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(54) Cross laminated nonwoven fabric having intermediate layer

(57) A cross laminated nonwoven fabric has an intermediate layer between a first nonwoven fabric and a second nonwoven fabric. The first nonwoven fabric is composed of filaments aligned and stretched in one direction. The second nonwoven fabric is composed of filaments aligned and stretched in a direction which is perpendicular to the aligned direction of the filaments of the first nonwoven fabric. The intermediate layer is made to have a desired property matching with the use of the cross laminated nonwoven fabric.

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a cross laminated nonwoven fabric having a first nonwoven fabric composed of filaments aligned and stretched in one direction and a second nonwoven fabric composed of filaments aligned and stretched in a direction which is cross to the aligned direction of the filaments of the first nonwoven fabric.

2. Description of the Related Art

[0002] As a conventional laminated nonwoven fabric, the inventors et. al have proposed a cross laminated nonwoven fabric having a longitudinally stretched nonwoven fabric composed of filaments aligned and stretched in a substantially longitudinal direction and a transversely stretched nonwoven fabric composed of filaments aligned and stretched in a substantially transverse direction which is perpendicular to the aligned direction of the filaments of the longitudinally stretched nonwoven fabric.

[0003] This cross laminated nonwoven fabric has a large tensile strength in the longitudinal direction and the transverse direction at a small fiber amount per square meter, the tensile strengths in both of the directions are well balanced, and the cross laminated nonwoven fabric is thin and hence provides good conformity, the surface thereof is smooth and glossy and provides a property suitable for printing, the cross laminated nonwoven fabric provides good feeling of texture, the surface thereof has toughness against abrasion and so on, as compared with a spunbonded nonwoven fabric, a melt blown nonwoven fabric or the like.

[0004] Some conventional nonwoven fabrics are given various properties such as an antibacterial property, water resistant property, antirust property, deodorant property and so on. As a general method for giving such a property to the conventional nonwoven fabric, there are methods in which different kinds of fiber elements are blended with each other or one in which the nonwoven fabric is impregnated with resin or the like. The nonwoven fabric as a target of product may be laid on another nonwoven fabric which is made to have some desired property.

[0005] As described above, the cross laminated nonwoven fabric has various advantages. However, such kind of cross laminated nonwoven fabric is still desired to have additional property such as antibacterial property, water resistant property, antirust property, deodorant property and so on, which are described above, depending on the use of the nonwoven fabric.

[0006] As a method for giving an additional property to the cross laminated nonwoven fabric as described above, it can be considered that a web made to have the desired property is simply attached on one side of the cross laminated nonwoven fabric. In this case, however, the web attached on one side of the cross laminated nonwoven fabric appears on one side of the combined nonwoven fabric, with the result that the characteristic including the drawback of the attached web sheet also becomes conspicuous, which fact deprives the cross laminated nonwoven fabric of its advantageous characteristics.

[0007] On the other hand, it is desired to improve the adhesive strength, which is an inherent problem deriving from the structure thereof, effected between the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric. Further, improvement is desired in the whole strength of the cross laminated nonwoven fabric, the feeling of texture from the paper-like one to another, giving a voluminous property, and increasing in the advantageous property of the cross laminated nonwoven fabric.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to provide a cross laminated nonwoven fabric which is made to have a desired property without deteriorating the original merit of the cross laminated nonwoven fabric.

[0009] To achieve the above objects, the cross laminated nonwoven fabric according to the present invention includes an intermediate layer with a desired property, a first nonwoven fabric composed of filaments aligned and stretched in one direction and laid on one side of the intermediate layer, and a second nonwoven fabric composed of filaments aligned and stretched in the direction of the filaments and laid on the other side of the intermediate layer so that the aligned direction of the filaments is cross to the aligned direction of the filaments of the first nonwoven fabric.

[0010] In the above arrangement, the first and second nonwoven fabrics are made in such a manner that a continuous filaments are spun by a spinning apparatus so that the filaments are aligned to produce a web, and thereafter the web is stretched in the aligned direction of the filaments, whereby the stretching rate of the continuous filaments is 3 to 30 times, the mean filament diameter of the continuous filaments after stretching is 1 to 20 µm, and the tensile strength of the web after stretching is 8.83 to 883mN/tex (0.1 to 10 g/d). In the description of the present invention, the value of the tensile strength of the nonwoven fabric is converted into "denier" (tex) based on the mass at a unit area of the fabric, and the tensile strength is expressed by a strength per unit tex (mN/tex). A tensile strength per one denier (d) is also shown as a reference.

[0011] As described above, the cross laminated nonwoven fabric according to the present invention has an arrangement in which an intermediate layer having a desired property is sandwiched between the first nonwoven fabric and the second nonwoven fabric. Therefore, the cross laminated nonwoven fabric according to the present invention can retains the original advantage which derives from the arrangement including the first nonwoven fabric and the second nonwoven fabric while the intermediate layer sandwiched between them exerts its desired property. Further, the arrangement including the first nonwoven fabric and the second nonwoven fabric provides tensile strength in both of the directions. Therefore, even if the intermediate layer lacks a sufficient tensile strength, the nonwoven fabrics sandwiching the intermediate layer will recover the drawback deriving from the lack of tensile strength of the intermediate layer. Accordingly, the cross laminated nonwoven fabric according to the present invention can be utilized for a use that requires a sufficient tensile strength. Moreover, as the intermediate layer can be protected from being exposed to the outside, the intermediate layer can be free from requirement in appearance or surface characteristics. Therefore, the cross laminated nonwoven fabric according to the present invention can find any utilization depending on its function.

[0012] For example, if the intermediate layer is made of a melt blown nonwoven fabric, the cross laminated nonwoven fabric according to the present invention will have a function of a filter, water-resistant property, antibacterial property, and so on which derive from the fine fiber of the melt blown nonwoven fabric. Particularly in this case, if the melt blown nonwoven fabric is electretized, the cross laminated nonwoven fabric according to the present invention will have a high dust collecting performance when it is utilized as a filter.

[0013] If the intermediate layer is made of a spunbonded nonwoven fabric, the cross laminated nonwoven fabric according to the present invention will have a voluminous property, with the result that the cross laminated nonwoven fabric according to the present invention will have a good feeling of texture. In this case, if the spunbonded nonwoven fabric contains a low melting point polyester fiber, the adhesive surface between the fabrics will be improved.

[0014] Furthermore, if the intermediate layer may be made of a web having air permeability and moisture permeability of less than 20 $m^2 \cdot s \cdot Pa/\mu g$, the cross laminated nonwoven fabric according to the present invention can be utilized as a water proof sheet with a moisture permeability. If the web is designed to have a thickness of 50μm or more, the cross laminated nonwoven fabric according to the present invention can be utilized as a core texture of a cloth.

