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Tillisch et al.

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[54] **STUD FOR FIRE RATED GYPSUM BOARD WALL**

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[52] **U.S. Cl.** **52/738,** 52/481, 52/495

[51] **Int. Cl.** **E04c 3/07**

[58] **Field of Search** 52/479, 481, 483, 495, 52/732, 738, 720, 737, 354, 355, 281, 282

[56] **References Cited**

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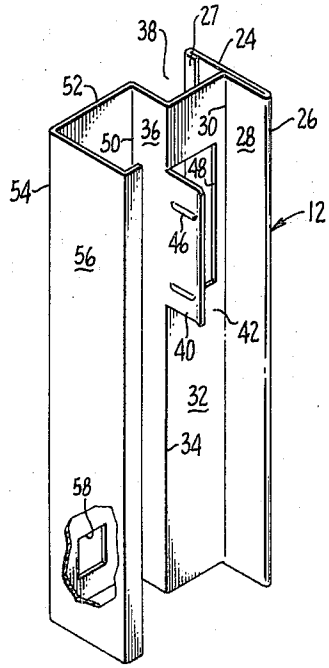
[57] **ABSTRACT**

A fire rated gypsum board wall and a sheet metal stud forming a part of the wall. The stud has a continuous flange that lies on the exterior surface of one side of the wall. The flange totally covers and seals the joint between abutting gypsum panels so as to elimiate further fastening and/or taping of such joint. The stud is provided with strategically located excisions that reduce the cross-sectional area of the heat flow path through the stud and afford visual inspection openings which are useful during erection of the wall to achieve alignment of the studs and the wall boards.

6 Claims, 4 Drawing Figures



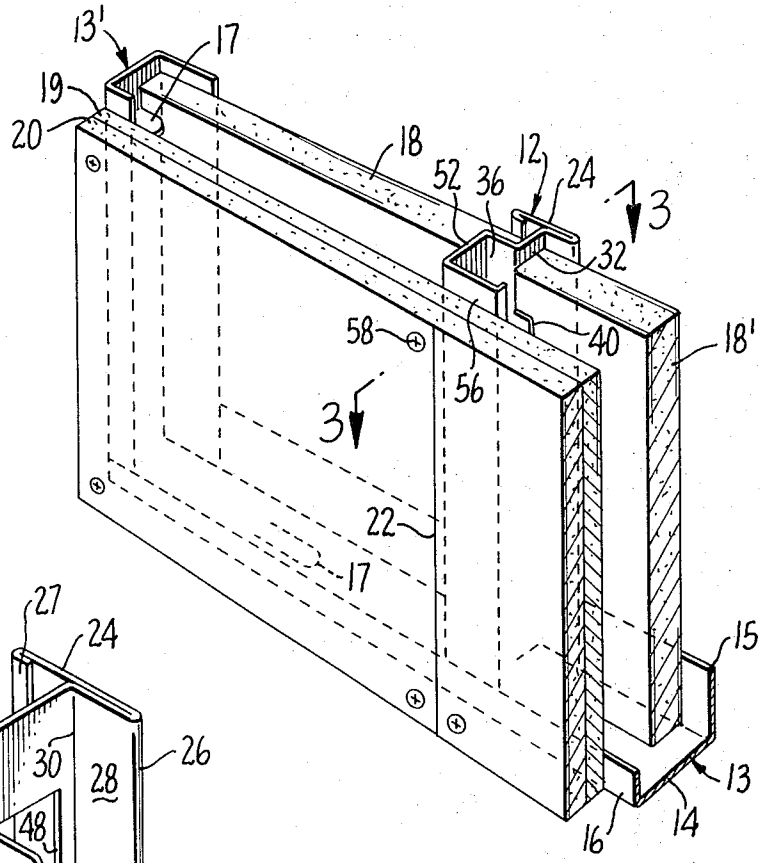


FIG. 1.

