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(54) CONTRACTABLE SIDE FLAPS FOR DISPOSABLE DIAPER

(71) We, THE PROCTER & GAMBLE COMPANY, a corporation organised and existing under the laws of the State of Ohio, United States of America, of 301 East Sixth Street, Cincinatti, Ohio 45202, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to disposable diapers, which are designed to be worn by babies and which have an elasticated portion which conforms to the contours of the body and permits movement of the body while maintaining contact with the body.

Absorptive devices such as disposable diapers are well known, these devices being used to absorb liquid discharged from the body and to retain that liquid. Present disposable diapers are generally flat composite sheets which are fitted to the wearer, usually a baby in the flat state, or incorporate geometrical folding to achieve a suitable "baby shape". A major problem with all of these diapers is that, in use, gaps between the diaper and the baby's legs tend to develop owing to the semi-rigid nature of the absorbent body, especially after the diaper has been worn for some time. These gaps permit leakage from the diaper, thereby making the outer clothing or bedding around a baby damp or absolutely wet.

Disposable diapers generally involve single-pinned attachments at the waist. Single taping each side or single pinning tends to force the mother into choosing between leg leakage or waist leakage. Mothers can pin or tape a disposable diaper "low" so that the edge wraps tightly around the thigh and thus minimizes leg leakage but only at the cost of encouraging the front of the diaper to blossom or pouch outward as though it were trying to form a damp apron. When the child is expected to be sleeping, she can avoid this by taping or pinning "high" along the waistline which is not only aesthetically more acceptable but also minimizes waist leakage, albeit at the expense of increased leakage at the legs. This disadvantage is not important with cloth diapers in plastics pants because the legs and waist of plastics pants are usually elasticized and they generally employ either multiple such fasterners on both sides (at the waist closure, the leg closure, and an intermediate position) or a "pull-on" style which needs no snap fasteners at all.

One of the problems therefore facing disposable diaper designers is to develop a diaper in which a single closure along each side can successfully effect closure both around the thighs and waist without excessive use of expensive tape or use of multiple pins or tape. If disposable (i.e., single use) diapers could be made from compliant woven material, this would not be a difficult problem. It does become difficult, however, when one recognizes that paper-based diapers are considerably less compliant than cloth and do not stretch and conform readily to body movements. An acceptable solution to this inherent problem associated with a single use absorptive pad integrally formed with single-use plastics pants is not obvious from the prior art which teaches the use of independent, non-attached, multiple use plastics pants.

For example, elastication of leg openings for diaper covers and diaper holders is shown in U.S. Patent Specifications Nos. 3,000,381; 2,969,065; 2,675,805; 2,509,674; and 2,468,445. All of these Specifications are concerned with and teach elastic leg openings for devices which are not part of an integral disposable diaper, but are either separate plastics pant devices which are put over a diaper already applied to an infant or

SPECIFICATION AMENDED - SEE ATTACHED SLIP

separate carrier members for detachable absorbent pads held in place by the carrier. It is an object of the present invention, therefore, to provide an integral disposable diaper, i.e. a unitary disposable diaper which does not have separate parts such as a separate holder and liner, having elasticated portions which, in use, form leg openings which seal around wearer's legs.

According to one aspect of the present invention, an integral disposable diaper has front and back ends and lateral edges, a front portion extending from the front end towards the back end, a back portion extending from the back end towards the front end and a crotch area between the front portion and the back portion, and the diaper comprises a backsheet, a semi-rigid absorbent body also having front and back ends and lateral edges, the absorbent body being superposed and retained substantially in position relative to the backsheet, and a flexible side flap extending outwardly from and along each lateral edge of the absorbent body at least in the crotch area of the diaper, each side flap having an elastic member secured to it in an elastically contractable condition to provide an elastic contraction line through the side flap along which the elastic member will tend to contract and gather the side flap, the elastic contraction line being spaced at least three-quarters of an inch from the lateral edge of the semi-rigid absorbent body at least at one point along the length of the contraction line within the crotch area of the diaper, whereby the diaper has elasticated side flaps which are compliant and, in use, form an effective seal about each of the wearer's legs.

According to another aspect of the invention, an integral disposable diaper has front and back ends and lateral edges, a front portion extending from the front end towards the back end, a back portion extending from the back end towards the front end and a crotch area between the front portion and the back portion, the diaper comprising a semi-rigid absorbent body, a moisture impermeable, flexible side flap extending along each lateral edge of the diaper at least in the crotch area, and an elastic member operatively associated with each side flap in an elastically contractable condition to make the side flap longitudinally contractable, the elastic members being effective to longitudinally gather the side flaps thereby providing an elasticized contractable line through each flexible side flap, the elasticized contractable lines being disposed opposite each other one on each side of the diaper, each flexible side flap being located laterally inwardly towards a longitudinal centre line which extends through the midpoints of the width of the diaper from its elasticized contractable line, each flexible side flap having a width of at least 3/4 inch at least at one point along the length of the contraction line in the crotch area, and the elasticized contractable lines being at least 4 inches apart, whereby during wearing each elasticized contractable line maintains contact with the wearer's thigh and the flexible side flap permits free movement of the wearer's legs while spanning the gap between the semi-rigid absorbent body and the thigh.

