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(54) **Method and device for producing a decorative film for leather, synthetic leather and cloth**

(57) An apparatus for manufacturing a decorative film for semi-finished products such as leather, imitation leather and fabric includes a first gravure-printing station (5) consisting of a photo-engraved cylinder (5a) that picks up a molten thermoplastic material from an underlying heated tray (5b) and transfers it to a print substrate (2) with the aid of an overlying rubber cylinder (5c), followed by a first cooling station (6) suitable to cool and fix the thermoplastic material applied to the print substrate (2), as well as a second gravure-printing station (9) arranged downstream from the first cooling station and consisting of a photo-engraved cylinder (9a) that picks up a second molten thermoplastic material from an underlying heated tray (9b) and transfers it to the print substrate (2) with the aid of an overlying rubber cylinder (9c), followed by a similar second cooling station (10). The invention also relates to the manufacturing method of said decorative film and to the film thus manufactured.

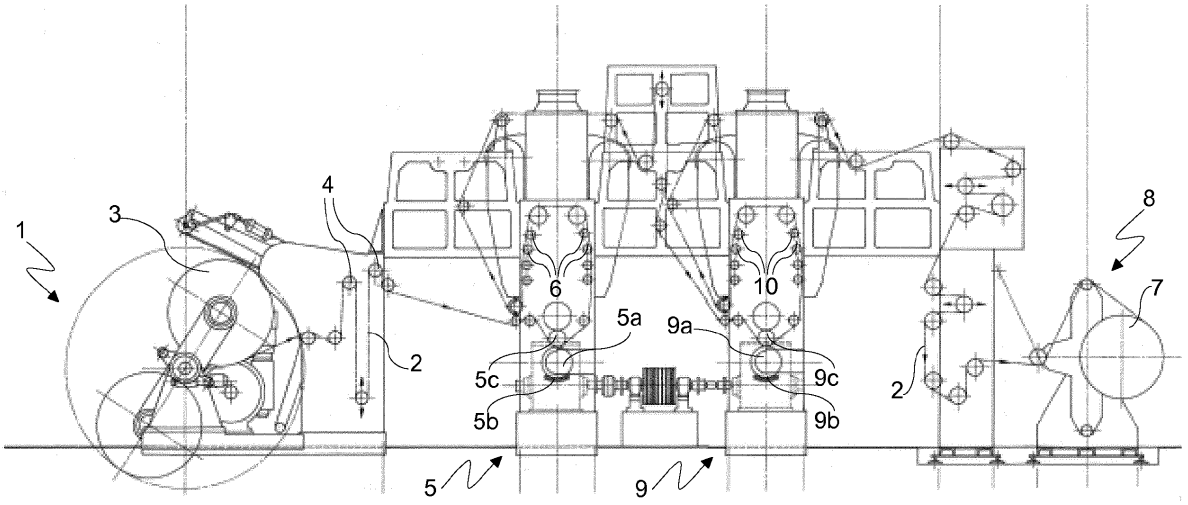

Fig.1

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Description

[0001] The present invention relates to the surface finishing of semi-finished products such as leather, imitation leather and fabric, and in particular to a method and apparatus for manufacturing a decorative film that is at least two-coloured as well as to the film thus manufactured.

[0002] It is known that the surface finishing for decorative purposes of these products is achieved by applying one or more films on which there is printed the pattern and/or colour that is meant to be given to the product. For example, to obtain a coloured "crocodile skin" effect it is possible to apply a first film carrying a transparent scaled pattern and a second film carrying the colouring (with one or more colours).

[0003] An inked decorative film is usually manufactured with an apparatus that performs a gravure printing by means of a photo-engraved roller carrying in relief the decorative pattern to be applied to the print substrate (e.g. a 23 μm polyester web) with the aid of a rubber impression roller. In the case of a multi-coloured film there is used an apparatus provided with various printing stations, each one comprising a tray with a differently coloured ink, in alternation with drying stations to dry the colour that has just been printed prior to printing the following colour.

[0004] On the contrary, in order to manufacture a film with a pattern that provides the product with a particular effect or design there is usually used an apparatus with a single printing station comprising a tray heated at 150-200°C for melting a powder of thermoplastic material such as e.g. copolyester, transparent or coloured, that replaces the ink. In this case, a cooling station is provided after the printing station to fix the pattern prior to winding the film.