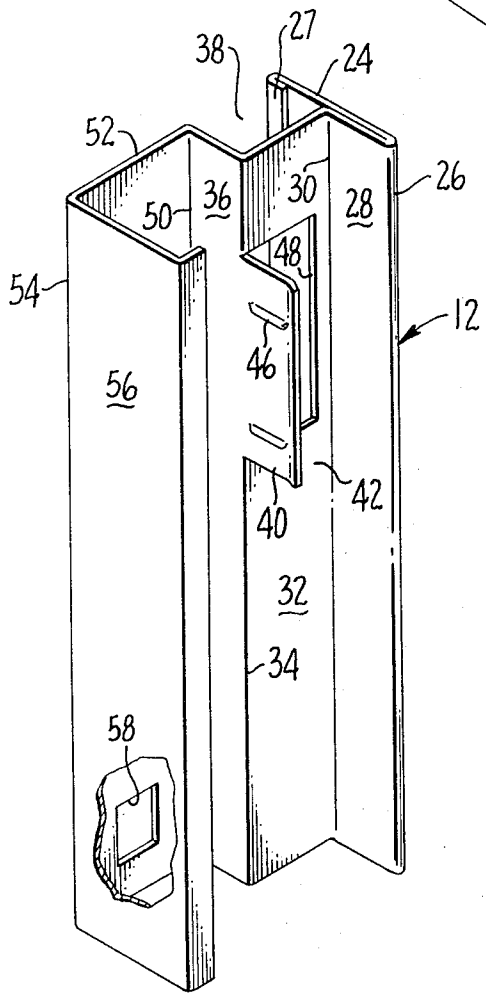


FIG. 2.

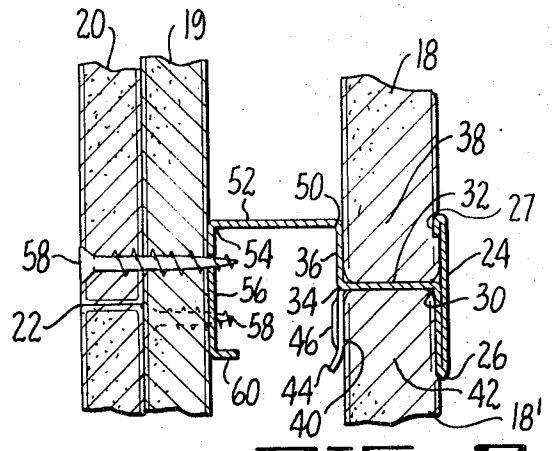
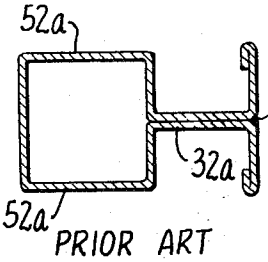


FIG. 3.



PRIOR ART

FIG. 4.

STUD FOR FIRE RATED GYPSUM BOARD WALL

This invention relates to a fire rated gypsum board wall and particularly to a framing system and improved stud for such wall.

A preferred embodiment of the present invention qualifies for a 2-hour rating, as prescribed under ASTM design specification **E119-69,** and can be utilized where building codes require such rating. For example, in buildings having an elevator shaft, it is typical that the wall enclosing or defining the shaft be of a 2-hour rating.

Accordingly, it is an object of the present invention to provide an improved fire rated wall constructed with gypsum boards or panels. Achievement of this object is possible according to the present invention by provision of an improved sheet metal stud which is so configured as to minimize the amount of metal used and therefore minimize the area of the path available for heat conduction through a wall employing such stud.

A feature and advantage of reducing the amount of metal required to construct the stud is that the cost of the stud is reduced as well as the weight of the stud and consequent exertion required by workmen constructing such wall.

Another object of the present invention is to provide a wall having the advantageous characteristics referred to above which can be constructed from only one side of the wall. Achievement of this object is extremely important in enclosing elevator shafts since it eliminates the need for scaffolding within the elevator shaft and materially enhances the safety with which the workmen installing the wall can work. According to the present invention, the joints on one side of the wall (the elevator shaft side of the wall), are spanned by a continuous metallic flange which seals any possible air flow paths without necessitating access to such side for installation of fasteners and/or taping compound.

A factor contributing to achievement of the aforestated object is that portions of a stud employed in the present invention are excised to define inspection openings through which a workman can determine whether the relative position between the edge of a gypsum board and a stud is correct. Additionally, the material removed from the web of the stud to define the inspection openings reduces the area of the stud through which heat can be conducted.

The foregoing, together with other objects, features and advantages, will be more apparent after referring to the following specification and accompanying drawing in which:

FIG. **1** is a fragmentary perspective view of a wall constructed according to the present invention with portions being broken away to reveal internal details;

FIG. **2** is a fragmentary perspective view of a stud constructed according to the present invention;

FIG. **3** is a cross-sectional view of the wall taken along the plane designated by line **3—3** of FIG. **1**; and,

FIG. **4** is a cross-sectional view of a known prior art stud.

