

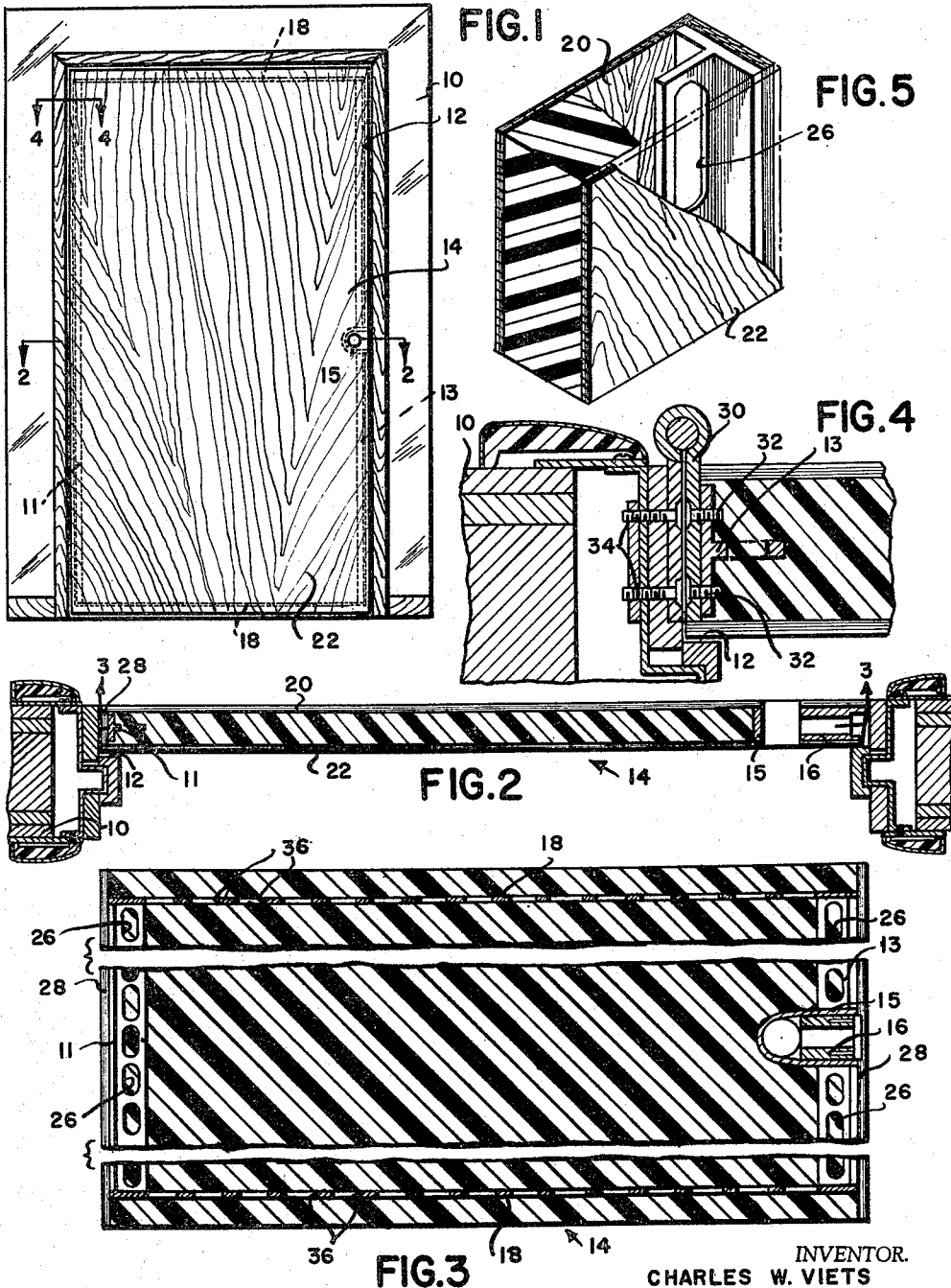
Feb. 16, 1960

C. W. VIETS
FLUSH TYPE DOOR HAVING FOAMED PLASTIC
FILLER AND METHOD OF CONSTRUCTING

2,924,861

Filed July 16, 1957

2 Sheets-Sheet 1



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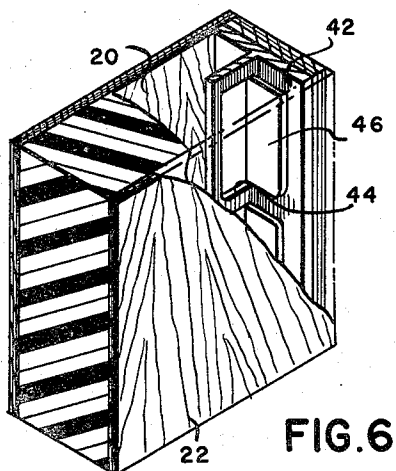


FIG. 6

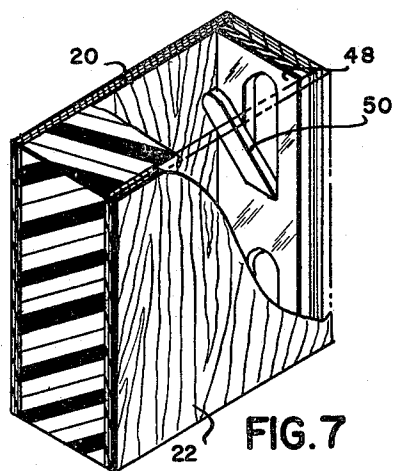


FIG. 7

FIG. 8

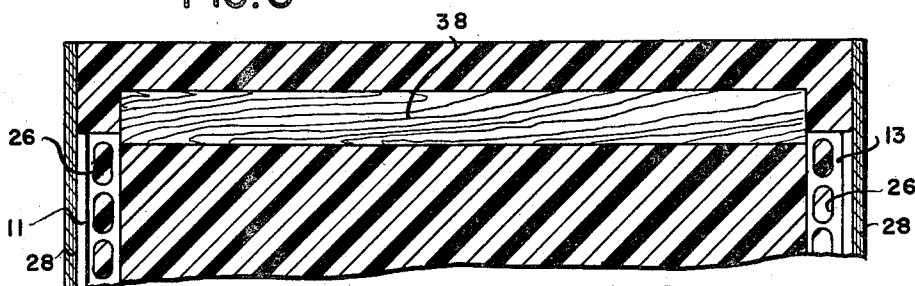


FIG. 9