According to yet another aspect of the invention, an integral disposable diaper has front and back ends and lateral edges, a front portion extending from the front end towards the back end, a back portion extending from the back end towards the front end and crotch between the front portion and the back portion, the diaper comprising a flexible, moisture impermeable backsheet, a semi-rigid absorbent body having a crotch area width narrower than the width at the back end thereof, whereby the absorbent body has ears at the corners of the back portion thereof, the ears having flexural rigidity so that they are resistant to inward forces imposed thereon in a direction towards the mid-point of the length of the diaper, the absorptive body being superposed on the backsheet, the backsheet extending laterally beyond the edges of the absorbent body whereby a flexible side flap along each lateral edge of the diaper is formed, an elastic member longitudinally operatively associated with each side flap in an elastically contractable condition to provide a longitudinally elastically contractable side flap, the elastic member being effective to longitudinally gather the side flap thereby providing an elasticized contractable line through the side flap, and the elasticized contractable line being spaced outwardly from the edge of the semi-rigid absorbent body at least 3/4 inch, at least at one point along the length of the contraction line in the crotch area of the diaper, whereby elastic side flaps are formed on the integral diaper and the side flaps are compliant and contractable and, in use, form effective seals about the wearer's leg.

Usually the side flaps will be formed, at least in part, by the backsheet which extends laterally beyond the lateral edges of the absorbent body.

Preferably each side flap is attached to its adjacent lateral edge of the absorbent body so that tension forces in the side flaps are transmitted to the lateral edges of the absorbent body, whereby the absorbent body, if compacted by the legs of the wearer while the diaper is being worn, is

uncompacted or stretched out by outward movement of the wearer's legs owing to the pull imposed on the edges of the absorbent body by the tension developed in the side flaps by the outward movement of the wearer's legs.

Different examples of the disposable diapers in accordance with the present invention will now be described with reference to the accompanying drawings, in which the thickness of some of the materials are exaggerated for clarity and in which:

Figure 1 is a plan view of one example of a disposable diaper in a flat and unfolded condition, and partially broken away to show more detail;

Figure 2 is a cross-section through the diaper of Figure 1 taken along the line 2—2 in Figure 1;

Figure 3 is a cross-section through the diaper of Figure 1 taken along the line 3—3 in Figure 1;

Figure 4 is a perspective view of the diaper of Figure 1 in the configuration which it adopts when applied to an infant;

Figure 5 is a view similar to that of Figure 1, but showing another example of a disposable diaper in accordance with the invention;

Figure 6 is a view similar to those of Figures 1 and 5, but showing a third example of a disposable diaper;

Figure 7 is a transverse cross-section through the diaper of Figure 5 in a folded configuration; and,

Figures 8 and 9 show alternative shapes of absorbent bodies which may be used in diapers in accordance with the invention.

Figures 1, 2, 3 and 4 illustrate a preferred example of an integral disposable diaper in accordance with the invention having a semi-rigid absorbent body and elastically contractable, flexible side portions, hereinafter referred to as side flaps. Although "flap" may generally mean a thin member, it is also intended to encompass any portion having the requisite flexural rigidity, whether it is thick or thin. The integral disposable diaper 21 comprises a backsheet 22, a topsheet 23, an absorbent body 24, and a side flap 25 at each side of the diaper. For the purpose of making a portion of each side flap 25 elastically contractable along a line within the side flap 25, a stretched elastic member 26 is attached to each side flap 25. Fastening tapes 27 are shown as the means for fixing the disposable diaper on an infant.

The elasticized portion of each side flap 25 should be positioned sufficiently remote from the semi-rigid absorbent body 24 to permit the elastic member 26 through each side flap to maintain the flap in a good fit about the leg during normal in-use leg/diaper movements. The minimum desirable effective width of each flexible side flap at each location along the edge of the diaper, the effective width being the distance from the elastically contractable line to the nearest edge of the semi-rigid absorbent body, should be dimensionally equivalent to one-half of the maximum anticipated longitudinal displacement of the elastic contractable line at that point as experienced during normal in-use wearing. Since the maximum in-use displacements normally occur in the wearer's crotch area, a preferred side flap design would make the side flap width a maximum in this region. In addition, since the relative leg movements in the upper leg pivot/thigh region are considerably lower, the side flap width may be narrower in that region without reducing the fit/containment attributes of the side flaps.

The disposable diaper 21 has a longitudinal centre line 28, a lateral centre line, which is not shown, but which passes through a point midway between the ends of the diaper, a back portion 30, a front portion 31, a back waist portion 32, a front waist portion 33 and a crotch area 34.

