

DISPOSABLE DIAPERS

The invention relates to disposable diapers or nappies of the type which are in the form of a pair of briefs or pants and which may be used for infants or for incontinence purposes.

Conventional diapers (flat diapers) are generally flat and have an adhesive tape fastener with which to fasten the sides of the diaper together around a wearer. Such diapers are designed so that a wearer can easily put on and/or wear a diaper whilst lying down or another person can easily put the diaper onto the wearer. However, such conventional disposable diapers have the following problems. When the wearer is a highly active infant who has just learnt to walk, it is difficult to ensure that the diaper is put on and/or worn correctly and gaps are often formed around the waist and around the legs. Even disposable diapers of the type having gathered regions, e.g. around the waist and leg areas, for preventing leakage of waste material such as urine and the like, do not operate satisfactorily, and it is practically impossible, in use, to achieve complete prevention of leakage from around the waist and/or legs. Another type of disposable diaper has also been proposed in which a target tape or pad is provided on a flap portion of the waist to which the adhesive tape may be fastened and subsequently peeled off and refastened, so that the position, or fit or tightness, of the diaper can be readjusted whilst the diaper is worn. However, this type of diaper also has the problem that, in use, the tape fasteners are easily accidentally unfastened or loosened, e.g. the wearer

may unknowingly apply stress to the fastener thereby unfastening it and allowing leakage of waste material.

More recently, a disposable diaper called a "brief type diaper" or "disposable pants" has been developed, in which no tape fastener is used and in which the side portions of the diaper are already connected together. The diaper thus takes the form of a convention pair of briefs or pants. An example of such a brief type diaper is described in Japanese Patent Laid-Open Publication No. Sho 58-115106 which discloses a disposable diaper with gathered regions in the parts of the diaper which, in use, will be around the waist and legs of the wearer. Another example of a disposable diaper is described in Japanese Patent Laid-Open Publication No. Sho 62-231005. Here, the diaper has leg holes (leg openings) displaced forwardly from the centre line of the diaper, thereby, in use, preventing gaps forming around the legs of the wearer or the diaper loosening: thus the absorbing ability and general performance of the diaper is enhanced. These brief type diapers are designed so that the wearers can put them on and wear them whilst standing up as with a convention under garment. The diapers are intended not only for the use of young infants who spend the majority of their time lying down but also for older babies and children, e.g. during toilet training, and for the use of incontinent persons, including adults.

However, a problem with these brief type diapers is that it is difficult, whilst putting on the diapers, to spread the legs of the wearer, so that the diaper fits well in the crotch, when the wearer is standing up.

Thus in a brief type disposable diaper, it is practically impossible to provide a sufficiently wide absorbent portion between the legs of the wearer (i.e. a sufficient distance between the elastic in the gathered regions on each side of the inside of the wearer's legs - the "gather pitch") to prevent leakage as effectively as a flat type diaper. As a result, in use, waste material tends to leak out of each side of the crotch region of the diaper because the distance from the part of the diaper into which urine and faeces is discharged to the edge of the diaper is too short. This problem is more severe when the waste material is faeces, because it is not significantly absorbed by the absorbent material of the diaper.

Another problem with these brief type diapers is that, even if faeces is prevented from leaking out when the diapers are being worn, faeces which has already spread, inside the diaper, to the gathered regions around the leg holes, tends to spill out when the diapers are removed.

It is an object of the present invention to provide a brief type disposable diaper having gathered regions around the leg holes which, in use, fit snugly into the inguinal area of a wearer to help prevent the leakage of waste material. It is a further object to provide a diaper which is capable of reliably catching and containing waste material such as faeces which is difficult to absorb.

According to the present invention a disposable diaper in the form of a pair of briefs has a liquid permeable

inner sheet, a liquid impermeable outer sheet and an absorbent layer located between the said sheets and elastic members at the front and rear of the waist of the diaper and around each leg hole of the diaper to gather the diaper at these areas, the diaper further including an elongate liquid permeable liner sheet which extends adjacent the inner sheet over the crotch region of the diaper and whose ends are attached to the inner sheet.

The liner sheet helps to catch and retain faeces and prevent leakage. When, in use, the diaper is removed the faeces may be wrapped in the liner sheet to avoid it spilling out of the diaper.

