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(71) Applicant: **Voith Patent GmbH**
89522 Heidenheim (DE)

(72) Inventors:
- **WAN AHMAD NATHRI, Wan Zeti Zafina**
  31200 Chemor, Perak Darul Ridzuan (MY)
- **ALIAS, Anas**
  31200 Chemor, Perak Darul Ridzuan (MY)
- **KARAPAYAH, Izharraj**
  31200 Chemor, Perak Darul Ridzuan (MY)
- **AHMAD KAMAL ARIFFIN, Syahrul Ramadhan**
  31200 Chemor, Perak Darul Ridzuan (MY)
- **KÖCKRITZ, Uwe**
  89522 Heidenheim (DE)

(74) Representative: **Voith Patent GmbH - Patentabteilung**
St. Pöltener Straße 43
89522 Heidenheim (DE)

(54) FIBER WEB MACHINE CLOTHING WITH EDGE SEALS AND METHOD OF PRODUCING THE SAME

(57) The invention concerns a fiber web machine clothing (10) adapted to run as a continuous loop in a fiber web machine while carrying a fiber web through at least a portion of said machine, the clothing (10) comprising a permeable base fabric (12) which is substantially made up from yarns (14, 16), wherein the base fabric has a fiber web carrying surface and an opposite running surface, as well as two opposite lateral edges (18), wherein the clothing (10) further comprises a pair of continuous edge sealing strips (20) formed along the lateral edges (18) of the base fabric (12), said strips (20) comprising a U.V. curable sealant adhered to each edge portion, the U.V. curable sealant forming a coating comprising a continuous and uniform, impermeable bead over said fiber web carrying surface and the running surface, said bead extending through interstices of the base fabric (12) thereby stabilizing the yarns (14, 16) in the edge portions of the base fabric (12) and protecting the edge portions from wear, wherein the U.V. curable sealant comprises or consists of an acrylic material. Furthermore, the invention a manufacturing process for such a fiber web machine clothing (10).

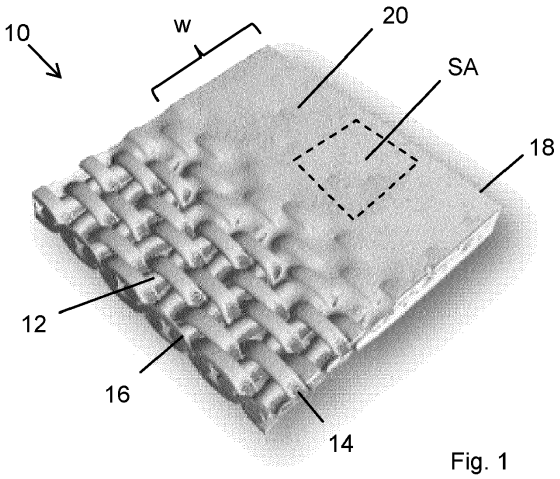

Fig. 1

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Description

[0001] The present invention refers to a fiber web machine clothing, in particular a paper machine clothing, adapted to run as a continuous loop in a fiber web machine while carrying a fiber web through at least a portion of said machine, the clothing comprising a permeable base fabric which is substantially made up from yarns, wherein the base fabric has a fiber web carrying surface and an opposite running surface, as well as two opposite lateral edges, wherein the clothing further comprises a pair of continuous edge sealing strips formed along the lateral edges of the base fabric, said strips comprising a U.V. curable sealant adhered to each edge portion, the U.V. curable sealant forming a coating comprising a continuous and uniform, impermeable bead over said fiber web carrying surface and the running surface, said bead extending through interstices of the base fabric thereby stabilizing the yarns in the edge portions of the base fabric and protecting the edge portions from wear. Furthermore, the invention refers to a method of producing such a fiber web machine clothing.

[0002] The running of fiber web machine clothings, such as dryer fabrics in a paper making machine, is often aligned by so-called guide spades which can be made for example from metal or ceramic materials. When getting into contact with the guide spades, the edges of a fiber web machine clothing are subject to wear and tear over the time. This is particularly true if the clothing is circulated at high machine speeds, such as speeds of up to 2.000 m/min or even higher.

[0003] It is already known to protect the edge portions of a base fabric of the clothing by applying a sealant to these edge portions. The sealant adds additional material to the base fabric at the edge portions. Thus, even if the abrasion rate, measured for example in abraded volume per time, stays constant, the additional material makes the clothing to last longer. Also this effect is meant when speaking from "protecting the edge portions from wear. Usually, a two-component polyurethane material is used as sealant. However, a disadvantage of such material is that it requires between twenty minutes and twenty for hours to dry completely, when applied as a liquid to the edge portions of the base fabric. Hence additional powder is needed to aid the curing process so that the clothing can be rolled up to a core. Nevertheless, the material stays tacky for quite some time and cleaning efforts are high.

