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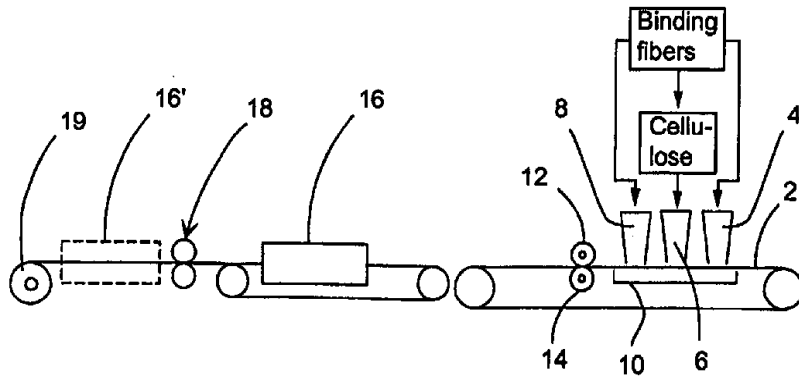


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<p>(21) International Application Number: PCT/DK97/00066 (22) International Filing Date: 12 February 1997 (12.02.97) (30) Priority Data: 0144/96 12 February 1996 (12.02.96) DK (71) Applicant (for all designated States except US): SCAN-WEB I/S [DK/DK]; Bryggervej 21, DK-8240 Risskov (DK). (72) Inventor; and (75) Inventor/Applicant (for US only): SCHILKOWSKI, Helmut, Erwin [DK/DK]; Østergårdsvej 28, DK-8340 Malling (DK). (74) Agent: K. SKØTT-JENSEN, PATENTINGENIØRER A/S; Lemmingvej 225, DK-8361 Hasselager (DK).</p>	<p>(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report. In English translation (filed in Danish).</p>	

(54) Title: AN ABSORBENT SHEET OR WEB MATERIAL AND A METHOD OF PRODUCING THE MATERIAL BY DRY FORMING



(57) Abstract

An inexpensive sheet or web shaped fibre material for use e.g. in sanitary napkins typically consists of a mixture of short cellulose fibres and some 15 % of relatively long, thermoplastic binder fibres. It is a noticeable problem that the short fibres "dust" out of the material, and according to the invention this is remedied in that the material, when made by dry forming, is provided with a surface coating of very thin layers of pure binder fibres. In addition to a marked holding back of the dust, these layers condition that the amount of binder fibres in the base material can be halved and that the breaking stress of the material is noticeably improved. Thereby the products are usable not only as inserts, but also as individual, self-contained units e.g. for wiping in domestic or industrial cleaning.

An absorbent sheet or web material and a method of producing the material by dry forming.

5 The present invention relates to a method of producing an absorbent sheet or web material by dry forming of a layer of short cellulose fibres in admixture with relatively long, thermoplastic binding fibres which are actuated by heating. Products of this type are typically used as absorbent inserts in sanitary articles, e.g. in sanitary napkins for women.

10 With respect to both production price and absorption capacity it is desirable to use a relatively low degree of admixture of the binding fibres, normally some 15%, but in return the problem arises that the products "dust" with the short fibres, which may amount to a serious problem, in particular in relevant further processing operations. In principle, it is possible to avoid the dusting by applying a bonding substance onto the product
15 surfaces, but this will complicate the manufacturing and make the products more expensive.

 It is the object of the present invention to provide an improved method of producing an absorbent sheet or web material.

 Accordingly, in a first aspect, the present invention provides a sheet or web
20 material of absorbent type consisting of an air laid product of short cellulose fibres and relatively long, thermoplastic binding fibres, the material having at least at one side a surface layer with an upconcentrated content of binding fibres, wherein the web material comprises a core or main layer of cellulose fibres in admixture with a small amount of binding fibres and, at one or both sides, a very thin surface layer solely consisting of
25 binding fibres.

 In a second aspect, the present invention provides a method of dry forming a material web according to the first aspect, whereby a mixture of short cellulose fibres and reforming wire from a forming head, whereafter the binding fibres are actuated by the web passing through a heat zone, wherein a very thin layer of binding fibres, is laid out
30 from a separate forming head before or after the laying out of the said fibre mixture so as to form a very thin surface layer on the top or bottom side of the web.

