Aug. 19, 1969 A. L. McCONNELL ET AL 3,461,872

DIAPER RETAINING GARMENT

Filed May 17, 1966 2 Sheets-Sheet 1

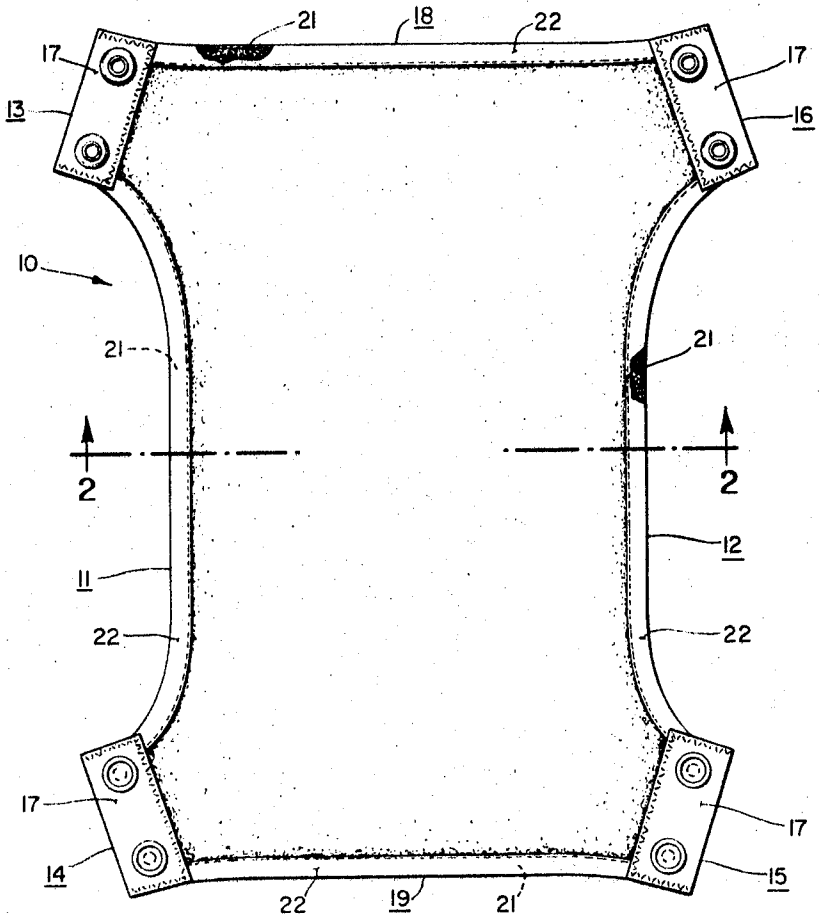



Fig. 1

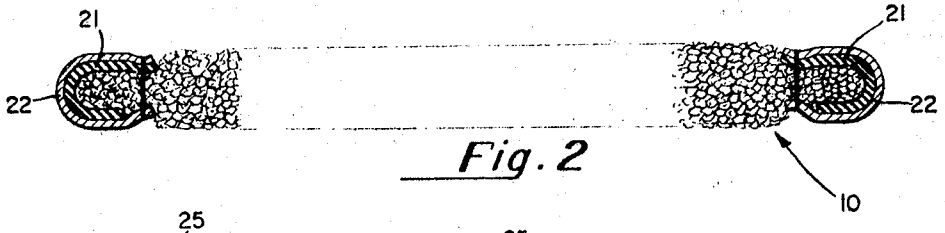



Fig. 2

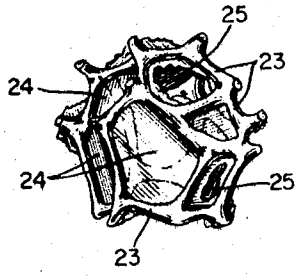



Fig. 3

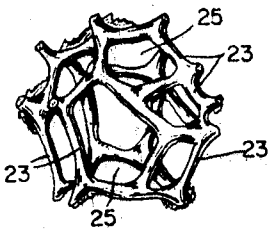



Fig. 4

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Filed May 17, 1966 2 Sheets-Sheet 2

