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Miller et al.

[11] **3,826,051**

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[54] **WALL STRUCTURE**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 191,276, Oct. 21, 1971.

[52] **U.S. Cl.** **52/227,** 52/241, 52/274, 52/403, 52/600

[51] **Int. Cl.** **E04c 3/10,** E04c 3/26

[58] **Field of Search** 52/227, 228, 262, 264, 52/341, 396, 393, 403, 225, 600, 227, 241, 274

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[57] **ABSTRACT**

A wall member of generally slab-like configuration is formed of a foamed polymer dispersed throughout a cementitious matrix between a pair of side panels and includes elongate reinforcing members secured under tension and rigid in the depth dimension of the slab. One end of the wall member is positioned in a groove formed in a floor, the floor normally being made of concrete material. Adjacent widths of the wall members may be interconnected in tandem by aligning hollow tubular members in each of the wall members and securing a structural metal rod through the hollow tubular members. Alternatively, a hollow channel member may be positioned on the top ends of the aligned tandem wall members. Structural rods are positioned through openings in the channel member and are used to secure the wall members together. In addition, an environmental seal formed of a gasket-like material may be positioned between abutting ends of the wall members.

1 Claim, 8 Drawing Figures

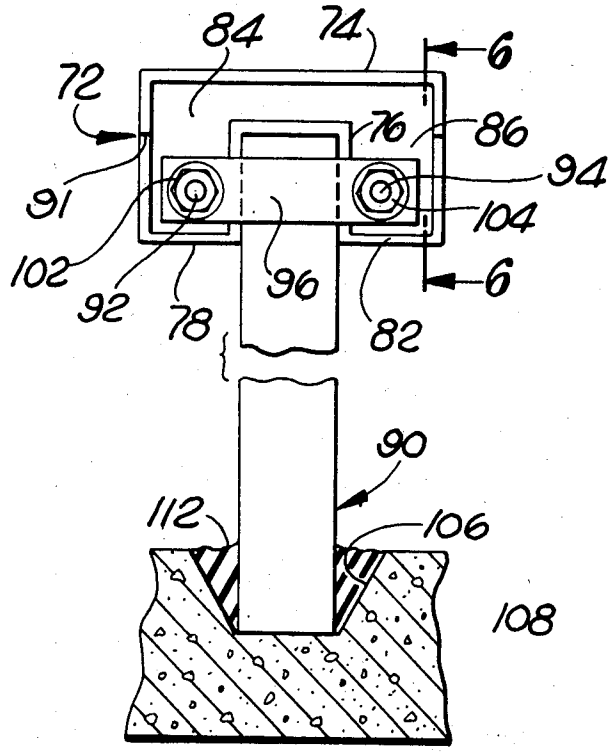
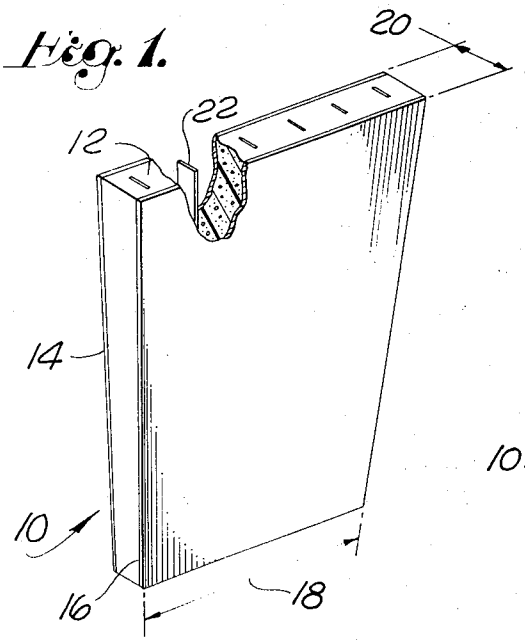


Fig. 1.



