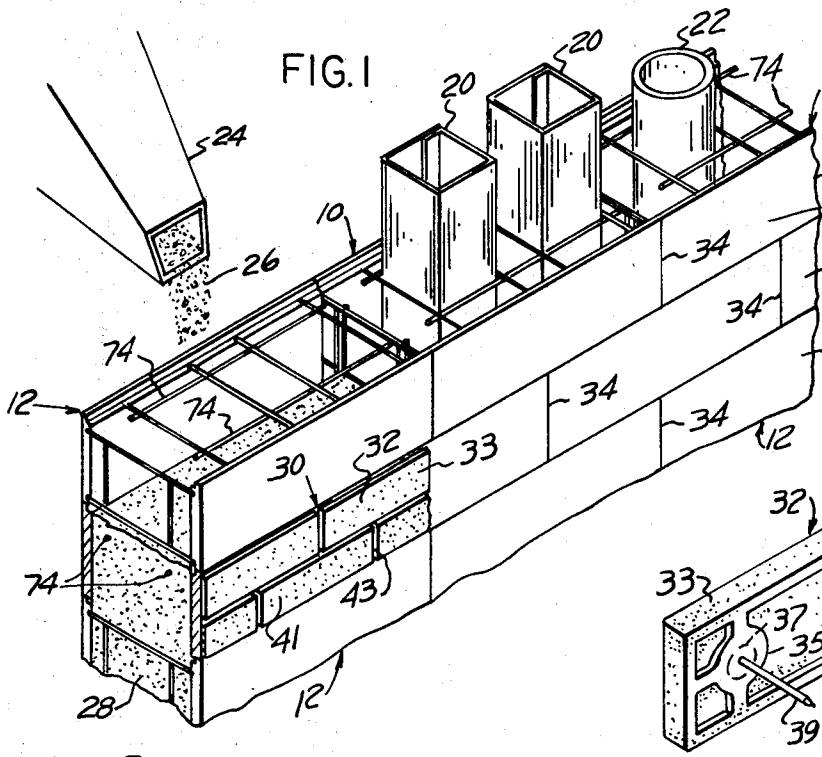
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BUILDING WALL CONSTRUCTION AND MODULE THEREFOR

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FIG. 1



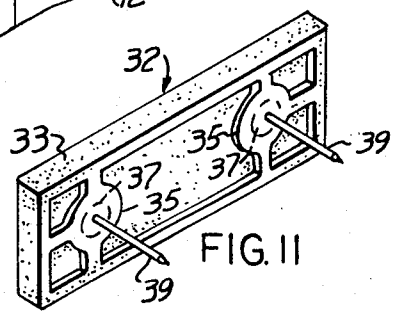
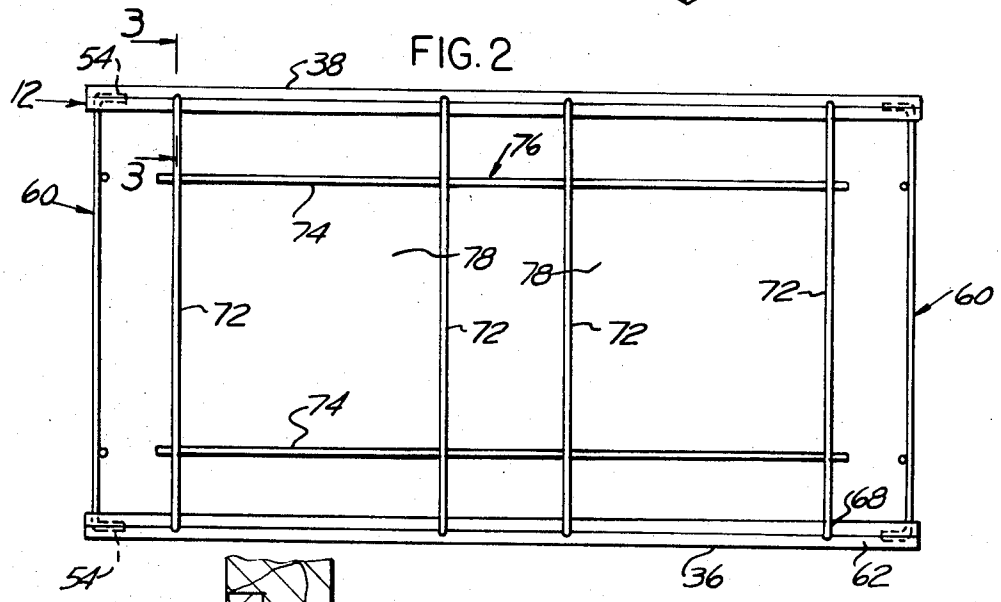