[0005] To perform the decorative treatment, starting from a material M to be decorated (see Fig.4a), the first step consists therefore in applying by means of a hot calender a thermoplastic material T carried by a support substrate S (Fig.4b), so that the heated thermoplastic material T sticks to the material M to be decorated. Upon removal of the support substrate S, the thermoplastic material T remains stuck on material M forming a pattern thereon (Fig.4c) that defines the regions on which the second decorative film formed by an ink layer P carried by a similar support substrate S' (Fig. 4d) will act.

[0006] In the second step said film is applied to the semi-finished product, again by means of a hot calender, on the previously treated side whereby the thermoplastic material T that is already present, once heated by the calender, will act as an adhesive allowing the colour or design of the second film to stick thereon (Fig.4e). In this way the second film colours, with a solid colour or a design, the thermoplastic material applied in the first step to the material to be decorated. Upon removal of substrate S' that carries ink P of said second film, there is obtained a product with a pattern of thermoplastic material decorated with a solid colour or a design.

[0007] Therefore it is clear that in order to obtain a decoration comprising a multi-coloured pattern it is necessary to use at least two films: a first film to transfer the pattern to the material, possibly already with a base colour, and a second film that provides the required final colouring. This requires therefore at least four working steps: application of the first film, removal of the first substrate S, application of the second film and removal of the second substrate S'.

[0008] It should be noted that while the first film with the pattern of thermoplastic material T is self-adhesive thanks to the properties of said material upon heating, the second film printed with ink P requires an adhesive for its application to material M thus making impossible to use it alone, i.e. without the first film, but with a pretreatment of material M that implies a further working step.

[0009] Therefore the obj ect of the present invention is to provide a method and an apparatus which simplify the above-mentioned process. This object is achieved by means of a method and an apparatus in which a print substrate is directly gravure-printed at two or more printing stations, each one comprising a heated tray containing molten thermoplastic material and being followed by a cooling station, wherein the first station provides the application of thermoplastic material in a reduced amount and/or of light colour whereas the second and possible further stations provide the application of thermoplastic material in a higher amount and/or of a darker colour.

[0010] The advantage of the film manufactured according to the present invention is that of allowing the decoration of an imitation leather or the like with a multi-coloured pattern in a single simple step like the application of a self-adhesive film, rather than requiring the subsequent application of two or more films at least one of which requires an adhesive.

[0011] This and other advantages and characteristics of the method and apparatus according to the present invention will be clear to those skilled in the art from the following detailed description of an embodiment thereof, with reference to the annexed drawings wherein:

Fig.1 shows a diagrammatic side view of an apparatus according to the invention;
Figs.2a-2d show diagrammatic top plan and sectional views of the manufacturing steps of a film according to the invention;
Figs.3a-3b show diagrammatic sectional views of the application of a film according to the invention to a material to be decorated; and
Figs.4a-4e show diagrammatic top plan and sectional views of the decorating process steps according to the prior art.

[0012] With reference to Fig.1, there is seen that an apparatus performing the method of the invention conventionally includes a feed unit 1 where the print substrate 2 is unwound from a reel 3 and subsequently taken

by means of a plurality of idle rollers 4 to a first printing station 5. Said printing station 5 includes a photo-engraved cylinder 5a that picks up the molten thermoplastic material from an underlying heated tray 5b and transfers it directly to substrate 2 with the aid of an overlying rubber cylinder 5c located on the opposite side of the print substrate 2.

[0013] Above the printing station 5 there is arranged a cooling station consisting of two rows of water-cooled cylinders 6 that cool and fix the thermoplastic material applied on substrate 2 before the latter is wound in a reel 7 in a winding unit 8 at the apparatus outlet.

[0014] A first novel aspect of the present invention resides in the presence of at least a second printing station 9, arranged between the first cooling station and the winding unit 8. Said second printing station 9 includes in turn a photo-engraved cylinder 9a that picks up the molten thermoplastic material from an underlying heated tray 9b and transfers it directly to substrate 2 with the aid of an overlying rubber cylinder 9c located on the opposite side of the print substrate 2. Similarly to what previously described, above the printing station 9 there is arranged a second cooling station consisting of two rows of water-cooled cylinders 10.

