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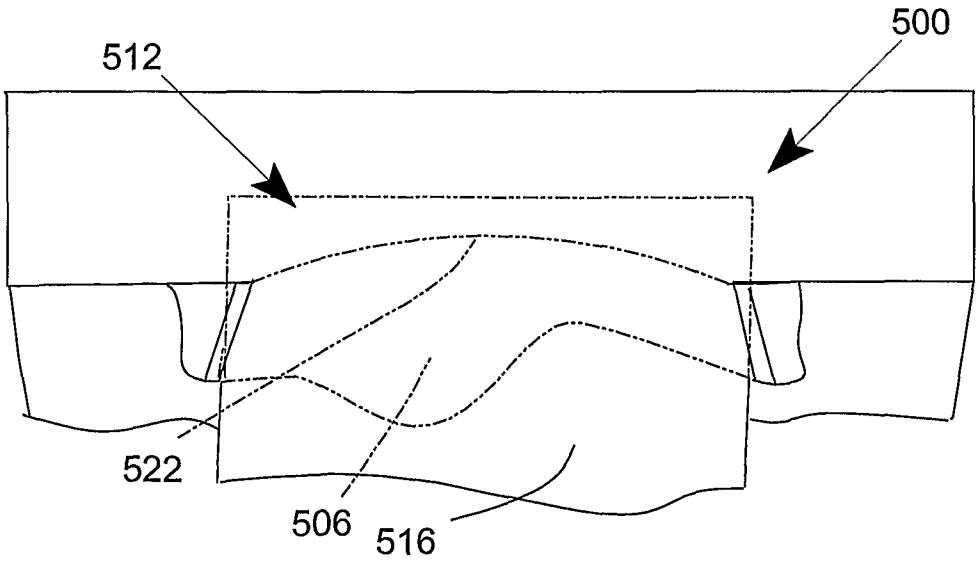
(54) Title: PROTECTIVE UNDERGARMENT WITH IMPROVED ARCUATE S-POCKET



(57) Abstract: A protective undergarment includes a sling that is suspended from an outer shell. The sling forms a pocket in which a reusable or disposable absorbent pad can be positioned. The sling has arcuate, stitched end edges at both the front and the rear of the sling. The garment thus fits better will less chance that portions of the sling at opposite ends of the pocket will be exposed to moisture. Instead the absorbent pad will remain in close proximity to the wearer, so that it can more readily absorb any fluids. The absorbent pad can be a trifold member, which limits lateral migration of fluids, and fasteners for securing the undergarment in place will not irritate the wearer's skin.

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PROTECTIVE UNDERGARMENT WITH IMPROVED ARCUATE S-POCKET

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to protective undergarments that can be constructed in different sizes, and which may be used by adults and children.

Description of the Prior Art

Protective underwear having a waterproof or water-resistant sling is shown in US patent 5,137,526; US Patent 5,409,476; US Patent 5,707,364; US Patent 6,254,583; US Patent 5,722,127; US Patent 6,895,603; and US patent 6,926,705. US Patent 5,814,037 shows a protective undergarment with a releasable pocket-sling. Front and rear ends of these slings are joined to an outer shell so that the sling can isolate body fluids and fecal matter from the outer shell. A suspended pocketed sling shown in US Patent 6,895,603 is formed by folding front and rear sections of a rectangular fabric about fold lines extending transverse to the major or longitudinal dimension of the rectangular fabric, so that overlapping portions of the rectangular fabric form fore and aft pockets. Exterior crease lines are covered by an elastic trim. Elastic is also placed along side edges to recess and cup the entire frontal potion of the sling to better fit the wearer's anatomy. Stitching along the edges of the pocket holds the three plies of the S-folded fabric construction together. A rectangular pocket opening is thus formed by the transverse fold lines and the longitudinal edges of the rectangular fabric. Remote ends of this pocketed sling can then be attached or stitched to the outer shell, which may be in the form of a pant or a diaper. The sling can hang freely from the opposite ends of the garment, and the absence of stitching between the sling and the garment in the area of the pocket eliminates a leakage path. A disposable pad, either reusable or disposable can be fitted in the pocket, with the ends of the pad held by the fore and aft overlapping or S-shaped sections at opposite ends of the rectangular pocket opening. Although this rectangular pocket can provide a pocket of sufficient volume to collect bodily wastes, and an absorbent pad can be

held in place within the pocket, the rectangular opening does not naturally conform to pubic area of the wearer. The exposed material along the crease lines formed by the transverse fold can become soiled compromising the effectiveness of the protective undergarment. This is especially a problem along the front of the undergarment when used for males, especially small boys, because the straight edge of the rectangular opening is wets easily.

In some prior art undergarments formed with S-pockets having rectangular edges, elastic encircles the rectangular sling opening. This elastic pulls material inward and can cause the pocket opening to take on an oval shape with curved front and rear openings. However, this effect of the elastic reduces the size of the pocket opening and provides less, not more, exposure of a disposable pad. This effect thus exposes more of the layer of the sling adjacent to the wearer to the pubic area and increases the area that can be wetted, especially for males. This ovaling effect thus reduces the effectiveness of S-pocket garments formed by a rectangular fold line.

US Patent 5,707,364 discloses another type of recessed pocket, in which a replaceable pad may be positioned. Figure 17 is a view of a diaper constructed in accordance with the teachings of this patent. The recessed pocket formed in Figure 17 according to US Patent 5,707,364 includes drop strips 8A(PA) on either side of the pocket. These drop strips 8A(PA) provide depth to the pocket and they are stitched to an absorbent channel 16A(PA) at the base of the drop strips. As disclosed in US Patent 5,707,364, the absorbent pads fit between the drop strips 8A(PA), and it is the added depth that is primarily relied upon to retain the removable absorbent pads in place. Some embodiments depicted therein include elastic strips extending over the pads between the drop strips 8A(PA) to provide additional restraint. A bumper strip 14(PA) extends across the front of the sling 8(PA), and that sling is free to float relative to the outer shell of the protective undergarment or diaper shown therein. The sling 8(PA), formed by the drop strips 8A(PA), and the channel 16A(PA) are joined to the bumper 14(PA) by an arcuate seam 82A (PA). US Patent 5,707,364 refers to this as recessing and pocketing, but the pocket referred to therein is in the middle of the sling 8A(PA), and not at its ends. there is no pocket above the acruate seam 82A(PA), because that seam, as shown in Figure 17, extends through both the drop strips 8A(PA) and the channel 16A(PA). Thus there is no S-pocket formed above seam 82A(PA) for receiving or retaining an end of a disposable pad either at the front

or rear of the garment, nor does the arcuate seam 82A(PA) provide a capability to retain a pad of any kind.

SUMMARY OF THE INVENTION

Two seemingly contradictory problems are addressed by the various embodiments of the instant invention depicted herein. First, a pocketed sling containing an absorbent pad is configured to increase the area of the pad exposed to the wearers skin and pubic area. The sling if recessed from areas where it might be soiled, by forming the ends of the sling opening with an arcuate contour. At the same time retention of the absorbent pad in a S-shaped contour is maintained by insuring that the pad is held in corners of the S-shaped sling, the pads are exposed near the center of the S-shaped pockets. At the same time no seams, which might cause leakage paths are located in portions of the pockets near the absorbent pads. The arcuate contour of the S-shaped pocket ends is formed not by folding material at the edge of the pocket, as in previous structures, but this arcuate contour is formed by stitching to pieces of fabric, each of which has an arcuate edge or in which a portion of that edge has an arcuate cut or cutout.

A protective undergarment that can be usee with an absorbent pad will accomplish these objections by including an outer fabric shell and an inner sling attached at opposite ends to the outer shell. This inner sling includes a pocket in which the absorbent pad can be positioned. The pocket extends inwardly from a pocket opening on an inner face of the sling so that an absorbent pad positioned in the pocket will be exposed to a wearer's pubic area. The pocket has S-shaped ends formed by overlapping layers of fabric. Each S-shaped end is formed by two pieces of fabric stitched together along an arcuate seam through arcuate edges of the two pieces of fabric. Opposite end edges of the pocket opening each have an arcuate contour with the greatest separation between opposite end edges being adjacent a longitudinal centerline. The pocket openings form corner S-shaped pocket sections on opposite sides of the centerline to project over corners of an absorbent pad when positioned in the pocket. The primary retention of the absorbent pad is in the corner pocket sections. The arcuate contour increases the exposure to an absorbent pad in the pocket in both fore and aft regions of the wearer's pubic area.

This sling of this protective undergarment can be formed by a central fabric piece with concave acruate edges on opposite ends and fore and aft fabric sections, each having a concave arcuate edge. Opposite concave arcuate edges of the central fabric piece are attached to adjacent concave arcuate edges of the fore and aft fabric sections. The central fabric piece is folded about transverse fold lines in partially overlapping relationship at opposite ends with the fore and aft fabric sections overlying overlapping portions of the central fabric piece. The attached arcuate edges form opposite S-shaped ends of the pocket. In one embodiment, the overlying fore and aft fabric sections can be attached along side edges to the overlapping portions of the central fabric piece to form corner pocket sections into which corners of the absorbent pad can be positioned for retention of the absorbent pad in the pocket.

Arcuate edges at both ends of the pocket expose portions of the absorbent pad to a wearer's pubic area to limit exposure of the end portions of the fabric sling to regions of the wearer's pubis in which the fabric sling can be soiled during use. Only the absorbent pad is exposed to regions of the wearer's pubis where soiling could occur.

In one version of this invention the protective undergarment includes an S-shaped inner sling with front and rear sections of the inner sling being folded over and joined to an overlapping fabric layer along arcuate edges of the inner sling and the overlapping fabric layer. The overlapping fabric layer can joined to the outer fabric shell along an opposite edge, so that the S-shaped inner sling is not stitched directly to the overlapping layer leaving no leakage paths along seams between the S-shaped inner sling and the overlapping layer. The overlapping layer can be stitched to a fastener strip on the outer surface of the shell to prevent the fastener strip from rolling under to irritate the wearer's skin.

According to another aspect of this invention, the protective undergarment includes first and second co-operable fasteners for securing the protective undergarment around the wearer's pubic area. The first fastener is located along one end of the protective undergarment. The second fastener is located along an opposite end of the protective undergarment and includes at least one fastener tab. The fastener tab includes a partially exposed fastener member and two tab layers of fabric. One edge of the fastener member is stitched between portions of one tab layer of fabric along a ridge so that the one edge is not exposed. The two tab fabric layers are initially, partially stitched together to form an interim sandwich, with one unattached

edge and with the fastener member initially between the two tab fabric layers. This sandwich is reversible to place the fastener member on the exterior of the second fastener, so that the one edge of the fastener member is covered.

An absorbent pad for use with this or other protective undergarments includes an absorbent section with waterproof strips or gussets extending along opposite edges of the absorbent section to limit lateral penetration of moisture absorbed in the absorbent section. In a preferred embodiment this removable absorbent pad can be received in the pocket in the undergarment. This absorbent pad has a first absorbent section with water resistant strips extending along lateral edges of the first absorbent section. Second and third absorbent sections are joined to the water resistant strips located between absorbent sections. The absorbent pad can be folded along the water resistant strips to form a multi-layer configuration in which moisture can migrate through the absorbent sections away from the wearer. The relatively flexible waterproof gussets facilitate folding the absorbent sections. Lateral migration of moisture is restricted by the water resistant strips to resist lateral leakage out of the pocket.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a view of a first embodiment of a protective undergarment according to this invention showing an absorbent pad disposed within a sling having end pockets with arcuate openings.

Figure 2 is a view of the protective undergarment shown in Figure 1 showing the absorbent pad removed from the sling pocket.

Figure 3 is a view of the protective undergarment of Figures 1 and 2 in which the sling is folded relative to the outer shell to expose seams between sections of the sling.

Figures 4A–4C are views showing the fabrication of the sling from individual fabric pieces for use in the protective undergarment of Figures 1-3.

Figures 5A-B show the completion of the sling pocket and the manner in which an absorbent pad can be retained in the pocket with arcuate end edges.

Figure 6 is a view of an alternate embodiment of this invention in which a sling with arcuate ends is used in a lady's panty.

Figure 7A show the separate component parts of a sling employed in the embodiment shown in Figure 6.

Figure 7B is a perspective view showing and intermediate step in the fabrication of the sling from components shown individually in Figure 7A.

Figure 8 shows a third embodiment of a protective undergarment as a partially completed configuration.

Figure 9 is a view of the interior of another version of this invention. This embodiment limits the tendency of the front edge of the undergarment to roll inward and irritate the wearer's skin.

Figure 10 is a view of the exterior of the protective undergarment of Figure 9.

Figure 11 is an enlarged view of the front edge of the protective undergarment of Figures 9 and 10.

Figure 11A is a view taken along section lines 11A-11A in Figure 11 showing the S-pocket configuration formed at the front of the sling. This view is not to scale, so that smaller features may be seen, and therefore the acruate edge and seam are smoother than may appear in this view.

Figure 12 is a view of a tri-fold, multi-layer absorbent pad that can be employed in this invention.

Figure 13 is an enlarged view of a fastening tab located on the rear corners of this protective undergarment.

Figure 14 shows the three principal components employed in fabricating the fastening tab of Figure 13.

Figures 15A – 15F show the main fabrication steps in constructing the fastening tab of Figure 13 in a manner so that hook fasteners will not be exposed so as to avoid irritation to the wearer.

Figures 16A-16F show the steps for fabricating the front edge of the S-pocket sling of the protective undergarment of Figures 9-11.

Figure 17 is a view of a prior art protective undergarment having a different type of pocket formed by a sling.

Figure 18 is a view of another embodiment of the protective undergarment in which the sling is detachable from the outer shell.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The first embodiment of the protective undergarment 2, shown in Figures 1-3 is a reusable diaper, which includes an outer fabric shell 20 with an inner sling 30 extending between front and a rear of the outer shell 20. The sling 30 forms a pocket 40 in which a reusable or a disposable absorbent pad 10 is retained so that the absorbent pad 10 will be adjacent the wearer's pubic area. Unlike other protective undergarments, the pocket 40 has arcuate end edges 44 and 46 at both ends to form a pocket opening 42 in which the exposure of the absorbent pad 10 is increased to limit soiling of the sling 30 and the outer shell 20. The pocket opening 42 with arcuate end edges 44 and 46 has been found to conform better to the wearer's anatomy so that portions of the sling fabric adjacent to a longitudinal centerline of the sling and pocket will not be soiled as has occurred with prior art protective undergarments, which have straight edges on one or both ends of the sling pocket. In addition to increasing the exposure of the absorbent pad 10 in areas likely to be soiled, this embodiment also eliminates seams between the sling 30 and the outer fabric shell 20 in the vicinity of the pocket 40 and the absorbent pad 10 where fluid leakage paths formed by the seams could otherwise cause problems.

Although the arcuate pocket end edges 44, 46 expose the absorbent pad 10, four corner pocket sections 38 will retain corners of the absorbent pad 10 securely within the pocket 40. These four corner pocket sections 38 are formed of multiple layers of fabric pieces bordered by the arcuate end edges 44, 46. The construction of these corner pocket sections 38 will be subsequently described in greater detail. Furthermore, these arcuate end edges 44, 46 together with the generally parallel pocket side edges 48 form a pocket opening 42, on the inner sling face 36, allowing the absorbent pad to be easily inserted into the pocket 40. A soiled pad 10 can be easily extracted since the user can grasp unsoiled portions of the absorbent pad 10 along its edges. An elastic trim 80 extending completely around the pocket opening 42 provides additional retention.

