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(54) **PAPER MATERIAL, APPARATUS AND METHOD FOR ITS PRODUCTION**

(57) A paper material (1), comprising at least a yielding laminar support (2) comprising cellulose fibers and having at least a first surface (3) and a second surface (4) opposite each other; at least one fibrous layer (5;5a,5b;5a,5b,5c) is applied on at least one of said first

surface (3) and second surface (4), such layer comprising fibers different from cellulose that confer specific tactile and/or olfactory and/or visual properties to said yielding laminar support (2).

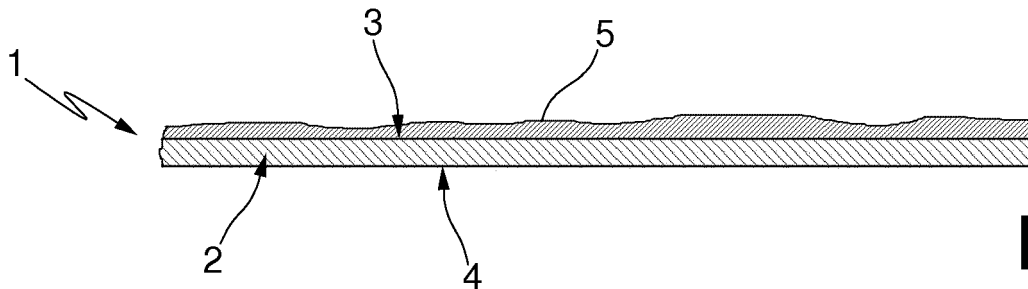


FIG. 1

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention concerns a paper material.

[0002] In addition, the present invention concerns an apparatus and a process for producing the aforesaid paper material.

BACKGROUND ART

[0003] Various types of paper material are widespread on the market, having different features and intended for many different uses.

[0004] For example, some of these materials are intended for making the so-called "tissue" products, i.e. napkins, toilet paper, medical rolls, dusters, multi-purpose towels, and the like, mainly but not exclusively intended for hygienic and sanitary use.

[0005] Other materials are instead intended for product packaging uses, or more generically uses in the packaging field.

[0006] The field of manufacturing paper materials, of various type, is increasingly oriented today towards an improvement and refinement of various features thereof, and particularly those features that are immediately perceived by the consumer in the use of the material, or of the specific products obtained with such material, such as, in some case, softness to touch, flexibility, pliability/yieldability, or also other more strictly visual and/or olfactory properties.

[0007] It is known that in order to modify some features of paper materials, it can be advantageous to use, for the production of the same, fibers different from cellulose fiber.

[0008] Such fibers can be of natural or even of synthetic origin.

[0009] Examples of this type include silk fibers, cotton fibers, fibers derived from milk proteins, cellulose rayon, polylactic acid, soy, and still others: more generally, any fiber, in yarn or granular form, can be used in the context of a process for manufacturing a specific paper material.

[0010] More particularly, currently the application of these fibers occurs directly in the paper production process phase, and especially by mixing these materials with the cellulose fibers in bulk - i.e. in the mixture - in various percentages.

[0011] With the use of these fibers in the above-described manner, i.e. in bulk, one normally obtains a fairly uniform mixture between the cellulose fibers and the other fiber types: this means that the quantity of admixed fibers which is situated on the surface of the paper product is not essentially different from the quantity that is instead found in the innermost layers of the material itself.

[0012] For this reason, the most superficial layers of the paper material are affected by the presence of the admixed fibers only to a very limited extent, and hence

the desired effect in terms of features perceivable by the user may, at times, not at all be evident.

[0013] To this we must add that these admixed fibers have a cost that is usually much greater than that of cellulose fibers, and hence they are normally used in very low percentages, such that their presence in the final product may in fact be entirely imperceptible for the abovementioned reasons.

[0014] Moreover, the use of these fibers for obtaining specific features in the final material is entirely incompatible, in particular, with the current manufacturing technologies for "tissue" type products, which operate with increasingly higher speeds and with increasingly lower basis weights per square meter: this makes the obtaining of a sufficient distribution of these fibers on the surface of the product extremely difficult, when admixing the fibers in the mixture.

[0015] Another fact that certainly does not facilitate the use of such additive fibers in the manufacturing of products of "tissue" type is that the relative production plants are normally equipped with selecting devices (called in jargon "screen") that are much more severe than those used in plants of other types, since they are usually set for discarding objects having dimensions greater than 4 mm: this constitutes a considerable limitation in the use of fibers different from those of cellulose, or in any case of fibers of size greater than the above.

[0016] There is therefore the need to implement alternative solutions that allow overcoming the above-lamented drawbacks.

OBJECTS OF THE INVENTION

[0017] The technical aim of the present invention is that of improving the state of the art.

[0018] Within such technical aim, an object of the present invention is to implement a paper material in which fibers of nature different from those of cellulose can be incorporated, in such a way that the properties and features conferred by the same can be effectively perceived by the user in the final product made with such material.

[0019] Another object of the present invention is to provide a paper material comprising fibers of nature different from those of cellulose and having a surface distribution such that the properties and the features conferred by the same can be effectively perceived by the user in the final product made with such material.

[0020] Still another object of the present invention is to implement a process and an apparatus for producing a paper material comprising fibers of nature different from cellulose wherein the properties and features conferred by the same can be effectively perceived by the user in the final product made with such material.

[0021] Another object of the present invention is to provide a paper material, as well as a process and an apparatus for the production thereof, comprising fibers of nature different from cellulose and wherein the quantity

by weight of such fibers is as limited as possible.

[0022] A further object of the present invention is to attain a paper material, as well as a process and an apparatus for the production thereof, that is more versatile and personalizable with respect to that currently present on the market.

[0023] Such aim and such objects are all achieved by a paper material according to the attached claim 1.

[0024] The paper material comprises a yielding laminar support comprising, in turn, cellulose fibers, and which has at least a first surface and a second surface opposite each other.

[0025] According to the present invention, at least one fibrous layer comprising fibers different from cellulose is applied on at least one of the aforesaid first surface and second surface, such fibers conferring specific tactile and/or olfactory and/or visual properties to the aforesaid yielding laminar support.

[0026] According to a further aspect of the invention, the aforesaid fibrous layer comprises fibers of natural or synthetic origin, selected from among silk fibers, cotton fibers, milk protein fibers, cellulose rayon, polylactic acid.

[0027] According to still another aspect of the invention, the aforesaid fibrous layer is obtained starting from a liquid suspension of the aforesaid fibers.

[0028] Such aim and such objects are also all achieved by an apparatus for producing a paper material, comprising at least one yielding laminar support comprising cellulose fibers, and having at least a first surface and a second surface opposite each other.

[0029] According to the invention, the aforesaid apparatus comprises at least a station for applying, at least on the first surface and/or at least on the second surface of the yielding laminar support, at least one fibrous layer comprising fibers different from cellulose, that confer specific tactile and/or olfactory and/or visual properties to such yielding laminar support; the aforesaid fibrous layer is applied in the form of liquid suspension of such fibers different from cellulose.

[0030] Due to the solution, object of the present invention, the fibers different from cellulose, suitable for conferring specific tactile and/or olfactory and/or visual properties to the paper material, are exclusively distributed on the surface of the yielding laminar support: this means that their presence can be immediately perceived in a clear manner by the user.

[0031] The dependent claims refer to advantageous embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] These and further advantages will be further understood by every man skilled in the art from the following description and from the enclosed drawings, given as a nonlimiting example, in which:

figure 1 is an enlarged schematic and side section view of the paper material according to the invention;

figure 2 is an enlarged schematic and side section view of the paper material, according to another embodiment of the invention;

figure 3 is an enlarged schematic and side section view of the paper material, according to still another embodiment of the invention;

figure 4 is an enlarged schematic and side section view of the paper material, according to a further embodiment of the invention;

figure 5 is an enlarged schematic and side section view of the paper material, according to another embodiment of the invention;

figure 6 is an enlarged schematic and side section view of the paper material, according to still another embodiment of the invention;

figure 7 is an enlarged schematic and side section view of the paper material, according to still another embodiment of the invention;

figure 8 is an enlarged schematic and side section view of the paper material, according to a further embodiment of the invention;

figure 9 is a diagram of the apparatus for producing paper material according to the present invention;

figure 10 is a side view of structural details of the apparatus of figure 9;

figure 11 is a perspective view of a product made with the paper material according to the present invention, provided in roll form;

figure 12 is a schematic perspective view of another product made with the paper material according to the present invention, provided in the form of single tissues or wipes.

EMBODIMENTS OF THE INVENTION

[0033] With particular reference to figure 1, reference number 1 overall indicates the paper material according to the present invention.

