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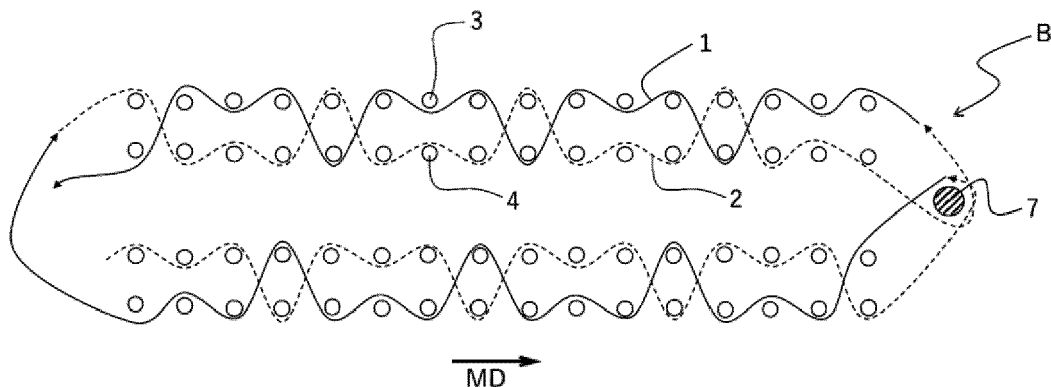
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(54) **BASE FABRIC FOR PAPERMAKING FELT, PAPERMAKING FELT, AND METHOD FOR PRODUCING PAPERMAKING FELT**

(57) Provided is a base fabric for a papermaking felt from which a papermaking felt which is lightweight, has excellent water squeezing properties, prevents an icicle phenomenon, and prevent occurrence of seam mark is obtained. A base fabric (B) for a papermaking felt forms a warp-weft double woven structure and has a wet paper side surface and a roll side surface. In the base fabric, the base fabric (B) is made of an MD yarn (1, 2) in a MD direction and a CD yarn (3, 4) in a CD direction, and the base fabric (B) includes a weave repeat. In the weave repeat, the CD yarn (3, 4) includes an upper CD yarn (3)

located on the wet paper side surface and a lower CD yarn (4) located on the roll side surface, the MD yarn (1, 2) is woven into both of the upper CD yarn (3) and the lower CD yarn (4), the MD yarn (1, 2) includes at least one combination of a first MD yarn (1) and a second MD yarn (2) adjacent to the first MD yarn (1) in the CD direction, the weave repeat includes first to fourth structural units, and the weave repeat includes a location at which the first structural unit and the second structural unit are formed in pairs on both surfaces of the base fabric.

FIG. 1



Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a base fabric for a papermaking felt, a papermaking felt, and a method for producing a papermaking felt.

BACKGROUND ART

10 **[0002]** A papermaking machine for dewatering paper materials generally includes a wire part, a press part, and a dryer part. The wire part, the press part, and the dryer part are arranged in this order along a transfer direction of wet paper. The wet paper is moved in a papermaking machine in a belt shape with a constant width in a felt cross direction (cross machine direction (CD direction)) perpendicular to a felt running direction (machine direction (MD direction)) in the papermaking machine, and is dewatered while being transferred one after another by papermaking tools attached to

15 each of the wire part, the press part, and the dryer part, and is finally dried in the dryer part.

[0003] A press device arranged in the press part includes a plurality of press devices arranged in series along the transfer direction of the wet paper. Each press device includes an endless felt or an open-ended felt that has been formed into an endless felt by connecting it in the papermaking machine, and a pair of rolls (that is, a roll press) arranged vertically to face each other such that a part of each felt is sandwiched therebetween or a cylindrical belt (that is, a shoe press) containing a roll and a shoe. The wet paper transferred by the felt that travels in the same direction at substantially the same speed is pressed and pressurized together with the felt by the roll and roll or by the cylindrical belt containing the roll and the shoe, thereby continuously dewatering the wet paper.

[0004] A base fabric for a papermaking felt is required to be lighter in weight because the product price increases as the basis weight increases. A seam felt has an effect of reducing a load when hanging.

25 **[0005]** Further, in terms of functionality, a mark (seam mark) is likely to occur due to a difference in thickness between a seam region and a base region of the seam felt. Therefore, it is desired to prevent the occurrence of the seam mark while ensuring the strength of the seam region.

[0006] JP 2007-277783 A discloses a shoe press device that provides excellent water squeezing properties and paper quality in the production of thin paper by adjusting a relation of void volumes between a papermaking felt and a paper-making belt.

30 **[0007]** JP S63-126991 A discloses a papermaking felt having a smooth press surface with an increased contact area with paper and a roll side surface having abrasion resistance by tightly binding a top layer of the fabric and a bottom layer of the fabric in a longitudinal direction.

[0008] JP 2004-36021 A discloses a papermaking felt that includes a base fabric in which a base region is formed by a double woven structure obtained by entangling wefts with both of a pair of warps that form a connection loop, and brings about an effect of reducing vibration and abnormal noise generated during running in a papermaking machine without extremely increasing a basis weight of the base fabric by including a single-cloth overlapping region having single-cloth fabric layers overlapped each other in the vicinity of the connection loop.

35 **[0009]** JP 2006-9207 A discloses a papermaking felt that is made of a woven fabric in which both MD direction yarns and CD direction yarns are made of only a single yarn, has excellent dimensional stability and resistance to fiber loss by applying a crimp to the MD direction yarns by heat-setting a base material, and brings about an effect of preventing an icicle phenomenon (the MD direction yarns jump out in a loop shape on a felt surface during use in the papermaking machine).

45 SUMMARY OF INVENTION

[0010] However, the papermaking felts disclosed in the above patent literatures can achieve any of a plurality of required important properties, but cannot be said to simultaneously achieve a plurality of the properties. In addition, the plurality of required properties cannot be achieved simultaneously by simply combining the property of the papermaking felt disclosed in each of the above patent literatures.

50 **[0011]** In view of the above circumstances, an object of the present invention is to provide a base fabric for a papermaking felt from which a papermaking felt which is lightweight, has excellent water squeezing properties, prevents an icicle phenomenon, and prevents occurrence of seam mark is obtained.

[0012] As a result of intensive studies, the present inventors have found that the above object can be achieved by using a specific structure of the base fabric for a papermaking felt, and the present invention was completed.

55 **[0013]** That is, the present invention relates to the followings.

<1> A base fabric for a papermaking felt, forming a warp-weft double woven structure and having a wet paper side

surface and a roll side surface, wherein

the base fabric is made of an MD yarn in a felt running direction (MD direction) and a CD yarn in a felt cross direction (CD direction), and
the base fabric comprises a weave repeat, and
in the weave repeat,
the CD yarn includes an upper CD yarn located on the wet paper side surface and a lower CD yarn located on the roll side surface,
the MD yarn is woven into both of the upper CD yarn and the lower CD yarn,
the MD yarn includes at least one combination of a first MD yarn and a second MD yarn adjacent to the first MD yarn in the CD direction,
the weave repeat includes a first structural unit, a second structural unit, a third structural unit, and a fourth structural unit,
the first structural unit represents a 1/1 plain weave structure formed by the upper CD yarn and the first MD yarn,
the second structural unit represents a 1/1 plain weave structure formed by the lower CD yarn and the second MD yarn,
the third structural unit represents a structural unit in which the first MD yarn alternately comes into contact with a wet paper side surface of the upper CD yarn, a roll side surface of the lower CD yarn, and a wet paper side surface of the upper CD yarn,
the fourth structural unit represents a structural unit in which the second MD yarn alternately comes into contact with a roll side surface of the lower CD yarn, a wet paper side surface of the upper CD yarn, and a roll side surface of the lower CD yarn, and
the weave repeat includes a location at which the first structural unit and the second structural unit are formed in pairs on both surfaces of the base fabric.

