This invention relates to an improved hollow core door.

It is an object of the present invention to provide an improved hollow core door in which warpage, distortion, shrinkage and expansion are minimized or eliminated and in which the dimensional changes resulting therefrom are confined substantially within the structural limits of the door whereby no adjustments or alterations in the door are necessary, even though such changes should take place.

Flush type hollow core doors are well known and they consist generally of a pair of surface sheets, skins or veneers on opposite sides of the door arranged in spaced parallel relationship with plastic reinforced fibre core or lumber strips or honeycomb material interposed between the two surface sheets and adhesively secured thereto. A pair of small extend longitudinally of the door on opposite sides thereof and a pair of rails extend transversely of the door on the upper and lower ends thereof and the stiles and rails are glued to the surface sheets. Difficulty has been experienced with doors of this type in that they are subject to warpage and distortion and to dimensional changes so that adjustments and alterations in the door become necessary. I have found that a variety of factors contribute to the difficulties heretofore encountered as, for example, the surface sheets on opposite sides of the door might be subject to different amounts of shrinkage or expansion and in addition the stiles are at times warped causing distortion of the door.

It is a prime object of my present invention to overcome the difficulties heretofore encountered and to provide an improved hollow core door, particularly a flush type hollow core door, in which warpage and distortion are substantially eliminated or minimized and the dimensional changes resulting from shrinkage or expansion are confined within the structural limits of the door.

In carrying out my invention, I provide a hollow core door in which the surface sheets can have limited relative longitudinal movement with respect to each other and in which fixed rigid connection of the surface sheets to longitudinally extending stiles is eliminated.

In the accompanying drawing—

Fig. 1 is a perspective, partially fragmentary, view of a flush type hollow core door embodying my invention;

Fig. 2 is a longitudinal sectional view in the direction of the arrows on the line 2—2 of Fig. 1;

Fig. 3 is a detailed cross-sectional view in the direction of the arrows on the line 3—3 of Fig. 1;

Fig. 4 is a view similar to Fig. 3 showing a slightly modified form of door in which the channel frame is recessed into the surface sheets;

Fig. 5 is a perspective view of a modified form of hollow core door in which the inner surface sheet is made of a plurality of separate panels;

Fig. 6 is a detailed sectional view in the direction of the arrows on the line 6—6 of Fig. 5;

Fig. 7 is a fragmentary perspective view of the upper portion of a modified form of hollow core door embodying my invention;

Fig. 8 is a cross-sectional view in the direction of the arrows on the line 8—8 of Fig. 7 with the central portion of the door omitted;

Fig. 9 is a detailed, fragmentary view in perspective showing a modified form of channel shaped plug which may be employed for attaching the intermediate portion of the channel frame to the door in place of the wooden plug shown in the first form of my invention; and

Fig. 10 is a detailed, fragmentary view in perspective of a modified form of longitudinal frame members for frictionally gripping the edges of the surface sheets.

My invention is applicable to hollow core doors, particularly to flush type hollow core doors. In the accompanying drawings, I have illustrated my invention as embodied in hollow core doors of the sliding type rather than of the swinging type; although the essential principles of my invention are applicable to either type of door.

Referring specifically to the form of my invention shown in Figs. 1, 2 and 3 the door comprises a pair of surface sheets or skins 10 and 11 forming the surfaces on opposite sides of the door and arranged in spaced parallel relationship. The surface sheets may be made of any desired material such as plywood, pressed wood, paper, material or metal and the surface sheets on opposite sides of the door may be made of different materials if desired.

My improved door construction is such as to permit the two surface sheets to have limited relative longitudinal movement and so as to confine the dimensional changes resulting from expansion, contraction, etc., within the structural limits of the door. Thus, between the sheets 10 and 11 I provide suitable spacing material such as the cellular core material 12 and extending transversely of the upper and lower ends of the door I provide the rails 13 and 14 while the edges of the door are confined by the longitudinal frame members 15 and 16 which are arranged to permit limited relative movement between the two surface sheets.

The cellular core material 12 is of the well-known honeycomb type made of reinforced fibre such as Kraft fibre which can be impressed with integral cellular structure material. The cellular core material generally consists of strips of fibre secured together at spaced intervals so that the assembly may be expanded to produce the honeycomb effect shown in the drawings. The expanded honeycomb or core is adhesively secured to the inner surface of sheets 10 and 11 and is arranged parallel to the rails 13 and 14 and to the extreme longitudinal edges of the surface sheets so as to give support along the edge portions.

