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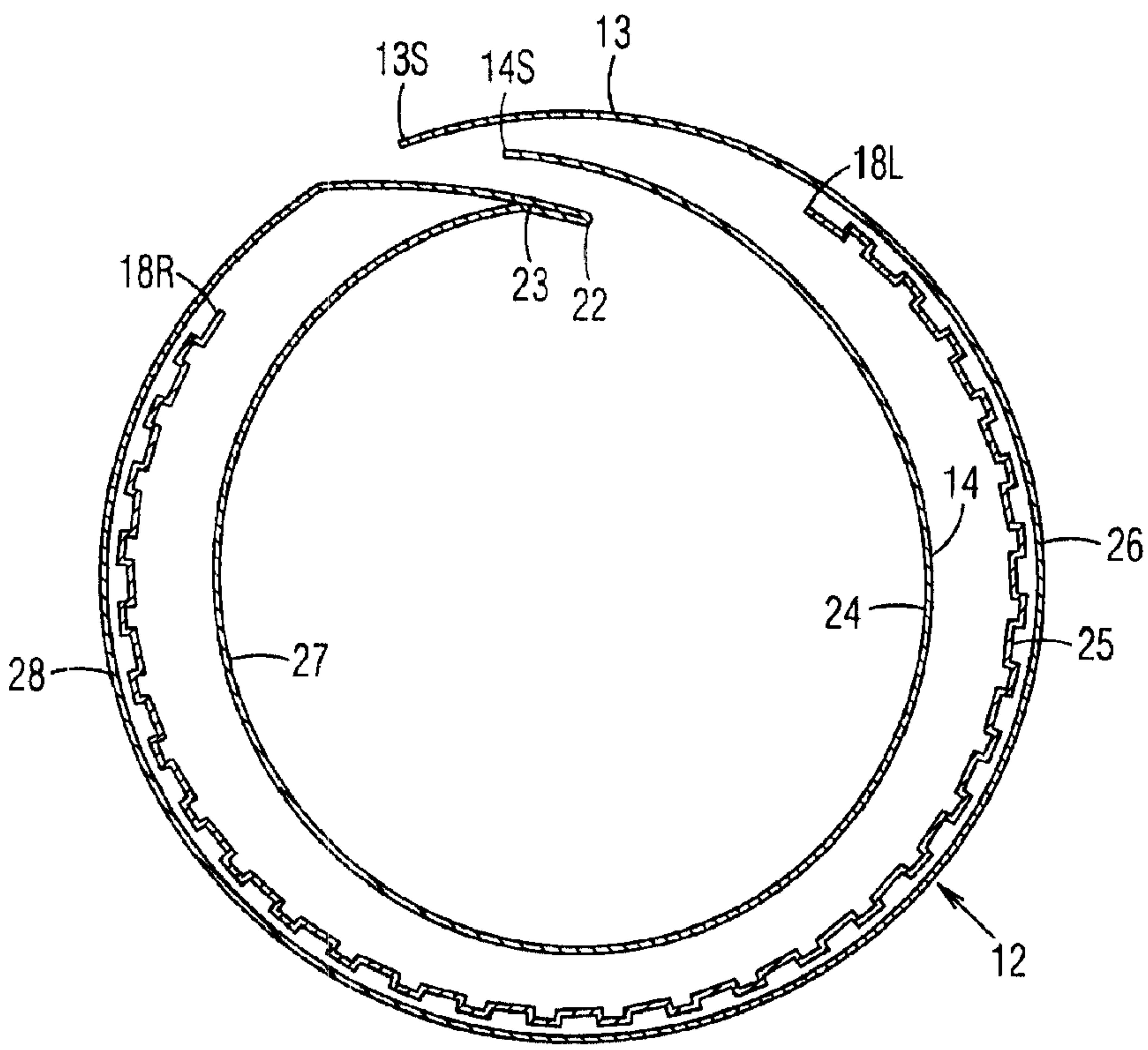

(57) Abrégé/Abstract:
An insulating container (50) and a method of manufacturing it comprises providing a sidewall blank (12B) having two sections separated by a fold score (15), and a separate insulating sheet (18) (corrugated, ribbed, embossed, foamed, perforated, etc.) adhesively fastened to one of the sections. Adhesive is applied to an area (12) adjacent the fold score bonding two sections adjacent the folded score. The assembly is wrapped around a mandrel to bring the outer edges together at a side seam (22S) which is sealed to form a sidewall (12). In a second embodiment, the insulating layer can be a coating on one or both of the sections of the two-section starting blank. In a third embodiment, the insulating section (40) can be integral with, and extend from, one edge of the starting blank. It is folded over first to form the middle layer of the wrappable assembly.

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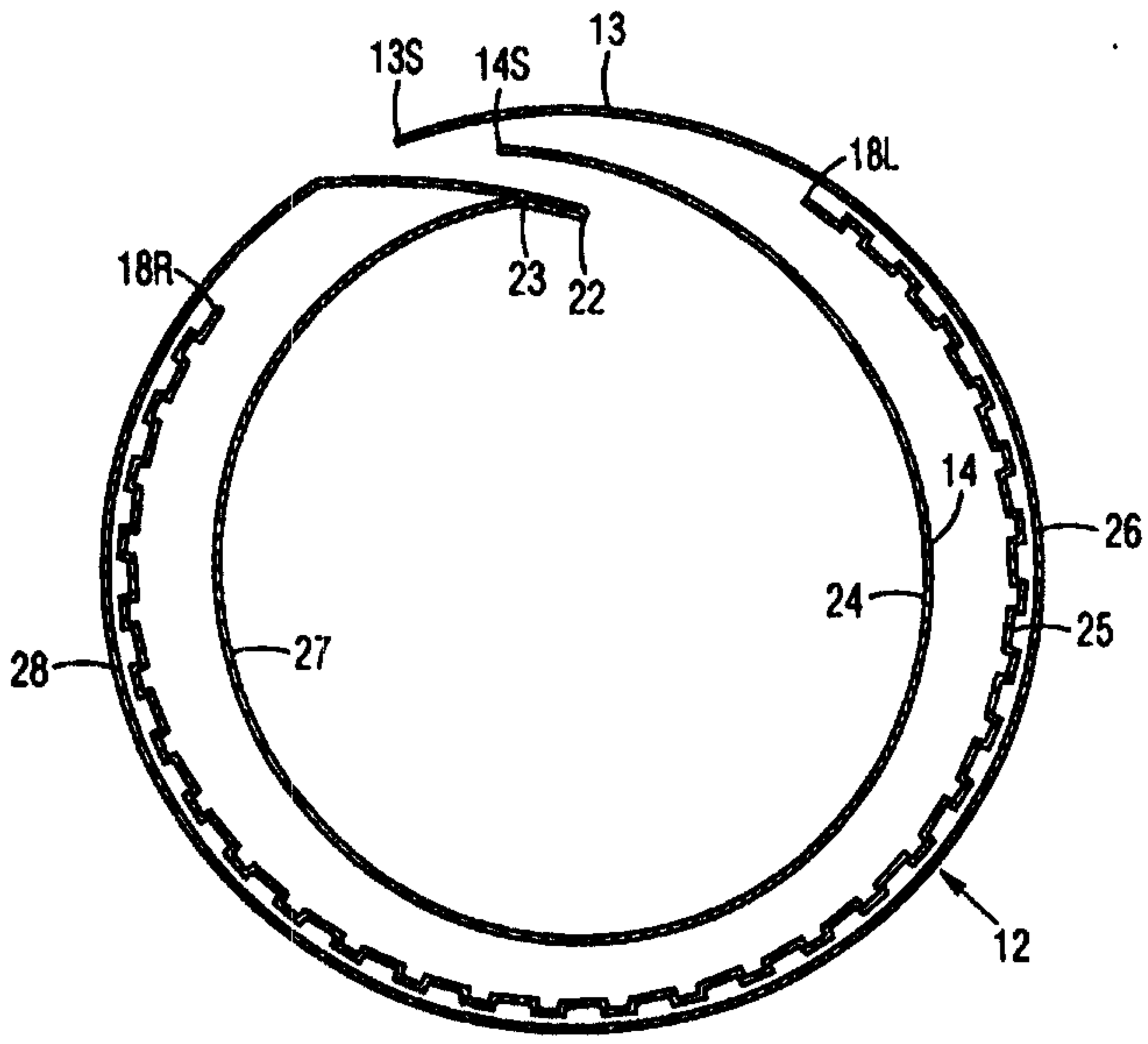


(57) Abstract

An insulating container (50) and a method of manufacturing it comprises providing a sidewall blank (12B) having two sections separated by a fold score (15), and a separate insulating sheet (18) (corrugated, ribbed, embossed, foamed, perforated, etc.) adhesively fastened to one of the sections. Adhesive is applied to an area (12) adjacent the fold score bonding two sections adjacent the folded score. The assembly is wrapped around a mandrel to bring the outer edges together at a side seam (22S) which is sealed to form a sidewall (12). In a second embodiment, the insulating layer can be a coating on one or both of the sections of the two-section starting blank. In a third embodiment, the insulating section (40) can be integral with, and extend from, one edge of the starting blank. It is folded over first to form the middle layer of the wrappable assembly.

Insulated Cup And Method Of Manufacture

Background—Cross-Reference To Related Cases

This invention is an improvement on the inventions in U.S. patent Re.35,830 (1998 Jun 30) to C. E. Sadlier, and patents 5,660,326 (1997 Aug 26) and 5,697,550 (1997 Dec 16) to R. Varano and C. E. Sadlier.

Background—Field of Invention

This invention relates generally to disposable containers and specifically to an insulated disposable cup or container and a method of manufacture.

Background—Prior Art

There are three main types of disposable cups now in use: polystyrene, expanded polystyrene, and paper.

Polystyrene cups are aesthetically pleasing, but they do not provide much insulation and therefore are only used for holding cold drinks. Further they are not biodegradable or easily recycled. Condensation forms on the outside of these cups when holding a cold drink, making the cup wet, cold, and uncomfortable to use for prolonged periods of time. Also the condensation makes the cup slippery and difficult to hold.

Cups made from expanded polystyrene (EPS), and sold under the trademark Styrofoam, are excellent thermal insulators, so that they can maintain the temperature of a drink, whether hot or cold, for long periods of time. They are inexpensive and comfortable to handle because their exteriors stay close to ambient temperature, regardless of the temperature of the drink. However, they are environmentally unfriendly because they are not biodegradable or easily recyclable. As a result, their use has been banned in some municipalities. Also, in order to print these types of cups, a slow and costly printing process must be used, because the cups must be printed after they have been formed, and their rough surface does not allow high resolution printing.

Standard single-wall paper cups are recyclable and biodegradable and therefore more environmentally sound. However they are poor thermal insulators, so that a beverage in a paper cup quickly warms (if cold) or cools (if hot). They are also uncomfortable to handle because a hot or cold drink can burn or uncomfortably cool a hand. Also, as with the polystyrene cups, a cold drink will cause condensation to appear on the outside, making a paper cup slippery, and difficult to hold. Their single-wall construction makes them fragile, so that large cups filled with liquid may crumble after prolonged handling.

Paper cups also have a greater propensity to leak at the side seam after prolonged periods of holding liquid. This is due to the fact that once the cup's sidewall blank has been cut from a larger sheet, the cut edges do not have a waterproof barrier on them. Therefore when the cup is formed, the cut edge of the blank at the overlapping side seam—a raw edge—is exposed to the liquid inside the cup. After prolong periods of time, the liquid will wick into the paper through this raw edge. The liquid will then migrate down the side seam and through the bottom of the cup. All existing paper cups have this raw edge and potential leaking problem.

Multi-layered paper cups have been designed to provide thermal insulation and increased strength. U.S. patents 3,908,523 to Shikaya (1975), 5,205,473 to Coffin, Sr. (1993), 5,547,124 to Mueller (1996), 5,769,311 to Noriko et al. (1998), and 5,775,577 to Titus (1998) show multi-layered paper cups with an inner cup body and a multi-layered insulating wrap. The wrap provides air pockets or space for thermal insulation.

Although strong and thermally efficient, these cups are all expensive and impractical to manufacture because the inner cup body and insulating wrap are formed separately, and then must be assembled together. The outer wrap is formed from separate pieces that are laminated together, again adding additional cost. The extra steps slow the production process and prevent the cups from being made with standard cup-forming machinery.

Patents 5,490,631 to Iioka et al. (1996), 5,725,916 to Ishii et al. (1998), and 5,766,709 to Geddes (1998) show paper cups coated with a foam material for insulation. These cups are also expensive to manufacture because the foam material must be coated on the cup's outer layer and then activated in order to expand the foam. The activation process is an extra step that slows and increases the expense of the production process. Another major drawback of these cups is that the textured foam surface is not conducive to printing with sharp and crisp graphics. Yet another drawback is that, although these cups are not EPS foam cups, their foam coated exterior wall still has the "look" and "feel" of foam cups, which has a negative impact on consumer acceptance.

Although the cups of the above Sadlier, and Varano and Sadlier patents are a major improvement over existing cups, I have discovered that both the cups and the manufacturing processes by which they are made can be improved.

Objects and Advantages

Accordingly, several objects and advantages of the invention are to provide a cup which (i) has improved thermal insulating properties, (ii) uses less costly materials, (iii) is leak resistant, (iv) can be formed more easily on existing cup machinery through the placement of adhesive, (v) has a surface that is conducive to printing with sharp and crisp graphics, and (vi) has an exterior wall which does not have the undesirable look and feel of foam cups, thereby providing good consumer acceptance.

Further objects and advantages will be apparent from a consideration of the ensuing description and accompanying drawings.

Summary

In accordance with one embodiment of the invention, a thermally insulated cup is formed from a sidewall blank having two panels, connected along a common fold score, and a separate insulating sheet. The insulating sheet is adhesively attached to one of the panels of the sidewall blank. Adhesive is applied to an area adjacent to the fold score. The sidewall blank is then folded in half along the fold score, such that the insulating sheet is sandwiched between the two panels, thereby creating a three-layered cup blank. The adhesive which was applied adjacent the fold score bonds the two panels together at that area. The three-layered cup blank is then wrapped or bent around a mandrel and sealed at the overlapping edges. A separate bottom is sealed to the inner layer and the top of the inner layer is rolled radically outward to form a rim.

Drawing Figures

FIG 1 is a cross-sectional elevational view of a cup made according to the present invention.
FIG 2A is a plan view of a cup blank used to make the cup of FIG 1.

