Dec. 28, 1965 L. C. LYTZ 3,225,505

FIRE-RESISTANT DOOR

Filed Aug. 13, 1963

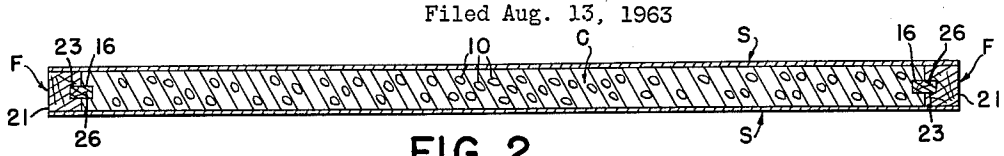


FIG. 2.

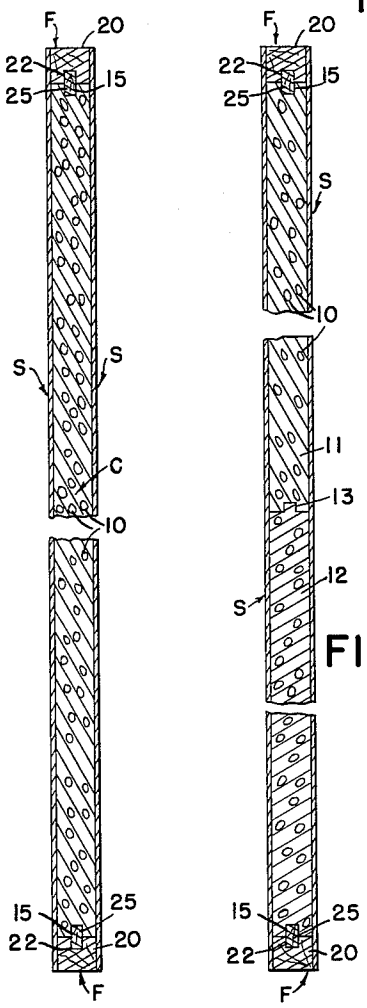


FIG. 3.

FIG. 5.

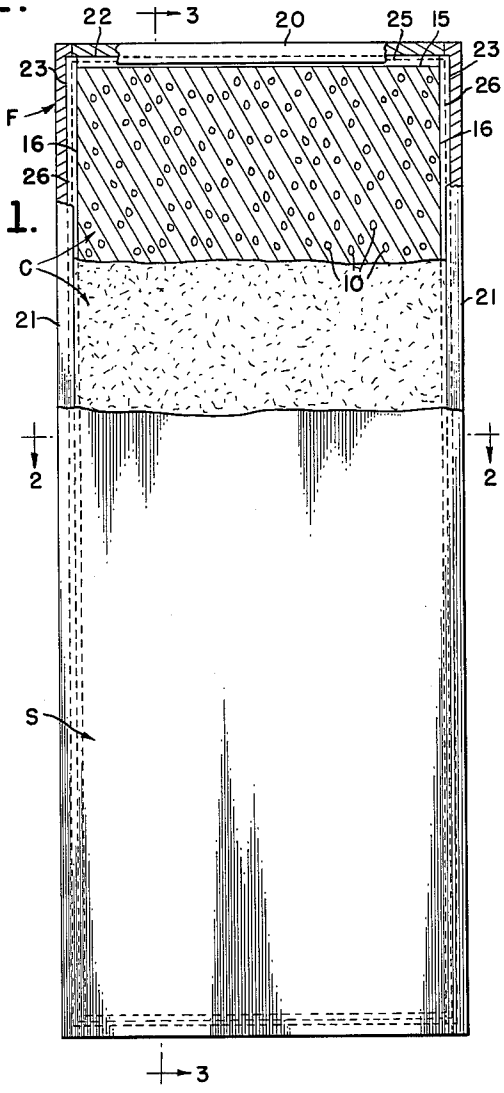
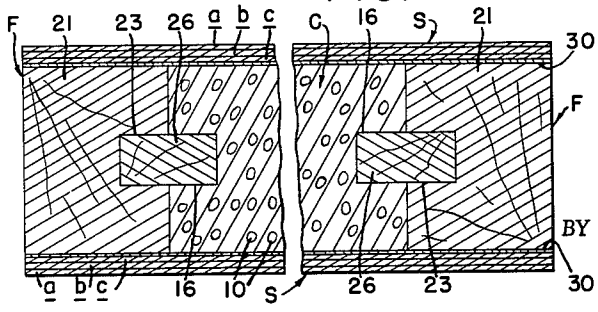


FIG. 1.

