Sept. 16, 1952 M. PASQUIER 2,610,938

MANUFACTURE OF HOLLOW PANELS

Filed Feb. 1, 1947

FIG. 1.

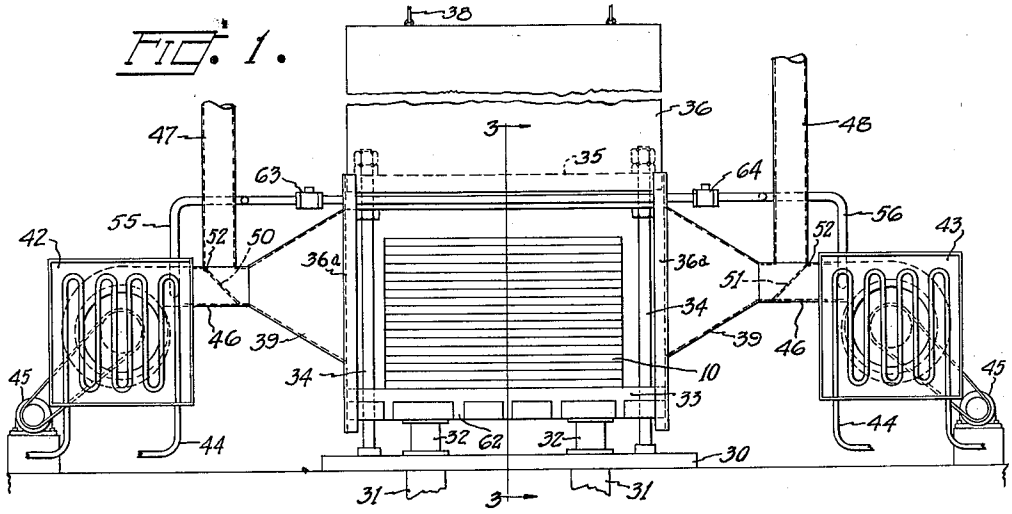


FIG. 2.

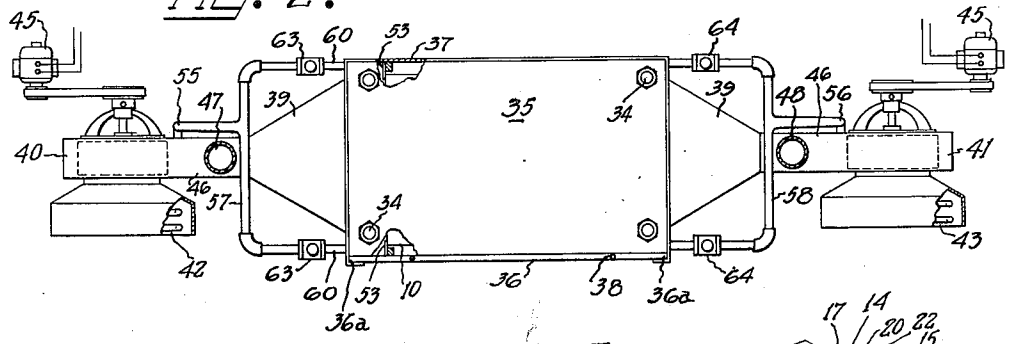


FIG. 5.

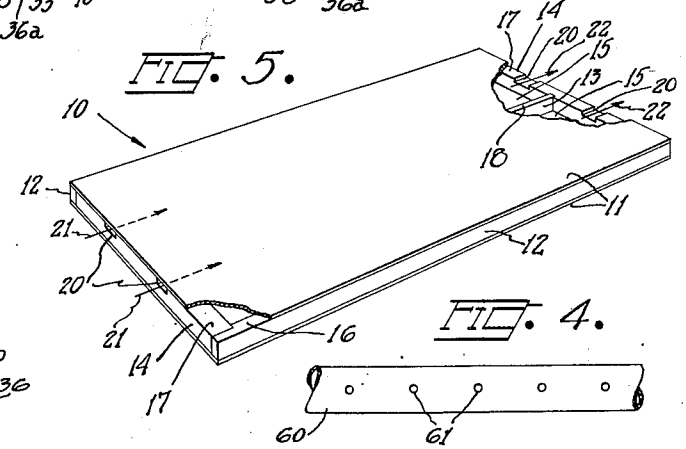


FIG. 3.