<2> The base fabric for a papermaking felt according to <1>, wherein the lower CD yarn included in the third structural unit and the upper CD yarn included in the fourth structural unit are not adjacent in the MD direction.

<3> The base fabric for a papermaking felt according to <1> or <2>, wherein the third structural unit and the fourth structural unit are formed in pairs on both surfaces of the base fabric.

<4> The base fabric for a papermaking felt according to any one of <1> to <3>, wherein each of the third structural unit and the fourth structural unit is not a twill weaving pattern.

<5> The base fabric for a papermaking felt according to any one of <1> to <4>, which has a basis weight of 850 g/m² or less.

<6> The base fabric for a papermaking felt according to any one of <1> to <5>, wherein the number of the CD yarns is 140 Numbers/5 cm or less.

<7> The base fabric for a papermaking felt according to any one of <1> to <6>, wherein the CD yarn is a twisted yarn.

<8> The base fabric for a papermaking felt according to <7>, wherein the CD yarn is a twisted yarn formed by twisting two or more yarns.

<9> A papermaking felt comprising: the base fabric for a papermaking felt according to any one of <1> to <8>.

<10> The papermaking felt according to <9>, wherein a nonwoven fabric is entangled on both the wet paper side surface of the base fabric and the roll side surface of the base fabric.

<11> The papermaking felt according to <9> or <10>, which has a basis weight of 1700 g/m² or less.

<12> The papermaking felt according to any one of <9> to <11>, wherein a weight of the base fabric with respect to a weight of the entire papermaking felt is 11/20 or less.

<13> The papermaking felt according to any one of <9> to <12>, comprising seam loop portions at both ends.

<14> A method for producing the papermaking felt according to any one of <9> to <13>, the method comprising: in

any order,

weaving the first MD yarn with the upper CD yarn in a 1/1 plain weave structure, and weaving the first MD yarn with one of the lower CD yarns and two of the upper CD yarns, the lower CD yarns having another two lower CD yarns each being adjacent to the one lower CD yarns, the another two lower CD yarns being adjacent to the two upper CD yarns on a wet paper side, respectively, such that the first MD yarn is alternately in contact with a wet paper side surface of one of the two upper CD yarns, a roll side surface of the one lower CD yarn, and a wet paper side surface of the other of the two upper CD yarns; and
weaving the second MD yarn with the lower CD yarn in a 1/1 plain weave structure, and weaving the second MD yarn with one of the upper CD yarns and two of the lower CD yarns, the upper CD yarns having another two upper CD yarns each being adjacent to the one upper CD yarn, the another two upper CD yarns being adjacent to the two lower CD yarns on a roll side, respectively, such that the second MD yarn is alternately in contact with a roll side surface of one of the two lower CD yarns, a wet paper side surface of the one upper CD yarn, and a roll side surface of the other of the two lower CD yarns.

[0014] According to the present invention, it is possible to provide a base fabric for a papermaking felt from which a papermaking felt which is lightweight, has excellent water squeezing properties, prevents an icicle phenomenon, and prevent occurrence of seam mark is obtained.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

FIG. 1 is a diagram showing one aspect of a base fabric for a papermaking felt in the present invention with a temporary core wire during production.

FIG. 2 is a diagram showing one aspect of the base fabric for a papermaking felt in the present invention.

FIG. 3 is a diagram showing one aspect of the base fabric for a papermaking felt in the present invention.

FIG. 4 is a diagram showing one aspect of the base fabric for a papermaking felt in the present invention.

FIG. 5 is a diagram showing one aspect of the base fabric for a papermaking felt in the present invention.

DESCRIPTION OF EMBODIMENTS

[0016] Hereinafter, an aspect of a base fabric for a papermaking felt, a papermaking felt, and a method for producing the same according to the present invention are described. However, the present invention is not limited thereto.

[0017] In the present disclosure, "A to B" indicating a numerical range means a range including A and B and indicates "A or more and B or less".

<Base Fabric for Papermaking Felt>

[0018] The base fabric for a papermaking felt in the present disclosure (hereinafter, simply referred to as a "base fabric" in some cases) forms a warp-weft double woven structure and has a wet paper side surface and a roll side surface. The base fabric is made of an MD yarn in a felt running direction (MD direction) and a CD yarn in a felt cross direction (CD direction). The base fabric comprises a weave repeat. In the weave repeat, the CD yarn includes an upper CD yarn located on the wet paper side surface and a lower CD yarn located on the roll side surface, and the MD yarn is woven into both the upper CD yarn and the lower CD yarn. The MD yarn includes at least one combination of a first MD yarn and a second MD yarn adjacent to the first MD yarn in the CD direction. The weave repeat includes a first structural unit, a second structural unit, a third structural unit, and a fourth structural unit. The first structural unit represents a 1/1 plain weave structure formed by the upper CD yarn and the first MD yarn. The second structural unit represents a 1/1 plain weave structure formed by the lower CD yarn and the second MD yarn. The third structural unit represents a structural unit in which the first MD yarn alternately comes into contact with a wet paper side surface of the upper CD yarn, a roll side surface of the lower CD yarn, and a wet paper side surface of the upper CD yarn. The fourth structural unit represents a structural unit in which the second MD yarn alternately comes into contact with a roll side surface of the lower CD yarn, a wet paper side surface of the upper CD yarn, and a roll side surface of the lower CD yarn. The weave repeat includes a location at which the first structural unit and the second structural unit are formed in pairs on both surfaces of the base fabric.

<MD Yarn and CD Yarn>

[0019] The base fabric for a papermaking felt in the present disclosure is made of the MD yarn in the felt running direction (MD direction) and the CD yarn in the felt cross direction (CD direction).

[0020] In the weave repeat of the base fabric for a papermaking felt in the present disclosure, the CD yarn includes the upper CD yarn located on the wet paper side surface and the lower CD yarn located on the roll side surface. The MD yarn is woven into both the upper CD yarn and the lower CD yarn, and includes at least one combination of the first MD yarn and the second MD yarn adjacent to the first MD yarn in the CD direction. That is, the base fabric for a papermaking felt in the present disclosure forms a warp-weft double woven structure.

[0021] In the present disclosure, "the MD yarns being adjacent in the CD direction" means that two of the MD yarns are in the closest positional relationship in the CD direction. There are usually two MD yarns adjacent to the first MD yarn in the CD direction, and either MD yarn may be used as the second MD yarn. However, the MD yarn contained in the combination of the first MD yarn and the second MD yarn is not redundantly contained in the other combination of the first MD yarn and the second MD yarn.

[0022] In the base fabric for a papermaking felt in the present disclosure, the first MD yarn and the second MD yarn may be woven back and connected at an end portion when a base fabric is woven by a weaving machine, or may be independent yarns that are not connected to each other.

