April 24, 1962 J. R. STITT ETAL 3,031,044

FIRE RETARDANT WALL CONSTRUCTION

Filed Nov. 4, 1957 4 Sheets-Sheet 1

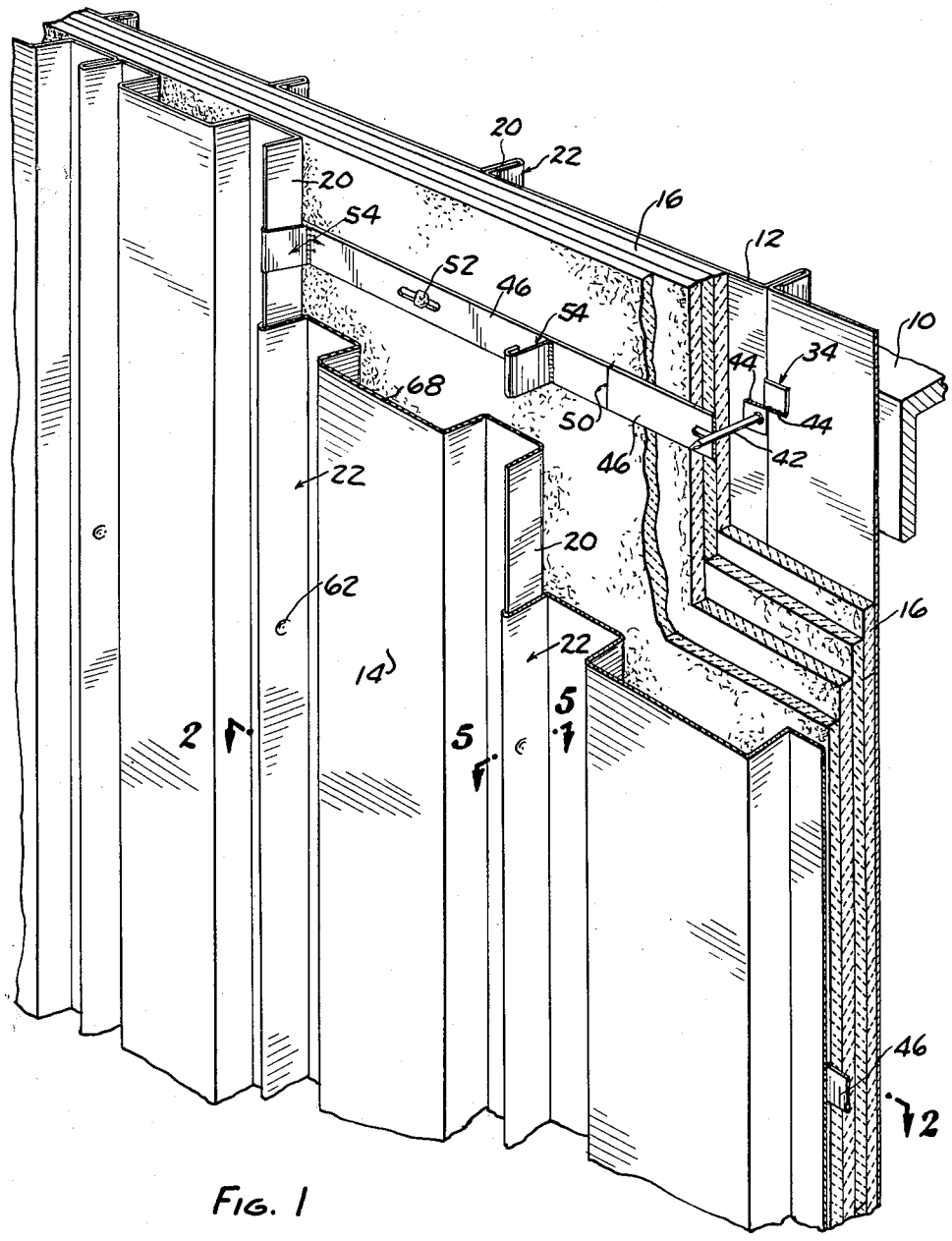


FIG. 1

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FIRE RETARDANT WALL CONSTRUCTION