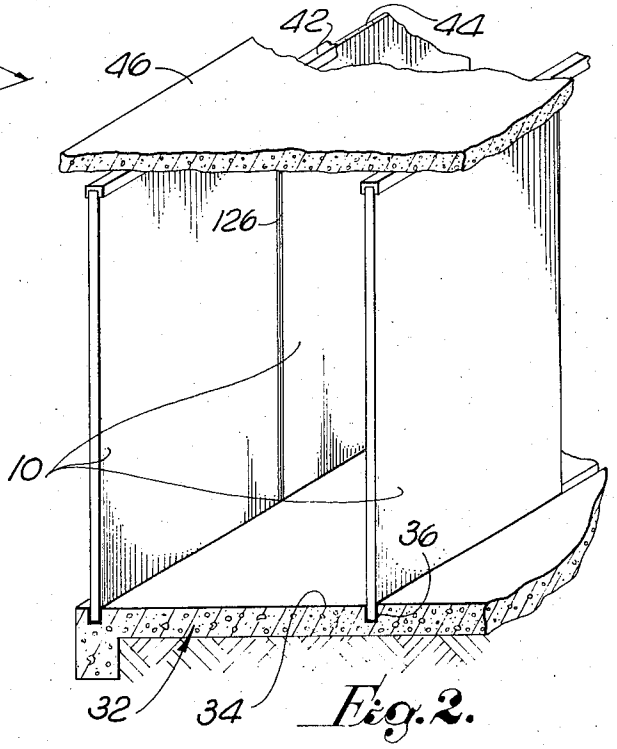
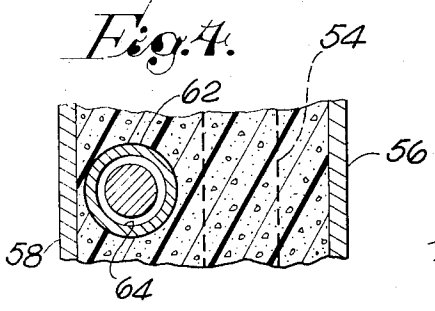


Fig. 2.

Fig. 4.



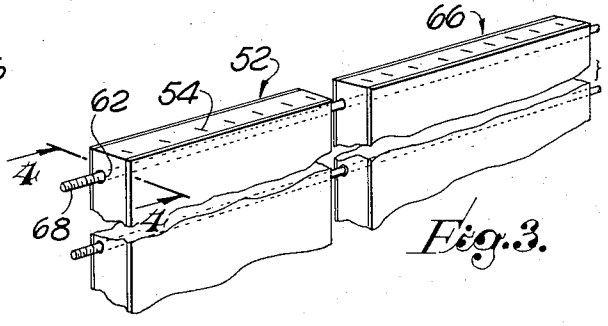


Fig. 3.

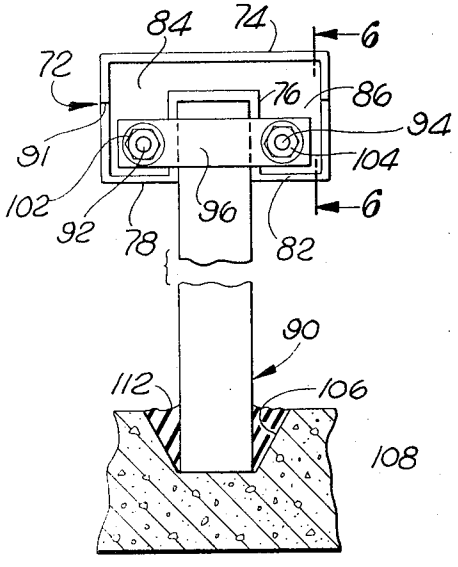


Fig. 5.

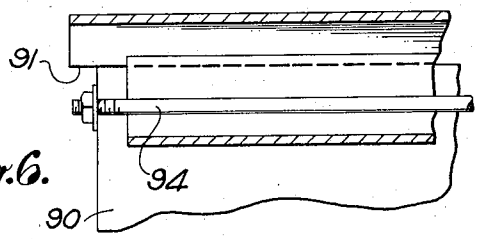


Fig. 6.

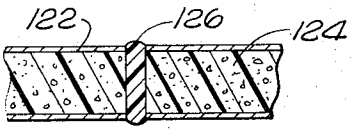


Fig. 7.

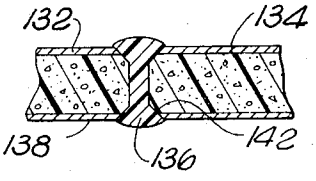


Fig. 8.