[0023] In the base fabric for a papermaking felt in the present disclosure, the number of CD yarns is not particularly limited, but is preferably 140 Numbers/5 cm or less, more preferably 90 Numbers/5 cm or less, still more preferably 60 Numbers/5 cm or less, and particularly preferably 45 Numbers/5 cm or less. The lower limit of the number of CD yarns of the base fabric for a papermaking felt is not particularly limited, but the number of CD yarns may be 10 Numbers/5 cm or more, 20 Numbers/5 cm or more, 25 Numbers/5 cm or more.

[0024] When the number of CD yarns of the base fabric for a papermaking felt is 140/5 cm or less, the base fabric for a papermaking felt and the papermaking felt are further reduced in weight, which is preferable.

[0025] In the base fabric for a papermaking felt in the present disclosure, the CD yarn may be a single yarn or a twisted yarn, and is preferably a twisted yarn. The CD yarn is preferably a twisted yarn because it is less likely to be fibrillated. When the CD yarn is a twisted yarn, the CD yarn may be a twisted yarn formed by twisting one yarn or a twisted yarn formed by twisting two or more yarns.

[0026] The CD yarn is preferably a twisted yarn formed by twisting two or more yarns because fiber loss of a nonwoven fabric is reduced. From a viewpoint of improving the water-squeezing properties (compression property and recovery property), the number of yarns to be twisted is preferably 2 to 50, more preferably 2 to 20, and still more preferably 2 to 4.

[0027] A material of fibers constituting the MD yarn or the CD yarn in the base fabric for a papermaking felt in the present disclosure is preferably a thermoplastic resin. For example, a polyethylene resin, a polypropylene resin, a polyvinyl chloride resin, a polystyrene resin, a polyvinyl acetate resin, a polyurethane resin, a Teflon (registered trademark) resin, an ABS resin, an AS resin, an acrylic resin, a polyethylene terephthalate resin, a polyamide resin, a polyacetal resin, a polycarbonate resin, a polyester resin, a polyphenylene sulfide (PPS) resin, a polytetrafluoroethylene (PTFE) resin, a polyether ether ketone (PEEK) resin, or the like can be used, and among these, a polyamide resin is preferred. The materials of the MD yarn and the CD yarn may be the same or different from each other.

[0028] A form of the fibers constituting the MD yarn and the CD yarn may be a monofilament, a multifilament, a spun yarn, a processed yarn such as a textured yarn subjected to crimp processing or bulky processing, a bulky yarn, and a stretch yarn, or a twisted yarn formed by twisting these yarns. A cross-sectional shape of the fiber may be circular, substantially elliptical, polygonal, substantially star-shaped, substantially rectangular, or the like.

[0029] Fineness of the fibers constituting the MD yarn and the CD yarn is not particularly limited, but may be preferably 89 dtex to 3220 dtex (0.10 mm to 0.60 mm), and more preferably 200 dtex to 2000 dtex (0.15 mm to 0.47 mm).

[0030] In the base fabric for a papermaking felt in the present disclosure, the CD yarn includes the upper CD yarn located on the wet paper side surface. The upper CD yarn forms a 1/1 plain weave structure with the first MD yarn.

[0031] In the base fabric for a papermaking felt in the present disclosure, the CD yarn includes the lower CD yarn located on the roll side surface. The lower CD yarn forms a 1/1 plain weave structure with the second MD yarn.

[0032] A positional relationship between the upper CD yarn and the lower CD yarn is not particularly limited, but it is preferable that the lower CD yarn is located on a straight line vertically drawn from the upper CD yarn to the roll side surface of the base fabric from the viewpoint of improving the water-squeezing properties (compression property and recovery property) and preventing occurrence of a seam mark.

<First to Fourth Structural Units>

[0033] The weave repeat of the base fabric for a papermaking felt in the present disclosure includes the first structural unit, the second structural unit, the third structural unit, and the fourth structural unit. The weave repeat preferably consists of the first structural unit, the second structural unit, the third structural unit, and the fourth structural unit. Further, the

weave repeat may include a plurality of combinations of the first structural unit, the second structural unit, the third structural unit, and the fourth structural unit, or may be made of a plurality of combinations of the first structural unit, the second structural unit, the third structural unit, and the fourth structural unit.

[0034] Hereinafter, each of the structural units is described in detail.

(First Structural Unit and Second Structural Unit)

[0035] The first structural unit represents the 1/1 plain weave structure formed by the upper CD yarn and the first MD yarn. The second structural unit represents the 1/1 plain weave structure formed by the lower CD yarn and the second MD yarn.

[0036] The weave repeat of the base fabric for a papermaking felt in the present disclosure includes a location at which the first structural unit and the second structural unit are formed in pairs on both surfaces of the base fabric. Accordingly, the weight of the base fabric can be reduced. As long as the location at which the first structural unit and the second structural unit are formed in pairs on both surfaces of the base fabric for a papermaking felt is included, other locations at which the first structural unit and the second structural unit are not formed in pairs on both surfaces of the base fabric may be included.

[0037] In the present disclosure, the first structural unit and the second structural unit being formed in pairs on both surfaces of the base fabric means a state in which there is a point at which the second MD yarn included in the second structural unit is closest to or is most spaced from the roll side surface of the base fabric on an MD cross-section of the base fabric that passes through a point at which the first MD yarn included in the first structural unit is closest to the wet paper side surface of the base fabric.

[0038] Here, the MD cross-section of the base fabric is a cross-section obtained by cutting the base fabric and means a cross-section parallel to the CD direction of the base fabric and perpendicular to the MD direction of the base fabric.

[0039] It is preferable that all the first structural units and the second structural units included in the base fabric for a papermaking felt in the present disclosure are formed in pairs on both surfaces of the base fabric.

[0040] The weave repeat of the base fabric for a papermaking felt in the present disclosure includes the first structural unit and the second structural unit, and accordingly, the number of locations at which the MD yarn passes between the upper CD yarn and the lower CD yarn is reduced. When the number of locations at which the MD yarn passes between the upper CD yarn and the lower CD yarn is large, the basis weight of the base fabric increases.

[0041] The base fabric for a papermaking felt in the present disclosure can ensure an appropriate void volume without increasing the basis weight. Accordingly, the base fabric can be reduced in weight and exhibit excellent water-squeezing properties.

(Third Structural Unit and Fourth Structural Unit)

[0042] The third structural unit represents a structural unit in which the first MD yarn alternately comes into contact with a surface of the upper CD yarn on a wet paper side, a surface of the lower CD yarn on a roll side, and the surface of the upper CD yarn on the wet paper side. The fourth structural unit represents a structural unit in which the second MD yarn alternately comes into contact with the surface of the lower CD yarn on the roll side, the surface of the upper CD yarn on the wet paper side, and the surface of the lower CD yarn on the roll side.

[0043] The weave repeat of the base fabric for a papermaking felt in the present disclosure includes the third structural unit and the fourth structural unit, and accordingly, the base fabric is not completely crushed during use of the papermaking felt, and an appropriate void volume can be ensured. In a seam felt in which a papermaking felt is connected by interlocking seam loops to be described later and inserting a core wire, the thickness of the base region with respect to the seam region under pressure during use does not become small, and unevenness in thickness of the base fabric can be reduced. Accordingly, even when the base fabric for a papermaking felt is reduced in weight, the base fabric exhibits excellent water-squeezing properties, and occurrence of the seam mark due to the unevenness in thickness of the base fabric is prevented. In addition, since the unevenness in thickness of the base fabric for a papermaking felt is small, vibration and abnormal noise are also prevented, and wear of the nonwoven fabric entangled to the base fabric is also reduced.

