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S P E C I F I C A T I O N

PROCESS FOR MAKING DISPOSABLE UPPER GARMENT

FIELD OF THE INVENTION

This invention relates to a process for making a disposable upper garment.

BACKGROUND ART

Recently there has been an increased demand for disposable upper garments adapted to be worn not only by medical team including physicians and nurses but also by patients during surgical operation and traveler or diagnosis and to be disposable after a single use. Such disposable garments are required to be mass-producible at a lower cost. Accordingly, it is not suitable to use known manufacturing processes of usual garments for making such disposable garments. As far as the inventors know, none of the techniques meeting the demand has been disclosed in any documents except for the case of disposable diapers. Considering the fact that the disposable pull-on diaper is exclusively used as the undergarment adapted to absorb and contain body wastes, the techniques for making the usual pull-on diaper can not be helpful in making the



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foregoing garment.

In view of the problem as has been described above, it is an object of this invention to provide a process for making disposable upper garment enabling such garment to be mass-produced at a high productivity per unit time.

SUMMARY OF THE INVENTION

According to an aspect of this invention, there is provided a process for making disposable upper garment comprising steps of:

(a) continuously feeding forward a front body sheet made of a nonwoven fabric in a longitudinal direction thereof, said front body sheets having upper and lower surfaces, transversely opposite side edges extending in said longitudinal direction and a center line extending in said longitudinal direction to bisect a dimension of said sheet in a transverse direction therebetween said transversely opposite side edges, and cutting off portions from said front body sheet to form laterally symmetric neckline cutouts each describing a convex curve extending from said transversely opposite side edges toward said center line;

(b) feeding sleeve members made of a nonwoven fabric forward in said longitudinal direction one by one, each of said

sleeve members being shaped to be longer in said transverse direction than in said longitudinal direction and having, in addition to wrist-openings at a longitudinally opposite ends thereof, respectively, a center line extending in said longitudinal direction to bisect a dimension of said sleeve member in said transverse direction, placing the single sleeve member upon an upper surface of said front body sheet with the center line of said front body sheet coinciding with the center line of said sleeve member and bonding said sleeve member to said front body sheet in first bonding zones extending in parallel to and on both sides of said center line slightly ahead of said neckline cutouts;

(c) cutting said front body sheet and said sleeve member along said center line and thereby dividing said front body sheet in a first front body sheet lying on the right side of said center line and a second front body sheet lying on the left side of said center line as viewed forward in said longitudinal direction;

(d) laterally inverting a relative position of said first front body sheet and said second front body sheet so that said neckline cutouts of said first and second front body sheets may be opposed to each other in a relationship of plane symmetry;

(e) continuously feeding a rear body sheet forward in a

longitudinal direction thereof, said rear body sheet having upper and lower surfaces, transversely opposite side edges extending in said longitudinal direction and a center line extending in said longitudinal direction to bisect a transverse dimension of said rear body sheet between said transversely opposite side edges, placing the respective lower surfaces of said first and second front body sheets upon an upper surface of said rear body sheet with respective inner side edges of said first and second front body sheets lying adjacent to each other and extending in said longitudinal direction coinciding with said center line of said rear body sheet, and bonding said first and second front body sheets to said rear body sheet in second bonding zones lying slightly behind said sleeve member and extending in said transverse direction;

(f) folding said transversely opposite side edges of said rear body sheet onto the respective upper surfaces of said first and second front body sheet and bonding said first and second front body sheets, said sleeve member and said rear body sheet are bonded together in third bonding zones extending in said longitudinal direction along the transversely opposite side edges of said front and rear body sheets;

(g) cutting, at a position slightly behind said second bonding zones as viewed in said longitudinal direction, said

first and second front body sheets and said rear body sheet in and cutting, at a position at a predetermined distance ahead of said sleeve member as viewed in said longitudinal direction, these sheets in said transverse direction.

