

(19) **DANMARK**

(10) **DK/EP 2132041 T4**



Patent- og
Varemærkestyrelsen

(12) **Oversættelse af ændret
europæisk patentskrift**

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- (51) Int.Cl.: **B 41 M 5/50 (2006.01)** **B 32 B 27/04 (2006.01)** **D 21 H 17/20 (2006.01)**
D 21 H 17/33 (2006.01)
- (45) Oversættelsen bekendtgjort den: **2018-02-26**
- (80) Dato for Den Europæiske Patentmyndigheds
bekendtgørelse om opretholdelse af patentet i ændret form: **2017-11-15**
- (86) Europæisk ansøgning nr.: **08715946.3**
- (86) Europæisk indleveringsdag: **2008-02-22**
- (87) Den europæiske ansøgnings publiceringsdag: **2009-12-16**
- (86) International ansøgning nr.: **EP2008001393**
- (87) Internationalt publikationsnr.: **WO2008110254**
- (30) Prioritet: **2007-03-15 DE 102007013132**
- (84) Designerede stater: **AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC
MT NL NO PL PT RO SE SI SK TR**
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- (54) Benævnelse: **Fremgangsmåde til fremstilling af en fladeformet, påtrykt komponent**
- (56) Fremdragne publikationer:
EP-A1- 1 595 718
EP-A1- 1 749 676
WO-A1-03/008708
DE-A1- 19 715 268
Technisches Merkblatt "Egger Eurodekor Grundierfolie (GFE)" Oktober 2005
EP-A- 1 108 529
WO-A-2006/130708
JP-A- 8 197 697
JP-A- 10 000 747
JP-A- 2002 316 397

METHOD FOR PRODUCING A FLAT, PRINTED COMPONENT**Description**

[0001] The invention concerns a method for manufacturing a planar printed component, in particular for floor, wall, ceiling and/or furniture applications, in which a printable or printed, resin-impregnated paper layer being applied under the influence of pressure and heat to a planar base body of the component and wherein the paper layer being printed on only after the resin impregnation.

[0002] A method for the production of a planar printed component of the type described above is already known from WO 2006/130708 A2. It is disadvantageous that the paper produced according to the known method can lead to the ink being applied to the paper running easily, such that an unsatisfactory print result is produced.

[0003] Other methods for producing planar printed or printable components are known from JP-A-08197697, JP-A-10000747, and JP-A-2002316397.

[0004] A method and device for producing a paper web printable by means of an inkjet method and a printable object by means of this method is known from EP 1 749 676 A1. The object can be a panel or sheet.

[0005] The purpose of EP 1 749 676 A1 is to provide an inkjet printing process, wherein the printing result on the surface of the objects to be printed meets the highest quality requirements in terms of appearance. To this end, the prior art provides that a paper web being capable of absorbing liquid artificial resin along its entire thickness is impregnated with liquid artificial resin from one side such that the artificial resin does not entirely permeate the paper web, such that the other side of the web is at least substantially free of artificial resin. Lastly, the paper web known from EP 1 749 676 A1 comprises an upper side, substantially resin-free area, which makes up approximately 50% of the thickness of the paper web.

[0006] The known method seeks to create surfaces that are equivalent to conventional paper surfaces in terms of the properties required for printing, which should be optimally adjusted to the desired printing result through the selection of paper and inking fluid.

[0007] However, it has been found in connection with the semi-resin-impregnated paper web known from EP 1 749 676 A1 that depending on the paper material and ink used the ink coming into contact with the paper web runs in the upper area being non-resin-impregnated or only slightly resin-impregnated especially with high ink densities and/or high water content, resulting in the “blotter effect” . The result is also a relatively unsatisfactory printing result.

[0008] The purpose of this invention is to remedy this issue.

[0009] In order to solve the aforementioned problem, the invention provides in a method according to claim 1 that a completely resin-impregnated paper layer is used and that an ink layer being applied to the paper layer is dried during and/or after printing and that the drying occurs at a temperature below the reactivation temperature of the resin, in particular in the range between 30°C and 150°C. It has been found in connection with the present invention that excellent and reproducible printing results are then achieved if the print and/or ink coat is applied to the resin-impregnated paper. The complete resin impregnation of the paper layer has a dual effect here. On the one hand, the complete resin impregnation of the paper layer over its entire thickness ensures that the printing ink does not reach the paper of the paper layer, such that the aforementioned blotter effect cannot occur. Furthermore, the resin serves to bond the paper layer under the influence of pressure and heat with the base body of the component in a separate step.

