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(54) BONDING OF POROUS FIBROUS WEBS
 TO SUBSTRATES

(71) We, THE PROCTER AND GAMBLE COMPANY, a Corporation organised and existing under the laws of the State of Ohio, United States of America, of 5 301 East Sixth Street, Cincinnati, 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:—

10 The invention relates to a method of bonding a porous fibrous web to a substrate and articles made thereby, and more particularly to a process whereby and products wherein a 15 porous web is affixed to a substrate with excellent bond strength utilizing a very low level of hot-melt adhesive, the bond being essentially invisible and the porous web maintaining its flexibility and fluid transparency.

20 The process of the present invention may be applied in any instance where it is desired to provide a laminated product, at least one lamination of which comprises a fluid-porous, fibrous sheet. An excellent example of such a 25 product is an integral disposable diaper. While not intended to be so limited, for purposes of exemplary showing the present invention will be described in its application to the manufacture of integral disposable diapers.

30 Prior art workers have devised a number of different types of integral disposable diapers. Generally, however, such diapers comprise three basic parts: a moisture pervious topsheet intended to lie adjacent the body of the wearer, 35 a moisture proof backsheet and an absorbent core therebetween. Examples of such disposable diapers are taught in United States Letters patent Re 26,151 and 3,860,003. The absorbent core may or may not be provided with a layer 40 of high wet strength tissue on one or both of its faces.

45 In a typical practice, a topsheet may be provided with an extruded bead or stripe of hot-melt adhesive along each of its edges. These edges are folded about the edges of the absorbent core and are adhered to the under-side of the absorbent core. In somewhat similar fashion, extruded hot-melt adhesive stripes or

beads are located on the backsheet inset from and parallel to its longitudinal edges. The 50 folded edges of the topsheet are adhered to the backsheet by means of these last mentioned adhesive stripes. Additional adhesive stripes or beads may be provided on the top sheet to 55 join it to the backsheet at the waist band areas of the diaper.

60 In another approach, the backsheet is provided with a plurality of longitudinally extending hot-melt adhesive stripes or beads in parallel spaced relationship. The absorbent 65 core is applied to the backsheet and adhered thereto by the adhesive stripes. The topsheet is next applied, being adhered to those edge portions of the back sheet which extend beyond the core.

70 The above approaches utilizing hot-melt adhesive stripes or beads result in certain deficiencies. First of all, the adhesive usage is relatively high with respect to the area actually bonded and the adhesive stripes or 75 beads are apparent and unsightly. At the positions of the adhesive stripes or beads, the softness of the product is reduced. As a result, much work has been directed to making the stripes or beads of hot-melt adhesive as thin 80 as possible so as to be as flexible as possible. Wherever the adhesive stripes or beads are applied to, or are in contact with, the porous, fibrous topsheet, the porosity of the topsheet is lost or seriously affected. Further- 85 more, in products requiring large areas of bonding a multiplicity of adhesive stripes are required in close proximity thereby greatly exaggerating the above enumerated deficiencies. Finally, in those prior art 90 approaches wherein only peripheral gluing of the diaper components is practiced, the absorbent core may shift or bunch due to movement of the wearer.

95 The present invention provides a process whereby and a product wherein a hot-melt adhesive may be applied to even large areas of the porous, fibrous topsheet and the topsheet adhered to the substrate (the backsheet and/or the absorbent core). Hot-melt adhesive applied to the porous, fibrous topsheet in the

manner taught herein provides an excellent fiber-to-adhesive bond with very good peel and creep bond characteristics to substrates. Nevertheless, the adhesive is substantially invisible; the softness of the product is retained and the moisture transparency-permeability of the top-sheet is reduced only by 5% or less. Where the disposable diaper has cut longitudinal edges (as in diapers of the type taught in the above mentioned U.S. Letters Patent No. 3,860,003), the entire edge portions of the diaper can be laminated producing neater and more easily cut edges.