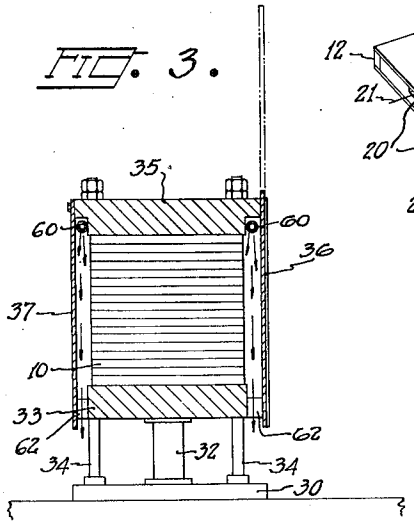


FIG. 4.

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MANUFACTURE OF HOLLOW PANELS

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16 Claims. (Cl. 154—118)

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This invention relates to a novel and improved method of and apparatus for drying and setting the glue in the manufacture of hollow core wood panels.

In the manufacture of hollow core wood panels with thermosetting glues it has heretofore been the usual practice to place the hollow panel assemblies in a hot press similar to a plywood hot plate press, and apply heat and pressure to the exterior faces of the panels in order to set the glue in the internal joints. In this operation the hollow panels are interspersed between a series of heated platens in an hydraulic press and are forced together as in making plywood. Heat is thereby transmitted from the hot platens through all parts of the face sheets of the panels to set the glue in the internal glue lines between the inside surfaces of the face sheets and the several longitudinal and transverse frame members with which they are pressed into firm contact.

This method of setting the glue is subject to several serious disadvantages. In the first place it will be readily apparent that a great amount of heat is wasted because substantially the entire wood content of the panel must be heated in order to heat the glue lines. Moreover, the highest temperature is produced on the outside surface of each face sheet with the glue line surface lying on the relatively cool side of the sheet whereby the outer surface must be raised to a temperature higher than that required to set the glue by an amount corresponding to the temperature gradient through the sheet. Most of the heat which goes into the panels from the heated platens is therefore wasted in raising the temperature of the outer portions of the face sheets which are relatively poor conductors of heat. In order to reduce the temperature gradient through the face sheets the time of treatment must be prolonged, thereby proportionately reducing the output of each hot press and necessitating a larger plant investment in hot presses for a given output of the product.

Another and very serious objection to the application of hot platens to the outer panel surfaces is the checking of the panel surface produced by the rapid drying action of the high temperatures, the checking being more severe when the face sheets are thick, because of the higher platen temperatures or longer heating times required. The checking tendency is aggravated by the usually high moisture content of the plywood surfaces whereby they are more susceptible to checking than the relatively dry veneers in the original hot pressing operation in which the plywood was previously formed.

Hollow core panels have also been glued up with cold setting resin glues, using clamps to hold the panel assemblies together after removal from the press. This procedure involves a long clamping time and greater glue spreads in the absence of heat. Also, in the absence of heat the glue is less water resistant. The clamps do not provide an absolutely positive pressure to prevent warping, and there is always danger of the clamps being disturbed upon removal from the press.

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The general object of the present invention is, therefore, to provide an improved method of drying and setting the glue in hollow panels which will obviate the objections and disadvantages mentioned above in order to produce hollow wood panels of higher quality and more economically than has heretofore been possible with conventional methods.

Another object is to provide a novel method of heating and setting a thermosetting glue in hollow panels wherein the heat is applied directly to the glue line surfaces where it is needed so that the finished outside surfaces may be maintained relatively cool in the gluing and pressing process, thereby to retain their normal physical properties.

A particular object is to provide a method of heating the interior surfaces which are to be glued by blowing a heating fluid into the panels.

