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METHOD OF MAKING PLYWOOD

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This invention relates to a method of making hot pressed plywood, wherein the constituent wooden plies are permanently bonded together with a resin bonding agent. More specifically, the invention relates to the coating and humidification control of the stacks of veneer sheets that are mounted in the hot press for forming plywood panels.

One of the major problems in the production of hot pressed plywood is the regulation of the moisture content of the wood and of the adhesive material during the hot pressing operations. If an excess of moisture is present, steam explosions and surface checks are very likely to occur. If, on the other hand, the moisture content is below a desired minimum, the binder or adhesive cannot function properly to bond the plies or veneers together.

In my Patent No. 2,068,759, there is described and claimed a method of making plywood wherein successive coats of an aqueous solution of a resinous partial condensation product are applied to a core sheet. The core is dried after each coating to a moisture content of not over 4%. The final dried coating is then humidified to impart to the coating itself a moisture content of from 15% to 40%. The thus treated and coated core sheet is sandwiched between the veneer sheets to make up a stack or pack of sheets for a plywood panel. The resulting stack is subjected to a heat and pressure treatment in a hot press for permanently uniting the sheets.

I have now found that the humidification treatment of the dried coatings prior to insertion in the hot press, can be eliminated. I have also found that it is desirable to utilize at least three coatings of the resinous binder solution. The first two coatings are dried while the third coating is applied to the core sheet prior to its insertion in the hot press, to impart the desired moisture content of from 15 to 40 per cent along the glue line.

The binder used for making the products of this invention is an aqueous solution of a partially condensed meta-cresol-formaldehyde resin capable of being set into a hard infusible mass upon the application of heat and pressure.

It is therefore an object of this invention to provide an improved method of making hot pressed plywood that avoids the necessity for humidifying the plywood veneer sheets prior to their insertion in the hot press.

Another object of this invention is to provide a process of making hot pressed plywood wherein a solution of a thermal setting bonding agent

is utilized to impart a desired moisture content at the glue lines between sheets of veneers during the hot pressing thereof to set the bonding agent.

A further object of this invention is to prevent steam explosions and checking in plywood panels during the hot pressing operation thereof.

Other and further objects of this invention will become apparent to those skilled in the art from the following detailed description.

Veneers, used in the manufacture of hot pressed plywood according to this invention, are prepared in the usual way by peeling wooden logs on a lathe. Redwood or Douglas fir "peeler" logs are desirable for forming veneer sheets. It should be understood, however, that the sheets can be formed by a slicing operation instead of a peeling step.

The veneer sheets are dried to a moisture content of about 2 to 3½%. The moisture content of the sheets should not exceed 4%. The dried veneer sheets should be stored in dry atmospheres.

According to this invention, the core sheets or cross banding veneers to be used in forming the plywood panels are coated on both sides thereof with an aqueous solution of a meta-cresol-formaldehyde partial condensation product. This product is made by the exothermic reaction of meta-cresylic acid (meta-cresol) and formaldehyde in the presence of an alkali metal hydroxide condensing agent. The reaction is allowed to proceed exothermically until somewhat constant temperatures of around 208 degrees F. are reached. Further reaction is then arrested by dumping into the reaction mass an aqueous solution of sodium hydroxide. The resulting material is a true aqueous solution of a meta-cresol-formaldehyde resin that is soluble in water in all proportions.

It is preferred to carry out the reaction between the meta-cresol and formaldehyde in the presence of an alkali metal hydroxide equivalent to not less than 10% of sodium hydroxide based on the weight of the meta-cresol. It is also preferred to arrest the reaction with a weak alkaline aqueous solution containing an amount of alkali metal hydroxide equivalent to not less than 6% of sodium hydroxide based on the weight of the meta-cresol. The aqueous solution of the meta-cresol-formaldehyde condensation product is soluble in water in all proportions and is adjusted to form a standard 30% solution.

The dried core veneer sheets are then given a first coating of the 30% resin solution on both surfaces thereof by passage of the sheets through

a coating machine having top and bottom coating rolls. A coating of 20 pounds of resin solution per thousand square feet of core surface is applied. The thus coated cores are dried in a drying tunnel to reduce the moisture content of the coating and of the core ply to not more than 4%.

The dry coated cores are next passed through a second coating machine for applying a 30 pound coating of the same resin solution thereon. This 30 pound coating means that 30 pounds of resin solution are spread on each thousand square feet of core surface coated. The second coating on the cores is then dried to reduce the moisture content of the coating and of the cores to not more than 4% of the weight of the coated cores.

