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BINDER FOR PATCHING VENEERS

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This invention relates to a synthetic resinoid binder or adhesive especially adapted for bonding wood veneers. More specifically, the invention relates to a modified urea-formaldehyde resinoid binder capable of being set without the application of heat to form an infusible and insoluble bond.

In the manufacture of plywood for outdoor use, it is necessary that the adhesive for bonding the plies of wood together have weatherproof properties not possessed by cold setting glues. This outdoor plywood is therefore made according to the hot-press process wherein a thermo-setting resinoid binder coated on the core ply is converted by the application of heat and pressure in the press into an insoluble and infusible bond integrally uniting the core ply with the veneer sheet.

Since the resulting compressed plywood panel may have defects in the surface veneers thereof, such as pitch pockets, knots, stains and the like, it has become the practice in the plywood industry to cut out these defects from the surface veneers of the finished panels and to glue patches or pieces of wood in the place of the cut-out portions. After the panel has been sanded, these inserted patches are practically invisible and present a clear surface on the panel.

In the usual cold glue process of making plywood wherein the cores and veneer sheets are bonded together by adhesive that sets in the cold, without requiring the use of hot presses, the gluing of patches into the veneer sheets is relatively simple, since cold setting glues can be used. However, in the patching of outdoor plywood made by the hot press process, it is necessary that the patches be bonded to the panels with an adhesive or bonding agent having the same or substantially the same resistance to weather conditions as the thermally setting binder used for bonding the cores to the veneers.

It is not desirable to use thermal setting resins as patching adhesives since such bonding agents would require a second hot press treatment to set the same. If the plywood panel had been humidified or seasoned, such reinsertion of the panel in the hot press would necessitate a repetition of the humidifying or seasoning treatment.

According to this invention, a synthetic resinoid binder capable of cold setting is provided to form an infusible and insoluble bond permanently securing a patch to a surface veneer sheet of a plywood panel. The binder has almost the same gluing properties and resistance to weather condi-

tions as the thermo setting bonding agent used for uniting the veneer sheets.

In preparing the binder of this invention, urea is dissolved in an aqueous solution of formaldehyde. Water-resisting agents, such as cresylic acid or xylenol are added to the mixture of urea and formaldehyde. These agents are used in small amounts. An alkaline condensing agent is then incorporated into the mixture and the mass is heated under reflux conditions to temperatures below the boiling point of water. It is desirable to insert a plasticizer, such as glycerol or a glycol, into the reacting mass. Buffers or stabilizers, such as mono and tribasic sodium phosphates, are also desirable to aid in maintaining the reaction product in colloidal solution.

The reaction is allowed to proceed until a partial condensation between the urea and the formaldehyde is obtained. This condensation product must be retained in the hydrophilic colloidal stage, and therefore the reaction is arrested by the addition of a solubilizing agent, such as sodium borate.

The colloidal solution can be concentrated to a density around 29 to 30 degrees Bé. A solid content of from 62 to 65% is desirable for the mass.

In the patching operation, the edges of the patch and surface veneer sheet around the hole in the plywood panel are preferably painted with a mineral acid, such as phosphoric acid. The syrupy reaction product obtainable by the above described process is then smeared in the hole on the plywood panel and the patch pressed into the hole. The phosphoric acid will cause the reaction product to set into a hydrophobe condition. The set material is insoluble and infusible.

If desired, the syrupy liquid condensation product can be admixed with wood flour or other filler to form a paste. This paste can be smeared into the recess or hole cut in the plywood panel for receiving the patch.

The binder is substantially colorless and does not stain the wood. It has an adhesive strength equivalent to the strength of the bonding material used for uniting the plies of wood and equally resistant to moisture and weather conditions.

It is then an object of this invention to prepare a weatherproof cold setting adhesive for patching plywood veneers.

Another object of this invention is to provide a synthetic resinoid binder capable of being set to form an insoluble and infusible material without the aid of heat.

Another object of this invention is to provide a hydrophilic colloidal solution of a partially con-

densed urea-formaldehyde resin, and to convert the resin into a hydrophobe insoluble form by the aid of phosphoric acid.

A further object of this invention is to provide an adhesive capable of being set without the addition of heat and being infusible and insoluble in its set condition.

