

Feb. 17, 1970

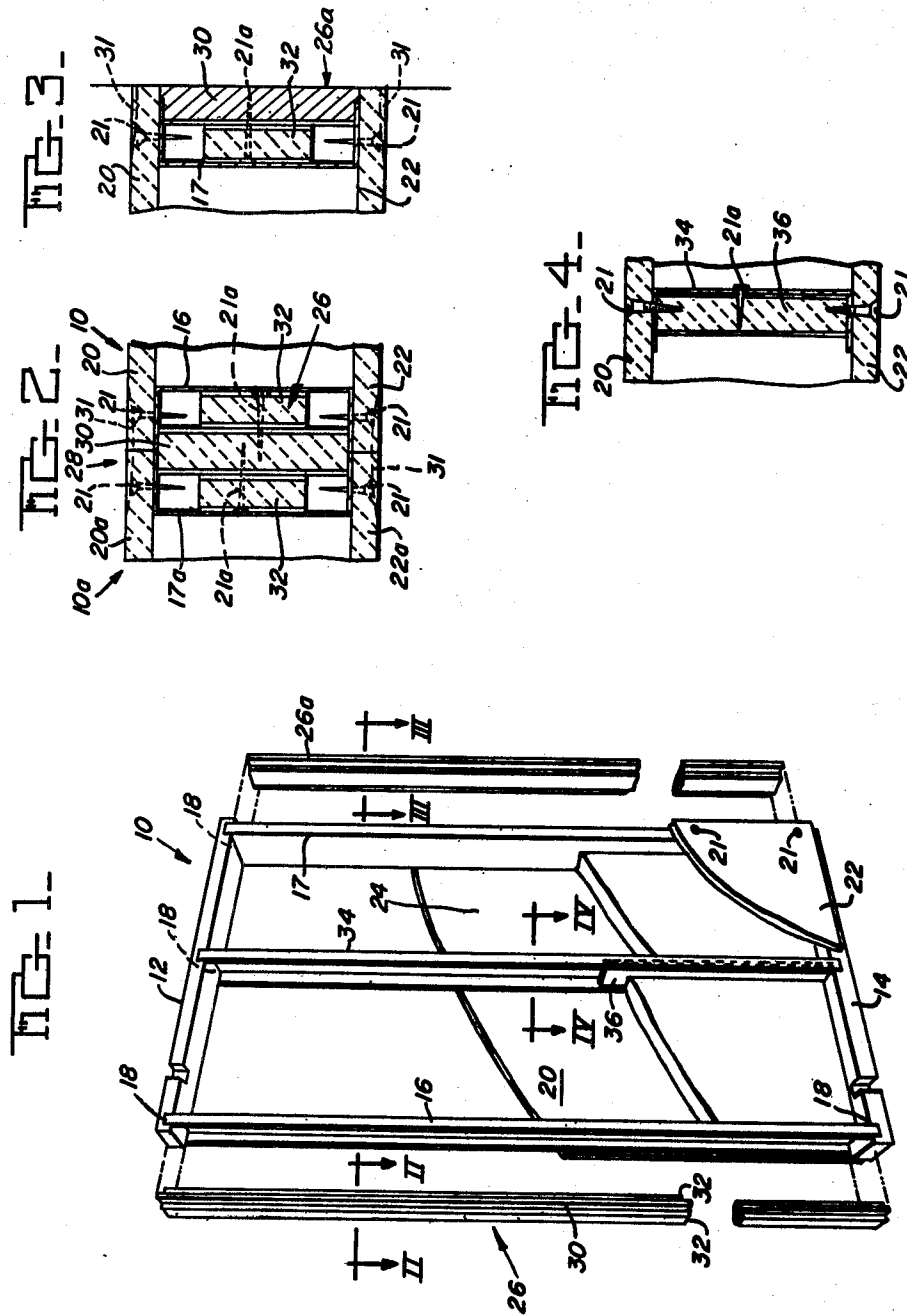
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3,495,417

