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(54) **DRYING WIRE**

TROCKENSIEB

TOILE DE SECHAGE

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a drying wire which comprises a backside surface and a web-side surface and which is woven of several machine-direction yarns and several cross-machine direction yarns, the yarns being monofilaments and the wire further comprising on the web-side surface several cross-machine direction yarns which differ from the rest of the wire yarns, the wire is a 1.5-layer structure, and the web-side surface is provided, upon weaving, with additional cross-machine direction yarns; which have an easily shapable structure.

BACKGROUND OF THE INVENTION

[0002] The drying section of a paper machine utilizes drying wires with which a paper web to be dried is conveyed through the drying section. The fabric structure of the drying wire is formed of high-temperature and moisture resistant yarns by using weaves that are appropriate for the purpose. In order for the contact between the web and the wire to be even and smooth, spun cross-machine direction yarns are arranged, according to the prior art, on the web-side surface. Present smooth-surface drying wires are multilayer structures having a high cross-machine direction yarn density. Manufacturing such drying wires is expensive. The cost of the present wires is further increased because the structures have a lot of expensive spun yarn. In addition, such drying wires are relatively thick, which causes draw between the web and the wire. US-A-5 449 548 discloses an industrial fabric including fibers with thin fins, which fill the fabric and reduce the porosity of the fabric. Furthermore, JP-A-3059189 discloses a fabric including yarns coated by synthetic resin.

BRIEF DESCRIPTION OF THE INVENTION

[0003] An object of the present invention is to achieve a novel and an improved drying wire.

[0004] The drying wire according to the invention is characterized in that the additional yarns are arranged to cover the spaces formed between machine-direction yarns on the web-side surface substantially completely, and that the additional yarns are of meltable fibre, which are shaped on the surface of the wire by means of heat treatment.

[0005] An essential idea of the invention is that the drying wire is a 1.5-layer structure where the monofilament cross-machine direction yarns are arranged to run on the backside surface of the wire and where there are additional cross-machine direction yarns that differ from the rest of the yarns running on the web side surface of the wire. The additional cross-machine direction yarns are easily shapable, being shaped during the weaving, in a heat treatment and/or during use in such a way that they can become wider in the direction of the wire surface,

whereby they fill the spaces between machine-direction yarns on the web-side surface substantially completely.

[0006] An advantage of the invention is that owing to the shapable additional yarns, the web-side surface of the wire has an extremely large contact area. This is because the additional yarns fill the spaces on the web-side surface of the wire. In addition, the monofilament machine-direction yarns form, relative to the area, a large number of contact points on the web-side surface. Thus, the heat transfers well from the wire to the web, and the drying is efficient. Further, an advantage of the invention is that a 1.5-layer fabric has significantly fewer yarns than a multilayer fabric, and therefore it is less expensive to manufacture. In addition, fewer expensive additional yarns than previously are needed for the structure according to the invention. Yet another advantage is that the wire according to the invention has the desired surface properties immediately after the weaving. Thus, the wire needs not necessarily be ground smooth, calendared or given an intensive shrinking treatment. In this way, the manufacturing may be quicker and the manufacturing costs smaller. Furthermore, no shrinkable or other special yarns need to be used in the basic weave.

[0007] The essential idea of an embodiment of the invention is that the starting point for the basic structure is a 3-shed weave, in which case each machine-direction yarn runs in the basic weave over two basic cross-machine direction yarns and further under one basic cross-machine direction yarn. In the final structure, the machine-direction yarn runs over three cross-machine direction yarns and under three cross-machine direction yarns.

[0008] The essential idea of an embodiment of the invention is that the dimensions of the yarns relative to each other are arranged in such a way that the structure is asymmetric.

[0009] The essential idea of an embodiment of the invention is that the additional cross-machine direction yarns running on the web side are of spun yarn. Spun yarn is flexible and shapes up well on the wire surface both during weaving and when it is subjected to pressing forces during use. Due to the effect of pressing forces, the structure of spun yarns can expand in the direction of the wire surface. Thus, the contact area of the wire surface may be extremely large, up to nearly 100%, depending on the pressing force. Despite the large contact area, the number of contact points is also large.

[0010] The essential idea of an embodiment of the invention is that the proportion of the additional yarns on the web-side surface is less than 60% of the area. When the number of expensive additional yarns is smaller in the structure, the wire is less expensive to manufacture. Further, when there are a limited number of additional yarns on the web-side surface, the wire remains clean for a long time.

[0011] The essential idea of an embodiment of the invention is that the proportion of the additional yarns is preferably between 30 and 60%.