Another object is to provide a method of heating hollow panels interiorly whereby a thermosetting glue may be heat set in a cold press instead of a hot press.

Another object is to provide a novel method of applying heat to glued joints.

Another object is to speed up the production of hollow core panels in multiple quantities in each press load, and to maintain a high production rate despite the use of plywood face sheets of different thickness.

Another object is to provide an apparatus for circulating a heated fluid medium through a load of hollow panels in a cold press.

With these and other objects in view the invention resides in the method and apparatus which will be described with reference to a preferred embodiment of the apparatus illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a view in side elevation showing a preferred form of apparatus for carrying out the method of the invention;

Figure 2 is a top plan view of the apparatus shown in Figure 1;

Figure 3 is a cross sectional view taken on the line 3—3 of Figure 1;

Figure 4 is an enlarged fragmentary view of one of the hot air pipes; and

Figure 5 is a perspective view with parts broken away of a hollow panel illustrating a type of construction to which the invention is applicable.

The apparatus shown generally in Figures 1 to 3 is adapted to carry out the method of the invention in gluing a stack of hollow core panels

having a typical construction as illustrated in Figure 5. The typical panel designated generally by the numeral 10 comprises a pair of face sheets 11 which are glued in the herein described process upon opposite sides of a hollow framework of longitudinal and transverse wood strips. The face sheets 11 are preferably plywood panels made by gluing three or more wood veneers together face to face in a previous operation whereby the glue between the veneers is already set and the panels 11 are in a finished condition before assembling and gluing up the composite hollow panel 10. The method of the present invention has its most advantageous application in connection with the use of thermosetting resin types of glue wherein both the glue used in making the panels 11 and in gluing these panels to the hollow framework is a thermosetting weather-resistant glue of the type ordinarily used for making exterior grade plywood, but the method may also be practiced with thermoplastic and other conventional cold setting glues in order to save time and space in the gluing-up process.

The framework for the panel 10 in the present instance comprises a pair of longitudinal strips 12 at the opposite side edges of the panel and one or more longitudinal strips 13 therebetween, depending upon the width of the panel. The ends of all these longitudinal strips are fitted by suitable joints into transverse end strips 14 at the ends of the panel to provide a solid marginal framework upon which the sheets 11 may be glued, and providing also intermediate supporting and spacing means at each of the internal longitudinal members 13. This arrangement of the frame members 12, 13 and 14 forms a plurality of chambers 15 within the panel containing the glue line surfaces to which glue is applied for uniting the face sheets with the internal framework. Thus, in gluing up the panel 10 the edge strips 12 have opposite faces 16 and the end strips 14 have opposite faces 17 all lying in common planes and in contact with the inner surfaces of the respective face sheets 11. Similarly the intermediate strip or strips 13 have opposite faces 18 lying in the same planes and in contact with the face sheets 11. These face surfaces 16, 17 and 18 constitute one side of the glue line surfaces between the frame and the face sheets which hold the panel together as an integral unit after the glue has set. In making up one of the hollow panels 10 glue is applied to these glue line surfaces and the different members are preferably temporarily held in place by a few small nails so that the panel may be handled to load it into the press for drying the glue.

In order to practice the method of the invention, the chambers 15 are not entirely sealed, but are provided with opposite end openings formed by notches 20 in the end strips 14. In making hollow panels for certain purposes it is customary to provide a plurality of notches 20 approximately in the positions shown to accommodate fastenings or other fixtures, but if these notches are not required for such purposes, similar notches or holes should be cut in the end strips to communicate with the interior of each chamber 15. Thus, if there is one central strip 13, there should be one notch or hole 20 in each end strip 14 on either side of the central strip 13, and if there are more of these strips a notch or hole 20 should be provided at each end of each of the chambers 15. The holes or notches can be plugged later if desired.

