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(54) Integral belt for an extended nip press

(57) Nip press belt of a wet press or a calender with elongated nip, in particular for a paper, cardboard or tissue machine, with a flexible elastomer or thermoplastic layer that is impermeable to liquids, one surface of which during operation serves as the sliding layer, being in contact with the pressing element, and with an integral, textile-based carrier- and function-layer that is intimately and fixedly connected to the other surface of the sliding layer and has a free superficial region that acts as water-extraction profile.

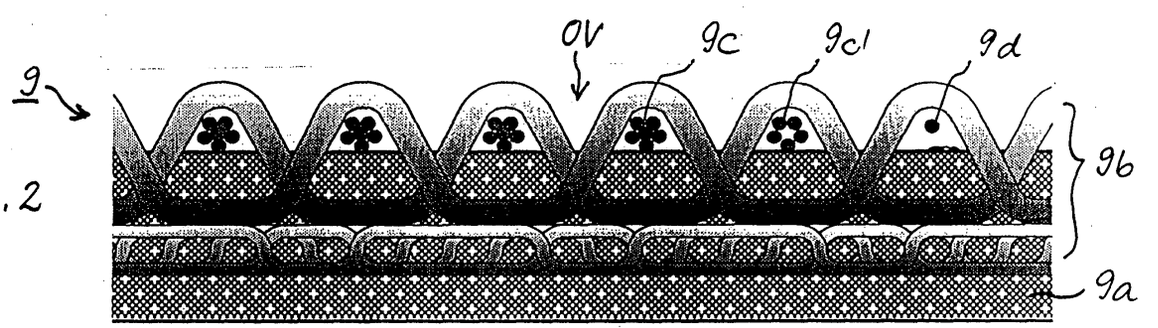

Fig. 2

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Description

[0001] The invention relates to a nip press belt for a wet press or a calender, in particular in a paper, cardboard or tissue machine, according to the precharacterizing clause of Claim 1.

[0002] A nip press belt of this kind, in German also called *Preßmantel* (translatable as "press jacket"), is used in paper, cardboard or tissue machines to extract most of the water from the product concerned (wet press) or to finish the surface (calender). Such presses or calenders have an elongated press gap ("nip") and are therefore also called "nip presses".

[0003] Within the nip the press belt makes sliding contact, by way of its back (lower) surface, with the actual pressing element; therefore this back surface must have excellent sliding properties. On its front (upper) surface the press belt makes contact either with a pulp felt (by way of which it indirectly contacts the product concerned) or - in the case of a calender - directly with the product, against which it is pressed by a rotating roller.

[0004] In addition to the above-mentioned sliding properties of the back surface, another important factor is the impermeability of the belt to liquid, because water should not pass from the product or pulp felt to the pressing element, nor may lubricant from the latter enter the product or the felt. Furthermore, certain elasticity and flexibility characteristics are required.

[0005] Nip press belts of various designs are known in the state of the art.

[0006] For example, the patent EP 0 420 372 B1 describes a nip press belt of this generic kind with a basic web in the form of an endless loop covered on its inner and outer surfaces with a smooth polymer-resin coating, which makes the web impermeable to liquids and endows it with a uniform thickness. The polymer resin that forms the elastomer is here specified as polyurethane.

[0007] The patent DE 50 20 005 C1 discloses another band for use in paper machines, in particular wet presses with elongated nip (nip presses). The band has on its back surface a smooth, flexible band layer that is impermeable to liquids, and on the front surface there is a carrier tread with a fiber layer attached thereto.

[0008] The patent DE 42 02 731 A1 also discloses a belt, here termed "jacket", of this generic kind for a nip press, which comprises an elastomeric jacket material and two layers of reinforcing threads. As specification of the jacket material, reference is made here on one hand to material capable of swelling, and on the other hand to polyurethane.

[0009] In WO 95/16820 a paper-machine web - specifically a nip press belt - is described in which a carrier web with a polymer coating is provided, which comprises a thixotropic material (for example, aramid or silica glass). The base material specified here, again, is polyurethane.

