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A. A. ALLEN

2,249,590

FIRE RETARDANT BUILDING MATERIAL.

Filed April 2, 1940

Fig. 1.

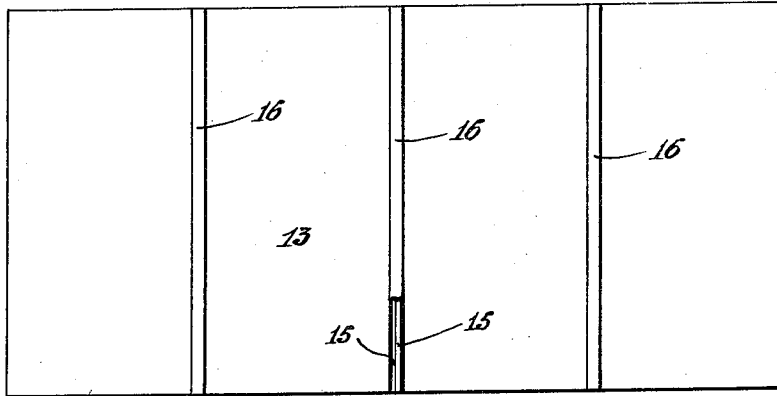


Fig. 2.

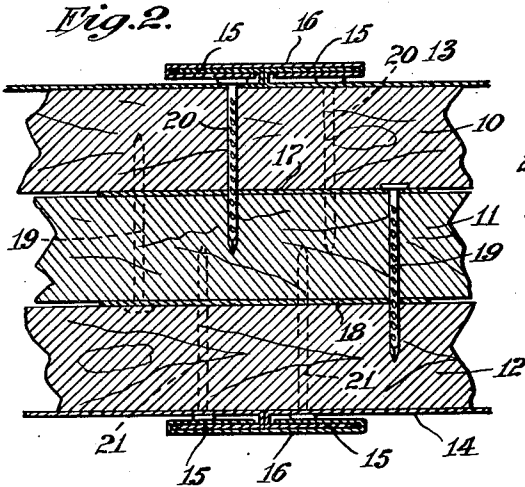


Fig. 3.

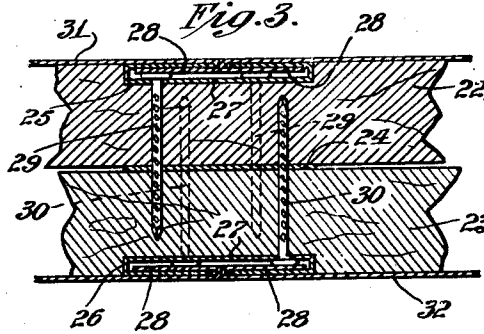


Fig. 4.

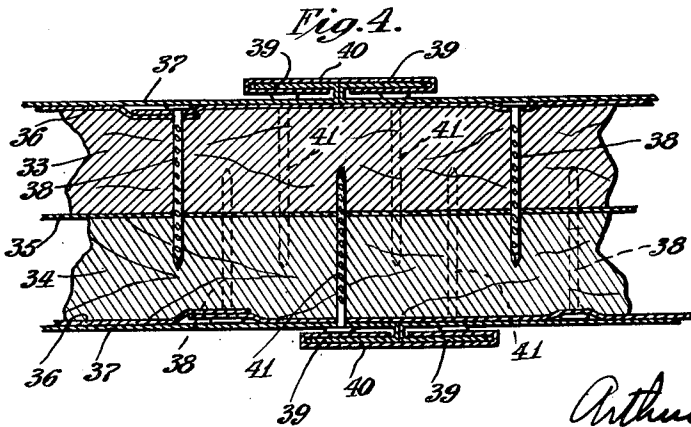
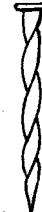


Fig. 5.



Fig. 6.



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UNITED STATES PATENT OFFICE

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FIRE RETARDANT BUILDING MATERIAL

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Application April 2, 1940, Serial No. 327,507

11 Claims. (Cl. 20—91)

The invention relates to fire retardant building materials, and more particularly to material particularly adapted for use in various types of doors and shutters, partitions and shaft enclosures.

