



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.12.2007 Bulletin 2007/52

(51) Int Cl.:
B44C 1/17 ^(2006.01) **B44C 1/16** ^(2006.01)
B41M 3/12 ^(2006.01)

(21) Application number: **06425410.5**

(22) Date of filing: **16.06.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

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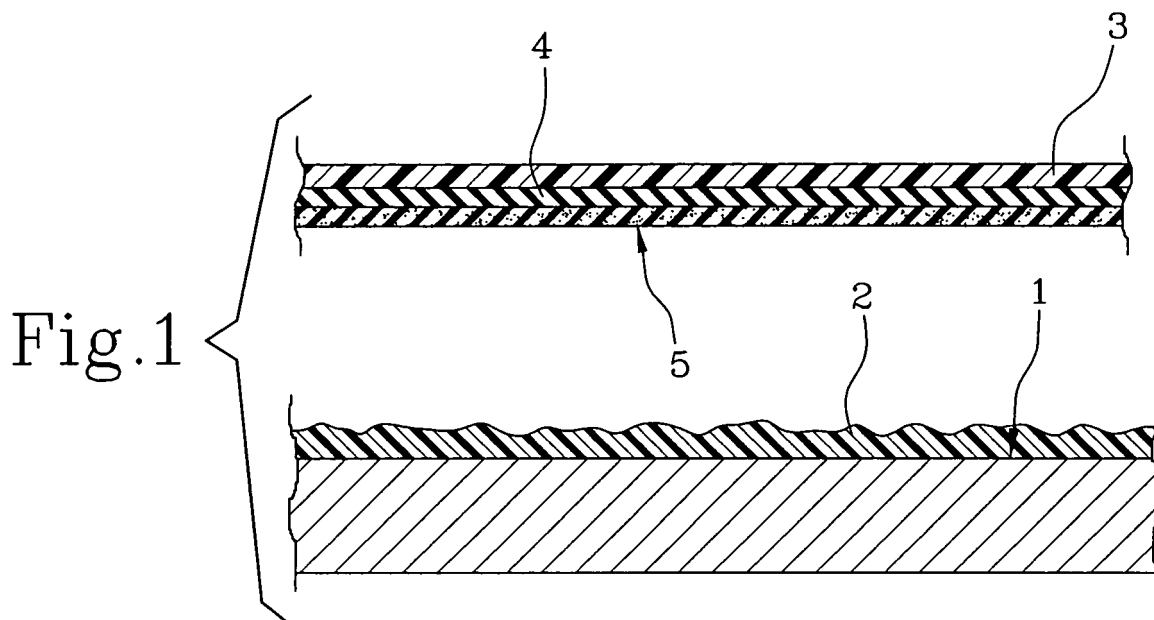
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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Process for surface decoration**

(57) A process for surface decoration comprises the steps of applying a thermosetting resin (2) to a surface (1) to be decorated, preparing a support (3) provided with a waxy layer (4) and with at least one decorative layer (5) superposed on said waxy layer (4), applying the support (3) to the surface (1) bringing the decorative layer

(5) into contact with the thermosetting resin (2). The surface (1) and support (3) are heated until the decorative layer (5) is detached from the support (3) and adhesion of the decorative layer (5) to the thermosetting resin (2) occurs, as well as subsequent polymerisation of the resin (2) together with said decorative layer (5).



Description

[0001] The present invention relates to a process for surface decoration.

[0002] In particular, the present invention is addressed to the decoration of metal surfaces belonging to aluminium section members, sheet metals, sheet metal rolls known in the particular technical field as "coils", etc., to which a particular appearance is required to be given. The present invention is also addressed to decoration of MDF surfaces, i.e. wooden surfaces made up of wood fibres or narrow bundles obtained through high-temperature thermomechanical grinding, bonded together with or without use of thermosetting adhesives and hot pressed.

[0003] For instance, the present invention is used for decorating metal door and window frames that must have a wood-like aesthetic appearance or reproduce particular chromatic fancy images.

[0004] In more detail, the present invention is concerned with the decoration of surfaces by means of inks/paints having colouring pigments of sizes included between 0.5 and 10 microns that cannot be applied by means of the known sublimation techniques.

[0005] Colouring of metal surfaces by a system known as "powder-on-powder process" is known. This process is carried out by first applying a thermoadhesive/thermosetting resin onto the surface to be decorated. To carry out this application, the metal surface is electrostatically charged and introduced into a mist of powders of said thermosetting resin. The resin, under the action of the electrostatic field, lays onto the surface and becomes fixed thereto.

