ABSTRACT OF THE DISCLOSURE

A plied fabric having high water resistance durable to repeated laundering. The fabric comprises at least two layers each formed from a woven fabric which is resistant to standing water and is air and vapor permeable.

This application is a continuation-in-part of application Ser. No. 361,904, filed Apr. 22, 1964, now abandoned. This invention relates to panties to be worn by infants, and more specifically to plied fabric suitable for use in the construction of adults' or children's panties.

Hereofby baby panties of the type which are suitable for being worn over diapers were prepared from plastic or rubber sheet material or from a plied material consisting of plastic or rubber sheet plied with a textile fabric. Such materials, while providing satisfactory water-proof properties, are easily cracked and ripped in laundering operations and are unhealthy due to the air and vapor impermeability of the plastic or rubber sheet material. It is known, for instance, that the principal cause of heat and diaper rash is the formation of ammonia compounds in diaper moisture. These ammonia compounds are known to form most quickly and to persist in most harmful concentrations where there is improper circulation of air through the diaper.

It is therefore an object of this invention to provide a fabric suitable for the construction of baby panties which is both highly water resistant and air and vapor permeable. It is another object of this invention to provide a fabric suitable for the preparation of baby panties which is highly water resistant, air and vapor permeable and durable to repeated laundering operations.

These and other objects will become apparent from the following description of the invention and of the preferred embodiments thereof. It has now been discovered that a plied fabric suitable for use in the preparation of baby panties may be prepared by plying at least two layers of fabric which are individually resistant to standing water and have an individual air permeability of from about 0.5 to about 150.0, and an individual vapor transmission of from about 50 to about 550 and preferably an air permeability of from 3.0 to 110 and a vapor transmission of from about 50 to about 450. The plied fabric should have an air permeability of from 0.5 to 110.0, a vapor transmission of from about 50 to about 450 and preferably an air permeability of from 3.0 to 10.0 and a vapor transmission of from 100 to 450. It should be understood that the fabrics used in the plied construction need not be identical fabrics, but need only pass the standing water test and have an air permeability in the range as previously given. Preferably, the inner or outer adjacent fabric of the plied has an air permeability of from about 0.5 to about 20.0 and a vapor transmission of from 150 to 450 while the outer fabric has an air permeability of from about 0.5 to about 45.0 and a vapor transmission of from about 100 to about 550. It should be noted that rubber or plastic panties have zero air permeability.

The air permeability as called for herein is an air permeability determined according to ASTM Designation D737-46 which is carried out substantially as follows:

A 10 inch by 10 inch fabric sample is mounted over a circular orifice with sufficient tension to draw the fabric smooth. Air is drawn through the known area of the fabric and through a calibrated flow meter. The pressure drop across the fabric is adjusted to 0.5 inch of water and the reading of the flow meter recorded. The volume of air passing through the fabric is then calculated and expressed as the air permeability of the fabric in cubic feet of air per minute per square foot of fabric at a 0.5 inch of water drop in pressure. The test is carried out under standard atmospheric conditions at 70° F. and a relative humidity of 65 percent.

The vapor transmission as called for herein is determined as follows:

Into a previously weighed aluminum cup is placed 60 g. of tap water. The sample to be tested is then secured over the mouth of the cup in an airtight manner by means of a rubber band. The cup is then placed in an oven at 60° C. for 16 hours (Precision Scientific Oven), removed and the weight of the water lost is determined by suitable weighing procedures. The numerical value for the vapor transmission is obtained by multiplying the weight of water lost due to evaporation by the figure 15.6 and the result is the grams of water per hour per square yard lost in evaporation or vapor transmission.

