United States Patent

Bailey et al.

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[54] METHOD FOR UNIFORMING THE COLOR OF WOOD AND WOOD ARTICLES

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[52] **U.S. Cl.** **8/111,** 117/57, 162/78

[51] **Int. Cl.** **D06l 3/02**

[58] **Field of Search** 8/111; 162/78; 117/57

[56] **References Cited**

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[57] **ABSTRACT**

A method for uniformly bleaching the color of wood substrates which is characterized by preheating the substrates to a temperature of between about 140° and 200° F. applying a bleaching solution of hydrogen peroxide with, or without, an alkali metal silicate to at least the surfaces of the substrates, exposing the covered surfaces to vapors of anhydrous ammonia and drying. The apparatus for carrying out the method has a conveyor arranged for presenting the substrates or finished articles to a preheating station, preheating means such as a quartz tube or a convection oven, bleach-applying means, ammonia applying means and finally drying means.

With this invention, after drying of the wood panel or assembled article, the surface thereof is free of residues which usually are left after other bleaching methods. No washing or neutralizing step is necessary with the claimed method.

12 Claims, 3 Drawing Figures

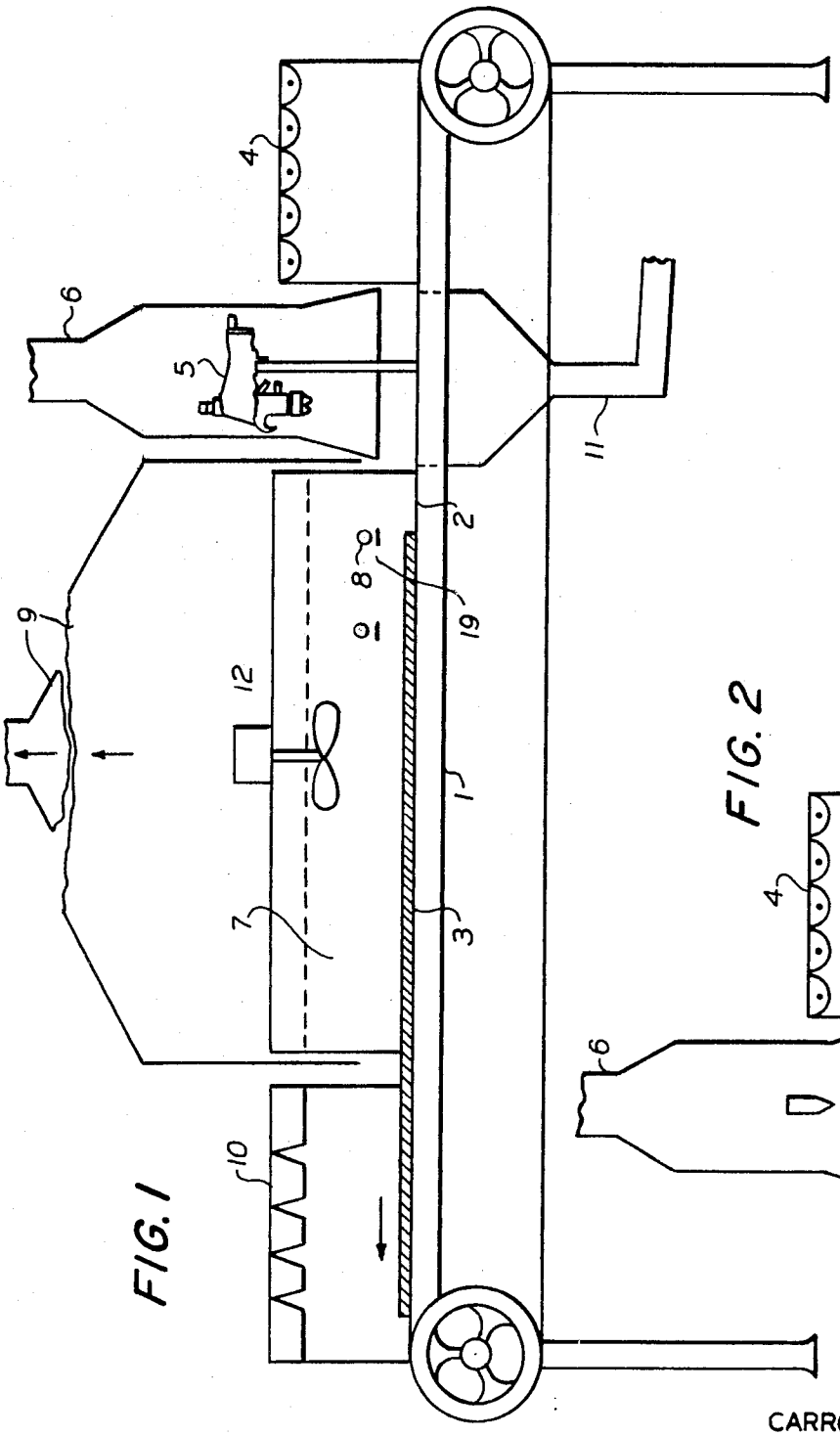


FIG. 1

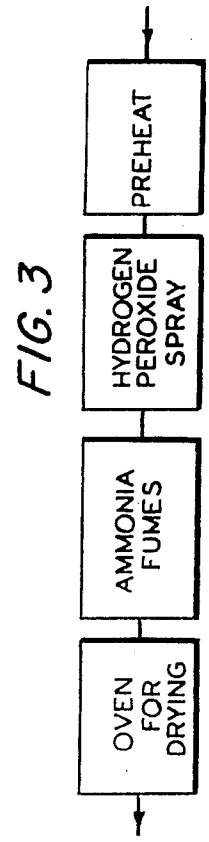


FIG. 3

FIG. 2

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METHOD FOR UNIFORMING THE COLOR OF WOOD AND WOOD ARTICLES

This invention relates to improvements in the bleaching of wood substrates including finished wooden articles to give the surfaces thereof a uniform lightened color, which color will be free of the yellowing effect caused by peroxide and alkali bleaches. The invention also finds utility in transforming stained or off-colored pieces of wood, either in finished shapes or in the rough, into acceptable products.

This invention specifically relates to a method for uniformly bleaching the color of wood substrates which is characterized by preheating the substrates to a temperature of between about 140° and 200° F., applying a bleaching solution of hydrogen peroxide with, or without, an alkali metal silicate to at least the surfaces of the substrates, exposing the covered surfaces to vapors of anhydrous ammonia and drying. The apparatus for carrying out the method has a conveyor arranged for presenting the substrates or finished articles to a preheating station, preheating means such as a quartz tube applying means and finally drying means.

With this invention after drying of the wood panel or assembled article, the surface thereof is free of residues which usually are left after other bleaching methods. No washing or neutralization step is necessary with the claimed method.

