

(19)



(11)

EP 1 601 834 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
11.04.2007 Bulletin 2007/15

(21) Application number: **04714343.3**

(22) Date of filing: **25.02.2004**

(51) Int Cl.:
D21F 7/08 (2006.01)

(86) International application number:
PCT/FI2004/000100

(87) International publication number:
WO 2004/076742 (10.09.2004 Gazette 2004/37)

(54) **DRYER WIRE**

TROCKNERSIEB

FEUTRE

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**

(30) Priority: **26.02.2003 FI 20030290**

(43) Date of publication of application:
07.12.2005 Bulletin 2005/49

(73) Proprietor: **Tamfelt Oyj Abp**
33710 Tampere (FI)

(72) Inventors:
• **ENQVIST, Rauno**
FIN-37120 Nokia (FI)

- **STALHAMMAR, Jari**
FIN-33980Pirkkala (FI)
- **OJANEN, Marja**
FIN-33960Pirkkala (FI)

(74) Representative: **Kuosmanen, Timo**
Kolster Oy Ab,
P.O. Box 148,
Iso Roobertinkatu 23
00121 Helsinki (FI)

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a dryer wire: which comprises a back surface and a surface facing the web to be dried; which has been woven from a plurality of machine direction longitudinal yarns and a plurality of cross machine direction transverse yarns; where the cross section of the longitudinal yarns is flat; and where longitudinal yarns are arranged in at least a first layer and a second layer, which are one on top of the other (e.g. see: document WO-A-0188260).

BACKGROUND OF THE INVENTION

[0002] A dryer section of a paper machine employs dryer wires, by means of which a paper web to be dried is guided through the dryer section. The weave of a dryer wire is formed from yarns that sustain high temperatures and moisture using suitable weave structures. The dryer wires also carry air with them, which may cause problems during the run in high-speed paper machines, in particular. The aerodynamic properties of existing wires have proven inadequate in some situations.

BRIEF DESCRIPTION OF THE INVENTION

[0003] The object of the invention is to provide a new and improved dryer wire.

[0004] The dryer wire of the invention is characterized in that at least one surface of the wire is provided with a plurality of machine direction grooves and that at least some of the longitudinal yarns travelling in the first layer are arranged to partly overlap the longitudinal yarns travelling in the second layer, the total width of the partly overlapping yarns being greater than that of a single longitudinal yarn.

[0005] The invention is based on the idea that at least one surface of the wire is provided with a plurality of longitudinal grooves. Furthermore, longitudinal yarns of the overlapping layers are arranged to partly overlap each other, which makes the structure denser.

[0006] An advantage of the invention is that the air carried in the wire can be controlled well since the grooves guide airflows in the longitudinal direction of the wire. Thus the wire has good aerodynamic properties, and consequently, the runability of the wire is good. The wire runability is further improved by the fact that the longitudinal yarns arranged to overlap each other make the wire structure denser, and thus the wire may have a relatively low air permeability. High-speed paper machines, in particular, require a dense structure. Thanks to the grooves, the drying capacity of the wire may be better than earlier. A further advantage is that the cleaning of the wire becomes easier since at least some of the water sprays of a typical injection device also hit the grooves, and thus the water sprays can also act on the dirt stuck onto the

wire surface from below. In addition, an advantage is that the grooves are empty and have a shape which prevents dirt from sticking to them easily. Thanks to the basic structure of the wire according to the invention, the wire is also wear resistant and stable in use.

[0007] The basic idea of an embodiment of the invention is that the depth of the grooves is substantially equal at least to the thickness of the longitudinal yarns that travel on the surface provided with grooves. In that case, the grooves are distinct and sufficiently large for guiding airflows.

[0008] The basic idea of an embodiment of the invention is that in the cross machine direction of the wire, the cross section of the grooves has the shape of a substantially sharp-angled letter U. It is easy to remove dirt from a groove of this shape. In addition, the groove is free from yarns that could hinder the airflow, in which case the airflow passing in the groove is not subjected to significant turbulence.

[0009] The basic idea of an embodiment according to the invention is that the grooves have been formed during weaving.

[0010] The basic idea of an embodiment of the invention is that at least the transverse yarns are made of a material that shrinks considerably in heat and that the wire has been treated thermally after weaving to provide the wire surface with machine direction grooves.