It has long been the practice to provide movable closure means for door and window openings of what is known as tin-clad doors and shutters, wherein a filler composed of wood or other material which, in itself, when subjected to high temperatures, was combustible or destructible by heat, was protected by a metal sheathing so as to resist the action of flames and heat thereon for a sufficient interval to retard the spreading of fire from one side of the closure to the other and thus provide a substantial factor of safety against the spreading of fire.

Experience has shown, however, that when such material is subjected to the direct action of flame and heat, the filler or core is weakened, thus destroying the effectiveness of the means securing the sheathing to the filler or core to an extent to permit the distortion and bulging of the sheathing. This frequently results in the complete breaking down of the filler or core material, forms openings in the seams of the sheathing and permits the passage of flames and heated gases from one side of the material to the other, so that both sides of the material, particularly toward the upper portion thereof, offer little or no resistance to the passage of flames and heated gases from one side of the closure to the other.

When wooden planks are used as the filler or core, the wood becomes so charred by distillation as to be converted ultimately into a mass of charcoal, and with the admission of air through breaks in the sheathing, this filler or core will burn. This develops high temperatures within said sheathing, which condition is very much accentuated when, by reason of the bulging of the sheathing at either or both sides of the material, the charred mass of the filler crumbles and falls between the opposite faces of the sheathing producing clear space above it which permits free burning of the filler. As a result of this, the side of the closure which is not directly exposed to flame and heat, as at the other side of the closure, becomes overheated due to the radiation of the heat from what may be termed the "hot" side of the closure and also from heat developed within the sheathing by the burning filler.

If the filler used be of a material or composition which will not undergo distillation from the application of heat thereto, but becomes disrupted or disintegrated as the result of such heat, the conditions are not as dangerous as when a wood filler is used. Nevertheless, the so-called "cold" side of the closure, toward the top thereof, will be subjected to radiated heat which will impair the efficiency of the material as a fire retardant.

The bulging or distortion of the sheathing also results in the formation of spaces through the material for the passage of flames and smoke.

With material of the type above referred to, the sheathing is held in place by nails, screws or other materials entering the filler or core, but with the breaking down of this filler or core, the support for the sheathing is destroyed, thus permitting free warping and bulging thereof under the influence of heat. The filler or core confined within the sheathing, by reason of the low heat conductivity of the material of this filler or core, is relied upon to prevent heat from passing by conduction from the sheathing upon one side of the material to that upon the other side, or the passage of heat by radiation from one sheathing to the other.

In various types of hollow metal doors, metal stays and struts are provided inside of the door in sufficient number and of sufficient bulk to permit a rapid transfer of heat by conduction from one side of the door to the other.

The main object of the invention is to provide building material of the type above referred to in which the metal sheathing is so secured in relation to the filler or core that any substantial buckling or deformation of this sheathing is prevented, even though the material may be subjected to temperatures sufficiently high to reduce a wooden core to charcoal or to disrupt or disintegrate a filler of material other than wood.

The manner of securing the sheathing in relation to the filler or core is such as to preserve the filler or core substantially intact as to form, notwithstanding the effect of heat thereon, so that conduction of heat from one side of the panel to the other is prevented, even though the filler or core has been completely reduced to charcoal form if of wood, or disrupted or disintegrated if of other material.

In material embodying the invention, the filler or core is not relied upon to secure the metal sheathing in relation thereto, nor to prevent buckling or distortion of the sheathing in the event of fire. Hence, the breaking down of this filler or core by distillation or other action of heat thereon, does not affect the permanency in the form of the sheathing. In fact, in material embodying the invention, the sheathing, instead of relying upon the filler or core as a support, is secured in relation to said filler or core by means which will support the sheathing independently of the filler or core and thus preserve or maintain the form of the latter even though its strength has been destroyed as a result of the application of a flame and high temperatures to the sheathing.

