June 13, 1967 L. K. HOSFELD 3,325,302

METHOD FOR PRODUCING ROLLER EMBOSSED WARP-RESISTANT FIBERBOARD

Filed June 14, 1963

2 Sheets-Sheet 1

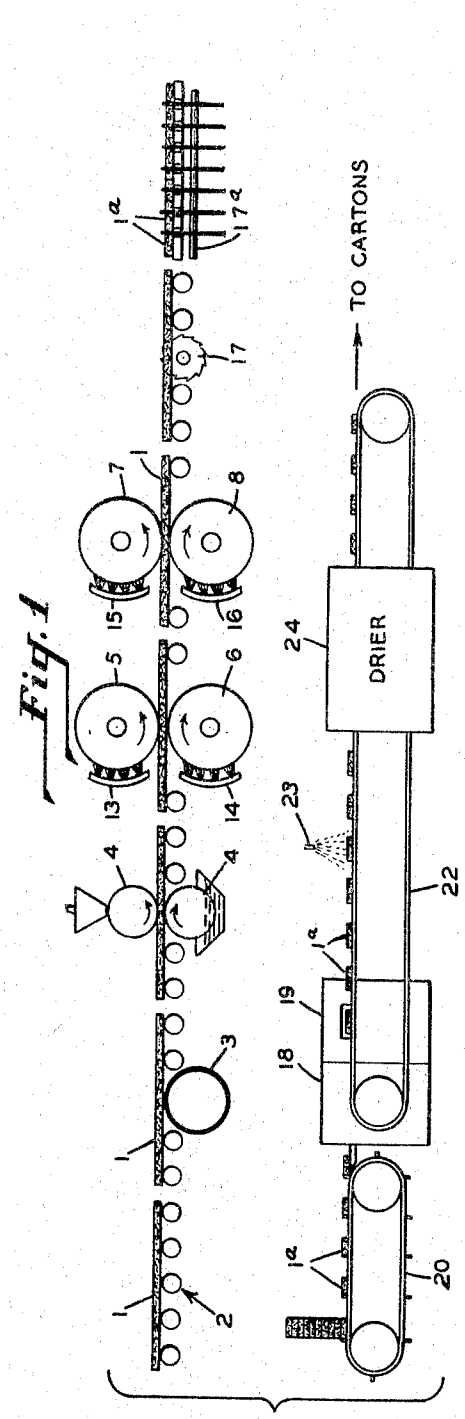

Fig. 1

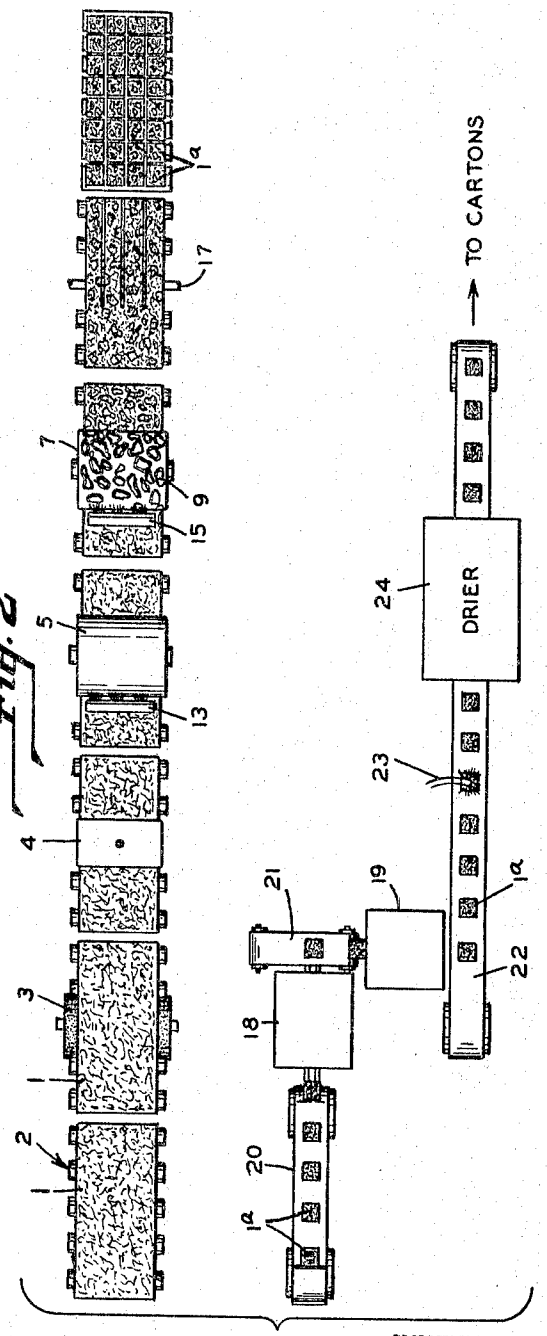

