Jan. 31, 1967 A. HILLER 3,300,919

MOVABLE FIREPROOF WALL AND JOINT

Filed Feb. 10, 1964

FIG. 1.

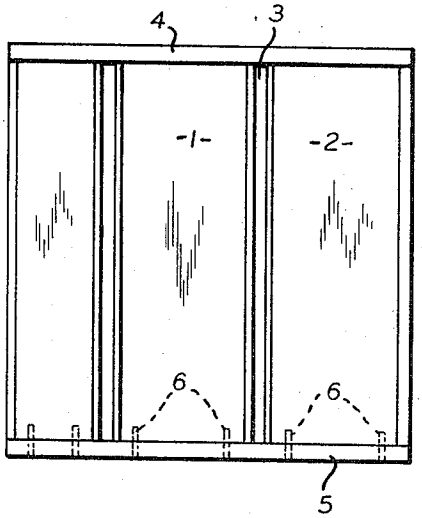


FIG. 2.

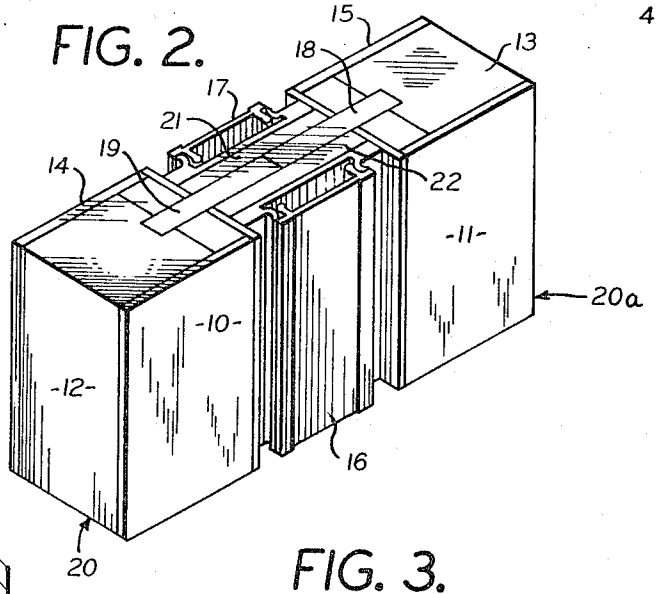


FIG. 3.

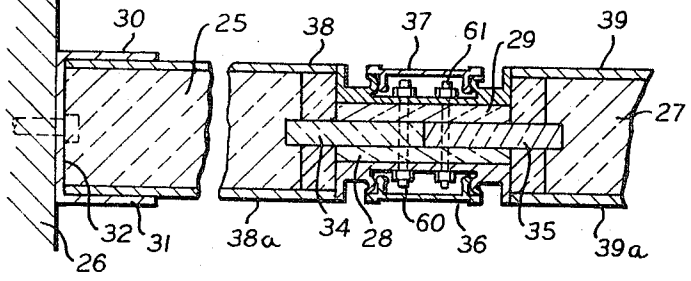
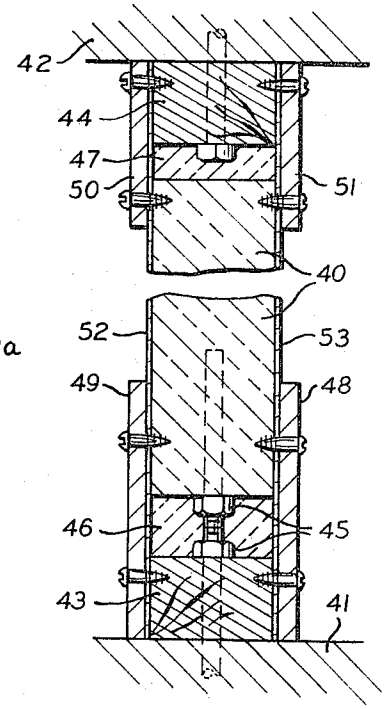


FIG. 4.



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MOVABLE FIREPROOF WALL AND JOINT

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The present invention is generally concerned with a unique movable fireproof wall or partition assembly. The invention is more particularly concerned with a wall or partition assembly which meets standards established by the Underwriters' Laboratories with respect to its ability to resist fire and heat minimum conditions. In essence, the fireproof partition assembly of the present invention comprises, in combination, a number of elements which are interrelated so as to secure a high quality wall or partition and the like which will readily pass all Underwriters' Laboratories requirements and thus meet the rigid Building Codes established by many regulatory bodies. The wall or partition of the present invention will materially reduce the hazard or danger of a general conflagration and thus will greatly increase the overall safety of life and property.