[0011] The basic idea of an embodiment of the invention is that the surface of the transverse yarns has been treated with a friction reducing substance before weaving.

[0012] The basic idea of an embodiment according to the invention is that longitudinal yarns are provided in two layers and that the cover ratio formed by the longitudinal yarns is less than 80%.

[0013] The basic idea of an embodiment according to the invention is that the air permeability of the dryer wire is less than 5000 m³/m²h.

[0014] The basic idea of an embodiment of the invention is that the wire comprises longitudinal grooves both on the back surface and on the surface facing the web to be dried.

BRIEF DESCRIPTION OF THE FIGURES

[0015] The invention will be described in greater detail in the accompanying drawing, in which

Figure 1 illustrates a schematic perspective view of a dryer wire according to the invention from the machine direction, and

Figure 2 schematically illustrates part of a dryer wire according to the invention from the machine direction.

For the sake of clarity, the figures illustrate the invention in a simplified manner. Like reference numbers refer to like parts in the figures.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Figure 1 illustrates a dryer wire of the invention, which has been woven from a plurality of machine direction MD longitudinal yarns 1 and a plurality of cross machine direction CMD transverse yarns 2, 3 and 4. The wire comprises a back surface (A) and a surface (B) facing the web to be dried. The longitudinal yarns 1 may have the cross section of a flat monofilament, having the shape of a rectangle with rounded edges or an oval shape, for example. The flat yarn refers to a yarn with a greater dimension in the width direction than in the height direction. The transverse yarns 2 to 4 may have the cross section of round monofilaments. Alternatively, flat transverse yarns may be used or the transverse yarns may be made of 'soft yarn', which may shape up during the manufacture. The longitudinal yarns may be made of polyethylene terephthalate (PET), polyamide (PA), polyphenylenesulphide (PPS), polyether etherketone (PEEK), polymethylene cyclohexylene terephthalate (PCTA) or polyethylene naphthalate (PEN). The transverse yarns 2 to 4 may be made of one of the above-mentioned materials.

[0017] As appears from Figure 1, the longitudinal yarns 1 travelling on the wire surface A may be arranged in a plurality of groups formed by at least two longitudinal yarns 1. Seen in the cross machine direction CMD of the wire, the longitudinal yarns 1 are substantially against each other in the groups. In that case, there are machine direction MD grooves 5 between these yarn groups. Grooves 5 may be provided only on one surface of the wire or alternatively on its both surfaces. The grooves 5 can be formed during weaving. The groove 5 formation can be influenced by selecting a certain weave structure for the wire, certain materials for the yarns or certain settings for the weaving machine. In the weave structure of the wire according to the invention, the number of longitudinal yarns 1 may be relatively scarce in relation to the width of the longitudinal yarns 1, which facilitates the formation of grooves 5. In addition, the formation of grooves 5 may be influenced by applying an abnormally high tension to the longitudinal yarns 1 during weaving. This generates cross forces in the wire to be woven, pulling the longitudinal yarns 1 so that they will overlap. The tension on longitudinal yarns 1 may be over 10 kN/m, preferably over 15 kN/m.

[0018] The surface of the transverse yarns 2 to 4 may have been made slippery so that the longitudinal yarns 1 move easier due to the influence of the weaving forces, enabling the formation of the grooves 5. Thus a material with a small friction coefficient can be selected as the material for the transverse yarns 2 to 4 or the transverse yarns 2 to 4 may be alternatively treated with a friction reducing material before weaving, such as polytetrafluoroethylene (PTFE). The outer surface of the transverse yarns 2 to 4 may be coated with a friction reducing material or it may be treated by spraying the transverse yarns with a friction reducing material, for example.

[0019] In addition, the groove 5 formation can be influenced by selecting a material that shrinks considerably in heat for the transverse yarns 2 to 4. After weaving, the wire can be treated thermally, in which case the shrinking of the transverse yarns 2 to 4 may intensify the groove 5 formation. In addition, the thermal treatment may stabilize the wire structure since the yarns attach better to each other and form yarn floats.

