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THERMALLY INSULATING DOOR

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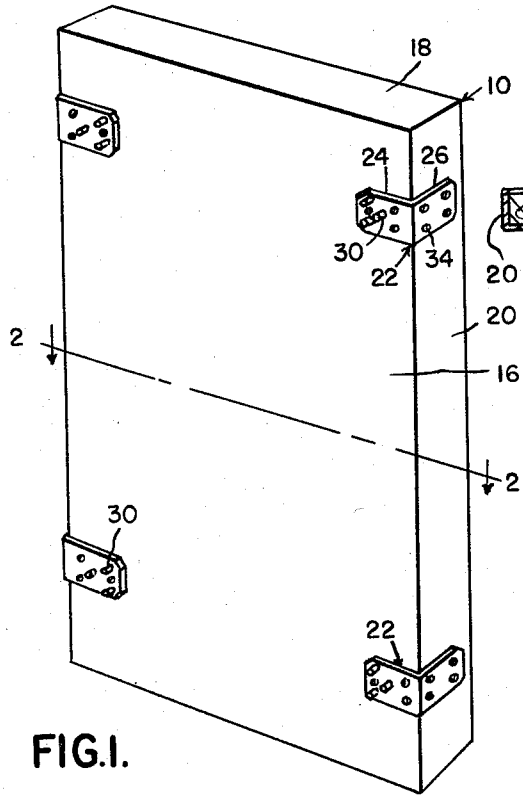
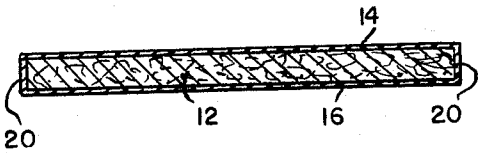


FIG.1.

FIG.2.



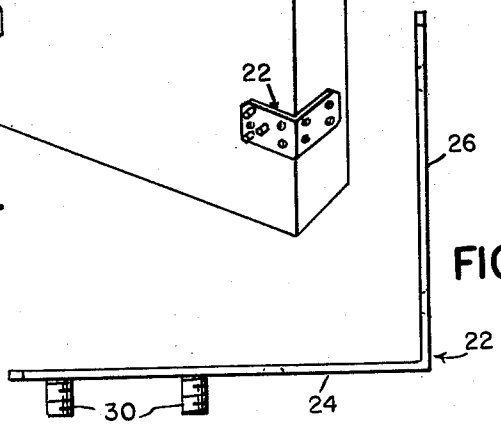


FIG.3.

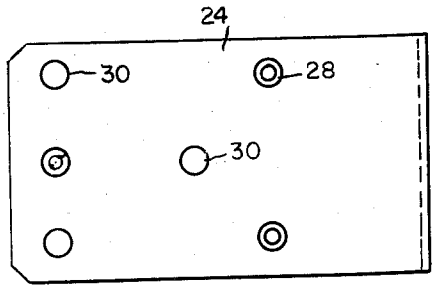
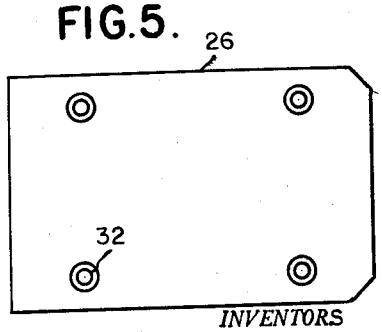


FIG.4.

FIG.5.



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THERMALLY INSULATING DOOR

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3 Claims. (Cl. 20—35)

The present invention relates to a thermally insulating door.

It is an object of the present invention to provide a highly efficient relatively inexpensive thermally insulating door comprising a block of expanded plastic material provided with cover sheets of relatively thin, strong, hard material and having hardware for mounting hinges or latches permanently secured thereto.

More specifically, it is an object of the present invention to provide door structure of the character described including hinge and/or latch mounting hardware comprising flat straps bent to right angular formation to provide flat leaves, means for attaching said hardware at the corners of the door with the leaves respectively secured to the side and edge surfaces of the door.