According to the present invention a porous, fibrous web is bonded to a substrate by a process in which the web is passed over a source providing a controlled flow of hot-melt adhesive so that individual fibres and fibre junctions at the surface of the web wipe adhesive from the source to form adhesive globules on the said surface, after which the web, with the said surface adjacent the substrate, is passed between a pair of nip rolls, the clearance between which is pre-set to provide a gap which is so sized as to deform the adhesive globules and avoid excessive press-through of adhesive through the porous web.

A process in accordance with the invention may be used in the continuous manufacture of integral disposable diapers of the type comprising a porous, fibrous topsheet, a fluid impermeable, non-fibrous backsheet and an absorbent core element therebetween. In this version of the process a continuous web of porous, fibrous topsheet material is passed over a source providing a controlled flow of hot-melt adhesive so that individual fibres and fibre junctions at the surface of the topsheet web adjacent the adhesive source wipe adhesive from the source to form adhesive globules on the individual fibres and fibre junctions, the topsheet web together with a continuous web of fluid-impermeable, non-fibrous backsheet material is passed between a pair of nip rolls, with the said surface of the topsheet web facing the backsheet web, core elements are continuously introduced one after another in spaced relationship between the topsheet web and the backsheet web upstream of the nip rolls, which are so spaced as to define a pre-set gap between them of such a size as to deform the adhesive globules on that portion of the topsheet web adjacent the backsheet web to bond the two webs directly together while avoiding excessive press-through of the adhesive through the topsheet web after which the bonded topsheet and backsheet webs are severed at intervals to form the diapers.

The liquid, hot-melt adhesive tends to form globules on the projecting surface fibres and fibre junctions, which globules are characterised by excellent adhesive-to-fibre attachment. It will be understood that the globules need not necessarily be spherical and most frequently are elongated in the direction of the

fibres to which they adhere and often in the direction of travel of the web. It has further been noted that at sites of surface fiber junctions the globules will be enlarged at the points of junction or cross-over of the surface fibers by virtue of surface tension or capillary effects. The subsequent passage of the porous, fibrous web, together with the substrate web, through the preset clearance nip roll assembly causes the fibrous porous web to become firmly bonded to the substrate web. In this way, a highly porous, fibrous web can be continuously adhesively coated and laminated to the substrate web. Very good bond strength is achieved and at the same time the moisture transparency/permeability of the porous, fibrous sheet is very little affected. The adhesive is essentially invisible and the flexibility and compliance of the final product is essentially unaffected.

To prevent the laminating hot-melt adhesive from pressing through the highly porous, fibrous web when being laminated to a substrate web, the laminating nip roll contacting the porous web may be double-wrapped by the porous web. This entails passing the porous web uncoated through the nip and then looping it back around and through the nip again, having been adhesive coated in the mean time. Any adhesive "press-through" occurring during the lamination operation will be transferred onto that portion of the uncoated fibrous web passing through the nip.

An embodiment of the invention is illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of an exemplary disposable diaper in an unfolded configuration and partially fragmented.

Figure 2 is a fragmentary, diagrammatic view, partially in cross section, and illustrating the application of a hot-melt adhesive to a porous, fibrous web and the laminating of that web to a substrate.

Figure 3 is a fragmentary, semi-diagrammatic, magnified bottom view (partly in cross section) of a narrow portion of the porous, fibrous web and substrate of Figure 2.

Figure 4 is a semi-diagrammatic side elevational view of a system for applying hot-melt adhesive to a porous, fibrous web and laminating the web to a substrate.

Figure 5 is an enlarged, fragmentary, cross sectional view of the preset nip of Figure 4.

Figure 6 is a perspective view of a modified form of that nip roll of Figure 4 contacting the substrate.

Figure 7 is a fragmentary plan view of a porous fibrous web for use as a topsheet in the diaper of Figure 1 and pattern coated with a hot-melt adhesive.

Figure 8 is a semi-diagrammatic elevational view of a system for applying hot-melt adhesive to a porous, fibrous web and laminating that

web to a substrate in the form of a second porous, fibrous web.

As indicated above, the manufacture of disposable diapers constitutes an excellent application of the present invention and, while not intended to be so limited, the invention will be described in terms thereof. To this end, an exemplary diaper of the type taught in the above mentioned United States Letters Patent 3,860,003 is shown in Figure 1. The diaper, generally indicated at 1, is made up of three basic parts: a flexible, moisture impermeable backsheet 2, an absorbent core 3 and a porous, fibrous topsheet 4.