In the prior art to which this invention relates, the use of strongly alkaline-based peroxide solutions has hitherto been deemed necessary together with sodium hydroxide, lime and/or sodium silicate or borate. Such solutions operate when heated into the surface to be bleached and leave behind a gritty residue of nonvolatile alkali which must be removed by neutralization with acid followed by washing. To avoid the formation of such residues, ammonia has been used as the alkaline agent but hydrogen peroxide solutions activated with ammonia have not thus far given as uniform bleaching as desired. Moreover, ammonia is highly toxic and creates a health hazard which must be guarded against with suitable equipment such as a protective mask.

Another procedure which is widely used, particularly in the furniture industry is to activate the peroxide with amines. For example, some companies use peroxide activated with triethyl amine. Alkyd amines, alkylene diamines and alkanol amines are used for this purpose. These compositions do not have an inorganic residue but do have amine residues which are very unstable and yellow quite badly on ageing. Furthermore, these amines are extremely hazardous to work with and are objectionable in odor. While ammonia is somewhat hazardous, it is confined in a chamber and presents no problem to operator.

With a view to overcoming the above-outlined disadvantages of prior art methods, the main object of this invention is to provide an improved method for uniforming the color of wood surfaces with hydrogen peroxide.

Another object of the invention is to provide a method for bleaching wood surfaces which does not require neutralization or washing.

A further object of the invention is to provide a method for bleaching wood surfaces without immersing such surfaces in the bleaching solution.

An equally important object of this invention is to provide means for treating wood surfaces in accordance with the method described below.

These and other related objects, features and advantages of the present invention will be more fully realized as the description thereof proceeds particularly when taken together with the accompanying drawing wherein:

FIG. 1 is a schematic representation of one embodiment of the apparatus used in the practice of the invention.

FIG. 2 is the same as FIG. 1 designed for bleaching wooden articles which have been assembled.

FIG. 3 is a simplified flow plan.

Use of anhydrous ammonia vapors instead of liquid ammonia as heretofore makes it easy to mask those parts of a substrate which are not to be bleached. Such masking can be done by using kraft paper or masking tape, to give a sharp

defining line. In turn, this makes the invention valuable for use in marquetry, parquetry and simulated inlay work. Employment of the method likewise will not interfere with the glue lines which bond the various plies of the plywood together and vice versa.