Still more specifically, it is an object of the present invention to provide structure as described in the preceding paragraph in which the hardware includes outwardly extending fastening elements, preferably in the form of threaded studs, for mounting hinges or latches as required.

It is a further object of the present invention to provide a novel method resulting in secure and permanent attachment of fixture mounting hardware to a door of the character described which comprises assembling the hardware to the door by driving screws through openings in the hardware through the cover sheet into the expanded plastic material to form their own threads, removing said screws, providing uncured flowable plastic material such for example as epoxy resin in the screw holes, remounting the hardware by replacing the screws, and causing the resin to cure.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawing, illustrating a preferred embodiment of the invention, wherein:

Figure 1 is a perspective view of the door with the hardware attached thereto.

Figure 2 is a section on reduced scale taken on the line 2—2, Figure 1.

Figure 3 is an edge view of one of the hardware elements.

Figure 4 is a view of the hardware element seen from below in Figure 3.

Figure 5 is a view of the hardware element as seen from the right in Figure 4.

The thermally insulating door generally designated **10** comprises a large unitary rigid block **12** of an expanded plastic material such for example as expanded polystyrene, sold under the trade name "Styrofoam." Materials of this sort are produced by foaming plastic materials while in flowable condition and thereafter causing them to set. As a result the material is characterized by the inclusion of a multiplicity of relatively small air bubbles enclosed in plastic material, thus providing exceptionally fine insulating properties.

The size of the slab or block **12** depends of course upon the opening, but in general it is of approximately the full desired size of the door. Excellent results have been obtained employing slabs 6 inches thick having a height of 6 feet 6 inches, and a width of 3 feet 6 inches.

This material is an extremely efficient insulator against transfer of heat, but while rigid, it is easily injured by impact with sharp objects or the like. On the other hand, its physical properties which render it particularly useful in the present invention is its lightness, its high thermal insulation factor, its high compressive strength, its high bending moment and shear strength, its low deflection, and excellent impact resistance.

While reference has been made to the use of expanded polystyrene, it is recognized that other plastic materials capable of expansion may be employed. Among such materials is poly-urethane.

In order to protect the door from injury and to enter into the hardware mounting which renders the construction commercially feasible, the block or slab or the expanded plastic material has both opposite sides and all four edges thereof covered with strong, thin, hard protective cover sheets, the sheets covering opposite sides of the door being designated **14** and **16**, the sheet covering the top edge of the door being designated **18**, and the sheets covering the side edges of the door being designated **20**.

Excellent results have been obtained when the cover sheets are produced by fiber glass laminated by polyester resin and bonded to mahogany plywood. Obviously of course, the fiber glass could be bonded to asbestos, cement board, metal, fiber board, or plastic materials. In some cases the resin impregnated fiber glass may be laminated directly to the expanded plastic although in general it is preferred to provide additional strength by employing a lamination including a hard board such as wood, plywood, metal, or the like between the fiber glass and the foamed or expanded plastic slab or block.

Inasmuch as the cover sheets are adhered over relatively massive areas to the surface portions of the expanded plastic slab, they are very strongly united thereto and thereby are enabled to enter into the support of hardware as will presently appear.

A problem is presented in attaching hardware to a door as described in the foregoing, for the reason that the expanded plastic material is not particularly well adapted to give strong support to attaching screws. Accordingly, special hardware is attached by a particular method to provide a strong, firm, permanent mounting of the hardware to which hinges and latch devices may be selectively attached. Moreover, the hardware referred to is applied in such a way that identical hardware is provided in the appropriate position for mounting either hinges or latch devices. As a result, the door is reversible and may have the latches and hinges attached at the site of erection to mount the door either right or left handed as may be desired.

