United States Patent [19]

Eischen et al.

[11] **3,802,139**

[45] **Apr. 9, 1974**

[54] **BUILDING CONSTRUCTED OF VERTICAL SUPPORTS, LONGITUDINAL BASE ELEMENT, AND PANEL MEMBERS**

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[21] Appl. No.: **228,126**

[30] **Foreign Application Priority Data**

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Feb. 22, 1971	Germany	2108370
Apr. 10, 1971	Germany	2117710
Apr. 10, 1971	Germany	2117711

[52] **U.S. Cl.** **52/293,** 52/239, 52/263, 52/274, 52/297, 52/622

[51] **Int. Cl.** **E04c 2/10,** E02d 27/32

[58] **Field of Search** 52/293, 294, 296, 239, 52/169, 622, 263, 274, 457, 458, 297; 211/176, 177

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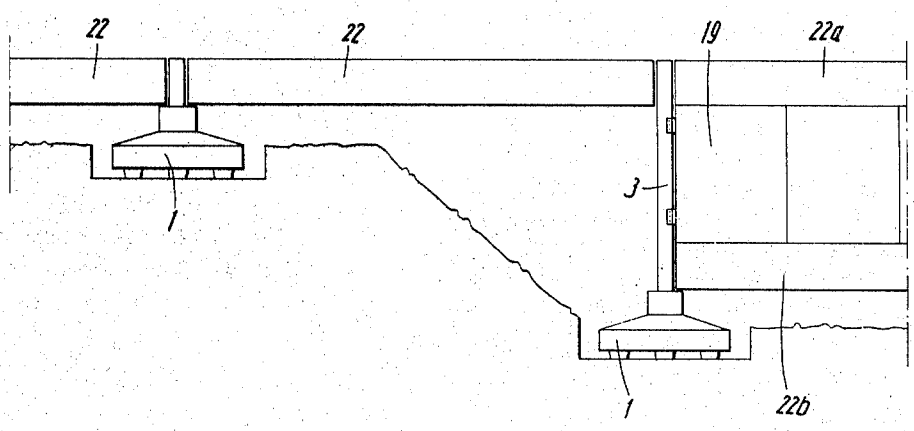
Primary Examiner—Henry C. Sutherland

Attorney, Agent, or Firm—Robert W. Beach; R. M. Van Winkle

[57] **ABSTRACT**

A building construction includes a plurality of spaced vertical supports, the supports being inter-connected by longitudinal base elements. Each support has a base made of steel reinforced concrete and supporting plate-like wall elements consisting of a composite of layers including magnesite mortar bonded wood chip, rock wool and asbestos cement layers.

