



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.09.2019 Bulletin 2019/39

(51) Int Cl.:
B41C 1/00 (2006.01)

(21) Application number: **19163104.3**

(22) Date of filing: **15.03.2019**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(30) Priority: **21.03.2018 IT 201800003853**

(54) **PROCESS FOR REALISING A BLANKET OR SLAB FOR OVERPRINT VARNISHING**

(57) The invention reveals a process for realising a blanket or slab for overprint varnishing (1) at least comprising a support layer (2) and a varnishing layer (3), characterised in that a digital model of the varnishing layer (3) is created having areas of shortage of material (6)

that modify in a localised way the thickness of said varnishing layer (3), and a non cross-linked elastomeric thermoplastic polymer material is applied onto said support layer (2) with an additive technology that physically reproduces the digital model of said varnishing layer (3).

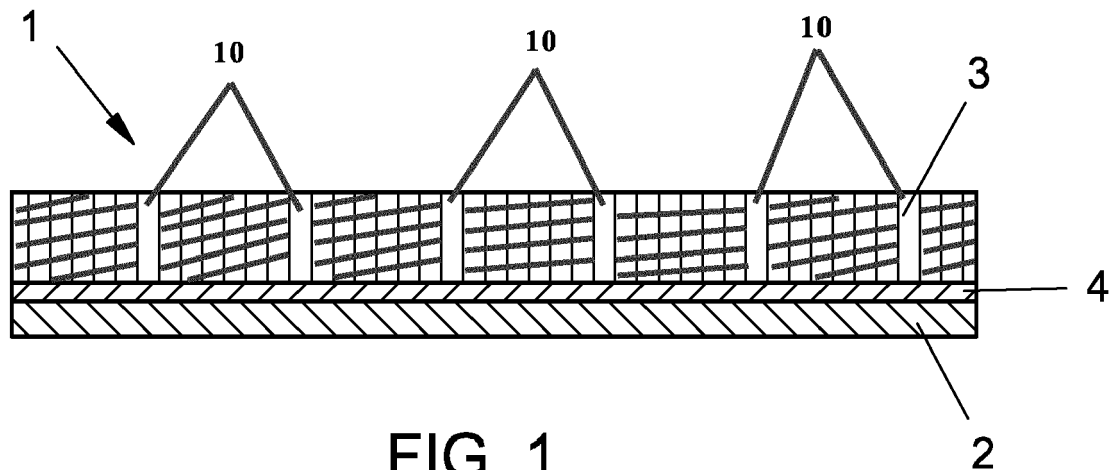


FIG. 1

Description

[0001] The invention relates to a process for realising a blanket or slab for overprint varnishing.

[0002] In the context of offset printing specific processes exist that allow the printed item to have special finishes or protections.

[0003] One of these processes is the application of overprint varnishes.

[0004] These varnishes are typically UV cross-linking or water-based acrylic; they are usually applied using one or more special printing units (known as "varnishing units") positioned as final elements of the machine and followed, if necessary, by ovens or lamps for the drying or cross-linking of the varnishes themselves.

[0005] The transfer of the varnish onto the support takes place using a rubber-coated fabric (blanket) or a varnishing slab that has the function of collecting the varnish and transferring it to the support for printing. If it is necessary to preserve some zones of this application, in common practice the upper layer of the blanket or of the slab is cut and removed in the aforementioned zones so that the difference in thickness allows the transfer of the varnish to be prevented. These areas of lack of material with a lower thickness notched in the blankets or in the slab are known as "reserves".

[0006] The reserves are normally performed by notching the varnishing layer which is then manually removed. The notching itself can be performed with a manual operation but it more commonly takes place through the aid of a cutting plotter.

[0007] Considering the manual removal of the varnishing layer and the use of blades for notching, in general the geometries that can be processed must be simple and of relatively large dimensions as there may be precision issues for more complicated geometries. These technical barriers enormously limit the possibilities of personalising the printed items.

[0008] In the case of complex graphics, in current common techniques, special slabs have normally been used that require a complex and expensive preparation.

[0009] In fact, these slabs are generally constructed using expensive photopolymers and normally undergo a complex preparation in three steps which, although automated, requires dedicated and expensive machinery.

