# United States Patent [19]

**Layne**

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[54] **PANEL MOLD FOR FORMING COMPOSITE CONCRETE-REINFORCED WALLS**


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[52] **U.S. Cl.** ..... **52/426**

[51] **Int. Cl.** ..... **E04b 2/86**

[58] **Field of Search** ..... 52/426, 425, 429, 430, 52/427, 428



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[57] **ABSTRACT**

A panel mold is disclosed herein for use in the construction of composite concrete-reinforced walls wherein the panel includes two parallel sheets of pressed composition material arranged in fixed spaced apart relationship by being rigidly separated by a plurality of metal rod members. Each rod member includes opposite end hooks embedded in an anchoring material carried by the sheets so as to be arranged in fixed parallel spaced relationship normal to the opposing wall surfaces of the sheets. The top and bottom edge marginal regions of the sheets are notched so as to provide a registering device for bearing against and interlocking with similar adjoining panels. The interior spaces of the panel between the opposing wall surfaces of the sheets are filled with concrete to form an interlocking composite wall structure.


**3 Claims, 3 Drawing Figures**

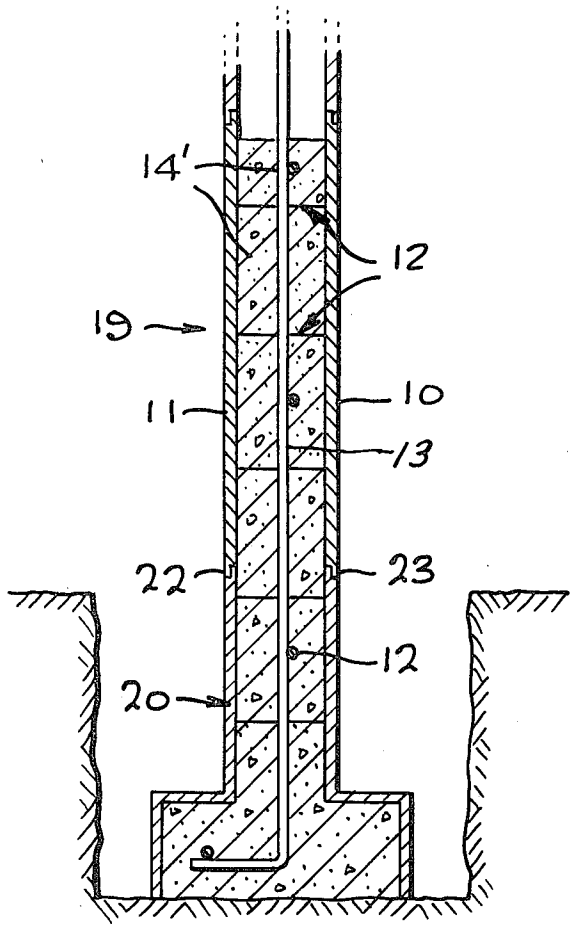


Fig. 2

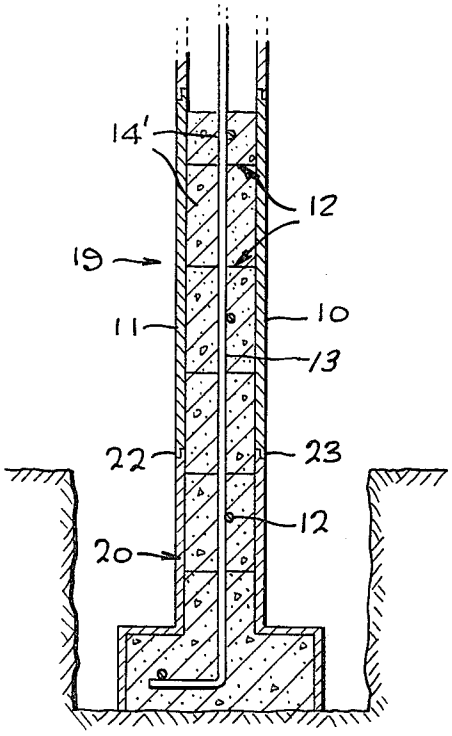



Fig. 1

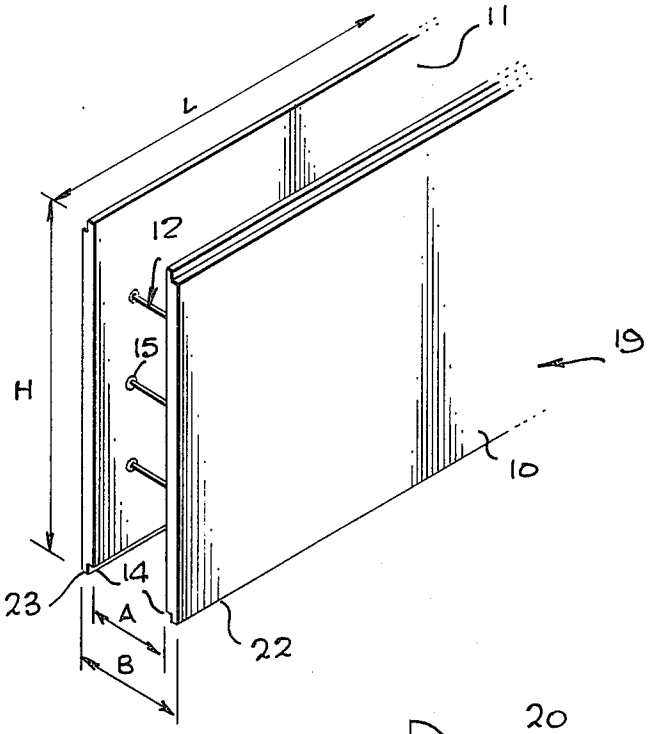
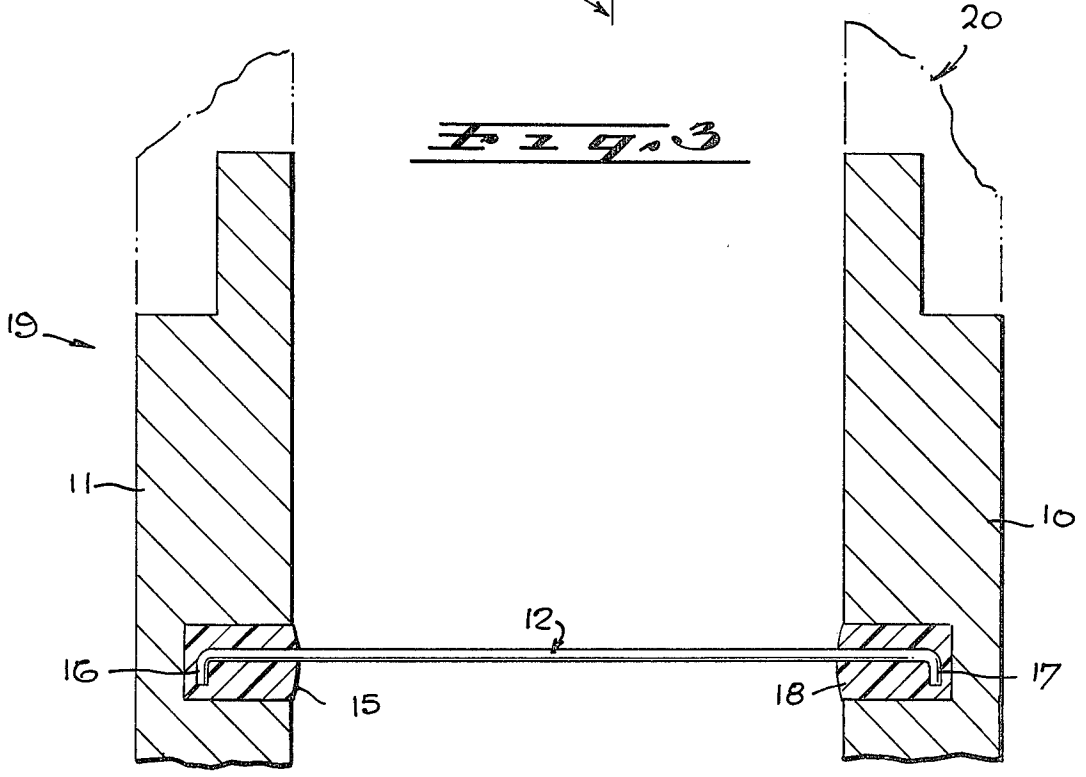



