Nov. 18, 1958 A. B. CHAPMAN 2,860,388

HOLLOW CORE FLUSH DOOR

Filed May 20, 1953

2 Sheets-Sheet 1

Fig-1

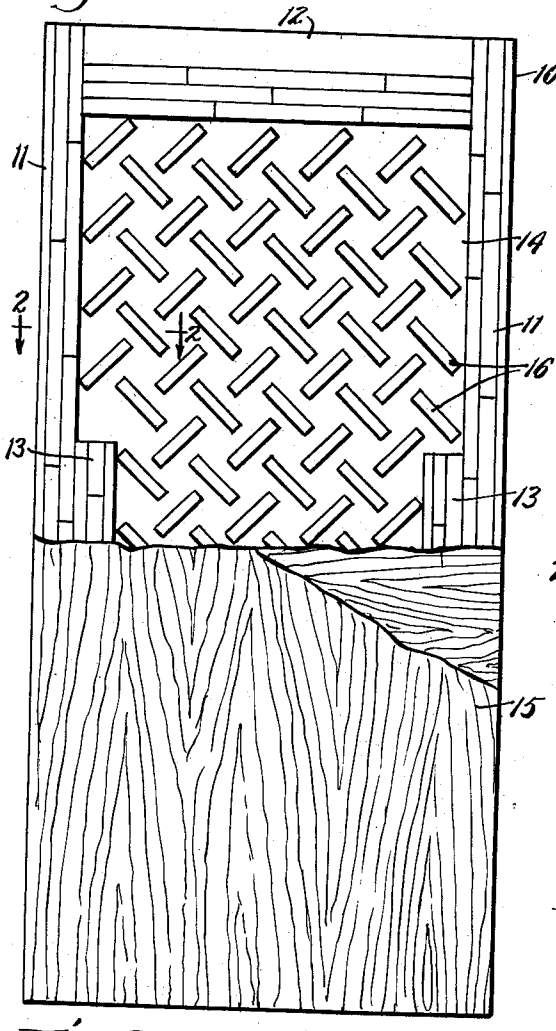


Fig-3

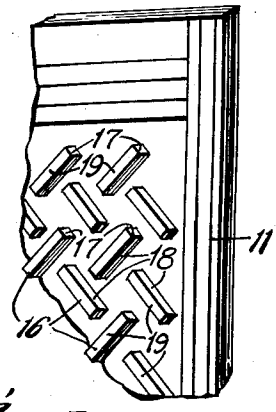


Fig-5

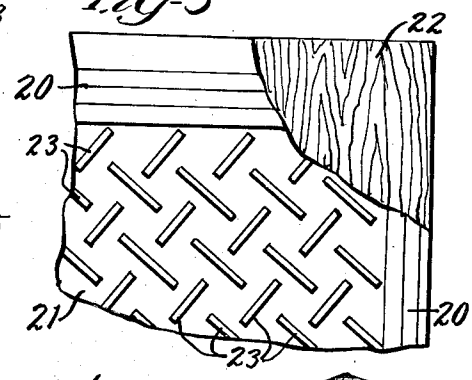


Fig-6

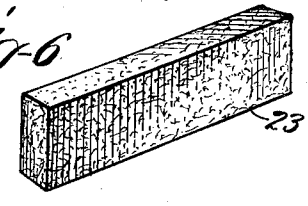


Fig-2

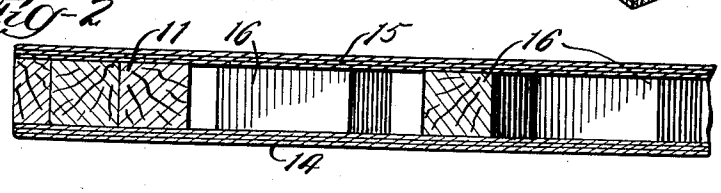
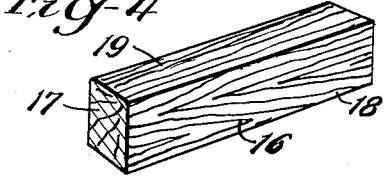


