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H. R. SPENCER

2,736,399

WALL STRUCTURE

Filed May 2, 1950

2 Sheets-Sheet 1

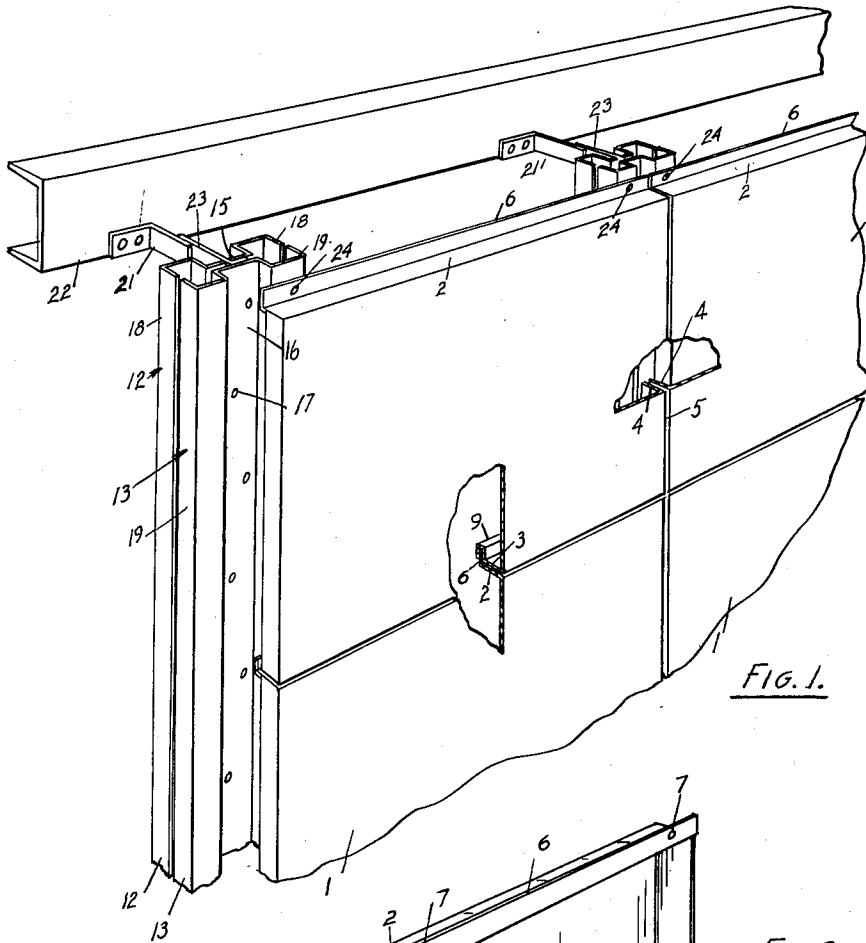


FIG. 1.

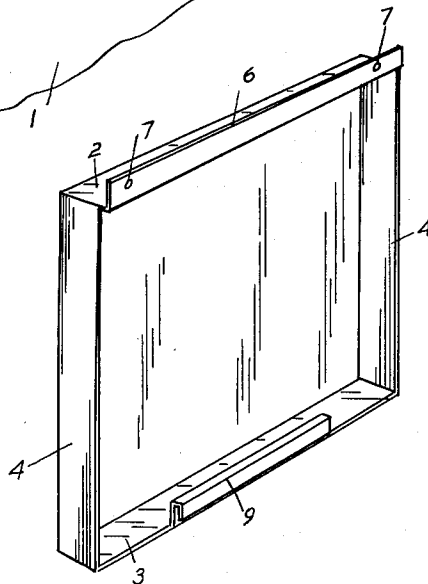


FIG. 2.

INVENTOR.
Herbert R. Spencer
BY
Ralph Hammar
Attorney

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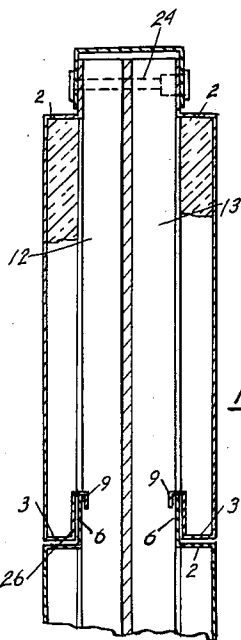


FIG. 5.