The moisture impermeable backsheet 2 may be made of any suitable material such as a low density, opaque polyethylene web having a thickness of about 0.0015 inch. The absorbent core 3 may be any of the absorbent materials known to those skilled in the art as for example a multiplicity of plies of crepe cellulose wadding, fluffed cellulose fibers, textile fibers, fluffed wood pulp (generally known as airfelt) or other absorbent materials. As a part of the core, a wet strength tissue layer may be applied to that face of the core adjacent backsheet 2, to that face of core 3 adjacent topsheet 4 or both. One such tissue layer is shown at 5.

Topsheet 4 may again be made of any suitable compliant, soft feeling, porous material. In general, a topsheet for a disposable diaper is made up of woven or non-woven fibers such as, for example, mixtures of polyester and rayon fibers.

In the embodiment illustrated, the absorbent core 3 is of an hour glass shape forming a back portion 3a, a front portion 3b and a crotch portion 3c. Between the back and front portions of absorbent core 3 and adjacent the crotch portion 3c the bottomsheets 2 and topsheet 4 are joined together to form side flaps 6 and 7. Elastic members 8 and 9 are operatively associated with side flaps 6 and 7, respectively, causing side flaps 6 and 7 to be gathered and to form a moisture proof seal with the wearers legs during use. The diaper of Figure 1 may also be provided with attachment tapes 10 and 11, as is well known in the art.

In the assembly of such a diaper structure, it is common to present the backsheet 2 and topsheet 4 as continuous webs. Core elements 3 and elastic members 8 and 9 are appropriately located between the topsheet and backsheet webs and the webs are caused to be joined together. Heretofore, the joiner of these elements was accomplished by double coated pressure sensitive tape, beads or stripes of hot-melt adhesive appropriately located on the topsheet web or the backsheet web or both, or by other attachment means or combinations of attachment means. These various attachment methods resulted in numerous deficiencies, as enumerated above.

In accordance with the present invention,

attachment of the diaper parts is accomplished by applying hot-melt adhesive to the topsheet web in a manner about to be described, and causing the topsheet web to become laminated to the absorbent core and those exposed portions of the backsheet web by passage between nip rolls having a preset gap between them. The absorbent core may be additionally attached to the backsheet web by any appropriate means, if desired.

Figures 2 and 3 diagrammatically represent the gluing and laminating of a porous, fibrous web to a substrate web. For purposes of an exemplary showing, a porous, fibrous non-woven web 12 is shown which may be equivalent to topsheet 4 of Figure 1. Similarly, a non-porous substrate web 13 is illustrated which again may be equivalent to backsheet 2 of Figure 1. For purposes of clarity, core elements such as core element 3 of Figure 1 and elastic elements such as elastic elements 8 and 9 of Figure 1 are not shown in Figures 2 and 3.

A hot-melt adhesive is applied to the porous, fibrous web 12 by direct contact extrusion. To this end, a glue nozzle 14 is provided having a slot extrusion orifice 15. Hot-melt adhesive 16 is pumped through orifice 15 forming a small pool of adhesive 17. As the porous, fibrous web 12 is drawn over nozzle 14 and the adhesive pool 17, surface fibres and fiber junctions will "pick-off" adhesive from pool 17. In this way, adhesive globules 16a are formed on the surface fibers and fiber junctions having excellent adhesive-to-fiber attachment points. As shown in Figures 2 and 3, adhesive globule 16a are randomly located at the position of the fibers and fiber junctions at the surface of porous web 12. The porous, fibrous web 12 is thereafter immediately combined with the substrate web 13 and webs 12 and 13 are subjected to moderate compression forces at the point of combination, generally indicated at 18. This is accomplished by a preset clearance nip roll assembly, as will be described hereinafter. The hot-melt adhesive globules are deformed (i.e. slightly flattened and widened under compression as at 16b in Figures 2 and 3) to increase the total adhesive contact area to the substrate surface. This assures good adhesion to the substrate web 13. In instances where a cooled "skin" forms on the adhesive globules the term "deformed" is intended to include the rupturing of the globule "skin" under compression to expose the heated interior to the substrate.