[0004] To overcome this problem, US 5,506,033 has already proposed to replace the two-component polyurethane material by a silicone rubber material. The silicone rubber material can be cured by ultraviolet radiation to become tack-free in only a few seconds after its application to the edge portions of the base fabric.

[0005] One problem of silicone rubber material is that its adhesion to the yarns of the base fabric is relatively poor resulting in small pull-out loads needed to pull out the yarns from the silicone rubber material used as sealant. Another problem of silicone rubber material is that it does not provide a very good grip for the clothing. If the clothing is for example a dryer fabric that is running over the outer surface of drying cylinders of a paper making machine, there exists the risk of guiding problems of the dryer fabric.

[0006] It is therefore an object of the present invention to overcome the above-mentioned problems. In particular, it is an object of the present invention to provide a fiber web machine clothing with an edge sealant which can be polymerized into a non-tacky condition immediately after application to the edge portions of the base fabric of the clothing and which - at the same time - exhibits good adhesion to the yarns of the base fabric and provides good guiding characteristics to the clothing.

[0007] All these objects are achieved by a fiber web machine clothing and a method of producing the same according to the independent claims. The dependent claims refer to advantageous embodiments. In particular, the objects are achieved by an above-mentioned fiber web machine clothing according to the preamble part of claim 1, which is characterized in that the U.V. curable sealant comprises or consists of an acrylic material.

[0008] Like the silicone rubber material described in the prior art, also acrylic material can be used as U.V. curable sealant, which allows immediate polymerization into a non-tacky condition after application to the edge portions of the base fabric of the clothing. In addition to this, tests have shown that the adhesion forces of acrylic material to the yarns of the base fabric are much higher compared to silicone rubber material and even compared to typically used polyurethane compositions. Moreover, the guidance problem can be solved by using acrylic material for the edge seals. In fact, U.V. curable acrylic material offers better grip, e.g. to the outer surfaces of drying cylinders compared to silicone rubber material.

[0009] In a preferred embodiment of the present invention, the clothing is a dryer fabric adapted to run through at least a portion of a dryer section of the fiber web machine. In particular, the dryer fabric can or should be adapted to be used the dryer section at a temperature of 90-180°C and/or at a steam pressure of up to 9 bar and/or at a machine speed of up to 2.000m/min. It was found out that using acrylic material for sealing the edge portions of such dryer fabrics perfectly matches these conditions.

[0010] In one embodiment of the present invention, the base fabric is a woven fabric. That means that comprises machine direction yarns and cross-machine direction yarns that are interwoven with each other. The base fabric may be a single layer fabric or may comprise several layers. If the fiber web machine clothing is for example a press felt, a batt of staple fibers may be attached, preferably needled, to the base fabric. The base fabric might be a flat woven or a round woven fabric.

[0011] In another embodiment of the present invention, the base fabric is a spiral fabric. Spiral fabrics are frequently used in the field of dryer fabrics. Above-men-

tioned prior art document US 5,506,033, the content of which is incorporated herein by reference, describes and shows in its figure 2 an example of such a spiral fabric. The fabric is formed of a plurality of transversely extending coiled monofilament yarns which are interconnected with a plurality of transversely extending monofilament pintles. The yarns and pintles are preferably formed of polyaryletherketone polymers PEEK, polyphenylene sulfide, RYTON, or other similar heat resistant, moisture resistant filaments. The end portions of the pintles and yarns can be fused together and the dryer fabric can be formed as a continuous loop. Notably, the term "yarns" in the sense of the present invention shall also encompass the pintles of such a spiral fabric.

[0012] To solve the above-mentioned problems, the inventors found out that the impermeable beads does not need to have a width of more than 50mm. Preferably their width is between 20mm and 45mm.

[0013] Even though it is advantageous if the maximum thickness of the impermeable beads slightly exceeds the maximum thickness of the base fabric in order to reliably protect the yarns of the base fabric against tear and wear, the maximum thickness of the impermeable beads preferably does not exceed the maximum thickness of the base fabric by more than 20%. For example, the impermeable beads may exceed each of the fiber web carrying surface and the opposite running surface of the base fabric by 1% to 10% of the caliper of the base fabric.

[0014] The impermeable beads preferably each have a substantially flat fiber web carrying surface and/or a substantially flat an opposite running surface. Furthermore, the beads preferably completely fill out the interstices of the yarns of the base fabric. In other words, the acrylic material shall not only decrease the free spaces formed between the yarns of the base fabric but should form some kind of impermeable monolithic block around them.

