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ART OF GLUING

No Drawing. Application filed September 29, 1931, Serial No. 565,930, and in Canada March 3, 1930.

This invention relates to the art of gluing, and more particularly to processes for the formation of plywood.

The present application is a continuation in part of the co-pending applications of Theodore Williams Dike, Serial No. 335,998, filed January 29, 1929, and renewed March 10, 1931, Serial No. 455,977, filed May 26, 1930, Serial No. 456,813, filed May 28, 1930, and Serial No. 456,814, filed May 28, 1930, and renewed September 9, 1931.

An object of the invention is the provision of a gluing procedure whereby the gluing may be effectively and expeditiously performed.

A further object is the provision of a procedure whereby adhesive bases in powdered or other discrete-particle form may be readily and effectively utilized.

A wide variety of difficulties attend the use of "liquid glues" i. e. dispersions of adhesive base materials, in gluing procedures such, for example, as the formation of plywood or the like. Among such difficulties mention may be made of that form of bond failure known as a "starved" joint, which may be caused, for example, by excessive mobility of the adhesive base in cases where the same is still in a fluid rather than a plastic state at the time of applying bonding pressure; the complications in the gluing operation involved in the elimination of the water applied with the glue; staining; etc. By the application of the adhesive base in powdered form, or, in some instances, in other discrete-particle form, certain, and, in many instances, all of these difficulties may be avoided.

It is desirable in such procedures that the discrete-particles of the adhesive be acted upon so that the same will be plasticized to a desirable extent, and to this end it is often desirable to utilize an agent to promote or otherwise control penetration of the adhesive into the surfaces of the material to be glued.

It has been found that alkali metal hydroxides, such as caustic soda and caustic potash, are particularly desirable for such use, due to their markedly rapid and effective action in assisting not only in plasticization, but also, in certain instances, in the conversion of the adhesive at the glue line. In accordance with the invention, caustic soda or caustic potash may be used in procedures involving the application of the adhesive in powdered form—and in some instances, as with adhesives which are non-dispersible in water, in the form of a suspension of discrete particles in water—in the gluing of relatively dry materials, such as commercially dry veneers, both in procedures involving the application of heat and pressure and in procedures involving the application of pressure without heat; and also in procedures wherein the adhesive is applied in powdered form to relatively wet materials such as wet or "green" veneer as it comes from the veneer cutter, and the application of pressure without heat. They may also be used, if desired, in certain instances, for example when the wood has an especially dense surface or where they effect a desirable conversion of the adhesive, in procedures where the heat is utilized in the gluing of wet woods.

The use of caustic soda or caustic potash enables particularly effective results to be obtained in procedures wherein a relatively small amount of water is available for the plasticization of the adhesive, as, for example, in the gluing of dry veneers under conditions wherein a relatively small amount of water is applied thereto and also enables particularly effective results to be obtained without the use of heat in procedures wherein the other conditions of operation are such that a proper plasticization or conversion of the adhesive base material would not otherwise occur.

Caustic soda and caustic potash possess a number of advantages for use in procedures such as contemplated by the invention. Their action is not only markedly effective, but is so rapid as to be almost instantaneous in some cases, permitting the assembly of a plywood panel, for example, in a particularly short time and providing for repetition manufacture at a high speed. Another advantage is that by varying the amount and/or concentration of the agent, the period of assembly time may be regulated to suit the condition of manufacture. Another advantage

which has already been touched upon is that in the gluing of dry materials the amount of water to be added may be very materially reduced. The provision of a small amount of water in turn materially reduces the danger of staining. A further advantage for many types of procedures is the plasticizing effect on the wood which assists in the welding of the plasticized adhesive with the surface fibres of the wood. This feature makes the use of caustic soda and the like of advantage in many instances, regardless of the particular character of the adhesive.

It is to be noted, moreover, that not only are stronger bonds produced in accordance with the invention, but also that they have increased water-resistant properties.

