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(54) **Shaft wall and horizontal metal stud therefor.**

(57) A hollow shaft wall (10,12) with horizontal studs (54) held between vertical corner posts (40), with acutely angled webs forming a channel with the stud inner flanges, and bevelled edge core boards (52) held by one edge in the angled channel and the other edge held by suitable means on an adjacent horizontal stud.

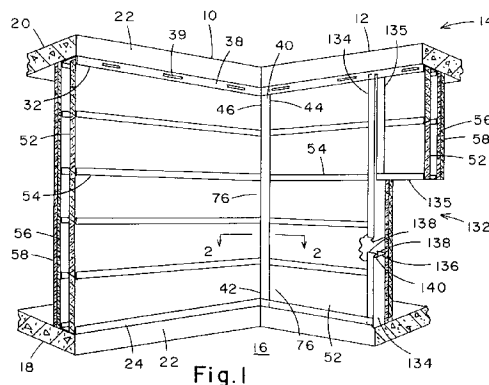


Fig. 1

This invention relates to sheet metal studs for supporting gypsum wallboard and to improved fire-resistant hollow shaft walls.

BACKGROUND OF THE INVENTION

Several patents have disclosed hollow shaft walls employing metal studs and gypsum wallboards; for example, U.S. patent Nos. 3,740,912 and 4,353,192. These prior patents all employ metal studs between adjacent gypsum core boards, which metal studs are vertical studs. These prior patents also have one-inch-thick core boards which have square edges abutting the webs of the vertical studs. The core boards commonly employed in these systems sometimes include slightly bevelled edges, strictly for ease of insertion into the channels formed between flanges and tabs.

These prior structures have enjoyed considerable commercial success; however, a shaft wall which can be more easily installed at lower cost and have improved performance is clearly desirable. These prior structures also required the studs to have greater flange-to-flange dimensions as walls were made progressively higher, resulting in increased steel usage and an increase in cost and labor.

SUMMARY OF THE INVENTION

In the present invention, novel sheet metal studs are placed horizontally between adjacent, horizontally extending gypsum core boards, typically in the four walls surrounding an elevator shaft and stairwells, and in area separation walls and the like. The metal studs include, essentially, an inner flange, an outer flange and an adjoining web with a core board abutting each side of the web. At least a narrow portion of the web which is closely adjacent the inner flange is in a plane which forms an acute angle with the inner flange creating a channel-like means for holding an edge of one of the two core boards against the inner flange. The web also includes means for holding an edge of the second core board against the inner flange, on the opposite side of the web.

Two-foot wide and up to ten-foot long, one-inch-thick gypsum core boards are disposed, with their widths extending vertically and their lengths extending horizontally, between the horizontally extending studs, said boards having bevelled lateral edges which abut the acutely angled webs of the studs.

The typical long side of a shaft enclosure is ten-feet long and consists essentially of alternating ten-foot long, horizontally extending core boards and ten-foot long, horizontally extending metal studs. The ends of the metal studs and the core boards are disposed within a channel in a suitable vertically extending corner stud or the like. Two layers of standard or special fire-retardant, typically 4-foot wide gypsum

wallboard (referred to herein as wide wallboard) are screw attached to the outer flanges of the metal studs.

The corner stud has two outwardly opening channels directed at right angles, and the core boards and horizontal studs of two perpendicular walls extend into the two respective channels.

It is an object of the present invention to provide a novel horizontal stud and a novel and improved wall construction utilizing such horizontal studs.

It is a further object of the invention to provide an improved, more economical shaft wall, suitable for erection from one side.

It is a still further object of the invention to provide a method of erecting walls which result in improved walls at a reduced cost.

It is a still further object of the invention to provide a method of erecting shaft walls which inherently includes the initial construction of a relatively low safety wall around the shaft opening that also provides ready access to the shaft for the installation of cants and the like.

It is a still further object of the invention to provide a shaft wall which is not substantially weakened by omission or removal of a narrow top portion for the installation of elevator rail supports/brackets.

It is still a further object of the invention to provide a shaft wall system that requires the stocking of fewer components for typical shaft wall installations.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention will be more readily apparent when considered in relation to the preferred embodiments as set forth in the specification and shown in the drawings in which:

Fig. 1 is a perspective view of a portion of two perpendicular walls of an elevator shaft enclosure, constructed in accordance with the invention.

Fig. 2 is a cross-sectional plan view of the wall corner, taken on line 2-2 of Fig. 1.

Fig. 3 is a cross-sectional end view of the left wall of Fig. 1.

Fig. 4 is an isometric view of a horizontal stud of the walls of Fig. 1.

Fig. 5 is a cross-sectional end view of a modified wall embodying the invention.

Fig. 6 is an isometric view of an extra-long wall embodying the invention.

Fig. 7 is an end view of a double-width board for forming two core boards.

Fig. 8 is an end view of a double-width board for forming two modified core boards.

Figs. 9-12 are isometric views of four modified horizontal studs with core boards in place, all in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1, there is shown part of a side wall 10 and part of a front wall 12 of a hollow shaft wall structure 14 surrounding an elevator shaft 16. Elevator shaft 16 extends vertically through a plurality of floor-ceiling platforms, including the lower platform 18 and the upper platform 20 of Fig. 1. The shaft wall structure 14 extends vertically from the lower platform 18 to the upper platform 20 along the edges 22 of these floor-ceiling platforms which surround and form the elevator shaft 16.

Side wall 10 consists of standard upwardly opening, channel-shaped floor track 24 (Fig. 3), having a horizontal web 26 and two vertical flanges 28, 30, a downwardly opening, channel shaped, ceiling track 32, having a horizontal web 34 and two vertical flanges 36, 38. Floor track 24 is mechanically affixed to the top of lower platform 18 and ceiling track 32 is mechanically affixed to the bottom of upper platform 20, each adjacent the edges 22 of these floor-ceiling platforms. Ceiling track 32 preferably has a plurality of spaced-apart vent openings 39 along the top edge of flange 38, to improve the wall fire-resistance. Ceiling track 32 can also be used as a floor track.

At the corner of side wall 10 and front wall 12, as seen in Figs. 1 and 2, a vertical corner post 40 is mounted with a bottom end 42 disposed in a floor track 24 and a top end 44 disposed in a ceiling track 32, where the two floor tracks 24 and the two ceiling tracks 32 meet to form a 90° corner 46 between side wall 10 and front wall 12. The corner post 40, which could be made by affixing two channels together back-to-side, is preferably a single, elongate, roll-formed sheet of metal having two outwardly opening channels 48, 50 formed of a single piece of 0.020-inch-thick steel, with the two channels 48 and 50 opening outwardly in directions at a 90° angle to one another and being directed toward, respectively, the side wall 10 and the front wall 12.

As seen in Figs. 1 and 2, vertical corner post 40 consists essentially of the two channels 48, 50 each of which consists solely of a bottom wall and parallel, spaced, inner and outer side walls extending perpendicularly from the bottom wall. The bottom wall of a first one of said channels (opening downwardly and to the right in Fig. 2) is also the inner side wall of a second one of said channels (opening downwardly and to the left in Fig. 2). Also, the bottom wall of the second one of said channels will be seen to be coplanar with the outer side wall of the first one of said channels.

Considering the side wall 10, Fig. 3 shows the arrangement of core boards 52, horizontal studs 54, and outwardly disposed gypsum wide wallboards 56, 58, which combine to form the side wall 10.

Typically the core boards 52 are paper-covered gypsum boards which are, in cross section, 2 feet by

1 inch, and will normally have a length equal to the extent of the wall 10. Of particular importance are the bevelled edges 60, 62 along the two long edges of each core board 52. Alternatively, non-bevelled board can be used. preferably, the bevelled edges 60, 62 on each core board 52 have a bevel 64, 66 which is in a plane forming an angle of 120° with one of the core board faces and 60° with the opposite core board face, and preferably, when installed as shown in Fig. 3, the bevelled edges 60, 62 are parallel, one with the other, whereby the bevel 64 on edge 60 is at an angle of 120° with core board face 68 and an angle of 60° with core board face 70, whereas bevel 66 on edge 62 is at an angle of 120° with core board face 70 and an angle of 60° with core board face 68.

Preferably, the bevelled edges 60, 62 have a flat portion 72, of a width of about 3/8 inch, however, this could be varied considerably.

The first core board 52 to be installed in constructing wall 10 has a flat portion 72 resting on web 26 of floor track 24 and face 70 is held against flange 30 by a plurality of screws 74. The two ends 76 (one shown in Fig. 1) of core board 52 extend into corner posts 40 (one shown) but are not affixed thereto. On top of the first core board 52 to be installed is the first horizontal stud 54 to be installed, and progressively, in constructing wall 10, additional core boards 52 and horizontal studs 54 alternately are put into place, each extending at each end thereof into the channel 48 of corner posts 40 (one shown) but, preferably, neither core boards 52 nor studs 54 are affixed thereto.

The horizontal studs 54, shown in Figs. 3 and 4, are each a single, elongate, roll-formed sheet of metal, preferably 0.020-inch-thick steel, and include, essentially a Z-shaped cross section which includes an inner flange 78, a web 80 extending outwardly from inner flange 78 with an inwardly facing surface 84 which forms an angle of 60° with inner flange 78, an outer flange 82 which is parallel to and preferably about 2-1/2 inches from inner flange 78 and a means 86 for holding a core board edge 62 against outwardly facing surface 88 of web 80. The stud 54 will be seen to form two opposed pockets for receiving the edges of two adjacent core boards 52.

