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METHOD OF MAKING PRESSED DECORATIVE LIGNOCELLULOSIC PRODUCTS

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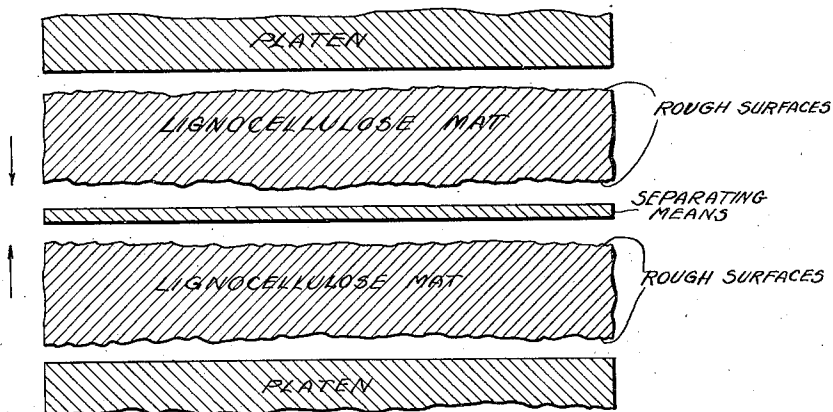


Fig. 1

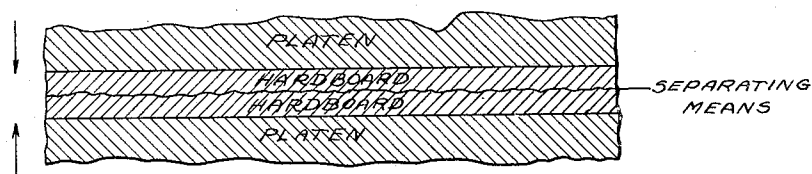


Fig. 2

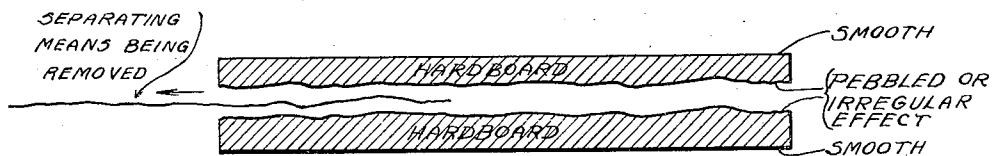


Fig. 3

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METHOD OF MAKING PRESSED DECORATIVE LIGNOCELLULOSIC PRODUCTS

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14 Claims. (Cl. 18—47.5)

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The present invention relates to a pressed decorative lignocellulosic product, preferably in the form of large sheets of the nature of what has come to be known in commerce as "hardboard," which has been provided, by a process herein described, with a pleasing decorative surface.

It has already been proposed to produce large sheets, say 4 x 12 feet, of compressed dense lignocellulosic material by a process which involves the application to a mass of substantially dry lignocellulosic material of sufficient pressure to consolidate the same to a density of about 1 or more, the process being carried out at temperatures between 350° and about 550° F. Preferably such a process was carried out at about 465° to 475° F., with a pressure of from 1000 to 2500 pounds per square inch, using, as a blank, light porous sheets of lignocellulosic fiber of the kind commonly known as insulation boards, and which have been made on either a Fourdrinier wire or an Oliver board former, and then, prior to pressing, dried down to a moisture content of about 1 or 2%, or even to bone dryness.

In the production of such boards, pressing members or platens or caul plates have been used, which have smooth surfaces, with the result that the boards produced likewise have smooth and light-reflective surfaces. For many purposes such boards are of course highly desirable.

However, it has been discovered by the present inventor that a modification of the surface of such boards is possible by a method which involves using the inherent surface characteristics of the blanks themselves to produce a decorative surface on the pressed product.

