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A. ELMENDORF

2,268,477

METHOD OF MAKING LAMINATED MATERIAL

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Fig. 1.

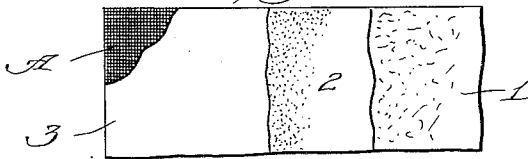


Fig. 2.

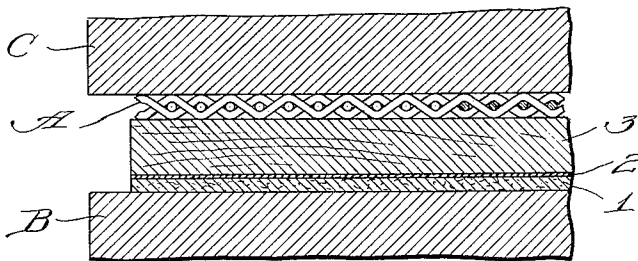


Fig. 3.

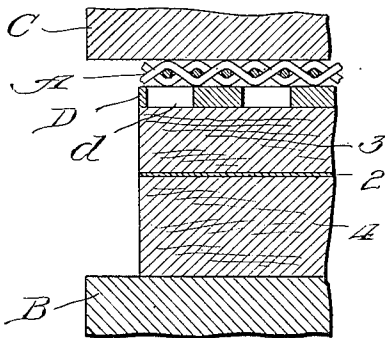


Fig. 4.

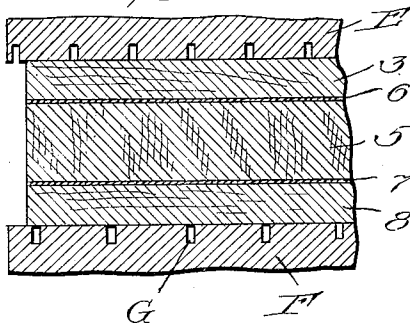
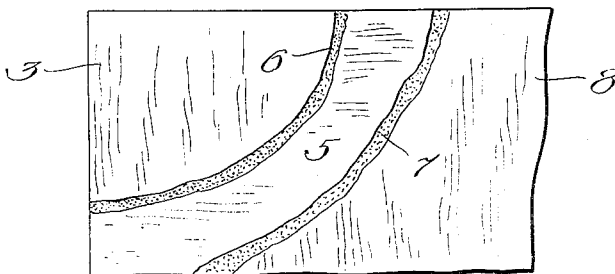


Fig. 5.



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METHOD OF MAKING LAMINATED MATERIAL

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6 Claims. (Cl. 144—309)

There are some types of wood veneers, particularly veneers cut from the crotches of trees, that are very difficult to handle. Crotch veneers become greatly distorted upon drying and, when it is attempted to flatten them, they usually become badly broken. In making experiments seeking satisfactorily to dry these irregular kinds of veneers, I have discovered a novel principle of drying that may advantageously be employed with veneers in general. Since this principle is adapted both to the drying of veneers as such and to the forming of laminated products, the present invention or discovery may be said to have for its object a simple and novel method of drying veneers or simultaneously drying them and bonding them to other members to produce laminated panels or other objects.

In accordance with my invention or discovery, the veneer to be dried, or to be dried and bonded to something else, is taken in such a state or condition that its moisture content comprises at least a large part of the maximum amount of moisture that may be present in hygroscopic form and, preferably, free moisture in addition to hygroscopic moisture. It is during the drying out of the hygroscopic moisture that the shrinkage across the grain results, and it is while shrinking that the wood becomes distorted if not restrained from doing so. Therefore, particularly in the case of veneers that may easily be irreparably damaged, such as crotch veneers, in drying, it is desirable that the drying in accordance with my invention or discovery take place shortly after the veneers have been cut, or, at least, before the wood has dried from its original wet state below the point at which shrinkage begins.

