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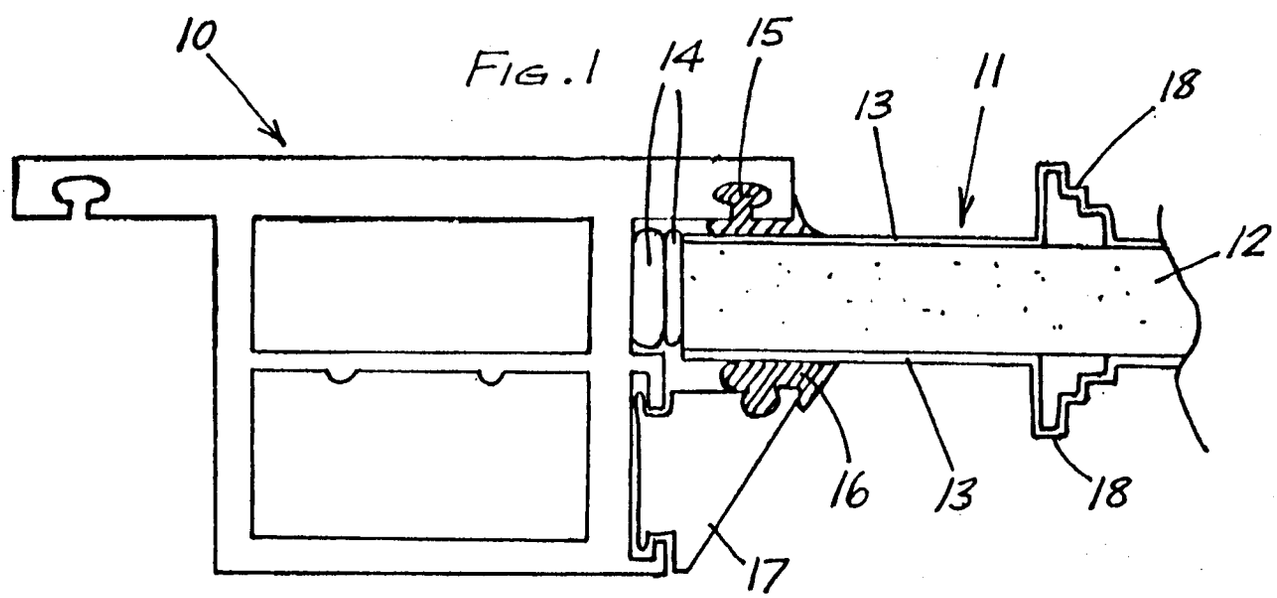
## (54) Door construction and method of manufacture.

(57) The door construction is obtained by making a door frame by bringing together extrusions (10) and connecting them to each other; thereafter placing a sheet (20,30) of an expanded cellular material within the confines of the door frame, the sheet being of a thickness such as to have one of its two large flat surfaces coplanar with first coplanar surfaces of the extrusions (10); and bonding a skin (24,31) not only to said first coplanar surfaces of the extrusions but also to said one large flat surface of the sheet (20,30).

The other of the two large flat surfaces of the sheet (20,30) has bonded thereto a skin (21,32) which, in one embodiment, is sealingly secured to inside (unseen) surfaces of the extrusions (10) of the door frame or, in another embodiment, is bonded not only to second coplanar surfaces of said extrusions but also to said other of the two large flat surfaces of the sheet (20,30).

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This invention relates to a door construction and to a method of manufacture of a door.

At present, doors made of extrusions of a thermoplastic polymer material, aluminium or other material (and it is with such doors that the present invention is concerned) comprise a door frame to which is connected an infill panel which consists of a block of expanded foam material covered on its opposite faces with skins of PVC or other thermoplastic polymer material moulded to suit virtually any taste. Said panel is mounted in the frame with gaskets and bead-like members (glazing beads)which are clipped into appropriately formed recesses in the extrusions from which the door frame is constructed. The completed door is then mounted on the outer frame which is connected to the brickwork, blockwork or the like.

The in-fill panel is, typically,between 20 mm and 28mm in thickness; therefore, the finished door is relatively flimsy because said panel may be 600-800 mm by 1800-2000 mm in area. From the point of view of heat-insulation and fire-retardation,such a thin panel is not entirely satisfactory.

From the point of view of security, the door with such a flimsy panel mounted in the manner used is decidedly unsatisfactory because either the panel can simply be kicked in by the criminal in order to gain entry or the panel can be carefully and relatively easily removed (and replaced) by the criminal.