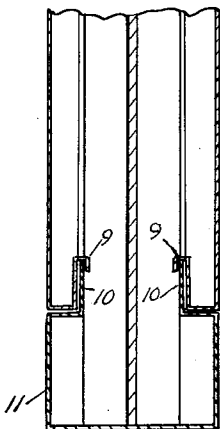


FIG. 6.

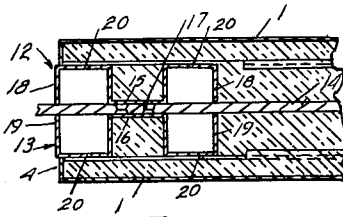


FIG. 3.

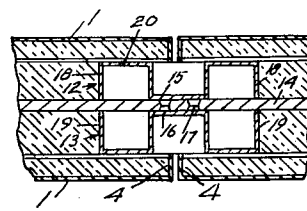


FIG. 4.

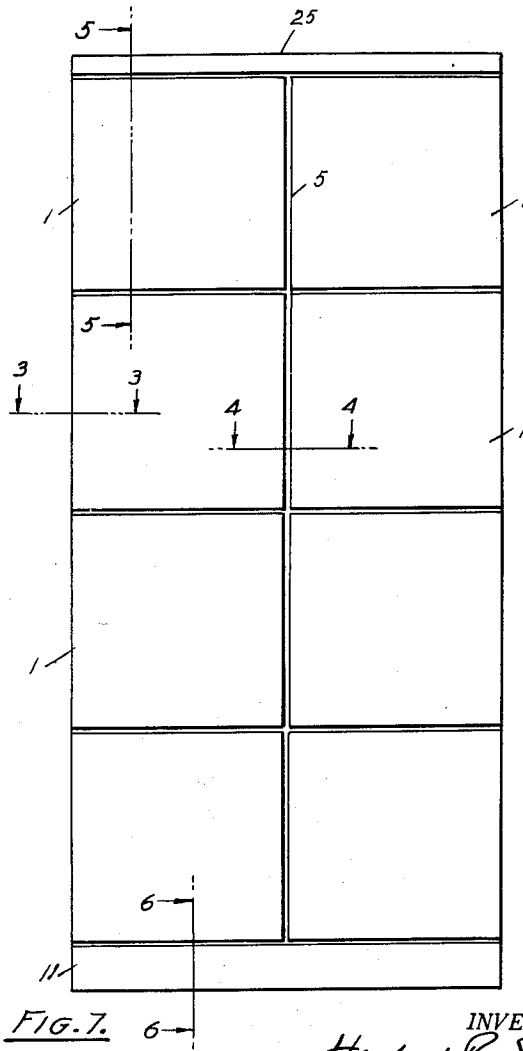


FIG. 7.

INVENTOR.
Herbert R. Spencer
BY
Ralph H. Hennessey
Attorney

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2,736,399

WALL STRUCTURE

Herbert R. Spencer, Erie, Pa., assignor to The Erie Enameling Company, Erie, Pa., a corporation of Pennsylvania

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6 Claims. (Cl. 189—34)

This invention is intended to provide a curtain wall which will meet the building code standards and can replace masonry and stone wall construction. In a preferred form the wall consists of metal panels (forming the inner and outer wall surfaces) which are fastened to metal studs, constructed so as to provide a minimum of metal to metal contact between the inner and outer panels. The panels can be made light enough to permit erection without scaffolding and can be insulated by poured insulation either wet (light weight concrete), or dry (vermiculite or rock wool). The wall is thinner than masonry walls of equivalent fire resistance, thereby increasing the usable floor space. Further objects and advantages appear in the specification and claims.

In the drawings, Fig. 1 is a perspective partly broken away of a partially completed curtain wall; Fig. 2 is a perspective of one of the metal panels; Fig. 3 is a section on line 3—3 of Fig. 7; Fig. 4 is a section on line 4—4 of Fig. 7; Fig. 5 is a section on line 5—5 of Fig. 7; Fig. 6 is a section on line 6—6 of Fig. 7; and Fig. 7 is an elevation of part of a wall.