FIG. 11

FIG. 2



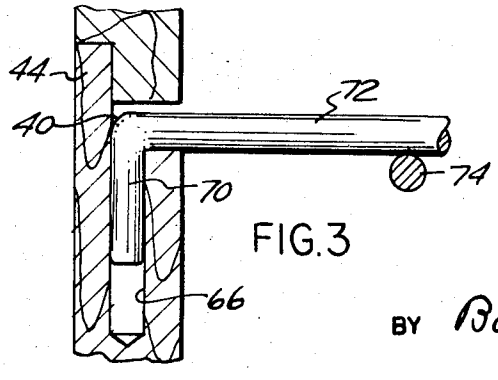


FIG. 3

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FIG. 4

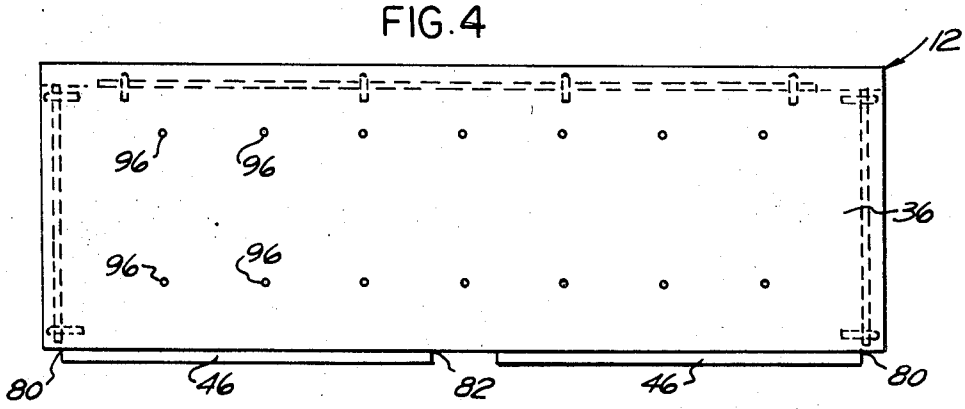


FIG. 5

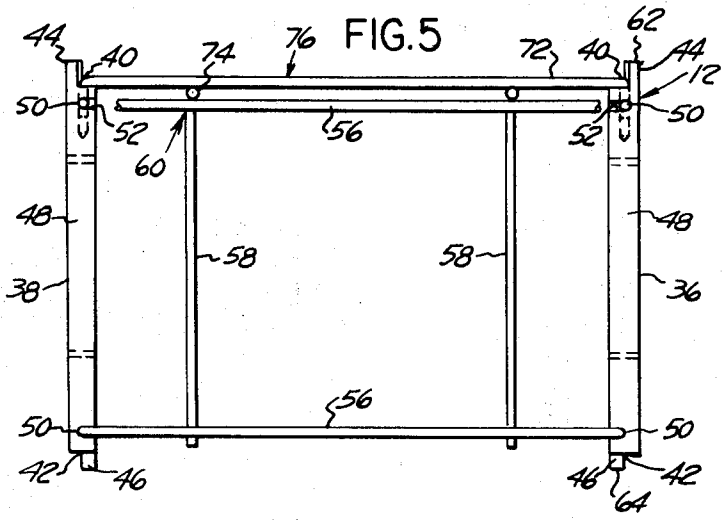


FIG. 6