Fabrication of the protective undergarment 2, shown in Figure 1-3 is demonstrated in Figures 4A-C, and in Figures 5A-B. Figure 4B shows a first step in the fabrication of an inner sling 30 from the individual fabric pieces shown in Figure 4A. These fabric pieces include a central fabric section 50, a fore fabric section 60, and aft fabric section 70 and an intermediate section 90, which has a greater elasticity

than the other fabric sections. Preferably, the fabric sections used to form the sling 30 are formed from a generally waterproof or water resistant material, such as commercially available materials, with the exception of the intermediate section 90, which can be formed of an elastic material, such as commercially available materials.

The central fabric section 50 is cut to form a first concave edge 52 and an opposite second concave edge 54. In the preferred embodiment, these concave edges 52, 54 have a generally constant radius of curvature, substantially equal to the radius of curvature to be formed as pocket end edges 44, 46. It should be understood however, that this arcuate contour need not have a constant radius of curvature, and that other embodiments can be adopted.

The fore fabric section 60 can be shorter than the central fabric section 50 and has a fore concave edge 62 and a fore upper edge 64, which in this embodiment is in the form of a straight line, which will extend perpendicular to the longitudinal centerline of the sling 30. As will be described with respect to other embodiments, this upper edge 64 need not be straight when the invention is employed with other protective undergarments. The arcuate contour of the fore concave edge 62, should, however conform to the fore concave edge 52 of the central fabric piece 50, because these two arcuate edges will be stitched together to form the sling 30.

The shape of the aft fabric section 70 can be generally the same as the shape of the fore fabric section 60, although its length can be different, because this aft section 70 can be attached to the intermediate piece 90, which in turn will be attached to the other shell adjacent the sling rear end 34. The contour of the aft concave edge 72 conforms to the concave contour of the rear arcuate edge 54 to which it will be stitched. Although the aft upper edge 74 can have different shapes, it will normally be straight since it will be stitched directly to the intermediate piece 90, which will form a generally elastic spacer between the remainder of the sling 30 and the outer shell 20 to which it will be stitched or otherwise attached.

The fabric pieces shown in Figure 4A will be stitched or otherwise attached together in the order shown in Figure 4B as part of the first step in the fabrication of the sling 30. Figure 4B shows all of these pieces stitched together end to end. The central fabric concave edges 52 and 54 are stitched to the corresponding fore and aft concave edges 62, 72 to form an arcuate front seam 82 and an arcuate rear seam 84. The intermediate piece 80 is stitched to the aft fabric piece 70 along a straight steam 94.

The next step in the fabrication of the sling 30 is to fold the central fabric piece 50 about transverse fold lines 56 located adjacent to and inward of the arcuate seams 82 and 84. Figure 4C shows the resultant structure in which overlapping corner pockets or sections 38 are formed at each of the four corners of the pocket opening 42. The fore and aft fabric sections 60 and 70 will now overlap portions of the central fabric section between the fold lines 56 and the seams 82 and 84, as well as central fabric portions inboard of the fold lines 56. A three layer construction or a S-shaped pocket will be formed, with overlapping sections in the corners having a greater longitudinal depth than nearer the longitudinal centerline of the sling 30. These corner pockets 38 are completed by side edge seams 86 and 88, which extend from the arcuate seams 82, 84 to the fore and aft upper edges 64, 74.

Figure 5A shows completion of the pocket 40 by addition of the elastic trim 80 around the pocket opening 42. This elastic trim 80 will be stitched over the arcuate seams 82 and 84, and will extend along the pocket side edges 48, so that the elastic trim 80 will be in a position to trap or retain an absorbent pad 10 inserted into the pocket 40 as shown in Figure 5B. In the preferred embodiment, this elastic trim can be a single piece with a first end attached adjacent the intersection between one of the side seams 86 or 88 and the corresponding arcuate seam 82 or 84.

The sling 30 can now be stitched to the outer shell 10 along the sling front end 32 and the sling rear end 34. The upper edge 64 of the fore fabric section 60 will be stitched directly to the outer shell 20, and the relatively elastic intermediate piece, attached to aft fabric section 70, will be stitched to the rear of the outer shell. In the preferred embodiment, the sling 30 will be attached to the outer shell 20 only along these ends with no intermediate seams. There will then be no leakage paths formed along and seams in the vicinity of section of the pocket 40 in which an absorbent pad 10 will be disposed.

Another alternate embodiment of this invention is shown in Figures 6 and 7A-B. Figure 6 show a panty 102 that is reversed to show the interior of the panty on which an absorbent pad 110 will be positioned. This embodiment is in the form of a lady's panty 102, that is specially suited as a protective undergarment, which is compatible with the female anatomy. In this embodiment a sling 130 and a shell 120, which forms the crotch portion of the lady's panty 102, are both stitched or otherwise attached to what is substantially otherwise a conventional lady's panty. Both the outer shell 120 and the sling 130 are preferably fabricated from a liquid or waterproof

or resistant material. The remainder of the panty can be fabricated from a conventional material or materials normally used in a standard lady's panty or other undergarment. For example, a conventional disposale pad has a waterproof covering on the back. The pocket for a lady's protective undergarment according to this invention could then be fabricated from a non waterproof or non water resistant material, such as a cool mesh material. The remainder of the panty can be fabricated from a conventional material or materials normally used in a standard lady's panty or other undergarment.

One significant difference between the configuration shown in Figure 6 and that employed in the embodiment of Figures 1-3 is the shape of the fore fabric section 60 and the rear fabric section 170. The fore fabric section 160 has an upper edge 164 that is formed by two intersecting upper edges instead of the right angle edge 64 in the first embodiment. The rear fabric section 170 has a curved or arcuate lower edge 174 instead of the straight edge 74 in the first embodiment. The sling 130 and outer shell 120 are also largely confined to the crotch area and do not extend to the waistband 196. The sling 130 extends between the leg openings 198 and elastic along the sides of the outer shell 120 will form a part of these leg openings 198 on either side of the sling 130.

The central sling fabric section 150 has the same basic shape as the central fabric section 50 in the first embodiment, although of course the dimensions need not be the same. The front edge 152 and the rear edge 154 are also concave and arcuate as in the earlier embodiment. In this embodiment the side edges 158 can also be slightly curved to insure a better fit. The fore fabric section 160 has an arcuate concave inner edge 162 and an upper edge 164 formed by two intersection edges so that this waterproof or resistant section can extend upwardly to provide a sufficient barrier. Lower fabric section 170 has an upper arcuate concave edge 172 and a convex edge 174, which will be attached directly to the fabric forming the major portion of the lady's panty. The curvature of the arcuate edges 162 and 172 is substantially the same as the curvature of the arcuate ends 152 and 154 on the central fabric section 150. As shown in Figure 7B, these arcuate edges on fabric sections 150, 160 and 170 will be stitched together along seams 182 and 184 and this subassembly will be folded along fold lines 156 to form a sling 130 in the same manner as in the earlier embodiment of Figures 1-3. Seams (not shown) are formed along the sides of the fore fabric section 160 and the aft fabric section 170 in the same

manner as in the first embodiment. The remote edges 164 and 174 of fore fabric section 160 and rear fabric section 170 respectively will be stitched to edges 164A and 174A, and in turn stitched to the remainder of the panty adjacent the upper and lower edges of the leg openings 198.

The pocket 140 formed by sling 130 is quite similar to that of the first embodiment, with of course extra room being formed at the apex of the top edge 164 of the fore fabric section 160. However, this additional space in the pocket does not provide extra retention for an absorbent pad 110 having the same shape as pad 10. Corner pocket sections 138 at both the front and rear ends still provide the primary retention for a pad 110 inserted in the pocket 140. The pocket opening 142 has the same shape as the pocket opening 42 with arcuate sections 144 and 146 at the front and rear of the pocket opening 142. The pocket side edges are substantially straight and an elastic trim extends around the pocket opening 142 in the same manner as in the first embodiment.

A third embodiment, shown in Figure 8, is even simpler than the first two embodiments. The protective undergarment 202 is shown at a stage prior to complete fabrication of the undergarment. To complete the protective undergarment 202, elastic trim can be added around the pocket opening 242, as in the other embodiments, and elastic straps will be attached to opposite sides of the rear of shell 220, so that these straps will extend around the wearer's waist to hold the garment in place. Loop fasteners on these straps (not shown) can then be attached to hook fasteners 296 on the outside of the shell 220. The sling 230 is formed of a central fabric segment 250, a fore fabric segment 260 and an aft fabric segment 270, which is in turn attached to a relatively more elastic intermediate section 290, which will be secured to the rear of the shell 220. Arcuate end edges 282 and 284 are formed on the front and rear of the pocket 240 in substantially the same manner as in the first two embodiments. The pocket 340 is formed in the same manner as in the earlier embodiments. An absorbent pad can then be inserted into the pocket 240 where it will be primarily held in place along the corners of the absorbent pad, in the same manner as in the earlier embodiments.

Another embodiment of a protective undergarment 500 is shown in Figures 9 and 10. This undergarment is intended to prevent potentially abrasive hook and loop fasteners from coming into contact with the sensitive skin of the wearer. In this representative embodiment, the outer shell of the diaper comprises a soft inner fluid

absorbent layer 502 stitched along peripheral edges to an outer fluid resistant or waterproof layer 504. A sling 506 is suspended from opposite ends of the undergarment 500, and the sling 506 is free to float between these two opposite ends. The sling 506 is preferably fabricated from a fluid resistant or waterproof material. There are no stitches directly connecting the sling 506 with the inner fabric layer 502, and therefore there are no potential leakage paths formed along connecting seams.

The rear portion of the sling 506 is joined at the rear edge 508 of the shell by an intervening fluid resistant section 510, in the same fashion as in the embodiment of Figure 1. An elastic trim 514 extends partially around the inner edge of the sling 506 to form a pocket 512 into which an absorbent pad 516 may be introduced and removed when soiled. The elastic trim 514 does not however extend around the front edge of the pocket 512, where the sling 506 is joined to the outer shell by a fabric strip 520 that extends between opposite sides of the undergarment 500. The edge 522 where the sling 506 is joined to the fabric strip 520 is still arcuate so that both the front and rear ends of the pocket conform to the wearer's pubic area and provide maximum exposure of the absorbent pad 516 to the wearer so that the remainder of the protective undergarment 500 will not be soiled.

A stitched seam connects the sling 506 to the fabric strip 520, and this arcuate shaped seam extends between opposite sides of the undergarment 500. In the center of this arcuate seam, the top edge of the fabric forming the sling 506 is stitched to the fabric strip 520. At the edges of the front edge of the sling 506, the sling is overlapped to form the pocket 512 and to define the corners that will retain the front edge of the absorbent pad 516 in place. The fabric strip 520 is on an opposite face of the undergarment 500 from the front fastener strip 528, which extends along between sides of the outer fabric 504 as shown in Figure 10. As shown in Figures 10 and 11 a line of stitching forming a seam 530 joins the fastener strip 528 to the fabric strip 520. This fastener strip 528 is preferably formed from a relatively soft loop fastener material, but if this fastener strip 528 tends to roll toward the skin during usage, sharper edges, where the fastener strip 528 is stitched to the outer fabric 504 can irritate the wearer's stomach or abdominal area causing discomfort. By employing the fabric strip 520, the tendency of the front edge of the undergarment to roll inward will be reduced or eliminated.

Fabrication of the front arcuate pocket 512 is shown in Figures 16A-D. The two main components are a fabric strip, which will form the overlapping layer 520,

the and the fabric, which will form the sling 516, both of which are shown in Figure 16A. The fabric forming the sling 516 is waterproof, or fluid resistant, and the sling is fabricated from a single piece of material, with no stitch lines in the areas in which they might form leakage paths. The fabric strip forming overlapping layer 520 in normally fabricated from the same material. As seen in Figure A, the overlapping layer 520 includes a curved or arcuate section 521 in which a concave edge is formed extending into one edge of the overlapping layer 520. The front edge of the material forming the sling 516, also includes an arcuate cutout 515. Preferably the curvature of the two arcuate sections or cutouts 515 and 521 have the same curved configuration, so they will fit together when overlayed.

Figure 16B shows the next step in the fabrication of the front arcuate pocket 512. As indicated by the arrows, the overlapping layer strip 520 is placed on top of the front edge of the sling 520 so that the arcuate cutout 521 is aligned with the arcuate cutout 515 on the sling 516. An arcuate seam 511 is stitched around the cutouts so that the bumper or overlapping layer 520 is partially stitched at the curve to the sling 516. The curvature of the two arcuate cutouts 521 and 515 can be greater than that depicted herein, since the main purpose of these arcuate cutouts is to permit greater exposure of an absorbent pad that will be mounted in the sling 516. The width of the overlapping layer 520 is more than half the width of the upper section 517 of the sling 516 as indicated by the location of the centerline of this upper section 517 as shown in Figure 16B. The upper end of this upper section will ultimately be stitched to the shell, and the upper sling section must be spaced from the attachment point of the overlapping layer 520 to the shell so that a pocket can be formed by the sling 516 below this overlapping layer 520.

Figure 16C shows the formation of a pocket 512 as the upper sling section is folded along its centerline beneath the overlapping layer 520. The interim subassembly shown in Figure 16C is upside down relative to the orientation of Figure 16B. As shown in Figure 16C, the overlapping layer 520 is in front of the folded upper sling section 517. Overlapping layer 520 has been folded back about the curved seam 521. Ends of the folded upper layer 517 are stitched along seam 527 prior to folding the overlapping layer 520 over the folded upper sling section 520. The seam 527 extends along two transverse edges of the upper sling section 520, but does not penetrate the overlapping layer 520. A pocket 512 is formed between the two folded layers of the upper sling section 517. This pocket 512 will extend beneath

the seam 512 and the arcuate edge 522 formed by stitching along the arcuate edges 515 and 521 formed by two of the layers that will be on the front of the protective undergarment 500.

The next step, begun in Figure 16C is to form a front S-pocket 512 having three layers of overlapping material on the front of the diaper shell. The interim subassembly shown in Figure 16B will be the starting point for the operations shown in Figure 16C. Figure 16C is upside down with respect to Figure 16B. Three layers of material are initially folded to form into an S-pocket as shown in Figure 16C. In Figure 16C, the overlapping layer 520 covers the other two layers formed by folding over the upper portion of the sling 516. The two folded layers formed by the folded upper section will form the top and bottom of pocket 512, which will ultimately receive an absorbent pad. The arcuate edge 522 will be raised relative to the adjacent edges to provide more clearance and more exposure to the wearer's pubic area by the pad. The corners above the arcuate edge 522 will provide an area for receiving and securing the corners of a pad as shown in Figure 9 when the pocket 512 is fully formed.

The final step in fabricating pocket 512 is shown in Figure 16D, which shows that the edges of the sling 516 along which an elastic if formed are folded inward as shown at 519, and then stitched transversely of the seams 527 and 529 to join seam 511. This seam 527 extends only along the folded edge of the upper sling section 517, and does not engage the lower layer of the sling section 517 leaving the pocket 512 open. Figure 16D does show another seam 529 that does extend through the lowest or innermost layer of sling 516 and the overlapping layer 520. This seam 529 extends between top and bottom edges of the overlapping layer and the pocket 512 is back folded and tacked with stitching 529 to layer 520 as shown in Figure 16D, and seam 529 serves as a blocking seam or dam that will prevent fluids from migrating laterally out of the S pocket 512. The sling 516 and pocket 512 have been completed in Figure 16D, and are now ready to be stitched to the outer shell 504.