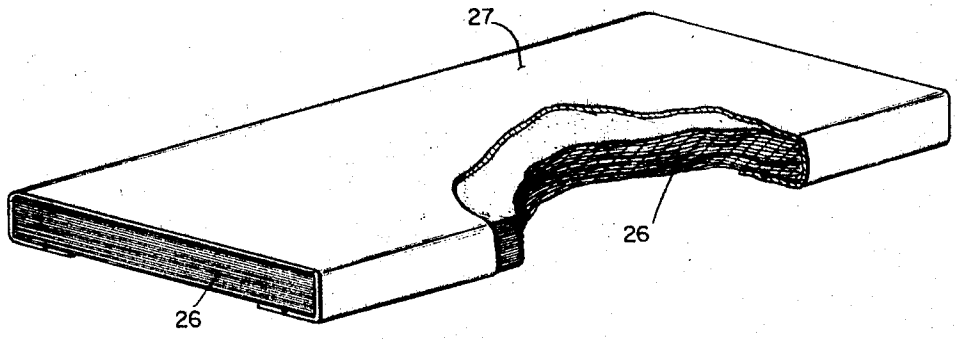



Fig. 5

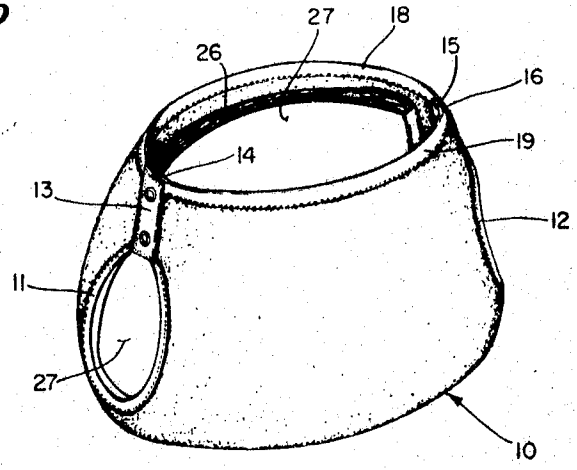



Fig. 6

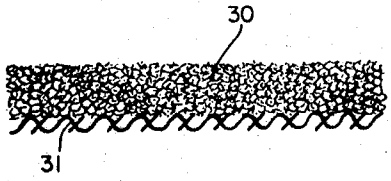



Fig. 7

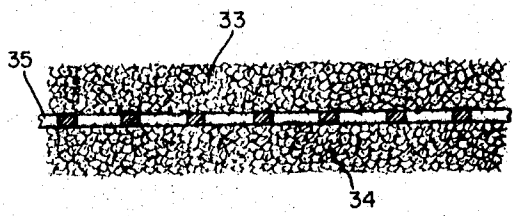



Fig. 8

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3,461,872

# DIAPER RETAINING GARMENT

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Int. Cl. A61f 5/48
U.S. Cl. 128—287 4 Claims

## ABSTRACT OF THE DISCLOSURE

A diaper supporting and retaining garment of polymeric cellular material such as open-celled or reticulated polyurethane foam, and laminates of such material with other sheet materials.

This invention relates generally to a new type of garment and, more particularly, to a new and improved panty construction for retaining a diaper, generally of the disposable type, in position adjacent the perineal region of a wearer.

In the past, many garment constructions have been devised for the purpose of retaining and supporting a diaper in position on a wearer. The more recent developments have been more specifically directed to providing a structure for retaining and supporting a disposable diaper pad on a wearer. Such disposable diapers are desired by users since, upon becoming soiled, they can be thrown away or disintegrated in the vortex of a flushed toilet. The chief characteristics of such disposable diaper pads are their high absorbency and relatively flimsy construction which is desirable to enable them to readily fall apart when disposed in the normal household sewage system.

Due to the fact that these disposable pads are normally made of paper fibers in one form or another, they are not held in place on a wearer by means of pins or other conventional means. Therefore, elaborate provision has been made in the outer supporting garment for not only supporting the disposable pad but also firmly holding it into position on the wearer by means incorporated in the supporting garment. Such means have included pockets, straps, snaps, buttons, etc.