The construction of the material is such that the sheathing upon one face thereof is secured in relation to the sheathing on the other face there-

of through the medium of a metal plate within the material of the filler or core and metal fasteners connecting the sheathing on both faces with said intermediate strip of metal. Such fastening means pass through the material of the filler or core and said intermediate metallic sheet.

The fastening means itself has dimensions which limit the degree of heat conductivity from the sheathing upon one face to that upon the other, particularly as the fasteners engaging the sheathing upon one face have no contact with the sheathing upon the opposite face of the material, although both sets of fastening means contact with the intermediate imbedded metal sheet.

With this construction, the filler or core, irrespective of its condition, will, by contact with the fastening means, tend to dissipate any heat being conducted from the sheathing upon either face of the material through said fastening means.

The fastening means employed are such that with any movement of the sheathing from expansion under heat, they will be canted in a manner to increase their binding action in relation to the intermediate imbedded metal sheet by a sort of snubbing action.

Any stresses to which the sheathing on one face of the material is subjected will be transmitted through the fastening means and the intermediate imbedded sheet to the sheathing upon the other face of the panel, which will have the effect of preventing any variation in the inside capacity of the panel from warping or distortion of the sheathing. This action, however, will be very slight and will be resisted by the filler or core irrespective of its condition.

It is obvious that the distillation, disruption or disintegration of the material of the filler or core will be materially retarded if buckling or other deformation of the sheathing is prevented, and that direct transmission of heat by radiation will not be permitted to any material extent if the original form of the filler or core is preserved, or substantially so. This material is selected because of its low heat conductivity or high heat insulating properties, and such properties are increased rather than reduced as a result of the action of heat thereon, particularly when the filler or core is of wood.

The invention consists primarily in fire retardant building material embodying therein a filler or core of low heat conductivity, metal sheathing upon opposite faces of said filler or core, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising a metal sheet imbedded in said filler or core intermediate and spaced from the opposite faces of said sheathing, and fasteners passing through the material of said sheathing, said filler or core and said intermediate metal sheet; and in such other novel features of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

Referring to the drawing,

Fig. 1 is a view of one side of a panel formed of material embodying the invention;

Fig. 2 is a sectional view through a portion of the material of the panel adjacent one of the seams of the sheathing;

Fig. 3 is a view similar to Fig. 2 showing the application of the invention to two-ply material having a flush surface at the seams;

Fig. 4 is a view similar to Figs. 2 and 3 show-

ing a multiple-ply sheathing for giving a finished surface to the material; and

Figs. 5 and 6 show two forms of fasteners which may be used in constructing the material.

Like numerals refer to like parts throughout the several views.

In the embodiment of the invention shown in Fig. 2, I provide a filler or core composed of three plies 10, 11 and 12. These plies ordinarily are formed of soft wood planks, although each may be made of any other desired material having low heat conductivity.

Upon one face of the material is a metal sheathing 13, and upon the opposite face thereof a similar metal sheathing 14. Each sheathing 13-14 may be composed of a plurality of strips, as indicated particularly in Fig. 1, the edges of adjacent strips being secured together by means of a folded and lapped joint. The usual practice is to turn these edges after securing the sheathing strips to the filler or core, apply a flanged and channelled cap to the turned edges, and then close the turned edges so as to conceal the seam and protect the fasteners.

The turned edges of the strips are indicated at 15 in the accompanying drawing, and the flanged and channelled cap at 16. This manner of forming the seams has long been used in the production of panels of various types of fire retardant doors. Ordinarily, fasteners are used only along opposite sides of each seam.

In Fig. 2 of the drawing a three-ply filler or core, as used in material having a thickness of approximately three inches, is shown. In Figs. 3 and 4 of the drawing, however, two-ply fillers or cores are illustrated.

To secure the opposite sheathings 13 and 14 in relation to each other in a manner to prevent buckling or distortion thereof, particularly on the face of the material which is subjected to high temperatures, I provide means by which these sheathings are secured, one in relation to the other, so as to prevent movement of one sheathing independently of the other, and to utilize the filler or core, irrespective of its condition, to prevent such displacement.

