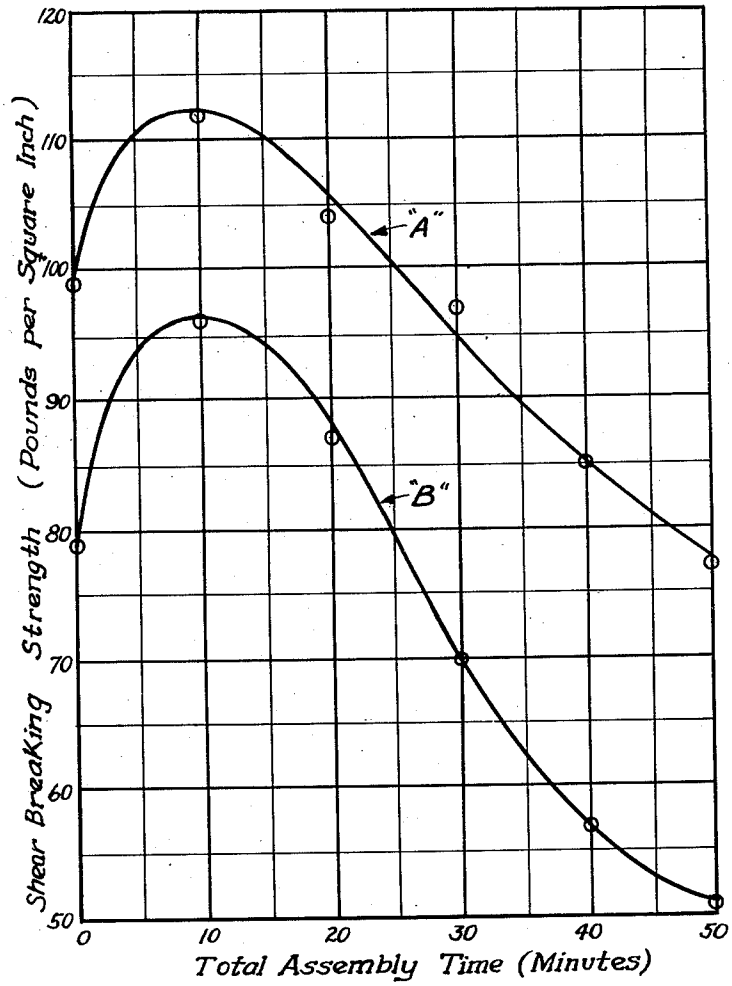
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PROTEIN BASE GLUES

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"A" - Protein Glue With Conditioner

"B" - Protein Glue Without Conditioner

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PROTEIN BASE GLUES

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Our invention relates to an improved hot press adhesive of the protein base type, and is particularly directed to an improvement in such a glue which enables joints of greatly increased strength to be made as compared to such joints made with prior glues of the protein base type. Nevertheless the usual technique of applying the glue and heating and pressing the joint may be utilized with our glue.

While our glue is not restricted to use in the manufacture of plywood from veneer sheets, it is especially useful for such purpose because it enables the veneer sheets to be laid up and to be pressed in the conventional fashion while insuring that the joints between the veneer sheets in the final plywood product will be far superior in strength to the joints usually made. In fact, almost invariably such a joint made with our improved glue is stronger than the maximum strength joint which could possibly be obtained by the use of protein base glues ordinarily used.

Glues of the protein base type which have been employed heretofore in the manufacture of plywood of "interior" grade have been either "seed base," "blood base" or "blend base." "Seed base" glue incorporates comminuted seed, such as the meal or flour residue remaining after the oil has been expressed, or extracted by solvent action, from such seed products as soya beans, peanuts, cottonseed and the like, according to well known methods. "Blood base" glue employs principally blood or blood albumin as its base. "Blend base" glue has both comminuted seed and blood ingredients mixed in various proportions. The base may also incorporate casein. To designate protein base incorporating blood, whether of the "blood base" or of the "blend base" type as defined above, we shall use the term "blood content base" in the following description, which sets upon the application of heat and pressure to the joint. It is customary with any of these protein base glues to add to the base caustic alkali, lime, sodium silicate or other ingredients. Our invention constitutes an improvement particularly in the blend base type of protein base glue, although it is also applicable to blood base glue, and hence is useful generally in blood content base glues.

In the manufacture of plywood it is customary to prepare a batch of glue and to spread such glue on both sides of core stock veneer. In laying up the veneer sheets preparatory to pressing them to form plywood, a face ply is first laid to form the bottom of the veneer stack. Next, core stock with glue applied to both sides is laid crosswise

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of the face veneer sheet, and on top of the core stock is laid either one or two dry sheets of veneer, depending upon whether three-ply plywood or plywood having a greater number of plies is being made. If three-ply plywood is desired, two dry face veneer sheets are laid on the core stock, and then on the upper of these is laid another layer of core stock having glue applied to both sides.