Fig. 2

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Fig. 3

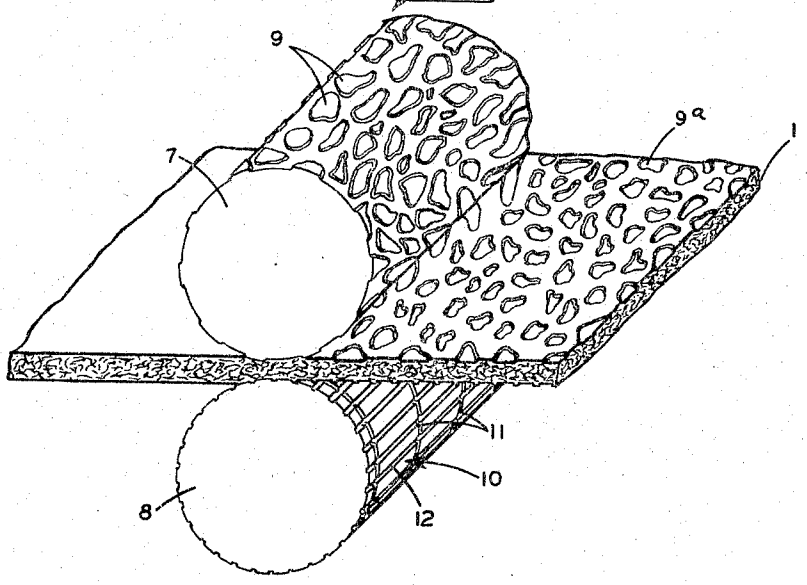


Fig. 4

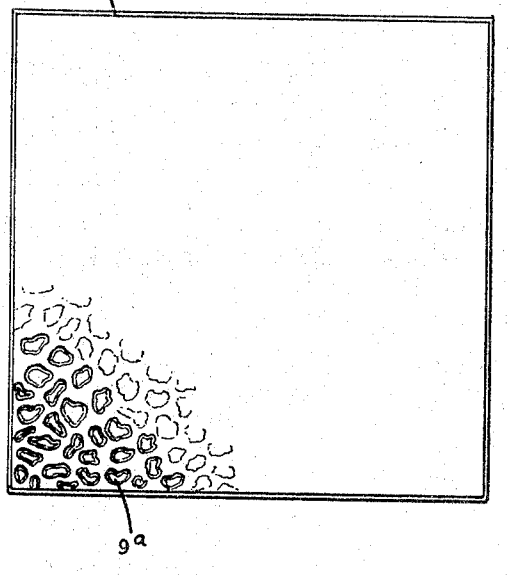
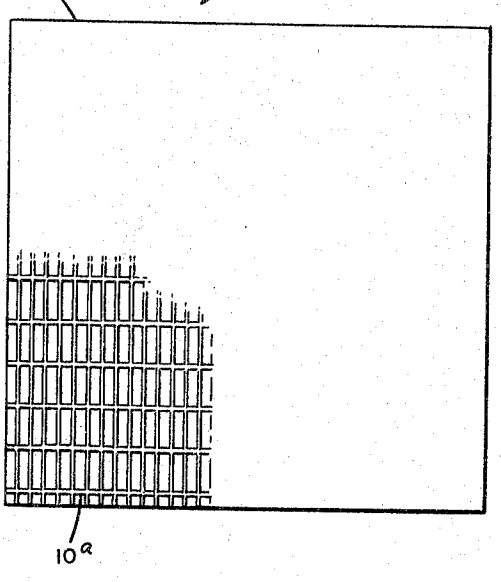