Referring more particularly to the drawing, reference numeral **12** generally indicates a stud according to the present invention which is supported at the upper and lower ends thereof by a J-shaped track **13,** the lower track, only, being shown in the drawing. Tracks **13** include a web **14** from the opposite edges of which extend respectively a relatively wide flange **15** and a relatively narrow flange **16.** The tracks are suitably anchored to the floor and ceiling surfaces in the building in which the wall according to the present invention is installed. Similar J-shaped tracks, one of which is indicated as **13'** in FIG. **1** are provided at opposite horizontal ends of a wall structure embodying the present invention. Spaced along web **14** of tracks **13** and **13'** are tabs **17** which can be bent out from the plane of the web during installation as described hereinafter. The edge of tab **17** closest to flange **15** is spaced from such flange by a distance approximating the thickness of the gypsum board that abuts flange **15.** J-shaped track **13** can be **25**-gauge (0.021 inch in thickness) galvanized sheet steel. One surface of the wall, for convenience hereinafter referred to as the elevator shaft side or simply shaft side of the wall, is defined by fire rated gypsum wall boards **18, 18'** which in one wall structure designed according to the invention are 1-inch gypsum boards having a width of 2 feet and a length suitable for the height of the wall. The opposite side of such exemplary wall, sometimes referred to hereinafter as the corridor side, is formed by two layers of **5/8** inch gypsum boards **19** and **20.** The outer or face boards **20** meet at a butt joint **22** which is aligned with stud **12**; such joint is finished in accordance with conventional taping techniques not shown in the drawing or further described hereinafter.

With specific reference to FIG. **2,** stud **12** includes a continuous flange **24** which is disposed on the shaft side of the wall and extends without interruption the full height of the wall so that the margins of boards **18, 18'** adjacent the joint therebetween are fully covered by the flange. The flange has a width such that it retains gypsum boards **18, 18'** in place even in the presence of slight misalignment and such that the surface of the flange makes face-to-face contact with the surface of the boards to substantially seal the joint against passage of air currents therethrough. In one stud designed according to the present invention, galvanized steel, such as **24**-gauge (0.027 inch in thickness) is employed and flange **24** has a width of 1-⅝ inch so that the flange overlaps the surface margin of gypsum boards **18, 18'** by about 13/16 inch. At one edge **26** of flange **24,** the material is bent to form a return bend portion **28** which extends along the reverse face of the flange. The opposite edge of the flange terminates in a rolled over portion or hem **27.** The return bend and rolled over portion stiffen the flange and define rounded edges which ease engagement of boards with the stud. Return bend portion **28** continues to a point medial of flange **24** at which there is a 90 degree bend line **30** from which extends a web section **32.** As can be seen most clearly in FIG. **3,** web section **32** is normal or perpendicular to flange **24.** Web section **32** extends to a bend line **34,** from which projects laterally a plate section **36.** As can be seen in FIG. **3,** web section **32** has a width equivalent to the thickness of gypsum board **18** so that there is defined, between the reverse side of flange **24** and plate section **36,** a groove or slot **38** into which the edge of the gypsum board is snugly received.

Struck from web section **32** at spaced apart intervals therealong are a plurality of tabs, one of which is indicated at **40** in FIG. **2.** Tab **40** is bent out from web segment **32** along bend line **34** so that is confronts the reverse side of flange **24** to define a discontinuous groove

42 which snugly receives the edge of wall board 18'. To facilitate insertion of wall board 18' into groove 42, the edge of tab 40 remote from bend line 34 is flared or curved away from groove 42, as at 44. Tab 40 is strengthened or reinforced by raising therefrom, by a suitable die or the like, one or more stiffeners 46 which stiffen the tab by defining a portion of material oblique of the plane of the tab. It will be noted that the bending out of tab 40 from web section 32 defines an opening 48 in the web section; opening 48 has several advantageous characteristics which will be described in more detail hereinbelow. Although tabs 40 can be struck from plate section 36, the construction shown in FIG. 2 is considered at present the best mode of carrying out the invention.

Plate section 36 terminates in a bend line 50 from which extends, parallel to web section 32, a web section 52. The extent of web section 52 depends on the desired thickness dimension of the hollow core of the wall, and particularly depends on the size of pipes and/or conduits, if any, to be installed in the core of the partition. Web section 52 extends to an edge 54 at which there is a flange 56 which affords an element for receiving screws 58, or the like, for effecting attachment of gypsum boards 19 and 20 to the stud.

At the edge of flange 56, opposite edge 54, there is a lip 60 which stiffens the flange. As can be seen in FIG. 3, lip 60 is of limited extent so that it is substantially spaced apart from web sections 32 and 36 and tabs 40. In one stud configuration designed according to the present invention, web section 52 is about 1-½ inches wide and lip 60 is ¼ inch wide, thereby providing a space of about 1-¼ inch from the lip to web section 32. This space is sufficient to avoid significant heat transfer therethrough. Where even greater fire resistance is required (e.g., more than a 2-hour rating), it is anticipated that a 1-inch gypsum board might be positioned in this space.