The gathered regions in the waist and around the leg holes are readily expandable and make putting on the diaper easy and wearing it comfortable. Furthermore, these gathered regions fit closely around the wearer, further helping to prevent the leakage of waste material.

Preferably, an elastic member is located in the region of each lateral side edge of the liner sheet.

The sides of the liner sheet are gathered and lifted from the inner sheet under the influence of the elastic members, thus forming a pocket. The gathered regions of the liner sheet, in use, fit snugly into the inguinal area of the wearer, and faeces is caught and retained in the pocket.

The liner sheet may also be attached to the inner sheet

between the ends of the liner sheet, to increase the stability of the liner sheet. The areas at which the liner sheet are attached to the inner sheet are preferably spaced laterally forwardly from each side edge of the liner sheet, to allow the edges to lift.

Further features of the invention will be apparent from the following description of four specific embodiments of the invention, given by way of example only with reference to the accompanying drawings, in which:-

Figure 1 is a perspective view of a first embodiment of diaper in accordance with the invention;

Figure 2 is a plan view from above of the diaper of Figure 1;

Figure 3 is a section taken on the line III-III of Figure 2;

Figure 4 is a plan view of the diaper of Figure 1, partially disassembled and laid flat;

Figure 5 is a section taken on the line V-V in Figure 4, showing the inner sheet of the diaper deformed;

Figure 6 is a similar view to Figure 5 of a second embodiment of diaper;

Figure 7 is a similar view to Figure 5 of a third embodiment of diaper;

Figure 8 is a perspective view of a fourth embodiment of diaper; and

Figure 9 is a front view of a baby model used in tests.

Referring firstly to Figures 1 to 5, the first embodiment of disposable diaper 1 comprises a liquid permeable top or inner sheet 2, a liquid impermeable back or outer sheet 3, an absorbent layer 4 located between the inner sheet 2 and the outer sheet 3, and

elastic members 7,8. The elastic members 7,8 are arranged to create gathered regions around the top of the front and rear waist portions 5 of the diaper and in the areas 6 around the leg holes of the diaper. The absorbent layer 4 does not extend to the gathered regions 5,6. The diaper is formed from a substantially flat sheet, cut into the shape of a pair of briefs, by bonding together the sides of the front and rear waist portions 5 by means of adhesive, ultrasonic welding, heat welding or the like.

Furthermore, the diaper has a liquid permeable upper surface sheet or liner sheet 9 above the inner sheet 2, the longitudinal ends 9a,9b of the liner sheet 9 being attached to the inner sheet 2 at the top of the waist portions 5, using adhesive, ultrasonic welding, heat welding or the like. The liner sheet 9 is narrower than the distance between the elastic members 8 in the areas around the leg holes 6 and this may be seen when the diaper is laid out flat (see Figure 4). Another elastic member 10 is located at each side edge of the liner sheet 9, so that in the absence of any other constraint, the side edges of the liner sheet 9 are gathered and lifted from the inner sheet 2 to form a pocket 11 (see Figure 5).

The liner sheet 9 is preferably a liquid permeable sheet comprising a woven or non-woven fabric, reticulated sheet or gauze, perforated film or the like. The elastic members 10 are preferably made from natural rubber, polyurethane, urethane foam or the like. They may also comprise a yarn or other material which contracts when wetted by water or the like.

The inner sheet used in the disposable diaper 1 is liquid permeable to allow waste liquid to permeate to the absorbent layer 4 and preferably has a texture similar to that of an ordinary under garment. The liquid permeable sheet may be a woven fabric, a non-woven fabric, a perforated film or the like. To prevent leakage due to permeation of urine, etc., in the areas 6 around the leg holes, the edges of the areas 6 of the inner sheet may be subjected to a water repellent treatment; for example by applying a hydrophobic compound such as an oil solution of a silicon group, paraffin wax or the like to the edges or applying a hydrophillic compound such as an alkyl phosphate and then cleaning the areas using warm water.

The outer sheet 3 is liquid impermeable to prohibit waste liquid from passing through, but is permeable to moisture, or vapour. It is also preferable that the outer sheet 3 has a texture similar to that of an ordinary under garment. The liquid impermeable sheet may be a composite material comprising a film and a woven fabric, a composite material comprising a film and a non-woven fabric, or a similar material.

