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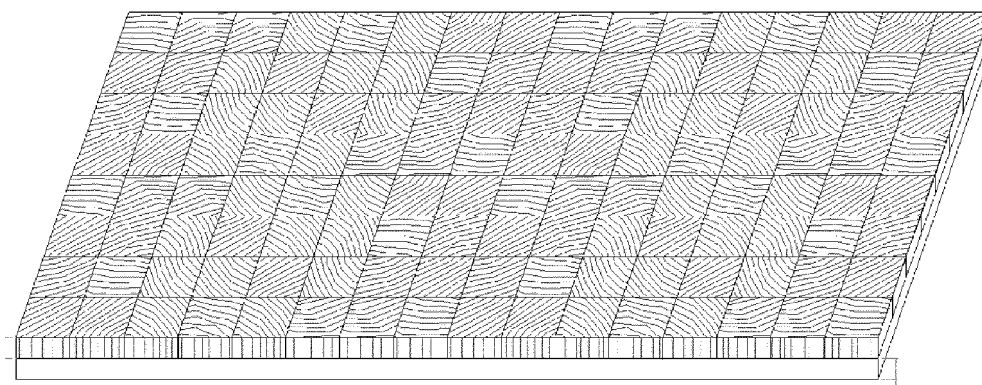
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(54) **Method for manufacturing a multilayer blockboard from solid coniferous wood lamella for an increased hardness and abrasion resistance**

(57) Method for production of multilayer blockboard from solid coniferous wood lamella of increased hardness and abrasion resistance is made by having those lamellas of the same thickness with milling of the surface which forms the glue fugue sorted and chosen, which width of growth rings does not exceed 2,5 mm and which grain arrangement in proportion to the working surface is at an angle of 90 degrees with a deviation in both directions of no more than 25 degrees for lamellas of a thickness of from 10 - 14 mm. One of the milled sides of the lamella is covered with a class D4/C4 resistant ad-

hesive and is connected into the panel. The glued in the press panel is calibrated and afterwards the calibrated panel is glued crosswise into a standard blockboard with the use of glue as stated before. A panel of a thickness above 14 mm is in turn cut again into lamellas transverse to the configuration of growth rings and lamellas are again glued into the panel and afterwards the monolayer panel prepared in such a way is calibrated and glued into a multilayer blockboard with lamellas put crosswise, whereas the finished panel is calibrated and finally the grinded panel is covered with hot melt curing agents.



*Fig. 5*

## Description

**[0001]** The invention relates to the method of producing the refined multilayer blockboard used as a panel in the production of furniture intended for exploitation in harsh conditions or as a panel for outer facade and as a clapboard or a floor panel.

**[0002]** Coniferous wood, especially pinewood, is used as one of the core building and decorative materials in the building industry and furniture joinery. This is due to the great availability of this material, its high decorative quality, as well as its low price compared to other types of wood. The only disadvantage of wood, pinewood in particular, is its low durability in terms of stress and abrasibility.

**[0003]** Over time, with the technological development, there were more and more possibilities to select wood in terms of its natural structure, which is the growth ring density as well as to select defects. The development in chemistry and mechanical engineering made it possible to remove defects and to make joints both on the length of width as well as thickness.

**[0004]** In the prior art, publication US 5,034,259 is known, which relates to a method of manufacturing the panel, in which a board with flat growth rings is cut lengthwise to obtain smaller boards, which are rotated alternately by a right angle and edges are glued together to obtain a panel of any width. The configuration of growth rings on the panel is beneficial in terms of increased durability of the product. The description of the invention WO2008/113890 presents a method of manufacturing a glued wood product and a glued wood product consisting of lamellas devoid of knots by using finger-joints. The lamellas are situated next to each other and glued to achieve vertical wood grain direction.

**[0005]** In the prior art, publication US 2003/0010434 is known, presenting a method of manufacturing a wood product out of lamellas which consists of the following steps. At the beginning, wood slats of uniform thickness are prepared. Their edges are bonded in order to form a bigger panel of a predetermined width. The panel is cut lengthwise into several small panels of the same width, which are then face-bonded in order to form a beam. The thickness is determined by the number of layers of small multiplied panels.

**[0006]** In the prior art, publication PL 346794 and PL 331003 are known, which present waterborne polyurethane dispersions, polyurethane, polyester, polymethacrylate or epoxy and their usage as coating agents, for example for varnishing wood, which harden exposed to radiation.

