July 15, 1941. A. A. ALLEN 2,249,591

FIRE DOOR

Filed Feb. 11, 1941

Fig. 1.

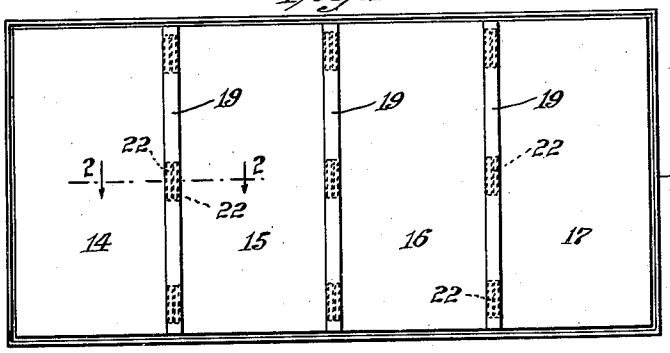


Fig. 2.

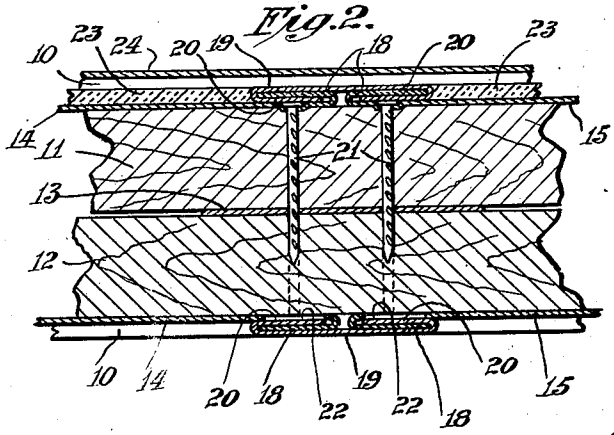


Fig. 3.

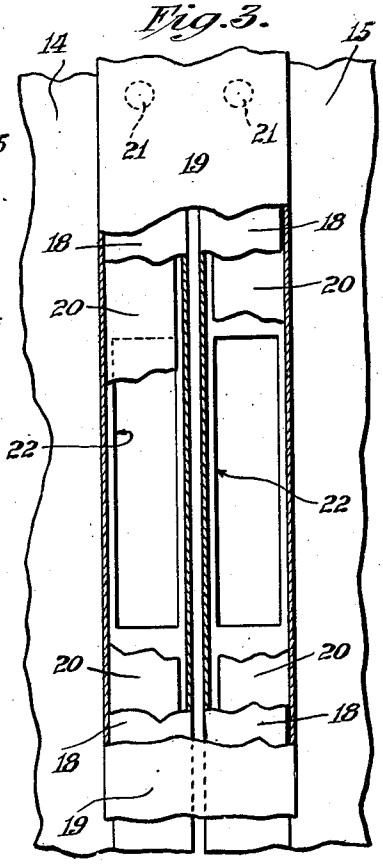
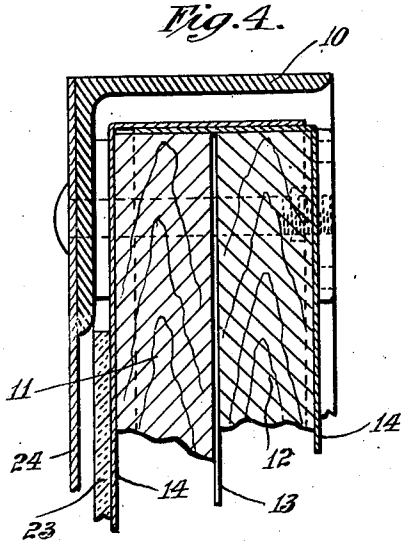


Fig. 4.



Arthur A. Allen

INVENTOR

Frank P. Wentworth

BY

ATTORNEY.

