Abstract: The invention relates to a clothing (1) for a web-processing machine, in particular a tissue machine, including a flat basic structure (3) with an upper side (2) and a lower side (9), and with a coating (6) which is applied to the upper side (2) and/or lower side (9) and includes at least one polymer material. At least one polymer material is a polyurea, in particular an elastomer polyurea.

Title: PAPER MACHINE CLOTHING WITH EDGE REINFORCEMENT

Fig. 1
Declaration under Rule 4.17:
— of inventorship (Rule 4.17(iv))

Published:
— with international search report
1. Field of the Invention

[0001] This invention relates to a clothing for a web-processing machine, in particular a paper machine, paperboard machine or tissue machine.

2. Description of the Related Art

[0002] To improve wear resistance and/or hydrolysis resistance, clothings for web-processing machines are often equipped in their edge region and/or seam region with a coating. Said coatings frequently have the disadvantage of not adhering firmly enough to the threads of the, for example woven, structure of the clothing and therefore of flaking off the threads when exposed to the effects of tensile stress, abrasion forces, heat and moisture. In particular on dryer fabrics or through-air dryer ("TAD") meshes, which are exposed to high temperature combined with a high level of moisture and for this reason are often equipped with or made from PET threads, it is a problem that the coatings known from the prior art flake off the PET threads after a short time already. These coatings frequently also improve the hydrolysis resistance of such meshes only to a limited extent or not at all.

[0003] What is needed in the art is a clothing of the type initially referred to on which the described flaking does not occur or occurs only to a much reduced extent and through which the hydrolysis resistance of the herewith equipped clothing is clearly being improved.

SUMMARY OF THE INVENTION

[0004] The present invention provides a clothing for a web-processing machine, in particular a paper machine, paperboard machine or tissue machine, including a flat basic structure with an upper side and a lower side, and with a coating which is applied to the upper side and/or lower side and includes at least one polymer material, whereby the at least one polymer material is a polyurea, in particular an elastomer polyurea.

[0005] By providing a coating containing a polyurea, a coating with a much improved adherence to the basic structure of the clothing, a far higher resistance to abrasion and a far
higher resistance to chemicals is provided. The penetration of moisture into the material of the basic structure is prevented by the coating, leading to a clear improvement in the hydrolysis resistance of the clothing that is provided with said coating.

[0006] The inventive clothing is used in this case preferably but not exclusively for applications in which the clothing is exposed to a high level of moisture combined with a high temperature. For example the inventive clothing is used as a dryer fabric or a TAD mesh. It is however also possible that the inventive clothing is a press felt or a forming screen.

[0007] One embodiment of the invention provides that the coating is applied only in some areas on the upper and/or underside of the basic structure. Alternatively it may be provided that the coating is applied to the entire upper- and/or underside of the basic structure. "In some areas" is to be understood specifically to mean that the coating is applied only to a section of the width of the clothing.

[0008] Preferably the flat basic structure is a fabric. The fabric is hereby formed preferably by monofilament threads. In the section where the coating is applied the threads which form the fabric are advantageously covered at least partly, especially completely, by the coating. Preferably the entire fabric is covered by the coating in that area in which the coating is applied to the fabric. In this way the threads of the fabric are protected from harmful ambient influences.

[0009] In addition, in the area(s) which is (are) provided with the coating the threads of the fabric are preferably connected with each other due to the coating at the thread crossing points and/or thread contact areas. Thread contact areas are created, for example, when the polyurea coating is applied to that area in which the threads run parallel to each other and touch each other. This clearly improves the dimensional stability of the inventive clothing. In addition, the accumulation of dirt in the thread crossing points is hereby clearly reduced.

Since the threads are connected with each other, the interior abrasion of the clothing is further
obviated or at least minimized, determined by the relative movement of the threads between each other.

[0010] In addition, trials conducted by the applicant have shown that the polyurea coating can accumulate also between the threads at the thread crossing points or contact areas and are separated from each other by this coating and are, so to speak, elastically stratified on said coating. In other words, the polyurea coating forms an elastic intermediate layer between threads at thread contact or thread crossing points.

[0011] In order to produce the inventive clothing it is possible to first produce the basic structure and to subsequently provide the completed basic structure with the coating. If the basic structure for example is in the embodiment of a woven fabric, then the fabric in this scenario is produced - in other words woven - first and is then provided with the coating.