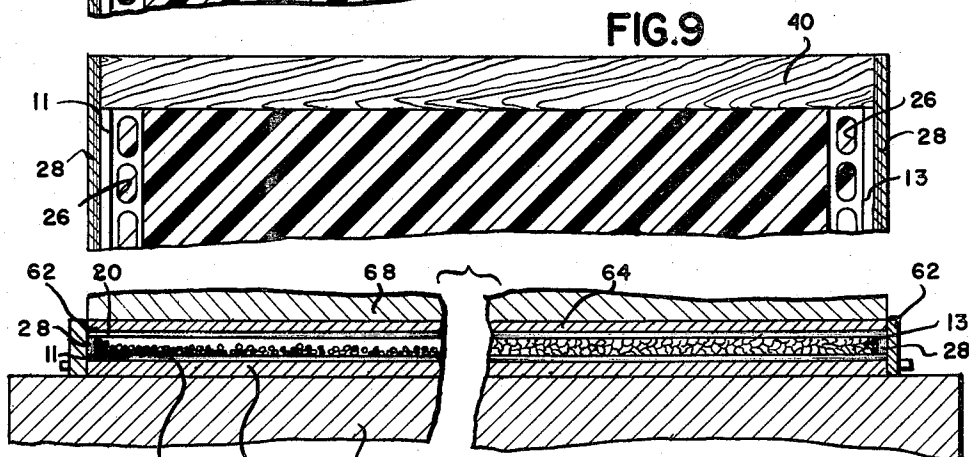


FIG. 10



FIG. 11

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FLUSH TYPE DOOR HAVING FOAMED PLASTIC FILLER AND METHOD OF CONSTRUCTING

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3 Claims. (Cl. 20—35)

This invention relates to doors, and in particular to flush-type doors consisting of a core portion and covering sheets on the front and back thereof.