[0020] It can be seen from Figure 2 that the wire comprises longitudinal yarns 1 in two overlapping and adjacent layers. Longitudinal yarns 1a travelling on the back surface A of the wire and longitudinal yarns 1b travelling on the surface B facing the web partly overlap by a predetermined distance M. The distance M is clearly shorter than the width P of the longitudinal yarns 1a and 1b. In that case, the total width N of the longitudinal yarns 1a and 1b is always greater than the width of a single longitudinal yarn 1a or 1b. When the longitudinal yarns 1a and 1b of different layers are arranged to partly overlap, the resulting structure is dense. Thus the air permeability of the wire can be rendered sufficiently small so that the wire is also suitable for use in high-speed paper machines. The air permeability of a dryer wire may be less than 5000 m³/m²h.

[0021] The weave structure of the wire can be selected so that the transverse yarns 2, 3 and 4 keep the longitudinal yarns 1 firmly in the partly overlapping position described above. In addition, the weave structure may be selected so that the wire will be stable in a paper machine.

[0022] Figure 2 further shows that the cross section of the grooves 5 may have the shape of a sharp-angled letter U. This shape is illustrated with line 6 in the figure. In grooves with this shape, airflows are not subjected to significant turbulence. Furthermore, dirt does not easily stick to this kind of groove. In addition, the grooves on the wire surface intensify drying.

[0023] When the cross section of the longitudinal yarns 1 is oval, for example, the cross section of the grooves 5 differs from that shown in Figure 2. Nevertheless, the grooves 5 may be deep and the bottom of the grooves 5 flat. Thus airflows can easily pass along the grooves 5 in this case, too.

[0024] Preferably, the width L of the grooves 5 is at least 0.4 mm and their depth S at least 0.2 mm.

Example 1:

[0025] A second feasible embodiment is as follows:

- There are longitudinal yarns, i.e. warps, in two layers
- The cross section of the longitudinal yarns is flat and their width is 0.60 mm and height 0.3 mm
- The density of the longitudinal yarns in the wire, i.e. warps, is set to 200 yarns/10 cm in the weaving machine
- The wire has shrunk about 20% from its original width during the manufacture. The shrinkage results from weave technical factors and thermal treatment after

weaving, for example

- After the manufacture, the warp density of the wire is 240 yarns / 10 cm
- The width of the grooves is 0.6 mm and their depth 0.3 mm
- The number of grooves in the width direction is 6 per cm
- The warp coverage of the wire is calculated to be 72%. The warp coverage can be calculated by multiplying the warp density by the width of the warps and by further dividing the product by the number of warp layers. The resulting number can then be converted into percentage in the conventional manner. In this case, the warp coverage is calculated using the formula: $[(240 * 0.6)/2] * 100\% = 72\%$

Example 2:

[0026] A third feasible embodiment is as follows:

- There are longitudinal yarns, i.e. warps, in two layers
- The cross section of the longitudinal yarns is flat and their width 0.70 mm
- The density of the longitudinal yarns of the wire, i.e. warps, is set to 180 yarns/10 cm in the weaving machine
- The wire has shrunk about 20% from its original width during the manufacture. The shrinkage results from weave technical factors and thermal treatment after weaving, for example
- After the manufacture, the warp density of the wire is 220 yarns/10 cm
- The warp coverage of the wire is calculated to be 77%. The warp coverage is calculated using the formula: $[(220 * 0.7)/2] * 100\%$

[0027] Furthermore, in some cases the weave structure of the wire may differ from those illustrated in Figures 1 and 2. Thus longitudinal yarns may be arranged into groups of three longitudinal yarns instead of two yarns, for instance. In addition, longitudinal and transverse yarns may be arranged in several layers.

[0028] The drawing and the related description are only intended to illustrate the inventive concept. The details of the invention may vary within the scope of the claims.

Claims

1. A dryer wire woven from a plurality of machine-direction (MD) longitudinal yarns (1) and a plurality of cross machine direction (CMD) transverse yarns (2, 3, 4) comprising a back surface (A) and a surface (B) facing the web to be dried whereby,

the cross section of the longitudinal yarns (1) is flat; and
the longitudinal yarns are arranged in at least a

first layer and a second layer, which are one on top of the other, **characterized in that** at least one surface (A, B) of the wire is provided with a plurality of machine direction (MD) grooves (5), and

at least some of the longitudinal yarns (1) travelling in the first layer are arranged to partly overlap the longitudinal yarns travelling in the second layer, the total width (N) of the partly overlapping longitudinal yarns (1) being greater than the width (P) of a single longitudinal yarn.