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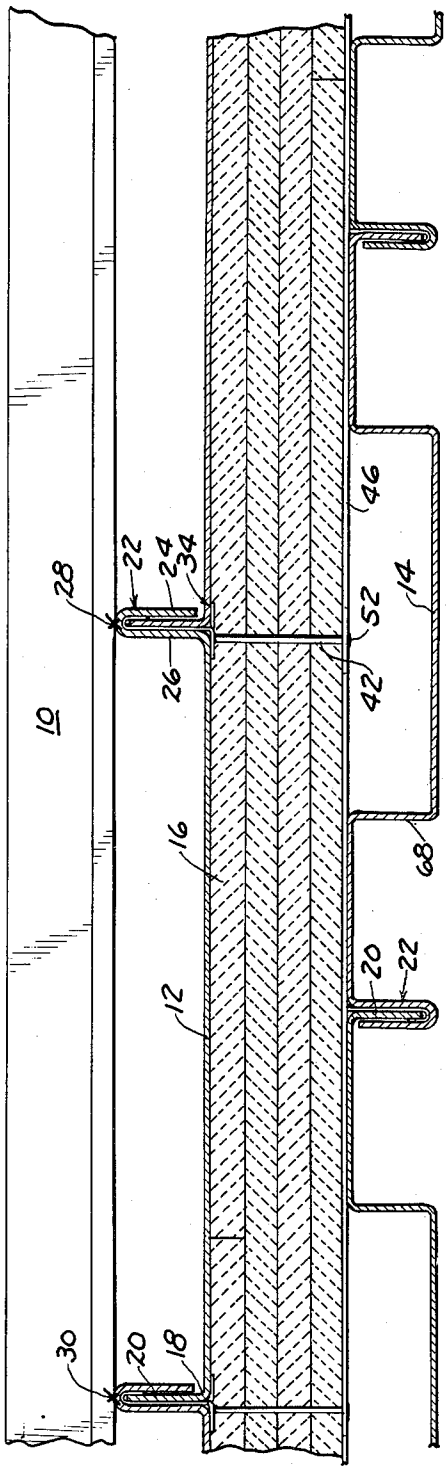


FIG. 2

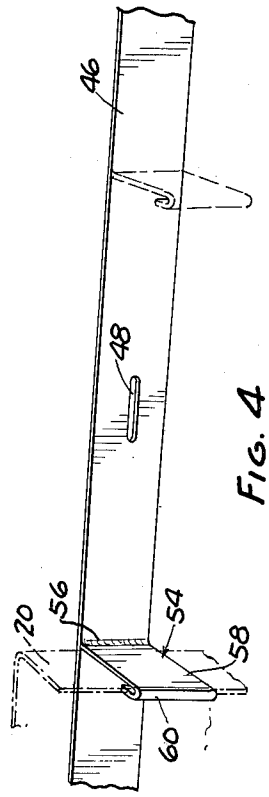


FIG. 4

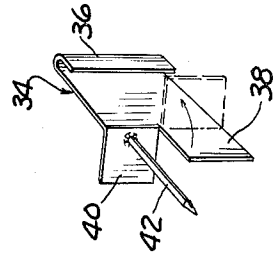


FIG. 3

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FIRE RETARDANT WALL CONSTRUCTION

