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BLEACHING OF WOOD

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My invention relates to the bleaching of wood and similar cellulosic material and has particular reference to the bleaching of wood veneers and wood panels with hydrogen peroxide.

5 It has heretofore been proposed to effect the bleaching of wood with alkaline solutions of hydrogen peroxide but this has been attended with various disadvantages. Among the alkaline materials used have been caustic soda, sodium silicates, and ammonia. Caustic soda has proven 10 unsatisfactory because of its destructive action on the wood fibre whereas the silicates possess the disadvantage of forming colloidal deposits or films on the surface of the wood. All of the 15 processes of bleaching wood with alkaline solutions of hydrogen peroxide with which I am familiar possess the important disadvantage that the bleaching action takes place essentially only upon the surface of the wood and does not penetrate into the body proper thereof. Since, in 20 staining wood veneers and the like, the veneers are preliminarily sanded whereby the surface layers of the wood are removed by abrasion, it is evident that, in order to have a bleached surface remaining after the sanding of the veneers, the 25 bleaching must affect not only the surface but also the interior layers of the wood. It is primarily because of this deficiency, namely, inability to bleach beyond the surface layers of the wood, that bleaching with hydrogen peroxide has not 30 come into more common use.

There are a number of woods which are of a relatively dark hue which are used to a considerable extent in the manufacture of furniture and the like and representative of which are certain 35 varieties of mahogany and burl. These woods possess admirable properties for certain purposes but their more extensive use has been hampered by the fact that they possess too dark a color. It has been a desideratum to employ such woods 40 for making furniture, etc., but to impart thereto a finish of a lighter hue, for example, similar to walnut. Heretofore, to my knowledge, this has not been accomplished with complete success. The failure has been due essentially to the fact 45 that it has not heretofore been possible to successfully bleach the wood so that the bleaching penetrates through the interior layers of the wood but such bleaching has affected substantially only the surface. The subsequent necessary sanding with the consequent removal of the 50 under layers of the wood which have not been bleached makes it apparent that it is essential, if such dark woods are to be given light finishes in furniture and the like, that the bleaching ac-

tion exert itself to some fair extent below the surfaces of the wood.

I have discovered a method of bleaching wood and similar cellulosic material, particularly in the form of veneers and panels, by means of hydrogen peroxide and the like in which a markedly improved bleaching action is obtained, particularly with regard to the penetration of the bleaching agent to a fairly substantial depth with the result that the bleaching action takes place not only on the surface of the wood or the like but also extends somewhat into the interior. In general, I accomplish this result by subjecting the veneer or the like to a preliminary treatment with a solution of an organic base, after which the veneer is contacted with a solution of hydrogen peroxide or the like. The nature of my invention will become clearer in the light of the more detailed description which follows.

It is accordingly an object of my invention to effect the bleaching of wood and similar cellulosic material by means of hydrogen peroxide and similar peroxides in a more effective manner than it has heretofore been accomplished.

Another object of my invention is the provision of an improved process for bleaching wood veneers, wood panels, and the like.

A further object is to effect the bleaching of wood so that the bleaching action will take place to a substantial depth below the surfaces of the wood, particularly with regard to those woods which normally possess a relatively dark hue or color.

Still another object is to effect the bleaching of wood veneers, wood panels, and the like by means of hydrogen peroxide and similar peroxides whereby the bleaching action will be exerted to a substantial depth below the surface thereof.

A further object is to preliminarily "condition" wood or similar cellulosic material so that a bleaching agent will penetrate into the wood or similar cellulosic material to a substantial depth.

In carrying out my invention, in the case of the treatment of wood veneers, the veneer is preliminarily "conditioned" by being immersed in or otherwise contacted with a solution of an organic base which does not form colored oxidation products. Among the organic bases which I have found are suitable for my process are primarily aliphatic amines including alkylol amines such as mono-ethanol amine, di-ethanolamine, triethanolamine, mixtures of said ethanolamines such as commercial triethanolamine, propanol amines, butanol amines, pentanol amines; al-

5 kylated derivatives of alkylolamines such as mono- and di-methyl mono-ethanolamine, mono, di-, and tri-ethyl triethanolamine, and the like; alkyl amines such as butyl amine, di-methyl amine, ethylene diamine, diethylene tri-
10 amine, triethylene tetra-amine, and alkylated derivatives thereof such as mono-methyl ethylene diamine, 1,1-dimethyl ethylene diamine, mono ethyl diethylene triamine, and the like;
15 aromatic and heterocyclic bases which produce a pH over 7 in aqueous media and which do not form colored oxidation products such as benzyl amine, pyridine, and homologues and derivatives thereof and similar compounds.

