United States Patent [19]

Schaar

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[45] **June 11, 1974**

[54] **EXPANDABLE ARTICLE**

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[73] Assignee: **Colgate-Palmolive Company,** New York, N.Y.

[22] Filed: **Mar. 26, 1971**

[21] Appl. No.: **128,267**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 41,377, May 28, 1970, abandoned.

[52] **U.S. Cl.** **161/49,** 128/285, 128/287, 156/196, 156/197, 161/145, 161/148, 161/149, 161/156

[51] **Int. Cl.** **B32b 3/06**

[58] **Field of Search** 161/145, 148, 17, 18, 19, 161/156, 49; 156/196, 197; 128/285, 287

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Primary Examiner—George F. Lesmes
Assistant Examiner—James J. Bell
Attorney, Agent, or Firm—Ellen P. Trevors

[57] **ABSTRACT**

Expandable articles comprising flat interleaved sheets of bendable material some portions of which overlap, and fastening means securing the sheets together in the overlapping portions without obstructing relative movement of the remaining portions of the sheets to bend the unfastened positions of the sheets independently of each other and bulk the article. The bulked article can function as a diaper, wipe or other absorbent, or as a pillow or other kind of spacer.

4 Claims, 21 Drawing Figures

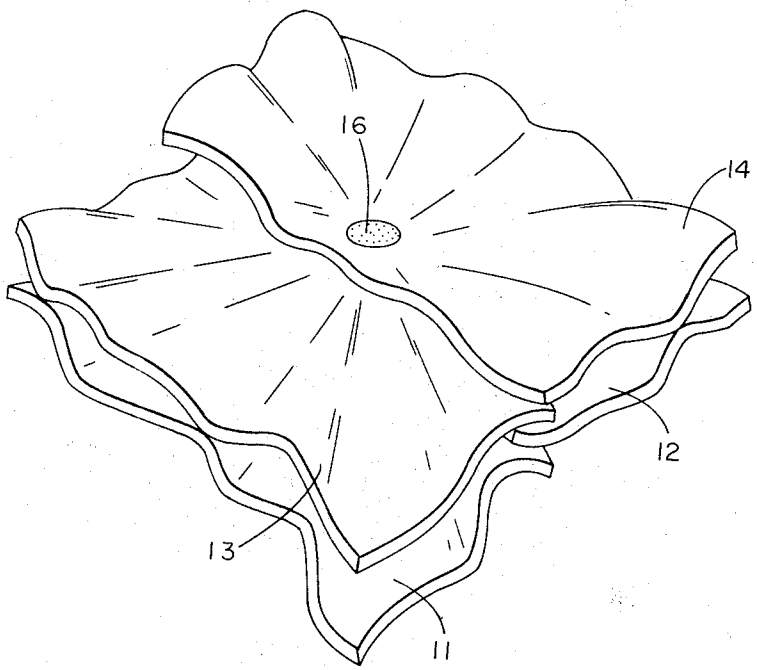
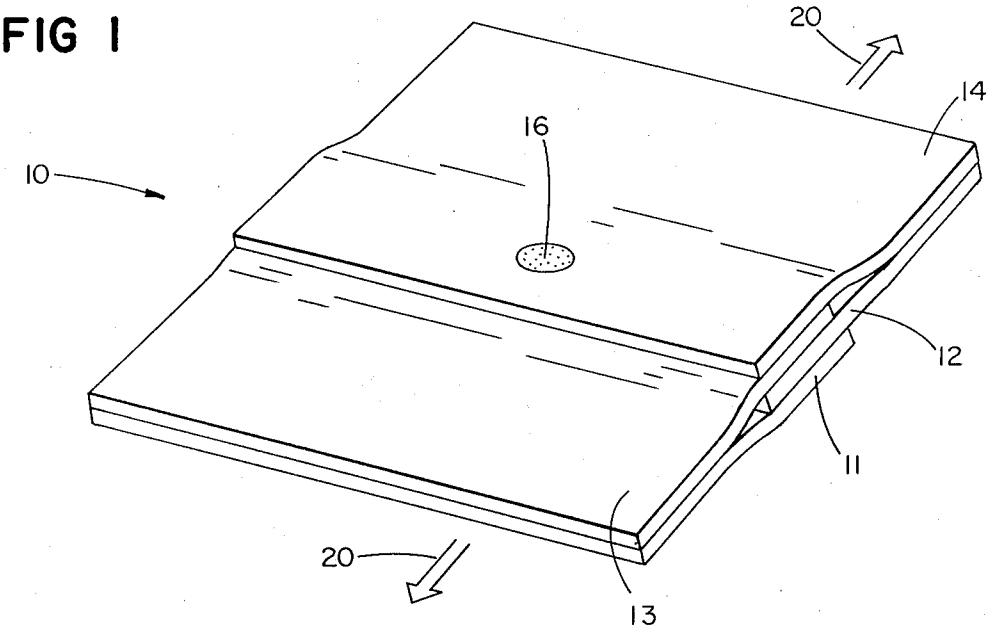


FIG 1



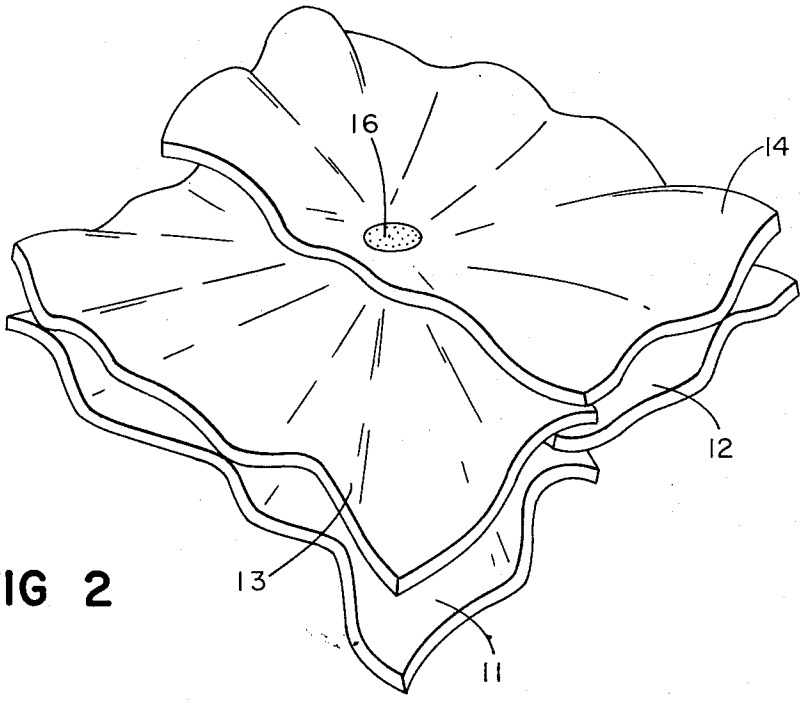
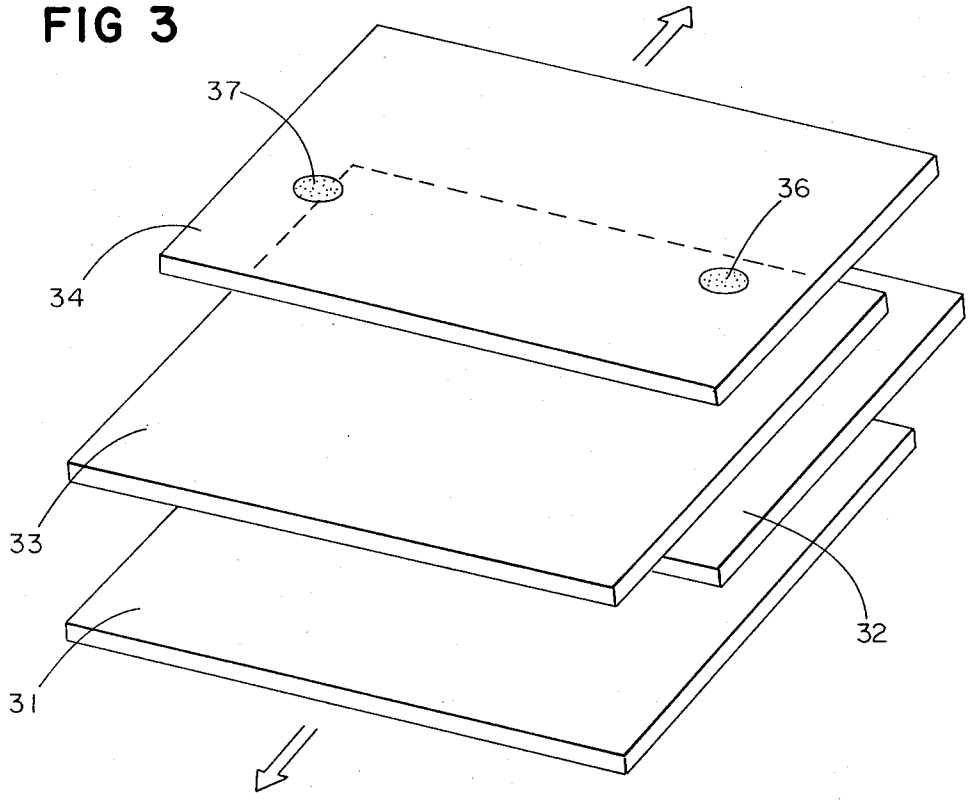