[0012] Alternatively it is possible to first provide a portion of the threads which make up the fabric with the coating, and to subsequently interweave the so coated threads during the production of the fabric.

[0013] Advantageously the basic structure is permeable for water and air. Depending on the requirements, the coating can be applied in this connection such that the permeability is not affected by said coating, meaning that the clothing in the coated area has the same or essentially the same permeability as in the uncoated area. Alternatively, the permeability of the clothing in the coated area can be lower than the permeability in the uncoated area. For example, the permeability of the clothing in the coated area can be a maximum of 20% less, for example a maximum of 15% less, for example a maximum of 10% less than in the uncoated area. With a fabric this is achieved in particular by filling out the meshes of the fabric in at least some areas.

[0014] In addition it is possible that the clothing in the coated area is impermeable for air and water and that the clothing in the uncoated area is permeable. This is achieved in particular by the upper side and the lower side of the basic structure in the coated area being
covered completely by the coating.

[0015] Preferably the coating is applied to the basic structure such that the thickness of the clothing in the coated area is equal to or only non-essentially greater than that in the uncoated area. In this connection, essentially greater is understood to be a clothing thickness in the coated area which is a maximum 15%, in particular a maximum 10% greater than in the uncoated area. The thickness of the coating can be in the range of approximately 1µm to approximately 6µm, preferably in the range of approximately 3µm to approximately 30µm. Layer thicknesses in the range of 1 - 60µm are especially advantageous if the clothing is permeable in the area of the coating.

[0016] The fabric is preferably a three-dimensionally structured fabric, in particular a TAD mesh.

[0017] The inventive clothing can be used preferably on a tissue machine on which the tissue web is formed on the clothing from the fibrous suspension and the formed tissue web is then conveyed on this clothing as far as the Yankee drying cylinder. Preferably the tissue web is charged in this case upstream from the drying cylinder with a hot air current and/or steam current.

[0018] For the previously mentioned application it makes sense in particular for the fabric to include polyethylene terephthalate ("PET") and/or polyamide ("PA") and/or polyphenylene sulfide ("PPS") threads. It is therefore possible that the fabric representing the basic structure is formed entirely from threads of one of the PET, PA or PPS materials. It is however also possible that the fabric is formed partially from threads from one of the first of the aforementioned materials and partially from threads of one of the subsequently aforementioned materials.

[0019] It has been discovered that the inventive coating already possesses the advantageous properties when the polyurea is present in the coating with a weight fraction of 10 % or more.

[0020] Preferably the polyurea is a two-component polyurea, whereby the one component
of the two is preferably a diisocyanate and the other of the two components is preferably a diamine. The use of a diamine is advantageous in particular due to its low viscosity, which permits auxiliary materials to be added without the viscosity and the mix behavior being affected thereby. Preferably used in particular is a diisocyanate known under the trade-name Araltide AY 8683. Also preferably used in particular is a diamine known under the trade-name Hardener HY 8683.

[0021] It is also conceivable that the polyurea is a single-component polyurea. A single-component polyurea of this type may for example be moisture-hardening or moisture-crosslinking. A catalyst can be used to speed up the hardening or cross-linking reaction. Products to be considered as single-component polyurea are for example products produced by "Nitroil Performance Chemicals" under the label "PC MD 8.6" or "PC MD 11".

[0022] Single or two-component polyurea may for example, be applied onto the basic structure in diluted form or as a solution in an organic solvent. The solvent used in this application is in particular a non-protic solvent. For example THF (Tetrahydrofurane) would be suitable as a non-protic solvent.

[0023] Preferably the coating including the polyurea possesses a temperature stability of 180°C to 220°C at a temperature reaction time of at least 2 minutes. In this context, temperature stability is to be understood to mean that the coating shows no degradation aspect, visible to the naked eye.

[0024] To improve further the adherence of the coating to the basic structure, a preferred embodiment of the invention provides for the basic structure to be subjected, prior to the coating being applied, to a surface treatment at least at those points which are covered with the coating. The surface treatment can include, either alone or in combination, cleaning with a solvent or by way of corona discharge. The surface treatment can, for example additionally include treatment of the basic structure with atmospheric pressure plasma. In this context it is also possible that the atmospheric pressure plasma is an oxygen plasma.
Another advantageous embodiment of the invention provides for the coating to contain an additive which increases the wear stability of the coating and/or reduces the coefficient of friction of the coating. In particular colloidal silicone dioxide, ultra high molecular weight polyethylene ("UHMW PE") or boronitride can be cited by way of example as additives for use alone or in combination in this connection.