The use of movable walls and the like in modern architecture and building construction is well known in the art. It is also well known of the desirability of providing fireproof construction. Usually this has been accomplished by utilizing incombustible material such as, steel panels, cement, asbestos, and the like. However, these materials do not have the warmth and pleasing appearance of materials, such as, wood panels, as for example, plywood panels and the like. However, it has been very difficult to fabricate a wall structure, particularly a movable wall structure, which comprises decorative wood panels, and also have this wood structure meet the Underwriters' Laboratories standards with respect to its ability of meeting the fire code regulations or tests.

The panel or wall structure of the present invention has accomplished this by the utilization of wood-faced, Weldrok [1] core panels, particularly in conjunction with a vertical joint. The structural units of the present invention have great flexibility and ruggedness. The present invention may be readily understood by reference to the drawings illustrating embodiments of the same.

FIGURE 1 illustrates a plurality of panels of the present invention in elevation or a front view of the same.

FIGURE 2 illustrates in some detail the method by which respective panels are attached one to the other by means of splines.

FIGURE 3 shows in detail a horizontal section showing one of the panels attached to a side wall.

FIGURE 4 is a vertical section of a panel showing the technique by which the same is attached to the floor and the ceiling.

Referring specifically to FIGURE 1, panels **1** and **2** are shown positioned abutting one another by means of a post assembly **3**. A floor element or edge trim element **5** is shown attached to these panels along the floor while a ceiling edge trim element **4** is shown attached to the top of the panels along the ceiling. Levelling bolts **6** are shown which operate in a manner as hereinafter described. Wood runners are utilized along the floor as will hereinafter be described. They are attached to the floor of masonry or concrete preferably with bolts spaced about 12 inches on center.

Referring specifically to FIGURE 2, two identical

[1] Incombustible calcium silicate gypsum composition with asbestos reinforcing fibers manufactured by United States Plywood Corp.

panels **20** and **20A** are shown attached one to another. Panel **20** consists of a core **12** which is of an incombustible material containing wood-like or plywood face elements **14** and **10**. Panel **20A** consists of an inner incombustible core **13** and two decorative wood faces **15** and **11**. The precise dimensions of these panels may vary appreciably, depending upon factors, such as, ultimate use, etc. Panels **20** and **20A** are preferably approximately 2¼" thick. These panels contain longitudinal grooves which are approximately ½" wide and 1" deep. These grooves are along the vertical edges and are adapted for the insertion of splines of an incombustible mineral composition type.

Again referring specifically to FIGURE 2, splines **18** and **19**, of an incombustible material, are positioned in the grooves and thereby attach the respective panels **20** and **20A** one to the other. Decorative elements **16** and **17** which may be of a metal type, such as aluminum, are then wedged or affixed intermediate the respective panels to produce a very decorative, pleasing, and fire-resistant barrier. Post elements **21** and **22** are shown intermediate the panels adjacent the splines.

Referring specifically to FIGURE 3, panel **25** is shown abutting up against wall **26**. Panel **27** is attached to panel **25** by means of post elements **28** and **29** which will be hereinafter described in detail. A simple thin U shaped metal molding or trim **32** having arms **30** and **31** is secured to the wall **26** by any suitable means.

Spline **34** is inserted in the groove of panel **25** while spline **35** is inserted in the groove of panel **27**. These splines are abutted tightly against one another as illustrated. The splines are preferebly cut from ½" thick mineral composition units and weigh about 36 lb./cubic foot. They are 2⅜" wide and are cut to the length of the building panels.

Posts **28** and **29** are placed between the panels and abut against the extended splines. These posts are preferably cut from ⅜" thick asbestos cement board and weigh about 120 lbs./cubic foot. They are 2¾" wide and extend the height of the respective units or panel.

Batten covers **36** and **37** are placed between the panels and abut against the respective post **28** and **29**. These covers comprises preferably extruded aluminum and are of any desirable shape or size. For example, they may be 1¾" wide by ⅜" deep. They are preferably of the snap-on type.

Referring specifically to FIGURE 4, panel **40** is shown positioned on the floor **41** and extending to the ceiling **42**. Wood floor runners **43** and wood ceiling runners **44** could preferably be boards 2¼" wide by 1½" high and preferably made of soft maple. These floor and ceiling runners consist essentially of wood pieces which are chemically treated to reduce the rate of flame spread. They are attached to concrete or masonry with suitable bolts or other means which bolts are preferably spaced 12 inches on center.