The back portion 30 in general, is that part of the diaper from the lateral centre line to the back end 35 of the diaper. The front portion 31, in general, is that portion of the diaper from the lateral centre line to the front end 36 of the diaper. The back waist portion 32 extends across the diaper adjacent and parallel to the back end 35. The front waist portion 33 extends across the diaper adjacent and parallel to the front end 36. The waist portions 32 and 33 cooperate with each other when the diaper is fitted and fastened on an infant to encircle the waist and hold the diaper on the infant. The width of the waist portions on a diaper can vary, but in general they are approximately 1 inch to 2-1/2 inches wide. Their effective in-use width is established primarily by the diaper fastening means, e.g. the fastening tapes 27.

The crotch area 34 of the diaper is that area of the diaper which is generally located directly between the legs and around the lower portion of an infant when the diaper is fitted on an infant, and is approximately centered on the lateral centre line.

The preferred form of diaper 21 shown in Figures 1, 2, 3 and 4 has an hour-glass shaped absorbent body 24 wherein the absorbent body in the waist portions 32 and 33 is wider than the absorbent body in the crotch area 34, thereby forming ears 37, 38, 39 and 40 at each edge of the waist portions. The absorbent material may be any suitable known absorbent material, for example, a multiplicity of plies of creped cellulose

wadding, fluffed cellulosic fibres or wood pulp (sometimes known as airfelt), or textile fibres. An acceptable absorbent body 24 made from creped cellulose wadding would comprise ten plies of tissue having a basis weight (air dried) of 13 to 15 pounds per ream of 3,000 sq. ft. before creping. The plies of wadding may have a 60 percent, or greater, crepe (the percent crepe being equal to 100 times the quotient of reduction in length caused by the creping of a piece of tissue divided by the length of the piece of tissue in uncreped form). Another, and at present preferred, absorbent body is made of airfelt and is faced on each of the top and bottom surfaces by a layer of tissue. The airfelt and tissue combination for such an absorbent body in a "daytime size" diaper which is intended to fit infants ranging from 14 to 28 pounds ordinarily has a basis weight of approximately 0.33 grams per square inch.

Absorbent bodies in disposable diapers are semi-rigid in nature owing to the absorbent material used therein. A measure of the rigidity of such absorbent bodies is Taber Stiffness per Tappi standard T489 OS-70 and for the purposes of this disclosure, an absorbent body having a Taber Stiffness of 7 gram-centimetres or greater is considered as semi-rigid.

The absorbent body provides flexural rigidity in the diaper so that the ears are resistant to inward forces and are maintained in an outwardly extending position when subjected to moderate inwardly contracting forces. This flexural rigidity of the ears of the integral diaper is from about 20 to 200 grams per inch of width to produce a 90° bend as measured on a packaging industry standard test machine, i.e., a PCA Score Bend Tester, manufactured by Thwing-Albert Instrument Company, Philadelphia, Pa., in accordance with the standard published instructions for conducting tests on that machine.

Part of the advantage of diapers in accordance with this invention is owing to the absorbent body 24 being semi-rigid. The absorbent body is held relatively immobile with respect to the side flaps 25, that is, the backsheet 22 does not slide back and forth over the absorbent body 24 as is possible with the combination of a separate absorbent diaper and conventional plastics pants. The absorbent body 24 may be rendered immobile with respect to the side flaps 25 in many ways, for example, bonding the backsheet 22 and absorbent body 24 together, bonding the absorbent body 24 to the topsheet 23 and the topsheet 23 to the backsheet 22, or merely tightly sandwiching the absorbent body 24 between the topsheet 23 and the backsheet 22.

As shown in Figure 1, the lateral edges 41 of the absorbent body 24 are directed inwardly from the diaper ends towards the diaper centre to form an hourglass shaped absorbent body. The lateral edge 41 of the absorbent body 24 in the front portion 31 of the diaper 21 forms a side flap angle α with a lateral line 29 which is displaced slightly from the lateral centre line towards the front of the diaper. The lateral edge 41 of the absorbent body 24 in the back portion 30 forms a side flap angle β with the lateral line 29. The angle α should be between 20° and 65° and preferably about 52°. The angle β should be between 20° and 70° and preferably about 58°. If the angles α and β are adjacent as shown in Figure 1, as opposed to being separated by a substantially linear segment in the crotch area 34, then the total angle α plus β should not be less than 90°. The lateral edges 41 of the absorbent body 24 may be either linear or curvilinear. If the edges 41 are curvilinear, the angle α or β is the angle between the chord of the arc in the front portion 31 or back portion 30, respectively, and lateral line 29.

The width of the absorbent body 24 along the back end 35 or the front end 36 is generally between 8 and 13 inches, preferably about 11 inches. The minimum width of the absorbent body 24 which is the width along the lateral line 29, is between 1 inch and 6 inches, preferably 2 to 3 inches. The length of the absorbent body 24 is typically from 11 to 18 inches, preferably about 16 inches. The narrowest portion of the absorbent body 24, i.e., the width along the lateral line 29 is preferably displaced from 0 to 3 inches, and more preferably about 1/2 inch, towards the front of the absorbent body from the lateral centre line (not shown) of the absorbent body, that is from the mid-point of the length of the body. This makes the diaper fit the bearer better.