Most doors used in modern construction are flush-type doors, and these are generally constructed by making up a core and applying to the opposite faces thereof metal or wood veneer sheets, generally wood veneer. Doors of this nature have a number of advantages as to cost of manufacture, ease of finishing, absence of dust collecting ledges, and the absence of seams and joints that might open up or become loose over a period of time.

Flush-type doors often have the relatively thin facing sheets less than completely supported, and this often leads to the appearances of irregularities in the surfaces of the door due to the lack of complete support of the facing sheets by the core of the door. While this is often a problem in connection with flush-type doors, what is a more serious problem is the twisting of the door from end to end on account of the wood side rails or stiles.

A particular object of the present invention is the provision of a flush-type door construction in which the drawbacks referred to above are entirely eliminated.

Another object is the provision of a flush-type door which is provided with reinforcing rails imparting dimensional stability thereto.

A still further object of this invention is the provision of a flush-type door construction in which the door can readily be cut off to fit various sized openings.

A still further object of this invention is the provision of a flush-type door which is extremely light, but which is at the same time extremely strong, and the surface panels of which will remain flat and true throughout the life of the door.

A still further object of this invention is the provision of a method of making a flush-type door in which the door can be fabricated quickly and relatively inexpensively, and a superior end product will result.

A still further object of this invention is the provision of a flush-type door and a method of manufacturing the same in which the basic door structure is adapted for both sliding doors and conventional swinging door installations.

A still further object of the present invention is the provision of a door which is essentially pre-fit in that it is completely ready for the attachment of the hinges and the installation of the latch assembly so that the user of the door need not perform any machine operations on the door itself.

These and other objects and advantages of this invention will become more apparent upon reference to the following specification taken in connection with the accompanying drawings, wherein:

Figure 1 is an elevational view illustrating a door according to the present invention installed in a door opening,

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Figure 2 is a plan sectional view indicated by line 2—2 on Figure 1;

Figure 3 is a vertical sectional view indicated by line 3—3 on Figure 2, and broken out to show both the top and bottom ends of the door;

Figure 4 is a fragmentary sectional view indicated by line 4—4 on Figure 1 showing the hinge arrangement by means of which the door is hung in the door opening;

Figure 5 is a fragmentary perspective view showing one form of rail extending along the edge of the door for stiffening the door and for imparting dimensional stability thereto;

Figure 6 is a view similar to Figure 5 but showing a different type of stiffening member along the edge of the door;

Figure 7 is another view similar to Figure 5, but showing still another type of stiffening member;

Figure 8 is a fragmentary view showing the upper end of a door and the manner in which it can be provided with a transversely extending wood sill that can be utilized for supporting door hardware for a sliding door installation;

Figure 9 is a view similar to Figure 8, but showing the transverse rail at the top of the door arranged in a somewhat different manner;

Figure 10 is a sectional view showing one manner in which a door according to the present invention can be manufactured; and

Figure 11 is a sectional view through an edge of a door showing a modified arrangement where the metallic stiffening rail is inset from the edge of the door to permit a covering strip of veneer to be placed thereover.

Referring to the drawings somewhat more in detail, Figure 1 shows a wall 10 having a door opening 12 therein in which is mounted a door 14 constructed according to the present invention.

According to the present invention, the door is constructed so that the core thereof is an expanded plastic material which completely fills the space between the front and back cover sheets which are preferably thin plywood having a decorative outer layer. The fact that the foamed plastic completely fills the space between the front and back layers provides complete support for the layers, and thus, when these layers are finished they will remain true and flat and will not warp or buckle or sink in toward the center of the door as sometimes occurs with conventional flush-type doors.

According to the present invention, the door is further provided with metal edge members extending vertically along the edges of the door, and interlocked with the plastic core material, thus providing for great strength and rigidity, and imparting dimensional stability to the door. The metallic rail at the hinge side of the door is utilized for attaching the hinges to the door, and this is of advantage because it does not impose any localized stresses on the door as in the case where hinges are fastened directly to the wood of the door or to an inset wood block or in a like manner.

