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PLYWOOD BOARD AND PROCESS OF MAKING THE SAME

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Fig. 1.

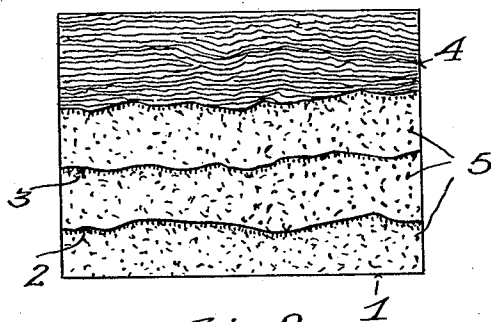


Fig. 2.

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UNITED STATES PATENT OFFICE

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PLYWOOD BOARD AND PROCESS OF MAKING THE SAME

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This invention relates to a novel composite board product and process of making the same.

The object of my invention is to produce a composite or plywood board consisting of a plurality of sheets secured together in flatwise relation by the use of dry glue and the application of heat and pressure.

A further object is to produce a composite board of the nature referred to, in a most simple, efficient, expeditious and economical manner, and whether soft or hard wood sheets are employed.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the steps, mode of procedure, operations, and product, hereinafter more fully set forth, and finally pointed out in the appended claims.

Referring to the drawing,—

Figure 1 is an elevational view of the plywood board of this invention.

Fig. 2 is a top plan with each layer broken away.

Heretofore in the manufacture of composite boards, panels or the like, it has been the practice to steam the stock wood, to soften it, then to slice the same, while so softened, into thin sheets, then to dry the sheets, then to apply glue in a wet condition to one or both surfaces of a plurality of said sheets and to pile them flatwise upon each other and finally to dry the assembled pile.

This operation is objectionable for several reasons. In the first place two drying operations are required, one after the stock wood is steamed, as glue will not adhere to the surface of a wet sheet, and another after the application of the wet glue. Again, after the wet glue is applied it is necessary to retain the assembled sheets under pressure for a sufficient length of time to enable the glue to set. This requires at least six hours and sometimes much longer. This necessitates a large area of space if the production is of any consequential volume, and reduces the capacity output and efficient operation of the factory. In addition, where the wet glue method is employed, the glue must be maintained during working hours in a fluid state to enable it to

be properly applied, and if any excess of glue remains at night it becomes set and hard over night and cannot be used the next day. This entails a serious waste and loss. Again, in the use of the wet glue process the sheets or panels must be applied together quickly after the glue has been applied to them, otherwise the glue will lose its binding power, thereby resulting in a failure to secure the desired degree of adherence of the boards or sheets. Finally, panels or boards built up by thin sheets secured together by means of wet glue are not efficiently waterproof. That is, while they may be able to resist the penetration of water when boiled for a few hours, or when steeped in water for a day or two, nevertheless they are unable to retain their waterproof quality for a year or more. These are some of the serious objections which are encountered by present methods of making composite boards, and which result in great loss and expense.

It is among the special purposes of my present invention to obviate these and many other difficulties attendant upon the use of the wet glue process of making up composite boards from thin sheets of wood.

In carrying out my invention, I propose to employ a glue product having adhesion and waterproofing qualities and of such nature as to enable it to be applied and used in the dry state, and pressing together the sheets to which it has been applied by means of hot presses. To this end I propose to employ a dry glue product which is thermoplastic.

The thin wood veneers or sheets are prepared by steaming the stock, as before, and slicing the steamed and softened stock into thin sheets, which are then dried, but with this difference. Instead of extracting the moisture by drying till not more than two percent (2%) remains in the sheets, as heretofore required with the wet process, the drying in preparation for utilization of my process need be carried on to the point of leaving from 10% to 15% moisture in the sheets. This greatly reduces the cost and time of preparing the sheets. The dry glue is then applied and spread over the surfaces

of the sheets and the sheets are stacked or piled upon each other as before, and the stack or pile is then subjected to heat and pressure. This may be accomplished either by hydraulic hot presses, or by heated rollers. Instead of the six or more hours heretofore required in this step of operation with the wet process it requires less than five minutes with the dry process of my invention, generally only about one minute. This attains an enormous advantage in saving time and expense, and results in the production of an efficiently waterproofed finished product, the conservation of factory space and a continuous production, particularly where heated rollers are employed. It also results in the production of efficient uniform quality of composite board products whether soft wood or hard wood sheets be employed, whereas with the wet glue process a difference in quality of the composite board product is caused according to whether the sheets are of hard wood or of soft wood.

