup **26** and lid **22**, discussed in more detail below. For example, the lid channels and brims have the shape shown schematically in **Figure 5**, except that in **Figures 1-4** the sealing beads are shown on the outer lateral walls of the sealing brim. Preferably the channels have a U-shaped profile as do all of the brims as shown in **Figures 1** and **5**. Note in **Figures 1** and **5** the brims and channels have U-shaped profiles provided with flat inner and outer walls, except where the sealing bead is formed. Each receptacle portion or cup also has a surround or skirt extending outwardly from the brim on its lower edge as is seen in **Figure 1** and perhaps better appreciated from **Figures 2** and **3** where the shaped construction of the sidewalls of the receptacle portion of the containers is likewise appreciated. That is to say

the rounded corners of the containers as well as the recessed sidewalls **58** of the various cups may also be seen.

There are shown schematically in **Figure 5** alternate locations of sealing
5 beads of the present invention.

Figure 5 illustrates a container including a cup portion **152** as well as a lid portion **154**. The cup portion has a brim **156** which might include a sealing bead on its inner wall as indicated at **158** instead of on the outer wall as in shown in
10 **Figures 1** through **4**. Likewise, lid **154** may include a channel **160** provided with sealing beads on its inner wall as indicated at **162** and/or on its outer wall as indicated at **164**. It is believed that the embodiment shown in **Figures 1** through **4** is preferable for many containers of the present invention; however, the beads as described herein may be suitably located at one or more locations as is shown in
15 **Figure 5**.

The length of the maximum projection, **P**, away from the sidewall of the brim upon which the medial sealing bead is disposed has an impact on the seal improvement for the container. It is found in accordance with the present
20 invention, that a seal with a maximum projection of 8 mils performed substantially better than a seal having a maximum projection of 0.005 inches or 5 mils. It is seen in the vinegar/oil leak test the percent pass for the 8 mil bead was 96 percent while only 46 percent of the 5 mil bead containers passed, suggesting that the projection distance impacts performance. Thus, if one looks at **Figure 3**
25 the linear length, **L**, of a straight portion of the brim may be for example one inch or so for a 2-ounce container where the optimal projection length away from the sidewall of the brim may be about 8 mils. Thus suitably a preferred ratio of **P/L** is preferably from about 0.0075 to about 0.01. That is to say, for a one inch straight sidewall length the projection should be from about 7.5 to 10 mils or so. In other
30 embodiments, preferred **P/L** ratios may vary. For example, **P/L** ratios of from

about 0.0025 to about 0.025 are within the scope of the invention as are **P/L** ratios of from about 0.005 to about 0.015.

The integrally formed, container/lid arrays of the present invention may be
5 conveniently formed by way of any conventional molding technique from a
plastic material such as by a thermoforming process from a suitable thermoplastic
sheet. "Thermoforming", "thermoformed" and like terminology is given its
ordinary meaning. In the simplest form, thermoforming is the draping of a
softened sheet over a shaped mold. In the more advanced form, thermoforming is
10 the automatic high speed positioning of a sheet having an accurately controlled
temperature into a pneumatically actuated forming station whereby the article's
shape is defined by the mold, followed by trimming and regrind collection as is
well known in the art. Still other alternative arrangements include the use of
drape, vacuum, pressure, free blowing, matched die, billow drape, vacuum snap-
15 back, billow vacuum, plug assist vacuum, reverse draw with plug assist, pressure
bubble immersion, trapped sheet, slip, diaphragm, twin-sheet cut sheet, twin-sheet
roll-fed forming or any suitable combinations of the above. Details are provided
in J.L. Throne's book, *Thermoforming*, published in 1987 by Coulthard. Pages 21
through 29 of that book are incorporated herein by reference. Suitable alternate
20 arrangements also include a pillow forming technique which creates a positive air
pressure between two heat softened sheets to inflate them against a clamped
male/female mold system to produce a hollow product. Metal molds are etched
with patterns ranging from fine to coarse in order to simulate a natural or grain
like texturized look. Suitable formed articles are trimmed in line with a cutting
25 die and regrind is optionally reused since the material is thermoplastic in nature.
Other arrangements for productivity enhancements include the simultaneous
forming of multiple articles with multiple dies in order to maximize throughput
and minimize scrap. In some preferred embodiments, the melt-compounded
composition from which the articles are made may include polypropylene and
30 optionally further includes a polyethylene component and titanium dioxide.
Suitable materials and techniques for fabricating the disposable containers of the

present invention from thermoplastic materials appear in the references enumerated above, see for instance United States Patent No. 6,211,501 to *McCarthy et al.* as well as United States Patent No. 6,211,500 to *Cochran II et al.* the disclosures of which are incorporated herein by reference. When
5 thermoformed, the containers are made from sheet having a caliper of from about 5 to 30 mils; typically from about 10 to 20 mils.

Alternatively, the lid/container ensemble may be injection molded; however, thermoforming is generally preferred.
10

The present invention provides a unique combination of leak resistance and ease of capping. This latter feature is very important especially for thermoformed articles which tend to crush if the capping force required is too high. This will be appreciated from the discussion which follows.

15

Product Testing

Products were tested for water or vinegar/oil leakage as follows: (a) with the containers still inter-connected and with their lids still inter-connected, they were filled with water or a 50/50 mixture of vinegar and vegetable oil; (b) the
20 containers were then closed; (c) the containers were then separated from one another and placed on blotter paper; (d) each container was then placed on a side thereof, the side selected not having a hinge or tab; (e) the container was allowed to remain on its side for up to ten minutes; (f) if the container did not leak in 10 minutes, it was recorded as a pass; all others were recorded as failures; and (g) the
25 test was repeated for another container ensemble, but the containers were placed on their sides opposite to those of the first trial.

The capping force test was conducted as follows: (a) with the containers uncapped, individual containers were separated from six-pack units, care being
30 taken not to tear or damage the brim of the cup; (b) the test specimen, including cup and cap, was placed in an automated capping tester with a preset gauge height

sufficient to receive the container without interference; (c) if the cup and lid were connected the lid was folded into a capping position, containers with separate cups and lids were prepared by placing the lid loosely in position on the cup brim; and a force gauge was zeroed and the speed set to 2½"/ minute; (d) the tester drive was
5 activated and the cross arm advanced until the cap was fully seated on the cup; (e) the container was inspected for damage; and (f) the capping force was recorded.