If a sheet of veneer can be constrained so that it cannot contract while drying, objectionable distortion is avoided. It is known that in the case of extremely thin veneers, it is possible to bond them in a wet state to a backing of sufficient mass and porosity to absorb the moisture that is driven out of the very thin veneer through the action of heat. Such a process is not applicable to the mere drying of a sheet of veneer nor to the forming of laminated material having a facing or facings of veneer whose thickness is as great as one-twenty-eighth of an inch, which is the most common thickness in facing veneers; and, heretofore, thick veneers have generally been dried in roller driers or chain driers. Even when the drying be done between flat platens or hot plates, these must be separated from time to time during the drying process, to permit the

steam to escape. This latter process is not only slow and costly but, during the open periods of the press, leaves the veneers unrestrained and allows them to contract. When the drying in a hot press is concurrent with a bonding operation to produce plywood, the contraction that takes place during the open periods of the press causes splitting of the facings.

I have found that I can place a piece of veneer to be dried or such a piece of veneer and any desired number of additional laminae, in a hot press, leave the press closed for a period of time that often need not be more than one-tenth as great as the time required for the old methods, and be able to remove the product in a satisfactorily dried and flat condition. Not only that, but even a two-ply material thus made possesses permanently a characteristic of flatness not approached by similar materials manufactured by ordinary methods. In order that the veneer may breathe and the steam escape therefrom while the press is closed upon the same, special means must be provided. The platen of the press in contact with the veneer to be dried may have substantial passages through the same for carrying away the steam, or I may employ a caul engaged with the veneers and composed of material sufficiently strong and rigid to insure against distortion that would close the passages for the exit of the steam under the pressures to which the work is subjected. Furthermore, the caul or other ventilating member engaging the veneer must be of a type that will not mar the surface of the veneer. I have found that wire screens of fine mesh, say, from fifty to one hundred per inch form satisfactory cauls. When a press is closed upon work covered with such a screen, the latter not only retains its shape, so as to provide closely spaced openings distributed across the entire length and breadth thereof, through which steam may flow, but the wires are pressed a little into the surface of the veneer. The pressing of the wires of a screen into the face of the veneer produces indentations which are so small as to be hardly visible. If desired, all traces of the indentations may afterwards be removed by a light sanding.

Where the steam is required to escape through a platen of a press, the platen, whether it be a permanent part of the press or a loose plate, need only have numerous deep, narrow grooves, extending entirely across one dimension of the same, cut into the same. The grooves may, for example, be about one one-hundredth of an inch wide, about one one-thirty-second of an inch

deep, and be spaced about one eighth of an inch apart. With such an arrangement, more than ninety percent of the area of the original flat face of the platen is left for contact with the face of the veneer, and the little ridges that are formed where the wood presses into the grooves, are more easily sanded away than are the little protuberances caused by a wire screen. Of course, a grooved platen and a wire screen or perforated plate may be employed together. In that case, the screen may be much finer because, if it should become completely embedded in the wood, the steam can still escape through the grooves in the platen.

A very important, unexpected effect was found to result from the indentation of the veneer by the caul or the grooved platen. Upon the removal from the press of a piece of veneer dried in this way, its characteristics are seen to be quite different from veneer dried in any of the usual ways; the veneer being limp, so that it may be rolled up and, upon being again unrolled, then or at some time in the distant future, lying flat when placed on a flat surface. The reason for this change in the character of the veneer is that by preventing the veneer from contracting, while drying, and thus, in effect, stretching it, the veneer is stressed beyond the elastic limit. The gripping of the veneer at fifty or more points in every inch of its width by the screen, or over almost its entire surface area by the grooved platen, localizes all ruptures within an extremely narrow area, and no wide cracks, spaced at considerable distances apart, can appear. As a result, the final structure of the dried veneer is one that is filled with tiny fissures so minute as to be invisible to the naked eye. A sheet of face veneer that has been thus disrupted, thereafter remains limp and will not be damaged in bonding it to a flat surface as in the case, for example, of crotch veneers and the like, dried in the usual way. Where the veneer is bonded to another member during the process of drying, it, also, has lost most of its capacity to exert a warping influence on such member and, therefore, even a two-ply material remains substantially flat if the ply or lamina to which the veneer was bonded, while drying, is of a character to permit it.