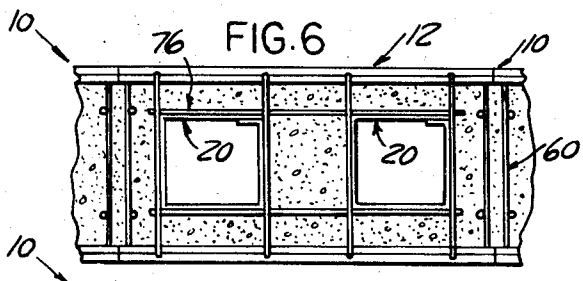


FIG. 8

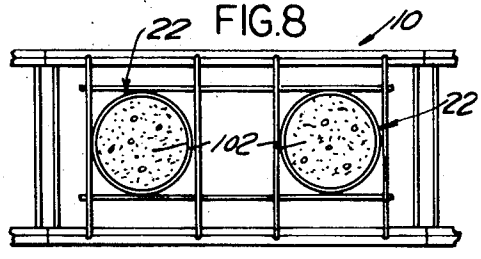


FIG. 7

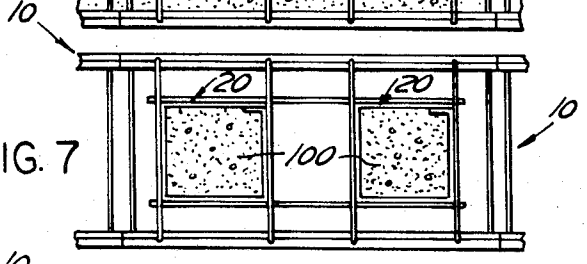


FIG. 10

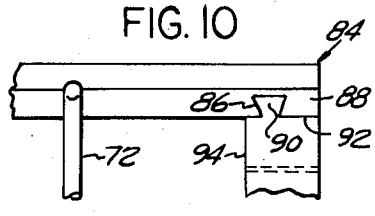
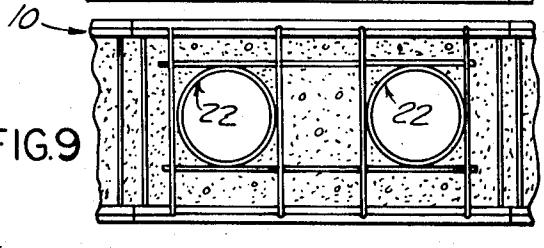


