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DISPOSABLE DIAPER

This invention relates to a disposable diaper having a leakproof seal means.

Various leakproof designs for disposable diapers have hitherto been proposed. A typical group of them, as disclosed in Japanese Patent Publication No. 40267/1977 and Japanese Patent Laid-Open Nos. 115939/1979 and 120045/1977, form gathers along the both edges of a disposable diaper by elastic members fitted to the edges longitudinally of the diaper so as to keep the diaper in intimate contact with the thighs of the wearer and minimize the leakage of excretions. Another seal design taught in Japanese Patent Laid-Open No. 35002/1982, uses water-absorptive, shrinkable fiber strings which contract on wetting, along the edges longitudinally of a disposable diaper so as to fit the diaper tightly to the wearer and minimize the leakage.

These leakproof designs of the prior art have disadvantages, however. The seal means of the former group, which utilize the elastic shrinking forces of

elastic material such as rubber, have to be pressed against the thighs of the wearer tightly enough to avoid urine leakage. Too tight fastening often results in reddish inflammation, irritation, or injury of the thighs. In addition, the close contact of the diaper tends to make the skin hot and moisty.

The latter design also has the disadvantage of inviting frequent leakage of feces when the wearer evacuates the bowels, discharging especially watery or loose feces, before urination. This is because the water-absorptive, shrinkable fiber strings cannot gather the edges of the diaper unless they are wet with urine.

With the view to overcoming these disadvantages of the two prior art concepts, the present inventors have made intense studies and have now arrived at this invention.

The present invention provides a disposable diaper comprising a liquid-permeable surface sheet, a liquid-impermeable backing sheet, and an absorbent pad sandwiched between the two sheets, characterized in that water-absorptive, shrinkable fiber strings, which contract lengthwise on contact with water and are rendered stretchable, are secured to the two sheets, extending midway longitudinally of the diaper in parallel along, but without overlapping, the both edges of the pad, the edge

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portions of the surface sheet outside the water-absorptive, shrinkable fiber strings and the surface sheet position on the absorbent pad being partly bonded together at two spots about halfway of the length, the distance between the two bonded spots being at least 50 mm and the bonded spots themselves being 10 to 50 mm long each, and elastic, stretch members, at least 70 mm long each and having a combined elastic force or tensile strength (the weight equivalent to the force required to stretch the diaper including any shrank portions thereof up to the total diaper length) of 20 to 600 g, are provided midway and longitudinally of the both edge portions of the diaper at least 5 mm outside the both bonded spots.

According to a further aspect of the invention there is provided a disposable diaper comprising:

- a liquid permeable surface sheet having a length greater than its width,
- a liquid impermeable backing sheet of similar size and shape to the surface sheet,
- an absorbent pad sandwiched between the two sheets and of smaller size than the two sheets and spaced from the longitudinal and transverse edges thereof, a water-absorptive shrinkable fibre string secured to complementary facing surfaces of each of the sheets, of shorter length than the pad and positioned between the pad and each of the associated longitudinal edges of the sheets,
- a longitudinal fold in said sheets, one to each side of said pad, with a first portion of the surface sheet

- outside the string contacting a second portion of the surface sheet which overlies the pad, said portions being secured together over a length of between 10 and 50 mm, with a gap between the secured portions of at least 50 mm and, elastic stretch members of length at least 70 mm and having a combined elastic force or tensile strength of between 20 g and 600 g and spaced at least 5 mm from said secured portions longitudinally of said diaper and between the secured portions and the associated longitudinal edge.

Brief Description of the Drawings:

Fig. 1 is a perspective view of an embodiment of the disposable diaper of the invention; Fig. 2 is a sectional view taken along the line A-A of Fig. 1; and Figs. 3 and 4 are sectional views of other embodiments, respectively.

1 ... surface sheet

2 ... backing sheet

3 ... gathers

3' .. elastic, stretch member

4 ... leg spot

5 ... water-absorptive, shrinkable fiber string

6 ... tape fastener

7 ... absorbent pad

8 ... pocket

The invention will now be described in more detail in connection with embodiments thereof shown in the accompanying drawings.

Fig. 1 is a perspective view of an embodiment of the disposable diaper of the invention, Fig. 2 is a sectional view taken along the line A-A of Fig. 1, and Fig. 3 is a sectional view of another embodiment.