[0010] In most cases printers contact external facilities that offer this preparation service.

[0011] In particular, in a first step a special protective film is removed by laser ablation which leaves the photopolymer uncovered in the zones of the graphics, in a second step the slab is exposed to a lamp (generally UV) which solidifies the unprotected parts of the film and finally a third step, known as development, in which the non cross-linked photopolymer is eliminated by washing with water or with solvent.

[0012] In very recent years a direct laser ablation technique for non-image areas has been developed, however also in this case the machines are expensive and com-

plex, the process is normally performed externally by specialised facilities and it is mainly used for the preparation of sleeves, not being very economically advantageous for slabs.

[0013] An alternative approach is represented by additive manufacturing techniques, which allows the blankets or slabs to be manufactured directly in the desired shapes, therefore avoiding the steps of notching and removing the reserves and limiting the waste of material connected therewith. In particular, 3D printing has developed exceptionally over the last decade, thanks to its versatility of use for prototyping and producing three-dimensional objects in a wide variety of materials. However, materials are commonly used that are not very suitable for printing and varnishing, in particular in terms of properties of the transfer of varnishes or inks, chemical resistance to UV varnishes or to slab washing solvents for UV varnishing, and mechanical resistance to impact and to abrasion.

[0014] The task of the present invention is therefore to eliminate the above-mentioned drawbacks of the prior art.

[0015] Within the context of this task an object of the invention is that of allowing the manufacturing of varnishing slabs made with materials and surfaces suitable for printing in highly customisable shapes and adaptable to the needs of the customer and the type of varnishing unit thanks to additive manufacturing techniques, in particular 3D printing.

[0016] Another object of the invention is that of making it no longer necessary to use an adhesive interposed between the varnishing layer and the support layer, or alternatively allowing the use of an adhesive with less restrictive adhesive properties: at the moment, the adhesives used must have adhesion properties comprised in a rather restricted adhesion range, to guarantee good manual peeling properties but prevent undesired delamination in the machine, and which represents an important risk factor and additional costs.

[0017] Another object of the invention is that of simplifying the production process both in terms of time and in economic terms and of minimising material waste, both in economic and ecological terms.

[0018] This task and these and other objects are reached by a process for realising a blanket or slab for overprint varnishing at least comprising a support layer and a varnishing layer, characterised in that a digital model of the varnishing layer is created having areas of lack of material that modify in a localised way the thickness of said varnishing layer, and a non cross-linked elastomeric thermoplastic polymer material is applied onto said support layer with an additive technology that physically reproduces the digital model of said varnishing layer.

[0019] Preferably, the thermoplastic polymer is a thermoplastic polyurethane.

[0020] Preferably, the elastomeric thermoplastic polymer is mixed with a silicone polymer. Advantageously, the process for realising a blanket or slab for overprint

varnishing forms a raised surface through the deposition of an additional quantity of said thermoplastic polymer in an area surrounding said lacking areas.

[0021] Preferably, the process envisages the deposit of a thin layer of said thermoplastic polymer on the bottom of said lacking areas.

[0022] Advantageously the support layer is made of PET or PVC or PC or PMMA or TPU or metal. Preferably, the process joins said support layer and said varnishing later through a surface treatment of said support layer through peeling with trichloroacetic acid.

[0023] Preferably, the process joins said support layer and said varnishing layer through the use of a water- or solvent-based urethane or acrylic adhesive.

[0024] Advantageously, the process comprises a step of finishing the exposed surface of said varnishing layer adapted to give said varnishing layer opaque and/or slippery and/or rough properties.

[0025] The finishing can be performed using a paper or a PET release film having the desired roughness properties, possibly applied hot and/or under pressure with a press or calender, installed on the line or off line, on the varnishing layer. Alternatively, the finishing layer can be performed using a notched cylinder or a notched press.

[0026] The varnishing blanket or slab further comprises a further layer that can be compressed to a side of said support layer.

[0027] Preferably, the further compressible layer is made of a thermoplastic polyurethane-based material and expanding additives.

[0028] Advantageously the varnishing layer is free from additives, plasticisers and molecular cross-linking agents.