FIG. 9



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FIG. 12

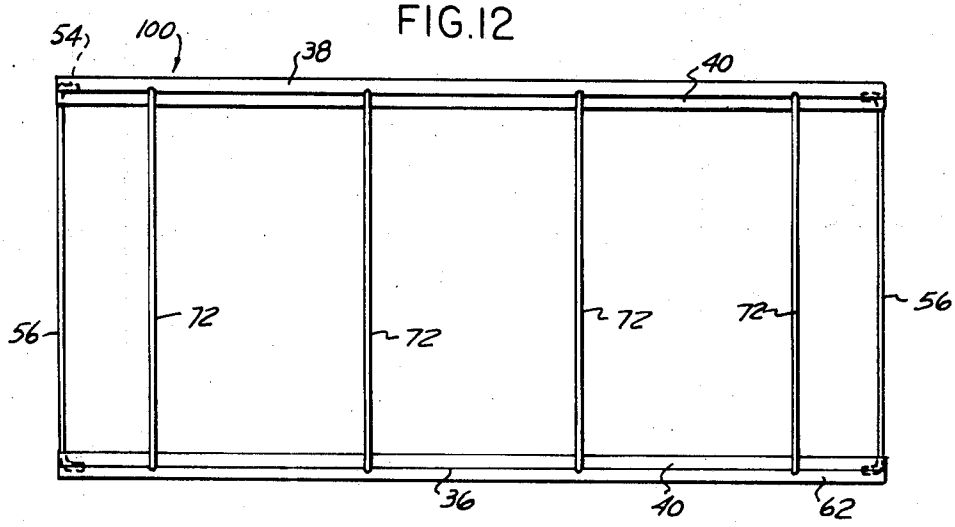


FIG. 13

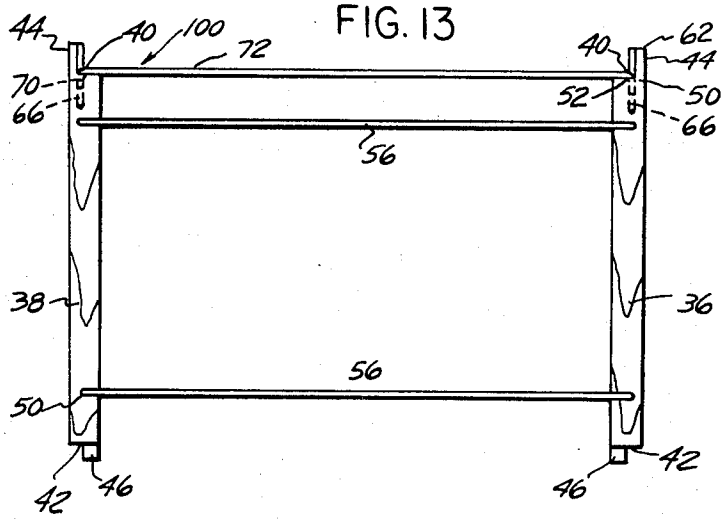
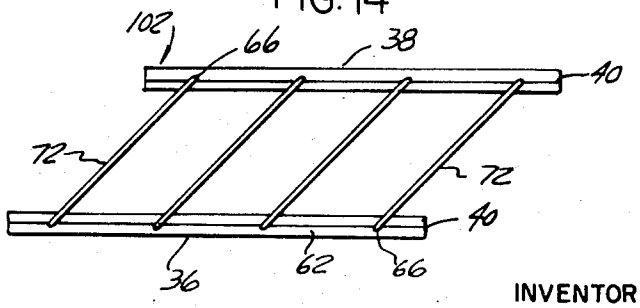


FIG. 14



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3,562,991

BUILDING WALL CONSTRUCTION AND MODULE THEREFOR

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Int. Cl. E04b 2/32; E04f 13/18
U.S. Cl. 52—564 5 Claims

ABSTRACT OF THE DISCLOSURE

Interfitting structural modules are built up in overlapping courses or tiers on a horizontal foundation into the desired building wall formation and either used as such or as a form assembly into which concrete is poured. Each module includes a pair of laterally-spaced elongated parallel vertical panels interconnected at their tops and ends by wire grating spacers into the interstices of which are optionally inserted vertical tubular members of either round or square cross-section. These serve as conduits for heating, ventilation, plumbing or electric wiring when concrete is poured around them, or as columns when filled with concrete. The panels and wire grating spacers are capable of being transported and packed in knocked down form and assembled either at the building contractor's establishment or at the building site. Each module has longitudinal edge rabbets which interlock with one another at the joints between successive courses or tiers. The outer panels are optionally provided with spaced holes which receive pegs or pins, the heads of which are embedded in rectangular face-brick-simulating plates. The open ends of the end modules in the wall construction are closed by end closure panels inserted in grooves in the elongated parallel side panels. A simplified module (FIGS. 12 and 13) omits the longitudinal rods of the top spacers and also the vertical rods of the end spacers and uses simple tie rods with perpendicularly-bent ends entering holes in the top and ends of the panels. A still further simplified module (FIG. 14) omits the end tie rods or spacers of FIGS. 12 and 13, retaining only the top spacers, and resulting in a module which can be folded flat for storage or shipment, with the end rods added at the building site, or used without the end rods in the oblique arrangement of FIG. 14 which enables the wall thickness to be varied as desired.