Thus dry veneer sheets and core stock having glue applied to both sides are laid up alternately and with their grains crossed until a stack of assembled plywood sheets sufficient to constitute a load for a multiplaten hot press has been produced. Such presses usually have from ten to twenty openings, and may have more, and frequently more than one plywood panel is pressed in each press opening, so that considerable time is required to fabricate such a pile of stock. The time expended in this operation should not be more than twelve minutes. When the veneer sheets, or other elements to be joined, have been assembled for longer than about ten minutes before being pressed, the bond of the resulting joint is affected adversely. The longer the joint stands with glue applied to it the greater is the deterioration of the glue bond in the set joint. Hence, in the use of usual hot press protein base glues to bond veneer in the manufacture of plywood, not appreciably more than twelve minutes should elapse between the laying up of the lowermost plywood panel and the application of heat and pressure to such panel during the glue-setting operation, in order to obtain a joint having sufficient strength.

The principal object of our invention is to provide a hot press glue of the protein base type which can produce a much stronger joint than it has been possible heretofore to make with hot press protein base glues. More particularly, it is an object to enable a joint of greatly superior strength to be obtained as compared to such previous joints for any given elapsed time between the laying up of the parts to be joined and completion of the pressing operation.

As a corollary to the foregoing objects, it is a further object to produce a joint at least equal in strength to those using hot press protein base glue made heretofore, even when very much more time elapses between the assembly of the parts to be joined and commencement of the pressing operation. As a specific example, in order to obtain maximum strength of joint with the usual hot press protein base glues, it would be necessary to press the elements between which the joint is

to be formed within approximately ten minutes after their assembly, as mentioned above, whereas a joint utilizing our improved glue would have substantially the same strength as such maximum strength prior art joints if almost thirty minutes, or virtually three times as great an interval, should elapse between assembly of the parts to be joined and application of pressure in the pressing operation.

It is an additional object not only to provide a glue which will produce a joint of much greater strength than those which could previously be obtained by the use of hot press protein base glues, but which will produce a joint in which the decrease in its strength occasioned by the parts to be joined remaining assembled with glue between them prior to the application of heat and pressure to them for any selected period exceeding ten minutes will be less than where such prior glues are used. Such smaller decrease in joint strength for a given assembly time, coupled with the higher strength characteristics of our glue, enables a joint of a strength at least equal to prior hot press protein base glue joints to be secured by the use of our glue even though approximately twice the usual time should elapse between assembly of the parts being joined and the pressing operation.

By reason of the superior characteristics of our glue discussed above, joints of far greater strength than previously obtained by the use of hot press protein base glues result when the same assembly time and technique are used as heretofore, and even if the assembly time employed is longer, such as where presses of greater capacity are utilized, or more time for assembly is required for other reasons, the joints secured may nevertheless be stronger than prior hot press protein base glue joints.

The drawing is a graph representing the superior strength-assembly time characteristics of joints made with our glue as compared to conventional hot press protein base glue joints.

We believe that a principal reason for the failure of hot press protein base glues incorporating blood to produce joints stronger than possible heretofore has resulted from the blood not being in its most efficacious form. We have found that this disadvantage can be overcome by adding to conventional blend base or blood base glues a small amount of a conditioning ingredient, believed to be in the nature of a solvent. Such conditioner is an alkylbenzene, one species of benzenoid hydrocarbons, and specifically methylbenzene or a polymethylbenzene.

By polymethylbenzene is meant a chemical of the benzene series which is composed of the benzene ring in which two or more methyl radicals are substituted. Of the polymethylbenzenes those most suitable for our glue conditioner are the xylenes, because they are least expensive and readily available. Methyl benzene, that is, toluene also is suitable. We have found that the commercial mixture of ortho, meta and para xylenes, commonly known as xylol, is quite satisfactory for our purpose. Other mixtures of alkylbenzenes could also be used. It is important that the conditioner have a boiling point higher than 100° centigrade. Thus, even toluene, having a boiling point of 110.6–110.8° centigrade is quite satisfactory for use as our glue conditioner, while the xylenes, having an even higher boiling point of 138–144° centigrade, are also suitable.

The conditioner preferably is incorporated in the glue with the other liquid ingredients when

they are blended with the dry glue base ingredients shortly before the glue is to be used. Alternatively, however, such conditioner may be sprayed into the dry glue base during its manufacture in the same manner defoaming agents are customarily incorporated with the glue base, and the conditioner may even be mixed with the defoaming agent or agents and sprayed with them into the glue base. Whether mixed with the glue base when other liquid ingredients are added to it shortly before use of the glue, or sprayed into the glue base, the amount of conditioner used should be from one to five percent of the dry glue base by weight, and preferably about two percent.