Patented July 15, 1941 2,249,591

UNITED STATES PATENT OFFICE

2,249,591

FIRE DOOR

Arthur A. Allen, Bellerose, N. Y., assignor to The Peele Company, Brooklyn, N. Y., a corporation of New York

Application February 11, 1941, Serial No. 378,460

9 Claims. (Cl. 20—35)

The invention relates to fire doors, and more particularly to wooden cored metal sheathed doors.

It has long been the practice to equip door openings in warehouses with closure means which, in many instances, consisted of a movable door section or sections having an angle metal frame, the opening in which was closed by a panel having a wooden core protected by a metal sheathing so as to provide a fireproof or fire retardant barrier at the door opening preventing flame from passing from one side of the opening to the other side thereof.

Such doors have been found to be highly effective in preventing the rapid spread of fire, particularly by way of the elevator shaft, from one floor to another in a building. When such doors are subjected to extremely high temperatures for a period of several hours, the heat, while insufficient to melt the metal of the sheathing, forms charcoal by distillation of the wooden core and so warps and disrupts the metal sheathing as to permit the escape of charcoal from within the metal sheathing. Such escape of charcoal becomes more rapid in case of the opening of seams of the sheathing. The escape of a substantial amount of such charcoal permits direct application of heat at one side of the door to the other side thereof and may cause the disruption or breaking down of the sheathing upon both sides of the door and permit flames to pass through the door.

I have recently devised fire retardant building material of the type to which I have above referred, wherein excessive bulging of the metal sheathing is prevented by means of a strip of metal imbedded in the inflammable material of the core enclosed by such sheathing, the edges of adjacent sheathing strips being secured in relation to the core by metal fasteners extending through the sheathing on each side of the core and the imbedded metal strip, without, however, contacting or engaging the sheathing upon the other side, so as to prevent or minimize the conduction of heat from one side of the material to the other side.

The present invention relates to a fire door structure utilizing the essential characteristics of building material of the character above referred to, so modified, however, as to adapt this material to use in various types of doors in a manner to be hereinafter described.

In a door embodying the invention, one face thereof may be more liable to be subjected to the heat of flames during a fire than the other, and a door embodying the invention is so constructed as to offer the maximum resistance to distortion due to high temperatures adjacent this face of the door.

In the event of a severe fire, the wooden core of the door will almost inevitably be reduced to charcoal, and the purpose of the invention is not to prevent the distillation of the wood of the core, but to permit such action of the heat while preventing the development of sufficient pressure of gases created by such distillation within the metal sheathing to cause excessive warping, bulging or displacement of any portion of the strips of the metal sheathing and a resultant escape or shifting of charcoal formed within the sheathing to an extent to materially impair the heat insulating properties of the door.

This is done by venting of such gases at divergent points throughout the panel of a door section where they may escape or be consumed without introducing any additional fire hazard about the door. The method employed in venting such gases neither accelerates nor retards distillation of the wood of the core, but does prevent the development of localized pressure spots tending to distort the metal sheathing or cause an opening of a seam between adjacent strips of metal of which said sheathing is formed.

The construction is such as to permit a direct flow of gases from within the sheathing to adjacent the face of the door subjected to flame, the construction and arrangement of parts being such as to so cover the vent openings as to avoid exposure of the inflammable material of the core and exclude flame from within the metal sheathing.

In a door embodying the invention, the provision for venting of the gases developed by the heat of distillation during a fire may be limited to one side of the door. The other side of the door, while provided with metal sheathing of the same character as that described, need have no vent openings but is preferably covered by a sheet or coating of non-inflammable material, such as asbestos or asbestos cement, which in turn, if desired, may be protected by an outer metal plate secured to the inwardly directed flange of the frame of the door, a construction which provides an insulating air pocket between the asbestos facing and the outer protecting plate upon that side of the door section.

With a door embodying the invention, the gases developed during distillation of the core escape

from within the sheathing at the face of the door which is subjected to the high temperatures, and is there consumed. While there may be slight bulging or distortion of the metal sheathing upon this side of the door, this has been found to be insufficient to cause any material disturbance of the charcoal filler, when such is formed, and the combined action of the imbedded strip and the securing means between same and the edges of the strips of metal sheathing, and of the vent openings through the strips contiguous to the seam, have been found to prevent any such opening of the seam as will permit the escape of charcoal from within the sheathing.