[0010] The invention makes it possible for the paper layer to be imprinted both before and after application to the base body. Thus, it is firstly possible after production of a resin-impregnated paper to print this initially and to store the paper subsequent to the printing process, on rolls or in sheets for example. The printed paper layer can then be pressed onto the base body of the component under the influence of pressure and heat, wherein the resin first melts and then immediately hardens. Alternatively, it is also possible for the resin-coated paper layer to be first applied to the base body as described above and then to print the base body with the paper layer being already applied.

[0011] The method according to the invention is preferably suited for use in “direct coating” using the short-cycle pressing method. In this case, the resin-coated paper layer melts and

then hardens directly on the base panel under heat and pressure. Essential to the short-cycle pressing method is firstly that the base body as the carrier panel only yields negligibly to the pressure of the press, which is generally between 200 and 650 N/cm². Additionally, the base body and the applicable paper layers must not touch the hot press plates during insertion and removal. The pressing temperature is generally between 80°C and 250°C, preferably between 140°C and 200°C. The respective temperature depends on the reactivation temperature of the resin. Lastly, the “critical idle period”, i.e., the time from the first contact of the resin-coated paper layer with the press plate to the moment at which the necessary pressure is achieved, must be observed. This critical idle period should be extremely brief.

[0012] Although it is possible in principle to apply the method according to the invention in connection with all known printing processes, in particular intaglio printing, the printing of the paper layer is preferably by means of a digital printing process and in particular inkjet printing. In this case, it is preferable to use digital inkjet printers, with which excellent print results can be obtained. Furthermore, unlike the intaglio process, decoration can be easily designed on computers and printed at short notice.

[0013] Inks containing solvents and/or water are preferably used for the printing. UV-based ink systems can in principle also be used. However, these have the disadvantage of developing an odour. Furthermore, problems may arise during pressing.

[0014] In order to prevent any running of the ink on the printed side of the paper layer, it is useful to smooth out, polish and/or specifically finely roughen the top of the paper layer before printing. The smoothing, polishing and/or roughening can be performed using special squeegees or rollers, for example.

[0015] As an alternative to roughening, polishing and/or smoothing the top of the paper layer or in addition thereto, it can be useful to provide the top of the resin-impregnated paper layer with a pigment coat. The pigment coat has barrier properties against aqueous or solvent-containing substances such as lacquers and/or printing inks while in comparison it is possible for the resin to penetrate from the bottom of the pigment coat. Incidentally, the pigment coat

ensures that no unintentional running of the ink and the undesired blotter effect occurs. Lastly, the pigment coat is a relatively reliable carrier for the printing ink.

[0016] Moreover, it shall be understood that another ink acceptance layer can be used instead of the pigment coat, which prevents the ink from running on the top of the paper layer.

[0017] Independently of the application of the ink acceptance layer and/or the smoothing or roughening of the paper layer, it is possible in procedural terms for the ink layer being applied to the paper layer or the top of the paper layer to be heated or dried. To this end, appropriate heating devices may be provided, which heat the paper layer and in particular the top of the paper layer. For example, this can be done using a suitable fan. Instead of or in addition to this, infrared and in particular NIR heaters and/or microwave heaters can be provided which have a direct effect on the water content of the ink layer. The heating or drying may occur before, during and/or after imprinting. To this end, one or more heaters can be provided, wherein the drying line is not just provided at a single point but rather extended over a larger area, for example between 0 and 5 m, and in particular between 0 and 2 m. The heating or drying temperature is dependent on the reactivation temperature of the resin and is preferably below this temperature. Normally, the heating temperature is between 30°C and 150°C. The aforementioned heating leads to immediate drying of the ink on the paper layer as soon as the ink has been released from the print head and applied to the paper layer. It should be noted here that the heating or drying also has independent significance as an invention, i.e., independently of the resin impregnation of the paper layer.