In practice, the diaper supporting and retaining garment is reused many times while the disposable diaper pads are discarded after becoming soiled in use. Due to the construction of prior panty garments and the above-mentioned complexities built into the structure, the cleaning of these garments is difficult especially where abnormal amounts of excreta spillage occurs from the pad onto the garment.

Another problem experienced with previous diaper retaining garments has been the necessity to make the material forming such a garment impervious to the circulation of air therethrough since it was desired to prevent the passage of moisture from the pad through the outer garment which sometimes would occur upon prolonged wearing and after the absorbency capacity of the pad had been exceeded. However, it is well-known by experts in the field of child care that one of the chief causes of irritation such as diaper rash is the lack of circulation of air in contact with the moist skin.

In view of the above difficulties and shortcomings, it was completely unexpected to discover that a diaper supporting garment could be made from a sheet of porous flexible cellular material which would serve ideally for retaining a diaper structure such as a disposable diaper pad in the proper position on a wearer without requiring any associated means to control the pad.

The garment of the invention is particularly well-



adapted to retain a disposable diaper pad adjacent to and in contact with the perineal region of a wearer and comprises an elongate body portion having cooperating fastener means secured to respective corners thereof for effecting securement of the corners of the ends of each respective longitudinal side edge to each other. The body portion comprises a sheet of flexible polymeric cellular material which in some embodiments is an open-celled foam such as polyurethane, and in some other embodiments is a reticulated foam such as polyurethane. In addition, it has been discovered that a diaper retaining garment such as the above being normally somewhat permeable to fluids can be treated so as to be made more hydrophobic than usual and, therefore, relatively impermeable to the passage of fluids. One means for treating the foam in this manner involves the application of a silicone composition to the surfaces of the foam; that is, to the surfaces of members throughout the foam structure defining the pores or outlining the cells.

Therefore, it is an object of the present invention to provide a new and improved diaper retaining garment.

It is an additional object of the invention to provide a diaper retaining garment comprised of a sheet of flexible polymeric cellular material.

It is a further object of the invention to provide a diaper retaining garment formed from a sheet of flexible polymeric cellular material which has been treated to make it hydrophobic.

These and additional objects and advantages of the present invention will become apparent from the following detailed description thereof when read in conjunction with the accompanying drawings, in which:

FIGURE 1 is an inner plan view of a diaper supporting garment of the invention,

FIGURE 2 is a sectional view taken along lines 2—2 of FIGURE 1,

FIGURE 3 is a greatly enlarged perspective view of a typical cell structure of a cellular polymeric material used in the invention,

FIGURE 4 is a greatly enlarged view of a cell structure of a reticulated polymeric material used in the invention,

FIGURE 5 is a perspective view of one type of pad which may be employed with the invention, showing part in section,

FIGURE 6 is a perspective view of a diaper supporting a pad in the approximate position of use, and

FIGURES 7 and 8 are sectional views of some alternative types of composite sheet material for use in forming body portion **10**.

Referring to FIGURE 1 of the drawings, an elongate sheet **10** of flexible polymeric cellular material is shown having its longitudinal side edges **11** and **12** recessed centrally of their ends. This results in the formation of laterally outwardly extending ears or apron portions **13**, **14**, **15** and **16**, depending from each end of each longitudinal side edge **11** and **12**. The elongate sheet **10** comprises the body portion of a diaper retaining garment of the invention. The surface of the sheet shown in FIGURE 1 is the inner surface of the garment. That is, this surface is adjacent to the body of a wearer during use of the garment as distinguished from the outer surface thereof which is not shown in FIGURE 1.