The disposable diaper embodying the invention comprises a liquid-permeable surface sheet 1, a liquid-impermeable backing sheet 2, and an absorbent pad 7, with two strings 5 of a fiber, which contracts lengthwise

on contact with water and is rendered stretchable, secured to the two sheets in parallel along, but without overlapping, the both edges of the absorbent pad 7. The edge portions of the surface sheet outside the water-absorptive, shrinkable fiber strings 5 and the surface sheet portion on the absorbent pad 7 are partly bonded together at two spots halfway of the length. These bonded areas 4 are referred to herein as leg spots. Between the superposed sheet portions farther outside the leg spots, there are secured two elastic, stretch members 3' designed to provide elastic gathers 3 outside these spots.

This disposable diaper is aimed at absorbing the urine and feces of the wearer without any leakage outside or excessive pressure upon the skin. The functions of the diaper will now be explained. The leg spots 4 combine with the elastic gathers 3 to form pockets 8 in the diaper between the buttocks and thighs of the wearer. The pockets prevent leakage of feces out of the diaper while the latter is not wet with urine. In case of urination, the water-absorptive, shrinkable fiber strings 5 prevent the leakage out of the diaper edges facing the thighs of the wearer. The elastic gathers 3 have to be just tight enough to form the pockets. Since the diaper uses no highly elastic stretch member, the pressure to be exerted upon the skin of the wearer is negligible,

and leakage of urine and feces out of the diaper is avoided.

It is important here to form effective pockets by means of the gathers 3 and the leg spots 4. In attaining this end the location and length of the elastic, stretch members and the length of the leg spots are critical. In order to provide the useful pockets it is necessary that the two leg spots be spaced apart a distance of at least 50 mm and the leg spots be 10 to 50 mm long each. Also, the distance (a) between each leg spot 4 and the associated elastic, stretch member 3' must be at least 5 mm. If the distance is less than 5 mm, the resistance of the leg spot will render it difficult to form effective gathers in its neighborhood. Moreover, the resulting pocket will be so shallow and small that frequent leakage will result.

As regards the length of the elastic, stretch members, too short members will fail to form pockets which effectively prevent leakage of feces. The members should, therefore, have a length in a stretched state of at least 70 mm, preferably not shorter than 100 mm.

Another important factor is the elasticity of the elastic, stretch members. Closely related to the pressure upon the skin, the elasticity should be the lowest possible for the diapered person. Thus, it should

be at a minimum required for forming effective gathers. In this respect the diaper of the invention, which utilizes water-absorptive, shrinkable fiber strings, need no elastic gathers for preventing urine leakage but gathers just enough for forming pockets. Only slightly elastic, stretch members are needed. In connection with the pressure upon the skin, a diaper having a tensile strength of more than 600 g when stretched will make the wearer uncomfortable. On the other hand, a strength of at least 20 g is required for the purpose of gathering. Any material which has such a tensile stregth may be used for the elastic, stretch member.

It is preferable that the strength of the elastic, stretch member be in the range of 20 to 100 g. In this preferable embodiment, it may be made of ordinary natural rubber, urethane rubber, or any other elastic material. Among the useful members, the most desirable is one formed of fine urethane filaments matted into nonwoven cloth and elasticized by the spun bond method. Such a

member is the best as it is soft to the touch and yet forms effective gathers.

Another preferable range of the tensile strenth of the elastic, stretch member is from 50 to 600 g when stretched. More preferably, it is from 20 to 150 g when it is elongated by 20 percent. A material suitable for this preferable embodiment is polyurethane, polybudiene, a copolymer of ethylene and vinyl acetate, modified polyethylene and a composition containing any of the beforegoings, for example in form of a sheet or foamed sheet.

The elastic, stretch member is preferred to have a width of 4 mm or larger, especially 5 mm or larger. For example the width of 4 to 40 mm is practicable to lessen the pressure on the skin of the user.

If the water-absorptive, shrinkable fiber strings are located close to the absorbent pad, they can be kept

from shrinking by the pad. In order to attain more effective shrinkage, the strings must be kept at a certain distance away from the pad. For the intimate contact of the diaper with the skin of the wearer by dint of the shrinkage of the water-absorptive, shrinkable fiber strings, the distance (b) between each edge of the absorbent pad and the associated string should be at least 10 mm. This spaced relation is helpful in avoiding the leakage of urine out of the diaper edge.

The water-absorptive, shrinkable fiber strings so far described are effective if they are made up of twisted yarns of a carboxymethylcellulose, hydrolyzed acrylic fiber or the like as disclosed in Japanese Patent Laid-Open No. 35002/1982. Desirably, the water-absorptive, shrinkable fiber strings are provided with means for conducting urine out of the absorbent pad into the strings.