[0010] Furthermore, the patent DE 44 38 354 A1 discloses another press jacket made of elastomeric material, in which is embedded substantially parallel to the surface a woven layer of an extremely stable material, for example aramid fibers.

[0011] In EP 0 258 759 a wet press for extracting the water from strips of fibrous material is described, which likewise comprises a nip press belt (here called "continuous belt"), and this document also discusses appropriate parameters for an elastomeric or rubber coating of this belt as well as the possibility of vulcanizing or pouring the elastomeric material onto the armoring of this belt.

[0012] The document EP 0 939 162 describes a nip press belt for paper machines with a multilayered construction, which also comprises specially oriented or wound textile layers and is said to be extraordinarily stable both in the machine direction and in the direction transverse thereto.

[0013] A nip press belt of this kind that has been further developed with respect to its elasticity properties and an advantageous multidimensional bending behavior is described in the applicant's patent EP 1 251 203 A1. This more recent nip press belt is distinguished by being made of soft rubber with particular properties and, in advantageous embodiments, by the special structure of a textile reinforement layer. This new belt, based on soft rubber, is preferably used in the so-called brown-paper market, but is also equally interesting for tissue applications, because the soft-rubber strip is well adapted to the movements of the so-called Yankee and promotes the production of a voluminous tissue product.

[0014] In the context of these known solutions, it is the objective of the present invention to disclose a nip press belt with especially simple construction and hence low manufacturing costs, which nevertheless fulfills all the demands made in practice and achieves a long running time. In addition, at least one appropriate manufacturing procedure for such a nip press belt is disclosed.

[0015] This objective is accomplished with respect to the apparatus by a nip press belt with the characteristics given in Claim 1, and with respect to method by a manufacturing method with the characteristics given in Claim 9 or 10.

[0016] The invention includes the fundamental idea that the nip press belt is integrally designed so as to produce the necessary profile of properties over its cross section, from the surface that contacts the pressing element to the surface that contacts the strip of fibrous material. It further includes the idea of implementing the water-extraction function of the belt by means of at least a superficial region of the carrier or reinforcement layer, which also provides the required tensile strength and is to a great extent embedded in the belt.

[0017] Thus the carrier web serves both to ensure the necessary stability and resistance to deformation and also to extract water from the strip of fibrous material, so that there is no longer any need for a separate layer with special properties for water extraction. Hence a special manufacturing step to produce such a layer can

be eliminated, which means that there is a considerable potential for cost reduction. The integral belt proposed here is suitable for all nip-press applications.

[0018] The integral basic web can be constructed as a stitched-felt or continuous fabric, and can be single- or multi-layered, depending on the intended use. Furthermore, the decision as to whether the components of the basic fabric should be twisted or untwisted monofilaments, or a longitudinal/transverse combination of these variants, is made according to the specific purpose of the belt.

[0019] In a preferred embodiment of the proposed nip press belt a substantial proportion, in particular in the range between 1/3 and 2/3, of the thickness of the integral carrier and functional layer serves as the water-extraction profile for the object being pressed, while the remaining fraction of the thickness is fixedly connected to the surface on which the belt slides. Also preferred is an embodiment with ca. 30-50% exposed area (textile surface) on the water-extraction side (as "water-extraction profile"). This feature advantageously enables the surface facing the object to be pressed to contain none of the water-extraction structure supplementarily impressed onto the textile structure.

[0020] As far as the design of the sliding surface to achieve optimal sliding properties is concerned, the first aspect to emphasize is that it should be absolutely impermeable to water and oil. Specific elastomer materials to be especially recommended are polyurethane or a soft-rubber material. Alternatively, or in combination therewith, a thermoplastic hair, in particular PEEK, or a thermoplastic film can be employed in forming the sliding surface.

[0021] A preferred embodiment of the method for manufacturing the proposed nip press belt is distinguished by the fact that the sliding layer is attached to a cylindrical carrier so that it covers the circumference thereof, after which a spliced (or continuous) textile material with shrinkage properties is pulled onto the carrier, over the sliding layer, and the sliding layer and textile carrier are together subjected to a thermal treatment during which the textile carrier shrinks onto the sliding layer and becomes intimately connected thereto.