[0044] Further, the weave repeat of the base fabric for a papermaking felt in the present disclosure includes the third structural unit and the fourth structural unit, and accordingly, the first MD yarn passes a position of the lower CD yarn, and similarly, the second MD yarn passes a position of the upper CD yarn. Each of the first MD yarn and the second MD yarn is in contact with the upper CD yarn and the lower CD yarn, and therefore a frictional force is generated at each contact point. The frictional force prevents the MD yarn from jumping out to a felt front surface or a felt rear surface, which prevents the icicle phenomenon.

[0045] In the weave repeat of the base fabric for a papermaking felt in the present disclosure, a positional relationship between the third structural unit and the fourth structural unit is not particularly limited, but it is preferable that the third structural unit and the fourth structural unit are formed in pairs on both surfaces of the base fabric because the water-

squeezing properties (compression property and recovery property) are improved and the occurrence of the seam mark is prevented.

[0046] In the present disclosure, the third structural unit and the fourth structural unit being formed in pairs on both surfaces of the base fabric means a state in which there is a point at which the second MD yarn included in the fourth structural unit is closest to the wet paper side surface of the base fabric on an MD cross-section of the base fabric that passes through a point at which the first MD yarn included in the third structural unit is closest to the roll side surface of the base fabric.

[0047] In the weave repeat of the base fabric for a papermaking felt in the present disclosure, it is preferable that at least one of the combinations of the third structural unit and the fourth structural unit is formed in pairs on both surfaces of the base fabric, and it is more preferable that all of the combinations of the third structural unit and the fourth structural unit are formed in pairs on both surfaces of the base fabric.

[0048] In the weave repeat of the base fabric for a papermaking felt in the present disclosure, it is preferable that the lower CD yarn included in the third structural unit and the upper CD yarn included in the fourth structural unit are not adjacent in the MD direction from a viewpoint of maintaining a shape of the base fabric, reducing the unevenness in thickness of the base fabric, and further preventing the occurrence of the seam mark.

[0049] In the present disclosure, the upper CD yarn and the lower CD yarn being not adjacent in the MD direction means a state in which, in the third structural unit and the fourth structural unit which are not formed in pairs on both surfaces of the base fabric, there is another CD yarn in a substantially rectangular plane surrounded by a straight line passing through the point at which the first MD yarn included in the third structural unit is closest to the roll side surface of the base fabric and extending perpendicularly to the wet paper side surface and roll side surface of the base fabric, a straight line passing through the point at which the second MD yarn included in the fourth structural unit is closest to the wet paper side surface of the base fabric and extending perpendicularly to the wet paper side surface and roll side surface of the base fabric, the roll side surface of the base fabric, and the wet paper side surface of the base fabric. In the present disclosure, the upper CD yarn and the lower CD yarn of the third structural unit and the fourth structural unit formed in pairs on both surfaces of the base fabric are not adjacent in the MD direction.

[0050] In the weave repeat of the base fabric for a papermaking felt in the present disclosure, each of the third structural unit and the fourth structural unit is not a twill weaving pattern, which is preferable because occurrence of sea disclosure m marks in the base region is prevented.

[0051] In the present disclosure, each of the third structural unit and the fourth structural unit being not a twill weaving pattern means a state in which the first MD yarn in the weave repeat and the other plurality of first MD yarns shifted in the CD direction with respect to the first MD yarn are woven into the CD yarn with the same weaving pattern, but the positional relationship in the MD direction is not regular (not in a row).

<Properties and Structure of Base Fabric for Papermaking Felt>

[0052] The basis weight of the base fabric for a papermaking felt in the present disclosure is not particularly limited, but is preferably 850 g/m² or less, more preferably 700 g/m² or less, still more preferably 600 g/m² or less, particularly preferably 500 g/m² or less, and most preferably 450 g/m² or less. The lower limit of the basis weight of the base fabric for a papermaking felt is not particularly limited, but the basis weight may be 200 g/m² or more, 250 g/m² or more, or 300 g/m² or more.

[0053] The case where the basis weight of the base fabric is 850 g/m² or less is preferable because the base fabric and the papermaking felt to be described below is reduced in weight.

[0054] The base fabric for a papermaking felt in the present disclosure includes the weave repeat described above. The base fabric may consist of the weave repeat or may include the weave repeat. Examples of a base fabric including the weave repeat include a base fabric constituted by the weave repeat and a part of the weave repeat.

<Specific Aspects>

[0055] Examples of specific aspects of the base fabric for a papermaking felt in the present disclosure are described below with reference to the drawings. The papermaking felt in the present disclosure is not limited to these specific aspects.

[0056] As one aspect of the base fabric for a papermaking felt in the present disclosure, FIG. 1 shows a base fabric B for a papermaking felt in which the CD yarns included in each of the third structural unit and the fourth structural unit are not adjacent, the third structural unit and the fourth structural unit are located in pairs, and further, a temporary core wire 7 at the time of production is provided.

[0057] As one aspect of the base fabric for a papermaking felt in the present disclosure, FIG. 2 shows a base fabric B for a papermaking felt in which the CD yarns included in each of the third structural unit and the fourth structural unit are adjacent and the third structural unit and the fourth structural unit are located in pairs.

[0058] As one aspect of the base fabric for a papermaking felt in the present disclosure, FIG. 3 shows a base fabric

B for a papermaking felt in which the CD yarns included in each of the third structural unit and the fourth structural unit are not adjacent and the third structural unit and the fourth structural unit are not located in pairs.

[0059] As one aspect of the base fabric for a papermaking felt in the present disclosure, FIG. 4 shows a base fabric B for a papermaking felt in which the CD yarns included in each of the third structural unit and the fourth structural unit are adjacent and the third structural unit and the fourth structural unit are not located in pairs.

[0060] As one aspect of the base fabric for a papermaking felt in the present disclosure, FIG. 5 shows a base fabric B for a papermaking felt in which an upper CD yarn (twisted yarn) 3 and a lower CD yarn (twisted yarn) 4 in FIG. 1 are replaced with an upper CD yarn (single yarn) 5 and a lower CD yarn (single yarn) 6, respectively.

[0061] From a viewpoint of ensuring a pullout strength of the MD yarn and a strength of the MD yarn itself, it is preferable that the base fabric for a papermaking felt in the present disclosure is not used in the form of a folded or overlapped base fabric having the MD yarns sewn or welded.

<Papermaking Felt>

[0062] The present disclosure also relates to a papermaking felt (hereinafter, also simply referred to as a "felt") including the base fabric for a papermaking felt described above.

[0063] The papermaking felt in the present disclosure may include the base fabric for a papermaking felt described above and an additional layer. Examples of the additional layer include any layer selected from woven fabrics, nonwoven fabrics, strands of yarn, grid-shaped materials, films, sheets, and foams. Examples of a method for providing the additional layer on the base fabric include entangling, adhesion, welding, bonding, welding by ultrasonic waves, and laying by 3D printing.