In practicing the method of the invention, hot air is blown interiorly through the panels so that it will come in direct contact with the surfaces which form the glue lines 16, 17 and 18 in order to provide a direct and short path from the heating medium to all parts of the glue line. In Figure 5 the arrows 21 indicate hot air blown in at one end of the panel, and the arrows 22 indicate the paths of hot air leaving the panel, whereby hot air is pumped through the panel in sufficient quantity to heat the glue lines to the temperature required to set the glue. It is, of course, necessary to apply pressure over the face of the panel to hold the face sheets and internal frame members in intimate pressure contact at their glue lines while the latter are being heated in order to obtain a good bond, this being the function of the press.

Figures 1 to 3 disclose an economical apparatus for gluing up a stack of hollow panels of the type described very quickly and with relatively small energy requirements in the press and in the heating system. The numeral 30 designates the base of a press which may be a conventional cold press of the type ordinarily used in making plywood with cold setting glues. Beneath the base 30 are a plurality of hydraulic cylinders 31 having pistons 32 for raising and applying the necessary upward pressure to a bottom platen 33 which is shown in Figure 1 in lowered position to receive a press load of the hollow panels 10. The panels in this press load have had a thermosetting glue applied to the surfaces 16, 17 and 18 and the face sheets have been nailed lightly to the various frame members to hold the parts in place. A plurality of posts of columns 34 extend upwardly from the base 30 to support a rigid top platen 35 in a fixed position. After a press load of panels has been placed on the bottom platen 33, the latter is raised by the pistons 32 to press the load against the top platen 35 in the usual manner as shown in Figure 3. Neither of these platens is heated, and when a thermosetting glue is employed which sets in the press, intermediate caul boards, platens and clamps are not used, the stack of panels 10 consisting solely of panels.

The press load is completely enclosed after it has been raised against the upper platen with sufficient force to apply the proper pressure over the glue lines. The sides of the press are adapted to be closed by panels 36 and 37, and if the press is loaded and unloaded from the same side, one of these panels such as the panel 37 may be fastened permanently in place. In the present construction, the panel 36 is slidable in guides 36a so that it may be raised vertically by ropes 38 or other lifting means but this panel may be hinged or mounted in any other way to open and provide access for loading and unloading the press. The ends of the press are enclosed by funnel shaped hoods 39 connected with the air outlets of blowers 40 and 41.

Air is drawn into these blowers through heat exchangers 42 and 43 having steam pipes 44 or other heating elements therein, and the blowers are driven by electric motors 45 wired in separate circuits for individual operation. Between the respective blowers and the hoods 39 are pipes 46 provided with angular discharge pipes 47 and 48. Suitable valve means are interposed between these discharge pipes and the pipes 46 so that when one of the pipes 46 is blowing into the press the other will exhaust, and vice versa. In the present embodiment this valve means

comprises the flap valves 50 and 51 which are hinged at 52 to fall by gravity to the positions shown when the blowers are not operating. When one of the blowers is started, the air flow therefrom operates to raise the adjacent flap valve to open the pipe 46 and close the entrance to the discharge pipe on the air input side of the press, the remote flap valve remaining down.

When the blower 40 is operating, the blower 41 is switched off, whereby the air stream delivered from the blower 40 raises the flap valve 50 to close the discharge pipe 47 and open the pipe 46 to admit hot air through the hood 39 to the left end of the stack of panels 10, the latter then being raised against the top platen 35 so that the lower platen 33 is approximately on a level with the bottom of the hoods 39. Vertical stops or partitions 53 are preferably provided between the ends of the press load and the side panels 36 and 37 to prevent the air from the blower from passing around the sides of the press load if the hoods 39 do not snugly fit the ends of the load. The partitions 53 separate the end chambers defined principally by hoods 39 from the side chambers which are defined principally by the panels 36 and 37. Operation of the blower 40 thereby produces sufficient pressure in the adjacent pipe 46 and hood 39 to cause air to pass through the openings 20 and flow through the interior chambers 15 in each panel in the stack to apply heat directly to the inner surfaces of the face sheets 11 to heat the various glue lines on these surfaces. Thus, air enters the panels as indicated by the arrows 21 in Figure 5 and leaves the panels as indicated by the arrows 22, after which it is diverted by the lowered flap valve 51 into the discharge pipe 48.