Figure 16E shows the attachment of the sling subassembly shown in Figure 16D to the outer shell 504. This sling subassembly is stitched to the outer shell 504 by a continuous seam 531, which extends along the top edge of overlapping layer 520 and along its lateral edges. The sling subassembly is stitched to the interior surface of the shell 504, and a fastener strip 528 is stitched to the exterior surface of the outer shell 504 opposite the overlapping layer 520. Preferably, this fastener strip 528 is a

loop fabric fastener to which hook fasteners can be attached. A seam 533 is stitched through the fastener strip 528 and the overlapping layer 520 to secure these two components on opposite sides of the protective undergarment together. By securing the fastener strip 528 to the overlapping layer 520, a force tending to pull down on the sling 516 will not cause the fastener strip 528 to roll under otherwise exposing a rough edge of the fastener strip 528 to the sensitive skin of the wearer of the protective undergarment 500. In other words if the absorbent pad becomes water logged or the pocket becomes full, the additional weight will not cause the fastener strip to roll inward into contact with the wearer's skin.

Fastener tabs 526 at the corners of the rear edge of the undergarment 500 are intended to grip the fastener strip 528 when the protective undergarment 500 is worn. The fastener strip 528 extends between opposite edges of the undergarment 500 to provide a very large amount of adjustability to account for the varying sizes of the wearer's of this protective undergarment. The tabs 526 have rounded corners, with no sharp edges that would irritate the wearer's skin. The construction of these tabs 526 will be subsequently discussed in greater detail.

Figure 12 is a view of the absorbent pad 516 that can be mounted in the pocket 512. In Figure 12, this pad is shown prior to being folded in a tri-folded configuration for insertion into the pocket 512 as shown in Figures 9 and 11. This pad has a central section 534 formed of a fluid absorbent material. Central section 534 is thicker than the other sections. Central section 534 is joined at opposite ends to side sections 536 by strips 532, which extend between the top and bottom of the pad. In use the side sections 536 are folded beneath the central pad section 534, so that the folded pad can be inserted into the pocket 512 with the absorbent central pad section 534 exposed to the wearer's pubic area. The side sections 536 are also fabricated of fluid absorbent material. The two strips 532, which are stitched between central section 534 and corresponding side sections 536, are fabricated or a fluid resistant or waterproof material. These waterproof strips 532 form hinges that help fold the side sections 536 of the pad 516 under the central section of the pad. Hinges 532 may be constructed of a material, such as a thin sheet of polyester that does not readily absorb moisture. As shown in Figure 11, these preferably waterproof strips or gussets 532 will form edges of the absorbent pad 516, which will be adjacent to the sides of the pocket 512. Although fluid can flow from the central pad section 534 to the folded side sections 536, located directly beneath the central pad section 534, the waterproof gusset-strips

532 will prevent or retard lateral flow of fluids. The waterproof strips 532 will therefore obstruct the passage of fluids laterally over the side edges of the pocket 512, a very desirable result.

Figure 13 is an enlarged view of one of the fastening tabs 526 located at the rear corners of the protective undergarment 500. These tabs 526 include a fastener 540 that can grip the fastener strip 528 on the front of the protective undergarment 500 when worn. Preferably the fastener 540 and the fastener strip 528 are hook and loop fasteners. In the embodiment depicted herein, the fastener 540 has a rectangular shape with hook fasteners, and the fastener strip 528 includes co-operable loop fasteners. The loop fasteners employed on fastener strip 528 can be chosen from commercially available materials that are smoother to the touch than co-operable hook fasteners. The fastening tabs 526 also include a section of material 542, which the hook fasteners 540 will engage when not in use, so that damage to the protective undergarment 500 will not result during handling. The hook fasteners 540 can also engage this section of material 542 to prevent tangling during handling.

As previously discussed, the construction of this undergarment reduces the tendency of sharp edges of the fastener strip 528 to irritate the wearer's sensitive skin. The same problem must be addressed with the fastening tabs 526. To accomplish this result, the fastening tabs 526 are fabricated from three components shown in Figure 14. A rectangular hook fastener section 540 will be attached to two layers of fabric 544 and 546, which can be the same material employed to construct the waterproof exterior 504 of the protective undergarment. Both fabric sections 544 and 546 have one smooth curved end with rounded corners, which in the final construction will form the distal or leading ends of the fastening tabs 526. These rounded ends or corners will be soft to the touch and will not irritate the wearer's skin and to the caretaker's fingers when fastenin the garment shut or pulling it open.

Major steps in the fabrication of the fastening tabs 526 are shown in Figures 15A-15F. In the first step shown in Figure 15A, the rectangular hook fastener section 540 is placed on one of the fabric sections 544, and the curved or rounded section 548 is folded partially over the hook fastener 540. This will cover one edge of the hook fastener 540 and this covered end will eventually form the distal edge of the hook fastener 540. It is this distal edge that, if exposed, would tend to scrape the wearer causing the most irritation.

As shown in Figure 15B, a seam 550 is stitched adjacent the folded edge of the curved section 548 of the fabric layer 544. This seam 550 extends through two folded layers of fabric 544 and through the hook fastener 540 to enclose the front edge of the hook fastener 540 between two layers of fabric. After the hook fastener 540 is secured in this manner, the curved section 548 is then folded back toward its original flat configuration. This will leave a ridge 552 shown in Figure 15C. The stitched distal edge of hook fastener 540 will be trapped between two folds of fabric 544 to form this ridge 552, and this rectangular hook fastener edge will thus be surrounded by softer fabric and can cause no irritation to the wearer. The other fabric section 546 can now be joined to the subassembly shown in Figure 15B by stitching around the curved sections of the two layers and along adjacent edges to form a interim sandwich configuration 545. The rectangular edge of this sandwich 545 is not stitched and the two fabric layers 544 and 546 are not attached along this edge during the step illustrated in Figure 15C. The sandwich assembly 545 shown in Figure 15C includes the primary materials for forming a fastening tab 526, but since this subassembly in not in its final shape it can be referred to as an interim tab assembly 526A,

The next step in fabricating a final fastener tab assembly 526 is to reverse the two partially stitched fabric layers 544 and 546 to expose the working portions of hook fastener 540. This step is shown in Figure 15D. The sandwich 545 is reversed by pulling the free edge of the two fabric layers 544 and 546 backward so that hook fastener 540 is exposed.. Figure 15D represents partial completion of this reversing step. Figure 15E shows the completion of this reversing step with the hook fastener 540 exposed, except for the front edge which is secured by seam 550 and is covered by fabric layer 544 along the ridge 552, which is now located between the two fabric layers 544 and 546 in the configuration shown in Figure 15E. Notice that in this interim configuration the hook fastener 540 is still not secured along three edges because it must still be pulled outward from its point of end attachment. The next step in the fabrication of this fastening tab is shown in Figure 15F, which shows stitch 560, which now secures the remaining edges of the hook fastener 540. Stitch 560 extends though both layers of fabric 544 and 546 forming a final tab subassembly 526B, which can subsequently be stitched to the protective undergarment to form the final fastening tab 526 as shown in Figure 13. In this fastening tab 526, the edges of the hook fastener 540 are now surrounded by regular stitching 550 and cross stitching 560, but more importantly these hook fastener edges are no longer in a position to

irritate or scrape the wearer's skin or fingers. The distal or front edge of the hook fastener 540, which will cause the most irritation is now completely covered with a curved or rounded end of the tab extending beyond this front edge of the hook fastener. Borders also extend beyond the three remaining edges so that the hook fastener and its substrate cannot cause irritation to a wearer. These manufacturing steps are not limited to curved ends. Square and rectangular or other shaped tabs can be fabricated in this manner.

Another embodiment of this invention is shown in Figure 18. This protective undergarment 600 includes a detachable pocket sling 606 that has pockets 612 for retaining an absorbent pad. The edges 622 and 624 are arcuate to provide maximum exposure of the absorbent pad, and these arcuate edges 622 and 624 are formed in the same manner as earlier embodiments. The pockets receiving the ends of the absorbent pads are still S-shaped. The sling 606 can be detached from the outer shell of this garment. In Figure 18, one side of the sling 606 remains attached to the outer shell, while on the other side edge, complementary fasteners are show in a disengaged position. At the front of the protective garment, complementary hook and loop fasteners 605 and 607 can be used to attach the sling 606 to the outer shell. Of course these fasteners can be disconnected. Therefore when slings are referred to as being attached to the outer shell, it should be understood that attached can be interpreted as permanently attached, as by stitching, or releasably attached as with this embodiment or by using snaps instead of hook and loop fasteners. Complementary hook and loop fasteners 611 and 613 are also located at the rear of the protective undergarment 600. Fastener 611 on the sling faces inwardly, away from the outer shell. Fastener 613 is located on a hidden surface of a cuff or fabric strip so that fastener would face away from the wearer, and the cuff or fabric strip would remain between the wearer and the fastener protecting the wearer from abrasive fasteners.

Numerous variations of this protective undergarment and its associated components are of course possible. One of ordinary skill in the art could make such modifications, and this invention is therefore defined by the following claims and is not limited to the details of the representative embodiments depicted herein.

I CLAIM:

1. A protective undergarment for use with an absorbent pad, the protective undergarment comprising:

an outer fabric shell; and

an inner sling attached at opposite ends thereof to the outer shell, the inner sling including a pocket in which the absorbent pad can be positioned, the pocket extending inwardly from a pocket opening on an inner face of the sling so that an absorbent pad positioned in the pocket will be exposed to a wearer's pubic area, the pocket having S-shaped ends formed by overlapping layers of fabric, each S-shaped end being formed by two pieces of fabric stitched together along an arcuate seam through arcuate edges of the two pieces of fabric;

wherein opposite end edges of the pocket opening each have an arcuate contour with the greatest separation between opposite end edges being adjacent a longitudinal centerline of the pocket opening to form corner S-shaped pocket sections on opposite sides of the centerline to project over corners of an absorbent pad when positioned in the pocket, so that the primary retention of the absorbent pad is in the corner pocket sections and so that the arcuate contour increases the exposure to an absorbent pad in the pocket in both fore and aft regions of the wearer's pubic area.

2. The protective undergarment of claim 1 wherein the arcuate contour at each end of the pocket opening has a constant radius of curvature.

3. The protective undergarment of claim 1 wherein the sling is only attached to the outer shell at opposite ends of the sling.

4. The protective undergarment of claim 1 wherein the sling is formed of a waterproof material.

5. The protective undergarment of claim 1 wherein the sling includes, on one end thereof, an intermediate piece having greater elasticity than a remaining portion of the sling in which the pocket is formed, the intermediate piece extending between the one end of the sling to the outer shell.

6. The protective undergarment of claim 1 wherein overlapping fabric sections forming at least one of the S-shaped pocket ends are joined by side edge seams stitched along each side edge of sling adjacent the arcuate contour.

7. The protective undergarment of claim 6 wherein the elastic trim extends continuously around the pocket opening with opposite ends of the elastic terminating at one of the side seams on one of the two pockets.

8. The protective undergarment of claim 1 wherein the sling is stitched to the outer shell only along opposite ends of the outer shell.

9. The protective undergarment of claim 1 wherein the S-shaped end on one end of the pocket includes first layer formed by a first piece of fabric extending to the sides of the outer shell and stitched to the outer shell, the first piece of fabric having an arcuate edge stitched to another arcuate edge of a second piece of fabric forming second and third layers of the S-shaped pocket end, and extending toward the opposite end of the protective undergarment to form the sling.

10. The protective undergarment of claim 9 including a fastener strip on an exterior surface of the outer shell, the fastener strip being opposite the first piece of fabric, the first piece of fabric being stitched to the fastener strip through the outer shell to stabilize the fastener strip, and prevent an edge of the fastener strip from rolling inward during use to otherwise irritate the wearer of the protective undergarment.

11. The protective undergarment of claim 1 wherein seams extending through the two pieces of fabric but not through the outer shell or opposite sides of the arcuate seam, form moisture dams to prevent lateral migration of moisture out of the pockets.

12. A protective undergarment for use with a fluid absorbent pad and comprising:

an outer shell; and

a sling attached to the outer shell and including a pocket in which the fluid absorbent pad is positionable so that the fluid absorbent pad can be disposed adjacent to a wearer's pubic area to limit soiling of the protective sling and the outer shell, the sling being formed by;

a central fabric piece having concave acruate edges on opposite ends thereof;

fore and aft fabric sections, each having a concave arcuate edge, opposite concave arcuate edges of the central fabric piece being attached to adjacent concave arcuate edges of the fore and aft fabric sections:

the central fabric piece being folded about transverse fold lines in partially overlapping relationship at opposite ends thereof with the fore and aft fabric sections overlying overlapping portions of the central fabric piece so that the attached arcuate edges form opposite S-shaped ends of the pocket, the overlying fore and aft fabric

sections being attached along side edges to the overlapping portions of the central fabric piece to form corner pocket sections into which corners of the absorbent pad can be positioned for retention of the absorbent pad in the pocket.

13. The protective undergarment of claim 12 wherein the sling is stitched to the outer shell only along opposite ends thereof.

14. A protective undergarment for use with an absorbent pad comprising:

an outer shell;

an absorbent pad, absorbent pads being replacable when soiled; and

a fabric sling attached to the outer shell only along opposite ends thereof, the sling including a pocket in which the absorbent pad is positioned during use, the pocket having arcuate edges, formed by stitching layers of fabric having alignable arcuate sections, at opposite ends thereof to form corner pockets for retaining the absorbent pad in the pocket, the arcuate edges at both ends of the pocket exposing portions of the absorbent pad to a wearer's pubic area to limit exposure of the end portions of the fabric sling to regions of the wearer's pubis in which the fabric sling can be soiled during use so that only the absorbent pad is exposed to regions of the wearer's pubis where soiling could occur.

15. A protective undergarment for use with an absorbent pad and comprising:

an outer fabric shell;

an S-shaped inner sling with front and rear sections of the inner sling being folded over and joined to an overlapping fabric layer along arcuate edges of the inner sling and the overlapping fabric layer, the overlapping fabric layer being joined to the outer fabric shell along an opposite edge, so that the S-shaped inner sling is not stitched directly to the overlapping layer leaving no leakage paths along seams between the S-shaped inner sling and the overlapping layer.

16. The protective undergarment of claim 15 wherein a front overlapping fabric layer at the front of the inner sling extends between opposite side edges of the outer fabric shell.

17. The protective undergarment of claim 16 wherein a fastener strip is located on the exterior of the outer fabric shell opposite from the front fabric layer, the fastener strip being stitched to the front fabric layer to reduce any tendency of the fastener strip to roll under into contact with the wearer's skin.

18. The protective undergarment of claim 16 wherein a rear S-shaped sling pocket is formed by stitching the sling material to a strip of fabric also attachable only to a rear edge of the outer shell.

19. A protective undergarment including first and second co-operable fasteners for securing the protective undergarment around the wearer's pubic area:

the first fastener being located along one end of the protective undergarment;

the second fastener being located along an opposite end of the protective undergarment, the second fastener comprising at least one fastener tab, the fastener tab including a partially exposed fastener member and two tab layers of fabric, one edge of the fastener member being stitched between portions of one tab layer of fabric along a ridge so that the one edge is not exposed, the two tab fabric layers being initially, partially stitched together to form an interim sandwich, with one unattached edge and with the fastener member initially between the two tab fabric layers, the sandwich being reversible to place the fastener member on the exterior of the second fastener, so that the one edge of the fastener member is covered.

