Sept. 19, 1939. G. D. KELLOGG 2,173,808

STRUCTURAL UNIT

Filed Dec. 12, 1935

Fig. 1.

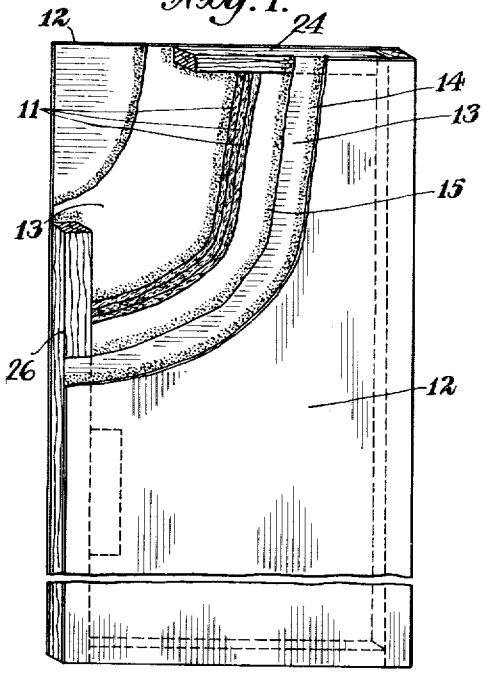


Fig. 2.

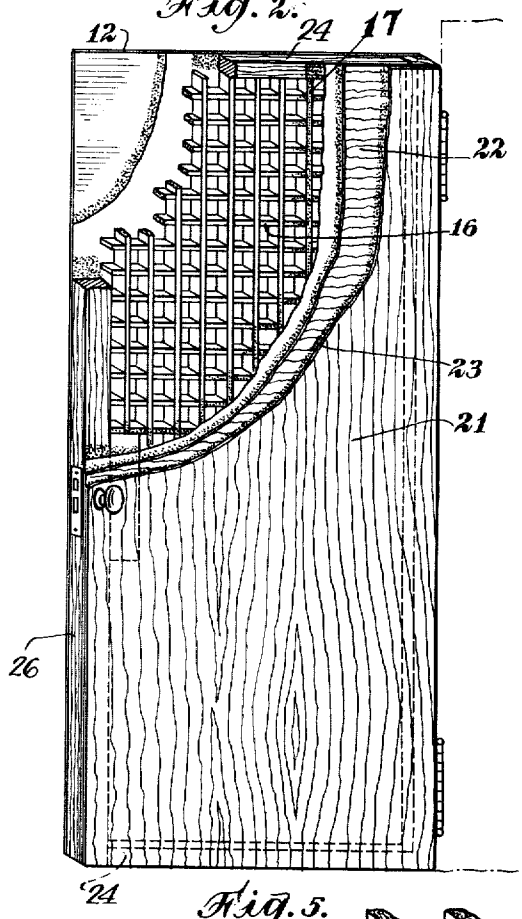


Fig. 3.

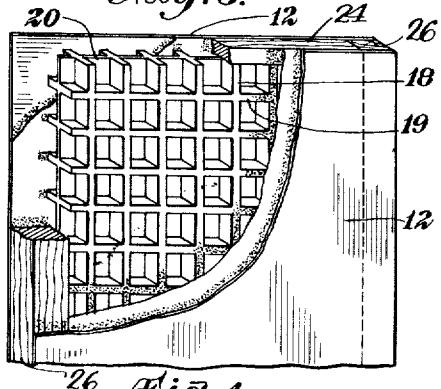


Fig. 4.