In this example, the absorbent body 24 is superposed on the backsheet 22 and is fixed to it, for example, by double sided pressure sensitive adhesive tapes, hot melt glues, or other adhesives. The absorbent body 24 may be fixed to the backsheet 22 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or a number of separated spots of adhesive. In addition, it has been found to be advantageous to secure the lateral edges 41 of the absorbent body 24 with respect to the side flaps 25, for example, by a pad-edge attachment 42 which is fixed to the backsheet 22.

The backsheet 22 is a flexible moisture impermeable sheet, preferable being a low density, opaque polyethylene web which is

about 0.001 inches thick, for example, a polyethylene web available from Monsanto Chemical Company and identified by them as film No. 8020. In this example the backsheet 22 has a modified hourglass shape and extends beyond the periphery of the absorbent body 24 all around the body. At each end, the backsheet 22 extends beyond the absorbent body by approximately 1/2 inch. Along the lateral edges the backsheet 22 initially extends (from each end) parallel to the lateral edges 41 of the absorbent body, but towards the crotch area 34, the backsheet periphery diverges from the edges 41 and extends substantially linearly parallel to the longitudinal centre line 28, shown at 44 in Figure 1. The distance between this edge 44 of the backsheet 22 and the edge 41 of the body 24 is a maximum at the lateral line 29 where the body 24 is narrowest and this area of the backsheet 22 at each side of the diaper forms part of the side flaps 25. The linear portion 44 of the lateral edge of the backsheet 22 is generally between 5 inches and 12 inches long, and for a daytime size diaper is about 9 inches long. The backsheet 22 is preferably embossed and/or matte finished.

The "modified" hour-glass shape described above and shown in Figure 1 for the backsheet 22 provides a diaper in which the length of the diaper edge is longer than the length of the longitudinal centre line 28 of the diaper. This difference in length enables a better fit to be obtained on the wearer, as can be appreciated by considering the anatomy of a human being whether infant or adult.

The topsheet 23 in this example is coextensive with and superposed on the backsheet 22 with the absorbent body 24 disposed between them. The topsheet 23 is attached to the backsheet 22 where their surfaces meet, that is in the areas beyond the periphery of the absorbent body 24, by a topsheet-backsheet attachment 43 which is highly flexible, especially in the region of the side flaps 25. Thus the side flaps 25 in this preferred example each comprise portions of the backsheet 22 and the topsheet 23 and the coextensive attachment 43 therebetween.

The topsheet 23 may be any compliant, soft feeling, porous, paper or non-woven fabric web. One example thereof is an unwoven fabric sheet comprising 1.5 to 3.0 denier rayon and containing approximately 20 to 35 percent binder (for example, copolymers of an ester of acrylic acids such as is sold by the Rohm & Haas Company and identified as Rhoplex, HA-8), and having a weight of about 15 to 19 gm. per sq.yd. Another example of a topsheet which has been found to be particularly suitable is a non-woven fabric sheet comprising 35 to 64 percent of 1.5 to 3.0 denier polyester fibres, 14 to 40 percent of 1.5 to 3.0 denier rayon fibres, and approximately 20 to 30 percent of binder, for example, the above-mentioned Rhoplex HA-8; the fabric having a weight of about 25 to 35 grams per sq. yd. and a thickness of 0.016 to 0.020 inches.

Each side flap 25 of the diaper 21 is essentially trangular and can roughly be defined as being bounded by the lateral edge 41 of the absorbent body in the back portion 30 of the diaper, the lateral edge 41 of the absorbent body in the front portion 31 of the absorbent body, and the linear edges 44 of the backsheet 22. The elastic contraction line through each side flap 25 is established by the outside edge of the elastic member 26 in the flap 25, and is adjacent and parallel to the edge 44 of the backsheet 22. Each side flap 25 is highly flexible and thus contractable along the contraction line under the action of its elastic member 26. Each flap should have a flexural rigidity no greater than about 6 gram-centimetres, and most preferably less than 0.5 gram-centimetres, as measured using a Taber Stiffness instrument in accordance with TAPPI standard T489 OS-70.

Each elastic member 26 is operatively fixed to its side flap 25 in an elastically contractable condition so that in a normally unrestrained state, the elastic member 26 effectively contracts and gathers the side flap material thereabout along the contraction line through the side flap. The elastic member 26 may be operatively fixed to the side flap to achieve an elastically contractable condition in at least two ways; either by stretching the elastic member and fixing it in a stretched condition to the side flap 25 while the side flap is in an uncontracted or flat condition; or by contracting the side flap (for example, by pleating) and fixing the elastic member to the contracted side flap while the elastic member is in a relaxed and unstretched condition.