From the aesthetic point of view, the present manufacturing method has built-in limitations because the panels may only be formed from white plastics materials (in order to match the door frame on which it is to be mounted). As a variation, the moulded panel can subsequently be covered by an adhesive-backed wood grain foil. However, these are the only choices.

Lastly, from another aesthetic viewpoint, the use of the gaskets (which are usually made from a black material) is undesirable because they always remain visible and spoil the appearance of the completed door.

The principal object of the present invention is to provide an improved construction of door which will provide enhanced security and fire ratings.

A subsidiary object of the present invention is provide a door construction which will enable aesthetic requirements to be recognised and met.

In the trade, an "externally glazed door" refers to the shape of the extrusions from which the door frame is built and thus, in turn, to the position of the glazing beads in the completed door, regardless of whether or not any glass has been mounted in the door frame. Therefore, the term "an externally glazed door" refers to the fact that the glazing beads are on that side or face of the door which will be exposed to weather, but the door may in fact have no glass in it and may comprise the door frame in which there is mounted a solid non-glass infill panel. As used herein, the term "an externally glazed door" will be intended to refer to the shape of the extrusions from which the door frame can be built, even though there is neither glass in the door nor glazing beads holding anything in position.

According to a first aspect, the present invention consists in a door construction which comprises a door frame made out of interconnected extrusions of thermoplastic polymer material or aluminium; expanded cellular material located within the confines of the door frame and of a thickness substantially equal to or not significantly different from the depth of the space bounded by said extrusions; and skins of a suitable material bonded to and covering the opposite faces of said expanded cellular material; the skin on at least the weather side of the door also being bonded to and covering the respective surfaces of the extrusions which are coplanar with that of the expanded cellular material to which said skin is bonded, and the skin on the other side of the door being connected to other surfaces of said extrusions.

In one door construction as described in the preceding paragraph, said skin on said other side of the door may be bonded to or sealed against inside surfaces of other parts of the extrusions.

In another door construction as described in the second preceding paragraph, said skin on said other side of the door may also be bonded to and cover the respective surfaces of said extrusions which are coplanar with that of the expanded cellular material to which said skin on said other side of the door is bonded.

The skins referred to in any of the three preceding paragraphs may be made of aluminium,steel or a plastics material (such, for example, as a thermoplastic polymer material). Moreover, said skins may be quite flat or plain (unadorned) or they may be moulded to provide profiled patterns.

According to a second aspect, the present invention consists in a method of manufacture of a door, including the following steps, namely,

(a) joining extrusions made of a thermoplastic polymer material or aluminium together to form a door frame;

(b) creating a quantity of expanded cellular material of such an area as will fit within said door frame with minimal spacing between the edges of said material and the door frame, the thickness of said cellular material being substantially the same as the depth of the space bounded by said door frame; and

(c) mounting said quantity of expanded cellular material in said door frame by placing said quantity within the door frame and bonding a skin of a suitable material to a first surface of said quantity and to those surfaces of the extrusions which are coplanar with said first surface of the quantity, whereby a weather-impervious side of the door is created.

In a method as described in the preceding para-

graph, the opposite or second surface of said quantity may be covered, prior to step (c) being carried out, by a skin of a suitable material which is bonded to said second surface; marginal portions of said skin which is bonded to said second surface being brought into sealing contact with inside surfaces of other parts of the extrusions when said quantity of expanded cellular material is placed within the door frame.

In another embodiment of the method described in the second preceding paragraph, after step (c) has been carried out, the opposite or second surface of said quantity may be covered by a skin of a suitable material which is also of such an area as also to cover those surfaces of the extrusions which are coplanar with said second surface of said quantity; said skin being bonded to said second surface and to those extrusions surfaces which are coplanar with said second surface.

The present invention further consists in a door construction, and in a method of manufacture of a door, substantially as hereinafter described with reference to and as illustrated in Figures 2 and 3 of the accompanying diagrammatic drawings.

Figure 1 illustrates the prior art as described in the second and third paragraphs of this specification. In Figure 1, there is an extrusion 10 of, for example, a PVC material which is always white. A door frame is constructed by connecting together four of such extrusions. An infill panel 11, consisting of a sheet 12 of an expanded cellular material covered on each of its opposite surfaces by a skin 13 which is bonded to the respective surface, is mounted in the door frame by means of packers 14, a gasket 15, a gasket 16 and a clip-in glazing bead 17. It will be seen that the skins 13 have been formed (e.g. by vacuum-forming sheets of a suitable plastics material which must also be white in order to match the white of the extrusions 10) with profiles 18 in order to simulate wooden doors which have spaced profiled panels.