[0018] In connection with the production of the paper layer, it should be noted that the resin treatment occurs after the actual manufacture of the paper. The resin coating can be carried out with just one resin or with different resins in several resin coating stages where applicable so that specific properties of the paper layer are achieved. After the resin coating, the paper layer may be dried and then the ink-acceptance layer can be applied if necessary. Another drying process can then follow. In an alternative embodiment, a “wet/wet treatment” is used. In this case, the ink acceptance layer is applied before the resin has fully dried, thus while it is still in a liquid or gelled or partially gelled state. This may be done simultaneously or

consecutively. The resin-treated paper layer being provided with an ink acceptance layer is then dried together.

[0019] After drying, the paper layer is either cut into sheets or rolled up as a continuous web.

5 In the method according to the invention, it is in principle also possible for printing to occur before cutting/rolling.

[0020] The present invention further concerns a paper layer or web for use in the process according to the invention previously described. It should be noted in this regard that resin-
10 impregnated paper webs that are then printed are known from prior art. However, essential to the invention in this case is the specific use of the paper web in relation to the aforementioned method.

[0021] The paper layer itself is a paper layer that has been completely impregnated with
15 resin through its entire thickness. It will be understood that the material and porosity of the paper layer are chosen such that complete impregnation of the paper layer with resin is possible.

[0022] Depending on the use, the weight per unit area of the paper layer without the resin
20 content should be between 30 and 300 g/m², preferably between 50 and 120 g/m². The weight per unit area of the resin content should preferably be between 5 and 300 g/m² and preferably between 20 and 100 g/m².

[0023] The resin itself is a reactivatable resin, in particular an aminoplast, such as a
25 melamine resin. Resins from the groups of diallyl phthalates, epoxy resins, urea-formaldehyde resins, uric acid-acetic acid ester copolyesters, melamine-formaldehyde resins, melamine-phenol-formaldehyde resins, phenol-formaldehyde resins, poly(meth)acrylates or unsaturated polyester resins are preferably used.

30 **[0024]** The printed side of the paper layer is preferably smoothed, polished and/or finely roughened by means of additional mechanical processing subsequent to the paper

production, for example by means of squeegees or rollers, to prevent any unintended running of the printing ink.

5 **[0025]** As an alternative to or in addition to the smoothing, polishing and/or roughening, a pigment coat or other ink acceptance layer may be applied to the top of the paper layer. The statements below concerning the pigment coat apply equally to an ink acceptance layer, even if individually specified. As in view of the complete resin impregnation of the paper layer there is no danger of the ink penetrating the paper layer thus creating the undesired blotter effect, the principal purposes of the pigment coat are firstly to prevent the ink running on the
10 printed side of the paper layer and secondly to homogenize the top of the paper layer.

[0026] In any case, the pigment coat should be provided as a constant, planar layer on the printed side of the paper layer. The weight per unit area of the pigment coat should be between 0.5 and 20 g/m². Preferably, the pigment coat comprises white pigments, such as
15 kaolin, calcium carbonate, aluminium hydroxide, talcum titanium dioxide, or coloured pigments, such as iron oxide pigments, carbon black, copper, aluminium, or other metallic pigments, or organic coloured pigments. The pigment coat can also comprise liquid colouring agents and/or silicic acids and/or colloidal silicas may be used. Furthermore, natural or synthetic binding agents, such as starch, polyvinyl alcohol, carboxymethylcellulose and
20 polymer dispersions based on acrylic acid, acrylester, styrene, butadiene, vinyl acetate or acrylonitrile may be used. The ratio of pigment to binding agent in the pigment coat is preferably between 1:0.05 and 1:1, and in particular 1:0.08 to 1:0.35 in relation to the solids content. In a preferred embodiment, the pigment coat comprises titanium dioxide, barium sulphate and silicates as the principal components, wherein other components may also be
25 provided.

[0027] Incidentally, a good printing result has been achieved when the pigment coat contains particles with an average size of less than 1000 nm. Most preferably, the particles should have an average diameter between 50 nm and 40 nm, preferably between 100 nm and 300
30 nm, and in particular between 150 nm and 200 nm. Very good test results not been obtained with particle diameters of approximately 200 nm.

[0028] It is expressly noted that the above and below ranges and intervals encompass all individual values located within the stated ranges and intervals and intermediate ranges or intervals without requiring explicit specification of individual values or intermediate ranges or intervals.

