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METHOD OF MAKING MASKED LIGNOCELLULOSIC MATERIAL

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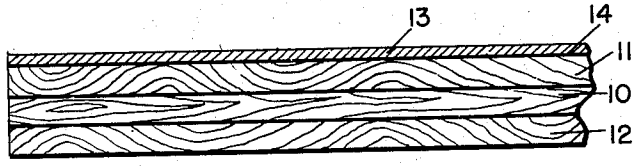


Fig 1

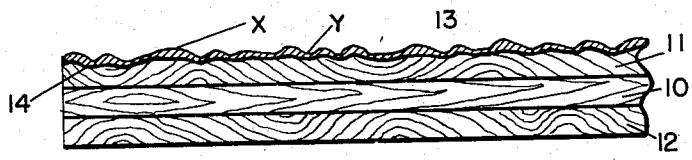


Fig 2

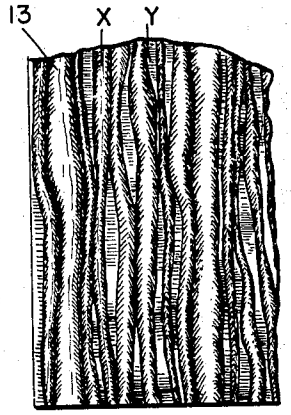


Fig 3

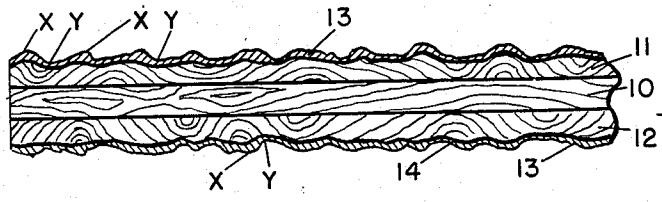


Fig 4

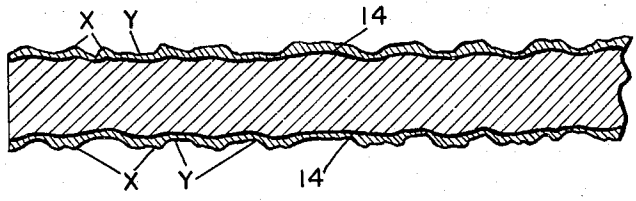


Fig 5

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METHOD OF MAKING MASKED LIGNOCELLULOSIC MATERIAL

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1 Claim. (Cl. 154—106)

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This invention relates in general to the manufacture of an improved board, the body of which is formed of forest material such as wood, or woody or lignocellulosic fibers, and at least one face of which is required to be provided with a special masking.

More specifically this invention relates to an improved composite product comprising an outer sheet of cellulosic material applied to and combined with a board or base of woody material or lignocellulosic material, particularly plywood.

The application of resin-containing paper to the face of plywood, in the form of what is known as plywood "overlay," has recently come into consideration as a practical means of enabling poorer grades of plywood to be employed. It has been known that resin-containing paper can be made and bonded to plywood in order to provide an improved surfacing capable, for example, of offering greater water-proofness or greater resistance to abrasion or a more satisfactory surface for painting or similar treatment.

However, heretofore it has not been possible, even with heavy resin-containing "overlay" paper, entirely to cover up or mask surface irregularities, grain rise, or other natural but undesirable defects. Particularly is this true where patches or plugs are made in the plywood, this being customary procedure where knots or pitch pockets occur. Painting the surface of "overlay" may cover up discolorations of the underlying plywood surface, which would otherwise show through the "overlay," and paint will also generally cover any discoloring marks which may inadvertently be present in the "overlay" paper itself, but not even painting of the "overlay" will completely mask the surface irregularities in the plywood such as those above mentioned.

An object of the present invention is to provide an improved masking for such material as plywood, through the medium of which masking any and all surface irregularities and all other undesirable characteristics, which would otherwise be apparent, will be completely hidden or obliterated.

A related object of the invention is to provide an improved masked product, as a component of which low-grade plywood, and plywood which might otherwise be rejected, can be utilized.

Another and specific object of the invention is to provide an improved method of "overlaying" or masking plywood or other boards of lignocellulosic material which will produce a novel, attractive, durable and completely finished surface, entirely free from all trace of any irregularities in the underlying plywood or base.

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A further object of the invention is to provide an improved masked lignocellulosic board which can be advantageously employed in any of the uses for which plywood or plywood with an "overlay" can be employed.

A still further object of the invention is to provide an improved masked board which will be practical and inexpensive to produce, which will possess a surface durability at least equal to any low density plywood "overlay" previously developed.