**[0007]** Previous methods of bonding coniferous wood were aimed at manufacturing a product of increased durability in terms of stress. Removing defects by using finger joints on length - US 2006/0263567 and layered gluing with alternating grain arrangement - RU 2357054 are methods generally applied. Wood which was glued with the usage of these methods, has a high resistance

for bending and static pressure. Glued wood is commonly used in the building industry for pocket-hole joinery as well as in constructions. Gluing on width make it possible to increase the floorage of wood e.g. blockboard and plywood. Traditional furniture boards are finished in a process, which comprises from 3 to 7 operations: skimming, grinding, applying a foundation layer, grinding and applying a surface layer. Available methods of manufacturing a furniture board are time-consuming, expensive and a layer on the surface of the panel has a low resistance to environmental conditions. Additionally, these technologies can be characterized by high emission of harmful substance to the atmosphere. Methods of manufacturing furniture boards that have been developed so far were not aimed at acquiring and have not achieved an increased surface resistance to abrasion and mechanical manipulation. The aim of the invention is to develop a technology which will enable the achievement of abrasion resistance parameters comparable to other types of wood of rarer distribution and thereby significantly higher price. The method consists of steps beginning with wood cut-out optimisation, the manufacturing of glue boards and also thermal finishing of the surface of the panel. The complexity of the above mentioned steps is meant to create an optimal closed process, directed towards manufacturing a finished product with a maximal saving of material. Highly selected wood creates the surface layer of the panel - the laminate.

**[0008]** The invention relates to the method for manufacturing the multilayer blockboard, in which round wood of a thickness increase of no more than 0,3 mm and a log diameter of no less than 0,2 m is selected and chosen. The log is sawed into beams to achieve grain as sloped as possible on the wide surface. Next, wood is gently dried to a humidity of a few %, optimally 7 - 9 %. Dried wood is cut out to achieve lamellas of the same thickness with simultaneous twofold milling of the surface which forms the glue fugue. The lamellas are sorted out and those are chosen whose width of growth rings does not exceed 2,5 mm and which grain arrangement in proportion to the working surface is at an angle of 90 degrees with a deviation in both directions of no more than 25 degrees for lamellas of a thickness of from 10 - 14 mm. For lamellas of a thickness exceeding 14 mm only grain consistency, which width should not exceed 2,5 mm, is controlled. One of the milled sides of the lamella is covered with a class D4 or C4 resistant adhesive, while the lamellas of the same thickness are put in parallel with each other so that the whittled side touches the glued whittled side and the surfaces after processing are put upwards and downwards horizontally. The prepared panel is placed in a hydraulic press at a temperature of 94-105 degrees with constant pressure control which decrease should not exceed a maximum of 5 % of given pressure, the glued panel is calibrated using the grinding method and afterwards the calibrated panel is glued crosswise into a standard blockboard with the use of glue as stated before, whereby a panel of thickness above 14

mm is cut again into lamellas transverse to the configuration of growth rings and lamellas are again glued into the panel, whereas glue compatible with the norm D4/C4 is put one-sidedly into grinded surfaces, where the grinded surface is being connected with the glued grinded surface or the calibrated panel is glued in layers with a similar calibrated panel or panels with lamellas put crosswise and finally the grinded panel is covered with curing agents with the additional usage of UV radiation. The grinded panel is effectively covered with agents made by the company Kleiberit: the curing agent PUR 555 NANO and then covered with the agent PUR HC 717.7 or 717.8 in a quantity of 60 - 100 g/m<sup>2</sup> in a temperature from 100 to 140 Celsius degrees and is cured by UV radiation with a coat of TopCoat 817, 10-15 g/m<sup>2</sup> coverage dosage. The entirety is afterwards rolled and left for 12 to 24 hours to attain the requested resistance.