In this connection, I prefer to initially arrange the core so that it projects slightly beyond the longitudinal edges and to then force or compress the material inwardly, before the adhesive has set, so that along the longitudinal edges the cells are relatively smaller and more compacted as shown in Fig. 1, with the result that there is a relatively higher concentration of fibre material along the longitudinal edges. Due to the concentrated arrangement of the fibre material along the edges, this area of the door is stronger and has relatively greater resistance to compression.

The rails 13 and 14 may be made of any desired material but are preferably made of wood in the usual manner. They extend completely across the upper and lower ends of the door between the surface sheets, as shown, and are fixedly secured to the sheets as by means of a suitable adhesive.

The longitudinal frame members 15 and 16 permit limited relative movement between the surface sheets 10 and 11 while at the same time confining any dimensional changes within the structural limits of the door. The frame members preferably take the form of elongated...
channels which may be made of suitable material such as aluminum, steel, brass or plastic material and for this purpose I have found that extruded aluminum channels serve very satisfactorily.

The channels embrace the longitudinal side edges of the door and should be of a size to overlap and frictionally grip the edges of the surface sheets so as to permit limited relative movement between the edges of the panels within the dimensional limits of the channels. In this connection, the side walls of the channels may be formed of suitable material such as aluminum, steel, brass or plastic. The channel members may be free from attachment to the intermediate portions of the side edges of the door. However, I have found that under certain circumstances it is desirable to provide such attachment between the intermediate portions of the side edges of the door. Thus, as shown in Figs. 1 to 3 a plug 19 made of suitable material such as wood may be nested into the cellular core material between the surface sheets at opposite side edges of the door, as shown, and a screw 18 may be extended through the channel member into the plug.

Instead of the wood plugs 19, a pressure clip 20 as shown in Fig. 9 may be employed. The pressure clip takes the form of a metallic channel member having outwardly flaring or diverging side walls which frictionally engage with the inner surfaces of the sheets 10 and 11. The channel members are secured to the pressure clips by machine screws or bolts as shown at 21. For the purposes of clarity the cellular core material has been omitted from Fig. 9 but it should be appreciated that the clips are nested in the cellular core material at substantially the same location as the wooden plugs 19.

In Fig. 10 I have shown a modified form of channel frame member 30 which, as in the case of the frame members 15 and 16, may be made of suitable material such as aluminum, steel, brass or plastic material and which is so designed that it can be made by extrusion molding. This form of channel frame member is provided with flanges 31 on the opposite longitudinal edges thereof which frictionally engage the outer surfaces of the sheets 10 and 11. The channel frame member also is provided with flanges 32 spaced inwardly from the flanges 31 a short distance and arranged to frictionally engage the inner surfaces of the sheets 10 and 11. The channel frame member 30 gives complete freedom to the door skins or surface panels while at the same time it provides a frictional grip along the longitudinal edges of the skins for the full length of the door.

In Fig. 4 I have shown a modified form of assembly in which the channel 16' has parallel side walls which are recessed into the surface sheets 10 and 11 as shown at 22 so that the projection caused by the edge of the channel is eliminated and the entire surface of the door is flush. In this arrangement, the walls of the channel frictionally engage the recessed surfaces of the sheet 10 and 11 permitting limited relative movement thereof while confining the dimensional changes of the surface sheets within the structural limits of the channels. If desired, a non-setting, permanently tacky adhesive of the type referred to above may be applied between the sheets 10 and 11 and the walls of the channel 16'.

Figs. 5 and 6 show a further modified form of hollow core door, embodying my invention, similar to the form shown in the first three figures of the drawing, with the exception that one or both of the surface sheets on one side of the door are formed of a plurality of separate panels. Thus, in the illustrated embodiment sheet 10' on the inside of the door is shown as being formed of a plurality of panels 24, 25 and 26 extending transversely of the door and arranged in an abutting parallel relationship. The panels 24, 25 and 26 may be made of any desired material such as plywood, pressed wood, plastic material, metal or the like and the panels, in turn, may be made from different material than the opposite surface sheet 11. The abutting edges of the panels are preferably shaped decoratively or recessed as shown so as to improve the appearance thereof.

As in the first form of my invention, the cellular core material 12 is attached between the surface sheets and is adhesively secured thereto and rails 13 and 14 extend transversely of the upper and lower ends of the door respectively between the surface sheets and are likewise adhesively secured thereto. Attaching inserts such as the wooden lugs 19 or, if preferred, such as the pressure rod 20 shown in Fig. 9, may be secured between the intermediate panel 25 of the surface sheet 10' and the opposite surface sheet 11. The channels 15 and 16 are applied in the same fashion as in the first form of my invention and are secured by screws 18 to the rails 13 and 14 and to the panel and the side of the door.

The base of the channel members may be adhesively secured to the exposed edges of the cellular core material and if desired the side walls of the channels may be secured to the surface sheets by a permanently tacky, non-setting adhesive such as a natural or synthetic rubber-base adhesive.