[0015] To obtain a complete filling of the interstices of the yarns of the base fabric, the viscosity of the acrylic material should be sufficiently low. Good results are achievable if the U.V. curable sealant has a viscosity of 2.800 mPa s to 6.500 mPa s before being cured. mPa s stands for milipascal-second. 1 mPa s corresponds to 1 cP, i.e. 1 centipoise. Notably, the viscosity of water at 20°C is almost exactly 1 cP.

[0016] The U.V. curable sealant can comprise at least one of the following components:

- N,N-dimethylacrylamide;
- 2-propenoic acid, 2-hydroxyethyl ester, polymer with 5-isocyanato-1-(isocyanatomethyl)-1,3,3-trimethylcyclohexane;
- isobornyl acrylate;
- 2-(2-ethoxyethoxy)ethyl acrylate;
- diphenyl(2,4,6-trimethylbenzoyl)phosphine oxide;
- [3-(2,3-epoxypropoxy)propyl]trimethoxysilane;
- acrylic acid;
- 2-hydroxyethyl acrylate,

wherein preferably none of said components contributes with more than 50 weight-% to the composition of the U.V. curable sealant.

[0017] According to another aspect of the present invention, the above-mentioned problems are also solved by a method of producing a fiber web machine clothing according to the present invention as described above, the method comprising the following steps:

a) providing a permeable base fabric which is substantially made up from yarns, wherein the base fabric has a fiber web carrying surface and an opposite running surface, as well as two opposite lateral edges;

b) coating via a dispensing system the edge portions of the base fabric with a U.V. curable sealant which comprises or consists of an acrylic material;

c) curing the U.V. curable sealant by using irradiation from a U.V. source to thereby form a pair of continuous edge sealing strips.

[0018] The same advantages mentioned above for the inventive clothing also apply to its production method and *vice versa*.

[0019] Good results have been achieved when the distance between the position where the U.V. curable sealant is applied to the edge portions and the position where the U.V. curable sealant is cured is not larger than 200cm, preferably is between 90cm and 120cm. As a rule of thumb, the distance should be kept as small as possible but must be large enough to give the liquid acrylic material sufficient time to fully penetrate the woven base fabric at its edge portions. The time depends upon the density of the base fabric, the density of the sealant material and also the moving speed of the base fabric during the coating and curing process. This speed can be chosen so that during the coating step b) and the curing step c) the base fabric is moving with a process speed between 8m/min and 12m/min relative to the dispensing system and/or the U.V. source.

[0020] Also depending upon the density of the base fabric, as well as the width of the edge portion of the base fabric that is to be coated, in the coating step b) the U.V. curable sealant can leave the dispensing system with a pressure between 2,5 bar and 6,5 bar and/or with a flow rate between 250 g/min and 950 g/min.

[0021] The U.V. intensity of the U.V. source for curing the U.V. curable sealant should not be larger than 250mW/cm^2, preferably it should be between 40mW/cm^2 and 100mW/cm^2.

[0022] In the following the present invention is explained in more detail with the aid of an exemplary embodiment illustrated in the following schematic figures:

Figure 1 shows a portion of a fiber web machine clothing with an edge seal according to the present invention;

Figure 2 shows a diagram of the mass distribution

of the edge seal along the caliper of the fiber web machine clothing;

Figure 2a shows different slices made for determining the mass distribution at the at region of the present invention with a comparative example

Figure 3 shows a diagram of the pull-out load of different sealant materials; and

Figure 4 shows schematically the manufacturing process according to the present invention.

[0023] Figure 1 shows a portion of a fiber web machine clothing 10, especially a paper machine clothing. The clothing 10 is preferably a dryer fabric. The fiber web machine clothing 10 comprises a base fabric 12. In the present exemplary embodiment, the base fabric is a spiral fabric formed of a plurality of transversely extending coiled monofilament yarns 14 which are interconnected with a plurality of transversely extending monofilament pintles. The base fabric 12 has two opposite lateral edges 18, one of which is shown in figure 1. The clothing 10 further comprises a pair of continuous edge sealing strips 20 (only one portion thereof is shown in figure 1) formed along the lateral edges 18 of the base fabric 12. The sealing strip 20 covers a certain width w of the edge portion of the base fabric 12, preferably a width w between 20mm and 45mm.

[0024] According to the present invention the sealing strip 20 comprises a U.V. curable sealant which comprises or consists of an acrylic material. It forms an impermeable bead over the fiber web carrying surface and the opposite running surface of the base fabric 12, said bead extending through interstices of the base fabric 12 thereby stabilizing the yarns 14 in the edge portions of the base fabric 12 and protecting the edge portions from wear. Preferably, the bead or the acrylic material of the bead completely fills out the interstices of the yarns 14 of the base fabric 12. In other words, the acrylic material shall not only decrease the free spaces formed between the yarns 14 of the base fabric 12 but should form some kind of impermeable monolithic block around them. The overall thickness of the bead is preferably slightly larger than the overall thickness that is also called caliper of the base fabric 12.

