Title: COATING PROCESS AND COATED PRODUCT

Abstract: Process for the manufacture of a product comprising at least a woven fabric and a coating on said woven fabric, whereby the fabric is submitted a weft straightening, whereby the heat melttable coating material is applied on a face of the weft straightened fabric, and whereby the coating is solidified while tensioning said fabric.
Coating process and coated product

Abstract of the disclosure

The present invention relates to a process for the manufacture of a woven fabric provided with a porous coating, such as a dot coating, said woven fabric being advantageously associated with a non woven fabric. The invention relates thus among others to a woven fabric laminated to a nonwoven fabric or web. The invention relates to a woven fabric provided with a coating of heat meltable material (not laminated with another support), as well as to a laminate of the coated woven fabric with another fabric, such as a mat or non woven fabric, or a woven fabric, or even with another support, preferably a flexible support, such as a foam support, an anti cut support, a fire resistant support, etc., but preferably a flexible support.

Prior art

In the field of house and furniture textiles situations are encountered where fabrics of different natures like woven and non-woven textiles and of different densities need to be assembled and laminated together to form one composite that meets a set of particular, stringent requirements — to form e.g. the outer envelope of said piece of furniture.

As furniture is meant as example only: sofa's, seats, mattresses, etc

In many sectors of the industry where textiles are used fabrics need to be assembled likewise.

As one important example of furniture textile composites is the family of the mattress tickings, i.e. the outer envelopes of mattresses which is to contain the cushioning body made of foam, a spring box or other fillings. The mattress ticking assembly consists typically of the outer jacquard (mostly) fabric with surface densities 120 - 400 g/m² which has for example PES yarns in the warp and PP
yarns in the weft. Other examples of compositions are PES/cotton, viscose/PP, PES/PP, PES/PES, cotton/cotton, etc. This outer fabric is quilted to a non-woven fabric made, for example, of PES, viscose, or cotton yarns. The quilting can also be done to a light foam sheet and to other materials. The surface densities vary widely.

For the mattress ticking assembly a set of features is required which are demanding and often contradictory.

The mattress ticking as a mattress component needs to have controlled geometric sizes, be strong yet soft to the touch, needs to cushion off, for example, the rigid elements of the spring box and it has to be breathing, i.e. allow for permeability of air and humidity for sleeping comfort. Further, in some countries and instances, fire resistance specifications need to be satisfied.

Specific requirements to be met for mattress ticking are:

- **The seam strength**: BS 3320, under a tension of 60 N the slippage at the seam needs to be less than 6 mm.
- **The tensile strength**: BS 2576, has to be higher than 350 N.
- **The burst strength**: BS 4768, has to be at least 1000 kPa
- **The tear resistance**: BS 4303, not lower than 25 N.
- **The stability of the fabric**: It has to be totally flat. The other parameter – the elasticity - is measured according to BS 2576. The measured value has to be lower than the one measured in the loom state.
- **The breathability**: for example a minimum breathability in accordance to norm DIN 53.333 or ASTM-E96(1995) (value of 10.000 g/m²/24 hours at 20°C or even more)
- **WVT (Water Vapour Transmission) rate**, expressed in grams per square meter per day, and defined as the water vapour flow in unit time through unit area of the fabric (under specific conditions of temperature and relative humidity), the WVT rates can be measured by evaporation: amount of water vapour through the sample into a controlled atmosphere, for example the water vapour transmission rate is of 10.000 g/m²/24 hours at 20°C or even more (Norm DIN 53.333 of ASTM-E96(1995))
Reduced sewing movement or reduced movement between two layers bounds therebetween by means of the coating layer.

All these requirements cannot be met without a notable degree of sophistication in the fabrics finishing and assembly processes used. The process for making such a mattress component has to be economical in the amounts of energy and other utilities that are required. It should also not be stressful ecologically. The resulting product has to have the required level of quality with minimal supervision and maintenance.

Many years ago the mattress ticking finishing process consisted essentially in a knife-over-air coating of a polymeric compound on said mattress ticking fabric. This compound was mostly a thermoplastic polymer dispersed in water. The coating was followed by a drying process.

These products were irregular in stiffness and had an unpleasant handle ("toucher" in French). The fire retardance was also embryonic.

Fabrics provided with a fusible dot coating are disclosed for example in US 4,613,538 and in US 6,344,238. The content of these documents is incorporated to the present specification by reference.

These two prior art documents do not teach nor suggest that it is important to have a weft straightening step (such as weft straightening of about 2cm per 100cm or about 2%, or possibly less) prior to the coating, as well as to maintain a transversal tension (transversal with respect to the moving fabric) during the solidification of the coating.

Due to the movement between the weft and the warp, said documents will not enable the manufacture of coated woven fabric with weft fibers extending in a direction substantially perpendicular to the moving direction of the woven fabric,
with a tolerance of less than 3 cm per 100 cm (or 3%) weft length for the weft fibers with respect to the direction perpendicular to the moving direction.

A simple lamination process is disclosed in EP 0 730 059 (Stellini process). In this process the mattress ticking fabric of irregular quality is improved by applying a film of transparent thermoplastic material with heat and pressure onto one side of the fabric. Partial softening of the foil through heating allows it to penetrate the meshes of the fabric and makes the foil substantially invisible. A major drawback of the resulting product is that it is not breathable, thereby not yielding the sleeping comfort that is expected. Further the product is very difficult to make flame retardant. While the foil made of PE can be flame retardant, the fabric itself made of PES and PP yarns is not flame retardant. Furthermore the handle or “toucher” of the Stellini mattress ticking is unpleasant as the inner side is a plastic foil.

Another process which has been taken into consideration is a process whereby the adhesion of the outer mattress fabric to the non-woven component is achieved through a powder coating process. Through a powder scattering process granules with particle size of typically 400 μm are spread as a thin layer of 15-20 g/m² over the surface of the outer mattress fabric. The material these granules are made of can be LDPE, HDPE, PA, PUR, EVA, and mixtures thereof. The non-woven component of the end-composite is applied onto these granules layer with heat and pressure in a calandering process. Whereby the granules melt and achieve the adhesion function. Overheating and overpressure are often required for achieving a correct melting of the granules. Furthermore due to the possible movement of the granules before their fusing, irregular thickness of the binding layer is possible. Such an increase of thickness (essentially due to the electrostatic charges on the powder particles) can also induce a risk of not sufficient melting of the granules, and thus a risk of low adhesion. The drawbacks of this method are the irregularity of the granules layer - because of the static charges on the granules - resulting in dry/uncovered spots and spots
where said granules are bunched together. In the dry spots zero adhesion between
the fabric and the non-woven components takes place, resulting in irregularities in
seam strength of the mattress ticking. The so obtained product with powder coating
is therefore not uniform. It is even very difficult and time consuming to
manufacture a fabric provided with a powder coating alone.
A further draw-back is the irregularity in width of the produced mattress ticking
assembly. For this reason, Applicant decides not to use such a method.

**Description of the invention**

The invention relates to a process for the manufacture of a breathable product
comprising at least a porous woven fabric and a coating on said woven fabric, in
which the woven fabric is moved in a direction, in which a heat meltable material
is applied on a face of the woven fabric so as to form a coating, after a
solidification step and/or a heating step,
- whereby prior to the application of the heat meltable material on the face, the
  woven fabric is submitted to a weft straightening so that the weft fibers of the
  fabric extend in a direction substantially perpendicular to the moving direction
  of the woven fabric, with a tolerance of less than 3% (advantageously about 2%
  or less than 2%) or less than 3 cm (advantageously about 2% or less than 2 cm)
  per 100 cm weft length for the weft fibers with respect to the direction
  perpendicular to the moving direction,
- whereby the material is applied on a face of the woven fabric after its weft
  straightening in a liquid or pasty form, possibly after a heat treatment for
  forming a coating or dot coating, and
- whereby the coating is at least partly, preferably substantially completely,
  solidified while said fabric is at least partly submitted to a tension
  perpendicular to the moving direction or to a tension preventing movement
  perpendicular to the moving direction.

Preferably, the weft straightening is controlled so as to reach a tolerance of less
than 2 %, preferably less than 1% (preferably less than 1 cm per 100 cm) weft
length for the weft fibers with respect to the direction perpendicular to the moving direction.

By using this process, it is possible to manufacture a product with well defined properties and well uniform properties, whereby enabling to avoid the formation of folding lines when associating the product with a further layer or when using such a product associated with a further layer.

The solidification step of the coating is advantageously carried out by a drying step, such as a drying by heating (for example direct heating, indirect heating, preferably with a heated gas directly contacting the dots to be solidified), by radiation, such as IR, UV, microwave, etc., by vacuum, and by any combinations of these methods. When the fabric comprises electrical conducting wires or properties, the heating or drying step can also be carried out by applying current to the fabric for ensuring a heating thereof (melting of the heat meltable material or drying of the coating when the coating is applied as a solution, suspension or paste). The solidification step comprises also advantageously a cooling step, especially in case the heating or drying is carried out at a temperature higher than the melting point of the heat meltable material.