[0015] It should be noted that in this second printing station 9 the application of the molten thermoplastic material occurs on a substrate 2 that already carries the thermoplastic material applied in the first printing station 5 and subsequently fixed by means of the cooling cylinders 6. As a consequence, cylinder 9a not only applies to substrate 2 the material coming from tray 9b but also inevitably removes a small fraction of the material already present on substrate 2 and coming from tray 5b, then dropping it into tray 9b.

[0016] In order to minimize the consequences of such an event, as previously mentioned, the present invention provides in a second novel aspect thereof that in the first printing station 5 there is applied little thermoplastic material and of a light colour, when not transparent at all, whereas in the second printing station 9 there is applied a higher amount of thermoplastic material and of a darker colour.

[0017] In this way, cylinder 9a does not find on substrate 2 much material which can be removed during the second printing step and in any case that little material coming from tray 5b which ends up in tray 9b does not significantly "pollute" the latter since it is a small amount of light material mixed to a lot of darker material. It should be noted that if the material contained in tray 5b is transparent then the amount applied in the first printing station 5 is irrelevant since in any case the transparent material will not alter the colour of the material contained in tray 9b.

[0018] The manufacturing of the decorative film according to the present invention is schematized in figures 2a-2d, where each figure presents a top plan view and a sectional view of the film being manufactured.

[0019] Substrate 2 (Fig.2a) is printed in the first printing station with a first thermoplastic material 11 that defines a first pattern (Fig.2b), then it is printed in the second printing station with a second thermoplastic material 12, for example in the regions not covered by the first print (Fig.2c) or, on the contrary, the second print could affect only the regions already covered by the first print. Finally, the substrate can be printed in a third printing station with a third thermoplastic material 13, for example in the regions already covered by the first print (Fig.2d).

[0020] Regardless of the number and arrangement of the prints applied to substrate 2, the resulting decorative film is then applied to the material to be decorated in just two process steps, as shown in figures 3a and 3b.

[0021] More specifically, in the first step illustrated in Fig.3a an applying device A, which can be cylindrical or flat, is shaped for the thermal application to the material M to be decorated of a film formed by substrate 2 on which there are printed two thermoplastic materials 11 and 12. It should be noted that in this case the print of the second thermoplastic material affects both regions not covered by the first print and regions already covered by the first print, where it overlaps with a thickness lower than the first thermoplastic material 11.

[0022] Upon removal of substrate 2 in the second process step, the decoration results applied to material M, obviously with materials 11 and 12 arranged in the reverse order with respect to the print order on substrate 2.

[0023] In the light of the description above, the method according to the present invention can be summarized as follows:

a) arranging a print substrate 2;
b) performing on said print substrate 2 a first direct gravure print using a first molten thermoplastic material 11;
c) cooling and fixing said first print;
d) performing on said print substrate 2 a second direct gravure print using a second molten thermoplastic material 12 darker than the first one; and
e) cooling and fixing said second print;

wherein the amount of molten thermoplastic material 11 applied in the first print is substantially lower than the amount of molten thermoplastic material 12 applied in the second print, possibly with an exception if the first molten thermoplastic material 11 is transparent.

[0024] It should be noted that the method and apparatus of the invention, as previously mentioned, could include after the second printing station 9 further printing and cooling stations fully similar to those described above. In that case, obviously, the materials applied sequentially in the various printing stations will in general increase in amount and in darkness.

[0025] It is therefore clear that the above-described and illustrated embodiment of the method and apparatus according to the invention is just an example susceptible of various modifications. In particular, the exact structure and arrangement of the printing and cooling stations of the apparatus can be freely changed according to spe-

cific manufacturing needs.

Claims

1. Apparatus for manufacturing a decorative film for semi-finished products such as leather, imitation leather and fabric, comprising a first gravure-printing station (5) consisting of a photo-engraved cylinder (5a) that picks up a molten thermoplastic material (11) from an underlying heated tray (5b) and transfers it directly to a print substrate (2) with the aid of an overlying rubber impression cylinder (5c) located on the opposite side of said print substrate (2), downstream from said first printing station (5) there being arranged a first cooling station suitable to cool and fix said thermoplastic material (11) applied to the print substrate (2), **characterized in that** it further includes at least a second gravure-printing station (9) arranged downstream from said first cooling station and consisting of a photo-engraved cylinder (9a) that picks up a second molten thermoplastic material (12) from an underlying heated tray (9b) and transfers it directly to the print substrate (2) with the aid of an overlying rubber impression cylinder (9c) located on the opposite side of the print substrate (2), as well as at least a second cooling station arranged downstream from said second printing station (9) and suitable to cool and fix said second thermoplastic material (12) applied to the print substrate (2).