 In a preferred embodiment, it has surprisingly been found that it is possible to achieve an inexpensively obtained surface sealing which will effectively prevent any noticeable dusting from the products. To this end the production is arranged such that a laminated product is built up, comprising a first, very thin layer of pure binding fibres,



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e.g. with an amount of only some 3 g/m² and thus with a rather open structure conditioning a

5 good penetration of liquid, a following layer of a fibre mixture of short cellulose fibres and longer binding fibres, though preferably with a reduced content of binding fibres, e.g. with a ratio of 93:7 or 95:5 of cellulose and binding fibres, respectively, and a final top layer corresponding to the thin layer of binding fibres as first laid out. The product thus shaped is passed through a heating zone for actuation of the binding fibres generally in the entire laminated product.

10 The low content of binding fibres in the middle layer may result in a delamination in small areas of the product in response to folding (forming "elephant skin"). This is avoided in a preferred embodiment of the invention



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by calendering the product in a heated calander such that top and bottom layers of the product are welded together, though only over 5-20% of the surface, preferably about 10%.

In the preferred embodiment having an amount of binding fibres of only 1-5 g/m² in the outer layers, preferably 2.4 g/m², it is easily understood that these layers will be readily liquid permeable, as the open surface area will amount to 80 - 90%. On the other hand, it is partly inexplicable how the same limited fibre coating can effect a marked reduction or almost total elimination of the dusting of short fibres from the products. However, both laboratory tests and test productions have verified that this effect with respect to dust binding is indeed achieved.

In the preferred embodiment, it has been found, surprisingly, that the very thin surface layers provide for a marked increase of the tensile strength of the products, viz. as much as 3-4 times, and that the surface wear strength of the material is also considerably increased. From a quality point of view the material is hereby upgraded from an absorbent insert material, which requires a surface protecting layer, to a self contained product that is usable e.g. for cleaning purposes domestically and in the industry, while still having a low content of binding fibres of only some 15% or less.

From US-A-4,054,141 it is known to produce relatively thick pad members with a core layer of absorption fibres and with surface layers consisting of a mixture of these fibres and binding fibres. The surface layers are in no way "thin" layers with binding fibres oriented mainly in the plane of the surface, as to the contrary it is emphasized that a large part of the fibres project inwardly in or from the surface so as to enable an easier penetration of liquid and a certain cohesion in the outer layer. Thus, the the relatively thick core layer is not internally bonded, whereby it will easily delaminate, and for the formation of the surface layers it will be necessary to use a considerable amount of binding fibres, which will only partially be active as a coherent, liquid permeable surface. It is well thinkable that in some



way, not further specified, it is possible to achieve a certain surface barrier effect against extrusion of the non-bonded, short fibres in the core layer, but then only with a rather large concentration of binding fibres in a surface layer of noticeable thickness.

Moreover, the relatively large amount of binding fibres with this known method will not result in the said surprising increase of product strength, inasfar as this increase has to be connected with the fact that the binding fibres are present in a thin layer with the fibres oriented in the surface plane itself; fibres projecting inwardly from the surface cannot contribute to a strength increase and not either to a barring against extruding short fibre dust, which is an established problem in connection with aftertreatment of the products.

The method known from the US-A-4,054,141 is based on a cell filling of special moulds for forming shaped, limited pad members, while the preferred embodiment of the present invention is based on a production of a relatively thin web material which can be manufactured with much higher capacity and can be folded or pleaded into a plural layer shape and then be cut to form pad members consisting of more layers. The web or sheet material, of course, also finds many other possibilities of application.

A preferred form of the present invention will now be described by way of example with reference to the accompanying drawings, wherein:

Fig. 1 is a schematic view of a system for producing products according to the invention, while,

Fig. 2 is a sectional view of a web produced thereby.

Fig. 1 shows a dry forming system with a perforated forming wire 2, above which there is provided three consecutive forming heads 4, 6 and 8 for distribution of supplied fibres across the wire 2. Beneath the wire, fully conventionally, there is mounted a section box 10 to which air is sucked down through the wire, partly for a rapid deposition of the fibres on the wire and partly for stabilizing the formed fiber layer or layers thereon.



It is well known that with such an arrangement with more forming heads it is possible to produce laminated products, and with the invention this principle is used to the effect that there is supplied to the first and the last forming head a weak flow of air fluidized, relatively long binding fibres for the formation of outer product layers with very small thickness and density, e.g. only 2-3 g/m², while the intermediate forming head is used for the formation of the basic fiber web. This web may be made with desired properties, thickness and density out of a mixture of cellulose fibres and binding fibres, preferably with a binding fibre content of only 2-4%.