**[0009]** The above mentioned method makes it possible to manufacture a panel from soft coniferous wood which is characterized by unique pattern-design of very high resistance to climate conditions and chemical agents and which. At the same time, it possesses a high resistance to mechanical manipulation - abrasion and kneading, not yet achieved. The introduction of polyurethane agents applied in high temperatures to the method for finishing a panel, allows the panel to achieve new, previously unattainable parameters of surface protection. The panel manufactured as a result of a proper selection of growth rings, its processing, gluing and coating, ensures obtaining a surface layer which is resistant to microcracks, UV radiation and atmospheric factors, resistant to scratches and at the same time highlights the aesthetic quality of the wood, wood optics, and its structure. Composites manufactured with the use of the described technology can find application especially in the building industry as floor coverings (plank panel), stair steps, window sills and in furniture joinery as table worktops and kitchen table tops. Their durability is greatly enhanced even during intensive exploitation and is comparable to hard types of wood such as oak and beech, as well as exotic wood, but manufactured at a low price.

Example 1.

**[0010]**

1. The preparation of pine lamellas of the cross-section size of 10/ 12/14 mm x 42 - 48 mm with a vertical grain arrangement and a slope permissible max 15% from the vertical direction.

2. The distance between growth rings cannot exceed 2 mm.

3. Segregated lamella is glued laterally into the panel of any width size.

4. An adhesive giving the resistance class D4 and

C4 (acceptable in the building industry as bearing construction wood with exposure to a high degree of humidity) is used in the gluing process.

5. Glued panels are calibrated using the cutting method.

6. Calibrated panels are glued together in layers with lamellas put crosswise.

7. An adhesive of the resistance class D4 and C4 is used for the glue connection.

8. Glued panels are submitted to a final grinding using sandpaper of a minimal granulation of 180.

9. The grinded panel is covered with agents made by the company Kleiberit: the curing agent PUR 555 NANO and then covered with the agent PUR HC 717.7 or 717.8 in a quantity of 60 - 100 g/m<sup>2</sup> using the HotCoating® method and is cured by UV TopCoat 817, 10-15 g/m<sup>2</sup> coverage dosage

Example 2.

**[0011]**

1. The preparation of pine lamellas of the cross-section size of 10/ 12/14 mm x 42 - 48 mm with a vertical grain arrangement and a slope permissible max 15% from the vertical direction.

2. The distance between growth rings cannot exceed 2 mm.

3. Segregated lamella is glued laterally into the panel of any width size.

4. An adhesive giving the resistance class D4 and C4 (acceptable in the building industry as bearing construction wood with exposure to a high degree of humidity) is used in the gluing process.

5. Glued panels are calibrated using the cutting method.

6. Calibrated panels are cut transverse to the configuration of the glue fugue into lamellas of 12 mm thickness.

7. Lamellas are glued laterally putting their core composition vertically.

8. Glued panels are calibrated using the grinding method using sandpaper of a minimal granulation of 120.

9. The panel prepared in such a way is glued on a

panel prepared using the technology described above using the glue of the resistance of class D4 or C4.

10. Glued panels are submitted to a final grinding using sandpaper of a minimal granulation of 180.

11. The grinded panel is covered with agents made by the company Kleiberit: the curing agent PUR 555 NANO and then covered with the agent PUR HC 717.7 or 717.8 in a quantity of 60 - 100 g/m<sup>2</sup> using the HotCoating® method and is cured by UV Top-Coat 817, 10-15 g/m<sup>2</sup> coverage dosage

**[0012]** The invention is further presented in the picture, on which fig. 1 shows the sawing of a log into beams, fig. 2 shows the sorting of lamellas of a thickness of 10 - 14 mm, whereas fig. 3 the sorting of lamellas of a thickness of 14 - 43 mm, fig. 4 presents the gluing of lamellas, while fig.5 the creation of a panel from layers of glued lamellas.

**[0013]** The method of manufacturing a panel begins from the selection of round coniferous wood, usually pine, of very big thickness. Yearly growths should not exceed 3 mm and the diameter of the log should not be smaller than 200 mm. Tree butt elements of a length of up to 4500 m of the smallest amount of lumber defects (knots visible on the surface) are used for the cut-out. The sorting is conducted manually.

**[0014]** The log, as shown in fig.1 is sawn into beams of a thickness of 48 - 55 mm and a width of 110 - 180 mm to achieve grain as sloped as possible on the wide surface.

**[0015]** Next, the cut-out wood is gently dried which prevents the creation of microcracks and deformations and brought to a humidity of 7 - 9 %.

**[0016]** Dried wood is cut out with simultaneous twofold milling (whittling) of the surface which forms the glue fugue. The obtained lamellas 1 are given a thickness of 10 - 43 mm and width of 43 - 48 mm.