The standing water test as called for herein is carried out substantially as follows:

A circular piece of the fabric to be tested, 3 inches in diameter, is layered between two vertical cylinders (2½ inches inside diameter) and the cylinders are joined together with the use of a gasket. The cylinders must be open at both ends in order to equalize atmospheric pressure. The fabric sample exposed to the column of water is 2½ inches in diameter. 250 cc. of tap water at 86° F. is gently poured over the fabric and allowed to run down the sides. The cylinder of water is allowed to stand against the fabric for 3 minutes. A fabric is considered acceptable if there is no water penetration.

A dynamic pressure test is used to determine the ability of the baby panties to resist the penetration of water and is carried out substantially as follows:

The sample (10 x 13) to be tested is placed on top of 2 layers of 8½ x 11 blotting paper (AFCO standard paper) weighing approximately 47 grams. Superimposed on the test sample are 4 layers of heavy weight, 8½ x 11 birdseye diaper material. The weight of the 4 layers is approximately 30 grams. On top of the diaper material is poured, with a dropping funnel, approximately 110 grams of water at 30° C. to 35° C. The water is allowed to stand for approximately one minute, then a brass weight, cylindrical in shape, 5 inches in length and 2½ inches in diameter, and weighing approximately 8 lbs. is rolled (by hand or machine) back forth and forth approximately 90 complete traverses. After the period of rolling is over, the blotting paper is weighed to determine how much water has penetrated through the test sample. The brass weight simulates the weight of a baby and exerts a pressure of 5 lbs. per square inch. It is estimated that a baby which weighs 26 lbs. would exert approximately 0.5 lbs. per square inch. As such, the test as set forth herein is more rigorous than the test as set forth herein as opposed to a baby. The rolling of the brass weight simulates the movement of the baby. The amount of water placed on top of the test diaper material is approximately two times more than the amount of urine that is normally exuded by a baby on diapers. The fabric weighs approximately less than 5 grams of water by this test is suitable for the preparation of water resistant baby panties.
It is known that a correlation exists between air permeability and the dynamic pressure tests. In general, a plied fabric prepared from individual fabrics having an air permeability of from 0.5 to 110.0 g/hr./yd. will pass the dynamic pressure test. It is preferred that the plied fabric made from single fabric layers meeting the aforementioned physical tests have an air permeability of from 3.0 to 10.0.

The fabrics employed in the plied fabric system of this invention are either composed of fibers which are hydrophilic in themselves or are composed of fibers which are subsequently rendered hydrophobic by suitable coating operations, the latter category including the blends of hydrophilic and hydrophobic fibers which are subsequently rendered hydrophobic in their entirety by suitable coating operations. Coating operations employed herein must be coating operations such as will not render the interstices of the fabric impermeable to air but be coating operations which are resistant to repeated laundering and dry cleaning operations. One type of coating composition which has been found to be especially suitable for purposes of this invention is the fluorocarbon chemical type textile finish which is marketed under the trademark "Scotchgard" by Minnesota Mining & Manufacturing Company. The coating composition may be applied by any of those well-known methods of the coating art such as for instance padding, spraying, immersion and the like.

The fabrics employed in the plied fabric of this invention may be made of any fibrous material which is hydrophobic or capable of being rendered hydrophobic. Fabrics which have been found to be especially suitable for purposes of this invention are cotton, rayon, polyester and blends thereof; cotton being the preferred fiber.

The plied structure consisting of two or more separate contiguous layers of fabric may be unified by simply stitching the layers together or by laminating by means of a suitable discontinuous adhesive coating. The adhesive coating is preferably of the flexible cross-linking type such as for instance certain of the acrylic adhesives.

The following specific examples of the preparation of the plied fabrics of this invention are given for purposes of illustration and should not be considered as limiting the spirit or scope of this invention.

**EXAMPLE I**

Cotton 136 x 64 broadcloth (40's warp, 30's filling yarn) is treated with the following aqueous formula with percentages being given as pickup based on the dry weight of fabric:

- **Aerotex 23 Special** (triazine thermosetting resin marketed by American Cyanamid Co.) —— 6.00
- **FC 208** (polymeric fluorocarbon marketed by Minnesota Mining and Manufacturing Co.) —— 2.00
- **Cationic softener** —— 0.07

The fabric is dried, cured at 320° F. for 1 minute and washed with a nonrewetting detergent. Two pieces of the above treated fabric are plied together and sewn into baby panties.