In the form as shown in Fig. 4, the means 86, for holding core board edge 62 against the outwardly facing surface 88 of web 80, is a plurality of tabs 86 formed of about 1-inch by about 3-inch sections of metal cut and bent out of web 80, located about every 12 inches. The inner flange 78 has a narrow, outwardly-turned hem 90. Inner flange 78 also has an outwardly depressed, elongate rib 92 with depth equal to the outward extent of hem 90. Rib 92 prevents twisting of the stud 54 when a builder rests a core board on the top of outer flange 82 during construction. Inner flange 78 has a short, downwardly extending, elongate lip 94 formed by a reverse bend of the sheet metal and web 80 is adjoined to inner flange

78 at the top of lip 94. The inner flange 78 can be strengthened to some degree by forming the flange with the double thickness extending upwardly and the single thickness extending downwardly, with a hem at the bottom, as illustrated in Figs. 9-12.

An elongate, outermost portion 96 of web 80 is perpendicular to the outer flange 82, and outer flange 82 has a narrow, inwardly turned hem 98.

In the embodiment shown in Fig. 3, all the horizontal studs 54 are disposed with the inner flange 78 extending primarily upwardly from web 80 and the outer flange 82 and tabs 86 extending downwardly from web 80. It will be readily understood how gravity assists in the installation of the upper core board engaged in each stud 54. Two layers of gypsum wide wallboard 56, 58, preferably 4-foot wide and 1/2-inch or 5/8-inch thick, are screw attached to the outer flange 82 of each horizontal stud 54 and to corner posts 40.

In alternative embodiments, not shown, the horizontal studs 54 could be reversed with inner flanges 78 extending downwardly and the outer flanges 82 and tabs 86 extending upwardly, necessitating a reversal of the faces of the core boards 52. In this embodiment, tabs could interfere with the installation of the upper board, making construction a little more difficult. In a still further alternative embodiment, alternate horizontal studs 54 could be reversed, necessitating the use of core boards with bevels on the same side on each core board and with core board faces alternating on adjacent core boards. This alternating embodiment will be clearly understood from the alternative embodiment of Fig. 5.

In Fig. 5, a different embodiment of the invention, employing modified horizontal studs 100, is shown, with the horizontal studs 100 arranged to show an alternating stud arrangement. The embodiment of Fig. 5 also has non-aligned core boards 102, which permit the inclusion of vent holes 104 in the webs 106.

The elongate horizontal studs 100 have inner flanges 108 and outer flanges 110 which are parallel and extend in the same direction from the web 106. The web 106 includes three elongate elements, a diagonal section 112 extending outwardly at 60° from one edge of inner flange 108, a mid-wall 114 extending from the opposite edge of diagonal section 112 in the opposite direction as and parallel to the inner flange 108, and an outermost portion 116 which is perpendicular to the outer flange 110 and to mid-wall 114.

In order to improve the fire-resistant character of the wall 118, the mid-wall 114 is spaced outwardly of the inner flange 108, a distance greater than the thickness of the core boards 102, preferably a 1-1/4-inch spacing with 1-inch-thick core board 102. Core board 102 having a flat portion 123 and a bevelled portion 124, has edges 122, 122 with the bevel 124 of each edge adjacent the same face 126. The core

boards 102 and the studs 100 are both erected in an alternating manner, with adjacent core boards 102 having faces 126 facing oppositely and adjacent horizontal studs having upper and lower sides reversed. Consequently, every other core board 102 is disposed outwardly 1/4 inch, leaving an inner 1/4-inch strip 128 of web 106 exposed. A plurality of vent openings 104 are formed at spaced locations along this inner 1/4-inch strip 128. When a wall 118 is exposed to a fire, air is able to move through vent openings 104, cooling the wall 118.

Referring now to front wall 12 of Fig. 1, an elevator doorway 132 is shown, formed by two vertical roll-formed, sheet metal elongate door-frame posts 134 (one vertical post not shown), (similar door frame posts are shown in Fig. 6). As shown in a broken-away portion in Fig. 1, the door frame posts 134 include a web 136, two perpendicular flanges 138 and an inwardly protruding lip 140. A short section of regular formed sheet metal elongate channel 135 is affixed back-to-back with the portion of vertical door frame post 134 extending from the top of doorway 132 to the ceiling track 32, and another section of channel 135 extends across the top of doorway 132.

Front wall 12 has short sections of core board 52 alternating with short sections of horizontal stud 54 along the side of doorway 132, with boards 52 and studs 54 extending into the channel 50 of corner post 40 and into the door frame post 134. Other short sections of horizontal studs 54 and core boards 52 extend horizontally over doorway 132 and into the short sections of channel 135. Two layers of gypsum wide wallboard 56, 58 are screw attached to the outer flanges of horizontal studs 54 and to posts 40 and 134.

Referring now to Fig. 6, an extra-long wall 142 is shown, constructed in accordance with the invention. The horizontal studs 54 preferably will not be more than 10-feet long for most elevator shaft walls, particularly with only 2-1/2-inch-wide studs. For walls having a length greater than 10 feet, an intermediate vertical post 144 is positioned at spacings of 10 feet or less. A suitable intermediate vertical post 144 is shown formed of two door frame posts 134, back-to-back, preferably mechanically affixed together, however other configurations can also be used. Core boards 52 and horizontal studs 54 are shown extending from within corner posts 40 to within intermediate vertical post 144. Wide wall-boards 56, 58 are affixed to the outer flanges 82 of the horizontal studs 54.

Figs. 9 thru 12 show four additional modifications of the invention.

Fig. 9 shows horizontal stud 170 with two core boards 172, in a manner similar to the structures of Figs. 1, 2 and 6. Horizontal studs 170 and core boards 172 are assembled into vertical corner posts 40, intermediate posts 144 and door frame posts 134 similar to core boards 102.

Horizontal stud 170 is an elongate, roll-formed

sheet of metal with a cross section which includes an inner flange 174, a web 176 extending perpendicularly outwardly from the middle of inner flange 174 for about 9/16 inch to a 30° upward bend 178, then extends upwardly and outwardly to a 30° downward bend 180 and then extends outwardly to downwardly extending outer flange 182. Bends 178 and 180 thus divide web 176 into an inner flat portion 184, a central diagonal portion 186 and an outer flat portion 188. In the several disclosed embodiments of this invention it is important that a portion of the web be at an acute angle to the inner flange at a portion which is spaced outwardly from the inner flange. This angled portion may extend inwardly and be adjoined to the inner flange or the angled portion may be adjoined to the inner flange by a narrow portion perpendicular to the inner flange.

Horizontal stud 170 also includes a plurality of downwardly extending tabs 190 formed of 1-inch by 3-inch sections of metal cut and bent out of central diagonal portion 186. Tabs 190 are adjoined to central diagonal portion 186 adjacent to bend 178, and include a downwardly and outwardly extending angled portion 192 and a downwardly extending portion 194 terminating in a downwardly and outwardly angled lip 196 for ease of insertion of a core board 172.

Inner flange 174 includes an upper double-thickness portion 198 and a lower single-thickness portion 200 which includes a lower hem 202 and a midway rib 204. Hem 202 and rib 204 both extend outwardly from the balance of lower portion 200.

Horizontal stud 170 is mounted atop an upper edge portion 206 of one of the two core boards 172 in Fig. 9, and a lower edge portion 207 of the other core board 172 is disposed atop stud 170.

The upper edge portion 206 of the one core board 172 is held firmly between tabs 190 and the hem 202 and rib 204 of single-thickness portion 200 of inner flange 174. Upper edge portion 206 has a flat top portion 208 and a bevelled portion 210. Flat portion 208 abuts inner flat portion 184 of web 176 and bevelled portion 210 is parallel to and closely spaced from angled portion 192 of tab 190.

The lower edge portion 207 of the other core board 172 has a flat bottom portion 212, similar to flat top portion 208, and a bevelled portion 214, similar to bevelled portion 210. Bevelled portion 214 rests on central diagonal portion 186 of web 176 and flat bottom portion 212 is parallel to and closely spaced from inner flat portion 184 of web 176.

The very heavy, normally about ten-foot-long core boards 172 are relatively easily inserted onto each previously mounted horizontal stud 170 by merely sliding the bevelled portion 214 down the central diagonal portion 186 until the lower edge 207 abuts the double-thick portion 198 of inner flange 174. Lower edge portion 207 is held firmly between inner flange 174 and diagonal portion 186 by the

weight of the core board 172, plus the weight of all core boards 172 and horizontal studs 170 which are thereabove a part of the wall.

The horizontal studs 170 fit tightly onto the upper edge 206 of core boards 172, but being much lighter and easier to manipulate than the core boards 172, very little problem is involved in this step. Gypsum wide wallboard (not shown) is screw attached against the outer surfaces 216 of the outer flanges 182 and to posts 40, 134 and 144.

Fig. 10 shows horizontal stud 220 with two core boards 222, similar to core boards 52. Horizontal studs 220 and core boards 222 are assembled into vertical corner posts 40, intermediate posts 144 and door frame channels 134 in a manner similar to the structures of Figs. 1, 2 and 6.