According to a preferred embodiment, after solidifying (at least partly) the melted coating or the liquid or pasty dot coating, the coated fabric is controlled so as to determine a variation of the weft direction with respect to the direction perpendicular to the moving direction. The weft straightening of the fabric and/or the tension perpendicular to the moving direction is controlled in function of the determined variation of the weft direction at least if the determined weft variation exceed an threshold value. This feed-back is advantageous for enabling the necessary correction at the weft straightening, in case of undesired movement during the coating step and/or solidifying step.

According to a more specific embodiment, after solidifying the coating, the coated fabric is controlled so as to determine local variations of the weft direction with
respect to the direction perpendicular to the moving direction. The weft straightening of the fabric and/or the tension perpendicular to the moving direction is controlled in function of the determined local variations of the weft direction at least if the determined weft variation exceed an threshold value.

According to a possible, but advantageous detail, in case a determined variation or a determined local variation of the weft direction is above an acceptable threshold value, the portion of the coated fabric with incorrect weft direction is marked. Such a marking could be advantageous so as to determine if some portions of a fabric or a multi layered fabric have to not to be used for the manufacture of an end product.

According to a further detail of a process of the invention applied to a fabric with warp fibers extending in a warp direction, the warp direction of the fabric is controlled so as to correspond substantially to the moving direction of the fabric. For example, the tolerance will be less than 1.5cm, preferably less than 1cm, most preferably less than 0.2cm per 100 cm warp length for the warp fibers with respect to the moving direction. The warp tolerance will for example be about 0.05 to 0.1cm/100cm length or even lesser. The warp tolerance for the position of the warp with respect to the moving direction is thus advantageously less than 1.5%, preferably less than 1%, most preferably less than 0.2%, such as from 0.05% to 0.1%.

In order to have a good control of the warp direction or to ensure a good measure of the position of the weft, it is advantageous to take away one or more warps, preferably only one warp, or to use a woven fabric with one or more specific warps which can easily be determined.

Advantageously, the coated woven fabric is further provided with at least one further layer, preferably with one or more breathable layer.
The solidified coating is advantageously made of an adhesive material, preferably a hot melt material. The further layer is preferably applied and pressed on the coated fabric while the coating is still adhesive.

According to a specific embodiment, the solidified coating is made in a hot melt material, whereby the coating is at least partly melted before applying and pressing thereon the further layer.

The further layer can be a woven or non woven material, advantageously a non woven material, preferably a flexible material. According to an embodiment, the coated woven fabric is not provided with any further layer.

The fabric has for example yarns made of a material selected from the group consisting of polyester, acetate, viscose, cotton, glass, basalt and combinations thereof, while the weft fibers are made of a material selected from the group consisting of polypropylene, cotton, polyester, glass, basalt and combinations thereof. The woven fabric can possibly be coated with a thin layer, such as a polyurethane, polyester or silicone layer, for example when using basalt fabric. Such a coating is preferably operated on the woven fabric after its weft straightening.

According to a specific embodiment, a porous web of heat meltable material is applied on the fabric while moving. By means of a belt laminator, the porous web is pressed against the woven fabric and is melted so as flow at least partly into the porous fabric.

The porous web of heat meltable material has advantageously a density of less than 0.25 kg/m², advantageously of less than 0.15 kg/m², preferably of less than 0.1 kg/m².
Preferably, the porous web has a thickness at most equal to twice the thickness of the woven fabric, advantageously at most equal to the thickness of the woven fabric.

According to a specific embodiment, the coating of the fabric is a dot coating made on the fabric while moving substantially vertically, while the drying of the liquid or pasty dot coating is made when the fabric is moving substantially in a horizontal plane.

The dot coating is advantageously made by pressing a liquid or pasty composition at predetermined place of the fabric, whereby the pressure is maximal when pressing a liquid or pasty composition on a place of the fabric resting on a counter-pressure roll.

According to a preferred embodiment, the liquid or pasty dot coating is at least partly solidified by means of a heat treatment followed by a cooling step, whereby said cooling step is at least partly carried out while said fabric is at least partly submitted to a tension perpendicular to the moving direction.

The dot coating is advantageously operated by using a liquid, semi liquid or pasta composition, especially an aqueous composition, such as an aqueous dispersion. Such a dispersion or composition is for example a two phase composition, such as comprising hot melt particles dispersed in an aqueous medium containing glueing means. The dot coating composition, preferably as an aqueous medium, when dried or cured, forms then a binding for the hot melt particles. It is also possible to use solvent based composition, such composition comprising organic solvent.

The dot coating is for example based on thermoplastic polymer or copolymer, ethylene vinyl acetate, polyethylene, polypropylene, polyamide, polyester, copolyester, and combinations thereof.

The dot coating is advantageously carried out, so that after drying or solidifying of the dot coating,
- the dot coating has a thickness lower than the thickness of the woven fabric, advantageously lower than the half of the thickness of the woven fabric, and/or
- the dots of the dot coating have an equivalent diameter (diameter measured by dividing 4 times the surface of a dot by the length of the edge of the dot) of less than 3 mm, advantageously comprised between 0.2 mm and 2 mm, preferably about 0.3 to 1 mm, and are distant from each other of a distance of at least 0.2 mm, advantageously from 0.3 and 3 mm, or
- the dots have an equivalent diameter comprised between 0.5 and 2 times the diameter of the warp and/or between 0.5 and 2 times the diameter of the weft and/or between 0.5 and 2 times the average diameter of the warp and weft, and/or
- the distance separating two adjacent dots is comprised between 0.5 and 2 times the diameter or width (measured perpendicular to the longitudinal direction) of the warp and/or between 0.5 and 2 times the diameter of the weft and/or between 0.5 and 2 times the average diameter or width (measured perpendicular to the longitudinal direction) of the warp and weft, and/or
- the number of dots per cm² is comprised between 5 and 100, advantageously between 10 and 70, preferably between 25 and 60.

According to a specific process, the dot coated fabric is not provided with one or more layers, or with one or more layers attached to the woven fabric by the dot coating.

Advantageously in the process of the invention, the coated woven fabric is submitted to heating step for melting the coating for a time sufficient for enabling at least 50% by weight of the coating, advantageously at least 75%, preferably at least 90% by weight of the coating to flow within the thickness of the woven fabric.

Preferably, the molten coating is submitted to a cooling step so as to reduce the temperature below the melting point, for example at least 5°C below the melting point, and thereafter, the coating with a temperature below the melting point is submitted to a compression step.
According to an embodiment, the compression step is carried out when the
temperature of the coating is comprised between about the softening point of the
coating material (such as a temperature 5°C lower than the softening temperature)
and a temperature about 5°C lower than the melting temperature of the coating
material. Such a compression step is advantageous for giving specific surface
properties, such as polish, glazing, flat appearance, etc.

The compression step is thus advantageously a cold compression step or a cold
calendering step.

Possibly the melting of the coating can be carried out at least partly when
submitted to a pressure. In this case, the compression step will be carried out with
a layer on which the melted coating has a poor adhesion. Such a layer can be a
siliconized paper or a layer having similar characteristics. The layer is removed
after cooling of the melted coating, for example prior its winding up in rolls or
prior its use (the coated fabric being then possibly rolled with intermediate
siliconized paper or layer having similar removal characteristics).

The so obtained coated fabric without extra further layer has as such, excellent
seam strength, tensile strength, burst strength, tear resistance, stability,
breathability, water vapor transmission rates, etc.

The product, advantageously not provided with a further layer, has preferably dots
made of a material which can be melted, whereby at least 50% by weight,
advantageously at least 75% by weight, preferably at least 90% by weight of the
dot coating material is located within the thickness of the woven fabric.

The dot coated fabric has for example dots forming or having a shape of one or
more letters, figures, logos, numbers, etc. and combinations thereof. Possibly for
giving a specific appearance to the product, it is possible to use dots with various
shapes or diameters, dots made of different materials, such as coloured material,
etc. The letters, figures, logos, etc. are for example made with a specific dot
coating device, applying for example further dots on a face of the fabric already provided with dots.

The invention relates also to a product that can be manufactured by the process of the invention as disclosed here above.

The breathable product of the invention comprises at least:
- a porous woven fabric with warp fibers and weft fiber, and
- a porous or dot coating on said woven fabric, in which the porous or dot coating has a thickness of less than twice the thickness of the porous woven fabric, preferably less than 0.5 x the thickness of the porous woven fabric, whereby the weft fibers of the fabric extend in a direction substantially perpendicular to the warp fibers, with a tolerance of less than 3cm per 100 cm weft length or of 3% (advantageously about 2cm or 2%, possibly less than 2cm or 2%, preferably less than 1.5cm or 1.5% per 100 cm weft length or even amore preferably less than 1% or 1cm per 100cm) for the weft fibers with respect to the direction perpendicular to the warp fibers.