The elastic member 26 within each flexible side flap 25 preferably develops a skin contact pressure of from 0.2 to 2.5 pounds per sq. in. A skin contact pressure within this range is acceptable to provide continued contact with an infant's thigh without exerting a pressure which detrimentally indents or marks the skin. An elastic member for providing the proper skin contact pressure in a suitable flexible flap should have a tensional force in its prestretched condition in the range of from 35 to 150 grams and preferably in the range of 60 to 100 grams. The elastic member should provide such a tensional force and

establish its prestretched condition at an elongation from its relaxed state in the range of from 25 to 200 percent and preferably in the range of from 50 to 100 percent.

One elastic member which has been found to work well is a natural rubber elastic tape having a cross-section of 0.007 inches by 0.25 inches, the rubber being available from Easthampton Rubber Thread Company and identified by them as L-1900 rubber compound. This elastic tape produces a tensile force of about 100 grams when stretched 100 percent from its relaxed condition. The rubber tape was used for the elastic members 26 in the preferred example shown in Figure 1, and was stretched 100 percent from its relaxed condition when attaching it in the stretched condition to the side flaps.

Each elastic member 26, as shown in Figure 1, is fixed to the side flap 25 by securing it to the backsheet 22, or to the topsheet 23, or both with an elastic attachment 45 which is flexible and of sufficient adhesiveness to hold the elastic member 26 in its stretched condition substantially indefinitely. The elastic member 26 is shown in Figures 2 and 3 attached to the topsheet 23 by the elastic attachment 45. One material which has worked as a flexible elastic attachment 45 is a double sided transfer tape compatible with the material of the member 26, being available from The Minnesota Mining and Manufacturing Company, St. Paul, Minnesota, and known by their designation as No. 465 pressure-sensitive tape (high tack). Other flexible adhesives compatible with the elastic member 26 could also be used as the attachment 45. The elastic member 26 need not necessarily be secured to the side flap along its entire length, but may be attached only at its two ends and be operatively connected with the side flap for the remainder of its length by extending through a sleeve within the side flap or loops fixed to the side flap.

The elastic contraction line in each side flap 25 is the "path of response" set up in the flexible side flap by the elastic member. Although the word "line" is used to describe the "path of response" in the side flap, this is not intended to preclude a "path of response" having width. In this example the elastic member is shown extending along the entire elastic contraction line in the side flap, but this arrangement is not absolutely necessary. An elastic contraction line can be established in a flexible side flap by attaching an elastic member to the side flap which, in its stretched condition, is shorter than the elastic contraction line. For example, an elastic member may extend only from the lateral line 29 to either of the intersections 60 with the absorbent body 24, or an elastic member shorter than the elastic member 26 may be placed anywhere along the path of elastic member 26. If an elastic member shorter than the elastic contraction line is used, it is, however, preferably located in the back portion of the diaper.

The elastic member 26, to be effective, must be spaced outwardly from the lateral edge 41 of the absorbent body 24 along at least part of its length, to establish the elastic contraction line at a distance from the lateral edge 41 of the absorbent body and enable the flexible side flap to contract. Otherwise, the side flaps would be prevented from contracting along the contraction line by the semi-rigid body 24 which is attached to the backsheet. The most effective portion of the elastic member 26 in this example is that portion in the crotch area of the diaper i.e., adjacent the lateral line 29 where the spacing of the member 26 from the edge 41 of the body 24 is greatest. The flexible side flap width should be a minimum of 3/4 inch at the narrowest part of the crotch area of the body 24, but is preferably from about 1-3/4 to about 4-1/2 inches, and is most preferably about 3 inches at this position.

An elastic member, when operatively fixed in an elastically contractable condition to a flexible side flap, provides an elastic contraction line or path of response through the side flap to form a longitudinally contractable side flap. There is a flexible side flap having an elastic contraction line on each side of the diaper, thereby providing oppositely disposed elastic contraction lines, and the minimum separation between these two contraction lines is: 4 inches and preferably 5-1/2 inches for babies weighing less than 14 pounds; 5 inches, preferably 6-1/2, and more preferably 7-1/2 inches for babies weighing from 14 to 35 pounds.

The elastic member 26, in its stretched condition, may be longer than the elastic contraction line so that each end of the elastic member 26 extends to and beyond the lateral edge 41 of the absorbent body 24 at the intersections 60 between the members 26 and the edges 41, and thereby overlaps the absorbent body 24. This structure is shown in Figures 1 and 3. The portions of the elastic members 26 beyond the intersections 60 may be operatively fixed to the absorbent body in any suitable way, e.g., glueing it to the topsheet 23, or glueing it directly to the absorbent body.

To perform most effectively, the elastic member in its stretched condition should have a minimum effective length of about 4

inches, and preferably a length of about 7 inches, to provide an effective elastically contractable side flap.