Initially the containers were made without medial sealing beads and did not perform well in the leak test. Initial trials involved making the lids tighter;
10 however more than half of these containers were crushed during capping. It was found however, that with a required capping force of four (4) pounds or so, no containers were crushed. The inventive design was conceived and tested after these initial failures. Composite results are shown in Table 1. Table 1 reflects the early approach toward improving leak testing by making a tighter cap, but as can
15 be seen from Table 1 this resulted in an unacceptably high rate of crushing of the container during capping. More importantly, it is seen from the data that with the present invention the containers are remarkably more leak resistant.

Table 1 – Leak/Cap Testing

	Water Leak	Vinegar/ Oil Leak	Capping Force with Hinge	% Crushed When Capped with Hinge	Capping Force without Hinge	% Crushed When Capped without Hinge	Avg 6 Pack Weight
	(% Pass)	(% Pass)	(lb.)		(lb.)		(grams)
Invention Tooling	100%	71%	4.8	0*	4.4	0*	31.694
Tooling A Without Sealing Bead	0%	0%	8.5	58%	8.2	58%	29.759
Tooling B Without Sealing Bead	75%	0%	4.1	0*	4.3	0*	29.870
<i>Vinegar/Oil Leak Breakdown</i>							
% Pass (0.008" Bead)			96%				
% Pass (0.005" Bead)			46%				

*very low percentage, believed negligible

5 In Table 1 there is seen a dramatic increase in leak resistance with the invention design, without the need for increased capping force and associated crushing of the containers.

Referring to **Figures 6 and 7**, there is shown a nested stack **200** of lid members **202, 204** and **206** each of which includes a plurality of nested lids such as lids **210, 212, 214, 216, 218** and **220** which are integrally formed and separably joined to each other by skirts such as skirt **222** which includes scored or perforated regions **224** to facilitate separation. Each individual lid has a channel such as channel **228** around its perimeter defining a plurality of top recesses **230, 232, 234, 236, 238** and **240** which are configured to receive the bottoms of cups of a corresponding cup member (**Figures 8 and 9**) so that assembled containers are

securely stackable. The channels themselves seal with the brims of corresponding cups as discussed above.

Referring to **Figures 8 and 9**, there is shown a nested stack **250** of cup members including cup members **252, 254 and 256**. Each cup member includes a plurality of cups such as cups **260, 262, 264, 266, 268 and 269**. The members are integrally thermoformed from a sheet, for example. The cups have bottoms such as bottom **270**, sidewalls such as sidewall **272** and brims such as brim **274**. The cups further include skirts such as skirt **276** and include scores as illustrated at **278, 280**. The bottom of each cup fits with the corresponding top recess of a lid member such as recesses **230-240** to make an assembled stack of sealed containers securely stackable as noted above. The components of the packaging system are compactly stored and a lid component may be used with a variety of cup components of different volume to provide flexibility and a minimum number of required components, while still providing color options so that servings can be color coded, if so desired.

Referring to **Figure 10**, there is shown an ensemble **310** of integrally formed separable containers including a first array **312** of containers and a second array **314** of containers arranged on either side of a medial axis **316**. The containers are separably joined to one another by a plurality of tear portions indicated by dashed lines such as portions **318, 320**. The tear portions may be scored portions and are most preferably scored perforated portions.

First array **312** of containers includes a receptacle or cup **322** having an upper aperture **324** as well as a rectangular brim **326**. A lid **328** is hingedly coupled to cup **322** by way of scored hinge portion **330** which is preferably a perforate scored portion as well. Lid **328** also has a channel **332** with a rectangular profile which cooperates with brim **326** (which also has a rectangular profile) to form a closed container. That is to say, upon pivotal motion of lid **328**

about hinge portion **330**, the lidded container including cup **322** and lid **328** forms a sealed container when the lid is secured to the brim.

It is seen that array **312** also includes a cup **334** with an upper aperture **336**
5 and a brim **338** as well as a lid **340** with a channel **341** secured to cup **334** by way of hinge **342**. Still further included in array **312** is a third container including cup **344** with upper aperture **346**, brim **348**, lid **350** with a channel **351** secured by way of hinge **352**.

10 Second array **314** of sealable containers includes: (i) a cup **354** with an upper aperture **356** and brim **358**, lid **360** with channel **362** and a hinge **363**; (ii) a cup **364** with an upper aperture **366**, brim **368**, lid **370** with a channel **372** and a hinge **374**; and (iii) cup **376** with an upper aperture **378** and a brim **380**, lid **382** with a channel **384** attached to cup **376** by way of hinge **385**.

15 Each of the cups and lids **334-382** has the features of cup **322** and lid **328**. Preferably the channels, such as channel **332**, **341**, **351** and so forth, have a U-shaped profile as do the brims such as brims **326**, **338**, **348** and so forth. Hinges, such as hinges **330** and **342** are also scored as shown by the dotted lines in **Figure**
20 **10** and may also be perforate scored if so desired. Each receptacle portion or cup also has a surround such as surround **386** and surround **388** located outside the brim on its lower edge as is seen in **Figure 10** and perhaps better appreciated from **Figures 2** through **5** where the shaped construction of the sidewalls of the receptacle portion of the containers is likewise similar.

25 Sheet **317** may be a coextruded sheet having a plurality of side-by-side coextruded regions **400**, **410** and **420** of different layers, optical clarity or composition. For example, regions **400** and **420** might be optically clear and extend from the outer edges **402**, **422** to the hinges **330**, **342**, **352**, **364**, **374** and
30 **385** between cups and their respective cups, while central region **410** of sheet **317** which is formed into the cups is heavily pigmented and opaque. Other

combinations are readily achieved by using sheet which is coextruded with side-by-side regions of different compositions or appearance. Likewise, visual effects are achieved with multilayer sheet, for example, where the interior surface of **425** of sheet **317** is white while the exterior surface **430** of sheet **317** is a darker color.