The apron portions **13**, **14**, **15** and **16**, are reinforced on each side thereof by an overyling layer of material **17**. That is, layers **17** of material are secured to both the inner and outer surface of those portions of the sheet **10** comprising the outwardly depending apron portions **13**, **14**, **15** and **16**, as by stitching. This material preferably is a scrim or fabric but may comprise any relatively strong and flexible sheet material. A plurality of cooperating snap fastener elements are secured to the respective corners of the elongate body portion. Thus, in FIGURE 1,

they are secured to each apron portion **13**, **14**, **15** and **16**, and arranged to effect securement of the corners at the ends of each respective longitudinal side edge **11** and **12** to each other. Obviously, many types of fastener means could be employed satisfactorily for this purpose.

The longitudinal side edges **11** and **12** and end edges **18** and **19** of the elongate body portion **10** are elasticized between the respective apron portions **13**, **14**, **15** and **16**, to provide stretch and form to the garment. This is preferably provided for by a sewing to these edges a strip **21** of elastic material, folded around each edge and stretched in the direction parallel to that edge. The cellular polymeric sheet material forming the body portion **10** is in the relaxed state when the elastic strip **21** is sewn.

Upon completion, the elastic strip **21** returns to a substantially relaxed state and the cellular polymeric sheet **10** in the areas adjacent the edges **11**, **12**, **18** and **19**, becomes slightly compressed. The resistance to tension of the elastic strip **21** is greater than the resistance to compression of the cellular material forming sheet **10**, resulting in substantially compression in sheet **10** along the edges thereof while strip **21** is only under slight tension and is substantially relaxed. This alters the form or configuration of the resulting structure, and causes the side edges and end edges to turn upwardly, generally out of the plane of the central portion of sheet **10**, forming a channel therebetween. The resulting article thus assumes the shape desired when in position on a wearer when it is in the relaxed condition. This shape is substantially shown in FIGURE 6.

The elasticized edges **11**, **12**, **18** and **19**, are preferably covered by fabric outer strip **22** to prevent contact of the wearer with the elastic material forming strip **21**. This strip **22** is sewn on along with the elasticized strip **21** and forms an envelope around it. The details of this construction feature can be clearly seen from FIGURE 2. The material forming the outer strip **22** may comprise any type of flexible material but is preferably a woven fabric or scrim.

The flexible polymeric cellular material used for the elongate body portion **10** may comprise any one of a number of open-celled foams. Thus, a primary feature of the invention is that the material forming the body portion is pervious to air. As will be seen subsequently, the material may be pervious to liquids in some instances. However, many of these materials are naturally hydrophobic and others are preferably rendered hydrophobic in accordance with the invention to prevent the passage of liquids therethrough while still permitting the passage of air. One factor which regulates the relative degree of fluid flow through the structure is the pore size or cell concentration of the flexible cellular material. In part, this depends upon the characteristics of the individual materials employed. However, it has been found that the cell concentration of the cellular material should preferably not be less than 20 pores per inch and should preferably be at least 60 pores per inch and higher. This is one measure of pore size.

One type of cellular polymeric material preferred for use in the garment of the invention is a polyurethane foam material which in some instances may be treated in a manner giving it advantageous properties. The nature of such polyurethane foam material is best illustrated in FIGURES 3 and 4 which are greatly enlarged illustrations of single cells of typical cellular polyurethane foam material. Each cell is a three-dimensional network of interconnected strands **23** which form junctions between the faces or walls of the cells of the foam body. Most so-called "open-celled" polyurethane foams possess thin mebrane-like sheets of material across at least certain or some of the cell faces as indicated in **24**. Other cell faces, as indicated in **25**, are open by virtue of the membranous material at the face having been broken during the foaming operation.



A polyurethane resin or polymer is formed by the reaction of a diisocyanate with a polyhydroxy material. Generally, these resins are classed as, e.g., polyether or polyester polyurethanes, depending on the chemical nature of their polymeric units. There are other, less commonly used, types classified as to the nature of the polymer with which the isocyanate is reacted. A polyurethane foam is produced by generating $CO_2$, e.g., by reaction of water with an isocyanate, or other gas in the reaction mixture, e.g., by a vaporization of a volatile liquid by the heat of reaction, while converting a liquid form of the polymer to a solid form of the polymer, e.g., by cross-linking or otherwise increasing the molecular weight of the liquid polymer.

