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P. STAMBERGER

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DIAPER

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FIG. 1.

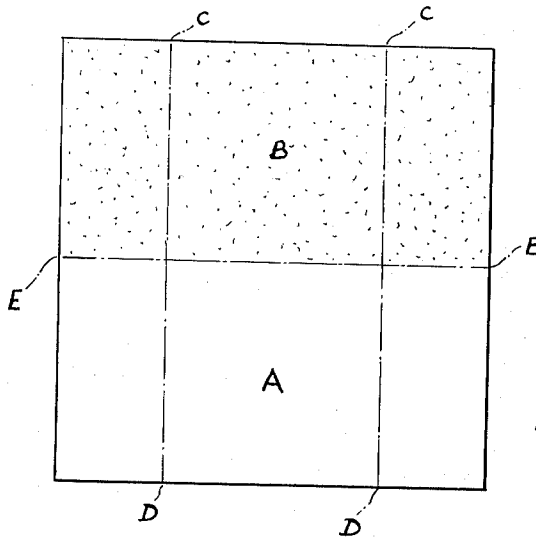


FIG. 2.

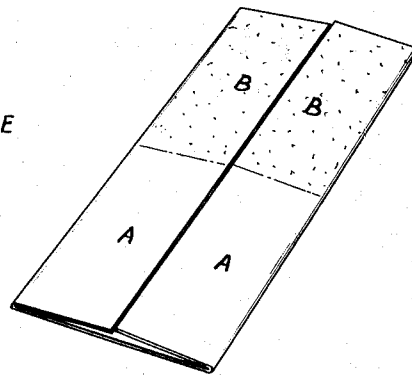


FIG. 3.

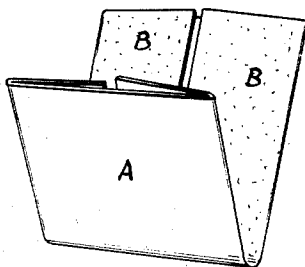
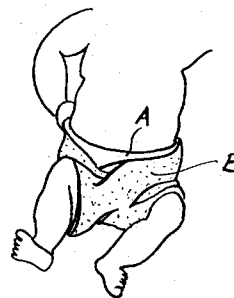


FIG. 4.



INVENTOR.

PAUL STAMBERGER

BY

Mock & Blum

ATTORNEYS

UNITED STATES PATENT OFFICE

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Paul Stamberger, Stamford, Conn.

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4 Claims. (Cl. 128—287)

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The present invention relates to an air permeable diaper.

Up to the present diapers have been made to absorb the infant's urinary fluid from an absorbent material, such as cotton fabric and the like. Such diapers have the disadvantage of being saturated quickly with the above liquid, which strikes through easily to other wearing apparel. To prevent wearing apparel and bed clothes from becoming wet and soiled, it has been suggested to use flexible water-proof material, such as latex, flexible rubberized fabric, jap silk, cellophane. The water-proof part is used over the absorbent material. It has been also suggested to have this water-proof material perforated to allow some circulation of air.

The present invention is based upon the discovery, that a greatly improved diaper can be produced, which will prevent wetting through, without substantial reduction of air permeability and porosity.

One of the primary objects of the present invention is to produce a permanent diaper, which can be repeatedly used, cleaned or laundered, without changing the water resisting property.

Another object of the present invention is to make a disposable diaper or a diaper lining, to be discarded after a single use.

Figure 1 is a plan view of the device.

Figures 2 and 3 are perspective views of the device folded and ready to be applied to an infant.

Figure 4 is a perspective view of the device as applied to an infant.

The diaper, according to the present invention consists in principle of two parts or sections. These parts or sections differ with respect to the uptake of the watery fluid. One part has the capability of rapid water adsorption, which will be called in the following "absorbing" section. The other part has such a nature, that the water absorption is retarded, at least to such an extent, that during normal use no penetration of the urinal fluid will take place. This section will be called in the following "retarding" section.

A diaper made according to the present invention absorbs the urinary fluid, but the "retarding" section is not saturated, consequently no penetration of the liquid through the diaper to other wearing apparel takes place. The diaper of the present invention will not prevent or substantially retard the circulation of air or the evaporation of water and will not cause any discomfort or irritation on the infant's tender

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skin, frequently noticeable when water-proof garments are used.

According to the present invention the improved air permeable diaper is made of an "absorbent" part, which is capable of being rapidly saturated with water, and a section or part which is resistant to the absorption of water, to at least such a degree, that it will not wet through during normal use.