Fig-4



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HOLLOW CORE FLUSH DOOR

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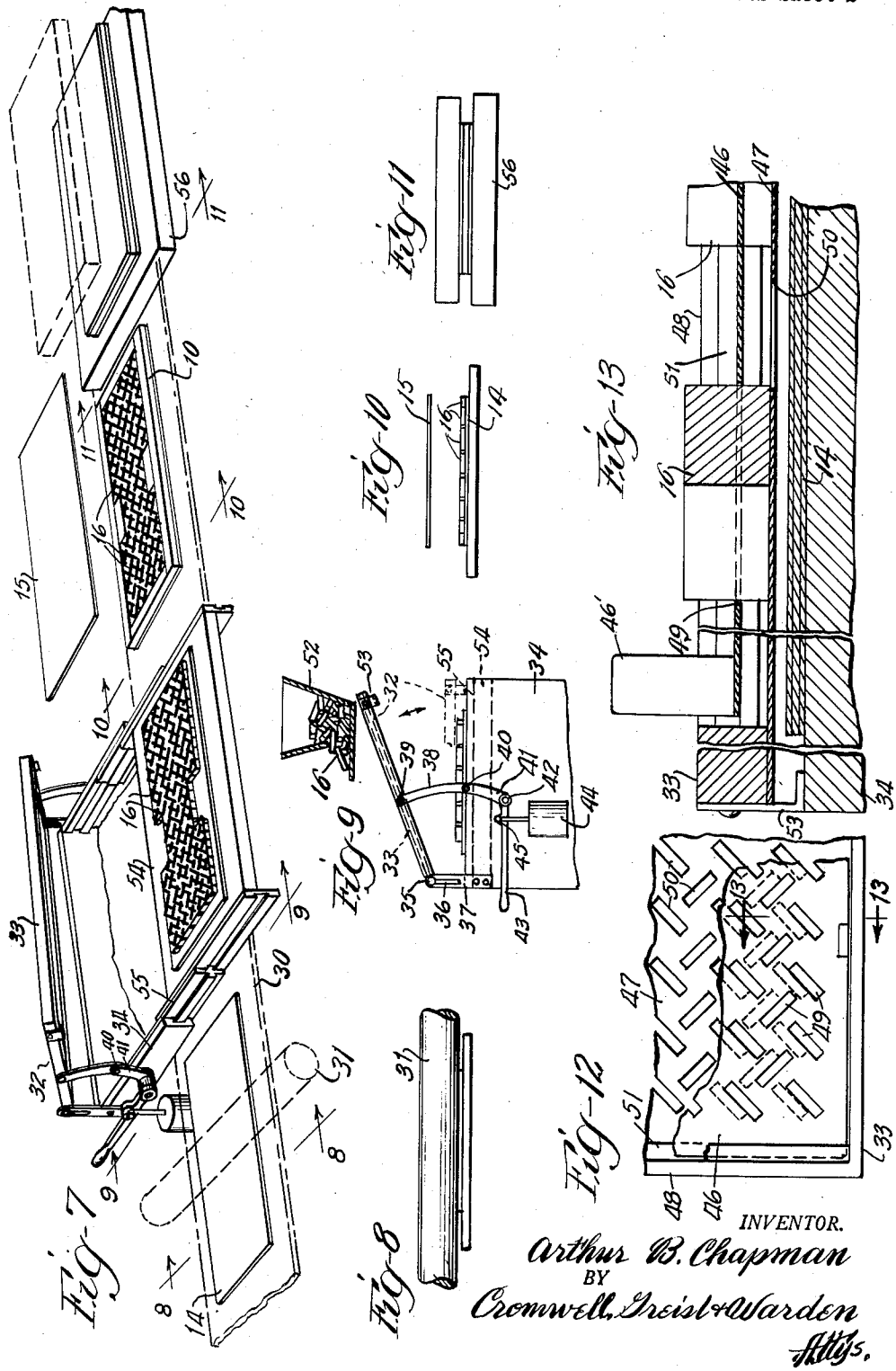


Fig-7

Fig-8

Fig-11

Fig-10

Fig-9

Fig-13

Fig-12

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United States Patent Office

2,860,388

Patented Nov. 18, 1958

2,860,388

HOLLOW CORE FLUSH DOOR

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Application May 20, 1953, Serial No. 356,185

3 Claims. (Cl. 20—35)

This invention relates to building panels and is more particularly concerned with improvements in reinforced hollow core flush door panel constructions.