In the preparation of foamed polymeric cellular structures, a gas or vapor is generated while the material to be formed is in the plastic state. The generation of this gas results in the formation of bubbles, approximately spherical in form. As the bubbles expand, cells are formed which have more or less definite geometric configurations. The optimum packing for spheres is an arrangement in which each sphere is surrounded by 12 other spheres; and correspondingly it has been found that the cells formed by the expansion of gas bubbles to the point of contact, so as to produce low-density, open-cell cellular structures, generally are in the form of dodecahedrons, with pentagonal sides or faces. This is the general rule, though in any foamed mass will be found cells of varying geometry. At the intersection of the faces are heavier strands of material. Between the strands forming the cell faces or walls are very thin membrane-like films. Generally a portion of the faces rupture during foaming, so that the cells are interconnected. Such a foam is referred to as open-celled.

The more preferred form of polyurethane foam for use in the invention is illustrated by the cell shown in FIGURE 4. It is from a reticulated structure formed from a conventional open-celled foam which has been subjected to an after-treatment which removes the membranous material from substantially all of the faces of the cell, leaving only the integrally interconnected strands **23**. A more detailed description of the interconnected strand structure of FIGURE 4 and a description of a method of its production are contained in U.S. Patent 3,171,820 to Volz. Such foam structures are basically three-dimensional porous structures and may be considered as three-dimensional honeycombs or cellular structures comprised of integrally interconnecting strands forming an isotropic skeletal outline of a multitude of polyhedrons whose faces are polygonal.

Obviously, any material used to form the elongate sheet or body portion **10** must resist "wet through" or the passage of liquids through itself. It was quite surprising to discover this could be achieved while allowing relatively free permeation of the body portion by air.

As mentioned above, many of the polymeric cellular structures and materials contemplated for use in the invention are hydrophobic in their natural condition. That is, they exhibit a pronounced tendency to resist wetting by liquids such as water. This tendency is one property of the polyurethane foam described above, both the open-celled variety and the reticulated form. The ability of a polymeric cellular layer to resist liquid permeation depends largely upon its pore size as well as its degree of hydrophobicity or resistance to wetting.

However, there are some materials which are not hydrophobic but could be used satisfactorily in the invention if the pores were small enough or if treated to become hydrophobic. In addition, the above naturally hydrophobic materials sometimes lose this property upon repeated washing under strong detergents. It will be apparent that during use of the garment of the invention, the pads will often not have the absorbency capacity for holding all fluids over a prolonged wearing time. It will then be necessary to clean the garment as well as to dis-

pose of the pad. The garment is designed to withstand rigorous cleansing up to 50 times or more in an automatic washer under high water temperatures and strong detergent conditions. However, it is sometimes desirable to initially treat the polymeric cellular material forming the body portion **10** of the garment to impart more permanent hydrophobicity to the material.

Accordingly, several methods of accomplishing this have been found very satisfactory and it is believed that others would be equally successful.

Generally, the methods for making the polymeric cellular material hydrophobic involve applying a coating material in liquid form to the surfaces of the cellular material and distributing it substantially uniformly thereon. Upon drying and removal of the excess coating material, the structure has a thin contiguous coating substantially over its entire interior and exterior surfaces. That is, the surfaces of the strand members forming the structure in the case of reticulated polyurethane foam are all coated with hydrophobic material which at least substantially retards the passage of liquid through the pores of the structure and in most instances, prevents it.

In some instances, the liquid coating material may be applied by spraying. It has been found preferable to dip the cellular material into the liquid bath to more thoroughly wet it, after which the cellular material is mechanically worked as by kneading or by passing it through a roll nip which may be either within or without the liquid bath. This working step insures uniform wetting of the surface of the cellular material by the coating material. The excess coating material is then drained from the structure. This may be assisted by the same or additional pressure rolls.

Upon completion of the coating application, the coating is normally dried. This is accomplished under conditions which depend on the characteristics of the particular coating material used, but should in any case be at a temperature below the fusion temperature of the cellular structure. In this case of polyurethane foam, this is generally below about 400° F.