According to one preferred embodiment of this invention, said step (d) of inverting the relative position of said first and second front body sheets comprises a step of feeding narrow belt members made of a nonwoven fabric successively pair by pair, each of said belt members having longitudinally opposite ends and transversely opposite side edges, placing said belt members upon the respective upper surfaces of said first and second front body sheets so that, at a predetermined distance ahead of said sleeve members as viewed forward in said longitudinal direction, the transversely opposite side edges of said belt member extending in parallel to the transversely opposite outer side edges of said first and second front body sheets, and bonding respective rear ends of said belt members to the respective upper surfaces of said first and second front body sheets.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram schematically illustrating earlier the steps of a process for making a disposable upper garment

of this invention;

Fig. 2 is a diagram similar to Fig. 1 schematically illustrating the steps following those illustrated in Fig. 1; and

Fig. 3 is a perspective view of a disposable upper garment made by the process illustrated in Figs. 1 and 2.

DESCRIPTION OF THE BEST MODE FOR WORKING OF THE INVENTION

A process for making a disposable upper garment according to this invention will be described by way of example in more details with reference to the accompanying drawings.

Figs. 1 and 2 are schematic diagrams illustrating, by way of example, sequential steps of a process for making a disposable upper garment of this invention in side views (1) and in plan views (2). Fig. 1 illustrates the first step (a) ~ the fourth step (d) and Fig. 2 illustrates the fifth step (e) ~ the seventh step (g) following the steps illustrated in Fig. 1. Along a line comprising the first step (a) ~ the seventh step (g), a front body sheet 2, a rear body sheet 3, a pair of sleeve members 4, 4 and a pair of belts 5, 5 are assembled to make an upper garment 1.

The front body sheet 2 is made of a nonwoven fabric having a given width and defined by upper and lower surfaces A, B, right

and left side edges 2a, 2b extending in the longitudinal direction and a center line Y1 extending in the longitudinal direction to bisect a width between the right and left side edges 2a, 2b. The rear body sheet 3 is made of a nonwoven fabric having a width larger than the width of the front body sheet 3 and defined by upper and lower surfaces A, B, right and left side edges 3a, 3b and a center line Y3 extending in the longitudinal direction to bisect a width between the right and left side edges 3a, 3b.

The sleeve member 4 is made of a nonwoven fabric sheet folded onto itself and bonded together along its transversely opposite side edges placed upon each other, and has wrist-opening 4a, 4b defined by longitudinally opposite ends 4a, 4b and a center line Y2 bisecting a width between these ends 4a, 4b.

The front and rear body sheets 2, 3 travel through the respective steps as nip rolls are driven by driving means. The sleeve member 4 and the belt members 5 travel through the respective steps as nip rolls, suction drums or endless conveyor belts are driven by driving means. The front and rear body sheets 2, 3, the sleeve member 4 and the belt members 5, 5 are fed at the same rate.

[First step]

The first step (a) is a step of forming the front body sheet 2 with a pair of cutouts 6 destined to form a neckline. On the first step (a), the front body sheet 2 stored on a delivery roll 100 is continuously fed forward in the longitudinal direction as a nip roll 101 rotates. A pair of regions are cut off from the front body sheet 2 by a cutter 102 placed at the downstream of the nip roll 101 so that the cutout 6 obtained by this step of cutting off may describe a convex curve extending from the right and left side edges 2a, 2b toward the center line Y1. In this manner, the cutouts 6 identical to each other in shape as well as in size. The cutouts 6 are symmetric about the center line Y1.

[Second step]

The second step is a step (b) of bonding the sleeve member 4 to the upper surface A of the front body sheet 2. On the second step (b), a plurality of the sleeve members 4 stored on a delivery roll 103 provided with suction means are fed forward in the longitudinal direction one by one at predetermined intervals in such a manner that the transversely opposite side edges 4c, 4d connecting the longitudinal opposite ends 4a, 4b of the sleeve member 4 extend in parallel to the transversely opposite side edges 2a, 2b of the front body sheet 2.

The sleeve member 4 is 90° turned by turning over means

104 placed at the downstream of the delivery roll 103 so that the side edges 4c, 4d of the sleeve member 4 intersect the side edges 2a, 2b of the front body sheet 2 at right angle. Then the sleeve member 4 is held on a peripheral surface of a suction drum 106 placed at the downstream of the turning over means 104.

The front body sheet 2 is coated in a first bonding zones S1 on the upper surface A with adhesive by an adhesive coating device 105 placed at the upstream of the suction drum 106. The first bonding zones S1 lie on both sides of the center line Y1 slightly ahead of the neckline 6 and extend in parallel to the center line Y1. Each bonding zone S1 is dimensioned to be substantially a half of a circumferential dimension of the sleeve member 4. The front body sheet 2 having been coated with the adhesive then passes between the contacting surfaces of the drum 106 and the nip roll 107.