While preferred embodiments of the disposable diaper of the invention have been described, it is to be understood that the invention is not limited thereto but various modifications may be made within the scope of the invention.

Examples 1 to 4 and Comparative Example 1

As shown in Fig. 4, a diaper was made by placing an absorbent layer 11 having 150 mm width and 380 mm length at the center on a polyethylene sheet 10 having 300 mm width and 430 mm length; placing an elastic, stretch member 12 each 22 mm inside of the edge of the polyethylene sheet; placing a water-absorptive, shrinkable fiber string 13 each 40 mm inside of the member; covering the resulting assembly with a non-woven sheet 14 having the same size as the polyethylene sheet, folding both non-woven sheet and polyethylene sheet each at 68 mm inside of either edges thereof and making the adhesion between each other at two positions each at 25 mm inside of the folding position. The elastic, stretch member is listed in Table 1 in way of material. It each had a an elastic length of 100 mm.

Table 1

material No.	material	width of the member	when stretched at the maximum elongation percent	when stretched at the maximum elongation elastic force	when stretched at 20 % ealstic force
1	polyethylene composite film	15 mm	44 %	310 g	90 g
2	polyethylene composite film	15 mm	45 %	440 g	180 g
3	polyethylene composite film	10 mm	42 %	130 g	45 g
4	the same as 3	5 mm	35 %	65 g	25 g
5	modified polyethylene film	20 mm	62 %	640 g	120 g

The materials 1 to 3 are each available from Right Co with grade number of 15040, 82035 and 15030, respectively. The material 5 is Tafmer P, a tradename of Mitsui Petroleum Chemical Co., Ltd.

Each obtained diaper was put on babies having M size, 10 babies of the body weight of 5 to 7 kg, 10 babies of 7 to 9 kg and 10 babies of 9 to 10 kg. The babies were observed on the skin where the diaper had attached to after 3 hours had passed. Results are shown in Table 2 with the number of babies who had the marks in red of the diaper.

Table 2

	material No.	influence on the skin		
		the babies of 5–7 kg	that of 7–9 kg	that of 9–10 kg
Example 1	1	0	0	0
Example 2	2	1	0	1
Example 3	3	0	0	0
Example 4	4	0	0	0
Comparative Example 1	5	0	2	5

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CLAIMS

1. A disposable diaper comprising a liquid-permeable surface sheet, a liquid-impermeable backing sheet, and an absorbent pad sandwiched between the two sheets, characterized in that water-absorptive, shrinkable fiber strings, which contract lengthwise on contact with water and are rendered stretchable, are secured to the two sheets, extending midway longitudinally of the diaper in parallel along, but without overlapping, the both edges of the pad, the edge portions of the surface sheet outside the water-absorptive, shrinkable fiber strings and the surface sheet portion on the absorbent pad being partly bonded together at two spots about halfway of the length, the distance between the two bonded spots being at least 50 mm and the bonded spots themselves being 10 to 50 mm long each, and elastic, stretch members, at least 70 mm long each and having a combined elastic force or tensile strength (the weight equivalent to the force required to stretch the diaper including any shrank portions thereof up to the total diaper length) of 20 to 600 g, are provided midway and longitudinally of the both edge portions of the diaper at least 5 mm outside the both bonded spots.

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2. A disposable diaper as defined in claim 1, in which the water-absorptive, shrinkable fiber strings are secured at a distance of at least 10 mm each from the opposite edges of the absorbent pad.

3. A disposable diaper as claimed in claim 1 or 2, in which said combined elastic force or tensile strength is in the range of 20 to 100 g.

4. A disposable diaper as claimed in claim 1 or 2, in which said combined elastic force or tensile strenth is in the range of 50 to 600 g.