The porous or dot coating is advantageously made of an adhesive material, advantageously a hot melt material. The coating can also be made in other materials, such as thermoset material, curable material, meltable materials, and combinations thereof.
The coating can further be made in a foamable material, whereby a foaming of coating or a portion thereof can be operated for example by heating the coating or portion(s) thereof above the foaming temperature.

The product advantageously further comprises at least one non woven layer (preferably porous, such as a porosity greater than the porosity of the coated woven fabric) attached to the woven fabric by the porous or dot coating, said product being preferably breathable or porous to gas, and most preferably substantially not porous to liquid.
Advantageously, part of the material of the porous or dot coating enters in between fibers of the porous woven fabric.

Instead of having a further non woven layer, the porous or dot coated woven fabric can be attached to various materials, such as foam layer, polyurethane foam layer, etc., micro sized plates, such as hexagonal plates, ceramic plates, cut resistance fibers or mat or fabric, knitted fabric, cut resistant knitted fabric, etc. The ceramic plates are disposed the one adjacent to the other, the surface area of one plate being for example comprised between 0.2 and 5cm², such as from 1 to 3 cm², while the free space between two adjacent plates is advantageously lower than 3mm, preferably lower than 2mm.

Preferably, the woven fabric as well as the possible non woven fabric have a melting point higher than the melting point of the porous or dot coating. Most preferably, the woven fabric as well as the possible non woven fabric have a softening point higher than the melting point of the porous or dot coating.

According to an advantageous embodiment, the dot coating has a thickness lower than 0.3 x the thickness of the woven fabric, advantageously lower than 0.2 x the thickness of the woven fabric.

According to still a further embodiment,
- the dots of the dot coating have an equivalent diameter of less than 3 mm, advantageously comprised between 0.2 mm and 2 mm, preferably about 0.3 to 1 mm, and are distant from each other of a distance of at least 0.2mm, advantageously from 0.3 and 3 mm, and/or
- the dots have an equivalent diameter comprised between 0.5 and 2 times the diameter of the warp and/or between 0.5 and 2 times the diameter of the weft and/or between 0.5 and 2 times the average diameter of the warp and weft, and/or
- the distance separating two adjacent dots is comprised between 0.5 and 2 times the diameter of the warp and/or between 0.5 and 2 times the diameter of the
weft and/or between 0.5 and 2 times the average diameter of the warp and weft, and/or
- the number of dots per cm² is comprised between 5 and 100, advantageously between 10 and 70, preferably between 25 and 60.

The invention relates also to an installation suitable for the working of a process of the invention, advantageously for the manufacture of a product of the invention.

According to an embodiment, the installation comprises a weft straightening unit for a woven fabric and a belt laminator for applying a porous web of heat meltable material on the straightened fabric while moving, whereby the belt laminator ensures that the porous web is pressed against the woven fabric and is melted so as to flow at least partly into the porous fabric, while being pressed.

The belt laminator comprises advantageously two moving bands between which the porous woven fabric and the porous web are pressed together, said bands being preferably substantially non porous for gas or having a porosity which is lower than the porosity of the porous web.

According to an embodiment, the band in contact with the porous web (non woven) has a porosity lower than the porosity of the woven fabric and than the band in contact with the porous woven fabric, the band in contact with the porous woven fabric having advantageously a porosity greater than the porosity of the woven fabric, as well as of the coated woven fabric. This enables that the gas present in the porous web passes though the porous woven fabric during the melting of the porous web.

The invention relates also thus to a process for combining together in a belt laminator (comprising two moving bands) a porous woven fabric with a heat meltable porous web (non woven material), said web having a higher porosity and pore volume than the porous woven material.

In said process, the band of the belt laminator in contact with the porous web (non woven) has a porosity lower than the porosity of the woven fabric and than the
band in contact with the porous woven fabric, the band in contact with the porous woven fabric having advantageously a porosity greater than the porosity of the woven fabric, as well as of the coated woven fabric. This enables the gas present in the porous web to pass through the porous woven fabric during the melting of the porous web.

The process is also suitable for making laminates comprising more than two fabrics, such as three fabrics, four fabrics, etc.

For example the both opposite side of the woven fabric can be associated to a web, or a woven fabric provided with dot coating is laminated with a web (non woven) so as to be in contact with the dots, while the other face of the woven fabric is laminated with another web with interposition of a film made of hot melt material.

The invention relates also to a mattress cover comprising at least a breathable product of the invention, and most specifically a mattress cover having at least a flexible portion consisting of a woven fabric which is bound to at least one non woven fabric or partly melted non woven fabric, preferably by means of an adhesive means, whereby said flexible portion is permeable to water vapor and has a dry weight of less than 500g/m², preferably less than 250g/m², whereby said flexible portion has a flexibility which is 10% to 75% greater than the flexibility of a reference product having the same dry weight per m² and consisting of the woven fabric bound to a layer of acrylic resin with a blow ratio of 1:2, whereby the flexibility is measured according to the Norm BS 5058 : 1973.

The reference product is preferably a woven fabric provided with a foamed layer of ethyl or butylacrylate with a blow ratio of 1:2 or a density (after drying) of 500g/l. Preferably, the flexibility is also improved with respect to a reference product consisting of the same woven fabric and a foamed layer of ethyl or butylacrylate with a blow ratio of 1:5 or a density (after drying) of 200g/l.

The foamed ethyl or butyl acrylate layer is advantageously produced from an aqueous dispersion of ethyl or butyl acrylate, which is cured.
Advantageously, the flexible portion of the mattress cover has a flexibility which is 15% to 75% greater than the flexibility of a reference product having the same dry weight per m² and consisting of the woven fabric bound to a layer of acrylic resin with a blow ratio of 1:2, whereby the flexibility is measured according to the Norm BS 5058 : 1973.

Preferably, said flexible portion of the mattress cover has a flexibility which is 10% to 75% (advantageously between 15% and 75%, preferably between 20% and 75%, most preferably between 40% and 75%) greater than the flexibility of a reference product having the same dry weight per m² and consisting of the same woven fabric bound to a layer of acrylic resin with a blow ratio comprised between 1:5 and 1:2 (density comprised between 200g/l and 500g/l), whereby the flexibility is measured according to the Norm BS 5058 : 1973.

The flexibility measured in accordance to the Norm BS 5058:1973 is an average flexibility, whereby the flexibility of the fabric is measured on its coated face coated and on its uncoated face, and whereby the average flexibility of the layered fabric is calculated on basis of their own weight.

According to an advantageous embodiment, the flexibility of said flexible portion is quite homogeneous, whereby the maximum flexibility variation per 10 cm² is lower than 15%, preferably lower than 10%, most preferably lower than 5% with respect to the average flexibility of 6 samples of 10 cm².

Preferably, the flexible portion has an upper face and a lower face, in which the variation between the flexibility of the upper face and the flexibility of the lower face is lower than 50%, preferably lower than 25%, most preferably lower than 20%, such as 15%, 10%, 5%.

The woven fabric can be manufactured in various materials or compounds, such as wool, cotton, polyamide, Nylon, polypropylene, polyester, etc. and mixtures thereof. For example, the weft of the fabric is realized in one material or compound, while the warp is realized at least partly in another material or
compound. The woven fabric for said specific application (mattress cover) is a fabric suitable for mattress cover.

The non woven fabric comprises fibres which are bound together, for example by means of an adhesive means. For example, the non woven fabric or web is realized in polypropylene, polyester, acetate, viscoe, ployamide (Nylon), etc. and mixtures thereof. The non woven fabric or web is for example a spun bond web or layer, especially the non woven material as disclosed in WO99/56588.

According to a detail of an embodiment, said flexible portion of the mattress cover has a water vapor permeability at 20°C comprised between 1 and 20 kg/m²/day (preferably between 5 and 15 kg/m²/day, such as 8, 10 en 12 kg/m²/day) measured according to the Norm DIN 53333 or ASTM-E96(1995).

The woven fabric has preferably a dry weight comprised between 50 and 200 g/m², such as 75 and 150g/m², while the non woven fabric or partly melted non woven fabric has a dry weight of less than 25g/m², such as less than 15g/m², 10g/m² and even 5g/m².

According to a preferred embodiment, the woven fabric and the non woven fabric, possibly partly smelted, have substantially the same flexibility.

According to a further detail, the woven fabric is bound to a non woven fabric by means of an adhesive layer or means with a weight of less than 50g/m², preferably less than 25g/m², such as from 5 and 15g/m².