The invention consists primarily in a fire door embodying therein a panel comprising a plurality of plies of inflammable material, a metal strip imbedded therein, a metal sheathing enclosing said core composed of a plurality of parallel strips of metal having a turned edge and a vent opening therethrough adjacent said edge, metal fasteners passing through said sheathing strips adjacent the edges thereof and an adjacent metal strip imbedded in the core, and a flanged cap the flanges of which form a lap joint with the inturned edges of adjacent sheathing strips, said cap being of a width to cover the seam between adjacent sheathing strips and a vent opening adjacent said seam; 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 an elevation of a portion of a section of an elevator door embodying the invention;

Fig. 2 is a section upon a larger scale, on the line 2—2 of Fig. 1;

Fig. 3 is a view of a fragmentary portion thereof on the shaft side of a door adjacent one of the seams, broken away upon different planes; and

Fig. 4 is a detail sectional view of a fragmentary portion of the upper portion of the door section shown in Fig. 1 upon a larger scale.

Like numerals refer to like parts throughout the several views.

The structure of the door of the present invention has to do with the enhancement of its fireproof or fire retardant properties, and in the accompanying drawing, only those characteristics contributing to this end are disclosed, other details old and well known in the art being omitted, particularly as such are capable of wide variation and have no bearing upon the present invention.

Referring to the drawing, a door section embodying the invention has an angle metal frame 10, the inwardly directed flange of which is located upon the floor side of a door opening. The opening in this frame is closed by a panel including a core comprising, as shown in the accompanying drawing, two plies 11 and 12 of wood, usually about an inch in thickness, a sheet metal strip or strips 13 imbedded in this core by being positioned between the plies thereof, and an outer sheet metal sheathing which will be more fully described hereinafter.

This metal sheathing incloses the core of the panel closing the metal frame which, except for the metal strips 13, the sheathing and the means securing said sheathing in relation to said metal strips, is ordinarily of inflammable or combustible material, such as wooden planks as stated, and is therefore subject to destruction or deterioration by heat resulting from fire either in the elevator shaft or upon any floor adjacent said shaft.

The metal sheathing upon each side of the door panel is made up of thin gauge sheet metal strips, ordinarily extending vertically of the door, such strips being indicated at 14, 15, 16 and 17. The width and length of these strips will vary with different size doors. In Fig. 1 of the drawing, a door section having a height of about four feet and a width of about six feet is illustrated. The ends of each of these strips are turned over the top and bottom edges of the wooden filler of the core, the ends of the strips on opposite sides being folded in overlapping relation to each other, as shown in Fig. 4, and secured in any desired manner to the edges of the panel planks. The outer edges of the end strips are also folded in overlapping relation across the side edges of the panel planking. This is an old and well known construction in the type of door shown in the drawing.

It is customary, in wooden core, metal sheathed door sections, to secure the vertical edges of each of the strips by nails driven therethrough into the wood of the core, and to turn and fold the adjacent edges of adjacent strips upon the strip, as shown at 18, so as to permit the formation of a lap joint between adjacent strips by means of a flanged cap strip 19 extending from top to bottom of the panel, the inturned flanges 20 of which cap strip interlock with the turned edges 18 of the adjacent sheathing strips.

This means of connecting the strips not only closes the seam between adjacent strips, but imparts a desirable finish to the door surface and excludes flame from any portion of the combustible core which might otherwise be exposed at the seam.

In the embodiment of the invention shown in the drawing, the edges of adjacent sheathing strips are secured in relation to each other and to the core by means of metal fasteners, such as nails 21, passing through the metal sheathing strips adjacent the edge thereof, through one of the plies of the core and through that metal strip 13 adjacent the edges of these strips. These fasteners, however, are not of a length to engage the sheathing strip upon the opposite side of the panel, so that there is no means of direct transmission of heat from the metal sheathing upon one side of the panel to the sheathing upon the other side thereof.