[0034] The paper material 1 comprises at least one yielding laminar support 2.

[0035] The yielding laminar support 2 can have any thickness, in relation to the specific application needs, without any limitation to the objects of the present invention.

[0036] The yielding laminar support 2 can be provided in any form.

[0037] More in detail, the yielding laminar support 2 can be provided in any form suitable for producing specific products using the paper material 1 according to the invention, or suitable for executing further steps for working the material itself. Whatever form is provided, the yielding laminar support 2 of the paper material 1 comprises at least a first surface 3 and a second surface 4.

[0038] The first surface 3 and the second surface 4 are opposite each other.

[0039] The first surface 3 and/or the second surface 4 of the yielding laminar support 2 can be intended - only one or both - for a specific functional use.

[0040] For example, in the case of making products of "tissue" type, the first surface 3 and/or the second surface 4 can be intended - only one or both - for contact with surfaces to be cleaned, dried, etc..

[0041] For example, in specific use applications of the paper material 1 according to the invention, only one of the surfaces 3,4 can be intended for a specific functional use; in other possible applications, both surfaces 3,4 can be indiscriminately intended for a specific functional use, or for different functional uses.

[0042] In other words, the yielding laminar support 2 can be indiscriminately used on one side or on the other side in order to obtain the same function or even for obtaining functions that are different from each other.

[0043] In other applications, for example, only one from among the first surface 3 and the second surface 4 could be intended for printing, or other processing or use destinations.

[0044] It is in any case specified that, in the present description, the distinction between first surface 3 and second surface 4 of the yielding laminar support 2 is entirely conventional, only for the purpose of an improved comprehension of the features of the invention, as will be clearer hereinbelow.

[0045] The yielding laminar support 2 could for example be of "tissue" type.

[0046] The yielding laminar support 2 comprises cellulose fibers.

[0047] More in detail, the yielding laminar support 2 can for example comprise long cellulose fibers, short cellulose fibers, chemithermomechanical pulp (C.T.M.P.), or still other types of cellulose fibers used for producing paper materials of various types (e.g. "tissue", or others).

[0048] In addition, the yielding laminar support 2 can comprise, in addition to the cellulose fibers, further additives suitable to modify the conformation of the fibers themselves, and/or of their respective bonds, in order to obtain certain features in the specific desired final product (for example, in the case of "tissue", specific mechanical features, such as wet strength, absorbance, and still others).

[0049] Such additives can comprise, or be constituted by, resins, polymers, or the like, to only mention a few possibilities.

[0050] In some embodiments of the invention in which the paper material 1 is employed for making products of "tissue" type, the yielding laminar support 2 can be used for making, for example, a single-ply product P; in other embodiments of the invention, the yielding laminar support 2 could be used for making each single ply of a multiply product P (e.g. toilet paper, kitchen paper, or the like).

[0051] More generally, the yielding laminar support 2 could be used for making products P of "tissue" type of any type and/or shape, without particular limitations.

[0052] According to an aspect of the present invention, at least a fibrous layer 5 is applied at least on the first surface 3 of the yielding laminar support 2, or at least on the second surface 4 of the yielding laminar support 2,

such layer comprising fibers different from cellulose.

[0053] In one embodiment of the invention, the fibrous layer 5 is applied, on the first surface 3 of the yielding laminar support 2, or on the second surface 4 of the yielding laminar support 2, in a continuous and uniform or substantially uniform manner, but in any case without interruption.

[0054] This solution is schematically shown in the enlarged section of figure 1.

[0055] In another embodiment of the invention, schematically shown instead in the enlarged section of figure 2, the fibrous layer 5 is applied on the first surface 3 of the yielding laminar support 2, or on the second surface 4 of the yielding laminar support 2, in a discontinuous manner (i.e. discontinuous, with one or more interruptions): for example, the fibrous layer 5 can be applied according to a dot-like, or spot-like, or stripe-like distribution, or a combination of the latter distributions, or so as to obtain particular drawings, logos, or the like.

[0056] In particular, the latter solution could be used if the fibrous layer 5 is characterized by a particular pigmentation: its application on at least the first surface 3 of the yielding laminar support 2, or on at least the second surface 4 of the yielding laminar support 2, can then determine, on the final product, a certain chromatic/graphical effect, which can be functional, for example for obtaining as stated drawings, logos, decorations, or the like.

[0057] According to another aspect of the invention, the fibrous layer 5 is applied, on at least the first surface 3 of the yielding laminar support 2, or on at least the second surface 4 of the yielding laminar support 2, in a quantity variable between 0.1 g/m² and 10 g/m² at the dry state (in a continuous or non-continuous manner, as clarified above).

[0058] According to the invention, the fibrous layer 5 can comprise fibers of natural or synthetic origin.

[0059] More particularly, the fibrous layer 5 can comprise, for example, silk fibers, cotton fibers, milk protein fibers, cellulose rayon, polylactic acid, and still others.

[0060] In addition, the fibrous layer 5 can comprise a mixture of fibers of different type, or it can only comprise fibers of a same type, in relation to the specific application needs.

[0061] The fibrous layer 5 can also comprise further natural substances such as aloe, natural glycol, natural glycerols, which add further tactile and/or visual and/or olfactory properties thereto.

[0062] The fibrous layer 5 can also comprise at least one fixative.

[0063] Such fixative facilitates the binding, i.e. the surface adhesion, of fibers different from cellulose on the yielding laminar support 2, without however altering the characteristics of the fibres themselves.

[0064] The aforesaid fixative can for example comprise glues based on carboxymethylcellulose or vinyl-based glues.

[0065] The fixative can be used in the minimum quantity sufficient for fixing the fibers on at least one of the

surfaces 3,4 of the yielding laminar support 2.

[0066] According to another aspect of the invention, the paper material 1 is provided in the dry state, or with a maximum moisture content of about 4-5%, and in any case not greater than about 7%.

[0067] In this state, the paper material 1 is particularly suitable for making products of various type, with optimal features (e.g. "tissue" products, or products for packaging, or others).

[0068] It has in fact been experimentally demonstrated that, with a maximum moisture content of about 7%, the paper material 1 remains taut and without creases or wrinkling; on the contrary, with a moisture content greater than 7%, there is the onset of creases or other surface imperfections that negatively affect the appearance of the final product that will be made with the paper material 1.

[0069] As stated, the latter specifications refer to the state in which the paper material 1 according to the invention is provided to the final user in the form of a specific product, i.e. the state in which it is sold.

[0070] Such specifications instead do not regard possible states of the paper material 1 during its production, or in specific steps of packaging, storing, etc..

[0071] It is also specified that, in one embodiment of the invention, the paper material 1 can also comprise, on the first surface 3 or on the second surface 4 of the yielding laminar support 2, multiple fibrous layers 5 superimposed on each other.

[0072] In one embodiment of the invention, the aforesaid superimposed fibrous layers 5 can comprise the same fiber type, or even fibers of different type, for example for obtaining particular effects that cannot be obtained with a single fibrous layer 5.

[0073] Therefore, in the present description, with the general definition of fibrous layer 5 (comprising fibers different from cellulose), it can be intended a single fibrous layer, comprising a single fiber type, or even a mixture of different fiber types; with the same definition, it can also be intended a plurality of superimposed fibrous layers, each comprising a respective single type of fibers, or even mixtures (equivalent or different) of different types of fibers.

[0074] In the preceding description, it is assumed that the fibrous layer 5 is only applied on the first surface 3 of the yielding laminar support 2, or only on the second surface 4 of the yielding laminar support 2, i.e. more generally only on one of the surfaces 3,4 of the yielding laminar support 2.

[0075] In other embodiments of the invention, respective fibrous layers 5a,5b could be applied both on the first surface 3 and on the second surface 4 of the yielding laminar support 2; more precisely, a first fibrous layer 5a and a second fibrous layer 5b, both comprising fibers different from cellulose.

[0076] The latter solution distinguishes the embodiments of figures 3,4.

[0077] More in detail, in the embodiment of figure 3,

both on the first surface 3 and on the second surface 4 of the yielding laminar support 2, a first fibrous layer 5a and a second fibrous layer 5b are respectively applied in a continuous and uniform or substantially uniform manner, in other words without interruption.

[0078] In the embodiment of figure 4, instead, both on the first surface 3 and on the second surface 4 of the yielding laminar support 2, a first fibrous layer 5a and a second fibrous layer 5b are respectively applied in a discontinuous manner, i.e. with one or more interruptions.