2. A dryer wire according to claim 1, **characterized in that** the depth (S) of the grooves (5) is substantially at least equal to the thickness of the longitudinal yarns (1) that travel on the surface (A, B) provided with grooves.

3. A dryer wire according to claim 1 or 2, **characterised in that** the longitudinal yarns (1) are monofilaments.

4. A dryer wire according to any one of the preceding claims, **characterized in that** the cross section of the grooves (5), as seen in the machine direction (MD) of the wire, has the shape of a substantially sharp-angled letter U.

5. A dryer wire according to any one of the preceding claims, **characterized in that** the grooves (5) have been formed during the weaving of the wire.

6. A dryer wire according to any one of the preceding claims, **characterized in that** the cross section of the transverse yarns (2-4) is substantially round.

7. A dryer wire according to any one of claims 1 to 5, **characterized in that** the cross section of the transverse yarns (2-4) is flat.

8. A dryer wire according to any one of the preceding claims, **characterized in that** at least some of the transverse yarns (2-4) have been treated with a friction reducing substance before weaving to facilitate groove formation.

9. A dryer wire according to any one of the preceding claims, **characterized in that** the width (L) of the grooves is at least 0.4 mm and that the depth (S) of the grooves (5) is at least 0.2 mm.

10. A dryer wire according to any one of the preceding claims, **characterized in that** the cross section of the longitudinal yarns (1) is a rectangle or a rectangle with rounded edges with a width of 0.6 mm and a height of 0.3 mm, and there are at least 6 grooves (5) per cm on at least one surface of the wire in the width direction of the wire.

11. A dryer wire according to any one of the preceding claims, **characterized in that** grooves (5) are provided on both surfaces (A, B) of the wire.
12. A dryer wire according to any one of the preceding claims, **characterized in that** longitudinal yarns (1) are arranged in two layers, and the coverage ratio formed by the longitudinal yarns (1) is less than 80%.
13. A dryer wire according to any one of the preceding claims, **characterized in that** the air permeability of the dryer wire is less than 5000 m³/m²h.

Patentansprüche

1. Trocknersieb, das aus einer Mehrzahl von Maschinenrichtungen (MD)-Längsgarnen (1) und einer Mehrzahl von Quermaschinenrichtungen (CMD)-Quergarnen (2, 3, 4) gewebt ist, umfassend

eine rückseitige Oberfläche (A) und eine Oberfläche (B), die der zu trocknenden Bahn zugekehrt ist, wobei

der Querschnitt der Längsgarne (1) flach ist; und die Längsgarne in mindestens einer ersten Lage und einer zweiten Lage angeordnet sind, die übereinander liegen, **dadurch gekennzeichnet, dass**

mindestens eine Oberfläche (A, B) des Langsiebs mit einer Mehrzahl von Maschinenrichtungen (MD)-Rillen (5) versehen ist und mindestens einige der Längsgarne (1), die in der ersten Lage verlaufen, angeordnet sind, um die Längsgarne, die in der zweiten Lage verlaufen, teilweise zu überlappen, wobei die Gesamtbreite (N) der sich teilweise überlappenden Längsgarne (1) größer als die Breite (P) eines einzelnen Längsgarns ist.

2. Trocknersieb nach Anspruch 1, **dadurch gekennzeichnet, dass** die Tiefe (S) der Rillen (5) im Wesentlichen mindestens gleich der Dicke der Längsgarne (1) ist, die auf der mit Rillen versehenen Oberfläche (A, B) verlaufen.
3. Trocknersieb nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Längsgarne (1) Monofilamente sind.
4. Trocknersieb nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Querschnitt der Rillen (5) bei Betrachtung in der Maschinenrichtung (MD) des Langsiebs die Form von einem im Wesentlichen scharfkantigen Buchstaben U aufweist.

5. Trocknersieb nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Rillen (5) während des Webens des Langsiebs gebildet worden sind.

6. Trocknersieb nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Querschnitt der Quergarne (2-4) im Wesentlichen rund ist.

7. Trocknersieb nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** der Querschnitt der Quergarne (2-4) flach ist.

8. Trocknersieb nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** mindestens einige der Quergarne (2-4) vor einem Weben mit einer reibungsmindernden Substanz behandelt worden sind, um eine Rillenbildung zu fördern.