Horizontal stud 220 is an elongate, roll-formed sheet of metal with a cross section which includes an inner flange 224, a web 226 extending outwardly and upwardly from the middle of inner flange 224 to a downward bend 228 and then extends outwardly to downwardly extending outer flange 230. Bend 228 thus divides web 226 into an inner diagonal portion 232 and an outer flat portion 234.

Horizontal stud 220 also includes a plurality of downwardly extending tabs 236 formed of 1-inch by 3-inch sections of metal cut and bent out of inner diagonal portion 232. Tabs 236 are adjoined to the inner diagonal portion 232 of web 226 at about the middle of diagonal portion 232 and includes a downwardly and outwardly extending portion 238, a downwardly extending portion 240, and a downwardly and outwardly angled lip 242 for ease of insertion of a core board 222.

Inner flange 224 includes an upper double-thickness portion 244 and a lower single-thickness portion 246 which includes a lower hem 248 and a midway rib 249, both extending outwardly.

Horizontal stud 220 is mounted atop an upper edge portion 250 of one of the two core boards 222 in Fig. 10, and a lower edge portion 252 of the other core board 222 is disposed atop stud 220.

The upper edge portion 250 of the one core board 222 is held firmly between tabs 236 and the hem 248 and rib 249 of single-thickness portion 246 of inner flange 224. Upper edge portion 250 has a flat top portion 254 and a bevelled portion 256 with an elongate corner 258 therebetween of about 150°.

The lower edge portion 252 of the other core board 222 has a flat bottom portion 260, similar to flat top portion 254 with the exception that it is on the opposite side of the core board 222, a bevelled portion 262, similar to bevelled portion 256 but also on the opposite side of core board 222, and an elongate corner 264 therebetween of about 150°.

The inner diagonal portion 232 of web 226 forms an angle 266 of 70° with upper double-thickness portion 244 of inner flange 224. Since the corners 258

and 264 are both about 150°, the bevelled portions 256 and 262 extend at an angle 268 of about 60° relative to the upper double-thickness portion 244. Consequently, the upper edge portion 250 and the lower edge portion 252 of the core boards 222 both about the web diagonal portion 232 at the corners 258 and 264.

The core boards 222 are easily inserted onto each previously mounted horizontal stud 220, and the lower edge portion 252 is held firmly between inner flange 224 and web diagonal portion 232 by the weight of the core board 222, plus the weight of all core boards 222 and horizontal studs 220 which are thereabove a part of the wall. Horizontal studs 220, being much lighter than the core boards 222, can be reasonably easily forced down onto the upper edge portions 250 of the core boards 222. Gypsum wide wallboard (not shown) is screw attached against the outer surfaces 270 of the outer flanges 230 and to posts 40, 134 and 144.

Fig. 11 shows horizontal stud 272 with two core boards 274, similar to core boards 102. Horizontal studs 272 and core boards 274 are assembled into vertical corner posts 40, intermediate posts 144 and door frame channels 134 in a manner similar to the structures of Figs. 1, 2 and 6. Horizontal stud 272 is an elongate roll-formed sheet of metal with a cross section which includes an inner flange 276, a web 278 extending perpendicularly outwardly from the middle of inner flange 276 about 5/8 inch to 30° downward bend 280, then extends downwardly and outwardly to an upwardly extending outer flange 282. Bend 280 thus divides web 278 into an inner flat portion 284, and an outer diagonal portion 286.

Horizontal stud 272 also includes, at spaced apart locations along web 278, a plurality of upwardly extending tabs 288 and a plurality of downwardly extending tabs 290, each formed of, respectively, 1-inch by 3-inch sections and 1/2-inch by 3-inch sections of metal cut and bent out of outer diagonal portion 286. Tabs 288 are adjoined to outer diagonal portion 286 adjacent to bend 280, and include an upwardly and outwardly extending angled portion 292 and an upwardly extending portion 294 terminating in an upwardly and outwardly angled lip 296, for ease of insertion of a core board 274. Tabs 290 are adjoined to outer diagonal portion 286 about 1/2 inch outwardly from bend 280, and include a downwardly extending portion 298 and a downwardly and outwardly extending lip 300.

Inner flange 276 includes an upper double-thickness portion 302 and a lower single-thickness portion 304 which includes a lower hem 306 and a midway rib 308, both extending outwardly from the other parts of lower portion 304.

Horizontal stud 272 is mounted atop an upper edge portion 310 of one of the two core boards 274 in Fig. 11, and a lower edge portion 312 of the other core board 274 is disposed atop stud 272.

The upper edge portion 310 of the one core board 274 is held firmly between tabs 290 and the hem 306 and rib 308 of single-thickness portion 304 of inner flange 276. Upper edge portion 310 has a flat top portion 314 and a bevelled portion 316. Flat portion 314 abuts inner flat portion 284 of web 278 and bevelled portion 316 is parallel to and closely spaced from outer diagonal portion 286 of web 278.

The lower edge portion 312 of the other core board 274 has a flat bottom portion 318, similar to flat top portion 314, and a bevelled portion 320, similar to bevelled portion 316. Flat bottom portion 318 is parallel to and closely spaced from inner flat portion 284 of web 278 and bevelled portion 320 rests on angled portion 292 of tabs 288.

The core boards 274 are relatively easily inserted between the tabs 288 and 290 and the inner flange 276 because of the bevelled portions 316 and 320, which engage and slide on the respective tab lips 296 and 300. Gypsum wide wallboard (not shown) is screw attached against the outer surfaces 322 of outer flanges 282 and to posts 40, 134 and 144.

In a preferred embodiment, Fig. 12 shows horizontal studs 324 with two core boards 326, similar to core boards 52. Horizontal studs 324 and core boards 326 are assembled into corner posts 40, intermediate posts 144 and door frame channels 134 in a manner similar to the structures of Figs. 1, 2 and 6. Horizontal stud 324 is an elongate roll-formed sheet of metal with a cross section which includes an inner flange 328, a web 330 extending perpendicularly outwardly from the middle of inner flange 328 about 5/8 inch, forming a flat portion 332, whereat a major portion 334 of web 330 extends upwardly and outwardly about 5/8 inch to bend 336 and thence downwardly and outwardly to an upwardly extending outer flange 338. A minor portion 340 of web 330, about a 3-inch length of each foot of web, extends downwardly and outwardly about 5/8 inch to bend 342, thence downwardly to bend 344 and thence outwardly to upwardly extending outer flange 338. Slits 346 were cut crosswise of web 330, during forming of horizontal stud 324, from the flat portion 332 to the outer flange 338. The slits 346 are preferably angled slightly to form minor portions 340 which have a shorter dimension along the outer flange bend 348 than along the bend 349, whereat the minor portion 340 is adjoined to the flat portion 332. By angling the slits 346, heat transfer through the stud, from one flange to the opposite flange is reduced, and, also, the studs are more easily stacked for warehousing and shipping.

The bend 336 divides the major portion 334 of web 330 into a ramp portion 350 and a connecting portion 352. The bends 342 and 344 divide the minor portion 340 into a bevel portion 354, a board holding portion 356 and a connecting portion 358.

Both ends of web major portion 334 and of web minor portion 340 are integrally connected to the

stud; they have no free or dangling ends. Thus, as shown in Fig. 12, web 330 has no tabs or any other part with a dangling or free end, all of which enhances the structural integrity of the web.

Inner flange 328 includes an upper double-thickness portion 360 and a lower single-thickness portion 362 which includes a lower hem 364 and a midway rib 366, both extending outwardly.

Horizontal stud 324 is mounted atop an upper edge portion 368 of one of the two core boards 326 in Fig. 12, and a lower edge portion 370 of the other core board 326 is disposed atop stud 324.

The upper edge portion 368 of the one core board 326 is held firmly between board holding portion 356 of web minor portion 340 and the hem 364 and rib 366 of single-thickness portion 362 of inner flange 328. Upper edge portion 368 has a flat top portion 372 and a bevelled portion 374 with an elongate corner therebetween of about 150°. Flat portion 372 abuts flat portion 332 of web 330. Bevelled portion 374 is parallel to and closely spaced from minor portion, bevel portion 354.

The lower edge portion 370 of the other core board 326 has a flat bottom portion 376, similar to flat top portion 372, and a bevelled portion 378 similar to bevelled portion 374. Flat bottom portion 376 is parallel to and closely spaced from flat portion 332 of web 330, and the junction of flat bottom portion 376 and bevelled portion 378 rests on ramp portion 350.

The core boards 326 are inserted onto each previously mounted horizontal stud 324 by merely sliding the bevelled portion 378 of lower edge portion 370 down the ramp portion 350 of the web 330 until the lower edge portion 370 abuts the double-thick portion 360 of inner flange 328. The lower edge portion 370 is held between the ramp portion 350 and inner flange 328 by the weight of the core board 326, plus the weight of all core boards 326 and horizontal studs 324 which are thereabove a part of the wall.

The horizontal studs 324 are forced onto the upper edge 368 of each core board 326, with the core board bevelled portion 374 guiding the stud web minor portion 340 into the space between the inner flange 328 and the board holding portion 356.

Gypsum wide wallboard (not shown) is screw attached against the outer surfaces 380 of the outer flanges 338 and to posts 40, 134 and 144.

In the preferred forms of the invention, narrow, elongate slots 382 are arranged at spaced locations along the webs 80, 106, 176, 226, 278 and 330, typically about 3 inches by 1/2 inch, spaced an inch apart, for reducing the heat conductivity through a wall, in case of fire on one or the other sides of the wall. Also, horizontal studs 54, 170, 220, 272 and 324 could have 3/16-inch by 2-1/4-inch vent holes 384 added, with 3/4-inch spacing, similar to the vent holes 104 in stud 100.