This securing means comprises a metal sheet between two adjacent plies of the filler or core, a sheet 17 being between the plies 10 and 11 and a sheet 18 between the plies 11 and 12. By this arrangement, each of the sheets 17 and 18 is imbedded in the body of the completed filler or core and spaced from the sheathings 13 and 14 respectively.

These sheets, in a three-ply construction, are secured together by fasteners 19 passing through each of said sheets and the intermediate ply, so that both sheets act as a unit in co-operation with both sheathings 13 and 14.

Fasteners 20 pass through the sheathing 13, the ply 10 of the filler or core and the sheet 17, and separate fasteners 21 pass through the sheathing 14, ply 12 and the plate 18. All fasteners 20 and 21 penetrate the ply 11, but none of these fasteners is in contact with any other fasteners so that there is no direct path for heat conductivity from one sheathing to the other.

The fasteners 19, 20 and 21 are shown as being ordinary nails provided with gripping portions along the length thereof, particularly adjacent the point where they pass through the sheets 17 and 18. There are various nails having these characteristics, used by woodworkers

to secure a more effective anchorage of the nail in the material.

In Fig. 5, such a fastener is shown having serrations between the head and the point, while in Fig. 6 this portion of the fastener is twisted.

If desired, screws may be employed instead of nails, since the threads of a screw will anchor firmly to a sheet 17 or 18, although drilling would have to be resorted to if screws were used.

In Fig. 3 of the drawing I have shown material embodying the invention having two plies 22 and 23, a sheet 24 being positioned between said plies in the same manner as the sheet 17 or 18.

To bring the sheathing flush throughout the outer face of the material, the plies 22 and 23 are recessed at 25-26 to receive a flanged and channelled cap 27, the adjacent edges of the metal strips forming the sheathing being bent inwardly and within the channel of said cap. These edges are indicated at 28.

Before engaging the edges 28 of the strips with the cap 27, fasteners 29 are driven through this cap, the ply 22 and the intermediate anchoring or locking sheet 24, and into the material of the ply 23. The cap 27, seated within the recess 26 of the ply 23, has fasteners 30 driven therethrough, through said ply and the sheet 24 into the ply 22.

Sheathing on one face of the material is shown at 31 and that upon the other face at 32.

The embodiment of the invention shown in Fig. 4 is two-ply material, one of the plies being shown at 33 and the other at 34. Between these plies is a metal sheet 35. In this embodiment of the invention, the material has a double or two-ply metal sheathing, the inner ply of each facing being shown at 36 and the adjacent outer ply of each facing at 37.

The inner ply is secured in relation to the sheet 35 by means of fasteners 38 having the characteristics of the fasteners in the other embodiments of the invention heretofore described, which pass through this inner sheathing ply through the adjacent ply 34 or 33 of the filler or core, the sheet 35 and into the other ply 33 or 34 of the filler or core. The outer sheathing ply 37 covers the heads of the fasteners and the edges of adjacent strips forming this sheathing ply, bent as indicated at 39 and interlocked with a flanged and channelled cap 40 as in the embodiment of the invention shown in Fig. 2. Before bending the edges of the sheathing ply, fasteners 41 are driven through both sheathing plies 36 and 37, the adjacent ply 34 or 33 of the filler or core and the intermediate metal sheet 35, and penetrate the other ply of the filler or core 34 or 33.

In Figs. 2 and 4 of the drawing, the sheathing is secured in relation to the intermediate or lock sheet by fasteners passing through the strip metal of the sheathing, and a cap is used to complete the seam between adjacent strips by the lap joint connection between the strips and the cap, which cap conceals the heads of the fasteners.

In Fig. 3, this condition, however, is reversed, and the fasteners are passed through a cap imbedded in the filler or core and a lap joint connection is formed between the strips and the cap as in the other forms of the invention, so that the strip material and a flange of the cap conceal the heads of the fasteners.