The glue nozzle 14 is a conventional slot extrusion orifice nozzle well known in the art. Excellent results have been achieved, for example, through the use of such nozzles manufactured by Acumelt Laboratories, Inc. of Newton Lower Falls., Massachusetts.

Hot-melt adhesives having a wide variety of temperature characteristics and adhesive properties are readily available. It is well within

the skill of the ordinary worker in the art to select a hot-melt adhesive having appropriate temperature, flow and adhesive characteristics for coating on the porous, fibrous web 12 and an application temperature to enable the adhesive globules to possess sufficient "open-time" (i.e., time to solidification) between the application of the adhesive to the porous, fibrous web 12 and the combining of web 12 with substrate web 13. For example, in applying a porous, carded non-woven fibrous top-sheet web (of 70% to 100% polyester fibers of 1-1/2 to 3 denier, 0% to 30% rayon fibers of 3 denier, and bonded together with 20% to 25% cross-linking vinyl acrylic latex, to achieve a total web basis weight of from 20 to 30 gm/yd² and having a thickness of from .008 to .020 inch) to a polyethylene backsheet web, excellent results have been achieved using a hot-melt adhesive manufactured by Findley Adhesives of Milwaukee, Wisconsin, under the formulation number 690-334 at an application temperature of from 280°F. to 320°F. (with an open time of up to 1 second).

It has been determined that for best results and for any desired web speed the hot-melt adhesive 16 should be pumped through the slot extrusion orifice 15 of nozzle 14 at a rate such that, if it were being applied to a smooth, non-fibrous web, a continuous, uniform adhesive layer of from .0002 inch to .0010 inch in thickness would be produced. This will result in globules on the surface fibres and fiber junctions of the porous, fibrous web of from about .001 inch to about .008 inch in the thickness.

A system for adhesive coating the porous, fibrous web 12 and laminating it to the substrate web 13 is diagrammatically illustrated in Figure 4. The web 12, from a source thereof generally indicated at 19 is caused to pass over a nip roll 20. The web 12 thereafter passes over additional idler rolls 21, 22 and 23. After its passage about roll 23 the web 12 is coated with hot-melt adhesive by causing it to pass over glue nozzle 24 equivalent to glue nozzle 14 of Figure 2. The coated web 12 again passes about nip roll 20 at which time it is combined with substrate web 13 passing about nip roll 25 to produce the desired laminated web assembly. Figure 5 is an enlarged view of the nip between rolls 20 and 25 it will be evident from this figure that that portion of web 12 provided with adhesive globules 16a (and indicated at 12a) passes through the nip between the substrate web 13 and the initial, unglued portion of web 12, indicated at 12b. This "double-wrapping" of web 12 about nip roll 20 will assure that during lamination any hot-melt-adhesive pressed through the highly porous web portion 12a will be transferred onto the back-up web portion 12b and will not accumulate on the laminating nip roll 20.

In the preferred practice of the system of Figures 4 and 5, idler roll 21 is so positioned

that the unglued portion of web 12 will remain in contact with the glued portion of web 12 until the unglued web portion reaches idler roll 21. This will give any adhesive pressed through web portion 12a during its passage through the nip and contacting web portion 12b (see Figure 5) an opportunity to solidify. While the amount of adhesive "press through" or "strike-through" will be very little, any points of joiner between the glued and unglued porous web portions will be cleanly broken at idler roll 21 without glue stringing or the like.

Combiner rolls 20 and 25 are set at a fixed, predetermined nip clearance. The preset nip gap should be such as to produce a soft compression force between the hot-melt adhesive treated porous, web 12 and the substrate web 13. As used herein, the phrase "a soft compression force" is intended to mean a force sufficient to deform the globules into intimate contact with the substrate web and rupture the surface film of the hot-melt adhesive globules 16a (if required) while minimizing "strike-through" or "press-through" of the adhesive. As an example, excellent results were achieved with a preset nip gap of .012 inch during the lamination of a porous, fibrous, carded non-woven web of the type described above and having a thickness of .016 inch (double wrapped about nip roll 20 for an effective uncompressed thickness of .032 inch) and a polyethylene substrate web of .0015 inch thickness, utilizing the adhesive formulation set forth above.