FIG 2B is a plan view of an insulating layer used in the cup of FIG 1.

FIG 2C is a side view of the insulating layer.

FIG 2D is a plan view of the bottom blank of the cup.

FIG 2E is a sectional view of FIG 2D taken along the line 2E—2E.

FIG 3A is a plan view of a sidewall blank used to make the cup during the application of adhesive.

FIG 3B is a plan view of the sidewall blank after folding.

FIG 3C is a side or edge view of the sidewall blank after folding.

FIG 4A is a sectional view of the blank after wrapping but before sealing.

FIG 4B is a sectional view of the blank after wrapping and sealing.

FIG 5 is a plan view of a plain, unscored blank for the middle layer.

FIG 6A is a plan view of a foil-laminated blank for the middle layer.

FIG 6B is a sectional view of the foil-laminated blank.

FIG 7 is a plan view of a foraminous blank for the middle layer.

FIG 8 is a plan, partly perspective view of a foam blank for the middle layer.

FIG 9A is a plan view of a fluted paperboard blank for the middle layer.

FIG 9B is a sectional view of the fluted paperboard blank laminated to a linerboard for the middle layer.

FIG 10A is a plan view of a foam-coated paperboard sheet blank for the middle layer.

FIG 10B is a sectional view of the foam-coated paperboard blank.

FIG 11A is a plan view of an alternative starting blank for the cup.

FIG 11B is a plan view of the alternative starting blank after grooves are formed into the insulating section.

FIG 12A is a plan view of the blank after folding the insulating section.

FIG 12B is a plan view of the blank after folding the insulating section and the left section.

FIG 12C is a side or edge view of the blank after folding the insulating section and the left section.

FIG 13A is a sectional view of the blank after wrapping but before sealing.

FIG 13B is a sectional view of the blank after wrapping and sealing.

Reference Numerals

11 bottom	11B bottom blank	11I inner surface
12 sidewall	12B sidewall blank	13 left section
13B back side	13F front side	13L lower edge
13S side edge	13U upper edge	14 right section
14B back side	14F front side	14L lower edge
14S side edge	14U upper edge	15 fold score
16 tab	18 insulating sheet	18T top edge
18B bottom edge	18L left edge	18R right edge
19 grooves, scores, or corrugations	20 adhesive area	21 adhesive area
22 fold edge	22S side seam	24 inner layer
25 insulating middle layer	26 outer layer	27 inside surface of cup
28 outside surface of cup	30F foil or metalized film	30P paperboard
31 holes	33M fluted medium	33L liner board
35P paperboard	35F foamed layer	40 blank
41 fold score	42 insulating section	42L lower edge
42S side edge	42U upper edge	42F front side
42B back side	43 fold edge	50 cup
51 top curl		

FIRST EMBODIMENT—Sheet blanks—FIGS 1 and 2A TO 2E

In accordance with a first embodiment of the invention a cup or container (FIG 1), includes bottom 11 and a sidewall 12. The bottom is formed from a bottom blank 11B (FIGS 2D and 2E).

Sidewall 12 is formed from sidewall blank 12B (FIG 2A), which is die cut from a larger sheet or roll (not shown) of paper or other suitable sheet material. The preferable thickness of this material is approximately 0.33 mm (13 mils), but it can be in a range of 0.2 to 0.6 mm (8 to 24 mils). (One mil = 0.001 inch.) The blank includes an arc-shaped left section 13, which will form an outer layer of the sidewall, and an arc-shaped right section 14, which will form an inner layer of the sidewall. The two sections border or share a common fold score 15. The purpose of this fold score is to assist in folding the blank along a precise line. Score 15 is preferably formed into sidewall blank 12B at the time that the blank is die cut from the larger starting sheet. However, the score can be formed into blank 12B after the blank is cut, but prior to being folded (operation discussed below). Sections 13 and 14 have respective side edges 13S and 14S, upper edges 13U and 14U, and lower edges 13L and 14L. Sections 13 and 14 also have front sides 13F and 14F, respectively, and back sides 13B and 14B, respectively.

Once blank 12B is formed into sidewall 12 (operation discussed below), back side 13B will form an outside surface 28 of the cup, and back side 14B will form an inside surface 27 of the cup (FIG 1). For reasons to be described, section 13 is longer from side edge 13S to fold score 15 than section 14 is from side edge 14S to fold score 15. Section 14 is taller from upper edge 14U to lower edge 14L than section 13 from upper edge 13U to lower edge 13L. Section 13 includes a small tab 16, which extends from lower edge 13L to fold score 15, for purposes to be described.

Sidewall blank 12B has been coated on at least the back side (sides 13B and 14B) with a known waterproof material (not shown), such as plastic. Bottom blank 11B has been coated on at least inner surface 11I with a similar waterproof material. Preferably polyethylene is used (low, medium or high density) because it serves as both an adhesive and a waterproof coating. Other types of waterproof and heat sealable coatings can be used in lieu of polyethylene, including polypropylene or polyester. Currently, other types of biodegradable and/or recyclable waterproof and heat sealable coatings are being developed within the industry. Once available, these types of coatings can also be used. The preferable thickness of the polyethylene coating is 0.019 mm (0.75 mil), but can be in a range of 0.013 mm (0.5 mil) to 0.038 mm (1.5 mils). The coating can have either a matte or a gloss finish. Various methods of applying the coating are well known in the art.

Sidewall 12 also includes a second component—an insulating sheet 18 (FIGS 2B and 2C), which will form a middle layer of the sidewall. This sheet is die cut from a larger sheet or roll (not shown) of paper or other suitable sheet material. Preferably the thickness of this material is 0.4 mm (16 mils), but can be in a range of 0.25 to 1 mm (10 to 40 mils). It is preferably made from recycled chipboard (plain chip or bending chip) or from recycled liner board, because this material is cost effective and recycled. Alternatively, it can be made from virgin paperboard or partially recycled paperboard such as SBS (solid bleach sulfite) or SUS board (solid unbleached sulfite). It has a top edge 18T, a bottom edge 18B, and left and right edges 18L and 18R, respectively.

Sheet 18 includes spaced grooves or scores 19 (FIG 2C) formed into its surface. These provide air space within sidewall 12. The scores run substantially from top edge 18T to bottom edge 18B (FIG 2B). Preferably the scores are in a range of 3 to 13 mm (1/8" to ½") apart and in a range of 0.13 to .76 mm (5 to 30 mils) deep. The scores are formed by a known die operation (not shown). Preferably the scores are placed into the sheet simultaneously while cutting it from a larger starting sheet. However the scores can be formed prior to, or after cutting the sheet. Instead of scores 19 running from top to bottom, they can be positioned to run from side 18L to side 18R. Instead of scores or corrugations embossed dimples or any other type of integral deformities can be formed into the sheet. The area of the sheet is smaller than the area of either sections 13 or 14 of FIG 2A for reasons to be described. Besides the examples given above, many different types of materials and structures can be used to serve as an insulating middle layer of sidewall 12. These will be described later.

Placing and Folding—FIGS 3A to 3C

After sidewall 12B (Fig 2A) and layer 18 (Fig 2B) are cut and formed, they are assembled into sidewall 12 (Fig 1) as follows: Sheet 18 is attached onto sidewall blank 12B to provide the assembly of FIG 3A. First a small amount of adhesive, preferably hot-melt adhesive, is applied near the center of section 13F at adhesive area 20. Sheet 18 is then placed in a substantially centered position on section 13F, where it is held in place by the adhesive. Because sheet 18 is smaller than section 13, its edges do not extend to the edges of section 13. Preferably there is a gap or margin of at least 6 mm (¼") between left edges 18L and 13S, right edge 18R and fold score 15, top edges 18T and 13U, and bottom edges 18B and 13L.

Next a small amount of adhesive, preferably cold adhesive, such as a starch-based adhesive or paste, is applied to blank 12B at or adjacent to fold score 15, at adhesive area 21.

Section 13 is then folded over section 14 (or vice-versa), to form a flat three-layered arrangement having a fold edge 22 (formerly fold score 15) with sections 13 and 14 on opposite sides of insulating sheet 18 (FIGS 3B and 3C). Sections 13 and 14 are glued, bonded or otherwise fastened directly to each other (i.e. directly between the two layers) at bond area 21 adjacent fold edge 22, on the inside surface of folded blank 12B (FIG 3B and 3C). This bond serves to hold blank 12B in the folded state. As will be described later, it is important to the forming of the sidewall that sections 13 and 14 be fastened to each other only at or near fold edge 22, preferably at a distance not to exceed 5.1 cm (2") from fold edge 22.

The placing and folding operation is preferably performed by a machine (not shown) called a folder-gluer, which is a standard piece of machinery used to make folding cartons and boxes. A placing machine (such the machine sold under the trademark Pick 'n Place by MGS Machine Corp. of Maple Grove, MN, not shown) is attached to the folder gluer. Blank 12B is loaded into the feeding station of the folder-gluer and insulating sheet 18 is loaded into the feeding station of the placing machine. First, blank 12B is moved into position under an adhesive applicator (not shown) where adhesive (preferably hot-melt adhesive because of the fast tack time required) is applied at area 20. Next, the blank is moved into position under the placing machine, where insulating sheet 18 is placed onto section 13F and held into place by the adhesive. Next, blank 12B (FIG 3A) is moved into position under another adhesive applicator where adhesive is applied at area 21, near score 15. Finally, section 13 is folded over section 14 and the two sections are held together at area 21 by the adhesive on the inside surface of folded blank 12B, thereby forming the flat, three-layered arrangement shown in FIGS 3B and 3C. The adhesive used to attach sections 13 and 14 at area 21 is preferably a cold-glue or paste adhesive, because minimal thickness is desired adjacent fold 22. Other types of adhesives can be used to bond sections 13 and 14 at area 21. For example hot-melt adhesive can be applied, or a preapplied layer of thermoplastic material, such as polyethylene, can be used. In the latter example the thermoplastic material is heat activated and sections 13 and 14 are bonded to each other at area 21 through the application of heat and pressure.

Obviously to make the cup, sheet 18 can be attached to section 14F (rather than section 13F) in the same manner as described above. If sheet 18 is attached to section 13F, it will be attached to the outer layer of sidewall 12 (because section 13 forms the outer layer of the sidewall). Similarly, if sheet 18 is attached to section 14F, it will be attached to the inner layer of sidewall 12 in finished cup 50. In either case, sheet 18 still provides an insulating middle layer 25 (FIG 4B) of sidewall 12 sandwiched between inner and outer layers 24 and 26.

Wrapping and Forming—FIGS 4A and 4B

Next, the three-layered arrangement shown in FIGS 3B and 3C is wrapped or bent around a known tapered mandrel (not shown) to form sidewall 12 (FIG 4A) having inner layer 24, middle layer 25, and outer layer 26. The wrapping is done such that fold edge 22 is inside and thus becomes part of inner layer 24. A marginal portion of section 14 adjacent edge 14S overlaps a marginal portion of section 13 adjacent fold edge 22. Section 13 is longer than section 14 so that edge 13S overlaps both edge 14S and a marginal portion of section 13 adjacent folded edge 22. These overlapping layers are heat sealed together through the application of heat and pressure to form a side seam. The heat fuses and joins the previously applied layer of polyethylene or other heat sealable and waterproof coating. Note from FIG 4B, a sectional view of the wrapped sidewall after sealing, that the overlapping edges form a side seam 22S.

Insulating sheet 18 does not extend completely around sidewall 12, i.e., it covers less than 100% of the circumference of the sidewall. This is clearly shown in FIG 4B. This is because sheet 18 is not as long as sections 13 or 14. As such, left and right edges 18L and 18R, are not parts of side seam 22S. This is an advantage because it saves paper, and it reduces the thickness of the side seam (by two layers). Likewise insulating sheet 18 does not cover the entire vertical length of the cup sidewall as shown in FIG 1. Again this is an advantage because it saves paper without significantly effecting the insulating performance of the cup.

An important feature of the cup is the location in which sections 13 and 14 are adhesively bonded or otherwise fastened to each other when blank 12B is folded. Sections 13 and 14 are fastened to each other on the inside surfaces of the folded blank (FIG 3B and FIG 3C) so that blank 12B stays in a flat, three-layered arrangement prior to wrapping. If the sections were not glued, blank 12B may come unfolded prior to wrapping and sealing. I have found that by fastening sections 13 and 14, much higher production speeds are possible on standard machinery, thereby providing a less expensive manufacturing process. As discussed, it is very important that section 13 be bonded or fastened to section 14 at or near fold edge 22, no further than 5.1 cm (2") from fold edge 22, at bond area 21, which becomes the inside surfaces of the folded blank. This is necessary in order to wrap the flat three-layered arrangement into sidewall 12.

As shown in FIG 4A, outer layer 26 has a larger circumference than inner and middle layers 24 and 25, respectively. Because of this larger circumference, section 13 must travel a greater distance relative to section 14 as the blank is wrapped. Because section 13 is attached to section 14 at fold edge 22, section 13 must compensate for this greater distance of travel by moving or sliding around section 14, such that the distance between edges 13S and 14S shortens as the blank is wrapped. If section 13 were glued or otherwise fastened to section 14 at a location too far from fold edge 22, it would cause the portion of section 13 which lies between fold edge 22 and the location of fastening to be unable to slide relative to section 14. If this were to occur fold edge 22 would not lie flat and substantially parallel to the other edges as shown in FIG 4A, as blank 12B is wrapped around a mandrel, and side seam 22S would not be sealed properly. However, I have found that by fastening section 13 to section 14 at or adjacent fold edge 22 (at bond area 21) this negative effect is mitigated and section 13 is allowed to slide relative to section 14 as it is wrapped. By bonding section 13 to section 14 adjacent fold edge 22, the fold edge will lie flat and substantially parallel to the other edges as shown in FIG 4A as blank 12B is wrapped, thereby allowing side seam 22S to be sealed properly, as shown in FIG 4B.

In order to finish cup 50 (FIG 1), upper edge 14U (FIG 2A) of inner layer 24, which is extends past upper edge 13U, is rolled radically outward to form a rim. Bottom blank 11B (FIGS 2D and 2E), is attached to inner layer 24 and lower edge 14L, is folded inward and heat sealed to bottom blank 11B. Various methods of forming the rim and sealing the bottom are well known in the art.