[0079] With reference to the latter solution, and as stated above, both on the first surface 3 and on the second surface 4 of the yielding laminar support 2, a first fibrous layer 5a and a second fibrous layer 5b can be respectively applied with dot-like, spot-like or stripe-like distributions or combinations thereof, or in a manner so as to make particular drawings, logos, decorations, or the like.

[0080] The first fibrous layer 5a and the second fibrous layer 5b can have the same composition, or they can have compositions that are different from each other, for example in relation to the fibers used, or in relation to other features.

[0081] The use of fibrous layers 5a,5b having different compositions respectively on the first surface 3 and on the second surface 4 of the yielding laminar support 2 allows obtaining different tactile and/or visual, and/or olfactory effects on each of the two surfaces 3,4 of the support 2.

[0082] Further possible configurations of the paper material 1 according to the present invention form the object of the embodiments schematically represented in figures 5-8.

[0083] In particular, figure 5 shows an embodiment of the invention in which the paper material 1 comprises two yielding laminar supports 2 coupled to each other.

[0084] The two yielding laminar supports 2 can be identical, or even different, e.g. regarding composition, thickness, etc.

[0085] The two yielding laminar supports 2 are coupled to each other at respective surfaces 3 or 4; on the remaining surfaces 4, or 3, a first fibrous layer 5a and a second fibrous layer 5b are instead respectively applied.

[0086] The layers 5a,5b are applied in a continuous and uniform or substantially uniform manner.

[0087] The two yielding laminar supports 2 are coupled to each other, for example, by application of a glue, or by using other techniques already available in the field of production of paper material in order to join together two or more supports (e.g. two or more plies, in case of manufacturing of products of "tissue" type).

[0088] Here too, the first fibrous layer 5a and the second fibrous layer 5b can have the same composition, or they can have compositions different from each other in terms of fibers used, in order to achieve different tactile and/or visual, and/or olfactory effects on the two sides of the paper material 1.

[0089] Figure 6 shows an embodiment of the invention in which the paper material 1 comprises two yielding lam-

inar supports 2 coupled to each other with the interposition of a third fibrous layer 5c.

[0090] Also in this case, the two yielding laminar supports 2 can be identical or different, e.g. regarding composition, thickness, etc.

[0091] More in detail, the layer 5c is interposed between the surfaces 3, or 4, of the two yielding laminar supports 2.

[0092] On the remaining surfaces 4, or 3, of the yielding laminar supports 2, a first fibrous layer 5a and a second fibrous layer 5b are respectively applied, as in the case of the preceding embodiment.

[0093] The fibrous layers 5a, 5b, 5c are applied in a continuous and uniform or substantially uniform manner.

[0094] The third fibrous layer 5c, whose presence during use in reality is not perceived by the user, can be made by using fibers (different from cellulose) which allow, for example, obtaining specific improved mechanical features (for example strength, absorbance, flexibility, and still others).

[0095] Figure 7 shows a further embodiment of the invention similar to that of figure 5, and which differs from the latter due to the fact that the first fibrous layer 5a and the second fibrous layer 5b are applied in a discontinuous manner (for example, they are applied in a dot-like, spot-like, stripe-like manner, or combinations of these, or in a manner so as to obtain a specific logo, drawing, decoration, or the like).

[0096] Figure 8 shows a further embodiment of the invention similar to that of figure 6, and which differs from the latter due to the fact that the fibrous layers 5a, 5b, 5c are applied in a discontinuous manner (in particular, at least the first layer 5a and the second layer 5b are applied in a dot-like, spot-like, stripe-like manner, or combinations of these, or in a manner so as to obtain a specific logo, drawing, decoration, or the like).

[0097] The embodiments of the paper material 1 according to figures 5-8 can be particularly used, for example, for making double-ply "tissue" products.

[0098] Of course, further embodiments of the paper material 1 according to the present invention can also be assumed, comprising even three or more yielding laminar supports 2, coupled together directly or via interposition of multiple fibrous layers 5c, according to one or more of the previously-described modes.

[0099] The invention thus described allows obtaining important technical results.

[0100] The paper material 1 thus obtained is extremely personalizable from the standpoint of tactile and/or visual and/or olfactory properties, which are fully perceivable, due to the fact that the yielding laminar support 2 comprises at least one fibrous layer 5, 5a, 5b distributed only on the surface of the support 2 itself.

[0101] For example, by using specific fibers rather than others, it is possible to attain paper materials 1 that are particularly soft and smooth to the touch.

[0102] This is of particular interest, for example, in case of use in making "tissue" products, since the conventional

products of this kind usually have a surface that is rather rough and irregular.

[0103] In addition, this expedient also allows obtaining considerable economic savings in terms of use of fibers different from cellulose, with respect to other products that employ such fibers directly in the manufacturing of the yielding laminar support 2. Indeed, the achievement of at least one surface fibrous layer 5, 5a, 5b allows obtaining satisfactory results even when employing a quantity of fibers up to ten times less than that used in the above-described products of known type (i.e. in which the fibers are introduced directly into the manufacturing mixture of the support of the paper material).

[0104] It is also underlined that the solution, object of the present invention, allows obtaining a variety of applications that cannot be obtained with the technologies of known type, since providing for a surface fibrous layer, rather than the use of the fibers in the manufacturing mixture for the support, allows maximum freedom in selecting the kind of fibers to be used: the same versatility cannot be obtained with current technologies, since specific fiber types might not be compatible with their use directly inside the mixture.

[0105] Not least, the solution, object of the present invention, also allows applying - if desired - different fibrous layers in different parts of the yielding laminar support 2, in order to obtain different effects on the aforesaid parts: this is not obtainable with the current technologies, in which the possible use of fibers of different nature would have no effect since all fibers would be uniformly mixed in the mixture for producing the yielding laminar support 2.

[0106] It is also an object of the present invention an apparatus 6 for producing paper material (figure 9, 10).

[0107] In one embodiment of the invention of particular practical interest, the apparatus 6 is specifically intended for producing the paper material 1 having the above-described features.

[0108] The apparatus 6 comprises an inlet zone 7 for a yielding laminar support 2.

[0109] The yielding laminar support 2 comprises cellulose fibers, and possible other additives.

[0110] The yielding laminar support 2 crosses the inlet zone 7 in the form of a continuous belt 8.

[0111] The continuous belt 8 comes from an upstream plant for producing paper material of any type.

[0112] Also the plant for producing the paper material can be of any type, without limitations.

[0113] In other words, the aforesaid production plant can have different features relating to the specific kind of paper material that one intends to manufacture.

[0114] The yielding laminar support 2 comprises a first surface 3 and a second surface 4, opposite each other.

[0115] In addition, the apparatus 6 comprises an outlet zone 9 of the yielding laminar support 2.

[0116] The yielding laminar support 2 crosses the outlet zone 9, still in the form of a continuous belt 8.

[0117] According to one aspect of the invention, the

apparatus 6 also comprises at least an application station 10 of at least a fibrous layer 5, comprising fibers different from cellulose, on at least the first surface 3 of the yielding laminar support 2, or at least on the second surface 4 of the yielding laminar support 2.

[0118] The application station 10 is comprised, i.e. interposed, between the inlet zone 7 and the outlet zone 9.

[0119] The apparatus 6 comprises means for advancing the yielding laminar support 2 in the form, as stated, of a continuous belt 8, which crosses the inlet zone 7, the application station 10 and the outlet zone 9, in that order.

[0120] The paper material 1, made with the apparatus 6 according to the invention, is provided (to the final user) in the dry state, or with a moisture content of about 4-5%, and in any case not greater than about 7%.

[0121] According to another aspect of the invention, the fibrous layer 5 is obtained starting from a liquid suspension containing the aforesaid fibers different from cellulose. By liquid suspension, it is intended a suspension in water, or in other products containing water, which carry and keep separate in uniform suspension the fibers which must be transferred onto the yielding laminar support 2.

[0122] In one embodiment of the invention, the liquid suspension comprises, in addition to the fibers different from cellulose, also natural substances such as aloe, natural glycols, natural glycerols which, in addition to acting as vehicles for transferring the fibres, can add further tactile, and/or visual, and/or olfactory properties to the treated support 2.

[0123] The fibres different from cellulose are present in the aforesaid liquid suspension with a maximum concentration of 25% by weight.

[0124] In addition, the aforesaid liquid suspension comprises at least one fixative; the fixative has the function of facilitating the binding of the fibers different from cellulose on the yielding laminar support 2, without altering the properties and features of the fibers themselves.

[0125] For example, the aforesaid fixative can comprise, or can be constituted by, glues based on carboxymethylcellulose and/or starches and/or vinyl-based glues.

[0126] The fixative can have a maximum concentration of about 5% by weight in the liquid suspension.