In the drawings:

FIG. 1 is a top perspective view of a section of a building wall construction built up of structural modules according to one form of the invention, showing a filling spout from which concrete is being poured;

FIG. 2 is a top plan view on an enlarged scale of one of the structural modules;

FIG. 3 is a fragmentary section on a still further enlarged scale taken along the line 3—3 in FIG. 2;

FIG. 4 is a front elevation of the module shown in FIG. 3;

FIG. 5 is a left-hand end elevation thereof, with the opposite ends of an upper rod broken away to disclose the construction behind them;

FIG. 6 is a top plan view, upon a reduced scale, of a portion of a wall construction with the modules filled solidly with concrete up to the level of the topmost spacer;

FIG. 7 is a top plan view similar to FIG. 6 but with tubular members of rectangular shape inserted in interstices of the spacers and filled with concrete to form columns, the remainder of the wall structure being empty;

FIG. 8 is a top plan view similar to FIG. 7 but using tubular members of circular cross-section filled with concrete to form columns;

FIG. 9 is a top plan view similar to FIG. 6 but with empty tubular members of circular cross-section inserted in the interstices of the spacers to form conduits and surrounded by poured concrete;

FIG. 10 is a fragmentary top plan view of the corner portion of one of the end modules of a course or tier equipped with an end closure panel having dovetail ribs inserted in dovetail grooves thereof;

FIG. 11 is a rear perspective view of a face-brick-simulating plate.

FIG. 12 is a top plan view of a simplified building structure module using cross rods without longitudinal rods;

FIG. 13 is an end elevation of FIG. 12; and

FIG. 14 is a top plan view, upon a reduced scale, of a still further simplified building structure module wherein the end spacing rods have been omitted.

Referring to the drawings in detail, FIG. 1 shows a building wall construction, generally designated **10**, composed of interfitting building wall structural modules **12** arranged in alternately offset or staggered or overlapping-joint courses or tiers **14**, **16** and **18**, it being understood that more than three courses or tiers are employed in the usual building wall construction. Optionally inserted in interstices of the modules **14**, as explained more fully below, are tubular members **20** of rectangular cross-section or tubular members **22** of circular cross-section formed from any suitable material, such as plain or corrugated cardboard, plastic or metal. Shown diagrammatically above the building wall construction **10** is the pouring spout **24** of a concrete mixer (not shown) in the act of pouring a stream **26** of concrete **28** into the individual modules **12** which make up the building wall construction **10**. An optional simulated brick facing **30** composed of individual overlapping-joint rectangular brick-simulating facing plates **32** (FIG. 11) can be used. Each such plate **32** is of the size of a standard face brick, with a body **33** of moldable material such as synthetic plastic or ceramic material with reinforcement ribs **31** connecting bosses **35** in which the heads **37** of pins or pegs **39** are embedded. The joints **34** are staggered or offset in alternate courses or tiers. Such a plate is disclosed and claimed in my co-pending application Ser. No. 777,930 filed Aug. 2, 1968 for Siding Brick.

Each module **12** includes a pair of rectangular front and rear panels **36** and **38** respectively (FIGS. 2 to 5 inclusive) formed of plywood or other suitable material and having at their upper longitudinal edges inwardly-facing upper longitudinal rabbets **40** and at their lower edges outwardly-facing lower longitudinal rabbets **42** (FIG. 5). The upper rabbets **40** provide upper longitudinal ribs **44** projecting upward from the outer surfaces of the panels **36** and **38** whereas the lower rabbets **42** provide lower longitudinal ribs **46** projecting downward from the inner surfaces of the panels **36** and **38**. These rabbets **40** and **42**

and their corresponding ribs **44** and **46** interlock with the corresponding rabbets and ribs of other modules **12** in courses or tiers above and below them, as shown at the left-hand end of FIG. 1.

The opposite ends **48** of the outer and inner panels **36** and **38** are provided near their top and bottom ribs **44** and **46** with longitudinally-extending holes **50** (FIG. 5) having horizontal grooves **52** extending laterally inward to the inner surfaces of the panels **36** and **38**. Seated in these holes **50** are the perpendicularly-bent ends **54** of the upper and lower horizontal rods **56** interconnected by vertical tie rods **58** spot-welded or otherwise secured thereto and collectively constituting end spacers, generally designated **60** (FIG. 5). These end spacers **60**, as their name signifies, tie together and space the opposite ends of the front and rear panels **36** and **38** while the grooves **52** countersink the horizontal rods **56** so that the end spacers **60** do not project beyond the ends **48**, and hence do not interfere with adjacent ends **48** of adjacent panels **36** and **38** abutting them.