5

Typical components for side-by-side partially pigmented products and unpigmented products appear in Tables 2 and 3 below. The silicone solution is applied to the sheet after extrusion but before thermoforming.

Table 2 – Typical Product Compositions Side By Side

	Side by Side Sheet		
	Black	Natural	Clear
Resin	Atofina 960E*	Atofina 960E*	Atofina 520/Atofina 524 blend*
Denesting Agent	Silicone 4% solution	Silicone 4% solution	Silicone 4% solution
Application	topical	topical	topical
Technique	metering roll	metering roll	metering roll
Location	topical, top and bottom	topical, top and bottom	topical, top and bottom
Pigments/colors	black pigment	None	None
Amount	4%	NA	NA

* Polystyrene available from Atofina Petrochemicals

Table 3 – Typical Product Composition – Natural Product

	All natural
Resin	Nova 5400**
Denesting Agent	Silicone
Application	Topical
Location	topical, top and bottom
Pigments/colors	None
Amount	N/A

**Polystyrene available from Nova Chemicals,
designated STYROSUN 5400

While the invention has been described in connection with specific examples, modifications to those examples within the scope of the invention will be readily apparent to those of skill in the art.

CLAIMS

We Claim:

1. A container ensemble comprising:
 - a. an array comprising a plurality of substantially planar lids, each lid having a sealing channel and a skirt extending outwardly therefrom, wherein the lids are integrally formed and tearably joined to each other, and wherein each lid comprises:
 - i. a plurality of lid rounded corner portions; and
 - ii. a plurality of lateral lid walls extending between the lid rounded corner portions, the lateral lid walls being substantially linear between adjacent lid corner portions interconnected thereby;
 - b. an array comprising a plurality of cups, each cup having a brim and a skirt extending outwardly therefrom, wherein the cups are integrally formed and tearably joined to each other, and wherein each cup comprises:
 - i. a plurality of rounded corner brim portions; and
 - ii. a plurality of lateral brim walls extending between the rounded brim corner portions, the lateral brim walls being substantially linear along a direction between adjacent brim corners interconnected thereby;
 - c. a plurality of medial sealing beads disposed on lateral walls selected from lateral brim walls or lateral lid walls, wherein the sealing beads:
 - i. project away from their respective lateral walls a maximum distance at a central portion thereof between and distal to adjacent corners with lesser projections away from their lateral walls at their end portions proximate adjacent corners; and
 - ii. extend over the major portion of the length of the lateral wall between adjacent corners upon which they are disposed.

wherein the sealing channel of the lid and the brim are adapted to cooperate to form an assembled container having a substantially liquid proof seal, and wherein both the cup and lid arrays consist essentially of thermoformed polymeric material.

2. The container assemble of claim 1, wherein the lid array and cup array are each, independently, fabricated from different sheets of polymeric material.
3. The container ensemble according to claim 1, wherein the plurality of separably joined cups and lids are arranged in an $N \times M$ array, N and M being independently selected integers of from 1 to 6.
4. The container ensemble according to claim 1, wherein the arrays are each, independently, separably joined by tearable portions that are perforated or scored.
5. The container ensemble according to claim 1, wherein each container has a fill volume of from 1 to 8 fluid ounces.
6. The container ensemble according to claim 1, made from a thermoplastic composition comprising polystyrene.
7. The container ensemble according to claim 1, made from a thermoplastic composition comprising a polyolefin polymer.
8. The container ensemble according to claim 1, wherein the brims of the cups have profiles that are U-shaped and the sealing channels of the lids comprise corresponding U-shaped channels.
9. The container ensemble according to claim 1, wherein the plurality of medial sealing beads extends over substantially the entire distance between rounded corners.
10. The container ensemble according to claim 1, wherein each medial sealing bead defines a semi-circular profile extending between adjacent rounded corners.

11. The container ensemble according to claim 1, wherein the medial sealing beads each diminish to 0.000 inches at a tangency of a corner radius at the ends of the medial sealing beads.
12. The container ensemble according to claim 1, wherein the medial sealing beads are each tangent at their end portions to the rounded corners.
13. The container ensemble according to claim 1, wherein the lateral walls upon which the medial sealing beads are disposed have an upper portion and a lower portion and the medial sealing beads are located proximate to the upper portions of the lateral walls upon which each is disposed.
14. The container ensemble according to claim 1, wherein the lateral walls upon which the medial sealing beads are each disposed have a top and bottom defining a height and the medial sealing beads are each disposed at the upper portion of its respective lateral wall at substantially two-thirds the height of the lateral wall.
15. The container ensemble according to claim 1, wherein the medial sealing beads each have a maximum projection away from the lateral wall at substantially the center line of the lateral wall.