[0022] In another form of the manufacturing method the spliced textile material is stretched onto a cylindrical carrier and closed by a stitched seam, and thereafter a sliding-layer material is put onto the textile carrier - in particular, a thermoplastic material is pressed onto the textile carrier during the application of heat. In preparation for the latter procedure, in particular the region of the seam is covered by a strip of plastic film, in particular a Teflon strip, before the sliding-layer material is applied.

[0023] Other advantages and useful aspects of the invention will be apparent from the subordinate claims, as well as from the following description in outline of an exemplary embodiment with reference to the figures, wherein

Fig. 1 is a schematic drawing of the wet-press section of a paper machine in longitudinal section, and

Fig. 2 is a simplified cross-sectional drawing of an embodiment of the nip press belt of such a wet press, constructed in accordance with the invention.

[0024] Figure 1 shows part of the nip of a wet press 1 (nip press) of a paper machine with elongated nip. Opposite a pressing element 3 is disposed a press-roller 5, and in the gap between these two, namely the nip 7, water is removed from a paper web 13 enclosed between the surface of the press-roller 5 and a nip press belt 9 that slides along the pressing element 3, with a pulp felt 11.

[0025] The nip press belt 9 must on one hand have elasticity and flexibility such that it conforms as well as possible to the curved surface of the pressing element 3 and exerts an elastic pressure uniformly upon the paper web 13 (by way of the pulp felt 11). On the other hand, it must be sufficiently stable to withstand the high, long-term stress (tension, pressure and vibration) in the nip 7 for a service time that is economically acceptable.

[0026] A nip press belt 9 suitable to meet these demands is shown (schematically) in cross section in Fig. 2. This belt is so designed that it will remain stable in the long term at temperatures above 100°C, and can tolerate brief temperature peaks of up to ca. 130°C; its overall thickness is in the range between 3 and 6 mm, and it has a hardness in the range between 5 and 30 P+J.

[0027] In the illustrated embodiment the nip press belt 9 consists of a thick elastomeric sliding layer 9a, made for instance of a thermoplastic resin or polyurethane, into which, while it was still in the fluid state, a multilayered carrier fabric 9b has been shrunk. Figure 2 should be regarded as a synoptic representation, inasmuch as in the upper region various kinds of multifilament threads 9c, 9c' and monofilaments 9d are symbolized as a possible implementation of the threads in the integral carrier fabric. The reference code OV designates the open volume in the belt 9, namely the space formed by the free-standing loops in the upper layer of the carrier fabric, which constitutes the water-extraction profile on the felt side.

[0028] The belt 9 is preferably constructed so that the liquid or viscous sliding layer is applied to a mandrel (or drum), after which an overdimensioned textile fabric is pulled over it, and finally this fabric is shrunk down to size by the application of heat. The particular design of the fabric to be shrunk and/or the choice of shrinkage temperature determines the force that induces the shrinking and hence the degree to which the continuously woven or spliced and seamed fabric can penetrate the sliding-layer mass.

[0029] The hardened (or at least cross-linked until it

has reached a state in which it is suitable for handling) nip press belt is subsequently removed from the processing mandrel, for example by the application of compressed air. The process of pulling the belt away from the mandrel is also facilitated by the fact that prior to the application of the sliding-layer material, the mandrel has been provided with a non-stick coating, by covering it with one of the customary substances or by wrapping a film around it.

[0030] The implementation of the invention is not restricted to the construction disclosed and described above and the above-mentioned manufacturing method, but is also possible in many modifications that are within the competence of a person skilled in the art.

Claims

1. Nip press belt of a wet press or a calender with elongated nip, in particular for a paper, cardboard or tissue machine, with a flexible elastomer or thermoplastic layer that is impermeable to liquids, one surface of which during operation serves as the sliding layer, being in contact with the pressing element,
   characterized by
   an integral, textile-based carrier- and function-layer that is intimately and fixedly connected to the other surface of the sliding layer and has a free superficial region that acts as water-extraction profile.