With regard to the application of two layers of

gypsum wide wallboard 56, 58, on any of the horizontal stud embodiments, these 1/2-inch or 5/8-inch wallboards may be screw applied with their long dimension horizontal or vertical or with one layer horizontal and one layer vertical. All-vertical application is normally preferred, with joint locations staggered. With regard to the installation of all-horizontal studs 54, 170 and 220 in side wall 10 with tabs 86, 190 and 236 extending downward, although this is the preferred construction, the walls could be constructed with tabs 86, 190 and 236 extending upward; that is, by reversing the horizontal studs 54, 170 and 220 and reversing the core boards 52 and 222.

Figs. 7 and 8 show how two 2-foot-wide core boards 52 and 222 or 102 can be manufactured as a substitute for the more common standard 2-foot-wide core board. In Fig. 7, a 4-foot-wide, 1-inch-thick, paper-covered gypsum board 146 is shown with a jagged break line 148 in the center of board 146. By forming board 146 with two bevelled edges 150 adjacent the top face 152 and a V-groove 154 in the center of the back face 156, the wide board 146 can be broken in half to form two core boards 52 or 222.

In Fig. 8, a 4-foot-wide, 1-inch-thick, paper-covered gypsum board 158 is shown with a jagged break line 160 in the center of board 158. By forming board 158 with two bevelled edges 162 adjacent the top face 164 and V-groove 166 in the center of the top face 164, the wide core board 158 can be broken in half to form two core boards 102. The present invention has an added advantage in that the rough, jagged edges formed by breaking wide gypsum boards 146, 158, extend into a 60° channel in either of the horizontal studs 5, 100 or 220 where the jagged edges present no problem.

Another very important advantage of the present invention is in the fact that the construction of a wall in accordance with the invention, such as side wall 10, involves constructing, essentially, a two-foot wall with the lowest core board 52, then a four-foot wall with the second lowest core board 52, etc. Construction of these walls can be stopped at any two-foot multiple height. Accordingly, a desired four-foot wall can be erected with no extra trouble for use as a temporary safety wall around an elevator shaft prior to the time when a complete elevator shaft wall is desired, leaving access to the shaft, over the four-foot wall, during early phases of construction, for easy installation of cants or the like. Also, accordingly, core boards can be omitted or removed from between the top horizontal stud and the ceiling track without weakening substantially the resultant wall, as occurs in prior vertical stud structures, wherein portions of vertical studs must be cut away. This omission is sometimes necessary to install elevator rail supports/brackets.

Of greatest significance, is the fact that with horizontal studs carrying the weight of core boards, the

horizontal studs are effectively made stronger proportional to the weight on them, which is not true of vertical studs, which obviously do not carry the weight of core boards between them. With core board edges bevelled and horizontal stud webs or tabs at corresponding acute angles, a substantial increase in strength and stiffness is provided in the resultant wall. As a result, horizontal studs which are only about 2-1/2 inches, flange-to-flange, are adequate regardless of the height of the wall.

It should also be noted that the construction of walls in accordance with the invention is easier and faster than prior shaft walls, and is suitable for construction from one side, the side opposite the shaft. Contributing most to the ease of erection is the use of the horizontal stud with a wide, angled-bottom channel into which the bottom edge of each core board is fed. More particularly, the web of the stud includes structure for guiding the bottom edge of the core board laterally toward the stud's inner flange, under the urging of gravity. For example, in the embodiment of Fig. 9, the guide structure comprises web diagonal portion 186; in Fig. 10, it comprises web diagonal portion 232; in Fig. 11, it comprises upwardly and outwardly extending lip portion 296 and angled portion 292; and in Fig. 12, the guide structure comprises web ramp portion 350. This type of guide structure facilitates positioning of the core board at the desired location on the stud by an assembler whose vision of that location can be impeded by the core board during assembly. In all such embodiments the guiding function results from the presence of web structure which is engageable with the lower edge of the core board and which is inclined downwardly and inwardly toward the inner flange of the stud which, in the preferred embodiments, includes an upper portion having a double thickness of sheet metal. That part of the core board adjacent its lower edge is positioned adjacent the double thickness of sheet metal on the inner flange, and that feature functions to retain the core board in place, during a fire, for a relatively long period of time compared to an inner flange having a single thickness of sheet metal at that location.

Although the invention has been described as a shaft wall for construction around elevator shafts, its advantages will be equally available when the wall is constructed anywhere else, such as around stairwells or as area separation walls of the type commonly constructed between adjoining condominiums and townhouses. It is presently contemplated that the walls of the present invention can be successfully constructed with heights of up to about 36 feet, compared to about 12 feet for a similar sized vertical stud of prior shaft walls. If core boards can be made with greater resistance to crushing than presently normal, there would be no reasonable height limitation. Conversely, prior shaft walls required vertical studs with dimensions of more than 2-1/2 inches flange-to-

flange when the wall exceeded the normal heights. For example, 4-inch and 6-inch flange-to-flange vertical studs were required for constructions when heights increased above about 14 feet. The present invention provides a system wherein the 2-1/2-inch flange-to-flange dimension is adequate regardless of wall height. Still further, the horizontal stud of the present invention requires the same or less metal than any prior shaft wall stud.

It will be appreciated that a solid wall configuration built in accordance with the present invention will also provide a number of benefits of the preferred embodiments of the invention.

Having completed a detailed description of the preferred embodiments of my invention so that those skilled in the art may practice the same, I contemplate that variations may be made without departing from the essence of the invention.

Claims

1. A hollow wall, extending vertically upwardly from a floor, readily assembleable from a first outer side and suitable for construction where the second inner side is relatively inaccessible, comprising:

(a) two fixed vertical posts each extending upwardly from said floor at each end of said hollow wall and each having a vertically extending channel with a channel opening directed toward the opposite of said vertical posts;

(b) at least one horizontally disposed, elongate, formed sheet metal stud, said stud being formed from a single sheet of sheet metal and having an inner flange, a central web and an outer flange;

(c) a plurality of core boards, each said board having an upper edge and a lower edge, said lower edge of at least one of said core boards being supported on a central web of said stud immediately therebelow and said upper edge of a second said core board being disposed against and supporting said central web of said stud immediately thereabove, said boards being in contact with said studs throughout substantially the full length of each said stud, means (for example tabs cut and bent out from said stud web) on said stud holding said core board edges spaced inwardly from said outer flange of said stud;

said horizontal stud and said core boards having opposed ends extending into said channels of said pair of vertical posts; and

(d) wallboard affixed to an outer face of said outer flange of said horizontal stud.

2. A hollow wall as defined in claim 1, wherein said horizontal stud web includes a portion closely adjacent said inner flange extending outwardly and upwardly at an acute angle to said inner flange, said lower edge of said one of said core boards is supported at least in part on said outwardly and upwardly angled portion of said web of said stud immediately therebelow and said upper edge of said second core board supports said web immediately thereabove.

3. A hollow wall as defined in claim 1 or 2, wherein said horizontal stud web includes a mid-wall portion parallel to said inner flange and said means on said stud holding such core boards spaced inwardly from said outer flanges comprises said acutely angled portion of said web as to one edge of one of said core boards and said mid-wall portion as to one edge of a second of said core boards.

4. A hollow wall as defined in claim 2, wherein said means on said stud for holding said core boards spaced inwardly from said outer flange comprises alternating portions of said web, said web having a plurality of spaced laterally extending slits separating said alternating portions, said alternating portions being upwardly bent web portions and downwardly bent portions, said outwardly and upwardly extending portion of said web being a part of said upwardly bent web portion, said downwardly bent portions including means for holding said core board upper edge spaced from said outer flange.

5. A hollow wall as defined in any preceding claim, further comprising an upwardly opening channel-like floor track affixed to a floor having a vertical inner flange and a vertical outer flange, a downwardly opening channel-like ceiling track affixed to a ceiling having a vertical inner flange and a vertical outer flange, said vertical posts having bottom ends affixed within said floor track and top ends affixed within said ceiling track, a lowermost of said core boards having a lower side edge affixed to an inner side of said floor track inner vertical flange, an uppermost of said core boards having an upper side edge affixed to an inner side of said ceiling track inner vertical flange, and said wallboard having bottom and top edges affixed to an outer side of said floor and ceiling tracks outer vertical flanges, said webs and said ceiling tracks preferably having vent holes for air circulation.

6. An enclosure formed by four hollow walls as defined in any preceding claim, said four walls being interconnected by said fixed vertical posts, each

having a pair of perpendicularly directed, vertically extending channels, whereby each said fixed vertical post functions as said fixed vertical post for each of two of said inner connected walls.

7. An enclosure as defined in claim 6, wherein said four walls are disposed adjacent a floor opening, and said horizontal stud inner flanges are disposed on a side of said walls which is adjacent said floor opening, for example, an elevator shaft wall enclosure with a door in one wall.