For stabilizing the very thin outer layers on the produced web, the web together with the wire is passed through a pair of rollers 12,14, which are preferably heated for achieving a slight compaction of the product, whereby it is consolidated sufficiently for a following conveying to a flow-through oven 16, in which the binding fibres are activated.

From the oven 16 the web, now stabilized, is moved through a calander unit 18, the rollers of which are kept heated to a temperature a few degrees below the actuation temperature of the binding fibres. Thereafter the web is finally reeled up at 19.

In connection with the calandering the web may be subjected to a point or line embossing for additional stabilization of the thin outer layers and for counteracting a delamination of the products.

As shown in Fig. 2 the web product will consist of an absorbent middle layer 20 of a desired thickness with surface layers 22 of binding fibers and of very small thickness. As mentioned, it has been found as a surprising fact that these surface layers even for an opening degree of 80-90% act retaining on the short cellulose fibers as present in unbonded condition in the middle layer. It is undoubtedly contributory to this effect that the surface layers are provided as separately laid out, thin layers, in which the binding fibres will predominantly be oriented in the layer plane itself, while the same fibres in the middle layer occur with random orien-

tations so as to have no special barrier effect towards the loose short fibres.

5 It is also the pronounced layer orientation of the cover fibres that will condition the said marked increase of strength, because of the strong mutual binding of the fibres. In this connection it is important that the binding fibre layers are as "clean" as possible, because the presence of even a small amount of cellulose fibres would weaken the binding in the layers noticeably.

10 It is not required to use precisely the same type of binding fibres in the middle layer and the surface layers, respectively, and it can even be considered to optimize the surface fibres without heavy economical consequences, because they are used in very small amounts only.

15 For certain products, e.g. for further monolateral lamination, it may be sufficient to use a surface layer 22 at one side only.

20 It should be mentioned that it has been found by experiments that a layer thickness of 7-10 g/m² in the surface layers of the heat actuated binder fibres results in an unacceptable reduction of the absorption capacity and the opacity. In a product of 75 g/m² the total content of binding fibres will then be some 30%, rendering the product perceivably "synthetic" and unrealistically expensive.

25 It has been found that it is possible to obtain a further and quite noticeable increase of the tensile strength by moving the web material, after the calendering at the rollers 18, through a heating zone as shown in dotted lines at 16', such that a renewed actuation of the binding fibres can be effected. This also results in an improved barrier effect against dusting from the material as well as an improvement of the retention capacity, i.e. the ability to retain rest liquid after squeezing of wet material.

30 The discussed properties will now be illustrated by two examples;

Example 1:

With the use of

14,4% Al-Special-C Phil 65/35 1,7 x 6

(heat actuated binding fibres, Danaklon A/S, Denmark

and

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85,6% NF 405 (Softwood pulp, wood cellulose, Weyerhaeuser, USA)

two different products are made by dry forming:

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A: With homogenous fibre mixture and conventional heat actuation of binding fibres.

B1: With bottom and top surface layer 3g/m² 100% binding fibres and a middle layer of a homogenous mixture of cellulose and binding fibres in the ratio 93:7.

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B2: B1 after calandering.

B3: B2 after passage of heat tunnel 142°C.

Relevant measuring results:

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	Weight	Thickness	Density	Breaking-	Dust	Waterab-	Retention
	g/m ²	mm	kg/m ³	strength	mg	sorption	g/g
				MD, g/2''		g/g	
25	A: 76	1,20	63	315	90	15	4,9
	B1: 74	1,10	67	750	18	14	5,0
	B2: 73	0,60	122	1770	1,0	6,4	4,5
	B3: 72	0,63	114	2010	0,6	6,7	5,3

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The listed values should serve primarily for mutual comparison, so it is deemed superfluous to describe the measuring methods in more detail.

Example 2:

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In the same manner, products A, B1 and B2 are produced based on

15,6% A1-Special-C Phil 65/35 1,7 x 6 binding fibres

and

5 84,4% Rayfloc-X-J (Softwood pulp, wood cellulose; ITT Rayonier Inc., USA)

	Weight	Thickness	Density	Breaking-	Dust	Waterab-	Retention
10	$\frac{g}{m^2}$	mm	$\frac{kg}{m^3}$	strength	mg	$\frac{g}{g}$	$\frac{g}{g}$
				MD, $\frac{g}{2''}$			
A:	101	1,22	83	785	61	14	6,1
B1:	97	1,08	90	1020	19	13	6,0
B2:	102	0,76	134	2100	1,6	5,4	4,8

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The claims defining the invention are as follows:

1. A sheet or web material of absorbent type consisting of an air laid product of short cellulose fibres and relatively long, thermoplastic binding fibres, the material having at least at one side a surface layer with an upconcentrated content of binding fibres, wherein the web material comprises a core or main layer of cellulose fibres in admixture with a small amount of binding fibres and, at one or both sides, a very thin surface layer solely consisting of binding fibres.
2. A material according to claim 1, wherein said very thin surface layer consists of binding fibres in an amount of only 1 to 5g/m² and with these fibres predominantly oriented in the plane of the surface layer.
3. A material according to claim 1 or 2, wherein the content of binding fibres in the mixed main layer is in the range of 2 to 10%.
4. A material according to claim 2, wherein the content of binding fibres in the mixed main layer is in the range of 5 to 8%.
5. A material according to claim 1 or 2, wherein said material is provided with the thin binding fibre layers at both sides and appears as a trade product for direct use, such as a wiper material.
6. A method of dry forming a material web according to claim 1 or 2, whereby a mixture of short cellulose fibres and reforming wire from a forming head, whereafter the binding fibres are actuated by the web passing through a hat zone, wherein a very thin layer of binding fibres, is laid out from a separate forming head before or after the laying out of the said fibre mixture so as to form a very thin surface layer on the top or bottom side of the web.
7. A method according to claim 6, wherein said layer of binding fibres comprises an amount of only 1 to 5 g/m².



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8. A method according to claim 6 or 7, wherein from an additional forming head a corresponding thin binding fibre layer is laid out for coating also the opposite side of the web.

5 9. A method according to claim 6 or 7, wherein the mono- or double-sided coated web is subjected to a calandring after its passage through the heating zone.

10 10. A method according to claim 9, wherein the web is additionally moved through a heating zone after the calandring.

11. A method according to claim 8, wherein for the calandring there is used a heated calender providing a welding together of the two surface layers over 5 to 20% of the web area.

15 12. A method according to claim 9, wherein said welding together is provided over approximately 10% of said web area.

20 13. A method according to claim 6 or 7, wherein the mixed fibre layer is used with a content of only 2 to 10% of binding fibres.

14. A method according to claim 11, wherein said mixed fibre layer has a content of only 5 to 8% of binding fibres.

25 15. A sheet or web material of absorbent type substantially as hereinbefore described with reference to the accompanying drawings.

16. A method of dry forming a material web, said method being substantially as hereinbefore described with reference to the accompanying drawings.

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Dated 7 March, 2001

Scan-Web I/S

Patent Attorneys for the Applicant/Nominated Person

SPRUSON & FERGUSON



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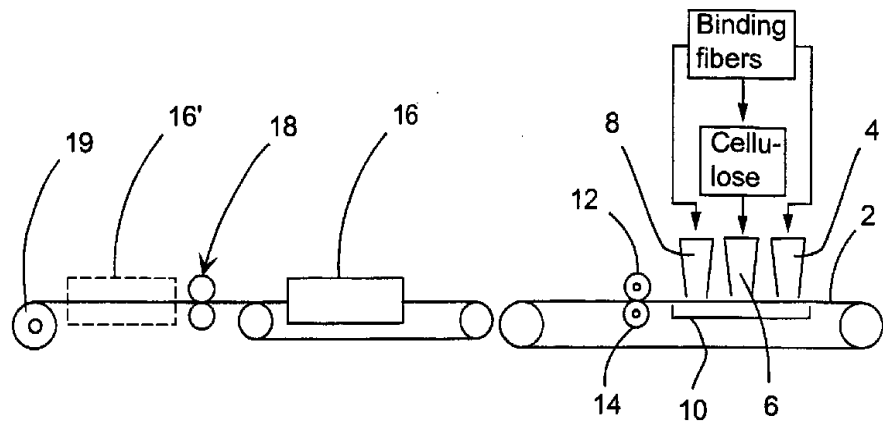


Fig.1

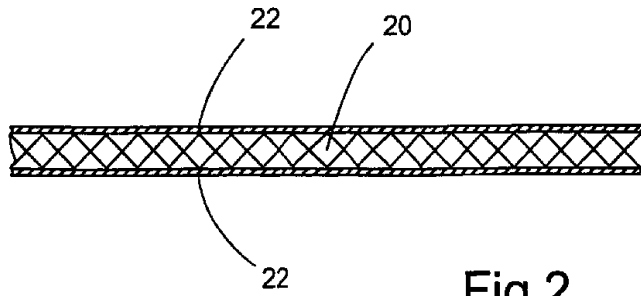


Fig.2