[0025] The diagram shown in figure 2 illustrates on the y-axis the mass distribution in % of the material at the edge portion of the clothing 10, going from the fiber web carrying surface (at 0mm on the x-axis) down to the running surface (at about 1.7mm on the x-axis). The mass distribution might have been measure in a sample area SA of the edge portion that is shown with a dotted line in figure 1. To find out the mass distribution it is possible to make a computer tomographic scan of the clothing 10 at the sample area SA and then to make a number of slices parallel to the sample area SA, wherein each slice is going down a little bit in the thickness direction of the clothing 10. In each slice the ratio between material and free space is evaluated which give the mass distribution (y-value in the diagram of figure 2) in that particular depth (x-value in the diagram of figure 2). If the slice is completely filled with material, the mass distribution value is 100%. If the slice only comprises air and, thus, no solid material, the mass distribution value is 0%.

[0026] This is illustrated in figure 2a which shows a couple of such slices. In total 100 slices have been made going down in the thickness direction of the clothing from the fiber web carrying surface (slice number 1) to the running surface (slice number 100). Only the slices with numbers 15, 30, 45 and 90 are shown. The lower part of figure 2a refers to inventive embodiment with acrylic material, whereas the upper part refers to the comparative example with polyurethane type A. Notably, the slices shown in figure 2a do not correspond exactly to the sample area SA shown in figure 2. Instead, the slices are chosen so that only the lower part of each slice refers to the edge region, while the upper part is outside the edge region. As can be seen, slices number 45 from the middle of the clothing in its thickness direction does not show significant differences between the inventive embodiment and the comparative example. However, slices number 14 and 90 at the fiber web carrying surface and the running surface, respectively, significantly differ from each other. At the comparative example there is hardly any additional sealant material between the interstices of the yarns of the base fabric, while at the embodiment with acrylic material, the interstices are substantially completely filled.

[0027] The lowest curve in the diagram of figure 2 illustrates the mass distribution of the base fabric 12 alone, i.e. of the coiled monofilament yarns 14 and the transversely extending monofilament pintles 16 in this exemplary embodiment. The mass distribution curve of the base fabric has a clear peak in the middle between the fiber web carrying surface and the running surface and decreases rapidly from that peak. However, even at the peak the mass distribution value is only about 80% meaning that about 20% is just air. The reason for this is that the base fabric 12 comprises a lot of free space due to the typical topography of a spiral fabric.

[0028] Another curve in the diagram of figure 2 illustrates - as a comparative example - the mass distribution of the same base fabric 12 provided with a typical polyurethane-based sealant (a polyurethane of type A), as known form the prior art. The polyurethane-based sealant material fills out almost completely the interstices of the base fabric 12 in its middle between the fiber web carrying surface and the running surface. However, the platform of the curve (where the mass distribution is almost 100%) is rather small compared to the overall thickness or caliper of the clothing 10, resulting from the fact that the upper and lower surfaces of the polyurethane-based sealant are quite uneven.

[0029] Finally, a third curve in the diagram of figure 2 shows the mass distribution of the clothing 10 of figure 1 which comprises the acrylic material as sealant. By using the acrylic material as a sealant according to the

present invention, it is possible and preferred to have a curve that resembles almost a rectangle. In other words, the mass distribution value is almost 100% along almost the complete caliper of the clothing 10, i.e. from the fiber web carrying surface to the running surface. That means that the upper and lower surfaces of the acrylic-based sealant are preferably substantially flat. A more uniform mass distribution of almost 100% along almost the complete caliper also means that more sealant material is provided within the voids or interstices of the base fabric 12, which leads to a better protection of the yarns of the base fabric from wear and tear. The inventors have found out that using a U.V. curable sealant that is based on acrylic material is advantageous when trying to achieve a uniform mass distribution of almost 100% along almost the complete caliper, because such sealant material can be forced into the interstices of the base fabric by using e.g. a high precision, double-acting dispense valve with a high resolution stroke of up to 50 bar. With sealant material that is based on polyurethan or silicone, this is usually not possible, mainly due to the usually higher viscosity of such materials. Furthermore, a sealant material that is based on a polyurethan having 2 components needs to be mixed within certain ratios. A mismatch in mixing can easily create non-cured or over-cured material and difficulties when passing through coating devices during the process. Also the cleaning efforts of the dispenser valve is much higher when using a polyurethan-based sealant.