The single sleeve member 4 moving together with the peripheral surface of the drum 106 is controlled so that the center line Y2 of the sleeve member 4 coincides with the center line Y1 of the front body sheet 2 and the sleeve member 4 is exactly placed upon the bonding zones S1. In this manner, passing between the contacting surfaces of the drum 106 and the roll 107, the sleeve member 4 is bonded to the front body sheet 2 by means of the adhesive. A transverse dimension of the sleeve

member 4 is larger than that of the front body sheet 2 and the longitudinally opposite ends 4a, 4b of the sleeve member 4 extend outward beyond the transversely opposite side edges 2a, 2b of the front body sheet 2.

[Third step]

The third step (c) is a step of dividing the front body sheet 2 in a first front body sheet 2A and a second front body sheet 2B. On the third step (c), the front body sheet 2 and the sleeve member 4 are cut along their center lines Y1, Y2, respectively, by a cutter 108. The front body sheet 2 is divided in the first front body sheet 2A lying on the right side of the center lines Y1, Y2 and the second front body sheet 2B lying on the left side of the center lines Y1, Y2 as viewed in the longitudinal direction.

[Fourth step]

The fourth step (d) is a step of inverting the relative position of the first front body sheet 2A and the second front body sheet 2B. On the fourth step (d), an inverter 109 inverts the relative position of the first and second front body sheets 2A, 2B so that the first front body sheet 2A may lie on the left side and the second front body sheet 2B may lie on the right side as viewed forward in the longitudinal direction. Such inversion of the relative position may be achieved by

simultaneously moving these sheets 2A, 2B to their new positions of one of these two sheets 2A, 2B may be moved to its new position opposed to the other sheet.

After the relative position of the first and second front body sheets 2A, 2B have been inverted, the cutouts 6 of these sheets 2A, 2B are opposed to each other and placed side by side in a relationship of plane symmetry. The side edges 2a, 2b which have been the transversely opposite side edges 2a, 2b of the undivided front body sheet 2 now define side edges 2a, 2b of the first and second front body sheets 2A, 2B closely adjacent and opposed to each other. The longitudinally opposite ends 4a, 4b of the sleeve member 4 is now placed upon each other. Laterally inversion of the relative position of the first and second front body sheets 2A, 2B enables the sleeve member 4 longer than the width of the front body sheet 2 to be attached to the jacket 1 without being restricted by the width of the front body sheet 2.

The fourth step (d) includes a step of bonding the paired belt members 5, 5 to the upper surface A of the first and second front body sheets 2A, 2B, respectively. While the diagram illustrates the belt members 5, 5 to be bonded to the upper surface A of the first and second front body sheets 2A, 2B after the relative position of these sheets 2A, 2B have been inverted,

it is also possible to bond the belt members 5, 5 to the first and second front body sheets 2A, 2B before the relative position of these two sheets 2A, 2B are inverted.

Each of the belt members 5, 5 is a narrow rectangular strip made of nonwoven fabric and defined by transversely opposite side edges 5a, 5b and longitudinally opposite ends 5c, 5d. The belt members 5 are fed forward pair by pair at predetermined intervals from a delivery roll 110 on which a plurality of the belt members 5 are stored and including suction means in the longitudinal direction. Each pair of the belt members 5, 5 are coated on their rear ends with adhesive by an adhesive coating device 111 interposed between said delivery roll 110 and a suction drum 112. These belt members 5, 5 are then hold on a peripheral surface of said drum 112.

The belt members 5 moving together with the peripheral surface of the drum 112 is so controlled that each of the paired belt members 5, 5 has its transversely opposite side edges 5a, 5b extending in parallel to the transversely opposite outer side edges 2c, 2d and lie at a predetermined distance ahead of the sleeve member 4 as viewed in the longitudinal direction. Passing between the contacting surfaces of the drum 112 and the roll 113, these belt members 5, 5 are bonded to the first and second front body sheets 2A, 2B, respectively, by means of

adhesive.

