United States Patent [19]

Huettemann

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[45] **Sept. 16, 1975**

[54] **BUILDING WALL UNIT**

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[21] Appl. No.: **445,818**

[52] **U.S. Cl.** **52/593;** 52/314; 52/603

[51] **Int. Cl.**[2] **E04C 1/10**

[58] **Field of Search** 52/314, 593, 311, 316, 52/98, 421, 415, 596, 603, 604, 605, 52/666, 744

[56] **References Cited**

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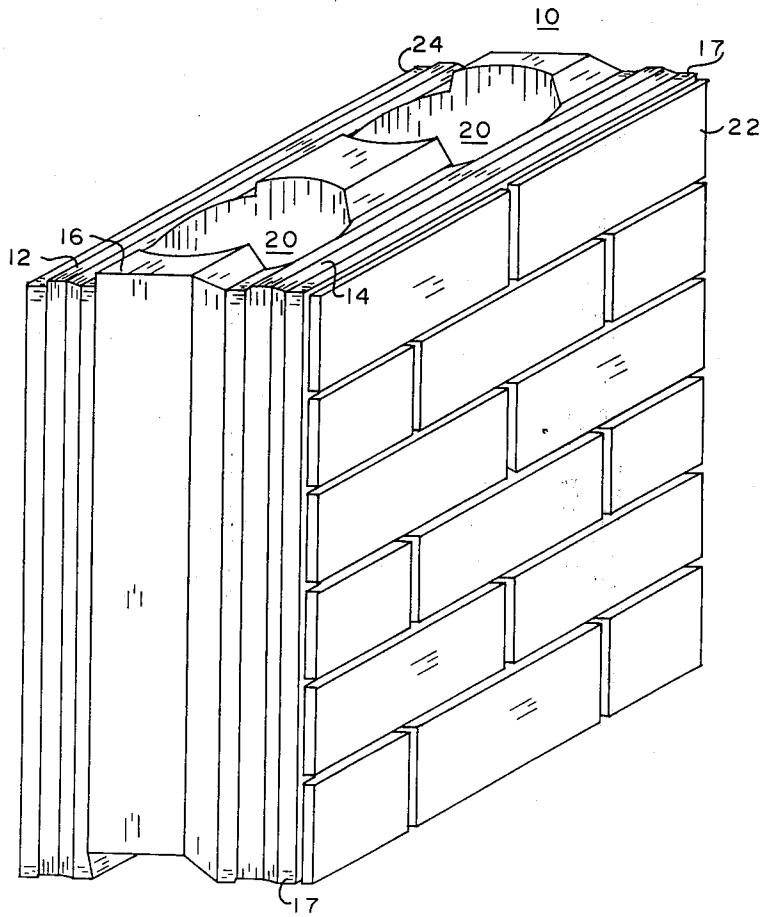
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Primary Examiner—J. Karl Bell

[57] **ABSTRACT**

A building wall unit of a non-combustible insulating material which is nailable, has one pre-finished dense and water-repellent exterior and interior face surface, and has four tongue and groove edge side surfaces, weighing not more than 50 pounds maximum whereby a building may be constructed with both vertical and horizontal interlocked elements.