A plywood board made in accordance with this invention is clearly shown in the figures. As depicted the board is made up of four plies of thin wood veneers or sheets 1, 2, 3 and 4 and bound together by very thin layers of glue 5. As shown, the wood layers are arranged so that their grain in adjacent layers extends at right angles. Of course, the board may consist of any desired number of layers from two upwards.

It is essential, in accordance with my invention, not only that the dry glue material used shall be thermoplastic, but also that it shall have a strongly binding power and shall be of waterproof character. Any glue substance which possesses these characteristics of being thermoplastic, waterproof and having strongly binding power is suitable for use in carrying out my invention.

I have found that vegetable proteidal substances, such as soya bean proteid, or animal proteid substances, such as casein, or blood, when treated with an active methylene compound, as well as synthetic resins such as phenol condensation products, or urea condensation products, or a combination of such proteidal and condensation products may well serve the purposes of my invention. In practice, the combination of the proteidal and condensation products is preferable not only because it is more economical, but also it is more efficient since it utilizes to best advantage the increased and predominating binding power of the proteidal substances and the increased predominating waterproofing characteristics of the condensation products. Moreover, when the combined products are employed the proteidal part forms a very thin coating on the wood surface which prevents or retards the absorption of the condensation product into the wood tissues, which would be objectionable

in that it would reduce the binding power of the glue.

I will now describe specific examples of the utilization of dry glue products in carrying out my invention.

First, by the use of vegetable or animal proteidal substances indurated with an active methylene compound.

To, say, 100 pounds of soya bean meal is added a few pounds of diluted solution of ammonia or caustic soda, to serve as a glutinizing agent therefor. To this mass is added from 5 to 15 pounds of beta naphthol or its sodium salt to impart a desirably high degree of thermo plasticity thereto. Then I add from 8 to 15 pounds of formaldehyde solution or its equivalent. The whole mass is then thoroughly kneaded into homogeneity and is finally dried into powder form.

Or, to say, 100 pounds of soya bean meal and 5 to 10 pounds of blood, mixed together, I add 10 pounds of sodium triphosphate and 10 to 15 pounds of calcium hydroxid, and 10 pounds of copper sulphate. In this case the sodium tri-phosphate glutinizes the mass and the calcium hydroxid and copper sulphate act as condensing agents. The mass is thoroughly mixed in powder form.

Instead of using the soya bean meal its extracted refined proteid may be used.

Instead of blood, casein may be used.

The wood sheets are prepared in the usual way except that they may and preferably should contain from 10% to 13% moisture. The surfaces of the wood sheets which are to receive the dry powdered glue product are preferably slightly moistened by wiping the same with a dampened cloth, or otherwise, as may be convenient. If desired this moistening may be readily accomplished either by hand or by passing the sheets between rolls covered with a dampened cloth. To the dampened wood surface the dry glue powder is applied in any suitable or convenient way, as, for instance, by passing the dampened board through a box in which the powdered glue material is maintained in a flying whirl by means of an air blast. Thus a thin film of the glue material is applied to the dampened surface of the wood sheets. Of course, many other methods of applying the dry powdered glue material may be employed.

The panels after receiving the dry glue material are then stacked or piled upon each other in the desired number, with the grain of each sheet in cross-wise relation to that of the adjacent sheets. The stack or pile of assembled sheets is then subjected to heat and pressure, either in press or by being passed through heated rolls, and maintained in such heat and pressure from one and one-half to five minutes. A heat of from 90 degrees C. to 120 degrees C. is sufficient.