20. The protective undergarment of claim 19 wherein the fastener member comprises a hook fastener.

21. The protective undergarment of claim 20 wherein the second fastener has rounded corners on a front end, and the covered edge of the fastener member is adjacent to the front end.

22. The protective undergarment of claim 20 wherein a first tab fabric layer is more subject to shrinkage than a second tab fabric layer, to cause the tab to bow, bowing of the tab causing the tap to close up when not in use to limit damage from sharp edges of the hook fastener.

23. An absorbent pad for use in a protective undergarment comprising an absorbent section with waterproof strips extending along opposite edges of the absorbent section to limit lateral penetration of moisture absorbed in the absorbent section.

24. The absorbent pad of claim 23 wherein the absorbent section comprise a central section, with the waterproof strips extending between opposite edges of the central sections and flank absorbent section, the flank absorbent sections being foldable beneath the central sections so that moisture can travel through the folded absorbent sections, but lateral transport of moisture is retarded by the waterproof strips along which the absorbent pad can be folded.

25. A protective undergarment comprising

an outer shell;

a sling joined to the outer shell the sling including a pocket open to the pubic area of a wearer;

a removable absorbent pad received in the pocket, the absorbent pad having a first absorbent section with water resistant strips extending along lateral edges of the first absorbent section, second and third absorbent sections being joined to the water resistant strips located between absorbent sections, the absorbent pad being foldable along the water resistant strips to form a multi-layer configuration in which moisture can migrate through the absorbent sections away from the wearer, but lateral migration of moisture is restricted by the water resistant strips to resist lateral leakage out of the pocket.

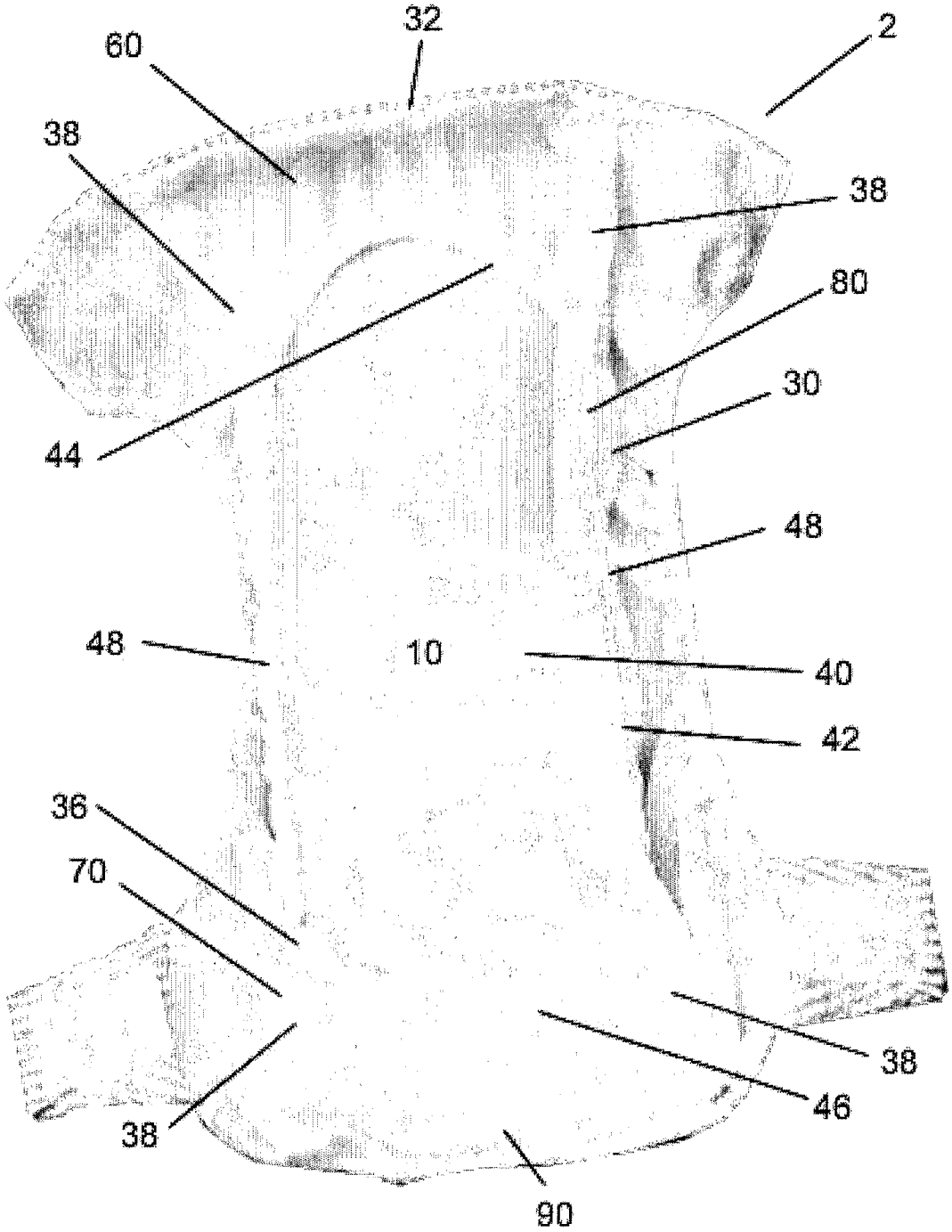


FIG 1

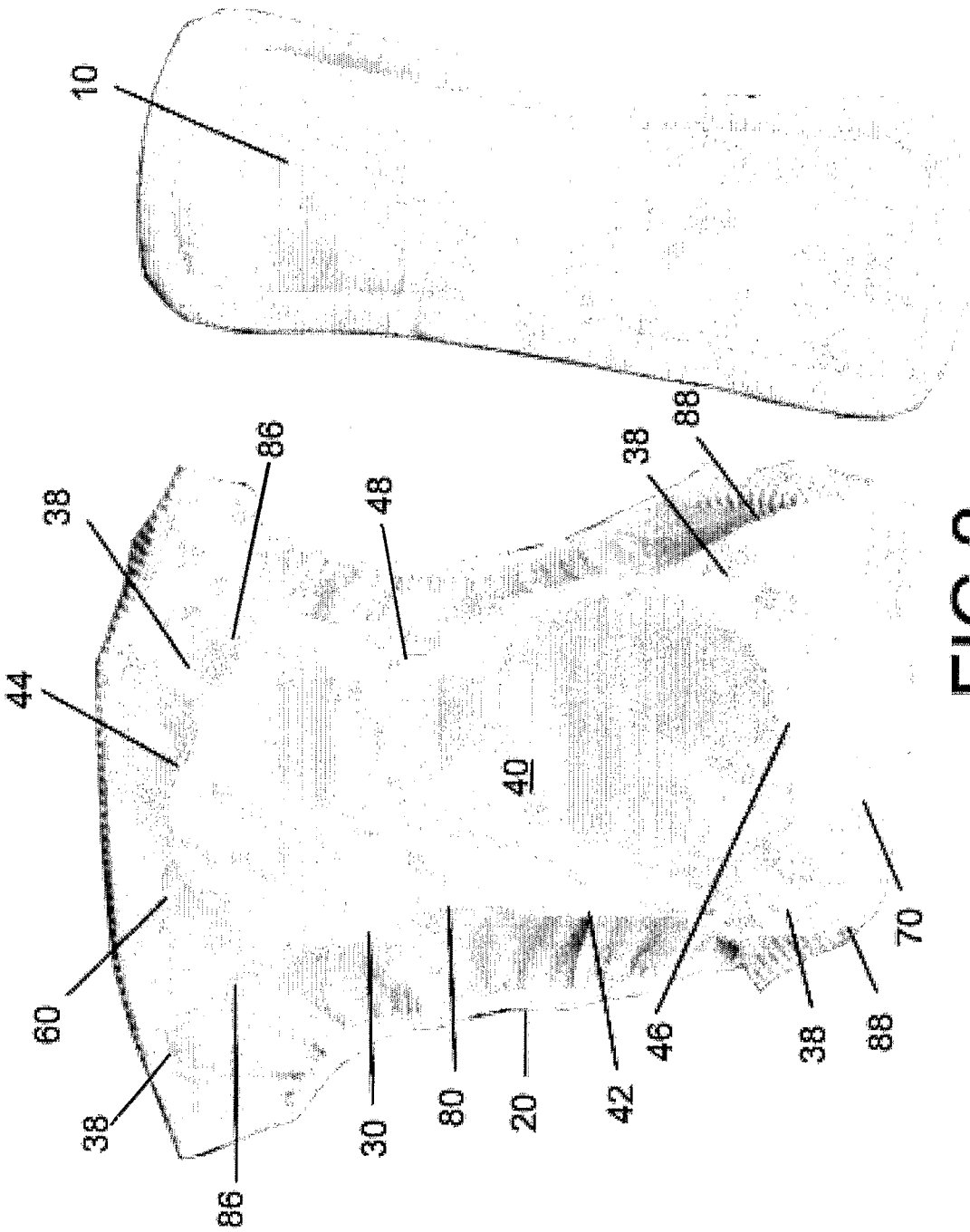
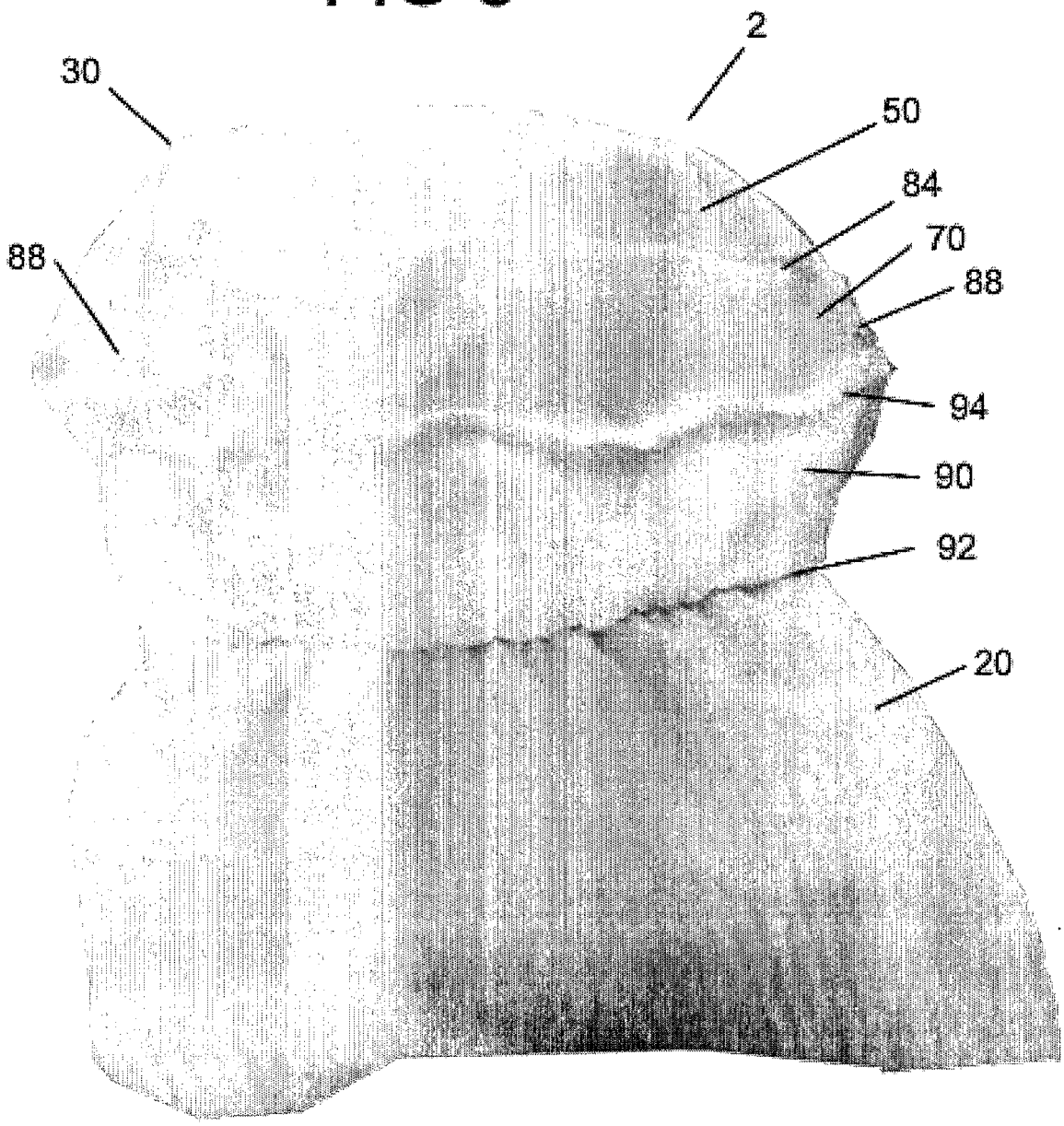