Extensive experimentation with the invention has shown that the method thereof is operative to uniformly bleach wood such as hard woods of the Phillippine mahogany type (lauan), birch, walnut, coniferous or soft woods such as pine, spruce, redwood, Douglas fir, etc. The method is particularly useful for uniforming Phillippine mahoganies which term generically encompasses hundreds of species different in texture, color and tone so that it is essential to bleach them to a common denominator color before finishing. Such Phillippine mahoganies include tangile, almon, mersawa, red lauan, white lauan, maranggo, shorea, duijo, myapis, lumbayau, apticong, tiaong, bagtikan, kalunti, manggasinoro, and malaanonang.

In the practice of the invention, the wooden article or substrate to be coated preferably is preheated to obtain maximum bleaching in a high speed operation. However, bleaching can also be carried out at ambient temperatures and reduced speeds. Similarly, the use of an alkali metal silicate is also optional but its use helps develop a good wood color by avoiding yellow casts which occur in some species when ammonia bleach is used.

One type of panel bleaching apparatus suitable for carrying out the method of the invention is shown in FIG. 1. This apparatus comprises a frame **1** on which rides an endless belt **2** which carries panels **3**. For example, the belt may be set to advance at a speed of approximately 48 feet per minute Preferably the panels are first preheated, such as by infrared lamps **4**, sold under the name of Calrod (trademark of Gen. Elec.).

Instead of infrared or quartz lamps there may be used other preheating means such as a convection oven used as a heat soak, etc. Equivalent other means may be resorted to for this purpose as long as such means can heat the panels to between 140° and 200° F., a temperature of around 180° F. being preferred for most substrates. The conveying means ensure that the panels are successively passed from one treating station to the next so as to keep the work treating means at the various stations operating the capacity.

Regardless of the preheating means used, the preheated panels are then conveyed to a spray station including a peroxide applicator consisting of one or more spray nozzles **5**, preferably made of stainless steel, which outlets spray hydrogen peroxide or combined solution on the panels in the amount of 8–10 cc./sq. ft. As shown the nozzle **5** is surmounted by a hood **6** to exhaust the peroxide vapors. A stainless steel collector **11** is positioned below the spray station to collect the overspray of peroxide so the same can be reused. The peroxide used is supplied from a pressure tank (not shown) which advantageously is cooled with ice and acetone with a pressure of 10 lbs./sq. in. built up in the tank so that the atomization pressure going to the nozzles is around 35 lbs./sq. in.

The work wetted with peroxide then passes into an ammonia chamber **7** filled with ammonia fumes from jet bank **19** forced into it through jets **8** which communicate with a source of pressurized anhydrous ammonia. Naturally the size of the ammonia or activator chamber **7** will depend on the size of the work piece bleached and the speed of the conveyor. The work piece should remain in the ammonia atmosphere for at least **5** seconds and no more than for 20 seconds for complete activation of the peroxide. Optimum exposure time is about 10 seconds. The ammonia flow rate should be so arranged that the concentration of ammonia in the chamber is more than 6 g. of ammonia per sq. ft. of substrate. The jets are so positioned that the gas is projected in the direction of the substrate. Chamber **7** has a fan blower **12** above jets **8** for circulating the ammonia vapors and a heater coil to raise the temperature in the chamber i.e., the ammonia vapors, to 200° to 210° F. Other methods of application for the peroxide solu-

tion, such as roll coating, curtain coating, etc., may be employed.

In one preferred embodiment of the invention, a distance of about 5 feet separated the peroxide chamber from the activator chamber to allow time for the peroxide to soak into the wood before going into the activator chamber. The activator chamber in this embodiment was 8 feet long × 27 inches wide. This chamber was precharged for 10 minutes before running panels through it and anhydrous ammonia was forced into the chamber, which had been heated to 200° F., at the rate of 15 c.f.p.h.

The apparatus of the invention further comprises drying means **10** to which the substrates are brought by conveyor **1** to dry the volatile products of the reaction from the surfaces. The drying means can be a high velocity oven or a convection oven or other similar drying device. After drying, the substrates are in condition for light sanding in preparation for prefinishing.

The apparatus shown in part in FIG. **2** is designed for the bleaching of assembled articles. Here chamber **5** is larger enough to hold items of furniture, such as, table **20** and chair **22**. It will be noted that the nozzles are positioned at the top, bottom and sides of the chamber so as to direct the peroxide solution to all parts of the article being bleached. Since the ammonia is supplied in gaseous form, it is unnecessary to provide a similar arrangement in the activator chamber.