The absorbent part can be made from any type of material capable of soaking up liquid and in any convenient shape or size.

The retarding section can also be made from the same or similar material in any convenient shape or size. To prevent rapid saturation with urinary fluid, this part must, however, be treated in a definite manner, to make this section water resistant without impairing the porosity and air permeability. Water or urinary fluids of high surface tension will not wet such a treated surface and will only show penetration by application of pressure without absorption by the fibers. Such a treated surface will not soak up a water solution of high surface tension during its use, it will be, however, easily wetted by a soap solution, or solutions of low surface tension, consequently it can be easily cleaned or laundered.

The fact, that the surface will be wetted by, and the material is absorbent for a soap solution can be used to test and also to demonstrate, that the porosity and permeability of the material remained substantially unchanged after the treatment.

The porosity and the size of the pores of the "retarding" section must be, however, kept within certain limits. If the size of the pores is above such a limit, even if the surface is not wetted, water will flow unhindered through. The limit for the size of the pores also depends on the type of treatment performed on the material of the "retarding" part and can be determined by experiments. Any convenient type of measurement for permeability, such as the standard hydrostatic test of the American Association of Textile Chemists and colorists can be used. This test consists in measurement of the water level, which will force water through the openings of the fabric. Satisfactory results were obtained with a product capable of resisting pressures of 5 to 100 mm. Products which resisted over 20 mm. pressure were found to be most suited for the purpose of this invention. Satisfactory results were obtained with material with a porosity over 30%, better results were, however obtained with porosities of 50% or higher.

The treatment of the "retarding" section must be carried out in a manner, that no substantial reduction in the porosity takes place. No substantial resistance should be observed when passing liquids through of low surface tension, such as a 3% solution of sodium laureate in water, or a commercial soap solution. In general solutions of low surface tension, such as 30 dynes per cm. should permeate the "retarding" part easily. A drastic change in the permeability would take place, had a continuous film formed on the surface.

It is advantageous to make the "absorbing" part or section from a material of good absorbing property and porosity and of good wetting property for water. The "retarding" part or section can either be made from the same material, or from material of lesser porosity and absorbing property. When cotton fabric is used, for example, the "retarding" section can be a tighter woven or knitted fabric. The retarding part can also be made from fibers or yarns which have no tendency to absorb water, such as fibers from plastic material, as polyvinyl products, polyamides, glass and the like. Any style or cut can be used for this diaper product, as long as the absorbing part or section, which comes in contact with the infant's body can be placed over the retarding part in actual use.

For making a permanent diaper woven or knitted cotton fabric, either by itself or in combination with a fabric from synthetic nonabsorbing fibers can be used. Instead of cotton or fabric containing cellulose, fabrics made from proteins, such as wool can be considered.

For making disposable diapers or diaper linings paper is a suitable material.

Both the permanent type of diaper and the disposable one consist of absorbing and retarding parts.

To give to the "retarding" section the property essential for the purpose of the present invention, a porous, fibrous material must be treated either chemically or by physical means with a suitable substance. After this treatment the fibrous material or the surface of the non-absorbent yarns became water repellent or water resistant without substantial change in the air or vapor permeability.

The treatment of cellulose containing material will be discussed specially in the following.

A surface treatment, which will withstand the necessary cleaning operation or repeated laundering, for the "resisting" part or section, must be of such a nature, that the surface becomes permanently water resistant. Such a treated surface is essential for a permanent diaper. A suitable method to achieve this result is reacting the cellulose molecule on the surface of the fibers with a hydrocarbon radical, for example a long chain paraffin hydrocarbon. An example for such a treatment is the reaction of cellulose with the halogen derivatives of long chain fatty acids, such as stearyl thiocyanate, chloride, bromide and the like, resulting in the formation of esters with the hydroxyl radical of the cellulose molecule. Such a product will not be wetted any more by water, will resist absorption, although the pore structure is substantially unchanged. Another method to obtain satisfactory water resistance for the "resisting" section, is the treatment with alkyl-chloro-silicones, such as methyl or dimethyl-silicone chlorides. These silicone compounds form a water repellent alkyl silicone polymer after decomposing in the presence of

water. Other silicone derivatives suitable for such a treatment are the tertiary-alkyl-amino-silanes. In general, treatment resulting in permanent water resisting, but porous, surface is satisfactory. The most satisfactory treatment results in products with maximum water resisting property with minimum change in the porosity or pore volumina.