After the step of pressing under heat the composite board or panel is ready for use,

no further drying being necessary, or it may be shipped or stored ready for shipment, as may be desired.

It is to be noted that in moistening the surface of the sheets preparatory to the application of the dry glue thereto, if a 1% caustic soda solution is used instead of water, a much better result is attained as the caustic soda solution will react with the glue powder to impart to the latter a greater adhesive or binding power. This constitutes a valuable feature of my invention.

Second, when synthetic resins, or the mixture of synthetic and natural resins, or the mixture of synthetic resins and proteidal substances are employed as the dry glue product, the wood sheets are prepared in the same way as above described.

For an example, 100 pounds of phenol are mixed with an equal weight of formaldehyde solution and a few pounds of catalyzing agent such as ammonia or caustic soda added. With the resulting phenolic oily mass from 10 to 20 pounds of natural gums, such as shellac or dammergum are mixed, and finally from 30 to 100 pounds of soya bean meal, or other proteidal substance, are added. The mass is then thoroughly mixed into a dry powder which is ready for use as a dry glue product in accordance with my invention. In this case natural resins, while imparting adhesive power to the glue product, are not always necessary, whereas the proteidal material is necessary, otherwise the heat of the hot press or rolls would liquefy the synthetic resin which, in liquid form, would be absorbed into the tissue of the wood sheets, thereby losing its adhesive power. The use of a proteidal substance therefore, in this example, is a most important feature of my invention and its omission by others who have worked on the problem marks the real cause of their failure to attain success.

The remaining operations are the same as above described except that in this instance a minimum amount of dilute caustic soda solution should be used in dampening this surface of the wood sheets.

The resulting composite board or panel, in this instance, is much more waterproof and is stronger than in the first example above given.

It is not necessary for the synthetic resin and the proteidal substances to be mixed together. These substances may be applied separately to the wood sheets. In this case the proteidal glue product is formed into a paste by mixing the same with water, and this paste is first applied to the surface of the wood sheets, as little as possible of the paste being employed, just sufficient to fill up the wood tissue pores to prevent absorption of the resins. The synthetic resin, diluted to a thin liquid is then applied. Instead of organic solvents for the resins, such as alcohol,

amyl-alcohol, or amyl-acetate, I prefer to use a caustic soda solution for this purpose, as well as to thin the liquid resin. This results in imparting an increased binding power to the glue product. It is necessary to employ 100 to 150 pounds of the caustic soda of ten per cent solution with 100 pounds of oily synthetic resin. Not only does the proteidal substance employed in this case fill up the pores of the wood and prevent absorption of the resinous constituent into the wood, but it also reacts chemically with the synthetic resin to impart an enhanced binding power. Not only this but the setting of the glue is accomplished quicker and at a lower temperature.

In place of the glue product hereinbefore described, my invention may also utilize the lacquer product set forth in my Patent No. 1,245,981, granted November 6, 1917. In the use of the glue-like mass therein described, said mass is diluted with a suitable solvent, such as alcohol, benzol, acetone and the like, or diluted caustic soda solution may be used. The diluted mass is then applied to the wood sheets which are then air dried. When a pile of assembled sheets or panels thus treated is subjected to pressure and heat the lacquer-glue becomes thermoplastic and possesses a strongly adhesive property. Instead of first adding phenol to the proteid to glutinize it, and then adding formaldehyde as a condensing agent, to obtain the glue-like mass, the glutinizer and the condensing agent may be mixed together and then the proteid glutinized by means of caustic soda as a dissolving binder agent. The mixed glutinizing and condensing agents are preferably heated thereby obtaining an oily viscous synthetic resin. In this form it is added to the diluted proteidal material.

If desired, the varnish product of my Patent No. 1,280,861, granted Oct. 8, 1918, may be used as the adhesive agent in carrying out my present invention, being applied to the wood sheets which are then air dried and pressed together under heat which renders the varnish thermoplastic with excellent adhesive properties.