Filed Nov. 4, 1957 4 Sheets-Sheet 3

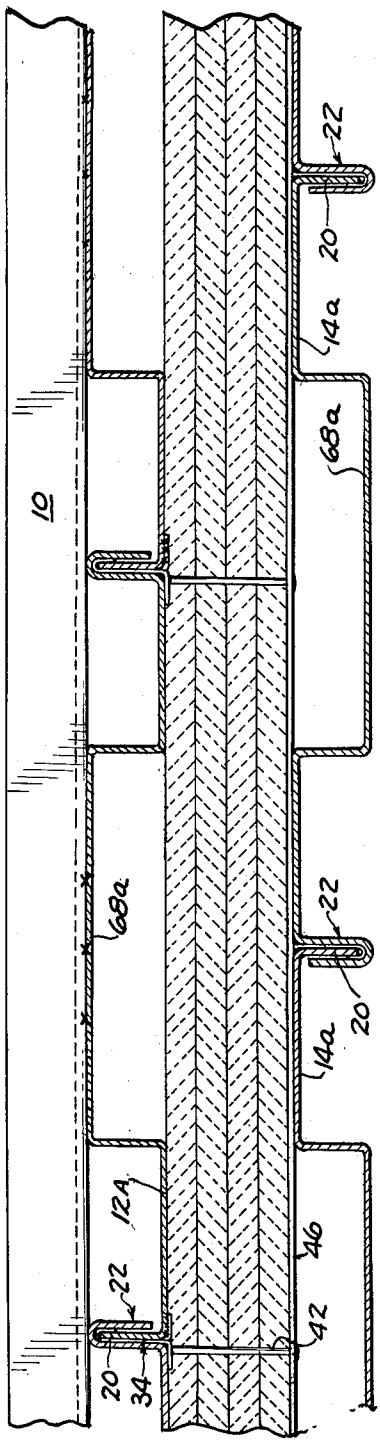


FIG. 6

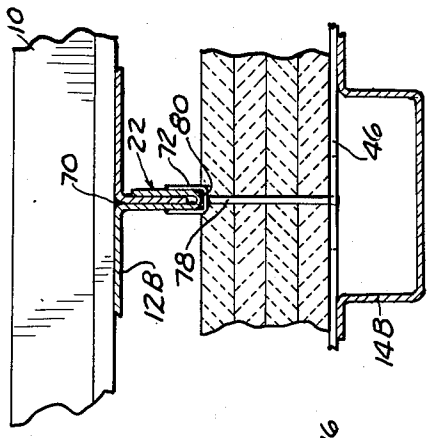


FIG. 7

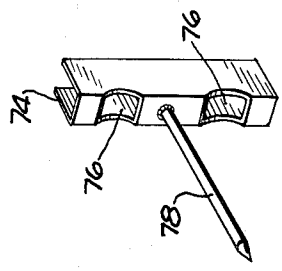


FIG. 8

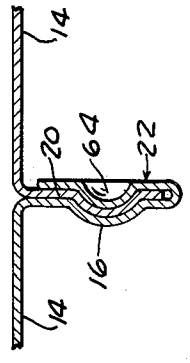


FIG. 5

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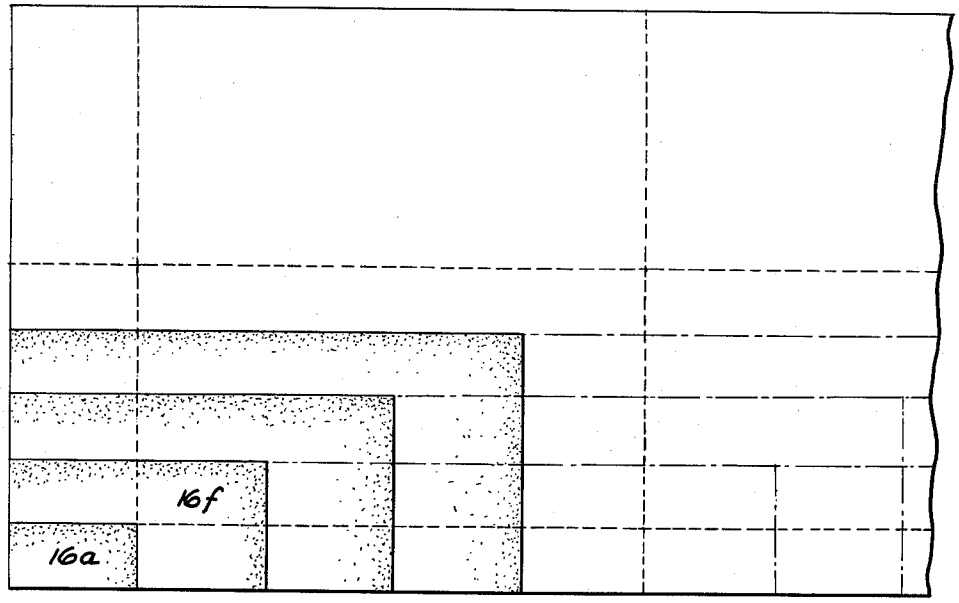