WALL STRUCTURE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of application Ser. No. 191,276, filed Oct. 21, 1971, entitled LIGHTWEIGHT REINFORCED STRUCTURAL MATERIAL.

FIELD OF THE INVENTION

The field of art to which the invention pertains includes the field of building materials and wall structures, particularly with respect to cementitious materials and means for interconnecting adjacent panels which form the wall members.

BACKGROUND AND SUMMARY OF THE INVENTION

Our United States patent application Ser. No. 191,276, filed Oct. 21, 1971 illustrates a structural board made of foamed polymer dispersed throughout a cementitious matrix forming a slab of structured material sandwiched between paper covered sheets or panels, and the disclosure of that application is incorporated herein by reference. Such plasterboard can be conveniently formed into sheets of 2 to 3 inches deep with a 3 foot width and a length of about 8 feet. Although other sizes can be provided the above mentioned size can be utilized for interior walls, floors and ceilings without the need for conventional two-by-four supports. In addition steel bands and/or ribbons are disposed under tension (from the foaming operation) within the slab so as to be relatively rigid in the depth dimension of the slab to structurally reinforce the board. The structural integrity of the board allows most building codes to be met in a simple fashion.

Numerous alignment and securement problems arise in positioning prior art wall members on a floor surface and in joining adjacent wall members. Conventional plasterboard is normally nailed to two-by-fours, but the purpose of the structural board described above is to eliminate two-by-four support structures, and thus the necessity for positioning the cementitious wall members in a correct position has required the development of new techniques in the construction industry.

In order to overcome the attendant disadvantages of prior art wall structures, the present invention provides means in a floor surface for easily positioning the cementitious wall members. Channel members are provided for securing adjacent wall members to each other. Moreover, environmental sealing may be provided between the adjacent cementitious wall members.

Specifically, a wall member of generally slab-like configuration is provided formed of a foamed polymer dispersed throughout a cementitious matrix between a pair of sheets or panels and includes elongate reinforcing members secured under tension and rigid in the depth dimension of the slab. The bottom end of the wall member is positioned in a groove formed in a cement floor which enables the correct positioning of the wall member with respect to the floor. Adjacent widths of wall members may be joined in tandem by means of a hollow tube which extends throughout the width of a wall member and which is aligned with an adjacent hollow tube in the adjacent wall members. A structural rod is threaded through the adjacent wall members and is

secured to maintain the adjacent wall members in alignment. Alternatively, a U-shaped channel member having longitudinal openings therethrough is positioned along the top edges of two or more tandemly adjacent wall members. Structural rods are then positioned through the channel openings. Brackets are provided at the ends of the channel members which abut the wall members and are used to secure the wall members in alignment. In addition, a sealing member may be provided between adjacent ends of wall members for providing an environmental seal therebetween.

The advantages of this invention, both as to its construction and mode of operation, will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like referenced numerals designate like parts through the figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective, partially cut-away view of a structural wall member which may be used with the present invention;

FIG. **2** is a perspective view of a building structure embodying one form of the present invention;

FIG. **3** is a perspective view of the top portions of wall members joined in accordance with principles of the invention;

FIG. **4** is a sectional view of a wall structure of FIG. **3** taken along the lines **4—4** of FIG. **3**, in the direction of the arrows;

FIG. **5** is an end view, partially in section, of alternative embodiments of the invention;

FIG. **6** is a side view, partly in section, of the structure of FIG. **5** taken along lines **6—6** of FIG. **5**, in the direction of the arrows;

FIG. **7** is an illustrative view, partly in section, of a pair of wall members joined together; and

FIG. **8** is an alternative embodiment of the arrangement of FIG. **7** for joining adjacent wall members.

DETAILED DESCRIPTION

Referring now to FIG. **1** there is shown a structural board **10** made in accordance with the principles of United States patent application Ser. No. 191,276, referred to above. The board **10** is made of a foamed polymer which is dispersed throughout a cementitious matrix and forms a slab **12** of structural material sandwiched between paper cover sheets **14** and **16.** When manufactured for use as wallboards the slab **12** has a width dimension **18** of approximately 3 feet and a depth dimension **20** of approximately 2 inches. Normally the length of the board would vary with the size of the room with approximately 8 foot lengths being convenient. Alternately, of course other dimensions can be used as explained in the aforementioned patent application. Embedded in the slab **12** are a plurality of steel bands or ribbons **22** which are disposed perpendicularly with respect to the cover sheets **14** and **16** and spaced from the outer edges of the slab **12.** By this disposition the steel bands have greater rigidity in the depth dimension **20** of the slab than in the width dimension and serve to resist compression, flexure, and deflection forces.

