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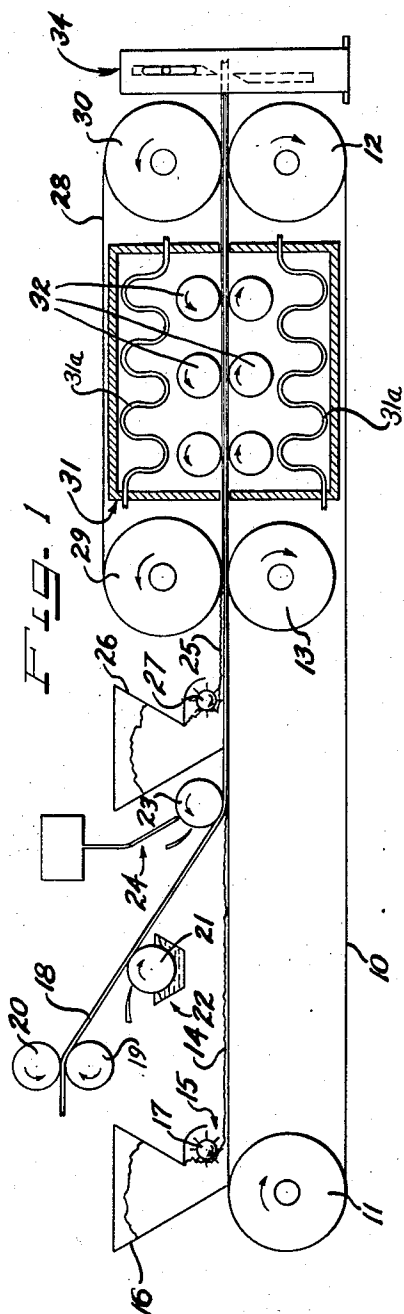
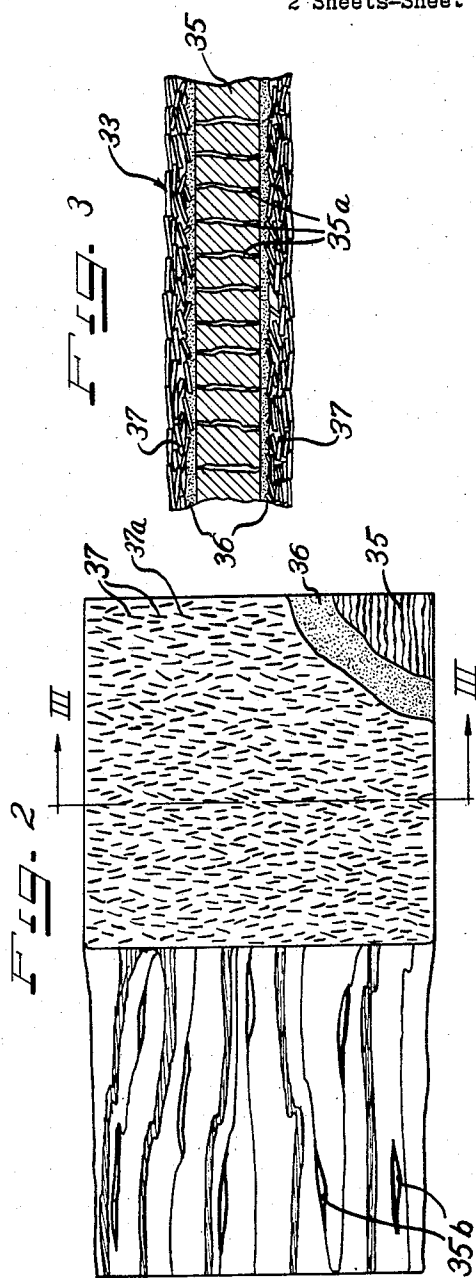
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2,853,413