The panels are preferably levelled to the desired degree by means of levelling bolts **45** which are steel rods preferably about 5/16" in diameter and about 6" long with two nuts ⅛" thick by 1" diameter steel washers. All clearance openings such as **46** and **47** are filled with Rockwool or equivalent non-combustible material. Edge trim **48** and **49** is used along the floor while edge trim **50** and **51** is used along the ceiling. This edge trim is maintained in position by metal screws similar to that illustrated in FIGURE 3.

The panels consist of an incombustible core faced with wood veneers **38**, **38***a*, **39** and **39***a* in FIGURE 3 and with veneers **52** and **53** in FIGURE 4. The entire assembly is held rigid and in place by means of through screws **60** and **61**. These screws are prefer-

ably about 1½" long and are spaced vertically at approximately 8" on center to secure splines, posts and battens. The heads are preferably staggered vertically 16" on center on opposite sides.

The present invention is primarily concerned with a 1-hour structurally rigid rated fire wall assembly having a vertical joint. The panel itself consists of an incombustible core which is of great flexibility and ruggedness. The Weldrok core, in essence, comprises an incombustible calcium silicate composition with asbestos reinforcing fibers as mentioned before. The hardwood veneers, preferably, could comprise a 1/28" thick veneer on a 1/16" basswood or some other species substrate.

The panels of the present invention consist essentially of a non-combustible core material faced on both sides with wood veneers. The vertical joints formed by adjacent panels or units are protected by means of mineral composition splines, asbestos cement board posts, and aluminum battens and noncombustible trim. The buildings units or panels are supported along the edges by means of levelling bolts, wood runners, and asbestos cement board trim.

The panel or partition of the present invention meets fire resistance classification for a wall assembly and can be erected and constructed of materials conforming in quality and physical properties to those described, and will pass all fire tests in accordance with the standards for fire tests of building constructions and materials, UL 263 (ASTM 119 and NFPA 251). The panel which comprises a movable wall combines the extreme provisions of a fire-rated wall with the flexibility inherent in a movable partition and yet maintains the aesthetic design features of a pleasing post in combination with painted or natural hardwood faced panels.

In order to further illustrate the invention the following specific example and facts are given.

The panel or wall assembly of the present invention was tested at the Underwriters' Laboratories in Chicago in a furnace having a 10' x 10' opening. Although ASTM test **119** requires one hour exposure to 1700° F., this wall proved itself for one hour and ten minutes by withstanding heat rise on an unexposed surface of 250° F., above its ambient temperature. After the fire endurance test the wall assembly was subjected to the hose stream test for a maximum of one minute at 30 lbs./sq. in. water pressure at the base of the nozzle.

Example

The wall was constructed in which the respective materials used were as follows:

Building Units—The wood faced building units measured 2¼" thick by 9'7½" long and were supplied in 4' and 1'7" widths. Grooves measuring 9/16" wide by 31/32" deep were cut in the vertical edges of the units to allow for the insertion of mineral composition splines.

The wood runners, used to support the top and bottom edges of the building units, consisted of two pieces of ¾" by 2¼" soft maple, chemically treated to reduce the flame spread and glued together to form 1½" high by 2¼" wide runners. The runners were supplied in 8'1⅜" lengths. Steel levelling bolts, were used to align and support the units, measured 5/16" diameter by 6" long and were supplied with two 5/16" nuts and ⅛" thick steel washers. The splines, inserted in the grooves provided in the vertical edges of the units, were fabricated from ½" thick mineral composition units, listed by Underwriters' Laboratories, Inc., Guide No. 40 U8.13, weighing 36 lb./cubic foot, supplied in 10' lengths and cut into 2⅜" widths. The posts, placed on both sides of the assembly over the splines, were fabricated from ⅜" thick asbestos cement board, weighing 120 lb./cubic foot, and supplied in 8'1" lengths and 2¾" widths.

The battens, placed over the posts, were fabricated from extruded aluminum, 3/32" thick, and measured 2¾" wide by ½" deep. The batten covers were of the snap-on type, fabricated from approximately 1/16" thick extruded aluminum, and measured 1¾" wide by ⅜" deep. The edges or trim of the assembly were protected with ⅜" thick asbestos cement board, weighing 120 lb./cubic foot, supplied in 4½", 3" and 2" widths and 8'1" lengths. The 2" by 2" steel support angles, used to secure the vertical edges of the assembly to the test frame walls, were fabricated from No. 16 gauge steel. The Rockwool insulation, placed in the clearance openings between the edges of the units and the test frame walls and runners, weighted 3.5 lbs./cubic foot.