One coating material employed for imparting hydrophobicity to the cellular material is a water-dilutable nonionic silicone emulsion. This may be Dow Syl-mer 72, or Dow Corning ET 5317, manufactured by Dow Corning Corporation, Midland, Michigan. A catalyst must be used with the above emulsion and a satisfactory one is Catalyst 62, manufactured by Dow Corning Corporation. It is used in a weight ratio of about 1 pound of catalyst to about 5 pounds of Syl-mer 72.

Typical properties of the above compounds are as follows:

| | Syl-mer 72 | Catalyst 62 |
|---|---|---|
| Solids | 30% | 50%. |
| Chemial nature | Organopolysiloxane | Metal-organic salt. |
| pH | 3-5 | 8-9. |

The bath of coating material is prepared in the following manner to obtain a pickup of coating material on the polymeric cellular material in the range of 1 to 5% coating material solids based upon the dry weight of the cellular material. When using the above-described compounds in the coating material, Catalyst 62 is used in a weight ratio of 1 pound of catalyst to 5 pounds of Syl-mer 72. The catalyst should be added to the diluted silicone emulsion for the best bath stability.

A typical 50 gallon coating material bath of Syl-mer 72 should be mixed in the following manner.

(1) Weigh 20 pounds (2½ gallons) Syl-mer 72 emulsion into mixing tank (5% Syl-mer 72 emulsion based on total bath).

(2) Add 20 to 25 gallons cold water (40 to 50% of the total bath) with gentle agitation.

(3) Mix into the diluted emulsion 4 pounds (2 quarts) of Catalyst 62 (1.0% of total bath or 20% of Syl-mer 72 used).

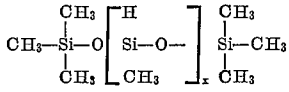
(4) Add enough cold water with gentle agitation to bring the total bath volume to 50 gallons.

The cellular material coated with the above-described bath is then dried and cured with conventional drying equipment. As pointed out above, the length of time and the temperature required for drying will vary depending upon the types of coating materials employed, as well as upon the type of cellular material being coated. The pore size of the cellular material is also a factor. However, the following table illustrates typical drying and curing times and temperatures for the above Syl-mer 72 emulsion bath.

| Temperature, ° F.: | Time, minutes |
|---|---|
| 150 | 20 |
| 200 | 10 |
| 250 | 5 |
| 300 | 3 |
| 350 | 2 |

Another silicone material that can be used in place of Syl-mer 72 is Union Carbide L–31 Silicone Fluid, manufactured by Union Carbide Corporation, 270 Park Avenue, New York 17, N.Y.

Union Carbide L–31 Silicone Fluid is similar to dimethylpolysiloxane fluid and is represented as:



Whereas dimethylpolysiloxane is inert and nonreactive, L–31 Silicone Fluid, because of the Si-H bond, is a highly reactive material which can be cured to a variety of substrates.

To use L–31 Silicone Fluid, it must first be emulsified by any number of emulsifiers to 30% solids. Suitable catalysts that can be used are emulsions of zinc octoate, tin octoate or dibutyltin dilaurate. Zirconium and iron soaps and amines are also effective catalysts. The catalyst emulsions, when made up to 50% solids, are used in the same ratio 5–1 with L–31 silicone emulsion as the Syl-mer 72 emulsion and Catalyst 62. The coating material bath is made up in the same manner as described for the Syl-mer 72 bath. Treatment and curing times and temperatures are also the same.

Other types of sheet material have been found to be advantageous in certain instances. For example, to impart a different appearance to the garment as shown in FIGURE 7, a layer of cellular material **30** is secured to a layer of woven fabric **31** such as nylon, cotton, or tricot. The air permeability feature of the garment is retained and it is constructed in substantially the same manner as described above. The fabric **31** may be bonded to the polymeric cellular material **30** by thermal fusion or by adhesive, such as a flexible latex adhesive, applied in a pattern or over the entire surface thereof, as is well-known in the art. The fabric surface is preferably the outside surface although not necessarily so.