FIG. 9

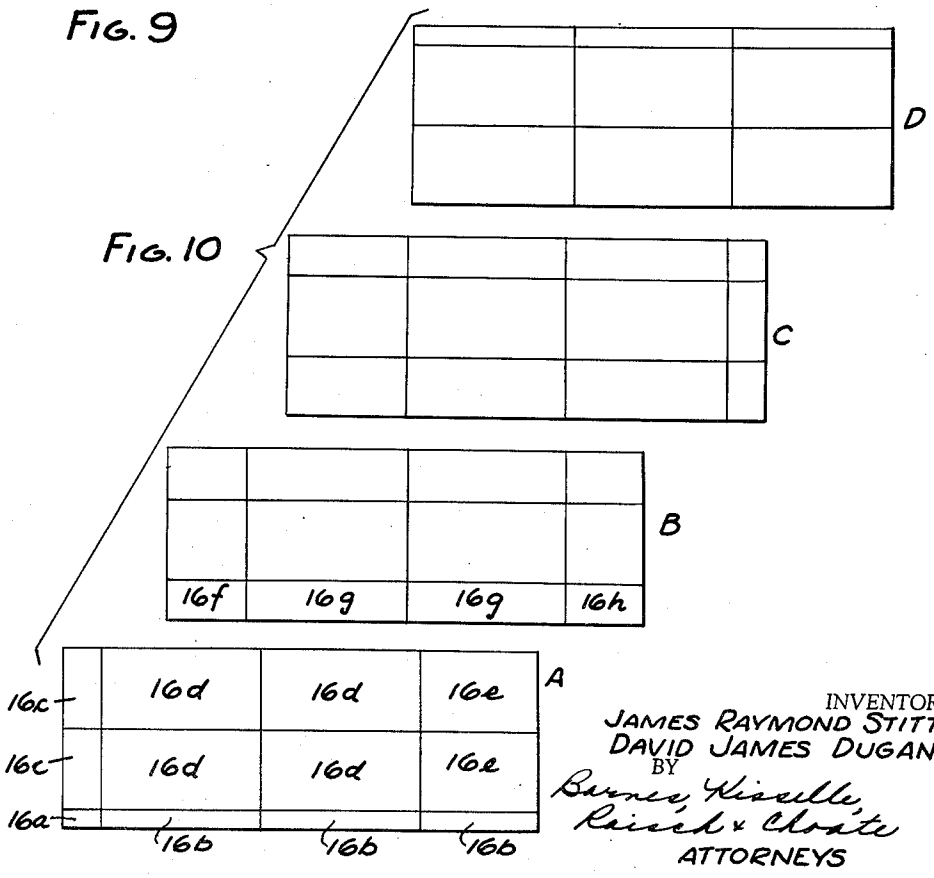


FIG. 10

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3,031,044

FIRE RETARDANT WALL CONSTRUCTION

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Filed Nov. 4, 1957, Ser. No. 694,319
13 Claims. (Cl. 189—34)

This invention relates to a wall construction and more particularly to a structural wall that has fire retardant properties.

A fire retardant wall as distinguished from a fire resistant wall is one that not only will not burn, but one which also has a minimum tendency to transfer heat. A fire retardant wall is one where the fire in the space on one side of the wall is not apt to heat up the other side of the wall so that any combustible material adjacent the other side of the wall has a minimum tendency to catch fire.

Heretofore, there have been suggested fire retardant walls in the form of spaced apart sheet metal panels with insulation material therebetween and fastening means extending from one panel through to the other panel for connecting the panels together. Such walls do not have very good fire retardant properties because the fastening means form excellent conductors for heat from the outside of one panel to the outside of the other panel. Thus, in fire tests where intense heat is applied to one side of the wall and cotton waste material is fastened to the other side of the wall, the fastening means that extend directly through both sets of sheet metal panels provide a direct path through the wall for the heat applied to one side of the wall and the cotton waste material invariably smokes or catches fire under conditions substantially below minimum standards that have been set up in the industry.

The primary object of the present invention is to produce a wall that has excellent fire retardant properties.

Another object of the invention is to produce a wall of the type described that has excellent structural qualities.

A further object of the invention is to provide a wall of the type described wherein all of the through fastening means are concealed from view.