WALL CONSTRUCTION

Filed June 14, 1968

4 Sheets-Sheet 1



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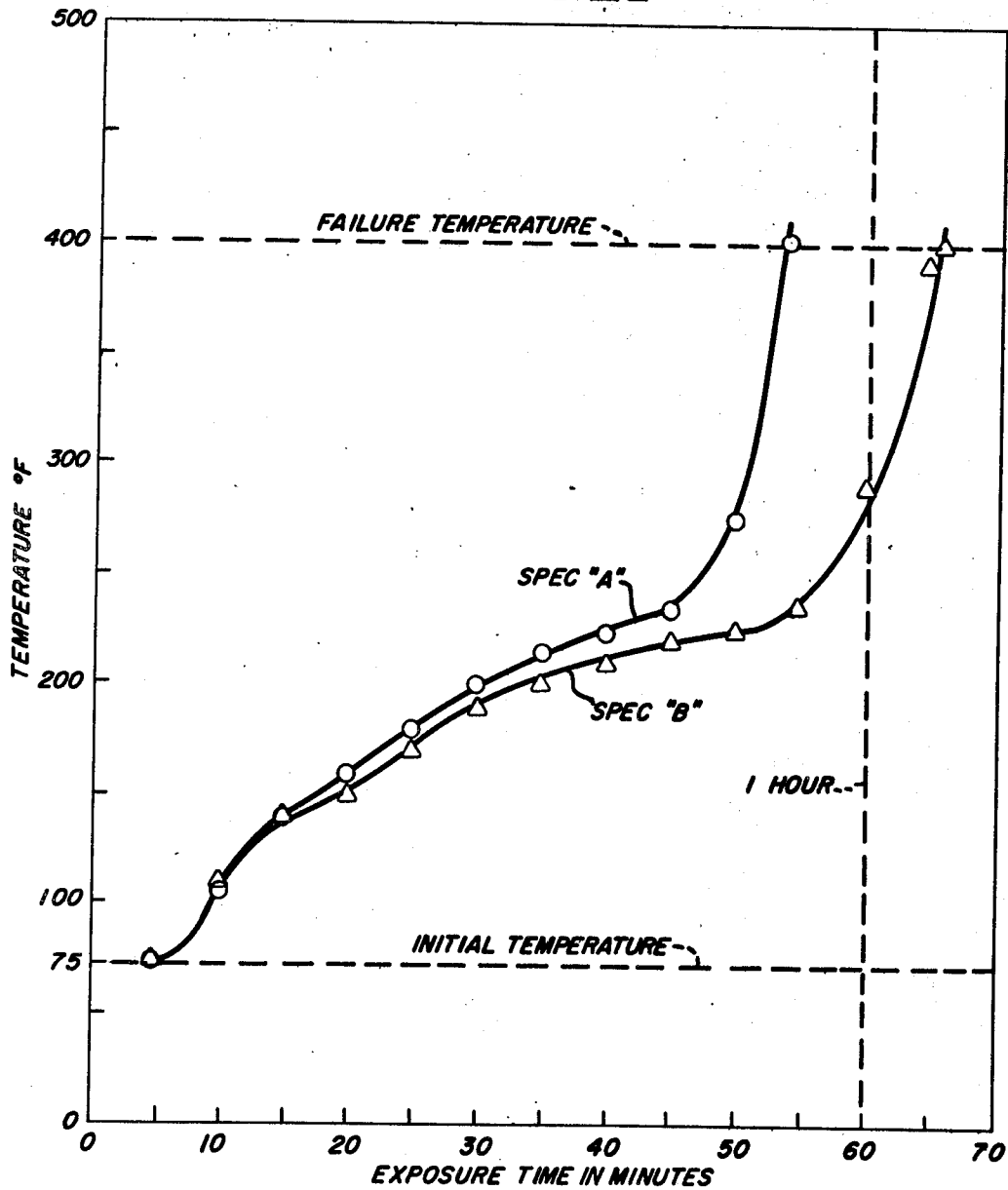
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WALL CONSTRUCTION

Filed June 14, 1968

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FIG. 5



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Filed June 14, 1968

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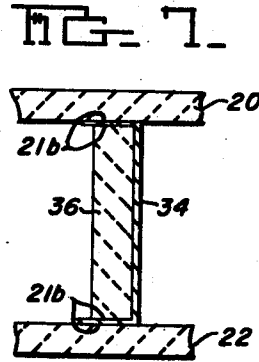
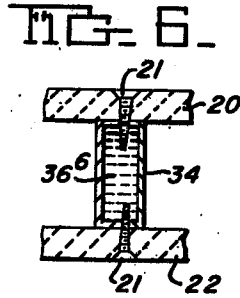