In a similar manner, the top edges or surfaces **62** of the panels **36** and **38** are provided with longitudinally-spaced vertical holes **66** (FIG. 3) and grooves **68** extending inward toward one another (FIG. 2). Seated in the vertical holes **66** are the downwardly-bent perpendicular ends **70** of four cross rods **72** which on their under sides are joined by longitudinal rods **74** spot-welded or otherwise secured thereto and collectively constituting a top spacer, generally designated **76**. The cross rods **72** are so spaced relatively to one another and to the longitudinal rods **74** as to form a pair of square openings **78** which alternatively and optionally receive either the tubular members **20** of square cross-section or the tubular members **22** of circular cross-section (FIGS. 1 and 7 to 9 inclusive). Thus, the panels **36** and **38** are interconnected at their opposite ends by end spacers **60** and at their tops by the spacers **76**, the bottoms being left open.

For the purpose of joining the building wall construction **10** with a wall construction **10** extending perpendicularly thereto, as at a corner, the front and rear panels **36** and **38** are provided with corner notches **80** (FIG. 4) and intermediate notch openings **82** in the bottom ribs **46**. The corner notch **80** in the module **12** located at an intended corner of the building and the intermediate notch opening **82** thereof respectively receive the upper edge portion near the end of the panels **36** and **38** of the module **12** of the wall structure **10** perpendicular thereto. To close the otherwise open ends, certain corner modules **84** (FIG. 10) are provided with vertical dovetail grooves **86** in the inner sides of the panels **88** corresponding to the panels **36** and **38**. Slidably received within the dovetail grooves **86** are correspondingly-shaped vertical dovetail ribs **90** formed on the opposite ends **92** of end closure panels **94**.

The front panels **36** (FIG. 4) are provided with vertically-spaced pairs of holes **96** which are adapted to receive the pins **39**, the heads **37** of which are embedded in the bodies **33** of the elongated brick-simulating plates **32**, as stated above.

In the use of the invention, let it be assumed that the building wall or structural modules **12** have been assembled in sufficient numbers, either at the contractors' workshop or at the building site, by mounting the perpendicularly-bent ends **54** of the horizontal rods **56** of the end spacers **60** in their respective holes **50** and countersunk below the end surfaces **48** in the grooves **52** (FIGS. 2 and 5). Let it also be assumed that the top spacers **76** have been similarly assembled with their perpendicularly-bent ends **70** inserted in the vertical holes **66** and horizontal grooves **68** (FIG. 3). Let it further be assumed that a sufficient number of the end modules **84** have been similarly assembled, with the exception of the fact that one of the end spacers **60** has been replaced by the end closure panel **94** with its dovetail tongues **90** inserted in the dovetail grooves **86** thereof. Let it finally be assumed that a sufficiently stable horizontal foundation has been provided, such as the conventional poured concrete footings for ordinary buildings. If any of the tubular members **20** or **22** are to be employed, these are also assembled or provided at the building site. It is assumed, of course, that if concrete is to be employed in the building structure, a suitable supply will be at hand at the proper moment.

The carpenter, mason or other workman designated to lay up the structure, places the lowermost row of structural modules **12** upon the footings in an end-to-end arrangement, with an end module **84** mounted at each end of the footing in perpendicular relationship thereto for starting the lowermost courses **14** on the perpendicular footing for the walls at right angles to the initial wall structure. The workman lays up the second course **16** with the midpoints of the modules **12** thereof aligned with the joints **34** in the lowermost course **14**, with the ends provided, as before, with corner modules **84** where necessary. The workman then lays up the third course or tier **18** with the joints **34** aligned with the joints **34** of the first course **14**, such as by the use of a plumb line. When this is properly done, the openings **78** will be aligned vertically but, of course, in alternating succession from the bottom tier through the second tier, through the third tier, and so forth. In other words, the right-hand opening **78** of the second tier **16** will align with the left-hand opening **78** of the first tier **14**, whereas the openings **78** of the third tier **18** will align with their corresponding openings **78** in the first tier **14**. If either the tubular members **20** of square cross-section or the tubular members **22** of circular cross-section are to be used, these are inserted from above through the openings **78** wherever it is desired to place them.