15 After immersion in the organic base solution for the required length of time, the "conditioned" veneer is removed, the excess of the organic base solution is drained off, and the veneer is then immersed in a solution of hydrogen peroxide preferably maintained at a temperature
20 somewhat above room temperature for a short period of time. It is then removed from the bleaching bath, washed with warm or hot water, and is then ready for drying and finishing.

25 As a specific example of carrying out my invention, I immerse a wood veneer in an aqueous solution of mono-ethanolamine containing about 10% of mono-ethanolamine by volume, which solution is previously brought up to a tempera-
30 ture of about 60° C. The veneer is maintained in this bath for approximately fifteen to twenty minutes after which it is removed and drained to remove the excess of mono-ethanolamine adhering to the surface of the veneer. The "conditioned" veneer is then immersed in a bath of
35 100 volume hydrogen peroxide (30% by weight of hydrogen peroxide), previously brought to a temperature of about 60° C., and allowed to remain in said bath for about fifteen to twenty
40 minutes. Considerable care should be taken when the "conditioned" veneer is immersed in the hydrogen peroxide solution since a semi-violent reaction takes place when the veneer contacts the hydrogen peroxide solution, oxygen being given
45 off and the hydrogen peroxide solution spattering about. Care should be taken to prevent the hydrogen peroxide solution from touching the bare skin. In the event that some should contact the skin, a satisfactory antidote is cold water.

50 After immersion in the hydrogen peroxide solution for fifteen or twenty minutes, the veneer is removed and given a thorough washing with water at a temperature of 60° C. to 70° C. to wash out all traces of the hydrogen peroxide.
55 The veneer is then dried and it may be finished in ways well known in the art. It will be found that the bleaching action has exerted itself to such an extent that the veneer is bleached for a distance approximately $\frac{1}{25}$ of an inch beneath the
60 surface of the wood. It is evident that longer periods of immersion, more elevated temperatures, and greater concentrations of materials will result in a greater depth of the bleaching action.

65 It is apparent that an assortment of veneers of different kinds can be immersed in the same treating baths. In the illustrative embodiment described hereinabove, measurements showed that five square feet of assorted dry veneers absorbed about 300 cc. of the solution of mono-ethanol amine which was slightly less than one-
70 third of a liter or 15% of the bath. The loss of the hydrogen peroxide solution was found to be approximately 150 cc. per five square feet of assorted veneers, or 7½% of the bath. Since there
75 is no loss of strength in the mono-ethanol amine

solution, it is necessary only to restore the amount lost so that the solution can be used over and over again.

In another example, I immersed a number of sheets of assorted wood veneers in an aqueous
5 solution of ethylene diamine containing approximately 10% of ethylene diamine by volume, the solution previously having been brought to a temperature of 60° C., and the veneers are allowed to remain in the solution for fifteen to
10 twenty minutes. They are then removed and the excess liquor is allowed to drain off.

The thus "conditioned" veneers are then immersed in a bath comprising 100 volume hydrogen peroxide, maintained at a temperature of
15 about 60° C., and allowed to remain therein for about fifteen to twenty minutes. They are then removed, rinsed well in warm water, dried and are then ready for the finishing operations. As noted above, the reaction is quite violent when
20 the "conditioned" veneers are immersed in the hydrogen peroxide bath and suitable precautions should be taken to prevent contact of the solution with the skin.

As has been stated above, and as is evident to
25 those skilled in the art, certain modifications can be made of the processes which I have described above by way of illustration only without departing from the spirit or true scope of the invention. For example, it is feasible to employ weaker or
30 stronger solutions of the organic base, say from 5% to 15% solutions, in the preliminary treatment of the wood. The same is true of the hydrogen peroxide solution. For example, I have obtained good results by using 75 volume hydrogen
35 peroxide; that is, the 100 volume solution may be diluted with 33% water, thereby effecting a saving in cost of materials. The temperature of the treating baths is preferably from 50° C. to 70° C. The time of immersion in the treating
40 baths and the temperature thereof may be correlated with the concentration of the active ingredients in said baths in order to obtain the desired bleaching effects, it being remembered that, within operative limits, higher concentra-
45 tions, higher temperatures, and greater period of treatment make for increased depth of bleaching action. It is evident that other methods of contacting the organic base and the hydrogen peroxide can be employed besides immersion.
50 For example, the respective solutions may be brushed on or sprayed on the wood or the like. Immersion, however, produces highly satisfactory results.

Among the peroxide bleaching agents which are
55 effective for my present purpose are organic peroxides such as urea peroxide, hydrogen peroxide, and the metallic peroxides such as sodium peroxide. With regard to the latter, care must be taken that the solution of sodium peroxide in
60 water does not have such a high degree of alkalinity as to cause destruction or deterioration of the wood fibres. If sodium peroxide is used, it may be advisable to neutralize the solution with an acid. Of all of the peroxides, I have found
65 hydrogen peroxide to be the most suitable, and the concentrations, temperatures and time of treatment described in the examples hereinabove to give admirable results.