A typical example of a glue of the blend base type incorporating our conditioner and the method of its preparation follows:

Dry glue base

	Grams
Soya bean flour	400
Soluble whole blood solids	100

Ingredients added when preparing glue for use

Calcium hydroxide	50
Caustic soda (sodium hydroxide)	37
Sodium silicate	100
Carbon bisulfide-carbon tetrachloride dope	3
Conditioner	10
Water	1900
Total	2600

In the above formula the conditioner may, for example, be toluene, a xylene, or xylol.

The procedure for preparing the dry glue base of mixed flour and soluble whole blood solids for use is first to stir such mixture into 1750 grams of water until thoroughly mixed. Stir the calcium hydroxide into 100 grams of water until thoroughly mixed in suspension, and add this suspension to the flour and blood suspension. Add the caustic soda dissolved in 50 grams of water to the combined flour, blood, and calcium hydroxide suspension and stir until thoroughly mixed. While stirring is continued, add to the suspension the sodium silicate, the carbon bisulfide-carbon tetrachloride dope and the conditioner, stirring in each instance until a homogeneous mixture is obtained. The total time for mixing together the ingredients by continuous stirring should be fifteen to twenty minutes.

We have found that by the use of a blend base glue, as described above, without conditioner added, a much weaker joint is obtained than when such glue with our conditioner added is used. Alternatively, a joint having a given strength may be secured by using such a glue with conditioner added despite the occurrence of a much greater assembly time in fabrication of the joint than in making the joint with glue devoid of our conditioner. Tests of comparative samples of joints made using such conditioned and unconditioned hot press protein base glues are illustrated in the drawing. Curve A represents the results of tests on joints made in various total assembly times utilizing blend base glue with xylol conditioner added, and curve B represents the results of tests on similar joints fabricated in various assembly times and using blend base glue without conditioner, but made by the same technique.

"Total assembly time" as used in preparing the curves of the drawing is defined as the total elapsed time between spreading the adhesive on

the first core layer of a press load of plywood panels and application of the full pressure to the load of panels in the hot press. The total assembly time which may be utilized is of considerable importance in present plywood manufacture. In the usual operation of manufacturing plywood by heating and pressing in a multiplaten hot plate press veneer to which hot press protein base glue has been applied, twelve minutes frequently is not sufficient time in which to lay up and press the veneer sheets satisfactorily, and often more time is used, to the detriment of the joint strength. An increase in assembly time from twelve minutes to the order of twenty minutes, readily afforded by the use of our glue while still producing a joint of greater strength, is very desirable.

Hot press protein base glue having a substantial blood content apparently has a tendency to dry out and progressively lose its adhesive character after it has been spread and before heat and pressure is applied to the parts to be joined to such an extent as to impair its thermoplastic properties to a greater or lesser degree when subjected to heat and pressure. Where hot press protein base glue of conventional type is employed in making plywood a decided difference in the strength characteristics of the plywood panels first laid up and those last laid up in a press load is very noticeable, resulting from the lower strength of the joint occasioned by the appreciable difference in time between the application of the glue to the lower panel core layer and to the upper panel core layer in such a press load. Where an unexpected delay occurs, therefore, the strength of the bottom panel or panels in a press load frequently is substandard, whereas such occurrence would almost invariably be avoided where our conditioned glue is employed, because of the generally higher strength characteristics of its joints and especially because of the smaller decrease in strength of its joints resulting from an increase in assembly time.

We claim as our invention:

1. An adhesive composition comprising a base incorporating blood material of the group consisting of whole blood solids and blood albumin,

and a conditioner of the group consisting of toluene and polymethylbenzenes in an amount by weight of 1 to 5% of said base.

2. The adhesive composition defined in claim 1, including a conditioner in an amount by weight of about 2% of the base.

3. The adhesive composition defined in claim 1, in which the conditioner is toluene.

4. The adhesive composition defined in claim 1, in which the conditioner is of the group consisting of xylenes.

5. The adhesive composition defined in claim 1, in which the base includes, by weight, a major proportion of comminuted seed and a minor proportion of blood material.

6. The adhesive composition defined in claim 5, in which the base includes, by weight, about 80% comminuted seed and about 20% blood material.

7. The adhesive composition defined in claim 6, including a conditioner in an amount by weight of about 2% of the base.

8. An adhesive composition comprising a base including, by weight, about 80% comminuted seed and about 20% blood material of the group consisting of whole blood solids and blood albumin, and a conditioner of the group consisting of toluene and xylenes in an amount by weight of about 2% of said base.

9. An adhesive composition comprising a base incorporating blood material of the group consisting of whole blood solids and blood albumin, and a conditioner of the group consisting of toluene and polymethylbenzenes in an amount by weight of about 10% of said blood material.

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