If the building to be constructed is for temporary or light duty purposes, and the wall construction **10** a non-load-bearing one, the concrete filling or core thereof may be omitted and the construction carried on tier by tier until the desired height of the walls has been obtained. For military or other temporary but somewhat stronger construction, the modules **12** of the wall construction **10** may be filled with dirt, sand, clay or, if desired, insulating material, such as fibrous glass, foam plastic or rock wool. The roof construction then follows in a conventional manner.

If, on the other hand, a concrete filling is to be employed, the wall **10** is built up tier by tier in the above-described manner until three, four or five tiers have been so erected. The concrete mixer is then set in operation and its spout **24**, or in lieu thereof a suitable concrete delivery hose (not shown) is positioned over the previously-assembled wall construction **10** and concrete is poured in the stream **26** into the interior of the wall construction **10**. The number of tiers or courses **14**, **16** or **18** poured at a single time is limited by the fact that if too many tiers are erected, the weight of the concrete is liable to burst the modules **12** by forcing the side panels **36** and **38** apart from one another and rupturing the connections between them and their respective end spacers **60** and top spacers **76**. If no tubular members **20** or **22** are used, the solidly-filled wall construction **10** has the appearance shown at the left-hand end of FIG. 1 when it is filled to the top thereof.

If, on the other hand, the tubular members **20** of square or other rectangular cross-section are used, the wall construction **10** has the appearance shown in FIG. 6 when looking down upon it from above. Where tubular members **22** are used, in a similar manner, the building wall construction **10** has the appearance in top plan view shown in FIG. 9. If, however, a hollow wall construction is to be employed and reinforced by concrete stanchions or posts, the concrete is poured only into the tubular members **20** of rectangular cross-section (FIG.

7) or into the tubular members **22** of circular cross-section (FIG. 8). The concrete-filled tubular members **20** or **22** of FIGS. 7 and 8 thus provide vertical concrete posts or stanchions **100** or **102** respectively of rectangular or circular cross-section.

If the wall construction **10** is to posses an external appearance simulating brick, the workman installs the brick facing **30** by inserting the pairs of pins **39** of each plate body **33** into the holes **96**, staggering the successive courses or tiers thereof so that they overlap one another as shown in FIG. 1. The brick-simulating plates **32** are of such dimensions that they leave gaps **41** and **43** between the sides and ends thereof respectively into which mortar or a simulating substance thereof can be inserted by a workman, such as by a brick mason.

After the building wall construction **10** has been erected in the manner described above, the floor, roof and window constructions follow conventional procedures. In order to provide for window and door openings, with the building wall or structural modules **12** arranged in overlapping or staggered courses, it will be evident that certain of the modules **12** adjacent the window or door opening will be of half length rather than full length so that the ends adjacent the window or door opening will be in vertical alignment.

In the foregoing specification, wherever the term "wall" or "wall construction" is used, it will be understood that this term also includes a partition. From the foregoing description it will be seen that the present invention provides a building wall construction which can be erected in less time and with comparatively semi-skilled labor than can be accomplished using presently-known materials and construction methods. As a result, the cost of construction is greatly reduced. The wall construction **10** is adaptable not only to stationary buildings but also to movable structures, such as ships or wheeled vehicles. The components of the movable wall construction are easily packed and transported in knocked-down or collapsed form and the tubular members **20** made up of flat foldable sheets along designated fold lines or grooves.

The simplified building structure module, generally designated **100**, shown in FIGS. 12 and 13 resembles the building structure module **12** of FIGS. 1 to 5 inclusive in most respects and similar parts accordingly bear the same reference numerals. In the module **100**, however, the longitudinal top rods **74** and the vertical end rods **58** have been omitted, leaving only the top cross rods **72** and the end cross rods **56**. In the building structure module **100** of FIGS. 12 and 13, it is assumed that low cost construction is involved where the tubular members **20** or **22** of FIGS. 1 and 6 to 9 inclusive are not used, hence for convenience the spacers or top cross rods **72** of FIGS. 12 and 13 are equally spaced since there is no necessity for providing large square openings for tubular members of either circular or square cross-section.