2. Apparatus according to claim 1, **characterized in that** the photo-engraved cylinder (5a) of the first printing station (5) is capable of transferring to the print substrate (2) an amount of molten thermoplastic material (11) that is substantially lower than the amount of molten thermoplastic material (12) that the photo-engraved cylinder (9a) of the second printing station (9) is capable of transferring to said print substrate (2).

3. Apparatus according to claim 1 or 2, **characterized in that** it includes further printing and cooling stations downstream from the second cooling station.

4. Apparatus according to claim 3, **characterized in that** the photo-engraved cylinder of each further printing station is capable of transferring to the print substrate (2) an amount of molten thermoplastic material lower than the amount of molten thermoplastic material that the photo-engraved cylinder of the following printing station is capable of transferring to the print substrate (2).

5. Apparatus according to any of the preceding claims, **characterized in that** each cooling station is arranged above the relevant printing station (5, 9) and consists of a row of water-cooled cylinders (6, 10).

6. Method for manufacturing a decorative film for semi-finished products such as leather, imitation leather and fabric, including the steps of:

   a) arranging a print substrate (2);
   b) performing on said print substrate (2) a first direct gravure print using a first molten thermoplastic material (11);
   c) cooling and fixing said first print;

   characterized in that it includes the further steps of:

   d) performing on said print substrate (2) at least a second direct gravure print using a second molten thermoplastic material (12) darker than the first one; and
   e) cooling and fixing said second print.

7. Method according to claim 6, **characterized in that** the amount of molten thermoplastic material (11) applied in the first print of step b) is substantially lower than the amount of molten thermoplastic material (12) applied in the second print of step d).

8. Method according to claim 6 or 7, **characterized in that** it includes further printing and cooling steps after step e).

9. Method according to claim 8, **characterized in that** in said further printing steps the thermoplastic materials applied in sequence in the various printing steps increase in amount and in darkness.

10. Decorative film for semi-finished products such as leather, imitation leather and fabric, consisting of a print substrate (2) and a decorative pattern of thermoplastic material (11, 12) applied on said print substrate (2) through direct gravure printing, **characterized in that** said decorative pattern includes two or more colours.