10 Claims, 13 Drawing Figures



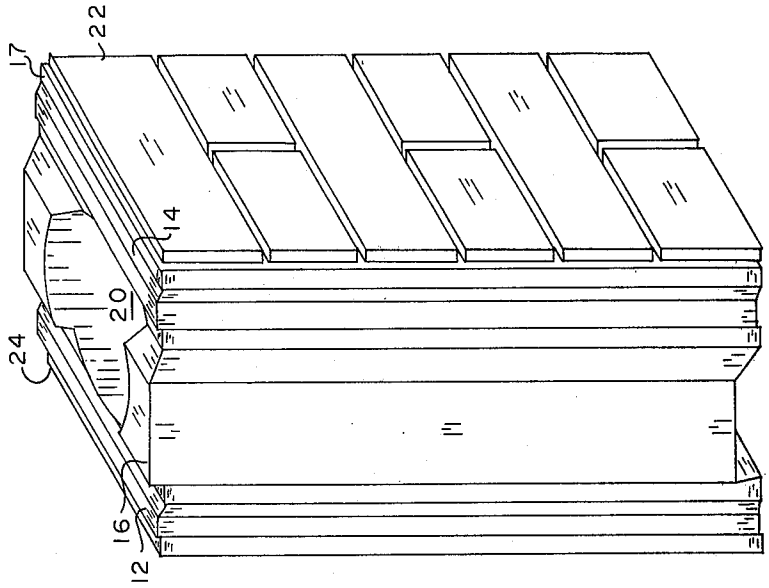


FIG. 2

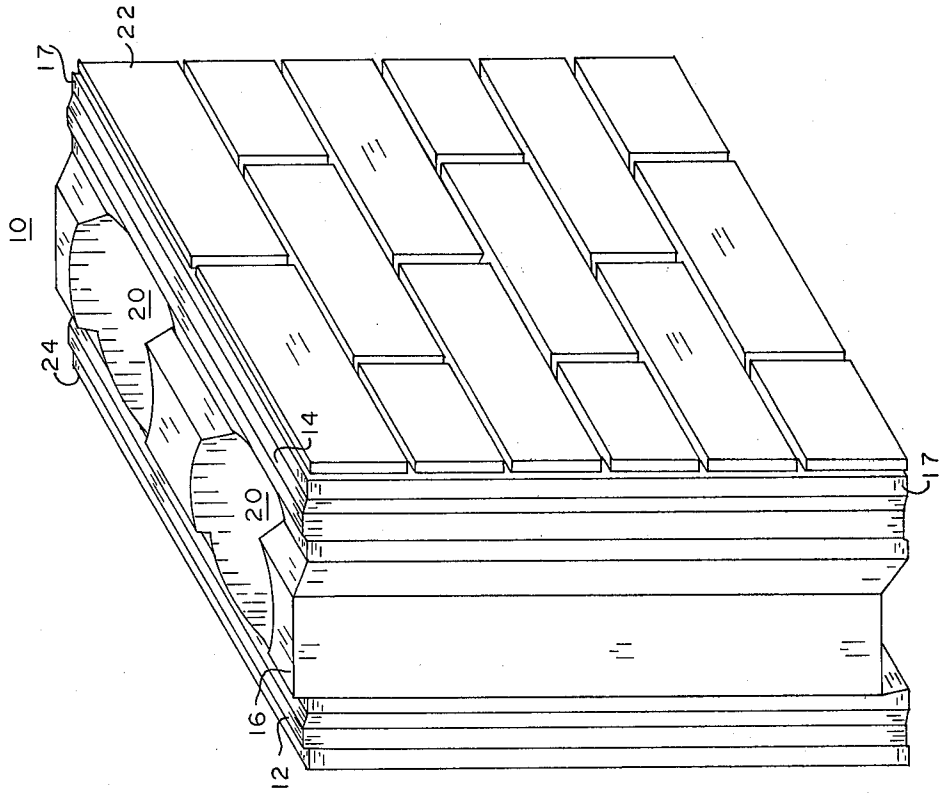


FIG. 1

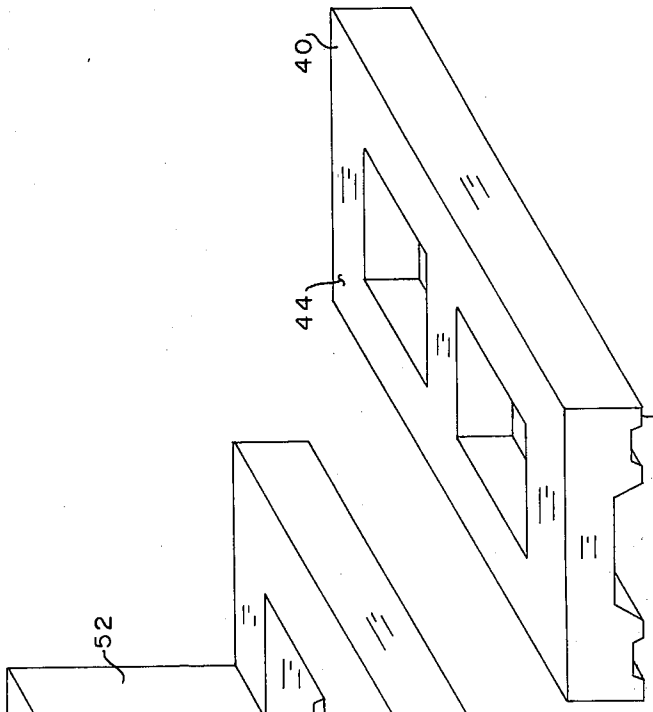


FIG. 4

FIG. 5

