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(54) **MANUFACTURING METHOD AND NONWOVEN WEB**

VLIESTOFF UND VERFAHREN ZU SEINER HERSTELLUNG

PROCEDE DE PRODUCTION ET VOILE NON TISSE

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## Description

**[0001]** This invention relates to a method presented in the introductory part of the accompanying claim 1 for making a nonwoven. Such a method is known from EP 0 491 383 A1. The invention also relates to a nonwoven presented in the introductory part of the accompanying claim 9.

**[0002]** For manufacturing nonwovens by dry laying, a product is formed from raw materials on a moving support with the help of an air stream. Traditionally, the raw material is mixed with bonding fibres which help keep the formed nonwoven from falling to pieces. Heating directed to the fibrous web moving on top of the support brings the bonding fibres to a state where they bind the fibres to each other. An alternative method is to use liquid bonding agents sprayed on the web and activated by heating.

**[0003]** An alternative for the use of a specific bonding fibre or other bonding agent is mechanical bonding. One advanced technique is spunlacing, i.e. hydroentangling carried out with fine liquid jets. The jets are directed to a fibrous layer moving at a certain speed on a support. The jets take the fibres along with them and make them entangled, and since the support is one with holes, for example a wire, the liquid of the jets is allowed to flow through the support to the other side. This is advantageous in that no specific heat-activated bonding fibres are needed as long as the fibres used as raw material are long enough. Bonding fibres and other bonding agents with reasonable prices are conventionally ones which do not decompose naturally which is an obvious defect considering the handling of the products made from nonwovens as waste.

**[0004]** The above-mentioned EP 0 491 383 A1 introduces a wet laying method in which polyester fibres (PET) are formed into a sheet on a so-called wet former and, with the help of a bonding fibre mixed with the fibres, thermal bonding is carried out prior to the spunlacing. Usually, a pre-web is formed where the fibres are bonded by thermal bonding after which several pre-webs are arranged on top of each other and this combination is spunlaced.

**[0005]** A previously known fibrous material which can be used as the basic raw material for making nonwovens is a fibre produced with a so-called solvent-spinning method. The fibre in question is a cellulosic fibre which is produced by dissolving cellulose into a specific solvent without preparing a derivative of it, after which a spinning into a water-based precipitation bath is carried out. The solvent used is an amine oxide solution which is spun into water or water solution to form the fibres. This technique is described particularly in GB 2 001 320 A and in the international publication WO 95/35399, the latter including statement about the fibrillation tendency of the fibres produced. This tendency makes these fibres particularly suitable for use in connection to spunlacing. The fibres also exhibit good ab-

sorption properties, making them attractive also as material for absorbent products. The fibres are also known as "Lyocell fibres".

**[0006]** The use of cellulose-based raw material to as great extent as possible is beneficial in that the product can be made perfectly biodegradable when it does not contain conventional bonding fibres or agents. However, in this case problems may arise despite the spunlacing in the coherence, i.e. the strength of the product.

**[0007]** The purpose of the invention is to remove the aforesaid defects and to present a method for making a product with good strength without using separate bonding agents. The purpose of the invention is also to present a product with the aforesaid good properties. To carry out these objectives, the method according to the invention is primarily characterized in what is presented in the characteristic part of the accompanying claim 1. Correspondingly, the product according to the invention is characterized in what is presented in the characteristic part of the accompanying claim 9.

**[0008]** In the method, the fibrous web is formed by dry laying from cellulosic fibres manufactured with the solvent-spinning method through an amine oxide solution, and furthermore before spunlacing the fibrous web is prebonded by raising the temperature of the fibrous web and by bringing it to contact with a surface causing mechanical shaping. This way excess flushing of fibres during the spunlacing can be prevented since the fibres are lightly prebonded to each other. Instead of the fibre type mentioned earlier, other cellulosic fibres can also be used in the fibre blend. Prebonding can be carried out with heated calenders placed before the point of spunlacing in the machine direction.

**[0009]** A product characterized in that the aforesaid prebonding prior to the spunlacing has been carried out is superior in its strength values and acquisition to a product produced with conventional methods. The product can be used for manufacturing various absorbent products, it is applicable for different types of disposable wipes, such as wet wipes, or for the surface layers of thicker absorbent disposables, such as baby diapers, feminine pads, incontinence products and so on. Because the parts of the product are both prebonded and spunlaced, no particles come easily off which would be particularly harmful with hygiene and hospital products.

**[0010]** The invention is described in more detail in the following with reference to the accompanying drawing which shows a profile drawing of a production line applying the manufacturing method.