Fig. 5



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3,325,302

METHOD FOR PRODUCING ROLLER EMBOSSED WARP-RESISTANT FIBERBOARD

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1 Claim. (Cl. 117—10)

This invention relates to a method for producing embossed fiberboard and the like, and more particularly to a method for producing a decorative, warp resistant fibrous board by applying a primer coating to its top and bottom surfaces, roller embossing a decorative design on the face thereof simultaneously with the embossing of a stress equalizing pattern on the back.

The desirability of enhancing the decorative character of fiberboard by embossing methods without increasing the warping tendencies therein is well known. It has been common practice in the past to emboss one surface of the fiberboard and then apply a finish coating thereto. Various difficulties were encountered in this method, however, among which were warping of the board due to unevenness of the stress between the embossed face and unembosseed back surface thereof, and the difficulties of producing and retaining a deep, well defined embossed pattern.

Much of the prior embossing of this type of material was done in an intermittent fashion using flat bed presses, or by roller embossing a decorative pattern on just one surface of the material. Of the two processes, roller embossing was the most desirable because of its speed, economy, and adaptability to use in the regular line of machinery used to form tile, etc., from such boards. However, in roller embossing, there was a pronounced tendency of the fiberboard to warp more in the direction of its travel through the rolls than across the width of the board. In addition, the brittle nature of the fibers used in such boards and the embossing pressure required, caused the surface of the fiberboard to often be broken. This created an undesirable ragged appearance which detracted from the decorativeness of the board and also weakened the surface thereof. Further, the natural tendency of the indented portions of the material to spring back also resulted in shallow, non clear-cut embossed patterns. The foregoing things rendered the boards generally unfit or undesirable for installation. Decorative coatings of paint applied to these boards further increased their tendency to warp, due to contraction of the painted surface upon drying.

Various proposals have been made in the past in attempts to overcome these deficiencies. Patent 2,248,233, for example, proposes the provision of "hills and valleys" in the face of the fiberboard to strengthen it against warping. Embossing of one surface of the fiberboard to counteract warping tendencies induced by alteration of the surface stress characteristics in the opposite surface has been disclosed in Eckert Patent 3,017,947. Simultaneous alteration of both surfaces of such a board is also disclosed in this patent. Simultaneous roller embossing of both surfaces of a coated, loosely matted and felted fiber cushion base is disclosed in Patent 2,585,109. However, all of these prior processes leave much to be desired in obtaining the maximum in efficiency of operation, assured warp control in a finished product of the type with which this invention is concerned, as well as functional and decorative qualities of the pattern.

It has now been discovered that warping tendencies in roller embossed fiberboard are substantially eliminated by embossing the back of a surface treated fiberboard in a manner and amount predetermined to cause an increase

in its surface measurements substantially equal to the increase in surface measurements on the embossed face of the board.

It is an object of this invention to provide a faster, more economical method for embossing both sides of a fibrous board. It is a further object to provide such embossing in sharper detail. A still further object is to provide a method for simultaneously embossing both sides of a fiberboard in which the direction, number and three dimensional measurements of embossing on the back of the board are accomplished in a manner and amount predetermined to ensure against warping of the board in its final form. It is an additional object of this invention to provide embossed designs on both surfaces of a fibrous board without breaking or cracking the surfaces thereof. Another object is to provide an improved continuous method of roller embossing both sides of a fibrous board simultaneously.