1 Claim, 18 Drawing Figures



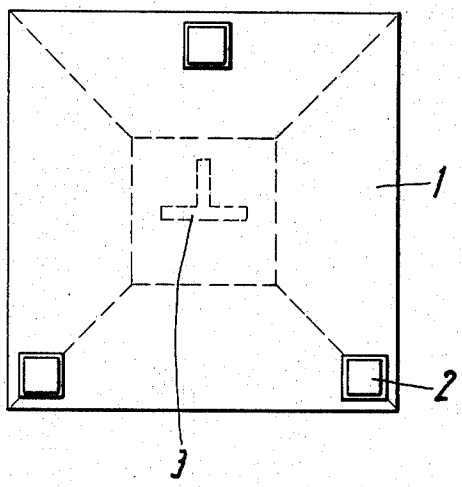


Fig. 2

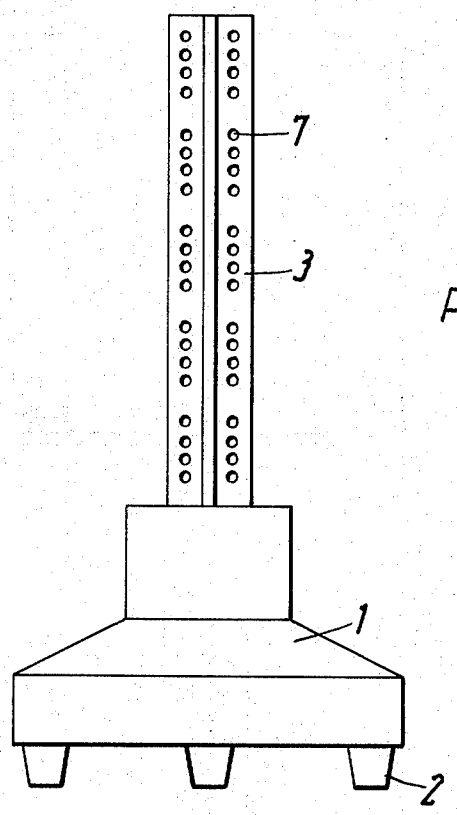


Fig. 1

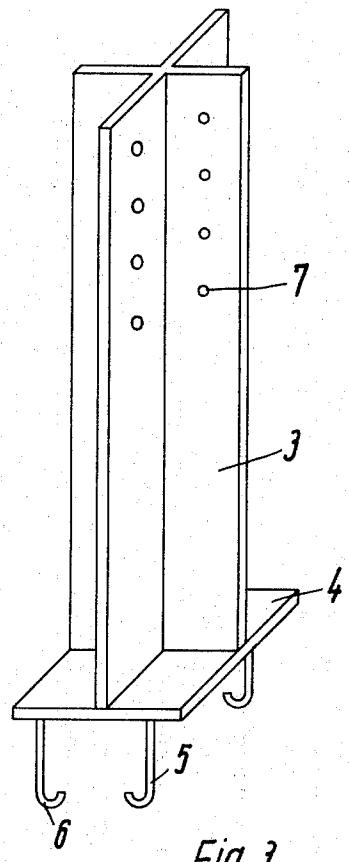


Fig. 3

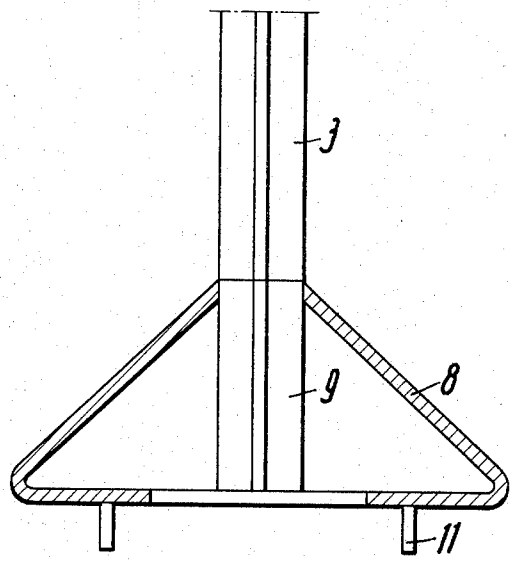


Fig.4

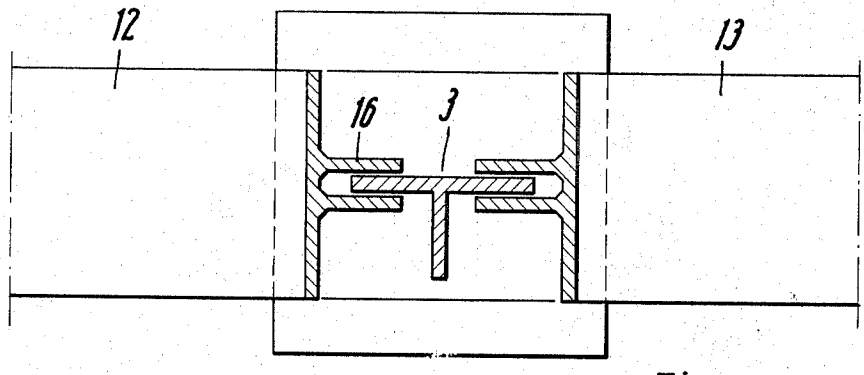


Fig.8

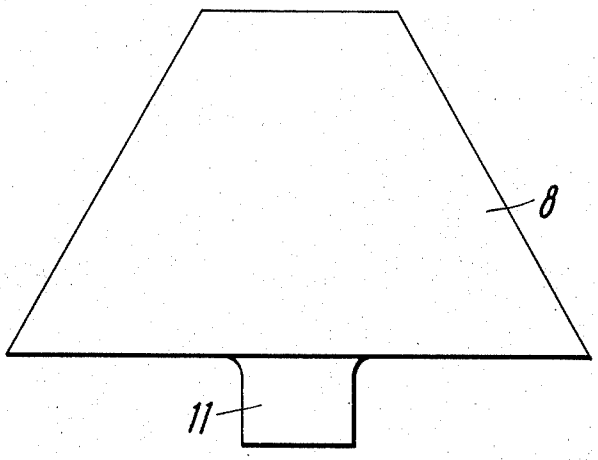


Fig. 5

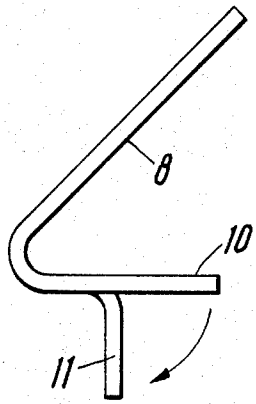


Fig. 7

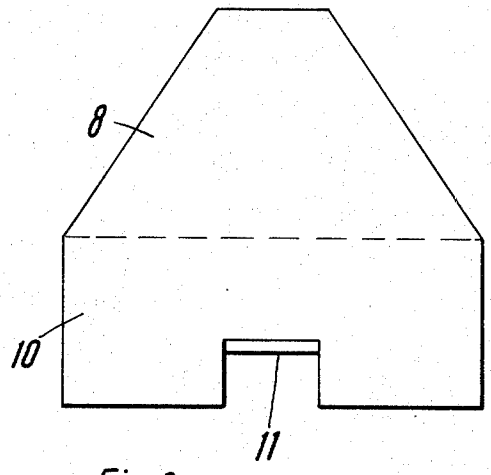
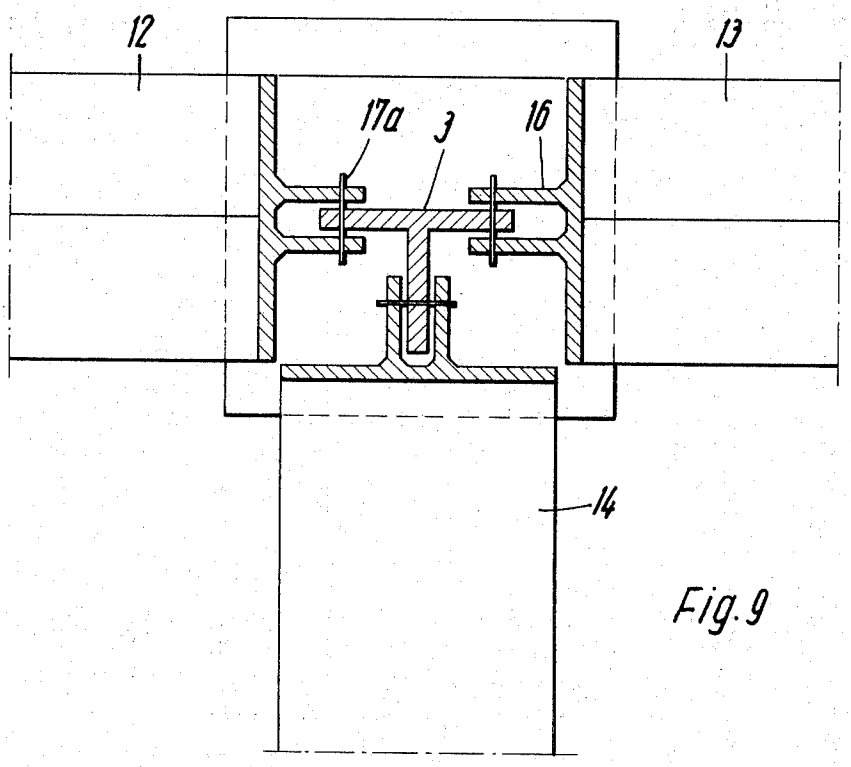