Instead of applying the glue product, whether in the dry, powdered, semi-plastic, lacquer or varnish form, directly to the wood-boards or panels it may be first applied to a thin sheet of paper, cloth or other suitable carrier, which is then dried and applied to or placed between the sheets of board or panels and the whole assembly pressed together under heat. In this method of utilizing my invention, the constituents of the adhesive are not absorbed by the fibres of the board sheets, thereby avoiding an objection sometimes encountered in applying the adhesive directly to the wood panel surface, particularly where the adhesive is more or less liquid.

From the foregoing description, it will be seen that I have provided a composite board

structure which is better, more strongly adhesive and waterproof to a higher degree than has ever been accomplished before, and a process of producing the same by the use of a dry glue product which is exceedingly simple, efficient and inexpensive.

Having now set forth the objects and nature of my invention and the manner of carrying out the same, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent is:

1. The process of forming composite boards which consists in applying to the surfaces of thin sheets of wood a dry thermoplastic glue comprising a proteidal product indurated with a methylene compound and possessing high binding and waterproofing qualities, stacking said sheets the one upon another, and applying heat and pressure to the stack.
2. The process of forming composite boards which consists in applying to the surfaces of thin sheets of wood, containing at least 10% of moisture, a dry thermoplastic glue containing proteidal and condensation products and possessing adhesive and waterproofing qualities, stacking said sheets upon each other, and applying heat and pressure to the stack.
3. The process of forming composite boards which consists in dampening with a caustic soda solution the surfaces of thin sheets of wood, then applying in the dry state a thermoplastic glue containing a proteid mixed with a condensation product to the dampened surfaces, then stacking the sheets upon each other, and applying heat and pressure to the stack.
4. The process which consists in dampening the surfaces of thin wood sheets and applying thereto a layer of dry thermoplastic glue containing a proteid material and a phenol condensation product, then stacking the sheets upon each other and applying heat and pressure to the stack.
5. The process which consists in applying to the surfaces of thin wood sheets a dry thermoplastic glue containing a proteid and a condensation product, then stacking the sheets upon each other, and applying heat and pressure to the stack.
6. The process which consists in applying to the surfaces of thin wood sheets a dry thermoplastic glue containing a proteid and a phenolic condensation product, then stacking the sheets upon each other, and applying heat and pressure to the stack.
7. The process which consists in applying a proteidal substance to the surfaces of thin sheets of wood, then applying a phenolic condensation product thereto, then stacking the sheets and applying heat and pressure to the stack.
8. The process which consists in applying in a dry state a synthetic resin and a pro-

teidal substance to the surfaces of thin sheets of wood, then stacking the sheets and applying heat and pressure to the stack.

9. That process which consists in applying to the surface of thin sheets of wood an adhesive of a thermoplastic nature containing proteidal substances and a methylene indurating compound, then assembling the sheets into a stack and applying heat and pressure to the assembled stack.

10. As a new article of manufacture, a composite board composed of a plurality of thin sheets of wood superposed upon each other and united by an indurated proteidal glue product applied dry as a surface layer and having thermoplastic properties.

11. As a new article of manufacture, a composite board comprising a plurality of thin sheets piled one upon another and joined by a thin layer of indurated waterproofing proteid adhesive applied dry and having thermoplastic properties, said sheets being pressed together under heat.

12. The process of forming composite boards which consists in applying to the surfaces of thin sheets of wood a dry glue comprising proteidal and condensation products and having thermoplastic adhesive and waterproofing characteristics, stacking said sheets one upon another and applying heat and pressure to the stack.

13. The process which consists in applying an adhesive having a thermoplastic nature and containing proteidal substances, and a methylene induration compound to the surfaces of thin sheets of wood, then assembling the sheets into a stack and applying heat and pressure to the assembled stack.

In testimony whereof I have hereunto set my hand on this 10th day of April A. D., 1930.

TEIKICHI SATOW.