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(54) Title: A THROUGH–COLOURED WOODEN ELEMENT AND A METHOD OF PRODUCING THROUGH–COLOURED WOODEN ELEMENTS

(57) Abstract

A method of producing a through–coloured wooden element in which the element is pressed isostatically in a first step, at a pressure greater than 800 bar, preferably greater than 1000 bar, whereafter the pressure is removed and the element is then placed in a liquid bath that contains a dissolved colorant in a second step. The invention also relates to a through–coloured wooden element.

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A THROUGH-COLOURED WOODEN ELEMENT AND A METHOD OF PRODUCING THROUGH-COLOURED WOODEN ELEMENTS

The present invention relates to a method of producing through-coloured wooden elements, particularly sawn wood products, and also to a through-coloured wooden element.

By through-coloured is meant here that the wooden element has been coloured or stained homogeneously throughout the wood. A sawn surface of the element will therefore be coloured or stained regardless of the direction in which the wood is sawn or cut. The term through-coloured is used in this significance hereinafter.

Coloured and stained wooden products become worn with time. Such wear, gouges, lacerations and like impairments of the wooden products are particularly noticeable because they expose the plain wood located beneath the coloured or stained surface. Surfaces that shall be re-stained or re-coloured require a significant amount of preparatory work, such as sanding, etc., which is very time-consuming. The actual colouring process is also very time-consuming. These problems are solved in accordance with the present invention with the aid of a method of through-colouring wood as hereinbefore defined. Lacerations, gouges, marks and wear in and on the wood are not as noticeable in this case. Furthermore, the wood can be sanded down or worked whilst retaining the same colour throughout. The through-colouring process is also less laborious than a manually performed colouring or staining process. This affords significant benefits. Flooring materials and table tops are examples of the areas in which such benefits are afforded. Thus, the invention enables the production of through-coloured wooden floors and table tops which when showing signs of wear need only be sanded down and then treated perhaps with an appropriate oil or varnish. Another area of use is found in the wooden handles of cutlery. Coloured or stained wooden cutlery washed in dishwashers quickly become disfigured as a result of the stain wearing-off in the dishwasher. This problem is solved when using through-coloured wood in accordance with the invention, since there is no colour surface that can be impaired, by virtue of the

fact that the wood is through-coloured. It is now possible to produce wooden handles for cutlery that withstand being washed in dishwashers.

Swedish Patent Application SE 9500689-6 describes a method of producing impregnated wooden products. This method involves pressing a wooden element, or wooden blank, isostatically in a so-called Quintus press or with the aid of some other appropriate pressing method in a first stage of manufacture, at a pressure greater than 800 bar, preferably greater than 1000 bar. The degree of compression to which the wood is subjected will depend on the dryness, fibre direction, hardness and other properties of the wood. Normally, this compression will result in the reduction of one of the cross-sectional dimensions by between 20-50%, wherewith the cells in said element are pressed together. The load on the wooden element is then removed.

In a second step, the element is placed in a bath that contains an impregnating agent, wherewith the element progressively swells as a result of liquid entering into and being absorbed by the cells. The liquid penetrates the cells such as to obtain complete impregnation of the element in its entirety. The extent to which the element expands will depend, *inter alia*, on the material properties of the element and its residence time in the bath. Pronounced expansion normally takes place within the space of some hours and, in some instances, the material returns to its original form within this time period. Suitable impregnating agents are liquid fire retardants, liquid fungicides and glue.

The first two method steps may be supplemented with a third step in which the element is again compressed isostatically with a pressure greater than 800 bar, preferably greater than 1000 bar, resulting in a hard element that is fire-resistant, fungus-resistant and also resistant to deformation when glue is used.

The aforedescribed pressing process, which is also described in Swedish Patent Application 9303821-4, raises the quality of low-quality wood by providing a much harder end product. For instance, pine can be made as hard as oak, and oak can be made twice as hard as its natural hardness. According to Swedish Patent Application 9500689-

6, it has been found that this pressing process makes it possible to impregnate wood that could not earlier be impregnated. Such impregnation can be achieved with large wooden products that are several square metres in area.