[0015] The intermediate layer may not be limited to a nonwoven fabric but may be made of a film. The film may be one made of a thermoplastic resin, in more particularly, a thermoplastic resin containing an adhesive agent. If the film is made of a thermoplastic resin containing an adhesive agent, the film will conform with the filaments constituting the first nonwoven fabric the second nonwoven fabric.

[0016] In the explanation of the direction in which the filaments are aligned and stretched, the term "longitudinal direction" means the machine direction in which the nonwoven fabric is manufactured, i.e., the direction in which the nonwoven fabric is fed, and the term "transverse direction" means the direction perpendicular to the longitudinal direction, i.e., the direction transversely across the nonwoven fabric.

[0017] The above and other objects, features and advantages of the present invention will become apparent from the following description with reference to the accompanying drawing which illustrates examples of the present invention.

BRIEF DESCRIPTION OF THE DRAWING

[0018] FIG. 1 is a perspective view of a cross laminated nonwoven fabric according to the present invention, a part of the intermediate layer and longitudinally stretched nonwoven fabric being cut away.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Referring to FIG. 1, there is shown a cross laminated nonwoven fabric 1 according to an embodiment of the present invention having a longitudinally stretched nonwoven fabric 2 composed of filaments aligned in longitudinal direction, a transversely stretched nonwoven fabric 4 composed of filaments aligned in transverse direction, and an intermediate layer 3 sandwiched between the longitudinally stretched nonwoven fabric 2 and the transversely stretched nonwoven fabric 4. Thus, the aligned direction of the filaments of the longitudinally stretched nonwoven fabric 2 is perpenducularly cross to the alingned direction of the filaments of the transversely stretched nonwoven fabric. The intermediate layer 3 is made to have a desired property in addition to the property of the cross over-lay structure of the nonwoven fabric 2 and 4.

[0020] As described above, since the intermediate layer 3 is provided between the nonwoven fabrics 2 and 4, the cross laminated nonwoven fabric 1 according to the present invention can be provided with a function in addition to the characteristic of the cros over-lay structure of the longitudinally stretched nonwoven fabric 2 and the transversely stretched nonwoven fabric 4. Since the cross laminated nonwoven fabric 1 according to the present invention has a couple of the longitudinally stretched nonwoven fabric 2 and the transversely stretched nonwoven fabric 4, intermediate layer 3 can be interposed between the longitudinally stretched nonwoven fabric 2 and the transversely stretched non-woven fabric 4. This structure utilized for the two-layer structure comes from a conventional cross laminated nonwoven fabric having a couple of nonwoven fabrics.

[0021] The longitudinally stretched nonwoven fabric 2 and the transversely stretched nonwoven fabric 4 will hereinafter be described in detail.

[0022] As the longitudinally stretched nonwoven fabric 2, a nonwoven fabric disclosed in Japanese Patent Laid-open Publication No. 204767/98 can be utilized. Now, the longitudinally stretched nonwoven fabric 2 will be described together with the method of manufacturing the same.

[0023] In order to produce the longitudinally stretched nonwoven fabric 2, initially, filament material is extruded from the plurality of nozzles arrayed in transverse direction with a draft tension. Owing to the draft tension applied to the filaments, the filaments are attenuated and stacked on a conveyor. The filaments soon after being extruded from the nozzles are positively heated. Alternatively, the filaments are maintained in an atmosphere having a high temperature near the nozzles from which the filaments are just extruded. The temperature of the atmosphere is maintained high enough as compared with the melting point of the filament material, whereby the molecular orientation of the filament material caused by the draft is made small as far as possible. As a means for maintaining the temperature of the atmosphere near the nozzles high, a heated airflow blew off from a die, any heating means, a heat retaining cylinder or the like can be employed. As means for heating the melted filament material, infrared radiation means or laser radiation means can be employed.

[0024] As a method of applying the draft tension to the filaments, a method of using a melt-blow die (hereinafter referred to as MB method) can be employed. MB method is advantageous in that the temperature of the heated air can be maintained high so as to suppress the molecular orientation of the filament material. However, in an ordinary MB method, filaments will be stacked on the conveyor at random. Further, the filaments will undergo any heat treatment on the conveyor due to the heated air flow, with the result that the filaments become one having a low stretchability. Thus, an air flow containing moisture as a state of mist or the like is applied to the filaments spun out from the nozzles at a slant angle with respect to the conveying surface of the conveyor. In this way, the filaments can be aligned in the longitudinal direction and properly cooled.

[0025] As another method of applying the draft tension to the filaments, there can be introduced a spun-bond method (hereinafter referred t as SB method) in a narrow sense, i.e., so-called an ejector or an air sucker is introduced below the plurality of nozzles. Also in an ordinary SB method, the filaments are cooled soon after they are extruded from the nozzles, and hence molecular orientation can be caused in the filaments. Also, the filaments will stacked on the conveyor at random. In order to improve the alignment performance of the filaments, similarly to the case in which the MB method is introduced, any means for maintaining the temperature near the nozzles high is introduced together with the SB method so as to suppress the molecular orientation. Further, a cooling airflow or moisture in a state of mist is supplied to the inner room of the ejector so that the filaments come to have a proper stretchability. Furthermore, it is desirable for the fluid material containing the filaments to be supplied onto the conveyor at a slant angle with respect to the conveying surface of the conveyor.

[0026] In this way, since the filaments is spun onto the conveyor at a slant angle with respect to the conveying surface of the conveyor, the filaments will be properly aligned in the longitudinal direction. In order for tilting the flow of filament material with respect to the conveying surface of the conveyor, the nozzles may be set tilted with respect to the conveyor, any auxiliary fluid flow may be applied to the flow of filaments to tilt the direction of the filament material flow, conveyor may be tilted with respect to the spinning direction of the filament. These means may be solely introduced or any combination of the plurality of means may be introduced. If any fluid flow is produced near the nozzle, it is desirable for the fluid to be heated. Further, if no fluid flow is produced near the nozzle, it is desirable for the filaments to be heated positively. This is because the molecular orientation can be suppressed as far as possible when the filaments are made to have a fine diameter owing to the draft.

[0027] In either of the MB method and the SB method, a fluid flow is introduced for tilting the flow of filaments with respect to the conveying surface of the conveyor. If the fluid flow is provided near the conveyor, it is desirable for the fluid flow to be a cooled fluid flow, particularly, a fluid flow containing moisture in the state of mist. Owing to the fluid flow, the filaments spun from the nozzle can be cooled rapidly, which makes it possible to prevent the filaments from being crystallized. If the filaments suffer from crystallization, the filaments lack stretchability. Also, if moisture component in the mist state is blew off toward the web stacked on the conveyor, the web stacked on the conveyor can be more stably fixed on the upper surface of the conveyor. As a result, the filaments can be more stably spun and the filaments can be more positively aligned.