A product treated in the above manner, although retaining its porosity will not absorb water, if a drop is brought on the surface. Such a treated surface will not be wetted by water, and a drop will not spread out, although it will be wetted and be absorbent in contact with a soap solution.

In making the "retarding" sections for disposable diapers or for diaper linings a chemical compound can be deposited on the surface of the fibres. After this treatment such a surface will become water repellent. An example for such a treatment is the impregnation of water absorbing paper with a soap solution, for example ammonium laureate and rendering the lauric acid insoluble by forming a salt with a bi- or tri-valent metal. Instead of the fatty acid, naphthenic acid can also be used. The behavior of the surface treated in the above manner will be similar to that of a treated cotton fabric, as already referred to.

The amount of such a water repelling material deposited on the surface, or formed on the surface of the fibers, must be limited to such quantities that no substantial decrease of the porosity shall take place and furthermore no continuous film can form. It is advantageous not to reduce the porosity with more than 10 to 30% of the original porosity.

A preferred form of the diaper in accordance with the present invention is illustrated in the drawings, in which A presents the absorbent section and B the water-repellant section, these sections as shown, practically dividing the sheet into substantially equal parts, the transverse line E—E indicating the dividing line between the two sections. Since the sheet requires folding to produce the multi-ply effect, the sheet dimensions are such as to permit the needed folding action to produce the folded assembly as having the dimensions desired for actual service use.

Due to the fact that the absorption section provides the inner ply of the assembly, it is apparent that the folding must take place in a particular regimen to secure this result. Hence, in practice, the sheet is first folded on lines which extend parallel with the longitudinal axis of the sheet, the direction of lines C—D. The particular distance of these lines from such axis will depend upon the width required for the securing of the diaper in position. Folding on these lines does not disturb the relation of sections A and B relative to each other, the overlying portions being of the same section as the underlying portions. The section A is then folded to overlie section B to permit positioning of the infant on the absorbent section. The diaper is then properly drawn about the infant and pinned as usual.

A disposable diaper or diaper lining, according to the present invention, can also be manufactured in one plane, whereby the retarding section has to be folded below the absorbent one. Such a diaper can also be made from laminated material.

The term water resisting or resistant is used in accordance with the technical literature. Water resistant means: resistant to water and

porous to air (see Herbert P. Pearson, Water Proofing of Textile Fabrics, New York 1924, page 8). For the purpose of the present invention material with substantial porosity and with hydrophobic surface properties are suitable. The softness of such a material must not be impaired by treatment.

The air permeable diapers, as described hereby, can be used either by themselves, or with a panty type air permeable garment. Such a garment can be made from a water resisting cotton fabric, or to facilitate cleaning, from fabrics woven or knitted of water non absorbing yarns, such as nylon or saran yarns. The surface of the latter must be rendered sufficiently water resistant or hydrophobic not to allow any penetration of watery liquids during regular use.

I claim:

1. An infant's diaper adapted to be folded upon itself to form a multi-ply formation, said diaper comprising a single-ply sheet of soft, porous, water-absorbing material dimensioned to permit folding to produce a multi-ply formation, said sheet having a predetermined portion of its length treated to render said portion water-repellant with the remaining portion unaffected by the treatment, said treatment being ineffective to materially vary the softness and porosity of the material of the treated portion, said treated portion being so located that when the diaper is folded for service the water-repellant portion overlies and forms a cover for the absorbent portion.

2. A diaper as in claim 1 characterized in that the sheet is initially of integral fibrous material of soft, porous and water-absorbing characteris-

tic and rendered serviceable for diaper usage by treatment of one of its end zones to render the fibres of substantially half the length of the sheet water-repellant while maintaining the sheet porosity unaffected.

3. A diaper as in claim 1 characterized in that the treated and the absorbent portions of the sheet are of substantially equal-sized dimensions and positioned to divide the sheet length transversely into respective end-sections, regimen-folding of the sheet into service formation serving to position the absorbent section as the inner ply of the formation with the water-repellant section as the outer ply of the formation.

4. A diaper as in claim 3 characterized in that the folding regimen involves an initial folding on a pair of lines parallel with the longitudinal axis of the sheet and intersecting such transverse division between sections to thereby retain the sectional relation of the sheet portions so folded, and then folding such folded sheet on or parallel with the transverse division line separating the sections to position the absorbent section as internal of the water-repellant section.

PAUL STAMBERGER.

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