2. Nip press belt according to Claim 1,
   characterized in that the integral carrier- and function-layer comprises a single-lamina basic fabric, in the form of a stitched-together or continuous fabric made of twisted or untwisted monofilaments.

3. Nip press belt according to Claim 1,
   characterized in that the integral carrier- and function-layer comprises a multiple-lamina basic fabric, in the form of a stitched-together or continuous fabric made of twisted or untwisted monofilaments.

4. Nip press belt according to one of the preceding claims,
   characterized in that a substantial fraction, in particular in the range between 1/3 and 2/3, of the thickness of the integral carrier- and function-layer serves as a water-extraction profile for the object to be pressed, whereas the remaining fraction of the thickness is fixedly connected to the sliding layer.

5. Nip press belt according to one of the preceding claims,
   characterized in that the surface facing toward the object to be pressed comprises none of the water-extraction structure additionally impressed onto the textile structure.

6. Nip press belt according to one of the preceding claims,
   characterized in that the sliding layer is made of polyurethane or a soft-rubber material.

7. Nip press belt according to one of the claims 1 to 5, **characterized in that** the sliding layer comprises a thermoplastic resin, in particular PEEK.

8. Nip press belt according to one of the claims 1 to 5, **characterized in that** the sliding layer comprises a thermoplastic film.

9. Method of manufacturing a nip press belt according to one of the preceding claims,
   characterized in that the sliding layer is applied to a cylindrical carrier so as to cover its circumference, and subsequently a quasi-continuous or spliced textile material with shrinkage properties is pulled onto the carrier, over the sliding layer, and sliding layer and textile carrier are together subjected to a thermal treatment in which the textile carrier shrinks onto the sliding layer and becomes intimately connected therewith.

10. Method of manufacturing a nip press belt according to one of the claims 1 to 8,
    characterized in that a quasi-continuous or spliced textile material is stretched onto a cylindrical carrier and stitched together to form a seam, after which a sliding-layer material is applied to the textile carrier, in particular a thermoplastic material is pressed onto the textile carrier by the application of heat, and during the process of cross-linking/hardening becomes intimately connected therewith.

11. Method according to Claim 10,
    characterized in that the region of the seam is covered by a strip of plastic film, in particular a Teflon strip, before the sliding-layer material is applied.