As shown in Figs. 1 and 7 of the drawings, the completed wall comprises a series of panels 1 or wall surface elements which may be made of fire resistant material such as porcelain enameled steel or stainless steel. Each of the panels is conveniently made in the form of a rectangular pan with top and bottom edges 2 and 3 and side edges 4 extending rearwardly from the front or exposed face of the panel. Upon erection to form the completed wall the edges 2, 3 and 4 of adjacent panels are slightly spaced apart to provide joints 5 which can be caulked. Both the inner and outer wall surfaces may be formed of the same type of panel. Extending upwardly from the top inner edge 2 of each panel is a flange 6 provided with suitably spaced bolt holes 7 by means of which the panel is attached to the framing. The flange 6 is offset to the rear of the edges 2, 3 and 4 as shown more clearly in Fig. 2. Extending upwardly from the bottom inner edge of each panel is a flange 8 terminating in a hook 9 which either hooks over the flange 6 on the panel beneath it or hooks over a flange 10 on a starting member 11. In the completed wall, the panels are erected shingle fashion and are fastened only at the top flanges 6.

The framing for supporting the panels, as shown more clearly in Fig. 1 and Figs. 3 to 6 inclusive, comprises hollow vertical studs fabricated from sheet metal members, porcelain enameled for rust protection, 12 and 13 which are spaced apart over the greater portion of their length either by an air space or by a sheet of insulating board such as asbestos board or plaster board 14 sandwiched between the members 12 and 13. The members 12 and 13 have webs 15 and 16 arranged back to back and slightly spaced apart and provided with aligned spot-welding dimples or projections 17 which as shown in Fig. 1 are staggered along the length of the webs. Upon spot-welding of the projections 17, the stud members 12 and 13 are rigidly joined with a minimum of through

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metal contact between the members. At each side of the webs 15 and 16 the stud members 12 and 13 are provided with vertical channels 18 and 19 arranged face to face. The channels are symmetrical and each have webs 20 the outer surface of which serve as bolting or attaching surfaces for the panels 1. From one aspect, the studs consist of vertical channel sections, the central channel sections which include the webs 15 and 16 being arranged back to back and the channel sections on each side which include the webs 20 being arranged face to face.

The studs formed by the members 12 and 13 extend either from beam to beam or from window to window depending upon the framing of the building. The studs are not intended to carry any of the structural load of the building but are merely intended to support the wall formed by the panels 1, including, of course, any window frames and sash or door forming part of the wall. A convenient structure for supporting the studs comprises brackets 21 attached by bolting or welding to the structural steel framework 22 of the building and hanger lugs 23 welded or suitably attached to the web 15 of the inner stud member 12, that is the stud member to which the panels forming the inner wall surface of the building are attached. The hangers support the studs and sustain the weight of the wall panels and wind loads but do not carry any of the building loads. The wall construction is accordingly of the type known as "curtain wall" construction in that the wall does not form part of the structural framing of the building.

The panels 1 are attached to the studs by through attachments or bolts 24 which extend through the webs 20 and clamp the flanges 6 of the panels 1 against the webs. Through-bolts 24 provide through metal contact between the webs 20 but since this metal contact is only at two points on each of the panels, there is insufficient heat conduction to cause failure under the standard building code fire tests.

In the erection, panels 1 are laid shingle fashion from the bottom toward the top, each pair of inner and outer wall surface panels being bolted by the through-bolts 24 through its top flange 6. The result is a curtain wall structure in which the panels 1 form both the inner and outer surfaces of the wall and are rigidly bolted to the studs which sustain the panels. It will be noted that all of the joints 5 which are to be caulked are backed either by one of the flanges 6 or by one of the webs 20 so the caulking material will not push through the joints. After each section of the wall is erected loose insulation, such as vermiculite, may be poured between the panels and within the hollow studding. If the building construction is such that an upper edge of the curtain wall is to be exposed to the weather, a cap member 25 may be bolted to the top edge of the wall at the same time that the last of the wall panels are bolted in place. Whether the cap member 25 is needed depends upon the design of the buildings and not upon the wall construction.

The curtain wall construction is adapted to single and multi-story buildings. Since the curtain walls do not carry any of the building loads but are merely called upon to withstand wind loads, the height of the building is immaterial in so far as the use of this wall structure is concerned.