[0028] As described above, filaments are stacked on the conveyor to form the web. If any means is effected for sucking the web from the back surface of the conveyor, the web, which can be unstable due to the tilting with respect to the conveyor surface, can restore stability. In addition, excessive heat on the web can be effectively removed. In this case, the suction of the web shall be effected in such a manner that sucking nozzles are aligned in a straight line extending in the width direction of the conveyor and the extending length is short. Any suction means is often effected in an ordinary SB method. In this case, the suction means is often provided so as to extend in a wide width of the conveyor, whereby the web is made uniform over a unit area and filament alignment is made random as far as possible. Therefore, the object for providing the suction means in the ordinary SB method is different from the object for providing the suction means in the SB method introduced in the present embodiment. Further, the suction means in the present embodiment can remove moisture component blew in the mist state for cooling. Thus, it becomes possible to suppress the influence deriving from the moisture component effected in the following stretching process. Polyester is sensitive to moisture in its stretchability. Thus, if moisture distribution on the web sheet is uneven, the stretchability thereof becomes also uneven, with the result that the web comes to have low tensile strength after stretching process and hence the web cannot withstand a high rate of stretch.

[0029] The web formed by stacking the filaments on the conveyor is stretched in the longitudinal direction, so that the web is made into the longitudinally stretched nonwoven fabric. The alignability of the filaments in the longitudinal direction can further be improved by stretching the web in the longitudinal direction. The better the alignability of the filaments in the longitudinal direction, the higher the probability that the filaments are substantially stretched when the web is stretched in the longitudinal direction, and the greater the mechanical strength of the finally stretched web. If the alignment of the filaments were poor, then only the distance between the filaments would be increased by stretching the web, and the probability that the filaments are substantially stretched would be lowered, failing to attain a sufficient mechanical strength after stretching the web.

[0030] When the web is subjected to the stretching process, though the stretching process is carried out by a single stage, the stretching process is often divided into multiple stages. The stretching process of the multiple stages may be carried out as follows. That is, the first stage of stretching process is carried out as a preparatory stage soon after the spinning of filaments. The second stage or the later stage of stretching process successively carried out after the first stage is carried out as a main stage of stretching. Particularly, it is appropriate for the present invention to employ a short distance stretching method for the first stage of stretching process of the multiple stages.

[0031] The short distance stretching is a method in which a couple of rollers are provided adjacent to each other and the web is stretched owing to the difference in the rotating rate of the couple of rollers. The term "short distance" comes from that the couple of rollers are disposed with a short distance (distance from the starting point of stretching to the ending point of the same) interposed between the rollers. When the short distance stretching method is effected, it is desirable for the distance between the rollers in which the stretching is effected to be 100mm or below. Particularly in the case of the present embodiment where the filaments are aligned in the longitudinal direction as a whole but each of the filaments can be somewhat distorted, it is essential for the distance between the rollers in which the stretching is effected to be maintained short for achieving stretching on each of the filaments effectively. When the short distance stretching is effected, heat is ordinarily applied to the web by means of the heated roller serving for stretching. A heated airflow or infrared radiation as an auxiliary function heats the stretching point of the web. Further, the heat source utilized upon effecting the short distance stretching may be hot water, steam or the like.

[0032] When the multistage stretching is utilized, the way of stretching suitable for the second stage stretching process, or the later stage stretching is not only the short distance stretching but also various stretching means employed for ordinary stretching for a web (such as a aggregate of fibers or filaments of a nonwoven fabric). For example, one of the possible stretching means is roller stretching, hot water stretching, steam stretching, hot plate stretching, or rolling. The short distance stretching is not always indispensable for the second or later stage stretching. This is because each of the filaments can be sufficiently stretched in the longitudinal direction at the first stage of stretching.

[0033] Transversely stretched nonwoven fabric 4 will hereinafter be described. As transversely stretched nonwoven web sheet 4, a web disclosed in Japanese Examined Patent Publication No. 36948/91 can be utilized.

[0034] To produce transversely stretched nonwoven fabric 4, initially a web in which filaments are aligned in substantially transverse direction is formed. The web in which filaments are aligned in substantially transverse direction can be formed in a manner that filaments extruded from a spinning nozzle is vibrated in the transverse direction by airflow jet from an airflow blowing nozzles provided around the spinning nozzle, and then the filaments are stacked on the conveyor.

[0035] The way to vibrate the filaments in the transverse direction by using airflow jet from the nozzles surrounding the spinning nozzle is as follows. That is, a first set of air blowing nozzles (ordinarily three to eight nozzles) are provided so that the set of nozzles surround the spinning nozzle and each of the airflow jets blew from the first set of air blowing nozzles has a circumferential component traveling around the center axis of the spinning nozzle. Further, in order to assure the vibration given to the filaments, a second set of air blowing nozzles composed of a couple of nozzles are provided on the outside of the first set of air blowing nozzles so that the airflow jets blew from the second set of air blowing nozzles collide with each other in the direction parallel with the machine direction of the conveyor. The filaments extruded from the spinning nozzle are rotated spirally owing to the airflow jets from the first set of air blowing nozzles. On the other hand, the airflow jets blew off from the second set of air blowing nozzles collide with each other on the traveling path of the rotating filaments. As a result, the filaments are spread in the transverse direction which is perpendicular to the machine direction of the conveyor. The filaments brought to the rotational motion are urged to the motion in the transverse direction owing to the airflow jet. As a result, the filaments are stacked on the conveyor so that majority of the filaments are aligned in the transverse direction.

[0036] The web obtained by the above method is stretched in the transverse direction. As a way to stretch the web, a tenter system, a pulley system or the like can be employed. The tenter system is generally utilized in a case where films or the like are extended. However, this system encounters drawbacks that a wide area of floor is required and the width of products or the stretching rate of the width of the product material cannot be changed with ease. As for the web production, the width of the web shall be changed depending on its use. Further, the stretching rate of the web shall also be changed depending on the thickness of the raw material sheet. Accordingly, when the web according to the present invention is stretched in the transverse direction, the pulley system is preferable because the pulley system allows the width of the product or stretching rate to be changed even when the system is operated.