[0006] Subsequently, the surface is maintained to a temperature of about 100-130°C, to enable the resin to reveal and keep its thermoadhesive properties, and sprayed by means of a spray gun for example, with a colouring paint adhering to the resin itself. The surface is then brought to a predetermined temperature of about 200°C, to which the resin polymerises retaining the colouring powders in a stable manner.

[0007] The just described known process is in any case a limiting process because it does not allow execution of particular patterns but it only enables colouring of the surfaces in a substantially uniform manner because laying of the individual paint pigments is quite random.

[0008] For application of patterns, use of the transfer technique is also known. In this technique, the pattern is originally positioned on a support, a layer of release material, of the waxy type for example, being interposed therebetween. The support is associated with the surface to be decorated with the colouring pigments in contact with said surface. Subsequently, the surface and support are brought to such a temperature (about 100-130°C) that detachment of the colouring layer from the support is caused through melting of the waxy layer, as well as transfer of same onto the surface.

[0009] The adhesion/clinging force of the dye or col-

ouring material to the surface carried out by means of the transfer process is in any case weak, so that the colouring layer often separates from the surface itself.

[0010] In this context, the technical task of the present invention is to propose a process for surface decoration that is free from the above mentioned drawbacks.

[0011] In particular, it is an aim of the present invention to propose a process for surface decoration ensuring an excellent adhesion/clinging of the paint or paints to the surface itself.

[0012] Another aim of the present invention is to propose a process enabling sure application of decorations also when they are very complicated.

[0013] It is a further aim of the present invention to provide a process that is cheap and can be executed with the same ovens belonging to the traditional painting and decoration equipment.

[0014] The technical task mentioned and the aims specified are substantially achieved by a process for surface decoration according to the features recited in one or more of the appended claims.

[0015] Further features and advantages of the present invention will become more apparent from the description of a preferred but not exclusive embodiment, given by way of non-limiting example, of a process for surface decoration, as illustrated in the accompanying drawings, in which:

- Fig. 1 shows a first operating step of a process for surface decoration in accordance with the invention;
- Fig. 2 shows a second operating step of the process seen in Fig. 1;
- Fig. 3 shows an enlarged portion of Fig. 2; and
- Fig. 4 shows the enlarged portion of Fig. 3 in a third operating step of the process.

[0016] With reference to the drawings, a surface to be decorated has been generally identified with reference numeral 1.

[0017] Surface 1 is preferably made of metal material such as steel or an aluminium alloy and for instance belongs to a section member, a flat section, a rolled section currently referred to as "coil", etc.

[0018] Surface 1 can also be a MDF surface, i.e. a wooden surface made up of wood fibres or narrow bundles obtained through high-temperature thermomechanical grinding, bonded together with or without use of thermosetting adhesives and hot pressed.

[0019] According to the process of the present invention, a thermosetting resin 2 is first applied to surface 1, the function of resin 2 being to form an anchoring substrate for the decoration.

[0020] The thermosetting resin 2 is preferably selected from two-component resins comprising catalysts that can be activated to predetermined temperatures.

[0021] Thermosetting resins are cross-linked polymers that, once modelled to high temperatures, cannot be modified as regards their shape. The main feature of

same is their resistance to high temperatures.

[0022] The thermosetting resins used are polyurethane powders, epoxy resins, polyamide resins, acrylic resins polyester resins, for example.

[0023] Application of the thermosetting resin 2 to surface 1 can be carried out following different methods, such as painting, spraying, coating, silk-screen printing, rotogravure, depending on the type of resin 2 used.

[0024] Preferably, this application is of the electrostatic type. For carrying out the application, in fact, the metal surface is electrostatically charged and introduced into a mist of powders of said thermosetting resin 2. The resin powder, under the action of the electrostatic field, lays onto the surface 1 and is provisionally fixed thereto.

[0025] Should surface 1 be made of MDF, in order to enable an application of the electrostatic type of the thermosetting resin 2 powders, surface 1 is previously made electrically conductive, by previously dipping said surface 1 into a solution of an electrically conductive material.

[0026] When laying has been carried out (Fig. 1), surface 1 is heated to a temperature T_p so as to fix the resin 2 to surface 1 at least provisionally. The exact pre-heating temperature T_p depends on the resin used and is generally included between 100°C and 150°C.

