(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 594 410 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.05.2013 Bulletin 2013/21

(51) Int Cl.:
B44C 1/17 *(2006.01)*

(21) Application number: **12193021.8**

(22) Date of filing: **16.11.2012**

(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

(30) Priority: **18.11.2011 IT PD20110361**

(71) Applicants:
- **Todeschini, Danilo**
  20010 Casorezzo (MI) (IT)
- **Graphic Report s.n.c. di Brigato A. & C.**
  35026 Conselve (PD) (IT)
- **Italgraf S.R.L.**
  22076 Mozzate (Como) (IT)

(72) Inventors:
- **Todeschini, Danilo**
  I-20010 Casorezzo (MI) (IT)
- **Brigato, Antonio**
  I-35026 Conselve (PD) (IT)
- **Caldirola, Dario**
  I-22076 Mozzate (CO) (IT)

(74) Representative: **Gallo, Luca et al**
Gallo & Partners S.r.l.
Via Rezzonico, 6
35131 Padova (IT)

(54) Printable support for transferable decorations

(57) Printable support for transferable decorations, which comprises a support layer (2), an intermediate layer (3) fixed on the support layer (2) and comprising a water repellent resin, and a substantially transparent protection layer (4), which is provided with a first face (A) removably adhering to the intermediate layer (3) and with a second face (B) intended to be printed with a decoration, and is susceptible of being transferred on a surface to be decorated (13).

The protection layer (4) of the printable support (1) comprises at least one mixture of acrylic and polyurethane resins (5) with a dry weight percentage of acrylic resins ranging from 80% to 85% and with a dry weight percentage of polyurethane resins ranging from 12% to 16%, has an average thickness ranging from 20 to 30 μm, exhibits a tensile elongation at break (ε_R) of at least about 45% at room temperature, and is susceptible, at room temperature, of remaining intact and maintaining the deformation imparted thereto substantially unaltered when it is made to adhere on the surface to be decorated (13), for extensions of the same protection layer (4) up to approximately 15% with respect to its original size.

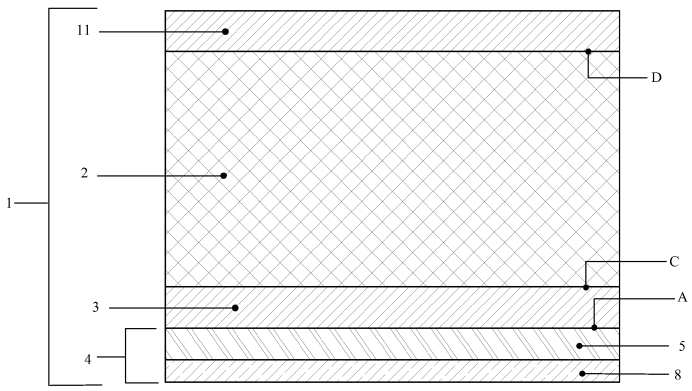

Fig. 1

EP 2 594 410 A1

Description

Field of application

[0001] The present invention regards a printable support for transferable decorations according to the preamble of the main claim.

[0002] The printable support for transferable decorations, object of the present invention, is inserted in the field of the production of items for obtaining wall decorations, both for internal settings, such as on walls and ceilings of building rooms, and for external settings, e.g. on building facades, on fencing walls etc.

State of the art

[0003] Known for some time on the market are printable supports for obtaining decorations on wall surfaces, which allow transferring an image previously printed or painted on such supports onto a surface to be decorated.

[0004] For example, the patent GB 1552232 describes a printable support for transferable decorations comprising a first support layer constituted by a paper sheet, a second silicone wax layer provided to coat the first layer, and a third transparent layer made of lacquer or shellac in turn provided to cover the second layer. On this third layer, a decoration is painted or printed by means of the deposit of a fourth ink layer. After the ink of the fourth layer has dried, a fifth adhesive layer is applied, which is treated with drying agents, such as mica powder, in order to prohibit the adhesiveness thereof during the transport of the printable support to the site where the surface to be decorated is situated.

[0005] In order to transfer the decoration on the surface to be decorated, it is necessary to moisten the fifth adhesive layer with spirits of turpentine in order to restore the adhesiveness conditions thereof and be able to subsequently apply the printable support to the surface to be decorated with the side on which the fifth adhesive layer is spread. Once the fifth adhesive layer is dried, it is necessary to remove the first support layer, by means of washing or rubbing, in order to uncover the third transparent lacquer layer on which the decoration is printed.

[0006] The main drawback of the printable support for transferable decorations described in GB 1552232 is due to the fact that it requires long, laborious operations for transferring the decoration printed thereon onto the surface to be decorated, since it is necessary to moisten the printable support in order to apply it to the surface to be decorated, and it is necessary to wait for it to dry before removing the first support layer.

[0007] A further drawback of the printable support described in GB 1552232 is due to the fact that after laying out the fourth ink layer on the third transparent lacquer layer, it is necessary to wait for the latter to dry before spreading the fifth adhesive layer, with consequent long attainment times.

[0008] For the purpose of overcoming the aforesaid drawbacks, printable supports were introduced on the market, capable of transferring the decorations dry, i.e. without using water or liquid solvents.

[0009] For example, the patent US 4,228,211 describes a printable support for transferable decorations comprising a first support layer constituted by a polypropylene sheet, a second varnish layer provided to coat the first layer, and a third ink layer deposited on the second transparent layer which forms the decoration to be transferred. The printable support also comprises a further fourth transparent varnish layer deposited to coat the third ink layer, and a fifth adhesive layer which is spread on the fourth layer and is covered with a sheet of coated paper.

[0010] In order to transfer the decoration on the surface to be decorated, it is necessary to remove the coated paper that covers the fifth adhesive layer and apply the printable support on the surface to be decorated with the side on which such fifth adhesive layer is spread. Subsequently, it is necessary to remove the first support layer, leaving the second and the fourth transparent varnish layer and the third ink layer attached to the wall. In particular, the third ink layer is deposited as a sandwich between the two transparent varnish layers, with the fourth transparent layer facing towards the surface to be decorated and the second transparent layer facing outward.

[0011] The main drawback of the printable support described in the patent US 4,228,211 is due to the fact that it cannot be employed for transferring decorations on rough, irregular or porous surfaces, such as in particular masonry walls, since the fourth transparent varnish layer cannot be adapted to the irregularities of such surface types; consequently, there is a poor adhesion to the surface to be decorated, which involves an easy detachment of the decoration and thus quick deterioration of the latter.

[0012] A further drawback of the printable support described in US 4,228,211 is due to the fact that it provides for the use of two transparent varnish layers intended to remain attached to the surface to be decorated, which have a relatively high thickness that causes an undesired relief effect of the printable support from the surface on which it is applied. Printable supports for transferable decorations are also known from the patents US 4,322,467 and US 3,007,829 which comprise a first support layer constituted by a paper sheet, a second protection layer deposited on the first support layer and composed for example by polyvinyl acetate, and a third layer of mineral or vegetable wax deposited on the second protection layer.

[0013] A fourth transparent layer of glass material is also provided which is deposited on the third wax layer. On such

fourth layer, the decoration is printed that to be transferred by means of the deposit of a fifth ink layer. On this fifth ink layer, a sixth thermoplastic adhesive layer is applied.

[0014] In order to transfer the decoration, it is necessary to preheat the surface to be decorated, constituted in particular by glass or ceramic, and to subsequently apply the printable support thereon with the side on which the sixth adhesive layer is deposited. The heat of the wall brings the sixth thermoplastic adhesive layer to partially melt, in a manner such that the latter is attached to the wall. In addition, the heat also melts the third wax layer to allow the first support layer and the second protection layer to detach from the transparent layer on which the decoration is printed. In particular, the second protection layer prevents the melted wax of the second layer from being absorbed by the paper sheet of the first support layer, making the detachment thereof difficult.

[0015] The main drawback of the printable support described in US 4,322,467 or in US 3,007,829 derives from the fact that it requires long, complex operations for transferring the decoration printed on such support on the surface to be decorated; this because it is necessary to preheat the surface to be decorated in order to melt the sixth thermoplastic adhesive layer and the third wax layer.

[0016] In addition, the need to heat the surface to be decorated makes the printable supports described in US 4,322,467 and US 3,007,829 entirely unsuitable for obtaining wall decorations, especially large-size decorations, since it is practically impossible to suitably heat large-size surfaces or those constituted by masonry walls.

[0017] A further drawback of the printable supports described in US 4,322,467 and US 3,007,829 lies in the fact that they require the use of the second protection layer between the first support layer and the third wax layer, with consequent high production costs of the printable supports themselves.