A difficulty heretofore which has been encountered when a more or less rigid sheet is applied to a comparatively rough, irregular or uneven plywood surface as an "overlay" is that there may not be a complete bonding of the "overlay" and plywood inasmuch as the pressure exerted when the "overlay" is secured to the plywood is greatest on the high surface spots and may result in bridging the high surface spots or insufficient bonding at the low surface spots. An additional object of the present invention is to prevent any such possibility by providing a strong permanent bond between the plywood and "overlay" over every portion of the covered surface regardless of surface irregularities.

Another object of the invention is to provide an improved unique masked lignocellulosic board of the type above indicated which will afford opportunities for various decorative effects.

The attainment of these objects and other advantages will be explained in the course of the following description of our invention and of a preferred method of practicing the same.

Briefly, in carrying out our invention with the masking of a plywood surface, we employ a resin-containing cellulosic sheet—for example heavy paper, treated with resin in such manner that the paper will remain hard surfaced and tough throughout, and opaque to a considerable degree although finally subjected to a temperature higher than the curing temperature of the resin. This sheet is bonded to the surface of the plywood, and then, either as part of the bonding operation or subsequent thereto, the sheet and covered plywood surface together are subjected to a heavy embossing treatment involving the simultaneous application of embossing pressure and heat. The embossing treatment molds the surface to conform to the desired pattern presented by the embossing elements and any previous surface irregularities are dispensed by the surface embossing molding. The temperature to

which the surface is momentarily subjected results in color effects in the resin-containing sheet, the nature of which will be later explained. The final result is a hard, permanent resin-containing heavily embossed and irregularly colored surface, presenting an attractive finished appearance, the embossing and coloring combining to provide a complete masking of the previous surface of the plywood, while the cured resin causes the composite finished product to have a considerably tougher and harder surface than that of the plywood itself.

The resin-containing cellulosic sheet may be fabricated in several ways. The resin treatment should meet three requirements—namely, there should be a sufficient concentration of the resin on the surface of the final sheet to produce the necessary hard, tough, abrasion-resisting surface; the body of the sheet must have and must retain sufficient resin to prevent any delamination or splitting of the sheet within its center; and the total amount of resin used for treatment of the sheet should not be so excessive as to render the sheet needlessly expensive. Also the resin and resin treatment employed should not be such as to reduce the degree of opacity in the sheet.

One method of producing such a resin-containing sheet involves the application of resin at two intervals in the making of the sheet. Water insoluble resin is first introduced into the beater furnish and later after calendering of the sheet further resin is applied in the form of a coating of water-soluble resin. Or the web, after leaving the press rolls and preliminary driers, may be passed through a tank containing a solution of water-soluble resin and subsequently, after a calendering operation, the sheet is given a coating of water-soluble resin. Such applications of resin at two intervals in the making of a sheet are described in U. S. Patent No. 2,497,712, issued February 14, 1950, to R. J. Auchter, entitled "Process of Manufacturing a Fibrous Sheet Covered Plywood."

While a sheet treated with resin according to the method of the above mentioned Patent No. 2,497,712 may be used in carrying out our invention, we prefer to introduce the resin only into the beater furnish. This can be done satisfactorily by using a resin of the phenol-formaldehyde type and having the same precipiated on and retained by the fibers. For this purpose it is necessary that the resin be characterized by a high formaldehyde-phenol ratio with a sodium content of from 1½% to 3% in the mixture. The pH of the liquid resin should be from 8 to 9.5. The resin is then precipitated on the fibers in the slurry by lowering the pH to 4 or 4.5 (this may be done, for example, by adding alum or a mixture of alum and sulphuric acid, or by adding acetic acid or phosphoric acid). A resin which we have found very satisfactory to use is a resin manufactured by the Snyder Chemical Corporation of Bethel, Connecticut, under the designation "Synco 721." Another is a resin manufactured by the American-Marietta Co. of Chicago, Illinois, and known by the designation "Amres 4971."

The further heating to which the sheet is subjected in the driers solidifies the resin but without curing it. A satisfactory sheet for the carrying out of our invention may be composed of 85% standard chemical or sulfite pulp and 15% groundwood pulp. Preferably the basis weight of the final sheet itself will be from 200 to 225 pounds per ream of 3000 square feet and the amount of

resin content should be approximately 20% of this basis weight.

Assuming that our invention is to be employed in the masking of a plywood panel, the resin-containing sheet is glued to the face of the panel by a conventional resin glue, preferably using approximately five pounds of resin glue per 1000 square feet. A resin glue satisfactory for this purpose is a phenol-formaldehyde resin glue manufactured by the American-Marietta Co. under the designation "Amres 1400."

The plywood panel and attached sheet are then placed in a heated press and subjected to a pressure of approximately 200 pounds per square inch at a temperature of approximately 300° F. and held under such pressure and temperature for about seven minutes. This results in partial curing of the resin in the sheet and a curing of the resin glue. The covered plywood surface is then ready for the final step in our process.