[0030] The diagram shown in figure 3 compares the maximum pull-out load measured in pound-force [lbf] of different types of sealants. Notably, 1 pound-force [lbf] corresponds to about 4.45 Newton [N]. From this diagram it can be clearly derived that using acrylic material for edge sealing leads to much higher maximum pull-out forces of the yarns in the edge region than using silicone rubber or polyurethane-based materials, that are known from the prior art. Consequently, the edges can be better protected. To test the strength of the sealant as an indicator of the maximum pull-out load, fabrics with coated edges can be tensioned on a universal tester machine. A coated yarn on one side of the edges can be pulled out in fabric's machine direction. When the yarn is pulled out, it will pass through cured sealant material. If the sealant material is "strong" enough the yarn will break or snap off at a later distance compared to a "weak" sealant material. With uniform and dense coating material inside the void or interstices of the base fabric 12, the yarns of the base fabric 12 are more "intertwined" with the sealant material which leads to a higher maximum pull-out load.

[0031] Finally, figure 4 schematically shows how the clothing 10 with the edge sealing according to the present invention can be manufactured. More details as to the general manufacturing process of an edge seal based on a U.V. curable material may be taken from figures 5 to 7 and the corresponding passages in the description of the above-mentioned prior art document US 5,506,033, that are incorporated herein by reference.

[0032] A permeable base fabric 12 which is substantially made up from yarns, such as the base fabric 12 shown in figure 1, is moving from the right side to the left side in figure 4, preferably with a speed between 8m/min and 12m/min. The lateral edge portions of the base fabric 12 are first coated via a dispensing system 22 with a U.V. curable sealant which - according to the present invention - comprises or consists of an acrylic material. Preferably the acrylic material is applied to the edge portions of the base fabric 12 from both sides at the same time, i.e. from the fiber web carrying surface and the opposite running surface of the base fabric 12. Good practical results have been achieved if the U.V. curable sealant leaves the dispensing system 22 with a pressure between 2,5 bar and 6,5 bar and with a flow rate between 250 g/min and 950 g/min.

[0033] Shortly afterwards the U.V. curable sealant is cured by using irradiation from a U.V. source 24 to thereby form a pair of continuous edge sealing strips 20. Preferably, two such U.V. sources 24 are irradiating the still liquid curable sealant also from both sides. The distance D between the dispensing system 22 and the U.V. source 24 measured in the moving direction of the base fabric 12 is preferably between 90cm and 120cm. That provides sufficient time for the still liquid acrylic material, which preferably has a viscosity of 2.800 mPa s to 6.500 mPa s, to substantially fill out completely the interstices at the edge portion of the base fabric 12 before being cured. The U.V. intensity of the U.V. sources 24 for curing the U.V. curable sealant is preferably between 40mW/cm^2 and 100mW/cm^2, more preferably between 50mW/cm^2 and 90mW/cm^2. A radiometer might be used to measure the U.V. intensity. Based on the measured value the corresponding U.V. intensity of the U.V. sources 24 can be controlled or adjusted to a pregiven value. The U.V. source 24 can comprise an iron-type bulb having a non-tacky surface. As an alternative, a mercury bulb might be used.

Reference signs:

[0034]

10	fiber web machine clothing (especially paper machine clothing, such as dryer fabric)
12	base fabric
14	coiled monofilament yarns
16	transversely extending monofilament pintles
18	lateral edge
20	sealing strip
22	dispensing system
24	U.V. source
D	distance
SA	sample area
w	width

Claims

1. A fiber web machine clothing (10), in particular a paper machine clothing (10), adapted to run as a continuous loop in a fiber web machine while carrying a fiber web through at least a portion of said machine, the clothing (10) comprising a permeable base fabric (12) which is substantially made up from yarns (14, 16), wherein the base fabric has a fiber web carrying surface and an opposite running surface, as well as two opposite lateral edges (18),

   wherein the clothing (10) further comprises a pair of continuous edge sealing strips (20) formed along the lateral edges (18) of the base fabric (12), said strips (20) comprising a U.V. curable sealant adhered to each edge portion, the U.V. curable sealant forming a coating comprising a continuous and uniform, impermeable bead over said fiber web carrying surface and the running surface, said bead extending through interstices of the base fabric (12) thereby stabilizing the yarns (14, 16) in the edge portions of the base fabric (12) and protecting the edge portions from wear,
   characterized in that the U.V. curable sealant comprises or consists of an acrylic material.

2. The clothing (10) according to claim 1,
   characterized in that the clothing (10) is a dryer fabric (10) adapted to run through at least a portion of a dryer section of the fiber web machine.