[0037] A stretching apparatus based on the pulley system includes a pair of pulleys disposed at both of the sides with a distance interposed in the width direction of the web, whereby the web can be held. The stretching apparatus based on the pulley system also includes a belt stretched on each of the pulleys. The pulleys are disposed symmetrically with respect to the centerline of the web in the width direction so that the circumferential surface of the pulley draws a divergent locus. The pair of pulleys are rotated at the same rate. On the other hand, the belt is stretched on each of the pulley with a tension. A part of the belt is engaged into a groove which is formed on the outer circumferential end face of each pulley over the region extending from the position at which the distance between the pulleys is narrowed to a position at which the distance between the pulleys is widen.

[0038] The web is introduced from the position at which the distance between the pulleys is narrowed. The web is held at its ends of the width by the pulleys and the belts. When the pulleys are rotated, the web is held between the pulleys and the belt while conveyed through the divergent locus which is formed by the pulleys. In this way, the web is stretched in the width direction. During the stretching process of the web, heat may be applied by hot water, heated airflow and so on.

[0039] As described above, transversely stretched nonwoven fabric 4 composed of filaments aligned in the transverse direction and stretched in the transverse direction can be obtained.

[0040] The material of the filaments constituting longitudinally stretched nonwoven fabric 2 and transversely stretched nonwoven fabric 4 may be made of thermoplastic resin such as polyethylene, polypropylene, polyester, nylon, polyvinyl chloride, polyurethane, fluorinated resin and denatured resin of these materials. Further, a resin for use with a wet type spinning means or a resin for use with a dry type spinning means such as polyvinyl alcohol type resin, polyacrylonitrile type resin can be utilized.

[0041] While longitudinally stretched nonwoven fabric 2 and transversely stretched nonwoven fabric 4 have been described in detail with one example for each of the first nonwoven fabric and the second nonwoven fabric, the first nonwoven fabric 2 and the second nonwoven fabric according to the present invention are not limited to the above described nonwoben fabric. Other preferable example of the nonwoven fabric can be produced as follows. That is, the spinning apparatus spins continuous filaments and aligns the continuous filaments in one direction, whereby a web is produced. Thereafter, the web is stretched in the aligned direction of the continuous filaments so that the stretching rate of the continuous filaments becomes 3 to 30 times, the average filament diameter of the continuous filaments after the stretching process becomes 1 to 20μm, and the tensile strength of the web after the stretching process becomes 8.83 to 883mN/tex (1 to 10 g/d).

[0042] The stretching rate of the continuous filaments is, preferably, 4 to 10 times, and more preferably, 4.5 to 8 times. The average filament diameter of the continuous filaments after the stretching process is, preferably, 5 to 18μm, and more preferably, 7 to 15μm. Further, the tensile strength of the web after the stretching process is, preferably, 100 to 300mN/tex (1.1 to 3.4 g/d), and more preferably, 130 to 220mN/tex (1.5 to 2.5 g/d).

[0043] In this case, the filaments constituting longitudinally stretched nonwoven fabric 2 and transversely stretched nonwoven fabric 4 are long filaments. The long filaments in this case are substantially long. The term "long filament" simply means a filament of which length is more than 100mm.

[0044] A concrete example of longitudinally stretched nonwoven fabric 2 and transversely stretched nonwoven fabric 4 will be described.

[0045] As for longitudinally stretched nonwoven fabric 2, polyester was selected for the material of the filaments. The filaments were spun by a melt-blow die at a constant width. The spun filaments were stacked on a conveyor so as to form a web. Thereafter, the web was stretched at a stretching rate of 3 to 30 times. Thus, a longitudinally stretched nonwoven fabric composed of filaments of which diameter was 1 to 20μm can be obtained. The longitudinally stretched nonwoven fabric obtained in the above process had a faiber amount per square meter of 3 to 20g/m^2, the elongation percentage in the longitudinal direction was 7 to 15%, the tensile strength in the longitudinal direction was 8.83 to 883mN/tex (1 to 10g/d). The elongation percentage in the transverse direction and tensile strength in the transverse direction were not measured because filaments came untangled. The elongation percentage and the tensile strength were those when the web was broken. The same was applied to the following description of an example.

[0046] As for transversely stretched nonwoven fabric 4, polyester was also selected for the material of the filaments. Vibration was effected on filaments in the transverse direction and the filaments were stacked on a conveyor to form a web. The web formed on the conveyor was stretched in the transverse direction by means of a pulley system transverse stretching apparatus at a rate of 3 to 30 times. Thus, a transversely stretched nonwoven fabric composed of filaments of which diameter was 1 to 20μm can be obtained. The transversely stretched nonwoven fabric obtained in the above process had a fiber amount per square meter of 3 to 20g/m^2, the elongation percentage in the transverse direction was 7 to 15%, the tensile strength in the transverse direction was 8.83 to 883mN/tex (1 to 100g/d). The elongation percentage in the longitudinal direction and tensile strength in the longitudinal direction were not measured because filaments came untangled.

[0047] As for intermediate layer 3, various materials such as nonwoven fabric, texture, film and so on can be selected.

[0048] Intermediate layer 3 will hereinafter be described in detail.

(Melt blown nonwoven fabric)

[0049] The melt blown nonwoven fabric was a nonwoven fabric formed of a very thin filament having a diameter of about 2 μm. The melt blown nonwoven fabric has a function of a filter, a water-resistant property, an antibacterial property, an anti-tick property or the like. However, the melt blown nonwoven fabric has a low tensile strength or surface strength when it is formed to have a small fiber amount per square meter. Thus, the melt blown nonwoven fabric can find a limited use. However, if the melt blown nonwoven fabric is utilized as the intermediate layer, the drawback of melt blown nonwoven fabric such as the lack of tensile strength or surface strength can be recovered by the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric. Therefore, the cross laminated nonwoven fabric having the melt blown nonwoven fabric as the intermediate layer will have not only a sufficient tensile strength and surface strength but also its inherent function deriving from the melt blown nonwoven fabric. Particularly, if the melt blown nonwoven fabric as the intermediate layer is electretized, the resultant cross laminated nonwoven fabric can serve as a filter with a high dust collecting performance. The electretizing is a treatment in which the nonwoven web is subjected to an electric discharging environment in a field of several ten thousand volts after spinning the nonwoven fabric or simultaneously with the spinning of the nonwoven fabric. In this way, electrons can be injected into the fabric and the electrons can be expected to stay in the fabric semi-permanently.