The final step consists in subjecting the covered face or surface to a special embossing treatment. This may be accomplished by passing the panel under a heated embossing roll. The embossing of course requires greater pressure than the 200 pounds per square inch employed in pressing the sheet to the wood face, and the pressure required will depend to some extent upon the depth of the maximum indentations or striations of the embossing pattern presented by the embossing roll. The valleys in the embossed pattern or design must be of sufficient depth so that any previous surface irregularities in the board will be completely eliminated in the embossing or molding of the masked face. The depth of the valleys will be at least equal to the thickness of the masking paper and, as illustrated in the drawings, will generally be deeper than the thickness of the overlay paper.

The temperature under which the embossing is performed, that is to say, the surface heat of the embossing roll, is important. In the preferred form in which we carry out our invention, thus with the resin treated sheet previously described, we have the surface temperature of the embossing roll approximately 600° F. and pass the covered plywood under the embossing roll at a speed of 30–35 feet per minute. This temperature is considerably greater than the previous temperature (300° F.) to which the resin is subjected in the press, so that the resin softens to permit molding. Such a temperature of 600° F. would be high enough to cause scorching of the paper sheet if the sheet had no excess resin. However, due to the resin on and in the sheet, no scorching occurs at this high temperature of 600° F. at the speed (30 to 35 feet per minute) at which the sheet and underlying panel pass under the embossing medium. One effect of the heat on the resin is to produce some discoloration of the resin and thus of the sheet. This discoloration is greatest in the valleys or depressions on the embossed design, thus making a color contrast between ridges and valleys in the finished embossed surface causing the embossed design to stand out more clearly and adding to the attractiveness or appearance of the surface of the final product.

In the accompanying drawings which illustrate the invention in part—

Fig. 1 is an enlarged fragmentary cross-sectional view of a plywood panel with a resin-containing sheet secured on one face of the same preparatory to the final embossing;

Fig. 2 is a corresponding cross-sectional view

of the same panel after the embossing has taken place;

Fig. 3 is a top plan view of the embossed surface;

Fig. 4 is an enlarged fragmentary cross-sectional view of a similar plywood panel with both faces finished or masked in accordance with our invention; and

Fig. 5 is an enlarged fragmentary cross-sectional view of a composite fiber board having its faces finished in accordance with the invention.

In Figs. 1 and 2 the plywood panel comprises a core layer 10 with outer or veneer layers 11 and 12 secured to the opposite sides of the core by suitable adhesive and in the well known manner. The masking sheet 13 of resin-containing paper is attached to the top face of the plywood panel by the resin glue coating 14, as shown in Fig. 1, the heat pressure treatment, previously described, causing the masking sheet 13 to become firmly secured to the underlying wood surface with the heat producing the initial and partial curing of the resin in the masked sheet and also a curing of the resin in the adhesive 14. The covered panel is then passed under a heated embossing roll causing ridges x and valleys or striations y of a desired embossing design, to be impressed into the masked sheet 13 and into the underlying wood layer 11.

The heat and pressure of the embossing roll not only cause the resin to flow in the surface but also produce some discoloration or darkening of the resin in the sheet 13. The coloring in the valleys or striations y will be darker than that of the ridges x due to the fact that the valley or striation portions have more and longer contact with the heated embossing roll and are subjected to greater heat and pressure than the ridge portions. Thus the contrast between the ridges and valleys will be intensified in appearance, as indicated in Fig. 3, giving a very pleasing effect to the finished surface and producing a more complete masking of the original face of the plywood panel.

The extent of discoloration produced by the embossing will depend upon the degree of the heat in the embossing roll or other embossing means employed, and of course care must be taken not to have the heat so intense that a burning of the resin and a corresponding scorching of the resin sheet would occur, as this would not only make the surface too dark but the masked sheet would then be brittle and not durable. For a less pronounced color effect the surface temperature of the embossing roll should be less than the suggested 600° F., but in any event must be higher than the temperature (300° F.) at which the initial and partial curing of the resin was accomplished, otherwise the embossing may produce some cracks in the sheet along the ridges of the embossed surface since the resin would not soften and be molded.

The speed at which the covered plywood passes under the embossing roll and the surface temperature of the embossing roll of course have an important relationship. Thus if the speed were very much slower than the suggested 30 to 35 feet per minute, a surface temperature of 600° F. of the embossing roll could scorch the resin sheet, while if the speed were considerably greater than 30 to 35 feet per minute a higher surface temperature than 600° F. not only would not scorch the sheet but would be necessary to produce a result comparable to the result obtained with the speed and temperature suggested. The speed and temperature mentioned are mentioned as a preferred example because we have found this to be practical and very satisfactory. However, it is to be understood that many variations may be made within reason and satisfactory results obtained.