[0127] In one embodiment of the invention of particular practical interest, the concentration of the fixative inside the aforesaid liquid suspension is comprised between 2% and 3% by weight.

[0128] The application station 10 of the apparatus 6 comprises at least a distribution chamber 11 for the aforesaid liquid suspension.

[0129] The application station 10 also comprises supply means 12 of the liquid suspension towards the aforesaid distribution chamber 11.

[0130] The application station 10 also comprises at least a pick-up cylinder 13 of the liquid suspension from the distribution chamber 11.

[0131] The application station 10 also comprises at least one distributor cylinder 14.

[0132] The distributor cylinder 14 is maintained in rolling contact with the pick-up cylinder 13.

5 [0133] The distributor cylinder 14, as better clarified hereinbelow, has the function of applying the liquid suspension supplied by the pick-up cylinder 13 (containing fibers different from cellulose) on the first surface 3 (or on the second surface 4) of the yielding laminar support 2, i.e. more in detail on the first surface 3 (or on the second surface 4) of the continuous belt 8 that crosses the application station 10. According to a further aspect of the invention, the pick-up cylinder 13 and the distributor cylinder 14 of the application station 10 are associated with
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respective actuation means.

[0134] Such actuation means are not represented in detail in the enclosed figures.

[0135] The actuation means can comprise, for example, two motors, or two gearmotor groups, respectively coupled to the pick-up cylinder 13 and to the distributor cylinder 14, and slaved to a same central control unit, which coordinates the operation thereof.

[0136] In one embodiment of the invention, the actuation means of the pick-up cylinder 13 and of the distributor cylinder 14 can be controlled in such a way that the cylinders 13,14 themselves rotate at different speeds, so as to be able to vary as desired the flow rate of liquid suspension transferred from the pick-up cylinder 13 to the distributor cylinder 14.

[0137] According to another aspect of the invention, the pick-up cylinder 13 is of the type having a porous external surface, in order to ensure a uniform drawing of the product from the distribution chamber 11.

[0138] In one embodiment of the invention, the pick-up cylinder 13 can be of the type known with the commercial name Anilox, with laser incision, with flow rate variable from 0.1 g/m² to 10 g/m².

[0139] In general, the flow rate varies as a function of the number of lines incised on the surface of the cylinder per linear centimeter.

[0140] The number of the incised lines can be comprised between 30 and 80 lines per centimeter, and tilt of the lines themselves is not greater than 45°.

[0141] In another embodiment of the invention, the pick-up cylinder 13 can be of mechanical incision type; this solution can be particularly recommended in the case of use of a high-density liquid suspension, or for transferring particularly high flow rates of liquid suspension.

[0142] In other embodiments of the invention, the pick-up cylinder 13 could be of any other type suitable for ensuring a uniform drawing of a certain flow rate of product from the distribution chamber 11.

[0143] If a pick-up cylinder 13 with mechanical incision is used, the application station 10 does not comprise any distributor cylinder 14, and a drying device can instead be provided, if necessary, for controlling the moisture of the final product.

[0144] Such drying device could be, for example, of air

type, or of infrared type, or of mixed type.

[0145] In one embodiment of the invention, the distributor cylinder 14 - if present - is covered with rubber, for example with hardness of 60 Pusey & Jones (PJ).

[0146] The distributor cylinder 14 can comprise a surface distribution of cells that allow an improved transport and transfer of the liquid suspension, or preferably allow distributing the liquid suspension (and in greater quantity) in certain zones of the yielding laminar support 2.

[0147] The distributor cylinder 14 is driven to rotate such that the peripheral speed of points belonging to the external surface thereof coincides with the advancing speed of the continuous belt 8: in other words, there is no relative sliding between the surface of the distributor cylinder 14 and the continuous belt 8 itself.

[0148] The supply means 12 comprise, more particularly, at least one tank 15, containing the liquid suspension.

[0149] The tank 15 is associated with at least one stirrer 16; the stirrer 16 prevents the formation of stratifications inside the tank 15.

[0150] The supply means 12 also comprise at least a supply manifold 17.

[0151] The supply manifold 17 places the tank 15 in communication with the distribution chamber 11.

[0152] The supply means 12 also comprise a pump 18; the pump 18 is provided along the supply manifold 17.

[0153] The pump 18 can be, for example, peristaltic, or a gear pump or a membrane pump, or a pump of another type.

[0154] The pump 18 achieves the forced transfer of the liquid suspension from the tank 15 to the distribution chamber 11.

[0155] According to another aspect of the present invention, the supply manifold 17 leads to a plurality of secondary pipes 19.

[0156] The secondary pipes 19 are in turn communicating with the distribution chamber 11 at respective connection points 20 distributed along its width.

[0157] This expedient is schematically represented in figure 10.

[0158] The number of the secondary pipes 19 used depends on the width of the apparatus 6, and/or on the width of the paper material 1 to be manufactured.

[0159] The connection points 20 between the secondary pipes 19 and the distribution chamber 11 are arranged, for example, along a row parallel to the axis of the cylinders 13, 14.

[0160] In one embodiment of the invention, the supply manifold 17 can have variable section, in order to ensure uniform pressure in all zones of the distribution chamber 11, and in particular in all the secondary pipes 19 which communicate with the aforesaid distribution chamber 11.

[0161] The connection points 20 are positioned at mutual distances D selected such to obtain a distribution as uniform as possible of the liquid suspension for the entire length of the pick-up cylinder 13.

[0162] For example, in the embodiment illustrated in

figure 10, the connection points 20 are arranged equidistant from each other and positioned at a specific minimum distance D.

[0163] The minimum distance D can for example be about 10 cm; it is in fact evaluated that independent of the features of the liquid suspension, such minimum distance D in any case ensures a uniform distribution of the product itself over the entire length of the pick-up cylinder 13.

[0164] In addition, such minimum distance D ensures a uniform distribution of the liquid suspension over the entire length of the pick-up cylinder 13, also in the case of possible obstruction - partial or complete - of one of the secondary pipes 19.

[0165] The supply means 12 also comprise a return manifold 21.

[0166] The return manifold 21 places the distribution chamber 11 in communication with the tank 15; such manifold 21 can be traversed in the opposite sense with respect to the supply manifold 17.

[0167] The presence of the return manifold 21 allows maintaining the distribution chamber 11 always perfectly full of liquid suspension, so that the supply to the pick-up cylinder 13 is never lacking; the possible excess suspension in fact returns into the tank 15, just through the return manifold 21.

[0168] According to another aspect of the invention, if the distributor cylinder 14 is present, the application station 10 of the apparatus 6 comprises winding means 22 of the continuous belt 8 around the distributor cylinder 14 itself.

[0169] The winding of the continuous belt 8 around the distributor cylinder 14 occurs for a predetermined winding angle α .

[0170] In other words, at every instant of the production cycle, the continuous belt 8 is in contact with the distributor cylinder 14 for a portion of its surface corresponding with the circular segment defined by the aforesaid winding angle α ; this means that the contact between the continuous belt 8 and the distributor cylinder 14 is not point-like but - observed in section - extended over a certain arc or circular segment.

[0171] The distributor cylinder 14 is therefore in contact with one from among the aforesaid first surface 3 and second surface 4, while the remaining surface 3, 4 is free, i.e. it is not in contact with any roller or any other mechanical member.

[0172] The winding of the continuous belt 8 around the distributor cylinder 14 - for a certain pre-established winding angle α - allows obtaining the optimal distribution and application of the liquid suspension on the first surface 3, or on the second surface 4, of the yielding laminar support 2 (i.e. of the continuous belt 8).

[0173] In other words, such winding allows obtaining a contact - between the surface of the distributor cylinder 14 which bears the liquid suspension, and the first surface 3, or the second surface 4, of the continuous belt 8 - that is sufficiently extended, and taking place for a sufficient

time interval, so that there can be an effective transfer of the liquid suspension from the distributor cylinder 14 to the continuous belt 8, according to the desired modes.

[0174] The selection of the aforesaid pre-established winding angle α depends on various parameters, such as the features of the material constituting the continuous belt 8, the features of the liquid suspension, and still other features.

[0175] It was evaluated that such pre-established winding angle α can vary between 15° and 90°, in relation at least to the above-listed parameters.

[0176] In one embodiment of the invention, it was determined that the optimal value for the pre-established winding angle α is fixed at about 60°.

[0177] Due to these expedients, the quantity of liquid suspension used for obtaining the desired result may be limited: in other words, a material savings is attained, with all the beneficial effects pertaining thereto.

[0178] The winding means 22 comprise, more particularly, a fixed roller 23.