The favorable action of alkali metal hydroxides, such as caustic soda and caustic potash, is present in gluing procedures utilizing a wide range of adhesive bases, either singly or in combination, and including materials which are dispersible in water, such as blood albumin, egg albumen, animal glues, as well as materials which are non-dispersible in water, such as casein, gluten, isolated vegetable proteins from oil seeds, such as soya bean, hempseed, castor bean, cottonseed, etc., flours from the residue of oil seeds, such as soya bean, hempseed, castor bean, cottonseed, peanuts, flaxseed, perillaseed, rapeseed, tung nuts, etc., starches, starchy flours, etc. The use of an alkali metal hydroxide is of marked advantage in connection with the use of materials which are non-dispersible in water, since by its use the penetration of such materials into the wood may be desirably promoted, due to the rapid and effective plasticizing action of the caustic soda or the like. It is to be noted that it also has a powerful jellying action which with certain dispersible adhesives, such as blood, may be used in some cases to prevent excessive penetration. Low concentration may, with an adhesive of this character, promote penetration while a high concentration will set up the material into a stiff jell which retards penetration.

The alkali metal hydroxide may be applied as a dry powder before and/or after the adhesive base or as a component of a mixture including powdered adhesive base and powdered caustic soda, for example, or it may be dissolved in the moistening water and applied, preferably as a spray, with, before or after the spreading of the dry adhesive. The alkali metal hydroxide, moreover, may be applied at two stages of the coating operation. For example, a caustic soda solution may be sprayed on a surface to be incorporated, the adhesive base dusted on and a caustic soda solution sprayed upon it.

The members to be glued are associated, an adhesive base and other concomitant materials being suitably provided at each glue line, and the assembly subjected to pressure either in conjunction with heat or under conditions wherein heat is not transferred to the glue line.

The pressure utilized in the bonding may, as will be understood, vary widely, depending upon the materials being glued and other factors, but may range from about 40 to 300 pounds per square inch. Pressures of about 200 pounds give satisfactory results. In instances where heat is utilized a temperature of about 160° F. to 260° F. may be used. Higher temperatures are advantageous in many instances. Care should be taken, however, that the heat is not so great as to damage the wood.

An alkali metal hydroxide is preferably provided for interaction with the adhesive or otherwise at the glue line by applying the caustic soda or the like as such to a surface to be incorporated. It may, however, in certain instances be otherwise provided, as, for example, by applying an alkali metal salt and also an alkaline earth hydroxide either in admixture, or independently as by including powdered lime with the powdered adhesive and dissolving sodium fluoride in the moistening water. Another method of providing an alkali metal hydroxide is by the use of hydrolyzable alkali metal salts, for instance, borax or trisodium phosphate. These materials when dissolved in water liberate some caustic soda by hydrolysis; but because of the slowness of the action and the relatively small amount of caustic soda provided, are undesirable for use in the majority of cases.

It is of course to be understood that the term "alkali metal hydroxide" as used herein does not include the alkaline earth hydroxides.

It is also to be understood that the term "non-dispersible" as used herein to describe adhesive materials does not exclude materials which might in a strict sense be considered dispersible to some extent, as for instance materials containing proportions of dispersible ingredients.

It is also to be understood that the term "wood" as used hereinafter is intended to include artificial wood as well as natural wood.

Among the many advantages of the invention is the fact that, because of the plasticizing effect of the caustic soda or the like on many adhesives and on wood, adhesives, which when applied in powdered or other discrete-particle form would otherwise form between the wood and another member of substantial body a bond securing only the superficial fibres of the wood, will, under the same conditions, tend to penetrate into the wood sufficiently to present a firm resistance to separating forces.

There are outlined below several specimen procedures which may be carried out in accordance with the invention.

Example 1.—Three plies of 1/16" commercially dry veneer of heavy wood may be glued under heat and pressure, a surface involved in each glue line having been spread with soya-bean flour and a 5% caustic soda solution in the proportion of 1 to 1½ by weight.

Example 2.—3 plies of 1/16" birch may be glued, a surface involved in each glue line being spread with water, then with powdered casein, and then with 10% caustic soda solution in the proportions of 1 to 1⅔ to 1, and pressure of 200 lbs. per square inch, and heat at a temperature of 225° F., applied at 1 minute after the initial spreading and maintained for from 1 to 5 minutes.

Example 3.—Commercially dry veneer may be glued, water, powdered casein and 10% caustic soda solution being spread in the order named and in proportions of 1 to 1⅔ to 2, and subjected at one minute after the initial spreading to pressure of 200 lbs. per square inch without heat for 5 minutes.