Fig. 6



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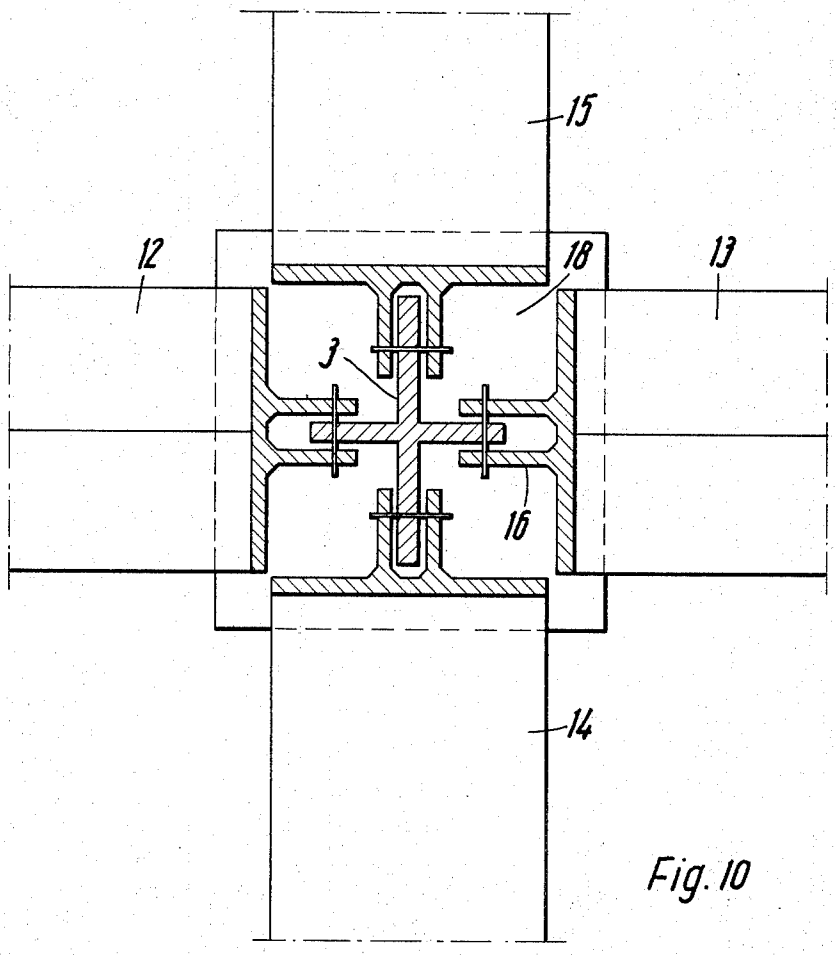