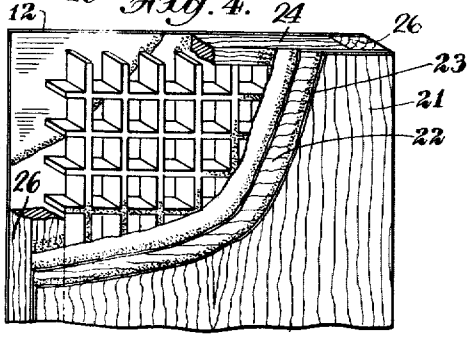
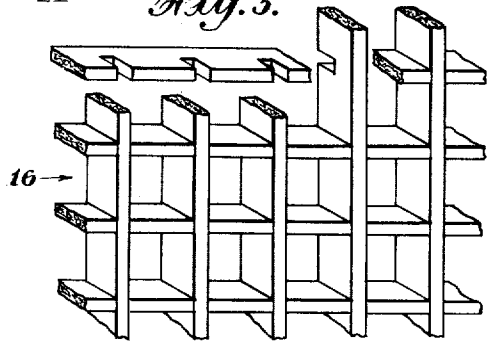


Fig. 5.



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2,173,808

STRUCTURAL UNIT

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Application December 12, 1935, Serial No. 54,011

10 Claims. (Cl. 20—35)

This invention relates to a structural unit for use in fire-resistant walls, partitions, doors, and the like.

Because the unit is particularly adapted for use in doors, the invention will be illustrated, in detail, with reference thereto.

In constructing doors of plane surfaces, such as those used in flush door assemblies, attempts have been made to use a solid wooden core with facing elements of wood veneer or the like adhered over both front and back of the core. Such solid, strong cores, on warping, disturb the shape of the relatively weak faces of the doors. In an attempt to overcome this warpage of the door, due to the varying percentages of moisture absorbed upon exposure to air of varying relative humidity, there has been proposed, as cores for doors, grids of thin strips of wood, the grids being provided with ventilating holes to permit breathing and escape of moisture.

There is great need of a door that is light in weight and thermal insulating, fire-resistant, inexpensive to manufacture, stable as to shape upon exposure to air of varying relative humidity and workable and strong at its edge portions, so that hardware such as latches, door knobs and the like may be inserted thereinto and held firmly in desired position.

It is an object of the present invention to provide a door meeting the above requirements. Other objects and advantages will appear from the detailed description that follows.

The invention comprises the novel features of the structural unit hereinafter described or illustrated. In a preferred embodiment, the invention comprises a door having facing elements, a lightweight thermal insulating core, and means, preferably an adhesive, securing the facing elements to the core, the core being yieldable or inert in that it does not affect appreciably the shape of the facing elements, upon absorption of moisture in varying amounts by the core. Another embodiment includes a fire-resistant door including a fire-resistant core, facing elements, a fire-resistant barrier disposed between the said facing elements and core, and fire-resistant means securing the said barrier to the core.

The invention is illustrated in the attached drawing and will be described in connection therewith.

Figs. 1 and 2 are perspective views of doors constructed in accordance with the invention, with parts broken away for clearness of illustration.

Figs. 3 and 4 are similar views of portions of doors, each including a modified form of core material.

Fig. 5 is a perspective view on an enlarged scale of the grid core of the type shown in Fig. 2, partly broken away for illustration.

The doors include a lightweight thermal insulating core, such as, fibre board of the kind frequently used for thermal insulation and weighing, for instance, 8 to 14 pounds to the cubic foot. When the door is to be fire-resistant, the core material should be also fire-resistant, as, for example, to the degree caused by substantially uniform distribution throughout the wood fibre board of the reaction products of a mixture of several per cent, say, about 10 per cent by weight of borax, boric acid and alum, in accordance with commercial practice for making fire-resistant board of this type. Several plies 11 of the fibre board may be used to give the desired thickness of core and may be adhered together, as by sodium silicate, calcium silicate, calcium aluminate, or other fire-resistant adhesive.

The doors include also facing elements 12, secured either directly or indirectly to the core or insulating sheets.

In the embodiment shown in Fig. 1, the door is fire-resistant. In this embodiment the facing elements are incombustible sheets of asbestos and Portland cement or the like, including suitably a compressed and hardened composition of asbestos fibres, and Portland cement. It has been found that such sheet material is substantially stable as to shape, that is, does not warp appreciably when exposed to air of various relative humidities. If desired, wood veneer or other decorative material, such as paint, for example, may be applied to the exposed faces of the asbestos-cement facing elements.