WOOD PARTICLE VENEER BOARD AND METHOD OF MAKING SAME

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2 Sheets-Sheet 1



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Fig. 4

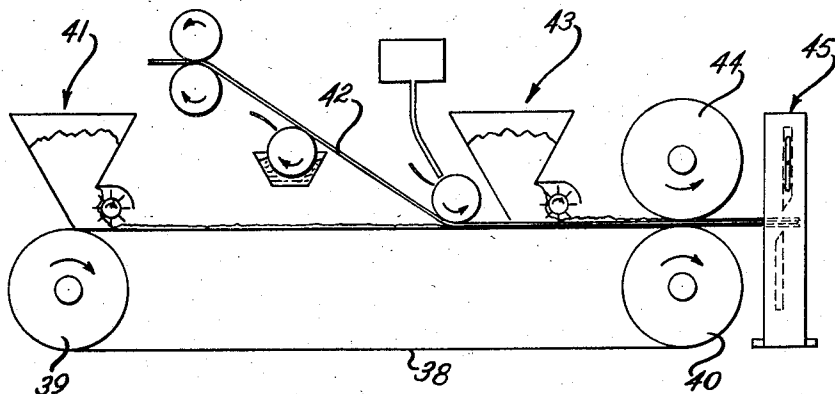
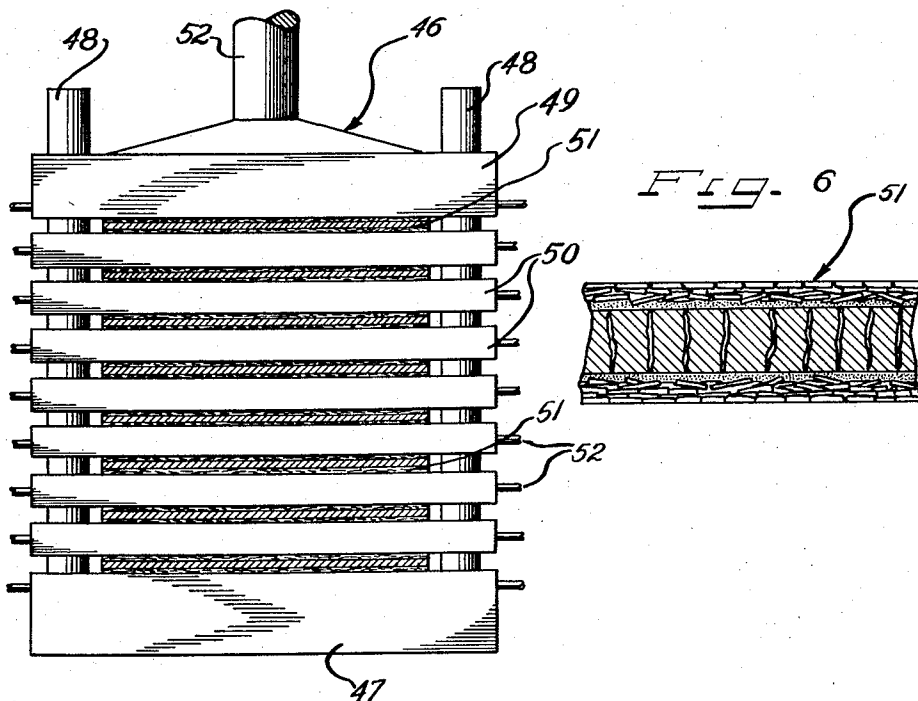


Fig. 5



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WOOD PARTICLE VENEER BOARD AND METHOD OF MAKING SAME

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8 Claims. (Cl. 154—132)

This invention relates to the production of an all wood, nailable, sawable, laminated board having a wood veneer core and covers composed of discrete wood particles bonded together and to the core.

Specifically, the invention deals with a board having surface covers of disintegrated wood fibers holding a dry wood veneer cover in the expanded condition of wet wood, and includes a method of making the product from green undried wood fibers and glue, wherein the laminated assembly is dried only after the glue bond is sufficiently strong to prevent slippage between the wood fibers and the wood so that the layers of wood fibers will hold the wood in the expanded condition of its green state.

According to this invention, any species of wood, including woods that were heretofore unfit for use except as fuel, in its green, undried, and swollen state, is lathe cut or peeled into a thin veneer sheet and is covered on one side or both sides with a layer of wood fibers preferably impregnated or admixed with glue. The top and bottom faces of the wet wood are suitably coated with any type of adhesive which will bond wood together, but preferably a glue formulated from soya bean flour or any other type of cold setting water resistant protein-type glue is used.