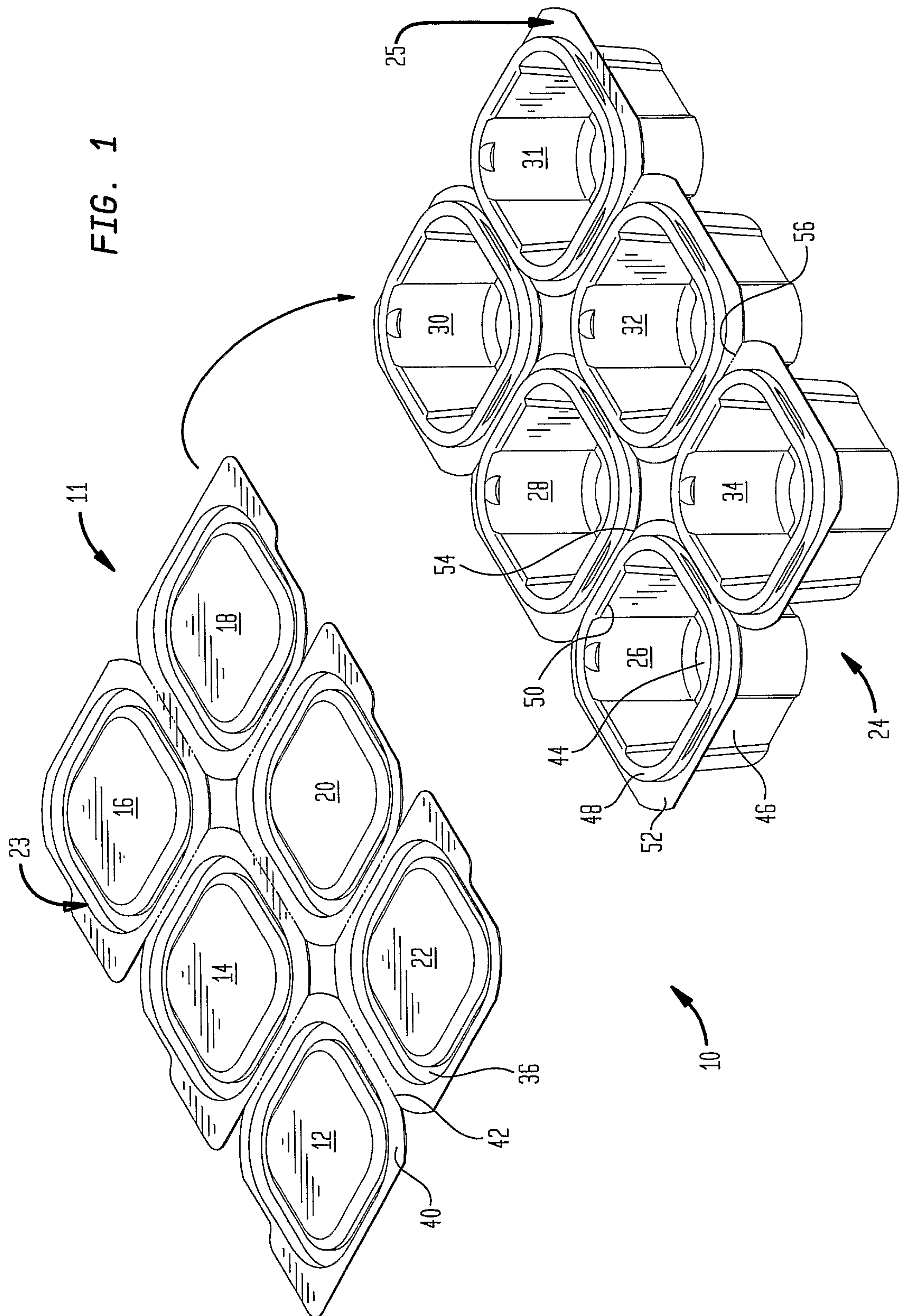


FIG. 2

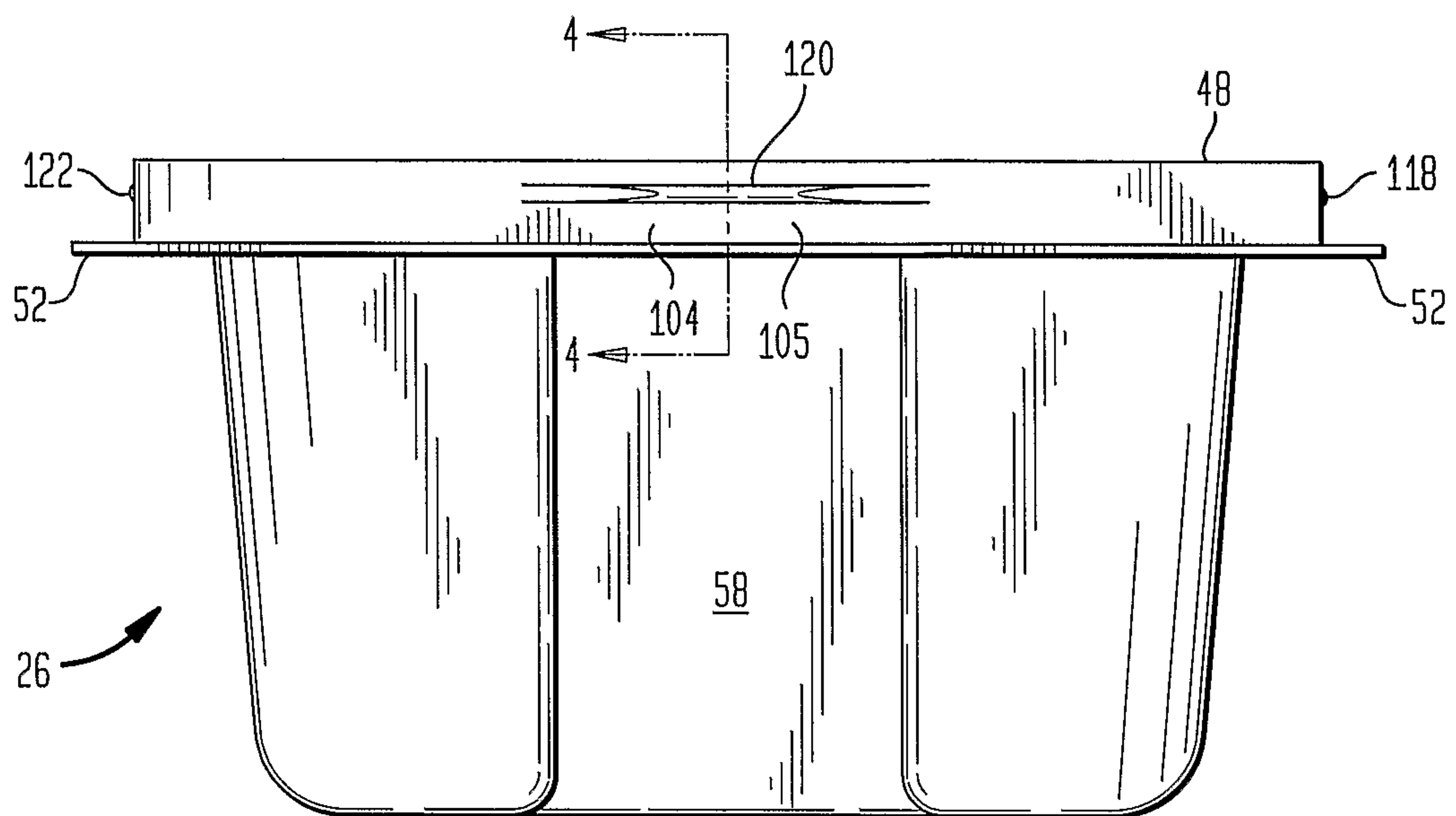