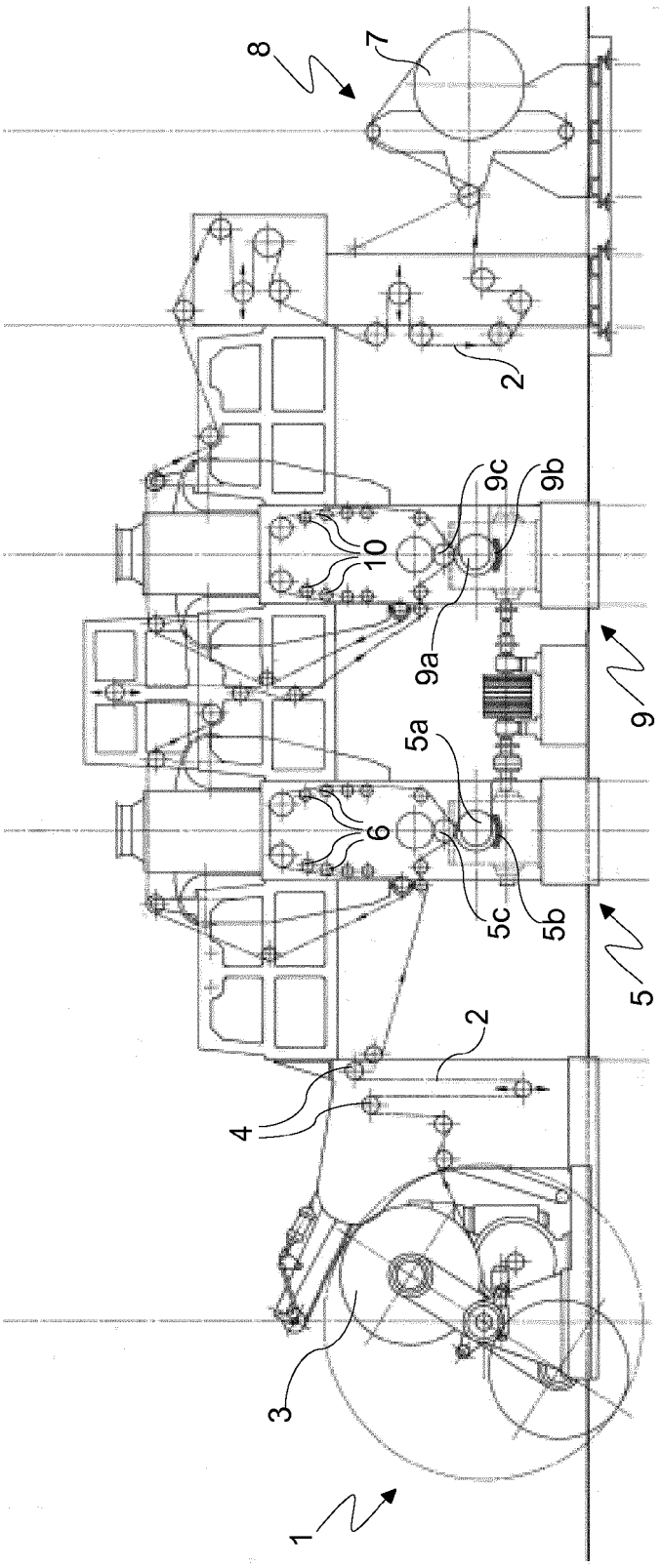

Fig.1

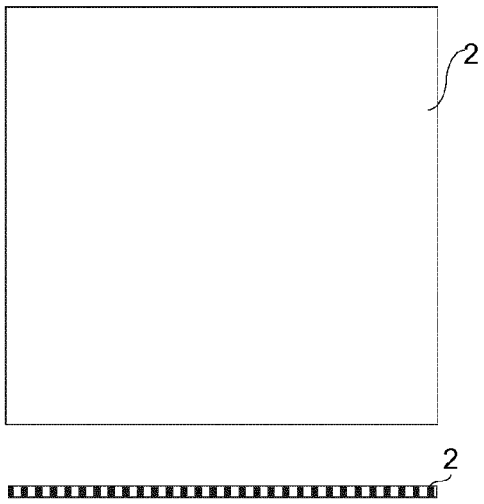

Fig.2a

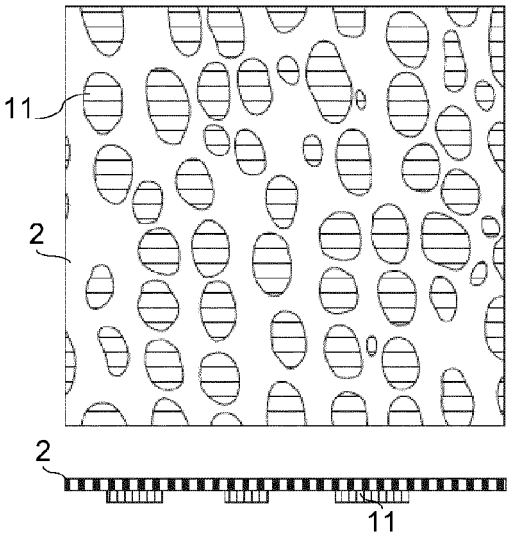

Fig.2b

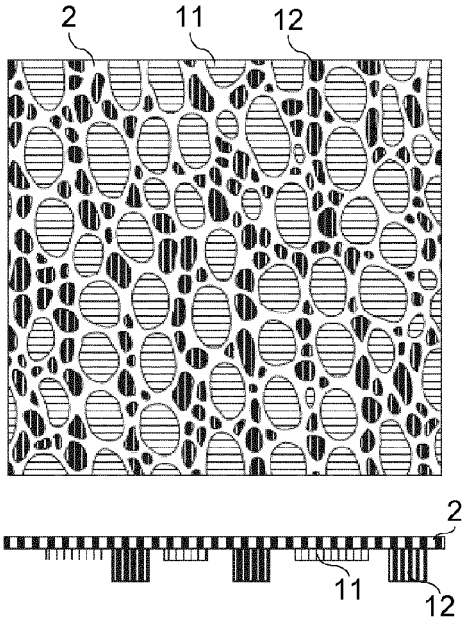

Fig.2c

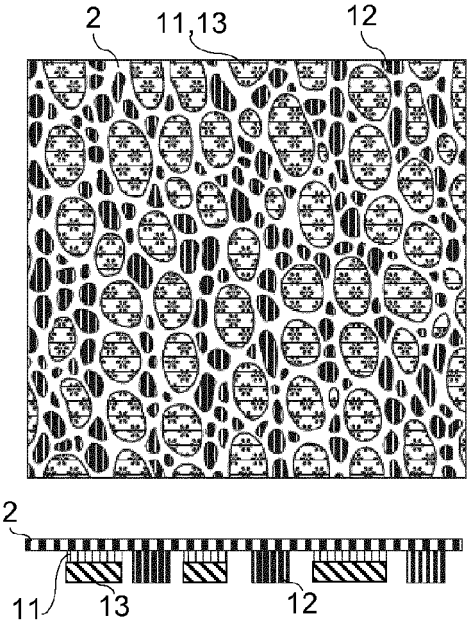

Fig.2d

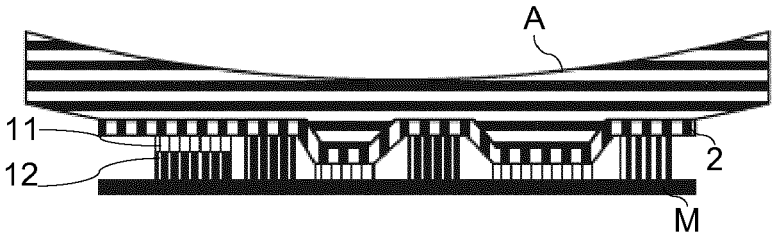

Fig.3a

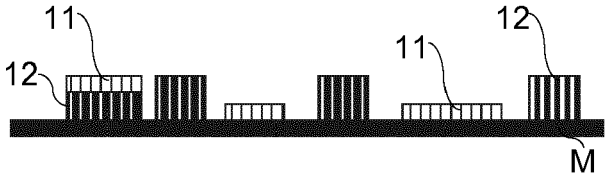

Fig.3b

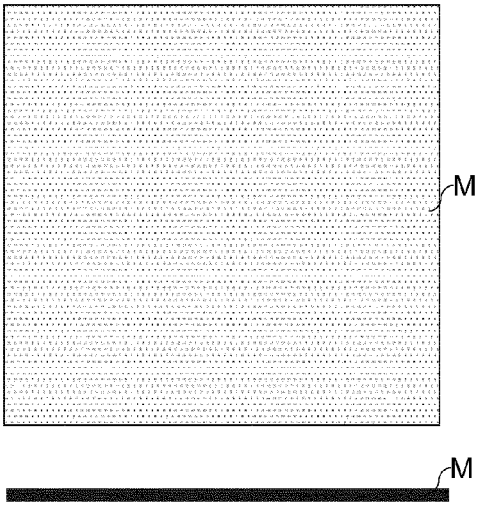

