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ART OF GLUING

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In the practice of gluing with vegetable proteinous materials it has been customary to employ a dispersed or liquid form of adhesive. It has been assumed, in fact, that it was necessary to bring the adhesive into such form in order to attain union. In such practice, dispersing agents of alkaline character have been usual. Considerable difficulties have accordingly been experienced in the provision of simple and effective gluing methods and in providing a glue which does not stain the wood. This has been especially serious in gluing the more expensive woods. Besides, such practice involves the necessity of very particular attention as to the conditions in the preparation of the adhesive, so as to come within practicable limits of viscosity, spreadability, control of foaming, etc. Even where such materials as the residues from oil seeds after oil extraction were employed, the reduction of the material to a fluid state has been consistently practiced.

By the present invention, however, a new and useful method of uniting materials is had without the necessity of making up a glue in liquid form. All of the preliminary procedure characteristic of the prior practice is thus initially obviated.

As adhesive base material, I may employ segregated proteins, such as gluten, segregated or isolated protein from oil seed flours, such as soya bean, hempseed, castor, etc., or I may employ a vegetable proteinous material in the form of a ground seed flour, for instance the residue of oleaginous seeds from which the oil has been removed being particularly advantageous. Examples of this are flour or meal made from cake or residue from soya bean, peanuts, cottonseed, flaxseed, perillaseed, hempseed, rapeseed, copra, tung nuts, castor beans, etc. The adhesive base is employed undispersed, and is thus supplied to the elements to be united.

In some instances, particularly where there are employed articles to be glued having a relatively dense surface, I may also incorporate with the adhesive a penetration-promoting agent, or, before or after, or both. Such agent may be an alkaline compound, in some instances an alkaline earth hydroxide, or a caustic alkali in small amounts, an alkaline compound such as a salt of a weak acid and a strong base, sodium silicate, etc., or a mixture of an alkaline earth hydroxide and an alkali metal salt such for instance as sodium fluoride, sodium phosphate, etc.

Where an undried wood is involved, it is not necessary to supply any moisture. In some instances green material as coming from the veneer cutting machine may contain more moisture than is desirable and this may be reduced, if preferred, by suitable means such as drying. In the case of a material which is dry, it is desirable to supply moisture, and water may be introduced before, with or after the binder. The minimum water so supplied may in general amount to about $\frac{1}{4}$ to $1\frac{1}{2}$ times the weight of the binder, and the total may range for example up to about three times the weight of the binder, depending upon the particular character of the surfaces to be united. The binder material, for instance in the form of the seed flour, of which soya bean flour may be taken as a preferred example, is suitably supplied to the surfaces to be united, being dusted on or otherwise conveniently applied, and the pieces are assembled and are subjected to pressure and heat, for example. In the production of plywood for instance, the seed flour may be supplied to the surface of one of the plies, water being also supplied if desired, as by spraying by an atomizer head before or after the application of the powdered binder. Another wood ply is superposed, binder is dusted on, water being supplied if desired, and a further wood ply superposed. The assemblage is then pressed, the amount of pressure depending upon the particular character of the material. Green cottonwood is satisfactorily treated for instance with a pressure of about 40 pounds per square inch, while with denser woods, such as green fir, about 100 pounds pressure is desirable. With less than 40 pounds pressure, there is a diminution in the strength of the bond. With dry woods, to which surface moisture only is supplied, pressures of a higher range are satisfactory, and pressures up to 300 pounds per square inch may be readily employed. In general the upper limit is de-

termined by possible crushing of the wood texture.

While in some instances it is not necessary to apply heat with the pressure, in other instances it is desirable to subject the assemblage to pressure and heat both. Conveniently, the plates of the press may be heated by such means as steam, a steam supply at about 125 pounds pressure being ordinarily satisfactory, this temperature hastening the setting of the binder changing it to a much more water-resistant state and at the same time drying out the wood. Temperatures in general between 212 degrees F. and about 375 degrees F. may be employed, the higher temperatures affecting favorably the final condition of the binder by changing it into a more water-resistant form, injury to the wood being readily avoided, since the present method greatly shortens the time under which subjection to heat will be necessary.

