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# UNITED STATES PATENT OFFICE.

ALFRED C. LINDAUER, OF MADISON, WISCONSIN, DEDICATED, BY MESNE ASSIGNMENTS, TO THE PEOPLE OF THE UNITED STATES.

## BLOOD-ALBUMIN GLUE.

No Drawing.

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(FILED UNDER THE ACT OF MARCH 3, 1883, 22 STAT. L., 625.)

*To all whom it may concern:*

Be it known that I, ALFRED C. LINDAUER, a citizen of the United States, residing in Madison, in the county of Dane and State of Wisconsin, have invented a new and Improved Blood-Albumin Glue, of which the following is a specification.

Blood albumin glue is commonly more water-resistant than casein, but when it is used in the industries it almost always has to be pressed in hot-plate presses. Hot pressing is a slow and expensive process, and this fact has had the effect of limiting the use of blood albumin glues to a few highly specialized industries. The blood albumin glue I have invented eliminates the need of applying heat in order to coagulate the albumin. In other words, the glue I have invented can be pressed cold, as are vegetable and casein glues. Of course, it can be used in hot presses too if that should ever be desired.

I am aware that mixtures of blood albumin, water, lime, ammonia, etc., in different proportions have been used in the industries for years, and I do not claim anything with regard to them when used as heretofore.

What I do claim as novel and original is the use of paraformaldehyde (trioxymethylene) in mixtures with blood albumin and water.

In carrying out my invention I use dry blood albumin, ammonium hydroxide, paraformaldehyde (trioxymethylene), and water. One part by weight of dry blood albumin is soaked in about 2 parts by weight of water for at least one hour, preferably in a cold place. Blood as it comes from the slaughter house could be used instead of dry blood albumin, but the latter is recommended because wet blood decomposes promptly and because the dry albumin can be handled more conveniently. After the blood albumin has stood in contact with water for the required length of time, the mixture is stirred either by hand or by means of a mechanical mixer until the blood albumin has gone into solution. When this has been accomplished about 5½ per cent by weight of ammonium hydroxide (based on the weight of the dry albumin) is added. The mixture is stirred again for a few moments.

Now ammonium hydroxide could be used in amounts larger than 5.5 per cent, or it could be left out entirely. I have found,

however, that if the use of ammonium hydroxide is omitted, the glue is apt to be too fluid to be used conveniently. On the other hand, if a large amount of ammonium hydroxide is used, there is danger that it will combine chemically with the paraformaldehyde, forming hexamethylenetetramine or some analogous compound which would not be so effective in coagulating the blood albumin.

Fifteen per cent by weight of paraformaldehyde (trioxymethylene), based on the weight of the dry blood albumin, is then slowly added to the mixture of blood albumin, water and ammonium hydroxide. The paraformaldehyde should be sifted into the mixture, and stirred constantly at a fairly high speed. The powder should not be added so rapidly as to form lumps nor so slowly that the mixture will thicken and coagulate before the required amount of the chemical has been added; but no matter how slowly the paraformaldehyde is added it will cause a thickening of the blood albumin mixture. This thickening, however, does not make the mixture permanently unfit for use, for I have discovered that a blood albumin glue which has thickened in this way will become fluid again in a short time at ordinary temperatures. Ordinarily, this blood albumin glue containing paraformaldehyde will return to a good working consistency in about half an hour. In case the mixture thickens before all the paraformaldehyde has been added, no harm is done, because if the reaction mixture is allowed to stand it will liquefy again, and then the rest of the paraformaldehyde can be added. It is desirable, however, to add the coagulant before the mixture has become too thick to stir, and this can be accomplished by adding the paraformaldehyde at the proper rate.

Although I specify 15 per cent of paraformaldehyde or trioxymethylene, I do not wish to limit myself to that particular amount, because I have found that paraformaldehyde or trioxymethylene in amounts quite different from that will give very good results. As the amount of paraformaldehyde is increased from 0 to 15 per cent, a gradual increase in the dry strength and water-resistance of the blood albumin glue is produced, but as the amount is increased



from 15 per cent upward, the improvement in the properties of the glue is so slight as not to warrant the use of the additional material.

5 The reason why paraformaldehyde acts as it does is not known to me. Of course, it liberates formaldehyde on standing and this formaldehyde coagulates the blood albumin, but why this coagulated mass of  
10 blood albumin should liquefy on standing and then set again, forming a hard, strong, elastic mass, which is practically insoluble in water, I do not know.

The glue described above can be applied to  
15 veneers or wooden blocks by means of a brush or a mechanical spreader such as is used in the ordinary wood-working factory. The glued panels are kept under pressure in the usual way for about 18 hours, more or  
20 less, at the end of which time they are stacked and dried in the same way as animal, vegetable or casein glue panels.

Although this glue is especially advantageous for use in gluing boards or sheets of  
25 veneer, I do not wish to limit myself to its use for that purpose only, for I have found that it can be used successfully as an adhesive or binding medium for cementing into a compact mass ground and comminuted  
30 substances such as sawdust, wood chips, wood pulp, and other finely divided cellulosic material. A mixture of blood albumin,

water, ammonium hydroxide and paraformaldehyde (trioxymethylene) can be used either alone or as a binder for comminuted  
35 matter such as sawdust, filings, powders, earths, minerals, or other fillers in the fabrication of pressed and moulded articles such as buttons, combs, toilet seats and covers, door handles, drawer pulls, brush backs,  
40 umbrella handles, automobile steering wheels, mouldings, rails, composition flooring, electrical insulators, handles, and cores for veneer doors and plywood panels.

The claims that I make for my invention  
45 are as follows:

1. A glue, consisting essentially of dry blood albumin, water, ammonium hydroxide and paraformaldehyde (trioxymethylene).
2. A glue consisting of 100 parts by  
50 weight of dry blood albumin, 200 parts by weight of water, 5.5 parts by weight of ammonium hydroxide, and 15 parts by weight of paraformaldehyde (trioxymethylene).
3. An adhesive adapted for use in gluing  
55 wood consisting of blood albumin glues containing paraformaldehyde (trioxymethylene).

In testimony whereof I affix my signature  
in the presence of two subscribing witnesses. 60  
ALFRED C. LINDAUER.

Witnesses:

WILBUR LLOYD JONES,  
BRYANT D. DAIN.