[0018] In addition, the printable supports described in US 4,322,467 and US 3,007,829, along with the printable support described in US 4,228,211, have the drawback that they cannot be employed for transferring decorations on rough, irregular or porous surfaces, such as in particular masonry walls, since the fourth transparent layer of glass material cannot be adapted to the irregularities of such surface types; consequently, there is a poor adherence to the surface to be decorated, which involves an easy detachment of the decoration and hence a quick deterioration of the latter.

[0019] In general, the printable supports of known type briefly described above are not suitable for being employed for transferring decorations over opaque surfaces, i.e. non-translucent surfaces, since their transparent layer - on which the decoration is printed and intended to remain visible in front of the decoration applied to the surface to be decorated - is obtained with materials that give a translucent appearance to the decoration, creating an undesired effect of discontinuity between the non-decorated surface area and the area where the decoration is applied.

[0020] In addition, the printable supports for transferable decorations of known type have the serious drawback of being easily and quickly deteriorated following the cracking of the ink layer due to the expansion and shrinkage of the transparent layer, on which the ink layer itself is printed, following variations of temperature, air humidity etc.

[0021] Known from the patent WO2010119471 is a printable support formed by a first layer of paper, textile or plastic material, a second layer of transfer water repellent resin, and a third layer of acrylic, vinyl or polyurethane transparent varnish, for the quick, permanent, dry and cold transfer, on a surface to be decorated, of decorations printed on the third layer.

[0022] The printable support described in the patent W02010119471, and in particular the third layer of such support, nevertheless does not have mechanical properties optimized for allowing the application and permanence of the third varnish layer on surfaces with high roughness. Indeed, the characteristics of high elasticity of the third varnish layer, even if they facilitate the application of the latter on very irregular surfaces, prevent the third varnish layer itself from yielding and being perfectly set on the surface to be decorated, given that over time they can cause the formation of cracks or the lifting of the layer itself from the surface on which it is applied.

Presentation of the invention

[0023] In this situation, the main object of the present invention is therefore that of eliminating the drawbacks of the solutions of known conventional type mentioned above, by providing a printable support for transferable decorations which allows transferring decorations on any surface type, in particular on rough, irregular or porous surfaces, ensuring an optimal adhesion of the decoration to the surface.

[0024] Further object of the present invention is to provide a printable support for transferable decorations which allows obtaining decorations that are resistant over time, in particular not subjected to the onset of cracking on the ink layer.

[0025] Further object of the present invention is to provide a printable support for transferable decorations which allows transferring decorations on opaque surfaces, ensuring visual uniformity of opacity between the decorated surface area and the non-decorated surface area.

[0026] Further object of the present invention is to provide a printable support for transferable decorations which allows obtaining decorations of particularly thin thickness, and in particular which does not have reliefs from the decorated surface that are visible to the naked eye.

[0027] Further object of the present invention is to provide a printable support for transferable decorations that allows

a quick drying of the printed decoration and, in particular, which can be wound in a roll immediately after printing without the ink layer attaching to the back of the support.

[0028] Further object of the present invention is to provide a printable support for transferable decorations, which allows simply and quickly transferring the decorations onto the surface to be decorated, in particular cold (i.e. without the need to heat the surface to be decorated or the printable support itself) and dry (i.e. without the need to wet or moisten the printable support with water or with aqueous solutions) transferring.

[0029] Further object of the present invention is to provide a printable support for transferable decorations that is simple and economical to manufacture.

Brief description of the drawings

[0030] The technical characteristics of the finding, according to the aforesaid objects, can be clearly seen in the contents of the above-reported claims and the advantages of the same will be clearer from the following detailed description, made with reference to the enclosed drawings, which represent several merely exemplifying and non-limiting embodiments thereof, in which:

- Fig. 1 shows a schematic view in section of the printable support, object of the present invention, in accordance with a preferred embodiment thereof, comprising a water repellent-oil repellent material layer, a support layer, an intermediate layer and a protection layer;
- Fig. 2 shows a schematic view in section of only the water repellent-oil repellent material layers, support and intermediate layers of the printable support of Fig. 1;
- Fig. 3 shows a schematic view in section of the printable support di Fig. 1, with an ink layer deposited on its protection layer;
- Fig. 4 shows a schematic view in section of the printable support of Fig. 3, during its application on a wall to be decorated;
- Fig. 5 shows a first load-displacement curve example relative to a first sample of a provided protection layer of the printable support, object of the present invention;
- Fig. 6 shows a second load-displacement curve example relative to a second sample of the protection layer of the printable support, object of the present invention.

Detailed description of a preferred embodiment

[0031] With reference to the enclosed drawing of Figure 1, the printable support for transferable decorations, object of the present invention, was indicated in its entirety with 1.

[0032] The present printable support 1 is intended to be advantageously employed for obtaining wall decorations both for internal settings, for example on walls and ceiling of building rooms, and for external settings, for example on building facades, on fencing walls, etc.

[0033] More in detail, the printable support 1 is advantageously employed for obtaining permanent graphical decorations on rough or porous surfaces, e.g. constituted by plaster, masonry, concrete etc.

[0034] In particular, the printable support 1 allows obtaining large-size wall decorations, e.g. reproductions of frescoes or paintings in general.

[0035] With reference to the enclosed Figure 1, the printable support 1 for transferable decorations comprises a support layer 2, advantageously constituted by a sheet of double-coated paper, and an intermediate layer 3 fixed on the support layer 2 and comprising at least one water repellent resin.

[0036] In addition, the printable support 1 comprises a substantially transparent protection layer 4, which is provided with a first face A removably adhering to the intermediate layer 3, and with a second face B facing towards the opposite direction with respect to the first A and on which a decoration is intended to be printed in a mirror-like manner by means of the deposition on such second face B of at least one ink layer 12.

[0037] The protection layer 4 is susceptible to being transferred, together with the ink layer 12, on a surface to be decorated 13.

[0038] More in detail, for transferring the protection layer 4 on the surface to be decorated 13, it is necessary to spread a layer of adhesive glue 14, i.e. adhesion promoter, on the surface to be decorated 13 itself or on the ink layer 12 fixed on the second face B of the protection layer 4 of the printable support 1. The latter is made to adhere to the surface to be decorated 13 with the side on which the ink layer 12 is deposited, i.e. with the side on which adhesive glue layer 14 is spread, and it is pressed against the surface by pressing on the support layer 2, e.g. with a brush or with a bristle roller. Subsequently, the support layer 2 and the intermediate layer 3 are detached from the protection layer 4, which remains attached to the surface in front of the ink layer 12 to protect the latter.

[0039] In accordance with the idea underlying the present invention, the protection layer 4 comprises a mixture of

acrylic and polyurethane resins 5 with a dry weight percentage of acrylic resins ranging from 80% to 85% and with a dry weight percentage of polyurethane resins ranging from 12% to 16%.

[0040] In particular, the acrylic and polyurethane resins of the mixture of acrylic and polyurethane resins 5 are of thermoplastic type.

[0041] In addition, according to the invention, the protection layer 4 has an average thickness ranging from 20 μm to 30 μm and, at room temperature, exhibits a tensile elongation at break ε_R, when subjected to tensile stress, of at least about 45% and is susceptible of remaining intact and maintaining the deformation imparted thereto substantially unaltered when it is made to adhere on the surface to be decorated 13, for extensions of the same protection layer 4 up to approximately 15% with respect to its original size. The protection layer 4, therefore, has the capacity to be deformed by being extended up to approximately 15% with respect to its original size without showing structural damage, i.e. remaining intact and maintaining the deformation conferred thereto substantially unaltered when it was made to adhere to the surface to be decorated 13. In particular, the protection layer 4 is capable of being extended up to approximately 15%, as specified above, without immediate breakage being verified of the same and without detachment and/or crack zones forming over time due to residual tensions present therein.

[0042] For such purpose, the protection layer 4 advantageously has an instantaneous tensile elastic elongation ε_E lower than approximately 10%.

[0043] With the term elongation, it is intended to indicate, as is known to the man skilled in the art, the percentage ratio between the variation of the length (i.e. the difference between the final length l_f and the initial length l_0: $\Delta l = l_f - l_0$) of a material sample subjected to tensile stress, i.e. in this case of a sample of the protection layer 4 subjected to tensile strength, and the initial length l_0 of the same sample, i.e. the ratio $\Delta l / l_0$.

[0044] Preferably, the protection layer 4 of the printable support 1 in accordance with the present invention has substantially viscoelastic behavior. The application of a stress on the protection layer 4 therefore gives rise to an instantaneous elastic deformation, which substantially follows the Hooke laws, followed by a viscous deformation, dependent on time, with an anelastic behavior.

[0045] With the expression "instantaneous tensile elastic elongation", it is therefore intended to indicate the immediate elongation that the sample undergoes when subjected to tensile stress, such instantaneous tensile elastic elongation susceptible to being completely and immediately recovered once the external tensile stress acting on the sample itself has terminated.