FIG. 3

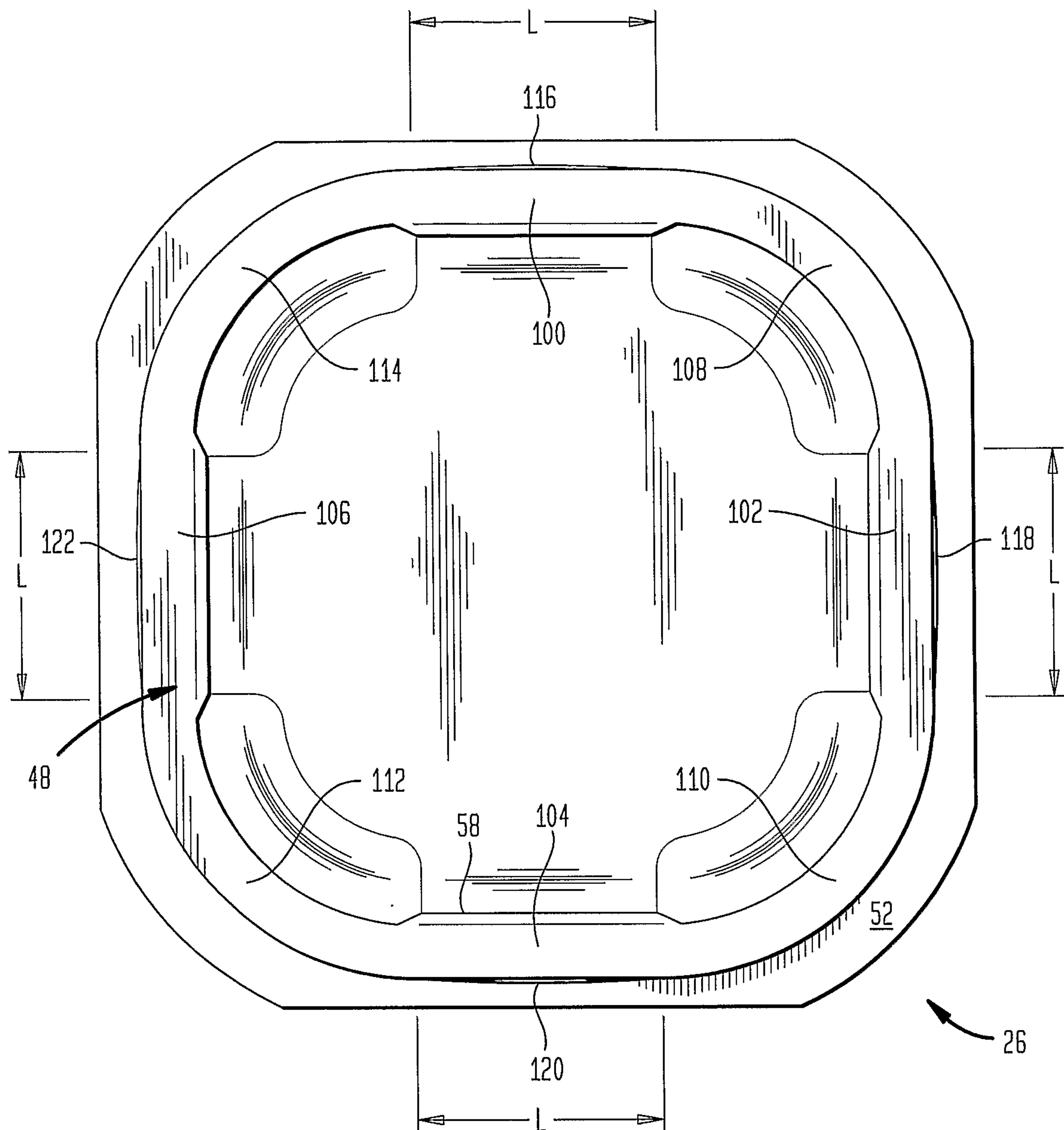


FIG. 4

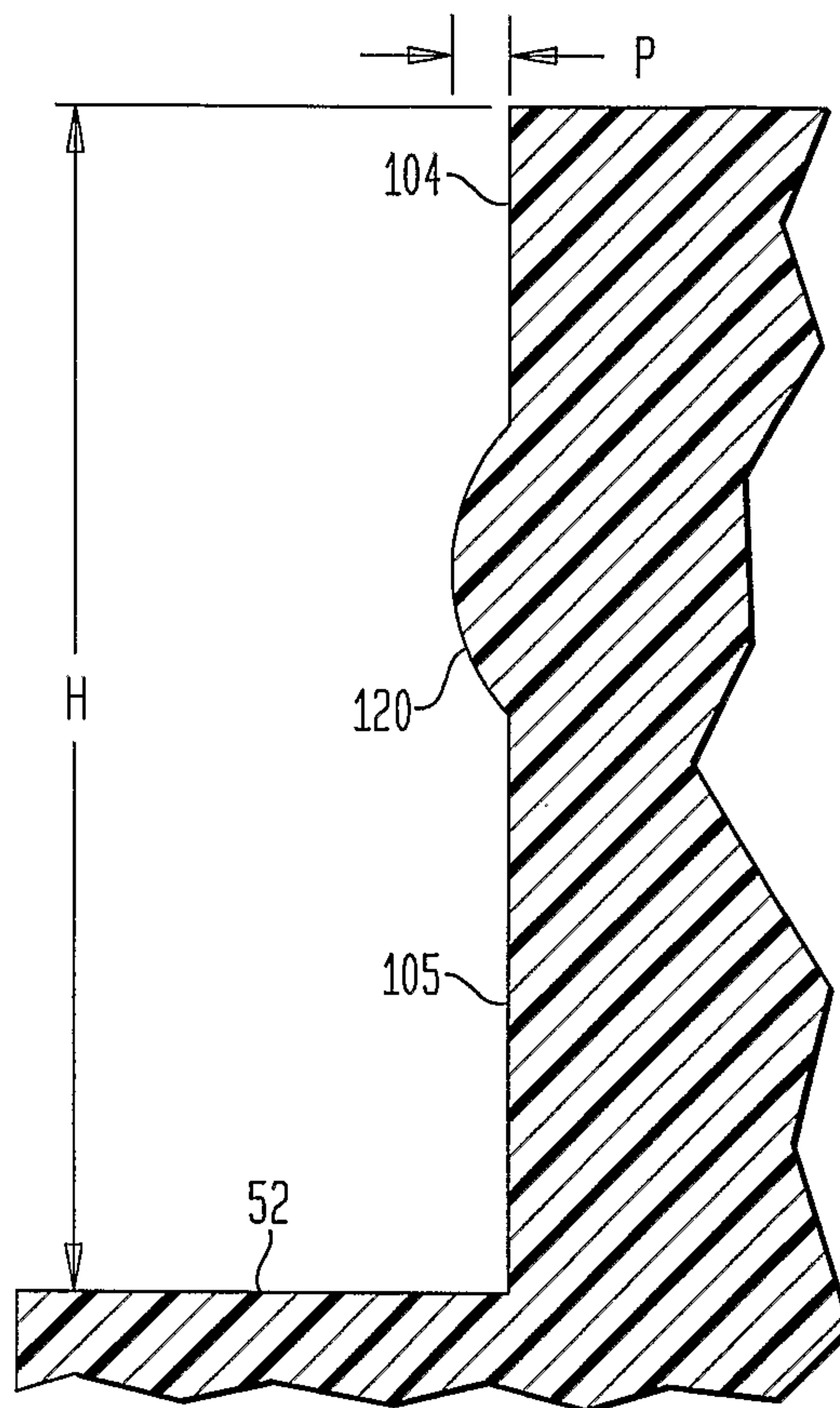