5

[0029] Exemplary embodiments of the invention are described in detail below based on the drawings, which show:

Fig. 1 a schematic cross-section of a completely resin-impregnated paper layer,

10

Fig. 2 a schematic cross-section of a surface-treated paper layer that is already printed,

Fig. 3 a schematic cross-section of a planar component, on the base body of which the paper layer has been applied,

15

Fig. 4 a flow chart of the method according to the invention, and

Fig. 5 an alternative flow chart schematic of the method according to the invention.

20 **[0030]** Fig. 1 shows a paper layer 1. The paper layer 1 consists of a conventional absorbent or liquid-absorbing paper or fibrous material. The paper layer 1 as such may be part of a roll or a sheet. Fig. 1 shows schematically that the paper layer 1 is impregnated with resin over its entire thickness. The resin concentration can in principle be equal over the thickness of the paper layer 1 or vary from one side to the other or from both sides to the middle. In any
25 case, the resin, which is preferably a melamine resin, and its viscosity is adjusted such to the type of paper material of paper layer 1 and also to the resin impregnation process that complete impregnation of the paper layer 1 over its entire thickness is guaranteed. The weight per unit area of the paper layer 1 shown in Fig. 1 including the resin content is approximately 170 g/m². The weight per unit area of the paper layer 1 without the resin
30 content is approximately 90 g/m².

[0031] Fig. 1 does not show that the paper layer 1 comprises a very uneven surface both on its top 2 and on its bottom 3, which is not particularly relevant here. To homogenize the top 2 of the paper layer 1, a pigment coat 4 is applied to the top 2 over the entire surface, as shown in Fig. 2. The application of the pigment coat 4 can in principle be carried out using
5 any coating method, in particular by rolling, spraying, squeegeeing, blade coating, airbrushing, pouring, film pressing, glue pressing, curtain coating, or by application with slotted nozzles. Here, an ink layer 5 is applied to the pigment coat 4. The pigment layer 4 here serves not only to homogenize the top 2 of the paper layer 1 and thus to homogenize the print side of the paper layer 1, but also to accept the printing ink, to affix the ink layer 5
10 and to prevent running of the individual inks in the ink layer 5.

[0032] The figure does not show that, instead of the pigment layer 4, surface treatment of the top 2 is also possible in principle, namely through smoothing, polishing and/or fine roughening of the top 2 by roller or squeegee. It is incidentally also possible to provide
15 mechanical surface treatment by smoothing, polishing and/or roughening as well as applying an additional pigment coat 4. This has the advantage that the pigment coat 4 must only be very thin, as the homogenization of the top 2 has already occurred by means of mechanical pretreatment and the pigment coat then at least substantially only serves to affix the ink on the print side of the paper layer 1. Depending on the material of the dye or the selected ink,
20 the weight per unit area of the pigment coat 4 is between 0.5 and 20 g/m², wherein only a minimal application of the pigment coat 4 is required if the surface has additionally been mechanically homogenized.

[0033] Here, the ink layer 5 has been applied by a digital inkjet printer not shown here, i.e.,
25 by means of the inkjet method, although other printing processes, in particular intaglio, are also possible. Both printing inks containing solvents and containing water may be used.

[0034] Fig. 3 shows a section of a printed planar component 6. The component 6 can, in particular, be a plate or a panel. Preferably, it is a floor, wall and/or ceiling covering or a
30 panel-shaped piece of furniture. The component 6 comprises a planar base body 7, which is only shown partially, which may have one or more layers and is made specifically of wood and/or synthetic materials. In particular, the component can be a wooden panel, such as

MDF, HDF, or DKS panels, or an HPL (high-pressure laminate) panel. However, the component can also be a thicker foil, cardboard, or plasterboard panel.

5 [0035] The printed paper layer 1 is applied to the top 8 of the base body 6 of the component 6 shown in Fig. 3 and tightly linked with it. Furthermore, a protective layer 9 is applied to the ink layer 5. The protective layer 9, which is also treated with resin, serves to protect the ink layer 5 from UV radiation and in particular from mechanical damage. In order for the ink layer 5 to remain recognizable, the protective layer 9 is transparent. The protective layer 9 may contain very hard particles, such as corundum. It should be noted that the protective layer 9 is generally realised in such components 6 that are used in flooring. However, the protective layer 9 may also be dispensed with. This applies in particular in the case of wall and ceiling applications, as well as furniture elements.