[0046] Therefore, the fact that the protection layer 4 has an instantaneous tensile elastic elongation ε_E lower than approximately 10%, and preferably lower than 8%, ensures that the protection layer 4 itself is not affected by considerable shrinkage phenomena. Such phenomena are manifested immediately after application of the protection layer 4 on the surface to be decorated 13, when the stress exerted thereon in order to make it adhere to the surface to be decorated 13 is no longer present.

[0047] Advantageously, the deformation of the protection layer 4, when subjected to an external stress greater than its yield strength σ_n, given its substantially viscoelastic behavior, is given by the sum of an elastic deformation, instantaneously reversible and/or over time and a permanent plastic deformation. Given the low value of reversible instantaneous tensile elastic elongation ε_E, the protection layer 4 in accordance with the present invention is mainly affected by permanent plastic deformations, and by viscous deformations susceptible to being recovered over time.

[0048] The same protection layer 4 is also advantageously affected by relaxation phenomena when maintained in a state of substantially constant deformation. Therefore, when a deformation is imparted to the protection layer 4 that is susceptible to being maintained over time, as occurs for example when the protection layer 4 is made to adhere to the surface to be decorated 13, a relaxation over time is observed of the residual tensions inside the protection layer 4, i.e. a relaxation of the elastic return forces that would induce the protection layer 4 to return to its original size. Such relaxation is mainly due to a realignment of the macromolecular chains that constitute the mixture of acrylic and polyurethane resins 5 of the protection layer 4. The relaxation of the residual internal tensions hence ensures that the protection layer 4 maintains the deformation conferred thereto substantially unaltered when transferred on a surface to be decorated 13.

[0049] Such characteristics ensure an optimal adhesion of the protection layer 4 to the surface to be decorated 13, since the protection layer 4, during application, is capable of being deformed by easily expanding up to about 15% with respect to its original size and following the roughness of the surface to be decorated 13; in addition, at the end of application, when no more stress is applied, due also to the relaxation of the residual internal tensions, the protection layer 4 remains substantially deformed, without returning to its original form and without undergoing considerable shrinkage. Preferably, the protection layer 4 has a yield strength σ_n lower than about 5 MPa, and preferably lower than about 3 MPa, as calculated by means of stress tests carried out on protection layer 4 samples with square form, having 100 mm side and having thickness of 24 μm, in a 22°C setting and with a relative air humidity equal to 50%.

[0050] The fact that the protection layer 4 has a low yield strength σ_n value ensures that the protection layer 4 itself is deformed in a substantially permanent manner, even if a small-size stress is applied thereto, such as the pressure exerted on the printable support 1 in order to make it adhere to the surface to be decorated 13. In addition, the fact that the protection layer 4 has a low instantaneous tensile elastic elongation ε_E value ensures that the protection layer 4 itself

maintains its deformation substantially unchanged, even when there is no more stress applied thereto.

[0051] Preferably, the protection layer 4 has an average thickness ranging from 22 and 28 μm, and still more preferably is approximately 26 μm, and in particular it has a dry weight of about 23 - 27 g/m^2.

[0052] As stated above, the protection layer 4 has a tensile elongation at break ε_R of at least about 45%, and, advantageously, it has un tensile strength σ_r, at room temperature, of at least approximately 110 g/cm^2, such that it is capable of being elongated in order to be modeled with respect to the irregularities and roughness of the surface without breaking. More in detail, the tensile elongation at break ε_R and the tensile strength σ_r of the protection layer 4 were measured by executing stress tests on samples, each constituted by a strip of protection layer 4 with 25 mm width and 200 mm length, which were subjected to tensile stress along their longitudinal extension direction, with a traction speed of 300 mm/min. The tests were executed in a 22°C setting and with a relative air humidity equal to 50%.

[0053] The values of tensile strength, yield strength, tensile elongation at break and instantaneous tensile elastic elongation of the protection layer 4 reported herein were measured in the above-specified test conditions. Such values are strongly influenced by the test conditions, i.e. in particular by the deformation speed, by the temperature and by the chemical nature of the surrounding environment, i.e. by the relative air humidity in the test setting, and could therefore be very different from those reported where samples have been tested in different conditions than those specified above.

[0054] In accordance with a particular embodiment of the printable support 1, object of the present invention, described below, the tests indicated that the samples of the protection layer 4 have a tensile strength value ranging from 130 g/cm^2 to 190 g/cm^2 and a tensile elongation value at break ranging from 49% to 70%.

[0055] In accordance with a particularly advantageous preferred embodiment, the aforesaid mixture of acrylic and polyurethane resins 5 of the protection layer 4 of the printable support 1 is obtained from a compound in liquid phase comprising a first amount of acrylic resins in water emulsion and a second amount of polyurethane resins, these too in water emulsion, blended together.

[0056] Advantageously, such compound in liquid phase is applied by means of spreading on the intermediate layer 3.

[0057] The first amount of acrylic resins in water emulsion and the second amount of polyurethane resins in water emulsion respectively have a dry residue preferably of about 49% and preferably of about 40%.

[0058] More in detail, in accordance with a preferred embodiment of the printable support 1 according to the present invention, the mixture of acrylic and polyurethane resins 5 is obtained from a compound in liquid phase in which the second amount of polyurethane resins in water emulsion is introduced in an amount by weight ranging from 21% to 24% with respect to the amount by weight of the first amount of acrylic resins in water emulsion. Preferably, the second amount of polyurethane resins in water emulsion is introduced into the liquid phase mixture in an amount by weight equal to about 22% with respect to the amount by weight of the first amount of acrylic resins in water emulsion.

[0059] The aforesaid advantageous characteristics of substantially permanent deformation of the protection layer 4 of the printable support 1 are connected to the percentages of acrylic resins and polyurethane resins of the mixture 5 of the protection layer 4 itself according to the present invention.

[0060] More in detail, the percentage of acrylic resins of the mixture of acrylic and polyurethane resins 5 confers the property of substantially plastic elongation to the protection layer 4, such that it can be adapted to the irregularities of the surface to be decorated 13 without breaking.

[0061] The percentage of polyurethane resins of the mixture of acrylic and polyurethane resins 5 inhibits the elastic behavior of the acrylic resins, preventing the protection layer 4 from undergoing considerable shrinkage after it has been deformed according to the irregularities of the surface to be decorated 13, remaining completely adherent thereto. The aforesaid characteristics of the protection layer 4 allow the latter to optimally adhere to the surface to be decorated 13, in particular to coarse or slightly rough surfaces.

[0062] More in detail, the protection layer 4 has viscoelastic and plastic deformation characteristics such to allow it to be elongated in order to perfectly adhere to the irregularities or pores of rough or coarse surfaces following a light pressure applied on the support layer 2, in this way modeling itself on the surface. In addition, once the pressure applied to the support layer 2 has terminated, the protection layer 4 does not shrink in a significant manner, preventing the onset of any problem of adhesion to the surface to be decorated 13, or defects of aesthetic/visual type of the decoration.

[0063] In addition, the use of the printable support 1 according to the invention has shown to be particularly advantageous for attaining decorations of large size, which require being divided into multiple contiguous sectors. Such sectors are intended to be printed, each on a corresponding printable support 1 which is applied to the surface to be decorated 13 flanking the printable support 1 on which the contiguous sector is printed, in a manner so as to recompose the decoration on the surface to be decorated 13. In this case, the use of the printable support 1 ensures a perfect correspondence along the junction edges between two contiguous sectors of the decoration, since after the application of the printable support 1 and removal of the support layer 2, the protection layer 4 is not subjected to any significant shrinkage, hence preventing the formation of cracks between the contiguous sectors of the decoration.

[0064] Advantageously, the percentage of polyurethane resins of the mixture of acrylic and polyurethane resins 5 of the protection layer 4 according to the invention inhibits the residual stickiness of the acrylic resins, conferring zero stickiness to the protection layer 4. In particular, this allows rolling the printable support 1 in a roll without any risk of

pasting the second face B of the protection layer 4 with the support layer 2.

[0065] In addition, the percentage of polyurethane resins of the mixture of acrylic and polyurethane resins 5 according to the invention confers an opaque aspect to the protection layer 4 (i.e. non-translucent), since it inhibits the translucent characteristics of the acrylic resins, allowing the protection layer 4 to confer to the decoration the opaque characteristic of masonry decorations and not cause annoying light reflections. Advantageously, the first amount of acrylic resins in water emulsion mentioned above comprises for about 50% soft acrylic resins in water emulsion and for the remaining 50% hard acrylic resins in water emulsion.

[0066] With the expression "soft acrylic resins" it is intended herein to indicate acrylic resins having a glass transition temperature lower than or equal to -15°C and with the expression "hard acrylic resins" it is intended herein to indicate acrylic resins having a glass transition temperature higher than or equal to 35°C.