Heat transfer from the air stream to the interior surfaces of the panels lowers the temperature of the air as it travels through the panels to thereby establish a temperature gradient through the panels. In order to reduce the temperature difference in different parts of the panels, the present system is designed to reverse the air flow from time to time to bring both ends of the panels up to substantially the same temperature. This is accomplished by merely switching off the blower 40 after a short interval of operation and switching on the blower 41, which function may be performed automatically by a time or temperature responsive switch mechanism. The discharge from the blower 41 then raises the flap valve 51 and reverses the direction of air circulation through the stack of panels. When this occurs the flap valve 50 falls by gravity, if it is not already down, and connects its hood 39 with the discharge pipe 47. Hot air from the blower 41 is then blown into the cool ends of the panels and out of the previously heated ends until the end of the press load facing the blower 41 becomes hotter than the end facing the blower 40. The air flow may thus be reversed from time to time until the glue lines in the centers of the panels have been raised to a temperature sufficient to set the glue, at which time the operation is completed, and the blower then operating may be stopped and the press load removed from the press.

To conserve heat, the air may be re-circulated by leading the discharge pipe 48 back to the inlet of heat exchanger 42 and blower 40, and similarly leading the discharge pipe 47 back to the inlet of heat exchanger 43 and blower 41. In the return circulation of the air provision should be made for removing moisture and this may be accomplished by venting part of the air to atmosphere and introducing some outside relatively dry air to take its place.

Regardless of which way the air is circulating at any particular instant, the heated air in both hoods 39 in contact with the panel ends heats the edge surfaces of the strips 14 and the ends of the face sheets 11, causing the heat to travel back through the glue line on the surfaces 17. The hot air within the chambers 15 heats this glue line from its other edge and causes heat to travel into the joint, whereby half the width of the glue line is heated from the outside and the other half is heated from the inside of the panel. Similarly, in the case of the glue line surface 18 on the strip or strips 13, the heat travels inwardly from both edges exposed in the two chambers 15 so as to heat the entire width of the glue line surface to the temperature necessary for setting the glue.

In the case of the glue line surfaces 16 on the marginal strips 12, the hot air in the chambers 15 causes heat to travel outwardly through the glue line, and if these surfaces are relatively narrow and sufficient time is allowed, the heat applied from the inside will travel entirely across the glue line to heat all parts thereof to the temperature necessary for setting the glue. However, it is preferred to apply heat externally to the sides of the stack of panels to cause heat to also travel inwardly through these glue lines in order to reduce the time factor and to reduce the temperature gradient which would have to be established if the heat flow were entirely in one direction through the joint.

Various types of heating means such as infrared or other radiant heaters may be used to heat the sides of the stack of panels, but in the present apparatus it is preferred to utilize hot air from the heat exchangers 42 and 43. For this purpose pipes 55 and 56 are led out of the housings of the blowers 40 and 41 at points of maximum pressure therein to provide a good flow of hot air. The pipes 55 and 56 connect with headers 57 and 58 which distribute the flow equally between a pair of pipes 60 mounted on opposite sides of the top platen 35 just above the top of the press load, as shown in Figure 3. The pipes 60 are provided with a series of holes 61 on their under sides to direct hot air downwardly along the sides of the press load as shown. This air is discharged through openings 62 provided either in the side edges of the bottom platen 33 or between the platen and the side panels 36 and 37.