[Fifth step]

The fifth step (e) is a step of bonding the first and second front body sheets 2A, 2B to the rear body sheet 3 in second bonding zones S2. On the fifth step(e), the rear body sheet 3 stored on a delivery roll 114 is continuously fed forward in the longitudinal direction as a nip roll 116 rotates. An adhesive coating device 115 interposed between the delivery roll 114 and the nip roll 116 coats the upper surface A of the rear body sheet 3 with adhesive along transversely opposite side edges 3a, 3b as well as along portions of respective lines transversely extending between the opposite side edges 3a, 3b of the rear body sheet 3.

Passing between the contacting surfaces of paired nip rolls 117 opposed to each other, the first and second front body sheets 2A, 2B are placed upon the rear body sheet 3 with the transversely opposite outer side edges 2c, 2d of the first and second front body sheets 2A, 2B coinciding with the center line Y3 of the rear body sheet 3. Simultaneously, the respective lower surfaces B of the first and second front body sheets 2A, 2B are bonded to the upper surface A of the rear body sheet 3 by means of adhesive in the second bonding zones S2 extending transversely of the first and second front body sheets 2A, 2B

except the cutouts 6 destined to define the neck-opening.

[Sixth step]

The sixth step (f) is a step of bonding the first and second front body sheets 2A, 2B, the sleeve members 4, 4 and the rear body sheet 3 together in third bonding zones S3. On the sixth step (f), a folding device 118 folds the transversely opposite side edges of the rear body sheet 3 onto the respective upper surfaces A of the first and second front body sheets 2A, 2B. In this manner, the first and second front body sheets 2A, 2B, the sleeve members 4, 4 and the rear body sheet 3 are bonded together in the third bonding zones S3 extending in the longitudinal direction along the transversely opposite side edges 3a, 3b of the rear body sheet 3.

[Seventh step]

The seventh step (g) is a step of cutting the first and second front body sheets 2A, 2B and the rear body sheet 3. On the seventh step (g), at a position slightly behind the second bonding zones S2 as viewed in the longitudinal direction, a cutter 119 cuts these sheets 2A, 2B, 3 transversely of them and, at a predetermined distance ahead of the belt members 5, 5 as viewed in the longitudinal direction, the same cutter 119 cuts these sheet 2A, 2B, 3 transversely of them.

Fig. 3 is a perspective view showing the disposable jacket

1 made using the process as the sleeve members 4 have been laterally spread. As seen in Fig. 3, the upper garment 1 comprises the first and second front body sheets 2A, 2B and the rear body sheet 3 bonded together, a pair of the sleeve members 4, 4 attached to the upper ends of these sheets 2A, 2B, 3 and extending outward from these sheets 2A, 2B, 3, and a pair of belt members 5, 5 partially bonded to the first and second front body sheets 2A, 2B in their middle zones. The upper garment 1 has the neckline defined by a pair of the cutouts 6 in the middle of its upper end, a hemline defined by its lower end and a front slit-like opening 8 extending between the upper and lower ends of the upper garment 1. The upper ends of the front and rear body sheets 2, 3 except the cutouts 6 of the neckline define a pair of shoulders. Bonding of the front and rear body sheets 2, 3, the sleeve members 4 and the belt members 5 may be carried out using suitable adhesive agent such as hot melt adhesive or suitable sealing technique such as heat- or ultrasonic-sealing. Bonding of these sheets may be achieved in continuous or intermittent mode. Cutting of the sheets 2, 3 may be carried out not only using a cutting die but also using the other cutting technique utilizing laser rays or ultrasonic wave.

The front and rear body sheets 2, 3, the sleeve members

4, 4 and the belt members 5, 5 are preferably made of a nonwoven fabric formed by thermoplastic fibers such as a spun bond nonwoven fabric or a melt blown nonwoven fabric. Taking account of moisture-holding property and rigidity to be improved, particularly preferable stock material for these members includes a spun bond, a point bond or melt blown nonwoven fabric having a basis weight of $50 - 100\text{g/m}^2$ each containing dependently rayon, nylon, pulp or a mixture thereof. Useful stock material for these sheets further includes a nonwoven fabric made porous to improve its moisture-permeability, a nonwoven fabric embossed to generate irregularity and thereby to improve its cushioning property or nonwoven fabric treated to have an elasticity.