FIG 2

FIG 3



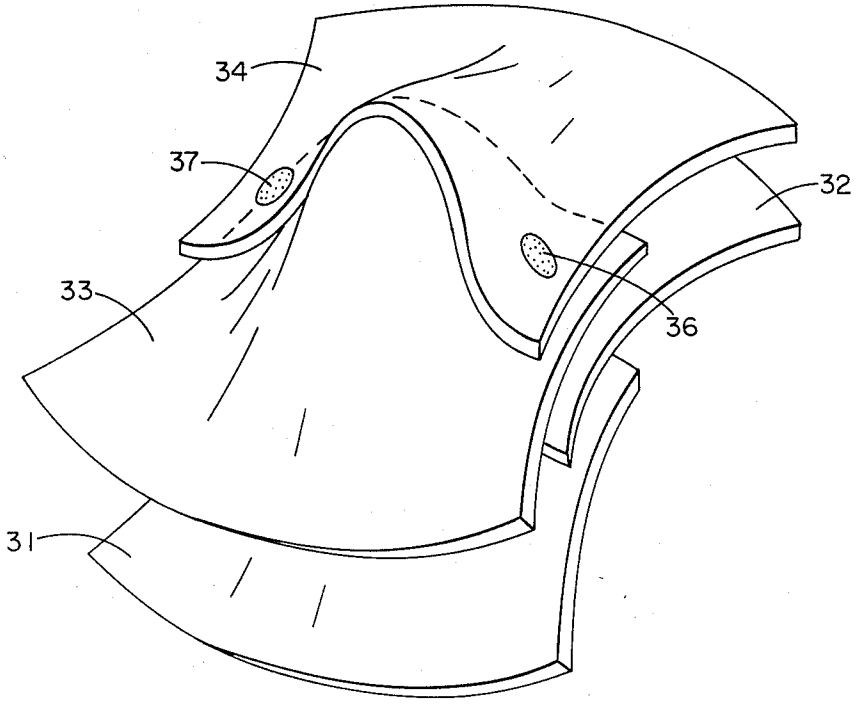
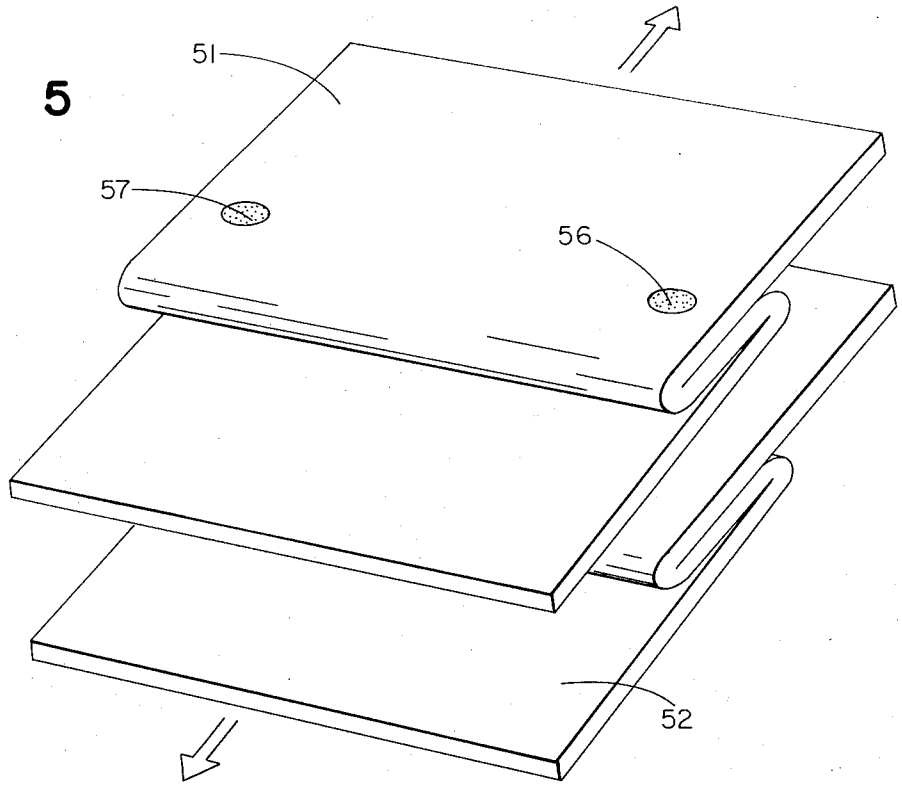