8. A formed elongate sheet metal stud suitable for horizontal application in a hollow wall consisting essentially of an elongate inner flange, an elongate outer flange, an elongate web, preferably containing vent holes, joining said inner and outer flanges and means (for example tabs cut and bent out of said web) for holding two boards against said web and spaced inwardly from said outer flange, said means for holding one of said boards against said web comprising a channel formed by an acutely angled portion of said web and said inner flange, preferably about 60°, said acutely angled portion being, for example, a portion of an upwardly extending tab, said acutely angled portion of said web extending outwardly from closely adjacent said inner flange forming an acute angle with said inner flange preferably for guiding a core board toward said inner flange by gravity, said stud being preferably about .020-inch sheet metal and about 2-1/2 inches inner flange to outer flange.

9. A formed elongate sheet metal stud as defined in claim 8, wherein said means for holding a second of said boards against said web is a short mid-wall section of said web which is parallel to said inner and outer flanges.

10. A formed elongate sheet metal stud as defined in claim 8, wherein said web comprises alternating portions and a plurality of spaced laterally extending slits separating said alternating portions, said alternating portions being upwardly bent portions and downwardly bent portions, said means for holding said one of said boards being said upwardly bent web portions wherein said means for holding a second of said boards against said web is said downwardly bent web portions.

11. A stud as recited in claim 10, wherein said upwardly bent web portions each comprises:
a first portion extending laterally from said inner flange toward said outer flange;
a second portion extending upwardly from said first portion, away from said inner flange;

and a third portion extending downwardly from said second portion toward said outer flange;

and wherein preferably said downwardly bent web portions each comprise:

a first portion on the downwardly bent web portion, extending laterally from said inner flange toward said outer flange;

a second portion on the downwardly bent web portions, extending downwardly from said first portion on the downwardly bent web portions, away from said inner flange;

and a third portion on the downwardly bent web portions extending from said second portion of the downwardly bent web portions toward said outer flange;

and wherein preferably said second portion on the downwardly bent web portions is disposed substantially parallel to the third portion on the upwardly bent web portions.

12. The method of erecting a hollow wall comprising the steps of mounting a pair of fixed vertical posts, each being mounted on a floor and having a vertically extending channel extending upwardly from said floor, directing said channels of each said post toward said opposite post and alternately mounting core boards and horizontal metal studs progressively upwardly from said floor with ends of said boards and studs extending into said post channels, said horizontal studs having elongate vertical inner flanges, elongate vertical outer flanges and webs interconnecting said inner and outer flanges, said core boards having bottom edges and top edges, mounting said horizontal studs with said webs supported on said core board top edges, and mounting said core boards with said bottom edges supported on said webs, preferably on an acutely angled portion, relative to said inner flange, with said core boards spaced inwardly from said outer flanges, for example by tabs cut and bent out of said web, and affixing wallboard to outer surfaces of said outer flanges.
13. The method of claim 12, wherein said core boards are held inwardly spaced from said outer flanges by one board edge being placed in a channel formed by said acutely angled web portion and said inner flange and said second board edge being placed in a channel formed by said acutely angled web and a mid-wall section of said web which is parallel to said inner and outer flanges.
14. The method of claim 12, wherein said acutely angled web portion and said inner flange form an upwardly opening channel and said core board lower edge is inserted downwardly into said

channel with said lower edge disposed against said acutely angled portion, whereby said bottom edge slides quickly down said acutely angled portion to a firm position against said inner flange preferably with said acutely angled web portion and a bevelled edge on said core board lower edge both acutely angled at about 60°.

15. The method of making an enclosure along an opening in a floor comprising the method steps of claim 12, wherein said pair of fixed vertical posts is positioned such that the wall will be disposed along said floor opening, and said horizontal studs are mounted with said inner flanges on the side of said wall adjacent said opening and wherein, if desired, a lower part of said wall is used as a temporary safety wall by halting temporarily the construction of said wall at a time when said core boards and said horizontal studs have been mounted up to a partial wall height suitable to function as a safety wall, proceeding with construction of other parts of a building containing said wall for a desired period of time, and subsequently resuming the construction of said wall until completed.
16. The method of claim 12, wherein said core board edges include a bevelled portion, further comprising the steps of forming said bevelled core board by breaking a relatively wide bevelled edge board in half along an elongate V-groove formed along the center of a face of said wide board, whereby a rough edge is formed in a non-bevelled portion of one edge of each board which fits into a channel formed by said acutely angled portion and said inner flange without any interference caused by said rough edge.
17. A wall corner structure comprising a vertical corner post affixed at a bottom end and at a top end, by suitable means, between a pair of adjacent floor-ceiling platforms, said corner post consisting essentially of a single, elongate formed metal element having a cross section consisting essentially of two channels opening outwardly in directions at a 90° angle to one another, said channels consisting solely of a bottom wall and parallel, spaced, inner and outer side walls extending perpendicularly from said bottom wall, wherein said bottom wall of a first one of said channels is said inner side wall of a second of said channels and wherein said bottom wall of said second channel is coplanar with said outer side wall of said first of said channels, said channels having substantially equal width, and said channel widths being suitable for receiving and horizontally retaining the ends of a plurality of spaced parallel horizontal studs.

18. A wall corner structure as defined in claim 17, wherein said corner post is a roll-formed sheet metal element.

19. A wall corner structure as defined in claim 18, wherein a first plurality of spaced, parallel horizontal studs all have an end retained within said first of said channels and a second plurality of spaced, parallel horizontal studs all have an end retained within said second of said channels, said first plurality of studs all being within a first vertical plane perpendicular to a second vertical plane within which are all of said second plurality of studs.

20. A wall corner structure as defined in claim 19, wherein said horizontal studs in each respective plurality of studs are held in a spaced relation by paper-covered gypsum core boards disposed therebetween.

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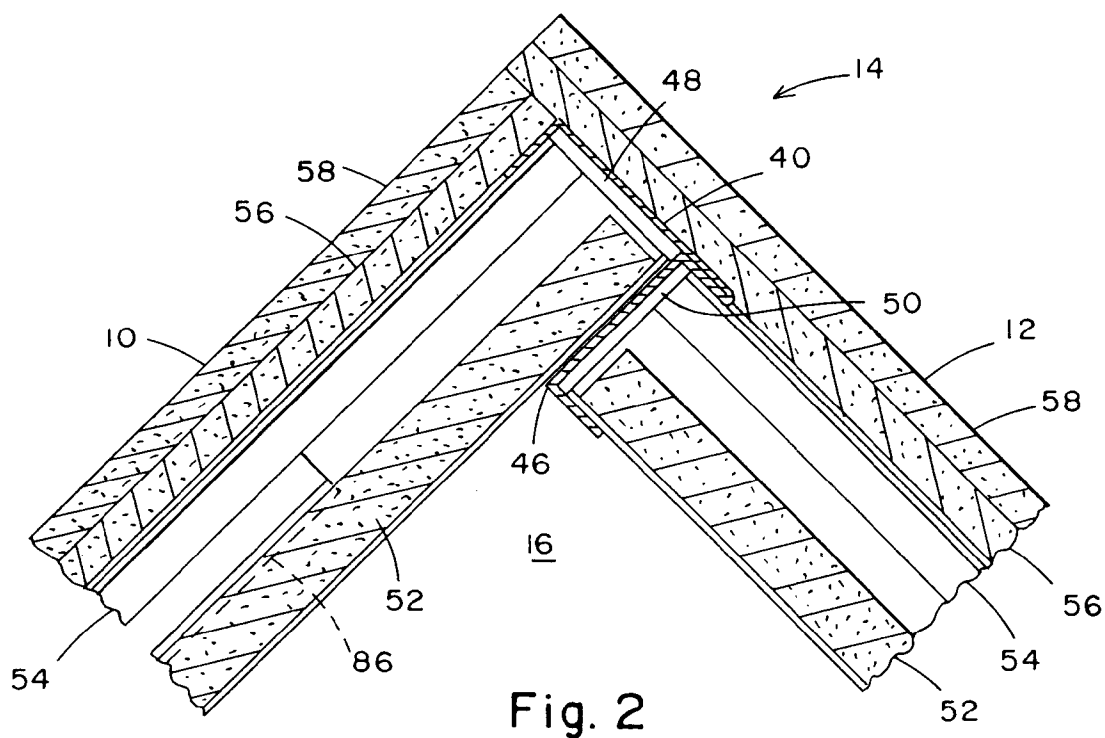
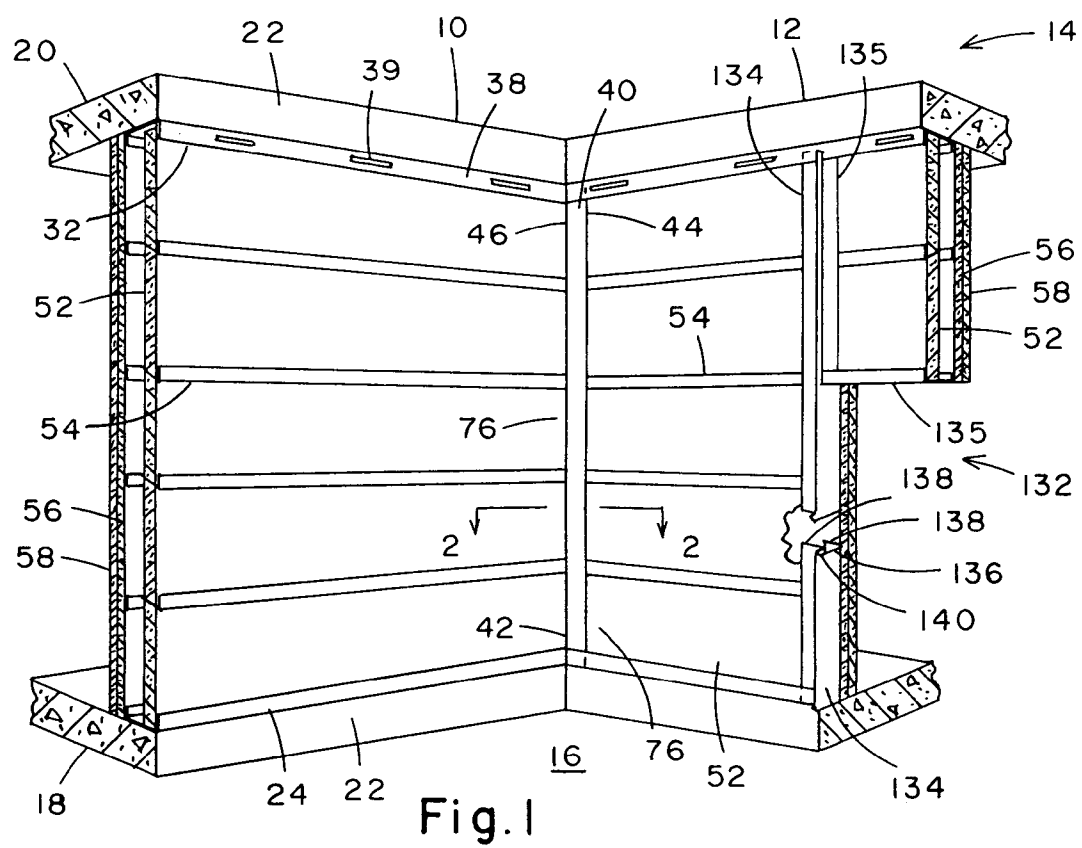
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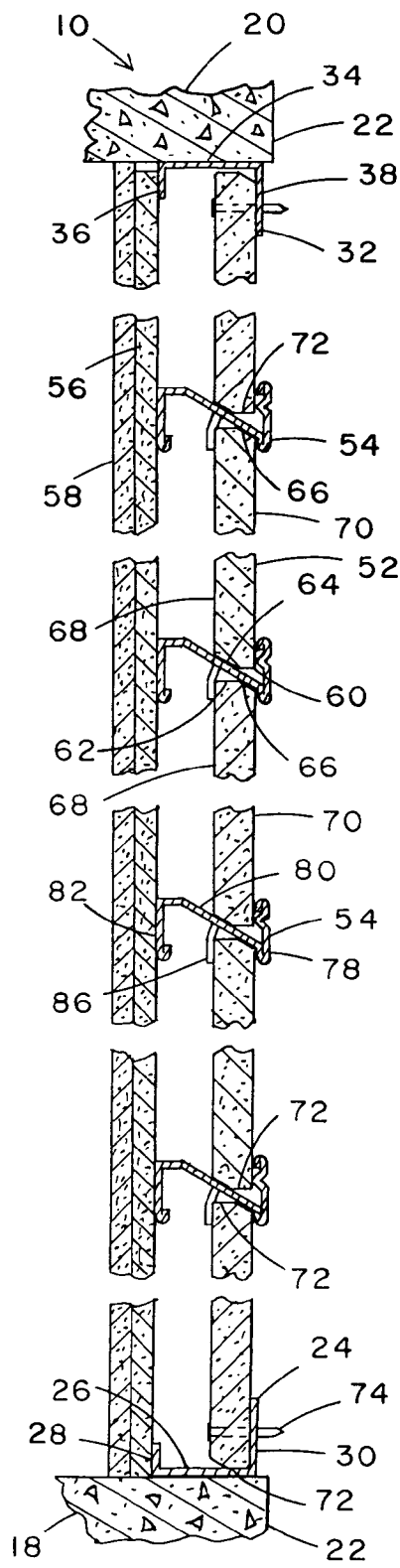