Fig.1

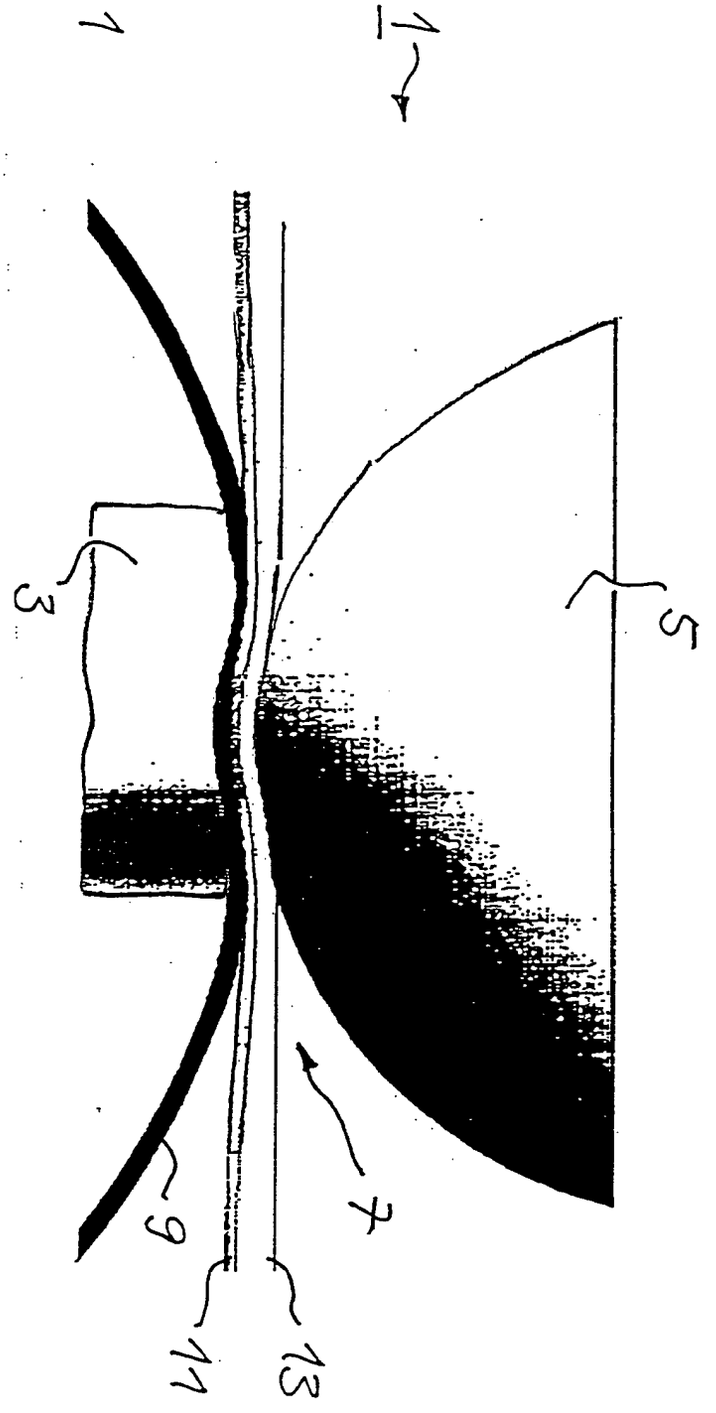
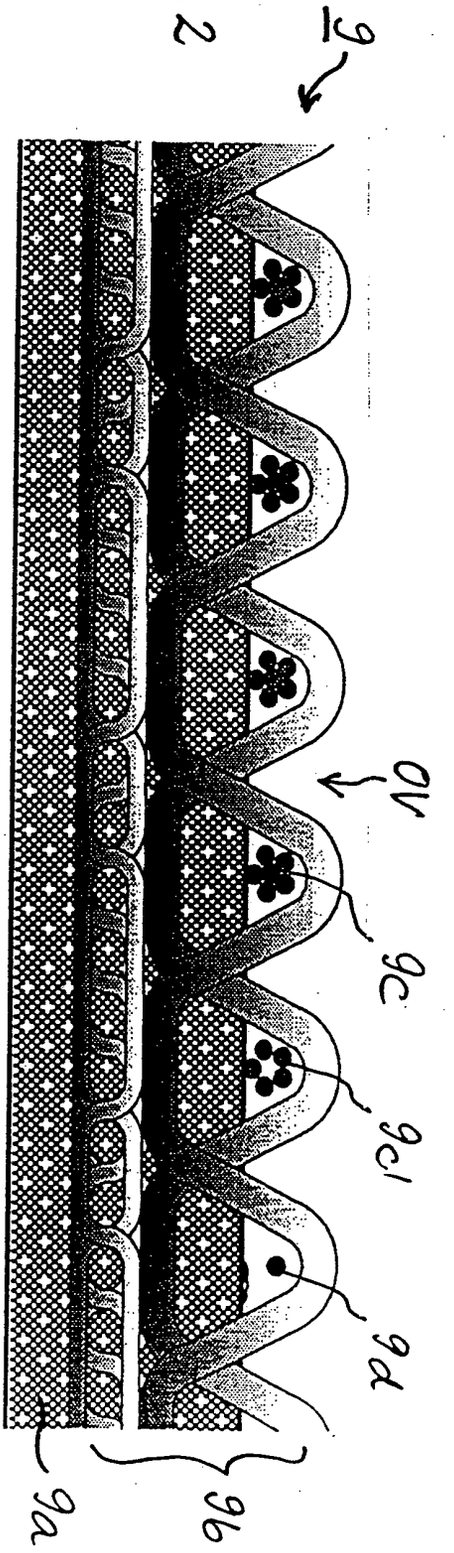


Fig. 2



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EUROPEAN SEARCH REPORT

Application Number
EP 05 00 4087

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 March 2005	Maisonnier, C

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