FIG. 5

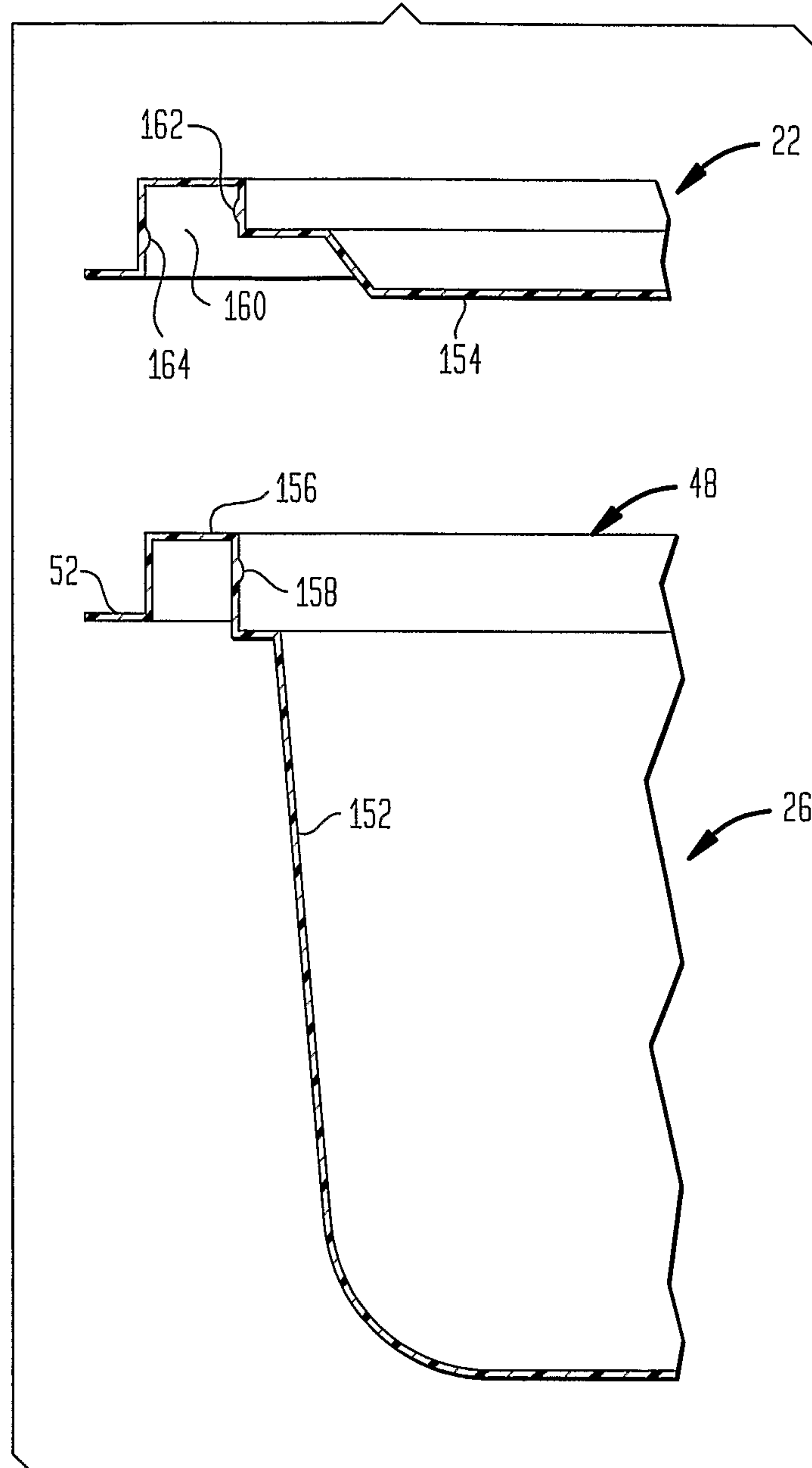