Not only is the veneer substantially as wide after drying as it was in its original wet state, but it has largely lost its capacity to change substantially in width under subsequent changes in its moisture content. Therefore, it is practically inert under varying moisture conditions that cause a very considerable expansion and contraction of ordinary veneers. This characteristic adapts my improved veneer to the production of a new and improved type of laminated material in which any number or all of the plies are unaffected by moisture conditions; and which thus not only remain flat but free from objectionable internal stresses.

I have discovered, further, that if my improved veneer is subjected to a subsequent wetting and is then again dried in the same way as before, a further diminution of its capacity to expand and contract under changes in moisture content occurs. In fact, by so processing veneer two or three times, there can finally be obtained a veneer which has an oven dry width the same as its original wet width.

For most purposes a single drying is sufficient since the capacity to shrink is thus caused to be so much less than in the case of air dried

or oven dried wood of the same species. In Technical Bulletin No. 279 of the Department of Agriculture, the tangential shrinkage of black walnut from the green to the oven dry state is shown to be 7.1% and the radial shrinkage 5.3%. In the case of white oak the corresponding percentages are 9% and 5.3%, respectively. For both of these woods, dried in accordance with my new process, the tangential shrinkage has been reduced to 1.5% or less.

Since my improved process eliminates most of the shrinkage heretofore deemed unavoidable in the drying of veneer by previous commercial processes, one of the objects of my invention or discovery may be said to be to dry wood veneer in such a manner that, in effect, a substantially greater amount of veneer is obtained than has heretofore been the case.

Also, because of the novel characteristics possessed by plywood made from or containing my improved veneers, the present invention or discovery may be said to have for its object to produce a new type of wood-faced laminated material having valuable, novel characteristics.

I have illustrated my invention or discovery more or less diagrammatically in the accompanying drawing, wherein: Figure 1 is a plan view showing a fragment of an assembly for a two-ply material, together with an overlying caul, sections being broken away to disclose the various layers; Fig. 2 is a section through a press closed on an assembly such as illustrated in Fig. 1, the section being taken at right angles to the plane of the sheet of veneer; Fig. 3 is a view similar to Fig. 2, showing a somewhat different caul and a thick backing lamina or ply instead of the thin one appearing in Fig. 2; and Fig. 4 is a view similar to Fig. 3, illustrating the method of making a three-ply panel while drying the two face plies; and Fig. 5 is an elevational view of a fragment of the panel of Fig. 4, broken away to disclose the various wood and glue layers.

In Figs. 1 and 2, 1 represents a sheet of tough paper coated with an adhesive layer 2 that is adapted to form a bond under heat and pressure. With the element 1 and its glue coating in a dry state, there is laid upon the coating a sheet 3 of wood veneer which still contains all of its original hygroscopic moisture or, at least, a substantial part thereof which it is desired to eliminate. In fact, the veneer may be in the same wet state at which it left the log. On top of the sheet of veneer is placed a caul A, illustrated as being in the form of a wire screen of fine mesh. I prefer that the mesh shall be from fifty to one hundred to the inch, a good working size being about eighty mesh to the inch, although these are not to be regarded as absolute limits. The assembly is laid on the lower platens of a hot press B, and the upper platen C is then lowered and the requisite pressure applied. With the hot press at the temperature usual in bonding veneers by the hot process, the press need remain closed only a minute or so in order to dry a sheet of one-twenty-eighth inch veneer and bond it to the backing. The caul is so open that the steam created by the heating of the moisture in the veneer escapes freely.