Example 4.—Plies of birch or fir, for example, may be glued using a spread of water, powdered soya-bean flour and 10% caustic soda solution in the proportion of 1 to 1⅔ to 3 and subjecting at one minute after the initial spreading to pressure of 200 lbs. per square inch without heat for 5 minutes.

Example 5.—Plies of birch, gum or fir, for example, may be glued using a spread of water, blood albumin and 12% caustic soda solution in the proportion of 1 to 1⅔ to 2 and subjecting at one minute after the initial spreading to bonding pressure of 200 lbs. per square inch for 5 minutes.

Example 6.—Dry cottonwood veneer may be glued using a spread by dusting on a composition containing 75 parts soya-bean flour, 6¼ parts of sodium fluoride and 18¾ parts of hydrated lime, spraying on an equal proportion of water, and subjecting to pressure without heat for 1 hour at 233 lbs. per square inch.

Since certain changes may be made in carrying out the above process without departing from the scope of the invention, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which as a matter of language might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A process of gluing which comprises applying to a surface to be incorporated an adhesive base in discrete-particle form, supplying also material which will provide an alkali metal hydroxide for interaction with the adhesive base, assembling and subjecting to pressure.

2. A process of uniting a wood member to another member of substantial body which comprises applying to a surface to be incorporated an adhesive-providing material in discrete-particle form, supplying also material which will provide an alkali metal hydroxide at the glue line, assembling and subjecting to pressure and heat.

3. A process of uniting a wood member to another member of substantial body which comprises applying to a surface to be incorporated an adhesive-providing material in discrete-particle form, supplying also material which will provide an alkali metal hydroxide at the glue line, assembling and subjecting to pressure without transfer of heat to the glue line.

4. A process of uniting a wood member to another member of substantial body which comprises applying to a surface to be incorporated an adhesive-providing material in powdered form, supplying also material which will provide an alkali metal hydroxide at the glue line, assembling and subjecting to pressure and heat.

5. A process of gluing which comprises applying to a surface to be incorporated a proteinous adhesive base in discrete-particle form, supplying also material which will provide an alkali metal hydroxide for interaction with the adhesive base, assembling and subjecting to pressure.

6. A process of gluing which comprises applying in discrete-particle form to a surface to be incorporated an adhesive base of a character which is non-dispersible in water, supplying also material which will provide an alkali metal hydroxide for interaction with the adhesive base, assembling and subjecting to pressure.

7. A process of uniting a wood member with another member of substantial body which comprises applying to a surface to be incorporated an adhesive-providing material in a discrete-particle form, supplying also an alkali metal hydroxide, assembling and subjecting to pressure.

8. A process of uniting a wood member with another member of substantial body which comprises applying to a surface to be incorporated an adhesive-providing material in discrete-particle form, supplying also an alkali metal hydroxide, assembling and subjecting to pressure and heat.

9. A process of uniting a wood member with another member of substantial body which comprises applying to a surface to be incorporated an adhesive-providing material in discrete-particle form, supplying also an alkali metal hydroxide, assembling and subjecting to pressure without transfer of heat to the glue line.

10. A process of gluing which comprises

applying to a surface to be incorporated an adhesive base in powdered form, supplying also an alkali metal hydroxide, assembling and subjecting to pressure.

11. A process of uniting a wood member to another member of substantial body which comprises applying to a surface to be incorporated an adhesive-providing material in powdered form, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure.

12. A process of uniting a wood member to another member of substantial body which comprises applying to a surface to be incorporated an adhesive-providing material in powdered form, supplying also caustic soda, assembling and subjecting to pressure.

13. A process of uniting a wood member to another member of substantial body which comprises applying in discrete-particle form to a surface to be incorporated an adhesive base of a character which is non-dispersible in water, supplying also an alkali metal hydroxide, assembling and subjecting to pressure.

14. A process of uniting a wood member to another member of substantial body which comprises applying in powdered form to a surface to be incorporated in an adhesive base of a character which is non-dispersible in water, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure and heat.

15. A process of uniting a wood member to another member of substantial body which comprises applying in powdered form to a surface to be incorporated in an adhesive base of a character which is non-disprsible in water, supplying also an alkali metal hydrixide of the empirical class comprising caustic soda and caustic potash, assembling an dsubjecting to pressure without transfer of heat to the glue line.