When one considers that a mass of fibers from which an insulating board is made differs in length and degree of compressibility, it will be evident that if two such boards are placed in surface contact with each other and are then compressed under the conditions of heat and pressure above enumerated, there will be some tendency for the two boards to adhere to each other. However, it has been found in actual practice that such boards do not readily adhere to each other, but rather that the surface characteristics, that is to say, the hills and valleys of the surfaces, will tend to reproduce themselves upon whatever it is they are pressed against, provided that the pressing member is soft enough to take the impression of the insulating board. Of course when a rigid and non-resisting steel platen or caul plate is used, this will smooth out the imperfections and leave a smooth surface. Consider, however, what takes place if two insulation boards were pressed in contact with each other and were then subjected to hydraulic pressure within the temperature stated, and then removed from the press and separated. It will be found that the higher parts of the one blank will have made correspond-

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ing mirrored indentations on the other board, while the low spots of one board will have permitted some of the material from the opposite board to extend thereto. The result will therefore be a composite effect in which the face of each blank will be, as it were, mirrored in the opposing board. The over-all effect will be a pebbly appearance closely resembling the surface of grained leather.

It is, of course, desirable under these conditions to prevent any possible adhesion between the two boards or other blanks, and for this purpose some means of preventing such adhesion must be employed.

It is therefore one of the objects of the invention to produce compressed lignocellulosic products having a pebbly or varying decorative surface by a process which involves pressing two blanks together with some intervening or intermediate material of a nature which is inert to the lignocellulosic material, and which also will not adhere thereto under the conditions of operation.

A further object of the invention is to produce a laminated lignocellulosic product, as, for example, from sheets of lignocellulosic material such as paper, which have been caused to adhere to each other so as to build up a laminated structure consisting of a plurality of layers, but the outside surfaces of which have the characteristic markings of the present invention; this being accomplished by preventing the adhesion between certain of the laminations so that eventually the assembly can be taken apart to form a plurality of laminated products provided at least on their contacting surfaces with the decorative effect above mentioned.

Further objects of the invention are to produce compressed lignocellulosic products, the surfaces of which are provided with the replicas of intermediate sheets placed therebetween, which themselves have some desired surface characteristic or marking, such, for example, as canvas, linen, or other decorative effect.

Other objects of the invention will become apparent from the further description and claims hereinbelow.

The principles of the present invention are illustrated in a single sheet of drawings containing three figures, in which

Fig. 1 is a more or less diagrammatic sectional elevational view of two sheets or mats of loosely compacted lignocellulosic fiber with separating means therebetween, with sections of hydraulic means operated platens which, as indicated by the arrows, are about to compress the assembled material, which is shown in a sort of "exploded" view;

Fig. 2 illustrates the results of the operation shown in Fig. 1, with hardboards formed, but still

separated by the separating means, and while still under pressure; and

Fig. 3 illustrates the two resulting hardboards, while the separating means are shown as being withdrawn.

Suitable legends direct attention to conditions that would not be otherwise visible in the drawing.

The invention is based upon recognition of the fact that if two sheets of lignocellulosic material, for example, two sheets of paper, are subjected to pressure within the temperature range of from 350° to 550° F., and a pressure of, say, from 500 to 2500 pounds per square inch, they will be rendered denser and will have developed therein certain decomposition products of the ligneous constituents of the lignocellulosic fiber, but will not adhere to each other by reason of the fact that insufficient binder is developed to effect mutual adhesion between the sheets. However, the surface markings of the one sheet will reproduce themselves upon the other, and vice versa. Self-evidently, the process can be applied to thicker sheets; for instance, starting out with insulating boards of anywhere from ½ inch to 1 inch or more in thickness.

In order to insure the absence of mutual adherence, some intervening material must be placed between the sheets. This may take the form of some thin membrane, sufficiently soft so as not to interfere with the development of the desired effect. Moreover, this membrane must be of a material which is not particularly affected by either the temperature or the pressure, such, for example, as thin metal foil, paper, fabric such as canvas, linen, duct, cotton, twill, and the like. Materials which melt under the conditions of the operation, such as cellulose esters or ethers, should of course be avoided.

It is also possible to employ an intermediate layer or separatory material in discrete particulate form, such, for example, as powdered brick dust, clay, talc, or particularly advantageously, flake mica, that is to say, mica in the form of particles which will just pass, say, through a 40-mesh sieve. These mica particles, having a lamellar structure, will also inherently develop a peculiar effect which, coupled with the inter-penetration of the fibrous material from one surface to the other, but without adhesion, will contribute to a peculiarly pleasing appearance.