Referring now to FIG. **2,** there is shown one form of the invention wherein a plurality of the boards **10** are utilized as wallboards and as ceiling or roofing mem-

bers. A conventional cement floor **32** which may be of slab or raised configuration is depicted having the wallboards **10** positioned thereon. Grooves **36** are longitudinally formed in the top surface **34** of the concrete and have widths slightly larger than the depth dimension **20** (FIG. **1**) of the boards **10.** Normally, the grooves **36** are formed when the concrete **32** is poured although they can be cut into the concrete subsequent to the hardening and forming of the concrete floor **32.** Thus, the boards **10** can be utilized in previously constructed homes where reconstruction or remodeling of the home is being accomplished. The boards **10** are inserted into the concrete grooves **36** and normally a sealing putty or other sealer is positioned in the groove prior to insertion of the wallboards so as to provide a secure joint between the concrete floor and the boards **10.** Importantly, the structural reinforcement of the boards enables their simple securement in the grooves **36.**

As can be seen in FIG. **2,** a plurality of boards **10** are joined together so as to form the desired length of a wall. A U-shaped metal channel **42** is positioned on, and overlaps, the top surfaces **44** of adjacent boards and constitutes an interconnection member for holding the adjacent boards together. A board member **46** which is similar in construction to the board **10** is utilized as a ceiling member or as the second story floor of the building. Normally, the ceiling or second floor member **46** will be made thicker than the wall members with **3** inches being the minimum thickness for the ceiling or floor **46** whereas **2** inches are considered satisfactory for wall members. However, it should be understood that such dimensions are merely convenient and that in view of the relatively lightweight material, greater thicknesses can be used when desirable.

Referring now to FIGS. **3** and **4,** there is shown an arrangement for securely positioning together wall or ceiling boards made in accordance with the configuration of FIG. **1.** As can be more clearly shown in the cross-section of FIG. **4** the boards **52** of FIGS. **3** and **4** are made similar to the boards **10** of FIG. **1.** However, the steel bands **54** of FIGS. **3** and **4** are offset somewhat to the right so that they are closer to one cover sheet **56** and spaced somewhat further from the opposite cover sheet **58.** Running along the width dimension of the boards **52** in a plane perpendicular to the ribbons **54** are a plurality of hollow tubes **62.** The tubes **62** have internal threads **64** near the ends of the board **52.** When joining the board **52** of FIG. **3** to an adjacent, similarly constructed board **66,** the boards are normally mounted in the floor groove, such as the groove **36** of FIG. **2,** and the openings in adjacent hollow tubes **62** are aligned. A structural rod **68** is then passed through the tubes **62** in both boards **52** and **66** and threaded at opposite ends thereof. Continued rotation of the rod **68** will provide a tight joint between adjacent wallboards. Alternatively, the tubes **62** can be unthreaded and the threaded ends of the rod **68** fitted with suitably sized retaining washers and nuts. The rod **68** can of course be made long enough so that more than two wallboards can be joined together. It should be noted that **3** or **4** hollow tubes **62** are normally utilized in each wallboard to join adjacent boards together. In typical construction the hollow tube **62** has an outer diameter of approximately one-half inch and the inner diameter is such that a ⅜ inch rod **68** is insertable therein.