The hot air supplied by the pipes 60 in the spaces or chambers between the side panels 36 and 37 and the sides of the press load thereby heats the outside surface of each strip 12 and the edge of each face sheet 11 to cause heat to travel inwardly across each glue line surface 16 in the same manner that the hot air in the hoods 39 causes heat to travel inwardly across the glue line surfaces 17 at the ends of the panels. The air discharged from the pipes 60 is preferably confined between the stops or partitions 53, or other suitable headers at the ends of the press load, so that this air circuit constitutes a separate heating medium which is maintained separate and distinct from the air circuit through the hoods 39. In this way the air flow through the interiors of the panels is not short circuited around the sides of the press load and the relative discharge rates of the pipes 46, 55 and 56 may be controlled to produce optimum temperatures

at the exposed edges of all the glue lines. It is, of course, understood that all of the air pipes and conduits are of sufficient size to carry a flow of air which is adequate to produce the desired heating effect. Likewise the holes 61 in pipes 60 are of sufficient size and in sufficient number for the intended purpose.

One way check valves 63 and 64 are provided in the ends of the pipes 60 to close the open ends of these pipes and cause all the air to be discharged through the holes 61. The discharge of air from the blower 40 causes the valves 63 to open and the valves 64 to close, and the discharge of air from the blower 41 causes the valves 64 to open and the valves 63 to close, somewhat in the manner of the flap valves 50 and 51 except that the valves 63 and 64 do not discharge air from the pipes. All the air introduced into the pipes 60 is discharged through the holes 61 and exhausted from the press through the bottom openings 62, but this air, also, may be recirculated if desired.

The apparatus for practicing the method of the invention may employ only a single blower and single heat exchanger provided with suitable piping and valve arrangements to introduce the air flow alternately into opposite ends of the panels, the side edges of the panels being heated either by separate pipes such as the pipes 60, by a return flow of the air which has passed through the panels, or by radiant heaters. It is at present preferred, however, to use two heat exchangers and two blowers for alternate operation in the general arrangement shown, although the arrangement of the apparatus and the details of construction are subject to considerable modification as will occur to persons skilled in the art in practicing the method of the invention. It is also, of course, understood that suitable insulation should be provided on all the pipes, hoods, side panels and other exposed surfaces subjected to elevated temperatures in order to minimize the heat loss.

For the successful application of the method of the invention the chambers 15 in the panels need not be entirely empty or devoid of filling material. It is often customary in panels of this type to insert some form of thermal insulation as a filler in the chambers 15 when the panels are assembled, and several different forms of such insulating material are available which do not interfere with the internal heating of the glue lines in the manner described. Certain common forms of insulation furnished in batts or strips to be tacked in place within the panels offer substantially no impedance to the flow of air through the panels and permit the satisfactory heating of the glue line surfaces. Crinkled paper insulation, for instance, even though considerably stretched out and tacked in place to completely fill the length and width of each chamber 15, exhibits a tendency to flutter in the internal air stream and thereby provide equal access to the air for heat transfer to all the inside surfaces of the panel. The term hollow panel does not preclude the use of filling materials which permit an air flow through the panel.

The great advantage of the present invention is that the heat is applied directly to the glue line surfaces so that it has a relatively short distance to travel along such surfaces to the innermost parts of the joint. The heat travel into the interior areas of the glue line is enhanced by the fact that the glue film is a relatively good conductor of heat in comparison with wood. When heat is applied to the panel faces in the conventional manner, as by heated platens and the like, to heat the glue line surfaces 16, 17 and 18, a high temperature gradient must be produced through the thickness of the relatively non-conducting face sheets in order to heat a thermosetting glue to its critical temperature. Ordinarily, the heat from such a heated platen is applied more or less uniformly over the entire face of the panel whereby most of the heat is wasted in raising the mean temperature of the face sheets considerably above the temperature attained in the glue lines. When the face sheets are thick, the high platen temperature necessary on the outer surface produces such severe cracking and checking that it becomes impossible to produce a high grade product.