FIG 2

FIG 3



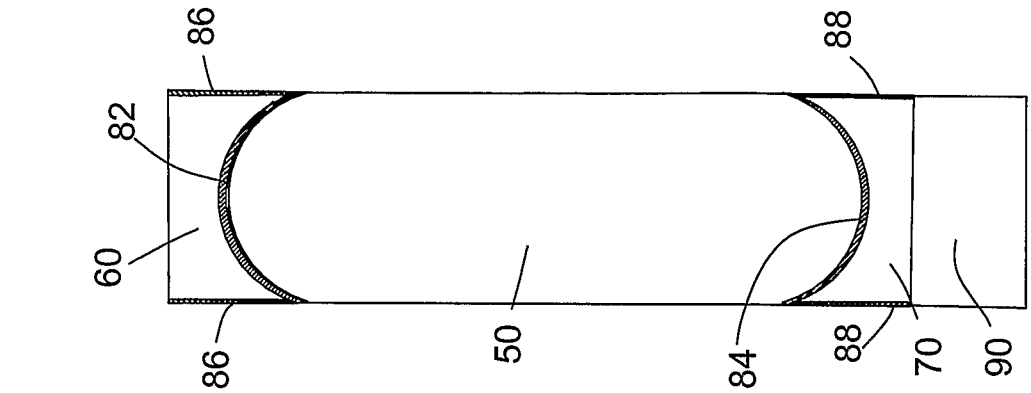


FIG 4B

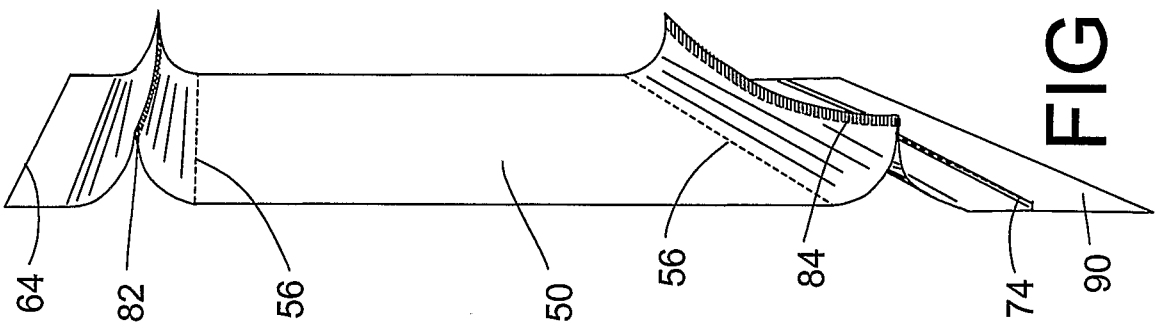


FIG 4C

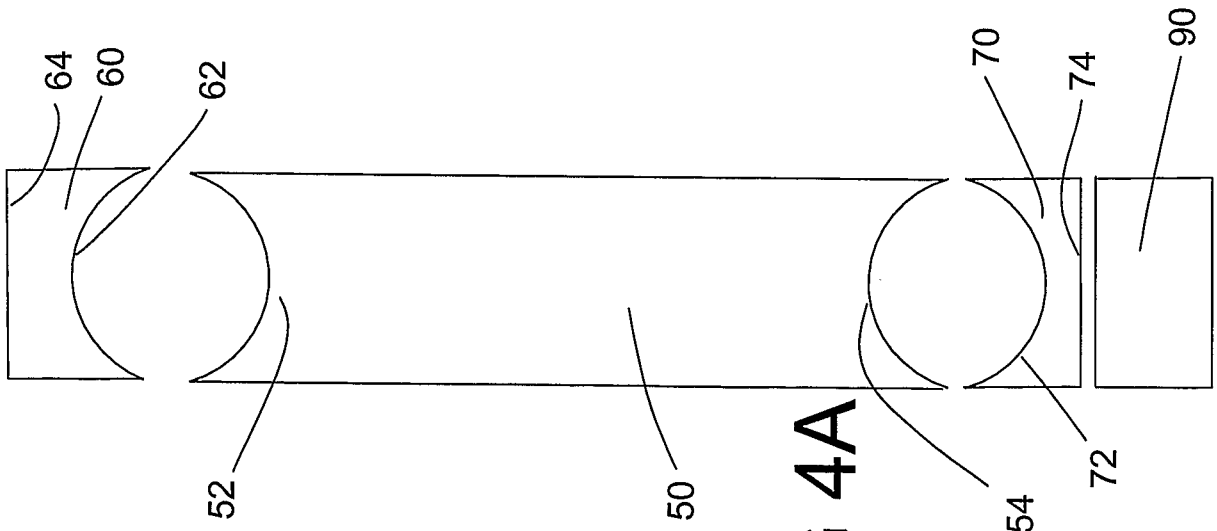


FIG 4A

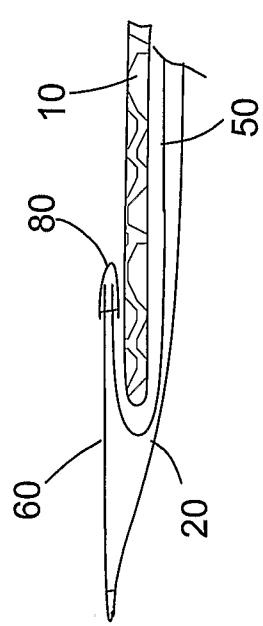


FIG 5C

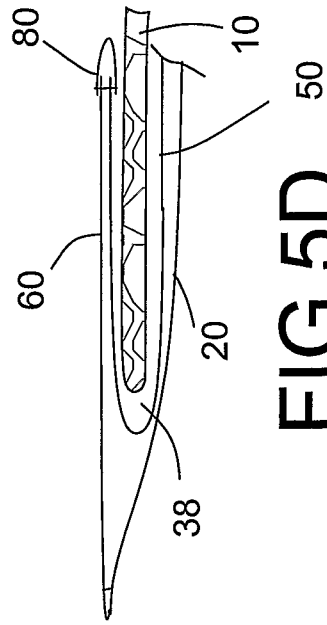


FIG 5D

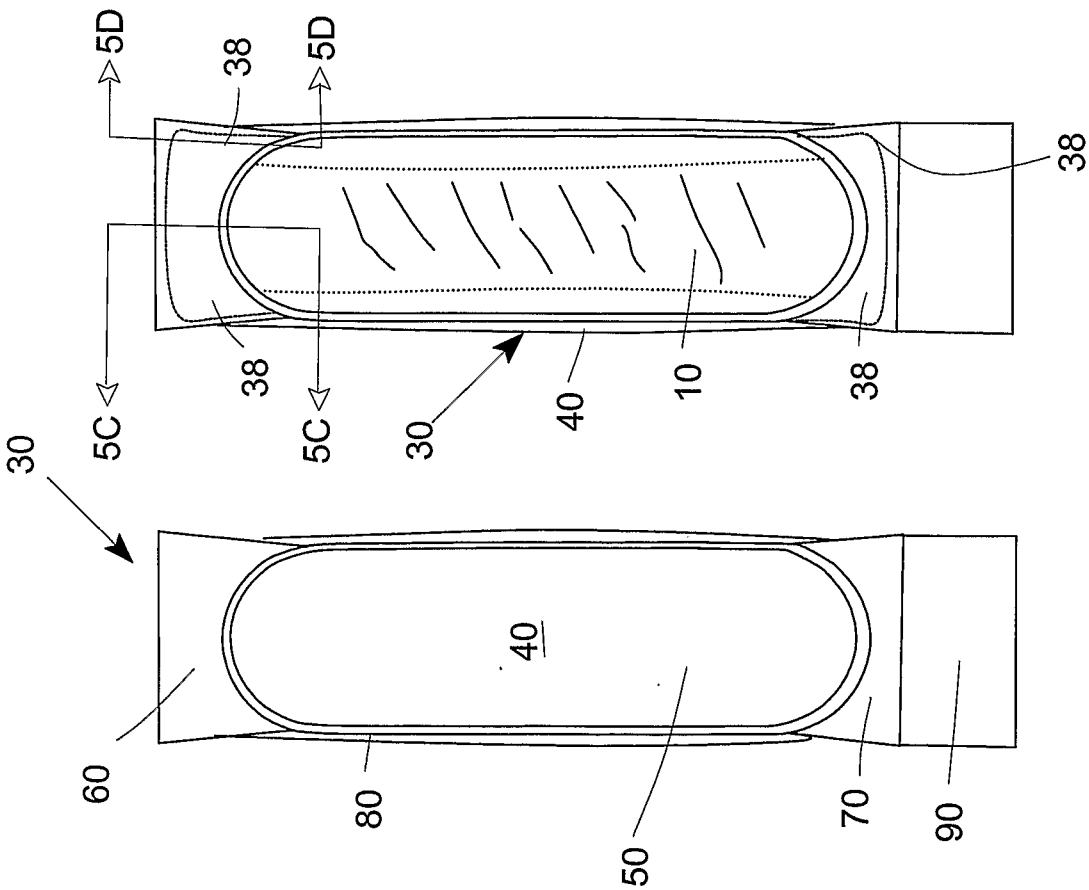


FIG 5A FIG 5B

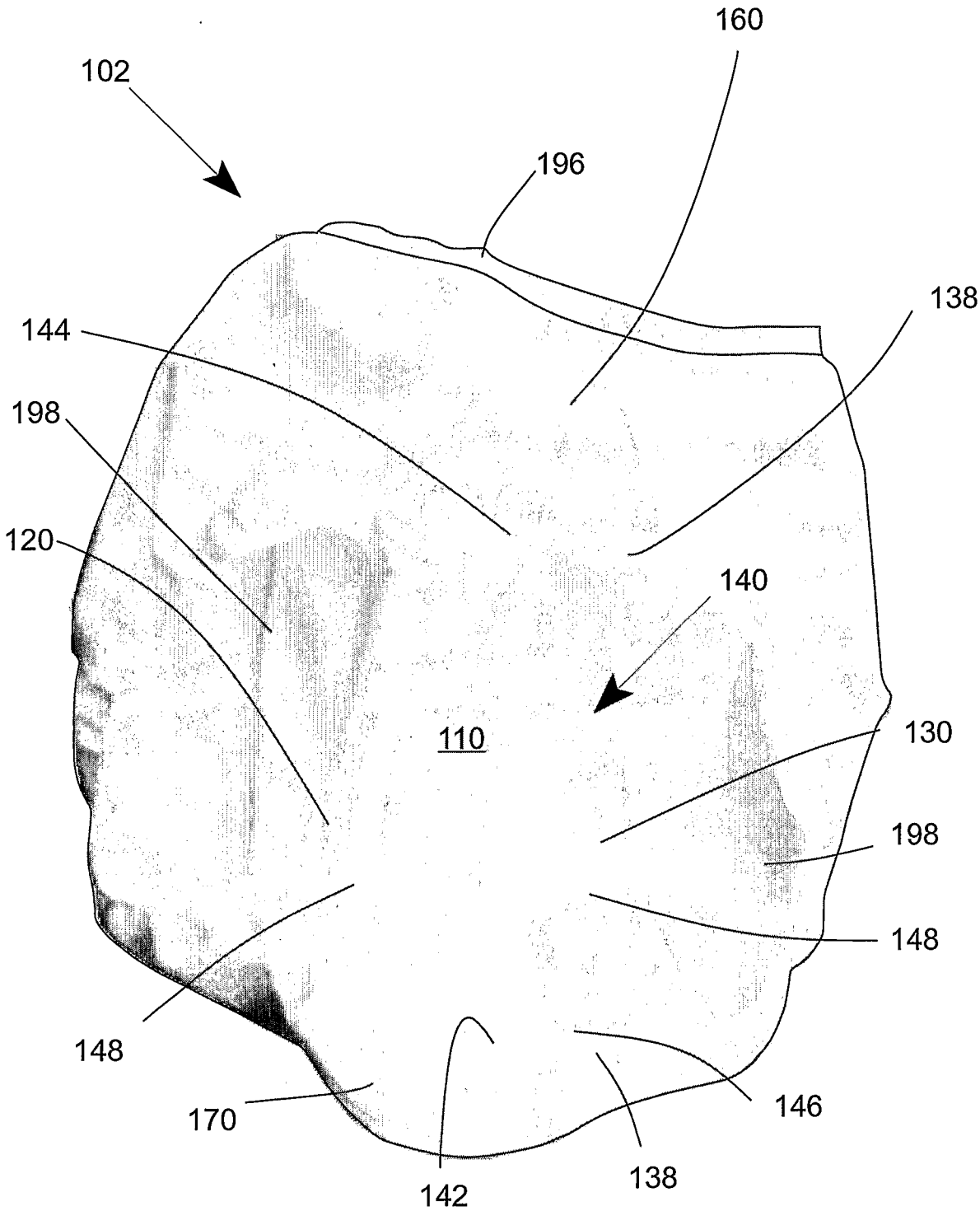

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FIG 6

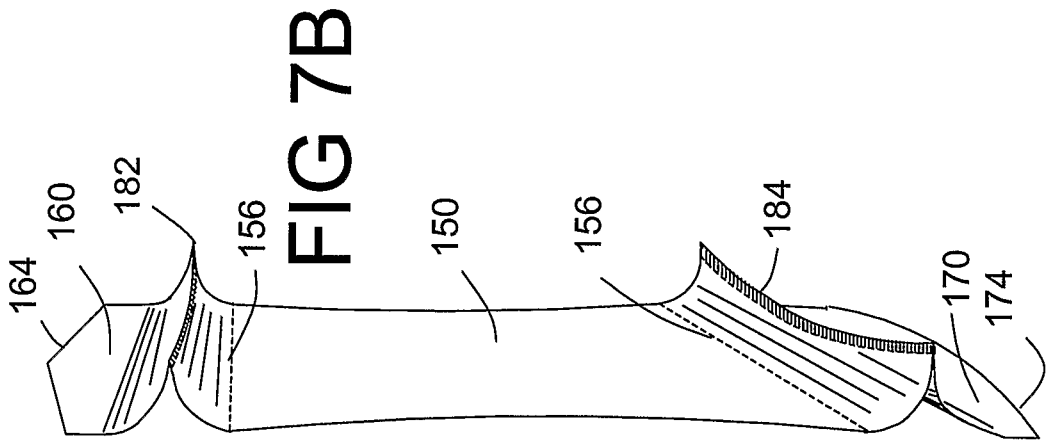
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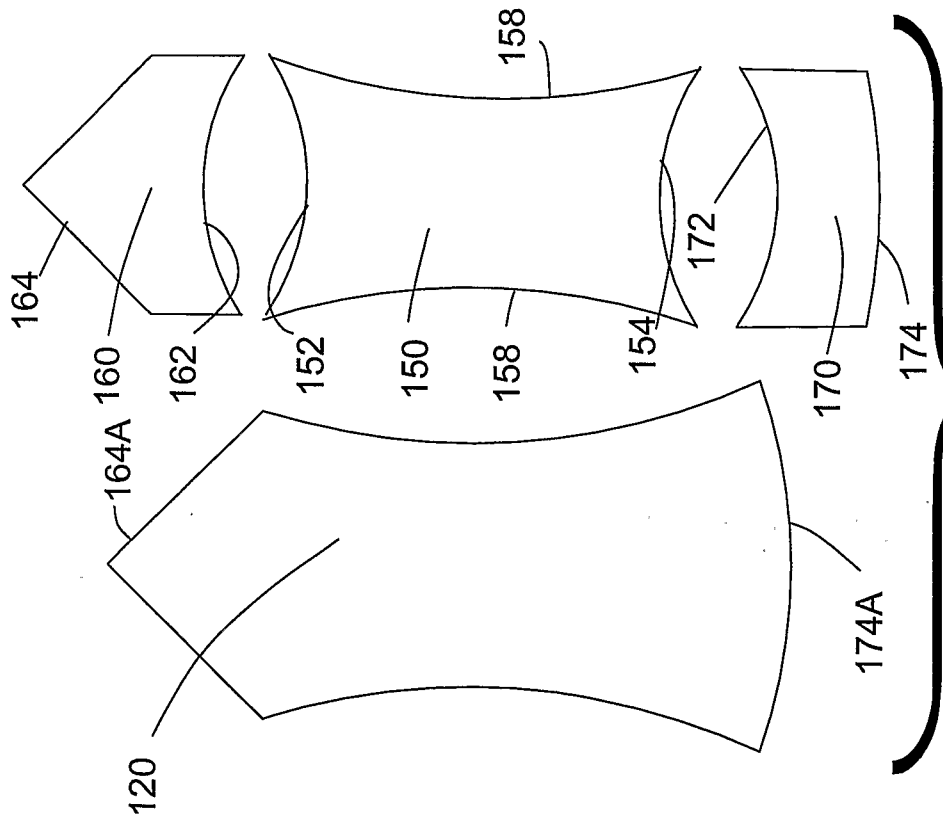
FIG 7B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174A