Fig.4a

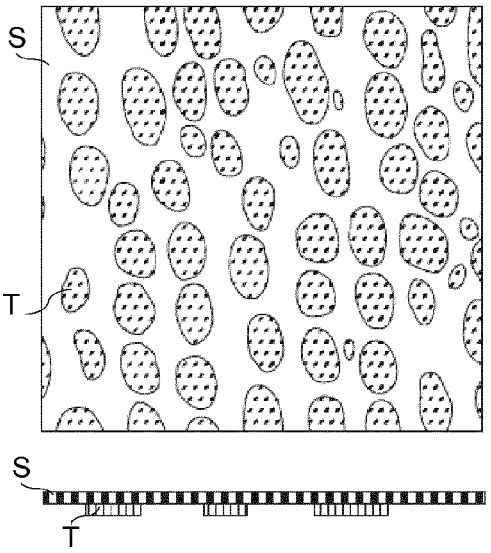

Fig.4b

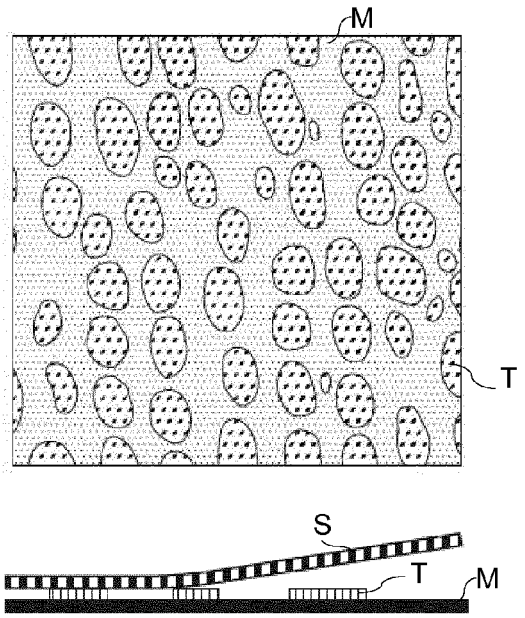

Fig.4c

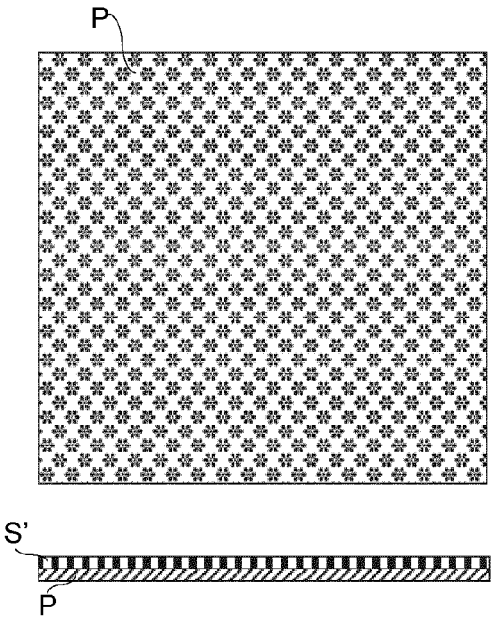

Fig.4d

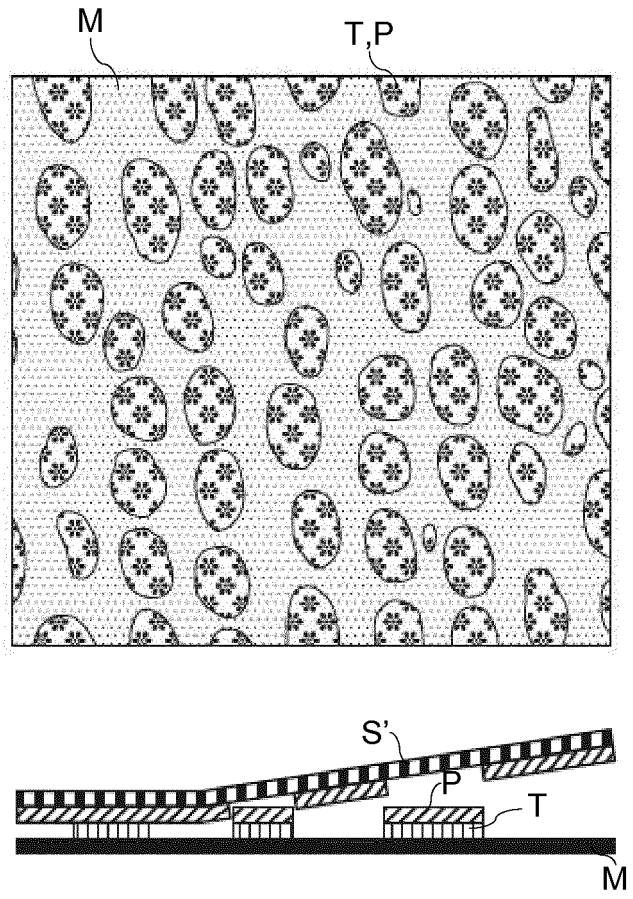

Fig.4e

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EUROPEAN SEARCH REPORT

Application Number
EP 12 17 0059

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	* column 4, line 52 - column 5, line 19 * * column 6, line 52 - column 7, line 12; figure 3 *	1,6	
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A	JP 11 059089 A (HOSOYANOBUKICHI SHOTEN KK; HOKUYO KK) 2 March 1999 (1999-03-02) * abstract *	1,6	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 August 2012	D'Incecco, Raimondo

CATEGORY OF CITED DOCUMENTS

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