The method of the present invention is economical of heat because the heat is not required to travel through the thickness of the face sheets at a steep temperature gradient before it can perform its function of setting the glue. The glue line surfaces themselves attain the highest temperature and the glue therein is set before there is an appreciable heating of the mass of the face sheets. When the face sheets are relatively thick, their surfaces remain substantially unheated and therefore undamaged by checking. The panel production rate is therefore essentially the same for any thickness of face sheet, and if desired the face sheets may be of different thickness on opposite sides of the same panel. In contradistinction to conventional hot press methods, whatever temperature gradient exists through the face sheets in the present method operates to maintain a relatively cool exterior surface so that even with thin face sheets the outer surfaces are not heated to a temperature high enough to produce checking. Any checking under the present method is limited to interior surfaces where it is not objectionable. The heat content and face temperatures of a press load of panels leaving the press is relatively low in comparison with conventional practice, so that the panels may be handled immediately upon leaving the press without inconvenience to the workers and without damage to the panels from sudden cooling of platen heated surfaces.

When the core strips within the panel are relatively narrow, such as 3/16" or 3/4" stock, the glue may easily be heat set completely through the joint while the panel is in the press. When the core members have a considerably wider glue line, as for instance, in the case of 2" x 4" stock, a cold setting catalyzed resin glue such as resorcinol, phenol or urea resin may be used. Such glues set quickly when heated and more slowly at lower temperatures. By heating the glue under time and temperature conditions sufficient to heat set the glue lines for some distance in from the edges of the joint a sufficient bond is quickly formed to hold the panels together so that they may be handled and removed from the press without waiting for the interior parts of the joint to heat set. This partial bond forms an ideal clamp to hold the joint surfaces tightly together and prevent warping of the panel, while the rest of the glue continues to set gradually over the whole joint area. Even after the source of heat is removed there is heat flow into the glue lines from the hot surfaces for some time which progressively increases the width of the marginal heat set bonds. The interior parts of the joint thus set more slowly until ultimately the whole area of the glue line is completely set, and without the use of mechanical clamps.

Another important advantage of the method of the invention is the fact that it may be carried out in apparatus utilizing a relatively inexpensive cold press. The press itself may be of light construction inasmuch as the total upward force produced by the pistons under the lower platen need be sufficient only to lift the press load of light hollow panels and then to apply such additional pressure as is required to establish the correct unit pressure over the relatively small area of glued surface, the ratio of the gluing surface to the total area of the panel being quite small. The cost of installation of such a press is much less than that of the usual plywood hot press which is ordinarily used for gluing up hollow panels. Therefore, in virtue of the reduced heat input, the shortened press time, and the low initial cost of equipment, the present method effects a material saving in the over-all cost of production of hollow panels.

Although the fluid heating medium has been hereinabove referred to as hot air it is to be understood that other gases and vapors having suitable thermal conductivity, specific heat, and moisture absorbing properties may be used, as desired.

Having now described my invention and in what manner the same may be used, what I claim as new and desire to protect by Letters Patent is:

1. The method of heating interior glue joints in a hollow panel to set the glue without excessively heating the outside faces of the panel, comprising applying external pressure to said outside faces to hold the joints together, and introducing a heating fluid into the interior of said panel to supply the only source of heat for the panel.

2. The method of heating interior glue joints in hollow panels to set the glue without excessively heating the outside faces of the panels, comprising pressing the panels between flat unheated surfaces, and introducing a heating fluid interiorly of the panels.

3. The method of heating interior glue joints in a hollow panel to a higher temperature than the outside faces of the panel, comprising applying external pressure without heat to said outside faces to hold the joints together, and introducing a heating fluid interiorly of the panel.

4. The method of heating interior glue joints in a hollow panel to a higher temperature than the outside faces of the panel, comprising applying external pressure without heat to said outside faces to hold the joints together, and applying heat at substantially atmospheric pressure to the interior surfaces of the panel.

5. The method of heating interior glue joints in a hollow panel to set the glue without excessively heating the outside faces of the panel, comprising applying external pressure without heat to said outside faces to hold the joints together, introducing a heating fluid interiorly of the panel at approximately atmospheric pressure, and discontinuing said application of pressure and introduction of heating fluid when the glue has set in portions of the joints.

6. The method of heating interior glue joints in hollow panels to set the glue without excessively heating the outside faces of the panels, comprising pressing a stack of the panels in face to face contact, and passing hot air through the panels at approximately atmospheric pressure.