[0012] The essential idea of an embodiment of the invention is that the cross-machine direction yarns of the backside surface of the wire are flat monofilaments. Flat yarns support the wire structure in the direction of its surface. Further, the surface of the backside surface may be smoother when flat yarns are used, compared with the use of round yarns, and therefore the wire carries less air with it. Thus, the wire has good aerodynamic properties and good runnability in a paper machine.

[0013] The essential idea of an embodiment of the invention is that the thickness of the wire is less than 1.5 mm. Owing to the wire being thin and having an asymmetric structure, the draw between the wire and the web in a paper machine can be small. Thus, detrimental stretching of the web and/or wearing of the wire can be avoided.

[0014] The essential idea of an embodiment of the invention is that the contact area of the monofilaments on the web side in the wire is 40% or more, and at the same time, the number of contact points of the monofilaments is 30 points/cm² or more. Such a wire has a good heat transfer capacity.

[0015] The essential idea of an embodiment of the invention is that the additional yarns are hydrophilic. When the web-side surface of the wire is appropriately hydrophilic and smooth, the web is well pressed adhered to the wire surface, owing to which the runnability of the wire is good.

BRIEF DESCRIPTION OF THE FIGURES

[0016] The invention will now be described in greater detail with reference to the attached drawing, of which

Figure 1 shows schematically a cross-section of a drying wire according to the invention from the cross-machine direction; and

Figure 2 shows schematically a part of the web-side surface of the drying wire of Figure 1.

[0017] For the sake of clarity, the figures show the invention in a simplified manner. Similar parts are denoted with the same reference numerals.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Figure 1 shows a cross-section of a wire according to the invention. The wire comprises a backside surface A which is against the paper machine and a web-side surface B which is against the web to be dried. The wire is run in the running direction MD of the paper machine. Further, the cross-direction of the paper machine is indicated in the figure as CMD. The wire is a 1.5-layer structure formed by weaving from machine-direction yarns 1 and cross-machine direction yarns 2. The weave has a 3-shed structure. The machine-direction yarns 1 run over two cross-machine direction yarns 2 and further under one cross-machine direction yarn 2, continuing

then according to the same pattern. All machine-direction yarns 1 in the fabric run according to the same weave pattern. However, adjacent machine-direction yarns 1 always have a shift of one cross-machine direction yarn in the same direction or in a different direction. Further, the web-side surface B is provided, upon weaving with additional cross-machine direction yarns 3, which may be of spun yarn. Spun yarn shapes up well in the space between machine-direction yarns 1 on the surface of the wire. The material of spun yarns may be, for instance, polyacrylonitrile (PAN) and/or aramid. The additional yarns 3 are of meltable fibre, the heat treatment after weaving causing the additional yarns 3 to shape up on the surface of the wire. Further, suitable twisted yarn, multifilament and/or multi-component yarn may be used as additional yarns 3. One option is to use polypropylene (PP) as the additional yarn material. What is essential in the selection of additional yarns 3 is that the yarns 3 are relatively easily shapable yarns which shape up due to weaving forces and/or pressing forces during the use of the paper machine in such a way that they fill the spaces between machine-direction yarns 1 on the web-side surface substantially completely, whereby a large contact area is achieved. The original cross-section of the additional yarns 3 may be flat or round. The machine-direction yarns 1 may be monofilaments and their material may be polyethylene terephthalate (PET), polyamide (PA), polyphenylene sulphide (PPS), polyether ether ketone (PEEK), polycyclohexylenedimethylene terephthalate (PCTA) or polyethylene naphthalene (PEN). The cross-section of the machine-direction yarns 1 may be flat, in which case a large contact surface is achieved. The cross-machine direction yarns 2 running on the backside surface A of the wire may also have a flat cross-section. The cross-section of flat yarns may be oval or rectangular with rounded edges. Flat yarns are, as known, rigid in one direction and very flexible in another direction. Thus, a wire woven of flat yarns is very firm in the direction of the wire surface. Further, owing to the flat cross-machine direction yarns 2, the backside surface A may be smooth, in which case it carries little air with it.

[0019] Since the basic weave of the drying wire is a one-layer structure, the wire may be thin. In empirical tests it has been observed that preferably the thickness of the wire is less than 1.5 mm, particularly preferably less than 1.3 mm. Further, it has been observed that the air permeance of the wire may be even less than 1 000 m³/m²h. However, the air permeance is preferably in the range of 1 000 to 3 000 m³/m²h.