A further object of the invention is to provide a wall of the tpe described wherein one set of fastening means is utilized for securing an intermediate member to the sheet metal panels on one side of the wall and another set of fastening means is utilized for securing the sheet metal panels on the other side of the wall to the intermediate member, the two sets of fastening members being staggered along the intermediate member so that heat transferred through the metal of the wall construction is restricted to follow a circuitous path in passing through the wall.

In the drawings:

FIG. 1 is a fragmentary perspective view with portions broken away showing one form of wall construction according to the present invention.

FIG. 2 is a sectional view taken along the line 2—2 in FIG. 1.

FIG. 3 is a perspective view of a clip member utilized in the wall construction of the present invention.

FIG. 4 is a fragmentary perspective view of several assembled components of the wall construction of the present invention.

FIG. 5 is a sectional view taken along the line 5—5 in FIG. 1.

FIG. 6 is a horizontal sectional view of a modified wall construction of the present invention.

FIG. 7 is a fragmentary horizontal sectional view of a

further modified form of wall construction according to the present invention.

FIG. 8 is a perspective view of the form of clip shown in the construction illustrated in FIG. 7.

FIGS. 9 and 10 are diagrammatic views showing the manner in which the insulating panels are arranged in overlying relation with the joints between the panels staggered.

In the form of construction shown in FIGS. 1 through 5, numeral 10 indicates a conventional structural steel girt of the framework of a building structure against which the wall of the present invention is adapted to be supported. The wall of the present invention generally comprises two sets of spaced apart panels 12 and 14 between which are arranged panels of a highly fire retardant material 16.

Referring now to FIG. 2, the panels 12 which, in the arrangement shown, provide the inner surface of the wall extend vertically of the wall and are interconnected as illustrated to provide a continuous inner wall surface. Along one vertical edge, each panel 12 is bent as at 18 to form a flange 20 which extends perpendicularly to the plane of the panel. Along its other vertical edge, each panel 12 is bent to form a U-shaped clip member 22 having spaced apart legs 24, 26 and a bight portion 28. The panels 12 are applied to the girts 10 side by side successively. The U-shaped clip portion 22 of one panel is positioned against and welded to each girt 10 as at 30. Thereafter, a plurality of clips 34 illustrated in FIG. 3 are arranged over the flange 20 of the next adjacent panel. Clips 34 are fashioned with a hook portion 36 having an extension 38 and a bent-over tab portion 40. Clips 34 include stainless steel pins 42 welded to the bent-over tab portions 40. Clip members 34 are arranged on flange 20 by engaging the hook portion 36 over the free edge of flange 20. Thereafter, the flange 20 with the clips 34 arranged thereon is inserted into the clip portions 22 of the panel previously welded to the girts 10. After the flange 20 is fully inserted in the clip member 22, the extensions 38 are bent over the panel 12 and the clips 34 are thus effectively locked in place with the tabs 40 engaging the inner face of one panel and the bent-over tabs 38 engaging the inner face of the next adjacent panel 12. In order to positively locate the clip members 34 in position, they may be welded to the adjacent panels along the edges of tabs 40 and 38 as shown at 44 in FIG. 1. The entire outer surface of the wall is built up in this manner with the panels 12.

The next step in erecting a wall of the present invention consists in arranging the panels 16 on the erected panels 12. Panels 16 are preferably of the standard gypsum board type. The standard size for these panels are four-by-eight feet or four-by-ten feet and the standard thickness is one-half inch. In the wall construction illustrated, four layers of such panels are arranged against the sheet metal panels 12. These panels are arranged against the sheet metal panels 12 by impaling them over the pins 42 of the clip members 34. In order to reduce the amount of heat that is transmitted through this wall, it is preferred to arrange the panels 16 in a pattern such that the joints between the panels in one layer are staggered with reference to the joints between the panels in the next adjacent layer. This may be accomplished in the manner shown, for example, in FIGS. 9 and 10.

In FIG. 10, the successive layers of panels 16 are designated A, B, C and D. Assuming that the panels illustrated in these drawings are standard four-by-eight foot panels, the size of the wall illustrated is nine feet in height and twenty-four feet in length. In arranging the first layer of panels 16 against the sheet metal panels 12, we may start at the lower left corner of the wall as illustrated in FIG. 10A. The lower corner panel designated 16a

may be dimensioned one foot in height and two feet in length. A horizontal row of panels **16***b* are arranged end-to-end in line with panel **16***a*. Panels **16***b* are of the standard eight foot length and are one foot in height. Panels **16***c* are arranged vertically above panels **16***a*. Panels **16***c* are standard four foot width panels, two feet long. Thereafter, the panels **16***d* and **16***e* are arranged to cover the remainder of the wall. Panels **16***d* are standard four-by-eight panels whereas panels **16***e* are four feet in width and only six feet in length.