FIG 7A

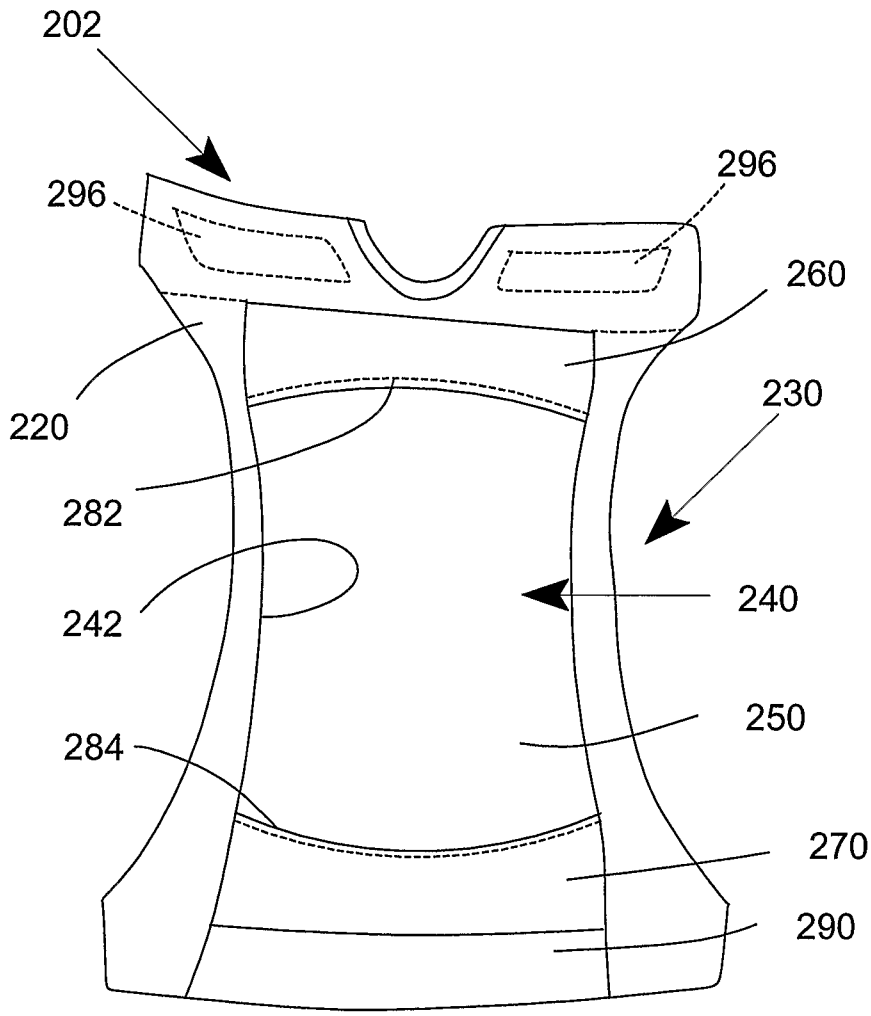
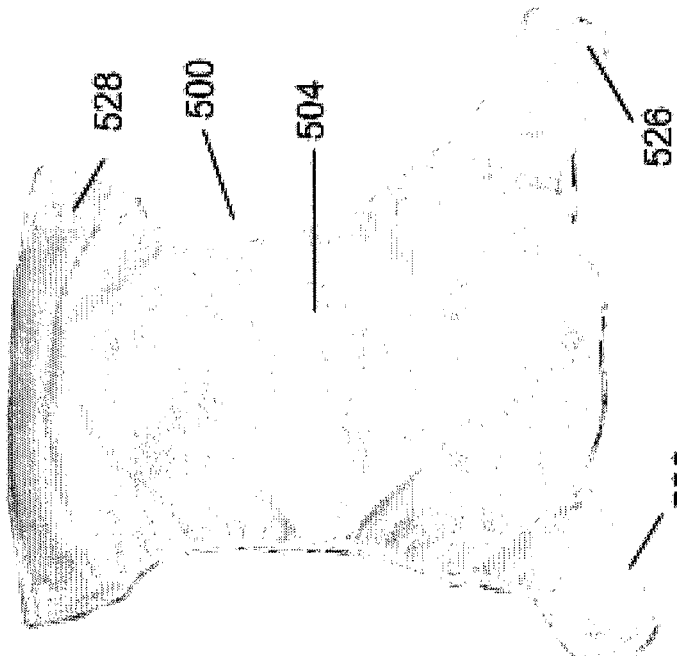


FIG 8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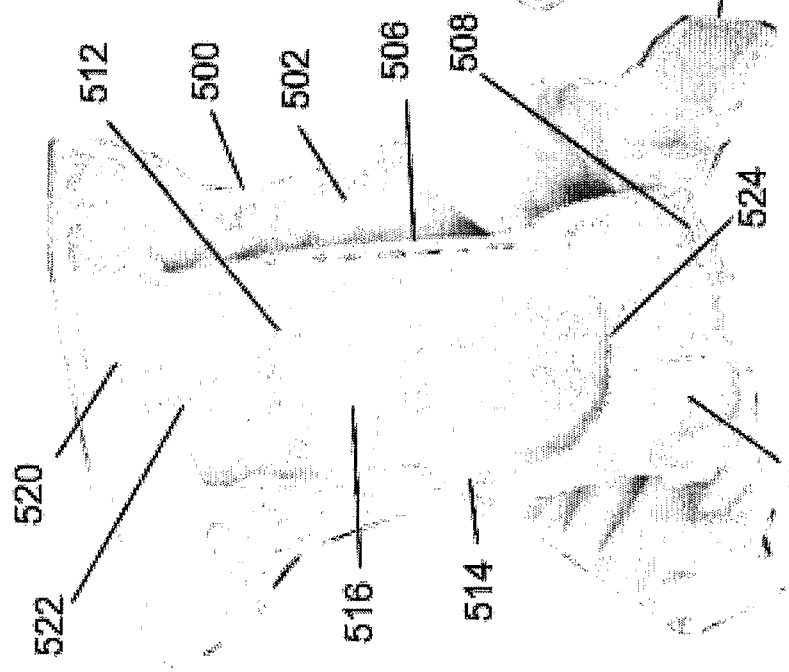
500
504
526
526
526

FIG 10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510

FIG 9

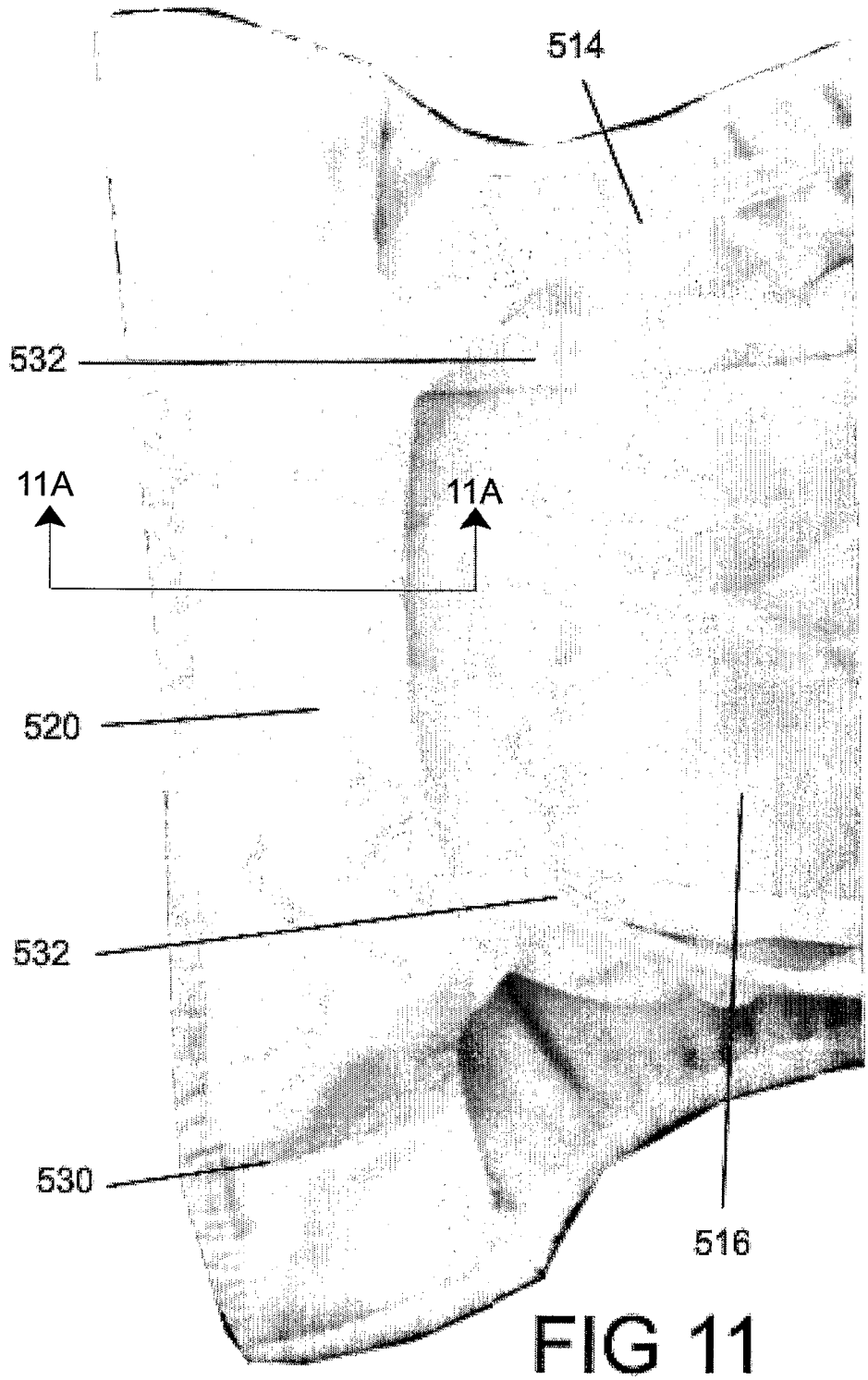


FIG 11

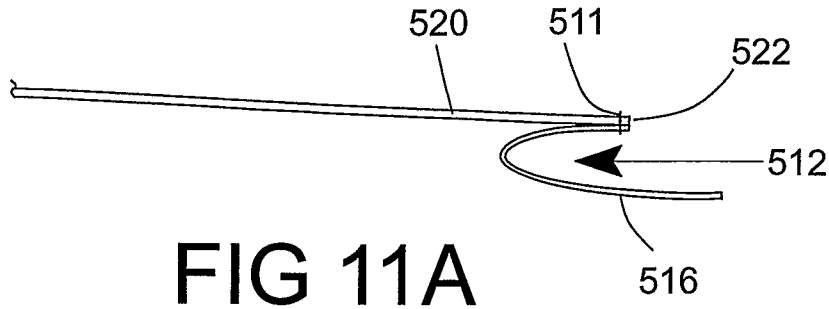
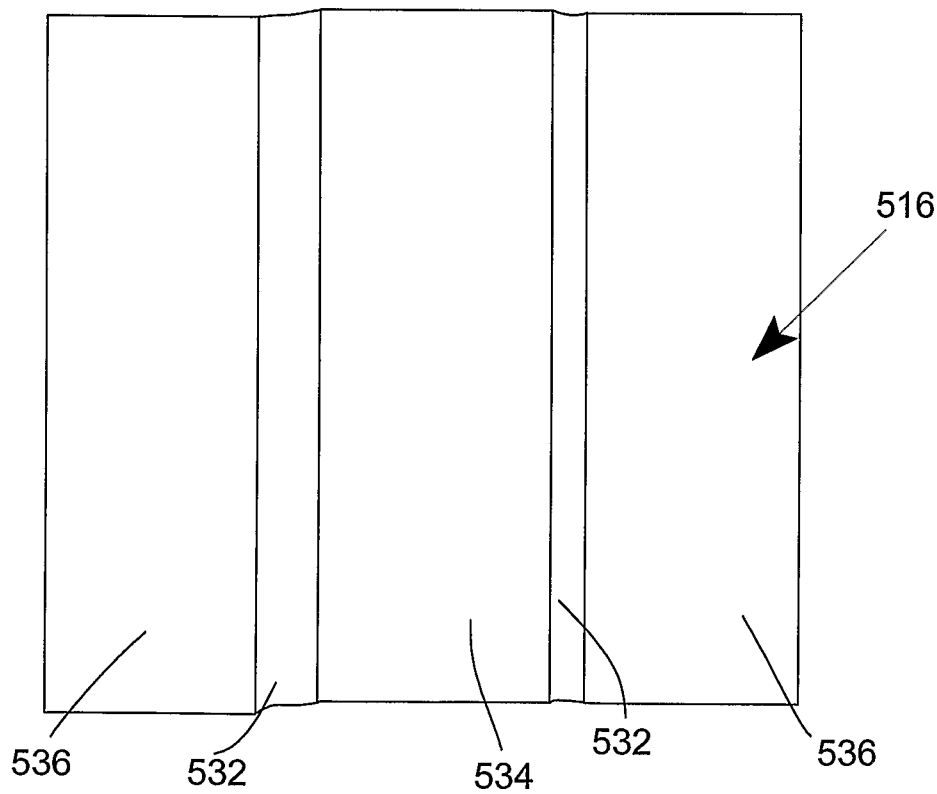