(Spunbonded nonwoven fabric)

[0050] If spun-bond nonwoven fabric is utilized as the intermediate layer, the resulting cross laminated nonwoven fabric will have a voluminous property and good feeling of texture. Further, if the spunbonded nonwoven fabric is made of filaments of which material is a low-melting point resin or adhesive resin, the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric can be firmly attached to the intermediate layer, with the result that the sewing strength is increased. As the low-melting point resin, in a category of polyester, a low-melting point resin copolymerized with isophthalic acid can be selected. In a category of polyamide, nylon 6 relative to nylon 66 can be selected. Also, as an example of the adhesive resin, hot-melt polyester resin or hot-melt polyamide can be selected.

[0051] The filaments constituting the spunbonded nonwoven fabric are not sufficiently subjected to the stretching process unlike the longitudinally stretched nonwoven fabric or the transversely stretched nonwoven fabric. Therefore, the molecular orientation property of the filaments constituting the spunbonded nonwoven fabric is not highly developed and its softening point is low. Thus, if the pun-bond nonwoven fabric is interposed between the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric, and intermediate thermal embossing processing is applied to the laid fabrics, the spunbonded nonwoven fabric is firmly attached to the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric. Further, the filaments of the spunbonded nonwoven fabric tend to get twisted with one another and connection among filaments has an abundant of flexibility. Therefore, if the cross laminated nonwoven fabric having the spunbonded nonwoven fabric as the intermediate layer is subjected to sewing, a force applied to a thread will be well dispersed, with the result that the sewing strength is improved.

[0052] As described above, if the spunbonded nonwoven fabric is utilized as the intermediate layer, in addition to the dimension stability and anti-wear property, which are inherent in the conventional nonwoven fabric composed of the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric, strength is improved. Therefore, the cross laminated nonwoven fabric having the spunbonded nonwoven fabric as the intermediate layer is suitable for cloth, wrapping material, bag-forming material, table cloth, interior material, wall paper and so on, by taking the advantage of the printing property of the surface material (i.e., the exposed surface of the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric).

[0053] As a raw material for the spunbonded nonwoven fabric for use for the intermediate layer, it is desirable to select a raw material same as that of the stretched nonwoven fabrics sandwiching the intermediate layer. For example, if the stretched nonwoven fabrics sandwiching the intermediate layer are made of olefin type material such as PP, the spunbonded nonwoven fabric is also made of PP type material. If the stretched nonwoven fabrics sandwiching the intermediate layer are made of PET type material, the spunbonded nonwoven fabric is also made of PET type material. In this way, the stretched nonwoven fabrics will be satisfactorily adhered to the intermediate layer.

[0054] Further, the spunbonded nonwoven fabric may be made of a material blended with a fiber of a low-melting point material or adhesive material. The spunbonded nonwoven fabric may utilize a material of core-and-case, a conjugate filaments of a side-by-side (e.g., see Japanese Patent Laid-open Publication No. 182963/90, Japanese Patent Laid-open Publication No. 41762/92, Japanese Patent Laid-open Publication No. 316608/92) and so on. These materials have a further advantageous property such as adhesive property or voluminous property. In particular, the spunbonded nonwoven fabric is made of PET type material or nylon type hot-melt adhesive resin, the adhesive property effected between the sheets will appropriately be improved.

(Flush spun nonwoven fabric)

[0055] A flush spun nonwoven fabric has an advantage of a large tensile strength and large tear strength. However, this nonwoven fabric is made of polyethylene as a raw material, its surface is unsuited for printing. Therefore, if this nonwoven fabric is utilized, the fabric shall be coated with a sizing material on its surface or subjected to a corona treatment so as to improve the printing property of the surface. However, if the flush spun nonwoven fabric is utilized as the intermediate layer of the cross laminated nonwoven fabric, the resulting nonwoven fabric can be improved in the printing property without undergoing the coating or the treatment. In addition, the resulting nonwoven fabric comes to have a surface of a good feeling of texture and strength is improved.

(Short fiber nonwoven fabric)

[0056] The intermediate layer may be made of nonwoven fabric of which raw material is short fiber such as needle punch nonwoven fabric or thermal bond nonwoven fabric. The short fiber nonwoven fabric can be formed of a material blended with any material such as self-shrinking fiber which can be shrank by heat application for making the fabric have a voluminous property, adhesive fiber, short fiber such as antibacterial property, anti-tick property or deodorant property, depending on necessity. If the short fiber nonwoven fabric described above is utilized as the intermediate layer, the adhesive ability to the stretched nonwoven fabrics can be improved, the voluminous property or any special function can be given to the resulting cross laminated nonwoven fabric. Further, the short fiber is not limited to a chemical fiber but the short fiber can be made of any natural fiber such as wool, cotton or the like, semi-synthetic fiber such as rayon, inorganic fiber such as glass fiber, ceramic fiber or the like.

(Tow opening nonwoven fabric)

[0057] If a tow opening nonwoven fabric is utilized for the intermediate layer, the resulting cross laminated nonwoven fabric will have not only the tensile strength in the longitudinal direction and the tensile strength in the transverse direction deriving from the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric, respectively, but also a tensile strength in an oblique direction deriving from the tow opening nonwoven fabric. Accordingly, the sewing strength can be improved.

(Any material other than nonwoven fabric)

[0058] As a material for the intermediate layer, in addition to various nonwoven fabric, paper, texture, knit, film, foam sheet or the like can be selected. Further, any material made to have a function such as a magnetic shielding property, electromagnetic wave shielding property, or water-resistant property can be utilized.

[0059] Particularly, if a film is utilized for the material of the intermediate layer, the cross laminated nonwoven fabric is suitable for a base sheet of an adhesive tape. A method of using the cross laminated nonwoven fabric for the adhesive tape is disclosed in Japanese Patent Laid-open Publication No. 36795/98, for example. If the cross laminated nonwoven fabric is applied to the adhesive tape, the film is interposed between the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric so that filaments of the longitudinally stretched nonwoven fabric can be restricted in motion, and the transversely stretched nonwoven fabric is firmly fixed. Thus, the cross laminated nonwoven fabric can be torn in the transverse direction with ease. As a material of the film, any thermoplastic resin such as polyethylene, polypropylene, polyester can be selected. In particular, a film in which an adhesive component is subjected to copolymerization is suitable because of its intimacy with the filaments.

[0060] As a way to stick the film to the stretched nonwoven fabrics may be such one that a film as the intermediate layer is fed between the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric and pressed together by a pair of heated rolls. Alternatively, the film is directly extruded onto the longitudinally stretched nonwoven fabric and then the transversely stretched nonwoven fabric is laid thereon and pressed by a heated roll to stick the transversely stretched nonwoven fabric to the film. Furthermore, the film may be resin layer formed by dipping an emulsified resin onto the stretched nonwoven fabric and drying the resin.