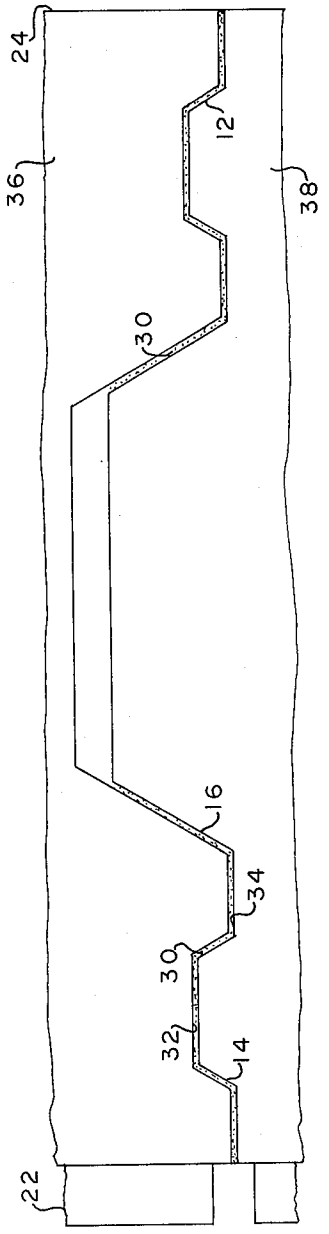


FIG. 6

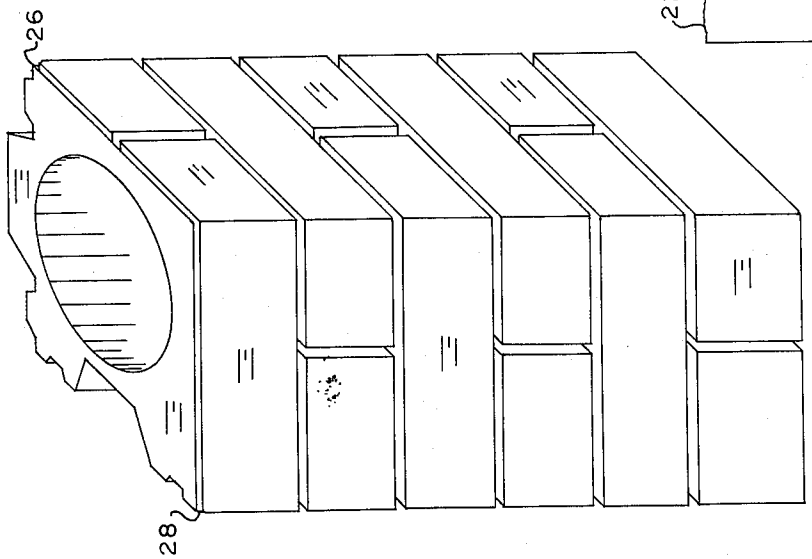


FIG. 3

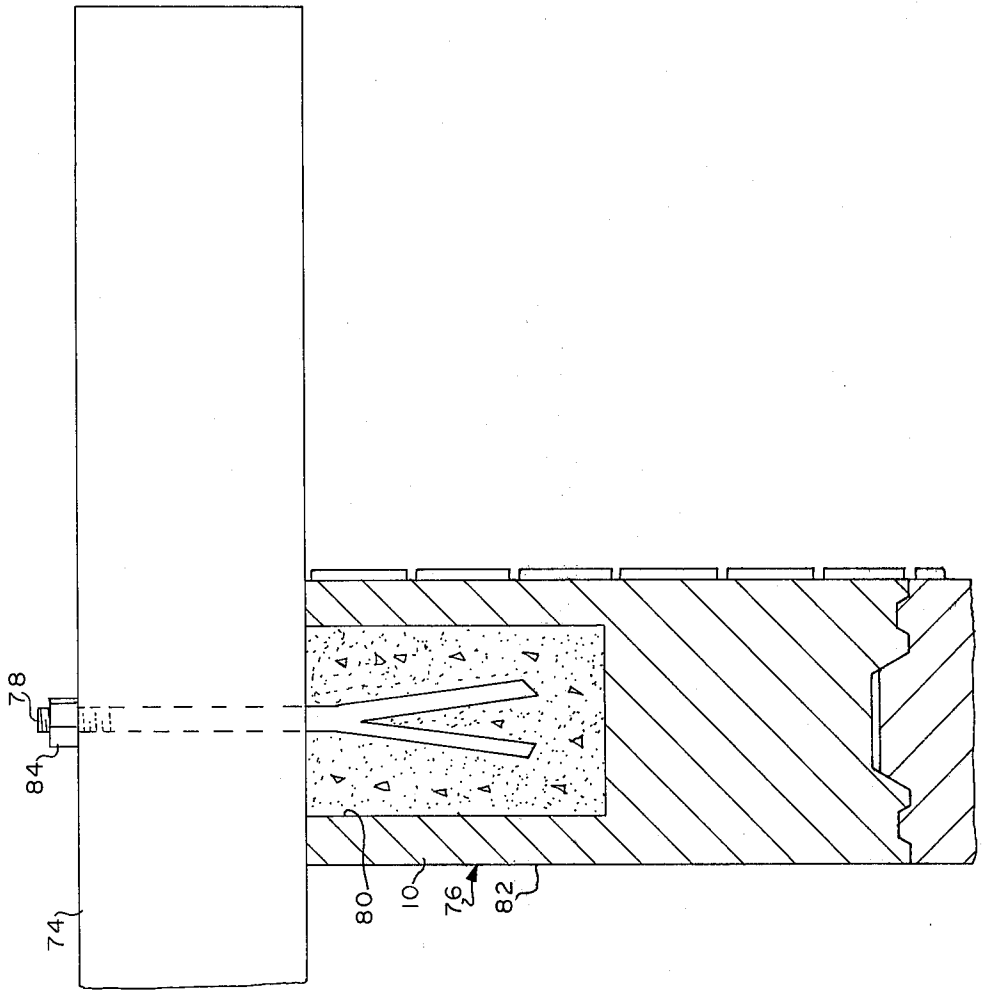


FIG. 10

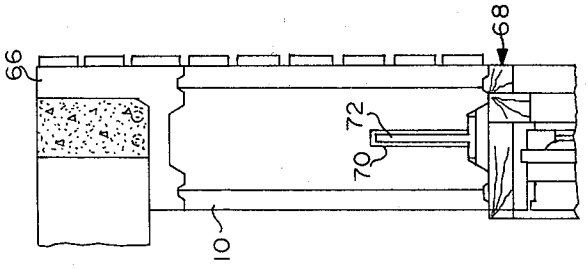


FIG. 7