FIG. 8

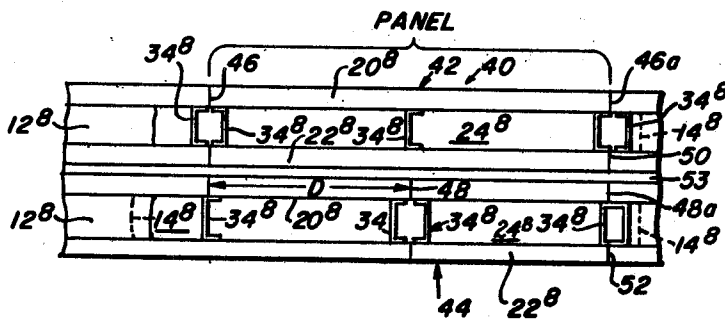
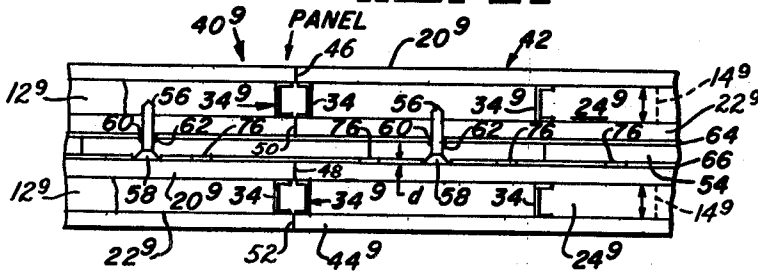


FIG. 9



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WALL CONSTRUCTION

Filed June 14, 1968

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FIG. 11

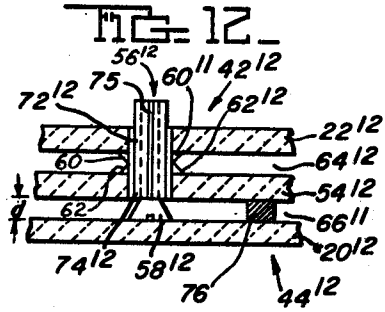
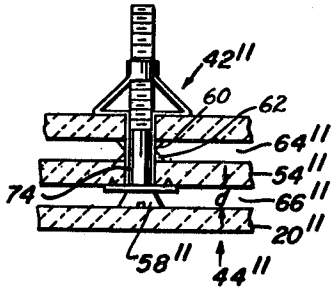
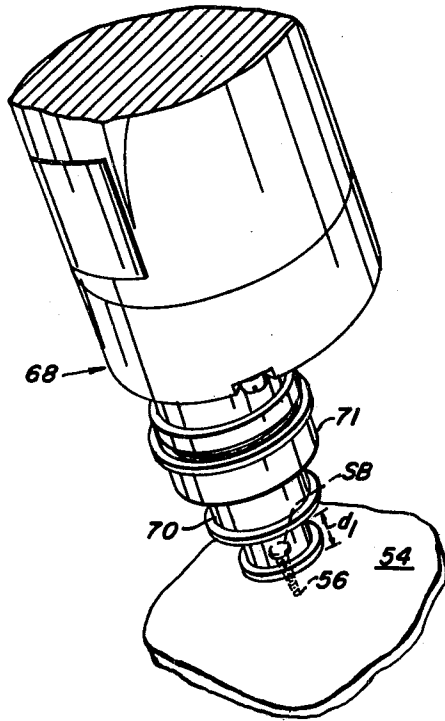


FIG. 10



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WALL CONSTRUCTION

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Filed June 14, 1968, Ser. No. 737,173