The wood fiber cover may be of ground wood pulp, hogged or disintegrated wood, or even waste sawdust in its wet or dry state mixed together with an adhesive of the type above described. The glue-coated faces of the wet wood receive the layers of wood fibers and the assembly is pressed under sufficient pressures to firmly contact the wood with the wood fibers, and the wood fibers are also pressed firmly into any surface defects of the wet wood to fill the cavities, knots, etc., thereby enhancing the strength of the completed product. The glue is then set rather rapidly because of absorption of some of its water content by the wood fibers, but the wet wood is not dewatered below its shrinking point, viz, about thirty percent moisture content. A strong bond is formed so that slippage between the wood fibers and the wet wood cannot occur. The assembly is then passed through a drying kiln where it is dried to a moisture content between six to twelve percent.

Alternatively, a dry veneer may be used in fabricating the panel, wherein the wood fiber covers are cold pressed, subsequently passing the assembly through a drying kiln, or they are hot pressed while passing through a drying kiln.

The term "moisture content" as used herein and in the claims is based upon the oven dry weight of the wood and, when expressed in terms of percentage, means the weight of the water present in the material divided by the oven dry weight (bone dry weight) of the material multiplied by one hundred. Thus, if the moisture-laden wood sample weighed ten pounds, and, when oven dried to a bone dry basis, it weighed five pounds, it would have contained 5 pounds of water, and its moisture content would be determined as follows:

$$\frac{5}{10} \times 100 = 100\%$$

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Normally, wood begins to shrink as its moisture content is reduced below thirty percent and the shrinkage of wood from a green wet state to a dry state averages about ten percent. Further, normal shrinkage of wood brings about the formation of cracks and splits because the stronger bundled fiber portions will pull away from the weak bundled portions as shrinkage progresses. The present invention minimizes this shrinkage and its cracking and splitting of wood, because the wood fiber cover which is bonded to the wood while the wood is still in its wet, swollen condition will hold the wood in its expanded condition, even after the moisture is driven therefrom. The product of the invention therefore includes a wood veneer core with the wood in an open mesh expanded condition free from splits or cracks.

A feature of the invention includes combining of the fibers as they are laid on the veneer sheet to orient the fiber direction at right angles to the direction of the grain of the veneer. A "cross banding" effect is thereby obtained.

An object of this invention is to provide a nailable, sawable, high strength all wood laminated board composed of a wood veneer core and wood fiber covers bonded to the core in nonslipping relation.

A further object is to provide such a board with the core held by the covers in the condition of unshrunk green wood.

Another object of the invention is to provide an all wood laminated board having a wood veneer core and sawdust or hogged wood fiber covers.

A further object of the invention is to provide a sawdust or hogged wood fiber covered wood veneer product from green, undried wood, wet glue, and a slurry of wet, glue-impregnated wood fibers without permitting the wood to shrink substantially as the product is dried to a moisture content between six to twelve percent.

Another object of the invention is the provision of a method of making sawdust or wood fiber covered wood veneer from any species of green or wet wood, including heretofore unusable woods and waste sawdust mixed with an adhesive to form a wood fiber lamina which holds the wood in its expanded green state form even after the assembly is dried.

Still another object of the invention is to produce a sawdust or wood fiber covered wood veneer product free from splits, cracks, loose knots and other defects normally present in dry wood veneer.

Still another object of the invention is to provide an all-wood laminated board having a wood veneer core and sawdust or wood fiber covers wherein the covers increase the bursting strength of the wood veneer from five to seven and one-half times.

A further object of the invention is to provide a method of making sawdust or wood fiber covered wood veneer wherein the wood fibers in the covers may be oriented with regard to the grain of the wood veneer core so as to obtain a good cross-banding effect.

Other and further objects of the invention will become apparent to those skilled in the art from the following description and from the annexed sheet of drawings forming a part of this specification.

On the drawings:

Figure 1 is a somewhat diagrammatic side elevational view illustrating the method of this invention for making the sawdust or hogged wood fiber covered wood veneer product of this invention;

Figure 2 is a plan view of a panel of this invention with successive layers partially removed to show underlying layers, and with one half of the wood veneer core uncovered and shrunk to its normal dry wood condition to illustrate the manner in which the wood fiber covers hold the wood veneer against shrinkage;

Figure 3 is an enlarged fragmentary cross-sectional view of the product taken along the line III—III of Figure 2;

Figure 4 is a somewhat diagrammatic side elevational view illustrating another method of making the all-wood laminated board of this invention;

Figure 5 is a side elevational view of a hot plate press for the laminated wood panels produced from the method illustrated in Figure 4; and

Figure 6 is a cross-sectional view of the all-wood laminated board taken from the hot plate press, and particularly illustrating the opposite smooth flat surfaces of the board.