The purpose of tab 16 (FIG 2A) on section 13 is to help prevent leaking. This tab extends from the side seam, into the seal between bottom blank 11B and inner layer 24.

In this cup a problem that has plagued all paper cups is eliminated. That is the problem, discussed above, associated with having a cut edge along the side seam on the inside of the cup. Because there is no waterproof coating on the cut edge, moisture migrates, wicks, or seeps into the paper over time, and may cause leaking. In the current cup there is no raw edge inside the cup. Rather fold edge 22, which is coated with a waterproof material, is on the inside layer of the cup. Cup 10 is therefore more resistant to moisture migration and leaking than a standard paper cup, and therefore provides a longer shelf life.

Many standard paper cups are coated with polyethylene on both sides of the cup blank in order to waterproof the inside, and provide a coated printable surface on the outside. Coating both sides of the blank costs more than coating only one side and it is more detrimental to the environment. As discussed above, if blank 12B is coated on at least back sides 13B and 14B, the coating will end up on both inside surface 27, fold edge 22, and outside surface 28 of sidewall 12 (FIGS 1 and 4A). This saves costs because coating both sides of blank 12B is not necessary to waterproof both the inside and outside surfaces of the cup.

I have found it useful to use a suction cup with vacuum, in combination with a PTFE-coated lower clamp pad, on the cup machine at the blank wrapping station in order to hold a central portion of section 14L (which extends past section 13L) stationary as the blank is wrapped around the mandrel. This allows section 13, which forms outer layer 26, to slide along the PTFE lower clamp pad, relative to stationary inner layer 24, which is held in place by the vacuum cup when sidewall 12 is formed.

Alternative Insulating Materials

As mentioned above, many different types of insulating materials can be substituted for insulating sheet 18 (FIG 2B).

Flat, Unscored Insulating Sheet--FIG 5

For some applications it is more suitable to use a flat unscored paperboard sheet (FIG 5) instead of insulating sheet 18 for the middle insulating layer. In this case a thicker board can be used to offset the insulation efficiency lost by not scoring the sheet. The preferable thickness of unscored paperboard, such as chipboard, liner board, SBS, or SUS board is in a range of 0.25 to 1 mm (10 to 40 mils).

Foil Or Metalized Film Laminated Insulating Sheet—FIG 6

For some applications it is desirable to use a sheet (FIG 6A) that has been laminated with foil or metalized film, instead of insulating sheet 18, for the middle insulating layer. Foil and metalized film act as excellent moisture barriers and also serve to reflect radiant heat, thereby providing added insulation. I have found that both flat and scored foil or metalized film laminated paperboard will provide effective insulation and serve as moisture barriers. A foil or metalized film 30F (FIG 6B) is laminated to at least one side of a paperboard sheet 30P. The preferable thickness of the foil or metalized film is between 0.013 to 0.05 mm (0.5 to 2.0 mils). The preferable thickness of the paperboard to which the foil is laminated is in a range of 0.25 mm to 1 mm (10 to 40 mils). Metalized film laminated chipboard can be purchased from Jefferson Smurfit Corporation of Santa Clara, CA. Because the sheet is trapped between inner layer 24 and outer layer 26, a cup made with this type of insulating layer may be used in microwave applications, without the metal causing arcing.

Foraminous Flat Insulating Sheet—FIG 7

For some applications it is desirable to use a foraminous sheet (FIG 7), i.e., the sheet has a plurality of holes cut throughout the surface, instead of insulating sheet 18, for the middle insulating layer. The holes 31 (which may be shapes other than circles, such as triangles, squares or rectangles) are cut into a flat sheet of paperboard. The preferable thickness of the flat sheet is the same as in FIG. 5. The holes have the dual benefit of providing insulating air space between inner and outer layers 24 and 26, and reducing the weight of the finished cup. The holes can be cut into the surface of the sheet with a standard die cutting operation, which is well known in the art.

Foam Insulated Sheet—FIG 8

For some applications it is desirable to use a sheet FIG 8 that is made from foam, preferably expanded polystyrene, instead of insulating sheet 18, for the middle insulating layer. Polystyrene foam is a lightweight and cost effective material with good thermal insulating properties. The sheet can be die cut from a larger starting sheet of polystyrene foam, or it can be thermoformed or extruded to the proper finished size. The methods of providing sheet from polystyrene foam are well known in the art. The preferable thickness of this sheet is the same as the sheet of FIG. 5. Due to its porous structure, this sheet has the dual benefits of providing insulating air space between inner and outer layers 24 and 26, and reducing the weight of the finished cup.

Fluted Paperboard Insulating Sheet—FIG 9

For some applications it is desirable to use a sheet (FIG 9) that is made from fluted paperboard, instead of insulating sheet 18, for the middle insulating layer. The sheet may consist of fluted medium 33M alone (FIG 9A), or sheet 33M in combination with a liner board 33L (FIG 9B) which is adhered to sheet 33M at the tips of the flutes. This type of material is often referred to as microflute. The methods of making fluted paperboard are well known in the art. The preferable thickness of this sheet is similar to the sheets of FIGS 5 to 8. Fluted paperboard is readily available from a number of suppliers. This sheet can die cut from a larger starting sheet or roll (not shown) by a standard die cutting operation.

Water-Soluble Insulating Sheet

For some applications it is desirable to use a sheet (appearance similar to the sheet of FIG 5) that is made from a water-soluble material, instead of insulating sheet 18, for the middle insulating layer. This sheet is constructed of a water-soluble material, such as a starch-based material. The material is typically extruded into sheet form. It can be die cut from a larger starting sheet (not shown). The thickness of this sheet is preferably the same as the sheet of FIG 5. Due to its porous structure and water solubility, this sheet has the dual benefits of providing insulating air space between the inner and outer layers and reducing the weight of the cup.

Foam-Coated Insulating Sheet—FIG 10

For some applications it is desirable to use a sheet (FIG 10A) that is constructed from a paperboard sheet 35P with a foamed heat-insulating layer 35F (FIG 10B) coated on at least one side, instead of insulating sheet 18, for the middle insulating layer. Layer 35F is formed from thermoplastic synthetic resin, which is a low-to-medium density polymer and may include (but is not limited to) polyethylene, polyolefin, polyvinylchloride, polystyrene, polyester, nylon, and other similar types of material. The thermoplastic synthetic resin is extruded onto paperboard sheet 35P and then heated at a temperature in the range of 93° to 204° C (200° to 400° F) for between 30 seconds to 2.5 minutes. Upon the application of heat, the polymer will foam. The preferable thickness of this foam-coated sheet is in a range of 0.3 to 1 mm (12 to 40 mils). Various methods of making a foam-coated sheet are well known in the art. The foam-coated sheet will provide insulating air space between the inner and outer layers.

Finally, for all of the above alternative embodiments of sheet 18, any of the sheets can be provided in more than one piece, in order to cover the same area as sheet 18. For example sheet 18 can be provided as two or more separate pieces that are each adhesively attached to section 13F or 14F to provide insulating layer 25.

SECOND EMBODIMENT—Foam Coating For Middle Layer

In a second embodiment, the use of a separate insulating sheet is eliminated entirely. It is replaced with a layer of foam which is coated on sections 13F and/or 14F of blank 12B (FIG 2A) to produce a paper and foam-coated structure similar to that shown in FIG. 10B. In order to provide the layer of foam, section 13F (and/or section 14F) of blank 12B is first coated with a layer of thermoplastic synthetic resin film. The thermoplastic synthetic resin is a low-to-medium density polymer. Such a polymer may include (but is not limited to) polyethylene, polyolefin, polyvinylchloride, polystyrene, polyester, nylon and other similar types of materials. I prefer to use a low-density polyethylene. Opposing sections 13B and 14B of blank 12B are coated with a high-density polyethylene film. Next, blank 12B is heat treated at a temperature and for a time sufficient to permit the low density thermoplastic synthetic resin film to foam and form a heat-insulting layer. Depending upon the melting point of the thermoplastic synthetic resin chosen, the material is heated at a temperature as stated above in the discussion of FIGS 10. Because the low-density polyethylene film has a lower melting point than high density polyethylene film, low density film foams, while high density film does not. Blank 12B can be heat treated in the unfolded state of FIG 2A or in the folded state of FIG 3B.

In this embodiment, the foamed layer coated on blank 12B replaces sheet 18. When blank 12B is wrapped and sealed, the foamed layer provides the middle insulating layer, which is sandwiched between inner and outer layers 24 and 26 respectively. With the exception of coating section 13F and 14F with a layer of thermoplastic synthetic resin and heat treating the resin until it foams, the cup is made in substantially the same manner as described in the first embodiment.

Although I prefer to form the foam layer through the process described above, the foam layer can also be provided by spraying, extruding, or otherwise applying a foamable or foamed material directly to sections 13F and/or 14F of blank 12B prior to folding. This operation can be accomplished while the blank is positioned upon, and moving along, the folder gluer prior to being folded. Upon folding and wrapping, the foam layer becomes insulating layer 25, thereby replacing the need for insulating sheet 18.

THIRD EMBODIMENT—FIGS 11A TO 13B

In accordance with a third embodiment, blank 12B and insulating sheet 18 can be replaced with blank 40 (FIG 11B) to form cup or container 50 (FIG 1).

Sheet Blanks and Scoring—FIGS 11A TO 11B

Blank 40 (Fig 11A) is die cut as a single sheet from a larger sheet or roll (not shown) of paper or other suitable sheet material. The preferable thickness of this material is approximately 0.33 mm (13 mils), but it can be in a range of 0.2 to 0.6 mm (8 to 24 mils). Blank 40 is similar to blank 12B (FIG 2A), except that it has three sections: left section 13, right section 14, and an insulating section 42. Left 13 and right sections 14 share common fold score 15, and are substantially identical to sections 13 and 14 of FIG 2A. Insulating section 42 (which replaces insulating sheet 18) is connected to section 14 at fold score 41. Section 42 includes upper edge 42U, lower edge 42L, side edge 42S, front side 42F and back side 42B. Sections 13, 14 and 42 will form respective outer, inner, and insulating middle layers of sidewall 12' (FIGS 13A and 13B).

Sidewall blank 40 has been coated on at least the back side (sides 13B, 14B and 42B) with a known waterproof material (not shown), such as polyethylene, as more fully described in the first embodiment.

Next, spaced grooves, corrugations, or scores 19 are formed into section 42 for providing insulating air space within sidewall 12'. The scores are substantially the same as the scores of FIG 2B and FIG 2C. The scores run substantially from top edge 42U to lower edge 42L.

Preferably the scores are in a range of 3 to 13 mm (1/8" to ½") apart and in a range of 0.13 to .76 mm (5 to 30 mils) deep. In order to form the scores, a rotary die station (not shown) can be attached to a folding-gluer (not shown). As blank 40 (FIG 11A) travels along the folder-gluer, section 42 passes between rotary dies that form scores 19 into section 42 to produce the scored blank of FIG 11B. Alternatively, scores 19 can be formed into section 42 at the time the blank is die cut from a larger starting sheet or roll. Instead of scores 19 running from top to bottom, they can be positioned to run horizontally from side 42S to score 41. Instead of scores or corrugations, embossed dimples or any other type of integral deformities can be used.

Folding—FIGS 12A TO 12C

Next section 42 is folded over on onto section 14 at fold score 41 (FIG 12A). Adhesive, such as paste adhesive, cold glue, or hot melt is applied at area 21 adjacent fold score 15. Section 13 is then folded over section 42, to form a flat, three-layered arrangement having fold edges 22 and 43, with sections 13 and 14 on opposite sides of insulating section 42 (FIGS 12B and 12C). Sections 13 and 14 are glued, bonded, or otherwise fastened to each other at bond area 21 adjacent fold edge 22, on the inside surfaces of folded blank 40. This bond serves to hold blank 40 in the folded state. As described more fully in the first embodiment, it is important to the forming of sidewall 12 that sections 13 and 14 be fastened to each other only at or near fold edge 22, preferably at a distance not to exceed about 5.1 cm (2") from fold edge 22.

As an optional step, insulating section 42 may be fastened to section 14 when it is folded, which will increase production speeds. This can be accomplished through the use of a small amount of adhesive applied to either section 14F or 42F prior to folding. The adhesive can be applied in a central location on section 14F or 42F, or at a location adjacent to fold score 41. Cup 12 can also be formed without adhering insulating section 42 to section 14. Section 42 can simply be held in place, in its folded state, between folded section 13 and 14 after they have been bonded at area 21.

The scoring and folding operation is preferably performed by a folder-gluer, described above. A rotary die station (not shown) is attached to the folding gluer. First blank 40 (FIG 11A) is loaded into the feeding station of the folder-gluer. Blank 40 is carried along the machine and section 42 is passed between rotary dies which form the scores, ribs, grooves, or other type of corrugation into section 42. Next blank 40 (FIG 11B) is moved into position under an adhesive applicator (not shown) where adhesive is applied either to section 14 or section 42. Next, section 42 is folded onto section 14 and attached (FIG 12A). (Section 42 may be attached in a central location or at a location adjacent to fold score 41. Fastening section 42 to section 14 with adhesive is an optional step as discussed above.) Next, blank 40 (FIG 12A) is moved into position under another adhesive applicator where adhesive is applied at area 21, adjacent fold score 15. Finally, section 13 is folded over section 42 and sections 13 and 14 are held together at area 21 by the adhesive on the inside surface of folded blank 40, thereby forming the flat, three-layered arrangement shown in FIGS 12B and 12C. The adhesive used to attach sections 13 and 14 at area 21 is preferably a cold-glue or paste adhesive, because minimal thickness is desired adjacent fold edge 22. Other types of adhesives can be used to bond sections 13 and 14 at area 21. For example hot-melt adhesive can be applied, or a preapplied layer of thermoplastic material such as polyethylene, can be used. In the latter example the thermoplastic material is heat activated and sections 13 and 14 are be bonded to each other at area 21 through the application of pressure.

Wrapping —FIGS 13A to 13B

Next, the three-layered arrangement shown in FIGS 12B and 12C is wrapped or bent around a known tapered mandrel (not shown) to form sidewall 12' (FIG 13A) having inner layer 24, middle layer 25, and outer layer 26. The wrapping is done such that fold edge 22 is inside and thus becomes part of inner layer 24. A marginal portion of section 14 adjacent fold edge 43 overlaps a marginal portion of section 13 adjacent fold edge 22. Section 13 is longer than section 14 so that edge 13S overlaps both fold edges 43 and 22. These overlapping layers are heat sealed together through the application of heat and pressure to form a side seam. The heat fuses and joins the previously applied layer of polyethylene or other heat-sealable and waterproof coating. Note from FIG 13B, a sectional view of the wrapped sidewall after sealing, that the overlapping edges form side seam 22S'.