[0020] Figure 2 shows the web-side surface of the drying wire according to the invention. Between machine-direction yarns 1, there are empty spaces 4, which are filled by additional yarns 3. Since the additional yarns 3 are easily shapable, they fill the empty spaces 4 substantially completely. As seen from the figure, the wire surface has a large contact area. On the other hand, the machine-direction yarns 1 form a large number of contact points on the web-side surface.

[0021] It has been observed in the use that if the proportion of additional yarns on the web-side surface is too high, the wire surface may become too hydrophilic. If the wire surface is too wet, dirt sticks easily to it and the wire may be clogged prematurely. In addition, the wire surface is rougher, which also contributes to the sticking of dirt. In the invention, the proportion of additional yarns on the surface is less than 60% of the area, and no such problems have been observed.

[0022] Further, the drying wire according to the invention may, in some cases, have a two-shed, four-shed or six-shed structure.

[0023] The drawings and the related description are only intended to illustrate the idea of the invention. The details of the invention may vary within the scope of the claims.

Claims

1. A drying wire which comprises a backside surface (A) and a web-side surface (B) and which is woven of several machine-direction (MD) yarns (1) and several cross-machine direction (CMD) yarns (2), the yarns (1, 2) being monofilaments and the wire further comprising on the web-side surface (B) several cross-machine direction yarns which differ from the rest of the wire yarns, the wire is a 1.5-layer structure, and the web-side surface (B) is provided, upon weaving, with additional cross-machine direction yarns (3); which have an easily shapable structure, **characterized in that** the additional yarns (3) are arranged to cover the spaces (4) formed between machine-direction yarns (1) on the web-side surface (B) substantially completely, and **that** the additional yarns (3) are of meltable fibre, which are shaped on the surface of the wire by means of heat treatment.
2. A drying wire according to claim 1, **characterized in that** the machine-direction yarns (1) are arranged in the basic weave to run over two cross-machine direction yarns (2) and under one cross-machine direction yarn (2) and to continue according to the same pattern.
3. A drying wire according to claim 1 or 2, **characterized in that** the dimensions of the yarns relative to each other are arranged in such a way that the structure of the wire is asymmetric.
4. A drying wire according to any one of the preceding claims, **characterized in that** the machine-direction yarns (1) are flat monofilaments, and that the cross-machine direction yarns (2) of the backside surface

(A) are flat monofilaments.

5. A drying wire according to any one of the preceding claims, **characterized in that** the proportion of the additional yarns (3) on the web-side surface (B) is less than 60% of the total area.
6. A drying wire according to any one of the preceding claims, **characterized in that** the proportion of the additional yarns (3) on the web-side surface (B) is between 30 and 60%.
7. A drying wire according to any one of the preceding claims, **characterized in that** the thickness of the wire is less than 1.5 mm.
8. A drying wire according to any one of claims 1 to 7, **characterized in that** the thickness of the wire is less than 1.3 mm.
9. A drying wire according to any one of the preceding claims, **characterized in that** the additional yarns (3) are hydrophilic.
10. A drying wire according to any one of the preceding claims, **characterized in that** the machine-direction yarns (1) are monofilaments; **that** the contact area of the monofilaments on the web-side surface (B) of the wire is 40% or more; and **that** at the same time, the number of contact points of the monofilaments on the web-side surface (B) is 30 points/cm² or more.

Patentansprüche

1. Ein Trockensieb, das umfasst eine Rückseiteoberfläche (A) und eine Gewebeseiteoberfläche (B) und das gewoben ist aus mehreren Garnen (MD) (1) in Maschinenrichtung und mehreren Garnen (CMD) (2), die in Querrichtung zur Maschinenrichtung liegen, wobei die Garne (1, 2) Monofilamente sind und das Sieb weiter auf der Gewebeseitenoberfläche (B) mehrerer Garne in Querrichtung der Maschinenrichtung umfasst, die sich von dem Rest der Siebgarne unterscheiden, das Sieb eine 1,5-Lagenstruktur ausweist und die Gewebeseiteoberfläche (B) beim Weben mit zusätzlichen quer zur Maschinenrichtung liegenden Garnen versehen wird, die eine leicht formbare Struktur haben, **dadurch gekennzeichnet, dass** die zusätzlichen Garne (3) so angeordnet sind, dass sie die Zwischenräume (4), die zwischen den in der Maschinenrichtung liegenden Garnen (1) auf der Gewebeseiteoberfläche (B) gebildet sind, vollständig abdecken und dass die zusätzlichen Garne (3) aus schmelzbaren Fasern bestehen, die auf der

Oberfläche des Siebs mittels Wärmebehandlung geformt sind.