[0027] Advantageously, heating is obtained by introducing the workpiece carrying surface 1 to be decorated into an oven, an infrared oven for example, of known type and as used in current painting processes.

[0028] Before or during preparation of surface 1, a support 3 is to be provided which has an intermediate release layer 4, of the silicone, Teflon™, paraffin type, and preferably of the waxy type, and at least one decorative layer 5 superposed on the waxy layer 4 (Fig. 1).

[0029] Irrespective of the specific composition, the intermediate layer 4 is capable of retaining the decorative layer 5 at room temperature and melting at temperatures included between 100°C and 150°C as specified below, so as to release the retained decorative layer 5.

[0030] The decorative layer 5 may contain one or more types of ink/paint and may represent the most different shapes and colours without any limitation. Preferably, the types of ink used are pigment inks, water inks or inks in a solvent and they are not sublimable.

[0031] In addition, the decorative layer 5 has colouring pigments 5a of sizes included between 0.5 and 10 microns.

[0032] The support 3 is preferably defined by a film of plastic or paper material. Preferably, the film is selected from the group consisting of polyesters, polyamides, polyethylene, polypropylene.

[0033] As already specified above, before applying the support 3 to surface 1, surface 1 and the thermosetting resin 2 are preheated to the temperature T_p , so as to fix resin 2 to surface 1 at least temporarily.

[0034] Subsequently, surface 1 is drawn out of the oven and preferably cooled to enable cold coupling of same to the support 3.

[0035] The support 3 is positioned on surface 1 by bringing the decorative layer 5 into contact with the resin 2, which resin 2 has not yet been submitted to polymerisation or hardened (Figs. 2 and 3).

[0036] Therefore, the support 2 temporarily adheres to surface 1 and, also when application has been completed, can be in any case shifted relative to said surface 1, so as to correct a possible positioning error.

[0037] The surface 1 and support 3 are therefore heated until causing separation of the decorative layer 5 from the support 3, adhesion of the decorative layer 5 to the thermosetting resin 2 and subsequent polymerisation and hardening of this resin 2 together with the decorative layer 5.

[0038] This heating too can be advantageously obtained by introduction of surface 1 and support 3 into an oven of known type.

[0039] Preferably, heating is carried out in a first step, during which the surface 1 to be decorated and the support 3 are brought to a first temperature " T_1 ". To this temperature the resin 2 takes the above mentioned adhesive properties and the waxy layer 4 loses its consistency and releases the decorative layer 5. Therefore transfer of the decorative layer 5 to surface 1 occurs.

[0040] Subsequently, in a second step, surface 1 and the transferred decorative layer 5 are brought to a second temperature " T_2 ", until the resin 2 polymerises and hardens, stably retaining the ink pigments 5a incorporated therein (Fig. 4).

[0041] It is to be noted that during polymerisation of resin 2, the ink pigments 5a partly penetrate into the resin 2 to different depth levels, giving the decoration a tridimensional effect (Fig. 4).

[0042] In other words, the parts of resin 2 not concerned with pigments 5a tend to increase their volume during polymerisation, while the parts of resin 2 covered with pigments 5a do not substantially increase their volume, generating therefore a decoration having different depth levels.

[0043] Between the first and second steps, surface 1 and support 3 are drawn out of the oven, the support 3 that is now devoid of the decorative layer 5 is removed and the only surface 1 provided with resin 2 and ink not yet hardened, is introduced again into the oven for polymerisation.

[0044] Removal of the support 3 devoid of the decorative layer 5 from surface 1 before polymerisation of the resin 2 facilitates the tridimensional effect of the final decoration.

[0045] The second temperature " T_2 " is higher than the first temperature " T_1 ". Said temperatures " T_1 ", " T_2 " depend on the type of resin used. The first temperature " T_1 " is included between 100°C and 150°C. The second temperature " T_2 " is included between 160°C and 220°C.

[0046] As said, transfer of the decoration from support 3 to surface 1 takes place to the temperature " T_1 ". Once surface 1 is to the temperature " T_1 ", the necessary time to enable occurrence of this transfer is practically instan-

taneous.

[0047] Surface 1 and the transferred decorative layer 5 are preferably maintained to the second temperature " T_2 " for a period of time included between 5 and 30 minutes, depending on the selected temperature " T_2 ".