[0179] The fixed roller 23 is positioned downstream of the distributor cylinder 14, with reference to the advancing sense of the continuous belt 8 (indicated by the arrow F in figure 9).

[0180] In addition, the winding means 22 comprise an adjustable roller 24.

[0181] The adjustable roller 24 is positioned upstream of the distributor cylinder 14, with reference to the advancing sense of the continuous belt 8.

[0182] Therefore the continuous belt 8 is wound, proceeding in its advancing direction indicated by the arrow F, around the adjustable roller 24, around the distributor cylinder 14 and around the fixed roller 23.

[0183] The adjustable roller 24 allows attaining the correct tension on the continuous belt 8 in order to obtain the desired pre-established winding angle α of the continuous belt 8 itself around the distributor cylinder 14.

[0184] According to one aspect of the invention, the adjustable roller 24 is associated with respective translation means 25.

[0185] The translation means 25 operate according to a direction substantially orthogonal to the advancing direction F of the continuous belt 8.

[0186] The translation means 25, as schematically shown in figure 9, allow continuously varying the position of the adjustable roller 24 with respect to the position of the distributor cylinder 14, in order to precisely obtain the pre-established desired winding angle α .

[0187] The translation means 25 can comprise, for example, a pneumatic linear actuator, or a hydraulic linear actuator, or an electric linear actuator.

[0188] Downstream of the fixed roller 23, a possibly drying station can be provided, which the continuous belt 8 crosses after the application of the liquid suspension.

[0189] The drying station, if provided, allows bringing the paper material 1 thus attained to the desired dry state, or with the desired moisture content (e.g. around 4-5%, and in any case not greater than 7%, as stated above).

[0190] The drying station can for example be of heated roller type, or of another type suitable for the present application.

[0191] According to a further aspect of the invention, the apparatus 6 can for example be installed in any plant (possibly already existing and operating) for producing paper, or for producing another material suitable for making the requested yielding laminar support 2 in order to obtain the desired paper product 1.

[0192] The advancing means of the continuous belt 8 through the application station 10 are not represented and described in detail since, as stated, in one embodiment of the invention the apparatus 6 is intended to be installed in the context of a more complex plant (for example a plant for producing paper of "tissue" type, or paper for uses in packaging, or for other uses) where means for advancing/driving the continuous belt 8 itself through the various production stations are already provided.

[0193] However, this does not exclude the possibility that the apparatus 6 according to the invention can be provided in an autonomous version, i.e. not installed in a more complex plant that is possibly already existing and operating.

[0194] In this case, the apparatus 6 can be provided with autonomous means for advancing the continuous belt 8 through the application station 10 of the liquid suspension.

[0195] It is specified that the apparatus 6 schematically represented in figure 9, being provided with a single application station 10, allows applying a fibrous layer 5 on one of the surfaces 3,4 of a single yielding laminar support 2.

[0196] It is possible to obtain a paper material 1 comprising multiple fibrous layers 5a,5b (for example as in the embodiments of figures 3,4) by providing for an apparatus 6, according to the invention, comprising two application stations 10, arranged mirrored, which respectively operate on the first surface 3 and on the second surface 4 of a same yielding laminar support 2.

[0197] In one embodiment of the invention, the apparatus 6 can also comprise at least one station for coupling two yielding laminar supports 2.

[0198] For example, such coupling station can be more specifically constituted by a gluing station, or by a station of another type suitable for connecting two yielding laminar supports 2.

[0199] In this embodiment, therefore, the apparatus 6 - also provided with a suitable number of application stations 10 of respective fibrous layers 5a,5b,5c - allows making a paper material 1 according to the embodiments of figures 5-8.

[0200] The operation of the apparatus 6 according to the invention is entirely intuitive, in light of what disclosed above.

[0201] The continuous belt 8 is made to advance through the application station 10 in the manner illustrated in figure 9.

[0202] The continuous belt 8, in its transit through the application station 10, winds the distributor cylinder 14 according to the desired pre-established winding angle α . As stated, the distributor cylinder 14 is driven in such a way that the peripheral speed at the surface thereof coincides with the advancing speed of the continuous belt 8.

[0203] The pick-up cylinder 13 is instead driven with a different rotation speed with respect to that of the distributor cylinder 14.

[0204] More in detail, the peripheral speeds of the cylinders 13, 14, at the respective surfaces, are different: for example, the actuation of the two cylinders 13, 14 can be controlled in such a way that the peripheral speed of the pick-up cylinder 13 is less than the peripheral speed of the distributor cylinder 14: this allows optimizing and making more effective the transfer of the liquid suspension from the pick-up cylinder 13 to the distributor cylinder 14.

[0205] The liquid suspension, present in the tank 15, is sent, by means of the pump 18, through the supply manifold 17; from here, it reaches the distribution chamber 11 through the secondary pipes 19.

[0206] As stated, the liquid suspension inside the distribution chamber 11 is picked up by the pick-up cylinder 13 with the desired flow rate, and is transferred via contact to the distributor cylinder 14.

[0207] From the latter, the product is transferred onto the first surface 3, or onto the second surface 4, of the continuous belt 8, which encloses the distributor cylinder 14 itself with the desired pre-established winding angle α .

[0208] The transfer of the liquid suspension from the distributor cylinder 14 to the continuous belt 8 occurs with modes that depend on the features of the cylinders 13, 14: for example, it is possible to carry out a uniform or substantially uniform transfer, or transfer that is dot-like, spot-like, stripe-like or combinations thereof, in relation to the specific needs.

[0209] After the surface application of the liquid suspension, the continuous belt 8 can be subjected to a possible drying, in order to bring its moisture content to values of around 4-5%, and in any case not greater than about 7%.

[0210] Following this, the continuous belt 8 can be subjected to a further working, in order to define the configuration or the features of the desired final paper material.

[0211] For example, the continuous belt 8 can be cut in order to obtain continuous belts of smaller size to be wound again in rolls or coils, or pre-cuts T can be made along the belt which allow separating single sheets F that are autonomously usable; or the continuous belt 8 can be completely cut at regular distances, so as to obtain single sheets.

[0212] The finished paper material thus obtained can then be suitably packaged in order to be stored and/or transferred towards the distribution points, or it can be used as a material suitable for packaging products, or for still other uses.

[0213] It is also an object of the present invention a process for producing a paper material 1; in particular, the aforesaid material comprises at least a yielding laminar support 2 comprising cellulose fibers.

[0214] The yielding laminar support 2 comprises at least a first surface 3 and a second surface 4 opposite each other.

[0215] The yielding laminar support 2 is supplied in the form of a continuous belt 8.

[0216] According to the invention, the process comprises at least a step for applying, at least on the first surface 3 and/or at least on the second surface 4 of the yielding laminar support 2, at least a fibrous layer 5; 5a, 5b; 5a, 5b, 5c comprising fibers different from cellulose, that confer specific tactile and/or olfactory and/or visual properties to said yielding laminar support 2.

[0217] According to the process, the fibrous layer 5; 5a, 5b; 5a, 5b, 5c is obtained starting from a liquid suspension of fibers different from cellulose.

[0218] The liquid suspension is water-based, or based on natural substances such as aloe, natural glycols, natural liquid glycerols, which remain in the fibrous layer 5; 5a, 5b; 5a, 5b, 5c after the drying of the liquid suspension.

[0219] The liquid suspension also comprises at least a fixative suitable to bind the fibers different from cellulose to the yielding laminar support 2; the fixative comprises glues based on carboxymethylcellulose and/or starches and/or vinyl-based glues. In the liquid suspension, the fibers different from cellulose have a maximum concentration of 25% by weight.

[0220] According to the process, the step of applying the fibrous layer 5; 5a, 5b; 5a, 5b, 5c comprises providing at least a distributor cylinder 14 for the liquid suspension, and winding the continuous belt 8 around such distributor cylinder 14 for a pre-established winding angle α .

[0221] The distributor cylinder 14 is in contact with a surface from among the first surface 3 and the second surface 4, while the remaining surface 3, 4 is free.

[0222] The winding angle α is comprised between 15° and 90°; preferably it is 60°.

[0223] The process according to the present invention also comprises any other operating step described above regarding the operation of the apparatus 6.

[0224] In one embodiment of the invention, the paper material 1 obtained with the aforesaid process is the one having the above-described features.

[0225] It is thus seen that the invention attains the proposed objects.

[0226] The apparatus 6 according to the present invention allows obtaining the effective application of fibrous layers 5, comprising fibers different from cellulose, in such a way that the presence of the same fibers, even if used in definitely lower quantities with respect to other paper products of known type, is distinctly perceived by the user with regard to the tactile and/or visual and/or olfactory properties in the finished product.