The curtain wall structure can easily be erected without scaffolding provided the individual wall panels 1 are kept to a size which can be handled by one man. This is a desirable feature since both the inner and outer wall surfaces can be erected from the inside of the building, thereby materially reducing erection costs.

The staggered metal joints provided by the spot-welds 17 and the through bolts 24 provide the only through-

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metal conduction between the panels. The spot-welds are located remote from the points of attachment between the individual panels and the studs and an indirect heat transfer path is provided from the inner to the outer wall surfaces.

Throughout the wall through metal conduction is either eliminated or confined to an indirect path so heat cannot be transmitted directly through the wall. As previously described, the only through metal conduction in the studs is at the spot-welded projections 17. These projections are located at the center of the webs 15 and 16, a substantial distance from the inner and outer wall surfaces and are protected from direct heat transfer by the insulation fill. Staggering of the projections 17 keeps the through metal conduction to a minimum consistent with the necessary mechanical strength of the studs. Heat transfer between the members 12 and 13, which form the hollow studs is prevented by the insulating board 14 and by the insulation fill within the studs. The through bolts 24 which attach the panels to the studs are protected from direct heat by the over-hanging bottom edge of the panels above each of the bolts. It will be noted that there is an insulation fill between each end of the bolts 24 and the exposed wall surface. Also, the edges 3 and 4 are spaced from the flanges 6 as indicated at 26 in Fig. 5, so the heat transfer from the panel above each bolt must follow an indirect path through the hooks 9. The only direct heat transfer path to any bolt 24 is through the top edge 2 to the flange 6 through which the bolt extends. The only heat transfer path from the wall to the framing structure of the building is through the hangers 23 which are attached to the webs 15 and are protected from direct heat by the insulation fill. Not only is the through conduction of heat kept below the value causing failure in fire but the studs are kept cool enough so the wall can withstand the high pressure water streams.

What I claim as new is:

1. In a fire resistant wall construction having inner and outer wall surface elements, one of which comprises a plurality of metal panels having attaching parts spaced inward toward the center of the wall from the portion of the panels forming wall surfaces, vertical studs for supporting said wall surface elements comprising opposed spaced inner and outer metal members, a sheet of insulating board sandwiched between the members and preventing direct metallic heat transfer between the major portion of the area of the members, said members having opposed webs on opposite sides of the insulating board, aligned pairs of dimples extending from the opposed webs through the insulating board and spot welded to each other, said pairs of dimples being spaced along the length of the studs and occupying a minor portion of the area of the webs, said inner and outer members having opposed vertical channels offset from the center of the wall respectively toward but short of the inner and outer wall surfaces, said channels being arranged face to face and spaced from each other by the insulating board and having attaching surfaces on the outer surfaces of the channels, connections between the attaching parts of the panels and the attaching surfaces of the studs, and insulation interposed between the portions of the panels forming the wall surfaces and the attaching surfaces of the studs.

2. In a fire resistant construction for a wall having inner and outer wall surfaces, hollow vertical studs comprising inner and outer metal members spaced apart over the greater portion of their length, said members having spaced opposed webs arranged back to back at the center of the wall and spaced out of direct metal contact except where joined through aligned pairs of spot welded dimples extending toward each other from the opposed webs, said pairs of dimples being spaced along the length of the studs and occupying a minor portion of the area of the webs, said inner and outer metal members having a pair of vertical channels at one side of the webs spaced apart from

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each other and offset respectively toward but short of the inner and outer wall surfaces of the wall, said channels being arranged face to face and spaced from each other and having attaching surfaces on the outer surfaces of the channels, metal panels having portions forming one of the inner and outer wall surfaces, said panels having attaching parts spaced from the edges of the portions of the panels forming the wall surfaces and spaced inward toward the center of the wall from the portions of the panels forming wall surfaces, connections between the attaching parts of the panels and the attaching surfaces of the studs, and insulation interposed between the portions of the panels forming wall surfaces and the attaching surfaces of the studs.