3. The clothing (10) according to claim 2,
   characterized in that the dryer fabric (10) is adapted to be used the dryer section at a temperature of 90-180°C and/or at a steam pressure of up to 9 bar and/or at a machine speed of up to 2.000m/min.

4. The clothing (10) according to any one of the preceding claims,
   characterized in that the base fabric (12) is a woven fabric.

5. The clothing (10) according to any one of claims 1 to 3,
   characterized in that the base fabric (12) is a spiral fabric.

6. The clothing (10) according to any one of the preceding claims,
   characterized in that the impermeable beads have a width (w) of not more than 50mm, preferably a width between 20mm and 45mm.

7. The clothing (10) according to any one of the preceding claims,
   characterized in that the maximum thickness of the impermeable beads does not exceed the maximum thickness of the base fabric (12) by more than 20%.

8. The clothing (10) according to any one of the preceding claims,
   characterized in that the impermeable beads each have a substantially flat fiber web carrying surface and/or have a substantially flat an opposite running surface.

9. The clothing (10) according to any one of the preceding claims,
   characterized in that the U.V. curable sealant has a viscosity of 2.800 mPa s to 6.500 mPa s before being cured.

10. The clothing (10) according to any one of the preceding claims,
    characterized in that the U.V. curable sealant comprises at least one of the following components:

    - N,N-Dimethylacrylamide;
    - 2-Propenoic acid, 2-hydroxyethyl ester, polymer with 5-isocyanato-1-(isocyanatomethyl)-1,3,3-trimethylcyclohexane;
    - Isobornyl acrylate;
    - 2-(2-Ethoxyethoxy)ethyl acrylate;
    - diphenyl(2,4,6-trimethylbenzoyl)phosphine oxide;
    - [3-(2,3-Epoxypropoxy)propyl]trimethoxysilane;
    - Acrylic acid;
    - 2-Hydroxyethyl acrylate,

    wherein preferably none of said components contributes with more than 50 weight-% to the composition of the U.V. curable sealant.

11. Method of producing a fiber web machine clothing (10) according to any of the preceding claims, the method comprising the following steps:

    a) providing a permeable base fabric (12) which is substantially made up from yarns, wherein the base fabric (12) has a fiber web carrying surface and an opposite running surface, as well as two opposite lateral edges (18);
    b) coating via a dispensing system (22) the edge portions of the base fabric (18) with a U.V. curable sealant which comprises or consists of an acrylic material;
    c) curing the U.V. curable sealant by using irradiation from a U.V. source (24) to thereby form a pair of continuous edge sealing strips (20).

12. Method according to claim 11,
    characterized in that the distance between the position where the U.V. curable sealant is applied to

the edge portions and the position where the U.V. curable sealant is cured is not larger than 200cm, preferably is between 90cm and 120cm.

13. Method according to claim 11 or 12, **characterized in that** during the coating step b) and the curing step c) the base fabric is moving with a process speed between 8m/min and 12m/min relative to the dispensing system (22) and/or the U.V. source (24).

14. Method according to any one of claims 11 to 13, **characterized in that** in the coating step b) the U.V. curable sealant leaves the dispensing system (22) with a pressure between 2,5 bar and 6,5 bar and/or with a flow rate between 250 g/min and 950 g/min.

15. Method according to any one of claims 11 to 14, **characterized in that** the U.V. intensity of the U.V. source for curing the U.V. curable sealant is not larger than 250mW/cm^2, preferably between 40mW/cm^2 and 100mW/cm^2.