Upon separating the materials after pressing, some of the powdered materials may adhere and may then be removed by brushing, or, if desired, may be allowed to remain upon the surface, thus further modifying its appearance. In the case of mica, this will give a rather pretty glinting or glistening effect which is highly decorative and desirable.

The fineness of grinding of the lignocellulosic fiber has a distinct effect upon the appearance of the product. Thus, when working with ground wood pulp or with waste ground wood or paper, the surface will naturally be very fine.

On the other hand, when working with coarsely ground wood fiber such as is commonly employed for the manufacture of insulation board or hardboard, more pronounced fiber effects will be obtained.

As examples of carrying out the present invention, the following are cited:

Example 1

Paper made from what is known as "waste #2 books," and consisting of fine fibered ground wood, was used for this purpose. A number of

sheets of this paper were provided with suitable means to cause the sheets to adhere to each other under heat and pressure. For instance, the sheets were coated with a dilute solution of an acid-reacting material, for instance ferric sulfate, such as is more particularly described in the co-pending application of Willey and Ruthman Serial No. 505,586, filed October 8, 1943. Two sheets of paper coated on both sides with ferric sulfate, and a lower sheet coated on only the inside with ferric sulfate, and a similar outer sheet, were stacked up together. A second similar stack was imposed upon the first so that there would be in the center of the assembly two sheets which had not received the addition of the ferric sulfate or other adhesion-promoting material. The assembled stack was then placed upon the platens of a hydraulic press in which the assembly was compressed at a pressure of 1500 pounds per square inch, and at a temperature of about 470° F. for 1½ minutes, whereafter the pressure was released and the assembly removed from the press. The result was two separate boards each consisting of laminations. Where the two boards had been in contact with each other, the surface had the appearance of grained leather, while the surfaces which had been in contact with the plates of the press were perfectly smooth and polished. Moreover the sheets had adhered to those surfaces to which the ferric sulfate had been applied, but there had been no substantial adhesion between the surfaces of the two boards to which nothing had been applied.

Example 2

In this case the same operation was carried out as in connection with Example 1, except that a very thin film of metal foil (for instance, aluminum, tin, or copper) was placed between the two sheets which had no outer coating on them, in order to be sure to avoid adhesion. It was found that the effect was still apparent although it had been slightly modified due to the presence of the thin intervening metallic sheet.

Moreover, these separatory sheets could be used over again a number of times, provided they were carefully handled.

Example 3

In this case a sheet of glassine paper was placed between the two stacks of laminations in order to avoid any possibility of adhesion between the two sets, and again a very pleasing effect was obtained, the glassine sheet having been somewhat indented by the surface characteristics of both of the surface sheets of paper. Here again it was possible to reuse the separatory sheet a number of times.

Example 4

In this case at least one of the outer sheets of the laminations, that is to say, the ones which were in contact with each other, were dusted with finely powdered mica and then pressed. They readily separated after pressing, and the mica could be removed therefrom by brushing, but left very definite indentations in both sheets by reason of the fact that the mica is harder than the paper. The result was a pebbly grain of very pleasing appearance.

Example 5

Two mats of lignocellulosic fiber in the form of insulating boards about ½ inch thick were dried down to a moisture content of below 2% and then

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superimposed upon each other and pressed between the platens of a hydraulic press. Upon being pressed and then removed from the press, the sheets showed decided tendencies to adhere to each other, but where they did not adhere, a very satisfactory surface effect was obtained. In carrying the example further, however, the insulating blanks had interposed between them a thin sheet of ordinary paper, and were then pressed. Upon removal from the press (the pressing having been carried out at about 1200 pounds pressure at a temperature of 460° F. for 2 minutes), the boards readily separated from each other and from the paper, both of them having a very pleasing appearance, and the paper of course having also received the impression of both of the surfaces of the boards. This paper could be reused, and when this was done the second set of boards had an even more pleasing appearance due to the fact that certain of the characteristic markings which had transferred themselves to the paper had in turn transferred themselves to the surfaces of the two boards. Here again the paper could be used a number of times.