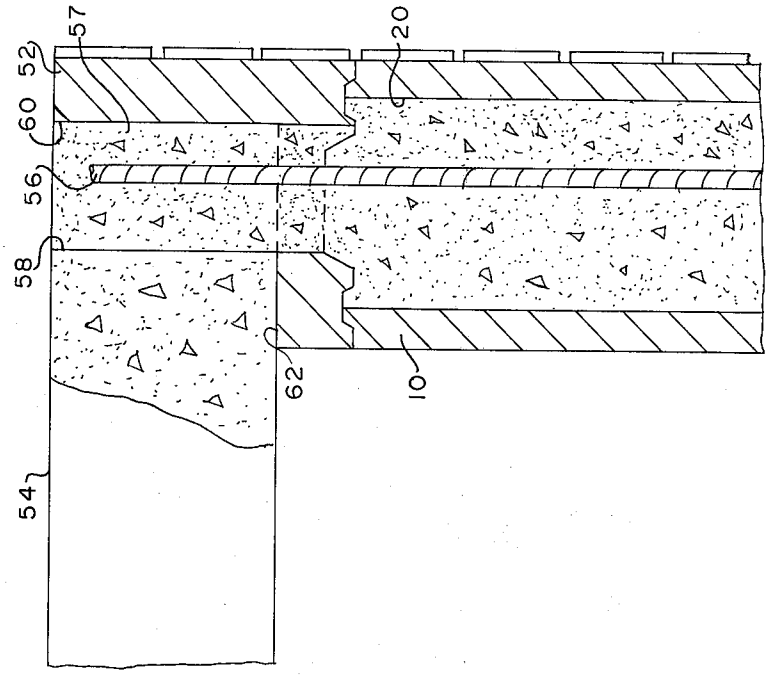


FIG. 8

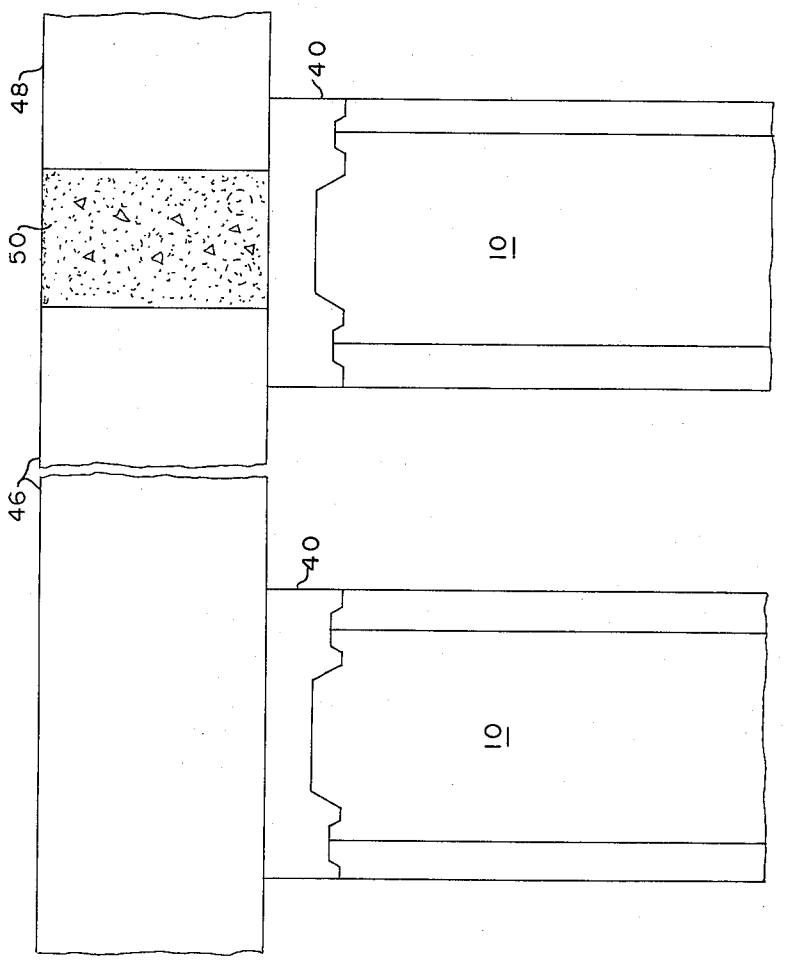


FIG. 9

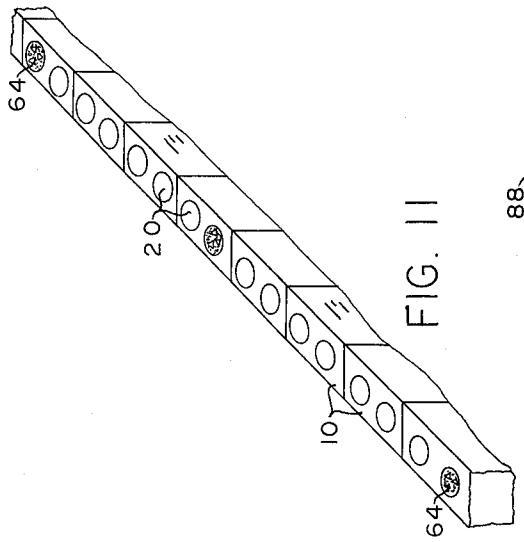


FIG. 11

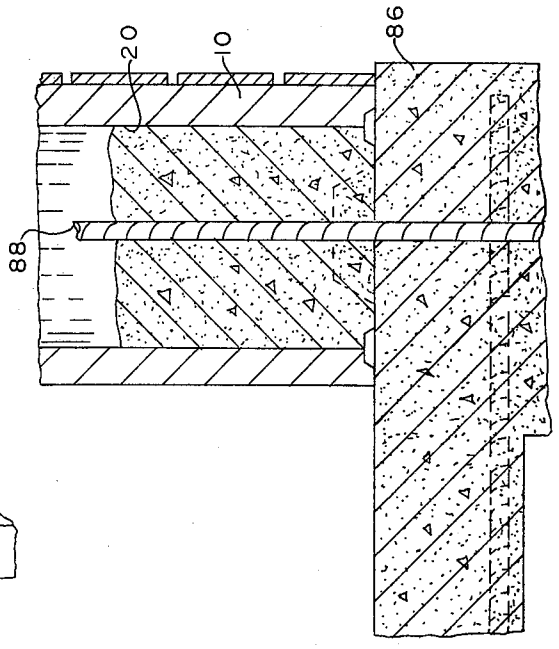


FIG. 12

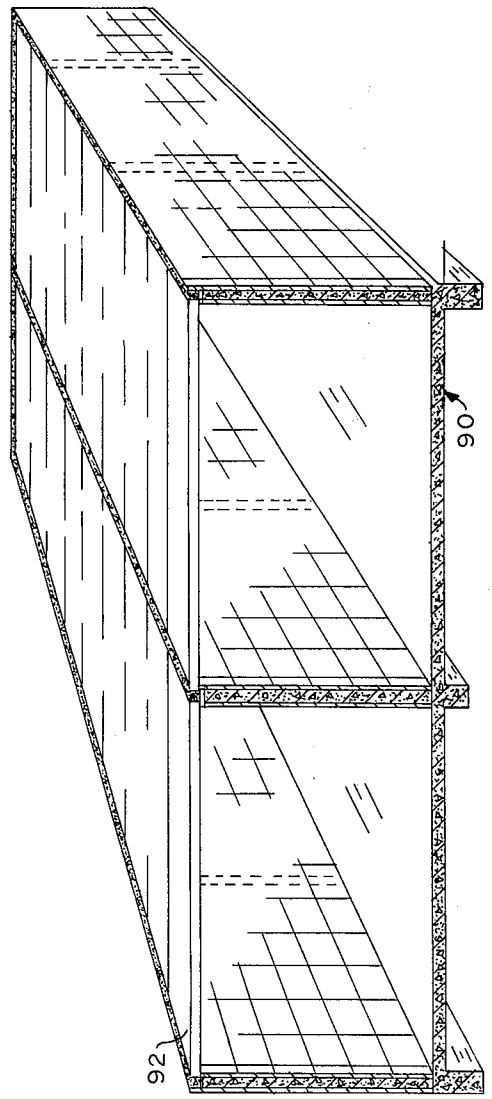


FIG. 13

BUILDING WALL UNIT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to building construction and particularly to an improved wall unit and to buildings constructed of such units.