In the next layer B of the panels, the lowermost row of panels are two feet in height, the corner panels **16***f* being four feet in length. The panels **16***g* are eight feet in length whereas the end panels **16***h* of the lowermost row of the second layer are only four feet in length. This pattern is continued in the successive layers as illustrated so that in the final wall, none of the joints in one layer of panels overlies any of the joints in the next successive layer of panels. This is illustrated in FIG. 9.

After all of the panels **16** are impaled on the pins **42** in this manner, they are secured in place by horizontally extending steel bars **46**. Bars **46** are provided with elongated apertures **48** therein which are adapted to register with pins **42**. Pins **42** are dimensioned in length so as to extend through the four layers of panels **16** and through the apertures **48** of bars **46**. Bars **46** are applied successively in horizontal rows to the rows of pins **42** projecting through panels **16**. At their abutting ends, the bars **46** may be welded together as shown at **50** in FIG. 1. The bars **46** are then secured to the pins **42** by simply welding the ends of the pins in the apertures **48** as illustrated at **52** in FIG. 1. This secures the panels **16** in position and at the same time mounts the bars **46** rigidly on the wall being erected.

The wall is now ready for the erection of the panels **14** which form the outer surface thereof. The panels **14** extend vertically of the wall and are arranged in place successively in a manner somewhat similar to the panels **12**. The first panel **14** is arranged on the bars **46** with the flange **20** being free and extending in a direction away from the bars **46**. These panels are anchored to the bars **46** by means of clips **54** that are welded to the bars **46** as at **56**. Each clip **54** is provided with a leg **58** terminating in a hooked end **60**. The hooked end **60** is engaged over flange **20** of the panel on the wall and the leg **58** is then welded to the bar **46** as at **56** to securely mount the panel in place. The use of clips **54** is preferred, but not absolutely necessary. The flange's **20** may be tack welded directly to bars **46**.

Thereafter, the clip portion **22** of the next adjacent panel **14** is engaged over the welded clips **54** to locate the panel in place. After a pair of successive panels **14** are arranged in this manner, the overlying clip portions **22** and the flanges **20** of the adjacent panels are button punched together as indicated at **62** in FIG. 1. Button punching in this manner is conventional and the joint produced thereby is illustrated in FIG. 5. The button punching is performed so as to produce an indentation **64** and a protuberance **66** on opposite sides of clip portion **22**. In this manner, the clip portions **22** and the flange portions **20** are interlocked.

In the arrangements shown in FIGS. 1 through 5, it will be observed that the sheet metal panels **12** forming the inner or girt supported surface of the wall are substantially flat except for the clip members **22** and flanges **20** at the opposite edges thereof. Sheet metal panels **14**, on the other hand, are provided with flutes **68** intermediate their opposite edges. If desired, both the inner panels **12** and the outer panels **14** may be similarly constructed as is shown in FIG. 6. In the arrangement shown in FIG. 6, the inner panels **12A** and the outer panels **14A** are of identical construction, each being provided with flutes **68***a* projecting outwardly from the plane of the panel in the same direction as the clip portions **22** and flanges **20**. In the arrangement shown in FIGS. 1 through 5, it will be observed that the joints between the panels **14** on the inside of the wall are staggered with reference to the joints between the panels **12** on the outside of the wall. In FIG. 6, the panel joints and flutes **68***a* on one side of the wall are staggered with reference to the panel joints and channel flutes on the opposite side of the wall. The wall shown in FIG. 6 is erected in the same manner as the wall shown in FIGS. 1 through 5.

In FIG. 7, there is illustrated a further modified construction of a wall in accordance with the present invention. In this arrangement, the inner sheet metal panels **12B** may take the form of either panels **12** or **12A**. However, the panels **12B** are reversely positioned relative to the steel frame work in relation to the panels **12** and **12A**. Panels **12B** are arranged on the steel frame work with their flat sides against the girts **10** and with their flanges **20** and clip portions **22** projecting away from the girts **10**. Panels **12B** are preferably tack welded to the girts **10** as at **70**.