[0029] As well as using a relatively cheap machine, the process according to the patent does not use photopolymeric slabs but economically more advantageous slabs made with thermoplastic polymers, preferably elastomers, preferably made of polyurethane.

[0030] It is to be noted that although the method of manufacturing flexographic slabs through 3D printing is known (e.g. CN103121323), the technique has always focused on the use of photocross-linkable mixtures of vinyl or acrylovinyl rubber (ABS, SBS, SIS) cross-linked with mono- or diacrylates. The present invention instead exploits degrees of non-cross-linked thermoplastic polyurethanes without additives, which combine hardness and resistance to impact and abrasion with excellent varnishing properties without the need for complex formulations, or liquid precursors that are potentially harmful to the environment.

[0031] The resolution of the deposition of material through 3D printing techniques by the extrusion of elastomeric thermoplastic polymers is comprised between 20 and 100 μm . Unlike flexographic printing where, to guarantee the printing quality, it is appropriate for the resolution to be $\leq 10\mu\text{m}$, in the application as varnishing layer, it is only required that the edges of the varnishing layer be clear and precise; furthermore, the very low

shrinkage percentages (0.8 - 1.8%) that characterise the thermoplastic polyurethane allow the deposition of shapes with high accuracy, even in the absence of cross-linking or reinforcing agents.

[0032] 3D printing is intrinsically based on the deposition of successive flat layers, which makes it particularly suitable for manufacturing shapes on flat substrates. However, the surface quality of the deposited material is often worsened by the presence of macroscopic irregularities, especially in the case of filament extrusion. On the contrary, the application of overprint varnishing requires surfaces with particularly controlled roughness. For this reason, the present invention comprises a final surface finishing step for the hot application under pressure of a film of paper or PET or another plastic material with release properties for the transfer of a fine weft of known roughness (typically $0.4\ \mu\text{m} < R_a < 1.2\ \mu\text{m}$). The finishing is also possible thanks to the thermoplastic properties of non cross-linked polyurethane, and confers the desired properties of opacity, slipperiness, prevention of the accumulation of varnishes or inks, surface tension.

[0033] Further characteristics and advantages of the invention will more fully emerge from the description of a preferred but not exclusive embodiment of a blanket or slab for overprint varnishing, illustrated by way of non-limiting example in the accompanying drawings, in which: fig. 1 is a lateral raised partial sectional view of a blanket or slab for varnishing according to a first embodiment of the present invention;

fig. 2 is a lateral raised view in partial section of a blanket or slab for varnishing in compliance with a second embodiment of the present invention, in which a compressible layer is positioned between the support layer and the varnishing layer;

figure 3 is a lateral raised view in partial section of a blanket or slab for varnishing in compliance with a third embodiment of the present invention, in which the compressible layer is applied to the support layer opposite the one in which the varnishing layer is applied;

figure 4 shows a plan view of a varnishing layer illustrating the various areas of lack of material; figure 5 shows a lateral raised sectional view of a detail of the blanket at the lacking areas.

[0034] With particular reference to the above-described figures, the blanket or slab for overprint varnishing according to the present invention is generically indicated by 1.

[0035] The blanket or slab for overprint varnishing 1 has a thickness comprised between 0.8 mm and 4 mm and comprises a support layer 2 and a varnishing layer 3 in non cross-linked thermoplastic polymer for the transfer of an overprint varnish to a printed support.

[0036] The varnishing layer 3 has areas with a lack 10 of material not subject to the transfer of varnish. Such lacking areas 10 are realised through the physical reproduction of a digital model of the varnishing layer 3.

[0037] The realisation of the blanket or slab for over-

print varnishing 1 takes place through the application on the support layer 2 of the non cross-linked elastomeric thermoplastic polymer material with an additive technology that physically reproduces the digital model of said varnishing layer 3.

[0038] Figure 4 shows by way of example the outer face of a varnishing layer 3 that shows some lacking areas 10 of the material not subject to the transfer of the varnish that form a graphic. The support layer 2 has a thickness comprised between 0.05mm - 0.40mm and is made of polymeric material (e.g. PET, PVC, TPU, PC, PMMA) or metal (e.g. aluminium) or natural fibre or synthetic fibre.

[0039] The thermoplastic polymer material of the varnishing layer 3 comprises a thermoplastic polyurethane (TPU) adapted for the application of overprint varnish.