In this connection it is particularly advantageous in particular for the additive to include particles, in particular nanoparticles, or for it to be formed by particles, in particular nanoparticles.

As it is in particular the longitudinal edges of the basic structure which are exposed to greater abrasion and/or an increased temperature stress, then it is an advantage in particular for the coating to be applied in the region of the two longitudinal edges of the basic structure. The increased temperature stress is caused especially in that the longitudinal edges along the edge areas of the clothing are not covered by a paper web and are therefore, for example in a TAD machine, subjected directly to the full hot air flow.

Especially in order to increase the hydrolysis stability it is useful if the coating - when viewed in transverse machine direction - extends from each of the two longitudinal edges in direction toward the center of the clothing to a point where at least the two areas of the clothing are coated which are never in contact with the paper web during operation of the clothing. In order to further increase the hydrolysis stability of the inventive clothing it can be useful if the coating extends from each of the two longitudinal edges in direction toward the center of the clothing to a point that the two areas of the clothing are coated which only come into contact with the paper web only temporarily while the paper web is in contact with the clothing, for example edge strip areas.

It can be useful, especially in order to increase the abrasion resistance, if the coating extends from the longitudinal edges over approximately 3/8 inch to 1 inch in the cross machine direction ("CMD direction"). In order to increase the hydrolysis stability it can be
useful if the coating extends from the longitudinal edges approximately 5 cm to 20 cm in CMD direction.

[0030] Also exposed to greater wear is the seam region. A preferred embodiment of the invention thus provides for the basic structure to have transverse edges, which extend in the CMD direction and can be joined together in order to render the basic structure endless while constructing a seam region, and for the coating to be applied in the region of the transverse edges.

[0031] Possible application methods for applying the coating are, for example, dip-coating and subsequent wiping in order to equalize the coating, roll coating, knife-coating, spray coating or extrusion coating.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and the invention will be better understood by reference to the following description of embodiments of the invention taken in conjunction with the accompanying drawings, wherein:

[0033] Fig. 1 shows a first embodiment of an inventive clothing in a plan view of its upper side;

[0034] Fig. 2 shows the clothing from Fig. 1 in cross-sectional direction;

[0035] Fig. 3 shows a top view of the upper side of a second embodiment of an inventive clothing;

[0036] Fig. 4 shows a cross-directional view of the clothing depicted in Fig. 3; and

[0037] Fig. 5 is a device for the production of an inventive clothing.

[0038] Corresponding reference characters indicate corresponding parts throughout the several views. The exemplifications set out herein illustrate embodiments of the invention, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.
DETAILED DESCRIPTION OF THE INVENTION

[0039] Referring now to the drawings, and more particularly to Fig. 1, there is shown an embodiment of an inventive clothing 1 in a plan view of its upper side 2.

[0040] The represented clothing 1 is a TAD mesh. The mesh 1 has a flat basic structure which is formed by a permeable fabric 3 woven from PET threads 4 and 5.

[0041] In addition the mesh 1 includes a coating 6 which is applied respectively in the region of the two longitudinal edges 7 and 8 extending in the machine direction (“MD direction”) and in edge areas 10, 11 on the fabric 3 on the upper side 2 and on the lower side 9 (shown only in Fig. 7). Between the two coated edge areas 10, 11 is an uncoated area 13.

[0042] According to the invention the coating 6 includes a polymer material, which in the example in question is formed by a two-component elastomer polyurea and nanoparticles 12 of boronitride. The wear stability of the coating 6 is increased by the boronitride nanoparticles 12.

[0043] The coated edge areas 10, 11 extend in this case respectively by approximately 1 inch from the longitudinal edges 7 and 8 in the CMD direction. The coating is applied in this case such that the upper side 2 and the lower side 9 of the fabric 3 in the coated edge areas 10, 11 are covered completely by the coating and the edge areas 10, 11 are impermeable.