In many instances it is desirable to mask both faces of a plywood panel or other lignocellulosic product, and in such case a resin-containing sheet is secured to both faces of the panel and the rolls through which the panel is then passed are both embossing rolls and both are heated to the same desired surface temperature. Fig. 4 illustrates a plywood panel on which the masking of both faces is done similarly and simultaneously.

While our invention probably has its greatest utility in the masking of plywood, a similar masking can of course be carried out with boards other than those of wood veneer. Fig. 5 illustrates a composite fiber board, both faces of which are masked in accordance with our invention. The masked surface is more durable, as well as more attractive in appearance, than the ordinary surfaces of composite fiber boards.

Our invention could be carried out to a certain extent with modifications. Instead of a special resin-containing sheet, ordinary heavy kraft paper could be used for masking. In such case the paper is secured to the underlying surface similarly by a resin glue (preferably a phenol-formaldehyde resin glue). While some of the resin from the glue would then penetrate into the masking paper the amount, if any, of resin which reached the outer face of the paper would be insufficient to produce a tough, durable surface which would generally be preferred. The resulting soft surface would produce good masking, but the embossing could be done only with a very moderate temperature and the color marking of the embossing would not be obtained.

Durable masking with a resin-containing sheet would of course be possible with embossing and without any discoloration by dispensing with most of the heat from the embossing rolls. However, such a mask would not in extreme cases cover up all color marks in the underlying wood. For a complete and perfect masking surface we have found that both the color contrast in the embossing as well as the changing of the surface contour by the embossing are necessary and desirable.

It would be possible in the carrying out of our invention, to eliminate the placing of the panel and masking sheet first in a heated press for partial curing of the resin prior to the final embossing. Thus, when the masking sheet has been attached to the panel with a layer of resin glue, the panel and sheet can be passed directly under the heated embossing roll. However, we consider that the more satisfactory procedure is to have partial curing of the resin under a heated press take place prior to the embossing, since greater uniformity of the characteristics of the finished surface will then be assured.

The embossing could of course be done with other means than embossing rolls, for example, by heated transfer molds or cauls. The use of embossing rolls however we believe to be simpler and more practical.

Although we prefer to use a phenol-formaldehyde resin for treating the paper or cellulosic sheet, our invention can also be carried out with urea-formaldehyde resin. For example, we have used paper made from a pulp furnish of 70% sulfite and 30% groundwood and treated with urea-formaldehyde resin. The particular urea-

formaldehyde resin which we have used for this purpose is made by Hercules Powder Company of Wilmington, Delaware, and is known under the trade name of "Hercules 138." We added this urea-formaldehyde resin to the pulp furnish in the beater, allowing 15 pounds of the resin for each 85 pounds of pulp. Sufficient alum was added to lower the pH to 4.5. A paper sheet weighing 200 pounds per ream totaling 3000 square feet was formed and dried in the conventional manner. The dried resin-containing paper was glued to the surface of plywood to be masked. We used phenol-formaldehyde glue, allowing five pounds of glue per 1000 square feet. The covered plywood was placed in a heated platen press and pressed at approximately 200 pounds per square inch and at a surface temperature of 300° F. for about 7 minutes, thus in the same manner as previously described for a phenol-formaldehyde resin-containing paper, and the covered plywood panel was then embossed also in the same manner.

The resulting embossed surface, when the urea-formaldehyde resin is thus used for treating the paper, will be found to be lighter in color than when paper treated with phenol-formaldehyde resin is employed. But while the embossed final product presents a surface having a hardness similar to that attained with the paper treated with phenol-formaldehyde resin, the surface does not have the same water resistance. Thus we have found that the use of urea-formaldehyde resin for treating the paper in the carrying out of our invention does not produce a product which would have sufficient weather resistance to be entirely satisfactory for use out-of-doors.

We claim:

The method of manufacturing an improved masked board, which method comprises covering a face of a plywood panel with a sheet of paper

treated with a phenol-formaldehyde resin, the amount of said resin in said sheet being not less than approximately 20% of the weight of the finished sheet, the resin having been precipitated on the fibers in the sheet in the making of the sheet, using a phenol-formaldehyde resin glue for attaching said sheet to said face of said plywood panel, placing said plywood panel in a heated press under a pressure of approximately 200 pounds per square inch at a temperature of approximately 300° F. for about 7 minutes in order to effect partial curing of the resin in said sheet and a curing of the resin in said glue, and molding said covered plywood panel face into a design pattern by passing the same under a heated embossing roll having a surface heat of approximately 600° F. at a speed of 30 to 35 feet per minute and under pressure of at least 400 pounds per square inch, whereby the resin in the valleys in said molded design will be darker in color than the ridges in said design without causing a scorching of said sheet, and thereby providing a better masking for said plywood face.

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RUSSELL V. HARKEMA.

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