When the system of Figures 4 and 5 is used in the manufacture of diapers of the type, for example, illustrated in Figure 1, core elements 3 and elastic elements 8 and 9 will be introduced between the porous topsheet web 12 and the moisture proof backsheet web 13 prior to the passage of these webs through the nip of rolls 20 and 25. In such an instance, the roll 25 will, as shown in Figure 6, have a peripheral cavity 26 configured to accept an absorbent core 3 as it passes between rolls 20 and 25. The cavity 26 may be filled with a resilient material 27 such as foam open pore urethane elastomer or the like. The cavity 26 is so sized and the resilient material 27 is so chosen that the portion of the web assembly containing an absorbent core is subjected to no greater compression force than that portion of the web assembly which does not have an absorbent core therebetween.

Once the core-containing web assembly has passed between the preset nip rolls 20 and 25 and beyond idler roll 21, the assembly may be cut into individual integral disposable diapers of the type shown in Figure 1. The disposable diaper products, made in accordance with the above described process, are characterized by the fact that the topsheet 4 has been firmly bonded to the wet strength tissue element 5, those portions of the absor-

bent core 3 which extend beyond tissue 5 and those portions of backsheet 2 which extend beyond the core 3. The bonding of the topsheet 4 to the core 3 and its wet strength tissue element 5 markedly improves the tearing and balling strength of the core and tends to retain the core in its proper position during movement of the wearer. The topsheet 4 having been coated with a hot-melt adhesive, nevertheless remains completely transparent to moisture transmission. The disposable diaper structure is highly flexible, shows little evidence of any adhesive attachment means and has excellent bond strengths (both peel and creep). The fact that topsheet 4 is firmly bonded to backsheet 2 particularly in the areas of side flaps 6 and 7 makes the cutting of lateral notches 28 and 29 therein both neater and easier. Despite their lamination, however, the side flaps 6 and 7 remain highly flexible and compliant.

In the manufacture of integral disposable diapers of the type shown in Figure 1, it has been found to be unnecessary to coat the topsheet 4 overall. The process described with respect to Figures 2 through 5 lends itself well to the use of direct web contacting, multi-slotted, hot-melt glue applicator nozzles (well known in the art) capable of applying the hot-melt adhesive in a pattern. A porous, fibrous topsheet web fragment having a pattern coating of hot-melt adhesive is illustrated at 30 in Figure 7. The adhesive pick-up by the surface fibers and fiber junctions of web 30 is the same as described with respect to Figures 2 and 3. The web 30 is provided with relatively wide glue areas 31 and 32 along its longitudinal edges the wide glue areas 31 and 32 are so sized as to incorporate a portion at least of the side flaps 6 and 7 (see Figure 1). Between the wide glue areas 31 and 32 there are a plurality of narrow glue areas 33 extending longitudinally of web 30 and in parallel spaced relationship. The width of glue areas 33 and the spaces therebetween have been exaggerated in Figure 7 for purposes of clarity. Excellent results have been achieved, for example, with glue areas 33 having a width of about 1/8 inch separated by non-glue areas having a width of about 1/4 inch.

A topsheet web of the type shown at 30 in Figure 7 may be laminated to a backsheet web in the same manner described with respect to Figures 4 and 5. An excellent bond with all of the advantages described above is achieved with an even greater saving in the amount of hot-melt adhesive used.

The process illustrated in Figures 4 and 5 is applicable to the adhering of a porous, fibrous web to any suitable substrate web. Figure 8 illustrates a system, similar to Figure 4, wherein a porous, fibrous web is adhered to a substrate in the form of another porous, fibrous web. To this end, a first porous, fibrous web 34 from a source generally indi-

cated at 35 is caused in unglued condition to pass about a nip roll 36 and a series of idler rolls 37 through 39. The rolls 36 through 39 are equivalent to rolls 20 through 23 of Figure 4. After its passage about idler roll 39, the web 34 has a hot-melt adhesive applied thereto by a glue nozzle 40 equivalent to glue nozzle 24 of Figure 4. Thereafter, the web again passes about nip roll 36.