Int. Cl. E04b 1/90, 2/72, 2/30

U.S. Cl. 52—168

14 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to non-bearing walls or partitions and, more particularly, to improved sound-proof, non-bearing walls or partitions which successfully pass ASTM Standard E119-61 fire tests for one and two hours. In a building structure, a partition wall is provided comprising a plurality of aligned modular panels. Each panel includes a pair of wallboards disposed in spaced substantially parallel relation and channel-shaped spacer members interposed between the wallboards along two opposite edges thereof. The wallboards and the spacer members define an air space. Each spacer member includes a web bridging the air space between the wallboards and a pair of substantially parallel flanges extending toward, but terminating short of, the opposite edges of the wallboards. Fasteners penetrate the wallboards and the flanges of the spacer members. Each fastener has an end extending inwardly of the spacer members. Contiguous edges of the wallboards of the aligned panels are positioned in abutting relationship and form joints between the aligned wallboards. The spacer members contiguous to said joints form a cavity. The flanges of the spacer members are spaced apart and defining a gap on opposite sides of the cavity. A fire-resistant spline member is disposed in and bridges the cavity. The opposite lateral sides of the spline member are seated in the gaps on the opposite sides of the cavity and overlays the joints between the abutting edges of the wallboards. Fire-resistant clearance members are secured to the opposite sides of the spline member, and the clearance members are of less lateral extent than the spline member, thereby clearing the ends of the fasteners.

BACKGROUND OF THE INVENTION

In order to satisfactorily pass the ASTM Standard E119-61 fire tests for a non-bearing wall and partition, certain conditions must be met. First, the wall or partition must withstand the fire endurance test (without passage of flame or gases hot enough to ignite cotton waste) for a period equal to that for which classification is desired. After the fire test the specimen is then subjected to the impact, erosion and cooling effects of a hose stream directed first at the middle and then at all parts of the exposed face, changes in direction being made slowly. Thirdly, transmission of heat through the wall or partition during the fire endurance test shall not have been such as to raise the temperature on its unexposed surface more than 250° F. (139° C.) above its initial temperature.

OBJECTS OF THE INVENTION

It is the general object of the present invention to avoid and overcome the foregoing and other difficulties of and objections to prior art practices by the provision of prefabricated panel:

- (a) Which has an increased fire rating; and
- (b) Which is an improved sound barrier.

BRIEF SUMMARY OF THE INVENTION

The aforesaid objects of this invention, and other objects which will become apparent as the description pro-

ceeds, are achieved by providing a partition wall comprising a plurality of aligned modular panels. Each panel includes a pair of wallboards disposed in spaced substantially parallel relation and channel-shaped spacer members interposed between the wallboards along two opposite edges thereof. The wallboards and the spacer members define an air space. Each spacer member includes a web bridging the air space between the wallboards and a pair of substantially parallel flanges extending toward, but terminating short of, the opposite edges of the wallboards. Fasteners penetrate the wallboards and the flanges of the spacer members. Each fastener has an end extending inwardly of the spacer members. Contiguous edges of the wallboards of the aligned panels are positioned in abutting relationship and form joints between the aligned wallboards. The spacer members contiguous to said joints form a cavity. The flanges of the spacer members are spaced apart and defining a gap on opposite sides of the cavity. A fire-resistant spline member is disposed in and bridges the cavity. The opposite lateral sides of the spline member are seated in the gaps on the opposite sides of the cavity and overlay the joints between the abutting edges of the wallboards. Fire-resistant clearance members are secured to the opposite sides of the spline member, and the clearance members are of less lateral extent than the spline member, thereby clearing the ends of the fasteners.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

For a better understanding of this invention reference should be had to the accompanying drawings, wherein like numerals of reference indicate similar parts throughout the several views and wherein:

FIGURE 1 is an exploded perspective view of a single panel wall of this invention capable of a one hour fire test and showing the novel heat sink, panel joint spline and panel end spline;

FIGURE 2 is a horizontal sectional view of the panel joint spline taken along the line II—II of FIGURE 1 in the direction of the arrows;

FIGURE 3 is a horizontal sectional view of the panel end spline taken along the line III—III of FIGURE 1 in the direction of the arrows;

FIGURE 4 is a horizontal sectional view of the heat sink taken along the line IV—IV of FIGURE 1 in the direction of the arrows;

FIGURE 5 is a graph of the exposure time and the highest temperature measured on the unexposed side of two test panel specimens;

FIGURE 6 is a view similar to FIGURE 4 of an alternative embodiment of a heat sink;

FIGURE 7 is a view similar to FIGURES 4, 6 of a further alternative view of the heat sink;

FIGURE 8 is a fragmentary plan view of a double panel wall capable of a two hour fire test;

FIGURE 9 is a view similar to FIGURE 8 of another alternative embodiment of a double panel;

FIGURE 10 is a schematic view of an automatic screwdriver provided with a depth insertion adapter for setting the fasteners of FIGURE 9;

FIGURE 11 is a fragmentary plan view of a toggle-type fastener; and

FIGURE 12 is a view similar to FIGURE 11 of an anchor-type fastener.