With binder material applied in the form of a flour or meal, it will be noticed that the material is in discrete particle form, as contrasted with a dispersed form, and even though in the presence of water such particles merely swell or soften without being dispersed. It is to be observed moreover that the conditions wherein it is desirable to use a penetration-promoting agent are ordinarily such that the adhesive base will undergo in the presence of such agent a softening or plasticization prior to bonding, but will not be transformed into a dispersed fluid condition. Due to the nondispersability of the adhesive base in water the particles, if desired, may be applied to the surfaces to be joined by means of a water suspension. In such condition, the particles still retain their discrete particle form, without dispersing. It will be understood that, when the adhesive base is applied in the form of a water suspension, penetration-promoting agents, if utilized, will be applied separately from the adhesive base.

Wood and other materials as well which are capable of being bound together by an adhesive may thus be readily glued; with a corresponding absence of the obstacles characteristic of the old methods in which a large surplus of water had to be introduced and eliminated. Nor is it necessary that the materials glued together be of definite geometrical shape.

It will thus be seen that among the advantages of the process are:

1. All the expense and trouble connected with the elaborate technique of making a dispersed glue compounded so as to have the necessary degree of spreadability, resistance to foaming, etc., are avoided.

2. Since an adhesive state of the binder is not developed until at the time of pressing, the character of bond attained is not modified by conditions prior to the pressing, as in the case with wet-gluing where the glue after being applied undergoes more or less change while standing waiting for accumulation of a press full. Accordingly, in the present process a uniformity of product may be had, as contrasted with the variable conditions heretofore in which some panels may have suffered an excessive penetration and loss from the glue line and others insufficient penetration.

3. Because of starting with a binder material which is largely insoluble, the product shows a superior water resistance and this may be enhanced by heating to make it more water-resistant.

4. Staining due to the highly alkaline fluid condition of dispersed glues is entirely obviated.

This application is a continuation in part of my application, Serial No. 335,998, filed January 29, 1929.

The following applications are continuations in part of the present application: Serial No. 518,944, filed February 28, 1931; Serial No. 538,983, filed May 21, 1931; Serial No. 565,929, filed September 29, 1931; Serial No. 565,930, filed September 29, 1931; and Serial No. 596,070, filed March 1, 1932.

Reference is also made to the following applications which are likewise continuations in part of said application Serial No. 335,998: Serial No. 454,832, filed May 22, 1930; Serial No. 455,977, filed May 26, 1930; Serial No. 455,978, filed May 26, 1930; Serial No. 456,813, filed May 28, 1930.

Other modes of applying the principle of my invention may be employed, change being made as regards the details described provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A process of gluing, which comprises supplying to a surface to be incorporated a non-dispersed vegetable proteinous material in discrete particle form, assembling, and applying pressure.

2. A process of gluing which comprises supplying to a surface to be incorporated a non-dispersed oil-seed flour, assembling, and applying pressure.

3. A process of gluing, which comprises supplying to a surface to be incorporated a non-dispersed oil-seed flour, assembling, and applying pressure and heat.

4. A process of gluing which comprises supplying to a surface to be incorporated a non-dispersed oil-seed flour, supplying moisture, assembling, and applying pressure.

5. A process of gluing, which comprises supplying to a surface to be incorporated a non-dispersed vegetable proteinous seed flour, supplying moisture, assembling, and applying pressure and heat.

6. A process of gluing, which comprises supplying to a surface to be incorporated a non-dispersed oil-seed flour, supplying moisture, assembling, and applying pressure and heat.

7. A process of gluing, which comprises supplying non-dispersed soya bean flour to a surface to be incorporated, assembling, and applying pressure and heat.

8. A process of gluing, which comprises supplying non-dispersed soya bean flour to a surface to be incorporated, supplying moisture, assembling, and applying pressure and heat.

9. A process of gluing, which comprises supplying a non-dispersed vegetable proteinous material to a wood ply, superposing another wood ply, supplying non-dispersed vegetable proteinous material thereto, superposing another wood ply, and pressing the assemblage.

10. A process of gluing, which comprises supplying non-dispersed vegetable proteinous material to a wood ply, supplying moisture, superposing another wood ply, supplying non-dispersed vegetable proteinous material thereto, supplying moisture, superposing another wood ply, and pressing the assemblage.

11. A process of gluing, which comprises supplying a non-dispersed vegetable proteinous material to a wood ply, superposing another wood ply, supplying non-dispersed vegetable proteinous material thereto, superposing another wood ply, and pressing and heating the assemblage.