FIG 4

FIG 5



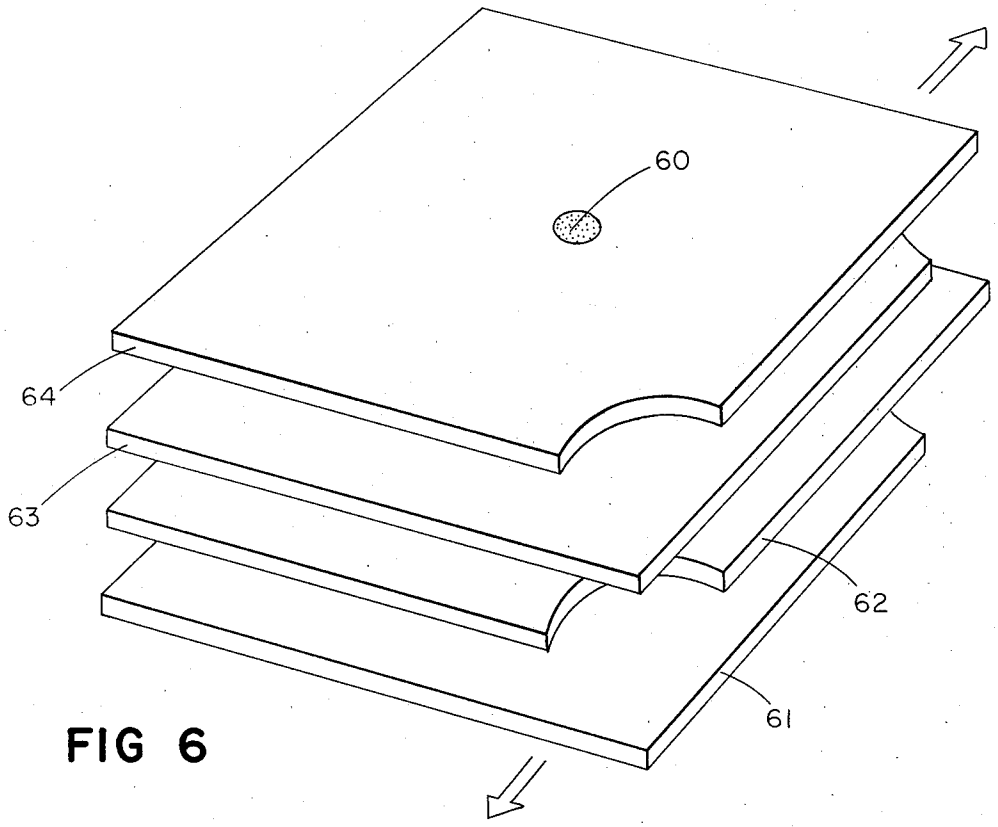


FIG 6

FIG 7

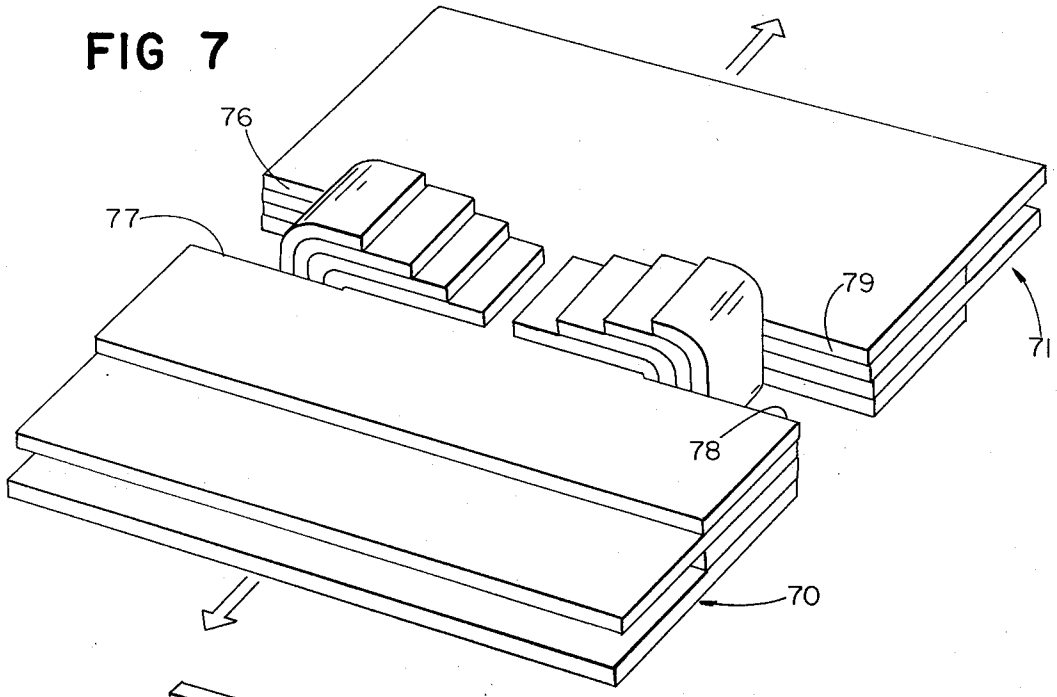
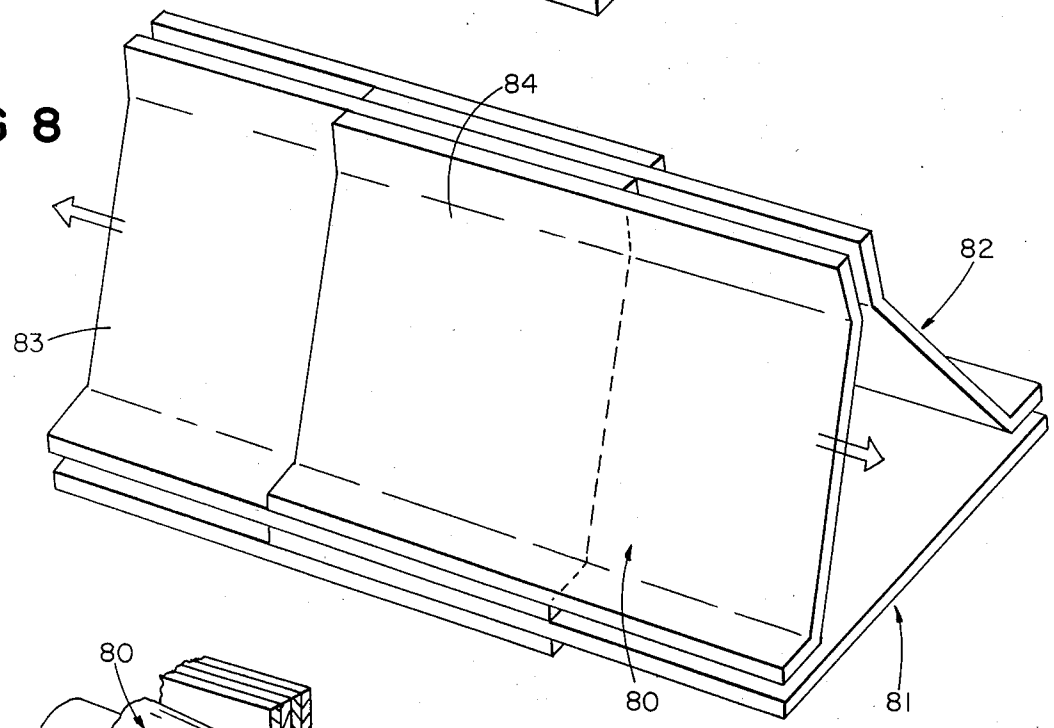