The aforementioned rails along the edges of the door are preferably set back into the door an amount sufficient to permit a strip of veneer to be applied along each edge of the door in covering relation to the said rails. This will thus leave all exposed or visible sides of the door with a wood finish.

Referring to the drawings more particularly, the side rail of the door on the hinge side thereof is indicated at 11, and on the opposite side of the door is a rail 13 that is interrupted in the center of the door to permit the mounting in the door of a member adapted for receiving the latch hardware of the door. This member comprises a U-shaped strap 15 preferably welded to the adjacent

ends of the interrupted rail 13, and positioned within the strap 15 is a plastic or wood block 16 to which the latch hardware can be attached.

The rail 13 for a swinging-type door is set at a slight angle to form the beveled edge necessary for this type of door. For a sliding door, of course, this beveled door is not necessary.

According to the present invention, both of the rails 11 and 13 terminate short of the top and bottom edges of the door, and there extends therebetween the metal rails or plates 18 which are preferably welded to the rails 11 and 13, thereby to form a rigid frame for the door. The transverse plates or rails 18 are set inwardly from the top and bottom edges of the door, so that the door can be cut off if necessary to fit the door opening. It is believed that an inset of about 2" at each end of the door will be sufficient for accommodating a single door model to most standard door frames.

The door structure comprises the facing panels 20 and 22 which are preferably thin plywood sheets having a decorative outer layer consisting of a sheet of veneer of a decorative wood. These facing sheets are supported in exact parallel spaced relation by a core body which, according to the present invention, is an expanded plastic material such as foamed polystyrene.

The rails 11 and 13 are in the form of T's with the head portion thereof extending parallel with the edges of the doors; and with the flange or leg part extending into the core of the door, and being provided with cut-outs 26 through which the plastic material passes when it is foamed, thereby tightly interlocking the rails with the core of the door.

The rails 11 and 13 are set inwardly from the side edges of the door a distance about equal to the thickness of the plywood veneer facing, and this permits the side edges of the door to receive the veneer strips 28 which are bonded to the head of the adjacent rail and between the edges of the face sheets 20 and 22, whereby the front and back faces and the two side edges of the door have an entire wood surface. The plywood strip along the latch side of the door would, of course, be interrupted or cut out to permit the latch mechanism to be mounted on the insert 16 and, similarly, the veneer strip 28 at the opposite edge of the door would be interrupted at the proper places to receive the hinge means 30 by means of which the door is hung in the door opening.

The hinge means 30 may then be fastened directly to the adjacent rail 11 by means of metal screws 32 extending through the hinge and into tapped holes in the head portion of the rail, which may be placed therein on the job site or which may be put in the rail at the time the door is manufactured.

The other portion of the hinge may similarly be fastened by metal screws 34 to a metal door frame of the nature disclosed in my copending application, Serial No. 600,065, dated July 25, 1956; or, if the door frame is wood, it may be attached thereto in a conventional manner by wood screws.

The door illustrated in Figures 1-3 consists essentially of the elements identified above and the portions of the door above and below the transverse rails 18 are filled with expanded plastic material thus forming, in effect, a continuation of the core of the door.

In order to integrally connect the main portion of the core of the door with the smaller portions at the opposite ends thereof, the rails 18 may be provided with apertures 36 through which the plastic material may extend.

The door structure of Figures 1-3 is adapted for readily being sawed off or planed off at either the top or bottom edge, or both thereof, to fit a door opening and to adapt the door to slight variations from true of the door frame or floor.

The present invention also contemplates, however, the use of a door for sliding doors wherein the door is gen-

erally suspended from the top by hardware attached to the door and running in guides along the top of the door frame. Such a door may also be supported at the bottom by being engaged by guideways and hardware on the bottom of the door.