The operation and advantages of the present invention can be understood by considering installation of a wall employing the invention. J-shaped tracks 13 are installed at the vertical and horizontal boundaries of the wall, and are fastened to existing structure. The relatively long flange 15 of J-shaped track 13 is installed opposite from the side of the wall to which workmen have unrestricted access. In other words, when the wall is installed to define an elevator shaft, flange 15 is disposed on the shaft side. A gypsum board 18, which is typically 2 feet in width, is cut to a length less than the distance between the edges of confronting flanges 16 and more than the distance between the edges of confronting flanges 15. Typically, a length approximately 1 inch less than the vertical distance between confronting tracks 13 is appropriate. Gypsum board 18 is slid laterally against end track 13' and is there held in place, as shown in FIG. 1, by bending tabs 17 into place. The provision of the tabs 17 eliminates the need for screws to hold the boards against the flange 15. Next, a stud 12 is installed between the flanges of tracks 14 and is slid laterally until the edge of gypsum board 18 enters slot 38. Because of the presence of opening 48 adjacent tab 40, the workmen can see through the opening and visually inspect the position of the edge to ascertain that the stud is fully engaged with the edge of the board. Secure engagement of the stud with the board is important to assure that the board cannot be accidentally dislodged and to assure vertical alignment of the studs. Vertical alignment is particularly important because the flange 56 must align with the edges of the boards 20 for purposes of receiving the screws 58. The next gypsum board 18' is then placed between tracks 13 and slid laterally so that it enters the discontinuous groove 42 defined between respective tabs 40 and flange 24. Because groove 42 is discontinuous, i.e., because tabs 40 are of limited extent, the relative position between the surface of web section 32 and the edge of the board is visible at all times so that workmen can ascertain when the board is snugly in place against web section 32. Another stud is installed until the edge of the preceding gypsum board is fully engaged in slot 38 of the stud, and such procedure continues until the opposite end of the wall is reached, whereupon tabs 17 are bent into place to retain the final gypsum board in place.

The opposite wall surface is completed in a conventional manner, first by installing a plurality of gypsum boards 19, preferably oriented with their long dimension in a horizontal direction and fastened to flange 56 by means of screws 58, and then by installation of surface panels 20 followed by application of tape and compound to the joints 22 between adjacent panels 20.

Certain advantageous features can be perceived by reference to FIG. 3 if it is assumed that the shaft side of the wall, i.e., the side at which flange 24 is located, has reached an elevated temperature because of the presence of a fire in the shaft. The sole heat conducting path from the shaft side of the wall is through web 32, a single layer of sheet steel. The cross-sectional area of this path is reduced to the extent that openings 48 are provided in web section 32. The heat path continues through web section 52, which, because it is typically provided with a series of openings 58 for wiring and/or piping, further reduces the cross-sectional area of the heat path. The length of the path is such that a 2-hour rating is achieved whereby the occupants on the corridor side of the wall have adequate time to vacate the premises without injury. Another advantage afforded by openings 48 and 58 is that they act as thermal expansion joints or sections whereby the tendency for the stud to twist in response to differential heating thereof is materially reduced. Thus, the stud construction, according to the present invention, if it twists at all, does not twist sufficiently to permit gypsum boards 18, 18' to escape from grooves 38 and 42 or to permit the screws 58 in the boards 19 and 20 from pulling free.

The continuous flange 24 secures the boards on the shaft side against being displaced into the shaft should a worker fall against the inside of a board. Thus, the flange adds greatly to the safety of workers installing the wall system. The provision for visual inspection of the edges of boards received behind the flange 24 provides means whereby the workers may ascertain if the boards are fully seated behind the flange and, thus, also contributes to the safety of the workers.

In one stud designed according to the present invention, tabs 40 and openings 48 have a longitudinal extent of about 3 inches and are spaced on 12-inch centers throughout the length of the stud. Accordingly, the cross-sectional area of the heat path afforded by web section 32 is reduced by 25 percent, thereby minimizing the amount of heat conducted through the wall and minimizing the distortion of the studs due to differential heating thereacross. Moreover, the number and

spacing of tabs 40 in such exemplary configuration is sufficient to afford firm engagement of gypsum board 18' within groove 42. The utility holes 58 in the web section 52 further reduce the thermal conductivity of the stud.