**[0017]** The whittling of glued surfaces is conducted in a way, in which a planer with a spindle rotation speed of 5800 - 6100 rpm is used with a rate of linear travel in the range of 6-7,5 m/min for every knife installed in the head.

**[0018]** The implementation of surface processing in lamellas 1 grinding ensures the creation of the smallest kinetic wave possible and thereby a minimal filling of the glue fugue 2, i.e. no deposition of glue between the peaks of the wave. Such method ensures an optimal connection of lamellas 1.

**[0019]** In the occurrence of mechanical sorting the cut-out is set in such a way to achieve from one beam lamellas of the same thickness.

**[0020]** In case of manual sorting two thicknesses are used.

**[0021]** In the processing it is absolutely necessary to maintain a parallelism of sides as well as right angles in the cross-section.

**[0022]** Lamellas, as in fig.2, of a thickness of 10 - 14

are sorted by grain arrangement and grain width - early growth. The sorting is made manually or with the usage of scanners, which very precisely determine the grain's width and its arrangement. Mechanical sorting is being conducted with the usage of cameras and a computer.

**[0023]** The sorting of lamellas of a thickness of 10 - 14 mm is made by choosing lamellas which width of growth rings does not exceed 2,5 mm and which arrangement in proportion to the wide surface is at an angle of 90 degrees with a deviation in both directions of no more than 25 degrees.

**[0024]** In the sorting of lamellas of a thickness of 14 - 43 mm, as shown in fig.3, the choice of grain consistency is crucial. The grain arrangement is not important due to the following technological process described below.

**[0025]** The growth rings are chosen with a width not exceeding 2,5 mm.

**[0026]** Lamellas sorted by grain width and by grain arrangement are segregated into lamellas of the same thickness and are prepared to be created by blockboard gluing.

**[0027]** The surfaces which were submitted to the process are only one-sidedly covered with glue in the amount of 80 - 120 gram/m<sup>2</sup>. The glue, which is used, must meet class D4 or C4 resistance parameters. Glued lamellas are put in parallel with each other so that the whittled side touches the glued whittled side, as shown in fig.4, and the surfaces after processing are put upwards and downwards horizontally. The prepared panel is placed in a hydraulic press with constant pressure control and a system which enables the replenishment of pressure in case of its decrease during the press process. The decrease should not exceed a maximum of 5 % of given pressure.

**[0028]** High temperature gluing is being conducted between two heat shelves which have both a heat and lamella leveling function. The temperature of gluing should be kept around 94 - 105 degrees Celsius. The strength of the leveling grip is 3,5-4,5 kg/cm<sup>2</sup>.

**[0029]** The strength of the lateral glue grip is 8.000 - 10.000 kg/mb with a press width of 1100 - 1900 mm. The time of the press is 90 - 240 s.

**[0030]** The glued panel is calibrated using the grinding method with a surface finish applied with sandpaper of a granulation of 120-150. During the calibration 0,6 - 0,8 mm is grinded per side. The grinding in the applied granulation ensures an optimal penetration of the glue and at the same time a minimal necessity of filling pores resulting in the connection becoming optimally durable.

**[0031]** The calibrated panel of a width of 8,4 - 12,4 mm is glued crosswise, as shown in fig.5, into a standard blockboard with the use of glue compatible with the norm D4 or C4. The coverage dosage of the glue is 100 - 140 gram/m<sup>2</sup>. The strength of the press grip is set to 10-12 kg/cm<sup>2</sup>.

**[0032]** The panel of a thickness of 14 - 41,6 mm is cut into lamellas of a thickness of 10 - 12 mm transverse to the configuration of growth rings. Lamellas are again glued into the panel. 80 - 120 gram/m<sup>2</sup> of the adhesive

is put one-sidedly into grinded surface. The adhesive should be compatible with the norm D4/C4. The lamellas are put next to each other so the grinded surface is being connected with the glued grinded surface. The initially placed panel is glued according to the press pressures given before.

**[0033]** The glued panel is calibrated using the grinding method using sandpaper with a surface finish of a minimal granulation of 120-150. The calibrated panel is glued into waterproof plywood of a thickness of 10 - 12 mm or a traditional blockboard manufactured using class D4 or C4 glue connections. The plywood (bearing panel) is calibrated beforehand keeping the same surface finish parameters as the prepared to be glued panel. Glue which is compatible with the norm D4 or C4 is used. The glue coverage dosage is 100 -140 gram/m<sup>2</sup>. The pressure force for the gluing is set in the range of 10 - 12 kg/cm<sup>2</sup>.