Fig. 3



# PANEL MOLD FOR FORMING COMPOSITE CONCRETE-REINFORCED WALLS

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to prefabricated wall panels and, more particularly, to a novel wall panel composed of at least two or more different weighted compositions in which the combined composite has load bearing characteristics so that the panels are useful in prefabricated building structures. Additionally, panels are provided in which the physical and mechanical properties of the composite material are selectively controlled to meet predetermined designed properties. Such properties as strength, stiffness and energy absorption may be selected by the choice of material composition and material geometry.

2. Description of the Prior Art

In nearly every climate on the earth, man must build shelter for himself and for his goods from various weather conditions such as rain and snow, temperature extremes, and wind. Such shelter often serves the further purpose of providing privacy for man and his goods. Accordingly, many different types of buildings and construction materials have been created depending upon the climatological and sociological factors of the individual locale and depending upon the availability of suitable building materials. Man has created shelter structures for use as residences, storage of goods in warehouses, factories, public meeting places, schools, office buildings and the like. In the past, these structures have required tremendous amounts of handwork and individual skills so that the cost of construction has risen in proportion to the cost of employment of the skilled labor involved.

In order to reduce the costs of such structures, considerable interest is being shown in the field of modular or factory building construction employing prefabricated wall panels which are assembled at the construction site of the building, or which are built within a factory site and transported to the building site as a module. Generally, the individual wall panels are placed adjacent each other in an end-to-end relationship and are suitably secured between a foundation and a roof so as to quickly and economically create an enclosure. Conventional wall or building panels are presently constructed by conventional methods and to standards which have been in use for many years. One early type of wall panel comprises a pair of spaced apart plywood or fiberglass sheets that serve as outer facings from the opposite sides of the core which may take the form of cardboard "eggcrating" that may or may not be filled with a plastic filler material such as polyurethane or polystyrene foam. Later developments in the prefabricated wall panel field have provided articles or structures of reinforced cellular composition consisting of reinforcing members arranged in a predetermined geometry located in a cellular matrix. Such panels provide a structure having a high strength-to-weight ratio. It is known that low density materials can be obtained by the addition of foaming agents thereto so that the cellular materials are created within various densities. For obtaining desirable physical characteristics, foam material of various synthetic resin such as various vinyl derivatives and other polymers such as polyesters and polyurethane derived from isocyanate may be employed, as well as various forms of foam rubber, both



natural and synthetic, and syntactic foams. All of these materials may be generally termed "plastic foam" and are generally considered as a non-load bearing filler material employable to occupy voids and cavities. However, such materials are basically isotropic and do not always have the requisite physical properties and resistance to loads applied in various predetermined directions for a variety of applications.

When employing composite materials such as in a wall panel, two or more materials are combined in an orderly manner to give a single material properties which are superior to the starting material. In most cases, the composite consists of high strength fibers embedded in a matrix of another substance, although other reinforcement configurations may also be used. Fiber reinforced composites are of particular interest since it has long been known that materials achieve their highest strength in fibrous form. Foam matrices have been reinforced by various methods so as to accommodate applied stresses which take the form of random oriented fibers, woven mesh, taut fibers in three dimension, and reinforcement by rigid core members of various configurations. Such attempts to provide a structural panel which is reinforced by means of incorporation of fibers arranged in orderly pattern is disclosed in U.S. Pat. No. 3,322,868. Disadvantages reside in using such oriented fibrous material since elaborate fixtures must be developed so as to initially lay out the fibers in the orientation desired. Also, such orientation requires skilled workers and particularly costly preparation.

As can be readily understood from the foregoing, a tremendous amount of expense and labor goes into the fabrication of the panels and their incorporation into a building structure, whether it be a public building, a factory, a storage structure or a residential unit. Therefore, improvements in the fabrication of structural and load bearing members which are permitted by modern technological approach and conceptural improvement can readily reduce the costs of such buildings and make them more durable by the use of prefabricated load bearing wall panels and related structures which readily accept, position and secure the prefabricated panels to create the building.