FIG 8



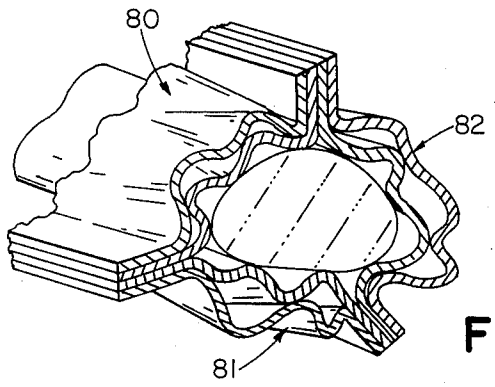
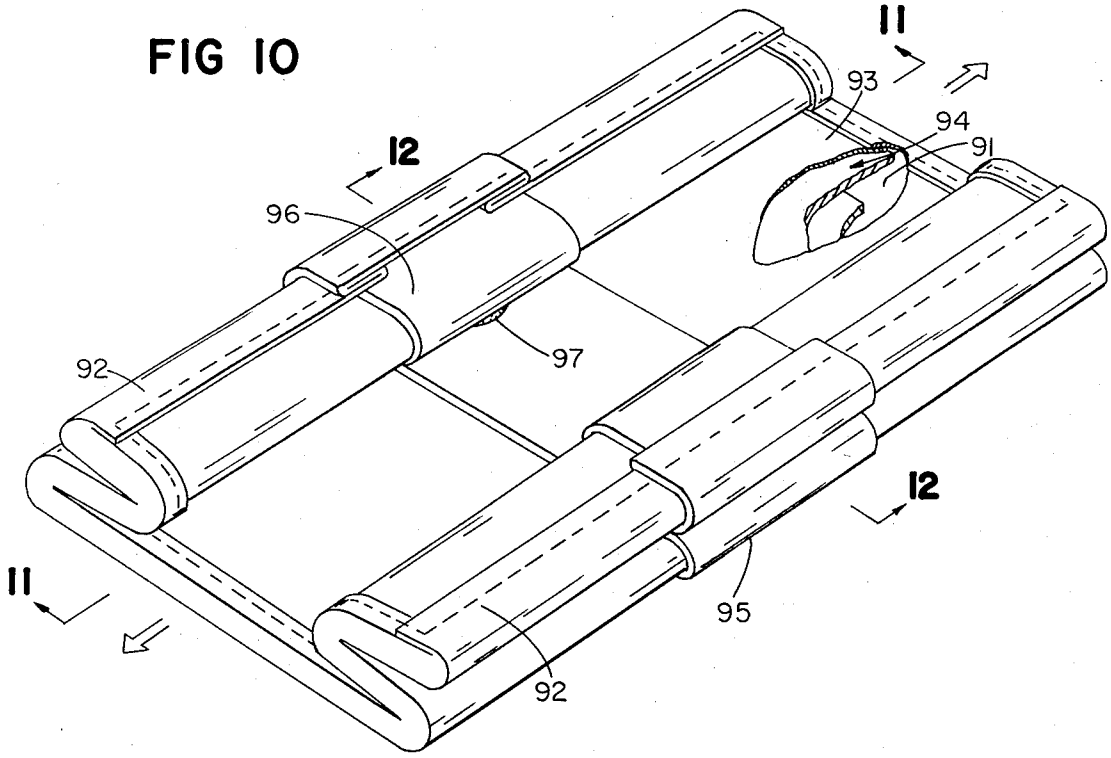


FIG 9

FIG 10



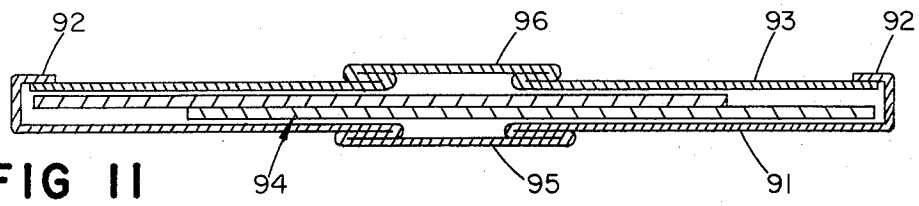


FIG 11

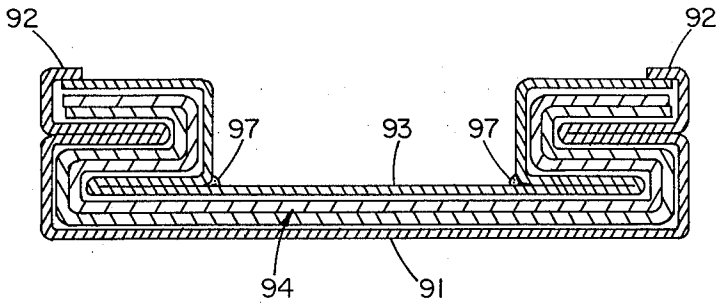


FIG 12

FIG 13

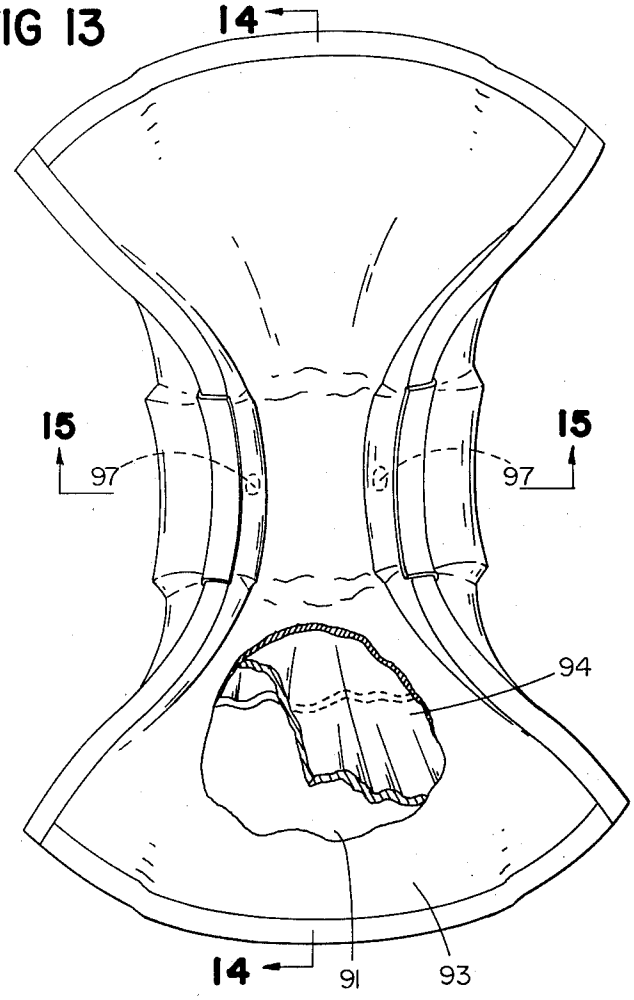
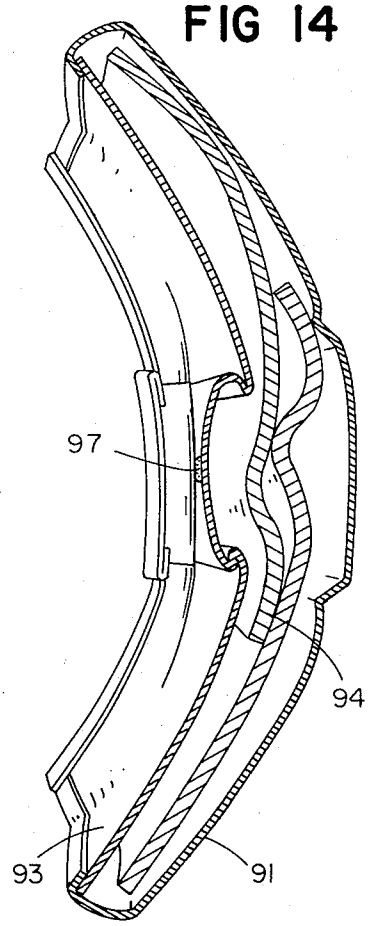