[0048] Irrespective of the specific values of these temperatures " T_1 ", " T_2 ", it is to be importantly pointed out that at the first temperature " T_1 " the selected resin 2 must become adhesive and at the second temperature " T_2 " it must polymerise and harden. Usually, the resin keeps to an adhesive state until polymerisation, i.e. at temperatures included between the first " T_1 " and second " T_2 " one.

[0049] Since after the first step the resin 2 and the ink are not yet stably anchored to surface 1, the decorated surface 1 can be advantageously submitted to a quality control.

[0050] If from said control the decoration quality appears to be faulty, surface 1 is not submitted to the second step but both the decorative layer 5 and resin 2 are stripped off.

[0051] Recovery of already decorated pieces is possible and easy. These pieces can be easily and quickly cleaned and submitted to the decorative process again. In this way, only top-quality decorations are submitted to subsequent polymerisation.

[0052] The invention reaches the intended purposes and achieves important advantages.

[0053] First of all, the process of the invention allows also complicated and aesthetically high-quality decorations to be obtained, which decorations show an excellent adhesion/clinging of the paint/paints to the decorated surface.

[0054] Advantageously, the present process enables the percentage of decorated pieces with faults to be drastically reduced, because the quality control takes place before polymerisation of the resin and the decoration.

[0055] In addition, for carrying out the present process, the same equipment used in known painting and decoration processes can be utilised. Thus a further investment for machinery is not required.

[0056] The process of the invention is also particularly advantageous even if compared with known sublimation techniques. In fact, since the present process gives optimal results also with colouring pigments of big sizes, RAL powders/ paints can be used which are less expensive than the specific paints used for sublimation techniques.

[0057] Finally, fastness to light of the decorations obtained with the present process is greatly higher than that of the decorations obtained by sublimation, because pigments having a lightfastness of 7-8 can be used, against values of 6-7 for pigments in sublimation paints.

Claims

1. A process for surface decoration, **characterised in that** it comprises the steps of:

- applying a thermosetting resin (2) to a surface (1) to be decorated;
- preparing a support (3) provided with an intermediate layer (4) and with at least one decorative layer (5) superposed on said intermediate layer (4);
- applying the support (3) to said surface (1), bringing the decorative layer (5) into contact with the thermosetting resin (2);
- heating the surface (1) and support (3) until separation of the decorative layer (5) from the support (3) is caused, as well as adhesion of the decorative layer (5) to the thermosetting resin (2) and subsequent polymerisation of said resin (2) together with said decorative layer (5).

2. A process as claimed in claim 1, wherein heating is carried out in a first step, during which the surface (1) to be decorated and the support (3) are brought to a first temperature (T_1) until the resin (2) takes adhesive properties and the intermediate layer (4) releases said decorative layer (5) that is transferred onto the surface (1), and subsequently in a second step during which at least the surface (1) and said transferred decorative layer (5) are brought to a second temperature (T_2) until the resin (2) polymerises.
3. A process as claimed in claim 2, wherein the second temperature (T_2) is higher than the first temperature (T_1).
4. A process as claimed in claim 2, wherein the first temperature (T_1) is included between 100°C and 150°C.
5. A process as claimed in claim 2, wherein the second temperature (T_2) is included between 160°C and 220°C.
6. A process as claimed in claim 2, wherein at least the surface (1), the resin (2) and said transferred decorative layer (5) are maintained to the second temperature (T_2) for a period of time included between 5 and 30 minutes.
7. A process as claimed in claim 2, wherein between the first and second heating steps, the support (3) is removed from the surface (1).
8. A process as claimed in claim 2, wherein between the first and second heating steps, the surface (1) is submitted to a quality control.
9. A process as claimed in the preceding claim, wherein if it appears from the quality control that the decoration is faulty, the decorative layer (5) and the resin (2) are removed from the surface (1).