Example 6

Instead of using paper as a separating medium, powdered mica flakes were employed and these were allowed to remain after the boards had been pressed. The effect was highly pleasing by reason of the fact that the light-reflecting properties of the mica particles gave a certain sheen or glisten to the surfaces of the boards. In this example powdered talc was employed as a separating medium, this being afterwards removed as far as possible by means of soft brushes. However, enough of it remained on the depressions to give a sort of mottled or speckled effect, which is very interesting in appearance.

Example 7

In this example anhydrous calcium sulfate (powdered anhydrite) was employed as a separating medium which was afterwards brushed from the pressed sheets. The effect was very similar to that of the talc, but the appearance was slightly dull, which for some purposes and uses would be desirable.

Example 8

In this example two insulating boards, dried down to a moisture content of less than 2%, were pressed between the platens of a hydraulic press with an intermediate sheet of fabric, such as canvas. After passing under the conditions above outlined, the sheets were separated and the canvas removed, and it was found that, in addition to having the effects of the two surfaces upon each other, there was also the effect of the surface characteristics of the canvas weave. The effect was somewhat like that of a fabric, but with additional grain-like markings, which are difficult to describe in language.

Example 9

In this example a coarser fabric, such as burlap, was employed, leaving its characteristic imprint in addition to self-developed surface markings.

Almost any kind of non-reactive, non-melting material can be employed as a separator, such as sand, powdered glass, or other mineral material, provided that this has no tendency to cause adhesion between the sheets which are separated thereby.

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The application of the present invention to more intricate sheets than flat sheets will, of course, be self-evident. Thus engraved plates might be employed as the pressing members themselves to leave their usual and expected markings on the surface of one side of the sheets, while the other side will be provided with the self-formed decorative effect resulting from the pressing of a lignocellulosic surface against another one without adhesion of the two adjacent surfaces to each other as produced by the interposition of some thin separatory material which will not interfere with the production of the decorative effect.

If two different kinds of materials are pressed together, then the effect will of course be different on each sheet. For instance, if the lower sheet consists of insulating board and the upper sheet of laminations of paper made from finely ground stock, the paper will have some of the imprint of the insulating board upon its surface, while the insulating board will have some of the smoothness of the paper imparted to it.

Obviously, therefore, a wide variety of effects is obtainable, depending upon the nature of the two surfaces of lignocellulosic materials which are placed in juxtaposition with each other in the press.

The use of the temperatures and pressures given is merely illustrative and is well within the skill of the art of making densified and consolidated lignocellulosic products, as this art has already developed to a large extent and hardboard has been manufactured in accordance with the general principles of the use of heat and pressure for some time. What is considered new, however, in the present connection is the development of the decorative surface by the employment of the inherently rough surface of the paper or of the lignocellulosic insulation board as a pressing member itself.

While hydraulic presses have been described as the pressing means, it will of course be obvious that suitably heated and suitably sized rollers may be employed for substantially the same effect. Thus two sheets of lignocellulosic materials might be simultaneously placed between large rollers while the material is either heated, using hot rollers, or suitably preheated or heated while passing through the rollers in a suitable manner, provided only that means are taken to prevent adhesion between the two surfaces whose characteristics it is desired to transfer from one to the other.

Therefore, the invention is not to be circumscribed or limited by the exact examples given, but is to be construed within the confines of such limitations only as appear in the hereunto appended claims.

Accordingly applicant claims:

1. Process of producing a dense pressed lignocellulosic product having a decorative surface which comprises interposing between two sheets of a rough-surfaced consolidatable self-supporting lignocellulosic material of relatively low apparent density a thin readily deformable intermediate layer of non-thereto-adherent material, compressing the assembly under sufficient heat and pressure to consolidate and densify the said sheets, and separating the same after such treatment, thereby providing the surfaces thereof, which have been in contact with the intermediate layer, with a decorative surface resulting from the partial transfer of the irregularities of one of said rough surfaces on to the other.

