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DISPOSABLE DIAPERS

The present invention relates to a method of welding a disposable diaper along laterally opposite side edges at its waist level, and a diaper.

One example of a pant type of disposable diapers is disclosed in Japanese patent application Disclosure No. 1993-15551 according to which a diaper comprising top- and backsheets and a liquid-absorbent core sandwiched therebetween is folded up along a transverse center line passing through a crotch zone to lay front and rear bodies one upon another and the top- and backsheets are ultrasonic-welded together along laterally opposite side edges at its waist level to obtain a pant type configuration. The top- and backsheets may be formed, for example, by nonwoven fabric of thermoplastic synthetic resin adapted to be welded by an ultrasonic treatment.

Nonwoven fabric employed in the technique disclosed in said Disclosure as material for the top- and backsheets may be composed from fibres of the same type as mentioned above and melted until the nonwoven fabric exhibits an appropriate viscosity so that a weld zone of the top- and backsheets may

present a smoothly finished appearance. However, if the topsheet formed by nonwoven fabric of polypropylene fibre having a relative high melting point is combined with the backsheet formed by polyethylene sheet or film having a relatively low melting point, the polyethylene sheet will be molten earlier than the polypropylene fibre when the diaper is folded up to form a pant type and subjected to the ultrasonic treatment. In consequence, the polyethylene sheet may be melted to an excessively low viscosity and stick to a horn for the ultrasonic treatment which has been pressed against this sheet. The polyethylene sheet which has stuck to the horn will present, after cooling, a rough surface stimulating itchiness of the wearer's skin as well as giving an uncomfortable feel and spoiling the aesthetic appearance of the diaper. If the polyethylene sheet remains sticking to the horn, no accurate clearance can be assured between the horn and an anvil for the ultrasonic treatment during the next cycle of the treatment, thus making continuous treatment difficult.

Accordingly, it is a principal object of the invention to solve the problem accompanying said prior art by placing a covering sheet having a melting point higher than a melting point of a backsheet upon an outer surface of the backsheet

and bringing it in contact with pressing means such as a horn for an ultrasonic treatment.

The object set forth above is achieved, according to the invention, by a welding method for a disposable diaper generally comprising steps of assembling a liquid-permeable topsheet, a liquid-impermeable backsheet and a liquid-absorbent core sandwiched between these sheets into a configuration of disposable diaper, putting wing-like portions of front and rear bodies outwardly extending from laterally opposite side edges of said core one upon another and welding said wing-like portions put one on another under heat and pressure together to form opposite side portions at waist levels of said front and rear bodies. The welding method comprising steps of assembling topsheet members associated with said topsheet so as to form extensions thereof with said backsheet made of material having a melting point lower than a melting point of the topsheet members to form said wing-like portions, putting said wing-like portions one upon another with said topsheet members opposed face to face inside said diaper, placing covering sheets having a melting point higher than the melting point of said backsheet

on an outer surface of said backsheet, and welding said wing-like portions along laterally opposite side edges thereof together with said covering sheets.

Preferably, the melting point of said covering sheets is higher than the melting point of said topsheet members.

According to the welding method as described above, the heating/pressing means such as an ultrasonic horn or a heating element of desired shape is pressed against the sheet portions to be welded together. The covering sheet having a melting point higher than that of the backsheet is brought in contact with the heating/pressing means so as to prevent the molten backsheet from sticking to the heating/pressing means.

A welding method of the invention will be described in more detail by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a pant type disposable diaper according to an embodiment of the invention;

Fig. 2 is a plan view of the diaper of Fig.1 unfolded;

Fig. 3 is a sectional view along a line X-X in Fig. 2;

Fig. 4 is a schematic diagram illustrating an ultrasonic welding treatment of a diaper according to an embodiment of the invention;

Fig. 5 (A) and (B) are sectional views of weld zones in a diaper according to the invention and a prior art diaper respectively;

Fig. 6 (A) and (B) are views similar to Fig. 3 showing different configurations of diapers embodying the invention.