10. A process as claimed in claim 1, wherein before applying the support (3) to the surface (1), said surface (1) and the thermosetting resin (2) are preheated to a temperature (T_p) to fix the resin (2) to the surface (1) at least temporarily. 5
11. A process as claimed in claim 1, wherein application of the thermosetting resin (2) to the surface (1) to be decorated is carried out by charging said surface (1) to be decorated electrostatically and inserting said surface (1) into a mist of powders of said thermosetting resin (2), the resin (2) adhering to the surface (1) under the action of the electrostatic charge. 10
12. A process as claimed in claim 1, wherein the support (3) is a film. 15
13. A process as claimed in claim 1, wherein the support (3) is made of a material selected from the group consisting of polyesters, polyamides, polyethylene and polypropylene. 20
14. A process as claimed in claim 1, wherein the support (3) is made of paper material. 25
15. A process as claimed in claim 1, wherein the thermosetting resin (2) is selected from the group consisting of polyurethanes, polyesters, acrylic resins, polyamides, epoxy resins. 30
16. A process as claimed in claim 1, wherein the thermosetting resin (2) is in the form of a powder.
17. A process as claimed in claim 1, wherein the intermediate layer (4) is selected from the group consisting of siliconic materials, Teflon™ materials, paraffinic materials, waxy materials. 35
18. A process as claimed in claim 1, wherein the decorative layer (5) comprises at least one ink. 40
19. A process as claimed in the preceding claim, wherein said at least one ink is an ink with non sublimable pigments. 45

Amended claims in accordance with Rule 137(2) EPC.

1. A process for surface decoration, **characterised in that** it comprises the steps of: 50
 - applying a thermosetting resin (2) to a surface (1) to be decorated;
 - preparing a support (3) provided with an intermediate release layer (4) and with at least one decorative layer (5) superposed on said intermediate release layer (4) and comprising at least 55

one ink or paint;

- applying the support (3) to said surface (1), bringing the decorative layer (5) into contact with the thermosetting resin (2);
- heating the surface (1) and support (3); wherein heating is carried out in a first step, during which the surface (1) to be decorated and the support (3) are brought to a first temperature (T_1) until the resin (2) takes adhesive properties and the intermediate release layer (4) releases said decorative layer (5) that is transferred onto the surface (1), and subsequently in a second step during which at least the surface (1) and said transferred decorative layer (5) are brought to a second temperature (T_2) to cause the resin (2) to polymerise and harden, stably retaining ink pigments (5a) of the at least one decorative layer (5) incorporated therein.

2. A process as claimed in claim 1, wherein the second temperature (T_2) is higher than the first temperature (T_1).

3. A process as claimed in claim 1, wherein the first temperature (T_1) is included between 100°C and 150°C.

4. A process as claimed in claim 1, wherein the second temperature (T_2) is included between 160°C and 220°C.

5. A process as claimed in claim 1, wherein at least the surface (1), the resin (2) and said transferred decorative layer (5) are maintained to the second temperature (T_2) for a period of time included between 5 and 30 minutes.

6. A process as claimed in claim 1, wherein between the first and second heating steps, the support (3) is removed from the surface (1).

7. A process as claimed in claim 1, wherein between the first and second heating steps, the surface (1) is submitted to a quality control.

8. A process as claimed in the preceding claim, wherein if it appears from the quality control that the decoration is faulty, the decorative layer (5) and the resin (2) are removed from the surface (1).

9. A process as claimed in claim 1, wherein before applying the support (3) to the surface (1), said surface (1) and the thermosetting resin (2) are preheated to a temperature (T_p) to fix the resin (2) to the surface (1) at least temporarily.

10. A process as claimed in claim 1, wherein application of the thermosetting resin (2) to the surface

(1) to be decorated is carried out by charging said surface (1) to be decorated electrostatically and inserting said surface (1) into a mist of powders of said thermosetting resin (2), the resin (2) adhering to the surface (1) under the action of the electrostatic charge. 5

11. A process as claimed in claim 1, wherein the support (3) is a film. 10

12. A process as claimed in claim 1, wherein the support (3) is made of a material selected from the group consisting of polyesters, polyamides, polyethylene and polypropylene. 15

13. A process as claimed in claim 1, wherein the support (3) is made of paper material.

14. A process as claimed in claim 1, wherein the thermosetting resin (2) is selected from the group consisting of polyurethanes, polyesters, acrylic resins, polyamides, epoxy resins. 20

15. A process as claimed in claim 1, wherein the thermosetting resin (2) is in the form of a powder. 25

16. A process as claimed in claim 1, wherein the intermediate release layer (4) is selected from the group consisting of siliconic materials, Teflon™ materials, paraffinic materials, waxy materials. 30

17. A process as claimed in the preceding claim, wherein said at least one ink is an ink with non sublimable pigments. 35