Another composite laminated material found to be useful in garments of the invention is shown in FIGURE 8. It is formed by two layers **33** and **34** of polymeric cellular material separated by a porous mesh **35** of thermoplastic material, such as polypropylene. This porous mesh **35** increases the resistance of the composite fabric to wetthrough since any moisture penetrating the first cellular layer **33** will be halted by the gap, between it and the next cellular layer **34**, created by the mesh layer **35**. The cellular material shown in each of FIGURES 7 and 8 is unreticulated open-celled polyurethane foam but, in some instances, is more preferably reticulated polyurethane foam to give greater porosity and ease of cleaning.

FIGURE 5 shows one type of disposable absorbent diaper pad adapted for use with the invention. It comprises a plurality of layers of crepe wadding **26** arranged in overlying relationship to each other. A covering layer

27 of nonwoven material is disposed over the uppermost sheet of crepe wadding and has its overlapping longitudinal side margins extending around the longitudinal sides of the layers of crepe wadding, folded over and secured to the elongate side margins of the bottom layer of crepe wadding, as by adhering. The central portion of the bottom layer of crepe wadding is preferably left open and exposed.

Upon contact of this pad with solution, the crepe wadding disintegrates into small clumps of fibers and the nonwoven layer is left having small bulk and being quite flexible and disposable. Other types of diaper pads can also be used including cloth diapers and disposable diapers of the composite type incorporating crepe wadding and fluffed wood pulp.

FIGURE 6 illustrates a panty or garment of the invention retaining therein a disposable diaper pad. It can be seen that, when in position on a wearer, the pad extends along the central portion from front to rear and rests on the inner surface of the garment within the channel or pouch formed by the upturned side edges 11 and 12.

During use, the diaper pad is held in place within the garment by friction created between the inner surface of the garment and the disposable pad. The surface of cellular material of the type contemplated for use in the invention is quite uneven although being very soft for acceptable contact with a wearer's skin. Thus, FIGURES 7 and 8 show that the surface of the open-celled foam is uneven and rough and would tend to grip a diaper pad. The surface of reticulated foam such as polyurethane has even greater frictional characteristics and is therefore more preferred since it has strand members 23 engaging the surface of the pad. It is also somewhat softer than the open-celled form of foam since the reticulated foam is more flexible and is not stiffened by membranes over the cell faces.

The reticulated foam material is preferred for use herein since it facilitates cleaning of the soiled garment. As can be seen from FIGURES 3 and 4, the open-celled foam allows flushing of each of the cells with liquid during cleaning. However, the reticulated variety is substantially free from membranous material and that structure is thus more open and easier to clean.

What we claim is:

1. A garment adapted to retain a disposable diaper pad adjacent to and in contact with the perineal region of a wearer, comprising an elongate body portion having cooperating fastener means secured to respective corners thereof for effecting securement of the corners at the ends of each respective longitudinal side edge to each other, said body portion comprising a sheet of flexible polymeric cellular material, said polymeric cellular material being treated to increase its hydrophobicity, and strips of elastic material extending along at least a portion of each respective longitudinal side edge and secured thereto, said sheet of flexible polymeric cellular material forming the elongate body portion being in compression along at least portions of its longitudinal side edges, said compression being in a direction parallel to those edges, respectively.

2. A garment according to claim 1, wherein said polymeric cellular material contains a silicone composition on at least portions of its surface, thereby rendering it hydrophobic.

3. A garment adapted to retain a disposable diaper pad adjacent to and in contact with the perineal region of a wearer, comprising an elongate body portion having cooperating fastener means secured to respective corners thereof for effecting securement of the corners at the ends of each respective longitudinal side edge to each other, said body portion comprising a composite laminate including two layers of flexible polymeric cellular material separated by a layer of thermoplastic material in the form of an open, porous mesh, all of said layers being secured together, and strips of elastic material extending along at least a portion of each respective longitudinal side edge and secured thereto, said composite laminate forming the elongate body portion being in compression along at least portions of its longitudinal side edges, said compression being in a direction parallel to those edges respectively.

4. A garment according to claim 3, wherein said thermoplastic material comprises polypropylene.


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