The absorbent layer 4 preferably comprises principally a comminuted fibrous pulp and preferably also contains a high polymeric water absorbing polymer. It is more preferable that the material of the absorbent member 4 is treated or mixed with a thermoplastic resin, a cellulosic fibre, and a high polymeric water absorbing polymer.

The elastic members 7 and 8 may be similar to yarn in shape and/or composition, or may be shaped like a belt, and are preferably similar to the elastic members 10.

The gathered regions at the top of the waist portions 5 and around the leg holes are readily stretched to enable the diaper to be put on easily and worn with comfort. Whilst the diaper is being worn, waste material is effectively caught in the pocket 11 provided by the gathered, highly flexible liner sheet 9, which is gathered and lifted from the inner sheet 2 by the elastic members 10 in the crotch region. This feature, in combination with the gathered regions in the areas 6 around the leg holes which fit into the inguinal area of the wearer, ensure effective prevention of leakage of waste material. Furthermore, leakage can be even more effectively prevented when the diaper has a inner sheet which has a water repellent treatment applied to it in the areas 6 around the leg holes, as described above.

As may be seen from the above description, the liner sheet 9 is configured to fit the wearer before the diaper is put on, which makes putting on the diaper easy and wearing it comfortable. Moreover, the gathered regions are highly expandable and the pocket can retain a large amount of waste material effectively. Also, different elastic members having varying elastic strengths may be used, to increase or decrease the capacity of the liner sheet to prevent leakage, according to the design requirements of the diaper. It has been found that the fit and the leak preventing effectiveness of an ordinary flat type

diaper can also be enhanced by providing a liner sheet having highly elasticated gathered regions. The liner sheet curves upwardly however, thus making it necessary to spread out the sheet when the diaper is put on. Furthermore, depending on the location of the tape fastener, it can sometimes happen that the front and rear side flaps contact the liner sheet and the sheet is accidentally twisted, and thereafter does not fit snugly to the wearer's waist and inguinal area.

Referring now to Figure 6, the second embodiment of diaper is the same as the first embodiment except that the liner sheet 9 is continuously bonded or attached to the inner sheet 2, from the front end of the liner sheet to the rear end. In this embodiment, the bonds 12 take the form of two laterally spaced, parallel, continuous lines each of which is located laterally inwardly of the side edges of the liner sheet, which allows the sides of the sheet to lift under the influence of the elastic members 10 and form a pocket 11. Other patterns of bonding are also envisaged. Since the liner sheet 9 is bonded to the inner sheet 2 along two lines, the sheet 9 is stable in use, and waste material such as faeces can more reliably be retained by the sheet 9, thus enabling leakage to be more reliably prevented.

Referring now to Figure 7, the third embodiment of diaper is the same as the second embodiment except that the bond 12 between the liner sheet 9 and the inner sheet 2 comprises a single central line extending from the front end to the rear end of the sheet 9, and in this embodiment, the line is intermittent, or broken.

Otherwise, the advantages of the third embodiment are similar to those of the second.

A modification of these embodiments would be to bond the liner sheet 9 to the inner sheet 2.

Referring now to Figure 8, the elastic members 13 are located between the inner sheet 2 and the outer sheet 3. In use, they expand or contract to accommodate the size and shape of the wearer's waist, so that the diaper is comfortable and secure to wear. Any of the features of the other embodiments may be incorporated into the fourth embodiment, in which case the advantages associated with these features will also be shown by the fourth embodiment.

A further modification, which may be applied to any of the above embodiments, would be to bond or attach the liner sheet 9 removably to the inner sheet 2, so that the liner sheet 9 and the inner sheet 2 may be detached without damaging either sheet. This may be achieved by any suitable means, such as adhesive.

The present invention is not limited to these specific embodiments and changes within the scope of the claims are envisaged.

The following leak test was carried out on a number of samples of diaper in accordance with the present invention to determine their effectiveness in preventing leakage.