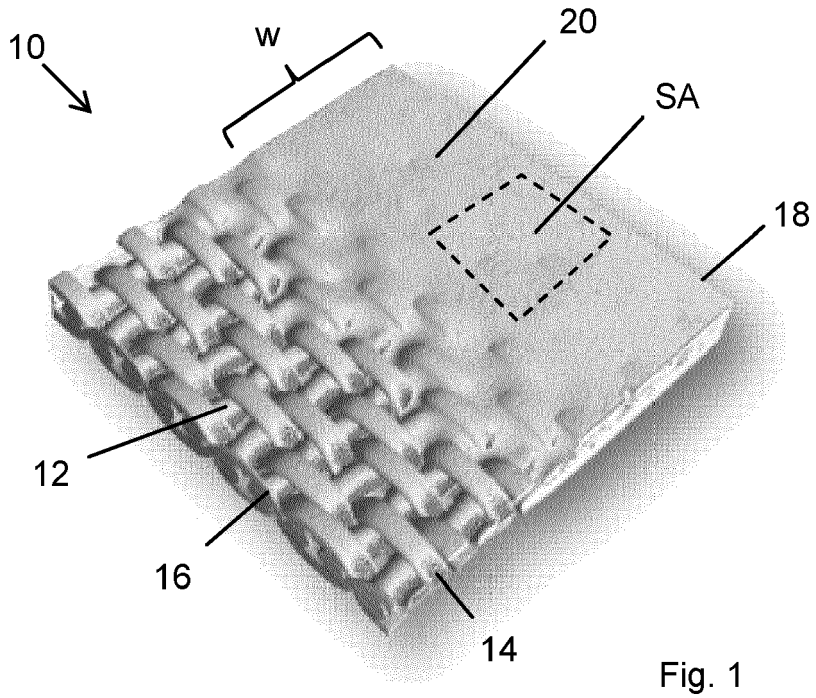

Fig. 1

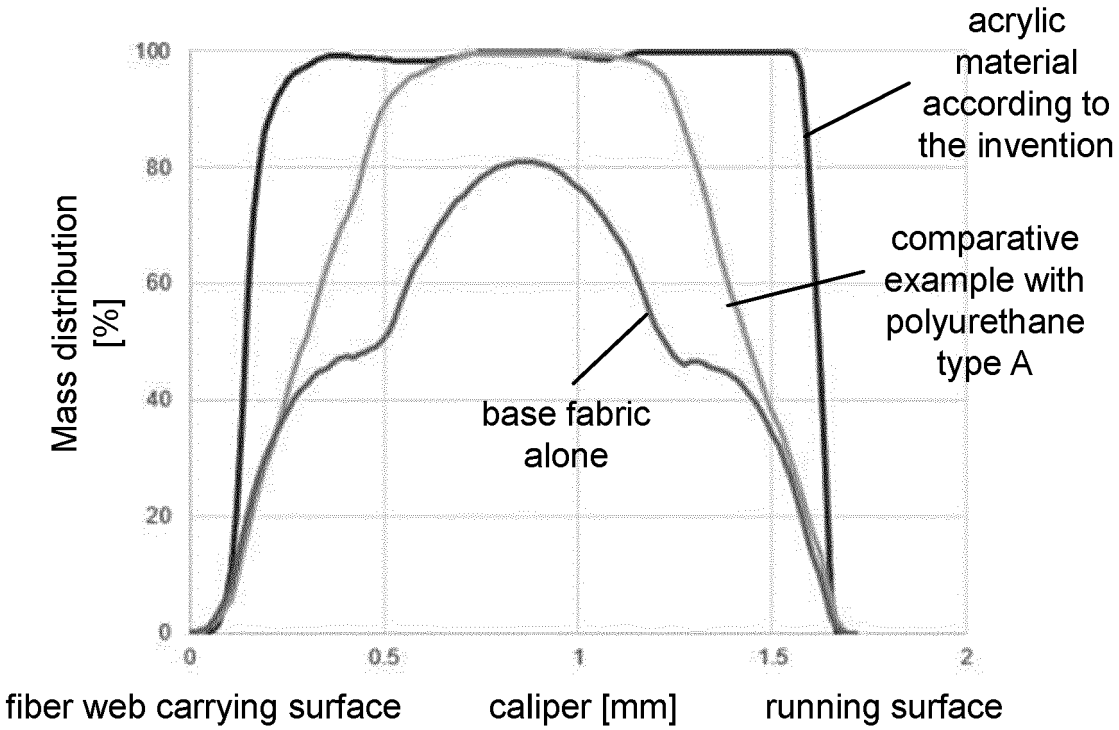
acrylic material according to the invention
comparative example with polyurethane type A
base fabric alone
Mass distribution [%]
100
80
60
40
20
0
0
0.5
1
1.5
2
fiber web carrying surface
caliper [mm]
running surface

Fig. 2

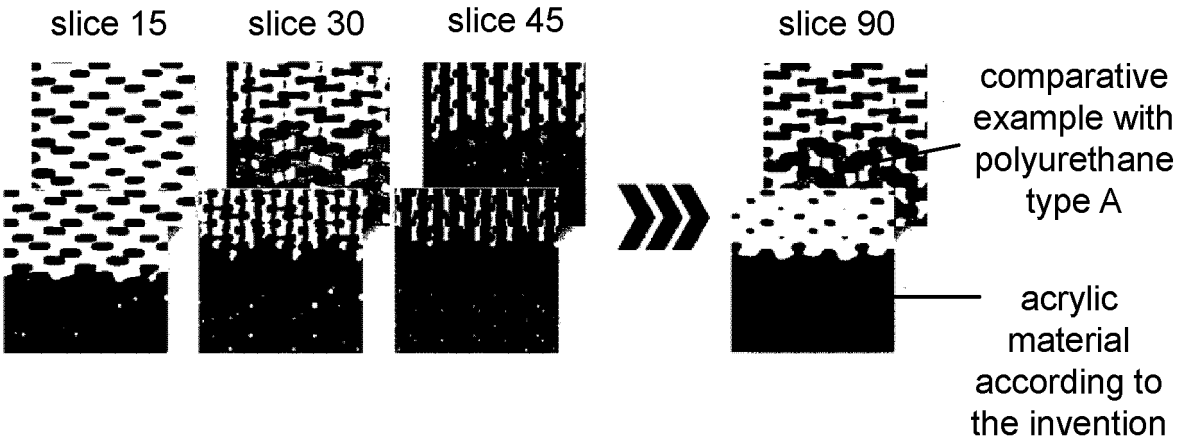
slice 15
slice 30
slice 45
slice 90
comparative example with polyurethane type A
acrylic material according to the invention