Although the principles of this invention are broadly applicable to walls and partitions, this invention is particularly adapted for use in conjunction with a non-bearing, fire-proof wall or partition and hence it has been so illustrated and will be so described.

DETAILED DESCRIPTION

With specific reference to the form of this invention illustrated in the drawings, and referring particularly to FIGURE 1, a fire-resistant, non-bearing panel wall is indicated generally by the reference numeral 10.

This panel 10 (FIGURE 1) has a top sill 12 and a bottom sill 14 (suitably wood or the like) disposed in spaced relation to the top sill 12. End support members, such as the 28-gauge galvanized steel channels or studs 16, 17 or the like are connected to the top sill 12 and bottom sill 14 by having the ends of such studs 16, 17 positioned in slots 18 in the top sill 12 and bottom sill 14 and integrate the top sill 12 with the bottom sill 14. A first wall board member 20, such as about a 1/2-inch thick gypsum wallboard or the like of the type X produced by the U.S. Gypsum Company, Chicago, Illinois, is connected to one side (in this case the back side) of the top sill 12, bottom sill 14 and end support members 16, 17 by fasteners 21, such as nails, screws or the like. A second wallboard member 22, similar to the first wallboard member 20, is connected by other similar fasteners 21 to the other side of the top sill 12, bottom sill 14 and the end support members 16, 17 and defines with the first wallboard member 20 an air space 24.

As shown in FIGURES 1 and 2, a spline member, suitably a panel joint spline 26, is positioned in one of the end support members 16, 17 (in this case end support member 16) to provide a physical fire barrier through a wall joint 28 of adjacent wall panels 10, 10a (FIGURE 2). Referring to FIGURE 2, the panel joint spline 26 has a barrier member 30 to seal the wall joint 28 which barrier member 30 is disposed adjacent clearance members 32 (to block a flame path through the wall joint 28) and is disposed adjacent end support members 16, 17a to provide clearance for the already-inserted fasteners 21. The barrier member 30 and clearance members 32 are, for example, 1/2-inch fire-rated gypsum wallboard and are integrated by fasteners 21a, such as 1 1/4 long annular-ringed drywall nails on 16-inch centers on both sides.

As shown in FIGURES 1, 3, the panel end spline 26a has a barrier member 30 and one clearance member 32 for use against end walls (not shown). All joints are sealed on the outside surface by tape 31.

Referring now to FIGURES 1, 4, an internal support member 34 substantially identical to the end support members 16, 17 is disposed between the end support members 16, 17 and the top sill 12 and bottom sill 14. A heat sink member 36, suitably 1/2-inch fire-rated gypsum wallboard, is provided in the internal support member 34 and secured thereto by fasteners 21a, such as 1 1/4-inch long annular-ringed drywall nails at the center, top and bottom of the internal support member 34 (FIGURE 4). The fasteners 21, suitably 1-inch long self-drilling, self-tapping drywall screws (type G supplied by U.S. Gypsum Company, Chicago, Illinois) on 12-inch centers of the edges of the internal support member 34 connect both the first wallboard member 20 and the second wallboard member 22 to the internal support member 34. The fasteners 21 extend through one of the first wallboard member 20 and the second wallboard member 22 and the internal support member 34 and into the heat sink member 36, thereby preventing heating of the fastener 21 above the failure temperature of the fire test (i.e. 250° F. above starting ambient temperature).

The heat sink member 36 contains a material, such as water, having a latent heat of vaporization and the material is operable during vaporization thereof to prevent a temperature rise in the fastener 21 as shown by the test results of the test specimens illustrated in FIGURE 5. The fire-rated gypsum wallboard in the heat sink member 36 is a material, such as water which is chemically bonded to CaSO₄ approximately as represented by the formula CaSO₄·6H₂O. Alternatively, concrete, such as vermiculite type, containing a material, such as water which is chemically and mechanically bonded to the cement may be used.