[0067] The introduction in the liquid phase compound of soft acrylic resins and hard acrylic resins has allowed obtaining a protection layer 4 provided with the optimal mechanical properties reported above, which make it particularly adapted for being applied and to adhere in an optimal manner on any surface to be decorated 13.

[0068] The protection layer 4 comprising a mixture of acrylic and polyurethane resins 5 obtained from the liquid phase compound as described above, and in particular containing a first amount of acrylic resin in water emulsion comprising for about 50% soft acrylic resins and for the remaining approximately 50% hard acrylic resins, has shown, as reported above, a tensile strength at break of at least approximately 130 g/cm^2 and a tensile elongation at break equal to about 49%.

[0069] The protection layers 4 obtained by varying the composition of the compound in initial liquid phase and, in particular, by varying the relative contents of soft and hard acrylic resins, have shown less satisfactory mechanical properties and lower performances. More in detail, by adding increasing percentages of soft acrylic resins, an improvement of the mechanical properties of the protection layer 4 was observed, due to an increase of the toughness of the material, i.e. due to an increase of its tensile strength and its tensile elongation at break. Nevertheless, the protection layers 4 obtained from compounds containing percentages of soft acrylic resins higher than about 50% of the total first amount of acrylic resin resulted particularly sticky and difficult to remove from the intermediate layer 3 after having been transferred, together with the ink layer 12, on a surface to be decorated 13.

[0070] By adding increasing percentages of hard acrylic resins, a decrease of the material toughness was observed, i.e. a decrease of its tensile strength and its tensile elongation at break, as well as a poor adhesion of the protection layer 4 to the intermediate layer 3. The printable support 1 provided with a protection layer 4 obtained with high percentages of hard acrylic resins also resulted difficult to print, due to detachment phenomena between the constituent layers, and in particular between the intermediate layer 3 and the protection layer 4, which can be verified during the printing process. The mixture of acrylic and polyurethane resins 5 of the protection layer 4 of the printable support 1 preferably has a dry residue of about 47%.

[0071] In particular, the polyurethane resins preferably have a dry residue equal to about 40%, the soft acrylic resins a dry residue equal to about 58% and the hard acrylic resins a dry residue equal to about 40%.

[0072] Advantageously, the mixture of acrylic and polyurethane resins 5 of the protection layer 4 comprises opacifying products, such as in particular colloidal silica, which further facilitates the obtainment of the aforesaid opaque aspect of the decoration. Advantageously, the percentage of acrylic resins of the mixture of acrylic and polyurethane resins 5 of the protection layer 4 according to the present invention confers the protection layer 4 with optimal wettability properties, which in particular allow the second face B of the protection layer 4 to absorb the ink layer 12 of the printed decoration, ensuring a long duration of the decoration time, as will be explained in detail below.

[0073] Preferably, the protection layer 4 exhibits on its second face B, on which the ink layer 12 is deposited, a surface tension of value ranging from 32 to 38 DIN, and preferably from 34 to 36 DIN.

[0074] The above-reported values of the surface tension of the protection layer 4 allow obtaining a contact angle (known the man skilled in the art) that is very small between the ink drops deposited on the second face B of the protection layer 4 and the second face B itself, and hence it confers optimal wettability characteristics to the protection layer 4. This allows the ink to be uniformly distributed on the second face B of the protection layer 4 and in particular to penetrate into the pores of the protection layer 4, without remaining only superficially deposited in drop form on the second face B thereof.

[0075] Advantageously, the ink layer 12 printed on the second face B of the protection layer 4 of the printable support 1 of the present invention is constituted by solvent-based inks, in particular of eco-solvent and mild solvent type.

[0076] Such inks are capable of being distributed in a particularly uniform manner on the protection layer 4, since each drop of such inks is spread on the second face B of the protection layer 4 and penetrates very easily into the pores of the latter.

[0077] Such characteristic ensures a long duration of the decoration over time, since the inks, by penetrating inside the pores of the protection layer 4, are not subjected to be detached from the latter, or to crack, following for example deformations of the protection layer 4 due to high temperature and/or hygrometric variations. For such reason, the printable support 1 of the present invention is particularly suitable for obtaining decorations on surfaces arranged in outside settings, such as on building facades, etc.

[0078] Advantageously, the mixture of acrylic and polyurethane resins 5 of the protection layer 4 of the printable support 1 according to the invention has optimal workability characteristics in production phase of the printable support 1 itself. More in detail, the mixture of acrylic and polyurethane resins 5 can be easily distributed in a uniform manner on the intermediate layer 3, in particular without the formation of discontinuities on the second face B of the protection layer 4; such discontinuities in decoration printing step would cause the formation of smear lines or the absence of ink. In addition, the mixture of acrylic and polyurethane resins 5 in production phase of the printable support 1 has specific density and fluidity characteristics, which allow distributing it in a uniform manner on the intermediate layer 3 by employing rotation cycle production appliances and methods *per se* known to the man skilled in the art. Preferably, the mixture of acrylic and polyurethane resins 5 comprises one or more additives for about 2% of the mixture 5 itself, such as wetting agents, thickeners, surfactants and anti-foaming agents in particular, which further facilitate the workability of the mixture 5, the uniform distribution of the same on the intermediate layer 3 in production step of the printable support 1, and the optimal deposition of the ink layer 12 on the second face B of the protection layer 4.

[0079] In addition, the mixture of acrylic and polyurethane resins 5 advantageously comprises inert charges for about 2% of the mixture 5 itself, which have a filler function and contribute to conferring a surface finish to the protection layer 4 that is adapted to receive the print ink.

[0080] Advantageously, the protection layer 4 of the printable support 1 of the present invention comprises a primer layer 8, which defines the second face B of the protection layer 4 on which the decoration to be transferred is intended to be printed, in order to further facilitate the deposition of the ink layer 12 on the second face B of the protection layer 4. Such primer layer 8 is composed by opacifiers, preferably silica, and by acrylic binders in water dispersion, in order to facilitate the absorption of the ink layer 12 by the protection layer 4.

[0081] More in detail, the primer layer 8 is placed on the mixture of acrylic and polyurethane resins 5, and has a thickness of about 1 μm and preferably a dry weight of about 0.60 g/m^2.

[0082] Advantageously, the primer layer 8 allows the protection layer 4 to quickly absorb the ink layer 12, speeding up the drying thereof In particular, this allows rolling the printable support 1 into a roll as it exits from the printer, without having to wait long times for the drying of the ink layer 12.

[0083] In addition, the primer layer 8 carries out the function of anti-adherent, in order to prevent the second face B of the protection layer 4 from attaching to the support layer 2, when the printable support 1 is wound as a roll, both before and after the printing of the ink layer 12 on the second face B of the protection layer 4 itself.

[0084] Advantageously, the intermediate layer 3 adheres to the protection layer 4 with a detachment strength (necessary for delaminating the support layer 2 and the intermediate layer 3 from the protection layer 4) of value ranging from 7.2 to 8.8 g/cm^2. More in detail, the values of the aforesaid detachment strength were calculated by executing trial tests in accordance with the law FINAT No. 1, known by the man skilled in the art. Such tests were in particular executed on samples each constituted by a strip of the printable support 1 that is 25 mm wide and 200 mm long.

[0085] In accordance with a particular embodiment of the printable support 1 object of the present invention, the tests detected a value of the detachment strength of about 8 grams/cm^2.

[0086] The arrangement of the intermediate layer 3 of the printable support 1 with the aforesaid detachment strength advantageously allows detaching the support layer 2 and the intermediate layer 3 itself, after the printable support 1 was attached on the surface to be decorated 13 by means the adhesive glue layer 14 applied on the ink layer 12, without the protection layer 4 tearing or without it deforming, creating wrinkles. In particular, such characteristic has proven to be especially advantageous for obtaining decorations on particularly porous, coarse surfaces, in which the adhesive glue layer 14 might not be attached in a fully uniform manner on the surface to be decorated 13. The value of the detachment strength of the intermediate layer 3 according to the invention is sufficiently small to allow detaching the support layer 2 from the protection layer 4 without causing elongation or deformation of the zones of the protection layer 4 at which the adhesive glue layer 14 is not perfectly attached to the surface to be decorated 13.

[0087] In addition, the detachment strength between the intermediate layer 3 and the protection layer 4 prevents the latter from detaching from the intermediate layer 3 (and hence also from the support layer 2) during the pulling of the printable support 1 inside the printer in order to execute the printing of the decoration on the printable support 1. More in detail, the aforesaid values of the detachment strength are greater than the traction that the drive rollers of the printer exert on the support layer 2 or on the protection layer 4 in order to drive the printable support 1 inside the printer itself.

[0088] Advantageously, the water repellent resin of the intermediate layer 3 comprises a silicone resin, which is control release treated to allow the first face A of the protection layer 4 to removably adhere to the intermediate layer 3 with the aforesaid values of the detachment strength.