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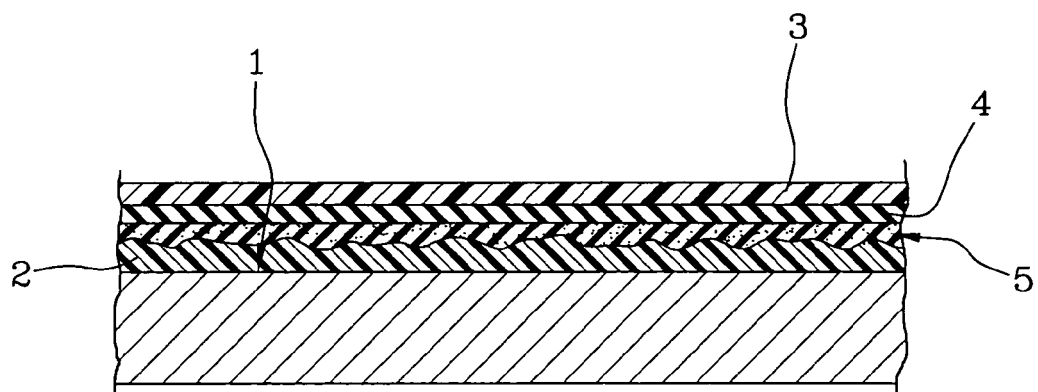
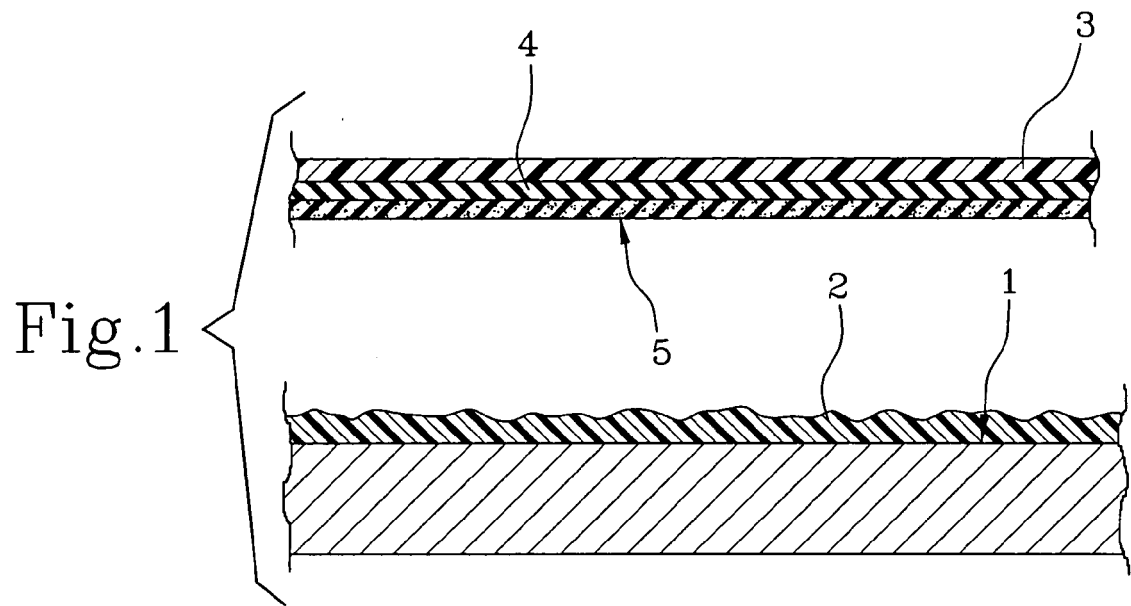