In Fig. 3 the backing ply or lamina 4 is shown as being a piece of veneer somewhat thicker than the sheet 3, this backing ply or lamina being dry. It is necessary, for successful commercial operation, that a thick bore or backing member be as dry as the dry wood of commerce usually is, or even drier, at the beginning of a bonding op-

eration. This is for the reason that such a backing or core member is able to absorb some of the moisture that originally was contained in the wet facing layer. If the backing member or core were also wet, it would be impracticable to bond a wet facing layer to the same and dry the latter until very little moisture remains, because that would mean that the backing or core member would also have to be dried to the same point of dryness. The grain of the wood in both of the plies 3 and 4 may extend in the same general direction and yet permit the panel to remain flat under changes in its moisture content at any time subsequent to leaving the press.

In Fig. 3 I have illustrated a variation in the caul device. In this arrangement I employ, in addition to the wire mesh A, a metal sheet D containing perforations *d* closely spaced and distributed across the length and breadth of the sheet. The member D rests upon the veneer, while the wire mesh overlies the perforated metal sheet. In this arrangement the solid portions of the sheet D, between the holes, are the elements that embed themselves slightly in the face of the veneer when pressure is applied. The plate D affords definite chimneys or vents for the steam, and insures that there will be no clogging of the vent passages in the wire screen due to the wood pushing up around the wires.

In Fig. 4 there is illustrated an assembly for the making of a three-ply panel comprising a central core 5, coated on both sides with dry glue, as indicated at 6 and 7. In addition to the veneer ply 3, there is on the other side of the core a facing ply 8. Assuming that both plies 3 and 8 require drying, the caul A may be laid on the veneer 3, as before, and another, similar caul, be placed underneath the veneer 8. When such an assembly is placed in the hot press and the latter is closed, the three plies are bonded together and the steam evolved by each facing veneer escapes through the adjacent caul. However, instead of using the means shown in Figs. 1 and 3 to permit the steam to escape while holding the veneers against contraction, the press of Fig. 4 is shown as being provided with platens E and F the working face of each of which is filled with numerous tiny grooves G extending entirely across the platen from one edge to the opposite edge. These grooves need not be more than one one-hundredth of an inch wide, a thirty-second of an inch deep and be spaced apart from each other about an eighth of an inch. While the grooves are tiny, they constitute channels of ample size to carry away the steam as rapidly as it is generated. In fact, the grooved platen is more efficient than the screen in that the latter may embed itself entirely in the wood under heavy pressure and thus cause the veneer to bear against the flat face of the platen and thus seal the outlets for the steam. However, screens may be employed along with grooved platens because the channels in the latter permit the passage of steam even though the screens become embedded in the wood.

Heretofore, the adhesive has been referred to as being a coating or coatings; but, obviously the adhesive may be employed in sheet form. Thus the adhesive layer may in each instance comprise a thin sheet of tissue paper impregnated with synthetic resin or other suitable adhesive material, the sheet being in a dry condition when inserted as part of the assembly.

My invention is not confined to wood veneers alone, since sawn boards of from three-sixteenths

to one quarter of an inch in thickness may be dried or dried and bonded to other members in the manner described above. Furthermore, my improved process is applicable to thin wood slabs or blocks having end grain in the broad faces thereof. In fact, end grain pieces, because many of the ruptures extend entirely through the thickness thereof and thus permit light to pass through the wood when a piece is held up to the light, enable one clearly to see the extent to which the rupturing of the wood is carried by any process. Therefore, where I refer to veneer in the claims, I mean to include thin sawn boards and slabs having end grain in their broad faces. In all cases, whether it be veneer, sawn boards or thin end grain slabs or blocks, the shrinkage from the green state, when drying to an oven dry condition by means of my process, is less than one-half that of the average for the species when drying in the free state from the green to the oven dry condition.

Whereas veneer may shrink as much as nine or ten percent in width, in drying from a wet state to an oven dry condition or one in which the moisture content is only a few percent, veneer dried in accordance with my invention may lose not more than one or two percent in width. One result of this is to obtain more square feet of oven dry veneer from a given quantity of green veneer than has been possible under old commercial drying methods. Repeated wettings, alternating with drying, disclose that there is only an insignificant change in width between a state of almost complete dryness and one of saturation, in the case of veneer dried in accordance with my invention.