[0089] According to a particular embodiment of the present invention, the silicone resin of the intermediate layer 3 has a grammage of about 2 g/m^2.

[0090] Preferably, inside the intermediate layer 3, inert charges are dispersed, such as colloidal silica in particular, in order to obtain an opaque visual effect of the protection layer 4 and hence of the decoration printed thereon.

[0091] With the term "opaque", it is intended that the protection layer 4 appears with a non-translucent, in particular slightly coarse aspect to the observer; this when the printable support applied to the surface to be decorated 13 and the

support layer 2 is removed. At the same time, transparency characteristics are maintained such to allow the observer to see the decoration without any optimal deformation or covering.

[0092] More in detail, the presence of inert charges in the silicone resin of the intermediate layer 3 creates micro-irregularities on the face of the latter adherent to the first face A of the protection layer 4. The latter is deformed according to such micro-irregularities, creating corresponding micro-irregularities on its first face A, which is intended to remain facing outward, after the support layer 2 and the intermediate layer 3 were removed from the protection layer 4 attached to the surface to be decorated 13.

[0093] The micro-irregularities on the first face A of the protection layer 4 prevent the light that hits such first face A from being reflected in a mirror-like manner, creating shade and light microzones that produce an opaque appearance of the decoration.

[0094] In this manner, the printable support 1 according to the invention allows transferring decorations on rough surfaces, such as masonry walls, maintaining visual uniformity of opacity between the decorated surface zones and the non-decorated surface zones.

[0095] The use of colloidal silica as inert charge allows advantageously obtaining a uniform distribution of the latter inside the silicone resin of the intermediate layer 3, producing the aforesaid opaque appearance of the decoration without covering the ink layer 12 fixed on the second face B of the protection layer 4 of the printable support 1 applied to the surface to be decorated 13.

[0096] According to a different embodiment of the printable support 1, the intermediate layer 3 consists of one or more fluorinated products, for example FCH.

[0097] In accordance with the embodiment illustrated in figure 1, the support layer 2 (sheet of double-coated paper) of the printable support 1 is provided with a third face C on which the intermediate layer 3 is fixed, and a fourth face D facing towards the opposite direction with respect to the third face C.

[0098] Advantageously, the printable support for transferable decorations comprises a layer of water repellent-oil repellent material 11 provided for coating the fourth face D of the support layer 2.

[0099] The aforesaid layer of water repellent-oil repellent material 11 ensures that the ink layer 12 fixed on the second face B of the protection layer 4 does not adhere to the fourth face D of the support layer 2 when the printable support 1 is rolled in a roll, and that such ink layer 12 is not detached from the second face B when the printable support 1 is unrolled.

[0100] Preferably, the layer of water repellent-oil repellent material 11 comprises one or more fluorinated products, such as FCH. The use of fluorinated products for obtaining the layer of water repellent-oil repellent material 11 ensures, during the printing of the decoration on the protection layer 4, that the printable support 1 does not slide on the drive rolls of the printer, since the layer of water repellent-oil repellent material 11 develops sufficiently high friction with the drive rollers of the printer.

[0101] In addition, if the support layer 2 is advantageously constituted by the sheet of double-coated paper, the water repellent and oil repellent material layer 11 makes the double-coated sheet more resistant to external agents, in particular during the transport and storage operations.

[0102] Hereinbelow we report the experimental data obtained by subjecting, to several tensile tests, a protection layer 4 for a printable support 1 for transferable decorations according to the present invention, in accordance with a preferred embodiment.

[0103] The tested protection layer 4, in particular, comprises a mixture of acrylic and polyurethane resins 5 with a dry weight percentage of acrylic resins equal to about 82%, with a dry weight percentage of polyurethane resins equal to about 14% and with a dry weight percentage of additives and inert charges equal to about 4%.

[0104] The mixture of acrylic and polyurethane resins 5 of the protection layer 4 was in particular obtained from a compound in liquid phase comprising a first amount of acrylic resins in water emulsion, comprising about 50% of soft acrylic resins and about 50% of hard acrylic resins, and a second amount of polyurethane resins.

[0105] From the protection layer 4 thus obtained, several samples of square form were taken, having 100 mm side and having 24 μm thickness; such samples were then subjected to tensile strength tests by means of an Instron machine (model 4442).

[0106] In particular, in a first test they were subjected to an increasing tensile stress, reaching and exceeding the yield strength. The curves of the load (Kgf) applied as a function of the displacement (mm) obtained during the tests for two different protection layer 4 samples are reported as an example in the enclosed Figs. 5 and 6.

[0107] In a second test, each sample was subjected to tensile stress up to reaching a preestablished elongation value. Once such elongation value was reached, each sample was maintained under traction with constant deformation for a time range equal to 15 seconds; at the end of such time interval, the stress was removed.

[0108] The residual elongation of each sample was then measured 30 minutes after the end of the test. The results obtained for each sample on which a different elongation was induced are reported hereinbelow in Table 1.

Table 1

Sample number	Maximum length reached (L_{max}) [mm]	Final length after 3 0 min (L_f) [mm]	Total (%)	Residual elongation (%) after 3 0 min	Residual elongation percentage with respect to the total elongation (%)
Sample 1	120	115	20	15	75
Sample 2	130	118	30	18	60
Sample 3	140	120	40	20	50
Sample 4	150	124	50	24	48
Sample 5	160	125	60	25	~42
Sample 6	170	126	70	26	~37
Sample 7	180	127	80	27	~34
Sample 8	190	128	90	28	~31
Sample 9	200	130	100	30	30

[0109] As one can observe from the values of the residual elongation measured with respect to the total lengthening induced in each sample, the residual lengthening is inversely proportional to the total induced lengthening and decreases with the increase of the latter.

[0110] Such characteristic is particularly advantageous for the type of application to which the protection layer 4 is intended, for a printable support according to the present invention. Indeed, the protection layer 4, when it is applied on the wall to be decorated, is subjected to small deformations. Hence, it is very important that small deformations in particular have a significant substantially permanent component of the total deformation, thus allowing the protection layer 4 to be modeled in accordance with the surface of the wall to be decorated, without considerable shrinkage occurring.

[0111] The finding thus conceived therefore achieves the preset objects.

[0112] Of course, in its practical attainment it can also assume forms and configurations that are different from that illustrated above, without departing from the present protective scope.

[0113] In addition, all details can be substituted with technically equivalent elements, and the size, shapes and materials employed can be of any type as required.

Claims

1. Printable support (1) for transferable decorations, which comprises:

- at least one support layer (2);
- at least one intermediate layer (3) fixed on said support layer (2) and comprising at least one water repellent resin;
- at least one substantially transparent protection layer (4), which is provided with a first face (A) removably adhering to said intermediate layer (3) and with a second face (B) intended to be printed with at least one decoration, and is susceptible of being transferred on a surface to be decorated (13);

said printable support (1) being **characterized in that** said protection layer (4):

- comprises at least one mixture of acrylic and polyurethane resins (5) with a dry weight percentage of acrylic resins ranging from 80% to 85% and with a dry weight percentage ofpolyurethane resins ranging from 12% to 16%;
- has an average thickness ranging from 20 to 30 μm,
- exhibits a tensile elongation at break (ε_R) of at least about 45% at room temperature, and
- is susceptible, at room temperature, of remaining intact and maintaining the deformation imparted thereto substantially unaltered when it is made to adhere on said surface to be decorated (13), for extensions of said protection layer (4) up to about 15% with respect to its original size.

2. Printable support (1) for transferable decorations according to claim 1, **characterized in that** said protection layer

(4) has an average thickness ranging from 22 μm to 28 μm.

3. Printable support (1) for transferable decorations according to claim 1, **characterized in that** said protection layer (4) has, at room temperature, an instantaneous tensile elastic elongation (ε_E) lower than approximately 10%.

4. Printable support (1) for transferable decorations according to claim 1, **characterized in that** said protection layer (4) has, at room temperature, a tensile strength at break of at least approximately 110 g/cm^2.

5. Printable support (1) for transferable decorations according to claim 1, **characterized in that** said mixture of acrylic and polyurethane resins (5) is obtained from a compound in liquid phase comprising a first amount of acrylic resins in water emulsion and a second amount of polyurethane resins in water emulsion, blended together, said first amount of acrylic resins in water emulsion comprising for about 50% soft acrylic resins, having a glass transition temperature lower than or equal to approximately -15°C, and for the remaining approximately 50% hard acrylic resins, having a glass transition temperature higher than or equal to approximately 35°C.

6. Printable support (1) for transferable decorations according to claim 1, **characterized in that** said protection layer (4) comprises a primer layer (8), which defines said second face (B), and consists of acrylic opacifiers and binders in water dispersion.