[0061] As described above, many modes can be implemented for the intermediate layer. If a nonwoven fabric with an adhesive property or voluminous property is utilized for the intermediate layer, the resulting cross laminated nonwoven fabric will come to have a fabric with a good feeling of texture. Thus, the resulting cross laminated nonwoven fabric can be utilized for a cloth such as a jumper or a coat. In particular, if the intermediate layer is made to have a thickness of 50μm or more, the cross laminated nonwoven fabric can be utilized as a core sheet for a cloth. Further, if the intermediate layer is given antibacterial property, the resulting cross laminated nonwoven fabric can be utilized for a medical use such as a surgical gown.

[0062] Further, if the intermediate layer is a web made to have air permeability and moisture permeability of less than 20 $m^2 \cdot s \cdot Pa/\mu g$, then the resulting cross laminated nonwoven fabric can be utilized for a moisture permeable water-resistant sheet for use for an outer wall of a house which is equipped with a condensation preventing structure and in which water resistant property is requested. In this case, the intermediate layer itself may be a multilayer structure. That is, the multilayer structure may be formed of a combination of a porous film having a plenty of minute holes, a sheet of closely packed flush spun nonwoven fabric, a sheet of paper or the like depending on necessity. The moisture permeable water-resistant sheet is requested to have not only a moisture permeability but also a strength. However, the requested strength is guaranteed by the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric. Therefore, even if the intermediate layer is made of paper or any porous film which tend to have a low strength, the cross laminated nonwoven fabric can be utilized as a moisture permeable water-resistant sheet so long as the intermediate layer satisfies a desired moisture permeability.

[0063] The longitudinally stretched nonwoven fabric, the transversely stretched nonwoven fabric, and the intermediate layer have been described. A method for laying these fabrics and layer can be provided in a simple way as follows. That is, in a process of laying the transversely stretched nonwoven fabric on the longitudinally stretched nonwoven fabric based on a conventional manufacturing method, the intermediate layer wound around a roll is fed so as to be inserted between the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric. In particular, if the intermediate layer is a nonwoven fabric, the intermediate layer need not be always produced in advance. That is, the intermediate layer may be produced directly between the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric by using any proper spinning means in the laying and bonding processes for the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric.

[0064] Further, as a method of laying the longitudinally stretched nonwoven fabric, the transversely stretched nonwoven fabric, and the intermediate layer, there can be selected a thermal pressing using a thermal embossing roll or a calender roll, an ultrasonic bonding, a powder dot bonding using an adhesive material, a hot-melt bonding, a dot-bonding in a state of emulsion, a through-air bonding in which the cross laminated nonwoven fabric undergoes a heated airflow going through the nonwoven fabric, a water jet bonding, a needle punch method, a stitch bond method and so on. These methods can be utilized solely or in a combined fashion depending on the use of the resulting cross laminated nonwoven fabric.

[0065] The cross laminated nonwoven fabric according to the present invention may be further subjected to any treatment such as a heat treatment, a thermal shrinkage treatment, a steam heating treatment or the like depending on its necessity, whereby the cross laminated nonwoven fabric is made to have more preferable nature as a final product. In particular, when the intermediate layer is subjected to the thermal shrinkage to make the intermediate layer have a voluminous property, this kind of heat treatment process becomes indispensable.

[0066] In the above description of the embodiments description has been made on a case in which longitudinally stretched nonwoven fabric 2 and transversely stretched nonwoven fabric 4 are utilized as the first nonwoven fabric and the second nonwoven fabric, respectively. However, the first nonwoven fabric and the second nonwoven fabric may be made of only one of the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric so long as the stretched nonwoven fabrics are laid on each other so that the aligned directions of the filaments constituting the nonwoven fabrics intersect at right angle with each other.

[0067] Inventive Examples and Comparative Examples will be described bellow in specific detail.

(Inventive Example 1)

[0068] The longitudinally stretched nonwoven fabric was made as follow. Initially, filaments are made from a polyester resin of which limiting viscosity IV value is 0.62 by using a melt-blow spinning apparatus so that the filaments are aligned in the longitudinal direction to form a web. Then the resulting web was stretched in the longitudinal direction at a rate of 5.5 times. Thus, the longitudinally stretched nonwoven fabric having a fiber amount per square meter of $10g/m^2$ was obtained. The transversely stretched nonwoven fabric was made as follows. Initially, filaments are made from a polyester resin of which limiting viscosity IV value is 0.55 by using a spray spinning apparatus so that the filaments are piled in the transverse direction to form a web. Then the resulting web was stretched in the transverse direction at a rate of 5.7 times. Thus, a transversely stretched nonwoven fabric having a fiber amount per square meter of 10g/m^2 was obtained. The raw material of the intermediate layer was a spunbonded nonwoven fabric of MARIX 09123WSO (name of product) supplied by UNITIKA. LTD. The fiber amount per square meter of the intermediate layer was 12g/m^2. The nonwoven fabric of the intermediate layer was inserted between the longitudinally stretched nonwoven fabric and the of transversely stretched nonwoven fabric. These were bonded together by an embossing roll heated at a temperature of 200°C. Thus, the cross laminated nonwoven fabric was obtained. The fiber amount per square meter of the cross laminated nonwoven fabric was 34g/m^2.

[0069] The obtained cross laminated nonwoven fabric was subjected to measurement of tensile strength, elongation, and sewing strength. As for the measurement of the elongation, the cross laminated nonwoven fabric was elongated in both of the longitudinal direction and transverse direction. As for the tensile strength, the cross laminated nonwoven fabric was made into a sample piece having a width of 50mm and the sample piece was elongated in the longitudinal direction, transverse direction and an oblique direction at an angle of 45° under condition of tensile rate of 100mm/min. At this time, as for the data of the tensile strength measurement of the oblique direction at an angle of 45° , the obtained data of the strength was divided by the fiber amount per square meter of the sample piece to make the data be normalized. Thus, the processed data of the strength measurement of the oblique direction at an angle of 45° becomes comparable and it serves as a reference of adhesive ability of the cross laminated nonwoven fabric. Further, the way for measuring the sewing strength was arranged in accordance with the method of measuring the sewing strength regulated for a sewing product by JISL1093. In accordance with the measurement standard, the sample piece was subjected to the final sewing ina direction perpendicular to the longitudinal direction at an interval of five unit of mesh per centimeter, by using a span thread of #80. Then, the sample piece was measured in tensile strength.