7. The method of heating interior glue joints in hollow panels having apertured ends to set the glue without excessively heating the outside faces of the panels, comprising pressing a stack of the panels in face to face contact, directing a stream of hot air toward one end of the stack, and confining said stream to the end surface of the stack to cause said air to flow through the panels.

8. The method of heating interior glue joints in hollow panels with apertured ends to set the glue without excessively heating the outside faces of the panels, comprising pressing a stack of the panels in face to face contact, applying a heating fluid to the whole end surface of the stack under sufficient pressure to pass said heating fluid through the panels, and removing said heating fluid from the other end of the stack.

9. The method of heating interior glue joints in hollow panels to set the glue without excessively heating the outside faces of the panels, comprising pressing a stack of said panels in face to face contact, passing a fluid heating medium interiorly through said panels in one direction, and reversing the direction of flow of said heating medium from time to time to establish a temperature gradient from both ends of said panels toward the centers thereof.

10. The method of heating interior glue joints in hollow panels having apertured ends to set the glue without excessively heating the outside faces of the panels, comprising applying hot air to the whole end surface of a stack of the panels and passing said air through the panels, removing said air from the other end of the stack, applying hot air to the whole end surfaces of said other end of the stack and passing said air through the panels in the opposite direction, and reversing said air flow from time to time to establish a temperature gradient from both ends of the panels toward the centers thereof.

11. The method of heating interior glue joints in hollow panels having apertured ends to set the glue without excessively heating the outside faces of the panels, comprising forming a press load stack of the panels, confining hot air around the four sides of the stack, passing the air at one end of said stack through the panels, and removing said air from the other end of the stack.

12. The method of heating interior glue joints in hollow panels having apertured ends to set the glue without excessively heating the outside faces of the panels, comprising pressing a stack of the panels in face to face contact, passing a heating fluid through said panels to heat the interior surfaces thereof, and applying a heating fluid to the outer edge surfaces of said panels forming the sides of said stack to heat the edge joints of the panels simultaneously from inside and outside without applying heat to the outer face surfaces of the panels.

13. The method of heating interior glue joints in hollow panels having apertured ends to set the glue without excessively heating the outside faces of the panels, comprising forming a press load stack of said panels, heating the ends and sides of said stack with a heating fluid, and passing said heating fluid through said panels alternately in opposite directions.

14. The method of making a glue joint having a glue line with an exposed edge comprising applying to the joint surfaces a cold setting resin glue which is adapted to set quickly when heated, applying mechanical pressure to the joint to hold the joint surfaces in intimate contact, applying heat to said exposed edge of the glue line to set quickly the edge portion of the glue line to hold the joint together, then discontinuing the application of said heat and pressure before all the glue has set, and allowing the remainder of the

glue to set more slowly at lower temperatures without external pressure on the joint.

15. Apparatus for gluing hollow rectangular panels having apertured ends, comprising a platen press for pressing a stack of said panels arranged with the apertured ends of the panels at two opposite ends of the stack, hoods defining chambers communicating with said opposite ends of the stack, chambers communicating with the opposite sides of the stack, partitions at the four corners of the stack to separate said end and side chambers, means for passing a heating fluid alternately in opposite directions through said hoods and the interiors of the panels, and means in said side chambers for exteriorly heating the opposite sides of said stack.

16. Apparatus for gluing hollow panels having apertured ends comprising a cold platen press for pressing a stack of said panels in face to face contact and arranged with the apertured ends of the panels at two opposite ends of the stack, a pair of hoods enclosing said opposite ends of the stack respectively when the press is closed, means for passing a heating fluid through said hoods and hollow panels to heat the interior surfaces of the panels while the press is

closed, and vertical stops for the heating fluid engaging opposite sides of the stack and confining the heating fluid in said hoods exterior of the stack to the respective ends of the stack to prevent the passage of heating fluid along the sides of the stack exterior to the panels and compel its passage through the interiors of the panels from one hood to the other.

MICHEL PASQUIER.

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