2. General Description of the Prior Art

Despite a considerable effort by both government and industry to provide new building materials and techniques which would enable housing, particularly residential housing, to be constructed faster, cheaper, and safer, little progress appears of late. Considering the technical revolution which has occurred in the past 50 years, which has changed and modernized most aspects of living, it is almost inconceivable that residential dwellings are still largely constructed with a hammer, saw, and nails out of lumber, but such is the case. While considerable use is made today of masonry and brick construction of homes, usually this is limited to an outer shell with a complete inner shell being constructed of wood and paper faced plaster board. In this mode of construction, there are thus the two complete structures, the outer one providing decoration and some weather proofing and the inner one providing an acceptable living space. Since the inner structure is largely constructed of combustible material, it is not safe from fire. Also, since the typical masonry wall provides little lateral support, the structure is not safe from high winds such as encountered with tornadoes. While modular homes may be constructed of concrete slabs, they must be set in place with large cranes at significant expense. Further, this type construction permits little variation in design to meet individual preferences.

It is the object of the present invention to overcome the aforesaid and other difficulties and provide a new building element and system of building construction which will finally provide a real alternative to conventional housing construction practices.

SUMMARY OF THE INVENTION

In accordance with a principal aspect of this invention, a construction block, unit, or element has these features. One, it has selected surfaces on each side depending upon whether it is to be used for an exterior wall or interior wall. Second, all four construction side surfaces, a top and a bottom surface and two side or edge surfaces, are of tongue and groove construction. Three, the composition of the block is a lightweight aggregate of mineral material. As a further feature of the invention, blocks or building elements of a type just described are assembled to form a wall on which masonry ceilings (and floors) may be supported to economically provide a total structure which is both fireproof and very resistant to high winds. A still further feature of the invention is to provide a wall unit which can readily be handled by one man and does not require particular skill to install.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a building wall unit constructed in accordance with the invention.

FIG. 2 is a perspective view of a wall unit of reduced width to that shown in FIG. 1.

FIG. 3 is a perspective view of a wall unit particularly adapted to construct a corner for a building.

FIG. 4 is a perspective view of a wall-to-ceiling adapter unit adapted to provide a support for a ceiling.

FIG. 5 is a perspective view of a wall-to-ceiling adapter unit adapted to provide support for a ceiling and provide an outside exterior surface region.

FIG. 6 is a view taken along tongue and groove surfaces of two units as they would be joined for construction of a wall.

FIG. 7 is an edge view of a wall section illustrating the positioned blocks above a window or door frame, the beam providing support for the portion of the wall extending above the window or door frame.

FIG. 8 is a sectional view illustrating the manner in which a reinforced masonry ceiling slab is supported by an exterior wall-to-ceiling adapter unit on exterior wall unit.

FIG. 9 is a sectional view illustrating support of a ceiling slab by an interior-to-wall adapter unit on a wall unit, illustrating in one instance bonding of end-to-end ceiling slabs.

FIG. 10 is a sectional view illustrating the connection of an over-hanging roof slab to a wall section.

FIG. 11 is a perspective view of a portion of a wall illustrating vertical reinforcement of a wall.

FIG. 12 is a sectional view illustrating the anchoring of a wall unit to the floor.

FIG. 13 is a perspective view generally illustrating a building structure employing a wall unit constructed in accordance with this invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a wall unit 10 as contemplated by this invention. As illustrated in this figure and in FIG. 6, a triple tongue and groove system is employed in which two small tongue portions 12 and 14 and one larger tongue portion 16 are employed on each tongue edge 17 of a wall unit. There is essentially zero clearance in the small groove to small tongue surfaces of adjoined wall units, but a clearance of approximately one-fourth inch exists between a large tongue and groove providing a space between wall units enabling placement of reinforcement material or door or window lintels. Wall unit 10 contains holes 20 having a cross section such that their volume is approximately that of 30 percent to 50 percent of the total volume of the wall unit. Where employed as an outside wall unit, as illustrated, a brick-shaped surface 22, or other design, is typically employed. As shown, 2¼ inches by 8 inches fired brick veneer plates are attached to the wall unit. Interior wall 20, the surface of which is not illustrated, may be plain or it, too, may be constructed with various veneer materials or designs.

In accordance with one facet of the invention, a wall unit is constructed from hydrated lime, cement, and silica flour as bonding composition, and a lightweight aggregate material such as styrofoam, pumice, perlite, vermiculite, glass nodules, puffed-up ceramics, etc., wherein the density of the aggregate would be within the approximate range of .08 to .6. Accordingly, a wall unit would have a weight of 5 to 40 pounds per cubic foot. The aggregate and bonding material would be mixed with water, and if necessary with a water repellent agent, compacted into a mold, then demolded and cured in a high-pressure steam of 100 to 300 PSI for 2 to 8 hours.