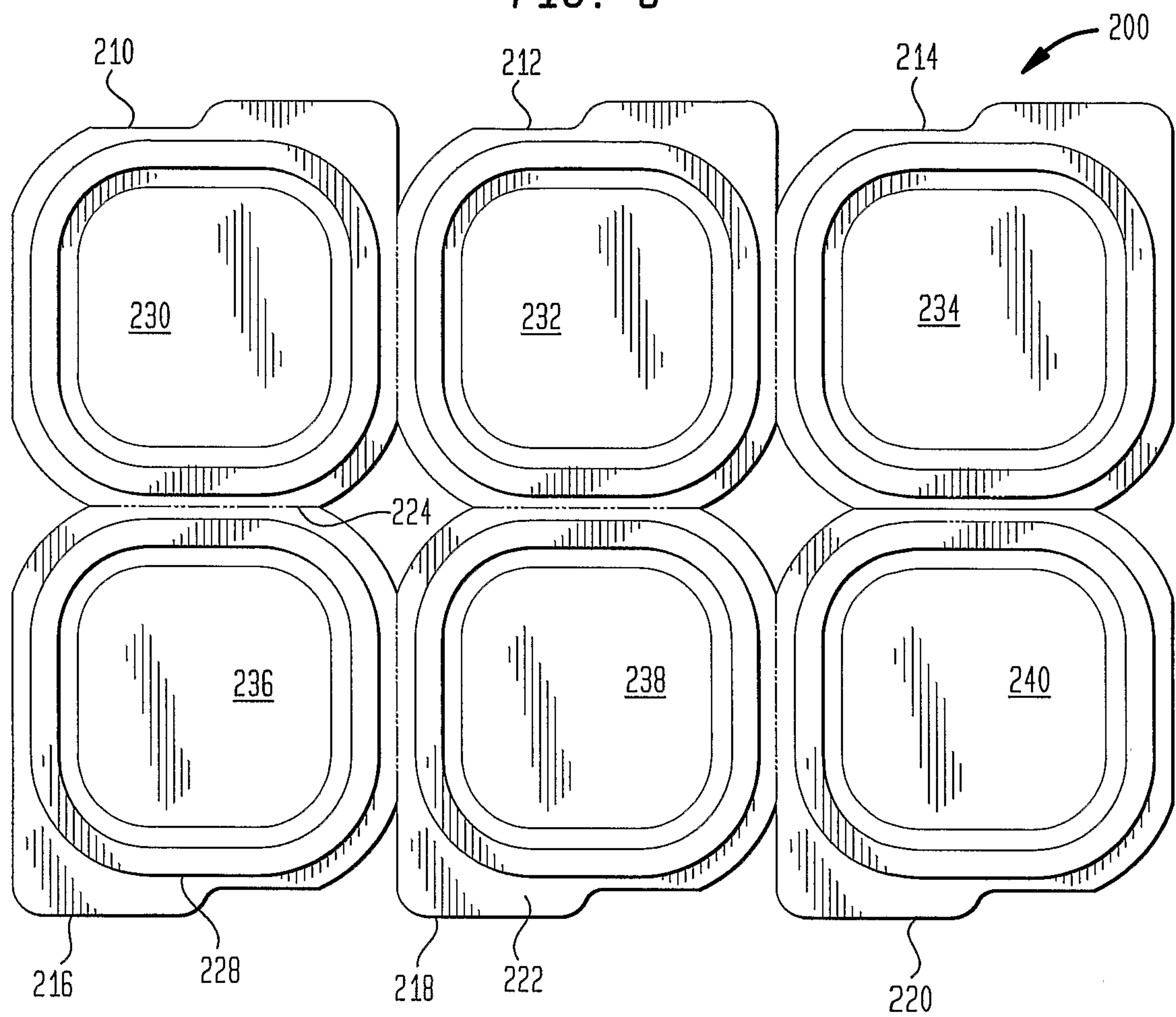
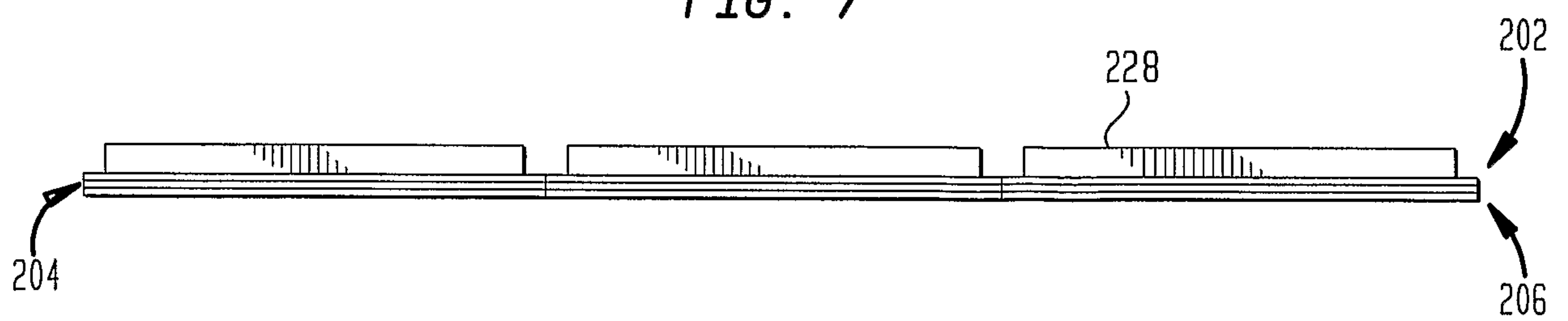
FIG. 6**FIG. 7**