Alternatively, as shown in FIGURE 6, a hollow heat sink member 36⁶ containing a material, such as water which is employed. The heat sink member 36⁶ is formed of a self-sealing material, such as foam rubber or the like.

As shown in FIGURE 7, the above-described heat sink members 36 (FIGURE 4) and 36⁶ (FIGURE 6) may be affixed by an adhesive fastener 21b (such as Synco 935D adhesive prepared by Synco Resins Division, Ashland Oil Company, Louisville, Kentucky) to the wallboard members 20, 22 and to each other.

ALTERNATIVE EMBODIMENTS

It will be understood by those skilled in the art that alternatively as shown in FIGURE 8, a wall 40 may have a first panel 42 and a second panel 44, each having a top sill 12⁸ and a bottom sill 14⁸ disposed in spaced relation to the top sill 12⁸. End support members (not shown) are connected to (as shown in FIGURE 1) the top sill 12⁸ and bottom sill 14⁸. Similarly a first wallboard member 20⁸ and a second wallboard member 22⁸ are connected respectively to opposite sides of the top sill 12⁸, bottom sill 14⁸ and end support members (not shown) by fasteners (not shown). One of the first wallboard member 20⁸ and the second wallboard member 22⁸ of the first panel 42 (in this case the first wallboard member 20⁸) has a first joint 46. In addition, one of the first wallboard member 20⁸ and the second wallboard 22⁸ of the second panel 44 (in this case the first wallboard member 20⁸) has a second joint 48. A first internal support member 34⁸, suitably face-to-face support members 34, are disposed adjacent the first joint 46 and second joint 48 in the respective air spaces 24⁸. The first joint 46 and the second joint 48 are displaced from each other a distance D (FIGURE 8) to provide a tortuous fire and sound path through the first panel 42 and the second panel 44.

Also, as shown in FIGURE 8, the other of the first wallboard member 20⁸ and the second wallboard member 22⁸ of the first panel 42 (i.e. the second wallboard member 22⁸) has a third joint 50 in alignment with a first joint 46a.

Similarly the other of the first wallboard member 20⁸ and the second wallboard member 22⁸ of the second panel 44, namely the second wallboard member 22⁸, has a fourth joint 52 in alignment with a second joint 48a. An air space 53 is provided between the first panel 42 and the second panel 44.

As shown in the double panel wall 40⁹ of FIGURE 9, a filler wallboard member 54, similar to the wallboard members 20⁹, 22⁹, is connected to the second wallboard member 22⁹ of the first panel 42⁹ by a fastener 56 having a head 58 protruding a predetermined distance *d* from the filler wallboard member 54. This fastener 56, suitably a type G Buglehead drywall screw provided by U.S. Gypsum Company, Chicago, Illinois, is operable to bulge the adjacent side walls at 60, 62 of the filler wallboard member 54 and the second wallboard member 22⁹ of the first panel 42⁹ to space the filler wallboard member 54 from such second wallboard member 22⁸ and to define a second air space 64 therebetween. The second panel 44⁹ has its first wallboard member 20⁹ positioned against the protruding heads 58 of the fasteners 56 to define therewith a third air space 66.

In order to set the fasteners 56 of FIGURE 9, an automatic screwdriver 68 (FIGURE 10), suitably a model 172 power screwdriver produced by the Skil Power Tool Company, Chicago, Illinois, is provided with a switch shut-off adapter 70; which adapter 70 engages the outer surface of the filler wallboard member 54 and moves backwardly with respect to the housing 71 of the screwdriver 68 a distance *d*₁ to close a switch (not shown) thus shutting off the screwdriver 68, thereby providing the protruding head 58 and thus preventing stripping of the holes in the second wallboard member 20⁹ of the first panel 42⁹ and in the filler wallboard member 54.

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Referring to FIGURE 9, adhesive beads 76, (such as Perf-a-Tape joint compound or USG Laminating Adhesive trade names of U.S. Gypsum Company, Chicago, Illinois) are employed to secure the filler wallboard 54 to the first wallboard member 20⁹ of the second panel 44⁹ in spaced relation therewith.