[0040] The thermoplastic polymer can also be mixed with a silicone polymer.

[0041] In particular, the varnishing layer 3 can comprise a polyether based thermoplastic polyurethane. The varnishing layer 3 preferably has a thickness comprised between 0.070 mm and 1.95mm.

[0042] According to one embodiment of the invention the process for the realisation of the blanket or slab for overprint varnishing 1 envisages joining the support layer 2 and the varnishing layer 3 through the use of an irreversible adhesive layer 4 made of water- or solvent-based urethane or acrylic material.

[0043] In particular, it is necessary for the adhesion force between the support 2 and the upper layers to be greater than 7 N/cm, preferably greater than 10 N/cm; To obtain this result it is possible to use an adhesive 4, preferably acrylic or urethane, with a thickness comprised between 5 μm and 50 μm , preferably between 15 μm and 30 μm . According to another embodiment of the invention, the join between said support layer 2 and said varnishing layer 3 is performed through a surface treatment of the support layer by means of peeling with trichloroacetic acid (TCA).

[0044] The blanket or slab for overprint varnishing 1 may further comprise a further compressible layer 5 applicable to a side of the support layer 2.

[0045] The compressible layer 5 can be interposed between the varnishing layer 3 and the support layer 2 or alternatively the compressible layer 5 can be applied to the opposite support layer 2 to the one on which the varnishing layer 3 is applied.

[0046] The presence of a compressible layer 5 allows the transfer performance of the overprint varnish to be improved.

[0047] Preferably, the compressible layer 5 is made of a TPU-based (thermoplastic polyurethane) material and expanding additives.

[0048] Both the varnishing layer 3 and any compressible layer 5 may contain organic or inorganic fillers for reaching the optimal rheological properties for the 3D printing step.

[0049] The suitable adhesion of the compressible layer

5 to the support layer 2 can be guaranteed through the use of an adhesive 4 or through a surface treatment as described above.

[0050] The reproduction precision of the area surrounding the lacking areas 10 is guaranteed by the formation of a raised surface that forms a collar around the perimeter of the lacking area 10 through the deposition of an additional quantity of the thermoplastic polymer. Advantageously the deposit of a thin layer 12 of thermoplastic polymer, having a thickness of 0.05/0.20 mm, on the bottom of the lacking areas 10 further guarantees a high resistance to the delamination caused by the varnishing products used and their washing solvents.

[0051] The invention focuses on the process for realising the blanket or slab for overprint varnishing 1. Below are some practical example embodiments of the varnishing blanket or slab.

Example 1

[0052] The varnishing layer 3 is a film of TPU ESTANE™ 58887 deposited through fused deposition modeling (FDM) on the support layer made of PET with TCA treatment with a thickness of 350 μm and then with a surface finish through coupling with a film of PET Transfer release 100 μm thick in a press heated to 150 °C with a pressure of 4 bar, possibly subsequently removed or maintained as the protective layer. The total thickness of the varnishing layer is 1.35 mm, and the varnishing layer has a surface roughness $R_a = 0.900 \mu\text{m}$.

Example 2

[0053] The compressible layer 5 is an expanded film of TPU ESTANE™ 54620 having a thickness of 0.500 mm and is obtained through the expansion of the film during the film extrusion process by adding the TPU with 2% Advantacell EHM401 and coupled directly during the process to a support layer 2 made of PET having a thickness of 250 μm (Mylar ADS) treated with TCA to increase adhesion. Subsequently the varnishing layer 3 of TPU based on polyether ESTANE™ 54620 in powder having a thickness of 1.4 mm is deposited on the support layer and sintered with SLS (Selective Laser Sintering) systems. The varnishing layer is subsequently surface finished through coupling with a PET Transfer release film having a thickness of 100 μm in a press heated to 150 °C at a pressure of 1.5 bar. The total thickness of the varnishing layer is 2.15 mm, and the surface roughness of the varnishing layer is $R_a = 0.700 \mu\text{m}$.