FIG 14



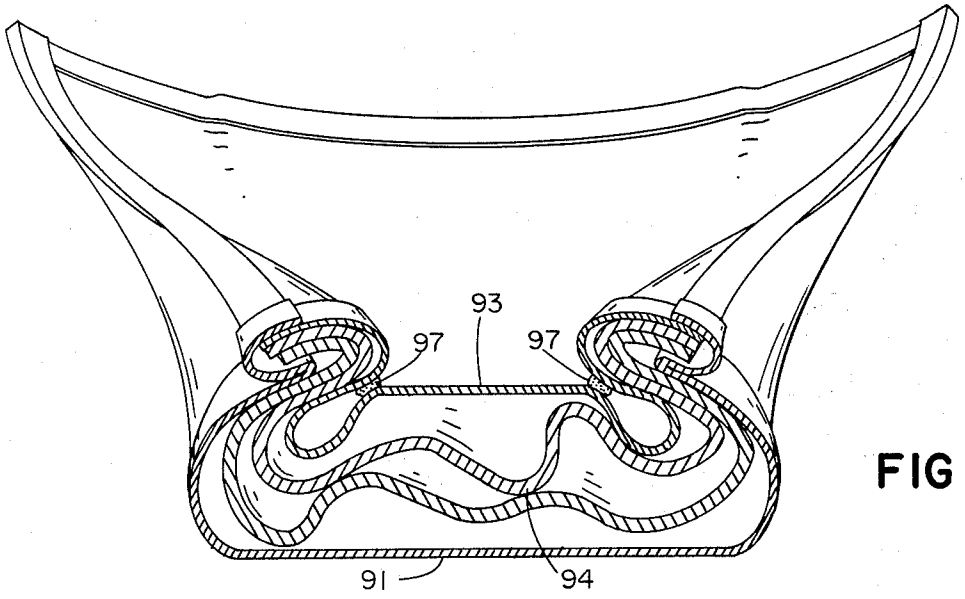
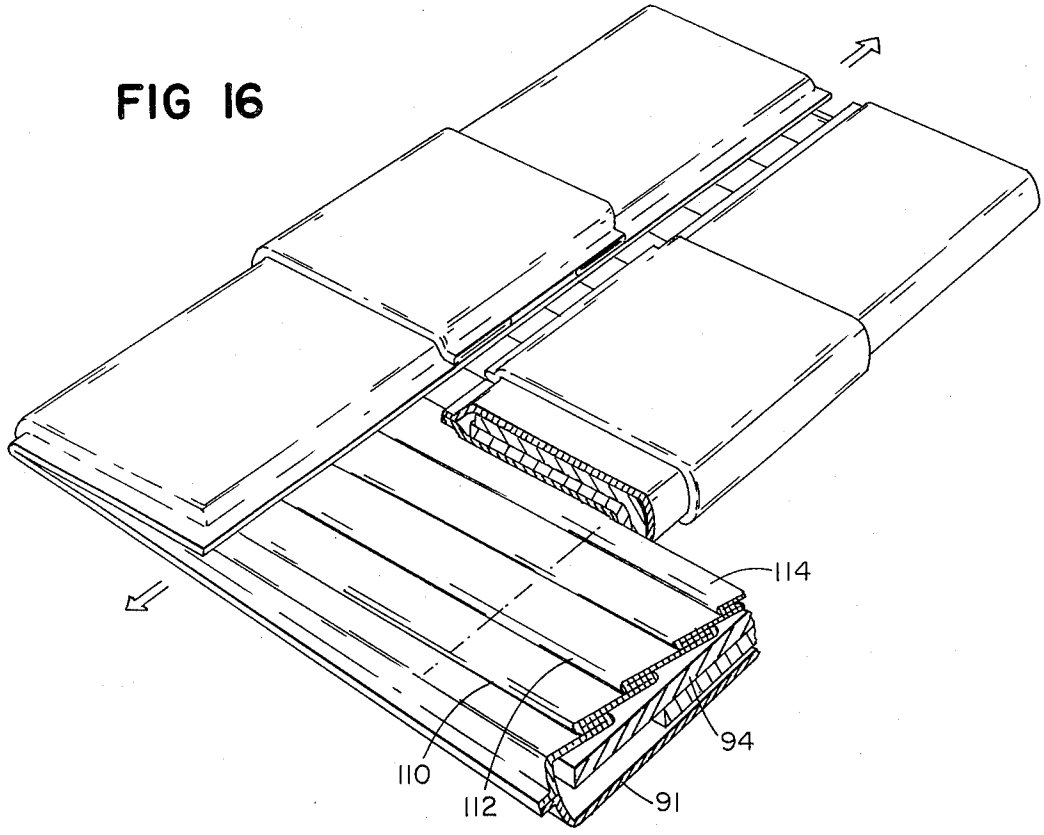


FIG 15

FIG 16



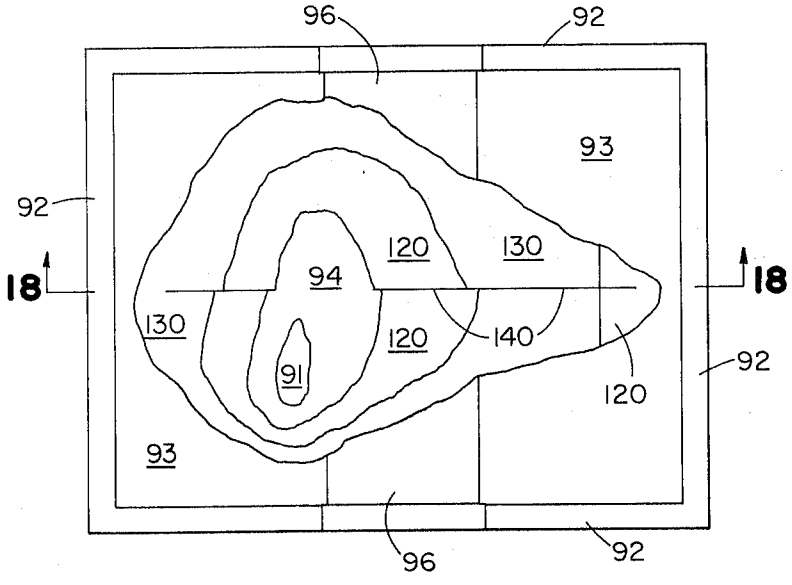
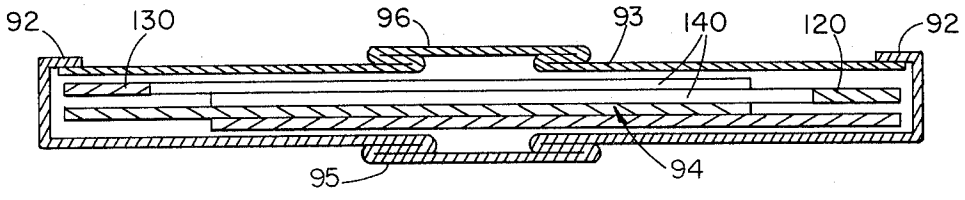