2. Process of producing a dense pressed lignocellulosic product having a decorative surface which comprises interposing between two sheets of a rough-surfaced consolidatable self-supporting lignocellulosic material of relatively low apparent density a thin intermediate readily deformable metal-foil layer, compressing the assembly under sufficient heat and pressure to consolidate and densify the said sheets, and separating the latter from each other and said metal-foil layer after the heat and pressure treatment, thereby providing the surfaces of the product which have been in contact with the intermediate metal-foil layer with a decorative surface resulting from the partial transfer of the irregularities of one of the said rough surfaces on to the other.

3. Process of producing a dense pressed lignocellulosic product having a decorative surface which comprises interposing between two sheets of a rough-surfaced consolidatable self-supporting lignocellulosic material of relatively low apparent density a thin intermediate readily deformable paper layer, compressing the assembly under sufficient heat and pressure to consolidate and densify the said sheets, and separating the latter from each other and said paper layer after the heat and pressure treatment, thereby providing the surfaces of the product which have been in contact with the intermediate paper layer with a decorative surface resulting from the partial transfer of the irregularities of one of said rough surfaces on to the other.

4. Process of producing a dense pressed lignocellulosic product having a decorative surface which comprises interposing between two sheets of rough-surfaced consolidatable self-supporting lignocellulosic material of relatively low apparent density a thin intermediate layer of powdered inorganic material, compressing the assembly under sufficient heat and pressure to consolidate and densify the said sheets, and separating the latter from each other and said layer of powdered inorganic material after the heat and pressure treatment, thereby providing the surfaces of the product which have been in contact with the intermediate layer of powdered inorganic material with a decorative surface resulting from the partial transfer of the irregularities of one of the rough surfaces on to the other plus the irregularities produced by the indentations occasioned by said inorganic material.

5. The process of claim 4 in which the inorganic material is powdered flake mica.

6. The process of claim 4 in which the inert inorganic material is powdered talc.

7. The process of claim 4 in which the inert inorganic material is powdered anhydrous calcium sulfate.

8. Process of producing hardboard having a decorative surface which comprises assembling a laminated structure comprising a light porous blank of rough-surfaced consolidatable lignocellulosic material, a thin sheet of readily deformable material inert to and non-adherent to said lignocellulosic material, and a second porous blank of said lignocellulosic material, compressing the resulting assembly under sufficient heat and pressure to consolidate and densify said blanks into hardboard, and then separating the two hardboards thus produced from the intermediate layer, thereby providing on each of said hardboards a surface having irregularities there-

on produced as the result of the impression thereof from one board on to the other through said intermediate layer.

9. Process of producing hardboard having a decorative surface which comprises applying a thin layer of comminuted inert infusible material upon the surface of a light porous blank of consolidatable lignocellulosic material, laying a second sheet of the same kind of material upon the thus coated surface, and compressing the assembly thus produced under sufficient heat and pressure to reduce both blanks to hardboard, and separating the pressed blanks, whereby the surfaces facing the comminuted material will have a pleasing leather-like surface appearance.

10. The process of claim 9 in which the inert infusible material is powdered flake mica.

11. Process of producing hardboard having a decorative surface which comprises forcing two substantially flat sheets of lignocellulosic material against each other under heat and pressure sufficient to consolidate and densify said material but with a thin inert readily deformable separatory layer between the surfaces thereof to prevent their adhesion to each other, whereby the irregularities in each surface will be reproduced on the other, thereby modifying the surfaces and imparting thereto a pleasing decorative effect.

12. Process of claim 11, in which the separatory layer is an inert pulverulent inorganic substance.

13. The process of claim 11 in which the inert separatory layer is powdered flake mica.

14. The processes of producing decorative hardboard having a species of pebbled finish which comprises forcing two separate rough-surfaced blanks of coherent lignocellulosic material against each other with sufficient pressure and at a sufficiently high temperature to compress and consolidate each of said layers into a hardboard while preventing the bonding of said blanks to each other by interposing between them during the compression step an inert layer of parting material sufficiently thin and deformable to permit the irregular surface characteristics of each of the blanks to be impressed upon the other.

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Certificate of Correction

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GRANT S. WILLEY

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows: Column 3, line 44, for the word "though" read *through*; column 5, line 37, Example 6, for "remained on" read *remained in*; line 55, Example 8, for "passing" read *pressing*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of April, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.