Fig. 3

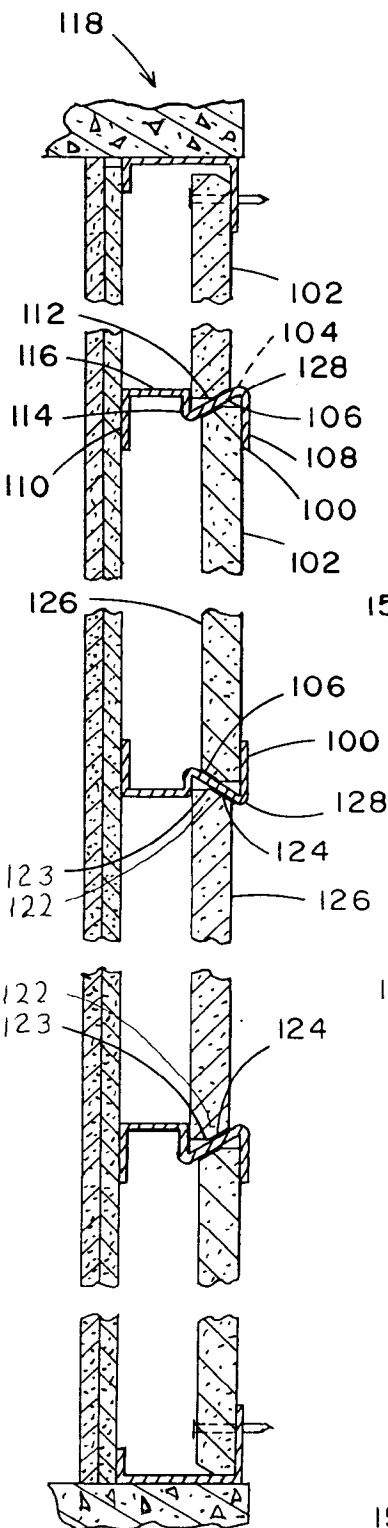


Fig. 5

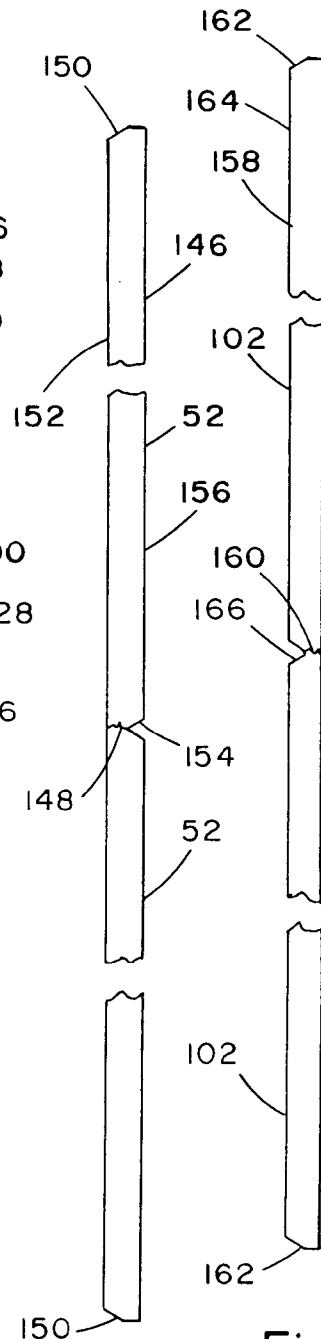
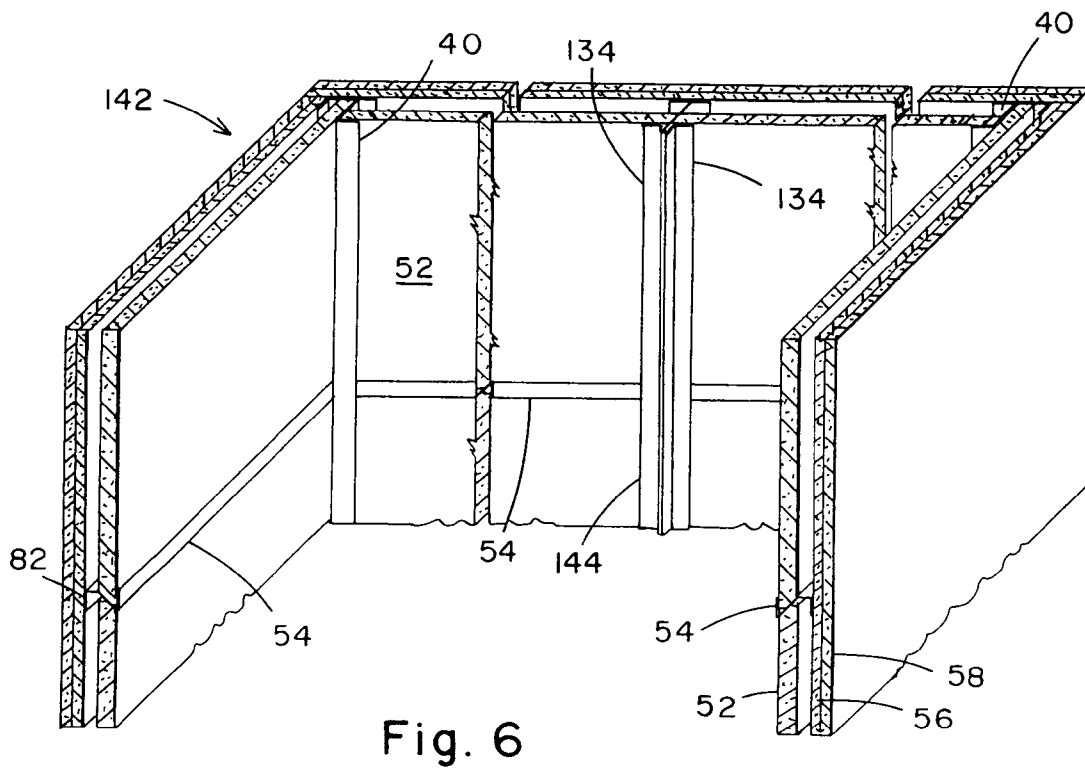