15 [0036] Fig. 4 schematically illustrates the method according to the invention in the case of a short-cycle pressing process. The process begins with the known manufacture of the paper in a paper-making machine, which is shown in step A. The paper layer 1 is still part of an almost endless paper web. Step A also includes the complete impregnation of the paper or the paper layer 1 with resin. The manufacture and resin impregnation of the paper in step A is followed by the surface treatment of the paper layer 1 in step B. In this case, the surface treatment B initially includes smoothing the top 2 in order to homogenize the surface, followed by fine roughening of the previously smoothed surface. Then, the pigment coat 4 is applied. It should be noted that the surface may be just smoothed, just polished, or just have the pigment coat 4 applied to it in step B. Incidentally, it is in principle also possible for the pigment coat 4 to be first applied to the top after the production of the paper, which is then resin-treated from below.

30 [0037] After the surface treatment of the resin-impregnated paper layer 1 being provided with the pigment coat a, the printing and thus the application of the ink layer 5 occurs in step C. The printing occurs with a digital inkjet printer using the inkjet printing process. During printing, the paper layer 1 can still be part of a paper web or can already be part of a sheet cut off from the paper web. It can however also be cut into sheets later.

[0038] Immediately following step C, or simultaneously to it, step D, i.e. the heating of the top of the paper layer 1 and thus the drying of the ink layer 5 is carried out directly after application to the paper layer 1. It should be noted that the paper layer 1 may in principle also have been heated or warmed before printing such that the ink is printed on a preheated paper layer 1, which assists with drying.

[0039] In step E, the paper layer 1 is pressed together with the base body 7. Simultaneously, the protective layer 9 is also pressed in an appropriate press. Under the pressure and heat of the press plates of the press, the resin in the paper layer 1 and the resin in the protective layer 9 melts and immediately hardens during pressing, such that firstly the paper layer 1 is tightly bonded to the base body 7 and secondly the protective layer 9 is tightly bonded to the paper layer 1. Due to the complete resin impregnation of the paper layer, this leads incidentally to such a close bond between the protective layer 9 and the paper layer 1 that unintentional separation of the protective layer 9 is not a concern.

[0040] Fig. 5 schematically illustrates an alternative embodiment of the short-cycle pressing process of direct coating according to the invention. Steps a and b correspond to the aforementioned steps A and B of the paper production and surface treatment. However, this is followed by step c, wherein the paper layer 1, already cut into sheets, is applied to the base body 7 but without the protective layer 9 by means of pressing in the aforementioned press.

[0041] After pressing the as-yet unprinted paper layer 1 onto the base body 7, the unprinted component 6 is then also printed using the inkjet process in step d. Simultaneously or immediately thereafter, the ink layer 5 is dried in step e. The paper layer 1 may naturally have been preheated here too. This is followed by the final pressing of the protective layer 9 in the press in step f in order to bind the protective layer 9 with the paper layer 1 after melting and hardening of the resin.

[0042] Although the procedure schematically illustrated in Fig. 5 is more elaborate in terms of the method, it has the advantage that unprinted components 6 can be readily available

and the printing can then occur at short notice as required in line with the customer specification.

References:

- 5 [0043]
- 1 Paper layer

2 Top

3 Bottom

4 Pigment coat

510 Ink layer

6 Component

7 Base body

8 Top

9 Protective layer
- 15
- A Paper production

B Surface treatment

C Printing

20 D Drying

E Pressing
- a Paper production

b Surface treatment

25 c Pressing

d Printing

e Drying

f Pressing

Fremgangsmåde til fremstilling af en fladeformet, påtrykt komponent

Patentkrav:

1. Fremgangsmåde til fremstilling af en fladeformet, påtrykt komponent (6), særligt til anvendelse på gulv, væg, loft og/eller møbler, hvor der på et fladeformet grundlegeme (7) på komponenten (6) ved brug af tryk og varme påføres et harpiksbehandlet papirlag (1), som kan påtrykkes eller er påtrykt og er harpiksbehandlet helt igennem, og hvor papirlaget (1) først påtrykkes efter harpiksbehandlingen,

kendetegnet ved,

at et på papirlaget (1) påført farvelag (5) tørres under og/eller efter påtrykningen, og at tørringen sker ved en temperatur, der ligger under reaktiveringstemperaturen for harpiksen, særligt mellem 30° C og 150° C.

2. Fremgangsmåde ifølge krav 1, **kendetegnet ved, at** papirlaget (1) påtrykkes, før eller efter det påføres grundlegemet (7).