**[0034]** Thanks to the applied grain arrangement in the lamella and segregated thickness parameters an abrasion class comparable and equal to oak, that is 0,9 - 1, is achieved.

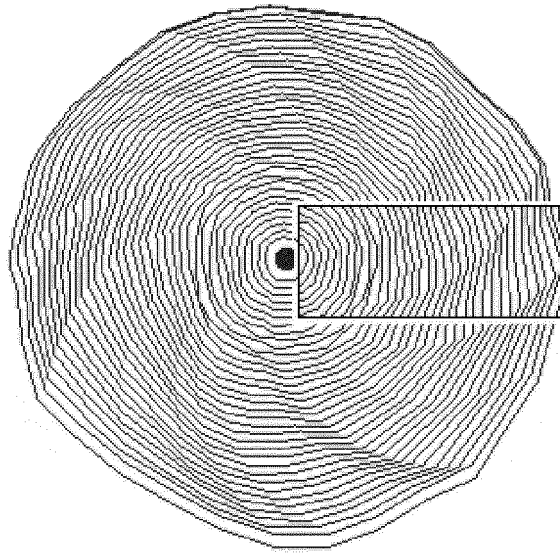
**[0035]** The panel is grinded and finished using sandpaper of a granulation of 180 - 220. After the grinding the surface is heated with infrared radiation and then the PUR 555 NANO agent produced by "Kleiberit" is thermally applied with the use of rollers. Directly after that the PUR HC 717.7 or 717.8 agent is applied. Both agents are applied in quantities of 60 - 100 gram m<sup>2</sup>. Then UV TopCoat 817 is applied directly onto the agent. It is afterwards hardened by UV radiation of an intensity of about 160 W. Next, the entirety is rolled and left for 12 to 24 hours. After that time it attains surface resistance of no less than 6 class.

## Claims

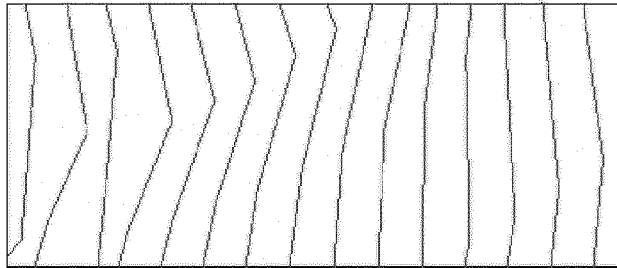
1. Method for production of multilayer blockboard from solid coniferous wood lamella of increased hardness and abrasion resistance in which round wood of a thickness increase of no more than 0,3 mm and a log diameter of no less than 0,2 m is selected and chosen, where the log is sawed into beams to achieve grain as sloped as possible on the wide surface, wood is afterwards gently dried to a humidity of a few, optimally 7 - 9 %, dried wood is next cut out to achieve lamellas of requested grain arrangement with their further segregation, processing, arrangement, gluing in heightened temperatures and at an increased pressure with surface processing, which is distinctive by having those lamellas of the same thickness with milling of the surface which forms the glue fugue sorted and chosen, which width of growth rings does not exceed 2,5 mm and which grain arrangement in proportion to the working surface is at an angle of 90 degrees with a deviation in both directions of no more than 25 degrees for lamellas of a thickness of from 10 - 14 mm and one of the milled

sides of the lamella is covered with a class D4 or C4 resistant adhesive, while the lamellas of the same thickness are put in parallel with each other so that the whittled side touches the glued whittled side and the surfaces after processing are put upwards and downwards horizontally, then the panel prepared in such a way is placed in a hydraulic press at a temperature of 94-105 degrees with constant pressure control, which decrease should not exceed a maximum of 5 % of given pressure, the glued panel is calibrated using the grinding method and afterwards the calibrated panel is glued crosswise into a standard blockboard with the use of glue as stated before, whereby a panel of thickness above 14 mm is cut again into lamellas transverse to the configuration of growth rings and lamellas are again glued into the panel, whereas glue compatible with the norm D4/C4 is put one-sidedly into grinded surfaces, where the grinded surface is being connected with the glued grinded surface and afterwards the monolayer panel prepared in such a way is calibrated and glued into a multilayer blockboard with lamellas put crosswise keeping the rules of applying D4/C4 resistance class adhesive in all steps of the process, whereas the finished panel is calibrated and finally the grinded panel is covered with PUR POLIURETAN hot melt curing agents.