(Inventive Example 2)

[0070] Inventive Example 2 as the cross laminated nonwoven fabric was produced in the same manner as that of Inventive Example 1 except for that the raw material of the intermediate layer was a spunbonded nonwoven fabric named ECULE (name of product) supplied by TOYOBO CO., LTD. Measurement for evaluating Inventive Example 2 was effected on the same items as those of Inventive Example 1. The nonwoven fabric utilized as the intermediate layer had a fiber amount per square meter of 50g/m^2 and the obtained cross laminated nonwoven fabric had a fiber amount per square meter of 71g/m^2.

(Inventive Example 3)

[0071] In the present Inventive Example, the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric were produced so that they had a fiber amount per square meter of 20g/m^2. The raw material of the intermediate layer was a spunbonded nonwoven fabric using DYNAC polyamide type adhesive resin named LSN0008 (name of product) supplied by Kureha Ltd. The fiber amount per square meter of the intermediate layer was 8g/m^2. The cross laminated nonwoven fabric was produced in the same manner as that of the above Inventive Examples except for that the bonding temperature was 180°C and measurement for evaluating Inventive Example 3 was effected on the same items as those of Inventive Example 1. The obtained cross laminated nonwoven fabric had a fiber amount per square meter of 48g/m^2.

(Inventive Example 4)

[0072] Inventive Example 4 as the cross laminated nonwoven fabric was produced in the same manner as that of Inventive Example 3 except for that the raw material of the intermediate layer was a spunbonded nonwoven fabric using polyester type adhesive resin named G0015 (name of product) supplied by Kureha Ltd. Measurement for evaluating Inventive Example 4 was effected on the same items as those of Inventive Example 1. The nonwoven fabric utilized as the intermediate layer had a fiber amount per square meter of 15g/m^2 and the obtained cross laminated nonwoven fabric had a fiber amount per square meter of 53g/m^2.

(Inventive Example 5)

[0073] The longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric of Inventive Example 5 were same as those of Inventive Example 1 except for that the fiber amount per square meter was set to 20g/m^2. As the raw material for the intermediate layer, a film made from REXPEARL ET-184M supplied from JAPAN POLYOLEFINS CO., LTD. so as to have a thickness of 50μm by a T-die was utilized. The manner for laying the fabrics and sheet was such that they were pressed by a calender roll of a temperature of 130°C at a linear load of 294N/cm, and thereafter pressed by a cooled roll of a temperature of 30 °C. Thus, the cross laminated nonwoven fabric having the film as the intermediate layer was obtained. The obtained cross laminated nonwoven fabric had a fiber amount per square meter of 75g/m^2.

[0074] The cross laminated nonwoven fabric as Inventive Example 5 was subjected to a tearing test using a second-type test piece of Elmendorf tearing test based on JISK7128-1991, in addition to the measurement of the tensile strength and the elongation test which were effected on Inventive Examples 1 to 4.

(Inventive Example 6)

[0075] Inventive Example 6 as the cross laminated nonwoven fabric was produced in the same manner as that of Inventive Example 5 except for that the raw material of the intermediate layer was a film made from HAIMIRAN supplied from MITSUI CHEMICALS, INC. and the film was formed to have a thickness of 50µm by a T-die. Measurement for evaluating Inventive Example 6 was effected on the same manner as that of Inventive Example 5. The obtained cross laminated nonwoven fabric had a fiber amount per square meter of 86g/m^2.

(Inventive Example 7)

[0076] Inventive Example 7 as the cross laminated nonwoven fabric was produced in the same manner as that of Inventive Example 5 except for that the raw material of the intermediate layer was a film made from thermoplastic elastomer FUREKURON M-type supplied from Nippon Synthetic Chemical Industry Co., Ltd. formed on the longitudinally stretched nonwoven fabric with a thickness of 50µm by a T-die, and the fabrics and film were pressed by a calender roll of a temperature of 150°C. The obtained cross laminated nonwoven fabric had a fiber amount per square meter of 86g/m^2. The film utilized as the intermediate layer had a tensile strength in the longitudinal direction of 20N/5cm.

[0077] The cross laminated nonwoven fabric as Inventive Example 7 was subjected to a moisture permeability test in accordance with JISZ0208 and a water proof test in accordance with JISL1092, in addition to the measurement of the tensile strength and the elongation test which were effected on Inventive Examples 1 to 6.

(Comparative Example 1)

[0078] The cross laminated nonwoven fabric having the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric of Inventive Example 1 and lacking the intermediate layer was produced. The obtained cross laminated nonwoven fabric had a fiber amount per square meter of 20g/m^2.

(Comparative Example 2)

[0079] The cross laminated nonwoven fabric having the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric of Inventive Example 2 and lacking the intermediate layer was produced. The obtained cross laminated nonwoven fabric had a fiber amount per square meter of 40g/m^2.

(Comparative Example 3)

[0080] The cross laminated nonwoven fabric having the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric of Inventive Example 5 and lacking the intermediate layer was produced. As for the manner for laying the fabrics, the calender roll method was not employed but an embossing roll method was employed. Further, the temperature at which the embossing roll method was executed was 200°C. The obtained cross laminated nonwoven fabric had a fiber amount per square meter of 30g/m^2.

[0081] Table 1 shows experimental results of Inventive Examples 1 to 7 and Comparative Examples 1 to 3.

Table 1

	tensile strength (N/5cm) Note 1			stretchability(%)		Sewing strength	tear strength	moisture permeability	water-resistance (Pa)
	longitudinal direction	transverse direction	45°	longitudinal direction	transverse direction				
Inventive Example 1	137	88	2.06	11	10	49	-	-	-
Inventive Example 2	225	127	1.86	14	13	69	-	-	-
Inventive Example 3	216	147	3.14	20	22	69	-	-	-
Inventive Example 4	216	157	3.23	24	22	69	-	-	-
Inventive Example 5	157	186	1.96	17	30	-	49	-	-
Inventive Example 6	157	206	1.96	18	29	-	29	-	-
Experimental Example 7	157	206	1.96	18	20	-	-	1800	19.6
Comparing Example 1	78	49	1.47	9	7	20	-	-	-
Comparing Example 2	196	137	1.86	9	7	39	-	-	-
Comparing Example 3	118	137	1.57	7	7	-	17	-	-

(Note 1) Unit of tensile strength in an oblique direction at an angle of 45° is $N/(gm^2)$.

[0082] The data of experimental result listed in Table 1 reveals the following facts.