[0227] The apparatus 6 in fact executes an actual spreading or lotioning of the liquid suspension on the

surface of the yielding laminar support 2 in such a way that the fibers different from cellulose are permanently bonded, also due to the presence of the fixative introduced in the liquid suspension.

[0228] The apparatus 6 can be easily installed in any paper material production plant.

[0229] For example, the apparatus 6 can be installed in the scope of a process for manufacturing material intended for making products of "tissue" type (in jargon also called "converting" process): the process of manufacturing the "tissue" material is however not at all modified in the essential steps thereof.

[0230] It is also an object of the present invention a paper product P made by using the paper material 1 having the above-described characteristics.

[0231] The aforesaid paper product P can for example comprise one or more sheets, extended or folded in some manner, one or more rolls, with or without core, or the like, etc..

[0232] In the embodiment shown in figure 11, for example, the product P can be provided in the form of a roll, large roll, or the like, made by using the aforesaid yielding laminar support 2.

[0233] In this case, the yielding laminar support 2 constituting the product P can comprise a plurality of pre-cuts T, suitable to separate single sheets F, separately usable.

[0234] In any case, it is specified that the product P comprising the yielding laminar support 2 can be provided in any other form, already known in the field or possibly even new.

[0235] In the embodiment schematically represented, instead, in figure 12, and again by way of example, the product P comprising the yielding laminar support 2 is provided in the form of tissues, wipes or the like.

[0236] In this other case, the single tissues or wipes are normally packaged stacked one on the other.

[0237] It is specified that, if the finished product P, made with the paper material 1 comprising the aforesaid yielding laminar support 2, is provided in roll form (such as in the case of the embodiment of figure 11), the continuous belt 8 - on which the liquid suspension (containing fibers different from cellulose) is applied that will form the fibrous layer 5 - will be, in subsequent working stations not shown in detail, wound on itself, for example on a core, or also according to a solution without winding core, with possible execution of pre-cuts T in order to allow the separation of single sheets F that can be used autonomously.

[0238] If, instead, the product P, made with the paper material 1 comprising the aforesaid yielding laminar support 2, is provided in the form of tissues or wipes (as in the embodiment of figure 12), the continuous belt 8 - on which the liquid suspension (containing fibers different from cellulose) is applied that will form the fibrous layer 5 - will be, in subsequent working stations not shown in detail, cut to size in order to obtain single yielding laminar supports 2 (i.e. which form the tissues or wipes), which

will for example be subsequently stacked and packaged.

[0239] The present invention has been disclosed according to preferred embodiments, but equivalent variants can be conceived without departing from the protective scope offered by the following claims.

Claims

1. Paper material (1), comprising at least a yielding laminar support (2) comprising cellulose fibers and having at least a first surface (3) and a second surface (4) opposite each other, **characterized in that** on at least one of said first surface (3) and second surface (4) at least a fibrous layer (5;5a,5b;5a,5b,5c) is applied, comprising fibers different from cellulose, that impart said yielding laminar support (2) with determined tactile and/or olfactory and/or visual properties.
2. Material according to claim 1, wherein said yielding laminar support (2) comprises additives such as resins, polymers and the like, suitable to modify determined mechanical features of said support (2), such as wet strength, absorbance, and others.
3. Material according to claim 1 or 2, wherein said fibrous layer (5;5a,5b;5a,5b,5c) comprises fibers of natural or synthetic origin, chosen from silk fibers, cotton fibers, milk protein fibers, cellulose rayon, polylactic acid.
4. Material according to one of the preceding claims, wherein said fibrous layer (5;5a,5b;5a,5b,5c) comprises further natural substances such as aloe, natural glycol, natural glycerols.
5. Material according to one of the preceding claims, wherein said fibrous layer (5;5a,5b;5a,5b,5c) comprises at least a fixative suitable to bind said fibers on said yielding laminar support (2) without altering the characteristics thereof.
6. Material according to one of the preceding claims, wherein said fibrous layer (5;5a,5b;5a,5b,5c) is applied in a variable amount between 0.1 g/m² and 10 g/m² in the dry state.
7. Apparatus (6) for the production of a paper material (1), said material comprising at least a yielding laminar support (2) having at least a first surface (3) and a second surface (4) opposite each other, **characterized in that** it comprises at least an application station (10), at least on said first surface (3) and/or at least on said second surface (4), of at least a fibrous layer (5;5a,5b;5a,5b,5c) comprising fibers different from cellulose that impart said yielding laminar support (2) with determined tactile and/or olfactory

and/or visual properties.

8. Apparatus according to claim 7, comprising advancing means of said yielding laminar support (2) in the form of a continuous belt (8) passing through said application station (10), and wherein said application station (10) comprises at least a distribution chamber (11) of a liquid suspension comprising fibers different from cellulose, supply means (12) of said liquid suspension towards said distribution chamber (11), and at least a pick-up cylinder (13) of said liquid suspension from said distribution chamber (11). 5
9. Apparatus according to the preceding claim, wherein said application station (10) comprises at least a distributor cylinder (14) in rolling contact with said pick-up cylinder (13), for the application of said liquid suspension on said continuous belt (8). 10
10. Apparatus according to the preceding claim, wherein said pick-up cylinder (13) and said distributor cylinder (14) are associated with respective actuating means controlled such that said cylinders (13,14) rotate at different speeds, to be able to vary as desired the flow rate of liquid suspension transferred from said pick-up cylinder (13) to said distributor cylinder (14). 15
11. Apparatus according to one of claims 8-10, wherein said supply means (12) comprise at least one tank (15), containing said liquid suspension, provided with at least one stirrer (16), and at least one supply manifold (17) which puts in communication said tank (15) with said distribution chamber (11), at least one pump (18) being provided along said supply manifold (17). 20
12. Apparatus according to the preceding claim, wherein said supply manifold (17) mouths in a plurality of secondary pipes (19) in turn communicating with said distribution chamber (11) at respective connection points (20) distributed along the width thereof, said supply manifold (17) having variable section to ensure even pressure in all areas of said distribution chamber (11). 25
13. Apparatus according to one of claims 8-12, wherein said application station (10) comprises means (22) for winding the continuous belt (8) around said distributor cylinder (14) for a predetermined winding angle (α), and wherein said distribution cylinder (14) is in contact with one from among said first surface (3) and said second surface (4), the remaining surface (3,4) being free. 30
14. Apparatus according to claim 13, wherein said winding angle (α) is comprised between 15° and 90°. 35
15. Method for the production of a paper material (1), said material comprising at least one yielding laminar support (2) comprising cellulose fibers, said yielding laminar support (2) having at least a first surface (3) and a second surface (4) opposite each other, said yielding laminar support (2) being fed in the form of a continuous belt (8), **characterized in that** it comprises at least a step of applying, at least on said first surface (3) and/or at least on said second surface (4), at least a fibrous layer (5;5a,5b;5a,5b,5c) comprising fibers different from cellulose that impart said yielding laminar support (2) with determined tactile and/or olfactory and/or visual properties, said fibrous layer (5;5a,5b;5a,5b,5c) being obtained starting from a liquid suspension of said fibers. 40
16. Method according to claim 15, wherein said fibrous layer (5;5a,5b;5a,5b,5c) being obtained starting from a liquid suspension of said fibers, said liquid suspension being water-based or based on natural substances such as aloe, natural glycols, natural liquid glycerols, which remain in the fibrous layer (5;5a,5b;5a,5b,5c) after the drying of said liquid suspension. 45
17. Method according to claim 16, wherein said liquid suspension comprises at least a fixative suitable to bind the fibers different from cellulose to said yielding laminar support (2), said fixative comprising glues based on carboxymethylcellulose and/or starches and/or vinyl-based glues. 50
18. Method according to one of claims 15-17, wherein in said liquid suspension said fibers different from cellulose have a maximum concentration of 25% by weight. 55
19. Method according to one of claims 15-18, wherein said step of applying said fibrous layer (5;5a,5b;5a,5b,5c) includes providing at least a distribution cylinder (14) of said liquid suspension, and winding said continuous belt (8) around said distribution cylinder (14) for a predetermined winding angle (α), said distribution cylinder (14) being in contact with one from among said first surface (3) and said second surface (4), the remaining surface (3,4) being free. 60
20. Method according to claim 19, wherein said winding angle (α) is comprised between 15° and 90°. 65
21. Paper material (1), obtained with the apparatus (6) according to one of claims 7-14, or with the method according to one of claims 15-20, or paper product (P) derived by said paper material (1). 70