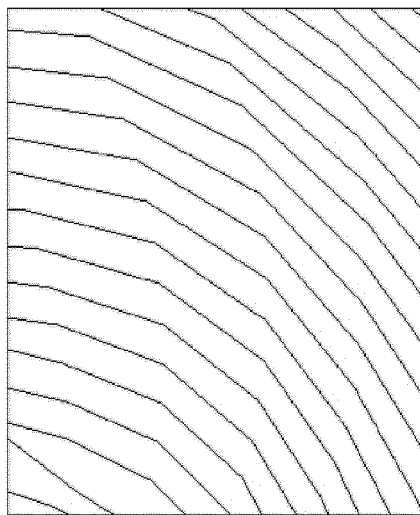
2. Method according to claim 1, **which is distinctive by** having the panel effectively covered with curing agents made by the firm Kleiberit: the curing agent PUR 555 NANO and then covered with the agent PUR HC 717.7 or 717.8 in a quantity of 60 - 100 g/m<sup>2</sup> in a temperature from 100 to 140 Celsius degrees and the surface layer is cured by UV radiation with a coat of TopCoat 817, 10-15 g/m<sup>2</sup> coverage dosage and afterwards the entirety is rolled and left for 12 to 24 hours to attain the requested resistance.



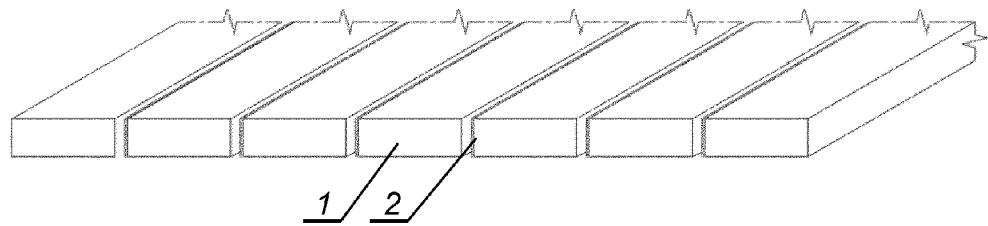
*Fig. 1*



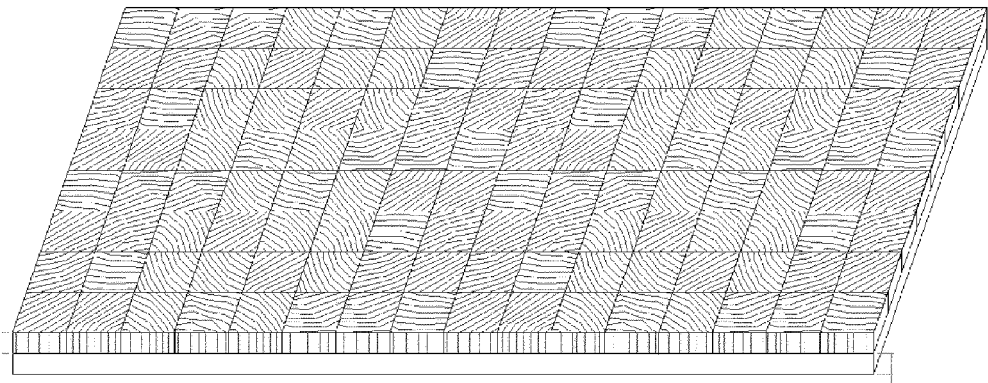
*Fig. 2*



*Fig. 3*



*Fig. 4*



*Fig. 5*



## EUROPEAN SEARCH REPORT

Application Number  
EP 11 46 1539

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The present search report has been drawn up for all claims			
Place of search <b>The Hague</b>		Date of completion of the search <b>10 February 2012</b>	Examiner <b>Huggins, Jonathan</b>
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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 &amp; : member of the same patent family, corresponding document</p>			

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EPO FORM 1503 03.82 (P04C01)





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Place of search The Hague		Date of completion of the search 10 February 2012	Examiner Huggins, Jonathan
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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

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