FIG 11A

FIG 12



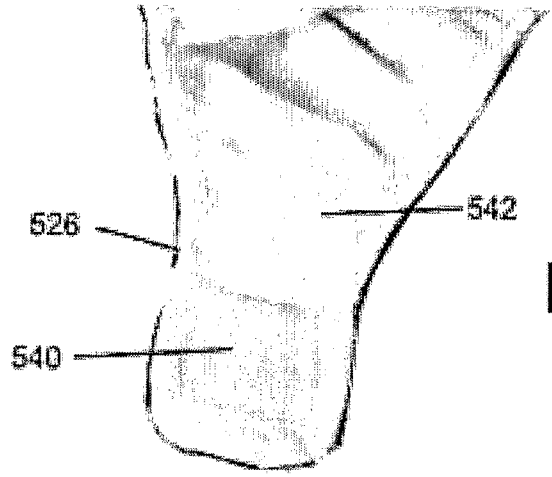


FIG 13

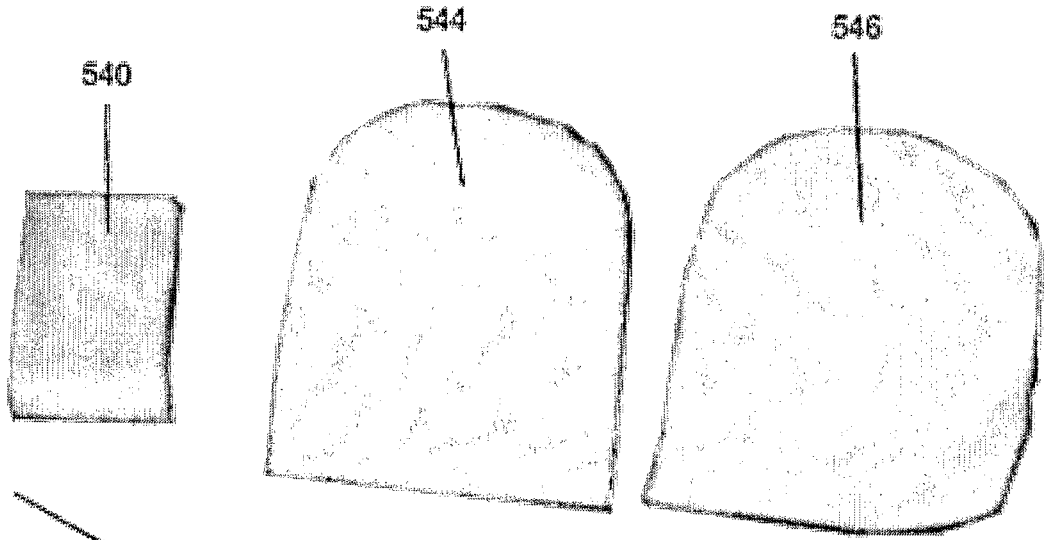


FIG 14

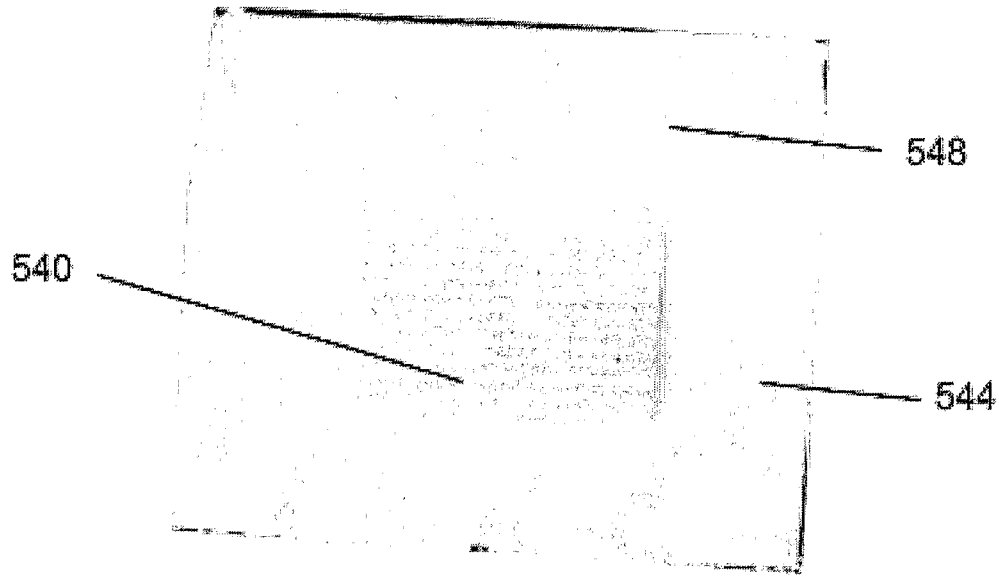


FIG 15A

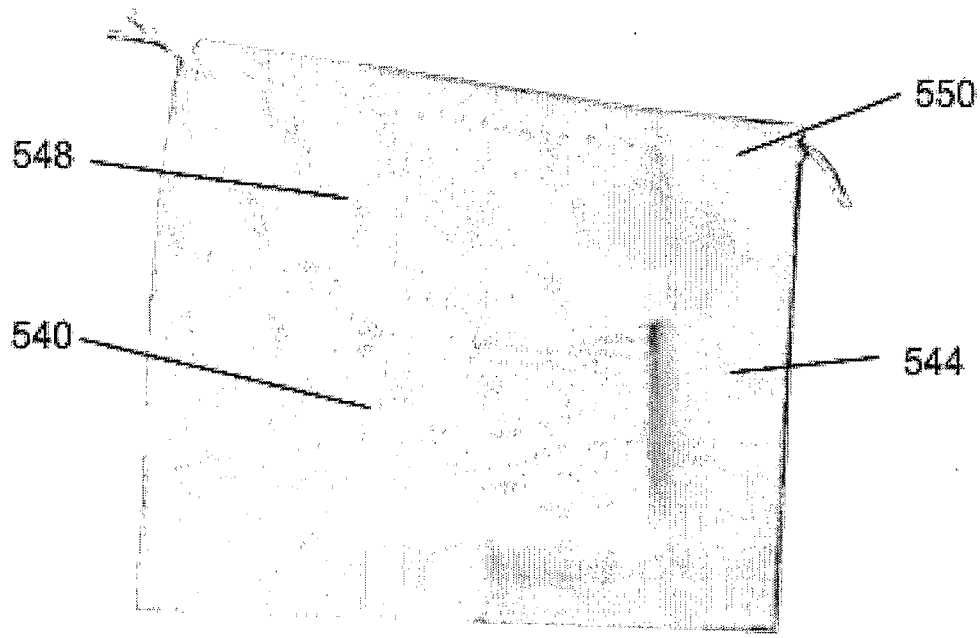


FIG 15B

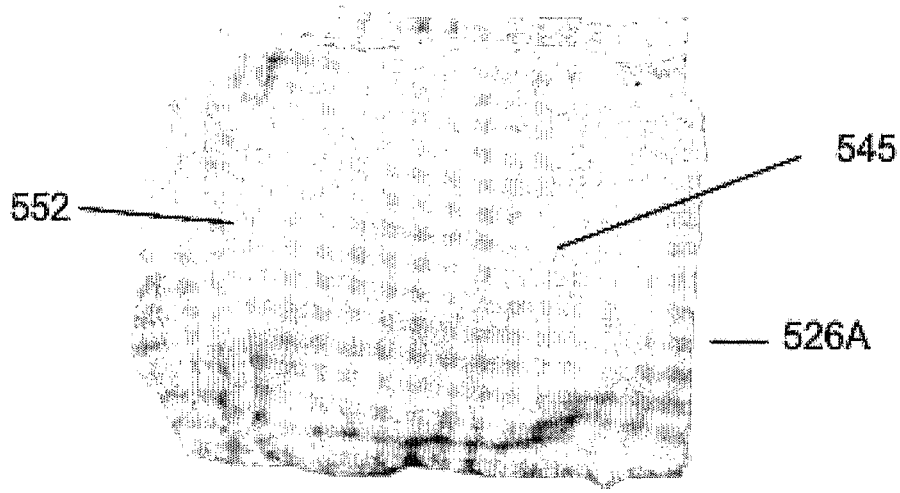


FIG 15C

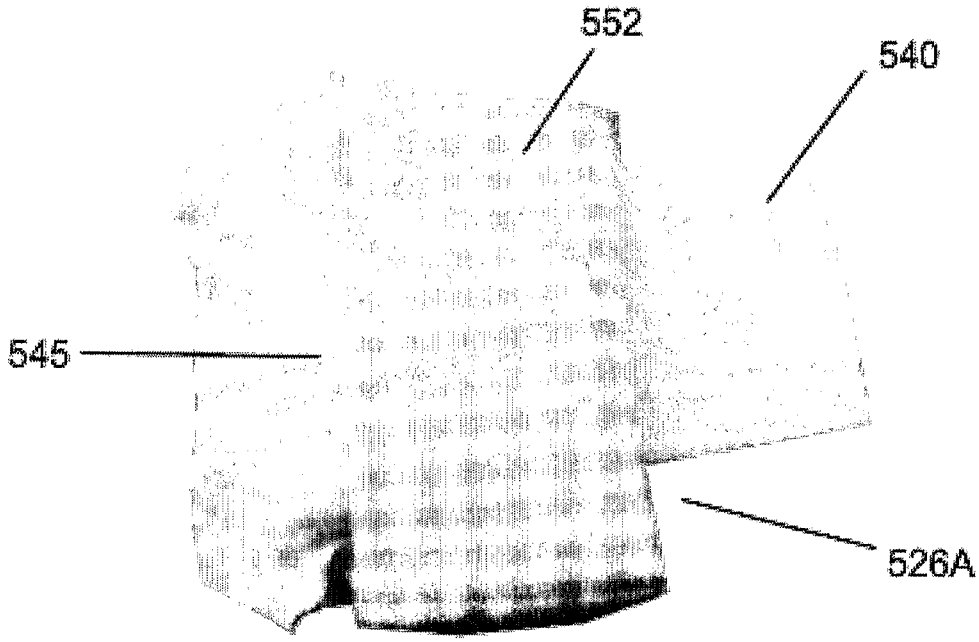


FIG 15D

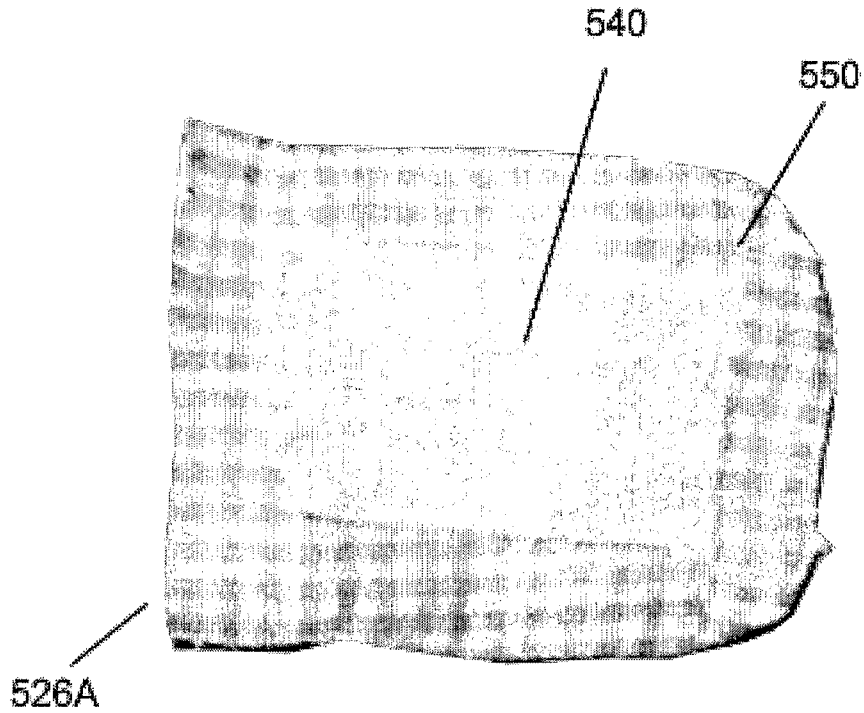


FIG 15E

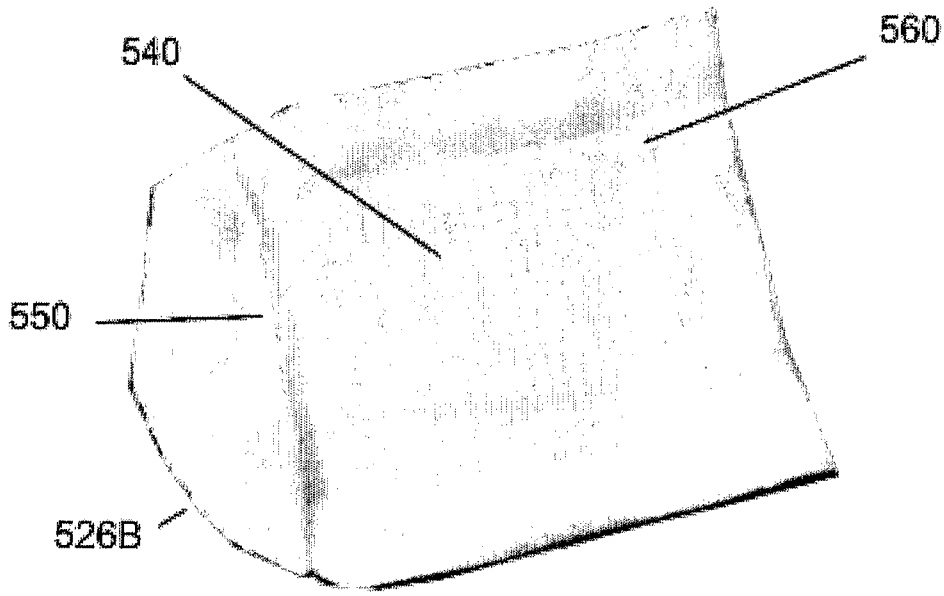