7. Printable support (1) for transferable decorations according to claim 1, **characterized in that** said at least one mixture of acrylic and polyurethane resins (5) of said protection layer (4) comprises opacifying products.

8. Printable support for transferable decorations according to claim 1, **characterized in that** said at least one water repellent resin of said intermediate layer (3) comprises at least one silicone resin, which is control release treated to allow the first face (A) of said protection layer (4) to removably adhere to said intermediate layer (3).

9. Printable support (1) for transferable decorations according to claim 1, **characterized in that** said intermediate layer (3) adheres to the first face (A) of said protection layer (4) with a detachment strength ranging from 7.2 to 8.8 g/cm^2.

10. Printable support (1) for transferable decorations according to claim 1, **characterized in that** said support layer (2) comprises at least one sheet of double-coated paper.

11. Printable support (1) for transferable decorations according to claim 1, **characterized in that** said support layer (2) is provided with a third face (C), on which said intermediate layer (3) is fixed, and with a fourth face (D) facing towards the opposite direction with respect to said third face (C);
said printable support (1) comprising at least one layer of water repellent and oil repellent material (11) provided for coating the fourth face (D) of said support layer (2).

12. Printable support (1) for transferable decorations according to claim 1, **characterized in that** said protection layer (4) exhibits on said second face (B) a surface tension ranging from 32 to 38 DIN.

13. Printable support (1) for transferable decorations according to claim 1, **characterized in that** it comprises an ink layer (12) which is fixed on the second face (B) of said protection layer (4), forms said decoration, and comprises solvent-based inks.