An alternate composition would consist of a bonding material consisting of autoclaved hydrated lime and fine silica flour with the percentage of each bearing 40

to 60 percent by weight. The silica flour would be fine ground with a residue of 5 percent to 30 percent through a No. 200 screen and with 1 percent to 0 percent residue through a No. 140 screen (U.S. Standards). The mixture would be 1 part bonding material to 1 to 4 parts aggregate and with 7 percent to 12 percent water, by volume. Still another alternate composition for the wall unit would consist of the following:

1 part, by volume, cement;

1½ to 3 parts by volume, lightweight aggregate; and

7 percent to 12 percent water, by volume; and wherein its composition would be compacted into a mold, demolded and cured in a low-pressure steam atmosphere for 16 to 20 hours, and after the steam treatment would be cured in air for at least 2 weeks. Still alternately, the steam treatment would be omitted. In the curing process of the compositions described, the composition of lime and silica flour forms calcium silicate hydrate; and where cement is employed, there is formed calcium aluminate hydrate and calcium silicate hydrate.

Molding would be accomplished by means of a press or mold wherein the material would be compacted by vibration being applied between horizontal plates parallel to the holes 20 illustrated in FIG. 1. Pressure heads would apply pressure in an opposite horizontal direction with a pressure of between 100 to 300 PSI; whereafter a top lid of the press would be opened. Then special surfaces would be applied, as for example, a brick surface as shown (FIG. 1). Alternate surfaces would include such surfaces as a colored stucco, clay brick tiles, aggregate or colored chips. After the application of the exterior surface, the wall unit would be completely demolded, lifted out of the mold, and stored for curing. By virtue of this construction, the wall units are nailable, sawable, with low water absorption and surfaces may be made extremely smooth so that they may be directly painted or wallpapered or paneled or gypsum board applied.

Typically, the wall unit would be 16 inches by 16 inches although other sizes include 24 inches by 24 inches, 12 inches by 12 inches, or 8 inches by 8 inches, 32 inches by 8 inches, and 16 inches by 8 inches. Similarly, varying thickness may be employed as for example, 12, 10, 8, 6, or 4 inches. Half-width units are particularly illustrated in FIGS. 2 and 3, with FIG. 3 illustrating corner construction wherein a tongue edge 26 is at right angles to groove edge 28. The cavities of wall units 10, which are aligned when laid, provide a conveniently accessible region for reinforcement or insulation. However, without insulation, the wall units provide significant insulating properties because of their composition.

In joining units (FIG. 6), adhesive 30 such as epoxy or cement-lime slurry is applied between the close-fitting surfaces 32 and 34 of wall units 36 and 38.

FIG. 4 illustrates a ceiling support or adapter unit 40 having a grooved lower surface 42 and flat upper surface 44 adapted to support the slab ceiling 46 on a wall unit 10 as illustrated in FIG. 9. As shown in FIG. 9, one adapter unit 40 simply supports ceiling slab 46 without further connection, and in one instance, ceiling adapter 40 provides support for spaced ends of ceiling slabs 46 and 48 in a region 50 of reinforced concrete bonding, connecting the slabs together and to ceiling adapter 40.

FIG. 5 illustrates a ceiling adapter 52 for exterior walls and its use is shown in FIG. 8 in which a slab 54 is supported by adapter 52 in turn supported on wall unit 10. As illustrated in this figure, concrete is reinforced with a steel rod 56, the concrete being poured down through one or more cavities 20. A reinforced or non-reinforced concrete bond 57 extends between an end 58 of ceiling slab 54, a vertical surface 60 of adapter 52 and horizontal surface 62 of adapter 52. Thus, as shown, with concrete poured in cavities 20 and extending upward to horizontal concrete bond 57, an extremely sturdy wall-to-seal joint is achieved. The employment of spaced concrete filled cavities 64 is shown in FIG. 11. These may be steel reinforced and may be in such frequency along the wall as necessary to achieve a desired strength.

FIG. 7 illustrates another example of interconnection of a ceiling slab to a wall unit 10, in this instance by an external wall-type ceiling adapter 66. In addition, as shown in this figure, provision is made for a course of wall units above window unit 68 in which wall units 10 have a cut-out (as by sawing), region 70 through which a steel beam 72 extends across the top of window unit 68 to provide support for the span across the window unit 68.

FIG. 10 illustrates a roof slab 74 adapted to extend out over an outer side of a wall 76 constructed of wall units 10 and in which roof slab 74 is directly placed on wall units. In this instance, anchor bolts 78 are set in concrete poured in cut-outs 80 of top row 82 of wall units 10. Slab 74 is finally secured by nuts 84.