[0064] The papermaking felt can be formed by entangling nonwoven fabrics to both the wet paper side surface of the base fabric for a papermaking felt and the roll side surface of the base fabric for a papermaking felt, which is preferable because the roll side surface of the base fabric is not damaged.

[0065] A basis weight of the papermaking felt in the present disclosure is not particularly limited, and is preferably 1700 g/m² or less, more preferably 1500 g/m² or less, still more preferably 1300 g/m² or less, particularly preferably 1100 g/m² or less, and most preferably 900 g/m² or less. The lower limit of the basis weight of the papermaking felt is not particularly limited, and the basis weight of the papermaking felt may be, for example, equal to or greater than the basis weight of the base fabric for a papermaking felt.

[0066] The case where the basis weight of the papermaking felt is 1700 g/m² or less is preferable because workability of installation of the felt in the papermaking machine is improved.

[0067] A weight of the base fabric with respect to a weight of the entire papermaking felt in the present disclosure is not particularly limited, and is preferably 11/20 or less, more preferably 9/20 or less, and still more preferably 2/5 or less. The lower limit of the weight of the base fabric with respect to the weight of the entire papermaking felt is not particularly limited, and the weight of the base fabric with respect to the weight of the entire papermaking felt may be 1/20 or more, 1/10 or more, 3/20 or more, or the like.

[0068] The case where the weight of the base fabric with respect to the weight of the entire papermaking felt is 11/20 or less is preferable because the felt is flexible and the workability of installation of the felt in the papermaking machine is improved.

[0069] The papermaking felt in the present disclosure may include seam loop portions at both ends. A seam loop of the papermaking felt may be fitted to another seam loop to engage these seam loops, and a core wire may be inserted into a tunnel-shaped space formed by the engaged seam loops to connect the felts. By repeating this operation one or more times, an endless papermaking felt can be formed on the papermaking machine.

[0070] Further, the papermaking felt in the present disclosure can also be formed as an endless felt having no seam loop portions at both ends.

<Method for Producing Papermaking Felt>

[0071] As a method for producing the papermaking felt described above, the present disclosure also relates to a method including, in any order, a step of weaving the first MD yarn with the upper CD yarn in a 1/1 plain weave structure and weaving the first MD yarn with one of the lower CD yarns and two of the upper CD yarns, the lower CD yarns having another two lower CD yarns each being adjacent to the one lower CD yarn, the another two lower CD yarns being adjacent to the two upper CD yarns on a wet paper side, respectively, such that the first MD yarn is alternately in contact with a wet paper side surface of one of the two upper CD yarns, a roll side surface of the one lower CD yarn, and a wet paper side surface of the other of the two upper CD yarns (hereinafter, also referred to as a "step 1"), and a step of weaving the second MD yarn with the lower CD yarn in a 1/1 plain weave structure and weaving the second MD yarn with one of the upper CD yarns and two of the lower CD yarns, the upper CD yarns having another two upper CD yarns each being adjacent to the one upper CD yarn, the another two upper CD yarns being adjacent to the two lower CD

yarns on a roll side, respectively, such that the second MD yarn is alternately in contact with a roll side surface of one of the two lower CD yarns, a wet paper side surface of the one upper CD yarn, and a roll side surface of the other of the two lower CD yarns (hereinafter, also referred to as a "step 2").

[0072] The step 1 is a step of forming the first structural unit and the third structural unit in the base fabric for a papermaking felt in the present disclosure. The step 2 is a step of forming the second structural unit and the fourth structural unit in the base fabric for a papermaking felt in the present disclosure.

[0073] The papermaking felt in the present disclosure can be produced by performing the step 1 and the step 2 in any order and performing a step of providing the additional layer as necessary. For example, after performing the method including the step 1 and the step 2 in any order, a step of entangling the nonwoven fabrics to both the wet paper side surface and the roll side surface of the obtained base fabric for a papermaking felt may be performed, a step of forming seam loop portions at both ends of the obtained base fabric for a papermaking felt may be performed, any other step may be performed, and a plurality of these steps may be performed.

[0074] Preferred aspects of the MD yarn, the CD yarn, the first to fourth structural units, and the additional layer in the production method in the present disclosure are as described above.

Examples

[0075] Hereinafter, the present invention is described in more detail with reference to examples, but the present invention is not limited to these examples.

Example 1

<Production of Base Fabric for Papermaking Felt>

[0076] The MD yarn (picking yarn) and the CD yarn (warp yarn) were used with the numbers of yarns being 110 Numbers/5 cm and 40 Numbers/5 cm, respectively, and a 1/1 warp-weft double woven base fabric was produced by a weaving machine to obtain a base fabric for a papermaking felt in Example 1.

[0077] A basis weight of the base fabric for a papermaking felt in Example 1 obtained by the above method was 410 g/m².

[0078] The base fabric for a papermaking felt in Example 1 has the structure schematically shown in FIG. 1 (a structure including the temporary core wire 7 is shown only in FIG. 1 to describe producing steps to be described below). That is, in the base fabric for a papermaking felt in Example 1, the CD yarns included in the third structural unit and the fourth structural unit were in a non-adjacent positional relationship. The third structural unit and the fourth structural unit had a pairwise positional relationship.

[0079] Further, in a weave repeat of the base fabric for a papermaking felt in Example 1, each of the third structural unit and the fourth structural unit is not a twill weaving pattern.

[0080] Details of the MD yarn and the CD yarn used in Example 1 are as follows.

- MD yarn: nylon 6, single yarn having fineness of 1100 dtex
- CD yarn: nylon 6, twisted yarn of 1500 dtex formed by twisting four single yarns having fineness of 375 dtex

<Production of Papermaking Felt>

[0081] After the base fabric for a papermaking felt was produced, the temporary core wire 7 for needling was inserted into an MD yarn folded portion (right end portion in FIG. 1) on a weaving machine, a nonwoven fabric was stacked, entangled, and integrated, the temporary core wire 7 was pulled out, and the fiber layer above the loop was cut and separated, thereby obtaining the papermaking felt in Example 1.

[0082] The basis weight of the papermaking felt in Example 1 obtained by the above method was 850 g/m².

<Evaluation of Papermaking Felt>

[0083] The papermaking felts in Example 1, and those in Examples 2 to 8 and Comparative Examples 1 to 4 to be described below were evaluated as follows. Results are shown in Table 2.

(Compression Rate and Recovery Rate)

[0084] The papermaking felt was punched into a circular shape having a diameter of 117 mm and immersed in water for 1 hour or more to obtain a sample for evaluation.

[0085] The sample for evaluation was set in a pressure tester, and an initial load thickness (mm) when pressure was applied with a surface pressure of 0.3 kg/cm², a load thickness (mm) when pressure was applied with a surface pressure of 30 kg/cm², and a pressure removal thickness (mm) when the load was removed were measured. The pressure was applied with a time from an initial load to the load removal being set to 1 second.

[0086] A compression rate (%) and a recovery rate (%) were determined from the following equations.

$$\text{Compression rate (\%)} = (\text{initial load thickness} - \text{load thickness}) / \text{initial load thickness} \times 100$$

$$\text{Recovery rate (\%)} = (\text{pressure removal thickness} - \text{load thickness}) / \text{load thickness} \times 100$$

[0087] The pressure tester used for measuring the compression rate and the recovery rate was as follows.