Fig.2

Fig.3

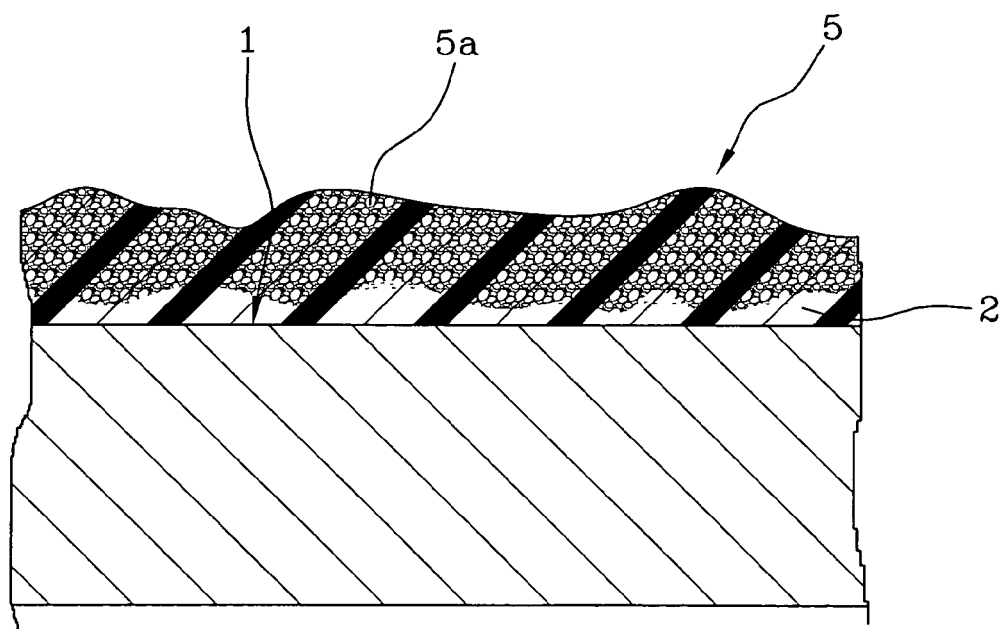
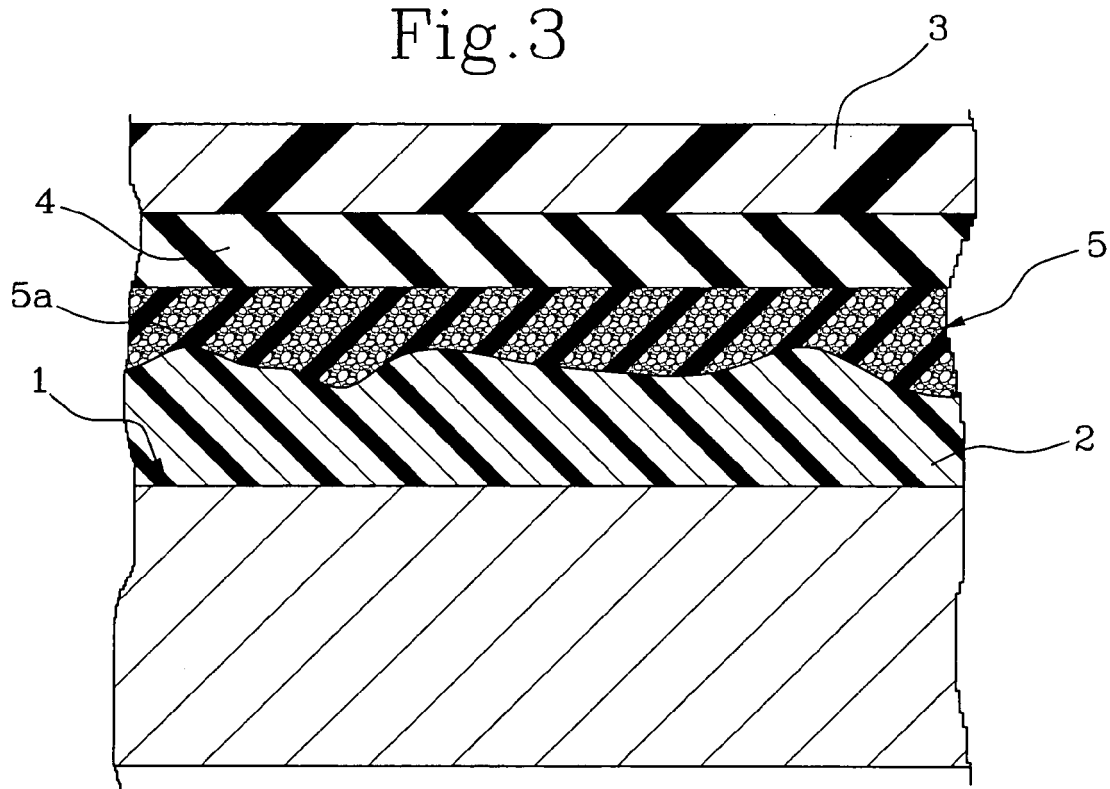


Fig.4



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Office

EUROPEAN SEARCH REPORT

Application Number
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 06 42 5410

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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