Alternatively, as shown in FIGURE 11, a toggle-type fastener 56¹² having a toggle sleeve 72 and a bolt 74 is employed. In FIGURE 12 an expansible anchor-type fastener 56¹² having an expansion sleeve 72¹² (provided with expansion slot 75) and a bolt 74¹² is used.

SUMMARY OF THE ACHIEVEMENT OF THE OBJECTS OF THE INVENTION

It will be recognized by those skilled in the art that the objects of this invention have been achieved by providing a one-hour fire test panel 10 (FIGURES 1-7) and the two-hour test double-panelled walls 40 (FIGURE 8) and 40⁹ (FIGURE 9) which walls 40, 40⁹ provide improved fire and sound resistance.

While in accordance with the patent statutes preferred and alternative embodiments of this invention have been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby.

I claim:

1. In a building structure:

(a) a partition wall comprising a plurality of aligned modular panels,

(1) each panel including a pair of wallboards disposed in spaced substantially parallel relation and channel-shaped spacer members interposed between said wallboards along two opposite edges thereof,

(b) said wallboards and said spacer members defining an air space,

(c) each spacer member including a web bridging said said air space between said wallboards and a pair of substantially parallel flanges extending toward, but terminating short of, said opposite edges of said wallboards,

(d) fasteners penetrating said wallboards and said flanges of said spacer members,

(1) each fastener having an end extending inwardly of said spacer members,

(e) contiguous edges of said wallboards of said aligned panels being positioned in abutting relationship and forming joints between said aligned wallboards,

(f) said spacer members contiguous to said joints forming a cavity,

(g) said flanges of said spacer members being spaced apart and defining a gap on opposite sides of said cavity,

(h) a fire-resistant spline member disposed in and bridging said cavity,

(i) the opposite lateral sides of said spline member being seated in said gaps on said opposite sides of said cavity and overlying said joints between said abutting edges of said wallboards,

(j) fire-resistant clearance members secured to said opposite sides of said spline member, and

(k) said clearance members being of less lateral extent than said spline member, thereby clearing said ends of said fasteners.

2. In the building structure recited in claim 1:

(a) a fixed wall,

(b) one panel of said modular panels having a terminal end disposed in angular relation to a fixed wall,

(c) said terminal end including a pair of terminal wallboards disposed in spaced substantially parallel relation and having terminal edges and a channel-shaped terminal spacer member interposed between said terminal wallboards along said terminal edges thereof,

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(d) said terminal wallboards and said terminal spacer member defining a terminal air space,

(e) said terminal spacer member including a web bridging said terminal air space between said terminal wallboards and a pair of substantially parallel flanges extending toward, but terminating short of, said terminal edges of said terminal wallboards,

(f) fasteners penetrating said terminal wallboards and said flanges of said terminal spacer member,

(1) each fastener having an end extending inwardly of said terminal spacer member,

(g) said terminal edges of said terminal wallboards being positioned in abutting relationship with said fixed wall and forming terminal joints between said terminal wallboards and said fixed wall,

(h) said terminal spacer member contiguous to said joints forming a cavity with said fixed wall,

(i) said flanges of said terminal spacer member being spaced apart and defining a terminal gap on the side of said terminal cavity opposite to said fixed wall,

(j) a fire-resistant terminal spline member disposed in and bridging said terminal cavity,

(k) the lateral side of said terminal spline member adjacent said web of said terminal spacer member being seated in said terminal gap and overlying said flanges of said terminal spacer member,

(l) a fire-resistant terminal clearance member secured to said terminal spline member, and

(m) said terminal clearance member being of less lateral extent than said terminal spline member, thereby clearing said ends of said fasteners.

3. In the building structures recited in claim 1:

(a) an internal support member disposed in said air space between said spacer members,

(b) said internal support member having:

(1) a channel-shaped internal spacer member interposed between said wallboards,

(2) said internal spacer members including a web bridging said air space between said wallboards and a pair of substantially parallel flanges extending toward one of said spacer members,

(3) said flanges of said internal spacer member being spaced apart and defining a heat sink gap,

(4) a heat sink member in said heat sink gap, and

(5) fasteners penetrating said wallboards and said flanges of said internal spacer member and extending into said heat sink member.

4. In the building structure recited in claim 3 said heat sink member contains a material having a latent heat of vaporization, said material 36, 36⁹ being operable to prevent a temperature rise in said fasteners during vaporization of said material.