According to still a further detail of the mattress cover, the adhesive layer or means is homogeneously dispersed, whereby the maximum weight per cm² is less than 10%, preferably less than 5% of the average weight of adhesive material per cm².
According to an advantageous embodiment, the woven fabric is bound to a non-woven fabric by means of a layer of adhesive dots, said dots being preferably distant from each other and not bound to each other by adhesive bond. Preferably, the layer of separate dots has a weight of less than 20 g/m², advantageously less than 10 g/m², preferably less than 5 g/m².

For example, the number of dots is comprised between 5 and 100 per cm², preferably between 25 and 60 per cm².

According to a possible embodiment of the mattress cover, the non-woven fabric is partly melted on the woven fabric.

According to a preferred embodiment of the mattress cover, said flexible portion (for example the woven fabric and/or the non-woven fabric or web or the adhesive layer or dot coating) contains at least a biocide.

The invention relates also to a mattress which is provided with a mattress cover of the invention.
Brief description of the drawings

Figure 1 is a schematic view of an installation for manufacturing a product of the invention according to the process of the invention;
Figure 2 is a schematic view of the weft straightening unit;
figure 3 is a schematic view of the dot coating unit;
Figure 4 is a schematic view of the dot coating roller;
Figure 5 is a partial enlarged view of the wall of the dot coating roller;
Figure 6 is a partial cross section view of the dot coating roller;
Figure 7 is an enlarged view of the laminating unit;
Figure 8 is an enlarged view of a portion of a dot coated woven fabric;
Figure 9 is a cross section view of the dot coated woven fabric of figure 8, before and after calendering with a non woven web,
Figure 10 is a schematic view of control step of the installation of figure 1,
Figure 11 is a further schematic view of an installation similar to the installation of figure 1,
Figure 12 is a partial enlarged cross section view of a dot coated fabric not provided with a further layer,
Figure 13 is a schematic view of another installation of the invention,
Figure 14 is a schematic view of the treatment step of the porous web heated and pressed against the woven fabric in a belt laminator,
Figure 15 is an enlarged view of a belt laminator,
Figure 16 is a view of an installation similar to that of figure 1, except that the laminating unit is a belt laminator,
Figure 17 is a rear or back view of a woven fabric before its treatment for making a mattress cover,
Figure 18 is the view of the back face of the fabric of figure 17 provided with a dot coating, and
Figure 19 is a cross section view of the fabric of figure 18 after calendering of said fabric with a non woven web.
Description of preferred embodiments

The invention relates in particular to the manufacture of mattress ticking assembly having as high a breathing through it as possible, while maintaining the other technical requirements, if not toughened.

The adhesive compound is applied in a regular dot pattern onto the mattress ticking fabric, which has been submitted to a weft straightening before the dot coating and to a transversal tensioning during the drying of the dot coating. After drying, the non-woven fabric is applied onto the dot coated outer mattress fabric with heat and pressure.

The adhesive material delivered in the particular pattern of regularly metered spaced dots of equal dimensions ensure a very regular and controlled adhesion of the two components of the mattress ticking to each other, better than with the powder process. Further the degree of breathing through the assembly is high and constant and the same in every spot of the product. This feature together with the discontinuous nature of the adhesive layer – having the shape of regularly separated dots - gives a very flexible product resulting in a mattress ticking assembly with very pleasant handle (“toucher” in French) and excellent sleeping comfort, superior than that obtained with the Stellini process and the powder coating processes.

The seam strength according to the BS 3320 Norm of the preferred mattress ticking assembly of the invention is superior to that of the mattress ticking assembly manufactured according to the Stellini process or the powder coating process.

The dot coating process ensures that, even if some dot coating material flows in between fibres of the woven fabric, no adhesive is visible on the front side of the fabric.
The process of manufacture is all in-line. This makes it economical in the use of energy. The laminate is held in a stenter frame throughout the drying process which imparts an excellent control of the width of the product after its weft straightening. The end product has a geometry with tighter tolerances than with the powder coating process.

Figure 1 shows a complete in-line process for the manufacture of a laminate product comprising a dot coated woven fabric and a non woven fabric, such a web, said product being breathable.

The fabric moves from the right to the left in said figure.

The installation comprises the following units:
- a weft straightening unit 1 for ensuring a correct position of the wefts of the woven fabric 4A, with a tolerance of less than 1 cm per 100 cm weft length for the weft fibers with respect to the direction perpendicular to the moving direction;
- a dot coating unit 2 for printing on one face of the woven fabric a pattern consisting of dots distant from each other;
- a drying unit 3 for drying the dot coated woven fabric 4B;
- a cooling unit 5 for cooling the heated and dried dot coated woven fabric 4C leaving the drying unit 3,
- a laminating unit 6 for connecting the dot coated woven fabric 4C with a non woven fabric 7, and
- a side slitter unit for cutting lateral edges of the fabric, and for cutting the fabric at the desired length, such as for a maximum length able to be roll up on a core or mandrel.

The speed of the fabric can be set between 5 and 80 m/min.

Rollers and or cylinders 8 are used for the moving and guiding of the fabric from one unit towards another unit.
The woven fabric 4A is provided from a roll 9 to be unwound. The unwinding is controlled so that the warp of the fabric is tensioned.

The woven fabric is treated in the weft straightening unit 1, so that at the outlet of the weft straightening unit 1, the weft are substantially perpendicular to the moving direction M of the woven fabric, with a tolerance of less than 1 cm per 100 cm weft length. The direction of the movement of the fabric corresponds substantially to the direction of the warp, with a tolerance of less than 0.3 cm per meter warp length.

The straightening unit 1 (see figure 2) comprises:
- a flexible cylindrical roller 10 which is rotatable around the axis 12, the position of said axis 12 being adjustable by the device 10A. During the movement of the fabric 4A, the curved cylindrical flexible roller 10 is rotating around the curved axis 12. In case a weft error is detected, the computer determines the position of the curved axis to be taken so as to correct the error. The device 10A enables to move the axis 12, so as to define a convex portion for the fabric up to a concave portion for the fabric, as well as to move laterally the axis with respect to the longitudinal direction of the movement of the fabric;
- a series of sensors 11, and
- a control system 13, such as a computer, receiving data from the sensors 11 and sending data to the motor 12, as well to the device 10A for adapting the position of the roller 10.

The roller has a shape differing from an exact cylindrical shape. For example, the roller has a contact surface corresponding to the revolution of a curved line with respect to the central axis. The curved contact line can be concave or convex. The radius of curvature of the curved line is advantageously quite high, for example more than 1 meter, such as more than 5 meters, 10 meters, etc. The length of the
roller 10 will advantageously be higher than the breadth or width of the woven fabric.

By adapting the rotation speed of the cylinder 10 and its position, it is possible to adjust the position of the wefts, so that they are substantially perpendicular to the moving direction.

Advantageously, a series of sensors 14 can be used for determining the position of the weft before the weft straightening, said sensors sending then signals to the control system for determining the speed of rotation of the roller 10 and its position.

Possibly two sensors 14 are placed along a line corresponding to the moving direction M of the fabric. Said sensors 14 are then used in order to control whether the warp direction of at least on warp corresponds to the moving direction. In case, the control system determines a displacement of the warp with respect to the moving direction above a threshold value (for example a variation of more than 0.3 cm per meter of warp length), the control system can modify the transversal position of the woven fabric at the inlet of the straightening unit 1, for example by means of guiding elements 15, the position of which can be laterally adapted. The guiding elements 15 guide the edges 4E of the woven fabric 4A and are advantageously associated to rollers 16 between which the lateral portions of the fabric 4A are moving, while being pressed.

The woven fabric after its weft straightening is moved towards the dot coating unit.

The dot coating is operated when the fabric 4A is moved substantially vertically.

The dot coating unit comprises:
- a hollow cylinder 20 with a perforated cylindrical wall 21 (i.e. a rotating cylindrical screen), said cylinder 20 being associated with an inlet pipe 22 for introducing dot coating composition C in the hollow of the hollow cylinder 20, with knives 23 and 24 for guiding the composition C towards a portion of the inner face of the wall 21, whereby the knife 24 is made of an elastic material
with a free end portion 24A pushed towards the inner face of the wall 21 so as to form a pressure for the flowing of the dot composition in the perforation 25 of the wall 21, and

- a counter pressure roll 26.

The dot coating compound C flows through the openings or perforations 25A located in front or substantially in front of the portion of the fabric located and pressed between the dot coating roller 20 and the counter roll 26. The pressure of the compound in the hollow chamber of the cylinder 20 is maximum for said openings. The pressure diagram 27 of the compound in the portion 21A of the wall is shown schematically in figure 2. As it can be seen from said diagram 27, the pressure is substantially null for portions of the cylinder not located in front of the chamber 28 located between the knives 23,24 and receiving the dot composition C. For the portion 21A (in front of the chamber 28) the pressure increase progressively from the inlet pressure PI of the composition in the chamber (pressure which is advantageously not sufficient for enabling a free flowing of the composition through perforations 25, up to a maximum pressure with a value sufficient for enabling a free flowing of the composition through the perforations. For example the flowing of composition through the perforation starts from a pressure PF, whereby dot composition starts to flow just before the perforations reach the position 25A due to the rotation of the cylinder 20.