Briefly stated, the invention comprises a method of forming a warp resistant, embossed fibrous board wherein a fiberboard is back-sanded to a uniform thickness and then coated on its top and bottom surfaces with a casein-clay primer containing about 0.05–0.2% of a wetting agent to slightly penetrate and soften the surface thereof. The coated board is then passed between two ironing rolls heated to about 600° F. to very lightly compress and initially dry it. The still moist board is then passed between two heated embossing rolls. The temperatures of the rolls would be varied directly with the rate of travel of the board therebetween. However, at the speed of about 120 feet per minute, the temperatures of the top and bottom rolls would be in the ranges of from 590° F. to 620° F., and 670° F. to 730° F. respectively. In those instances where it is desired, the board may then be cut into smaller pieces and advantageously used as ceiling tile or the like. In order that the invention may be more readily understood, it will be described in connection with the attached drawing in which

FIGURE 1 is a diagrammatic side elevational view of the board forming process of this invention, including the forming of tile size pieces therefrom;

FIGURE 2 is a top plan view of the board forming process shown in FIGURE 1;

FIGURE 3 is a perspective view of a portion of the top and bottom embossing rolls of this invention performing the embossing operation on a fibrous sheet;

FIGURE 4 shows a plan view of the face of a tile made according to the process of this invention, and

FIGURE 5 shows a plan view of the back of the tile of FIGURE 4.

In carrying out the invention, including the formation of tile pieces, the fiberboard sheet material which may consist of ground wood fibers, an amylaceous binder, and a sizing agent is produced in the conventional manner on a wet board forming machine such as that shown in U.S. Patent 1,927,360 and dried to the desired degree in a conventional gas fired drier. As best seen in FIGURES 1 and 2 of the drawings, blanks of the board **1**, which may be, for example, about 93" x 52" in size and about .540"–.570" thick, are fed over a conventional roller conveyor **2** to a suitable back-sanding arrangement **3** where they are sanded to a uniform thickness of slightly over ½". The boards **1** are then fed to a coating apparatus **4** where both top and bottom surfaces of the board are coated with a casein-clay primer at the rate of 15 to 19 grams per square foot of 40–60% solids. The primer contains about 0.05%–0.2% of a surfactant to aid in carrying the primer into the board surfaces to slightly penetrate and soften them. This improves the detail of the subsequent embossing. The board **1** is then passed between two smooth surfaced heating rolls **5** and **6** to

very slightly compact and partially dry the coated board. The wet surfaced steaming board **1** which is moving at the rate of about 120 feet per minute is then introduced between two iron embossing rolls **7** and **8** having their outer surfaces provided with the required embossing thereon to provide a raised and/or indented pattern in the opposite faces of the traveling coated board **1**. The top roll **7** of the two embossing rolls is engraved with a suitable decorative pattern **9**, while the bottom roll **8** has a machined pattern **10** thereon (see FIGURE 3). The rolls **5**, **6**, **7**, and **8** are heated by impinging gas flame heating means **13**, **14**, **15**, and **16** to about 600° F. They are spaced apart about .300", and the board **1** issuing therefrom springs back to a thickness of about .510". The boards **1** are then cut into slightly over 1 foot square pieces **1a** by a saw arrangement **17** and **17a** and fed to tenoning machines **18** and **19** by conveyor feeding means **20** and **21** to provide tongue and groove joints therein. The embossed tile **1a** then pass from tenoning machine **19** to a conveyor **22** where a finish coat is applied by means of a suitable spray apparatus **23** to the embossed face thereof. The coated tile **1a** then pass through drier **24** and are then placed in cartons for shipping.

As best seen in FIGURES 3 and 5, the machined bottom roll **8** serves several purposes; first, by imparting a stabilizing pattern **10a** to the back of the board **1** to equalize the change in stress on the face of the tile **1a** caused by embossing by the top roll **7**, warpage or sag of the finished tile is substantially reduced. It is not necessary for the design components **10a** on the back of the tile **1a** to be similar in number, shape or size to those on the face of the tile. Secondly, the machined bottom roll **8** serves to grip the board **1** during the embossing operation. Thirdly, the design **10a** which is imparted to the back surface of the board **1** is sharp and clearly visible. This proves valuable in some instances when handling the tile during installation of tile, for example, made therefrom, since the number and direction of the embossed elements **10a** on the back of the tile in many cases may be used as an indication of the direction of the pattern on the face thereof.

The following ingredients in the indicated amounts make about 1,000 gallons of one coating composition which may be used in carrying out this invention.