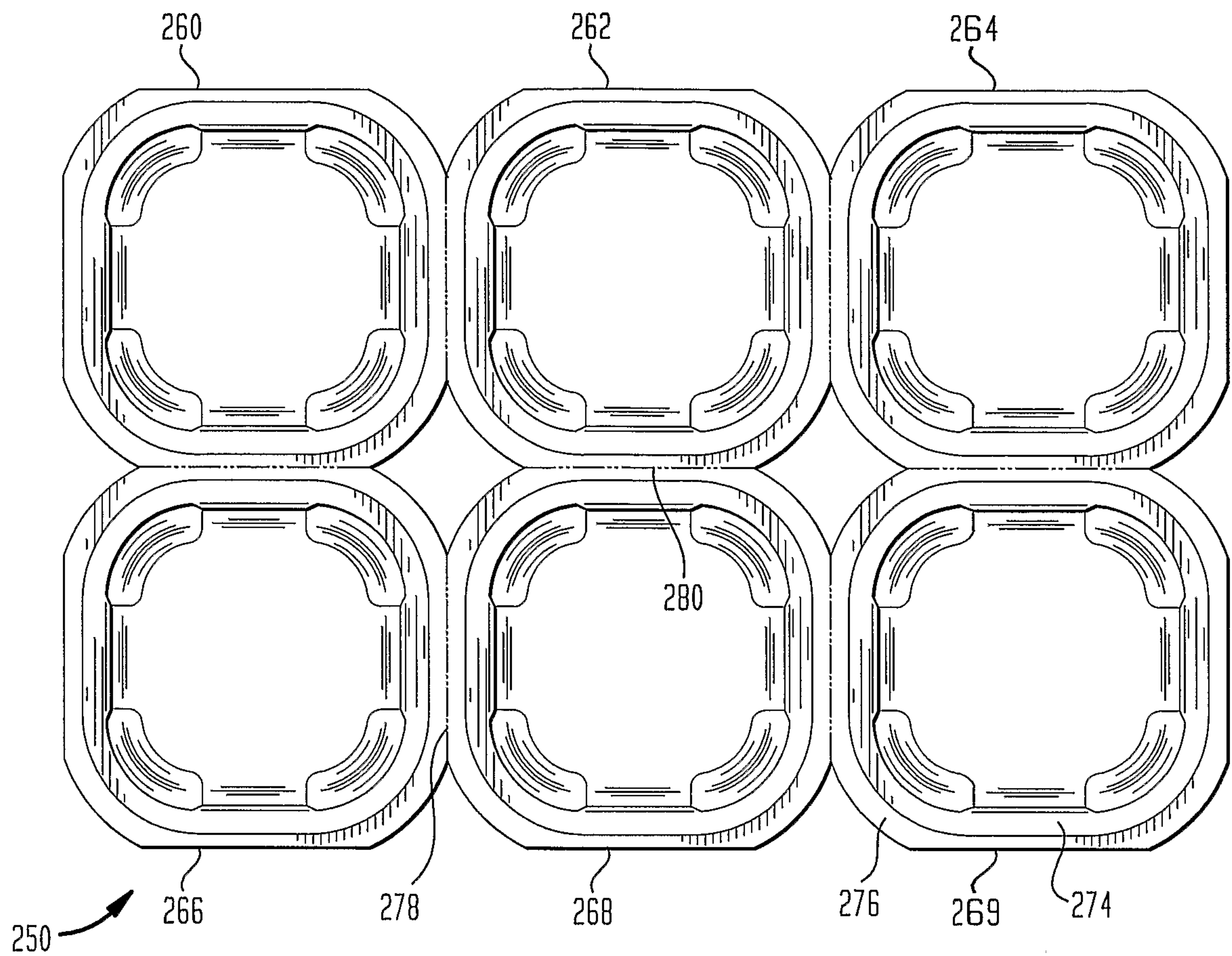
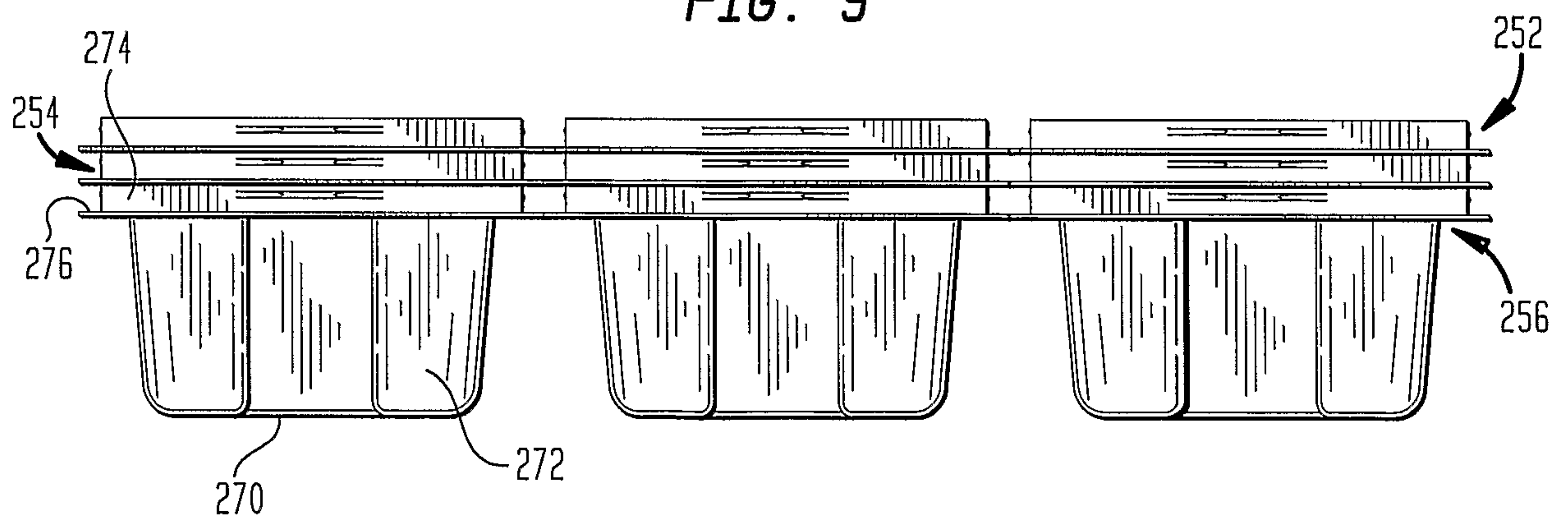
FIG. 8**FIG. 9**

FIG. 10

