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W. J. RUNCKEL

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METHOD OF MAKING A PAPER COVERED HARDBOARD

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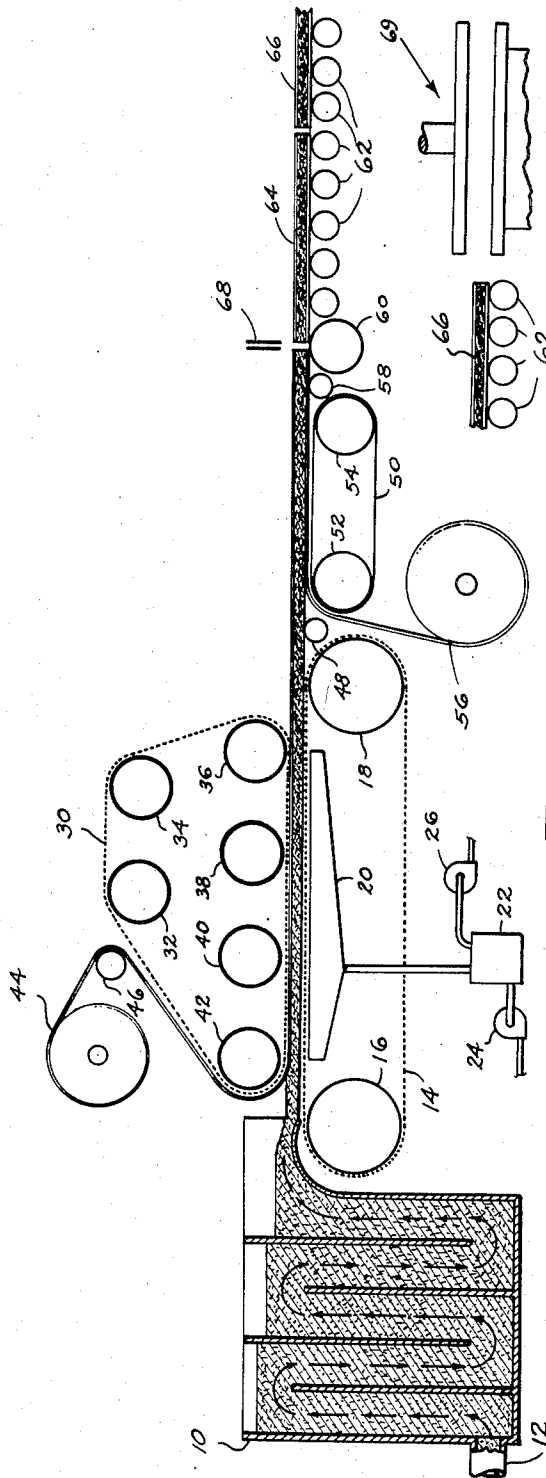


Fig. 1.

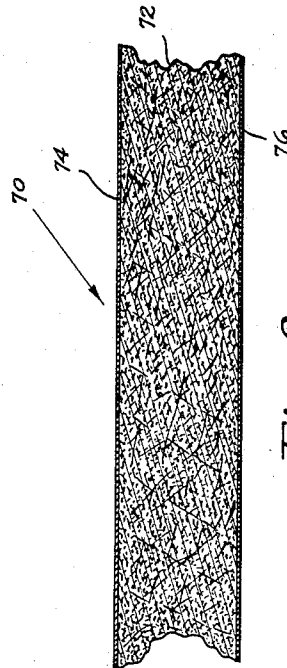


Fig. 2.

INVENTOR.
William J. Runckel
BY *Ernest P. Farley*
Atty.

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METHOD OF MAKING A PAPER COVERED HARDBOARD

William J. Runckel, Hood River, Oreg., assignor to
Oregon Lumber Co., Baker, Oreg., a corporation of
Oregon

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1 Claim. (Cl. 92—39)

This invention relates to a paper covered hardboard product and to the method by which it is produced.

In the wet process of hardboard manufacture wood is defiberized and formed into an aqueous slurry having a consistency of from 1 to 5%. Predetermined proportions of size and extraneous binder may be mixed into the slurry which then is formed into a felt or mat on a travelling screen or Fourdrinier wire. The resulting wet lap then is consolidated by the application of heat and pressure to the desired density, usually a density of from 0.5 to 1.25.

Although the foregoing procedure has been employed for many years, there still remain properties of the resulting hardboard product which might be improved. For example, its surface may be nonuniform in color. Also, the surface color may be so dark as to be undesirable, particularly, if the board is made from a cooked fiber or from a furnish containing a substantial amount of bark.