3. Fremgangsmåde ifølge krav 1 eller 2, **kendetegnet ved, at** grundlegemet (7) belægges direkte med papirlaget ved kontaktrykbehandling.

4. Fremgangsmåde ifølge et af ovenstående krav, **kendetegnet ved, at** papirlaget (1) påtrykkes ved hjælp af digital trykbehandling, særligt blækstråletryk.

5. Fremgangsmåde ifølge et af ovenstående krav, **kendetegnet ved, at** oversiden (2) af papirlaget (1), der er harpiksbehandlet helt igennem, udglattes mekanisk og/eller særligt oprues fint før påtrykning.

6. Fremgangsmåde ifølge et af ovenstående krav, **kendetegnet ved, at** der anvendes et papirlag (1), som på oversiden har et farveoptagelseslag, fortrinsvis en pigmentbelægning (4).

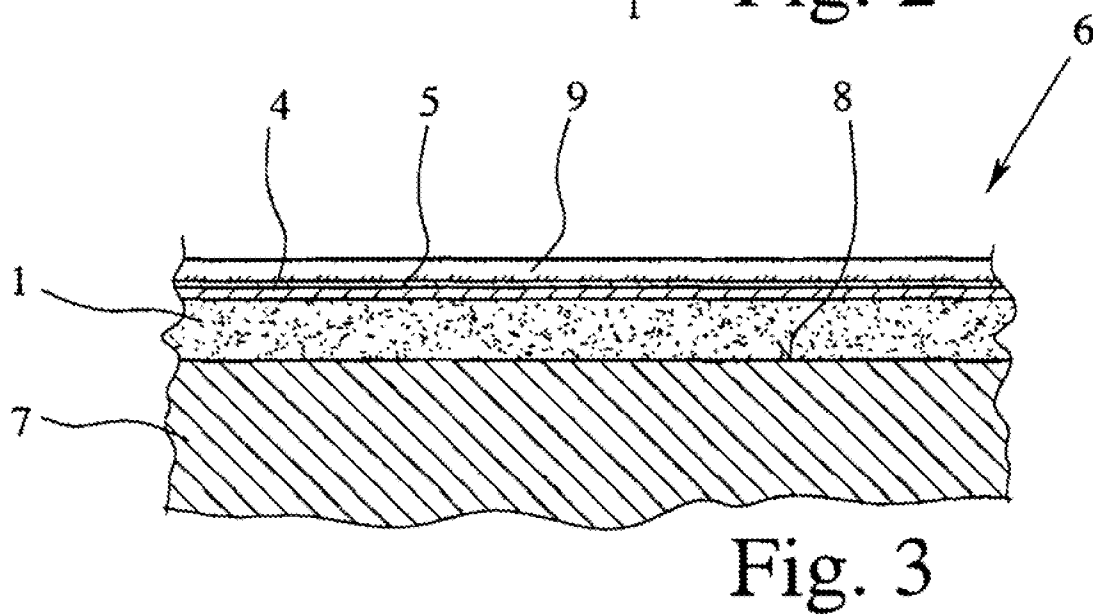
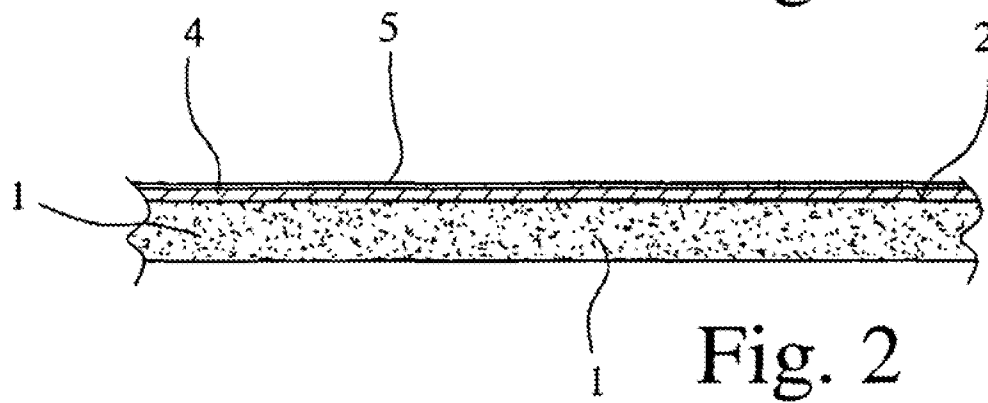
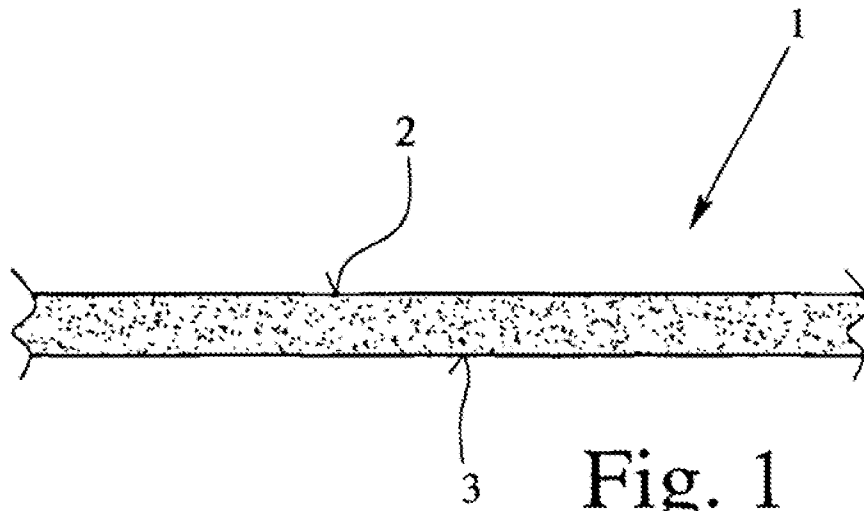
7. Fremgangsmåde ifølge et af ovenstående krav, **kendetegnet ved, at** harpiksbehandlingen først sker, når farveoptagningslaget er påført.