The equation for the basic reaction is as follows:

$$2H_2O_2+2NH_3 \rightarrow O_2+2NH_4OH$$

While sodium silicate is not essential to the invention, for the outstanding results herein defined, it is preferred to use a bleaching solution comprising hydrogen peroxide and sodium silicate, which acts as a promotor, a detergent, and aids in making the bleaching effect penetrate deeper. The equation for the reaction of the preferred solution is as follows:

1. $2H_2O_2+2NH_3 \rightarrow O_2+2NH_4OH$
2. $NH_4OH+\Delta \rightarrow NH_3+H_2O$

The silicate also buffers the solution and aids in maintaining its pH in the desired range of 7–8. A recommended sodium silicate is one having a 3.22 to 1 weight ratio of SiO_2 to Na_2O with a specific gravity of 40 Baume. This solution is diluted by half by mixing with water. More specifically, **150** parts of 40 Baume sodium silicate is stirred with 150 parts of water and the resulting solution is added with stirring to 2,000 parts of 35 percent hydrogen peroxide at room temperature. The resulting solution has a pH of 7–8 and is put in ice and acetone at 30° to 40° F., to minimize gelling. This solution has a pot life of 3–4 hours at 30°–40° F.

The following is more clearly set forth as follows:

150 units of 40° Baume is stirred with
150 units of water
300 units. Added gradually to
2,000 units of hydrogen peroxide while stirring
2,300 units of solution.

At room temperature and then put into ice and acetone bath to bring to 30°–40°

8–10 cc. of combined solution used per sq. ft.

E brand (3.22 by weight ratio of SiO_2 to Na_2O) of soda silicate manufactured by Philadelphia Quartz Co. is preferred but any type may be used. The critical point point is that the Hydrogen Peroxide solution be adjusted to approximately pH of 7.8 (7.0–8.0). The soda silicate is the promoter or the fulminating material.

With the method of this invention, it is possible to obtain a bleaching or blanching of the wood action which is 10–15 mils or more in depth and thereby will maintain its bleached condition forever.

It will be appreciated by those skilled in the art to which this invention relates that the apparatus represented in FIGS. **1** and **2** is amenable to various modifications as regards its operative elements. Thus it will be appreciated that instead of dispensing peroxide through nozzles the same may be done by using a roller coater, a curtain coater or other applicator. Similarly, the apparatus may be provided with a timed spring loaded clamp designed to hold the substrate under the preheating means for the desired time, e.g., 60 seconds. At the end of that time, the clamp will be released and the substrate will move to the applicator chamber. Obviously, there may be positioned in the way of the substrate and to the operated by its movement, a valve which will trigger the operation of spray guns which will spray peroxide. Other modifications are likewise within the spirit of this invention and are included herein.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Method for uniforming the color of a wood substrate comprising preheating said substrate to a temperature in the rang of about 140° F. to 200° F., applying to said substrate a spray of a solution of hydrogen peroxide for a time sufficient to wet said substrate and exposing the thus wetted substrate to vapors of substantially dry anhydrous ammonia.

12. The method according to claim **1** wherein the concentration of said hydrogen peroxide is approximately 35 percent and said ammonia is heated to a temperature in the range of 200°–210° F.

3. The method according to claim **1** wherein said solution includes hydrogen peroxide and an alkali metal silicate.

4. The method according to claim **1**, wherein there is applied to said substrata over 6.0 g. of ammonia per sq. ft. of substrate.

5. The method according to claim **1**, wherein said substrate is exposed to ammonia for at least 5 seconds.

6. The method according to claim **3**, wherein said solution has a pH ranging from 7 to 8, and said substrate is heated to approximately 180° F. and said ammonia is heated in the range of 200°–210° F.

7. The method of claim **3**, wherein the amount of solution applied to said substrate is from 8 to 10 cc. per sq. ft.

8. The method according to claim **3**, wherein said heating is carried out for a period of about 30 to 60 seconds.

9. The method of claim **3** wherein the alkali metal silicate is prepared by mixing 3.22 to 1 wt. ratio of SiO_2 to Na_2O with a specific gravity of **40** Baume, diluting 150 units of this solution with 150 units of water, subsequently adding gradually to 2,000 units of 35 percent hydrogen peroxide at room temperature, and then placing in an ice and acetone bath to bring to 30°–40 F. to minimize gelling.

10. The method according to claim **3**, wherein said alkali metal silicate is sodium silicate.

11. The method of claim **7** wherein the solution has a pH in the range of 7–8.

12. The method of claim **9** wherein the pH is adjusted to approximately 7.8, and said ammonia is at a temperature in the range of 200°–210° F.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,645,666 Dated February 29, 1972

Inventor(s) CARROLL F. BAILEY and W. RICHARD OETGEN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the cover sheet, line 6, the assignee should be written -- U.S. Plywood-Champion Papers Inc. --

In column 2 of the cover sheet, line 4, the attorney should be written -- James M. Heilman, and Heilman & Heilman --

In column 4, line 29, "claim 12" should read -- claim 2 --

Signed and sealed this 27th day of June 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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UNITED STATES PATENT OFFICE

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