The wall assembly was erected in the test frame so as to fill the masonry opening in accordance with the methods of the test, of Underwriters' Laboratories, Inc.

The 2¼" wide by 1½" high wood runners were attached to the concrete lintel and sill of the test frame. Section measuring approximatly 8'1" and 2'1" were abutted together to form continuous support along the lintel and sill.

The first panel was placed in the test frame opening and two levelling bolts were inserted in the holes previously drilled. The unit was aligned in the test frame by means of the top nut and washer of the levelling bolt.

The ½" thick spline was cut to the length of the building unit or panel and inserted in the groove provided in the unit. A second building unit was placed in the test frame in a similar manner as the first unit. There was approximately 2 25/32" clearance allowed between adjacent edges of the units, with the meeting edges of the splines butted together. A third panel measuring 19" wide was placed in the test frame as previously described. After alignment of the units, there was about 1" clearance between the bottom edge of the units and the floor runner, ½" clearance between the top edge and the ceiling runner, and ⅜" clearance between the vertical edges and the test frame walls.

Holes were spaced vertically 8" on center and 16" on center on both sides of the assembly, with one splice located at each post, extending the length of the units. Through holes were then drilled in the splines. The aluminum battens were placed on both sides of the assembly over the posts and the nuts on the through screws tightened. The aluminum batten covers were then snapped on the battens.

The ⅜" thick asbestos cement board trim pieces, measuring 4½" wide at the sill and 2½" wide at the lintel were attached to the top and bottom runners. The ⅜" thick by 2" wide trim at the sides was secured by placing the 2" by 2" angles over the trim and attaching the angles to the units with 1¼" wood screws and spaced vertically 18" on center, and secured to the brick walls of the test frame.

The clearance openings between the edges of the units and the test frame walls and runners were filled with Rockwool insulation to 3.5 lb./cubic foot density. The asbestos cement board trim and angles were attached to the opposite side of the assembly as previously described.

The partition was then tested in accordance with the "Standard for Fire Tests of Building Construction and Material UL 263 (ASTM E 119, NFPA 251)." In essence this test is as follows:

The furnace fire is started exposing one side of the wall assembly to gas flames of controlled severity and extent in accordance with the Standard Time-Temperature Curve. After the fire is extinguished, the partition is immediately withdrawn from the furnace and subjected to the impact, cooling, and eroding action of a 30 p.s.i. water stream applied with a 1⅛" nozzle at a distance of 20' for 60 seconds.

When the test was made as described the fire was luminous and well distributed throughout the test. The furnace temperature was controlled in accordance with the Standard.

The results on the panel being tested were that the wood facing began flaming shortly after the furnace fire was ignited. At the 3 minute duration of exposure, flaming of the exposed surface ceased and, at 5 minutes, small pieces of charred wood fell into the furnace chamber. As the test progressed, pieces of charred wood continued to fall and by 28 minutes, the core material was completely exposed to view.

At 16 minutes of exposure, both aluminum batten covers had pulled toward the fire at the top of the wall. At about 20 minutes the batten covers began to melt along the bottom half of the assembly and by 29 minutes they had completely melted. Also, at 29 minutes, the aluminum battens had melted at the bottom of the assembly and by 42 minutes they had completely melted.

At 23 minutes, of exposure, light flaming of the bottom and top wood runners was visible. As the test continued, light flaming of the top and bottom runners was visible intermittently throughout the test. At about 30 minutes, cracks began to develop in the vertical edge rails of the building units and pieces of the rail material began to pull toward the fire. By 51 minutes pieces of the rail material had fallen into the furnace chamber. At 60 minutes of exposure, there were no openings in the assembly and the core material remained in place. The furnace fire was extinguished at 70 minutes, and the partition immediately removed from the furnace and subjected to the hose stream test.

As to unexposed surfaces at five minutes of exposure, smoke was visible at the top edge of the assembly along the test frame lintel. By 8 minutes, all signs of smoking ceased. There were no changes in the appearance of the unexposed surface during the remainder of the test.

As to the temperature developed, the limiting end point temperatures are reached when heat transmission through the assembly is sufficient to raise the average temperature 250° F. above the ambient temperature, or when the temperature of any individual point rises 30 percent in excess of the allowable 250° F. rise. In this test, the initial temperature was 73° F.; therefore, the average limiting temperature was 323° F. and the individual limiting temperature was 398° F. Analysis of the unexposed surface temperature showed that at 60 minutes of exposure, the average and maximum temperatures were 273° and 315° F.