With this in mind, the present invention also contemplates providing transversely extending wood members across either the top of the door or both the top and bottom. For example, in Figure 8, there is illustrated a transversely extending wooden member 38 set downwardly somewhat from the top edge of the door, and which wooden member can be availed of for attaching hardware to the door so that the stresses accompanying such an attachment would not be imposed on the more fragile core structure.

It will be understood that the transversely extending wooden member 38 would be bonded directly to the front and back faces of the door, as well as being imbedded in the core of the door; and could, further, be attached at its ends to the side rails 11 and 13 of the door, if so desired. This could readily be accomplished by slotting the ends of members 38 to receive the inwardly projecting flanges of the side rails, and availing of the apertures 26 for making a positive connection between the wooden member and the rails.

Figure 9 illustrates a somewhat modified arrangement wherein there is a transversely extending wooden member 40 provided for the same purpose as the wooden member 38, but set between the front and back faces of the door at the extreme upper end thereof. The member 40 could be availed of for the attachment of hardware to the door, and also, this member provides a wooden surface at the top of the door which is, of course, harder and more indestructible than the core material of the door; and can be sawed and planed if necessary to fit the door into a door opening.

The rails 11 and 13 at the edges of the door may consist of the T section illustrated having the holes formed in the web; but, it will be understood that any suitably rigid metallic stiffening members could be utilized for this purpose.

For example, in Figure 6 there is illustrated a T rail 42 in which the apertures 44 are provided by striking out tabs 46 from the center leg of the rail. This arrangement permits the use of a standard, and thus inexpensive, T member for making the rails. In Figure 7, there is shown a rail 48 consisting of a flat strip of metal and having tongues 50 bent backwardly therefrom so as to be imbedded in the material of the core when the core is formed by expanding the plastic.

In making up a door according to the present invention, it is preferable first to make up the frame, then to place one of the panels of the door in a horizontal position, place the frame on the panel, place upon the panel then in addition a measured amount of unexpanded plastic material and distribute this material relatively uniformly over the panel, then place the second panel in place and expand the plastic by the application of heat while maintaining a predetermined pressure on the panels to prevent separation thereof.

In Figure 10, there is shown an arrangement wherein a mold has a bottom plate 60, and plates 62 and a top plate 64. This mold may be arranged in any suitable pressing or clamping means consisting of bed plate 66 and a movable top member such as platen 68.

It will be understood that it is desirable to have a good bond between the plastic material and the front and back panels, and for this reason the front and back panels may be coated with adhesive prior to the expanding of the plastic, and which adhesive will bond the plastic to the panels and be set up and cured simultaneously with the expanding of the plastic between the panels.

It is also contemplated to provide the inner faces of the panels with a mechanical bonding means in the form of upstanding fibers or a roughness, and this may be im-

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parted to the inner layer of the veneer cover panels by rough sanding or scratch brushing or in a like manner.

The strips 28 along the side edges of the door may be placed in the mold and bonding thereof with the rails 11 and 13 effected simultaneously with the expansion of the core material. However, these strips can also be added to the door after it is removed from the mold merely by supporting the rails during the formation of the door so as to leave the proper space for the said strips and then gluing the strips in the said space after the door is removed from the mold. More preferably still, the strips on the rail members are bonded thereto before the rail members are placed in the mold so that when the door comes from the mold all exposed surfaces thereof are of wood except where the hinges are to be attached and the opening for the latch assembly.

It will be evident that the door structure is especially designed so that the plastic material will expand relatively free between the facing panels of the door whereby the core of the door is of substantially uniform density throughout and firmly supports the panels over their entire area. The panels are thus prevented from warping or buckling, or sinking inwardly, but will remain flat throughout the life of the door.

The plastic material referred to is preferably expandible polystyrene, which is supplied in the form of fine granules that will expand up to 30 times the original volume when heated. For a door core, it is preferred to have somewhat less expansion; and, I have found that a density of about 2 pounds per cubic foot of the expanded plastic material provides for a suitable core density.

The heating of the mold may be accomplished in an autoclave or in an oven, or any other means of supplying sufficient heat to the plastic material will result in the foaming thereof. I have found that temperatures of from 230 to 290 degrees F. are sufficient for obtaining proper expansion and curing of the plastic material.