Since the surface of the board is somewhat permeable, and since the degree of permeability is variable across the surface, most conventional hardboards are not paintable because the paint soaks in at a variable rate depending upon the permeability of the surface. Tempering of the hardboard surface by immersion in a drying oil is not as efficient as it might be since the surface varies in permeability to the oil. Slivers may project from the surface, particularly on the screen side of the board. Spotting may occur during humidification of the pressed board because of the accumulation of water on certain areas of the board surface. The boards may be glued together only with some difficulty because of uneven spreading and penetration of the glue.

I now have discovered that the foregoing and other disadvantages of the prior art procedures for making wet process hardboard may be overcome, and a new hardboard product produced by a method which will be described hereinafter with reference to the drawings, wherein:

Figure 1 is a diagrammatic view in side elevation of apparatus which may be employed in the presently described process, and

Figure 2 is a fragmentary view in side elevation of the presently described hardboard product.

Broadly stated, the hardboard product of the present invention comprises a base of comminuted lignocellulose, preferably defiberized wood, having surface layers of porous paper having a weight of from 3 to 20 pounds per 3000 square feet, the base and the paper surface layers having been consolidated and welded together by the application of heat and pressure. This product is produced by a method, which, broadly stated, comprises forming a slurry of comminuted lignocellulose in water, forming the slurry into a mat, applying to the surface of the mat a porous paper weighing from 3 to 20 pounds per 3000 square feet, the moisture content of the mat and the porous character of the paper cooperating to unite the two adherently, and then hot pressing the resulting assembly to form the finished product.

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The lignocellulose which is employed as a base material may be derived from any suitable source, such as straw, cane, bagasse, wood and the bark of trees. It may be reduced by any suitable means to the form of feltable particles, but preferably is defiberized in conventional apparatus such as the Bauer, MacMillan, Allis-Chalmers or Asplund defibrators. A preferred base material thus comprises defiberized wood of coniferous or deciduous species of trees with or without an added proportion, e. g. from 20 to 50% by weight, dry weight basis, the bark of trees.

The comminuted lignocellulose is formed into an aqueous slurry in any suitable type of apparatus, the slurry having a consistency of from 1 to 5%, usually from 2 to 3%. Suitable proportions of added size and binder may be added to the slurry, although the addition of these constituents is not essential for the purposes of the present invention. Thus from 1 to 5% of papermaker's size, such as rosin, wax, dextrin, gelatine and the like, may be thoroughly mixed into the slurry. From 1 to 10%, usually from 1 to 3%, of added binder also may be incorporated.

Suitable binders comprise the usual thermoplastic or thermosetting materials such as asphalt, the thermoplastic natural gums, the thermoplastic synthetic resins, and the thermosetting resins, particularly the thermosetting phenol-aldehyde resins such as the thermosetting resinous condensation products of phenol and formaldehyde. These materials, usually in the form of their solutions in suitable solvents or as aqueous emulsions, likewise are thoroughly mixed into the slurry if desired.

The resulting slurry then is formed into a mat on a screen passing over a suction box, as is the case in the usual Fourdrinier apparatus. At this stage the porous paper covering sheet is applied to selected areas of the mat surface, e. g. to the top surface, the bottom surface, or to both of these surfaces.

The paper may be derived from pulps made by a variety of procedures, for example, the sulfite process, either sodium, magnesium or ammonium base; or from the ground wood or kraft procedures. As has been indicated above, however, it is essential that it be porous in character as is the case with white or colored napkin, waxing, toilet or semi-crepe tissues having weights of 3 to 20, preferably from 10 to 14, pounds per 3000 square feet. This requirement is critical to the success of the present invention for a variety of reasons, as follows:

(1) If the paper face sheets have a weight of less than 3 pounds their strength is insufficient, and they tend to break during application. If their weight is over 20 pounds, however, they are so dense that water will not penetrate them freely as is required for their satisfactory application and pressing.

(2) The paper, being porous, absorbs water readily so that it unites adherently with the wet mat without the necessity of added binder being included in the mixture.

(3) Since the paper is porous and transmits water readily, there is no interference in the action of the suction boxes and press rolls.

(4) The paper does not crinkle on the mat surface.

(5) The surface of the finished board will not water spot during humidification since the absorbent paper surface layer spreads any accumulation of water, preventing its concentration on a localized area.

(6) The ability of the board products to be bonded together is improved since the porous surface layer soaks up the glue uniformly, thereby obtaining a satisfactory spread.

(7) The hardboard product is paintable because the paper surface layer absorbs the paint uniformly, resulting in the application of a uniform coat.

(8) The paper may be placed on one or both sides of

the board without producing an unbalanced board having a tendency to warp.

Because it possesses the above qualities to a marked extent, paper made from ground wood pulp is preferred for the present purposes. It may comprise substantially entirely pulp of this class, or pulp mixtures containing a substantial proportion of ground wood, for example, from 10 to 80% of such pulp.