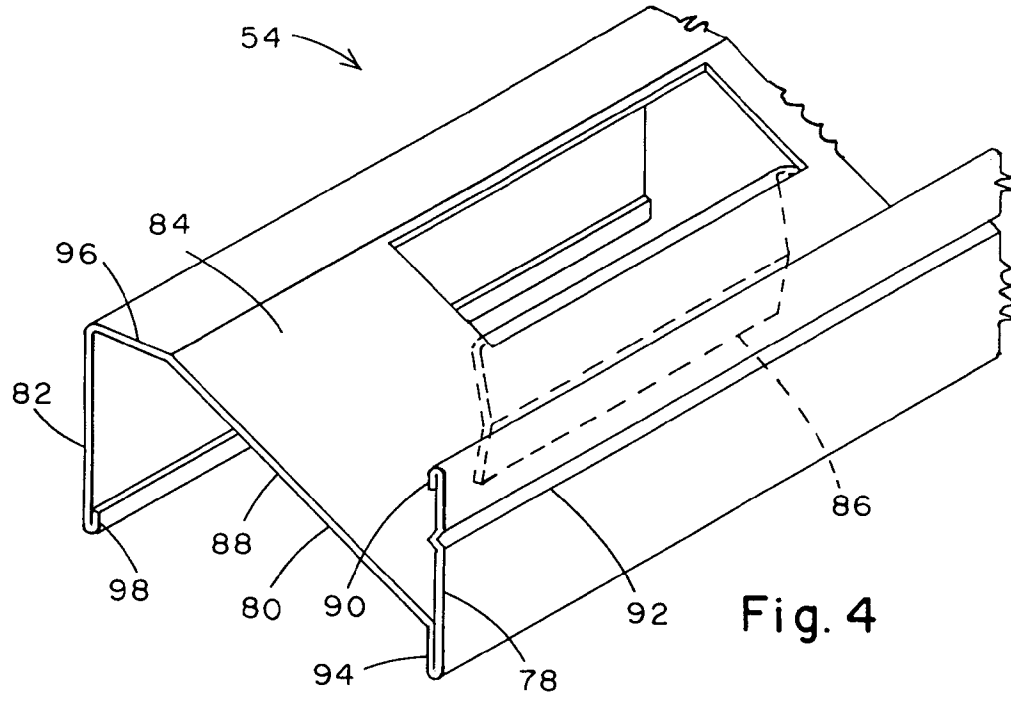
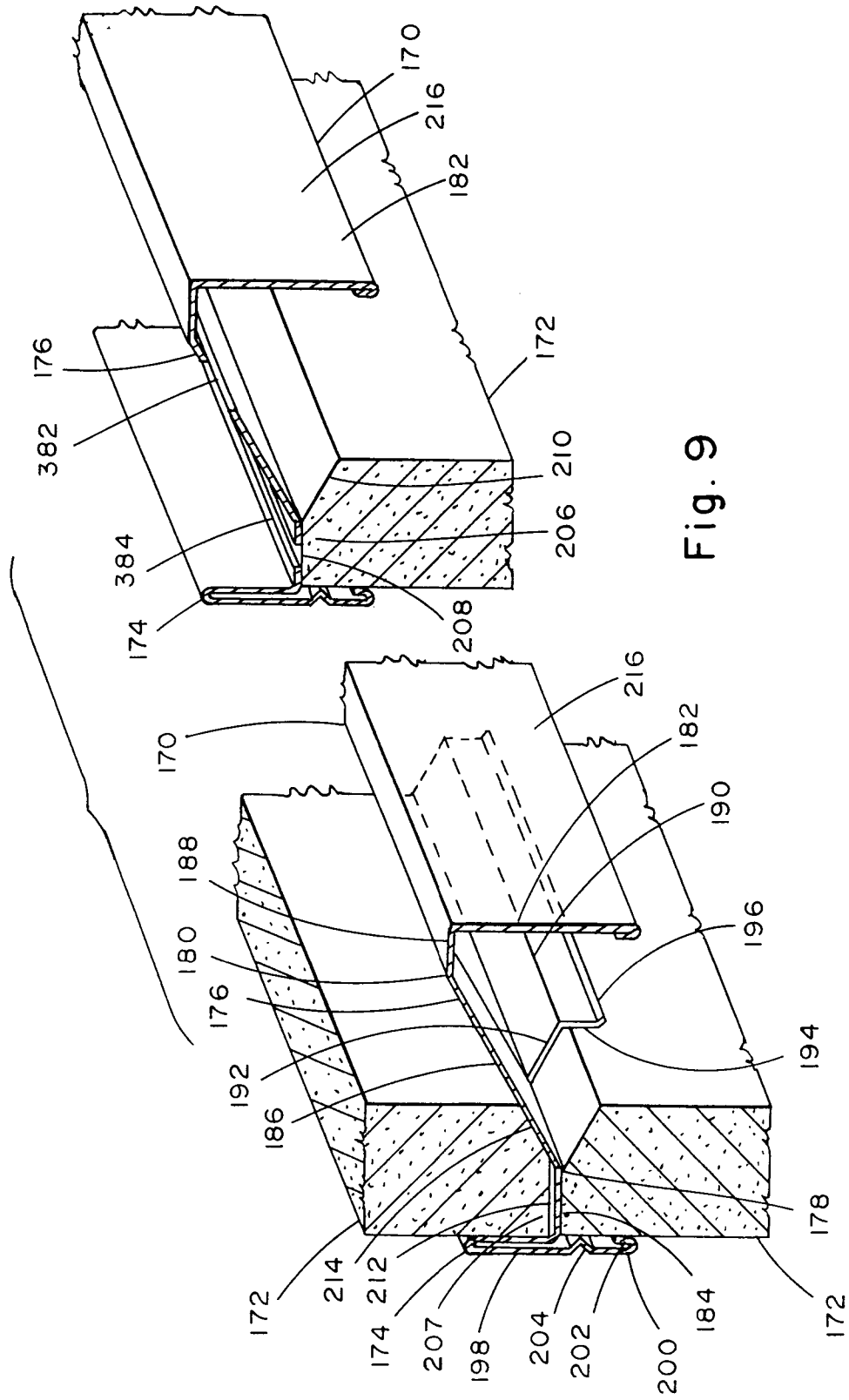
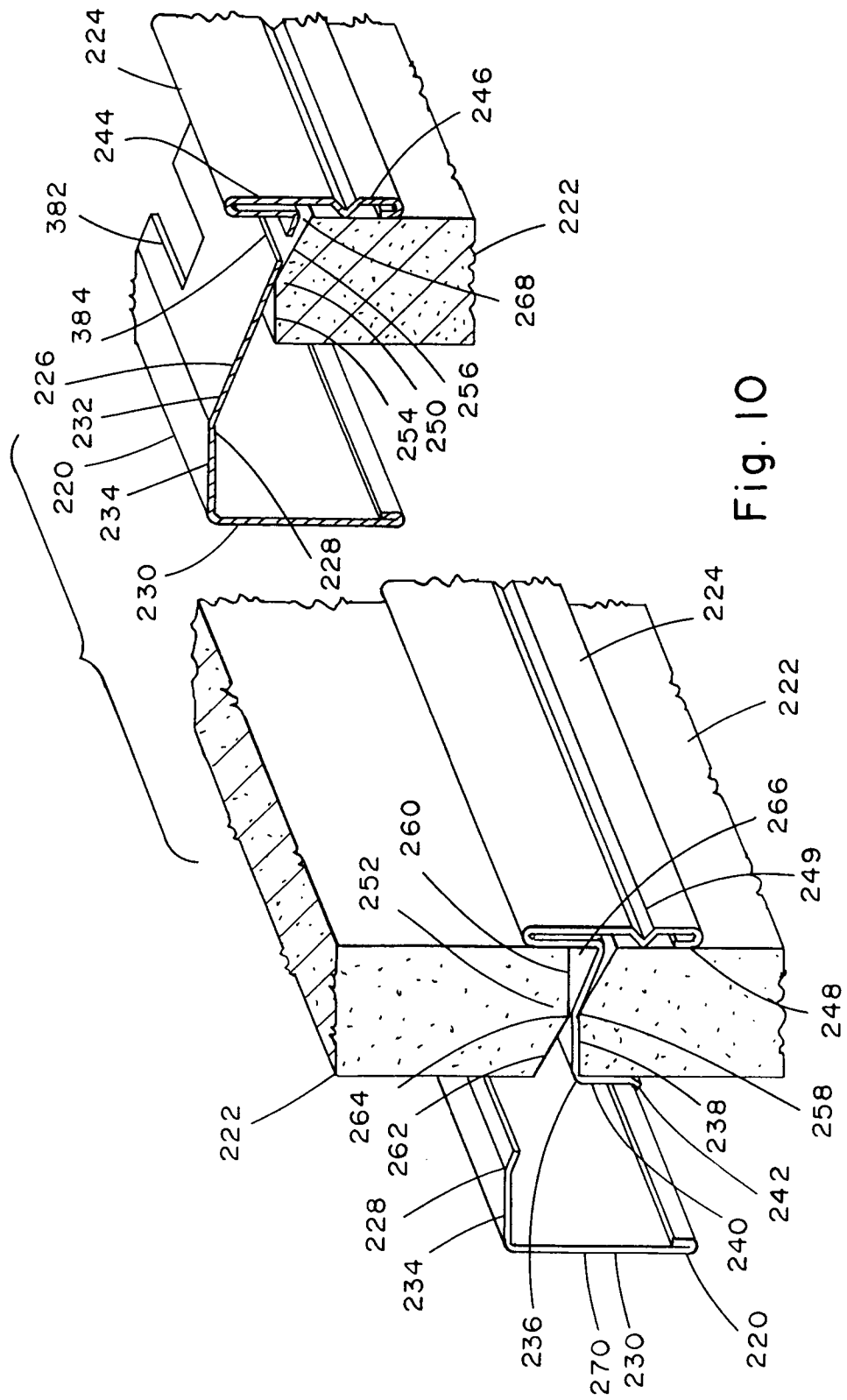