FIG 15F

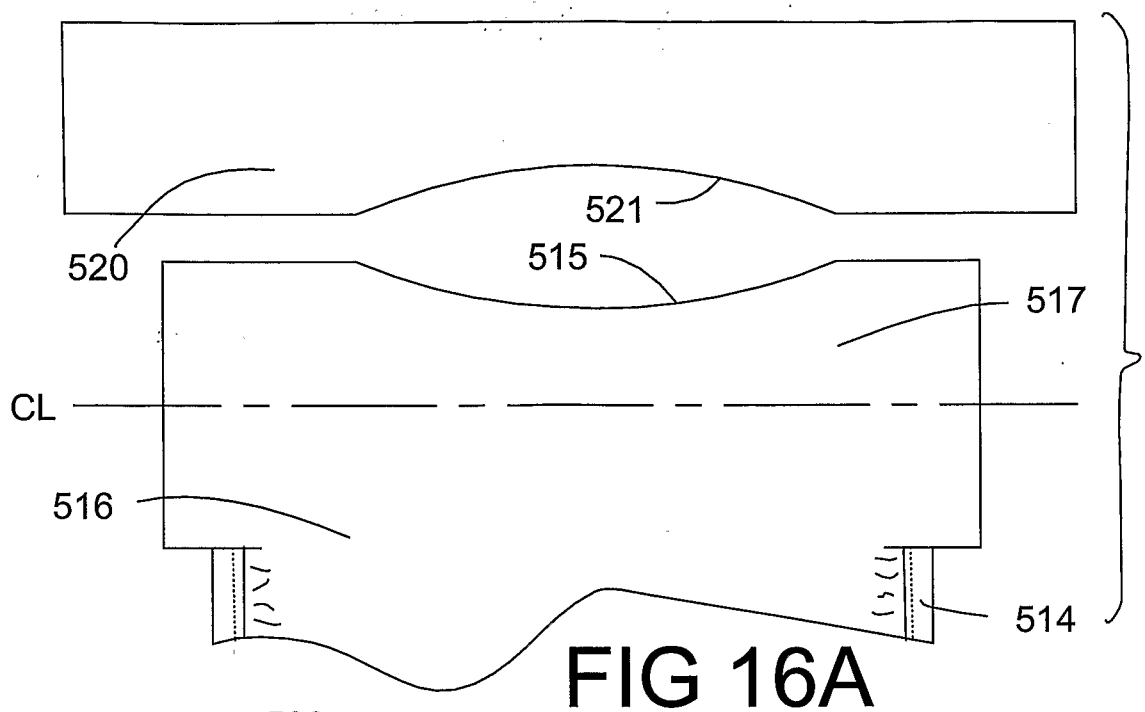


FIG 16A

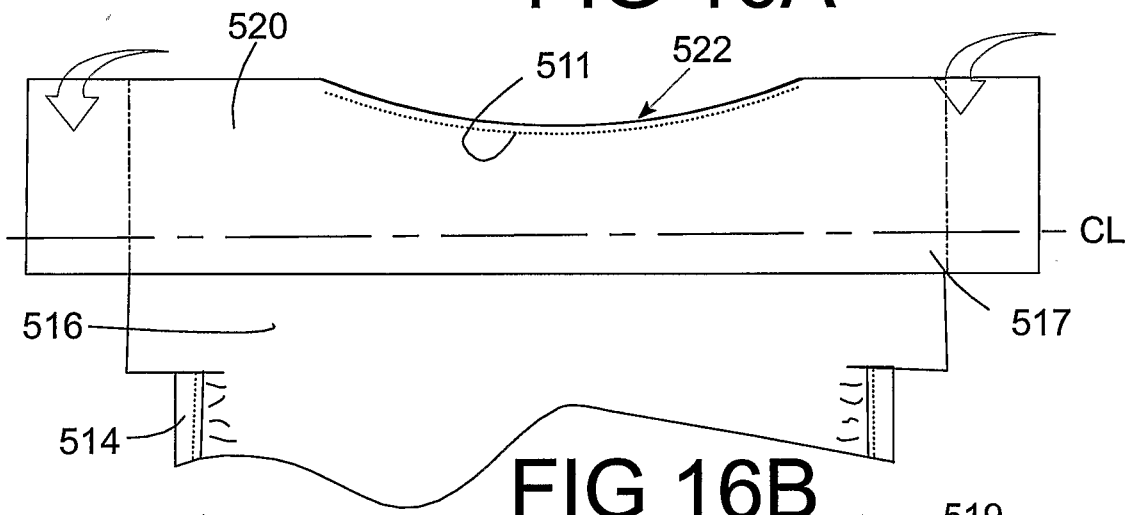


FIG 16B

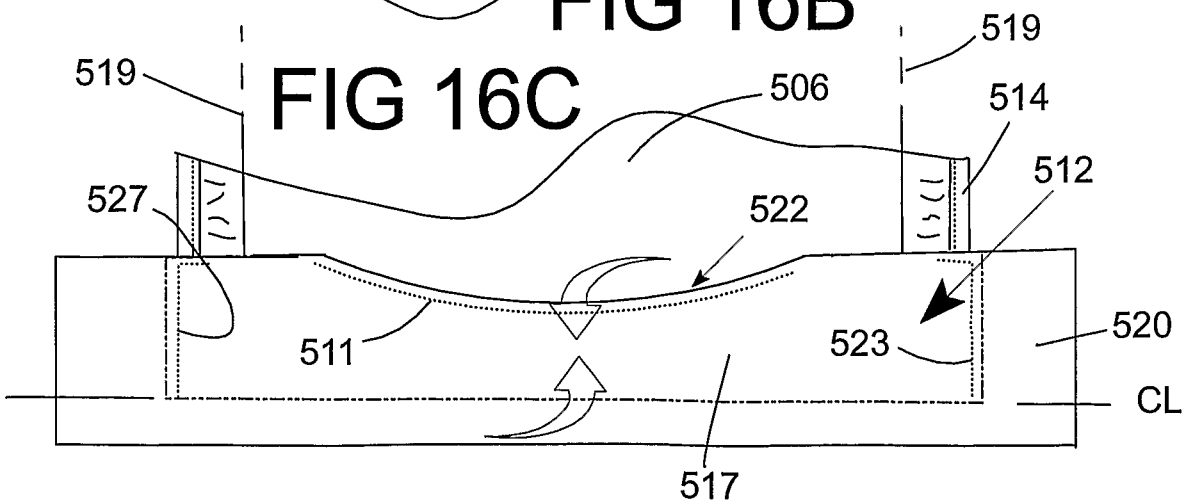


FIG 16C

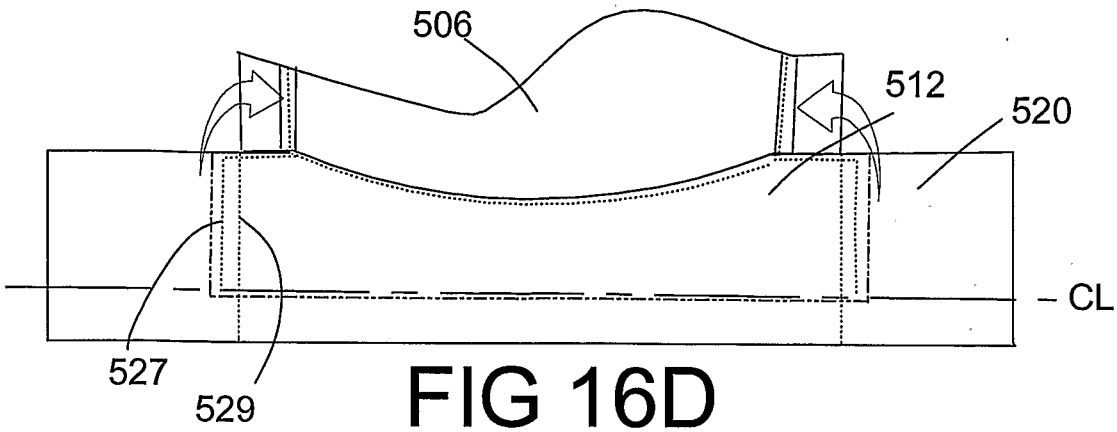


FIG 16D

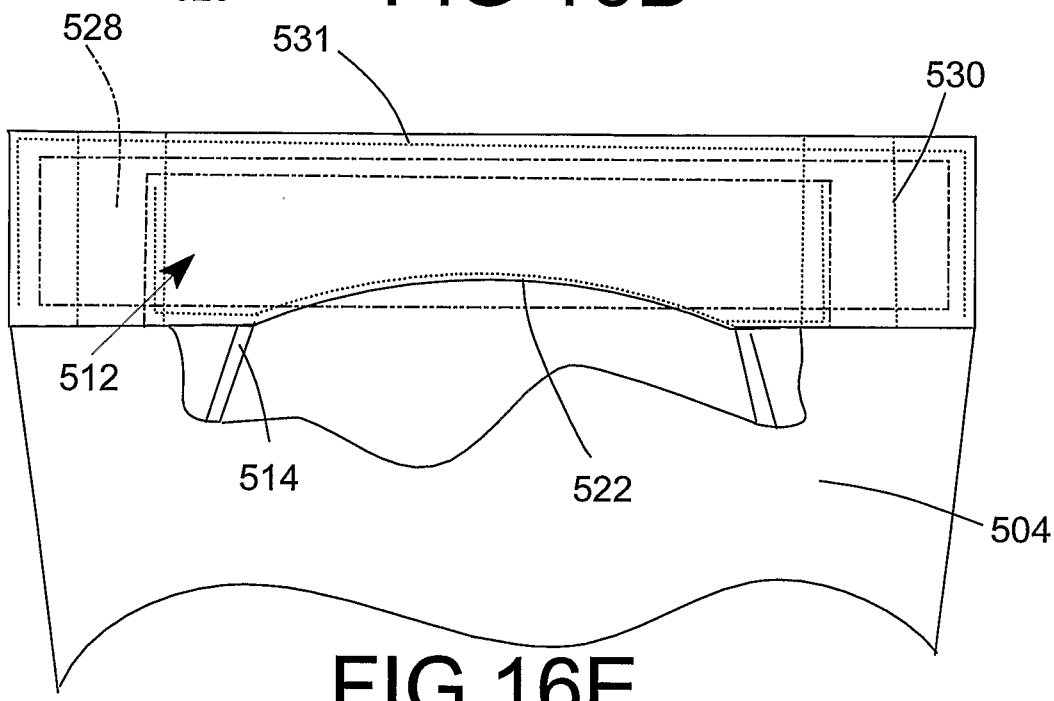


FIG 16E

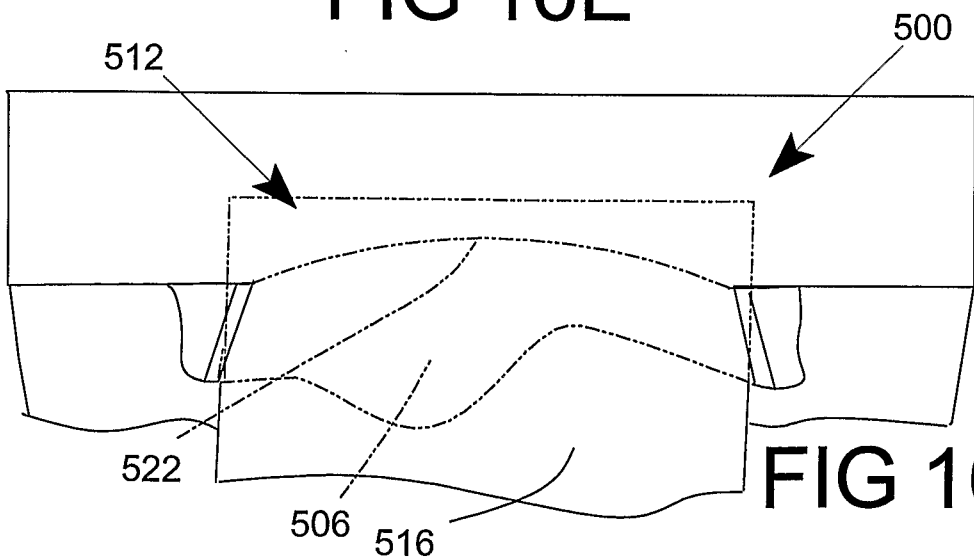
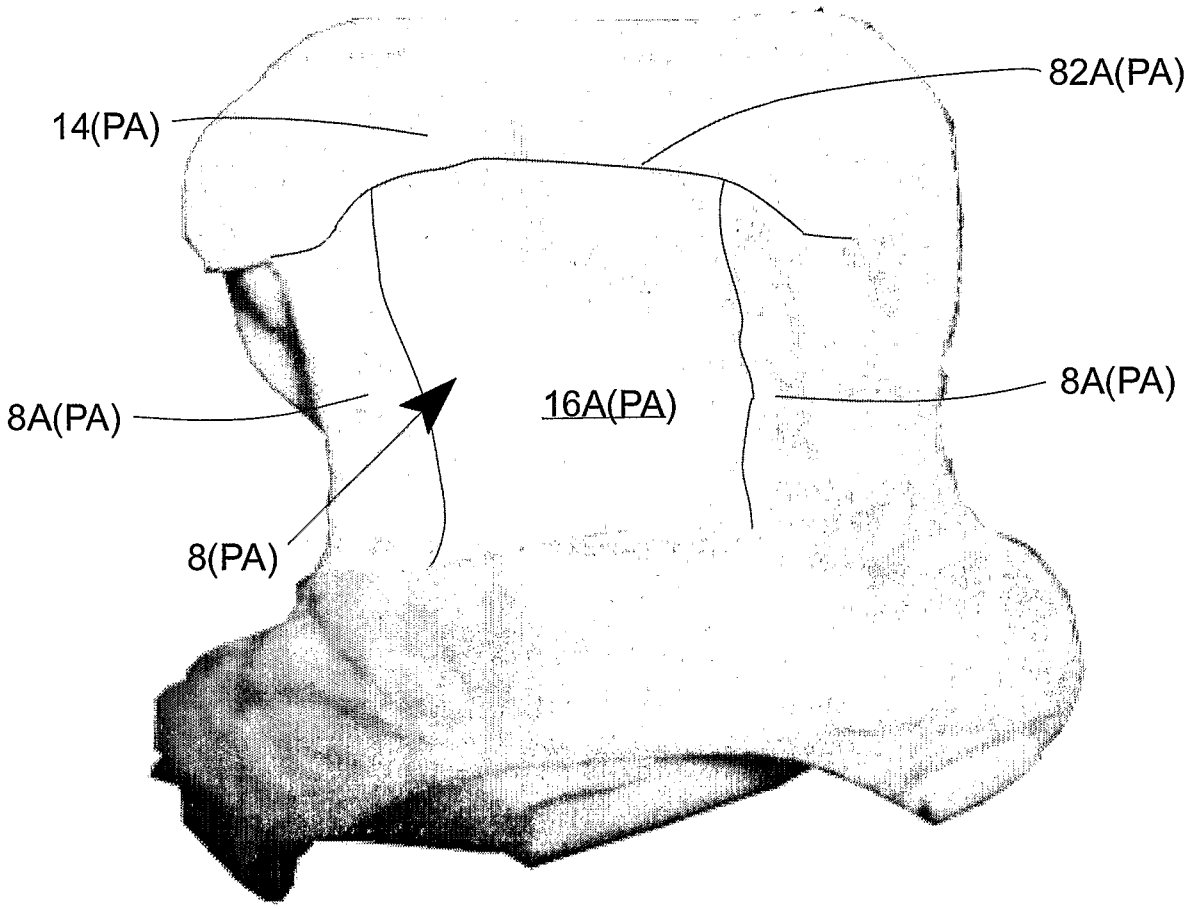


FIG 16F



PRIOR ART
FIG 17

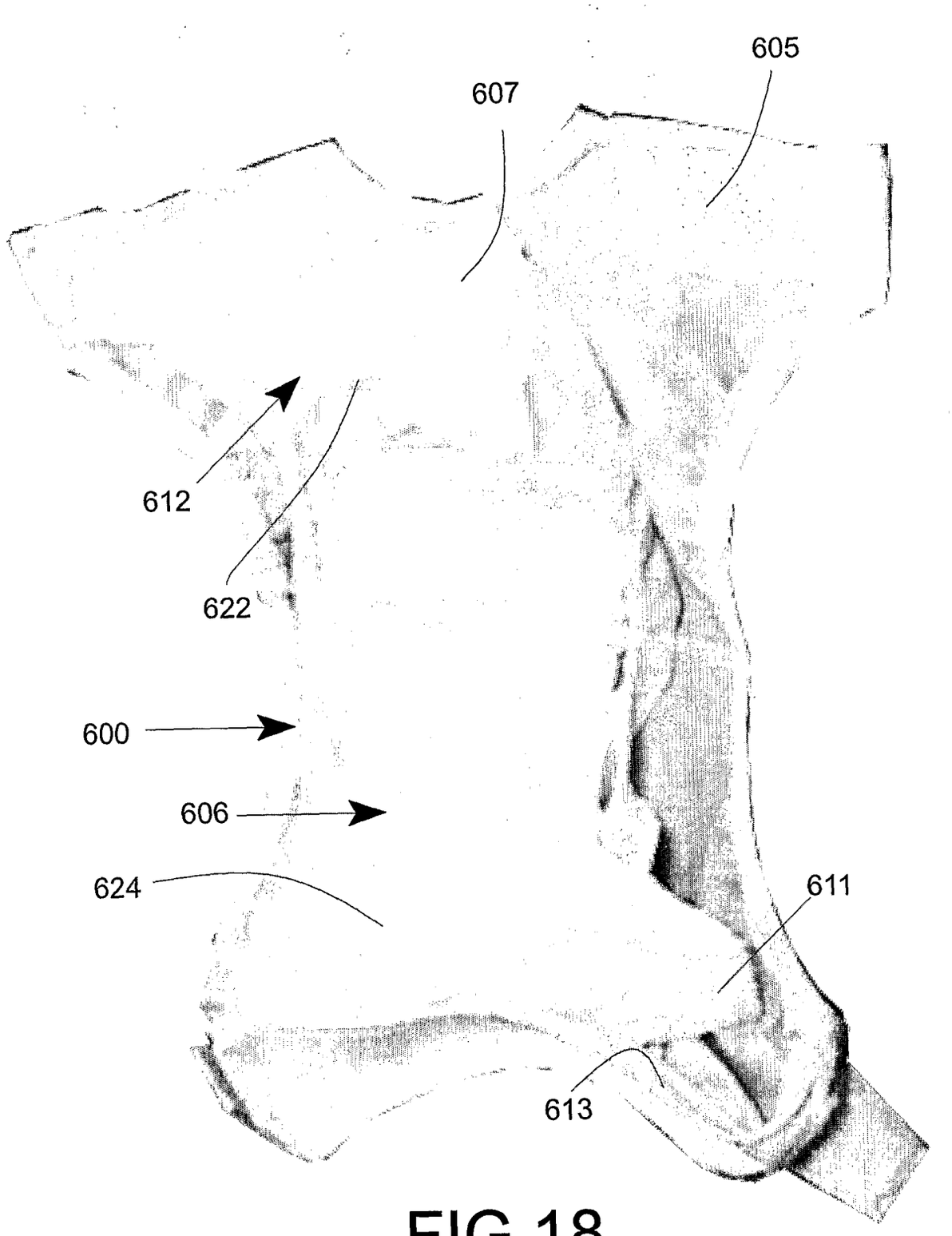


FIG 18