Side seam 22S' formed by blank 40 includes fold edge 43 and a marginal portion of insulating section 42 adjacent fold edge 43. This increases the thickness of the side seam by one layer of paper over side seam 22S (FIG 4B). This extra thickness may be reduced by using a scything unit to slice a predetermined thickness off of a marginal portion of blank 40, prior to wrapping, such as in the area adjacent to fold score 15 or 41.

Insulating section 42 does not extend completely around sidewall 12', i.e., it covers less than 100% of the circumference of the sidewall. This is clearly shown in FIG 13A. This is because section 42 is not as long as sections 13 or 14. As such, side edge 42S is not part of side seam 22S'. This is an advantage because it saves paper and reduces the thickness of the side seam (by one layer). Likewise, insulating section 42 is not as tall, from upper edge 42U to lower edge 42L, as sections 13 or 14, and therefore does not cover the entire vertical length of the cup sidewall as shown in FIG 1. Again this is an advantage because it saves paper without significantly effecting the insulating performance of the cup.

Once sidewall 12' has been formed, cup 50 is completed in the same manner as described in the first embodiment.

Conclusion, Ramifications, and Scope

The reader will see that I have provided a cup and a method of manufacture, which has improved thermal insulating properties. It uses less costly materials and is leak resistant. Also it can be formed more easily on existing cup machinery resulting in higher production speeds and lower manufacturing costs. Also it uses materials such as paper, which can be recycled and which are readily biodegradable and recyclable. Moreover it has a surface that is conducive to printing with sharp and crisp graphics, and has an exterior wall which does not have the undesirable look and feel of foam cups, thereby providing good consumer acceptance.

Although the above description contains many specificities, they should not be considered as limitations on the scope of the invention, but only as examples of the embodiments. Many other ramifications and variations are possible within the teachings of the invention.

For example, the materials, relative sizes, and arrangements of the parts can be varied.

The middle and outer layer can be extended to cover substantially all of the inner layer.

In any of the embodiments ribs, an array of dimples, corrugations, scores, etc., can be formed into the outer layer, thereby providing increase insulation and a better surface for gripping.

The use of a folder-gluer (not shown) in the production process also allows other operations to be accomplished if desired. For example, in the second embodiment, a foamable or foam layer can be applied to unfolded blank 12B as it is transported along the folder-gluer. In any of the embodiments, a coupon-applying unit can be used on the folder-gluer to insert labels onto the blank. Heat-sealing promoters, such as that sold under the trademark Adcote by Morton International, Inc. of Chicago IL, can be applied to sidewall blanks 12B or 40 as they are being transported along the folder gluer. These chemicals promote a better seal at the side seam, thus enhancing shelf life. Fold scores 15 and 41 can be placed into the sidewall blank, after it has been die cut and is traveling along the folder gluer. This operation can be accomplished by passing the blank between rotary dies. This will allow the flat starting blanks of FIGS 2A and 11A to be manufactured even more efficiently on standard punch-through die cutters, which do not have the ability to score.

Various types of folding scores can be used for fold scores 15 and 41, such as a crease score, cut score, or skip-cut (perforation) score. Fold score 15 is preferably a crease score.

When making straight-wall containers, the sidewall blanks of FIGS 2A to 3C, and FIGS 11A to 12C should be straight, rather than taper-shaped.

In lieu of glue, the folded blank can be held or bonded in the folded condition in other ways, such coating the blank with waterproof plastic before folding with the use of heat to fuse the plastic coatings together in area 21. Also, the folded blank can be staked in this area to hold the sides of the folds together.

Therefore the reader is requested to determine the scope of the invention by the appended claims and their legal equivalents, and not by the examples given.

1. A thermally insulated container, comprising:

a sidewall enclosure which defines an interior volume, said enclosure having top and bottom portions, with an opening at said top portion,

a bottom closure attached to said bottom portion,

said sidewall enclosure being formed from a folded sheet, said sheet having first and second sections joined at a fold edge, such that said first section defines an inner layer of said enclosure and said second section defines an outer layer of said enclosure, said folded sheet having an inner surface between said first and second sections,

said sidewall enclosure further including a means for fastening said first and second sections directly together at an area adjacent said fold edge on said inner surface.

2. The container of claim 1, further including an insulating middle layer sandwiched between said inner and outer layers, said middle layer being formed from a separate piece of sheet material.

3. The container of claim 1 further including an insulating middle layer sandwiched between said inner and outer layers, said middle layer being formed from foamed material.

4. The container of claim 1, further including a middle layer sandwiched between said inner and outer layers, said middle layer being formed from a third section connected to said first section opposite said second section, said third section having integral deformities for providing air space between said inner and outer layers.

5. The container of claim 1 wherein said second section of said folded sheet, and hence said outer layer, contains a plurality of integral deformities.

6. A method of making a container, comprising:

providing a bottom closure,

providing a sheet having first and second sections having a common fold score,

folding said first and second sections together at said fold score to form a multi-layered folded sidewall blank having a fold edge and an inner surface between said first and second sections, said blank having opposite end portions,

bonding said first and second sections directly together adjacent said fold edge on said inner surface, and

joining said opposite end portions together to form a sidewall which has top and bottom portions, said first and second sections forming respective inner and outer layers of said sidewall, and

sealing said bottom closure to said bottom portion, thereby to form a container.

7. The method of claim 6, further including providing a separate insulating sheet and attaching said sheet to one of said sections and folding said sheet between said first and second section to provide an insulating middle layer of said sidewall.

8. The method of claim 6, further including providing a foam layer and applying said layer onto at least one of said sections and folding said layer between said first and second sections to provide an insulting middle layer of said sidewall.

9. The method of claim 6 wherein said sheet has a third section having integral deformities formed therein, and further including folding said third section between said first and second sections to provide an insulating middle layer of said sidewall.

10. The method of claim 6 wherein said bonding comprises applying adhesive to said sheet at an area adjacent said fold score.

11. The method of claim 6 wherein said second section of said sheet, and hence said outer layer, contains a plurality of integral deformities.