16. A process of gluing which comprises applying to a surface to be incorporated a proteinous adhesive base in discrete-particle form, supplying also an alkali metal hydroxide, assembling and subjecting to pressure.

17. A process of glue which comprises applying to a surface to be incorporated a proteinous adhesive in discrete-particle form, supplying also an alkali metal hydroxide, assembling and subjecting to pressure and heat.

18. A process of gluing which comprises applying to a surface to be incorporated a proteinous adhesive base in discrete-particle form, supplying also an alkali metal hydroxide, assembling and subjecting to pressure without transfer of heat to the glue line.

19. A process of gluing which comprises applying in powdered form to a surface to be incorporated a proteinous adhesive base of a character which is non-dispersible in water, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure.

20. A process of gluing which comprises applying in discrete-particle form to a surface to be incorporated a vegetable proteinous adhesive base, supplying also an alkali metal hydroxide, assembling and subjecting to pressure.

21. A process of gluing which comprises applying in powdered form to a surface to be incorporated a proteinous seed flour, supplying also an alkali metal hydroxide, assembling and subjecting to pressure.

22. A process of gluing which comprises applying to a surface to be incorporated a proteinous adhesive base in powdered form, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure.

23. A process of gluing which comprises applying soya bean flour to a surface to be incorporated, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure.

24. A process of gluing which comprises applying soya bean flour to a surface to be incorporated, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure and heat.

25. A process of gluing which comprises applying soya bean flour to a surface to be incorporated, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure without transfer of heat to the glue line.

26. A process of gluing which comprises applying powdered casein to a surface to be incorporated, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure.

27. A process of gluing which comprises applying powdered casein to a surface to be incorporated, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure and heat.

28. A process of gluing which comprises applying powdered casein to a surface to be incorporated, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure without transfer of heat to the glue line.

29. A process of gluing which comprises applying a blood adhesive base in powdered form to a surface to be incorporated, supplying also an alkali metal hydroxide of the

empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure.

30. A process of gluing which comprises applying a blood adhesive base in powdered form to a surface to be incorporated, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure and heat.

31. A process of gluing which comprises applying a blood adhesive base in powdered form to a surface to be incorporated, supplying also an alkali metal hydroxide of the empirical class comprising caustic soda and caustic potash, assembling and subjecting to pressure without transfer of heat to the glue line.

32. The process of gluing, which comprises supplying to a surface to be incorporated a non-dispersed proteinous adhesive base in discrete-particle form, assembling, and applying pressure while promoting penetration by caustic soda supplied in addition to the adhesive base.

33. The process of gluing which comprises supplying to a surface to be incorporated a vegetable proteinous adhesive base in powdered form, assembling, and applying pressure while promoting penetration by caustic soda supplied in addition to the adhesive base.

34. The process of gluing which comprises applying to a surface to be glued a proteinous adhesive base in powdered form, applying also a solution of an alkali metal hydroxide, assembling and subjecting to pressure.

35. The process of gluing which comprises applying a caustic soda solution to a surface to be incorporated, thereafter applying a powdered proteinous adhesive base, assembling and subjecting to pressure.

36. The process of gluing which comprises applying a powdered proteinous adhesive base to a surface to be incorporated, thereafter applying a caustic soda solution, assembling and subjecting to pressure.

37. The process of gluing which comprises supplying to a surface to be incorporated a proteinous material in discrete-particle form, supplying also an alkaline earth hydroxide and an alkali metal salt with which the alkaline earth hydroxide will react to provide an alkali metal hydroxide for interaction with the adhesive base, assembling and subjecting to pressure.

38. The process of gluing which comprises supplying to a surface to be incorporated a proteinous material in discrete-particle form, supplying also lime and sodium fluoride, assembling and subjecting to pressure.

In testimony whereof I affix my signature, in the presence of two witnesses.

THEODORE WILLIAMS DIKE.

CERTIFICATE OF CORRECTION.

Patent No. 1,851,955. March 29, 1932.

THEODORE WILLIAMS DIKE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, line 51, claim 17, for "glue" read gluing, and line 53, after the word "adhesive" insert the word base; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of July, A. D. 1932.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)