It should also be noted that the lack of inclination to expand and contract under changes in its moisture content, permit my improved veneer to be employed as a facing for a single-faced panel of metal, plaster or fibrous board material which it has been found almost impossible to keep in a flat condition when faced on one side only with wood veneer having a thickness as great as one-twenty-eighth of an inch.

The thicker materials, say, from one-sixteenth to one-quarter of an inch thick, whether knife cut or sawn, dried in accordance with my process, are very satisfactory for use as floor coverings, because of their inertness under changes in atmospheric humidity.

I claim:

1. The method of making and drying laminated material including a facing lamina of wood veneer: which comprises assembling said wood veneer in a green state, and a much drier lamina, with dry glue interposed between the same; pressing the laminae together in such a manner that pressure is imposed on the face of the veneer at numerous spaced small areas distributed over said face, while the remaining areas of the said face remain exposed; and heating the assembly to cause the laminae to become bonded together and any desired part of the moisture in the veneer to be converted into steam and escape in part at the exposed areas in the veneer face and in part into said drier lamina.

2. The method of making and drying laminated material including two facing laminae of wood veneer and a much thicker core lamina: which comprises drying the core lamina, assembling said wood veneers while they contain at least the greater part of the hygroscopic moisture which they have the capacity to hold, and the dry core lamina, with glue interposed between the same;

pressing the laminae together in such a manner that pressure is imposed on the exposed face of each veneer lamina at numerous closely spaced small areas while the remaining areas of the said faces remain exposed; and heating the assembly to cause the laminae to become bonded together and any desired part of the moisture in the veneer to be converted into steam and escape in part at the exposed areas in the veneer faces and in part into the core lamina.

3. The method of making and drying plywood including two facing laminae of wood veneer and a much thicker core: which comprises assembling said wood veneers in a green state and a much drier core, with glue interposed between the core and the veneers; pressing the assembly together in such a manner that pressure is imposed on the exposed face of each veneer lamina at closely spaced small areas distributed across the length and breadth thereof, while the remaining areas of the said faces remain exposed; and heating the assembly to cause the laminae to become bonded together and any desired part of the moisture in the veneer to be converted into steam and escape in part at the exposed areas in the veneer faces and in part into the core.

4. The method of making and drying laminated material including a wood core lamina and a much thinner facing lamina of wood veneer: which comprises drying the core lamina, assembling said wood veneer containing at least the greater part of the hygroscopic moisture that it has the capacity to hold, and the dry core member, with glue interposed between the same; applying pressure and heat to the assembly to bond the laminae together and dry the veneer;

and preventing contraction of the veneer, while drying, by holding the face thereof at closely spaced parallel long narrow areas distributed across one dimension of said face and each extending entirely across another dimension transverse to the first and leaving the remainder of said face exposed to atmosphere.

5. The method of making and drying laminated material including a facing lamina of wood veneer: which comprises assembling said wood veneer while it retains at least the greater part of the hygroscopic moisture which it has the capacity to hold, and a much drier lamina, with glue interposed between the same; placing on the veneer a rigid member contacting the veneer over about ninety percent of its face and leaving the remainder of the face, disposed in small areas distributed over said face, exposed to atmosphere; and applying heat and pressure to the assembly.

6. The method of making laminated material including a face lamina of wood veneer: which comprises assembling said wood veneer while it retains at least the greater part of the hygroscopic moisture which it has the capacity to hold, and a much drier, thicker lamina, with glue interposed between the same; placing on the veneer a rigid member having in a smooth face thereof relatively deep grooves about one one-hundredth of an inch wide distributed with wide spacings between them over one dimension of said rigid member and extending entirely across another dimension of said rigid member, transverse to the face; and applying heat and pressure to the assembly.

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