Since, in both instances, the cap forms a part of the sheathing for preventing the opening of

a seam so as to permit the escape of filler or core material and the passage of flame to within the sheathing, it is immaterial whether the fasteners pass through the cap or the strips so long as they engage a part of the sheathing and the intermediate or lock sheet.

In the embodiments of the invention shown in Figs. 3 and 4, the plies of the filler or core may be of soft wood or any other material having low heat conductivity and sufficient solidity to facilitate the assembling of the material in the manner described.

The use of two-ply metal sheathing as shown in Fig. 4 permits the use of a greater number of fasteners than the other forms of the invention, since the outer sheathing ply covers the heads of these fasteners and permits the production of a material having a better finish. A two-ply sheathing will be somewhat stiffer than a single-ply sheathing, and the use of a greater number of fasteners will overcome any tendency of the sheathing to bulge and become distorted at a point remote from the seam. With a sheathing formed from strips which are approximately eighteen inches in width, and with fasteners positioned upon opposite sides and throughout the length of the seams at spaced intervals, an effective support of the sheathings in relation to the intermediate locking or anchoring sheet can be secured.

The embodiments of the invention shown in Figs. 3 and 4 are of a material embodying the invention having a thickness of approximately two inches, and as a fire retardant medium this thickness is highly effective. Material of varying thicknesses may be required for different uses of the material, or to conform to the requirements of different building codes.

The material of the invention may be used in the production of warehouse and freight elevator doors, window shutters, automatic fire doors in buildings, about dumbwaiter and elevator shafts, in building partitions and in various other connections where the use of fire retardant materials is required under building codes.

Such material is required to withstand high temperatures for three or four hours only, under existing codes, and the characteristics heretofore described are such as to meet such a requirement and prevent the passage of smoke and flame to an extent which would result in the spreading of a fire to upon the opposite side of the material.

The purpose of the invention is not to prevent the formation of charcoal from the wood of the filler or core, or the disruption or disintegration of said material. This is inevitable in the event of a severe fire.

The construction of the material, however, is such that under such conditions, the sheathing at opposite faces of the material will be supported by means independent of the material of this filler or core, and hence will not bulge and become otherwise so deformed as to permit the crumbling and collapsing of the material of the filler or core in a manner to prevent a continued utilization of this material as a heat insulating medium between the sheathings at the opposite faces of the material.

The presence of charred, disrupted or disintegrated material may not be effective throughout as great an area of the material as the material of the filler or core before being subjected to heat, but under no circumstances can there be any substantial portions of the material, toward the top of the sheathing, through which heat ra-

diated from the sheathing on one side thereof can affect the sheathing upon the other side thereof, because so long as the capacity of the space between the sheathing at opposite faces of the material is substantially the same throughout the entire area of a panel, there can be no substantial settling or disturbance of the material of the filler or core, irrespective of its condition.

Furthermore, in material embodying the invention, there can be no opening of any of the seams, because the material upon opposite sides of each seam is firmly anchored through the fasteners to the intermediate or lock sheet. The roughened portions of these fastening members ensures a firm anchorage upon the intermediate or lock sheet and, in the event of expansion of the sheathing, the fasteners will be canted one way or the other so as to increase the effectiveness of the locking action between same and the intermediate or lock sheet by a sort of snubbing action preventing any substantial movement of the sheathing away from said sheet.

In wood core, metal sheathed door structures heretofore in use, the material of the core was relied upon to hold the sheathing in place and give the structure the desired form. In the event of the destruction by distillation of the wood of the core, the anchorage for the fasteners was lost, or so weakened as to permit a free movement of the sheathing.

In the material of the invention, the sheathing upon opposite faces of the material is held in the proper relative position to give it the desired form, entirely independently of the filler or core, it being possible to provide openings through said material for the free passage of the fasteners, which openings are of a dimension to have no engaging relation with the fasteners. This, however, would not be an economical method of production.