The effective length of the elastic member in its stretched condition is that length available to contract. In the example shown in Figure 1, the effective length of the elastic member 26 in its stretched condition is the uncontracted length through the side flap 25 from the elastic member-absorbent body intersection 60 on the back portion 30 of the diaper to the corresponding intersection 60 on the front portion 31 of the diaper. An elastic member which does not extend beyond the flexible side flap has an effective length equal to the stretched length of the elastic member. In a "daytime" diaper, i.e., one intended for ordinary daytime use on infants weighing about 14 to 28 pounds, an effective length of about 9 inches is preferred for a diaper having the construction shown in Figure 1.

The fastening tapes 27 are applied to the back waist portion 32 of the disposable diaper to provide fastening means for holding the diaper on an infant, and may comprise the tape disclosed in U.S. Patent Specification No. 3,646,937, although many other types could be used. The fastening tapes 27, or other diaper fastening means such as pins, are usually applied near the top edge of a diaper in its "in-use" configuration (see Figure 4). Thus, such a diaper is fastened or fixed only near the top of the diaper and is not fastened or fixed near the leg opening, in contrast to the typical plastic panty which is fastened or fixed both at the top and at or near the leg opening.

A different example of diaper in accordance with the invention is shown in Figure 6. In this case the absorbent body 46 is of a different hour-glass shape from that of the previous example. The body has ears 49, and elastic members 47 extend between the ears 49 of the back and front portions, 50 and 51 respectively, of the diaper. Each elastic contraction line is positioned as far laterally outwards as possible, still being laterally inwards from, or in line with, the edges of the ears 49. A diaper of the configuration shown in Figure 6 can be folded in a "Z" fold as is taught in U.S. Patent Specification No. Re. 26,151, or in a "C" fold.

Other outline shapes for the absorbent body which provide ears which can be inherently stiff or stiffened through the use of stiffening members, such as stays, are "I" or "T" shapes such as are shown in Figures 8 and 9 respectively.

Another example of a diaper in accordance with this invention is shown in Figure 5. The topsheet 54, backsheet 55, and absorbent body 56 have configurations different from those described with reference to Figure 1, but the diaper is put together in essentially the same manner as that described for the diaper shown in Figure 1. In the diaper shown in Figure 5, the absorbent body 56 is essentially rectangular. The backsheet 55 is wider than the absorbent body 56 so that a portion of the backsheet 55 extends beyond each edge of the absorbent body 56 by an amount sufficent to form the flexible side flaps 58 which can be 2 to 3-1/2 inches wide, and a minimum of 3/4 inch wide. The backsheet 55 is also longer than the length of the absorbent body to provide a small margin of backsheet beyond each end of the absorbent body 56. An elastic member 57 is operatively fixed in each side flap 58 at a distance from the lateral edge 59 of the absorbent body 56. The distance between the elastic member 57 and the lateral edge 59 is sufficient to allow the member 57 to contract and draw with it the side flap 58, thereby providing a contractable or elasticized side flap for the disposable diaper.

The diaper shown in Figure 5 may also be folded in a "C" fold or "Z" fold as mentioned above in conjunction with the diaper shown in Figure 5. A transverse cross-section of the diaper in a "Z" fold configuration is shown in Figure 7.

An additional embodiment of the invention may be essentially the same as that shown in Figure 1 with the exceptions that the absorbent body is "T" shaped and the front ends of the elastic members 26 are not attached to the absorbent body but are attached in the backsheet or topsheet in the same manner as disclosed in detail for the major length of each elastic member 26. A "T" shaped absorbent body is one which does not have the ears 39 and 40 on the front portion of the diaper, e.g. see Figure 9.

Although the above described examples do not have any absorbent material within the side flaps of the diaper, some absorbent material could be present therein. The amount of absorbent material within the side flap, for example, located between the topsheet and the backsheet in the side flap area, would have to be limited so that the flexural rigidity of the side flap does not exceed the above stated maximum for the flexible side flaps, i.e., a maximum of 6, preferably less than 3, and most preferably less than 0.5 gram-centimetres. If some absorbent material were provided in the flexible side flaps the width of each side flap would be the distance between the elastic contraction line and the lateral edge of the absorbent body, this edge occurring at the point where the flexibility of the diaper

becomes less than the minimum above-mentioned.

WHAT WE CLAIM IS:—

1. An integral disposable diaper having front and back ends and lateral edges, a front portion extending from the front end towards the back end, a back portion extending from the back end towards the front end and a crotch area between the front portion and the back portion, the diaper comprising a backsheet, a semi-rigid absorbent body also having front and back ends and lateral edges, the absorbent body being superposed and retained substantially in position relative to the backsheet, and a flexible side flap extending outwardly from and along each lateral edge of the absorbent body at least in the crotch area of the diaper, each side flap having an elastic member secured to it in an elastically contractable condition to provide an elastic contraction line through the side flap along which the elastic member will tend to contract and gather the side flap, the elastic contraction line being spaced at least three-quarters of an inch from the lateral edge of the semi-rigid absorbent body at least at one point along the length of the contraction line within the crotch area of the diaper, whereby the diaper has elasticated side flaps which are compliant and, in use, form an effective seal about each of the wearer's legs.