The cylinder 20 and the counter roll 26 are moving in directions corresponding to the direction of the movement of the woven fabric. The tangential movements T1, T2 at the contact line of the cylinder with the roll 26 correspond to the direction of movement of the fabric 4A. Advantageously the speed of rotation of the cylinder 20 and roll 26 is adapted, so that the radial speed of the cylinder 20 and the radial speed of the cylinder 26 correspond substantially to the movement speed of the fabric.

The woven fabric is so provided with dots which are still not solidified, i.e. which are liquid or better pasty.
The cylinder is for example provided with circular openings with a diameter D1 comprised between 0.2 mm and 0.6 mm, said openings being distant from each other so that the openings correspond to substantially from 3 to 15% (advantageously from 5 to 10%) of the surface of the wall 21. The thickness of the dots is for example comprised between 50μm and 500μm, such as 100μm, 200μm.

The openings are for example spaced from each other from a distance D2 of at least the diameter of the opening.

The number of dots per cm² is for example comprised between 10 and 30, such 20 or 25.

The warp and the weft have for example a diameter comprised between 100 and 300 μm.

The dot coating is thus preferably operated on a portion of the fabric submitted to a compression, whereby reducing the risk that dot coating composition could flow through the fabric.

The quantity of applied compound through the screen is function of:

1) the selected screen (opening, size, number, shape, etc.)
2) the scrape blade in the screen cylinder, with its pressure and position versus the axis of the counter pressure roll 3.
3) The composition and the rheology of the compound
4) The speed of the base fabric
5) The temperature.

The dot coated woven fabric is then moved horizontally towards and in the drying unit 3, as well in the cooling unit 5.
Before entering the drying unit, the fabric 4B is grabbed along its edges by a set of combined pin clip chains 30 exerting a transversal tension on the base of the fabric. Such chains form a stenter frame. The chains are moved by independent motors or a same motor (for example only one single motor drives the chains). The movement of the chains can be controlled by a control system 31. The chains are advantageously moved at the same speed (for example at a substantially constant predetermined speed) by a single motor, with or without phase displacement. The chains exert a transversal tension and possibly a lateral displacement of one edge with respect to the other before the drying unit, in the drying unit, after the drying unit but before the cooling unit, in the cooling unit and after the cooling unit.

The speed of movement of the chains is advantageously the speed of movement of the dot coated fabric.

The distance between the two chains 30 is advantageously adjustable, so as to enable the treatment of woven fabrics with various widths. (such as from 50cm up to 300 cm)

The drying unit 3 is an oven comprising a series of drying fields 32, each field comprising a fan 33 and a gas burner 34.

Possibly further heating is obtained by means of extra hot air heaters 35, such as IR heater.

The hot air or gases are exhausted at the top of the oven by means of the pipe 37 and the fan 36.

The ventilators 33 create an overpressure on the face not dot coated of the fabric with respect to the dot coated face. Some air passes through the fabric 4B, whereby avoiding that the dot coating traverses completely fabric, for example by ensuring a quick drying of the coating in contact fabric.

The drying is advantageously carried out at a temperature below the melting point of the fabric 4B, preferably below the softening point of the fabric. The drying is
preferably carried out also at a temperature below the melting point of the coating composition, such as below the softening point of the dot composition.

The dot composition to be dried is for example a solvent or water based composition, said water or solvent having to be eliminated in the drier 3.

The drying is also advantageously carried out at temperature for which the dilatation of the fabric is limited, for example of less than 1%.

The hot dried dot coated fabric is then moved in a cooling unit 5, so as to reduce the temperature of the fabric. Said cooling unit comprises for example a fan 50 blowing cold air on the fabric 4B, for example cold filtered air (temperature from 5 to 25°C).

At the end of the drier 3 and/or after the drier 3 and/or at the end of the cooler 5 and/or after the cooler 5, sensors 38 (such as optical sensors) can be provided so as to determine the position of the weft with respect to the moving direction or with respect to the warp direction.

Said sensors 38 send signals to the control system 13 of the weft straightening unit 1 and/or to the control system 31 of the chains 30.

Said sensors 38 can possibly also send a warning signal to a marking device 52, for marking the portion of the dot coated fabric which have weft not correctly placed, such as extending outside an acceptable tolerance (for example more than 1.5 cm per 100cm weft length).

The sensors 38 controlling the weft position after the cooling step (5) are advantageously used for controlling the movement of the cylinder 62, the movement of the cylinder being adapted for tensioning the fabric and correcting the weft position. Said correction of the position of the cylinder and/or of the speed of rotation is advantageously controlled via the central unit 13.
The dried dot coated woven fabric is now moved towards the laminating unit 6 for laminating the dot coated fabric 4B with a non woven fabric 7 provided from a roll 40. In case the dried dot coated woven fabric has not to laminated or has to be later on laminated, for example in another plant, the dried dot coated woven fabric is advantageously not submitted to a calender, or submitted to a cold calendering or is simply and directly winded in a roll.

The laminating unit comprises:

- Possibly a heater 41, such as a Infra red heater, for heating the face of the fabric provided with the dots, said heater ensuring advantageously a heating of the dot at a temperature of at least about the softening temperature (for example just below the softening temperature), said temperature of the dots being preferably not higher than the melting temperature, and

- a calendering device comprising at least two rolls, preferably at least three rolls 42,43,44.

The heated dot woven fabric is calendered with the non woven mat 7 between the calendering rolls 42,43,44.

The pressure exerted between the calendering rolls and the temperature of said rolls is advantageously adjustable. The dot coated fabric is preferably not heated sufficiently on the roll 42 for reaching the melting point of the dots.

The dots are melted when the fabric + web is contacting the roll 43, whereby the temperature of the dots is reduced below the softening point when the fabric + web contacts the roll 44. As the dots are melted when the web is contacting the roll 43, the melted dots are pressed into the web 7 by the pressure exerted between the rolls 43 and 42, as well as between the rolls 43 and 44, and between the roll 43 and the woven fabric 4B. This ensure a good penetration of the dot material in the web 6 and thus a good adhesion of the web on the woven fabric 4A.
The so obtained fabric is breathable as the breathable fabric 4A is connected to the breathable web 7 by means of a series of independent dots.

The laminating unit 6 of figure 1 can also be a belt laminating unit 6 as shown in figure 15, the belt laminating unit being or not provided with an IR heater 41. (see figure 16)

The product is then moved towards a side slitter unit 51 (for example with rotary knives, compressed air, etc.) for cutting the laminate to the desired lengths and/or widths.

The product is then rolled up and wrapped under plastic foil and labelled.

Figure 8 is an enlarged view of a woven fabric 4A provided with a series of dots 60 distant from each other. The dots have a diameter D1 of about 300μm, while the distance D2 between two adjacent dots is about 300μm. The number of dots is advantageously about 25 per cm². The warp and the weft have a diameter X corresponding to 100 to 500μm. The woven fabric is porous, and thus breathable before and after the dot coating.

Figure 9 shows a cross section (enlarged scale) of the woven fabrics, before and after calendering with a porous web 7. The dots 60 before being calendered are dome shaped and circular, with a thickness E of 50μm up to 250μm. Other forms for the dome shaped dots are possible, such as square, rectangular, hexagonal, polygonal, etc. instead of circular. After calendering, the dots 60 are entering into the web, forming links in the web 7 so as to connect therebetween fibres 70 of said web 7, while forming a link between the web 7 and the woven fabric 6. As the web 7 is more porous than the woven fabric, the dots enter in the web and substantially not in the woven fabric, whereby preventing that the dots are visible on the face F of the fabric not directed towards the web 7.
Possibly the dot coated woven fabric is provided only on a portion with a web, whereby leaving dot surfaces available for connecting the fabric to another fabric or support, or for enabling a seaming, by means of hot melt bonds.

Figure 10 is a schematic view of a possible central control system for the installation of figure 1.