9. Trocknersieb nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Breite (L) der Rillen mindestens 0,4 mm beträgt und dass die Tiefe (S) der Rillen (5) mindestens 0,2 mm beträgt.

10. Trocknersieb nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass**

der Querschnitt der Längsgarne (1) ein Rechteck oder ein Rechteck mit gerundeten Ecken mit einer Breite von 0,6 mm und einer Höhe von 0,3 mm ist und

es in der Breitenrichtung des Langsiebs mindestens 6 Rillen (5) pro cm auf mindestens einer Oberfläche des Langsiebs gibt.

11. Trocknersieb nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Rillen (5) auf beiden Oberflächen (A, B) des Langsiebs bereitgestellt werden.

12. Trocknersieb nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass**

Längsgarne (1) in zwei Lagen angeordnet sind und

das durch die Längsgarne (1) gebildete Bedeckungsverhältnis kleiner als 80% ist.

13. Trocknersieb nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Luftdurchlässigkeit des Trocknersiebs kleiner als 5000 m³/m²h ist.

Revendications

1. Toile de sécheur tissée à partir d'une multiplicité de fils longitudinaux dans le sens de la machine (MD) (1) et d'une multiplicité de fils transversaux dans le sens transversal à la machine (CMD) (2, 3, 4), comportant

une surface arrière (A) et une surface (B) face à la nappe devant être séchée, de sorte que la section des fils longitudinaux (1) est plate; et les fils longitudinaux sont disposés dans au moins une première couche et une deuxième couche, qui sont l'une au-dessus de l'autre, **caractérisée en ce que** au moins une surface (A, B) de la toile est pourvue d'une multiplicité de rainures dans le sens de la machine (MD) (5), et au moins certains des fils longitudinaux (1) se déplaçant dans la première couche sont disposés afin de chevaucher partiellement les fils longitudinaux se déplaçant dans la deuxième couche, la largeur totale (N) des fils longitudinaux (1) se chevauchent partiellement étant plus grande que la largeur (P) d'un unique fil longitudinal.
2. Toile de sécheur selon la revendication 1, **caractérisée en ce que** la profondeur (S) des rainures (5) est sensiblement au moins égale à l'épaisseur des fils longitudinaux (1) qui se déplacent sur la surface (A, B) pourvue de rainures.
3. Toile de sécheur selon la revendication 1 ou 2, **caractérisée en ce que** les fils longitudinaux (1) sont des monofilaments.
4. Toile de sécheur selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la section des rainures (5), vue dans la direction de la machine (MD) de la toile, a la forme d'une lettre U à angle sensiblement aigu.
5. Toile de sécheur selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les rainures (5) ont été formées pendant le tissage de la toile.
6. Toile de sécheur selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la section des fils transversaux (2 à 4) est sensiblement ronde.
7. Toile de sécheur selon l'une quelconque des revendications 1 à 5, **caractérisée en ce que** la section des fils transversaux (2 à 4) est plate.
8. Toile de sécheur selon l'une quelconque des revendications précédentes, **caractérisée en ce que** au moins certains des fils transversaux (2 à 4) ont été traités avec une substance de réduction de la friction avant tissage afin de faciliter la formation de rainures.
9. Toile de sécheur selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la largeur (L) des rainures est d'au moins 0,4 mm et la profondeur (S) des rainures (5) est d'au moins 0,2 mm.
10. Toile de sécheur selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la section des fils longitudinaux (1) est un rectangle ou un rectangle avec des bords arrondis avec une largeur de 0,6 mm et une hauteur de 0,3 mm, et il y a au moins 6 rainures (5) par centimètre sur au moins une surface de la toile dans la direction transversale de la toile.
11. Toile de sécheur selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les rainures (5) sont prévues sur les deux surfaces (A, B) de la toile.
12. Toile de sécheur selon l'une quelconque des revendications précédentes, **caractérisée en ce que** des fils longitudinaux (1) sont disposés en deux couches, et le rapport de couverture formé par les fils longitudinaux (1) est inférieur à 80%.
13. Toile de sécheur selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la perméabilité à l'air de la toile de sécheur est inférieure à 5000 m³/m²/h.