FIG 17

FIG 18



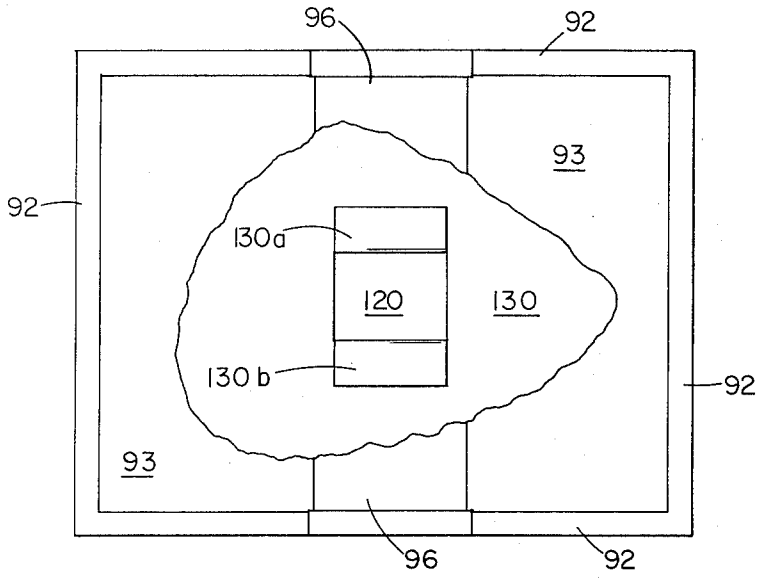
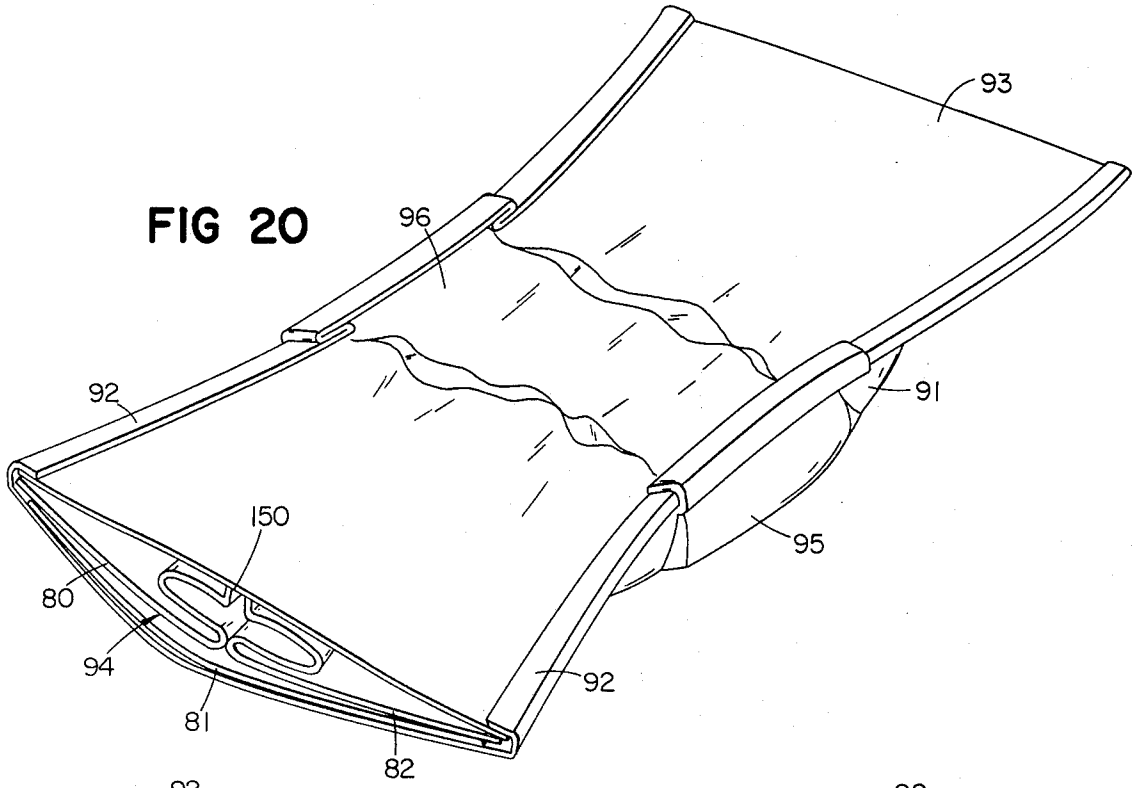


FIG 19

FIG 20



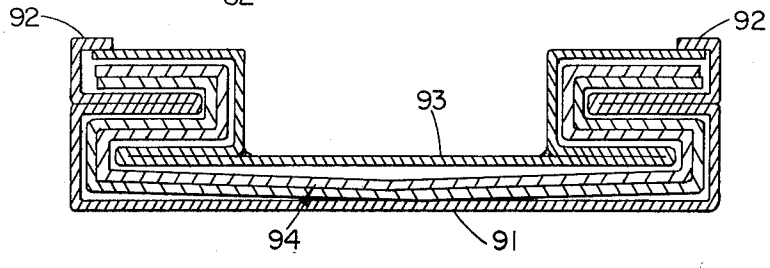


FIG 21

EXPANDABLE ARTICLE

This application is a continuation-in-part of copending application Ser. No. 41,377, filed May 28, 1970 and now abandoned.

This invention relates to articles which are expandable to provide bulk, which articles in their bulked form are useful for a variety of purposes, for example, as fillers, absorbents, insulators, spacers and the like. In many such uses the articles are of the disposable type.

More specifically, this invention relates to an expandable article which comprises a plurality of sheets of bendable material superposed together in flat planar relation and presenting more layers in a central region than in other regions, and at least one fastening means retaining said interleaved sheets in superposed planar relation in the central region while permitting remaining portions of the sheets to be moved into irregularly bent layers which patulously bulk the product as by the formation of cusps or conical areas. The article is retained in its expanded form by the cusps or conical areas, or other opposed non-planar irregularities in the moved layers.

Illustrative of the articles included in the scope of this invention are disposable diapers for infants and geriatric patients; pillows, such as for ambulances, airplanes, etc.; temporary splints for first-aid kits; handkerchiefs; absorbent wipes; dusting and polishing materials; body swabs; surgical sponges; insulating panels; sanitary pads; disposable adsorbent bonnets for use after washing and/or treating hair; etc.

The structure of said articles will be better understood by reference to the following description of the invention and the accompanying drawings in which:

FIG. **1** is a perspective view of one form of the article of this invention prior to expansion;

FIG. **2** is a perspective view of the article of FIG. **1** after expansion;

FIG. **3** is a perspective view of a modified form of article with the sheets spaced from one another for clarity;

FIG. **4** is a perspective view of the article of FIG. **3** after expansion;

FIG. **5** is a perspective view of another embodiment of the invention prior to expansion;

FIG. **6** is a similar perspective view of another embodiment of this invention prior to expansion;

FIG. **7** is a similar perspective view of another embodiment of this invention prior to expansion;

FIG. **8** is a perspective view of a tubular form of the invention useful as a splint;

FIG. **9** is a view of the splint of FIG. **8** in its expanded form applied to a human limb;

FIG. **10** is a perspective view of a disposable diaper of this invention prior to expansion;

FIG. **11** is a cross-sectional view taken along the longitudinal center line **11—11** of FIG. **10** prior to folding the diaper;

FIG. **12** is a cross-sectional view taken along the line **12—12** of FIG. **10**;

FIG. **13** is a plan view of the diaper of FIG. **10** after expansion, with a portion broken away to show the bulked interior;

FIG. **14** is a cross-sectional view taken along the line **14—14** of FIG. **13**;

FIG. **15** is a cross-sectional view taken along the line **15—15** of FIG. **13**;

FIG. **16** is a perspective view illustrating another form of a disposable diaper with a portion of one end cut away and unfolded to show the internal construction;

FIG. **17** is a fragmentary plan view of an alternate embodiment of a disposable diaper;

FIG. **18** is a cross-sectional view taken along line **18—18** of FIG. **17**;

FIG. **19** is a fragmentary plan view illustrating another embodiment of a disposable diaper;

FIG. **20** is a perspective view after expansion of a disposable diaper employing the structure of the article shown in FIG. **8**; and

FIG. **21** is an end view of an alternate embodiment of a disposable diaper.