By this construction, however, the sheathing strips upon one side of the door are secured indirectly to sheathing strips upon the opposite side of the door. The securing means 21 act entirely independently of the wood of the core to the extent that the relative position of parts is maintained even though the wood of the core be reduced to charcoal, which affords no grip for the nails or other securing members.

By the use of strips 13, any substantial displacement of the sheathing strips upon one side of the panel in relation to those upon the other side is avoided, although some bulging or warping of the metal may occur in the presence of high temperatures. The amount of such, however, is small compared to previous constructions, and there is little or no tendency toward the opening of seams between the edges of adjacent sheathing strips.

When a door is subjected to high temperatures, the wood of the core undergoes distillation and is converted into charcoal, the extent of this action being determined of course by the tempera-

tures and the time during which the door is subjected to such temperatures. After several hours, experience has shown that the wood throughout the core is completely reduced to charcoal.

During this action, gases are developed within the metal sheathing, and the construction is such as to avoid the formation of gas pockets and distortion of the sheathing by the pressure of the gas therein, while, at the same time, permitting the escape of these gases in a manner to avoid any increase of the fire hazard therefrom.

To secure the desired action, I provide the sheathing strip adjacent the turned edge thereof with one or more vent openings permitting gases to escape from within the panel between the lap joint and the outer surface of the sheathing strip having the opening therethrough. Such openings are shown at **22**, and, in the accompanying drawing, three such openings, slightly over two inches in length are provided, one of which is arranged substantially centrally of the height of the door and the others at equal distances above and below this opening. The width of these openings is such that the lap joint between the strips and the cap completely overlays the opening so as to not only conceal same, but prevent the flame from acting directly upon the wood through the vent openings.

With an arrangement as described, any gases within the metal sheathing of the door escaping through one or another of the numerous vent openings to between the cap **19** and the adjacent face of the door, will be discharged upon the side of the door, the sheathing upon which is provided with such vent openings.

By providing the vent opening in the sheathing beneath the lap joint securing adjacent strips of such sheathing together, and adjacent an intermediate strip **13**, there is little or no obstruction to the flow of such gases, even though bulging of the sheathing strips is prevented, so that there can be no development of substantial pressure, irrespective of the extent of the destruction by distillation of the wood core. Hence, distortion of the portion of the sheathing adjacent the seams between adjacent sheathing strips, from gas pockets within the panel, is substantially prevented, or prevented to an extent to permit any substantial disturbance or displacement of the core or filler, even though it be reduced to charcoal. Obviously this condition will minimize likelihood of the escape of the granular material from within the sheathing in a manner to permit the heat upon one side of the door to act directly upon the other side thereof.

Vent openings **22** may be provided only upon one side of the door, so that gases generated in the event of fire are discharged into the flame and, even though they become ignited, they will introduce no fire hazard.

By using a plurality of spaced vent openings **22** adjacent the edges of the sheathing strips, a number of widely divergent points of venting of the gases is afforded.

Solid portions of the sheathing strips are provided intermediate the vent openings for the location of the various nails or screws or other securing means **21**. The metal of the strips at the fold has a stiffening effect along the entire edge of the sheathing strip.

The width of the turned edge of the sheathing strips is sufficient to substantially cover the vent openings, and the cap strip is of a width to extend across and cover the seam between adjacent sheathing strips and all vent openings adjacent said seam.

The various securing means **21** ordinarily consist of nails having twisted or serrated shanks to secure an effective anchorage between these nails and the imbedded strips **13**.

The sheathing strips and the metal of the cap strip **19**, in actual practice, are about fourteen gauge stock, although this dimension is exaggerated in the drawing.

When vent openings are provided in the sheathing upon only one side of the door, the other face of the door ordinarily is coated with asbestos or asbestos cement, indicated at **23**, covering the entire face of the panel toward the inwardly directed flange, so as to minimize likelihood of excessive heat radiation from this face of the door, and, if desired, a supplemental metal facing sheet **24** may be secured at its edges to the inwardly directed flange of the frame, leaving an air gap between it and the non-inflammable facing **23**. This arrangement, while desirable, is not essential. It has been found, however, that with this arrangement, a temperature of 1700 or 1800° may be maintained upon one side of the door, and a temperature of less than 200° may be maintained upon the other side thereof.