The material of the invention, in the event of the distillation of a wood filler or core, will result in the formation of charcoal between the sheathings, and the fasteners will actually support the body of charcoal which, with the intermediate or lock sheet, prevents any outward or inward movement of the sheathing upon either side of the panel.

The intermediate or lock sheet may be of a width which will extend only to adjacent and on opposite sides of the seams of the sheathings, as illustrated in Figs. 2 and 3, or this sheet may be co-extensive in area with the plies of the filler or core, as shown in Fig. 4, or have any other desired dimensions.

It will be noted that in all forms of the invention shown, the fasteners engaging the sheathing upon one face of the material do not engage the sheathing upon the other face thereof, so that there can be no direct transmission of heat from one face to the other to an extent to impair the fire retardant properties of the material. The aggregate mass of the fasteners used is so small as to preclude any substantial conduction of heat therethrough, and such heat as is taken up by these fasteners will be somewhat diffused as a result of the contact of the filler or core with the fasteners and with the intermediate or lock sheet, irrespective of the condition of the material of the filler or core.

I have found that a direct pull upon the fasteners, such as would be necessary to permit bulging or distortion of the sheathing, has no effect in disengaging the fasteners from the intermediate or lock sheet.

The intermediate or lock sheet is not incorporated in the structure because of its fire retardant properties, but merely for the purpose of affording a permanent anchorage for the fasteners engaging the sheathing upon opposite sides of a panel of the material of the invention.

The terms "filler" or "core" as herein used are synonymous, since in different parts of the country this material is designated by one or the other of these terms.

The thickness of the material of the filler or core and of the sheet metal of the parts of the sheathing and of the intermediate or lock sheet may vary, as may the thickness and other dimensions of a panel embodying the structural characteristics of the invention. It is not, therefore, my intention to limit the invention to the specific dimensions herein specified.

I believe it to be broadly new to provide fire retardant building materials in which permanency in the relative positions of sheathing upon opposite sides of a panel of such material is assured by reason of the employment of fastening means engaging such sheathing and an intermediate or lock sheet of metal imbedded in the material of the filler or core, so that the effects of heat upon said filler or core will not permit the bulging of the sheathing as above set forth, and I intend to claim such broadly.

Having described the invention, what I claim as new and desire to have protected by Letters Patent is:

1. Fire retardant building material embodying therein a filler or core of low heat conductivity, metal sheathing upon opposite faces of said filler or core, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising a metal sheet imbedded in said filler or core intermediate and spaced from the opposite faces of said sheathing, and fasteners passing through the material of said sheathing, said filler or core and said intermediate metal sheet.

2. Fire retardant building material embodying therein a filler or core of low heat conductivity, metal sheathing upon opposite faces of said filler or core composed of a plurality of metal strips and a flanged and channeled metal cap, the edges of adjacent strips having a lap joint with the flange of said cap, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising a metal sheet imbedded in said filler or core intermediate and spaced from the opposite faces of said sheathing, and fasteners passing through the material of said sheathing, said filler or core and said intermediate metal sheet.

3. Fire retardant building material embodying therein a filler or core of low heat conductivity, metal sheathing upon opposite faces of said filler or core, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising a metal sheet imbedded in said filler or core intermediate and spaced from the opposite faces of said sheathing, and fasteners having roughened portions adjacent the point thereof passing through the material of said sheathing, said filler or core and said intermediate metal sheet.

4. Fire retardant building material embodying therein a filler or core composed of a plurality of plies of material of low heat conductivity and subject to deterioration from heat, metal sheath-

ing upon opposite faces of said filler or core, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising a metal sheet imbedded in said filler or core intermediate and spaced from the opposite faces of said sheathing, and fasteners passing through the material of said sheathing, one of the plies of said filler or core and said intermediate metal sheet and penetrating another of said plies.