A porous substrate web 41 from a source generally indicated at 42 is caused to pass about a second nip roll 43. Thereafter, web 41 passes over idler rolls 44 through 46 and again about nip roll 43 whereupon it is laminated with adhesive-coated web 34. The double wrapping of nip rolls 36 and 43 will prevent accumulation of hot-melt adhesive thereon in the same manner described with respect to Figure 4. Again, It is preferred that idler rolls 37 and 44 be so located that the initial flights of webs 34 and 41 are stripped from the bonded web assembly 34-41 by these idler rolls, should any hot-melt adhesive strike through to the initial web flights. While for many purposes adequate bond strength between webs 34 and 41 can be achieved through the application of hot-melt adhesive to web 34 only, additional bond strength can be realized by applying hot-melt adhesive to web 41 by means of a second glue nozzle 47 shown in broken lines.

Modifications which may be made to a process in accordance with the invention include the use of various types of substrate webs. The same is true with respect to the porous, fibrous web which may take the form, for example; of a wet-strength paper, a woven cloth or the like.

The process of the present invention may be used to apply an over all coating on the porous, fibrous web or a pattern coating as described above. Various adhesive coating patterns are possible including stripes running in the machine direction, wide bands, or interrupted or intermittent patterns. It is also within the scope of the present invention to substitute gravure wipe-coating techniques for the slot-extrusion orifice nozzles taught above to provide the adhesive globules on the surface fibers and fiber junctions of the porous web.

In an instance where it might not be convenient to combine the porous, fibrous web and the substrate web immediately after application of the hot-melt adhesive to the porous web, the adhesive globules can be allowed to solidify and can subsequently be reheated prior to the lamination step. In an instance where adhesive "press-through" or "strike-through" proves to be a particular problem, combiner roll 20 of Figure 4 or combiner rolls 36 and 43 of Figure 8 could be web-wrapped more than twice. This would entail a proper adjustment of the preset combiner nip clearance.

In the manufacture of the integral disposable diapers, it will be understood by one skilled in

the art that the topsheet need not be adhered to both the core and the backsheets. By appropriate pattern coating of the topsheet or the like the topsheet may be adhered to the backsheet only.

WHAT WE CLAIM IS:—

1. A process of continuously bonding a porous fibrous web to a substrate in which the web is passed over a source providing a controlled flow of hot-melt adhesive so that individual fibres and fibre junctions at the surface of the web wipe adhesive from the source to form adhesive globules on the said surface, after which the web, with the said surface adjacent the substrate, is passed between a pair of nip rolls, the clearance between which is pre-set to provide a gap which is so sized as to deform the adhesive globules and avoid excessive press-through of adhesive through the porous web.

2. A process according to claim 1 wherein the adhesive globules are randomly located on surface fibres and fibre junctions over all of the said surface of the porous web.

3. A process according to claim 1 wherein the adhesive globules are randomly located on surface fibres and fibre junctions within a pattern on the said surface of the porous web.

4. A process according to any one of claims 1 to 3 wherein the controlled flow hot-melt adhesive source comprises a slot extrusion orifice nozzle.

5. A process according to claim 4 in which hot-melt adhesive is pumped through the slot extrusion orifice of the nozzle at a rate such that a uniform continuous layer of adhesive having a thickness of from 0.0002 inch to 0.0010 inch would be deposited on a non-porous, non-fibrous web moving at the same rate as the porous web.

6. A process according to any one of claims 1 to 5 in which the porous web is caused to travel in a closed path so as to pass between the nip rolls at least twice, the porous web being free of adhesive globules during at least its first passage between the rolls and having the adhesive globules on the said surface thereof during its last passage between the rolls, during which last passage the surface of the porous web with the adhesive globules is pressed against the substrate and the opposite surface of the porous web is pressed against an adhesive-free portion of the web whereby any adhesive pressed through the adhesive-bearing portion of the porous web by the rolls will accumulate on the adhesive-free portion of the porous web passing through the rolls.