The further simplified building structure module **102** of FIG. 14 omits the end spacers or tie rods **56** of the module **100**. This omission renders the module **102** collapsible either for storage or transportation. It also serves to form a thinner building wall for a low cost structure, as well as enabling the thickness of the wall to be varied as desired. For an interior wall, for example, the panels **36** and **38** of the module **102** could be moved closer together than for an exterior wall.

The invention contemplates the use of siding bricks on either an outside or an interior wall, or both. Such bricks would be used, for example, on an interior wall of the building for a room used as a kitchen, a laboratory, a surgical operating room, a bathroom, basement workshop, recreation room or in any other location where an easily cleaned sanitary wall facing is desired.

In addition to plywood, the panels may be conveniently made of chipboard, flakeboard, press-wood, asbestos, ceramic materials or other suitable materials. Before the siding bricks are installed, a thick layer of a suitable mastic type adhesive is applied to the surface, then the siding bricks are applied and the excess mastic is squeezed into the spaces between the bricks, thus automatically creating a mortar line effect.

I claim:

1. A self-supporting building structure module for a building wall construction comprising

a vertically extending rectangular front panel,

a vertically extending rectangular rear panel disposed in a horizontally spaced parallel relationship with said front panel,

substantially rigid first spacer means extending horizontally between said front and rear panels, the ends of said first spacer means being attached respectively directly to said front and rear panels adjacent vertically adjacent longitudinal edges thereof,

projecting portions disposed on the upper and lower longitudinal edges of said front and rear panels for engagement with adjacent longitudinal edges of vertically adjacent building structure module, whereby relative forward and rearward displacement of vertically adjacent modules is prevented,

and substantially rigid second spacer means extending horizontally between and connected to said front and rear panels, the ends of said second spacer means being connected to horizontally adjacent opposing ends of said front and rear panels, said second spacer means being recessed in said ends,

said first spacer means comprising a substantially rigid wire grating structure having spaced parallel cross members with perpendicularly bent opposite ends seated in said panels and having spaced parallel longitudinal members perpendicular to and interconnecting said cross members,

said longitudinal edges of said panels having horizontally spaced holes therein with transverse grooves extending inward from said holes with said perpendicularly bent opposite ends of said first spacer means seated in said holes and with the adjacent portions of said first spacer means disposed in said grooves below said longitudinal panel edges.

2. A building structure module, according to claim **1**, wherein said members are disposed perpendicular to one another and form a plurality of rectangular openings in said horizontal spacer, and wherein a vertical tubular element of substantially the same rectangular cross-section as one of said openings is disposed in said one opening in mating engagement with the portions of said members bounding the edges of said one opening.

3. A building structure module, according to claim **1**, wherein said second spacer means comprise substantially rigid wire structures with perpendicularly-crossed members secured to one another, wherein horizontally extending ones of said members extend perpendicularly to said panels and have opposite ends seated in said panels and vertically extending ones of said members are secured to and interconnect said horizontally extending ones of said members, wherein said opposite ends of said panels have vertically spaced holes therein with transverse grooves extending inward from said holes and wherein said opposite ends of said horizontally extending members are bent perpendicular to the remainder thereof and are seated in said holes in said ends with the adjacent portions of said second spacer means disposed in said grooves behind said panel ends.

4. A building structure module, according to claim **1**, wherein one of said panels has a plurality of vertically-spaced rows of horizontally-spaced holes in one side thereof, and wherein brick-simulating plates are disposed in abutting relationship with said one panel and have pins embedded therein with shanks perpendicular to said plates seated in said holes.

5. A building structure module, according to claim **1**, wherein said projecting portions have rectangular notches

disposed at one end and at the approximate midportion thereof.

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HENRY C. SUTHERLAND, Primary Examiner

U.S. Cl. X.R.

52—380, 385, 426