A better appreciation of the advantages of the present invention can be had by comparing the same with the known prior art shown in FIG. 4. It will be noted that the stud, there disclosed, has a double web section 32*a* as well as double web sections 52*a*. Accordingly, the cross-sectional area of the heat conduction path afforded by the prior art device is more than twice that afforded by the present invention. Because web sections 52*a* are doubled and are spaced from one another. it is at best difficult and at worst impossible to provide openings through them for utility lines or for reducing the cross-sectional area of the heat conduction path through the wall of which the prior art stud is a part. Moreover, the resiliency in the sheet metal of which the stud is made has in some cases made the manufacturer spot weld the web sections together, as at W, so as to avoid separation of gypsum boards when exposed to fire. Finally, the disclosed prior art stud employs a considerably greater amount of sheet metal than is required in the stud of the present invention, thereby increasing the cost and the weight thereof.

Another example of the prior art is found in U.S. Pat. No. 3,217,460. This patent is in the field of non-fire rated walls and discloses a sheet metal stud wherein the channeled edge of the stud does not have a continuous flange totally covering and sealing the joint between adjacent gypsum panels. The resultant wall requires taping or grouting if the joint is to be sealed and offers little resistance to displacement by internal force applied to the panel received in the channel with the discontinuous flange.

Thus, it will be seen that the present invention provides a gypsum board wall that can be rapidly installed, and that affords a two-hour fire rating. Additionally, the wall is so arranged that it can be fabricated from only one side thereof thereby rendering the wall construction suitable for enclosing elevator shafts and the like.

Although one embodiment of the invention has been shown and described, it will be obvious that other adaptations and modifications can be made without departing from the true spirit and scope of the invention.

What is claimed is:

1. A stud for supporting a gypsum board, hollow core wall that is fire rated for flame exposure from at least one side thereof, the wall being of the type that has a plurality of coplanar first gypsum boards of a first thickness dimension on said one side and a plurality of coplanar second gypsum boards on the side opposite said one side, said stud enabling said wall to be assembled from the side opposite said one side without the need for anyone on said one side, and comprising in a unitary integral sheet metal structure: a continuous flange, adapted to cover the joint between abutting board edges on said one side of said wall so as to lie in substantial contact with the outer surface of the margin of the boards adjacent the abutting edges thereof, said flange being defined by an outer planar element extending from one edge of the flange to the other and an inner planar element folded upon and beneath the outer planar element from said other edge to a medial region of the flange; a first web section extending normal from the inner planar element at the medial region of said flange to a first bend line disposed at a distance from said flange corresponding to the thickness of the boards on said one side of the wall; a plate section extending from said first bend line in parallelism to said flange and beneath the outer planar element thereof on the side opposite that beneath which said inner planar element extends to define, in cooperation with the outer planar element, a substantially continuous groove for receiving and retaining the edge of one of said boards of said one side of the wall, said plate section being disposed to reside on the side of said boards opposite said one side; a plurality of spaced apart tabs struck from one of said sections so as to be coplanar with said plate section and extend from said first bend line in a direction opposite said plate section to define, in cooperation with the inner planar element of the flange, a discontinuous groove for receiving the edge of the other of said boards of said one side of the wall; a second bend line parallely spaced from said first bend line at the end of the plate section opposite the first bend line; a second web section extending from said second bend line perpendicular to the plate section, said second web section terminating at an edge disposed at a distance from said plate corresponding to the thickness of the hollow core; and a second flange extending from last said edge in parallelism with said continuous flange for affording attachment of the boards that define the second side of the wall, the combination of said second flange, said second web and said plate section defining a channel section spaced from said one side, said channel section reinforcing said stud against distortion in the presence of an elevated temperature on said one side.

2. A stud according to claim 1 wherein said first web section defines at least one opening therein for affording visual access to said substantially continuous groove from the side of said first section opposite said groove.

3. A stud according to claim 1 wherein said tabs are struck from said first web section thereby defining a plurality of spaced apart openings in said first web section to afford visual access to said substantially continuous groove from the side of said first section opposite said groove.

4. A stud according to claim 1 including a lip extending from a portion of said second flange remote from said edge, said lip extending generally normal to said second flange toward said first mentioned flange for reinforcing said second flange, said lip terminating in spaced apart relation to said first mentioned flange.

5. A stud according to claim 1 wherein said tabs include at the margin thereof remote from said second bend line a flared portion that is curved away from said flange for facilitating entry of the edge of a gypsum board into said discontinuous groove.

6. A stud according to claim 1 wherein said tabs each include at least one reinforcing rib extending generally normal to said first bend line, said rib being formed integrally of said tab and including a portion oblique of the plane of said tab.

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