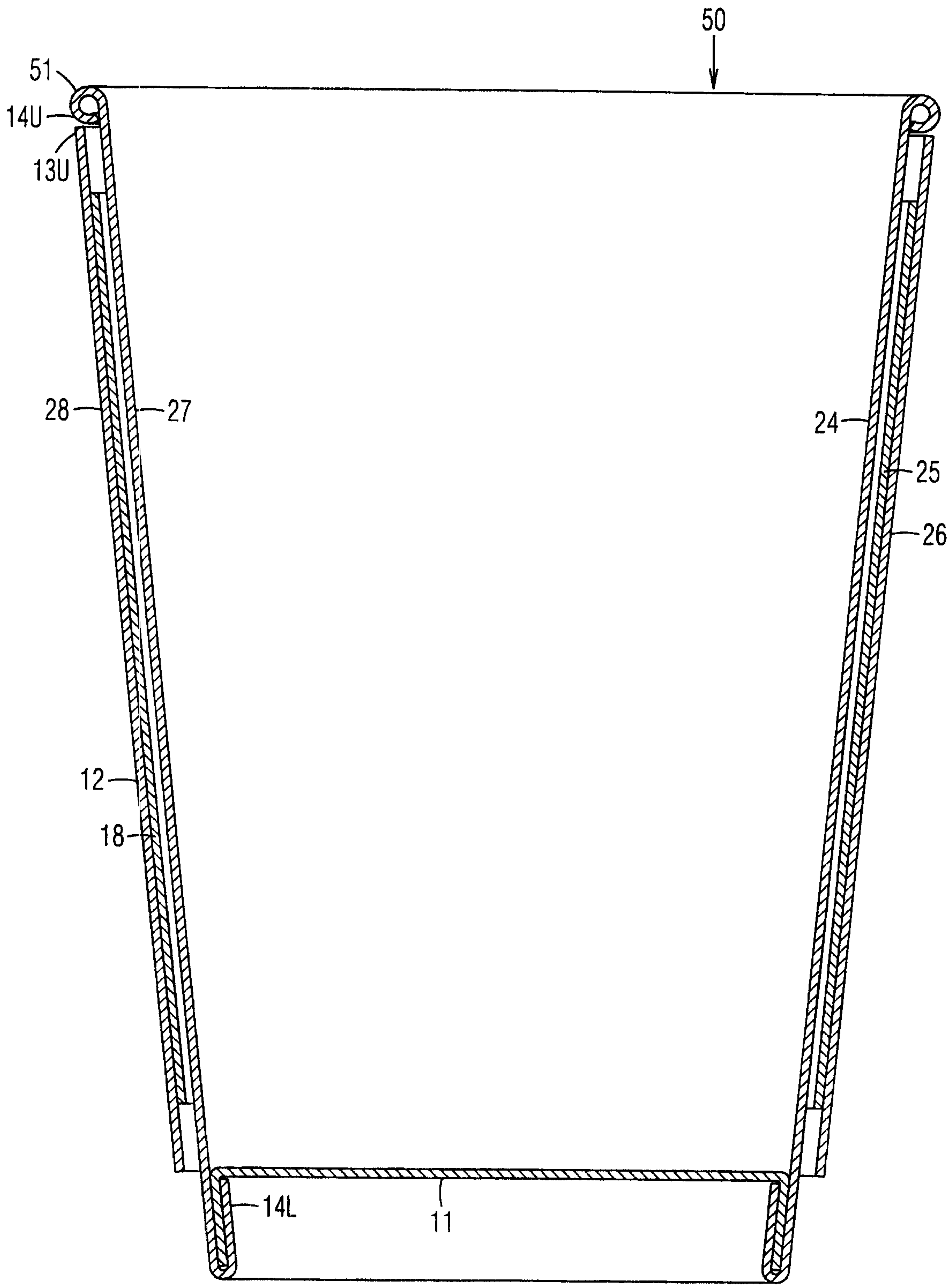


Fig. 1

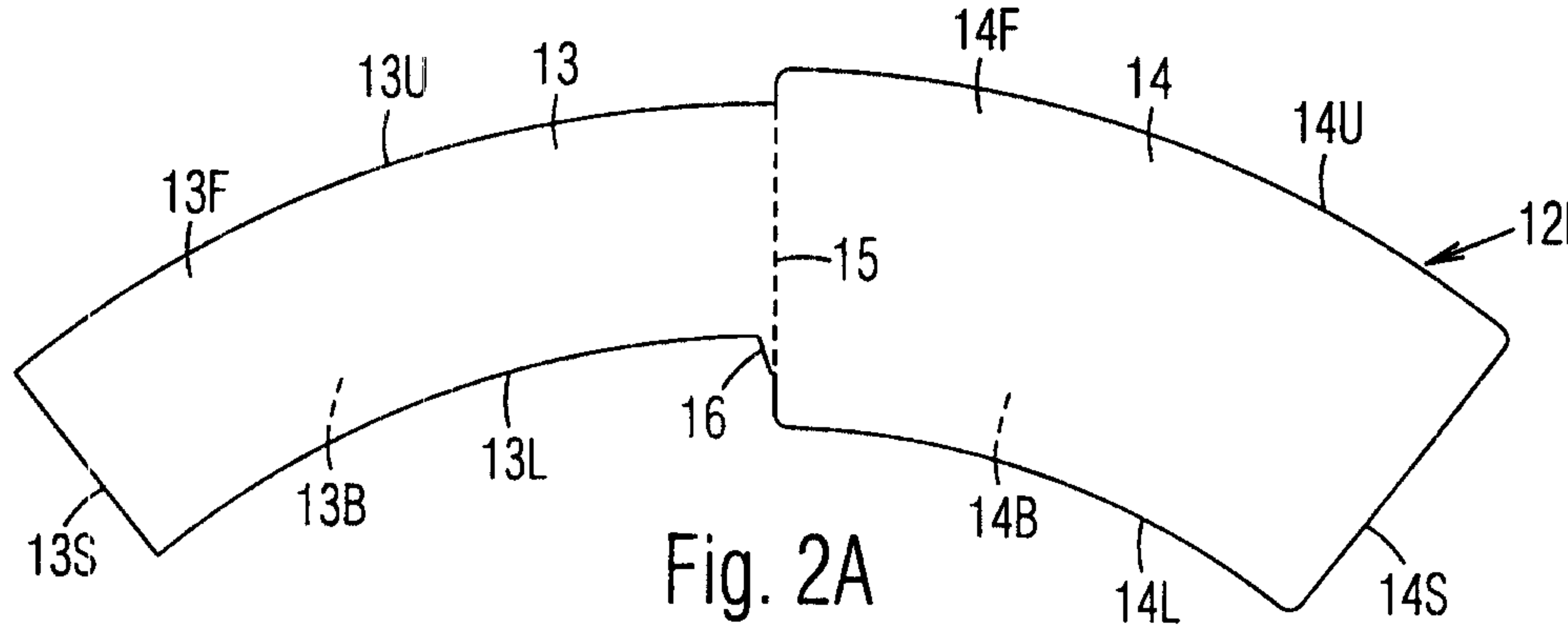


Fig. 2A

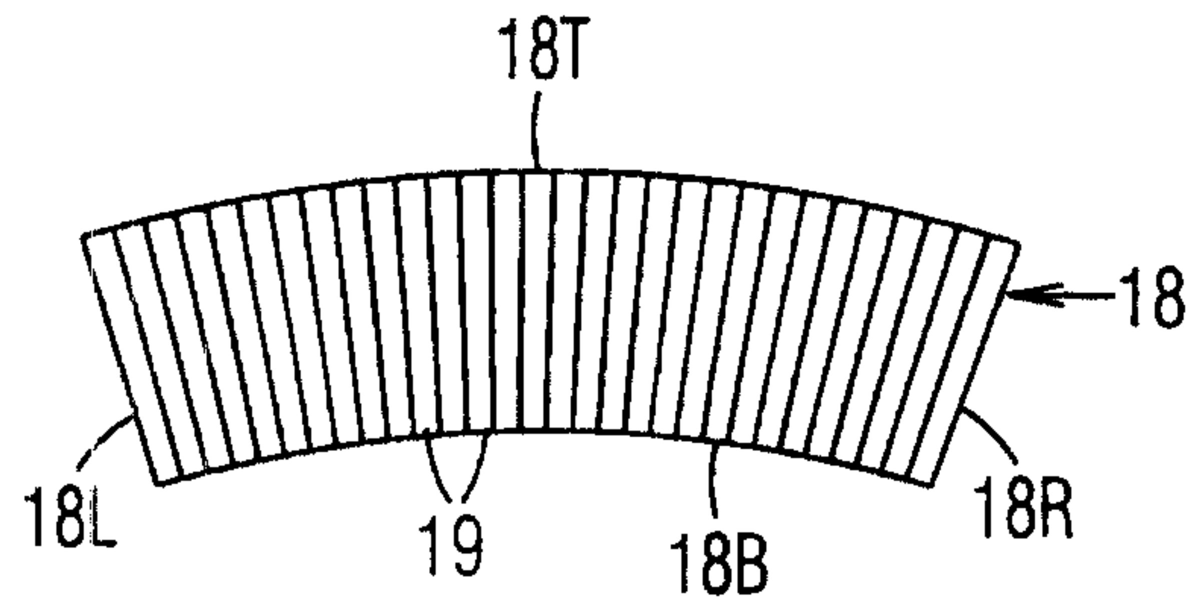


Fig. 2B

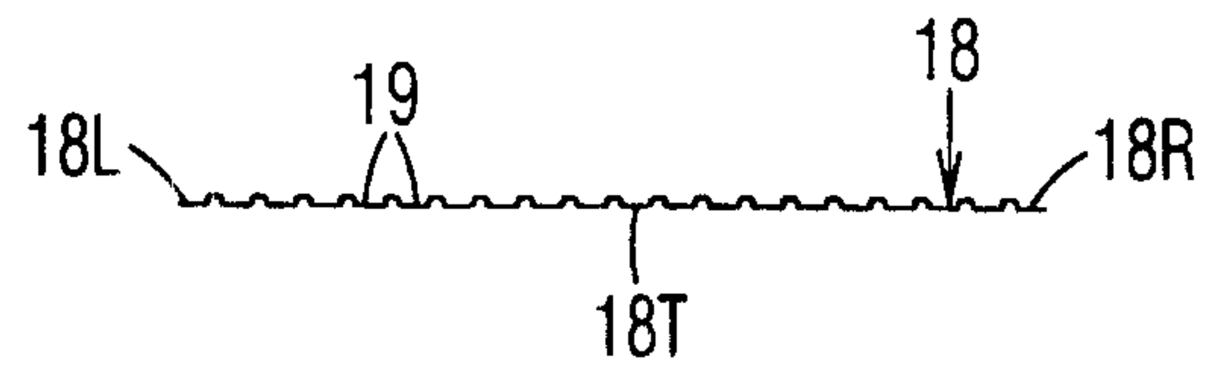


Fig. 2C

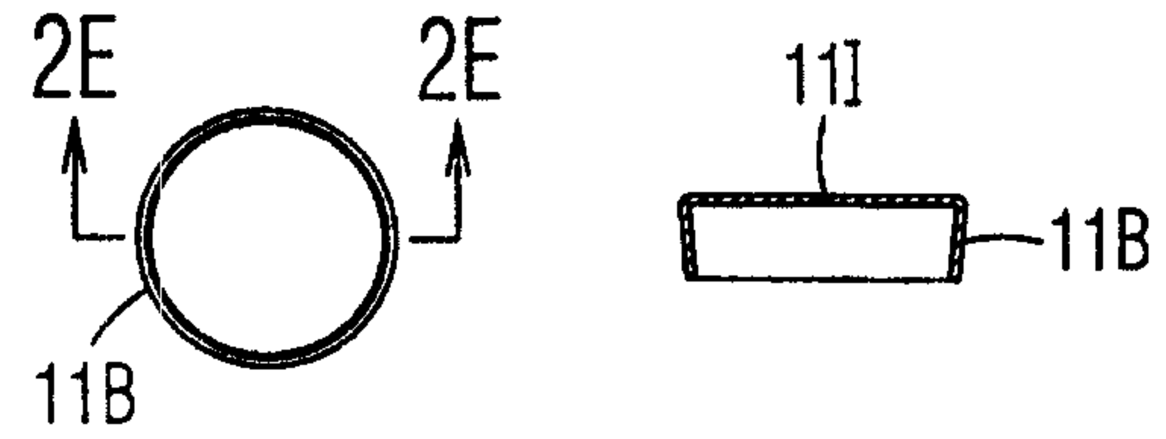


Fig. 2D Fig. 2E

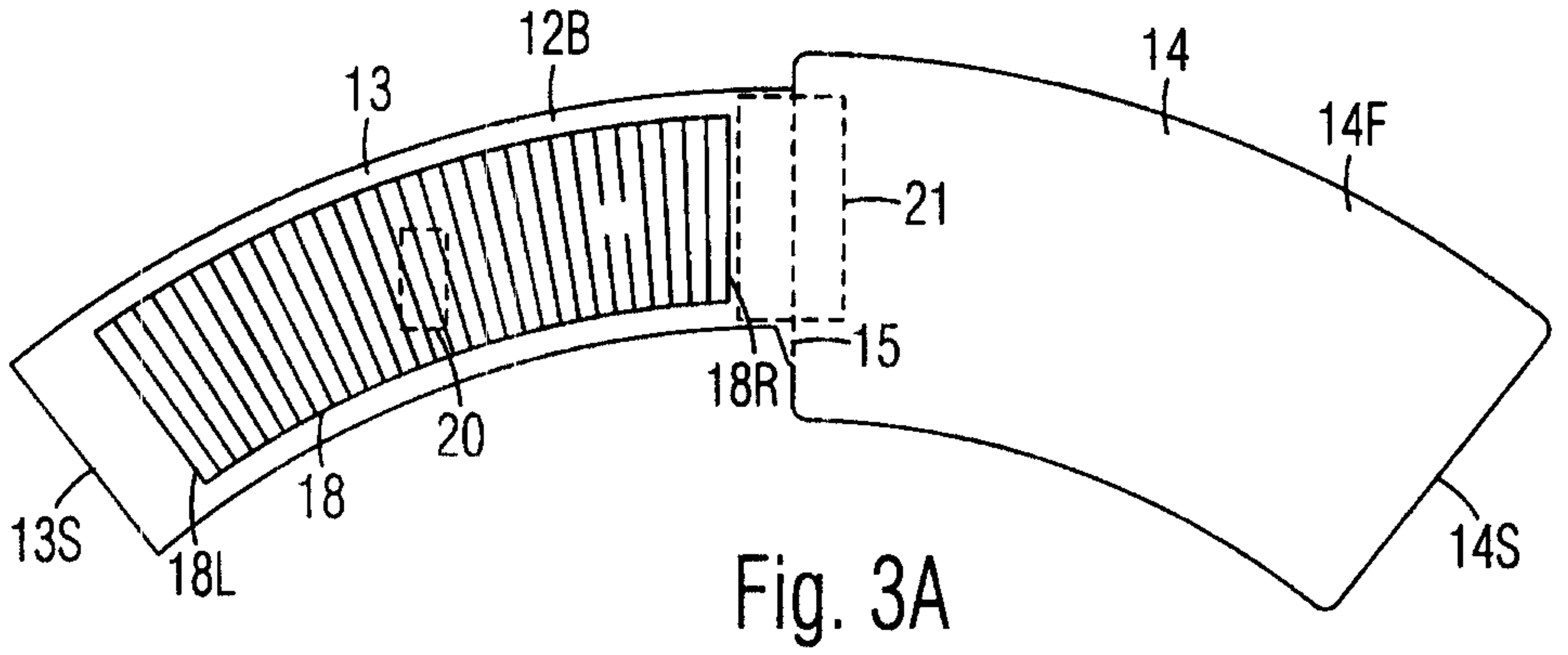


Fig. 3A

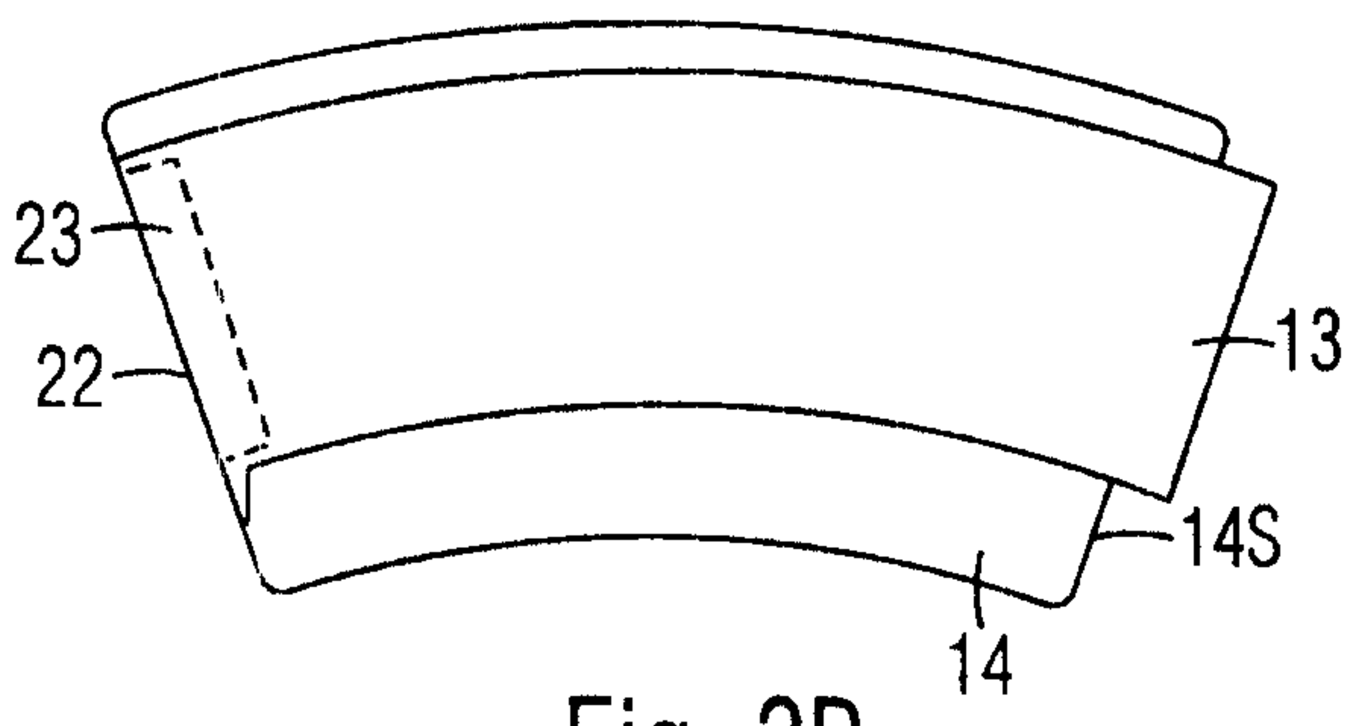


Fig. 3B