**EXAMPLE II**

Cotton 144 x 76 broadcloth (50's warp, 30's filling yarn) is treated with the following aqueous formula with percentages being given as pickup based on the dry weight of fabric:

- **Aerotex 23 Special** (triazine thermosetting resin marketed by American Cyanamid Co.) —— 6.00
- **FC 208** (polymeric fluorocarbon marketed by Minnesota Mining and Manufacturing Co.) —— 2.00
- **Cationic softener** —— 0.07

The fabric is dried, cured at 320° F. for 1 minute and washed with a nonrewetting detergent. Two pieces of the above treated fabric are plied together and sewn into baby panties.

**EXAMPLE III**

One layer of 136 x 64 broadcloth (Example I) and one layer of 144 x 76 broadcloth (Example II) are plied together and sewn into panties.

**EXAMPLE IV**

Cotton 136 x 64 broadcloth (40’s warp, 30’s filling yarn) is treated with the following formula based on the dry weight of fabric:

- **Aerotex 23 Special** (triazine thermosetting resin marketed by American Cyanamid Co.) —— 6.00
- **FC 208** (polymeric fluorocarbon marketed by Minnesota Mining and Manufacturing Co.) —— 1.75
- **Argus DWR Special** (reactive methylol urea type water repellent marketed by Argus Chemical Co.) ——— 0.40

The fabric is then dried, cured at 350° F. for 1 minute and washed.

Two pieces of the above treated fabric are plied together and sewn into baby panties.

**EXAMPLE V**

Cotton 144 x 76 broadcloth of the type employed in Example II is knife coated with SE 100 silicone rubber (a long chain dimethylsilanediol polymer marketed by General Electric Co.) to produce a thin discontinuous film of rubber and then related with the following aqueous formula based on the dry weight of fabric:

- **Rhonite D12** (heterocyclic nitrogenous resins marketed by Rohm & Haas Chemical Co.) —— 7.0
- **FC 208** (polymeric fluorocarbon marketed by Minnesota Mining and Manufacturing Co.) —— 1.8

Thereafter, the fabric is dried, cured at 350° F. for one minute and washed.

Two pieces of the above treated fabric are plied together and sewn into baby panties. The panties have air permeability and vapor transmission properties similar to the panties of the preceding examples. The panties pass the dynamic pressure test after 100 washes.

The silicone rubber and resin-fluorocarbon treatments may be performed in reverse order with similar results.

The above description, drawing and examples show that the present invention provides a plied fabric having high water resistance. Moreover, the plied fabric of the invention retains such high water resistance even after repeated launderings of 100 or more times.

What is claimed is:

1. A baby panty having a high water resistance which is durable to repeated launderings, said panty comprising a plied fabric of at least two layers each of which is formed from a woven fabric with at least a 136 x 64 construction and each of said fabric layers having been treated with a fluorochemical type textile finish and a resin and being resistant to standing water and having an air permeability from about 3 to 110 and a vapor transmis-
sion from about 50 to about 450 and said plied fabric
having an air permeability from about 3 to 10 and a
vapor transmission from 100 to 450.

2. The baby panty of claim 1 wherein said fabric is
a cotton 144 x 76 broadcloth fabric.

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CHARLES F. ROSENBAUM, Primary Examiner.

U.S. Cl. X.R.
UNIVERS STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,439,678
Dated April 22, 1969

Inventor(s) Manuel A. Thomas

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In Column 4, Example III, line 2, delete "broadcloth"; in Example V, line 5, insert --treated-- and delete "related".

SIGNED AND SEALED
JUN 16 1970

(SEAL)
Attest:
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