In this arranement, the clips **72** are employed for attachment to bars **46**. One of the clips **72** is illustrated in FIG. 8. Each clip comprises a U-shaped member **74** formed with openings **76** in the bight portion thereof. A stainless steel pin **78** is welded to the bight portion of clip **72** intermediate the openings **76**. The legs of clips **72** are spaced apart to correspond with the width of the U-shaped clip portion **22** along one edge of the panels **12***b*. After the panels **12***b* are arranged on the frame work **10** as illustrated, the clips **72** are arranged in horizontal rows over the joints of the previously erected panels **12***b*. They are tack welded in place through openings **76** as shown at **80**. Thereafter, the insulating panels **16** are impaled over the pins **78** in the same manner as described above with reference to FIGS. 1 through 5 and 9 and 10. The bars **46** are then secured to the ends of pins **78** by welding and the outer panels **14***b* are then secured in place as by the clips **54** and the button punching operation, all as previously described with reference to FIGS. 1 through 5.

The wall construction described herein has excellent properties with reference to fire retardation because the components thereof are arranged so that heat on one side of the wall must travel a circuitous route to penetrate through the other side of the wall. For example, in the form illustrated in FIG. 1, assuming that the side of the wall defined by the panels **12** was subjected to an intense heat, in order for the heat to penetrate through to the panels **14**, its path is restricted to the clip portion **22**, the flanges **20**, clips **34**, pins **42** through the panels **16**, to the bars **46** and then along the bars to the joints at **20**, **22** of panels **14**. This circuitous path in combination with the fire retardant effect of the panels **16** with their staggered joints reduces the travel of heat through the wall to a minimum. Pins **42** are formed of stainless steel to further retard heat conduction. In addition, the heat transfer is further retarded by the fact that by impaling the gypsum panels on the pins **42**, the pins are tightly embraced by the gypsum. Thus, heat conducted by the pins is to a large extent absorbed by the gypsum and utilized for vaporizing the water contained therein. It will be appreciated that until the H_2O content of each successive panel **16** is evaporated, the temperature of each panel will remain at or below about 212° F.

Under actual testing, walls constructed in accordance with this invention have given very excellent results. The standard test usually used for determining the fire retardant properties of a wall is usually conducted in accordance with A.S.T.M. Standard, E119–55. In this test, one side of a wall is heated to predetermined high temperatures within a given period of time and thermocouples are applied to the opposite side of the wall in a predetermined pattern. A material such as cotton waste is also applied to the opposie side of the wall. The fire retardant properties of the wall are indicated by the time the wall will withstand the heat applied to one side be-

fore the thermocouples show a predetermined maximum increase in tempeatue or before the cotton waste on the other side begins to char or burn. Under this standard test, walls of the present invention have withstood a two hour exposure successfully. When one considers the economy of this wall construction from the standpoint of both time and material, it will be appreciated that the fire retarding properties as evidenced by the successful exposure for two hours under the test conditions prescribed by the above referred to A.S.T.M. Standard are excellent. These excellent fire retardant properties are undoubtedly attributed in part to the minimum amount of metal actually interconnecting the metal panels on the opposite sides of the wall. In actual construction, it has been found that the wall meets structural requirements using one 5/32" diameter pin 42 per four square feet of wall surface. This amounts to only one-half square inch of metal connecting the inner and outer panels in a hundred square foot area. This is possible because pins 42 are made of stainless steel and will not corrode with age as would be true of other steel.