·Servo Pulser EHF-EDU-20-40L (manufactured by Shimadzu Corporation)

(Pullout Strength)

[0088] The papermaking felt was punched into a rectangular shape having a size of 300 mm in the MD direction and a size of 30 mm in the CD direction. The nonwoven fabrics at portions of 75 mm from both ends in the MD direction and a portion of 10 mm around the center in the MD direction (portions of 5 mm from the center in the MD direction toward both MD directions) were removed, and the CD yarn of the exposed base fabric was removed. Among the exposed MD yarns in the portion of 10 mm around the center in the MD direction, MD yarns other than those in the portions of 5 mm from both ends in the CD direction were cut. The obtained papermaking felt was immersed in water for 3 hours to obtain the sample for evaluation.

[0089] One end of a portion of the sample for evaluation in the MD direction at which the nonwoven fabric was not removed was gripped by one chuck of a tensile tester, and one first MD yarns located at a center in the CD direction was gripped by the other chuck among the first MD yarns exposed at the other end of the sample for evaluation, followed by having been pulled in the MD direction at a pulling speed of 100 mm/min to measure the pullout strength of the first MD yarn.

[0090] A tensile strength of the second MD yarn was measured in the same method as in the measurement of the tensile strength of the first MD yarn except that one of the second MD yarns located at the center in the CD direction was gripped by the other chuck instead of gripping one of the first MD yarns located at the center in the CD direction by the other chuck.

[0091] The smaller value of the pullout strength of the first MD yarn and the pullout strength of the second MD yarn was evaluated as the pullout strength.

[0092] The tensile tester used for measuring the pullout strength is as follows.

·Precision Universal Tester Autograph AG-X (manufactured by Shimadzu Corporation)
(Seam Mark)

[0093] The evaluation of the seam mark of the papermaking felts was performed in Examples and Comparative Examples other than Example 2 which did not include any seam loop.

[0094] The papermaking felt was punched into a circular shape having a diameter of 70 mm such that the seam loop portion was located at the center, and immersed in water for 1 hour or more to adjust a water content to about 30%.

[0095] Leaf bleached kraft PULP (LBKP) was beaten to have a beating degree of 300 C.S.F. to 500 C.S.F. (Canadian Standard Freeness: an index of fineness of paper raw material), followed by being used to prepare a wet paper with a sheet former to have a basis weight of 220 g/m². The obtained wet paper was punched into a circular shape having a diameter of 60 mm, and the water content was adjusted to about 80%.

[0096] The felt having the water content adjusted to about 30% and the wet paper having the water content adjusted to about 80% were overlapped and placed, and a press plate was freely dropped at a surface pressure of 50 kg/cm² to collect the seam mark of the wet paper and then dried to obtain the sample for evaluation.

[0097] The seam mark was visually evaluated as follows.

A (Good): a width of the seam mark is very small and is hardly visually observed.

B (Poor): a width of the seam mark is large and there is a problem in practical use.

Example 2

[0098] A base fabric for a papermaking felt was produced in the same manner as in Example 1 except for the contents shown in Table 1. Except for not performing disposing and pulling out of temporary core wire and not performing cutting of fiber layer above the loop and separating, nonwoven fabrics were stacked, entangled, and integrated by the same method as in Example 1 to obtain a papermaking felt in Example 2. The base fabric for a papermaking felt in Example 2 has a structure schematically shown in FIG. 1 except for having an endless form.

[0099] Further, in a weave repeat of the base fabric for a papermaking felt in Example 2, each of the third structural unit and the fourth structural unit is not a twill weaving pattern.

Examples 3 to 6

[0100] A base fabric for a papermaking felt and a papermaking felt were produced in the same manner as in Example 1 except for the contents shown in Table 1. The base fabrics for a papermaking felt in Examples 3 and 4 have structures schematically shown in FIGS. 2 and 3, respectively, and the base fabrics for a papermaking felt in Examples 5 and 6 have the structure schematically shown in FIG. 1.

[0101] Further, in a weave repeat of the base fabrics for a papermaking felt in Examples 3, 4, and 6, each of the third structural unit and the fourth structural unit is not a twill weaving pattern.

[0102] In contrast, in a weave repeat of the base fabric for a papermaking felt in Example 5, each of the third structural unit and the fourth structural unit is a twill weaving pattern.

Example 7

[0103] A base fabric for a papermaking felt and a papermaking felt were produced in the same manner as in Example 1 except for the contents shown in Table 1. The base fabric for a papermaking felt in Example 7 has the structure schematically shown in FIG. 5.

[0104] Further, in a weave repeat of the base fabric for a papermaking felt in Example 7, each of the third structural unit and the fourth structural unit is not a twill weaving pattern.

[0105] The CD yarn used in Example 7 was the same single yarn as the MD yarn used in Example 1.

Example 8

[0106] A base fabric for a papermaking felt and a papermaking felt were produced in the same manner as in Example 1 except for the contents shown in Table 1. The base fabric for a papermaking felt in Example 8 has the structure schematically shown in FIG. 1.

[0107] Further, in a weave repeat of the base fabric for a papermaking felt in Example 8, each of the third structural unit and the fourth structural unit is not a twill weaving pattern.

[0108] The CD yarn used in Example 8 is a twisted yarn of 1500 dtex obtained by twisting two nylon 6 yarns having a fineness of 750 dtex.

Comparative Examples 1 to 4

[0109] A base fabric for a papermaking felt and a papermaking felt were produced in the same manner as in Example 1 except for the contents shown in Table 1.

Table 1

	Base fabric for a papermaking felt										Papermaking felt	
	MD yarn		CD yarn			Structure	Basis weight (g/m ²)	Positional relationship of CD yarns (*1)	Positional relationship of structural units (*2)	Not twill weaving pattern (*3)	Form	Basis weight (g/m ²)
	Form	The number ofyarns(per Number/5 cm)	Form	The number oftwisted yarns	The number ofyarns(per Number/5 cm)							
Example 1	Single yarn	110	Twisted yarn	4	40	111 Warp-weft double	410	Not adjacent	Pairwise	Not twill	Seam	850
Example 2	Single yarn	110	Twisted yarn	4	40	1/1 Warp-weft double	410	Not adjacent	Pairwise	Not twill	Endless	850
Example 3	Single yarn	110	Twisted yarn	4	40	1/1 Warp-weft double	410	Adjacent	Pairwise	Not twill	Seam	850
Example 4	Single yarn	110	Twisted yarn	4	40	1/1 Warp-weft double	410	Not adjacent	Not paired	Not twill	Seam	850
Example 5	Single yarn	110	Twisted yarn	4	40	1/1 Warp-weft double	410	Not adjacent	Pairwise	Twill	Seam	850
Example 6	Single yarn	80	Twisted yarn	4	130	1/1 Warp-weft double	800	Not adjacent	Pairwise	Not twill	Seam	1600
Example 7	Single yarn	110	Single yarn		80	1/1 Warp-weft double	410	Not adjacent	Pairwise	Not twill	Seam	850
Example 8	Single yarn	110	Twisted yarn	2	40	1/1 Warp-weft double	410	Not adjacent	Pairwise	Not twill	Seam	850

(continued)