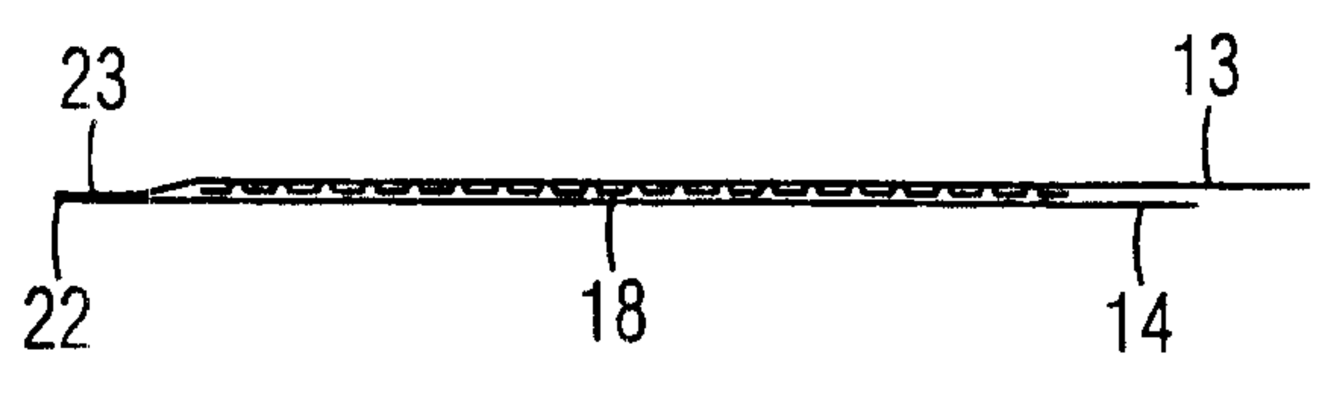


Fig. 3C

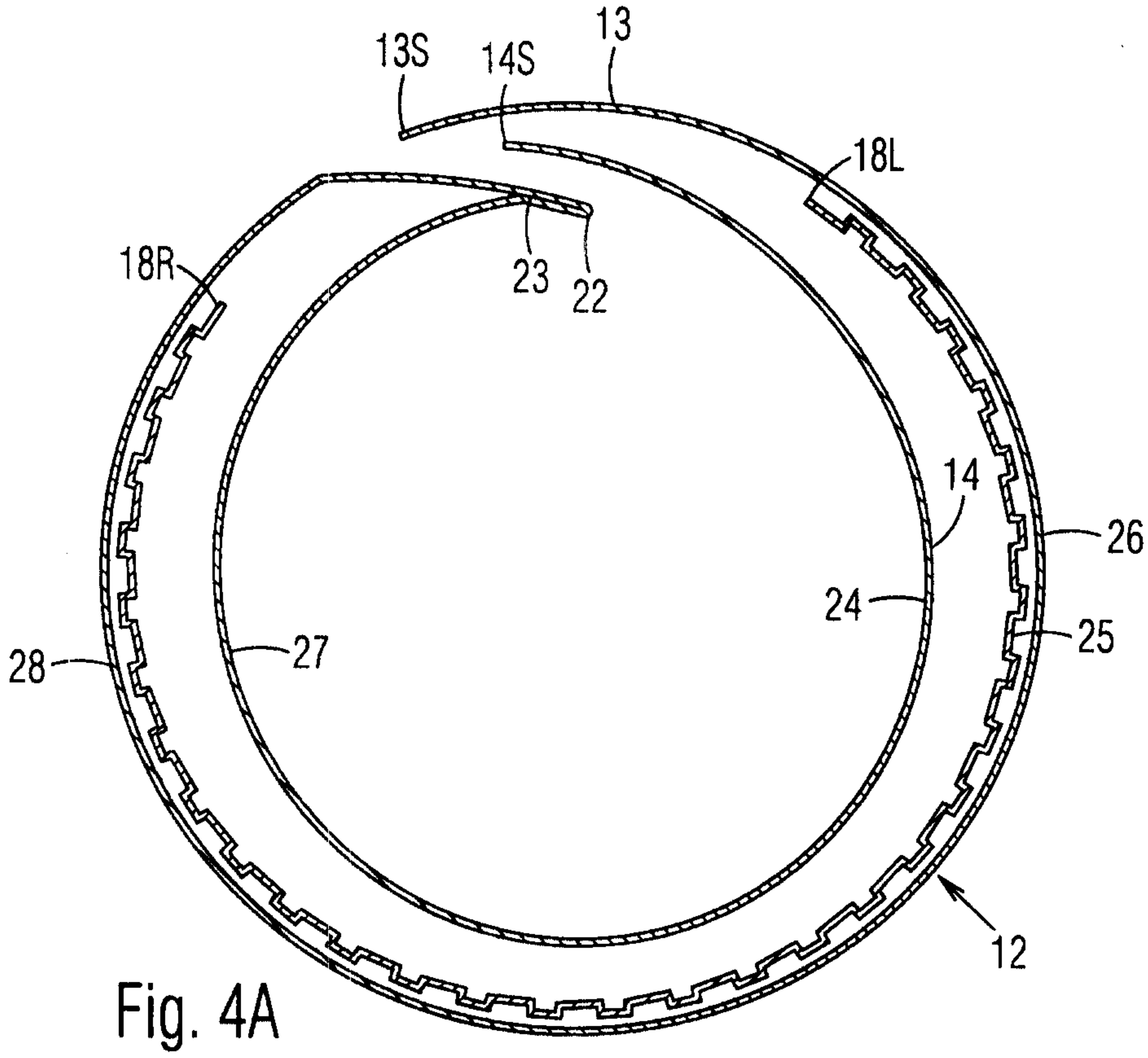


Fig. 4A

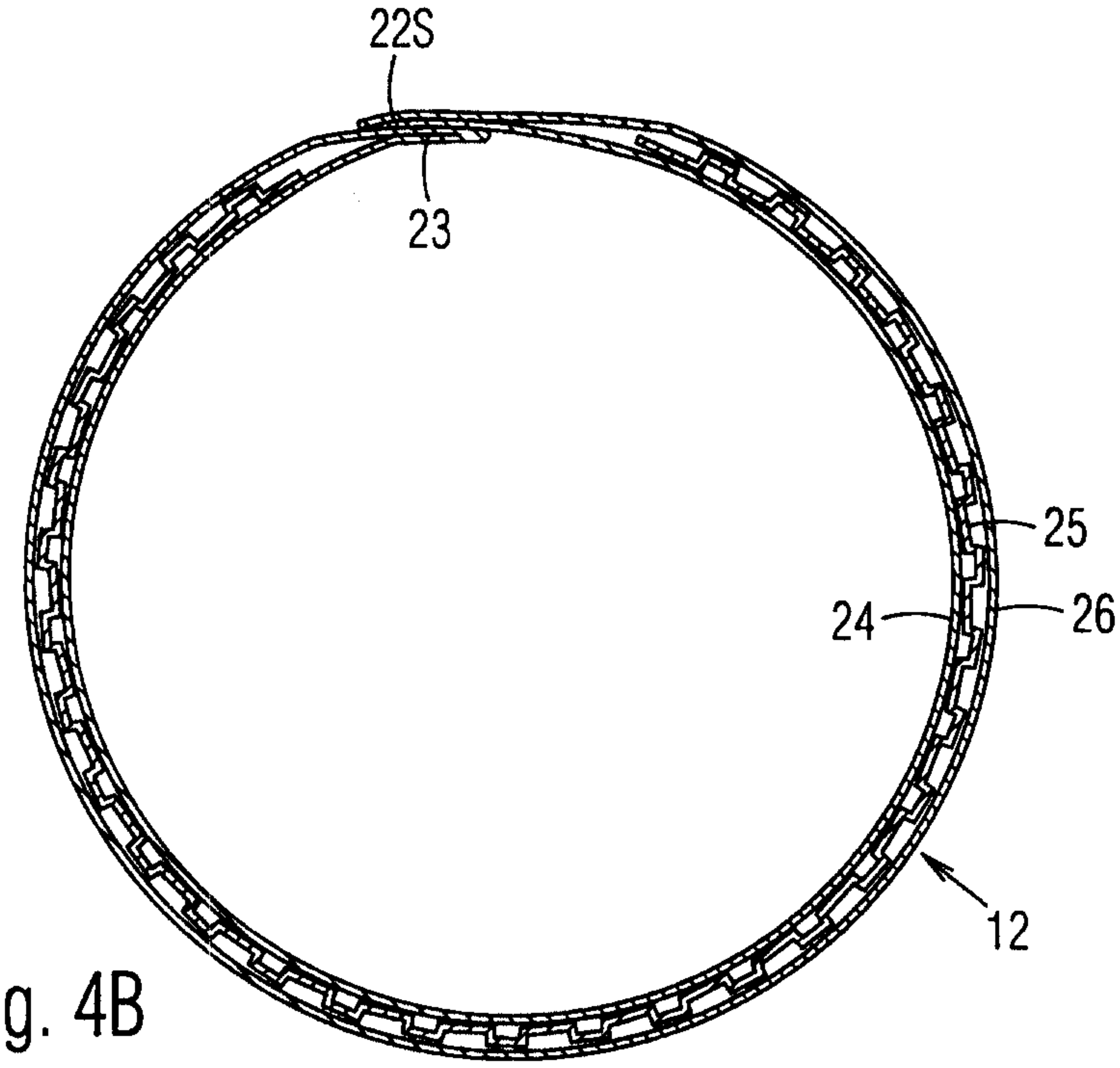


Fig. 4B

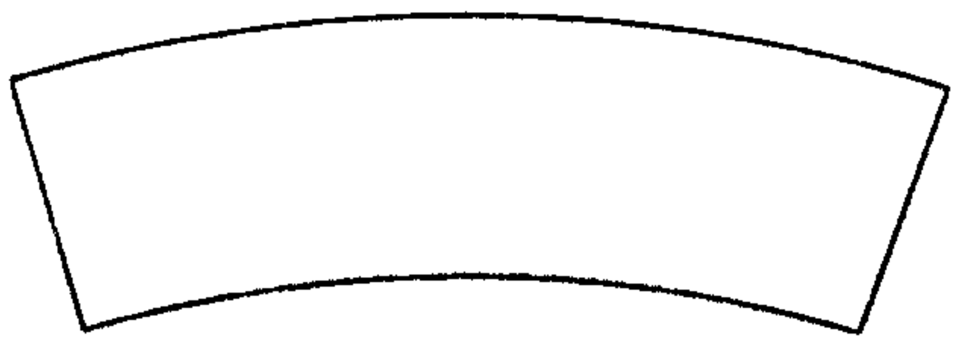


Fig. 5

Fig. 6A

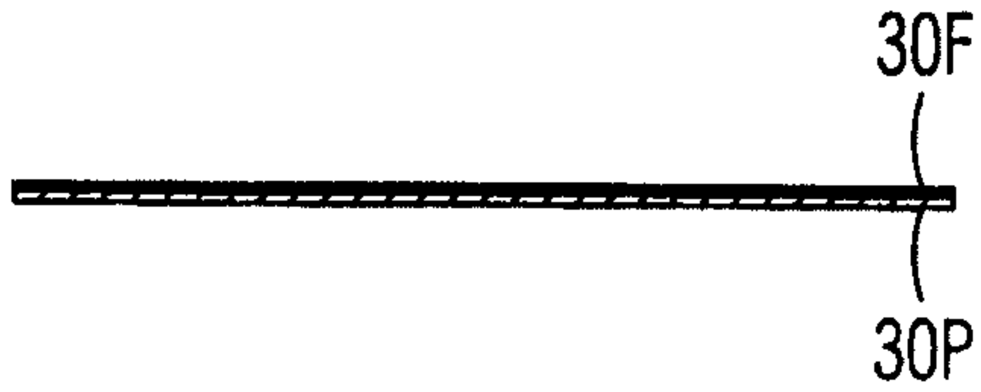


Fig. 6B

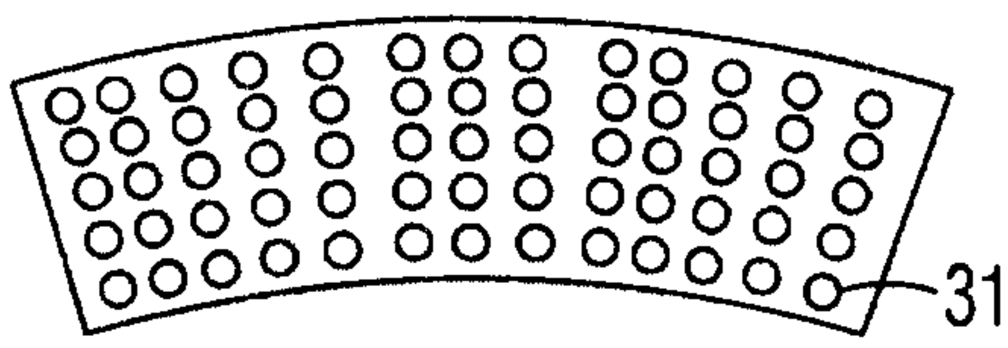


Fig. 7

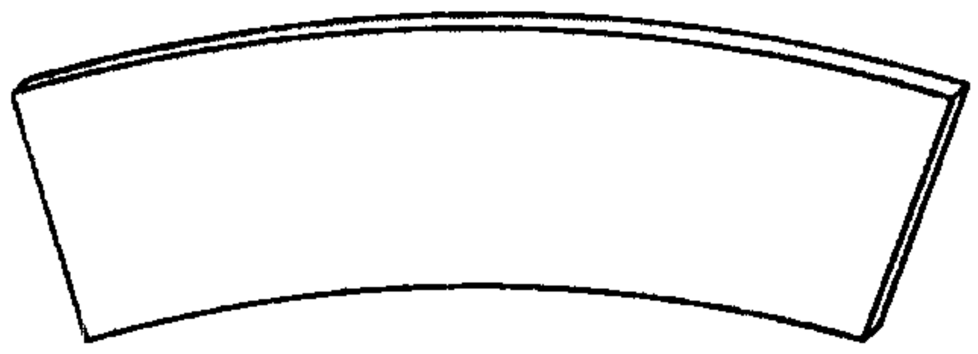


Fig. 8