Fig. 1 is a perspective view showing a pant type of disposable diaper 1 obtained by a welding method of the invention. The diaper 1 comprises a liquid-permeable topsheet 2 formed by melt bond nonwoven fabric of polypropylene fibre, a liquid-impermeable backsheet 3 formed by polyethylene sheet and a liquid-absorbent core 4 sandwiched between these sheets 2, 3. The diaper 1 is also generally configured by a front body 5, a rear body 6 and a crotch zone 7. A waist-opening 11 and respective leg-openings 12 are provided with elastically stretchable members 13, 14, respectively, adhesively attached thereto along their peripheries. The front and rear bodies 5, 6 are laid one on top of another with the topsheet 2 having opposed faces within the diaper 1 and the backsheet 3 is provided along laterally opposite sides of waist portions of the front and rear bodies 5, 6 with covering sheets 20 so that these sheets 2, 3, 20 are welded together by an ultrasonic intermittent

weld line (see reference numeral 15) vertically extending along lateral sides of the waist portions.

Fig. 2 is a plan view of the diaper 1A prior to said welding as unfolded longitudinally of the front and rear bodies 5, 6 and partially broken away. In the diaper 1A, the waist portions of the front and rear bodies 5, 6 extending outward from lateral side edges of the liquid-absorbent core 4 define wing-like portions 21, 22, respectively. It should be understood that these wing-like portions 21, 22 may be defined by top - and/or backsheet side members of desired characteristics bonded to the topsheet and/or the backsheet to form extensions thereof rather than said top- and backsheets. The wing-like portions 21, 22 carry on their side of the backsheet 3 the previously mentioned polypropylene covering sheets 20. On laterally opposite sides of the diaper 1A inside the wing-like portions 21, 22, there are provided a pair of flaps 31 longitudinally extending on the topsheet 2. Each flap 31 is bonded to the topsheet 2 along its outer edge 25 and its longitudinally opposite ends 26, 27 so that its inner edge 28 may be risen off the topsheet 2 under the effect of an elastic member 29 bonded, in a stretched condition, to the inner edge 28.

Fig. 3 is a sectional view along a line X-X in Fig. 2.

It should be understood here that a sectional view along a line Y-Y in Fig. 2 is substantially the same as Fig. 3. Over each wing-like portion 21 of the diaper 1A, the top- and backsheets 2, 3 are intermittently bonded to each other by means of hot melt adhesive 33, and the backsheet 3 and the covering sheet 20 are also bonded to each other by means of hot melt adhesive 33. Each flap 31 cooperates with the topsheet 2 to form a pocket opening inwardly of the diaper 1A. The liquid-absorbent core 4 may be bonded, if necessary, to the topsheet 2 and/or the backsheet 3.

Fig. 4 is a schematic side view illustrating a manner in which said diaper 1A is folded along a center line C-C in Fig. 2 inwardly, and the wing-like portions 21, 22 of the front and rear bodies overlapped together are welded together by means of an ultrasonic welder 40. The welder 40 may be of the conventional type and comprises a horn 41 connected to an ultrasonic oscillator (not shown) and a stationary anvil 42, between which the wing-like portions 21, 22 are held and welded together so as to form a weld zone 15 (Fig. 1) being conformable to a shape of the horn 41 at its forward end.

In the ultrasonic treatment of the diaper 1A, the optimal condition of the treatment must be selected to weld together sections of the topsheet 2 folded against each

other. During this treatment, the polyethylene sheet forming the backsheet 3 having a melting point lower than a melting point of the polypropylene sheet forming the topsheet 2 is molten earlier to become sticky and, in order to prevent the polyethylene sheet (backsheet 3) from sticking to the horn 41, the polypropylene covering sheet 20 is interposed between the polyethylene sheet (backsheet 3) and the horn 41.

Fig. 5 is a schematic side view of the weld zones obtained by the ultrasonic treatment, wherein (A) illustrates the weld zone 15 obtained utilizing the covering sheet 20 according to the method of the invention and (B) illustrates the case in which no covering sheet 20 is utilized. In the case illustrated by (A), the decrease of viscosity of the polypropylene sheet (backsheet 3) is not significant and the welding occurs in a rather viscous molten state, so a mark pressed by the horn 41 on the weld zone 15 is round, resulting in a smooth finish which does not stimulate the wearer's skin. In the case illustrated by (B), on the other hand, the polyethylene sheet (backsheet 3) is molten and sticks to both the horn 41 and the anvil 42 when the molten state of the polypropylene sheet (topsheet 2) is of a relatively high viscosity, so the weld zone 15a after cooling presents a rough surface giving an itchy stimulus to the wearer's skin.