For a workpiece of the size of a door, it may be necessary to provide means for heating the plastic material directly in the cavity that the core will occupy, and this can be done according to more or less conventional practices by introducing heating probes into the cavity and withdrawing these probes as the plastic material expands, so that when the expansion is complete the probes are completely withdrawn.

The probes could, for example, be introduced through openings in the top and bottom rails of the door, and these openings thereafter plugged. This would be the case where wooden rails were employed, whereas in the case where the perforated rails, as indicated at 18 in Figure 3 were employed, the probes could be introduced directly through the apertures in these rails, thus eliminating the necessity of plugging any holes after the completion of the door.

It has been mentioned that the plastic material is placed into the cavity of the door in measured amount, and distributed therein in order to obtain substantially uniform density of the core when the material is expanded. Since the density of the core is relatively low, the present invention also contemplates pre-expansion of the plastic material before being placed in position, so that the cavity could be filled level-full with pre-expanded plastic, and thereafter the cover sheet placed on the door and the final expanding of the material accomplished. In this manner, substantially completely uniform characteristics of the core would be had throughout.

While a specific plastic material disclosed is polystyrene, and while this material at the present is actually preferred for reason of cost, it will be evident that other foaming plastic material could also be employed, for example, polyurethane and isocyanate could also be employed; and, these materials will also foam to form a suitable plastic body having the advantageous characteristics referred to.

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In the case of fully prefinished doors, it may in some cases be preferable to form the facing sheets on the opposite sides of the door and the cover strip on the side rail of the door with mitred edges as disclosed in Figure 11. In Figure 11 the core 70 has the facing sheets 72 and 74 and the edge rail 76 having a cover strip 78 and with the strip 78 and with the strip and facing sheets being mitred as at 80. This eliminates all edge grain and the facing sheets and strip can be prefinished smooth and after coming from the mold will only require at the most only a light sanding operation to trim up imperfections along the mitred joint.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions; and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. In a door, front and back panels, a foamed plastic core filling the space between said front and back panels and bonded to said panels to support them in flat parallel relationship, metal side rails extending vertically along the side edges of said door between said panels and terminating short of the top and bottom edges of the panels and core, and transverse members connecting corresponding ends of said side rails so that the portions of the panels and plastic core outwardly of said transverse members provide a trim allowance on the top and bottom edges of the door, said core being also bonded to said side rails and transverse members.

2. In a door, front and back panels, a foamed plastic core filling the space between said front and back panels and bonded to said panels to support them in flat parallel relationship, metal side rails extending vertically along the side edges of said door between said panels and terminating short of the top and bottom edges of the panels and core, transverse members connecting corresponding ends of said side rails so that the portions of the panels and plastic core outwardly of said transverse members provide a trim allowance on the top and bottom edges of the door, said core being also bonded to said side rails and transverse members, a member positioned in one of said side rails in substantially the center of the door for receiving the latch mechanism of the door, a hinge plate fastened on the other of said side rails, strips covering said side rails and positioned between the edges of said panels, said strips being interrupted in the region of said hinge plates and said latch mechanism member, said panels and strips comprising an outer face of decorative wood veneer, and at least the strip on the hinge edge of said door having the same thickness as the hinge plate secured to the door.

3. In a door, front and back panels, a foamed plastic core filling the space between said front and back panels and bonded to said panels to support them in flat parallel relationship, metal side rails extending vertically along the side edges of said door between said panels and terminating short of the top and bottom edges of the panels and core, each of said rails comprising a T-section with the web thereof having a plurality of perforations spaced along the length thereof and said web extending into said plastic core intermediate of said panels with the flange of the T-rail being parallel to the adjacent edge of the door and spaced inwardly therefrom a short distance, transverse members connecting corresponding ends of said side rails so that the portions of the panels and plastic core outwardly of said transverse members provide a trim allowance on the top and bottom edges of the door, said core being also bonded to said side rails and transverse members, and strips of the same material as said panels set between the edges of the panels and bonded to the flanges of said side rails whereby all of the vertical surfaces of the door are of the same material.

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