8. Fremgangsmåde ifølge et af ovenstående krav, **kendetegnet ved, at** der anvendes et papirlag, hvis vægt pr. arealenhed uden at medregne den andel, som udgøres af

13

behandlingsharpiks, ligger på mellem 30 g/m² og 300 g/m², fortrinsvis mellem 50 g/m² og 120 g/m².

- 5 9. Fremgangsmåde ifølge krav 8, **kendetegnet ved, at** vægten pr. arealenhed af andelen af behandlingsharpiks ligger på mellem 5 g/m² og 300 g/m², fortrinsvis mellem 20 g/m² og 100 g/m².
- 10 10. Fremgangsmåde ifølge et af kravene 8 eller 9, **kendetegnet ved, at** der på tryksiden på papirlaget (1) tilvejebringes et farveoptagelseslag, særligt en pigmentbelægning (4).
11. Fremgangsmåde ifølge et af kravene 8 til 10, **kendetegnet ved, at** pigmentbelægningen (4) påføres som et lag over hele arealet med en vægt pr. arealenhed på mellem 0,5 g/m² og 20 g/m².
- 15 12. Fremgangsmåde ifølge et af ovenstående krav 8 til 11, **kendetegnet ved, at** papirlaget efter harpiksbehandlingen oprulles som en bane eller skæres i ark til videre bearbejdning.



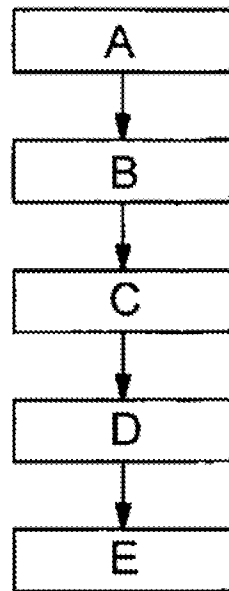


Fig. 4

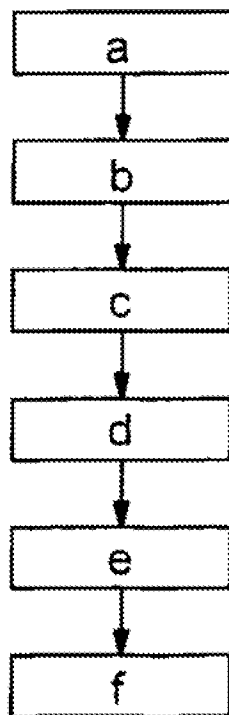


Fig. 5