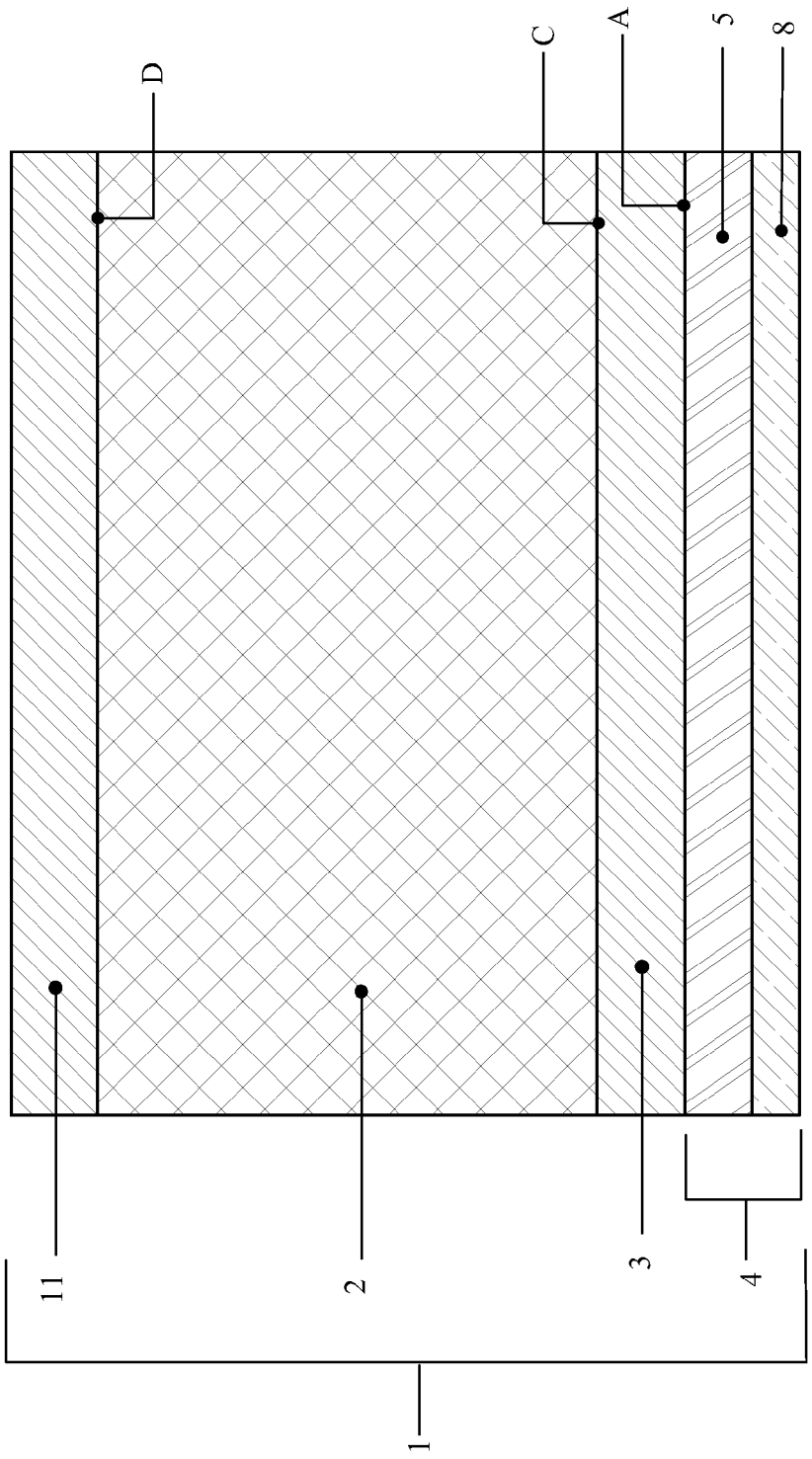

Fig. 1

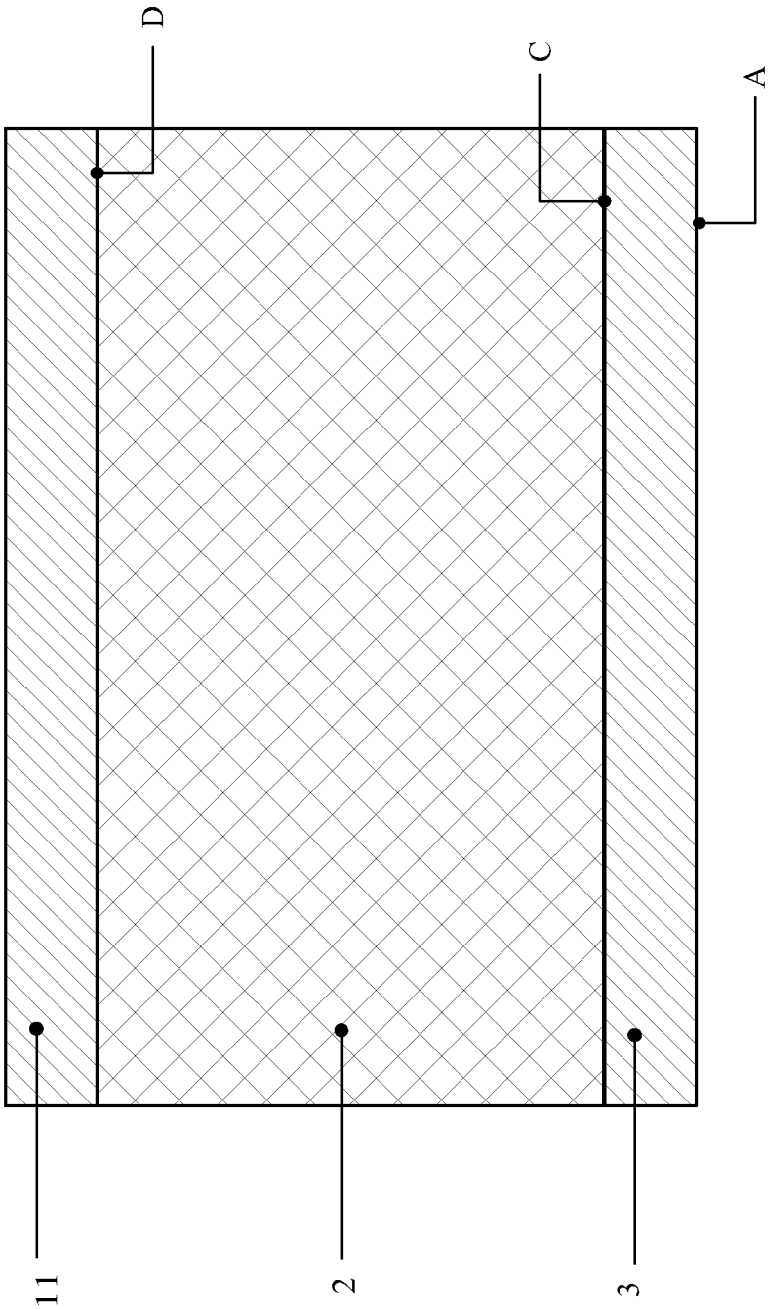

Fig. 2

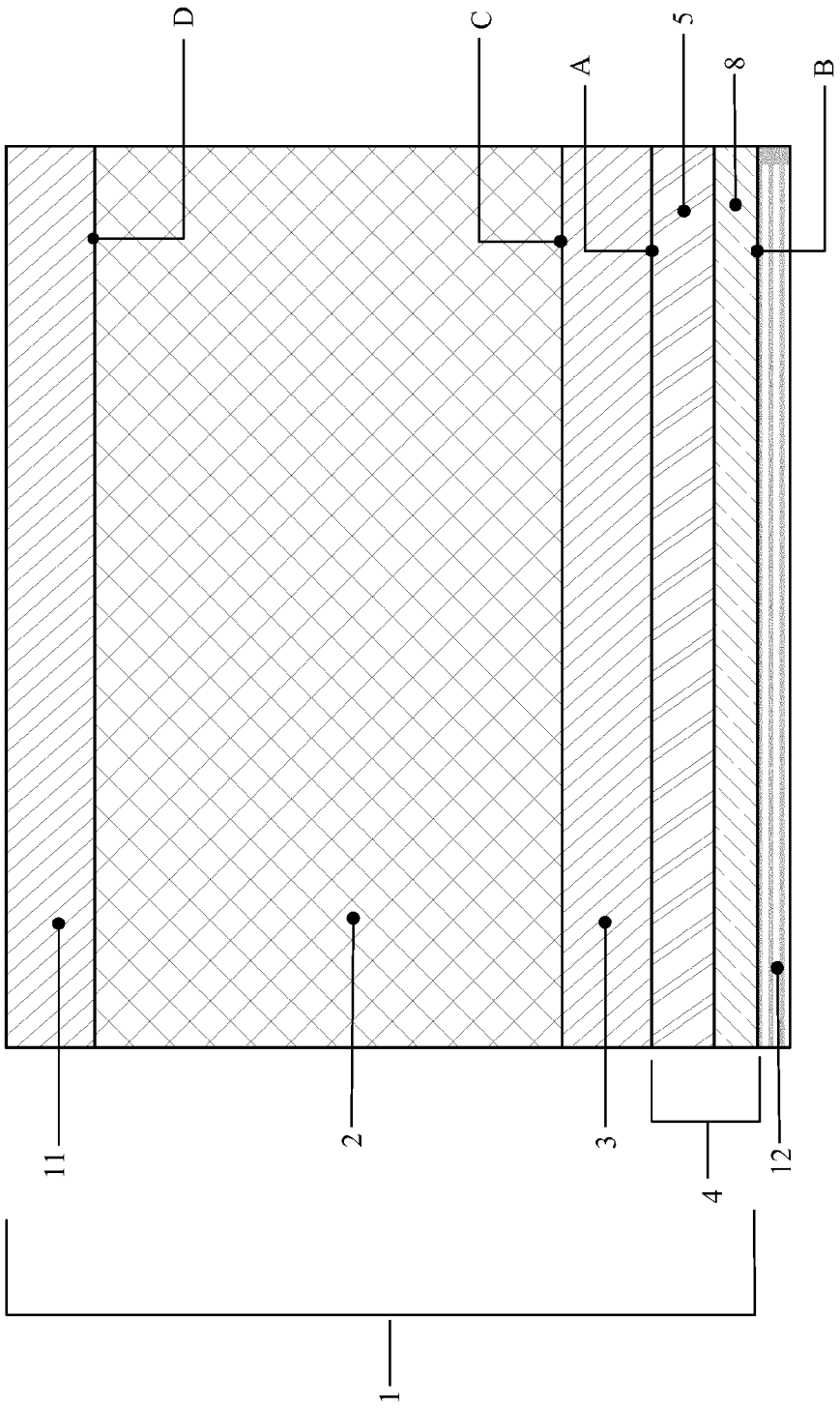

Fig. 3

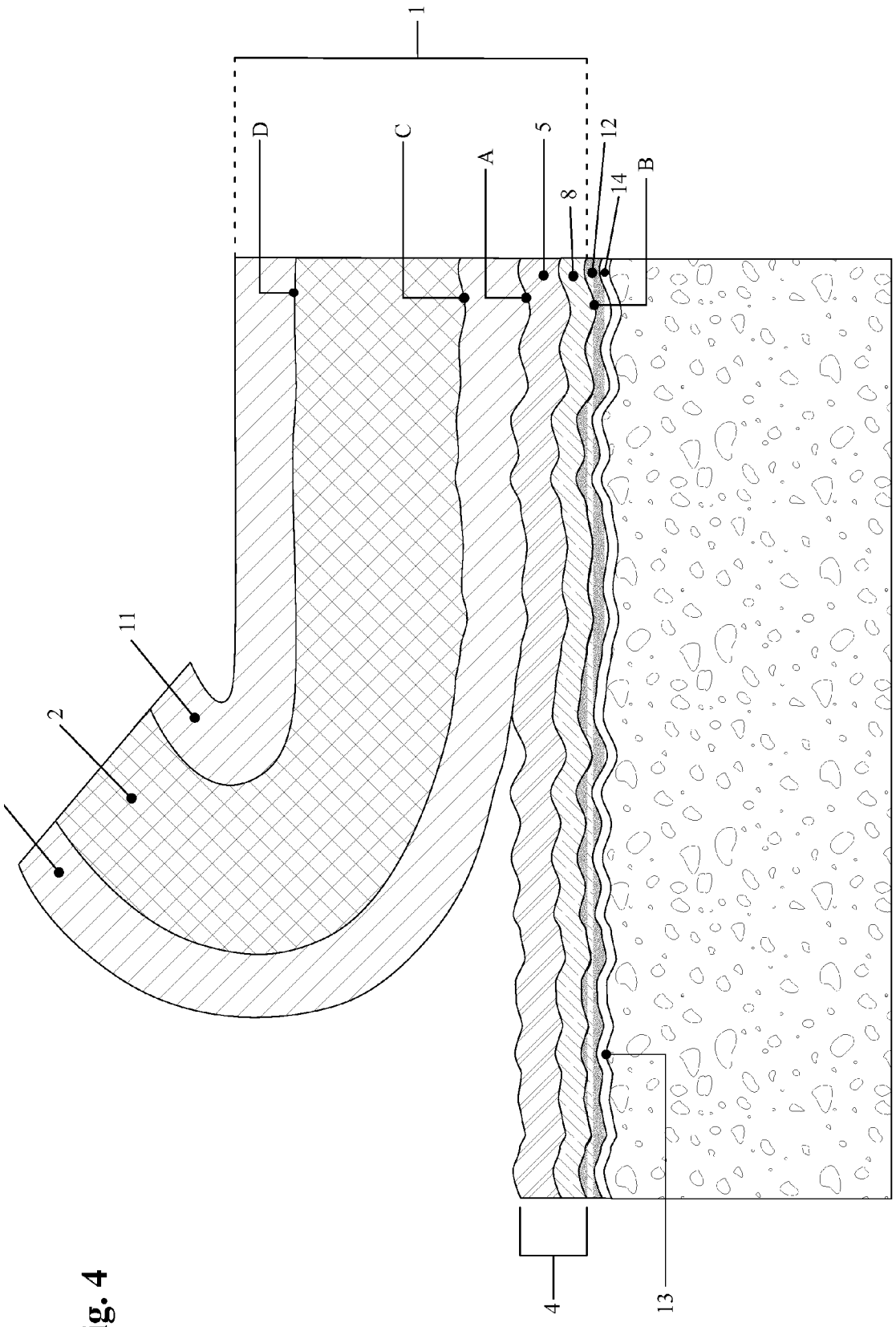

Fig. 4

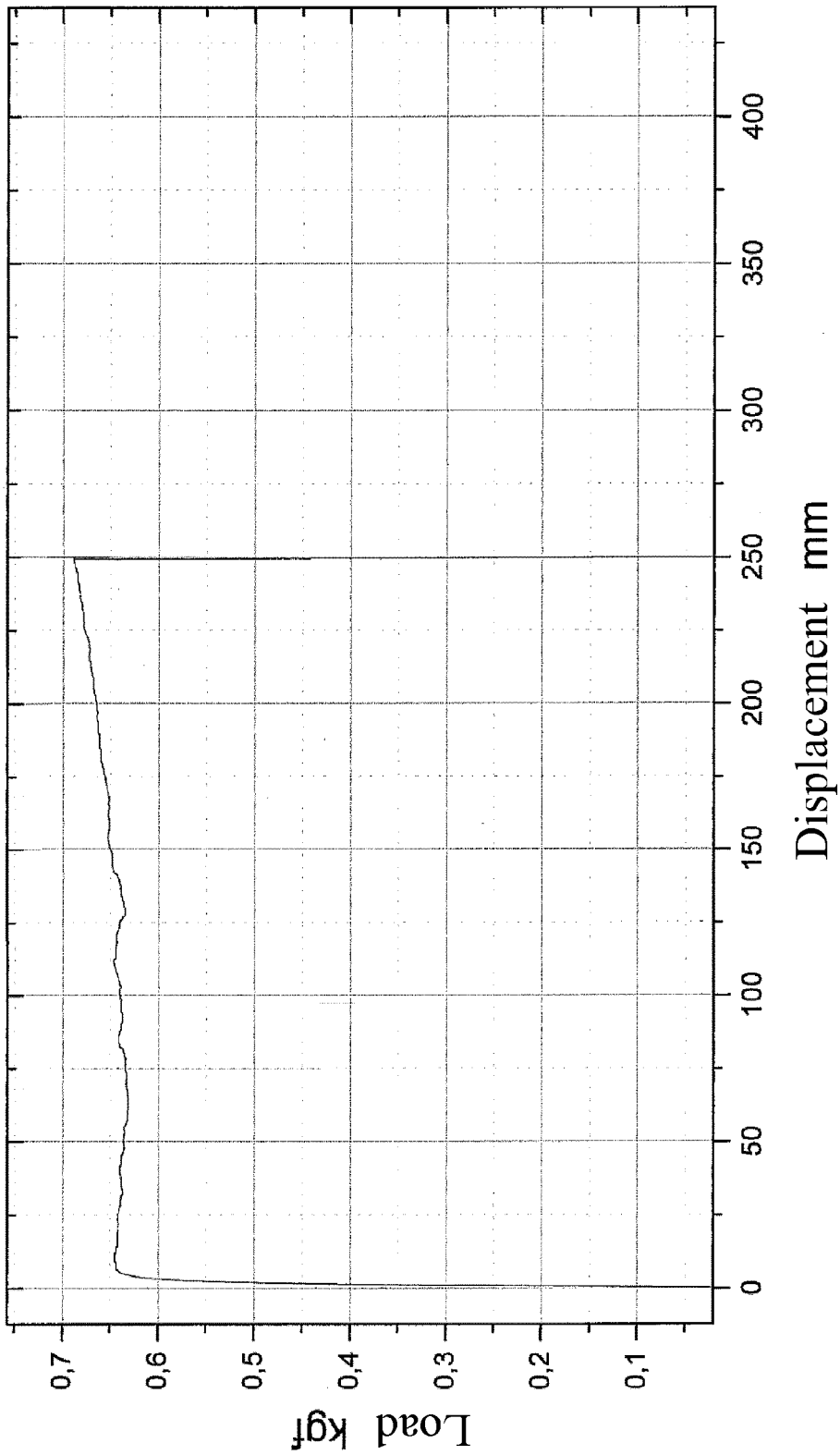
Load kgf
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
50
100
150
200
250
300
350
400
Displacement mm

Fig. 5

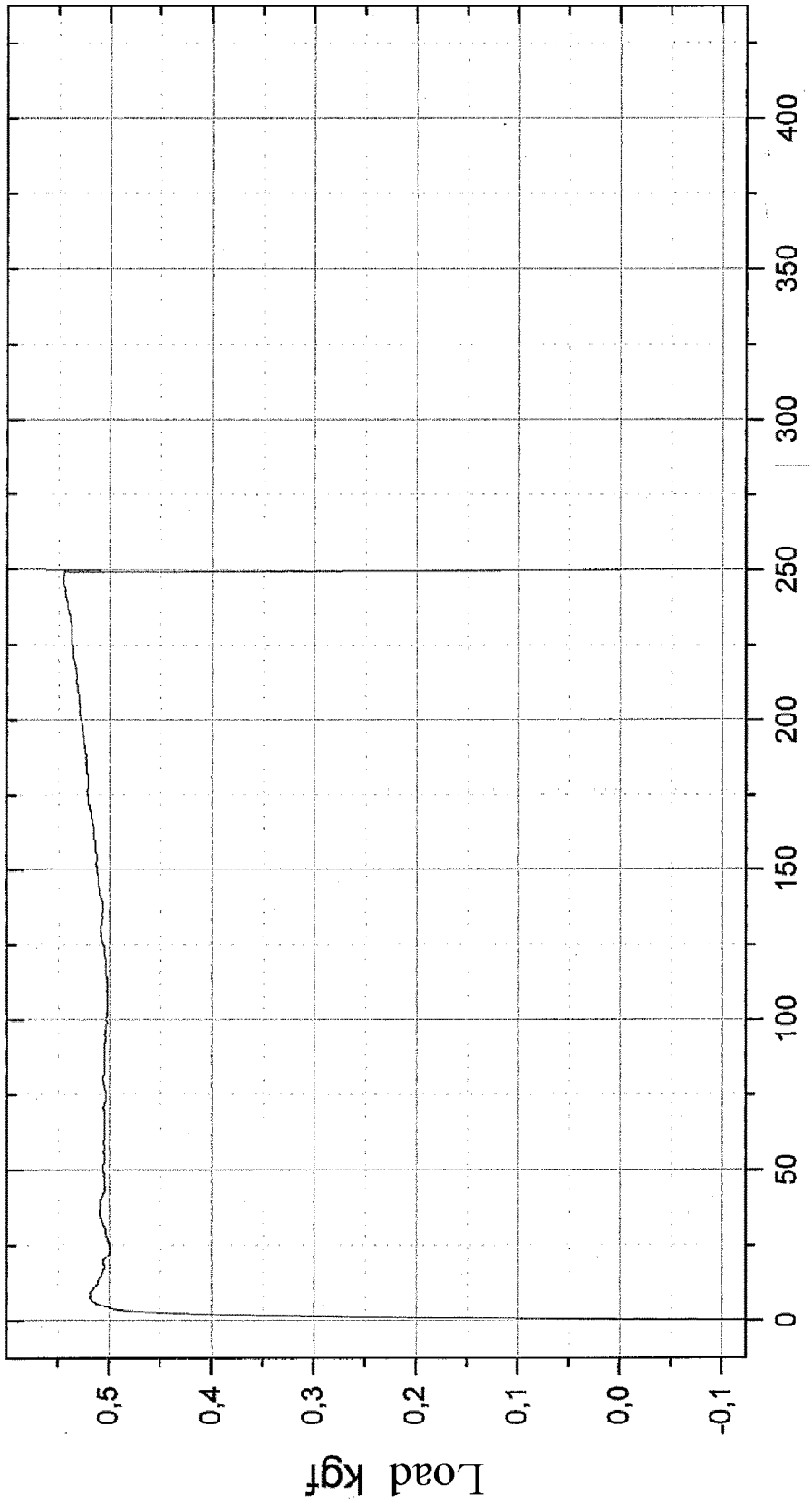
Load kgf
0,5
0,4
0,3
0,2
0,1
0,0
-0,1
0
50
100
150
200
250
300
350
400
Displacement mm

Fig. 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 12 19 3021

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 3 007 829 A (AKKERON LUDWIG F) 7 November 1961 (1961-11-07) * column 6, line 38 - column 8, line 42; figures 1,2 *	1-13	INV. B44C1/17
A	EP 0 266 094 A1 (MINNESOTA MINING & MFG [US]) 4 May 1988 (1988-05-04) * example 1 *	1-13	
A	US 5 968 624 A (LIEBE JR ROBERT JAMES [US]) 19 October 1999 (1999-10-19) * column 3, line 5 - column 3, line 16 *	1-13	
A	US 5 702 790 A (LIEBE JR ROBERT JAMES [US]) 30 December 1997 (1997-12-30) * claim 1 *	1-13	
			TECHNICAL FIELDS SEARCHED (IPC)