As mentioned before, after the furnace fire was extinguished at 70 minutes, the partition of this invention was removed from the furnace and subjected to the impact, eroding and cooling effects of a hose stream. The purpose was to determine if the assembly was capable of withstanding the hose stream after the 70 minutes fire endurance test rather than continuing the fire exposure until end point temperatures were reached and then exposing a second sample to a 30 minute fire and hose stream test as permitted by the Standard.

The hose stream washed away loose pieces of the edge rail material of the building units at the vertical seams and pieces of asbestos cement board trim along the top and bottom edges of the assembly, but did not penetrate the assembly.

After being exposed to these tests the assembly of the present invention stood up remarkably well. On the exposed side, the top and bottom wood runners and rails of the building units were charred to various depths, the maximum metal angles located along the sides of the assembly were warped, but remained in position. The asbestos cement board posts protecting the joints were cracked in various locations, but remained held in place by means of the through bolts. The core material remained intact. There were no visible changes in the appearance of the unexposed surface.

Thus, in fact no passage of flame, smoke, or hot gases through the partition assembly occurred during the fire exposure. The transmission of heat through the assembly did not raise the average temperature of the unexposed surface over the allowable 250° F. limit, or 325° F. for any single temperature reading during the 1 hour classification period. The assembly withstood the hose stream test after 70 minutes of fire exposure without penetration of the assembly by the water stream.

I claim:

1. Movable fireproof partition which comprises in combination, (1) a plurality of incombustible core elements extending substantially from the floor to the ceiling of a room, said core elements characterized by having vertical recesses in their longitudinal edges, (2) incombustible splines seated in said recesses, said splines characterized by extending beyond the planes of said edges and abutting one against the other, (3) incombustible posts positioned along the entire extending face surfaces of said splines and (4) affixing means extending through said posts and said splines, whereby said core elements, said splines and said posts are rigidly affixed as a fireproof partition assembly.

2. Partition as defined by claim 1 wherein said core elements comprise a calcium silicate composition with asbestos reinforcing fibers, and wherein said posts comprise an asbestos cement composition.

3. Partition as defined by claim 1 where, (5) wood veneers are affixed to the face surfaces of said core elements and wherein (6) decorative metallic elements are positioned adjacent said posts between said panels, whereby a pleasing aesthetic fireproof structure results.

4. Partition as defined by claim 3 wherein, (7) levelling bolts are positioned along the lower sides of said core elements which are adapted to adjust the levels and heights of said core elements.

5. Partition as defined by claim 4 wherein, (8) floor runners are positioned along a supporting floor, where runners are adapted to support said levelling bolts.

6. Partition as defined by claim 5 wherein, (9) incombustible floor trim members abut against the supporting floor, against the sides of said floor runners and against the lower surfaces of said core elements.

7. Partition as defined by claim 6 wherein, (10) incombustible Rockwool is packed into the area bounded by the lower sides of said core elements, the upper surfaces of said floor runners and the inner surfaces of said floor trim panels.

8. A movable fireproof partition assembly which comprises in combination, (1) a plurality of incombustible core elements extending substantially from the floor to the ceiling of a room, said core elements characterized by having vertical recesses in their longitudinal edges, (2) incombustible splines seated in said recesses, said splines characterized by extending beyond the planes of said edges and abutting one against the other, (3) incombustible posts positioned along the entire extending face surfaces of said splines, (4) affixing means extending through said posts and said splines, (5) levelling bolts positioned along the bottom edges of said core elements which are adapted to adjust the levels and heights of said core elements (6) a wood ceiling runner rigidly affixed to a ceiling, (7) edge trim elements rigidly affixed to said ceiling runner and extending vertically downwardly in a manner to encase the upper edges of said panels and to provide a space between said upper edges and said ceiling runner, whereby when said levelling bolts are actuated, play is provided for movement in said space.

9. Assembly as defined by claim 8, wherein (8) a floor runner is rigidly affixed to a floor, and wherein (9) floor edge trim elements are rigidly affixed to said floor runner in a manner to encase the lower edges of said panels so as to provide a floor space between said floor runner and the lower edges of said panels, wherein said levelling bolts are positioned.

10. Assembly as defined by claim 9, wherein, (10) incombustible material is packed into said space and into said floor space.

11. Assembly as defined by claim 10, wherein (11) decorative metallic elements are positioned between the longitudinal sides of said panels abutting said posts in a manner to conceal said affixing means.

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