Fig. 2a

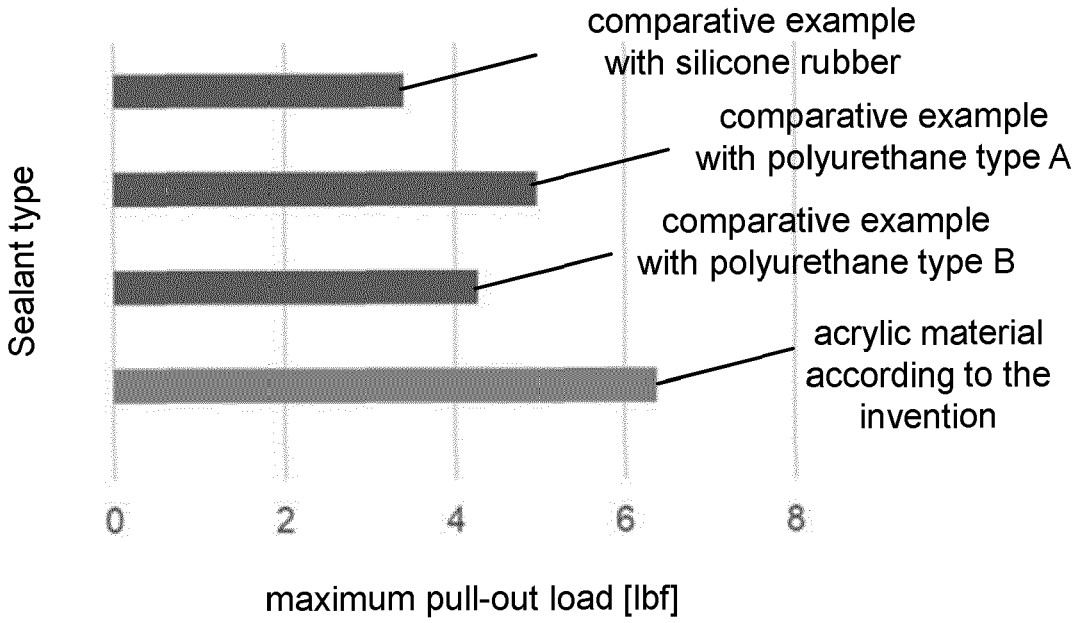
comparative example with silicone rubber
comparative example with polyurethane type A
comparative example with polyurethane type B
acrylic material according to the invention
Sealant type
0
2
4
6
8
maximum pull-out load [lbf]

Fig. 3

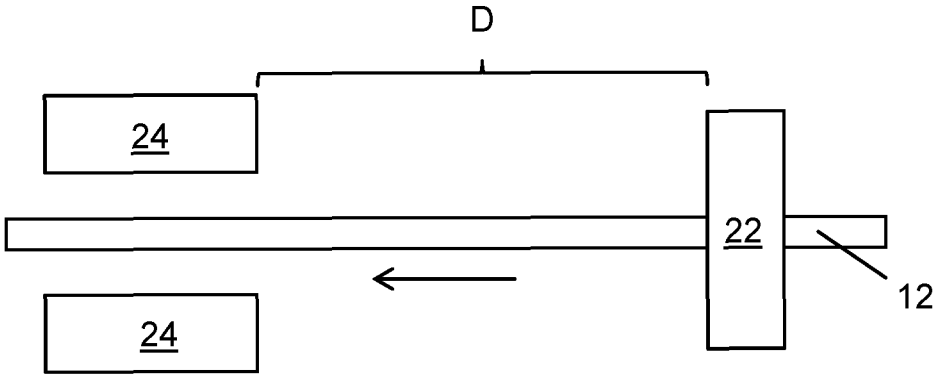
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Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 23 15 9843

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Place of search	Date of completion of the search	Examiner
Munich	30 August 2023	Pregetter, Mario

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