			B44C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 February 2013	Bevilacqua, Vincenzo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 19 3021

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-02-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3007829 A	07-11-1961	BE 587407 A1	09-08-1960
		DE 1193856 B	26-05-1965
		GB 883123 A	22-11-1961
		NL 248143 A	18-02-2013
		US 3007829 A	07-11-1961
EP 0266094 A1	04-05-1988	AR 245649 A1	28-02-1994
		AU 592894 B2	25-01-1990
		AU 7892487 A	05-05-1988
		BR 8705683 A	31-05-1988
		CA 1275009 A1	09-10-1990
		DE 3775170 D1	23-01-1992
		EP 0266094 A1	04-05-1988
		ES 2027300 T3	01-06-1992
		HK 55092 A	30-07-1992
		JP 2505224 B2	05-06-1996
		JP 63121041 A	25-05-1988
		MX 165276 B	04-11-1992
		US 4786537 A	22-11-1988
		ZA 8708126 A	28-06-1989
US 5968624 A	19-10-1999	NONE	
US 5702790 A	30-12-1997	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- GB 1552232 A **[0004] [0006] [0007]**
- US 4228211 A **[0009] [0011] [0012] [0018]**
- US 4322467 A **[0012] [0015] [0016] [0017] [0018]**
- US 3007829 A **[0012] [0015] [0016] [0017] [0018]**
- WO 2010119471 A **[0021] [0022]**