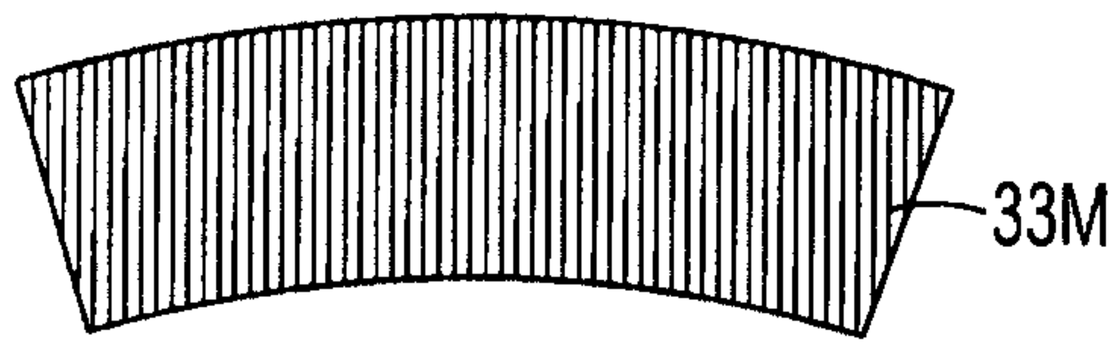


Fig. 9A

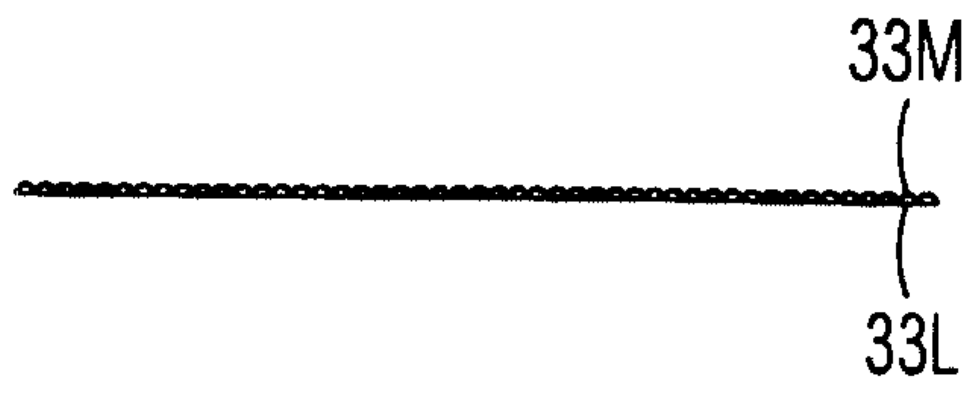


Fig. 9B

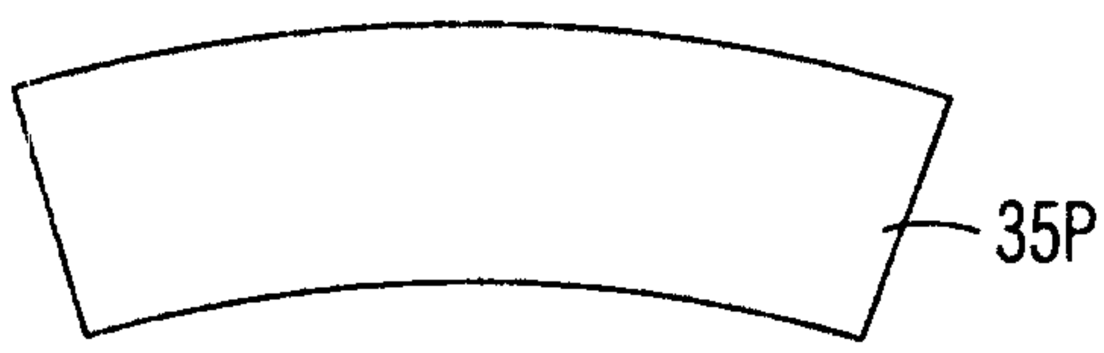


Fig. 10A

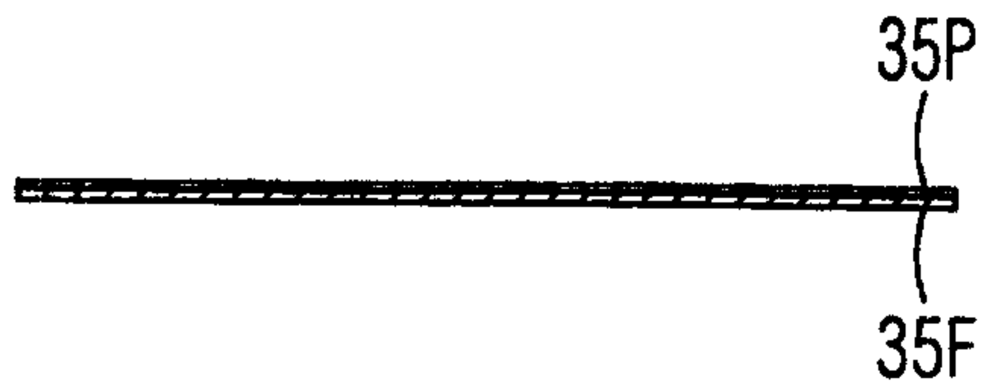


Fig. 10B

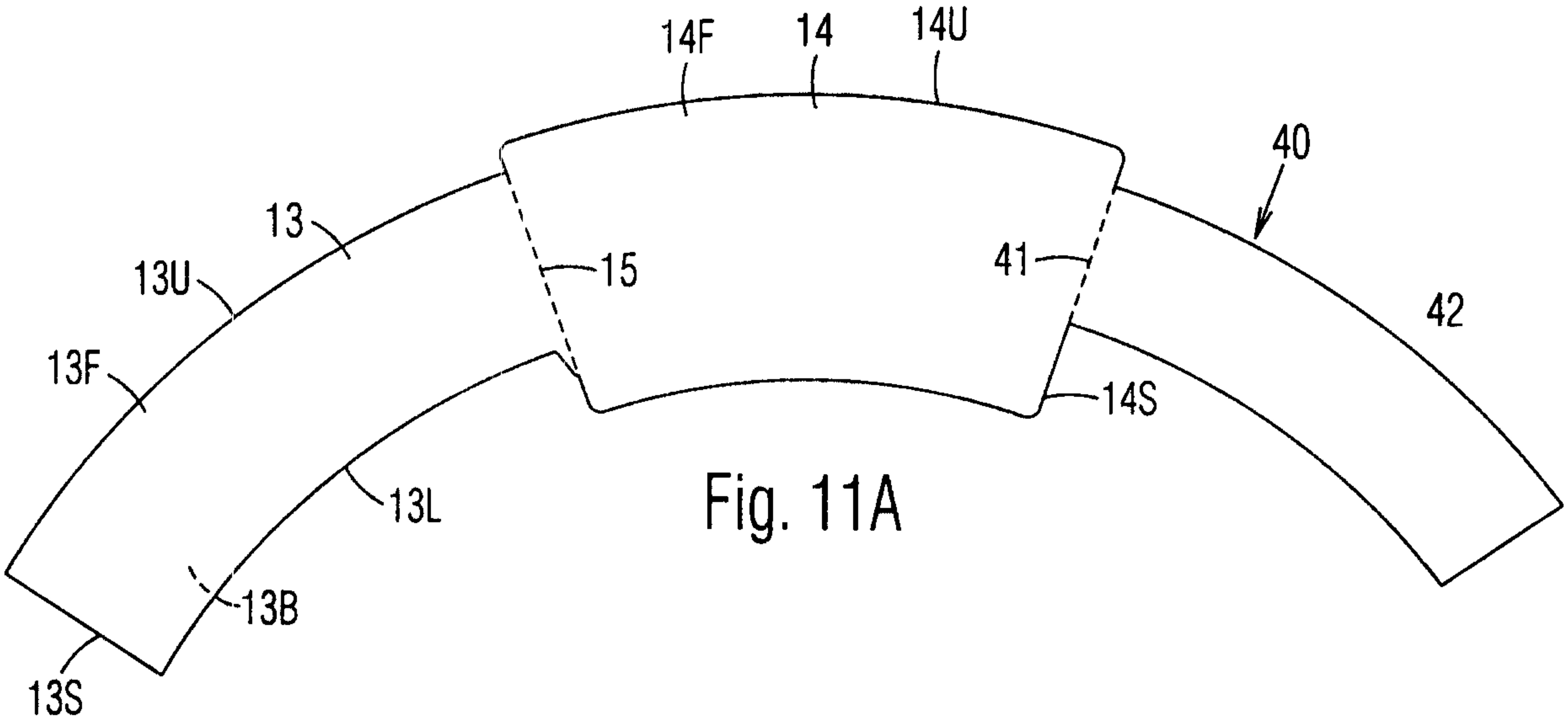


Fig. 11A

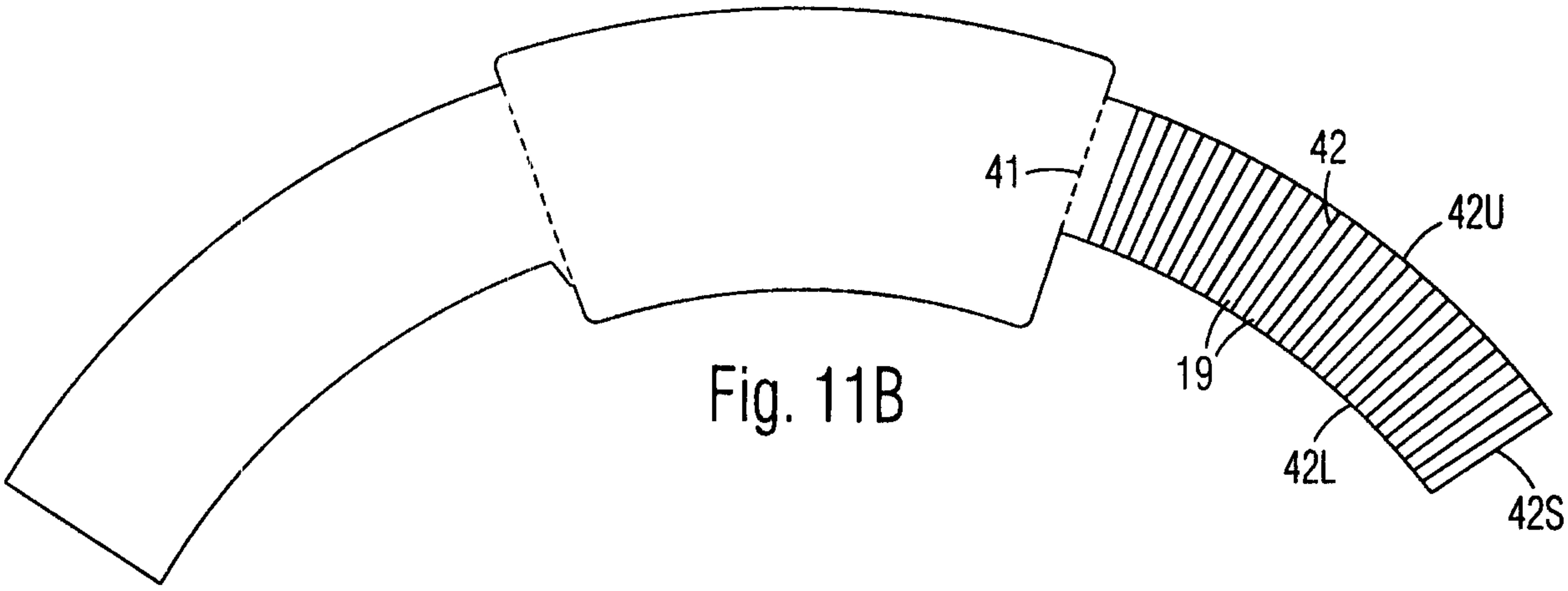


Fig. 11B

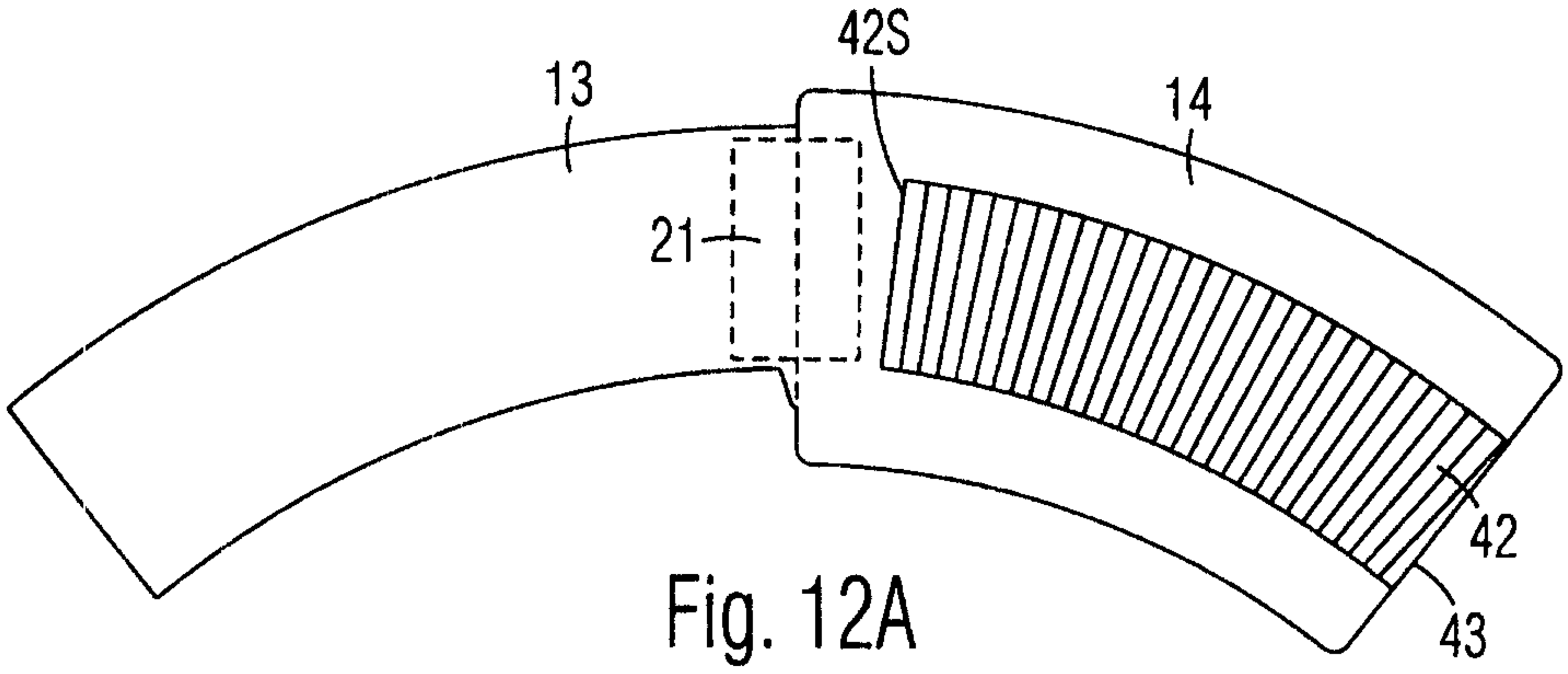


Fig. 12A

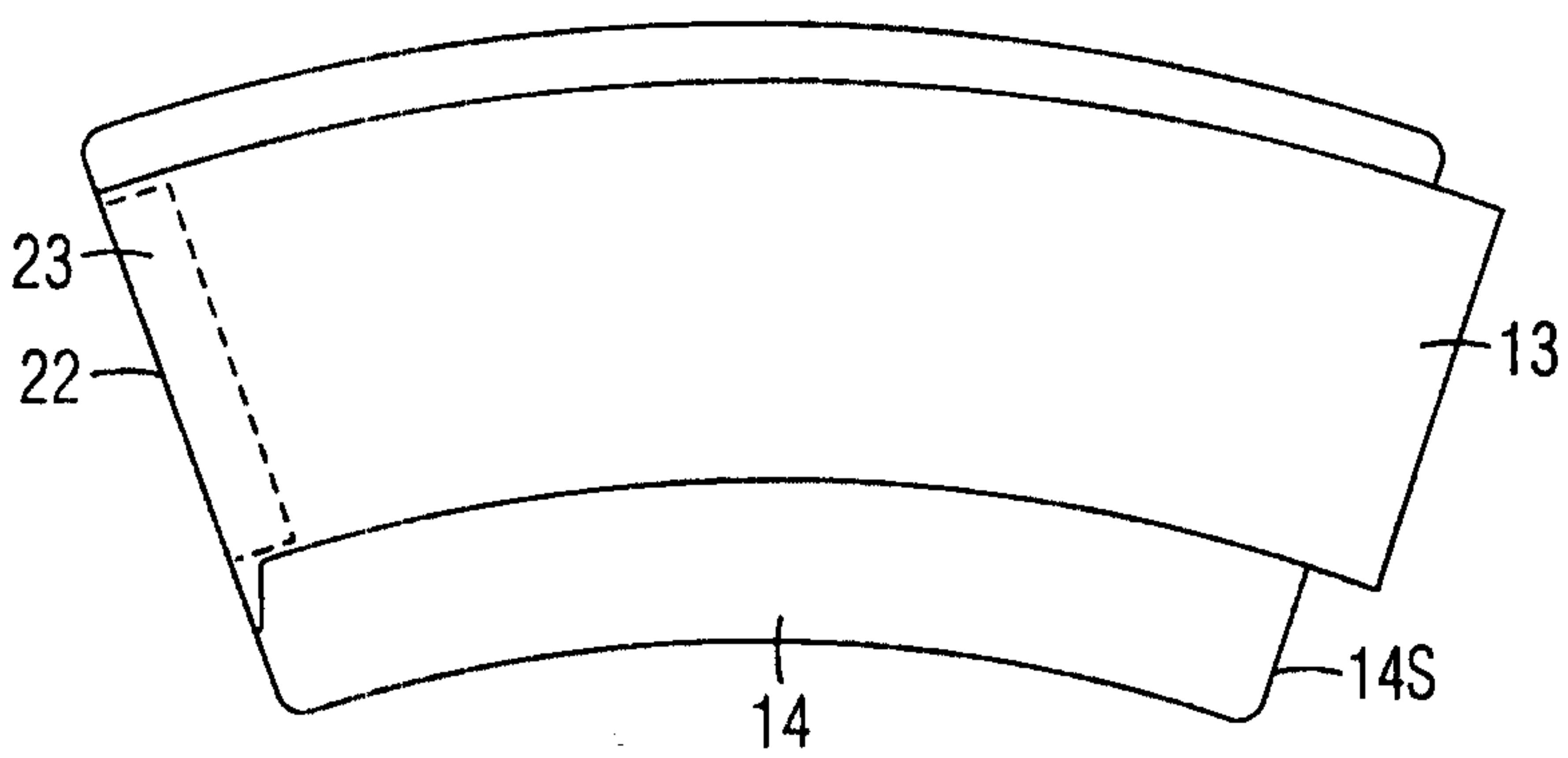