	Base fabric for a papermaking felt										Papermaking felt	
	MD yarn		CD yarn			Structure	Basis weight (g/m ²)	Positional relationship of CD yarns (*1)	Positional relationship of structural units (*2)	Not twill weaving pattern (*3)	Form	Basis weight (g/m ²)
	Form	The number ofyarns (per Number/5 cm)	The number ofyarns (per Number/5 cm)	The number oftwisted yarns	The number ofyarns (per Number/5 cm)							
Comparative Example 1	Single yarn	100	Twisted yarn	4	40	3/1·1/3 Warp double	370				Seam	850
Comparative Example 2	Single yarn	95	Twisted yarn	4	40	3f1.1/3 Weft double	360				Seam	800
Comparative Example 3	Single yarn	110	Twisted yarn	4	40	1/1 Plain laminate	420				Seam	850
Comparative Example 4	Single yarn	110	Single yarn		80	3/1·1/3 Warp double	570				Seam	1200
*1: Positional relationship between CD yarn included in the third structural unit and CD yarn included in the fourth structural unit												
*2: Positional relationship between the third structural unit and the fourth structural unit												
*3: Whether each of the third structural unit and the fourth structural unit in the weave repeat is not a twill weaving pattern												

Table 2

	Compression rate (%)	Recovery rate (%)	Pullout strength (N/Number)	Seam mark
Example 1	41.5	46.5	17.0	A (Good)
Example 2	41.5	46.5	17.0	-
Example 3	41.0	46.3	17.0	A (Good)
Example 4	41.7	46.1	18.0	A (Good)
Example 5	41.5	46.5	19.0	A (Good)
Example 6	40.0	45.0	20.0	A (Good)
Example 7	39.2	45.5	13.0	A (Good)
Example 8	40.5	45.8	15.0	A (Good)
Comparative Example 1	36.8	41.0	6.0	B (Poor)
Comparative Example 2	39.0	44.8	7.0	B (Poor)
Comparative Example 3	38.8	43.9	10.0	B (Poor)
Comparative Example 4	34.7	37.2	6.0	B (Poor)

[0110] From results shown in Table 2, it is found that the base fabrics for a papermaking felt in Examples are lightweight, have excellent water-squeezing properties, prevent the icicle phenomenon, and prevent the occurrence of seam mark as compared with the base fabrics for a papermaking felt in Comparative Examples.

Industrial Applicability

[0111] The base fabric for a papermaking felt in the present disclosure can provide a papermaking felt which is lightweight, has excellent water-squeezing properties, prevents icicle phenomenon, and prevent occurrence of seam mark, and therefore can be used to produce various papers such as newspaper, high-quality paper, paperboard, and household paper.

Description of Reference Numerals

[0112]

B: Base fabric for papermaking felt

1: First MD yarn

2: Second MD yarn

3: Upper CD yarn (twisted yarn) 4: Lower CD yarn (twisted yarn)

5: Upper CD yarn (single yarn)

6: Lower CD yarn (single yarn)

7: Temporary core wire

Claims

1. A base fabric for a papermaking felt, forming a warp-weft double woven structure and having a wet paper side surface and a roll side surface, wherein

the base fabric (B) is made of an MD yarn (1, 2) in a felt running direction (MD direction) and a CD yarn (3, 4, 5, 6) in a felt cross direction (CD direction), and

the base fabric (B) comprises a weave repeat, and

in the weave repeat,

the CD yarn (3, 4, 5, 6) includes an upper CD yarn (3, 5) located on the wet paper side surface and a lower CD yarn (4, 6) located on the roll side surface,

the MD yarn (1, 2) is woven into both of the upper CD yarn (3, 5) and the lower CD yarn (4, 6),
 the MD yarn (1, 2) includes at least one combination of a first MD yarn (1) and a second MD yarn (2) adjacent
 to the first MD yarn (1) in the CD direction,
 the weave repeat includes a first structural unit, a second structural unit, a third structural unit, and a fourth
 structural unit,
 the first structural unit represents a 1/1 plain weave structure formed by the upper CD yarn (3, 5) and the first
 MD yarn (1),
 the second structural unit represents a 1/1 plain weave structure formed by the lower CD yarn (4) and the
 second MD yarn (2),
 the third structural unit represents a structural unit in which the first MD yarn (1) alternately comes into contact
 with a wet paper side surface of the upper CD yarn (3, 5), a roll side surface of the lower CD yarn (4, 6), and a
 wet paper side surface of the upper CD yarn (3, 5),
 the fourth structural unit represents a structural unit in which the second MD yarn (2) alternately comes into
 contact with a roll side surface of the lower CD yarn (4, 6), a wet paper side surface of the upper CD yarn (3,
 5), and a roll side surface of the lower CD yarn (4, 6), and
 the weave repeat includes a location at which the first structural unit and the second structural unit are formed
 in pairs on both surfaces of the base fabric (B).

2. The base fabric for a papermaking felt according to claim 1, wherein the lower CD (4, 6) yarn included in the third
 structural unit and the upper CD yarn (3, 5) included in the fourth structural unit are not adjacent in the MD direction.
3. The base fabric for a papermaking felt according to claim 1 or 2, wherein the third structural unit and the fourth
 structural unit are formed in pairs on both surfaces of the base fabric (B).
4. The base fabric for a papermaking felt according to any one of claims 1 to 3, wherein each of the third structural
 unit and the fourth structural unit is not a twill weaving pattern.
5. The base fabric for a papermaking felt according to any one of claims 1 to 4, which has a basis weight of 850 g/m²
 or less.
6. The base fabric for a papermaking felt according to any one of claims 1 to 5, wherein the number of the CD yarns
 (3, 4, 5, 6) is 140 Numbers/5 cm or less.
7. The base fabric for a papermaking felt according to any one of claims 1 to 6, wherein the CD yarn (3, 4) is a twisted yarn.
8. The base fabric for a papermaking felt according to claim 7, wherein the CD yarn (3, 4) is a twisted yarn formed by
 twisting two or more yarns.
9. A papermaking felt comprising: the base fabric for a papermaking felt according to any one of claims 1 to 8.
10. The papermaking felt according to claim 9, wherein a nonwoven fabric is entangled on both the wet paper side
 surface of the base fabric and the roll side surface of the base fabric.
11. The papermaking felt according to claim 9 or 10, which has a basis weight of 1700 g/m² or less.
12. The papermaking felt according to any one of claims 9 to 11, wherein a weight of the base fabric with respect to a
 weight of the entire papermaking felt is 11/20 or less.
13. The papermaking felt according to any one of claims 9 to 12, comprising seam loop portions at both ends.
14. A method for producing the papermaking felt according to any one of claims 9 to 13, the method comprising: in any
 order,

weaving the first MD yarn (1) with the upper CD yarn (3, 5) in a 1/1 plain weave structure, and weaving the first
 MD yarn (1) with one of the lower CD yarns (4, 6) and two of the upper CD yarns (3, 5), the lower CD yarns (4,
 6) having another two lower CD yarns (3, 5) each being adjacent to the one lower CD yarn (4, 6), the another
 two lower CD yarns (4, 6) being adjacent to the two upper CD yarns (3, 5) on a wet paper side, respectively,
 such that the first MD yarn (1) is alternately in contact with a wet paper side surface of one of the two upper CD

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yarns (3, 5), a roll side surface of the one lower CD yarn (4, 6), and a wet paper side surface of the other of the two upper CD yarns (3, 5); and

weaving the second MD yarn (2) with the lower CD yarn (4, 6) in a 1/1 plain weave structure, and weaving the second MD yarn (2) with one of the upper CD yarns (3, 5) and two of the lower CD yarns (4, 6), the upper CD yarns (3, 5) having another two upper CD yarns (3, 5) each being adjacent to the one upper CD yarns (3, 5), the another two upper CD yarns (3, 5) being adjacent to the two lower CD yarns (4, 6) on a roll side, respectively, such that the second MD yarn (2) is alternately in contact with a roll side surface of one of the two lower CD yarns (4, 6), a wet paper side surface of the one upper CD yarn (3, 5), and a roll side surface of the other of the two lower CD yarns (4, 6).