It is a general object of the present invention to provide a method of forming a composite building panel which is characterized by a hollow frame having cover sheets secured to opposite faces thereof and a plurality of reinforcing members within the hollow frame arranged in such a manner as to provide a panel structure which is stabilized to a substantial degree against distortion resulting from varying conditions of humidity and which is particularly adapted for use as a door.

It is a more specific object of the invention to provide an improved hollow core flush door or other panel structure comprising a frame, facing members secured on opposite sides thereof and a core which comprises relatively short, narrow pieces of lumber secured on opposite sides to the facing members and arranged within the frame in such a manner as to resist stress and strain laterally, longitudinally and diagonally of the panel.

It is another object of the invention to provide a hollow core panel construction in which a plurality of relatively small elongate reinforcing blocks of rectangular cross section are arranged in T-shaped formation with opposite faces thereof secured to the facing members of the panel and with the ends of contiguous blocks in spaced relation to sides of the adjoining blocks.

It is another object of the invention to provide a panel construction characterized by a hollow frame having cover sheets secured to opposite faces thereof and a plurality of generally rectangular elongate reinforcing blocks secured within the frame and between the cover sheets, which reinforcing blocks are arranged in spaced row forming relation, with the long axis of the blocks extending diagonally of the panel, with each of the blocks forming with the diagonally adjacent block in the adjoining row a T-formation, with the ends of each block being spaced from the intermediate portions of the adjoining blocks, and with the blocks each presenting on the faces adjacent the cover sheets a surface area of substantial extent which is adhered to the cover sheet.

It is another object of the invention to provide a method of manufacturing a composite building panel which is characterized by a hollow frame having cover sheets secured to opposite faces thereof and a plurality of generally rectangular elongate reinforcing blocks secured within the hollow frame, which method comprises positioning the reinforcing blocks in an apertured assembly member in individually spaced row forming relation, with alternate rows having their longitudinal axis extending diagonally and in opposite directions, and with each block arranged in an aperture in the assembly member through which it is adapted to pass, temporarily supporting the blocks in the assembly member, positioning one of the cover sheets beneath the assembly member with an adhesive on the uppermost surface thereof, releasing the blocks from the assembly member and depositing the same on the adhesive coated surface of the

cover sheet by removing the temporary support, placing the hollow frame around the blocks on the cover sheet, placing the opposite cover sheet on the blocks and the frame with the cover sheet having an adhesive coated surface positioned in engagement with the uppermost face of the frame and blocks, and applying pressure thereto until the adhesive is set.

It is a further object of the invention to provide apparatus for use in assemblying a hollow core door panel which comprises a supporting frame having relatively movable plate-like rectangular assembly members mounted thereon, which assembly members are apertured to receive a plurality of reinforcing core blocks of generally rectangular shape, the apertures being arranged to position the core blocks in parallel row forming relation with the long axis of the blocks extending diagonally of the assembly members, and the assembly members being adapted to be positioned initially to support the blocks while they are being assembled in the apertures and being subsequently movable to align the apertures therein and permit the blocks to pass therethrough for deposit on one of the face members of the door panel, when the latter is positioned beneath the assembly members.

These and other objects and advantages of the invention will be apparent from a consideration of the panel construction and the method and apparatus for forming the same which are shown by way of example in the accompanying drawings; wherein:

Fig. 1 is a plan view of a hollow core flush door embodying the principles of the invention;

Fig. 2 is a section taken on the line 2—2 of Fig. 1, to an enlarged scale;

Fig. 3 is a perspective view of a corner portion of the door with the one face thereof removed;

Fig. 4 is a perspective view of one of the reinforcing blocks;

Fig. 5 is a fragmentary plan view of a modified form of the door;

Fig. 6 is a perspective view of the reinforcing block employed in the door of Fig. 5;

Fig. 7 is a schematic view illustrating the method employed in fabricating the door;

Figs. 8, 9, 10 and 11 are views taken on the lines 8—8, 9—9, 10—10 and 11—11, respectively, of Fig. 7;

Fig. 12 is a fragmentary plan view of a portion of the assembly apparatus for arranging the reinforcing blocks in row formation prior to their deposit on one of the faces of the door; and

Fig. 13 is a section to an enlarged scale, taken on the line 13—13 of Fig. 12.