[0083] Inventive Example 1 came to have a large tensile strength in the longitudinal direction and the transverse direction, and a strength of adhesive bonding between the fabrics and sewing strength, in addition to the surface property such as printing property and good appearance which are inherent in the conventional cross laminated nonwoven fabric having the longitudinally stretched nonwoven fabric and the transversely stretched nonwoven fabric with no intermediate layer (Comparative Example 1). Inventive Example 2 came to have a large tensile strength in the longitudinal direction and the transverse direction, and a strength of adhesive bonding between the fabrics and sewing strength, which exceed those of Inventive Example 1. The strength of adhesive bonding between the fabrics was further improved in Inventive Example 3 and 4. Inventive Example 5 and 6 were improved in a tensile characteristic and they were easy to tear. Inventive Example 7 was improved in not only the tensile strength but also water resistance and moisture permeability.

[0084] Although certain preferred embodiments of the present invention have been shown and described in detail, it should be understood that various changes and modifications may be made without departing from the spirit or scope of the appended claims.

Claims

1. A cross laminated nonwoven fabric, comprising:

   an intermediate layer with a desired property;
   a first nonwoven fabric composed of filaments aligned and stretched in one direction and laid on one side of said intermediate layer; and
   a second nonwoven fabric composed of filaments aligned and stretched in a direction and laid on the other side of said intermediate layer so that the aligned direction of the filaments is cross to the aligned direction of the filaments of said first nonwoven fabric.

2. A cross laminated nonwoven fabric, according to claim 1, wherein said first and second nonwoven fabrics are webs made of continuous filaments spun by a spinning apparatus so that the continuous filaments are aligned in the longitudinal direction of the web and then stretched in the aligned direction of the continuous filaments, whereby the stretching rate of the continuous filaments is 3 to 30 times, the mean filament diameter of the continuous filaments after stretching is 1 to 20 μm, and the tensile strength of the web after stretching is 8.83 to 883mN/tex.

3. A cross laminated nonwoven fabric, according to claim 1, wherein said intermediate layer is made of a melt blown nonwoven fabric.

4. A cross laminated nonwoven fabric, according to claim 3, wherein said melt blown nonwoven fabric is electretized.

5. A cross laminated nonwoven fabric, according to claim 1, wherein said intermediate layer is made of a spunbonded nonwoven fabric.

6. A cross laminated nonwoven fabric, according to claim 5, wherein said spunbonded nonwoven fabric contains a low-melting point polyester filament.

7. A cross laminated nonwoven fabric, according to claim 1, wherein said intermediate layer is a web made to have air permeability and moisture permeability of less than 20 $m^2 \cdot s \cdot Pa/\mu g$.

8. A cross laminated nonwoven fabric, according to claim 1, wherein said intermediate layer is made to have a thickness of 50μm.

9. A cross laminated nonwoven fabric, according to claim 1, wherein said intermediate layer is a film.

10. A cross laminated nonwoven fabric, according to claim 9, wherein said film is made of a thermoplastic resin.

11. A cross laminated nonwoven fabric, according to claim 10, wherein said film contains an adhesive component.

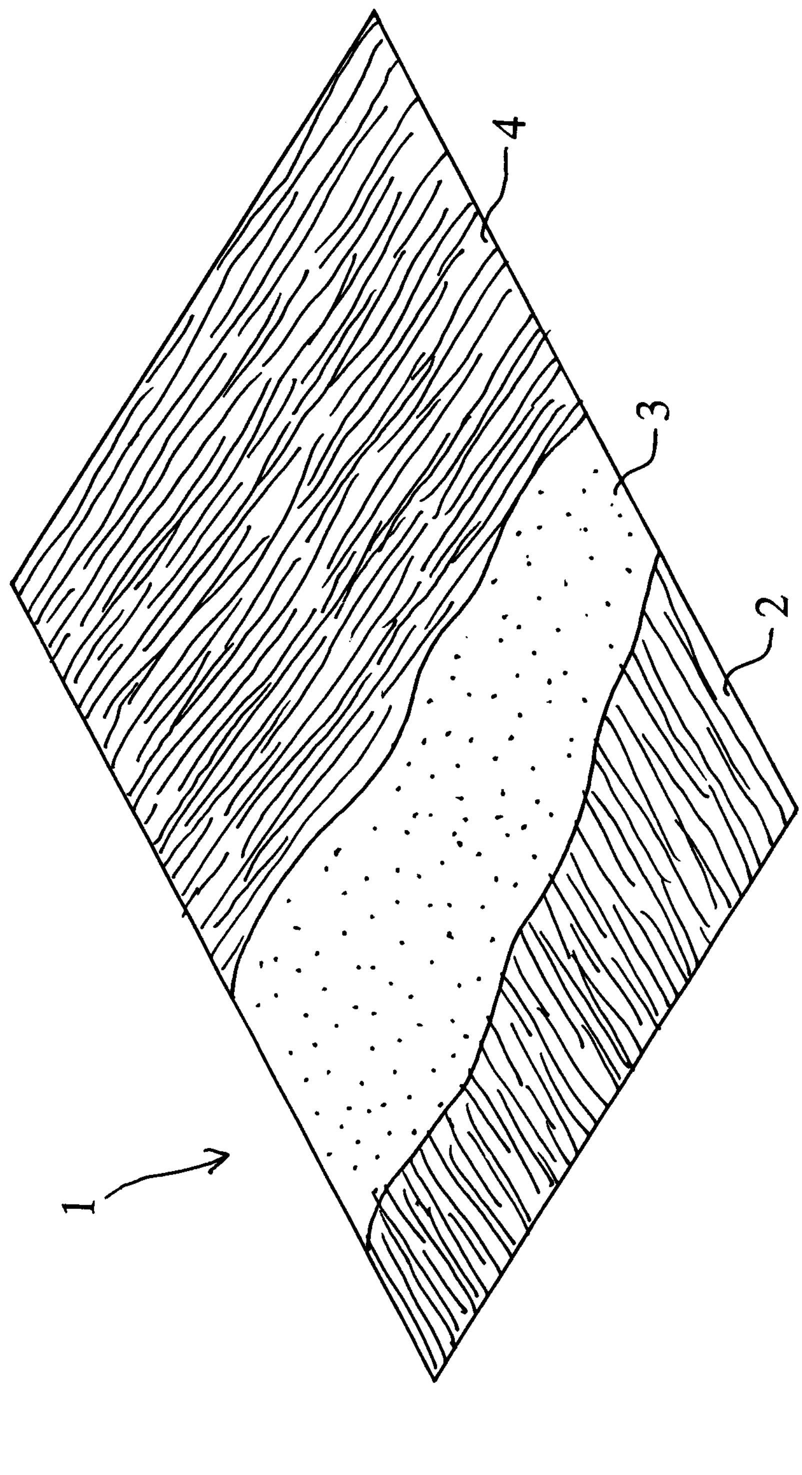

Fig. 1

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 40 3166

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D04H
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 March 2001	V Beurden-Hopkins, S

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 40 3166

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