Example 3

[0054] The varnishing layer 3 is a film of TPU ESTANE™ 58437 deposited through fused filament having a thickness of 2.00 mm (fused deposition modeling, FDM) on the support layer made of TPU ISOPLAST with hardness 87 Shore D with a thickness of 350 μm and

then surface finished through coupling FAVINI release paper film having a thickness of 100 μm in a press heated to 150°C with pressure of 4 bar, subsequently removed. The total thickness of the varnishing layer is 1.15 mm, and the varnishing layer has a surface roughness $R_a = 0.480 \mu\text{m}$.

Example 4

[0055] The varnishing layer 3 is a film of TPU ESTANE™ 54620 deposited through Selective Laser Sintering (SLS) on an aluminium band having a thickness of 300 μm by interposing a layer of hot melt acrylic-based adhesive having a thickness of 30 μm between the aluminium and the TPU. Subsequently, a surface finish is applied on the varnishing layer through treatment under a notched cylinder heated at 150°C and 4 bar with a sliding speed of 2 m/min. The total thickness of the varnishing layer is 1.35 mm, and the surface roughness is $R_a = 1.2 \mu\text{m}$. The blanket or slab for offset printing varnishing thus conceived is susceptible of numerous modifications and variants, all falling within the scope of the inventive concept; moreover, all of the details can be replaced with technically equivalent elements.

[0056] In practice the materials used, as well as the dimensions, can be any according to the needs and the state of the art.

[0057] For example, the varnishing layer made of non cross-linked thermoplastic polymer can also be made of silicone-based material.

Claims

1. A process for realising a blanket or slab for overprint varnishing (1) comprising at least a support layer (2) and a varnishing layer (3), **characterised in that** a digital model of the varnishing layer (3) is created envisaging areas (10) with a lack of material that modify in a localised way the thickness of said varnishing layer (3), and **in that** a material is applied on said support layer (2), such material being made of non-cross-linked thermoplastic elastomeric polymer with an additive technology that physically reproduces the digital model of said varnishing layer (3).
2. The process for realising a blanket or slab for overprint varnishing (1) according to claim 1, **characterised in that** said thermoplastic polymer is a thermoplastic polyurethane.
3. The process for realising a blanket or slab for overprint varnishing (1) according to claim 1, **characterised in that** said thermoplastic elastomeric polymer is mixed with a silicone polymer.
4. The process for realising a blanket or slab for overprint varnishing (1) according to any one of the preceding claims, **characterised in that** it forms a raised surface (11) through the deposition of an additional amount of said thermoplastic polymer in a zone surrounding said lacking areas (10).
5. The process for realising a blanket or slab for overprint varnishing (1) according to any one of the preceding claims, **characterised in that** a thin layer (12) of said thermoplastic polymer is deposited on the bottom of said lacking areas (10).
6. The process for realising a blanket or slab for overprint varnishing (1) according to any one of the preceding claims, **characterised in that** said support layer is made of PET or PVC or PC or PMMA or TPU or metal or natural or synthetic fibre fabric.
7. The process for realising a blanket or slab for overprint varnishing (1) according to any one of the preceding claims, **characterised in that** said support layer (2) and said varnishing layer (3) are joined through a surface treatment of said support layer through peeling with trichloroacetic acid.
8. The process for realising a blanket or slab for overprint varnishing (1) according to claim 4, **characterised in that** said support layer (2) and said varnishing layer (3) are joined through the use of a layer of water- or solvent-based urethane or acrylic adhesive (4).
9. The process for realising a blanket or slab for overprint varnishing (1) according to any one of the preceding claims, **characterised in that** it comprises a step of finishing the exposed surface of said varnishing layer (3) adapted to give said varnishing layer (3) opaque and/or slippery and/or rough properties.
10. The process for realising a blanket or slab for overprint varnishing (1) according to any one of the preceding claims, **characterised in that** a further compressible layer (5) is applied to one side of said support layer (2).
11. The process for realising a blanket or slab for overprint varnishing (1) according to the preceding claim, **characterised in that** said further compressible layer (5) is made of thermoplastic polyurethane based material and expanding additives.
12. The process for realising a blanket or slab for overprint varnishing (1) according to any one of the preceding claims, **characterised in that** said varnishing layer (3) is free from additives, plasticisers and molecular cross-linking agents.