Fig. 10

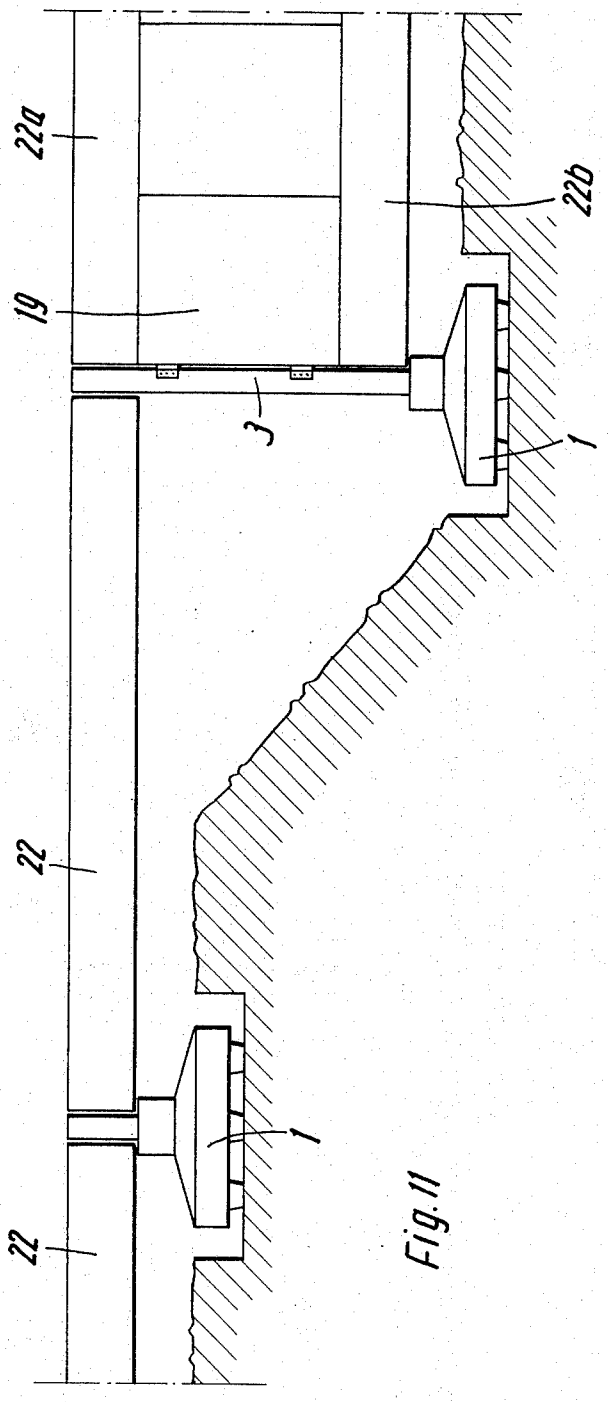

Fig. 11

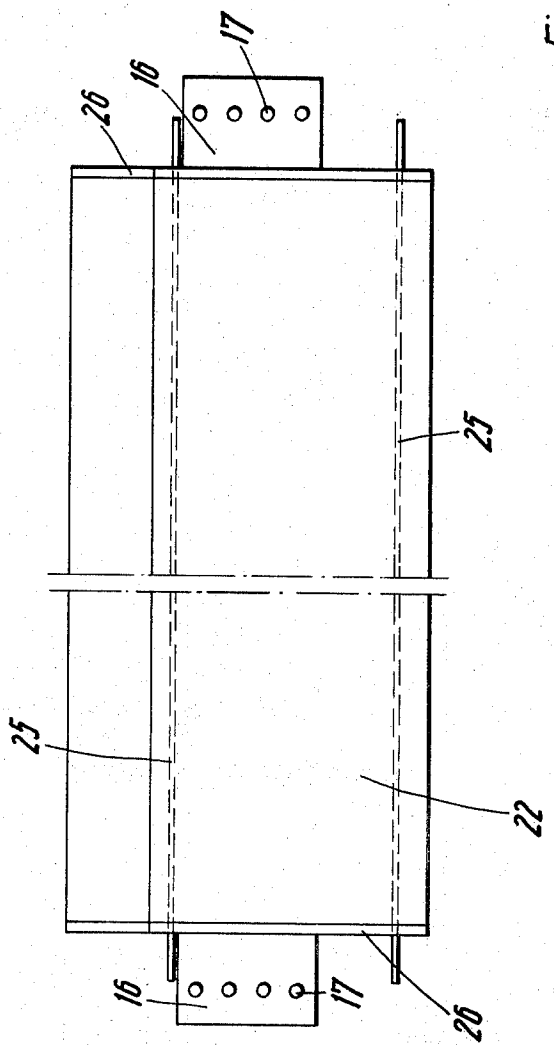

Fig. 12

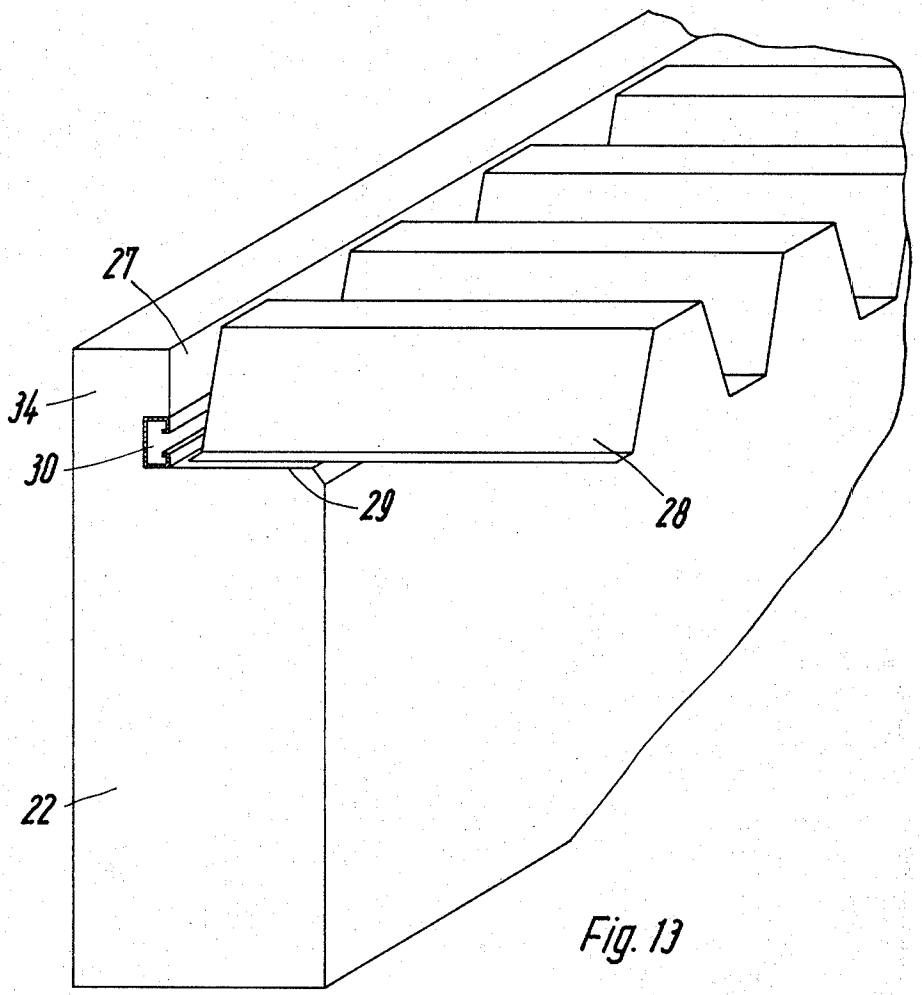

Fig. 13

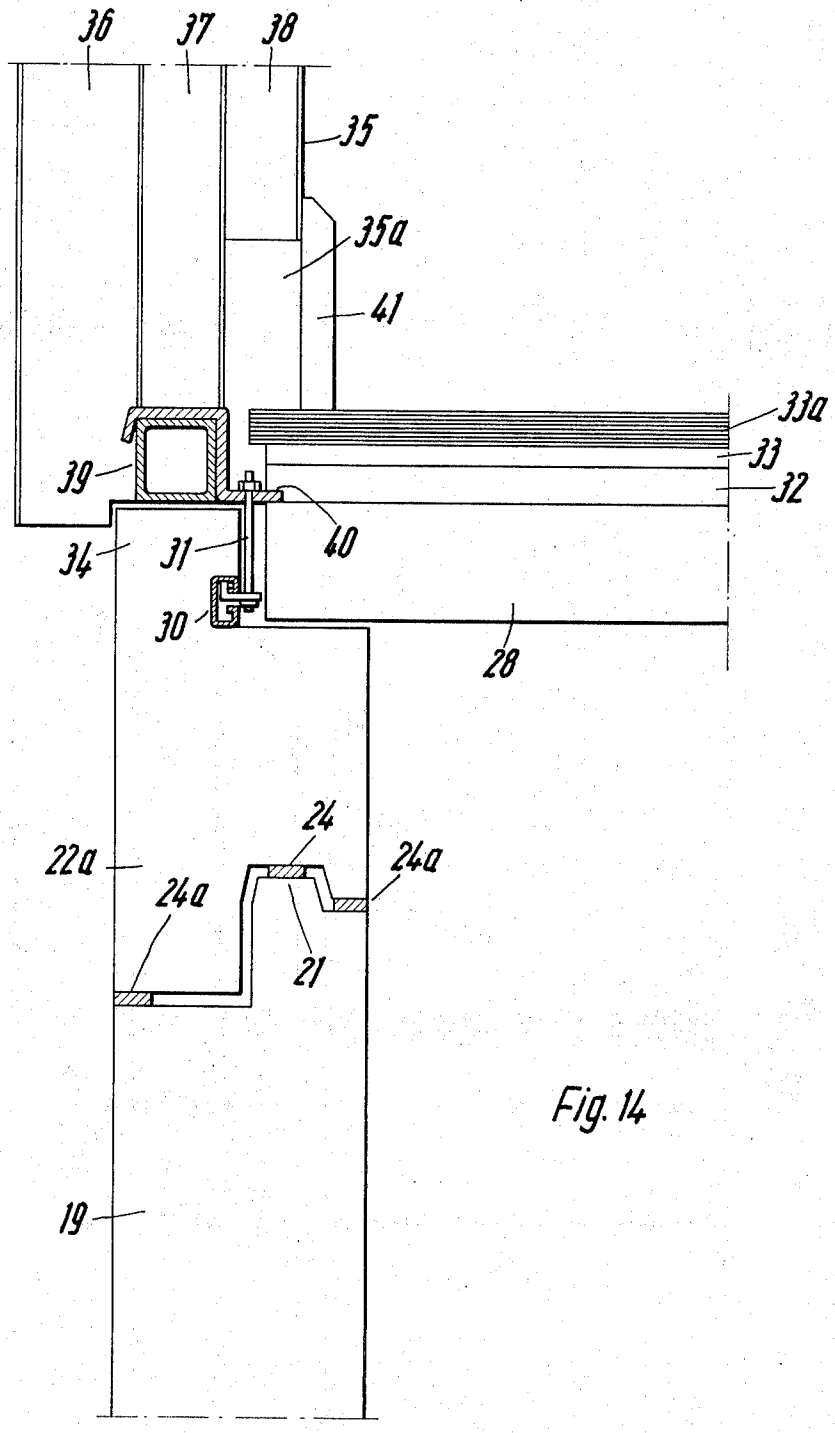

Fig. 14

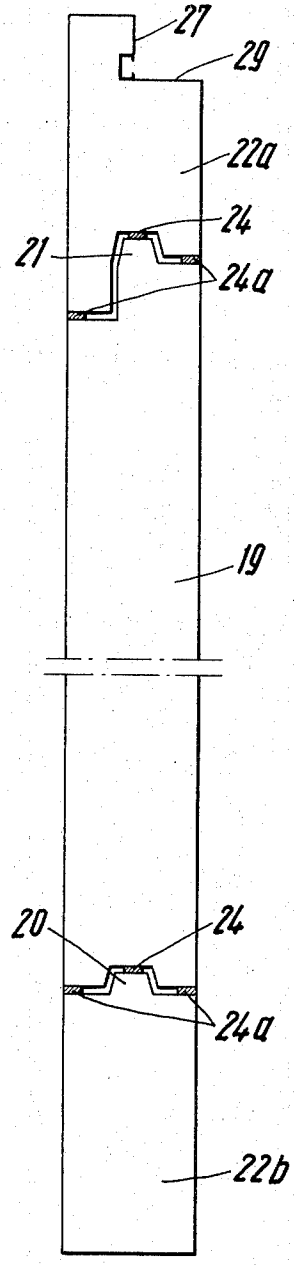

Fig. 15

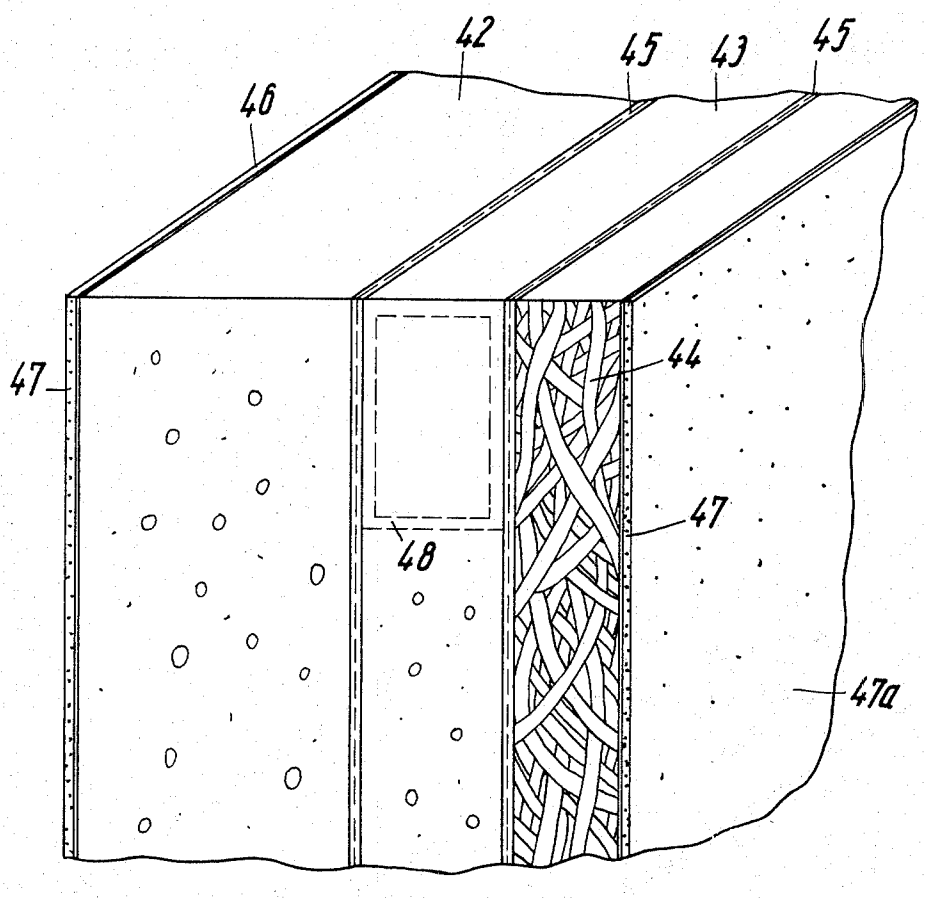

Fig. 16

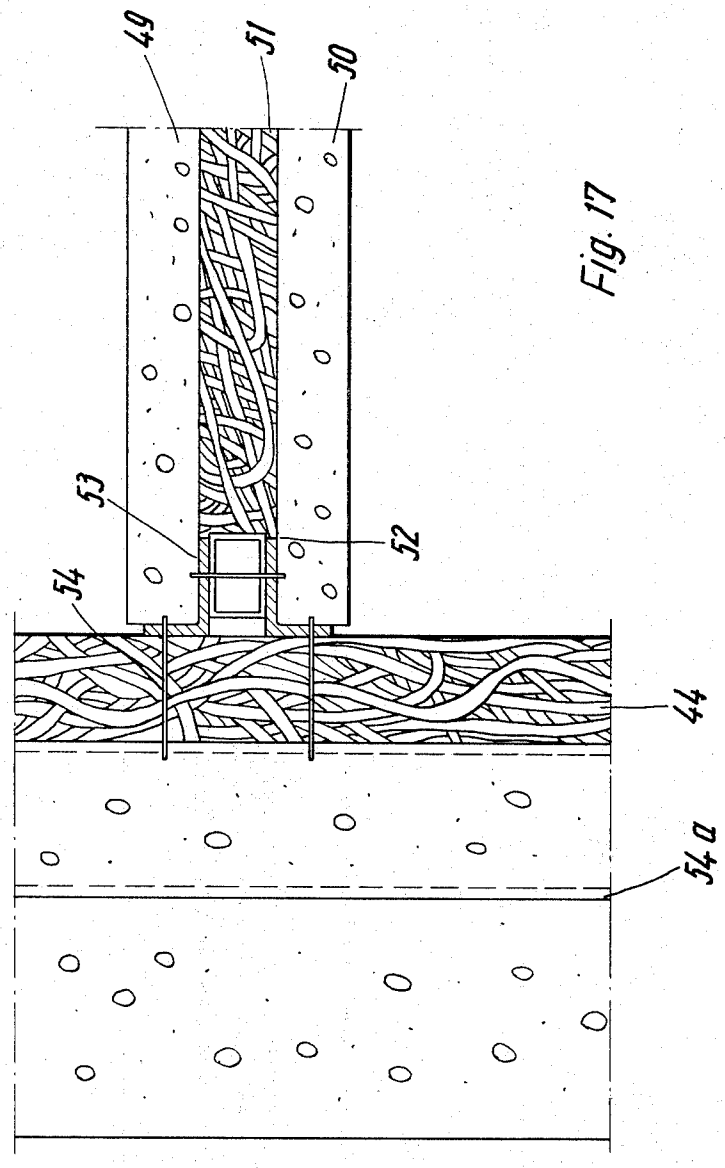

Fig. 17

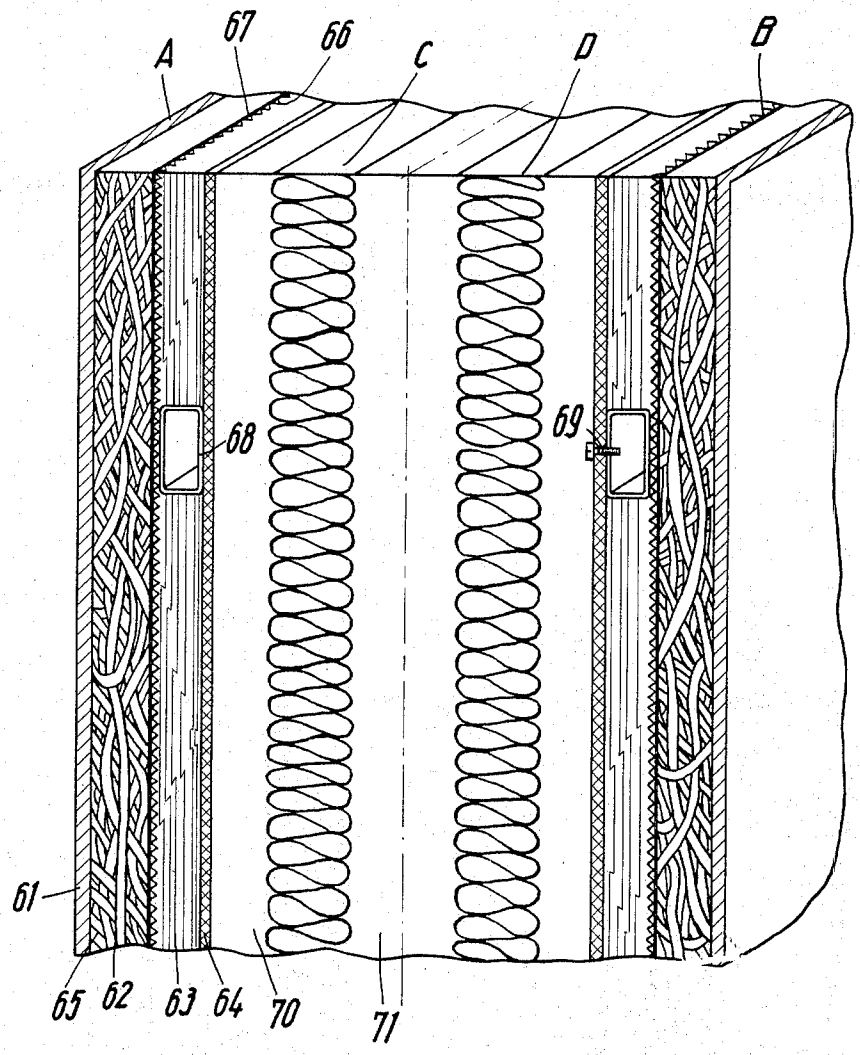

Fig. 18

BUILDING CONSTRUCTED OF VERTICAL SUPPORTS, LONGITUDINAL BASE ELEMENT, AND PANEL MEMBERS

The invention concerns the construction of buildings such as houses consisting of a plurality of spaced vertical supports, the supports interconnecting prefabricated base elements and serving as a framework for plate-like wall elements to be erected on the base formed by the base elements.

It is known to erect houses or buildings from prefabricated elements. These buildings consist of a frame work supporting plate-like wall elements. So called "pre-fab." houses are generally erected on top of a basement or foundation previously built or laid by traditional methods, such as poured concrete, made at the job site prior to erection of the building. As practical experience proves, this construction method presents many disadvantages, since the erector generally has no direct control over such locally erected basement or foundation system laid by outside contractors. On many occasions, it is not possible to have a proper time schedule established to co-ordinate erection of buildings on a previously locally erected basement or foundation.