Referring now to FIGS. **5** and **6,** there is shown an alternative embodiment for securing together adjacent sections of wallboard. In the embodiment of FIGS. **5** and **6,** the securing means are positioned externally of the wallboards and thus exact alignment as in FIGS. **3** and **4** is not necessary. In FIGS. **5** and **6** a channel member **72** comprises an outer generally U-shaped member **74** and an inner generally U-shaped member **76,** joined together at the bottom ends thereof by longitudinally extending plates **78** and **82** to form an integral, elongate structure. Longitudinally extending openings **84** and **86** are thus provided between the side walls of the U-shaped members **74** and **76.** The distance between adjacent side walls of the inner U-shaped member **76** are approximately equal to the thickness of a wall member **90** which may be of similar type construction as the wall member **10** of FIG. **1.**

As can be more clearly seen in FIG. **6,** at each end of the channel member **76,** the top half of the outer U-shaped member **74** extends beyond the ends of the inner U-shaped member **76** a short distance (e.g., 1–2 inches) forming downwardly facing shoulders **91.** Structural rods **92** and **94** are respectively inserted through the openings **84** and **86** between the U-shaped members **74** and **76.** The rods **92** and **94** are threaded at their ends and estend along the lengths of the longitudinal openings **84** and **86,** terminating approximately at the ends of the shoulders **91,** as can be seen in FIG. **6.** A bracket **96** is provided at each end and is formed with openings through which the rods **92** and **94** extend. The brackets **96** abut the opposite end surfaces of the wallboard **90** and the rods **92** and **94** are secured to the brackets **96** by means of nuts **102** and **104,** respectively. Tightening of the nuts provides a means of securing together adjacent wallboards contained by the channel member **72.** As illustrated in the embodiment of FIGS. **3** and **4** the rods **92** and **94** are sufficiently long so as to enable as many adjacent wallboard sections as is necessary to be joined together. The open construction provided by the vertical spacing between the inner and outer U-shaped members **76** and **74** provides a desirable measure of soundproofing between adjacent floors of a constructed building.

Referring specifically to FIG. **5,** the wallboards **90** are inserted into grooves **106** formed in concrete floor members **108.** These grooves **106** can be similar to the grooves **36** in the concrete floor **32** depicted in FIG. **2,** but in another embodiment of the invention are formed with a truncated triangular cross-section. A putty or other type of cementitious mix **108** is utilized to form a tight fit between the bottom of the wallboard **90** and the floor **108.** By providing a truncated triangular groove, a degree of flexibility is obtained in aligning the walls. As previously pointed out exact alignment of the wallboards is not necessary in the embodiment of FIGS. **5** and **6,** as securing of the wallboards together is done entirely on the external top surface of the adjacent wallboards. Accordingly, the triangular groove **106** functions together with the channel member **72** to enable the walls to be rapidly assembled.

Referring now to FIG. **7,** and in addition, back to FIG. **1,** there is shown an embodiment for weatherproofing and sealing adjacent surfaces of wallboards. In FIG. **7** the end surface of adjacent wallboards **122** and **124** have positioned therebetween a gasket-like material **126** which may be formed of neoprene or similar type long lasting and weather sealing material. When

the adjacent wallboards such as that depicted in FIG. **1-6** are secured together and tightened, the neoprene gasket material **126** forms as a tight seal so as to enable the adjacent wallboards to be completely weather-proofed. In place of plastic gasket material, one can use a hollow metal rod or pipe, e.g., of tin, which is crushed when pressed together to form the seal.

In the embodiment shown in FIG. **8** an alternative structure is shown for sealing adjacent wallboards. In FIG. **8,** a first wallboard **132** is joined to a second wallboard **134** and a gasket-like material **136** is utilized therebetween. The outer edge surfaces of the adjoining wallboards **132** and **134** are chamfered, at **138** and **142** so that when the boards **132** and **134** are drawn together by the mechanisms of FIGS. **3** or **6** the gasket material tends to enlarge at the outer edges of the wallboards and an enlarged seal is formed at the outer edges.

We claim:

1. A structure for interconnecting a plurality of adjacent widths of wallboard, comprising;

a hollow channel member defined by an outer U-shaped channel member and an inner U-shaped channel member coaxial with said outer channel member, the free ends of said U-shaped channel member being interconnected by a pair of channel wall members;

the spacing between said U-shaped members defining longitudinal openings, the inner surface of said inner U-shaped member being approximately equal to the width of a wallboard;

said channel member being positioned overlapping one end of said wallboards with said inner U-shaped member abutting the sides of said board;

at least one elongated structural rod extending through one of said longitudinal openings; and

means for securing said rod with respect to the outer ends of said wallboards to secure adjacent wallboards to each other.

* * * * *