[0044] Fig. 2 shows the mesh 1 from Fig. 1 in the cross-sectional direction (CMD direction) in the region of the coated edge area 10 and the adjacent uncoated area 13 of the fabric 3. It is evident that the thickness of the mesh 1 in the coated edge area 10 is only non-essentially greater than in the uncoated area 13, whereby in the case in question the clothing thickness in the coated edge area 10 is a maximum 5% greater than in the uncoated area 13.

[0045] Fig. 3 shows a top view of the upper side 102 of one embodiment of an additional inventive clothing 101.

[0046] The illustrated clothing 1 represents a dryer fabric or TAD mesh. The mesh 101 has a flat basic structure which is formed by a woven and permeable fabric 103 which consists of
PET threads 104 and 105.

[0047] The mesh 101 further includes a coating 106 which is applied respectively onto the top side 102 of the fabric 103 in the edge regions 110, 111 which run along the two longitudinal edges 107 and 108 progressing in MD direction, and onto the underside 109 which is only depicted in Fig. 4. A non-coated area 113 is located between the two coated edge areas 110, 111.

[0048] In accordance with the invention the coating 106 includes a polymer material which, in the current example is composed by a single-component, or two-component elastomer polyurea.

[0049] The two broken lines in the illustration in Fig. 3 separate a paper contact area 114 of the clothing 101. That is, they separate an area which may be brought into contact with a paper web during operation of the inventive mesh 101 from two paper-free areas 115 and 116 with which the paper web is never in contact during operation.

[0050] As can be seen in the illustration in Fig. 3 the coating 106 - when viewed in cross machine direction (CMD) - extends from each of the two longitudinal edges 107 and 108 in the direction toward the center of the clothing 101 to a point where at least the two areas 115 and 116 of the clothing 101 are coated which are never in contact with the paper web during operation of the clothing 101. In this example the coating 106 even extends from each of the two longitudinal edges 107 and 108 in CMD direction into a section of the paper contact area 114.

[0051] In this scenario the coating 106 is applied onto the upper side 102 and the underside 109 of the fabric 103 in such a way that the threads 104 and 105 are completely enveloped in the coating 106. In addition, the threads 104, 105 are connected with each other through the coating 106 at the thread crossing points 117. The coating 106 has a thickness which may be in the range of approximately 1µm to approximately 60µm. The permeability of the clothing 101 is not substantially affected by the coating 106, so that the fabric 103 has a permeability
in the non-coated region 113 which is essentially the same as the permeability in the two coated edge sections 110, 111.

[0052] "Essentially the same permeability" in this context is to be understood to mean that the permeability in the coated edge sections 110, 111 is a maximum of 15%, preferably a maximum of 10% less than the permeability in the non-coated section 113.

[0053] Fig. 4 shows the mesh 101 of Fig. 3 in cross direction (CMD-direction) in the area of the coated edge section 110 and the non-coated section 113 of the fabric 103 adjacent to it. It is evident that the coating forms a film which fully covers the threads 104, 105 in the coated edge area 110 and which connects the threads 104, 105 with each other at the thread crossing points 117.

[0054] Fig. 5 shows a device for the production of an inventive clothing. Here, a continuous basic structure in the embodiment of for example a fabric 203 is stretched between two rolls 204, 205 which are positioned parallel to each other. Prior to the application of the coating 206 the fabric 203 is pre-treated by way of atmospheric pressure plasma which is produced by a plasma nozzle 207. An applicator roll 209 is used to apply the polyurea coating 206 with which the polyurea which was dissolved in an organic solvent is applied onto the fabric 203. After the application of the coating material said coating material is, for example, subjected to a heat treatment by way of a dryer 208, causing it to harden or cross-link and forming the coating.

[0055] While this invention has been described with respect to at least one embodiment, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.
WHAT IS CLAIMED IS:

1. A clothing for a machine which processes a web of fibrous material, said clothing comprising:
   a flat basic structure including an upper side, a lower side, and a coating applied to at least one of said upper side and said lower side, said coating including at least one polymer material which is a polyurea.

2. The clothing according to claim 1, wherein said polyurea is an elastomer polyurea.

3. The clothing according to claim 1, wherein said coating is applied in a plurality of areas of said basic structure only on at least one of said upper side and said lower side of said basic structure.

4. The clothing according to claim 1, wherein said coating is applied to at least one of all of said upper side and all of said lower side of said basic structure.