A diaper was put on a baby model 20, weighing 10kg,

(see Figure 9) and the model was placed in a horizontal position, intended to simulate a baby lying down. Then artificial faeces was supplied through tubes 22 and 23 to outlets in the discharge area 21, to simulate the discharge of real waste material from a baby. The rate of discharge of artificial faeces was maintained at 4g/sec until leakage occurred. The composition of the artificial waste was as follows.

Artificial faeces: Suspension of bentonite of 3wt.% whose viscosity was made up to 10c.p. by the addition of carboxyethyl cellulose.

Example 1

In this example, a diaper of the first embodiment, in which the liner sheet 9 was not attached to the inner sheet 2 excepting at the front and rear ends, was tested. The material used in the diaper was as follows.

inner sheet :

non-woven fabric comprising polypropylene fibre (35g/m²).

outer sheet :

polyethylene film (40μ in thickness).

absorbent layer:

complex of ^{uff}flap pulp and highly absorbent polymer (bridging moiety of sodium polyacrylate)

liner sheet :

heat fused non-woven fabric comprising a polyethylene/polypropylene complex fibre (30g/m²).

Example 2

In this example, a diaper of the second embodiment was tested whose constituent materials were similar to those of the diaper of example 1, except that a perforated polyethylene film (30 μ in thickness) having micropores (100/cm²) of 1 μ in diameter, was used as the liner sheet 9 and rubber yarn (of 150% expansibility) was attached to both side edges of the sheet 9. Also the sheet 9 was bonded to the inner sheet along two parallel lines.

Example 3

In this example, a diaper of the third embodiment was tested. The materials of the diaper were similar to those of the diaper of example 1, except that a non-woven fabric (20g/m²) comprising a polyester fibre produced by a water needling method was used as the liner sheet 9. Furthermore, an elastic member made of rubber and having a flattened cross section (180% expansibility) was attached to both side edges of the liner sheet 9 and the sheet 9 was bonded to the inner sheet 2 centrally between the side edges, in a single discontinuous line.

Example 4

In this example, a diaper of the fourth embodiment was tested. The materials of the diaper were similar to those of the diaper of example 1 except that an elastic expansibility was provided by a urethane spun bond (50g/m²) 13 along the connected portions at each side of the waist portion.

Comparative Example 1

In this example, a diaper was tested which was in all respects similar to the diaper of example 1, except that it did not have a liner sheet 9.

The results of the above five examples are shown in Table 1 below. They show each of the four embodiments of diaper according to the invention is capable of absorbing and/or retaining a larger amount of artificial faeces before leakage than a brief type diaper without a liner sheet 9.

TABLE

MASS OF ARTIFICIAL FAECES DISCHARGED INTO THE DIAPER BEFORE LEAKAGE (grams)	
Example 1	80
Example 2	100
Example 3	90
Example 4	80
Comparative Example 1	30

CLAIMS

1. A disposable diaper in the form of a pair of briefs having a liquid permeable inner sheet, a liquid impermeable outer sheet and an absorbent layer located between the said sheets and elastic members at the front and rear of the waist of the diaper and around each leg hole of the diaper to gather the diaper at these areas, the diaper further including an elongate liquid permeable liner sheet which extends adjacent the inner sheet over the crotch region of the diaper and whose ends are attached to the inner sheet.
2. A disposable diaper as claimed in claim 1 wherein an elastic member is located in the region of each lateral side edge of the liner sheet.
3. A disposable diaper as claimed in claim 1 or claim 2 wherein the liner sheet is also attached to the inner sheet between the ends of the liner sheet.
4. A disposable diaper as claimed in claim 3 wherein the liner sheet is attached to the inner sheet at areas laterally equally spaced from each side edge of the liner sheet.
5. A disposable diaper as claimed in claim 3 or claim 4 wherein the liner sheet is attached to the inner sheet along two parallel longitudinal lines.
6. A disposable diaper as claimed in claim 5 wherein the lines each extend from the front end to the rear end of the liner sheet.



7. A disposable diaper as claimed in claim 4 wherein the liner sheet is intermittently bonded to the top sheet along a longitudinal line, centrally located between the side edges of the liner sheet.

8. A disposable diaper as claimed in any one of the preceding claims wherein the liner sheet is attached removably to the inner sheet.

9. A disposable diaper substantially as specifically herein described with reference to Figures 1 to 5, Figure 6, Figure 7 or Figure 8.