In Figs. 7 and 8, I have shown a preferred form of door somewhat similar to the arrangement shown in Figs. 1 to 3 but employing a modified form of attachment for the channels. Thus, the door has surface sheets 10 and 11 with cellular core material 12 between the same in the manner and having transverse rails 13 and 14 in the upper and lower ends thereof and longitudinal frame members in the form of channels 15 and 16 embracing the longitudinal side edges thereof. However, in this form of door the channel members 15 and 16 are not secured if the rails or to attaching inserts provided in the side edges. Instead the longitudinal channel frame members 15 and 16 are secured or tied together by means of rods 35. Any desired number of rods may be employed as, for instance, one each near the upper and lower ends of the door and another at an intermediate position. The rod or rods are engaged to the channel members in any suitable fashion and then extend for the entire width of the door through the cellular core material. In the illustrated embodiment the rods are in the form of metal wire members having one headed end 36 engaging the outer surface of the channel 15. The rod extends through an aperture in the channel and thence through the cellular core material to the opposite side of the door. The end of the rod adjacent the channel 16 is threaded, as shown at 37, and is engaged by a female cap screw 38 which is extended through an aperture in the channel member 16. The cap screw is tightened so as to provide the desired tension to the wire rod so as to stress the channel members and hold them firmly in place while, at the same time, permitting limited expansion and contraction of the surface sheets as in the first form of my invention, the side flanges of the channel members preferably too slightly inwardly so as to frictionally grip the edges of the door. It should be understood that the wire rods may be secured in place in any desired manner and that the headed end 36 and the cap screw 38 are intended only for purposes of illustration.

The several doors embodying my invention shown in the accompanying drawings are of the sliding rather than of the swinging type. In using the doors the hangers or slides are applied to the upper rails 13 in the usual man-
ner. It will be appreciated that the surface sheets of the doors embodying my invention are not rigidly fixed in position but, on the contrary, may have limited relative movement with respect to each other and with respect to the channel members 15 and 16. In the event that the door is subjected to different conditions of temperature or humidity the channel members permit limited relative expansion and contraction. This is also true if one of the surface sheets is subjected to different conditions from the opposite surface sheet. In this connection, it will be appreciated that even though the surface sheets are adhesively secured to the cellular core material, the cellular core material is resilient and flexible and will permit limited relative movement between the sheets. In the form of my invention shown in Figs. 5 and 6 the separation of the surface sheet into separate panels provides for even greater relative contraction and expansion.

From the foregoing, it will be appreciated that I have provided an improved hollow core door of relatively simple and inexpensive construction which eliminates or minimizes the difficulties arising from warping and distortion and serves to confine dimensional changes resulting from expansion or contraction within the structural limits of the door.

Modifications may be made in the illustrated and described embodiments of my invention without departing from the invention as set forth in the accompanying claims.

I claim:
1. A flush type, warp resisting hollow core door comprising: a pair of surface sheets forming opposite sides of the door and arranged in spaced parallel relationship, at least one of said surface sheets being formed of a plurality of separate panels extending transversely of the door in parallel relationship; a pair of relatively rigid rail members extending transversely of the door adjacent the upper and lower ends thereof and arranged between the surface sheets and being fixedly secured to the inner surfaces thereof; a cellular core made of fibrous material interposed between the sheets and adhesively secured to the inner surface thereof said cellular core extending from substantially the upper rail to the lower rail and outwardly to the two longitudinally extending side edges of the door for at least the greater portion of the length thereof; a pair of relatively rigid channel frame members extending longitudinally of the door on the opposite side edges thereof, the side walls of said channel members being arranged to overlap and embrace the edge portions of said surface sheets; and connecting means permitting limited relative movement securing the channel members in place on the opposite side edges of the door so as to provide for limited relative movement between the surface sheets and between the surface sheets and the channel members.

2. A flush type hollow core door as set forth in claim 1 in which the cellular core material is relatively more compacted adjacent the side edges of the door than adjacent the central portion thereof so as to provide greater strength and support adjacent the side edge portions.

3. A flush type hollow core door as set forth in claim 1 in which said channel member is made of resilient material and the side walls thereof are disposed at an inwardly extending angle with the end portions thereof in engagement with and resiliently gripping the surface sheets.

4. A flush type hollow core door as set forth in claim 1 in which a relatively rigid member is interposed between the surface sheets adjacent one of the side edges of the door and intermediate the ends thereof and the channel frame member is fixedly secured thereto.

5. A flush type hollow core door as set forth in claim 1 in which the channel frame members are adhesively secured to the cellular core material at the side edges of the door but are free from fixed connection with the surface sheets.

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