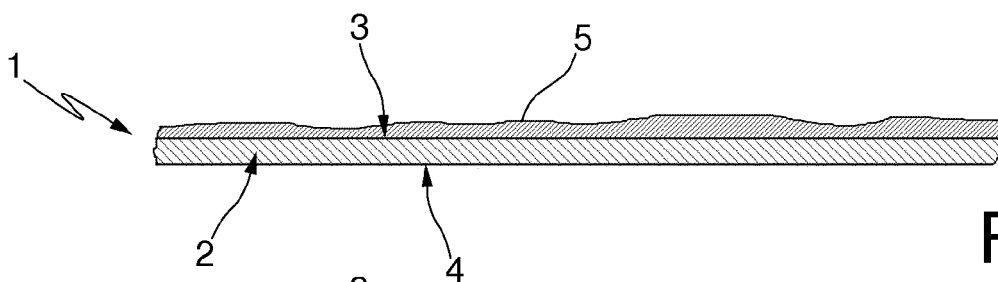


FIG. 1

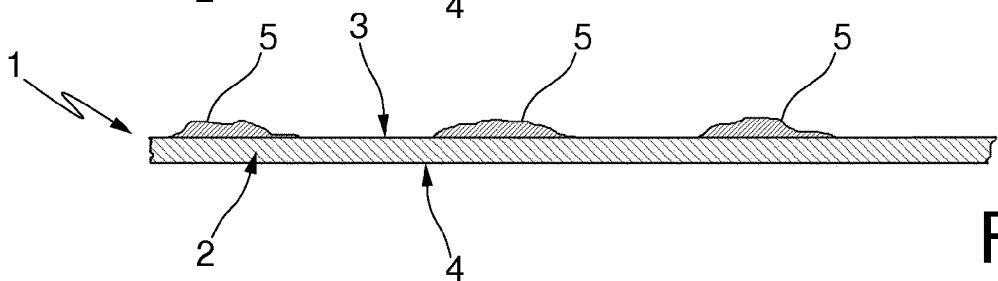


FIG. 2

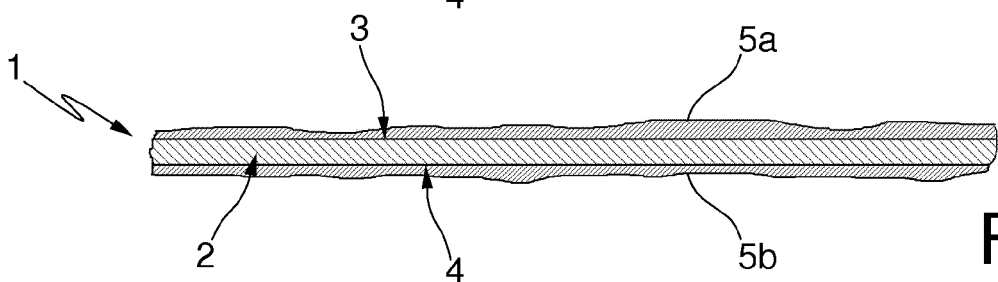


FIG. 3

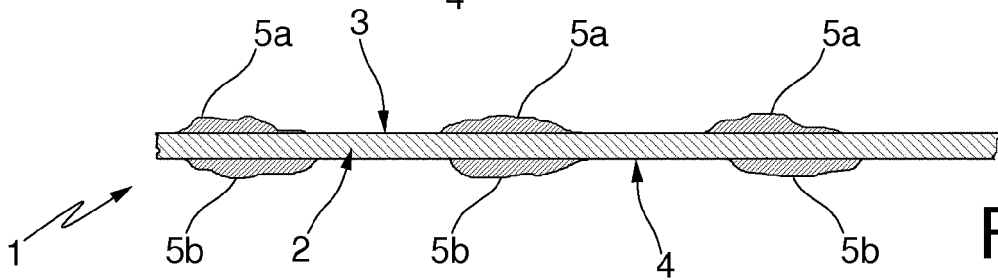


FIG. 4

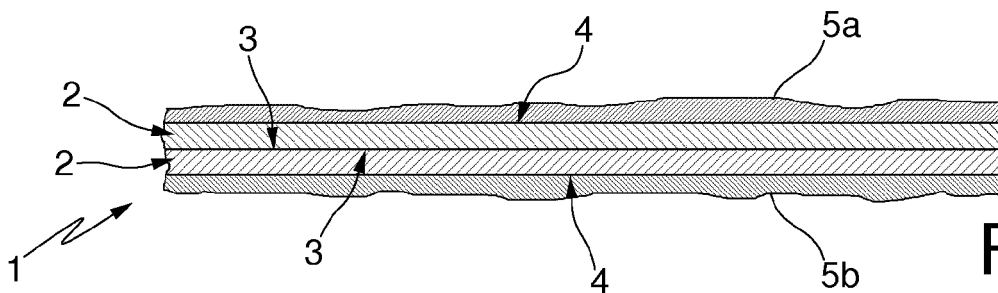


FIG. 5

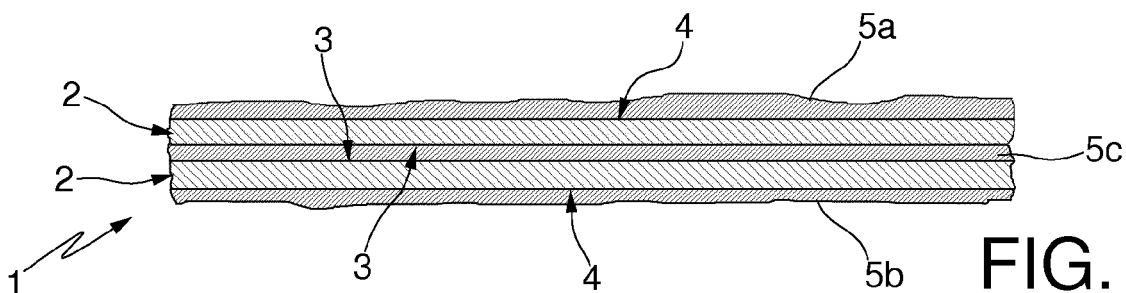
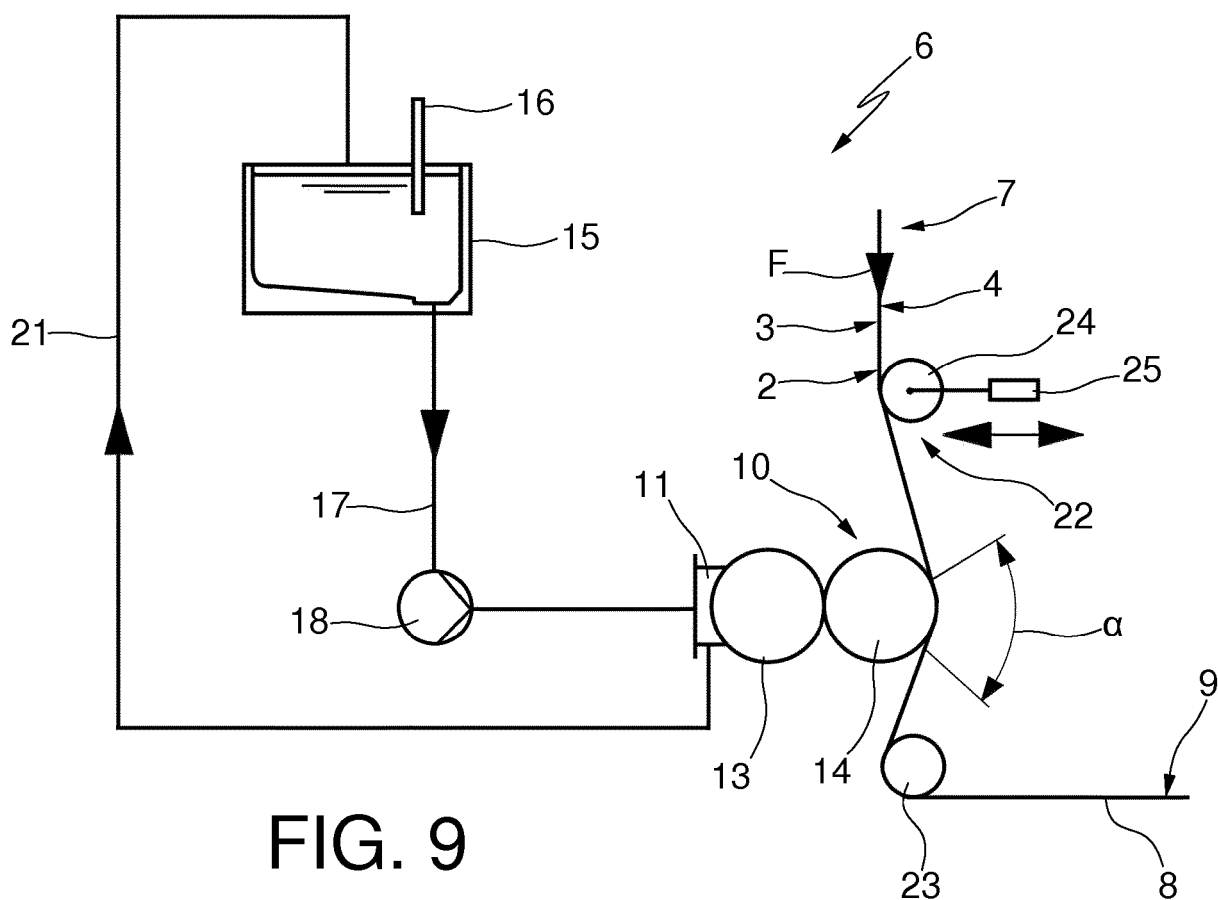
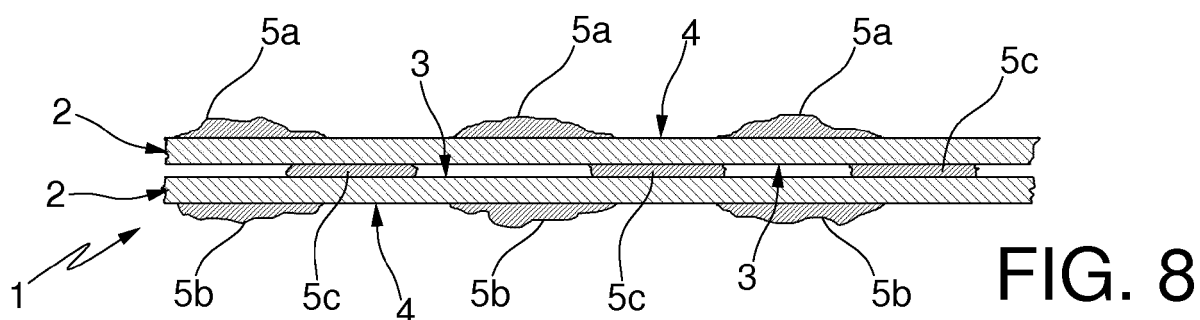
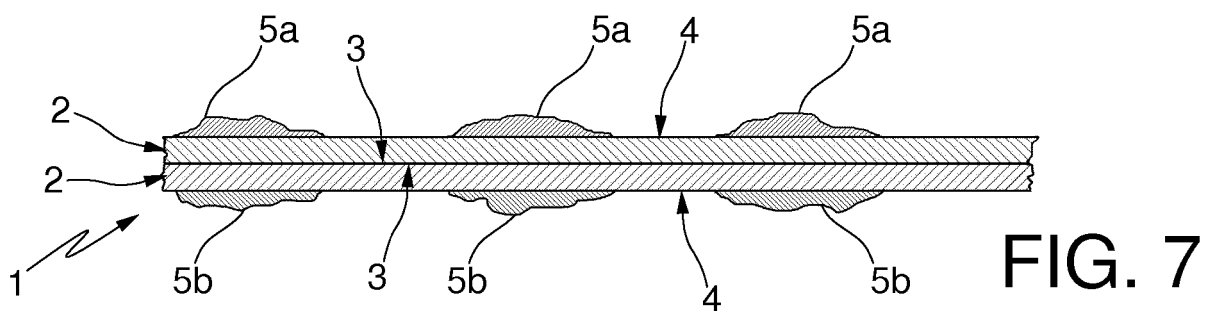