2. A diaper according to claim 1, in which each side flap is attached to its adjacent lateral edge of the absorbent body so that tension forces in the side flaps are transmitted to the lateral edges of the absorbent body, whereby the absorbent body, if compacted by the legs of the wearer while the diaper is being worn, is uncompacted or stretched out by outward movement of the wearer's legs owing to the pull imposed on the edges of the absorbent body by the tension developed in the side flaps by the outward movement of the wearer's legs.

3. A diaper according to claim 1 or claim 2, having earlike portions at at least one end of the absorbent body, the ear-like portions extending laterally outwards beyond the lateral edge of the absorbent body in the crotch area of the diaper and having flexural rigidity so that they are resistant to inward forces imposed thereon in a direction towards the mid-point of the length of the diaper, the elastic members being positioned laterally inwards towards a longitudinal centre line which passes through the mid-points of the width of the diaper from the lateral outer edges of the ear-like portions, whereby the ear-like portions tend to remain outwardly extended when subjected to forces imposed by the elastic members.

4. A diaper according to any one of claims 1 to 3, in which each elastic member has one of its ends intersecting a back portion of the absorbent body and the other of its ends intersecting a front portion of the absorbent body, the front and back portions of the absorbent body being situated in the front and back portions of the diaper respectively.

5. A diaper according to any one of the preceding claims, in which the minimum effective length of each elastic member in its stretched condition is 4 inches.

6. A diaper according to claim 3, or to claim 4 or claim 5 when dependent on claim 3, in which the absorbent body is substantially hour-glass shaped so that there are ear-like portions at both ends of the absorbent body and each side flap is substantially trangular.

7. A diaper according to claim 6, in which the acute angle α between one edge of each side flap and the line through the apex of the triangular flap normal to the longitudinal centre line of the diaper is between 20° and 65°, and the acute angle β between the other edge of each side flap and the normal is between 20° and 70°, and α plus β is between 90° and 135°.

8. A diaper according to claim 7, in which the angle α is 52° and angle β is 58°.

9. A diaper according to any one of the preceding claims, in which each elastic contraction line is spaced from the adjacent lateral edge of the absorbent body by at least 1-3/4 inches at the said at least one point.

10. A diaper according to any one of the preceding claims, in which the backsheet is formed of a flexible, moisture impermeable material and extends laterally beyond the edges of the absorbent body to form the flexible side flaps along the lateral edges of the diaper.

11. A diaper according to claim 1, substantially as described with reference to Figures 1 to 4, or to Figure 5, or to Figures 6 and 7, or to Figure 8, or to Figure 9 of the accompanying drawings.

12. An integral disposable diaper having front and back ends and lateral edges, a front portion extending from the front end towards the back end, a back portion extending from the back end towards the front end a crotch area between the front portion and the back portion, the diaper comprisng a semi-rigid absorbent body, a moisture impermeable, flexible side flap extending along each lateral edge of the diaper at least in the crotch area, and an elastic member operatively associated with each side flap in an elastically contractable condition to make the side flap

becomes less than the minimum above-mentioned.

WHAT WE CLAIM IS:—

1. An integral disposable diaper having front and back ends and lateral edges, a front portion extending from the front end towards the back end, a back portion extending from the back end towards the front end and a crotch area between the front portion and the back portion, the diaper comprising a backsheet, a semi-rigid absorbent body also having front and back ends and lateral edges, the absorbent body being superposed and retained substantially in position relative to the backsheet, and a flexible side flap extending outwardly from and along each lateral edge of the absorbent body at least in the crotch area of the diaper, each side flap having an elastic member secured to it in an elastically contractable condition to provide an elastic contraction line through the side flap along which the elastic member will tend to contract and gather the side flap, the elastic contraction line being spaced at least three-quarters of an inch from the lateral edge of the semi-rigid absorbent body at least at one point along the length of the contraction line within the crotch area of the diaper, whereby the diaper has elasticated side flaps which are compliant and, in use, form an effective seal about each of the wearer's legs.

2. A diaper according to claim 1, in which each side flap is attached to its adjacent lateral edge of the absorbent body so that tension forces in the side flaps are transmitted to the lateral edges of the absorbent body, whereby the absorbent body, if compacted by the legs of the wearer while the diaper is being worn, is uncompacted or stretched out by outward movement of the wearer's legs owing to the pull imposed on the edges of the absorbent body by the tension developed in the side flaps by the outward movement of the wearer's legs.

3. A diaper according to claim 1 or claim 2, having earlike portions at at least one end of the absorbent body, the ear-like portions extending laterally outwards beyond the lateral edge of the absorbent body in the crotch area of the diaper and having flexural rigidity so that they are resistant to inward forces imposed thereon in a direction towards the mid-point of the length of the diaper, the elastic members being positioned laterally inwards towards a longitudinal centre line which passes through the mid-points of the width of the diaper from the lateral outer edges of the ear-like portions, whereby the ear-like portions tend to remain outwardly extended when subjected to forces imposed by the elastic members.