The present invention is not directed broadly to the manner of securing the sheathing upon opposite sides of a combustible core by means of a metal strip imbedded in the material of this core, but to a development in a door structure embodying this characteristic by which the effectiveness of this securing means is increased by preventing the formation of gas pockets having pressure sufficient to distort the sheathing, particularly adjacent the securing means.

In a door embodying the invention, a number of divergent vent openings may be provided, each of which will be covered at all times by the folded and turned edge of the sheathing strip and the flange and top of the cap strip.

In the event of the formation of gases within the sheathing, these gases, instead of being required to follow the tortuous path formed by the cap, its flange and the inturned edge of the strips, may escape directly to atmosphere beneath said parts. The material forming the lap joint may flex sufficiently to permit the free flow of such gases, but under no circumstances are the vent openings so exposed as to permit flame to act directly upon the core or permit charcoal to escape through the vent openings.

It is not my intention to limit the number, size or shape of the vent openings as herein shown and described, it being obvious that such may be varied with different doors.

It is essential, however, that the parts used in forming the lap joint upon opposite sides of a seam shall overlay such vent openings so as to close them against the escape of any part of the core and prevent impingement of flame upon the material of the core through the openings, and yet permit a direct flow of gases through such openings to about the adjacent face of the panel.

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

1. A fire door embodying therein a panel closing a door opening, said panel comprising a plurality of plies of inflammable material, a metal strip imbedded therein, a metal sheathing enclosing said core composed of a plurality of parallel strips of metal having a turned edge and a vent opening therethrough adjacent said edge, metal fas-

teners passing through said sheathing strips adjacent the edges thereof and an adjacent metal strip imbedded in the core, and a flanged cap the flanges of which form a lap joint with the inturned edges of adjacent sheathing strips, said cap being of a width to cover the seam between adjacent sheathing strips and a vent opening adjacent said seam.

2. A fire door embodying therein a panel closing a door opening, said panel comprising a plurality of plies of inflammable material, a metal strip imbedded therein, a metal sheathing enclosing said core composed of a plurality of parallel strips of metal having a turned edge and a plurality of spaced vent openings therethrough adjacent said edge, metal fasteners passing through portions of said sheathing strips intermediate said openings, adjacent the edges thereof and an adjacent metal strip imbedded in the core, and a flanged cap the flanges of which form a lap joint with the inturned edges of adjacent sheathing strips, said cap being of a width to cover the seam between adjacent sheathing strips and all vent openings adjacent said seam.

3. A fire door embodying therein a panel closing a door opening, said panel comprising a plurality of plies of inflammable material, a plurality of metal strips imbedded therein at spaced intervals, a metal sheathing enclosing said core composed of a plurality of parallel strips of metal each having a turned edge and a plurality of vent openings therethrough adjacent said edge, metal fasteners passing through said sheathing strips respectively, adjacent the edges thereof and an adjacent metal strip imbedded in the core, and flanged caps the flanges of which form a lap joint with the inturned edges of adjacent sheathing strips, each of said caps being of a width to cover the seam between adjacent strips and a vent opening adjacent said seam.

4. A fire door embodying therein a panel closing a door opening, said panel comprising a plurality of plies of inflammable material, a plurality of metal strips imbedded therein at spaced intervals, a metal sheathing enclosing said core composed of a plurality of parallel strips of metal each having a turned edge and a plurality of spaced vent openings therethrough adjacent said edge, metal fasteners passing through portions of said sheathing strips intermediate said openings, adjacent the edges thereof and an adjacent metal strip imbedded in the core, and flanged caps the flanges of which form a lap joint with the inturned edges of adjacent sheathing strips, each of said caps being of a width to cover the seam between adjacent strips and all vent openings adjacent said seam.