Between the facing elements and fire-resistant core 11 there may be disposed fire barriers 13, such as sheets of asbestos paper.

An adhesive 14 that is water-resistant, as, for instance, a composition including casein or Bakelite adhesive, may be used to secure the facing elements to the barrier while a fire-resistant adhesive 15 adheres the barriers to the core. The fire-resistant adhesive may be an inorganic composition, such as a sodium or calcium silicate or calcium aluminate.

In the embodiment shown in Fig. 1, the lightweight core is continuous.

However, when fire-resistance of a high degree is not necessary, very satisfactory results, with economy in weight and cost of the core material, are obtained when the core material is

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a grid or lattice work 16, including two series of intercrossed strips of fibrous material, the strips in a given series extending substantially parallel to each other and at an angle, say, a right angle, to the strips in the other of the said series and the strips of the said two series being locked together as by notches, as illustrated, at the cross-over positions between the strips of the two series.

In order to minimize the twisting of the several strips on the longitudinal axes thereof, the strips are made thick (broad) on their edges and of lightweight material, such as the fibre insulating board already described. Strips that have been used to advantage are one-half inch or more in thickness. These strips, being broad, contact over a large area with the inside of the facing elements or fire barriers, if the latter are employed and thus provide a suitable extent of area for adhesion, as by the adhesive 17 that may be one of the organic or inorganic adhesives described and preferably extends substantially continuously over the areas of contact between the grid and facing elements or fire barriers.

Or, the core may be constituted of a preformed grid, as shown in Fig. 3. This preformed grid comprises a series of thick parallel strips 18, another series of similar strips 19 extending at an angle to the first-mentioned series and intermediate thin portions 20 extending as a web between the said strips. This preformed grid is integral in that the fibres in the intermediate portions and in the strips or ridges are interfelted. Such an integral grid may be made of felting the selected fibres of wood, cane stalk or the like into a wet sheet and then compressing the sheet between plates of waffle-forming type of configuration, to form the desired ridges and thin intermediate portions, after which the shaped sheet is dried.

Another type of core that may be used is the integral grid shown in Fig. 4 that may be made from a continuous sheet of felted fibres, by cutting or punching out portions, to leave the integrally fabricated, crossed strips illustrated.

A type of facing element that may be used is that shown in Fig. 2. This facing element includes a composite of a plurality of plies of wood veneer, the grains in one ply 21 being arranged crosswise with respect to the grains in an adjacent ply 22, a conventional adhesive 23 adhering the several plies together.

Such compensating composites of wood veneer are satisfactory for most purposes, if used with my improved core, from the standpoint of shape retention (freedom from warpage) on exposure to air containing moisture, although the asbestos-cement composition described above is much better and is required for proper functioning of the invention under certain severe conditions of use.

The inert core in my assembly, even though it may vary in moisture percentage, is so readly yieldable as not to exert upon the facing elements a stress adequate to cause warpage. At the same time, the core spaces apart the facing elements, gives a strengthening beam effect, the desired insulation, and, with the other elements, the overall thickness of the door.

To seal the edges of the door and provide a firm support for hinges, door latch mechanism or like hardware ordinarily used in association with doors, a frame is disposed around the edges of the core material and between the edge portions of the facing elements. This frame is formed of material which is workable, that is, may be sawed or drilled and is sufficiently firm to properly support the necessary hardware or accessories. Suitably, the frame material is solid wood. This frame constitutes the rails 24 and stiles 26 of the door. It will be noted that the hinges are secured to the stile or upright frame member at one side of the door, and the door-latching mechanism is secured to the stile at the other side of the door, as illustrated in Fig. 2.

Such frame material, when used in conjunction with the asbestos-cement sheets or wood veneer facing element described, these sheets and elements being also workable in permitting such operations thereupon as sawing or drilling, give a door which is workable at all parts and yet has the desirable properties stated.