3. In a fire resistant construction for a wall having inner and outer wall surfaces, vertical studs comprising spaced inner and outer metal members, a sheet of insulating board sandwiched between these members and preventing direct heat transfer over the greater part of the studs, said members having opposed webs on opposite sides of the insulating board, aligned pairs of dimples extending from the opposed webs through the insulating board and spot welded to each other, said pairs of dimples being spaced along the length of the studs and occupying a minor portion of the area of the webs, vertical channels on said members offset from the webs respectively toward but short of the inner and outer wall surfaces and providing attaching surfaces, metal panels forming one of the inner and outer wall surfaces, said panels having attaching parts spaced inward toward the center of the wall from the portions of the panels forming wall surfaces, connections between the attaching parts of the panels and the attaching surfaces of the studs, and insulation interposed between the portions of the panels forming the wall surfaces and the attaching surfaces of the studs.

4. A fire resistant construction for a wall having inner and outer wall surfaces, comprising metal panels having portions providing one of the inner and outer wall surfaces, and having attaching parts spaced inward toward the center of the wall from the portions of the panels forming the wall surfaces, vertical studs comprising inner and outer metal members having opposed webs arranged back to back at the center of the wall and spaced out of direct metal contact except where joined through aligned pairs of spot welded dimples extending toward each other from the opposed webs, said pairs of dimples being spaced along the length of the studs and occupying a minor portion of the area of the webs, said inner and outer metal members each having a pair of attaching surfaces offset from the center of the wall respectively toward but short of the inner and outer wall surfaces, through bolts extending through said attaching surfaces and the attaching parts of the panels and insulation interposed between the portions of the panels forming the wall surfaces and the attaching surfaces of the studs.

5. In a fire resistant metal panel wall construction having inner and outer wall surfaces, vertical studs arranged between and in spaced relation to the inner and outer wall surfaces comprising inner and outer metal members having opposed webs at the center of the wall arranged back to back at the center of the wall and spaced out of direct metal contact except where joined through aligned pairs of spot welded dimples extending toward each other from the opposed webs, said pairs of dimples being spaced along the length of the studs and occupying a minor portion of the area of the webs, said inner and outer members each having a pair of attaching surfaces offset from the center of the wall respectively toward but short of the inner and outer wall surfaces, metal panels forming one of the inner and outer wall surfaces, said panels having attaching flanges offset inwardly from said one wall surface and attached to the attaching surfaces of the studs, and insulation interposed between the panel wall surfaces and the attaching surfaces.

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6. A fire resistant construction for a wall having inner and outer wall surfaces comprising adjacent metal panels having vertical and horizontal joints therebetween, said panels having portions forming wall surfaces for one of the inner and outer surfaces of the wall and having attaching parts spaced from the vertical and horizontal joints and spaced inward from the portions forming wall surfaces, hollow vertical studs comprising inner and outer metal members spaced apart over the greater portion of their length, said members having spaced opposed webs arranged back to back at the center of the wall and spaced out of direct metal contact except where joined through aligned pairs of spot welded dimples extending toward each other from the opposed webs, said pairs of dimples being spaced along the length of the studs and occupying a minor portion of the area of the webs, said inner and outer metal members each having a pair of vertical channels at one side of the webs spaced apart from each other and offset respectively toward but short of the inner and outer surfaces of the wall, said channels being arranged face to face and having attaching surfaces on the outer surface of the channels, the studs being recessed inward from the attaching surfaces and toward the center of the wall opposite the vertical joints between adjacent panels,

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bolts attaching the attaching parts of the panels to said attaching surfaces, and insulation interposed between the panels and the recessed portion of the studs.

References Cited in the file of this patent

UNITED STATES PATENTS

1,417,102	Nyman et al. -----	May 23, 1922
1,700,512	Pedersen -----	Jan. 29, 1929
1,990,259	Walters -----	Feb. 5, 1935
2,049,278	Toussaint et al. -----	July 28, 1936
2,076,388	Venzie -----	Apr. 6, 1937
2,086,571	Novambere -----	July 13, 1937
2,114,155	Streich -----	Apr. 12, 1938
2,117,397	Bonsall -----	May 17, 1938
2,128,797	Bohnsack -----	Aug. 30, 1938
2,363,164	Waller -----	Nov. 21, 1944
2,508,032	Kennedy -----	May 16, 1950

OTHER REFERENCES

"Pennsylvania Turnpike" in American Builder, April 1951, page 158.

"Housed in Steel," Popular Science, March 1947, page 125.