The central control system 13 receives signals from various sensors 11, 14, 38. From said signals, the central control system 13 determines:

- the position (WP) of at least one warp with respect to the moving direction (MD), whereby determining a variation per unit of length of warp, such as a variation expressed in mm per meter of length of warp. The system compares this variation (Δposition) to a maximum tolerance (MT) and/or to an accepted tolerance (AT), whereby when the variation is below the accepted tolerance, no correction of the position of the woven fabric is carried out, while when the variation is above the accepted tolerance, a correction (correction factor) of the position of the woven fabric is calculated and a signal is emitted to the guiding means 15. Possibly if the variation is greater than a maximum authorized tolerance, the system 13 emits a warning signal or stop the further manufacture, meaning that the fabric is considered as not acceptable as such. And/or

- The position (WF1) of the weft before the weft straightening, whereby determining a variation per unit of length of weft with respect to a direction (PMD) perpendicular to the moving direction, such as a variation expressed in mm per meter of length of weft. The system compares this variation to a maximum tolerance MT1 and/or to an accepted tolerance AT1, whereby when the variation is below the accepted tolerance AT1, no correction of the position of the weft is carried out, while when the variation is above the accepted tolerance AT1, a correction (correction factor) of the position of the weft is calculated and a signal is emitted to the motor 12 and/or to the system 10A for adapting the position of the roller 10. Possibly if the variation is greater than a maximum authorized tolerance (MT1), the system 13 emits a warning signal or
stop the further manufacture, meaning that the fabric is considered as not acceptable as such. And/or

- The position of the weft (WF2) after the weft straightening and/or after the drier and/or after the cooling, whereby determining a variation per unit of length of weft with respect to a direction (PMD) perpendicular to the moving direction, such as a variation expressed in mm per meter of length of weft. The system compares this variation (Δposition) to a maximum tolerance (MT2) and/or to an accepted tolerance (AT2), whereby when the variation is below the accepted tolerance, no correction of the position of the weft is carried out, while when the variation is above the accepted tolerance, a correction (correction factor) of the position of the weft is calculated and a signal is emitted to system 10A for adapting the position of the roller 10 by adapting the position of the curved rod or axis 12. And/or

- The position of the weft (WF3) after the weft straightening and/or after the drier and/or after the cooling, whereby determining a variation (Δposition) per unit of length of weft with respect to a direction (PMD) perpendicular to the moving direction, such as a variation expressed in mm per meter of length of weft. The system compares this variation to a maximum tolerance MT3 and/or to an accepted tolerance AT3, whereby when the variation is below the accepted tolerance, no correction of the position of the weft is carried out, while when the variation is above the accepted tolerance, a correction of the position of the weft is calculated and a signal is emitted to the system controlling the frame stenter or chains 30 and/or the roller 62.

The accepted tolerance AT1, AT2 and AT3 has for example the same value.

It is to be stressed again that the invention described can be applied with advantage to composites used in other sectors of the industry than only in the bedding sector.
The product of the invention can combine a woven fabric made of various material with web or non woven fabric made of various material, said material being possibly the same as used in the woven material.

The woven fabric and/or the web can be manufactured in various materials, such as polypropylene, poyacryl, polyethylene, PVC, kevlar, aramid, elastane, tencel ®, lyocell ®, jute, hemp, ramie, sisal, silk, carbon fibre, glass fibre, vegetal fibers, banan fibers, bamboo, viscos, basalt fibers, polyester, polyamide, acetate, cotton, flax, maize, wool, mineral fibers, combinations thereof. The woven fabric has for example a warp density of 4 to 200 yarns per cm, advantageously from 5 to 50 yarns/cm, and a weft density of 4 to 200 yarns per cm, advantageously from 5 to 50 yarns/cm. The woven fabric has for example a weight comprised between 50 and 3500 g/m², such as from 100 to 1500g/m².

The non woven fabric possibly used has advantageously a weight of less than 100g/m².

The weight of the dot coating is for example comprised between 4 and 50 g/m², such as from 5 to 30g/m², in particular from 5 to 15g/m².

Figure 11 is a view of an installation similar to that of figure 1, except that the fabric after its drying enters in a heating chamber 61 provided with IR heater, for ensuring the melting of the dried dots. The dots are for example heated to a temperature comprised between the melting point and the temperature of degradation of the dot (temperature at which a degradation occurs for the period of overheating applied). For example, the overheating of the dot will be carried out at a temperature from 10°C to 50°C above the melting point. Thereafter, the fabric is cooled so that the temperature of the dot is reduced at least 5°C below the melting point. For example the cooling is controlled so that the fabric leaving the cooling station has dots with a temperature higher than the softening temperature.

The heating step of the dots above the melting temperature is operated during a time sufficient for enabling the material to enter substantially completely within the thickness of the fabric.
The dot coated fabric can be calendered or not, said calendering if any being a cold calendering or a heated calendering, for example carried out at about the softening point of the material of the dots.

Such a cold or heated calendering step can be carried out for giving a specific appearance to the fabric. Said calendering step is for example carried out between rollers 63.

Figure 12 is a schematic view of the fabric at various stage of the process of figure 11, namely

- after the drier 3, the fabric 4B is provided with dots 60 forming protuberances above a face (the upper face) of the fabric.
- After the heater 61, the material of the dots is melted and has flowed substantially completely (for example more than 95% by weight, such as more than 97% by weight) within the thickness M of the fabric, said dots being however still not visible on the other face (lower face) of the fabric. Some surface defects can some times still be seen,
- After the cold calendering step, whereby the upper surface of the dots is flattened, said dots being distant from each other.

The so obtained dot coated fabric without extra further layer has as such, excellent seam strength, tensile strength, burst strength, tear resistance, stability, breathability, water vapor transmission rates, etc.

The dots can also be used for giving some surface properties to a face of the fabric, such as anti slip properties, gliding properties, magnetic properties or suitability to be attached to a support by means of magnetic field (dots comprising iron powder).

Figure 13 is a schematic view of another process of the invention, for the production of a woven fabric provided with a coating of heat meltable material.

The installation comprises:
- a weft straightening unit 1 as disclosed for the installation of figure 1,
- a belt laminator 100 comprising two moving bands 101,102 (see figure 15),
- rollers 103 for moving towards the belt laminator the woven fabric 1 after its
  weft straightening,
- rollers 104 for moving towards the belt laminator a web 200 made of heat
  meltalbe material,
- a cooling unit 5 for cooling the coated woven fabric,
- a winding unit 105 for winding the coated fabric in a roll 106.

The weft straightening unit can be controlled by a central control unit as disclosed
in figure 10.

Figure 15 is a schematic enlarged view of a belt laminator 100. As it can be seen
the lower belt 102 moving along a path defined by rollers 120 and plates 121, while
the upper belt 101 is moved along a path defined by rollers 122 and plates 123, the
rollers 122 and plates 123 being adjustable in height with respect to the rollers 120
and plates 121, so to control the compression exerted between the moving bands.

The rollers 120A,122A,120B,122B,120C and 122C are advantageously heatable
rollers, while the plates 121A,121B,123A and 123B are also heatable so as to
enable a good lamination process.
The rollers 120D and 122D are advantageously cooling roller, while the plate 121C
and 123C.

The belt laminator of figure 15 enables a controlled thickness reduction of the
fabric.

If the woven fabric 4A has a thickness for example of less than 1mm, such as a
thickness comprised between 50 and 750μm, the web 200 has a thickness from
500μm up to 20 mm, advantageously comprised between 1 and 5 times the
thickness of non coated woven fabric. The web is made of fibers having a length
comprised between 100μm and 25mm, preferably comprised between 100μm and
5 mm. The fibers are made of a material which can be melted at a temperature below the melting temperature of the woven fabric 4A, preferably at a temperature lower than the softening temperature of the woven fabric. The fibers of the mat can be attached together by a partial melting or by means of an adhesive, such as made of heat meltable material.

The mat has a porosity which is greater than the porosity of the woven fabric 4A and has a total pore volume (volume of the pores or gaps extending between the two opposite faces of the mat. The total pore volume of the mat is for example comprised between 2 and 100 times the pore volume of the woven fabric.

The weight of mat applied on the woven fabric is for example comprised between 1 and 250 g/m², advantageously between 5 and 50 g/m², such as 10 g/m², 15 g/m², 25g/m², etc.. In case the woven fabric is thicker, the amount of mat applied on the woven fabric can be greater.

The belt laminator 100 comprises two moving bands 101,102 between which the woven fabric 4A and the mat 200 are pressed together. The belt laminator is provided with a heating system 103 for melting the mat 200. The moving bands are moved at a speed corresponding to the speed of movement of the fabric. The heating system is suitable for increasing progressively the temperature of the mat and of the woven fabric up to a temperature corresponding to the melting temperature of the mat or at a temperature greater than the melting temperature of the mat. The heating system maintains such a temperature during a time sufficient for achieving a flow of the material of the mat on and into the woven fabric. The temperature achieved is however below the thermal degradation temperature of the material of the mat, as well as below the softening temperature of the woven fabric.

The pressure exerted on the woven fabric and mat is progressively increased up to the area where the mat is melted. In order to achieve a better control of the pressure exerted, the belt laminator is provided with inner rollers 120B,120C,122B and 122C so as to adapt the pressure. The band 102 is contacting the woven fabric and has a porosity so as to enable the escape of gases during the compression of the web. The band 101 is contacting the web and is made in a material substantially non porous, so as to push the air present in the web through the woven
fabric and through the band 102. The bands 101 and 102 are made of a material on which the web, the woven fabric and the web material after its melting do not adhere. In fact, the web material after its melting has a higher adhesion force on the porous woven fabric than on the bands 101, 102.