The present most commonly used wall elements consist mainly of multiple layers of plywood, or plain wood, usually with an insulation material filling between these layers. These layers are fixed with nails or screws to a wood or metal frame. Such known wall elements have the disadvantage that the building up of these various layers requires a considerable amount of labour with a resulting high fabrication cost. Also, only wall elements based on existing standard plate sizes can be fabricated, thus requiring a design based on these dimensions. Furthermore, joints have to be provided at the edges of the plate.

Wall elements made out of plain concrete or similar material have the disadvantage that due to their heavy weight, erection can only be achieved by means of a heavy crane, and transportation costs are correspondingly very high.

It is an objective of the invention to provide a building construction from prefabricated elements, such as prefabricated support elements to be set at the floor level, which are part of a set of prefabricated elements, and which are delivered to the job site with the remaining parts of a building, enabling fast erection without special preparations or delays.

The support elements should be easy to erect with alignment and leveling quickly achievable yet be capable of forming a solid static base.

The plate-like wall elements should be cheap to fabricate completely in a work shop, should be simple to transport and should make possible fast erection and securing. Also the wall element should serve as a universal unit for the basic design of a complete house project.

There should be low heat conductivity, the water absorption should be minimal, and the water diffusion should be fast. The wall elements should be fire retardent and sound absorbing. They should also enable on site erection by unspecialised crews.

In order to achieve these objects, a building construction is proposed by the invention having the previously mentioned characteristics, which is characterized in that each vertical support element has a steel reinforced concrete base with three spaced apart supports, each support is of comparatively small size at its bottom, and, toward its upper end has at least two perpendicularly arranged flanges extending beyond a profiled. The plate-like wall element has at least two layers, which are inseparably interconnected by means of adhesive mortar or special glue, while one of these layers is surrounded by a closed metal frame or a frame made from synthetic plastics strip material.