FIG. 6



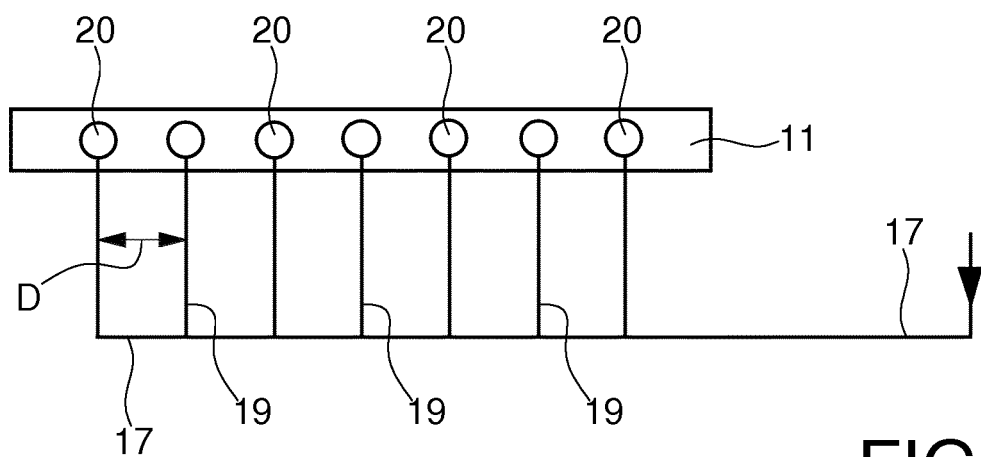


FIG. 10

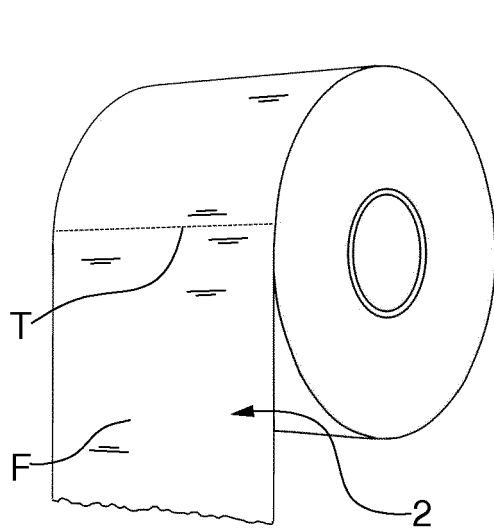


FIG. 11

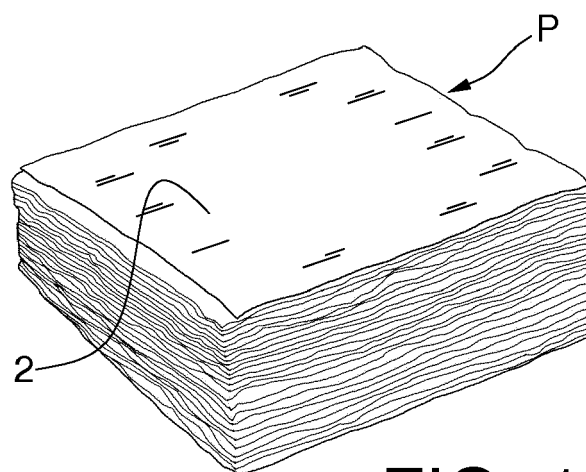


FIG. 12



EUROPEAN SEARCH REPORT

 Application Number
 EP 17 18 0371

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 659 218 A1 (PROCTER & GAMBLE [US]) 24 May 2006 (2006-05-24) * claims 1-13; figures 2, 4 * * paragraphs [0029], [0015], [0025], [0034], [0005], [0038], [0039], [0040] * * paragraphs [0005], [0022] *	1,3-5,7, 15-17,21	INV. D21H27/00 D21H27/38 D21H23/22 D21H23/56 D21H23/62 D21H11/12 D21H13/08 D21H13/24 D21H13/34
X	US 2013/071655 A1 (ZWICK KENNETH JOHN [US] ET AL) 21 March 2013 (2013-03-21) * paragraphs [0001], [0002], [0027], [0007] - [0011] * * paragraphs [0052] - [0054], [0059] - [0066] *	1-3,7, 15,16,21	
X	US 5 437 908 A (DEMURA TAKESHI [JP] ET AL) 1 August 1995 (1995-08-01) * column 1, line 30 - column 3, line 19 * * column 5, line 8 - line 12 * * column 2, line 38 - line 49 * * claims 1-9; examples 1-7 *	1,3,5,7, 15,17,21	
X	EP 1 138 474 A1 (UNI CHARM CORP [JP]) 4 October 2001 (2001-10-04) * paragraphs [0048], [0061], [0064], [0067], [0078], [0082] * * claims 1-21; figures 10, 11 *	1-3,5-8, 15-21	D21H B05C
X	US 4 569 864 A (MCINTYRE FREDERIC S [US]) 11 February 1986 (1986-02-11) * abstract * * claims 1-32; figures 1, 2 * * column 2, line 45 - column 5, line 49 * * column 4, line 1 - line 35 *	7-10	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 September 2017	Examiner Billet, Aina
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
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