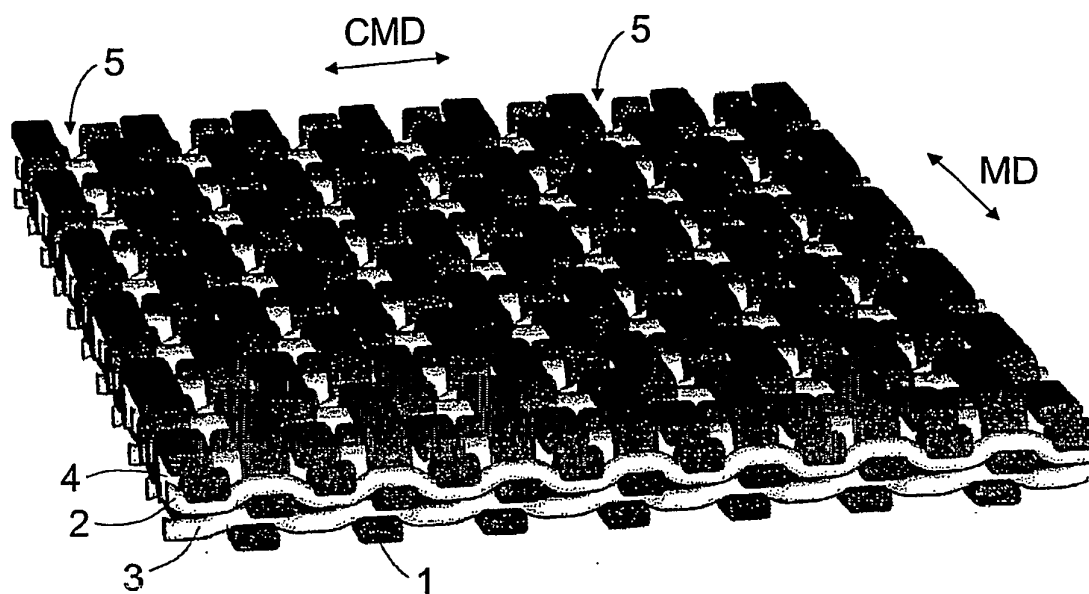


FIG. 1

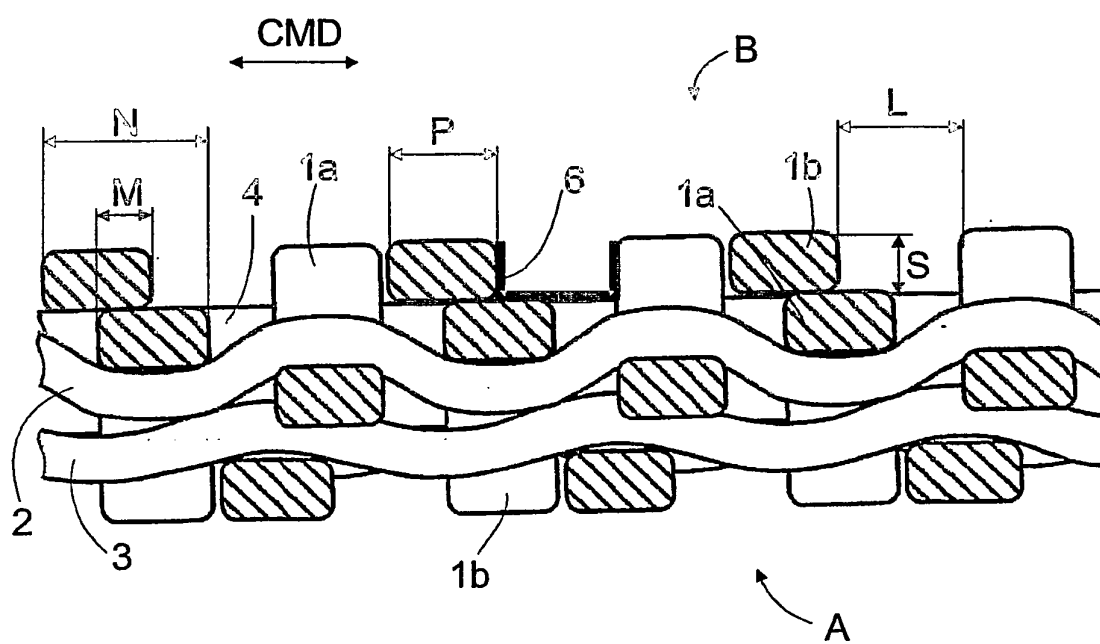


FIG. 2