Referring to FIG. **1**, there is shown an expandable article **10** comprising interleaved sheets **11, 12, 13, 14** of absorbent tissue paper. The inner edges of these sheets are overlapped and the sheets secured together at central area **16** by any suitable fastening means such as crimping, adhesive, double-face pressure-sensitive adhesive tabs, stapling, combinations thereof, etc. Furthermore, area **16** is shown for purposes of illustration only; fastening can be achieved at many other locations on the article.

In order to expand the article illustrated in FIG. **1**, one merely holds the ends of the article remote from the overlaps and pulls in a direction which is perpendicular to the overlapped edges (arrows **20**) along a line offset from a line passing through the fastened portion running in the direction of pull, thereby obtaining the bulked article illustrated in FIG. **2**. The bulk is retained due to crumpled distortion of the layers which prevents them from returning to their original flat configuration.

Sheets **11, 12, 13, 14** can be any bendable material, selection being dependent upon the end use of the article. Thus, where disposable diapers, pillows, handkerchiefs, etc. are intended, soft absorbent materials such as paper; creped wadding; sponge sheeting, e.g. urethane sponge; etc. are used; while fiberglass or asbestos sheeting can be employed in the construction of insulating panels.

Although the article depicted in FIG. **1** comprises four sheets, the invention encompasses articles having two, three and preferably four or more interleaved sheets, the number being dependent on the intended end use and the friction or stiffness of the material of which the sheets are comprised.

While the overlapping edges appear in alignment in FIG. **1**, random amounts of overlapping are contemplated. Furthermore, the individual sheets may be staggered in a relationship other than one-to-one, i.e., two-to-two, three-to-one or more. The extent of overlap will determine the final size of the article upon expansion.

In FIG. **3**, interleaved sheets **31, 32, 33, 34** are fastened at the side edges **36** and **37**. In this case, when the ends are pulled the article is pinched in and the layers move independently to form cusps. This cusping effect results in the edge of one layer catching on the face of an adjacent layer to "tent" the layers. Thus, the process of expanding the article of this invention adds a dimension to an initially regularly compact, planar article by

bending the layers into cusps or other non-planar configurations.

As illustrated in FIG. **4**, the article is necked down in the intermediate portion thereof upon expansion.

FIG. **5** depicts an article similar to that of FIG. **3** with the exception that interleaving and overlapping is achieved by folding individual sheets. Thus, sheets **51** and **52** are folded as shown and secured together at points **56** and **57**. Using this basic type of construction, it will be apparent that an article can be constructed from a single sheet of bendable material by making multiple folds both at the sides of the article and in the central portion thereof.

FIG. **6** illustrates an article having sheets **61, 62, 63, 64** in which corners of alternate sheets are torn away to provide means for grasping the remaining sheets. The sheets are secured together at point **60**. This construction permits the article to be expanded by pulling the alternate sheets, in opposite directions, as indicated by the arrows in the drawing.

In FIG. **7**, two stacks of sheets of bendable material, **70** and **71**, are arranged in an overlapping relationship wherein the stacks are cut inwardly along parallel lines and the intervening material is then folded inwardly towards the center. Thus, lines **76, 77, 78, 79** represent the cut lines. In this embodiment of the invention, the folded portions of the sheets function as retaining means. The individual sheets comprising stacks **70** and **71** can be individually cut, folded and assembled in a random or alternating overlapping relationship, or the overlapped stacks can be cut and folded together. Expansion by pulling as indicated in the drawing provides an article having greatly increased fluff in the intermediate portion. In a variation of this construction, the folded portions of one or more of the individual sheets comprising stacks **70** and **71** can be opened to lie flush with the article.

In FIG. **8**, a tubular article having sides **80, 81, 82** is illustrated, each side comprising a set of at least two sheets. Sheets **83** and **84** of side **80** are shown to depict the manner in which the sheets are interleaved. Preferably, these are sheets of aluminum foil or thin pliable metal. Fastening is achieved at any point or points along the lines joining the sides together by any of the aforementioned suitable means. This particular construction is preferred in the construction of splints wherein a limb is inserted into the article which is subsequently expanded by pulling in the direction shown in the drawing until the article becomes rigid enough to protect and immobilize the limb, as shown in FIG. **9**.

In FIG. **10**, a disposable diaper incorporating a construction similar to that shown in FIG. **3** is shown, except that the fastening means is provided by enclosure of the structure within diaper covers, instead of, or in addition to the adhesive fastening means of FIG. **3**.

As shown in FIGS. **10, 11** and **12**, the diaper is of the box pleat type and includes a water-repellant back cover **91** having side flaps **92** overturned on and secured to an absorbent front cover **93**. They contain therebetween a filler generally indicated at **94**.

In contrast to the usual box pleated disposable diaper, the composite construction shown in FIG. **10** includes a lateral box pleat **95** in the back sheet **91** and a similar box pleat **96** in the absorbent top cover sheet **93**.

The longitudinal box pleats and/or the lateral box pleats can, if desired, be maintained by application of adhesive at any convenient points so long as the lateral pleats can be opened by pulling the ends of the diaper.

The filler **94** has its overlapping layers between the top and bottom sheets with the sheets extending in staggered relation towards the two waist areas of the diaper. Thus when the waist ends of the diaper are taken hold of, each hand grasps only some of the filler layers permitting the entire diaper to be expanded in accordance with the invention, bulking the diaper due to the filler **94** assuming much the configuration shown in FIG. **4**, including the necking of the entire diaper.

FIG. **12** shows the application of adhesives at **97** to maintain a longitudinal box pleat configuration.

The configuration of the diaper after the expansion is generally shown in FIGS. **13, 14** and **15**. Thus the adhesive supports **97, 97** remain to maintain the box pleat in the crotch area with the waist sections of the diaper flaring out in the usual manner and the filler **94** having been constricted in the crotch area and having its several layers cusped to bulk the entire article as indicated by the non-planar configuration of the filler layers in FIGS. **14** and **15**.

Lengthwise, the diaper also assumes an arcuate configuration which is helpful in diapering.

In FIG. **16**, a modification of the diaper of FIGS. **10, 11** and **12** having edge pleats **110** and **112** in cover sheet **114** is shown. Thus, the type of pleat in both the top and back sheets is not critical, as long as the diaper expands in the desired manner when pulled. The filler **94** in FIG. **16** is enclosed between back sheet **91** and cover sheet **114** by heat sealing.

Another variation which can be obtained is shown in FIGS. **17** and **18**. This embodiment is similar to that shown in FIGS. **10–15**, except that additional layers **120** and **130** have been added to the absorbent pad under cover sheet **93**. Layers **120** and **130** are characterized by a slit **140** formed along the longitudinal center line in the crotch region of the diaper, which line parallels the direction of expansion of the diaper. Such a slit **140** provides greater ease in expanding the diaper, increased rate of absorbency especially in the slit region, and a greater amount of fluffing when expansion takes place.

Although only the two top sheets of the absorbent pad are slit in FIGS. **17** and **18**, it will be apparent that the slitting operation can be applied to one sheet, or to as many sheets as desired. Preferably the slit sheets are contiguous and are located directly under the cover sheet; it is also desirable not to slit some of the sheets which are nearer to the back sheet. Furthermore, the slit could extend the entire length of the diaper, but for ease of expansion it is preferable to terminate the slit short of the diaper ends.