Referring to Figs. 1 to 4 of the drawings there is illustrated a hollow core flush door construction having embodied therein the principal features of the invention, which door construction is particularly adapted for use as a closure member for an exterior opening.

The illustrated door panel consists of a frame 10 having side rails or stiles 11 and connecting top and bottom cross rails 12 which may be of solid wood construction or of built up sections or strips, as shown. The frame 10 is provided intermediate the ends of the stiles 11 with lock blocks 13 of substantial length and width which are adapted to accommodate the lock and handle hardware when the door is hung. The frame 10 is secured on opposite faces to relatively thin plywood face plates or members 14 and 15, each of which preferably comprises several plies of thin veneers arranged with the grain in cross relation, and with the outer surface adapted to receive the final finishing material it is desired to use on the door. A plurality of reinforcing blocks 16 are arranged in predetermined relation in the space enclosed by the frame 10 and its cooperating face plates 14 and

15, with each of the blocks secured on opposite faces thereof to the inside surfaces of the face plates 14 and 15 by a suitable adhesive applied to the inside surfaces of the latter, preferably in the form of an overall coating.

Each of the blocks 16 may be conveniently formed of wood of generally the same character as the frame of the panel. The blocks 16 are generally rectangular in cross section, with one cross sectional dimension being the same as the depth of the frame or the distance between the door faces 14 and 15 and the other cross sectional dimension being varied, depending generally upon the size of the stock from which the blocks 16 are cut. The blocks 16 may vary in length, being preferably between 3 and 4 inches for a standard outside door designed for use in a conventional dwelling house.

The blocks 16 are arranged within the space between the frame members in transverse and longitudinal row forming relation with the individual blocks in each row being substantially uniformly spaced from each other and being arranged with the long axis thereof extending diagonally of the frame members 11 and 12. The spacing between the blocks 16 will vary somewhat depending upon the width of the door but the blocks are arranged with the end faces 17 of each block in a row in confronting relation with the center portions of the side faces 18 of the adjacent blocks in the adjoining rows so that each block forms with each of the adjacent blocks in the adjoining rows a T-shaped formation, the longitudinal axes of the blocks being approximately at right angles to each other and the end faces 17 of each block being spaced from the adjacent side faces 18 of the adjoining blocks. The rows are spaced so that the ends of the blocks in each row extend into overlapping relation with the ends of the blocks in the adjacent rows, in both directions of the rows, which positions the blocks in nested relationship. The arrangement of the individual blocks 16 in the rows and the arrangement of the rows relative to each other results in each block forming with the blocks which are closest to it in the adjoining rows a T-shaped configuration with a space between the top or cross arm of the T and the stem or body thereof.

With the T-shaped formation provided by the spacing and arrangement of the blocks, the panel is reinforced in all directions against stresses and strains set up by contraction or expansion of the wood in the face plates 14 and 15 due to atmospheric conditions. At the same time each block is secured on its opposite faces 19 to the inner surfaces of the face plates 14 and 15 over a substantial area, with the face plates having a substantial unsecured area surrounding each block which permits the blocks to absorb the stresses and strains set up in the face plate without any appreciable warping of the surfaces of the face plate. While each of the blocks 16 restrains the movement of the face plate over a substantial area where the block is connected to the same, the space around each of the blocks which separates it from all of the adjacent blocks provides for interruption of the lines of restraint on the face plate and thus reduces the tendency to buckle and warp in the areas between the blocks. The blocks provide substantial reinforcement in all directions with the restraining forces being applied to the face plates by the blocks over a multiplicity of relatively small areas which are separated from each other by unrestrained areas. With the arrangement of the blocks shown and with relatively thin wood veneer on the faces of the panels no buckling of the face plates in the unrestrained areas between the individual blocks can be discerned.