The door construction illustrated in Figure 1 provides a door which is relatively flimsy because the overall thickness of the sheet 12 and the two skins 13 is only about 20-28 mm. Therefore, with such a small thickness over quite a large area, the panel 11 is not really very rigid and it can be kicked in by a burglar or other person. Moreover, because the door illustrated in Figure 1 is an externally glazed door (as defined above), the burglar or other person who wants to enter the premises illegally can quite easily take out the glazing beads 17 in order to remove the panel 11. Security is therefore poor and, because of the small thickness of the panel 11, the length of time for which fire can be retarded by the door is too small.

Lastly, the black gaskets 15, 16 are always visible and this detracts from the overall appearance of the door.

Referring to Figure 2, which illustrates one embodiment of a door construction according to the present invention, there is an extrusion 10 of which four are made up into a door frame, as before. A sheet 20 of an expanded cellular material (e.g. expanded cellular polystyrene marketed under the trade mark STYROFOAM) has a skin 21 bonded to one surface thereof. On the marginal portion of the skin 21, there is a layer 22 of an adhesive or sealant which comes into contact with the inside (i.e. unseen when the completed door is in use) surface of a so-called dog leg 23 of the extrusion when the sheet 20 is placed in the door frame. The other or opposite surface of the sheet 20 has bonded thereto a skin 24 which is large enough in area also to cover those surfaces of the four extrusions which are coplanar with said other or opposite surface of the sheet 20; those marginal portions of the skin 24 which extend over those surfaces of the extrusions are bonded to those surfaces.

In Figure 3, there is illustrated an alternative embodiment in which a sheet 30 is thick enough to occupy the whole of the depth of the space bounded by the door frame. Bonded to one surface of said sheet is a skin 31 which is exactly equivalent to the skin 24 in Figure 2. Bonded to the other surface of the sheet 30 is a skin 32 which covers, and is bonded to, those surfaces of the four extrusions which are coplanar with said other surface of the sheet 30.

The sheet 20 or the sheet 30 will usually be of the order of 75mm thick, or even more.

The skins 21, 24 and 31, 32 can be formed with ribs or profiles or any decorations which may be desired. Said skins may be made of aluminium or steel for the highest fire ratings but they may be made of a suitable plastics material of any colour (such, for example, as PVC or other thermoplastic polymer material).

It is mentioned above that the sheet 20 may be made of STYROFOAM which is an extruded material. However, said sheet may be made from beaded polystyrene or from polyurethane or from any composite board (e.g. ply, calcium silicate, et cetera).

Some of the advantages obtained by the door construction, and manufacturing method, according to the present invention are:-

(1) Thicker and therefore more solid door which provides, inter alia, improved security;

(2) Thicker door which also provides longer retardation of fire;

(3) There is no longer the ugliness of the black gaskets showing the ugliness stemming from the fact that the visible parts of the black gaskets made the door appear to be narrow and to seem to be a door within a frame;

(4) In the case of the Figure 2 embodiment, there is a saving of material because the skin 21 has a significantly smaller area than the skin 32 of Figure 3;

(5) In the case of the Figure 2 embodiment, there is a "picture frame" appearance given by the vis-

ible edge of the dog leg 23, this "picture frame" appearance being on the inside (non-weather side) of the door; and

(6) One or both skins 21, 24 and 31, 32 can be of any desired colour because the colour is carried, on the weather side, right out to the edge of the relevant surface of the extrusion;

(7) Insofar as the exterior (weather side) of the complete door is concerned , there is no need for an in-fill panel to be matched, in colour, to the surrounding door frame or sash because the latter is now within the door (covered by the skin concerned);

(8) In conventional in-fill panel doors, said panel does not make a full contribution to maintaining squareness to the frame; thus, such doors tend to "drop" and to need service calls. Doors according to and made in accordance with the present invention overcome this defect because at least one of two skins makes a 100% contribution to maintenance of squareness; there cannot be any significant "drop" of the door without total failure of the bond between the skin and the door frame and the sheet of STYROFOAM or other material.

## Claims

1. A door construction which comprises (a) a door frame made out of interconnected extrusions of thermoplastic polymer material or aluminium, (b) expanded cellular material located within the confines of the door frame and of a thickness substantially equal to or not significantly different from the depth of the space bounded by said extrusions, and (c) skins of a suitable material bonded to and covering the opposite faces of said expanded cellular material; the skin on at least the weather side of the door also being bonded to and covering the respective surfaces of the extrusions which are coplanar with that of the expanded cellular material to which said skin is bonded, and the skin on the other side of the door being connected to other surfaces of said extrusions.