FIG. 12 illustrates the anchoring of a course of wall units 10 to a masonry floor 86. In this instance, the masonry floor contains steel rods 88 which extend upward and over which wall units 10 are placed. Then, concrete is poured into the cavities 20 of the wall units which reinforcement rods 88 extend.

FIG. 13 generally illustrates a building constructed of wall units 10 and wherein the walls are attached to a poured concrete floor slab 90 and support, by means previously discussed, concrete ceiling slabs 92.

It will be appreciated from the foregoing that the applicant has provided a new and improved building unit and building system. Construction with the wall units of this invention is simple, expert labor is not required to assemble the wall units, and labor costs are greatly reduced. Walls constructed of the wall units are non-combustible, and thus, a truly fireproof home of attractive construction is made possible. Windows, door frames, paneling, cabinets, fixtures, and most interior devices may be directly attached to the wall units by simply nailing. Where reinforcement beyond that provided by the wall is necessary, this can be simply provided by the use of concrete with or without steel rods down in cavities in wall units. Because of the tongue and groove construction in which all four edges of a wall unit are joined in the fashion described, resistance to wind storms, tornadoes, earthquakes, or even atomic blasts are substantially improved over existing type construction.

What is claimed is:

1. A rectangular wall unit for building construction having two opposite face sides and four interconnecting edge sides comprising:

a composition comprising:

a cured mineral bonding material of hydrated lime and silica flour and wherein:

the ratio, by volume, of hydrated lime to the sum of hydrated lime and silica flour of said bond-

ing material is .4 to .6, and where the ratio, by volume, of constituents is within the range of one part bonding material to one to four parts aggregate and applied water is 7 to 12 percent;

a lightweight aggregate having a density of .08 to .6 and comprising at least one of the following: styrofoam, pumice, perlite, vermiculite, glass nodules, or puffed-up ceramic;

said edge sides of said unit are of tongue and groove configuration, with one of each two parallel edge sides having at least a tongue-shaped protrusion and the other having a complementary groove, and

at least one cavity extending between a pair of opposite edge sides of said unit.

2. A wall unit as set forth in claim **1** wherein said silica flour is fine ground with a residue of **5** percent to **30** percent through a No. **200** type screen and with **5** percent to **0** percent residue through a No. **140** size screen.

3. A wall unit as set forth in claim **2** wherein the ingredients are placed in a mold, forming the wall unit, and then cured in high pressure steam of from **300** to **350** PSI for **2** to **8** hours.

4. A rectangular wall unit for building construction having two opposite face sides and four interconnecting edge sides and wherein:

two said edges comprise three tongue-shaped protrusions, a central protrusion having tapered sides and two lower protrusions each having tapered sides and one being positioned on either side of said central protrusion;

two said edges comprise three grooves complementary to the size and shape of said three tongue-shaped protrusions except that the groove corresponding to the position of said central protrusion is of greater depth than the height of a said central protrusion, whereby a spacing between wall units is provided when wall units are joined for the application of a bonding agent or reinforcement member;

a composition of cured mineral bonding material and a lightweight aggregate having a density of .08 to .6; and

at least one cavity extending between a pair of opposite edge sides of said unit.

5. A building having a plurality of side walls and ceiling member extending between said side walls and wherein at least one of said side walls comprises a plurality of rectangular wall units, each wall unit having two opposite face sides and four edge sides in turn comprising:

a composition comprising a mineral bonding material from the group of cement and lime and a lightweight aggregate having a density of .08 to .6;

said edge sides of each said wall unit being of tongue and groove construction with one of each two opposite edge sides having at least a tongue-shaped protrusion and the other having a complementary groove;

at least one cavity extending between a pair of opposite side edge sides of a said wall unit;

said wall unit being joined in a tongue and groove relationship;

a plurality of ceiling adapter units, each having a lower side corresponding to an edge side of a said wall unit and an upper plane surface; and

a structural slab ceiling resting on said plane surface of said adapter units between walls of said building.

6. A building as set forth in claim **5** wherein said adapter units are basically of L-shaped construction, having a vertical plate portion adapted to cover ends of a said slab, thereby providing a continuous outer appearance of a building with the ends of said slab thus hidden.

7. A building as set forth in claim **5** wherein said cavities of said wall units are aligned vertically and further comprising:

reinforcing material extending vertically through at least one elongated cavity formed by a plurality of aligned said cavities.

8. A building as set forth in claim **7** wherein an insulating material is contained within a plurality of said cavities.

9. A building as set forth in claim **5** wherein there is included an interior wall between two other said walls, a said ceiling adapter supporting abutting ends of ceiling slabs on said interior wall, said abutting ends of said ceiling slabs being spaced, and a course of bonding material extending between said spaced ends of said slabs to said ceiling adapter.

10. A building as set forth in claim **5** comprising:

a slot extending horizontally through a plurality of side-by-side said wall units; and

a steel reinforcement member extending horizontally through said slot.

* * * * *