Advantageously, a steel reinforced plate is attached at the lower end of the vertical support member. To this plate are attached hook-like reinforcing steel bars. The profiled beam of the support member may have a T or X cross-section, and the flanges may be provided with spaced holes.

A modified version of the support member has a metal base, consisting of four angled plates bent at an angle of 45° inwards and having notched out small supports, forming a solid steel base. The angled plates and connecting plates can be mounted in a removable manner to the vertical support member.

The plate-like wall element consists advantageously of an outer section of foamed polystyrene a middle layer of foamed polystyrene and an inner magnesite bonded wood chip plate.

A modified plate-like wall element, especially for use in double house-separation-walls, consists of spaced multiple layer plates, of which each side consists of a magnesite bonded wood chip plate, a rock wool layer, an asbestos cement plate, and one or several freely hanging layers of sound insulating rock wool situated in the spaces between the plates.

On an outer side of the wall element to be outside the building, an adhesive mortar covering layer is advantageously applied with a stucco finish. A patch-up plaster solution may be applied on the side or sides to be inside the building to enable hanging of wallpaper. Incorporated in the adhesive mortar is a reinforcing layer of glass-fibre or expanded metal. One layer of the wall element has a hollow metal member of rectangular cross section extending around its margin.

This house-separation wall is specially designed to act as a fire and sound insulating wall.

Between the support member horizontally attachable elements are installed. Each horizontal member has a recess on its upper side and a groove along its under side. A rubber seal installed in this groove enables perfect sealing between various elements. The construction elements are reinforced by means of steel bars, the length of which is equal to the total length, and the bars form a cage with head plates at each end to which double attachment plates are attached to enable secure connection to the support members. This is achieved by means of bolts or other attaching devices through holes provided. The upper part of the support member carries a platform enabling the installation of a floor system.

The invention will be further described with reference to a preferred emdodiment which is described by way of example with reference to the accompanying drawings, wherein:

FIG. 1 is a side elevation of a support member;

FIG. 2 is a bottom plan of a support member according to FIG. 1;

FIG. 3 is a top perspective of the reinforcing structure for the support member;

FIG. 4 is a fragmentary side elevation of a modified version of support member, with parts in section;

FIGS. 5, 6, and 7, are side elevations of single parts of the reinforcing structure for the support member according to FIG. 4;

FIG. 8 is a horizontal section through the support member and two longitudinal base elements;

FIG. 9 is a horizontal section through the support member and three longitudinal base elements;

FIG. 10 is a horizontal section through the support member and four longitudinal base elements;

FIG. 11 is a side elevation showing a support member installed in a partial basement of a house;

FIG. 12 is a side elevation of a longitudinal base element;

FIG. 13 is a top perspective of an upper longitudinal base element and an installed floor plate with parts broken away;

FIG. 14 is a side elevation of a longitudinal base element with an installed floor and an erected house wall part, with parts in section and parts broken away;

FIG. 15 is a side elevation of an upper and a lower longitudinal base element and, placed between the two, a filler basement wall element;

FIG. 16 is a top perspective of a portion of a triple layer outer wall element with parts broken away;

FIG. 17 is a section through the connection of an outer wall to an inner wall; and

FIG. 18 is a top perspective of a portion of a soundproof and fire-retardent separation wall.

In FIGS. 1 and 2 is shown a support member which consists of a base 1 made of steel reinforced concrete, three small support legs 2 thereunder, and a verticle member 3 of T profile.

The support legs 2 facilitate vertical alignment of the support member, by means for example of the use of a hydraulic car lip jack, since they bear at three points only. They permit installation of plumbing after erection of the building with a minimum of earth excavation.

After erection and alignment, the free space under the support legs 2 will be filled with concrete, so that all the surface will support weight.

As shown in FIG. 3, the reinforcement incorporated in base 1 consists of a plate 4, which is attached to the lower part of a profile beam 3, which beam is shown in this case to be of X cross section. Attached to the plate 4 are steel bars 5, the lower end of each being bent to form a hook 6.

As FIGS. 1 and 3 further show, the flanges of the profile beam 3 are provided with spaced holes 7, permitting bolts or other attachment devices to be passed therethrough.

In FIGS. 4 to 7 there is shown steel reinforcement of a differently designed support member consisting of four steel plates, bent at angles of 45° to form an upwardly inclined flange 8 and a horizontal flange 10. The plates 8, 10 are connected to the lower end 9 of the profile beam 3, thus forming a solid base. From the lower flange 10 of the steel plates, small support legs 11 are notched out and bent downwards. Concrete can be poured around and under this so designed support member at the site, after erection.

As shown in FIGS. 8 to 10 the beam profile flanges 3, as already mentioned, can be of T or X cross section. The T-shape enables the attachment of three wall elements 12–13–14, according to FIG. 9. With an X cross section section according to FIG. 10 four wall elements 12–13–14–15 can be attached.

To enable this, attachment plates 16 are advantageously provided on the edges of the wall elements having bifurcations projecting outwardly to embrace a flange of beam 3. They are also provided with holes 17, as indicated in FIG. 12, alignable with beam holes 7 for enabling bolts or other attachment devices 17*a* to be passed therethrough to provide a clevis connection.

After erection of the support members and securing of the longitudinal base elements thereto, the remaining open areas or gaps 18 can be filled with concrete in order to increase the rigidity of the assembly and at same time achieve corrosion protection of the steel parts. In order to do this, only a simple cover shield is required.

As shown in FIG. 11, a complete basement construction by use of support members can be achieved, after earth excavation is performed. Special longitudinal base elements 19 are attached to the support member strip 3 perpendicular to each other. Additional supports 3 and base elements 19 can be provided to achieve a closed ring anchor, assuring a sound static base to the entire building.

As shown in FIGS. 14 and 15, each wall element 19 of the basement arrangement has a trapezoidal groove 20 in its respective lower base surface, and in the respective upper surface, a key or tongue 21. Between the lower edge area of the upper length element 22*a* and the upper area of the thereunder placed basement wall element 19, a rubber sealing strip 24 is installed along the center, and in the sides are additional strips 24*a*, granting a complete sealing of the area of the joint.