12. A process of gluing, which comprises supplying a non-dispersed vegetable proteinous material to a wood ply, superposing another wood ply, supplying non-dispersed vegetable proteinous material thereto, superposing another wood ply, and pressing and heating the assemblage.

13. A process of gluing, which comprises supplying non-dispersed oil-seed flour to a wood ply, superposing another wood ply, supplying non-dispersed oil-seed flour thereto, superposing another wood ply, and pressing the assemblage.

14. A process of gluing, which comprises supplying non-dispersed oil-seed flour to a wood ply, superimposing another wood ply, supplying non-dispersed oil-seed flour thereto, superposing another wood ply, and pressing and heating the assemblage.

15. A process of gluing, which comprises supplying non-dispersed oil-seed flour to a wood ply, supplying moisture, superposing another wood ply, supplying non-dispersed oil-seed flour thereto, supplying moisture, superposing another wood ply, and pressing the assemblage.

16. A process of gluing, which comprises supplying non-dispersed oil-seed flour to a wood ply, supplying moisture, superposing another wood ply, supplying non-dispersed oil-seed flour thereto, supplying moisture, superposing another wood ply, and pressing and heating the assemblage.

17. A process of gluing, which comprises supplying non-dispersed soya bean flour to a wood ply, superposing another wood ply, supplying non-dispersed soya bean flour thereto, superposing another wood ply, and pressing and heating the assemblage.

18. A process of gluing, which comprises supplying non-dispersed soya bean flour to a wood ply, supplying moisture, superposing another wood ply, supplying non-dispersed soya bean flour thereto, supplying moisture, superposing another wood ply, and pressing the assemblage.

19. A process of gluing, which comprises supplying non-dispersed soya bean flour to a wood ply, supplying moisture, superposing another wood ply, supplying non-dispersed soya bean flour thereto, supplying moisture, superposing another wood ply, and pressing and heating the assemblage.

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

21. A process of gluing, which comprises supplying to a surface to be incorporated a non-dispersed vegetable proteinous material in discrete particle form, assembling, and applying pressure and heat.

22. A process of gluing, which comprises supplying to a surface to be incorporated a non-dispersed proteinous vegetable seed flour in discrete particle form, assembling, and applying pressure.

23. A process of gluing, which comprises supplying to a surface to be incorporated a non-dispersed proteinous vegetable seed flour in discrete particle form, assembling, and applying pressure and heat.

24. A process of gluing, which comprises supplying to a surface to be incorporated a non-dispersed vegetable proteinous adhesive base in discrete particle form, assembling, and applying pressure and heat, while promoting penetration by a penetration-promoting agent supplied in addition to the adhesive base.

25. A process of gluing which comprises supplying to a surface to be incorporated a non-dispersed oil seed flour in discrete particle form, assembling, and applying pressure, while promoting penetration by a penetration-promoting agent supplied in addition to the adhesive base.

26. A process of gluing which comprises supplying to a surface to be incorporated a non-dispersed oil seed flour in discrete particle form, assembling, and applying pressure

and heat, while promoting penetration by a penetration-promoting agent supplied in addition to the adhesive base.

27. A process of gluing which comprises supplying to a surface to be incorporated a non-dispersed soya bean flour in discrete particle form, assembling, and applying pressure, while promoting penetration by a penetration-promoting agent supplied in addition to the adhesive base.

28. A process of gluing which comprises supplying to a surface to be incorporated a non-dispersed soya bean flour in discrete particle form, assembling, and applying pressure and heat, while promoting penetration by a penetration-promoting agent supplied in addition to the adhesive base.

29. A composite structure glued by a vegetable proteinous material identifiable as such and supplied in identifiable discrete particle form.

30. A composite structure glued by an oil seed flour supplied in identifiable discrete particle form.

31. A composite structure glued by soya bean flour supplied in identifiable discrete particle form.

32. A composite structure glued by a vegetable proteinous material identifiable as such and supplied in identifiable discrete particle form and containing identifiable amounts of a penetration-promoting agent utilized.

33. A composite structure glued by an oil seed flour supplied in identifiable discrete particle form and containing identifiable amounts of a penetration-promoting agent utilized.

34. A composite structure glued by soya bean flour supplied in identifiable discrete particle form and containing identifiable amounts of a penetration-promoting agent utilized.

Signed by me, this 12 day of May, 1930.

THEODORE WILLIAMS DIKE.