2. Trockensieb nach Anspruch 1, **dadurch gekennzeichnet, dass** die Garne (1), welche in Maschinenrichtung liegen, im Basisgewebe so angeordnet sind, dass sie über zwei Garnen (2), welche quer zur Maschinenrichtung liegen, und unter einem Garn (2), das in Querrichtung zur Maschinenrichtung liegt, angeordnet sind, und zwar so, dass sie kontinuierlich das gleiche Muster bilden. 5
3. Trockensieb nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Dimensionen der Garne relativ zueinander so angeordnet sind, dass die Struktur des Trockensiebs asymmetrisch ist. 10
4. Trockensieb nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Garne (1), welche in Maschinenrichtung liegen, flache Monofilamente sind, und dass die Garne (2), welche quer zur Maschinenrichtung, auf der Rückseite der Oberfläche liegen, flache Monofilamente sind. 15
5. Trockensieb nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, dass der Anteil der zusätzlichen Garne (3) auf der gewebeseitigen Oberfläche (B) weniger als 60 % der gesamten Fläche beträgt. 20
6. Trockensieb gemäß einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Anteil der zusätzlichen Garne (3) auf der gewebeseitigen Oberfläche (B) zwischen 30 und 60 % ist. 25
7. Trockensieb nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Dicke des Siebes weniger als 1,5 mm ist. 30
8. Trockensieb nach mindestens einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** die Dicke des Siebes weniger als 1,3 mm ist. 35
9. Trockensieb nach mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die zusätzlichen Garne (3) hydrophil sind. 40
10. Trockensieb entsprechend mindestens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Garne (1), welche in Maschinenrichtung liegen, Monofilamente sind; dass die Berührungsfläche der Monofilamente in der gewebeseitigen Oberfläche (B) des Siebs 40% oder mehr ist und 45
- dass gleichzeitig die Anzahl der Kontaktpunkte der Monofilamente auf der gewebeseitigen Oberfläche 50

(B) 30 Punkte/cm² oder mehr ist.

Revendications

1. Toile de séchage comprenant une surface arrière (A) et une surface côté bande (B) et qui est tissée de plusieurs fils (1) dans le sens machine (MD) et de plusieurs fils (2) dans le sens transversal à la machine (CMD), les fils (1, 2) étant des monofilaments et le fil comprenant en outre sur la surface côté bande (B) plusieurs fils dans le sens transversal à la machine différents du reste des fils de la toile, la toile est une structure de couche 1,5, et la surface côté bande (B) est munie, lors du tissage, de fils dans le sens transversal à la machine supplémentaires (3) qui ont une structure facilement façonnable, **caractérisée en ce que** les fils supplémentaires (3) sont agencés pour recouvrir sensiblement complètement les espaces (4) formés entre les fils dans le sens machine (1) sur la surface côté bande (B), et les fils supplémentaires (3) sont composés de fibres fusibles, qui sont formées sur la surface de la toile au moyen d'un traitement thermique. 5
2. Toile de séchage selon la revendication 1, **caractérisée en ce que** les fils dans le sens machine (1) sont agencés dans l'armure basique pour s'étendre sur deux fils dans le sens transversal à la machine (2) et sous un fil dans le sens transversal à la machine (2) et pour continuer selon le même motif. 10
3. Toile de séchage selon la revendication 1 ou 2, **caractérisée en ce que** les dimensions des fils les uns par rapport aux autres sont agencées de telles manière que la structure de la toile soit asymétrique. 15
4. Toile de séchage selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les fils dans le sens machine (1) sont des monofilaments plats, et **en ce que** les fils dans le sens transversal à la machine (2) de la surface arrière (A) sont des monofilaments plats. 20
5. Toile de séchage selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la proportion des fils supplémentaires (3) sur la surface côté bande (B) est inférieure à 60 % de la surface totale. 25
6. Toile de séchage selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la proportion des fils supplémentaires (3) sur la surface côté bande (B) est comprise entre 30 et 60 %. 30

7. Toile de séchage selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'épaisseur de la toile est inférieure à 1,5 mm.
8. Toile de séchage selon l'une quelconque des revendications 1 à 7, **caractérisée en ce que** l'épaisseur de la toile est inférieure à 1,3 mm. 5
9. Toile de séchage selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les fils supplémentaires (3) sont hydrophiles. 10
10. Toile de séchage selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les fils dans le sens machine (1) sont des monofilaments ; 15
la surface de contact des monofilaments sur la surface côté bande (B) de la toile est de 40 % ou plus ; et en même temps le nombre de points de contact des monofilaments sur la surface côté bande (B) est de 20
30 points/cm² ou plus.