5. A fire door embodying therein a panel closing a door opening, said panel comprising a plurality of plies of inflammable material, a metal strip imbedded therein, metal sheathing enclosing said core composed of a plurality of parallel strips of metal upon opposite faces of the panel, metal fasteners passing through said sheathing strips adjacent the edges thereof and the metal strip embodied in the core, a non-inflammable facing covering said sheathing upon one side of the panel, sheathing strips upon the other side of said door having turned edges and vent openings therethrough adjacent said edges, and a flanged cap the flanges of which form a lap joint with the inturned edges of adjacent sheathing strips, said cap being of a width to cover the seam between adjacent sheathing strips and all vent openings adjacent said seam.

6. A fire door embodying therein an angle metal frame having an inwardly directed flange upon one side thereof, and a panel closing the opening in said frame, said panel comprising a plurality of plies of inflammable material, a metal strip imbedded therein, metal sheathing enclosing said core composed of a plurality of parallel strips of metal upon opposite faces of the panel, metal fasteners passing through said sheathing strips adjacent the edges thereof and the metal strip embodied in the core, a non-inflammable facing covering said sheathing upon the side of the panel toward said inwardly directed flange, a metal plate secured to the inwardly directed flange of said frame and forming an air gap between same and said facing, sheathing strips upon the other side of said door having turned edges and vent openings therethrough adjacent said edges, and a flanged cap the flanges of which form a lap joint with the inturned edges of adjacent sheathing strips, said cap being of a width to cover the seam between adjacent sheathing strips and all bent openings adjacent said seam.

7. A fire door embodying therein a panel closing a door opening, said panel comprising a plurality of plies of inflammable material, a metal strip imbedded therein, metal sheathing enclosing said core composed of a plurality of parallel strips of metal upon opposite faces of the panel, metal fasteners passing through said sheathing strips adjacent the edges thereof and the metal strip embodied in the core, a non-inflammable facing covering said sheathing upon one side of the panel, sheathing strips upon the other side of said panel having turned edges and a plurality of spaced vent openings therethrough adjacent said edges, said metal fasteners passing through said sheathing strips intermediate said openings, and a flanged cap the flanges of which form a lap joint with the inturned edges of adjacent sheathing strips, said cap being of a width to cover the seam between adjacent sheathing strips and all bent openings adjacent said seam.

8. A fire door embodying therein a panel closing a door opening, said panel comprising a plurality of plies of inflammable material, a plurality of metal strips imbedded therein at spaced intervals, metal sheathing enclosing said core composed of a plurality of parallel strips of metal upon opposite faces of the panel, metal fasteners passing through said sheathing strips adjacent the edges thereof and the metal strip embodied in the core, a non-inflammable facing covering said sheathing upon one side of the panel, sheathing strips upon the other side of said door, each having turned edges and a plurality of spaced vent openings therethrough adjacent said edges, and flanged caps the flanges of which form a lap joint with the inturned edges of adjacent sheathing strips, said caps being of a width to cover the seam between adjacent sheathing strips and all vent openings adjacent said seam.

9. A fire door embodying therein an angle metal frame having an inwardly directed flange upon one side thereof, and a panel closing the opening in said frame, said panel comprising a plurality of plies of inflammable material, a plurality of metal strips imbedded therein at spaced intervals, metal sheathing enclosing said core composed of a plurality of parallel strips of metal upon opposite faces of the panel, metal fasteners passing through said sheathing strips adjacent the edges thereof and the metal strip embodied in the core, a non-inflammable facing

covering said sheathing upon the side of the panel toward said inwardly directed flanges, a metal plate secured to the inwardly directed flanges of said frame and forming an air gap between same and said facing, sheathing strips upon the other side of said door, each having turned edges and a plurality of spaced vent openings therethrough adjacent said edges, and flanged caps the flanges of which form a lap joint with the inturned edges of adjacent sheathing strips, said caps being of a width to cover the seam between adjacent sheathing strips and all vent openings adjacent said seam.

ARTHUR A. ALLEN.