The presently described product and method for making the same thus are to be distinguished from the laminated hardboard product in which a hardboard sheet is first prepared and then covered with facing sheets of paper glued to the surface of the board. In the present procedure the paper is applied to the wet lap and is saturated by moisture from the same before pressing. This accounts for the bonding and welding together of an integral unit having the above described properties.

The presently described product and method also are to be distinguished from products prepared by forming a wet lap with secondary head boxes. In the latter technique a laminated felt is produced by felting fibers of various classes in sequence on the forming wire. However, in this procedure there is necessarily a mixing or running together of the various fiber types so that a sharply defined surface covering of uniform thickness is not obtained.

After the paper covered mat is produced in the manner described above it is pressed in a hot-press of suitable construction. Thus it may be pressed in a multi-opening press at from 200 to 1000 p. s. i. and 300 to 450° F. for from 5 to 20 minutes, or long enough to dry out the mat, to consolidate it, and to integrate it with the surface paper covering. During the pressing operation the squeeze out water passes freely through the porous paper, facilitating removal of the water and insuring against displacement and rupture of the paper. This results in the formation of the finished board which may be humidified and tempered in the usual manner.

Suitable apparatus for carrying on the presently described method is illustrated in Figure 1. The selected aqueous slurry, with or without added size and binder, is introduced at a consistency of from 1 to 5% into the head box 10 through conduit 12. After passing between the baffles of the head box it traverses the apron thereof and flows out on the forming wire 14. The latter may be of the conventional Fourdrinier type and is supported by rolls 16, 18, driven at a suitable rate. A suction box 20 communicating with a reservoir 22, a liquid pump 24, and a vacuum pump 26 is positioned suitably beneath the forming wire.

Another wire 30 supported and driven by rolls 32, 34, 36, 38, 40, 42 cooperates with the lower wire in forming the mat. It also is used for applying a paper sheet to the upper mat surface. Thus porous paper on a rotatably mounted roll 44 is passed over a guide roll 46 and thence to the stretch of wire 30 between rolls 32 and 42. The paper is carried by wire 30 to the upper surface of the felt. There it is wetted by the wet felt and adherently united thereto by a water bond.

If desired, paper also may be applied to the under surface of the felt. This is accomplished in the illustrated embodiment by passing the felt, now partially dried, over the transfer roller 48 and on to conveyor 50. The latter conveyor is supported and driven by rolls 52, 54. It moves at a rate which is the same as the rate of movement of the wires 14, 30. Rotatably mounted beneath it is a roll of paper 56, the paper sheet being transferred over roll 52 onto the conveyor. Here it comes in contact with the wet lap by which it is soaked with water and to which it is adherently united through a water bond.

The resulting laminated assembly then passes over supporting rollers 58, 60 and the roller chain assembly 62. It is cut in sections 64, 66 by the saws illustrated schematically at 68. These then are transferred to the press 69 and pressed to form a finished board product.

The final hardboard is illustrated at 70 in Figure 2. As indicated, it comprises a consolidated lignocellulose base 72 having an upper layer of paper 74 and a lower layer of paper 76 covering its upper and lower surfaces. The density of the board is determined by its degree of consolidation, but in the case of the usual hardboard will range between 0.5 to 1.25.

Its surfaces have uniform, coherent coatings of paper which impart to the board numerous advantages including: imparting a selected color uniformly to the surfaces; covering over objectionable slivers; imparting the paintability and temperability of the board because of uniform absorption and permeation thereof by coating and tempering agents; producing a hardboard product which may be lithographed by passing it between etched ink rollers having for example, a grain pattern etched thereon; forming on the board a rough skin, which improves its wear properties; and providing a product which will not water spot.

The board, though laminated, is stable since the surface paper layers are integrated with the base layer and will not delaminate even upon soaking in water and even though no extraneous binder is employed. All of these manifold advantages are obtained, furthermore, through a processing operation which may be added to the usual wet process board making procedure without the installation of elaborate equipment and at very low cost, i. e. at a cost of about 25¢ per thousand square feet of hardboard product.

It is to be understood that the form of my invention herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of my invention, or the scope of the subjoined claim.

Having thus described my invention, I claim:

The method of making a paper covered hardboard which comprises forming a wet lap from a slurry of comminuted lignocellulose, applying to a surface of the wet lap in the absence of a discrete interfacial adhesive layer a sheet of porous water absorbent paper having a weight of from 3 to 20 pounds per 3000 square feet, thereby wetting the paper from the wet lap whereby adherently to unite said paper and wet lap, and subjecting the resulting assembly to heat and pressure whereby to compress the wet lap into a densified hardboard with the sheet of paper bonded integrally over its entire area to the surface thereof.

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