**[0011]** In the drawing, a web w is formed from the fibres used as raw material on a continuous support 1 which is permeable to air. A suction box into which the air is lead is placed on the opposite side of the support 1 from the point of view of the air stream delivering the fibres. From the forming point, the web w is lead forward to the moisturizing point where it is moisturized with a water jet device 2. The amount of water sprayed by the device is adjusted so that the web is evenly moisturized

but its water content is not noticeably increased. After this, the moisturized surface, i.e. the upper surface of the web is calendered with a hot roll 3 against which an unheated roll 4 on the other side of the support 1 presses the web. After the web has passed through the calender formed by rolls 3 and 4, it is transferred to another support 5 supporting it from the upper side. After this the unmoisturized lower surface is moisturized with a water jet device 6 which is similar to the device 2 in the first moisturizing point. Then the support 5 and the web w are lead through a calender formed by rolls 7 and 8 of which the lower roll 7 which is in contact with the lower surface of the web w is a heated roll. After this the web w is transferred to yet another new support 9 supporting it from beneath. The web w is transferred to a spunlacing station 10 where the web w is spunlaced according to the known method by directing the water jets from above so that the combined effect of heat and moisture make the prebonded fibres totally tangled with each other. The fine water jets are fed with a suitable nozzle device from above through the web w, and the water that passes through the support 9 is collected in the other side. After this, the support 9 together with the web w are lead through a dryer 11 after which the finished web, i.e. the nonwoven can be removed from the support 9, for example, by reeling it to a roll 12. The manufacture of a fibrous web is hence carried out in the same line where after the forming point the web w is constantly lead forward through various stages so that in the end a continuous product ready to be reeled or otherwise collected is provided.

**[0012]** The supports 1, 5 and 9 can be known forming supports permeable to water and air, such as wires equipped with the suitable mesh.

**[0013]** What is crucial to the prebonding of fibres is that it is carried out without any bonding agents by utilizing an elevated temperature higher than the temperature of the surroundings (the production line), and mechanical shaping which is achieved with the help of the pressure of the roll pairs 3, 4 and 7, 8. Alternatively, other types of surfaces can be used to which the web w is put in contact for the purposes of prebonding to create adequate strength. The influence of heat can be encouraged by moisturizing the surface of the web w before it is put into contact with the surface providing heating and shaping. To achieve an efficient combined effect of heat and shaping (pressure), the temperature must be at least 80° C and the pressure directed to the web expressed in rule pressure at least 9 kg/cm. When utilizing moisture, the web moisture content should be at least 5 %. Optimum values are for the temperature approx. 100° C, for the rule pressure approx. 21 kg/cm and for the moisture approx. 10 %. The aforesaid values are given to the web run rate of 5 m/min. As the run rate increases, the calender temperature can be increased, for example.

**[0014]** The temperature of the moisturizing water can also be utilized so that if hot water or vapour is used,

the surface following the moisturizing point does not necessarily have to be hot, the required heat being provided through the moisturizing water, and the shaping is carried out with an unheated surface. In this case, for example the rolls 3, 4 and 7, 8 of the calenders in the drawing can all be unheated.

**[0015]** As concluded earlier, one important component of a fibrous web are the fibres made with the solvent spinning method. Such fibres are made by diluting cellulosic fibres, usually some wood fibre, into an amine oxide solution, usually some water soluble N-oxide of tertiary amine. A substance generally used for this purpose is the water solution of the N-oxide of N-methylmorpholine. Other equivalent substances include N-oxide of N,N-dimethylcyclohexoic amine, N-oxide of N,N-dimethyletanol amine and N-oxide of N,N-dimethylbenzoic amine. The method for making the fibres as well as their tendency to fibrillate is described in the international publication WO 95/35399.

**[0016]** The fibrillation tendency can be defined by measuring the freeness according to the Canadian standard, C.S.F, from the fibre suspension. The fibrillation tendency is good if the fibres (6 g 5 mm long fibres in 2 l. of water) achieve a certain C.S.F value after a specific amount of rounds in a laboratory spreader according to the T-205 om-88 of the TAPPI standard. The fibrillation tendency is good if the C.S.F value measured according to the T-227 om-94 of the TAPPI standard is 400 ml or less after a maximum of 270 000 spreader rounds.

**[0017]** The aforesaid fibres can form a majority of the basis weight of a finished nonwoven, the nonwoven can, for example, be made completely from these fibres. However, mixtures of fibres can also be used, in which case all the fibres are brought well-mixed along an air stream to the forming point. Mixture fibres are preferably natural fibres and/or cellulosic converted fibres, such as viscose fibre, that is generally fibres with polymer structures derived from nature which are biodegradable. Suitable natural fibres include, for example, wood fibres, such as mechanical or chemical pulp with relatively long fibres generally used in paper making. Viscose fibre is a cut fibre made from regenerated cellulose. When using aforesaid natural fibres, the proportion of fibres made with the solvent spinning method can be very small, for example in the range 2 - 50 %, in which case their significance is in their good entangling and bonding abilities during hydroentangling, that is, they act in a way as bonding fibres.