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FIG. 1

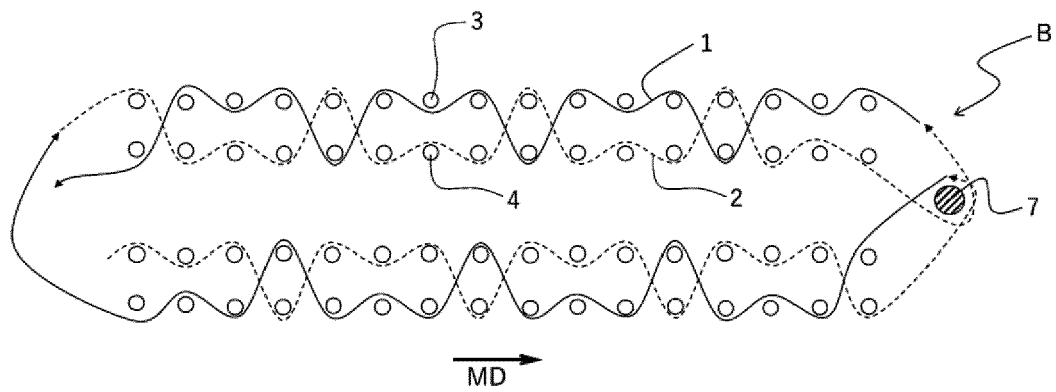


FIG. 2

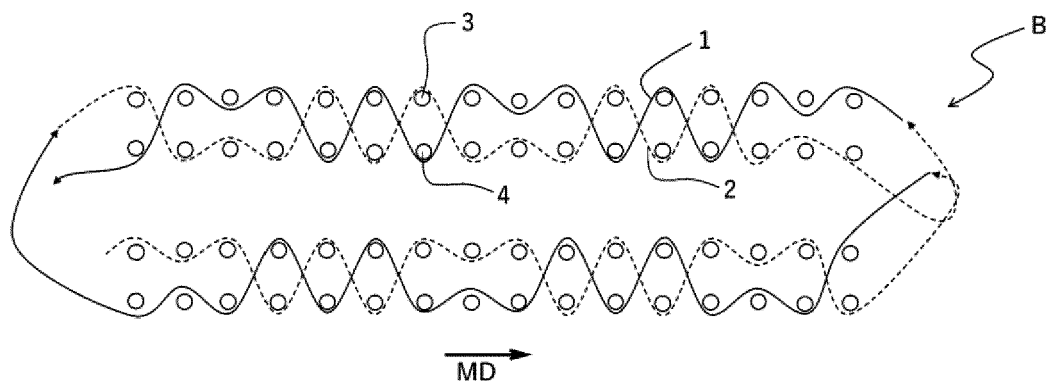


FIG. 3

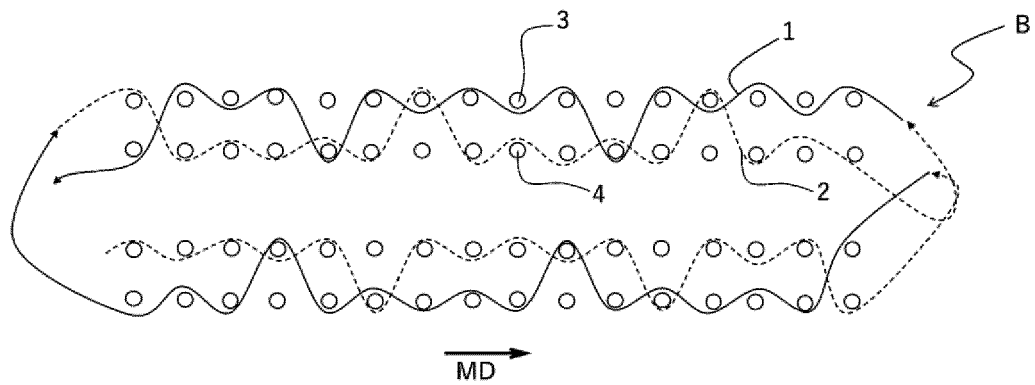


FIG. 4

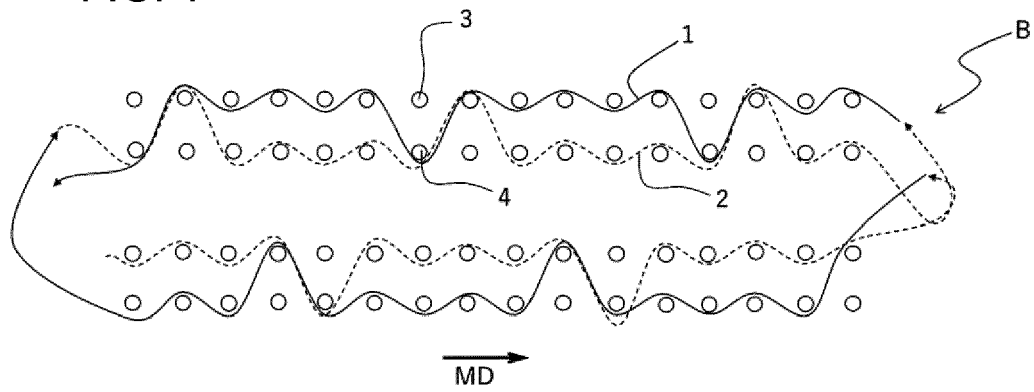
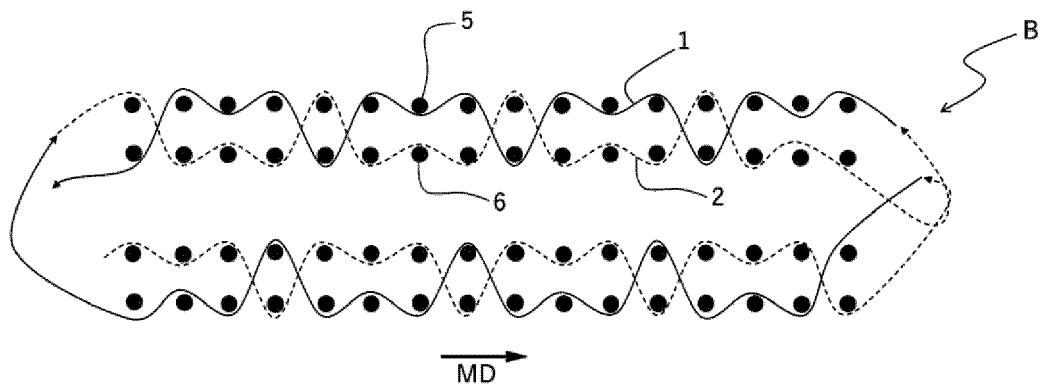


FIG. 5





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