4. A diaper according to any one of claims 1 to 3, in which each elastic member has one of its ends intersecting a back portion of the absorbent body and the other of its ends intersecting a front portion of the absorbent body, the front and back portions of the absorbent body being situated in the front and back portions of the diaper respectively.

5. A diaper according to any one of the preceding claims, in which the minimum effective length of each elastic member in its stretched condition is 4 inches.

6. A diaper according to claim 3, or to claim 4 or claim 5 when dependent on claim 3, in which the absorbent body is substantially hour-glass shaped so that there are ear-like portions at both ends of the absorbent body and each side flap is substantially trangular.

7. A diaper according to claim 6, in which the acute angle α between one edge of each side flap and the line through the apex of the triangular flap normal to the longitudinal centre line of the diaper is between 20° and 65°, and the acute angle β between the other edge of each side flap and the normal is between 20° and 70°, and α plus β is between 90° and 135°.

8. A diaper according to claim 7, in which the angle α is 52° and angle β is 58°.

9. A diaper according to any one of the preceding claims, in which each elastic contraction line is spaced from the adjacent lateral edge of the absorbent body by at least 1-3/4 inches at the said at least one point.

10. A diaper according to any one of the preceding claims, in which the backsheet is formed of a flexible, moisture impermeable material and extends laterally beyond the edges of the absorbent body to form the flexible side flaps along the lateral edges of the diaper.

11. A diaper according to claim 1, substantially as described with reference to Figures 1 to 4, or to Figure 5, or to Figures 6 and 7, or to Figure 8, or to Figure 9 of the accompanying drawings.

12. An integral disposable diaper having front and back ends and lateral edges, a front portion extending from the front end towards the back end, a back portion extending from the back end towards the front end a crotch area between the front portion and the back portion, the diaper comprisng a semi-rigid absorbent body, a moisture impermeable, flexible side flap extending along each lateral edge of the diaper at least in the crotch area, and an elastic member operatively associated with each side flap in an elastically contractable condition to make the side flap

longitudinally contractable, the elastic members being effective to longitudinally gather the side flaps thereby providing an elasticized contractable line through each flexible side flap, the elasticized contractable lines being disposed opposite each other one on each side of the diaper, each flexible side flap being located laterally inwardly towards a longitudinal centre line which extends through the mid-points of the width of the diaper from its elasticized contractable line, each flexible side flap having a width of at least 3/4 inch at least at one point along the length of the contraction line in the crotch area, and the elasticized contractable lines being at least 4 inches apart, whereby during wearing each elasticized contractable line maintains contact with the wearer's thigh and flexible side flap permits free movement of the wearer's legs while spanning the gap between the semi-rigid absorbent body and thigh.

13. An integral disposable diaper having front and back ends and lateral edges, a front portion extending from the front end towards the back end, a back portion extending from the back end towards the front end and a crotch area between the front portion and the back portion, the diaper comprising a flexible, moisture impermeable backsheet, a semi-rigid absorbent body having a crotch area width narrower than the width at the back end thereof, whereby the absorbent body has ears at the corners of the back portion thereof, the ears having flexural rigidity so that they are resistant to inward forces imposed thereon in a direction towards the mid-point of the length of the diaper, the absorptive body being superposed on the backsheet, the backsheet extending laterally beyond the edges of the absorbent body whereby a flexible side flap along each lateral edge of the diaper is formed, an elastic member longitudinally operatively associated with each side flap in an elastically contractable condition, to provide a longitudinally elastically contractable side flap, the elastic member being effective to longitudinally gather the side flap thereby providing an elasticized contractable line through the side flap, and the elasticized contractable line being spaced outwardly from the edge of the semi-rigid absorbent body at least 3/4 inch, at least at one point along the length of the contraction line in the crotch area of the diaper, whereby elastic side flaps are formed on the integral diaper and the side flaps are compliant and contractable and, in use, form effective seals about the wearer's leg.

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SPECIFICATION NO 1482677

In accordance with the Decision of the Principal Examiner, acting for the Comptroller-General, dated 19 October 1978 this Specification has been amended under Section 14 in the following manner:-

Page 2, lines 19 and 89, page 8, line 12, page 9, line 33, *after* body *insert* having a taber stiffness of 7 gram-centimetres or more and

Page 2, lines 34, 35, 36, 112, 113 and 114, page 8, lines 28 and 29, page 9, lines 58 and 59, *delete* at least at one point along the length of the contraction line

Page 2, *delete* lines 41 to 80 *insert* A preferred integral disposable diaper of the invention has

Page 8, *delete* lines 115 to 128

Page 9, *delete* lines 1 to 23

Page 9, *for* claim 13 *read* 12

Page 9, line 57, *after* inch *delete* comma

THE PATENT OFFICE
4 December 1978

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