5. Fire retardant building material embodying therein a filler or core composed of three plies of material of low heat conductivity and subject to deterioration from heat, metal sheathing upon opposite faces of said filler or core, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising metal sheets between adjacent plies of said filler or core, fasteners passing through both of said metal sheets and the intermediate ply, whereby said metal sheets are connected to act as a unit, and other fasteners passing through the material of said sheathing, the outer plies of said filler or core and one of said metal sheets, and penetrating the intermediate ply of said filler or core.

6. Fire retardant building material embodying therein a filler or core composed of three plies of material of low heat conductivity and subject to deterioration from heat, metal sheathing upon opposite faces of said filler or core composed of a plurality of metal strips and a flanged and channelled metal cap, the edges of adjacent strips having a lap joint with the flange of said cap, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising metal sheets between adjacent plies of said filler or core, fasteners passing through both of said metal sheets and the intermediate ply, whereby said metal sheets are connected to act as a unit, and other fasteners passing through the material of said sheathing, the outer plies of said filler or core and one of said metal sheets, and penetrating the intermediate ply of said filler or core.

7. Fire retardant building material embodying therein a filler or core composed of three plies of material of low heat conductivity and subject to deterioration from heat, metal sheathing upon opposite faces of said filler or core composed of a plurality of metal strips and a flanged and channelled metal cap, the edges of adjacent strips having a lap joint with the flange of said cap, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising metal sheets between adjacent plies of said filler or core, fasteners having roughened portions adjacent the point thereof engageable with said metal sheets and passing through both of said metal sheets and the intermediate ply, whereby said metal sheets are connected to act as a unit, and other fasteners having roughened portions adjacent the point thereof engageable with said metal sheets and passing through the material of said sheathing, the outer plies of said filler or core and one of said metal sheets, and penetrating the intermediate ply of said filler or core.

8. Fire retardant building material embodying

therein a filler or core of low heat conductivity, metal sheathing upon opposite faces of said filler or core, a flanged and channelled metal cap imbedded in the face of the material of said filler or core, a plurality of metal strips, the edges of said adjacent strips having a lap joint with the flange of said cap, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising a metal sheet imbedded in said filler or core intermediate and spaced from the opposite faces of said sheathing, and fasteners passing through the cap forming a part of said sheathing, said filler or core and said intermediate metal sheet.

9. Fire retardant building material embodying therein a filler or core of low heat conductivity, metal sheathing upon opposite faces of said filler or core, a flanged and channelled metal cap imbedded in the face of the material of said filler or core, a plurality of metal strips, the edges of said adjacent strips having a lap joint with the flange of said cap, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising a metal sheet imbedded in said filler or core intermediate and spaced from the opposite faces of said sheathing, and fasteners having roughened portions adjacent the point thereof passing through the cap forming a part of said sheathing, said filler or core and said intermediate metal sheet.

10. Fire retardant building material embodying therein a filler or core of low heat conductivity, metal sheathing upon opposite faces of said filler or core comprising an inner and an outer ply, the outer ply being formed of metal strips and a flanged and channelled cap, the edges of adjacent strips having a lap joint with the flange of said cap, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising a metal sheet imbedded in said filler or core intermediate and spaced from the opposite faces of said sheathing, fasteners passing through the inner ply of said sheathing, said filler or core and said metal sheet, and other fasteners passing through both plies of said sheathing, said filler or core and said intermediate metal sheet.

11. Fire retardant building material embodying therein a filler or core of low heat conductivity, metal sheathing upon opposite faces of said filler or core comprising an inner and an outer ply, the outer ply being formed of metal strips and a flanged and channelled cap, the edges of adjacent strips having a lap joint with the flange of said cap, and means securing the sheathing upon opposite faces of said filler or core together so as to prevent bulging or distortion thereof, comprising a metal sheet imbedded in said filler or core intermediate and spaced from the opposite faces of said sheathing, fasteners passing through the inner ply of said sheathing, said filler or core and said metal sheet, and other fasteners passing through both plies of said sheathing, said filler or core and said intermediate metal sheet, said fasteners respectively having roughened portions adjacent the points thereof engaging said metal sheet.

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