It has not earlier been possible to through-colour wood. However, it has surprisingly been found that wood can be through-coloured in accordance with the invention claimed in this Application by placing the wood in a colour bath after the first isostatic pressing step. The colour penetrates into the wood, which is then allowed to dry in a conventional manner, and may optionally be pressed again. This colour penetration results in wood that is coloured throughout. In addition, all the benefits of hardwoods are obtained by further pressing the wood in accordance with SE 9303821-4, after through-colouring the wood.

According to the inventive method, a wooden element is pressed isostatically in a first step at a pressure greater than 800 bar, preferably greater than 1000 bar, in a so-called Quintus press or by some other suitable pressing process, wherewith compressing the wood cells in said element. This process is described in SE 9303821-4. In a second step, the element is placed in a colour bath comprising, e.g., water and a water-dissolved colorant. As the pressure-treated wood comes into contact with water, the wood swells and draws water thereinto. The cellulose in the wood and the water are both polar, whereby the water is readily absorbed by the wood. The colorants are also polar and therewith accompany the water into the wood cells, said colorants having a molecular size, i.e. a smallness, that enables them to penetrate into the wood cells. The colorant shall not be excessively polar, since this would cause it to stop at the surface of the wood instead of penetrating into the wood. This also applies when the molecular size of the colorant is excessively large and therefore unable to penetrate into the wood. The molecular size and polarity of the colorant varies slightly, depending on the type of wood concerned. One of normal skill in this art will be able to decide upon a suitable colorant experimentally. This is achieved by through-colouring the type of wood concerned with different colorants in combination with solvents, e.g. water, after having pressed a wooden element isostatically.

The solvent used will be one that is absorbed by the wood. Water is a suitable solvent. Another suitable solvent is linseed oil, which has good penetrability and wetability due to its small molecules. The colorant is dissolved in the solvent and is sufficiently polar to accompany the solvent as it is absorbed in the wood, and shall have a molecular size which ensures that it has "room" to accompany said solvent into the wood. Azo dyes are suitable colorants in the present context. Monomers, dimers or polymers of the azo dyes may be applicable, depending on the molecular size of the azo dye or colorant and the choice of wood. The colorant shall also have the polarity necessary for it to be able to enter the wood. The skilled person is able to determine which colorant together with which solvent will penetrate into the wood.

Woods that can be coloured in accordance with the invention include hardwoods or leafwood, such as aspen and birch, and softwoods or coniferous wood such as spruce and pine (redwood). The first step in which the wood is pressed isostatically enables a large number of different types of wood to be through-coloured in accordance with the invention.

A number of trials have been run using aspen and spruce which was through-coloured with Herdins Äkta Bets, which was made up by mixing sodium chloride with an azo dyestuff according to the description of goods for genuine stain in powder form having product number 102051 and obtained from Herdins Färgverk AB. These trials will be described below.

The invention will now be described in more detail with reference to the following examples. The inventive method comprises pressing a wooden element isostatically in a first method step at a pressure greater than 800 bar, preferably greater than 1000 bar, in a so-called Quintus press or by some other suitable pressing process in which the wood cells in the element are compressed. The element is then relieved of load. In a second method step, the element is placed in a liquid bath containing a colorant dissolved in a solvent, such as water, wherewith water and colorant are absorbed by the element. The

colorant shall have a molecular size which enables it to penetrate the wooden element and shall have a polarity which enables it to penetrate the wood together with the water. Water and colorant migrate into the wood as it swells. This takes place over some hours, and may be effected at room temperature or at an elevated temperature of up to 100°C. The through-colouring process proceeds more quickly at temperatures above room temperature. Water containing colorant penetrates into the wood element as the wood swells, thereby resulting in a through-coloured element.

The element is then dried conventionally.

Alternatively, the wooden element can be through-coloured by means of a conventional pressure impregnation process.