As shown on the drawings:

As illustrated in Figure 1, an endless belt or band 10 preferably constructed of stainless steel, is trained around spaced pulleys or rollers 11 and 12, the upper run of which is further supported by a press roll 13, the function of which will be hereinafter explained. The end or terminal pulleys 11 and 12 are driven at the same speed by any suitable drive mechanism in the direction indicated by the arrows placed thereon, thus, advancing the endless band 10 from left to right. The band 10 constitutes a supporting surface for the product of the invention during its formation and its upper run can be further supported by table rolls (not shown).

Deposited at the receiving end of the band 10 on the upper run is a mat or layer of wood fibers 14, of substantially uniform thickness fed from the discharge outlet 15 of a hopper 16 containing a supply of the fibers in thick slurry form. The slurry of discrete wood fibers consists of waste sawdust, ground pulp board, or hogged or disintegrated wood particles of any type of wood, such as gum, oak, cottonwood, sycamore, pine, and fir, wet or dry, mixed with an adhesive which will suitably bond wood together but preferably an adhesive formulated from soya bean flour which has been found to be the cheapest. From three to fifteen percent of glue, based on the weight of the wood particles, with nine percent forming a preferred average, is mixed therewith to form the slurry. If desirable, water may be added to this mixture to provide the proper consistency to form the mat 14 without impairing the strength of the finished product.

The thickness of the deposited mat layer of wood fibers 14 is maintained substantially uniform and the fibers are oriented substantially parallel to the direction of flow, as illustrated in Figure 2 by fibers 37a, by the combing wheel 17 which is rotatively driven in the opposite direction of band 10 being disposed thereabove within a forward portion of the hopper 16. The band 10 defines the bottom of hopper 16 which has the usual upwardly and outwardly extending flared walls. Cooperating with the front wall of the hopper 16 is a housing, arcuately shaped to the contour of the radially-pinned combing wheel 17, the lower edge of said housing terminating above the band 10 providing the discharge opening 15.

A lathe-cut or peeled veneer sheet or web 18 in its green, undried condition, having a moisture content above thirty percent, because most woods begin to shrink as their moisture content drops below thirty percent, and usually having a moisture content which will average about 130%, is introduced from a suitable source through the oppositely disposed coating driven rollers 19 and 20 over the coating roll 21 of the coating machine 22, to receive on its bottom face a water solution of soya bean glue, and into contacting relationship with the wood fiber layer 14. Woods, such as gum, oak, cottonwood, sycamore, pine and fir are examples of satisfactory species of wood to form the product of this invention. Woods that otherwise were unusable except for fuel, such as white oak are now rendered useful in veneer making. Here-

an extent when being dried that they were totally unfit for veneers and plywood panels.

The veneer, web or ribbon 18 is quite thin and may have a thickness varying from .01 to $\frac{5}{16}$ inch, with a thinner sheet in this range being the most economical. If necessary, pieces of veneer are stitched or stapled together to form a continuous sheet or ribbon 18. The web 12 has the grain running crosswise or transversely thereof.

The top face of the ribbon 18 passes under a coating roller 23 of a coating machine 24 which applies a water solution of soya bean glue like that applied on the bottom of the web or ribbon.

A similar dispensing arrangement to the hopper 16 and the combing wheel 17 deposits a substantially uniform thickness of hogged wood fibers on the top adhesive face of web 18 at 25. This arrangement also includes a hopper 26 and a combing wheel 27 functioning in the same manner as hopper 16 and combing wheel 17.

Positioned above the band 10 and near the discharge end thereof and coating therewith is an endless band 28, also preferably of stainless steel, supported by driven spaced rolls 29 and 30. The roll 29, being directly above roll 13 and axially aligned thereon, cooperates therewith to form a pair of pressing and shaping rolls. The band 28 cooperates with the band 10 to advance the assembly through a drying kiln 31 where they pass between pressing rolls 32 so that the laminated assembly is hot pressed. Steam or any other suitable heating medium fed through the rolls 31a heats the kiln 31. The assembly is dried to a moisture content between six to twelve percent and preferably to a moisture content of eight percent.