7. A process according to claim 6 wherein the substrate also comprises a porous, fibrous web which is also caused to travel in a closed path so as to pass between the nip rolls at least twice.

8. A laminate comprising a porous, fibrous layer and a substrate layer abutting against the

porous layer, the abutting surface of the porous layer being defined by individual fibres and fibre junctions and in which the two layers have been bonded together by a process according to any one of the preceding claims.

9. A process of continuously manufacturing integral disposable diapers of the type comprising a porous, fibrous topsheet, a fluid impermeable, non-fibrous backsheet and an absorbent core element therebetween, in which process a continuous web of porous, fibrous topsheet material is passed over a source providing a controlled flow of hot-melt adhesive so that individual fibres and fibre junctions at the surface of the topsheet web adjacent the adhesive source wipe adhesive from the source to form adhesive globules on the individual fibres and fibre junctions, the topsheet web together with a continuous web of fluid-impermeable, non-fibrous backsheet material is passed between a pair of nip rolls, with the said surface of the topsheet web facing the backsheet web, core elements are continuously introduced one after another in spaced relationship between the topsheet web and the backsheet web upstream of the nip rolls, which are so spaced as to define a preset gap between them of such a size as to deform the adhesive globules on that portion of the topsheet web adjacent the backsheet web to bond the two webs directly together while avoiding excessive press-through of the adhesive through the topsheet web after which the bonded topsheet and backsheet webs are severed at intervals to form the diapers.

10. A process according to claim 9 in which the peripheral surface of the nip roll in contact with the backsheet web includes a recess filled with resilient material, the recess being so sized and the resilient material being so chosen as to accommodate the extra thickness of the core elements between the topsheet and backsheet webs as the core elements pass between the rolls, so that the adhesive globules on those portions of the topsheet web adjacent the core elements will be deformed to bond the topsheet web directly to the core elements with little press-through of adhesive through the topsheet web.

11. A process according to claim 9 or claim 10 wherein the adhesive globules are randomly located on surface fibres and fibre junctions over all of the said surface of the topsheet web.

12. A process according to claim 9 or claim 10 wherein the adhesive globules are randomly located on surface fibres and fibre junctions within a pattern on the said surface of the topsheet web.

13. A process according to any one of claims 9 to 12 wherein the controlled flow hot-melt adhesive source comprises a slot extrusion orifice nozzle.

14. A process according to claim 13 in which hot-melt adhesive is pumped through the slot extrusion orifice of the nozzle at a rate

such that a uniform continuous layer of adhesive having a thickness of from 0.002 inch to 0.0010 inch would be deposited on a non-porous, non-fibrous web moving at the same rate as the top sheet web.

5 15. A process according to any one of claims 9 to 14 in which the topsheet web is caused to travel in a closed path so as to pass between the nip rolls at least twice, the topsheet web
10 being free of adhesive globules during at least its first passage between the rolls, and having the adhesive globules on the said surface thereof during its last passage between the rolls during which last passage the topsheet web
15 with the adhesive globules is pressed against the backsheet web and the opposite surface of the topsheet web is pressed against an adhesive-free portion of the topsheet web whereby any adhesive pressed through the
20 adhesive-bearing portion of the topsheet web by the rolls will accumulate on the adhesive-free portion of the topsheet web passing through the rolls.

25 16. An integral disposable diaper comprising a porous, fibrous topsheet, a fluid-imperme-

able backsheet and an absorbent core element therebetween, the topsheet having a surface overlying the core element and portions of the backsheet, this surface of the topsheet being defined by individual fibres and fibre junctions, and in which the topsheet has been bonded directly to at least the said portions of the backsheet by a process according to any one of claims 9 to 15.

17. A diaper according to claim 16 wherein the topsheet is bonded directly both to the said portions of the backsheet and to the core element.

18. A process substantially as described and as illustrated with reference to Figures 2 and 3 together with either Figure 4 or Figure 8 of the accompanying drawings.

19. A laminate or diaper when produced by a process according to Claim 18.

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