**[0018]** Obviously, the invention is not restricted only to the method presented above but can be adapted within the frames of the invention idea presented in the claims. The line can be provided with types of conveyance of the web w different from the one shown in the drawing. The web w can be treated only on one side with the prebonding method described, even though to accomplish an even effect it is preferable to treat both sides of the web before spunlacing. The basis weight of

the fibrous web w and the finished nonwoven may naturally vary within the known limits and depending on the intended use of the nonwoven, usually within 30 - 300 g/m<sup>2</sup>.

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## Claims

1. A method for making a nonwoven in which method a fibrous web (w) is formed with a dry-laying method on a support (1) and the fibrous web is spunlaced, **characterized in that**
  - the fibrous web is at least partly formed from cellulosic fibres which are made with the solvent spinning method through an amine oxide solution, and
  - before spunlacing (10) the fibrous web (w) is prebonded by raising the temperature of the fibrous web and by bringing it in its transfer line into contact with a surface causing mechanical shaping, such as a roll (3).
2. A method according to claim 1, **characterized in that** the fibrous web (w) is moisturized (2) prior to contact to the aforesaid surface.
3. A method according to claim 1 or 2, **characterized in that** both the upper side and the lower side of the fibrous web is brought into contact with a surface causing mechanical shaping.
4. A method according to one of the claims 1 - 3, **characterized in that** the fibrous web is moisturized before prebonding.
5. A method according to one of the claims 1 - 4, **characterized in that** the fibrous web is thermocalendered.
6. A method according to claim 4, **characterized in that** the fibrous web is moisturized with hot water or water vapour which at the same time effects the raise of the temperature at least for the most part.
7. A method according to one of the claims 1 - 6, **characterized in that** in addition to cellulosic fibres made with the solvent spinning method, natural fibres or cellulosic converted fibres are used for the fibrous web.
8. A method according to any of the preceding claims, **characterized in that** the proportion of the fibres made with the solvent spinning method is 2 - 50 %.
9. A nonwoven manufactured with a dry-laying method and reinforced with spunlacing, **characterized in that** the raw material for the nonwoven is at least

partially cellulosic fibres made with the solvent spinning method through an amine oxide solution, which fibres are prebonded with one of the methods presented in the claims 1 - 6.

## Patentansprüche

1. Verfahren zum Herstellen eines Nonwovens, bei dem eine Faserbahn (w) mit einem Trockenlegeverfahren auf einem Träger (1) gebildet und die Faserbahn über Wasserstrahl verfestigt wird, **dadurch gekennzeichnet, dass:**
  - die Faserbahn zumindest teilweise aus Zellulosefasern gebildet wird, die durch eine Aminoxidlösung mittels Lösungsspinnverfahren hergestellt werden, und
  - die Faserbahn (w) vor dem Wasserstrahlverfestigen (10) durch Erhöhen der Faserbahntemperatur und durch das in Berührung Bringen der Faserbahn in ihrer Transferstraße mit einer mechanisches Verformen bewirkenden Oberfläche, wie beispielsweise einer Walze (3), vorverfestigt wird.
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Faserbahn (w) vor der Berührung der vorgenannten Oberfläche befeuchtet (2) wird.
3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** sowohl die Ober- als auch die Unterseite der Faserbahn in Berührung mit einer mechanisches Verformen bewirkenden Oberfläche gebracht wird.
4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Faserbahn vor dem Vorverfestigen befeuchtet wird.
5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Faserbahn thermokalandert wird.
6. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** die Faserbahn mit Warmwasser oder Wasserdampf befeuchtet wird, was zugleich zumindest weitestgehend den Temperaturanstieg bewirkt.
7. Verfahren nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** zusätzlich zu den mit dem Lösungsspinnverfahren hergestellten Zellulosefasern für die Faserbahn natürliche Fasern oder konvertierte Zellulosefasern verwendet werden.

8. Verfahren nach mindest einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Anteil der mittels des Lösungsspinnverfahrens hergestellten Fasern 2 bis 50% beträgt.
9. Mit einem Trockenlegeverfahren hergestelltes und über Wasserstrahlverfestigung verstärktes Nonwoven, **dadurch gekennzeichnet, dass** das Rohmaterial für das Nonwoven zumindest teilweise Zellulosefasern ist, die über das Lösungsspinnverfahren durch eine Aminoxidlösung hergestellt und mit einem der in den Ansprüchen 1 bis 6 vorgestellten Verfahren vorverfestigt sind.