The maximum pressure exerted on the woven fabric and web (before and/or during and/or after its melting) is for example comprised between 0.01 and 100 kg/cm².

The woven fabric is still submitted to a pressure in the laminator belt after the melting step of the web. Advantageously, the woven fabric provided with a coating is at least partly cooled in the belt laminator, so that the mean temperature of the coated woven fabric leaving the belt laminator is lower than the melting temperature of the material of the web, preferably below the softening temperature of the material of the web.

The coated woven fabric is then submitted to a cooling, for example by means of a cooling station 5 as disclosed for the installation of figure 1.

Finally the cooled coated woven fabric is winded in a roll 106.

The so obtained coated woven fabric has a porosity and a pleasant handle or "toucher". When applying a web at a rate of 5 to 50g/m² on a woven fabric having a weight comprised between 100 and 1000 g/m², the porosity of the coated fabric will correspond substantially to the porosity of the woven fabric before its coating.

The coated woven fabric can thereafter be combined with one or more further layers or films. According to an embodiment, the woven fabric, the mat of fiber and the further layer are compressed together in the belt laminator, whereby making in one step the coated woven fabric provided with a further layer or film.
The figure 13 is a schematic view showing different compression status of the mat of fibers and the woven fabric in the belt laminator.

The woven fabric 4A and the web 200 are moving in the belt laminator from the right to the left. (arrow XX).

When entering the belt laminator, the woven fabric 4A and the web 200 are substantially not compressed between the bands 101 and 102.

The mat and the woven fabric are then heated so as to start the melting of the web 200. For example the compression is such that the thickness of the compressed web is reduced by 50% with respect to the non compressed web.

The mat is finally completely melted and the mat material forms an overcoating 110 on the fabrics 4A as well enters partly in the fabrics 4A. The pressure exerted between the bands ensures a correct and regular flow of melted material on and into the fabric, whereby giving a product having a regular breathability.

Figures 17 to 19 relates to the preparation of a mattress cover having a flexible portion having specific properties.

A woven fabric TW made of polypropylene and polyester with a weight (dry) of 100g/m² has been treated so that the weft threads IG are substantially perpendicular to the warp threads KG, the maximum deviation MA being 2cm/m. This can be achieved by correct use of a weft straightening unit.

On the back face of the woven fabric, a dot (D) coating is applied. The number of dots is about 40 per cm². The diameter of the dot was about 0.5mm. The weight of the dot coating (after drying) is about 20g/m². The dots (adhesive points which are distant from each other and not bound together by means of adhesive links or bonds) are for example made of a hotmelt material which is compatible with the woven fabric and with the non woven web. Said hotmelt material is for example
polypropylene, polyethylene, polyethene, polyamide (such as Nylon),
thermoplastic PUR and mixtures thereof.

The woven fabric TW provided with the dot coating (D) (see figure 18) is then
laminated with a polypropylene web with a dry weight of 10g/m².

During the calendering, the dots and partly the web are melted and are pressed on
the woven fabric TW.

The flexibility of the so prepared mattress cover is measured on the crusick Drape
Tester in accordance to the Norm BS 5058: 1973. The test consists in the
measurement of the flexibility or bending on the front side (side of the woven
fabric) and on the back side (side of the web), and to calculate the flexibility of the
mattress cover as an average flexibility front side and back side in function of their
own weight. \[
\frac{[(\text{flexibility front side} \times \text{weight of the woven fabric}) + (\text{flexibility back
side} \times \text{weight of the web})]}{(\text{weight of the woven fabric} + \text{weight of the web})}
\]

The flexibility is expressed in %, as the difference of flexibility in % with respect
to a reference fabric. in said example, the reference fabric consist of a woven
fabric (polypropylene – polyester) with a dry weight of 100g/m² (the same woven
fabric as used for the preparation of the mattress cover of the invention), the back
side of which is provided with a foamed coating of acrylic resin (by means of the
wet process or the squeegee system) with a dry weight of 30g/m². The reference
fabric 1 is prepared by coating a woven fabric with an aqueous butyl acrylate
dispersion. Said acrylic is foamed up to a density of about 500g/l (blow ration of
1:2). The polymer is then cured. The reference fabric 2 is prepared as the
reference fabric 1, except that the acrylic resin is foamed up to a density of 200 g/l
(blow ratio of 1:5).

After cooling, the mattress cover of the invention has the following properties :
- a dry weight of 130g/m²,
- a flexibility which is 30% than the flexibility of the reference fabric 1, as well as than the flexibility of the reference fabric 2 (Norm BS 5058 : 1973) with a maximum flexibility variation of 10% (variation measured on at least 6 samples of 10cm² taken per m², preferably at least 10 samples of 10cm² taken per m² (for example a series of samples taken along a diagonal of a square portion of the fabric with an area of 1m²))
- a variation of flexibility between the front face (woven fabric) and the back face (web) of the fabric which is less than 50%, preferably less than 25%
- a water vapor permeability at 20°C of 15kg/m²/24 hours
- tear resistance of at least 60N after a needle piercing of 6mm diameter
- excellent resistance against delamination
- excellent “touché” or very pleasant handle
- a good seam strength
What I claim is:

1. Process for the manufacture of a breathable product comprising at least a porous woven fabric and a coating on said woven fabric, in which the woven fabric is moved in a direction, in which a heat meltable material is applied on a face of the woven fabric so as to form a coating, after a solidification step and/or a heating step,

   - whereby prior to the application of the heat meltable material on the face, the woven fabric is submitted a weft straightening so that the weft fibers of the fabric extend in a direction substantially perpendicular to the moving direction of the woven fabric, with a tolerance of less than 3% or 3 cm per 100 cm weft length for the weft fibers with respect to the direction perpendicular to the moving direction, advantageously less than 2% or 2 cm per 100 cm weft length for the weft fibers with respect to the direction perpendicular to the moving direction,

   - whereby the material is applied on a face of the woven fabric after its weft straightening in a liquid or pasty form, possibly after a heat treatment for forming a coating or dot coating, and

   - whereby the coating is at least partly, preferably substantially completely, solidified while said fabric is at least partly submitted to a tension perpendicular to the moving direction or to a tension preventing movement perpendicular to the moving direction.

2. The process of claim 1, in which the weft straightening is controlled so as to reach a tolerance of less than 1.5% or 1.5 cm, preferably less than 1% or 1 cm per 100 cm weft length for the weft fibers with respect to the direction perpendicular to the moving direction.

3. The process of claim 1 or 2, in which after solidifying the liquid or pasty coating, the coated fabric is controlled so as to determine a variation of the weft direction with respect to the direction perpendicular to the moving direction, and in
which the weft straightening of the fabric and/or the tension perpendicular to the
moving direction is controlled in function of the determined variation of the weft
direction at least if the determined weft variation exceed an threshold value.

4. The process of claim 1 or 2, in which after solidifying the liquid or pasty
coating, the coated fabric is controlled so as to determine local variations of the
weft direction with respect to the direction perpendicular to the moving direction,
and in which the weft straightening of the fabric and/or the tension perpendicular to
the moving direction is controlled in function of the determined local variations of
the weft direction at least if the determined weft variation exceed an threshold
value.

5. The process of claim 3 or 4, in which, in case a determined variation or a
determined local variation of the weft direction is above an acceptable threshold
value, the portion of the coated fabric with incorrect weft direction is marked.

6. The process of anyone of the preceding claims, in which the fabric has warp
fibers extending in a warp direction, whereby the warp direction of the fabric is
controlled so as to correspond to the moving direction of the fabric.

7. The process of anyone of the preceding claims, in which the coated woven
fabric is further provided with at least one further layer.

8. The process of claim 7, in which the solidified coating is made in an adhesive
material, preferably a hot melt material.

9. The process of claim 8, in which the layer is applied and pressed on the coated
fabric while the coating is still adhesive.

10. The process of claim 7, in which the coating is a dot coating and in which the
solidified dot coating is made in a hot melt material, and in which the dot coating is
at least partly melted before applying and pressing thereon the further layer.
11. The process of anyone of the claims 7 to 10, in which the further layer is a breathable woven or non woven material, advantageously a non woven material.

12. The process of anyone of the claims 1 to 6, in which the coated woven fabric is not further provided with one further layer.

13. The process of anyone of the preceding claims, in which the coated woven fabric is submitted to a heating step for melting the coating for a time sufficient for enabling at least 50% by weight of the coating, advantageously at least 75%, preferably at least 90% by weight of the coating to flow within the thickness of the woven fabric.

14. The process of claim 13, in which the melted coating is submitted to a cooling step so as to reduce the temperature below the melting point, and in which thereafter the coating with a temperature below the melting point is submitted to a compression step.