FIG. 4.



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FIRE-RESISTANT DOOR

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This invention relates to a fire-resistant door applicable to buildings generally. More particularly, it is concerned with the assembly, with a substantially fireproof core, of a surrounding fire-resistant wooden frame therefor and the joint therebetween whereby to produce a barrier for arresting the advance of a fire therethrough.

A primary objective in the present invention is the attainment, in a door of attractive appearance, of overall fire-resistant properties combined with economy in production and lightness in weight. This is accomplished, in part, by utilizing a continuous expansion joint between a substantially fire-proof core and a fire-resistant frame therefor, together with facings upon the door exterior which constitute the sole means of interconnection between the core and frame. A door so constructed will appreciably retard the progress of a fire advancing through one of its faces, entitling it to a high time-temperature rating when subjected to a fire-exposure test. This is also an important objective that is attained by the present door in that it complies with certain standard safety requirements.

These various objects and advantages, as well as others which will hereinafter appear, are realized by a door embodying the present invention of which a preferred embodiment is illustrated in the accompanying drawing in the manner following:

FIGURE 1 is an elevational view of one face of the door, with portions broken away to exhibit certain details of its core-frame assembly; FIGURES 2 and 3 are horizontal and vertical cross-sections through the door taken, respectively, on lines 2—2 and 3—3 of FIGURE 1; FIGURE 4 is an enlarged detail of opposite end portions of the door section as shown in FIGURE 2; and FIGURE 5 which is a view similar to FIGURE 3, shows a modification in the core unit of the door.

The door may be conventional to the extent that it combines in its structure a core C of rectangular configuration, a frame F of even thickness with the core, assembled therewith and extending continuously therearound, and skins S applied to opposite faces of the door to terminate flush with outer edges of the frame. Such a door, with the aid of suitable hardware, is adapted to be hung within a doorway to provide a closure therefor.

The core C which is substantially fire-proof may be produced from expanded mineral particles which, with the aid of mineral fibers and a mineral binder, are united inseparably together to form a unitary rectangular panel. Air entrapped within cells **10** formed in the core body contributes to lightness in weight and to its dimensional stability. Although the core is preferably of one piece, as shown in FIGURE 3, effective use may be made of smaller pieces **11** and **12** if they be formed along their meeting edges with a tongue and groove joint **13**, as suggested in FIGURE 5. To complete the core, slots **15** and **16** are plowed medially around their horizontal and vertical edges, respectively. A suggested dimension for each slot is ⅜" wide and ⅜" deep where the core thickness is 1½".

The frame F to be assembled with the core comprises a pair of rails **20** for its top and bottom, and a pair of stiles **21** for its vertical edges. These four pieces which remain disconnected are desirably produced from one of the hardwoods, and of even thickness with the core whereby opposite faces thereof may be aligned flush with the corresponding faces of the core when assembled therewith.

Each of the rails and stiles is chemically treated to become fire-resistant, and later dried to approximately 12% of moisture content. The dimensions of all rails and stiles outwardly from the proximate core edges is desirably about 1⅛" or so to provide adequate stock for plowed slots **22** and **23** extending lengthwise of the rails and stiles, respectively, all of these slots being formed medially along inner faces of the frame, and with dimensions similar to the slots **15** and **16** in the core. When the rails and stiles are properly assembled along the edges of the core, the slots **15** and **16** in the latter will face the slots **22** and **23** in the frame to register therewith and cooperate in providing four closed channels extending continuously around between the core and frame medially of their opposite flush faces.

Strips which are chemically treated to be fire resistant are also provided. Their dimensions approximate ⅜" x ¾" for cooperation with a core and frame having slot dimensions as just noted. As shown, the lengths of two of the strips **25** are coextensive with the core width less the depth of its two slots **16**, the length of the two remaining strips **26** then approximating the overall length of the core. When fully assembled, opposite end portions of the strips **26** will lap past ends of the strips **25** in position to engage therewith (FIGURE 1), and all four strips will completely occupy all four channels extending between the core and frame, thereby acting as splines to center one with respect to the other in the correct positions to assure flush relationships between their respective opposite faces.