5. The clothing according to claim 1, wherein said flat basic structure is a fabric.

6. The clothing according to claim 5, wherein said fabric includes a plurality of threads in an area of said fabric in which said coating is applied, said plurality of threads in said area being covered at least partly by said coating.

7. The clothing according to claim 5, wherein said fabric is a three-dimensionally structured fabric.

8. The clothing according to claim 7, wherein said three-dimensionally structured
fabric is a through-air dryer mesh.

9. The clothing according to claim 5, wherein said fabric includes at least one of a plurality of polyethylene terephthalate threads, a plurality of polyamide threads, and a plurality of polyphenylene sulfide threads.

10. The clothing according to claim 1, wherein said polyurea is present in said coating with a weight fraction of at least 10%.

11. The clothing according to claim 1, wherein said polyurea is a two-component polyurea.

12. The clothing according to claim 1, wherein said basic structure includes a plurality of points covered with said coating, said basic structure having been subjected, prior to said coating being applied, to a surface treatment at said plurality of points which are covered with said coating.

13. The clothing according to claim 1, wherein said coating includes an additive configured for at least one of increasing a wear stability of said coating and reducing a coefficient of friction of said coating.

14. The clothing according to claim 13, wherein said additive includes at least one of colloidal silicone dioxide, ultra high molecular weight polyethylene, and boronitride.

15. The clothing according to claim 13, wherein said additive includes a plurality of particles.
16. The clothing according to claim 13, wherein said additive includes a plurality of nanoparticles.

17. The clothing according to claim 1, wherein said basic structure includes two longitudinal edge regions each including a longitudinal edge of said basic structure, said coating being applied in each of said longitudinal edge regions.

18. The clothing according to claim 17, wherein said coating extends from each said longitudinal edge over approximately 3/8 inch to approximately 1 inch in a cross machine direction.

19. The clothing according to claim 1, wherein said basic structure includes two transverse edge regions each including a transverse edge of said basic structure, each transverse edge extending in a cross machine direction of the clothing, said transverse edges being joined together and thereby rendering said basic structure endless and forming a seam region, said coating being applied in said transverse edge regions.
INTERNATIONAL SEARCH REPORT

A CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B41M 5/00, D21F 11/04 (2008.04)
USPC - 428/195.1, 162/203

According to International Patent Classification (IPC) or to both national classification and IPC

B FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC - 428/195 1, 162/203

Documented searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 442/218, 402/56,59, 162/203,358 2,900, 156/181,92, 428/1 14,131,190,195 1,542 2 (text search - see search terms below)

Electronic data base consulted during the international search (name of database and, where practicable, search terms used)
PubWEST (PGPB,USPT,OC,EPAB,JPAB), DialogPro (General Research), Google Scholar
Cloth, cover, fabric, machine, process, coat, polymer, polyurea, elastomer, thread, yarn, structure, TAD, through-air, PET, PPS, PA, %, treatment, friction, wear, stability, resistance, colloidal, dioxide, polynuclear, boronitride, nanoparticle

C DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
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<tr>
<td>X</td>
<td>US 2008/0182936 A1 (PAYNE et al.) 17 August 2008 (17 08 2006) abstract. Fig 2-4 and 8, para [0003], [0011]-[0013], [0019]-[0021], [0034]-[0036] and [0048]-[0052]</td>
<td>1-3, 5, 6 and 9-11</td>
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<td>Y</td>
<td>US 2006/019567 A1 (LAYERS) 26 January 2006 (26 01 2006), abstract. Fig 1, 4, 5 and 9, para [0002]-[0006], [0016]-[0024], [0030]-[0033], [0036], [0038], [0039], [0069], [0070], [0076], [0078] and [0079]</td>
<td>4, 7, 8 and 12-19</td>
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<td>US 2002/018336 A1 (KOLB et al.) 12 September 2002 (12 09 2002), abstract, para [0001]-[0004], [0007]-[0010], [0013], [0024], [0060], [0062], [0063], [0093], [0095]-[0098]</td>
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<td>A</td>
<td>US 5,506,033 A (SMITH) 09 April 1996 (09 04 1996), entire document</td>
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Further documents are listed in the continuation of Box C

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Date of the actual completion of the international search
19 June 2008 (19 06 2008)

Date of mailing of the international search report
01 JUL 2008

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