The fixture mounting hradware comprises flat strap material bent into brackets **22** of right angular form comprising two flat attaching leaves **24** and **26**. Each of the leaves **24** and **26** is adapted to engage in extended surface contact with the outer surface of one of the side cover sheets **16** and an adjacent edge cover sheet **20** at a corner of the door. The leaf **24** is provided with a plurality of countersunk screw receiving openings **28** and is in addition, provided with a plurality of outwardly extending threaded studs **30**. The other leaf **26** is provided with a plurality of countersunk openings **32** for the reception of attaching screws.

In order to provide a firm, strong, permanent attachment between the brackets **22** and the door, the brackets

are placed in the position illustrated in Figure 1 and the screws 34 are forced home in such a way as to cause them to form threads in the cover sheets 16 and 20 and in the expanded plastic material 12. Thereafter, the screws 34 are withdrawn in the usual way and a suitable uncured flowable plastic material is introduced into the screw holes. Preferably, an excess quantity of the flowable plastic material is introduced so as to substantially fill the hole. Thereafter, the hardware is reattached by replacing the screws 34 and the plastic material is caused to set. Excellent results are obtained when the flowable plastic material introduced into the screw holes for this purpose is epoxy resin. This resin may be supplied with a chemical curing agent so that it sets shortly after insertion of the screws.

It has been found that this method of attachment results in strong, permanent connection between the hardware brackets 22 and the door. Evidently, the plastic material, such as the epoxy resin, introduced into the screw holes forms a strong solid plug around the screw within the expanded plastic material and bears against the rear surface of the strong cover sheet. As previously mentioned, the cover sheets themselves, due to the large area of attachment, become in effect an integral part of the expanded plastic material.

In any case it is found that the hardware brackets 22, when attached as disclosed in the foregoing, form extremely strong bonds with the door and provide door mountings which permit heavy weights to be hung on the door, to withstand jarring impacts of slamming the door, and to withstand forces developed in opening the door against the resistance of strongly acting latch means.

An important feature of the present invention is the provision of the L-shaped or angular hardware brackets 22 in position at opposite edges of the door so that any pair of the brackets may be connected by the studs 30 to suitable hinge means while the remaining brackets at the opposite edge of the door may be employed to attach suitable latch means. Obviously, this of course means that the door may be hung either right or left handed as desired.

The present invention also facilitates manufacturing and assembly of the door and frame which may be balanced and checked at the factory for plumb condition, by hinging the door in the frame.

The drawing and the foregoing specification constitute a description of the improved thermally insulating door in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What we claim as our invention is:

1. A thermally insulating door comprising a unitary rigid block of expanded plastic material, strong thin hard protective cover sheets attached to opposite sides and all edges of said block to completely enclose said block, hinge supporting hardware permanently attached to said door comprising flat straps bent to right angular shape and located at a vertical corner of said door, said straps having flat leaf portions connected against one edge of said door, and screws extending through openings in said flat leaf portions through the underlying cover sheets and into but not through the expanded plastic material, and plugs of hard dense plastic material surrounding the portions of the screws extending into the expanded plastic material and bearing against the rear surfaces of said cover sheets, one of said flat leaf portions having outwardly projecting threaded studs rigidly secured thereto.

2. A thermally insulating door comprising a unitary rigid block of expanded plastic material, strong thin hard protective cover sheets attached to opposite sides and all edges of said block to completely enclose said block, hinge supporting hardware permanently attached to said door comprising flat straps bent to right angular shape and located at a vertical corner of said door, said straps having flat leaf portions connected against one side and flat leaf portions connected against one edge of said door, and screws extending through openings in said flat leaf portions through the underlying cover sheets and into the expanded plastic material, one of said flat leaf portions having outwardly projecting threaded studs rigidly secured thereto.

3. A thermally insulating door comprising a unitary rigid block of expanded plastic material, strong thin hard protective cover sheets attached to opposite sides and all edges of said block to completely enclose said block, and identical hinge and lock supporting hardware secured to vertical corners at opposite edges of the door, said hardware comprising flat straps bent to right angular shape and having flat leaf portions connected against adjacent side and edge portions of the door, the leaf portions at the side of said door having laterally projecting threaded studs secured thereto for selective connection to latch and hinge members.

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