Another object of this invention is to provide a hydrophilic colloidal solution of a modified urea partial condensation product that contains a solubilizing agent for preventing setting of the resin until a mineral acid setting agent is incorporated into the resin.

Other and further objects of the invention will become apparent to those skilled in the art from the following example which illustrates a preferred specific embodiment of the invention. It should be understood that the example is intended to describe the invention specifically and that the invention is not limited to the specific details given in the example.

Example

The following formula illustrates the ingredients of a hydrophilic colloidal solution of a resinoid binder prepared from urea, formaldehyde, cresylic acid or xyleneol in the presence of an alkaline condensing agent. The formula contains other ingredients imparting desired characteristics to the product, as will be hereinafter described.

Parts by weight	
Urea	1700
Formaldehyde, 37% aqueous solution	4750
Cresylic acid, B. P. 210-216° C.	170
or	
Xyleneol, B. P. 210-225° C.	56
Ammonia, 28% aqueous solution	
Sodium borate	28
Glycerol	50
Sodium phosphate (monobasic)	3
Sodium phosphate (tribasic)	3

The urea is added to the formaldehyde solution and dissolved therein by the aid of a gentle heat. The cresylic acid or xyleneol is next added to the mixture of urea and formaldehyde. The mass is thoroughly agitated until well mixed. The ammonia, glycerol, monobasic sodium phosphate and tribasic sodium phosphate are next added to the reaction ingredients and the entire mass is heated under reflux conditions until the temperature reaches 198 to 200 degrees F. The reaction is then allowed to proceed exo-thermically without the application of further heat for about 40 minutes. During this exo-thermic reaction period, the temperature will gradually rise to 206 or 208 degrees F.

The reaction is then continued for at least 3 hours, with the application of heat to maintain the temperatures reached during the exo-thermic reaction. The sodium borate is then added to the reaction product, and the resulting colloidal solution is concentrated at temperatures around 180 to 200 degrees F. for a sufficient length of time to obtain a syrupy mass, which has a density of about 29 to 30 degrees Bé. and a solid content of from 62 to 65%.

The urea, formaldehyde and cresylic acid or

xyleneol are condensed with the aid of the ammonia condensing agent to form the resin in a hydrophilic condition. In other words, the condensation is not carried on to completion to form an insoluble product.

The presence of the glycerol and the sodium phosphate salts in the reaction mass stabilizes the product. The salts also act as buffers to control the hydrogen ion concentration so that an insoluble material is not obtained. The glycerol renders the final product flexible.

The cresylic acid or xyleneol increases the water-resistant and water-repellant properties of the resin. The sodium borate acts as a solubilizer to prevent the formation of a rubbery mass upon standing of the solution.

The resulting solution is quite stable and may be kept indefinitely. If desired, 500 parts of the thus obtained colloidal solution may be admixed with 30 parts of wood flour or fine sawdust to prepare a paste.

A setting or hardening agent composed of a 35 to 50% solution of phosphoric acid and water is next made up. The phosphoric acid solution is painted on the patch or edges of the veneer sheet surrounding the hole or recess, and this hole or recess is then coated throughout with the resin solution or with the paste of the resin solution containing the sawdust or wood flour.

The patch is then pressed into the hole in the veneer surface while the excess binder solution is extruded around the edges of the patch. In a short time, the phosphoric acid will harden or set the resin solution into an infusible and insoluble hydrophobe permanently uniting the patch with the veneer.

Other strong mineral acids might be used as hardening agents in place of phosphoric acid, although the phosphoric acid is preferable.

After the resin has set to bond the patch and veneer, the panel surface can be sanded smooth. The resulting surface will be clear and uniform, with the edges of the patch substantially invisible due to the lack of color of the set resin.

I am aware that numerous details of the process may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. An adhesive adapted for cold setting with a mineral acid into an infusible water resisting mass comprising sodium borate and the syrupy partial condensation product of a reaction between 1700 parts of urea and 170 parts cresylic acid with 4750 parts of 37% formaldehyde in the presence of small amounts of ammonia, sodium phosphate and glycerine.

2. An adhesive adapted for cold setting with a mineral acid into an infusible water resisting resinous mass comprising an aqueous dispersion of a resin derived from a simultaneous partial condensation of urea and a cresol with formaldehyde, a soluble borate, a polyhydric alcohol plasticizer and a soluble phosphate.

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