While a single slit along the longitudinal center line has been shown for purposes of illustration, multiple slits can be applied to each sheet, or a single slit offset from the longitudinal center line can be cut in one or more sheets.

Alternately, as shown in FIG. **19**, increased rate of absorbency can be achieved by slitting sheet **130** in a general I configuration and folding the portions bounded by the slits away from the center slit, thereby forming flaps **130a** and **130b** and revealing sheet **120**. Similarly, such slitting and folding can be applied to one or more sheets of the absorbent pad.

As illustrated in FIG. **20**, an absorbent pad having the structure illustrated in FIG. **8** can be used in a disposable diaper by placing a cover sheet **93** over sides **80** and **82** and a fluid impervious back sheet **91** over side **81**. Sides **80** and **82** are folded longitudinally, as illustrated by the fold lines shown in the drawing.

Although FIG. **20** illustrates an expandable diaper formed from three sets of two sheets each, a larger number of sets could be used to produce a greater bulkiness when the diaper is expanded, if so desired.

FIG. **21** illustrates another variation of a disposable diaper wherein the filler sheets are creased in a direction parallel to or coincidental with the line of pull. Such creases, which can be applied to one or more of the filler sheets, function to direct the bulking primarily in one direction. For example, a crease away from the cover sheet as shown in FIG. **21** will provide a desirable trough in the expanded article.

While the pleats in the back and cover sheets in FIGS. **10–20** are shown to be parallel to overlapping edges of the absorbent pad, they need only be approximately parallel to function as intended. Thus, they can even be diagonal to the overlapping edges and yet expand when pulled in a direction perpendicular to the overlapping edges. Furthermore, one or more pleats may be provided. For example, where the back sheet has several pleats, the diaper can be expanded to fit various sizes of babies by pulling out one or more of the pleats. In lieu of pleats, overlapping cover and/or back sheets can be used.

Back sheet **91** is any flexible, fluid impervious material, such as polyethylene film, polypropylene film, ethylene-acrylate copolymer film, ethylene-propylene copolymer film, vinyl chloride polymer and copolymer film, etc.

The sheets of filler **94** are comprised of any soft absorbent material such as paper; creped wadding; tissue; etc. Preferably, the sheets, which may be single or multi-ply, have a total weight of 20–40 pounds per ream.

Cover sheet **93** can be a wet strength tissue paper, polyurethane foam, or preferably a soft nonwoven material such as cotton, rayon, polypropylene, nylon, etc. The paper cover sheet has a basis weight of at least about **14**, and preferably **18** to **20** pounds per ream, while nonwovens having a weight of **15** to **20** grams per square yard are generally employed.

Alternately, a single sheet of stretchable material such as polyurethane foam, or perforated material, can be employed as the cover sheet.

Various modifications are possible in securing together the back sheet, filler and cover sheet. For example, the edges of the back sheet, which have larger dimensions than the filler or cover sheet, can be folded around the filler. The cover sheet is then secured to the folded around edges of the back sheet. Alternately, the cover sheet may be larger than the filler and back sheet, and the edges of the cover sheet folded around the corresponding edges of the filler. In this embodiment, the edges of the back sheet are secured to the folded around edges of the cover sheet. The diaper may also be constructed with both cover and back sheets having larger dimensions than the filler, and secured together in any of the aforementioned manners.

There are many advantages to the diaper constructions illustrated herein. Thus, expansion provides a diaper having three significant features. First, the diaper is fluffy and highly absorbent in the critical areas. Secondly, the operation to expand the diaper results in a narrowing down of the crotch area and thirdly, a contouring or girdling effect in the waist area. Accordingly, the expanded diaper assumes a shape having a better contact with the body, and the structure of the expanded diaper in the area into which the exudates flow is such that the diaper retains moisture and fecal matter without leakage. Also, it will be apparent the diapers are easily packaged and stored prior to use because of their compactness before expansion.

Another feature of the diaper construction disclosed herein is its applicability to sexually oriented diapers. Thus, the absorbent filler can be constructed so as to provide bulk offcenter from the transverse center line of the diaper. The diaper is applied according to the sex of the infant, the part having the region of increased bulk being placed against the bottom of a female and the front of a male. Thus, a diaper providing increased absorbency for both sexes when applied as previously described can be readily constructed.

If desired, free sheets of various materials can be interspersed in the articles of this invention. For example, waxed paper to assist in sliding the sheets can be added. Also, "fluff", which is a mass of loosely associated fibers such as cotton fibers or comminuted wood pulp, and/or talcum powder can be inserted in the disposable diapers.

While diapers of various dimensions can be constructed, the expandable feature eliminates the necessity of providing a series of different sizes for babies of different age and size. For example, a diaper approximately 13 inches wide by 14 inches long, and having a thickness in the crotch area of about ¼ inch, expandable to 17 or 18 inches long and 3 to 4 inches thick in the crotch area, would function both as a regular and large size diaper, since it could be used for smaller babies in a partially expanded form and then fully expanded to fit larger babies.

Although the various diaper constructions described herein have been directed to disposable types, it will be apparent that improved reusable diapers can be constructed according to this invention. Thus, expandable gauze diapers, which can be collapsed or reformed to approximately their original dimensions after use, are contemplated. After laundering, these diapers are again readily expandable. Furthermore, if no longitudinal box pleat is formed because the adhesive **97** is omitted, the disposable diaper can be collapsed and reformed after use, by pulling outwardly on the side flaps **92**. Such a use is contemplated in the event the disposable diaper has not been soiled, and is to be stored prior to reuse.

While this invention has been described above in detail with respect to certain preferred embodiments of the invention as illustrated in the drawings, other modifications and design changes are also contemplated which are within the spirit and scope of the appended claims.

What is claimed is:

1. A bulkable product comprising bendable sheet material superposed together in flat planar relation and presenting more layers of said sheet material in a central region of said product than in other regions thereof, the layers in the other regions having outer substantially aligned edges forming the major portion of the edges of the product, means retaining portions

of said layers in said central region in said superposed planar relation and remaining portions of said sheet material being movable independently of each other in a predetermined direction into irregularly bent nonplanar layers patulously bulking said product and retaining said product in bulked configuration.

2. A product in accordance with claim 1 wherein at least some of said layers are formed of an absorbent sheet material.

3. The bulkable product of claim 1 comprising separate pieces of bendable sheet material superposed together in flat planar relation and presenting more layers of said sheet material in a central region of said product than in other regions thereof, the layers in the other regions having outer substantially aligned edges forming the major portion of the edges of the product, means retaining portions of said layers in said central region in said superposed planar relation and remaining portions of said sheet material having fold-free edges movable independently of each other in a predetermined direction into irregularly bent non-planar layers patulously bulking said product and retaining said product in bulked configuration.

4. A bulkable product comprising bendable sheet material superposed together in flat planar relation and presenting more layers of said sheet material in a central region of said product than in other regions thereof, the layers in the other regions having outer substantially aligned edges forming the major portion of the edges of the product, with the product edges on one side of the product being constituted of edges of different layers than the product edges on an opposite side of the product, means retaining portions of said layers in said central region in said superposed planar relation and remaining portions of said sheet material being movable independently of each other in a predetermined direction into irregularly bent non-planar layers patulously bulking said product and retaining said product in bulked configuration.

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