15. The process of anyone of the claims 1 to 14, in which the fabric has yarns made of a material selected from the group consisting of polyester, acetate, viscose, cotton, glass, basalt and combinations thereof while the weft fibers are made of a material selected from the group consisting of polypropylene, cotton, polyester, glass, basalt and combinations thereof.

16. The process of anyone of the preceding claims, in which a porous web of heat meltable material is applied on the fabric while moving, in which by means of a belt laminator, the porous web is pressed against the woven fabric and is melted so as flow at least partly into the porous fabric.

17. The process of claim 16, in which the porous web of heat meltable material has a density of less than 0.25 kg/liter, advantageously of less than 0.15 kg/liter, preferably of less than 0.1 kg/liter.
18. The process of claim 17, in which the porous web has a thickness at most equal to twice the thickness of the woven fabric, advantageously at most equal to the thickness of the woven fabric.

19. The process of any one of the claims 16 to 18, in which a belt laminator is used for combining a porous woven fabric with a heat melttable porous web (non woven material), whereby said web has a higher porosity and pore volume than the porous woven material.

20. The process of claim 19, in which the belt laminator comprises two moving bands between which the woven fabric and the porous web are pressed together, whereby the band of the belt laminator in contact with the porous web (non woven) has a porosity lower than the porosity of the woven fabric and than the band in contact with the porous woven fabric, the band in contact with the porous woven fabric having advantageously a porosity greater than the porosity of the woven fabric, as well as of the coated woven fabric.

21. The process of anyone of the preceding claims 1 to 15, in which the coating is a dot coating made by pressing a liquid or pasty composition at predetermined place of the fabric, whereby the pressure is maximal when pressing a liquid or pasty composition on a place of the fabric resting on a counter-pressure roll.

22. The process of claim 21, in which the liquid or pasty dot coating is at least partly solidified by means of a heat treatment followed by a cooling step, whereby said cooling step is at least partly carried out while said fabric is at least partly submitted to a tension perpendicular to the moving direction.

23. A breathable product comprising at least:
   - a porous woven fabric with warp fibers and weft fiber, and
- a porous coating on said woven fabric, in which the coating has a thickness of less than twice the thickness of the porous woven fabric, advantageously less than the thickness of the porous woven fabric, preferably less than 0.5 the thickness of the porous woven fabric,

whereby the weft fibers of the fabric extend in a direction substantially perpendicular to the warp fibers, with a tolerance of less than 3% or 3cm per 100 cm, advantageously less than 2% or 2cm per 100 cm weft length for the weft fibers with respect to the direction perpendicular to the warp fibers.

24. The product of claim 23, in which the weft tolerance is less than 1.5cm or 1.5%, preferably less than 1cm per 100 cm or 1% weft length for the weft fibers with respect to the direction perpendicular to the warp fibers direction.

25. The product of claim 23 or 24, in which the coating is made of an adhesive material or an hot melt material.

26. The product of anyone of the claims 23 to 25, which further comprises at least one non woven layer attached to the woven fabric by the dot coating.

27. The product of anyone of the claims 23 to 26, in which part of the coating enters in between fibers of the woven fabric.

28. The product of anyone of the claims 23 to 27, in which the woven fabric as well as the possible non woven fabric have a melting point higher than the melting point of the coating.

29. The product of anyone of the claims 23 to 28, in which the woven fabric as well as the possible non woven fabric have a softening point higher than the melting point of the coating.
30. The product of anyone of the claims 23 to 29, in which the coating has a thickness lower than 0.3 x the thickness of the woven fabric, advantageously lower than the 0.2 x the thickness of the woven fabric.

31. The product of claim 30, which is not provided with a further layer, in which the coating is made of a material which can be melted, and in which at least 50% by weight, advantageously at least 75% by weight, preferably at least 90% by weight of the coating material is located within the thickness of the woven fabric.

32. The product of anyone of the claims 23 to 319, in which the coating is a dot coating, the dots of which have an equivalent diameter of less than 3 mm, advantageously comprised between 0.5 mm and 2 mm, preferably about 1 mm, and are distant from each other of a distance of at least 0.2 mm, advantageously from 0.3 and 3 mm.

33. The product of claim 32, in which the dots have an equivalent diameter comprised between 0.5 and 2 times the diameter of the warp and/or between 0.5 and 2 times the diameter of the weft and/or between 0.5 and 2 times the average diameter of the warp and weft.

34. The product of claim 30 or 33, in which the distance separating two adjacent dots is comprised between 0.5 and 2 times the diameter of the warp and/or between 0.5 and 2 times the diameter of the weft and/or between 0.5 and 2 times the average diameter of the warp and weft.

35. Installation for the working of a process according to anyone of the claims 1 to 22.

36. Installation of claim 35, which comprises a weft straightening unit for a woven fabric and a belt laminator for applying a porous web of heat meltable material on the straightened fabric while moving, whereby the belt laminator ensures that the
porous web is pressed against the woven fabric and is melted so as flow at least partly into the porous fabric, while being pressed.

37. A mattress cover comprising at least a breathable product of any one of the claims 23 to 34.

38. A mattress cover, especially of claim 37, said mattress cover having at least a flexible portion consisting of a woven fabric which is bound to at least one non woven fabric or partly melted non woven fabric, preferably by means of an adhesive means, whereby said flexible portion is permeable to water vapor and has a dry weight of less than 500g/m², preferably less than 250g/m², whereby said flexible portion has a flexibility which is 10% to 75% greater than the flexibility of a reference product having the same dry weight per m² and consisting of the woven fabric bound to a layer of acrylic resin with a blow ratio of 1:2, whereby the flexibility is measured according to the Norm BS 5058 : 1973.

39. The mattress cover of claim 38, in which said flexible portion has a flexibility which is 15% to 75% greater than the flexibility of a reference product having the same dry weight per m² and consisting of the woven fabric bound to a layer of acrylic resin with a blow ratio of 1:2, whereby the flexibility is measured according to the Norm BS 5058 : 1973.

40. The mattress cover of claim 38, in which said flexible portion has a flexibility which is 20% to 75% greater than, preferably 40% to 75% greater than the flexibility of a reference product having the same dry weight per m² and consisting of the woven fabric bound to a layer of acrylic resin with a blow ratio of 1:2, whereby the flexibility is measured according to the Norm BS 5058 : 1973.

41. The mattress cover of any one of the claims 38 to 40, in which the flexibility of said flexible portion is quite homogeneous, whereby the maximum flexibility variation per 10 cm² is lower than 15%, preferably lower than 10%, most
preferably lower than 5% with respect to the average flexibility of 6 samples of 10 cm².

42. The mattress cover of any one of the claims 38 to 41, whereby the flexible portion has an upper face and a lower face, in which the variation between the flexibility of the upper face and the flexibility of the lower face is lower than 50%, preferably lower than 25%, most preferably lower than 20%.

43. The mattress cover of any one of the claims 38 to 42, in which said flexible portion has a water vapor permeability at 20°C comprised between 1 and 20 kg/m²/day measured according to the Norm DIN 53333 or ASTM-E96(1995).

44. The mattress cover of any one of the claims 38 to 43, in which the woven fabric has a dry weight comprised between 50 and 200 g/m², while the non woven fabric or partly melted non woven fabric has a dry weight of less than 25g/m².

45 The mattress cover of any one of the claims 38 to 44, in which the woven fabric and the non woven fabric, possibly partly smelted, have substantially the same flexibility.

46. The mattress cover of any one of the claims 38 to 45, in which the woven fabric is bound to a non woven fabric by means of an adhesive layer or means with a weight of less than 50g/m², preferably less than 25g/m².

47. The mattress cover of claim 46, in which the adhesive layer or means is homogeneously dispersed, whereby the maximum weight per cm² is less than 10%, preferably less than 5% of the average weight of adhesive material per cm².

48. The mattress cover of any one of the claims 38 to 47, in which the woven fabric is bound to a non woven fabric by means of a layer of adhesive dots, said dots being preferably distant from each other and not bound to each other by adhesive bond.
49. The mattress of claim 48, in which the layer of separate dots has a weight of less than 20g/m², advantageously less than 10g/m², preferably less than 5g/m².

50. The mattress cover of claim 48 or 49, in which the number of dots is comprised between 5 and 100 per cm², preferably between 25 and 60 per cm².

51. The mattress cover of any one of the claims 38 to 50, in which the non woven fabric is partly melted on the woven fabric.

52. The mattress cover of any one of the claims 38 to 51, in which said flexible portion contains at least a biocide.

53. A mattress which is provided with a mattress cover of any one of the claims 38 to 52.
Fig. 3
Fig. 4

Fig. 12
Fig. 7
A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 D06M17/04 D06B1/16 B32B27/04 D06C3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D06M D06B B32B D06C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Bichi, M
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