Fig. 7

Fig. 8







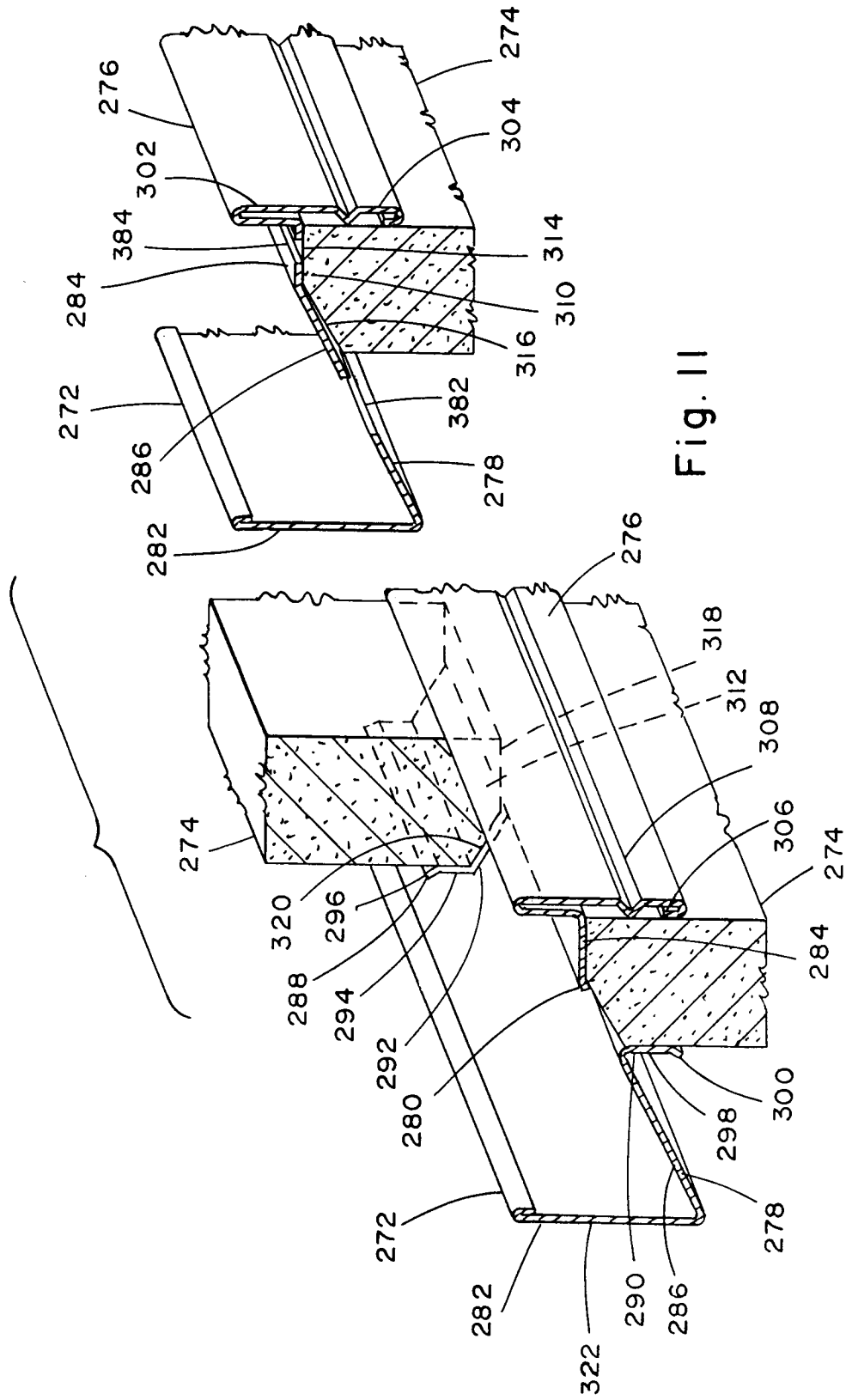


Fig. II

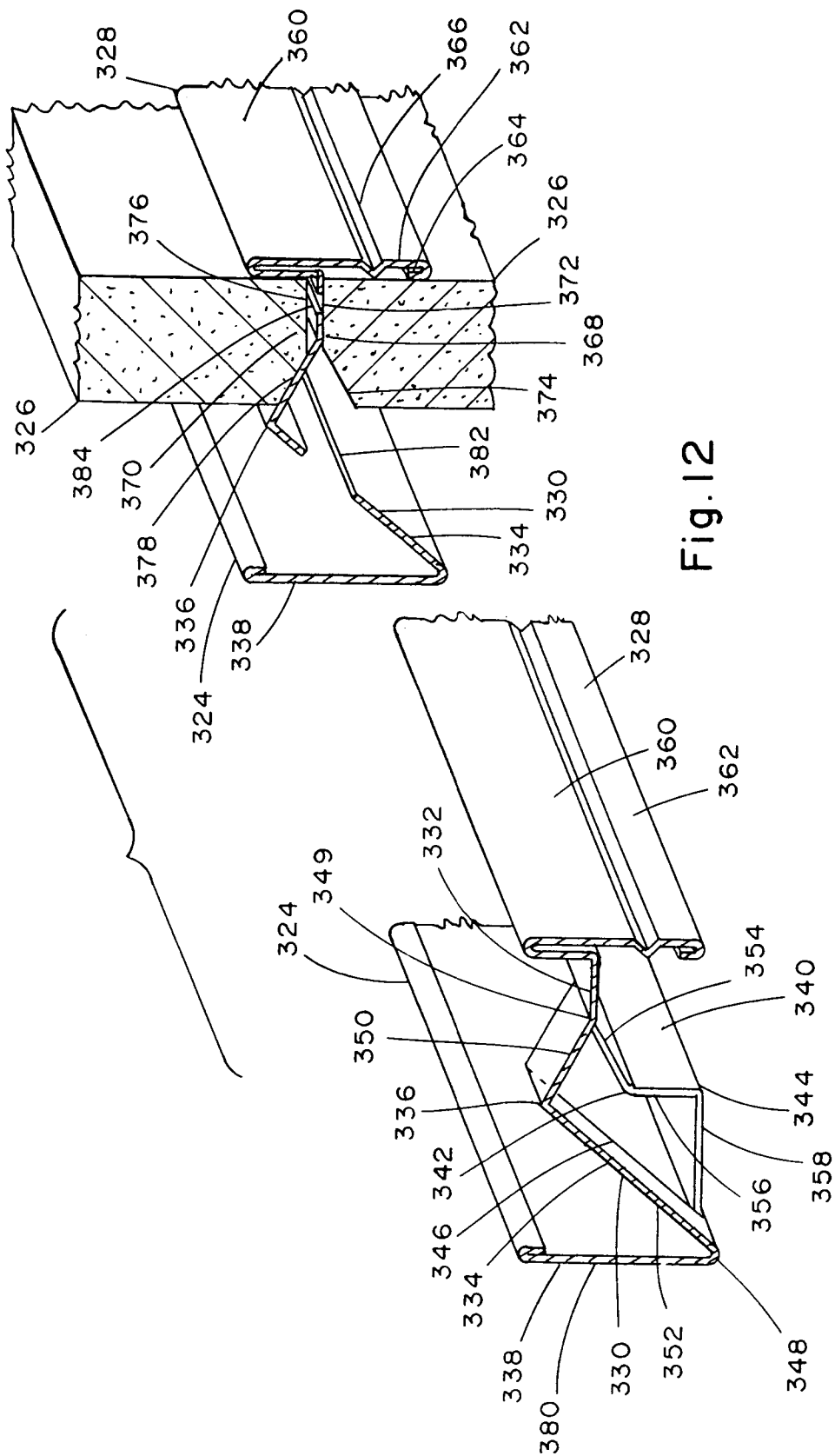


Fig. 12



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 30 2113

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-4 074 486 (GEARSON) * the whole document *	1	E04B2/74 E04B1/94 E04F13/08 E04F17/00
A,D	US-A-4 353 192 (PEARSON ET AL.) ---		
A,D	US-A-3 740 912 (SAUER ET AL.) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E04B E04F E04H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 JUNE 1993	Examiner CLASING M.F.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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