A door of the structure illustrated in Fig. 1 has been found to have very satisfactory fire-resistance. Such a door having facing elements of asbestos-cement sheets each one-eighth inch thick, asbestos paper of 8-pound grade, as fire barriers, and three plies of one-half inch fire-resistant insulating lumber, as the core, was subjected to the so-called "Hour Test" of the American Society for Testing Materials. With a hot side temperature of 1750° F., the opposite face had a temperature of 190° F. at the end of the hour.

A door made as described does not warp on being immersed in water for a short time or on long exposure to various atmospheric humidities.

It will be understood that the details given are for the purpose of illustration, not restriction, and that variations within the spirit of the invention are intended to be included within the scope of the appended claims.

What I claim is:

1. A preformed integral grid including two series of intercrossed thick strips of felted fibrous material extending in a given series parallel to each other and at an angle to the strips in the other of the said series and thin intermediate portions of felted fibrous material constituting webs extending between the said strips, the fibres in the said strips and intermediate portions being integrally felted with each other.

2. A lightweight door comprising a frame including stiles of such character as to permit the door to be supported therefrom, a core within the frame, the core including a grid formed of intercrossed strips of a yieldable, thermal-insulating fibre board, and facing members secured at opposite faces of the core, said facing members being formed of a material substantially stable as to shape upon exposure to air of varying relative humidity.

3. A lightweight door comprising a frame including stiles of such character as to permit the door to be supported therefrom, a core within the frame, the core including a grid formed of intercrossed strips of a yieldable, thermal-insulating fibre board, said strips being non-rigidly connected at their crossing points and presenting relatively broad panel supporting faces, and facing panels secured at opposite faces of the core, said facing panels being formed of a material substantially stable as to shape upon exposure to air of varying relative humidity.

4. A lightweight door comprising a frame including stiles of such character as to permit the door to be supported therefrom, a core within the frame, the core including a grid formed of intercrossed strips of a yieldable, thermal-insulating fibre board, and facing members secured at opposite faces of the core, at least one of said

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facing members including a compressed and hardened composition containing an intimate mixture of asbestos fibres and Portland cement.

5. A lightweight door comprising a frame including stiles of such character as to permit the door to be supported therefrom, a core within the frame, the core including a grid formed of intercrossed strips of a yieldable, thermal-insulating fibre board, and facing members secured at opposite faces of the core, at least one of said facing members including a composite of a plurality of plies of wood.

6. A lightweight door comprising a frame, a core within the frame, the core including a grid formed of intersecting strips of a yieldable, thermal-insulating fibre board, a layer of a flame-resistant material of the type of asbestos paper disposed over at least one face of the core and adhesively secured thereto and a facing sheet formed of a material substantially stable as to shape upon exposure to air of varying relative humidity adhesively secured to said flame-resistant layer.

7. A lightweight door comprising a frame, a core disposed within the frame, said core comprising a preformed integral grid including intersecting strips of felted fibrous material and intermediate webs extending between the strips, and facing sheets secured at opposite faces of the core.

8. A lightweight door comprising a frame, a core disposed within the frame, said core comprising a preformed integral grid including two series of intersecting strips of felted fibrous material, the strips in each series extending parallel to each other and at an angle to the strips in the other of said series, and thin intermediate webs extending between said strips with fibres in the said strips and intermediate webs interfelted with each other, and facing sheets secured at opposite faces of the core.

9. A lightweight door comprising a frame, a core within the frame, the core including a grid formed of intercrossed strips of a yieldable fibre board presenting relatively broad panel supporting faces, and facing panels adhesively secured to opposite faces of said core, said facing panels being formed of a material substantially stable as to shape upon exposure to air of varying relative humidity.

10. A lightweight structural unit comprising a frame, a core within the frame, the core including a grid formed of intercrossed strips of a yieldable fibre board presenting relatively broad panel supporting faces, and facing panels adhesively secured to opposite faces of said core, said facing panels being formed of a material substantially stable as to shape upon exposure to air of varying relative humidity.

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