As shown diagrammatically in FIG. 12, in each longitudinal base element 22, 22*a*, 22*b*, a respective reinforcing steel cage 25 is incorporated, the length of which is identical with the length of the body of the base element. The ends of the cage are connected to opposite head cover plates 26, to which are attached bifurcated connecting plates 16 by means of which the element is attached to the support member.

As further shown in FIGS. 13 and 14, the outer side of the upper edge of the base element 22 is stepped up, so the inner face 27 of step 34 serves as an abutment for floor elements 28, which bear on the inner upper edge surface 29. The inner side of step 34 is undercut to receive an anchor member 30 which, as especially shown in FIG. 14, permits the location of an attachment element 31.

According to the design shown in FIG. 14, the floor element 28, bearing in the recess or notch 29 of the base element 22, is covered with a concrete slab 32, on top of which is an insulation mat 33. A floating finishing layer consisting of asphalt 33a or similar material covers the insulation mat 33.

The upraised step 34 of the base element 22 supports an outer wall element 35, consisting of 3 layers 36, 37 and 38.

The middle layer 37 is surrounded by a perimetric frame 39, which is attached by means of a bracket 40 to the link member 31 to connect bracket 40 and the anchor member 30 of the base longitudinal element 22. Towards the house interior the house outer wall 35 has an open area 35a near the floor area for receiving bracket 40 and the flooring margin which is closed by

a wood baseboard, which closes off neatly the areas floor to wall.

The plate-like wall element according to FIG. **16**, which can be used as an outer or inner wall depending on the combination of the layers from which the wall element is built up, consists of an outer styrofoam layer **42**, a middle layer **43** of polystyrene foam and a magnesite bonded wood chip section layer **44**. The three layers are inseparably interconnected by means of adhesive mortar, incorporating glass-fibres **45**. At both outer surfaces of the extreme layers **42** and **44**, an additional adhesive mortar layer **46** is applied to the outside, on top of that a stucco finishing coat **47** or a finishing coat **47***a* is applied, depending respectively on whether the surface is to be an exterior or an interior surface.

The middle layer **43** is surrounded by a closed perimetric frame **48**, which lies in between both outer layers **42** and **44**, and is attached solidly to these.

The frame is advantageously made out of a rectangular hollow strip. The frame can also be made from a U-shape strip.

In FIG. **17** is again shown an outer wall, similar to that shown in FIG. **16**. Connected to inner layer **44** of this wall element is a triple layered inner wall element. This inner wall element consist of two polystyrene foam outer layers **49** and **50**, and one magnesite bonded wood chip-board inner layer. Also, in this case, all three layers are interconnected inseparably by means of adhesive mortar, or any other suitable adhesive material.

Further the inner walls are provided with a closed surrounding frame **52**. This frame **52** is provided with an attachment **53**, which enables attachment of frame **52** to the inner surface **44** of the outer wall by means of suitable attaching devices **54**, to an embedded strip **54***a*.

The plate-like wall element according to FIG. **18**, which is for use mainly as the house divider or party wall, consists of two multiple layer plates A and B, as well as rockwool mats C and D, which hang loose in the free inner area of this assembly between multi-layer plates A and B.

Each of the multi-layer plates A and B consist of an adhesive mortar layer **61** bonded to a layer **62** of magnesite mortar bonded wood chips, a rock wool solid bonded plate **63**, and another layer **64** made of non-flammable asbestos cement. Between the adhesive mortar layer **61** and the plate **62**, a glass fibre mat **65** is advantageously incorporated. Between the magnesite mortar bonded wood chip layer **62**, and the compacted rock wool plate **63**, expended metal **66** is incorporated and both layers or sections are interconnected inseparably by means of adhesive mortar **67**, or any other suitable adhesive.

A substantially perimetric metal frame **68** surrounds the major extent of rock wool plate **63**, and frame members are provided transversely to this frame and are attached by means of screws **69** to the asbestos cement plate **64**. Between the asbestos cement plate **64** and the loose hanging rock wool mat C is a free space **70**. Also a free space **71** is provided between the rock wool mats C and D. The multiple layer plate B is a symmetrical assembly with multi-layer plate A in a reversed manner.

As proven by recently conducted tests, this multiple layer wall element is fire retardent, so it is especially suitable for use as a house separation wall for semi-detached or terraced houses. It is at the same time designed for soundproofness.

What we claim is:

1. Building construction comprising a plurality of spaced upright support members each having a base and an upright column including a plurality of continuous upright flanges radiating from a common junction located centrally of the column, each of said flanges having a plurality of bores therethrough spaced along said flange, and an elongated connecting panel connecting two of said upright supporting members having bifurcated brackets projecting longitudinally from opposite panel ends, the furcations of each said bracket embracing a flange of one of said upright columns and including cooperating bores therethrough alignable with a column flange bore, and pin means connecting said embraced column flange and said embracing bifurcated bracket and further comprising a wall component having a plurality of parallel discrete sheet layers adhesively bonded to provide a composite panel, an interior layer of said panel being of uniformly smaller dimension than adjacent layers to provide a perimetric panel groove, a hollow tube of rectangular cross section received in said perimetric groove and perimetrically coextensive therewith, the elongated connecting panel having first and second panel-supporting ledges disposed in parallel planes but perpendicularly offset, a perpendicular wall connected to said first ledge and forming a salient angel therewith and to said second ledge and forming a reentrant angle therewith, a groove in said perpendicular wall adjacent to said reentrant angle, a split tube snugly received in and extending along said groove, said split tube and said groove having complemental cross sections, first hook means engageable in said split tube and projecting therefrom, second hook means engageable to embrace said panel perimetric tube, link means connecting said first and second hook means for securing a wall panel supported by one of said panel-supporting ledges to said elongated connecting panel, said wall panel including two composite plates each having a magnesite mortar bonded wood chip sheet layer, a compacted rook wool sheet layer, and an asbestos cement sheet layer, said three layers being adhesively bonded together, said composite plates being disposed in parallel spaced relationship with their asbestos cement sheet layers in adjacent relationship defining a hollow chamber therebetween, and a rock wool layer suspended in said chamber disposed parallel to, but spaced from, said composite plates.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,802,139 Dated April 9, 1974

Inventor(s) Gustave L. Eischen et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Title page, under "References Cited", change "Catch" to -- Gatch --; change "Tiezzini" to Trezzini --.

Column 6, line 38, cancel "angel" and insert -- angle --; line 51, cancel "rook" and insert -- rock --.

Signed and sealed this 15th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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U S GOVERNMENT PRINTING OFFICE : 869-930