#### Revendications

1. Procédé de fabrication d'un non-tissé, dans lequel un voile fibreux (w) est formé par un procédé par voie sèche sur un support (1) et le voile fibreux est lacé par filage, **caractérisé en ce que**
- le voile fibreux est au moins partiellement constitué de fibres cellulosiques qui sont fabriquées en utilisant le procédé de filage avec solvant dans une solution d'oxyde d'amine, et
  - avant le laçage par filage (10), le voile fibreux (w) est traité préalablement pour le collage en augmentant sa température et en le mettant, sur sa ligne de transfert, en contact avec une surface provoquant un façonnage mécanique, par exemple un rouleau (3).
2. Procédé selon la revendication 1, **caractérisé en ce que** le voile fibreux (w) est humidifié (2) avant d'entrer en contact avec la surface susmentionnée.
3. Procédé selon la revendication 1 ou 2, **caractérisé en ce que** le côté supérieur et le côté inférieur du voile fibreux sont mis en contact avec une surface provoquant un façonnage mécanique.
4. Procédé selon l'une des revendications 1 à 3, **caractérisé en ce que** le voile fibreux est humidifié avant le traitement préalable pour le collage.
5. Procédé selon l'une des revendications 1 à 4, **caractérisé en ce que** le voile fibreux est calandré thermiquement.
6. Procédé selon la revendication 4, **caractérisé en ce que** le voile fibreux est humidifié avec de l'eau chaude ou de la vapeur d'eau, ce qui simultanément produit l'augmentation de la température au moins en majorité.
7. Procédé selon l'une des revendications 1 à 6, **caractérisé en ce que** outre les fibres cellulosiques

fabriquées en utilisant le procédé de filage avec solvant, des fibres naturelles ou des fibres dérivées de la cellulose sont utilisées pour le voile fibreux.

- 5 8. Procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la proportion de fibres fabriquées en utilisant le procédé de filage avec solvant est de 2 à 50%.
- 10 9. Non-tissé fabriqué par un procédé par voie sèche et renforcé par laçage par filage, **caractérisé en ce que** le matériau brut du non-tissé est constitué au moins partiellement de fibres cellulosiques fabriquées en utilisant le procédé de filage avec solvant dans une solution d'oxyde d'amine, lesquelles fibres sont traitées préalablement pour le collage à l'aide de l'un des procédés présentés dans les revendications 1 à 6.

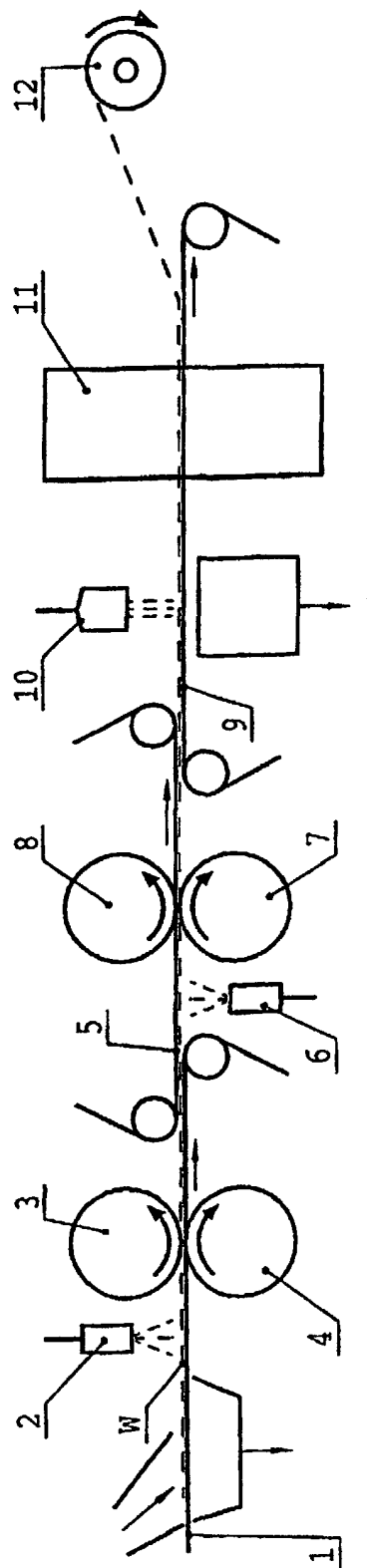


Fig. 1