	Lbs.
Water	5,552.4
Tetrasodium pyrophosphate	14.4
Sodium pentachlorophenate	10.8
Clay	4,800.0
Casein	360.0
Ammonium hydroxide	30.0
Formaldehyde solution (37%)	60.0
Pine oil	8.3
Defoamer (tributyl phosphate)	5.0
Nonionic surfactant (isooctylphenoxypolyethoxyethanol)	23.5

The above composition is applied to a board in the amount of 15–19 grams per square foot. As described earlier, the wet board is then passed between a pair of smooth surfaced heated rolls **5** and **6** to slightly compress and partially dry the board surfaces. The still moist board **1** next passes between a pair of embossing rolls **7** and **8** having, for example, random embossing elements **9** on the top embossing roll which may be, for example, about 0.50" in height, the sides of which are slanted at approximately 45° angles as an aid in avoidance of breaking of the board surface during the embossing operation.

The pattern **10** on the bottom roll **8** may consist of a plurality of circumferential grooves **11** and transverse grooves **12** whose sides are at approximately 45° angles. These grooves on the bottom roll are of suitable width and depth, and in sufficient number to cause an increase in the back surface area in an amount substantially equal

to the total increase in area of the front surface caused by the embossing thereof.

The lineal measurements of the roller embossed face of a tile are normally increased to a greater extent in the direction of travel of the tile through the rolls than across the width of the tile. This is believed to be due to freedom of the board to expand to a greater extent in the direction of its travel at the moment roll pressure is applied inasmuch as at that time it is confined across its width between the rolls. To correct this tendency for the board to warp more in the direction of its travel, we have placed substantially more grooves running across the length of the roll than those running around the circumference of the roll. This causes an increase in the lineal measurement of the back of the tile comparable to that of the face. Thus, it can be seen that the grooves running circumferentially on the back roll tend to control warpage in the tile mainly across its width, while the grooves running transversely of the roll control warpage of the tile along its length. Warpage in both directions is controlled by the spacing and depth of the grooves.

This method of embossing produces adequately deep and sharp embossed patterns **9a** and **10a** on both top and bottom surfaces of the tile. Consequently, the embossing on the face of the tile will not be obscured or obliterated by the finish coat usually applied thereto, and the embossing on the back of the tile will provide the needed stabilization to keep the tile from warping.

Obviously, any combination of top and bottom embossed patterns which result in comparable lengthening of both surfaces of a fiberboard or the like are intended as being included in the scope of this invention.

I claim:

A method for providing an embossed fiberboard having improved warpage control comprising coating both surfaces of a dry wood fiberboard of about ½" uniform thickness with a water-dispersed casein-clay prime coating of from 40%–60% solids and containing about 0.05%–0.2% of a wetting agent at the rate of approximately 15–19 grams per square foot, passing the coated board between two smooth surfaced heated rolls to apply slight smoothing pressure thereto and cause partial drying and penetration of said coating into the board surface to soften the fibers, passing the moist, warm surfaced board between two embossing rolls, the top roll of which is heated in the range of from 590° F. to 620° F., and the bottom roll of which is heated in the range of from 670° F. to 730° F. and whose temperatures are varied directly with the speed of the board passing therebetween, to compress the board and simultaneously emboss a deep decorative design on the face thereof and a plurality of embossed warp-controlling elements to the back thereof, said design on the face of said board, and said warp-controlling elements on the back thereof consisting of compacted upstanding and compacted depressed elements, said elements on said back portion of said board being equal in their three dimensional measurements but being provided in greater number along the length of the board than across the width thereof and in any case being in direct ratio to the directional increase in lineal measurement of the face of the tile caused by the embossing thereon.

References Cited

UNITED STATES PATENTS

1,856,370	5/1932	Baldwin	117—68
2,248,233	7/1941	Heritage	117—8
2,585,109	2/1952	Gordon	117—10
2,851,372	9/1958	Kaplan et al.	117—8
2,863,168	12/1958	Buckley et al.	264—137
3,017,947	1/1962	Eckert	144—320

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