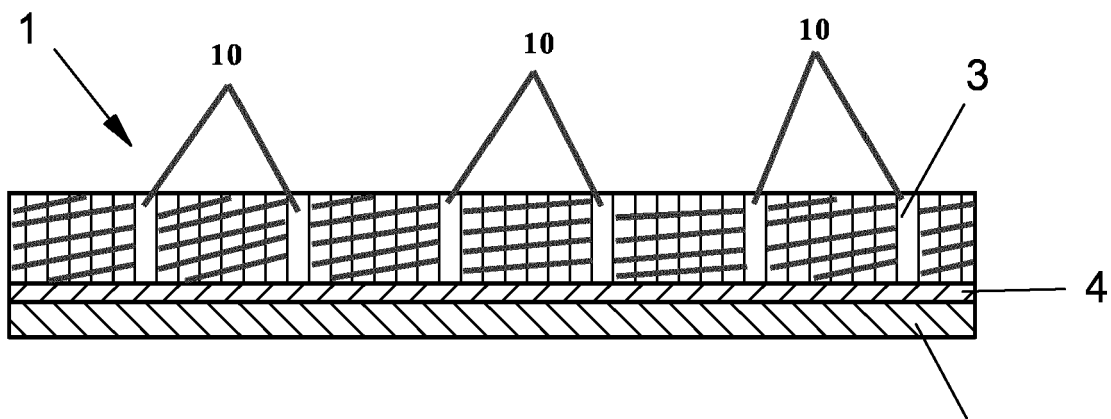


FIG. 1

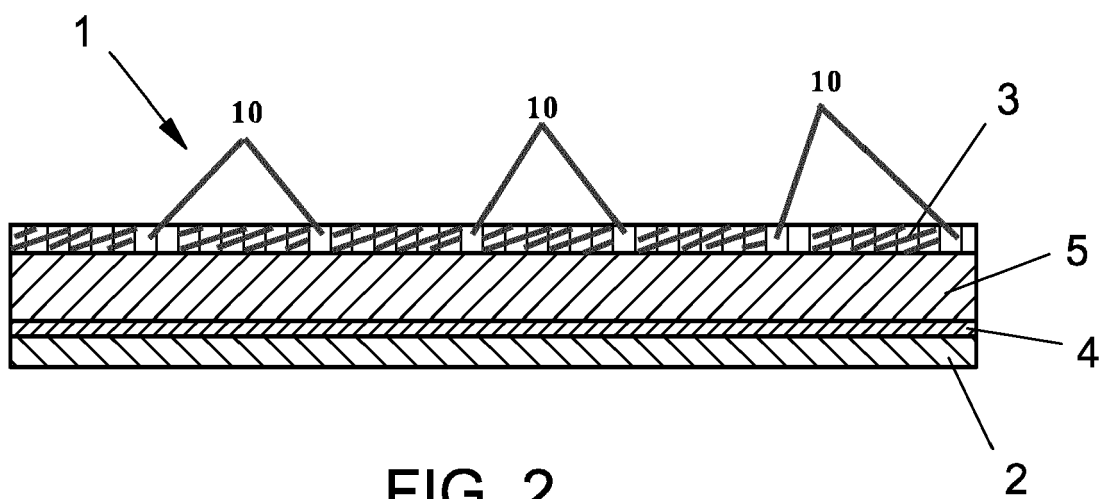


FIG. 2

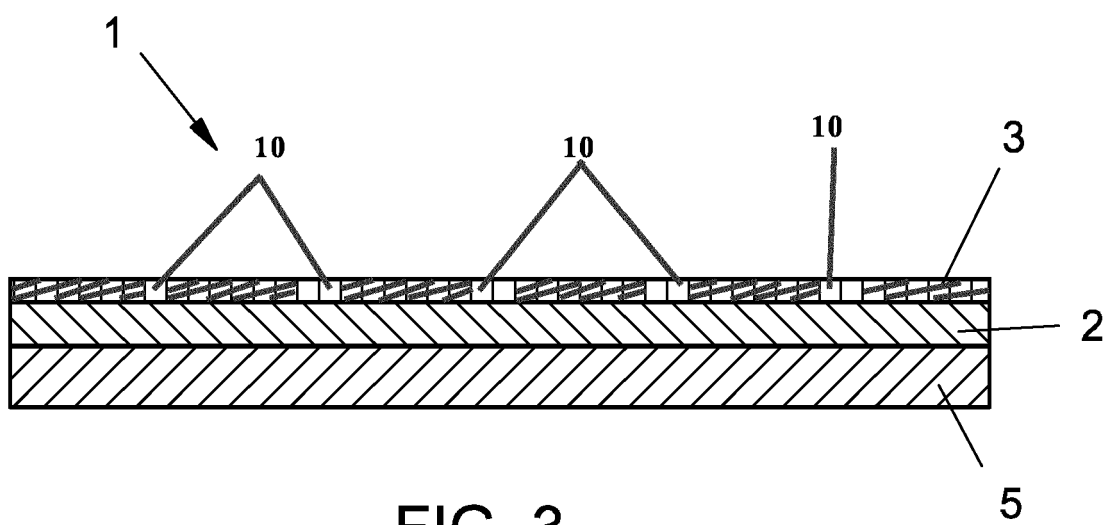


FIG. 3

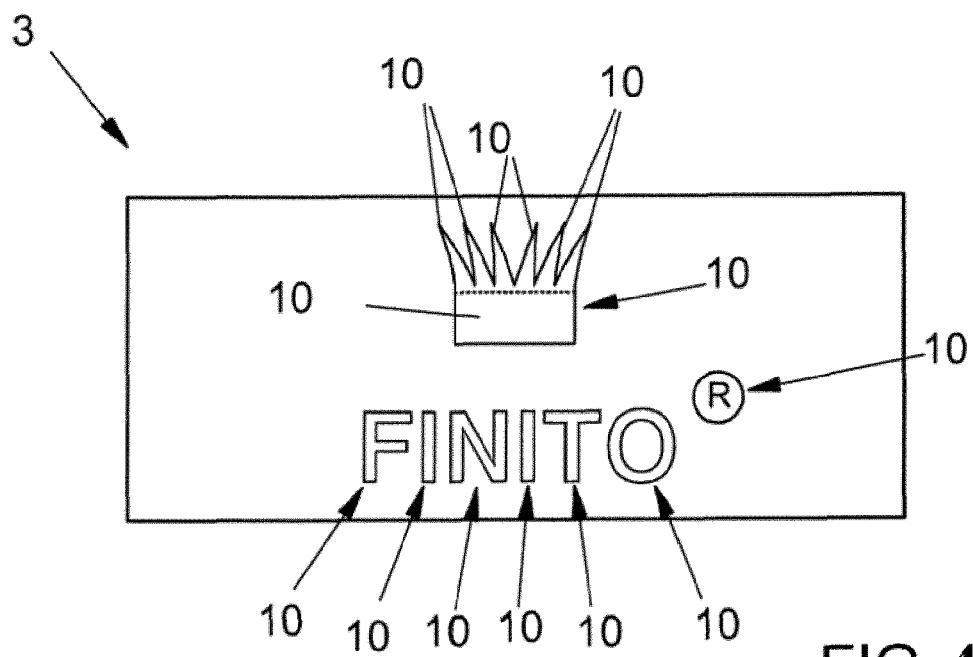


FIG. 4

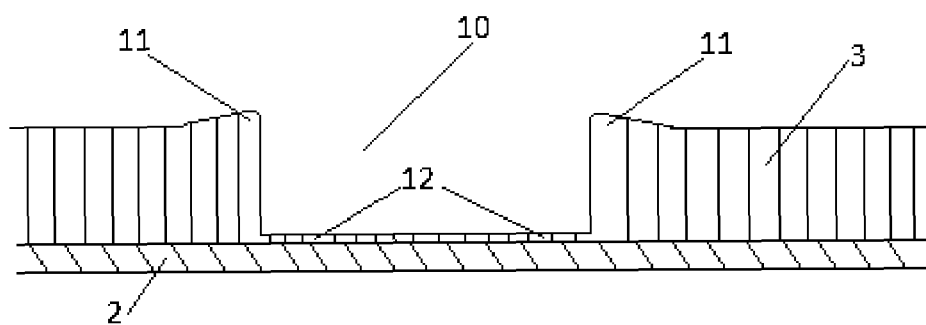


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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