Referring to Figs. 5 and 6 there is illustrated a modified form of door panel construction which is particularly adapted for use in the manufacture of doors for interior openings. In this construction the frame 20 and the face plates 21 and 22 may be substantially the same as the frame and face plates shown in the construction in Fig. 1. The blocks 23 which are provided for reinforcement in the hollow core of the door are formed of wood fiber materials such as is used for exterior sheathing in conventional building construction. The materials from which the blocks are formed comprises pressed wood fibers bonded together by a suitable moisture resistant, resin base, adhesive or bonding material. The blocks 23 may be somewhat narrower than the blocks 16 employed in the previously described construction. They are positioned in substantially the same T-formation with the adjacent blocks. The blocks are arranged in rows with the longitudinal axis extending diagonally and with the blocks in each row extending approximately at right angles to the blocks in the next row. The transverse spacing of the blocks is varied depending upon the width of the door panel. The wood fiber blocks provide a somewhat lighter weight door construction which has sufficient strength for indoor use. The spacing arrangement of the blocks 23 provides the same reinforcement for the facing panels 21 and 22 as in the previously described construction and results in the same distribution of stresses in the lateral, longitudinal and diagonal directions.

Referring to Figs. 7 to 13 of the drawings there is illustrated a method and apparatus for manufacturing the door panels in a rapid and efficient manner. In the manufacture of the door shown in Fig. 1, one of the face panels 14 is moved, preferably by a suitable conveyor, indicated schematically at 30, beneath a glue roller 31 which applies a coating of adhesive to the upper surface of the panel member 14. The panel member 14 is then moved into position to receive the core blocks 16 which are arranged on a specially constructed assembly jig or holder 32.

The assembly jig or holder 32 comprises a generally rectangular frame 33 which is supported on a suitable rectangular base 34. The frame 33 is connected to the base 34 by pivots 35 at the front corners which are slidably mounted in slots 36 in upstanding bracket plates 37 and by links 38 at each end which are pivoted at one end to the frame 33 at 39. At the other end the links 38 are pivotally connected at 40 to the short arm 41 of a bell crank which is pivoted to the base 34 at 42 and the long arm of which forms an operating handle 43. The handle 43 is provided with a counterweight 44 which is pivotally connected at 45 adjacent the pivot 42 and facilitates moving the assembly frame 33 from a tilted position, for filling, to a horizontal position, above the top of the base 34, for deposit of the blocks 16 on the face plate 14. The assembly frame 33 comprises relatively slidable plate members 46 and 47, the latter forming a base plate and having a surrounding marginal flange 48. The plate members 46 and 47 are provided with spaced apertures 49 and 50 arranged in the row formation in which the blocks are desired to be arranged in the core of the door frame. The apertures 49 and 50 in the two plates 46 and 47 are so arranged that they may be placed in superimposed alignment by a shuttle-like movement of the plates 46 and 47. The top plate 46 is held in oppositely disposed side guides 51 and may be slid relative to the bottom plate 47 to position the apertures 49 and 50 out of alignment and permit the blocks 16 to be supported by the bottom plate 47 while they are arranged in the apertures 49. Handle members 46' may be provided at opposite ends of top plate 46 to facilitate the sliding movement of the same. A bin 52 providing a supply of the blocks 16 for use by the assembly operator may be supported in any conventional manner above the frame 33 within reach of the operator who will remove the blocks 16 from the bin 52 and arrange the required number of blocks 16 in the apertures 49. After the blocks 16 have been arranged in the apertures 49 the assembly frame 33 is lowered by the handle 43 into parallel relation above the face plate 14 which has been positioned beneath the frame 33 in proper relation to receive the blocks 16 thereon. In the lowering

movement the rear edge or side of the frame **33** drops to proper position and rests on stop members provided by angle members **53** secured thereto adjacent the corners opposite the pivot pins **35**, while the pivot pins **35** drop in the slots **36** to properly position the front side of the frame **33** above the door member **14**. The door member **14** is supported on a drawer-like shelf member **54** which is slidable beneath the assembly frame **33** on drawer guides or supports **55** provided on the base **34**. With the frame **33** in proper position above the face plate **14** the top shuttle plate **46** is moved relative to the bottom plate **47** to align the apertures **49** and **50** and permit the blocks **16** to pass through the apertures **50** in the bottom plate **47** and be deposited on the upper surface of the door member **14**. The assembly frame **33** is thereafter moved to the elevated or tilted position leaving the blocks **16** in proper arrangement on the door member **14**, the pivots **35** rising first in the slots **36** to avoid interference with the blocks **16** by the rising frame. The loaded door member **14** is then withdrawn from beneath the frame **33** and advanced to a position to receive the assembled door frame **10**, after which the top face plate member **15** is positioned thereon, the lower side or face of the member **15** being first coated with adhesive. The door which is then completely assembled is moved into a suitable press, indicated at **56**, where it is retained under the required pressure until the adhesive has set and the blocks **16** are adhered to the face of the door members **14** and **15**.