5. A disposable diaper comprising

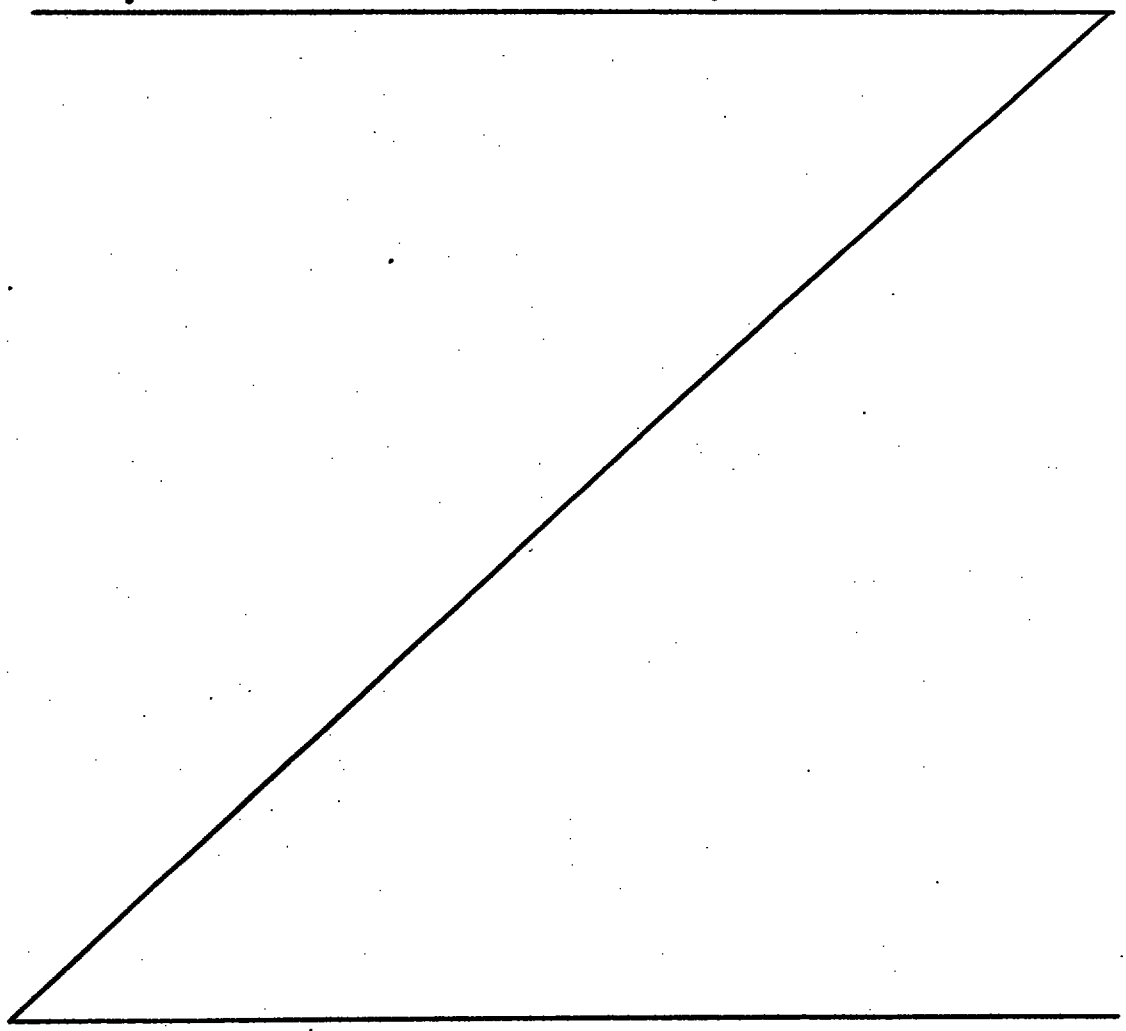
- a liquid permeable surface sheet having a length greater than its width,
- a liquid impermeable backing sheet of similar size and shape to the surface sheet,
- an absorbent pad sandwiched between the two sheets and of smaller size than the two sheets and spaced from the longitudinal and transverse edges thereof,
- a water-absorptive shrinkable fibre string secured to complementary facing surfaces of each of the sheets, of shorter length than the pad and positioned between the pad and each of the associated longitudinal edges of the sheets,
- a longitudinal fold in said sheets, one to each side of said pad, with a first portion of the surface sheet outside the string contacting a second portion of the surface sheet which overlies the pad, said portions being secured together over a length of between 10 and 50 mm, with a gap between the secured portions of at least 50mm and,

* C L M S *

- elastic stretch members of length at least 70 mm and having a combined elastic force or tensile strength of between 20 g and 600 g and spaced at least 5 mm from said secured portions longitudinally of said diaper and between the secured portions and the associated longitudinal edge.

6. A disposable diaper constructed and arranged substantially as herein described with reference to the drawings.

7. A method of making a disposable diaper as claimed in any of claims 1 to 6 substantially as herein described.



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