It has also been found that it is possible to through-colour wet wood or raw wood. In a first step of isostatically pressing the raw wood at a pressure greater than 800 bar, preferably greater than 1000 bar, the lumina are opened up or some properties of the wood are changed. The opened up lumina will be able to absorb the colorant and the solvent, in a later step, which makes the wooden element through-coloured. In a later step the wooden element is placed in a chamber and the colorant and the solvent is delivered. This later step can be done with a conventional pressure impregnation process, with vacuum and/or pressure. This step is necessary since the wood keeps a quite high content of sap. The pressure and/ or vacuum step makes the sap already contained in the wood able to be exchanged against the colorant and the solvent.

It is even possible to through-colour wet or raw spruce, which has been known to be impossible to impregnate.

Subsequent to having through-coloured the wooden element, said element may be pressed isostatically at least one more time in a third step, at a pressure greater than 800 bar,

preferably greater than 1000 bar. This results in a through-coloured wood that has the hardness of a hardwood.

The wood through-colouring process can also conceivably be combined with the impregnation process described in SE 9500689-6, therewith incorporating a fire retardant, an anti-fungus agent or glue into the through-coloured wooden element.

The invention also relates to a through-coloured wooden element that has been through-coloured in accordance with the aforedescribed method.

Example 1

A piece of aspen wood measuring 7x4.5x15.5 cm was pressed isostatically in a Quintus press (in accordance with the method described in SE 9303821-4). The wood was pressed at 1300 bar for two minutes at room temperature.

A colouring bath was prepared by mixing HERDINS ÄKTA BETS, No. 59, ebony black in powder form with water, in accordance with the instructions on the packet (without ammonia). The solution was brought to a boiling point and the pressure-treated wood piece then placed in the solution and kept there for about two hours while boiling the solution, after which the wood was removed and dried. The wood was then sawn in two, whereby it could be seen that the piece of wood was coloured throughout.

Example 2

A piece of spruce measuring 4x4x5 cm was pressed in a second test in the same way as that described in Example 1. The colouring bath was prepared in the same way as that described in Example 1 and the wood was through-coloured in the same way with the exception that HERDINS ÄKTA BETS, No. 51, red, was used instead. The wood was removed from the bath and dried and then sawn in two, from which it could be seen that the wood had been coloured throughout.

The present invention provides a unique method of through-coloured wood that has a wide area of use. Practically all types of wood can be treated in accordance with the invention. In addition, the invention can be applied to produce through-coloured wood of enhanced hardness. The through-colouring process is not so laborious as painting or staining wood by hand. As previously mentioned, the areas of use include flooring materials and table tops, and also wooden panels, wooden stairs, kitchen elements, glued wooden beams, shafts, sport equipment, etc. When such wooden products and articles become damaged and worn, their surfaces can be sanded down to expose new, blemish-free coloured surfaces that do not require re-colouring. Damage and wear to the surface of the wood will not be as noticeable as would otherwise be the case, since the wood is through-coloured and consequently no "white" wood will show through a damaged surface. It is also possible to produce cutlery with stained wooden handles that can withstand being washed in a dishwasher.

CLAIMS

1. A method of producing a through-coloured wooden element in which said element is pressed isostatically in a first step at a pressure greater than 800 bar, preferably greater than 1000 bar, whereafter the pressure is removed, **characterised** in that the wooden element is placed in a liquid bath containing solvent and a colorant dissolved therein in a second step, said solvent and colorant being absorbed by said element.

2. A method according to Claim 1, **characterised** by pressing the wooden element isostatically at least one more time at a pressure greater than 800 bar, preferably greater than 1000 bar.

3. A method according to any one of the preceding Claims, **characterised** by using a water solvent in the liquid bath.

4. A method according to any one of the preceding Claims, **characterised** by using a colorant that has a molecular size which enables it to penetrate into the wooden element.

5. A method according to any one of the preceding Claims, **characterised** by using a colorant whose polarity enables it to penetrate into the wooden element.

6. A method according to any one of the preceding Claims, **characterised** by using a colorant which comprises an azo dyestuff.

7. A through-coloured wooden element, **characterised** in that the wooden element has been through-coloured in accordance with the method of Claims 1-6.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/00631

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B27K 5/02, B27K 5/06, B27M 1/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B27K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

01/06/99

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