It will be understood that in the manufacture of the doors the materials from which the door is formed are selected with regard to the conditions under which the door is to be used and that where the door is to be used as a closure for an outside opening, for example, a moisture-proof or moisture resistant adhesive will be used. Also the adhesive, in some constructions, may be applied to the members in a suitable pattern as distinguished from the overall coating described.

I claim:

1. A hollow core flush door consisting of a hollow rectangular frame, relatively thin cover sheets secured on opposite sides of the frame and a plurality of spaced elongate reinforcing blocks mounted independently of each other within the frame, said reinforcing blocks being formed from a strip of resin bonded wood fiber sheathing having a generally rectangular cross section and of sufficient thickness to enable the blocks to remain upright when supported on one edge thereof, said blocks being arranged in said frame with opposite edges thereof adhesively secured to the cover sheets, said blocks being relatively short in length and being arranged in longitudinal and transverse row formation with the long axis of each block extending diagonally relative to the frame and with the blocks in alternate rows having their long axes extending at approximately right angles to the blocks in the adjoining rows, each of the blocks forming with the adjacent block in the adjoining row a T-formation and the ends of each of said blocks being in uncoupled spaced confronting relation with intermediate portions of the side faces of the adjacent blocks in the adjoining rows to provide free and unobstructed space surrounding each of said blocks, whereby stresses and strains developing in the face plates due to expansion and contraction thereof under varying atmospheric conditions are absorbed by said blocks, with each block acting independently of the adjacent blocks within the area immediately surrounding the same, thereby to restrain the door against warpage.

2. A composite building panel adapted for use as a door, said panel consisting of a hollow rectangular frame, relatively thin plywood cover sheets secured on opposite faces of said frame, elongate reinforcing blocks of rectangular cross section mounted in independent relation in the hollow frame between said cover sheets, said reinforcing blocks being formed of relatively short sections of resin bonded pressed wood fiber sheathing, said blocks being positioned in spaced longitudinal and transverse row forming relation with the long axes of the blocks extending generaly diagonally of the frame, each of said blocks forming with the adjacent block in the adjoining row a T-formation and each of said blocks being disconnected and spaced from the adjoining blocks, said blocks each being arranged with its edge faces adjacent the cover sheets, said edge faces presenting a rectangular surface area of substantial width which is adhesively secured to the cover sheets, whereby the cover sheets are connected to each other by said blocks and restrained against relative movement at spaced areas which are surrounded by areas in which the cover sheets are free to move relative to each other.

3. A composite structural panel adapted for use as a door, said panel consisting of a hollow wood frame, relatively thin plywood cover sheets secured on opposite faces of the frame and a plurality of spaced disconnected reinforcing blocks mounted independently of each other within the frame and between the cover sheets, said reinforcing blocks being generally rectangular in cross section and relatively short in length, said blocks having opposite edge faces of substantial width and said edge faces being adhered to the cover sheets, said blocks being arranged in longitudinal and transverse row formation with the long axis of each block arranged diagonally relative to the frame, the respective blocks in each row extending at substantially right angles to the blocks in the adjoining rows with the ends of each of said blocks being in uncoupled spaced confronting relation with the center portions of the adjacent blocks in the adjoining rows, and with the ends of the blocks in each row extending into spaced overlapping relation with the ends of the blocks in the adjoining rows in both directions of the rows to form a nested pattern and providing unobstructed space between the end of each block and the adjacent blocks, whereby stresses and strains developing in the face plates due to expansion and contraction thereof under varying atmospheric conditions are absorbed by said blocks, with each block acting independently of the adjacent blocks within the area immediately surrounding the same, thereby to restrain the door against warpage.

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