25

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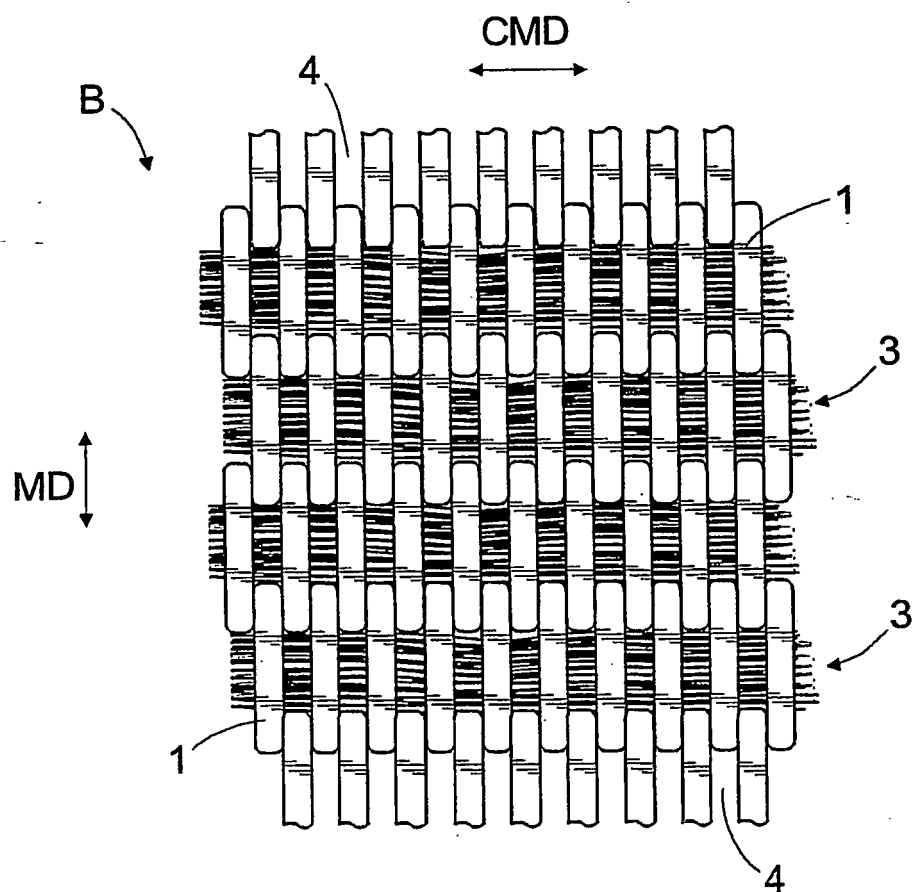
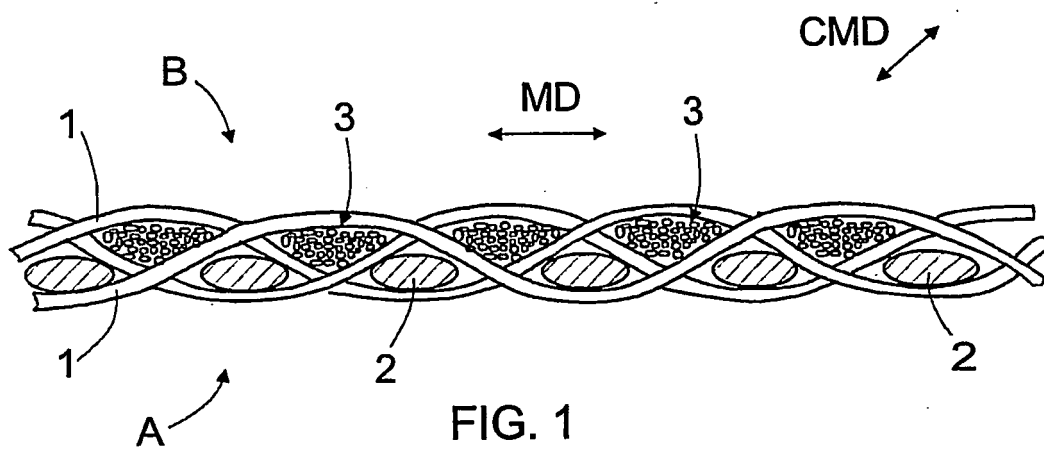
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REFERENCES CITED IN THE DESCRIPTION

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