The finished product 33, as shown in Figure 3, issuing from the drying kiln 31 has substantially the same dimensions as the wet material from which it was formed. Shrinkages averaging 1.5 percent or less are encountered and these shrinkages are represented by uniform shrinking of the expanded wet wood and the wood fibers. This shrinkage is much less than ten percent of the normal shrinkage of wood from its green, wet state to its dry state. After passage through the drying kiln and between the end rolls 12 and 30, the assembly is cut into laminated wood panels of the desired length by cutter 34.

As shown in Figures 2 and 3, the product 33 is composed of an intermediate sheet or core 35 of wood veneer which is dry, but still in its expanded swollen condition of its green state. Thus, this veneer is full of pores or cells 35a that were formerly filled with water but is free from cracks, splits or checks normally present in dry wood. Any defect, such as knots or cavities will be filled since the sawdust or hogged wood fibers will be pressed firmly thereinto. Both faces of the wood core 35 are covered with layers of fibers 37 which are bonded together by a suitable wood adhesive. Glue bonds 36 firmly unite the layers of wood fibers to the wood core.

As shown in Figure 2, the wood fiber covers 37, hold the wood core against shrinkage. Thus the half portion of the core which is uncovered by the fiber is in a shrunk and dried condition full of cracks and splits 35b, while the wood fiber cover portion of the veneer is uniformly porous. The grain of the wood fibers extends along the length of the ribbon and is at right angles to the grain of the wood core so that the crossbanding effect of plywood is obtained which enhances the strength of the completed product.

Now referring to Figures 4 to 6, a modified method of producing an all-wood laminated board and its finished product is illustrated. Figure 4 shows the method of initial formation, wherein an endless stainless steel band 38 is trained around longitudinally spaced parallel end rolls or pulleys 39 and 40. A dispenser 41 deposits a uniformly thin layer of sawdust or hogged wood fibers on the endless band 39. This layer then contacts the bottom glued face of the wet wood web 42 while the top

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glued surface of web 42 receives a layer of wood fibers from the dispensing means 43. Since this initial procedure is identical with that utilized in the method of making illustrated in Figure 1, the details of the dispensing means and the manner in which the glue was applied to the surfaces of the web have been omitted for purposes of preciseness. The assembly is then cold pressed by the coaction of the rolls 44 and 40, aligned. The assembly then is cut into panels of desired length by the cutter 45.

The panels then are inserted in the hot plate press generally indicated at 46 (Figure 5), which comprises a bottom platen 47 having vertically extending cylindrical side rods 48, a top platen 49, and a plurality of intermediate platens 50. The cut panels of the finished product 51 are inserted between spaced platens which are stacked alternately with the panels and guided by cylindrical rods 48. Pressure is then exerted through the rod 52 of the top platen 49 by hydraulic or other suitable means (not shown) substantially evenly distributing the pressure throughout the press. Steam or any other suitable heating medium is introduced within the platens through the conduits 52. The panels are dried to a moisture content between six to twelve percent, and preferably a moisture content of eight percent and the shrinkage is minimized as heretofore explained. Comparing the finished product of this modified method of making, with the finished product of Figure 3, from the first method of making, it is seen that the surfaces formed by the hot plate press and most clearly shown in Figure 6 is much smoother and more even. However, the veneer core in the finished product shown in Figure 6 takes the same cellular form as that of Figure 3.

The wood fiber covered wood veneer of this invention gives a very strong board, both in column strength and puncture. The sawdust or hogged fiber wood covers increase the bursting strength of the laminated wood board from five to seven and one-half times. For example, in the case of a one-eighth inch oak veneer having a mullen strength of 200 pounds p. s. i., the same oak veneer with the fiber covers $\frac{1}{32}$ of an inch thick on each side has a mullen strength of about 1500 pounds p. s. i. The product has better nail-holding power than the full sawdust board or any other molded board and is cheaper because a greater part of the product is already bonded together wood, hence, less glue is required. The soya bean glue, when dried, forms a bond which is water-resistant and the product will effectively resist weather conditions. The product is nailable and sawable in the same manner as plywood or lumber and is especially useful in the production of boxes and crates. The uniform moisture content of six to twelve percent in the finished product prevents buckling and warping irrespective of atmospheric humidity changes.

From the foregoing, it should be understood that the invention provides an all-wood laminated board which may be easily produced in volume at relatively low cost because of utilization of heretofore unusable waste wood, which has a high tensile and bursting strength, and which is highly resistant to adverse weather conditions, rendering it long lived. The discrete wood fibers as well as the veneer core contain all of the natural binders of wood to maintain the strength of wood and thereby decrease the required amounts of added glue.