2. A door construction as claimed in Claim 1, wherein said skin on said other side of the door is bonded to or sealed against inside surfaces of other parts of the extrusions.

3. A door construction as claimed in Claim 1, wherein said skin on said other side of the door is bonded to and covers the respective surfaces of said extrusions which are coplanar with that of the expanded cellular material to which said skin on said other side of the door is bonded.

4. A door construction as claimed in any one of Claims 1 to 3, wherein said skins are made of aluminium, steel or a plastics material (such, for example, as a thermoplastic polymer material).

5. A door construction as claimed in any one of Claims 1 to 4, wherein said skins are quite flat or plain (unadorned) or are moulded or otherwise treated to provide profiled patterns.

6. A method of manufacture of a door. including the following steps, namely,

   (a) joining extrusions made of a thermoplastic polymer material or aluminium together to form a door frame;

   (b) creating a quantity of expanded cellular material of such an area as will fit within said door frame with minimal spacing between the edges of said material and the door frame, the thickness of said cellular material being substantially the same as the depth of the space bounded by said door frame; and

   (c) mounting said quantity of expanded cellular material in said door frame by placing said quantity within the door frame and bonding a skin of a suitable material to a first surface of said quantity and to those surfaces of the extrusions which are coplanar with said first surface of the quantity, whereby a weather-impervious side of the door is created.

7. A method as claimed in Claim 6, wherein the opposite or second surface of said quantity is covered, prior to step (c) being carried out, by a skin of a suitable material which is bonded to said second surface; marginal portions of said skin which is bonded to said second surface being brought into sealing contact with inside surfaces of other parts of the extrusions when said quantity of expanded cellular material is placed within the door frame.

8. A method as claimed in Claim 6, wherein, after step (c) has been carried out, the opposite or second surface of said quantity is covered by a skin of a suitable material which is also of such an area as also to cover those surfaces of the extrusions which are coplanar with said second surface of said quantity; said skin being bonded to said second surface and to those extrusions surfaces which are coplanar with said second surface.