Among the woods which I have successfully
70 treated by my process are mahoganies of different kinds such as African mahogany, Mexican mahogany, mahogany crotch, walnut butt, walnut crotch, bird's-eye maple, cherry burl and various other types. The wood may be treated in the
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8. BLEACHING & DYEING; FLUID TREATMENT & CHEMICAL MODIFI- CATION OF TEXTILES & FIBERS,

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form of panels or veneers or in any other desired shapes. It is obvious that wood pulp, wood chips, and other cellulosic material such as paper may be similarly treated. It is further evident that the wood or the like may be treated in a wet or dry state, that is, whether uncured or cured. It is also apparent that solvents other than water may be used in the preliminary treatment step with the organic base. Among such solvents are those of an alcoholic nature such as ordinary ethyl alcohol, light petroleum hydrocarbons, coal tar derivative solvents, benzol, acetone, chlorinated hydrocarbons such as carbon tetrachloride and the like.

While I have described my invention in detail, it is clear that the description has been in terms of illustration and not limitation. The scope of my invention is accordingly to be determined by the state of the art and the appended claims.

What I claim as new and desire to protect by Letters Patent of the United States is:

1. A process of bleaching wood and similar cellulosic material comprising preliminarily contacting said material with an organic nitrogenous base which does not form colored oxidation products, and then contacting the material with an aqueous solution of a peroxide.
2. The process described in claim 1 wherein the organic base is an aliphatic amine.
3. The process described in claim 1 wherein the organic base is an aliphatic amine of the class consisting of mono-ethanolamine and ethylene diamine.
4. The process described in claim 1 wherein the peroxide is hydrogen peroxide.
5. The process of bleaching wood, particularly in the form of veneers and panels, which comprises immersing the wood in an aqueous solution of an aliphatic amine containing between 5% and 15% of the aliphatic amine at a temperature between 50° C. and 70° C. for from 15 to 30 minutes, removing the wood from the solution, immersing it in a solution of hydrogen peroxide having a strength of approximately 75 to 100 volume and at a temperature of 50° C. to 70° C., maintaining the wood therein for about 15 to 30 minutes, removing the wood therefrom, and rinsing it with warm water to remove the excess of hydrogen peroxide.
6. The process of bleaching wood veneers and the like comprising immersing the veneers in an aqueous solution of an aliphatic amine containing about 10% of the amine, the solution being maintained at a temperature of approximately 60° C., maintaining the veneers in said solution for from about 15 to 20 minutes, removing the veneers from said solution, removing the solution adhering to said veneers, immersing the veneers in 100 volume hydrogen peroxide maintained at a temperature of approximately 60° C.

for approximately 15 to 20 minutes, removing the veneers, thoroughly washing them with hot water, and then drying them.

7. The process described in claim 6 wherein the aliphatic amine is a member of the class consisting of mono-ethanolamine and ethylene diamine.

8. The process of bleaching wood veneers and the like comprising immersing the veneers in approximately a 10% aqueous solution of mono-ethanolamine at a temperature of about 60° C. for between approximately 15 and 20 minutes, removing the veneers from said solution, removing the excess adhering solution from the veneers, immersing the veneers in 75 to 100 volume hydrogen peroxide maintained at a temperature of about 60° C. for a period of from 15 to 30 minutes, removing the veneer, thoroughly washing it with warm water, and then drying it.

9. The process described in claim 6 wherein the wood is of the class consisting of mahogany, cherry burl, bird's-eye maple and walnut.

10. The process of bleaching wood veneers or panels which comprises contacting the wood veneers or panels with an organic solvent solution of an organic nitrogenous base which does not form colored oxidation products, removing the veneers or panels and contacting them with a solution of a peroxide, removing them from said latter solution, removing the excess of the peroxide, and drying the veneers or panels.

11. A light colored wood veneer or panel impregnated with an organic nitrogenous base and/or oxidation products thereof and resulting from the impregnation of a normally dark wood with an organic nitrogenous base followed by a peroxide treatment.

12. A normally dark wood in the form of a veneer or panel, said wood being impregnated to a substantial depth below the surfaces thereof with an organic nitrogenous base and/or oxidation products thereof, and being bleached to a relatively considerable depth beneath the surfaces thereof to render it light colored.

13. The product defined in claim 12, wherein the wood is bleached to at least approximately $\frac{1}{25}$ of an inch beneath the surfaces thereof.

14. The process of bleaching veneers or panels of wood of the class consisting of mahogany, cherry burl, bird's-eye maple and walnut, which comprises contacting the wood veneers or panels with an aqueous solution of an organic nitrogenous base which does not form colored oxidation products, removing the veneers or panels and contacting them with an aqueous solution of hydrogen peroxide, removing them from said latter solution and rinsing with water to remove the excess of the peroxide.

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