We claim:

1. A fire retardant wall for a building structure of the type adapted to resist a temperature of over 1000° F. for several hours on one side thereof without reaching a temperature on the opposite side thereof sufficient to initiate combustion, the frame work of which wall includes a plurality of vertically spaced, horizontally extending girts, comprising a plurality of sheet metal panels forming one side of the wall and a second plurality of sheet metal panels forming the opposite side of the wall, said panels having a rib along one vertical side edge thereof disposed generally perpendicular to the plane of the panel and a U-shaped flange along the opposite vertical side edge engaged over the rib along the vertical edge of the next adjacent panel to interlock the panels together in a direction parallel to the plane of the panels and perpendicular to the ribs, means forming rigid connections between the sheet metal panels forming one side of the wall and the girts, the last mentioned panels having a plurality of horizontal rows of spaced pins on the inner side thereof and projecting perpendicularly to the plane of the panels, each pin being integrally mounted on a support base for the pin, each of said pin bases being welded to a pair of adjacent panels at the interlocked, vertically extending edges thereof, a plurality of layers of rigid insulation board impaled on said pins, the edges of adjacent insulation boards being in abutting relation, a plurality of horizontally extending metal bars overlying the outer face of the topmost layer of insulation board and aligned with the pins in each row, said pins extending through said bars and being welded thereto such that the ends of the pins are substantially flush with the outer face of the bars, the sheet metal panels forming the opposite side of the wall being positioned against said bars with the U-shaped flanges opening toward the bars and means welded to said bars connecting the last mentioned panels to said bars.

2. A fire retardant wall as called for in claim 1 wherein said pin bases include J-shaped straps extending into the U-shaped flanges and hooked over the free edges of said ribs of the panels on the first mentioned side of the wall.

3. A fire retardant wall as called for in claim 1 wherein said last mentioned means comprises a plurality of J-shaped straps extending into the U-shaped flanges of the last mentioned panels and hooked over the free edges of said ribs.

4. A fire retardant wall as called for in claim 1 wherein said last mentioned means are staggered along said bars relative to said pins.

5. A fire retardant wall as called for in claim 1 wherein said pins are formed of stainless steel.

6. A fire retardant wall as called for in claim 1 wherein each of said panels includes alternately arranged channel portions and flat portions, the channel portions on one side of the wall being staggered with reference to the channel portions on the other side of the wall.

7. A fire retardant wall of the type adapted to withstand temperatures in excess of 1000° F. for several hours on one side thereof without reaching a combustible temperature on the other side of the wall, said wall being of the type which includes a plurality of supporting girts, comprising a plurality of sheet metal panels forming one side of the wall, a plurality of sheet metal panels forming the opposite side of the wall, said panels having an upstanding rib along one longitudinal edge thereof and a U-shaped flange along the opposite longitudinal edge for engaging over the upstanding flange of the adjacent panel to interlock adjacent panels together, means forming rigid connections between the girts and the panels forming one side of the wall, said last mentioned panels having on the inner side thereof a plurality of rows of spaced pins projecting inwardly generally perpendicular to the plane of the panels, each pin being integrally connected to a supporting base for the pin, each of the pin bases being welded to a pair of adjacent panels at the interlocked edges thereof, a plurality of layers of fire retardant wall boards impaled on said pins, the adjoining edges of the wall boards being in abutting relation, a plurality of metal bars overlying the outer faces of the topmost layer of the wall boards and aligned with said rows of pins, said pins being welded at their outer ends to said bars and presenting a substantially flush surface on the outer faces of the bars so as to enable the panels of the other side of the wall to be seated solidly thereagainst and means welded to said bars and securing the last mentioned panels to the outer faces of the bars.

8. A fire retardant wall as called for in claim 7 wherein said bars extend in a direction generally perpendicular to the direction of the joints of the last mentioned panels.

9. A fire retardant wall as called for in claim 7 wherein the first mentioned panels extend in a direction perpendicular to the girts and said panels are welded to the girts.

10. A fire retardant wall as called for in claim 7 wherein the last mentioned panels are mounted on said bars with the upstanding ribs and U-shaped flanges projecting in a direction away from the bars.

11. A fire retardant wall as called for in claim 10 wherein the last mentioned panels are provided with flat portions between said ribs and flanges which are generally in coplanar engagement with the outer faces of the bars.

12. A fire retardant wall as called for in claim 7 wherein said fire retardant wall boards comprise gypsum boards.

13. A fire retardant wall as called for in claim 1 wherein the first mentioned panels are mounted on the girts with the upstanding ribs and U-shaped flanges projecting inwardly of the wall and said pin bases include U-shaped straps seated over the edges of the U-shaped flanges and welds on said U-shaped straps extending through the U-shaped flanges to the upstanding ribs therein of the first mentioned panels for interconnecting said ribs, flanges and straps.

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