Fig. 12B

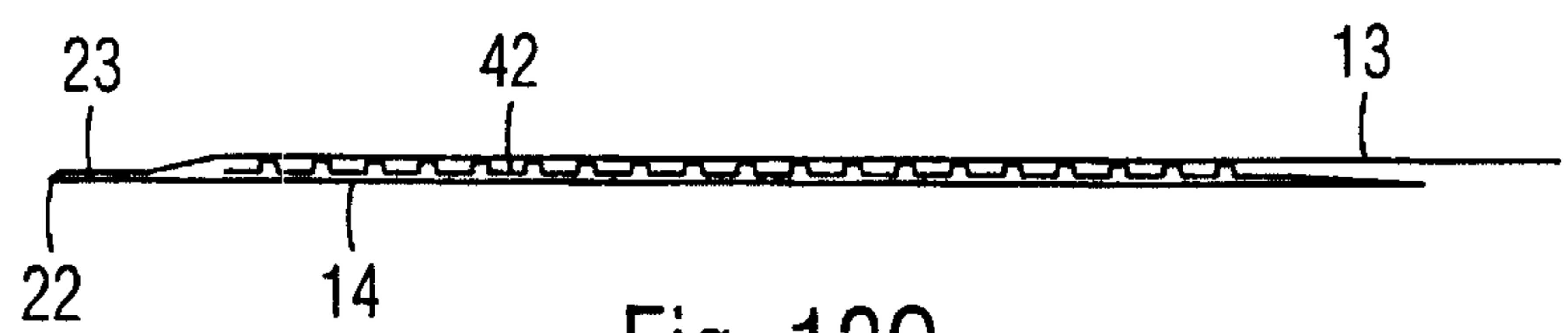


Fig. 12C

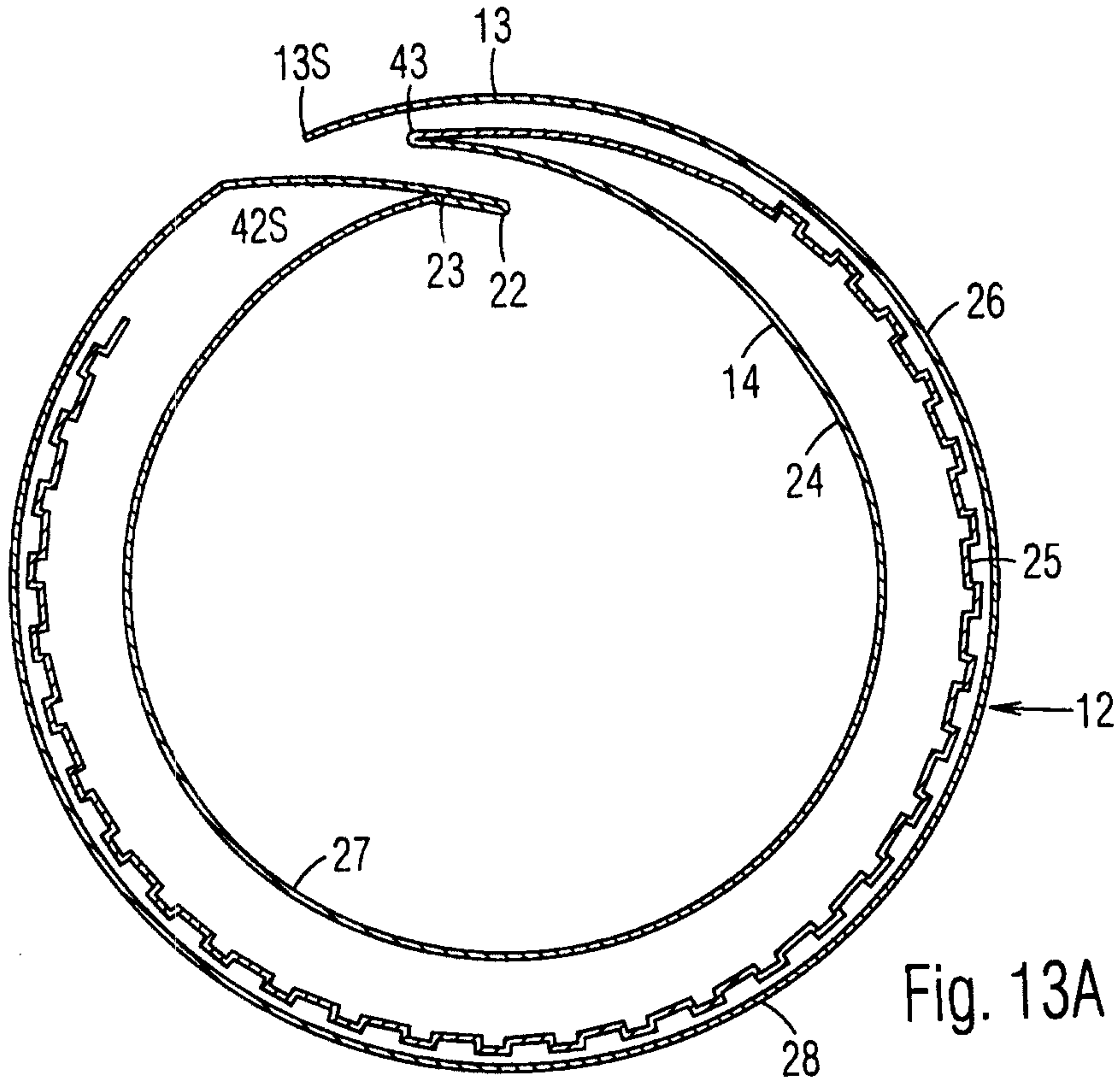


Fig. 13A

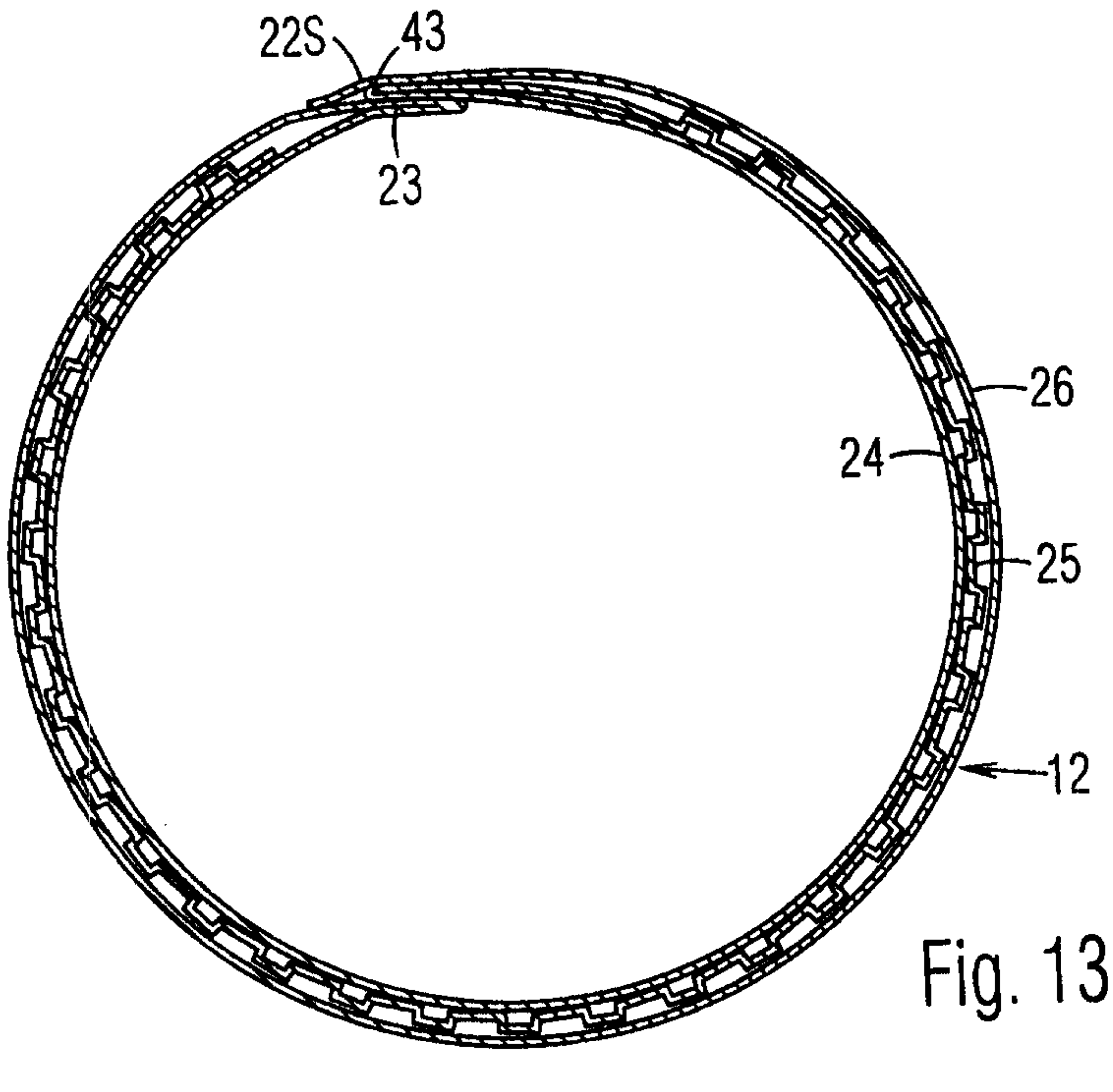
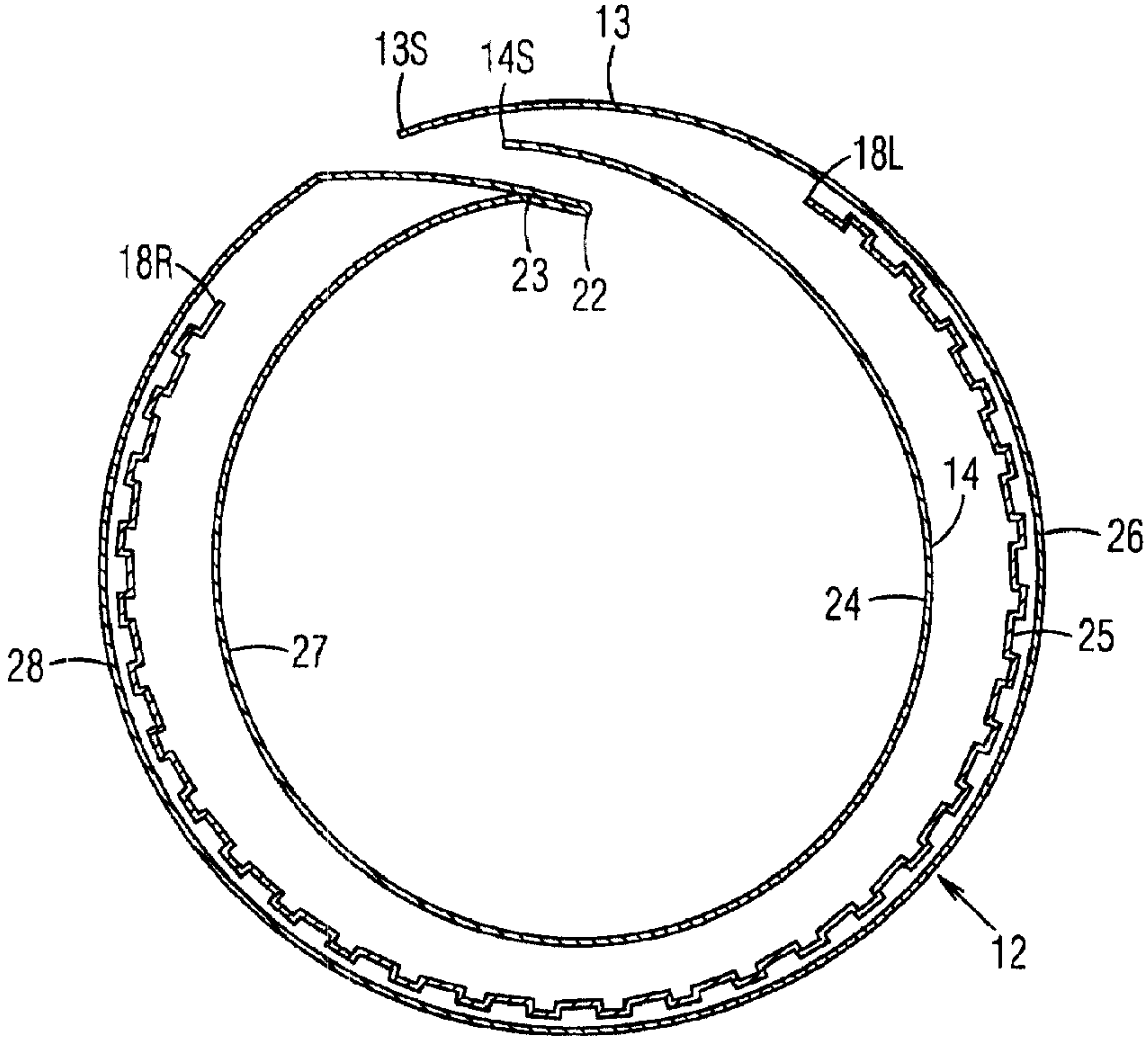


Fig. 13B



13
13S
14S
18L
18R
23
22
14
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24
25
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28
12