It will, of course, be understood that various details of the product and method may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than as necessitated by the scope of the appended claims.

I claim as my invention:

1. A wood laminate which comprises a wood veneer core having the grain of the wood extending in a first direction, a mat of discrete wood fibers on each face of the core with the fibers of each mat extending in directions substantially at right angles to said first direction,

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glue bonds uniting the fibers in the mats and uniting the mats to the core, said laminate having a moisture content of from 6 to 12%, and said bonds and mats holding the core in the expanded condition of green wood.

2. A composite board formed from unshrunk green wood; discrete natural wood fibers, and a water-resistant glue, which comprises a dry wood veneer sheet containing 6 to 12% moisture but remaining in its swollen green wood expanded condition, a layer of wood fibers united to said sheet, and a cold set water-resistant protein glue bond fixedly uniting the wood and fiber layer in non-slipping relation and causing the layer of wood fibers to hold the wood in expanded form.

3. A laminated wooden board formed from green wood having a moisture content above 30%, disintegrated wood fibers, and a water-resistant glue, which comprises a dry wood veneer sheet containing 6 to 12% moisture but remaining in its swollen green wood expanded condition, at least one lamina of hogged wood fibers with the fibers lying substantially parallel to the wood sheet and extending in substantially right angular relation to the grain of the wood sheet, and a water-resistant protein glue bond fixedly uniting said wood sheet and said hogged wood fibers in non-slipping relation and causing the hogged wood fibers to hold the wood in expanded form.

4. A composite board formed from green wood having a moisture content above 30%, sawdust and a water-resistant glue formulated from soya bean flour which comprises a dry wood veneer sheet containing 6 to 12% moisture but remaining in its swollen green wood expanded condition, a layer of glue impregnated sawdust on each side of said wood veneer sheet, and a water-resistant protein glue bond fixedly uniting said veneer sheet and each layer of sawdust in non-slipping relation and causing the sawdust to hold the wood in expanded form.

5. The method of making a laminated board which comprises providing a sheet of wet wood veneer, depositing a relatively thin layer of glue-impregnated wood fibers on a carrier, applying a water-resistant adhesive bond to at least one of the broad surfaces of said veneer capable of forming a non-slipping bond between the wood fibers and the veneer prior to removal of the moisture from the wood, pressing the wood fiber layer against at least one face of the veneer, setting the adhesive bond before the wood begins to shrink to form a non-slipping bond between the wood fiber layer and the unshrunk wood, and drying the laminated assembly to a moisture content between 6 to 12% whereby the non-slipping bond between the wood fiber layer and the wood will cause the wood fiber layer to hold the wood in its open mesh expanded swollen condition even after the moisture content is reduced below the point where the wood normally begins to shrink.

6. The method of making a wood laminated board from wet wood veneer containing more than 30% moisture which comprises forming a cover of glue-impregnated wood fibers, orienting the fibers to lie substantially transverse the grain of said wood veneer, applying a water-resistant glue to one side of the wood veneer, associating the cover of wood fibers with the wood veneer, applying a water-resistant glue to the other side of said wood veneer, depositing a second cover of glue-impregnated wood fibers to the other side of said wood veneer, setting the glue before the moisture content of the wood veneer is reduced below 30% thereby uniting the wood and wood fibers in non-slipping relation, subjecting the assembly to being formed presenting smooth-surfaced fibrous covers, and drying the laminated assembly under pressure to a moisture content between 6 to 12% whereby the wood veneer and the fibrous covers will cause the covers to hold the wood in its open mesh expanded swollen condition even after the moisture content of the wood is reduced below the point where the wood normally begins to shrink.

7. An all wood laminated board which comprises a core of wood veneer having 6 to 12% moisture but having the cells thereof in the swollen expanded form of green wood, a cover of disintegrated wood particles, a soya bean glue fixedly uniting in bonded relation the wood particles, and a soya bean glue fixedly uniting the wood particle cover with the veneer in non-slipping relation and causing the cover to hold the wood veneer in an expanded condition thereby materially reducing shrinkage and increasing the bursting strength of the wood veneer from 5 to 7½ times.

8. A wood laminate which includes a dry wood veneer core in the expanded open cellular condition of wet wood, and dry mats of discrete wood fibers bonded to each face of the core strengthening the core and holding it in the expanded unshrunk state of wet wood.

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