When this point in the assembly operation has been reached, all components of the frame will be located in their correct positions relative to the core, but none of them is secured thereto or to any of the others. The one remaining step is taken when the skins S are applied to opposite faces of the door, with each skin extended continuously thereacross to terminate flush with the outer edges of the frame. As shown best in FIGURE 4, each skin is laminated, being in the form of a board of three plies *a*, *b* and *c* which are permanently bonded together into a unitary structure. The outer ply *a* of each skin is desirably produced from one of the hardwoods so as to exhibit, when finished, a smooth surface which is grained or otherwise treated. The remaining two plies, *b* and *c*, which are added mainly for strength and reinforcement, may be of any suitable wood which is relatively inexpensive. The production of these plywood skins is completed in advance and, when positioned upon opposite faces of the core and frame, a spread **30** of suitable adhesive (FIGURE 4) is applied thereto and/or the inner faces of the skins. A thermo-setting adhesive having a working life of 24 hours, an assembly time of 15–20 minutes, and a cold press time of 24 minutes has proven satisfactory for bonding the skins to the core and frame. For best results, the adhesive should be applied by a power glue spreader.

It will be noted that, in a door so constructed, there is no securement of any of the frame components to any other part until after the skins S have been operatively installed. There is then established a firm adherence of the core and of each individual frame part with only the two skins which overlie opposite faces of the door. The strips **25** and **26** then continue, as previously, to center the core with respect to the frame, but free of any fast connection with either. However, continued presence of these strips does serve an important function which contributes to the fire-resisting value of the completed door, as will now be pointed out.

Tests have proven that a door which combines a fireproof core with a fire-resistant supporting frame may be inadequate to prevent a fire advancing toward one face

of a door, from making its first penetration therethrough in the lineal areas surrounding the core where the line of resistance is weakest. There may be several reasons for this, one being that any such frame, when subjected to the heat from an advancing fire, tends to distort and pull away from the core which it supports, thereby opening up small cracks or slots through which fire, smoke and gases may work their way to attack the skin on the far side of the door. This lineal point of weakness is even more vulnerable where there is a butt joint between the core and frame. By contrast, the door of my invention utilizes (1) a core which is relatively fire-proof and stable as to its dimensions due, inter alia, to the presence of bonded mineral particles as a major component in its composition and their resistance to development of any deflection or distortion of the door; (2) entrapped air in the core which acts to confine expansion or contraction thereof within the normal dimensions of the core itself; and (3) an overlapping connection at the meeting edges of the core and frame which provides an expansion joint permitting the frame to move away from the core, in case of fire, but without creating any opening therebetween. In other words, these several strips which are disconnected to permit full freedom of movement of the associated frame components provide, in effect, a fire-stop which tends to block advance of any fire which may eat its way past the skin on one face of a door, acting effectively to arrest its further progress through the door between the core and frame. This halting of the fire progress adds greatly to the fire-resisting value of any door so constructed, since time is thereby gained for fire-fighting equipment to arrive and be brought into effective action.

I claim:

1. A fire-resistant door having a one-piece core comprising expanded mineral particles, mineral fibers and a mineral binder, which is substantially fire-proof and dimensionally stable, a frame of substantially the same thickness as the core surrounding the edges thereof comprising fire-resistant rails and stiles, said rails and stiles being closely adjacent and unconnected with each other and allowing free relative movement between themselves and the core, a fire-stop between said frame and core in the form of an expansion joint extending continuously around the core between the core and the frame and connected to the frame and to the core for movement relative to at least one thereof, said fire stop normally interlocking opposite faces of the core and frame in mutual flush relationship, and skins covering each of the opposite faces of the core and frame rails and stiles and secured firmly thereto and interconnecting the same.

2. A fire-resistant door according to claim 1, wherein registering slots are formed longitudinally in all confronting edges of the core and frame to define therebetween four continuous channels closed on all four sides, and wherein the expansion joint includes a spline slidingly fitted into each channel for substantially the full length and depth thereof to maintain the core and frame in mutually flush relation whereby the slotted edge portion of each component of the frame, when distorted or warped in response to an attacking fire, is free to recede through a limited distance away from the core but without opening up any gap therebetween.

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