Fig. 6 (a) and (B) are sectional views showing configurations different from each other and different from the configuration shown by Fig. 3. In Fig. 6 (A), portions of the topsheet 2 extending from the laterally opposite side edges of the core 4 are extremely small. However, outer zone 25 of each flap 31 bonded to the topsheet 2 by means of hot melt adhesive 33, has a relatively large extent, and cooperates with the backsheet 3 to form the wing-like portion 21. The front and rear bodies 5, 6 (see Fig. 2) are folded along a boundary line therebetween to put the outer zone 25 on the side of the front body 5 and the outer zone 25 on the side of the rear body 6 together and these outer zones 25 are subjected to the ultrasonic treatment. Each flap 31 is formed by spun bond nonwoven fabric of polypropylene. In Fig. 6 (B), a topside sheet member of each wing-like portion 21 comprises spun bond nonwoven fabric covering sheet 37 of polypropylene which covers the associated outer zone 25. The topsheet 2, the outer zone 25 and the covering sheet 37 are bonded together by means of hot melt adhesive 33. The front and rear bodies 11, 12 are folded up against each other so as to put the covering sheet 37 on the side of the front body 11 and the covering sheet 37 on the side of the rear body 12 one on another and then this area is subjected to the

ultrasonic treatment. In both configurations shown by (A) and (B), the backsheet 3 is made of polyethylene.

It is also possible without departing from the scope of the invention to form each of the topsheet side member, the backsheet 3 and the covering sheet 20 from a mixture of fibres having different melting points. The differential melting point in each sheet should be understood here as the differential melting point between the composing fibres totally occupying 60% or higher by weight of this sheet.

The melting point of the covering sheet 20 should be higher than the melting point of materials composing the backsheet 3 and, more preferably, equal to or higher than the melting point of the topside sheet member so that the formation of a desirably shallow and small press mark under the heating effect may be facilitated.

When nonwoven fabric composed of polypropylene is used to form the topsheet 2 and the topsheet side member as in the diaper 1 illustrated as an embodiment of the invention, the polypropylene fibre having a relatively high firmness will make the nonwoven fabric cushiony, depending on a fineness as well as a density, and give the wearer a comfortable feel when the diaper 1 is put on the wearer's body. Use of the polyethylene sheet as the backsheet 3 will allow this

relatively inexpensive sheet to provide a comfortable soft touch.

It should be understood that the covering sheet 20 may be dimensioned to cover a desired area or whole area of the backsheet 3 and previously laminated thereon.

According to the welding method of the invention, the covering sheet having a melting point higher than that of the backsheet is interposed between the heating/pressing means such as the ultrasonic horn and the backsheet in order to prevent the molten backsheet from sticking to the heating /pressing means and thereby to avoid the problem unresolved by the prior art such that the weld zone presents, after cooling, a rough surface which may stimulate the wearer's skin to itch, and/or spoil an aesthetic appearance of the diaper. Moreover, the process of ultrasonic treatment is well stabilized, since no molten sheet material sticks to the horn.



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CLAIMS

1. A welding method for a disposable diaper comprising the steps of assembling a liquid-permeable topsheet, a liquid-impermeable backsheet and a liquid-absorbent core sandwiched between these sheets into the configuration of disposable diaper, putting wing-like portions of front and rear bodies extending outwardly from laterally opposite side edges of said core one upon another and welding said wing-like portions put one upon another under heat and pressure together to form opposite side portions at waist levels of said front and rear bodies, said welding method further comprising steps of:

assembling topsheet side members associated with said topsheet so as to form extensions thereof, with said backsheet made of material having a melting point lower than a melting point of said topsheet side members, to form said wing-like portions, putting said wing-like portions one upon another with said topsheet members having faces opposed within said diaper, placing covering sheets having a melting point higher than the melting point of said backsheet on an outer surface of said backsheet, and welding said wing-like portions along laterally opposite side edges thereof together with said covering sheets.



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2. A method according to Claim 1, wherein said topsheet member is part of said topsheet extending outward from a lateral side edge of said core.

3. A method according to Claim 1, wherein said topsheet member is a separated sheet bonded onto said backsheet of said wing-like portion.

4. A method as herein described with reference to the accompanying drawings.

5. A disposable diaper comprising a liquid absorbent core sandwiched between a liquid-permeable topsheet and a liquid impermeable backsheet having a lower melting point than said topsheet, and covering sheets on an outside surface of said backsheet having a higher melting point than said backsheet, the diaper having front and rear bodies and a waistband formed by side members of said top- and backsheet forming wing-like portions of said front and rear bodies which are overlayed with the faces of the topsheets opposed and welded together, said covering sheets being disposed over at least a portion of said backsheet side members.

6. A disposable diaper as herein described with reference to the accompanying drawings.