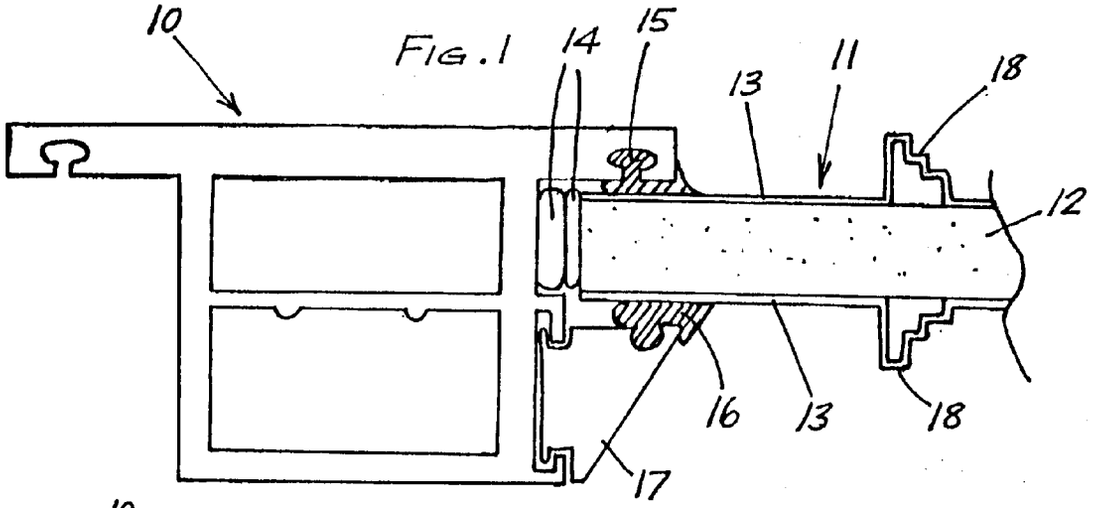


FIG. 1

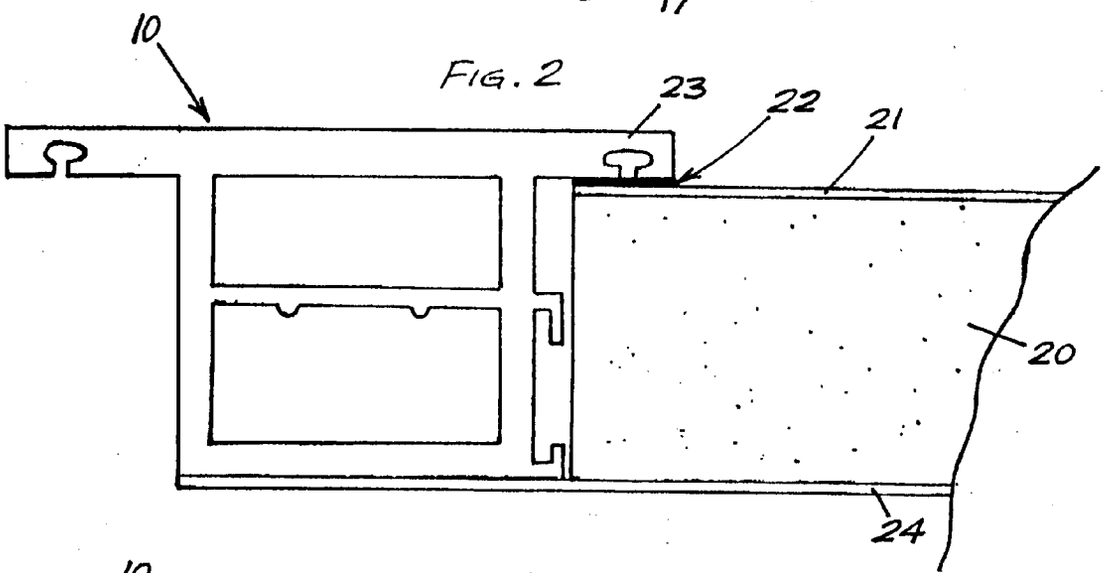


FIG. 2

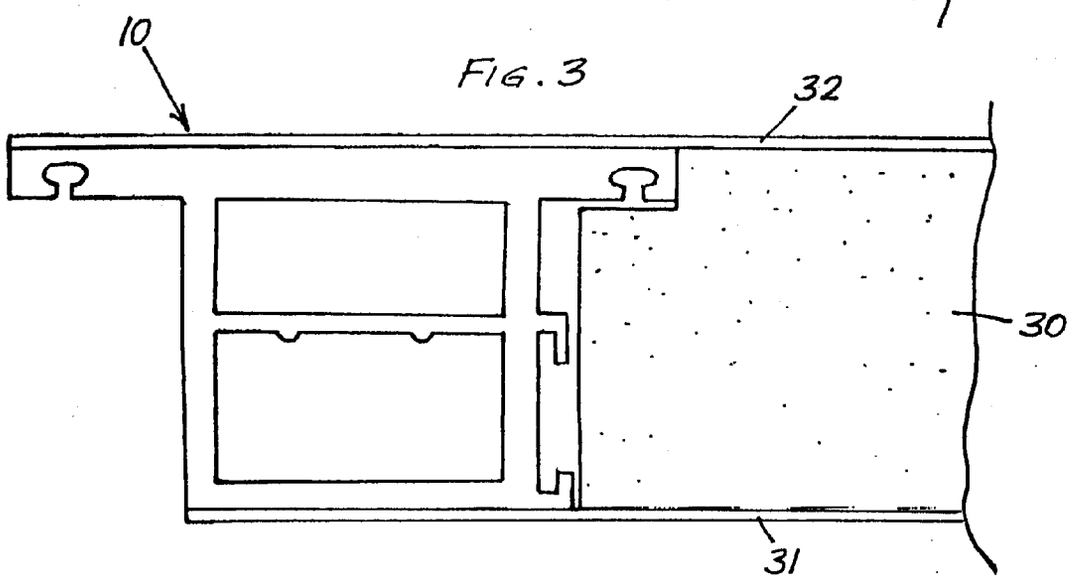


FIG. 3

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# EUROPEAN SEARCH REPORT

Application Number

EP 91 30 8482

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5 ) |
|---|---|---|---|
| X | GB-A-2 183 706 (HUNT)<br>* the whole document * | 1,3-6,8 | E06B3/72 |
| A | GB-A-1 159 222 (HOME COMFORT PRODUCTS CO.)<br>* page 2, line 36 - page 2, line 71 *<br>* page 2, line 99 - page 3, line 7; figures 1-3 * | 1,3-6,8 | |
| A | DE-A-2 412 692 (HCH. BERTRAMS AG.)<br>* page 3, line 17 - page 4, line 4 *<br>* page 6, line 12 - page 6, line 26; claims 1-3,11; figures 1,2 * | 1,3,4 | |
| A | DE-A-1 912 915 (LINDPOINTNER)<br>* claim 1; figures 1,5,6 * | 1 | |

TECHNICAL FIELDS SEARCHED (Int. Cl.5 )

E06B
E04C

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 20 DECEMBER 1991 | BLOMMAERT S. |

CATEGORY OF CITED DOCUMENTS

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