The first lighter coating penetrates appreciably into the surfaces of the core sheets. When this coating is dried, however, the surfaces of the core sheets are sealed, so that the second heavier coating remains on the surfaces.

The double coated and dried core sheets can now be stored in a dry atmosphere until it is desired to lay the same up into plywood panels. This storing, of course, is not necessary but is convenient in that a number of cores can be prepared ahead of time for subsequent panel formation in the hot presses. Thus, sufficient cores can be prepared in one work shift to supply the hot presses through three shifts.

The double coated and dried core sheets next receive a light third coating of the 30% resin solution thereon. This third coating is equivalent to 15 pounds of 30% resin per thousand square feet of core surface coated. The triple coated core sheets are next laid up into stacks between uncoated veneer sheets. The stacks are allowed to stand for thirty minutes to one hour before insertion into the hot presses, so that the third coatings on the core sheets have sufficient time to penetrate into the dried coatings. The total amount of dry resin deposited on the core sheet is 30% of the 65 pounds of resin solution applied in the three coatings, or 19.5 pounds. The first two coats containing altogether 15 pounds of resin are dried to a moisture content of 4%, leaving therefore .6 pound of residual moisture in the coatings. The final coating adds to this moisture, 10.5 pounds of water which remains in the coating, so that the final composition of the triple resin layer is 11.1 pounds of water together with 19.5 pounds of dry resin. In other words, the final moisture content along the glue line amounts to about 36%.

The hot presses are preferably operated at temperatures around 330 degrees F. to set the meta-cresol-formaldehyde resin into a hard, infusible and insoluble binder permanently welding the sheets together. If the veneer sheets are formed of Douglas fir, pressures of about 175 pounds per square inch are used in the hot presses. If the veneer sheets are redwood, lower pressures of around 130 pounds per square inch are used.

The total resin content of plywood panels prepared according to this process is about 19½ pounds of dry resin per thousand square feet of resin coated surface.

After the hot pressed panels are removed from the presses, the same are immediately inserted

in humidifiers before they cool down. This humidifying treatment imparts a desired moisture content into the panels of between 6 and 12% to prevent subsequent warping of the panels.

From the above description, it should be understood that this process of making plywood includes the triple coating of core sheets or cross banding with an aqueous solution of a thermo-setting resin. The first two coatings are dried to a moisture content of not over 4%. The third coating is then applied to the double-coated dried cores and is allowed to penetrate into the first two coatings on the cores. This third coating supplies the desired amount of moisture so that the binder will function to give a good "stick" and will be driven into the surfaces of adjacent uncoated veneer sheets in the plywood panel. At the same time, this third coating does not supply sufficient moisture at the glue lines for causing steam explosions or checks during the hot pressing operation.

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 is necessitated by the prior art.

I claim as my invention:

1. The method of making hot pressed plywood panels which comprises drying a core sheet of wood to a moisture content below four per cent, coating the broad faces of the dried core sheet with a thirty per cent aqueous solution of a thermo-setting cresylic acid-formaldehyde resin, drying the coated sheet to leave a substantially dry film of the thermo-setting resin on each face thereof, applying a second coating of said aqueous resin solution over the dried films, again drying the core sheet to dry the second coating into substantially dry films, applying to the coated core just prior to laying the same between veneer sheets a third coating of said aqueous resin solution over the dried film thereon in an amount sufficient to impart a moisture content of from 15 to 40 per cent along the glue line, sandwiching the triple coated core between the wooden veneer sheets without drying the third coating to form a stack, allowing the wet third coating to penetrate into the dried coatings and veneer sheets, and subjecting the stack to heat and pressure for uniting the core and veneers.

2. In the process of making hot pressed plywood from veneer sheets and a core sheet which has both broad faces thereof covered with substantially dry films of thermo-setting resin binder, the steps which comprise covering, just prior to laying the core sheet between the veneer sheets to form a stack, the dry films on the core with films of an aqueous thermo-setting resin binder in an amount sufficient to impart from 15 to 40 per cent moisture along the glue line, laying the thus coated core between the veneer sheets without drying the aqueous films, allowing the stack to stand to permit penetration of water from the aqueous films into the dry films and into the veneers, and uniting the core and veneers by subjecting the stack to heat and pressure for thermo-setting the binder.

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