5. In the building structure recited in claim 4, said material is mechanically bonded to said heat sink member.

6. In the building structure recited in claim 4, said material is chemically bonded to said heat sink member.

7. In the building structure recited in claim 1:

(a) an internal support member disposed in said air space between said spacer member,

(b) said internal support member having:

(1) a hollow internal spacer member interposed between said wallboards,

(2) said internal spacer member including a web bridging said air space between said wallboards and a pair of substantially parallel flanges,

(3) said internal spacer member being provided with a heat sink gap,

(4) a heat sink member in said heat sink gap, and

(5) fasteners penetrating said wallboards and said flanges of said internal spacer member and extending into said heat sink member,

(6) said heat sink member 34 having therein a material operable to prevent a temperature rise in said fasteners during vaporization of said material.

8. In the building structures recited in claim 1:
- (a) an internal support member disposed in said air space between said spacer members,
 - (b) said internal support member having:
 - (1) a channel-shaped internal spacer member interposed between said wallboards,
 - (2) said internal spacer member including a web bridging said air space between said wallboards and a pair of substantially parallel flanges extending toward one of said spacer members,
 - (3) said flanges of said internal spacer member being spaced apart and defining a heat sink gap,
 - (4) a heat sink member in said heat sink gap, and
 - (5) adhesive fasteners connecting said flanges of said internal spacer member to said wallboards.
9. In the building structure recited in claim 1:
- (a) a second partition wall disposed in substantially parallel relation to said partition wall and defining with said partition wall an internal air space,
 - (b) said second partition wall comprising a plurality of aligned modular second panels,
 - (1) each second panel including a pair of second wallboards disposed in spaced substantially parallel relation and having contiguous edges of said second wallboards of said aligned second panels positioned in abutting relationship and forming second joints between said aligned second wallboards, and a pair of opposed channel-shaped second spacer members interposed between said second wallboards adjacent said second joints,
 - (c) said second wallboards and said second spacer members defining a second air space,
 - (d) each second spacer member including a second web bridging said second air space between said second wallboards and a pair of substantially parallel second flanges extending toward, but terminating short of, said second joints of said second wallboards, and
 - (e) means for connecting said second flanges to said second wallboards,
 - (f) said second joints being displaced from said joints of said partition wall to provide a tortuous fire path through said second partition wall and said partition wall.
10. In the building structure recited in claim 1:
- (a) a second partition wall disposed in substantially parallel relation to said partition wall and defining with said partition wall an internal air space,
 - (b) said second partition wall comprising a plurality of aligned modular second panels,
 - (1) each second panel including a pair of second wallboards disposed in spaced substantially parallel relation and having contiguous edges of said second wallboards of said aligned second panels positioned in abutting relationship and forming second joints between said aligned second wallboards, and a pair of opposed channel-shaped second spacer members interposed be-

- tween said second wallboards adjacent said second joints,
 - (c) said second wallboards and said second spacer members defining a second air space,
 - (d) each second spacer member including a second web bridging said second air space between said second wallboards and a pair of substantially parallel second flanges extending toward, but terminating short of, said second joints of said second wallboards,
 - (e) means for connecting said second flanges to said second wallboards,
 - (f) a filler wallboard member in said internal air space and spaced from said partition wall and said second partition wall, and
 - (g) spacing fasteners each having a head protruding a predetermined distance from said filler wallboard member, extending through said filler wallboard member and one wallboard of the adjacent wallboards of said partition wall and said second partition wall, and being operable to create projecting bulges in the adjacent surfaces of said filler wallboard member and said one wallboard to space said filler wallboard members from said one wallboard,
 - (h) said other wallboard of the adjacent wallboards of said partition wall and said second partition wall being positioned against said protruding heads of said spacing fasteners.
11. In the building structure recited in claim 10:
- (a) adhesive means for securing said filler wallboard member to said other wallboard.
12. In the building structure recited in claim 10:
- (a) spacing fasteners which are wallboard screws.
13. In the building structure recited in claim 10:
- (a) spacing fasteners which are of the toggle type.
14. In the building structure recited in claim 10:
- (a) spacing fasteners which are of the anchor type.

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U.S. Cl. X.R.

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