Through the first step (a) - the seventh step (g), the production line as has been described heretofore utilizes an optical sensor comprising an emitting optics and a receiving optics, a rotary speed sensor adapted to measure a rotary speed of the rolls, a control device electrically connected to these sensors, and movable devices and a driving device also electrically connected to said control device to achieve proper positioning when the sheets 2A, 2B, 3 are placed one upon another or when the sheet 2 is placed upon the sleeve member 4, on one hand, and to control the rates at which said sheets 2, 3 and

said sleeve member 4 should be fed. A program to optimize a running environment for the production line is stored in a memory of said control device.

The process according to this invention enables the disposable upper garment to be made merely by bonding the body sheets, the sleeve members and the belt members together using adhesive or sealing technique and thereby enables a manufacturing cost to be remarkably reduced. In addition, the process according to this invention adopts continuous running and automation of the sequential steps, instead of adopting discontinuous stitching steps of relay mode and thereby improves a productivity per unit time.

C L A I M S

1. Process for making a disposable upper garment comprising the steps of:

(a) continuously feeding forward a front body sheet made of a nonwoven fabric in a longitudinal direction thereof, said front body sheets having upper and lower surfaces, transversely opposite side edges extending in said longitudinal direction and a center line extending in said longitudinal direction to bisect a dimension of said sheet in a transverse direction therebetween said transversely opposite side edges, and cutting off portions from said front body sheet to form a neckline each describing a convex curve extending from said transversely opposite side edges toward said center line;

(b) feeding sleeve members made of a nonwoven fabric forward in said longitudinal direction one by one, each of said sleeve members being shaped to be longer in said transverse direction than in said longitudinal direction and having, in addition to wrist-openings at its longitudinally opposite ends, respectively, a center line extending in said longitudinal direction to bisect a dimension of said sleeve member in said transverse direction, placing the single sleeve member upon an upper surface of said front body sheet with the center line of

said front body sheet coinciding with the center line of said sleeve member and bonding said sleeve member to said front body sheet in first bonding zones extending in parallel to and on both sides of said center line slightly ahead of said neckline cutouts;

(c) cutting said front body sheet and said sleeve member along said center line and thereby dividing said front body sheet in a first front body sheet lying on the right side of said center line and a second front body sheet lying on the left side of said center line as viewed forward in said longitudinal direction;

(d) laterally inverting a relative position of said first front body sheet and said second front body sheet so that said neckline cutouts of said first and second front body sheets are opposed to each other in a relationship of plane symmetry;

(e) continuously feeding a rear body sheet forward in a longitudinal direction thereof, said rear body sheet having upper and lower surfaces, transversely opposite side edges extending in said longitudinal direction and a center line extending in said longitudinal direction to bisect a transverse dimension of said rear body sheet between said transversely opposite side edges, placing the respective lower surfaces of said first and second front body sheets upon an upper surface

of said rear body sheet with respective inner side edges of said first and second front body sheets lying adjacent to each other and extending in said longitudinal direction coinciding with said center line of said rear body sheet, and bonding said first and second front body sheets to said rear body sheet in second bonding zones lying slightly behind said sleeve member and extending in said transverse direction;

(f) folding said transversely opposite side edges of said rear body sheet onto the respective upper surfaces of said first and second front body sheet and bonding said first and second front body sheets, said sleeve member and said rear body sheet are bonded together in third bonding zones extending in said longitudinal direction along the transversely opposite side edges of said front and rear body sheets;

(g) cutting, at a position slightly behind said second bonding zones as viewed in said longitudinal direction, said first and second front body sheets and said rear body sheet in and cutting, at a position at a predetermined distance ahead of said sleeve member as viewed in said longitudinal direction, these sheets in said transverse direction.

2. The process according to Claim 1, wherein, said step (d) of inverting the relative position of said first and second

front body sheets comprises a step of feeding narrow belt members made of a nonwoven fabric successively pair by pair, each of said belt members having longitudinally opposite ends and transversely opposite side edges, placing said belt members upon the respective upper surfaces of said first and second front body sheets so that, at a predetermined distance ahead of said sleeve members as viewed forward in said longitudinal direction, the transversely opposite side edges of said belt member extending in parallel to the transversely opposite outer side edges of said first and second front body sheets, and bonding respective rear ends of said belt members to the respective upper surfaces of said first and second front body sheets.