## SUMMARY OF THE INVENTION

Accordingly, the difficulties and problems encountered with conventional wall panels are obviated by the present invention which provides a novel panel useful in forming a composite concrete-reinforced wall comprising a pair of spaced apart sheets composed of pressed composition material which are joined by a plurality of rigid rod members having hooked ends anchored to the opposing faces or wall surfaces of the sheets. Poured concrete occupies the space between the sheets and surrounds the rod members so that a unitary structure is produced by locking the rod members, sheets, additional steel reinforcement and the concrete together. A feature resides in providing the exposed opposite edge marginal regions with outwardly facing notches adapted to register with and engage together in mated relationship with similar adjoining panels disposed in tiers above or below the panel.

Therefore, it is among the primary objects of the present invention to provide a novel load bearing wall panel composed of a combined low and high density materials so that the resultant composite has an im-

proved strength-to-weight ratio adapted to accommodate a variety of applied loads.

Another object of the present invention is to provide a panel mold apparatus for producing an improved load bearing wall panel utilizing composite materials which may take the form of a central concrete core encased by a pair of composition sheets in which the sheets become a load transmission path while the central core operates an an insulator and reinforcing stabilizer.

Another object of the present invention is to provide an apparatus for producing a novel prefabricated wall panel consisting of composite homogeneous material having a low and a high density matrix composite wherein a selected one of the composites is a load carrying element to create unique physical and mechanical properties and further including notched areas of attachment to other similar panels for transmitting loads to and from supporting structures.

Another object of this invention is to form concrete walls, such as are used in the construction of building structures, with a lower labor cost and with improved appearance of surface.

A further purpose of my invention is to enable the prefabrication of basic elements of such concrete walls at locations which may be removed from the final site of construction. By virtue of the lightness of structure, such basic wall elements may be readily transported to the construction side.

A further object or purpose of this invention is to make the basic elements of such wall structures larger in area than conventional concrete blocks, so that fewer units need be handled by construction laborers in building a concrete wall of a given area. Such larger units will require less labor expenditure, and furthermore this invention will eliminate the costly labor of cementing the conventional blocks together with mortar.

As compared with conventional poured concrete walls, this invention eliminates the cost of removing the concrete forms by the use of light inexpensive interengaging panels which serve as permanent external surfaces of the finished concrete wall.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the novel panel used to form a composite concrete-reinforced wall prior to filling the space between the pair of sheets or boards with concrete;

FIG. 2 is a transverse cross-sectional view of the panel illustrated in a typical course or installation; and

FIG. 3 is an enlarged sectional view of the notched edge marginal regions of the sheets or boards providing a joint between an upper and a lower panel prior to the joining of two sets of panels.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now descriptively to the drawings, in which similar reference characters denote similar elements throughout the several views, FIG. 1 illustrates a typical panel section **19**, composed of a pair of parallel sheets **10** and **11** composed of pressed composition material such as fibreboard or other light weight durable material. The sheets **10** and **11** are joined by a plurality of metal rods **12** at regular intervals so as to separate the sheet **10** from sheet **11** by a uniform spacing A. In the preferred embodiment, this spacing A is determined by the thickness of the panels so that the external surface of sheet **10** is spaced a distance B of 6 inches from the external surface of sheet **11.** Length L of each sheet is 4 feet and Height H of each sheet, 2 feet in the preferred embodiment, although the form of the invention lends itself to many combinations of dimensions to suit the needs of builders and constructors.

The lower edges **22** and **23** of panels **10** and **11** are notched at numeral **14,** the purpose of which is to align panel section **19** with adjoining panel section **20** as shown in FIG. **2.** As shown in the illustration, panel **20** is below panel **19,** but these notches **14** may also project from the sides of panel **19** to align panel **19** with other similar panels on either side and above it. The location of notches **14** is determined in such fashion that notches from adjoining sheets do not interfere with each other, but serve to strengthen the joint between adjoining panels during construction.

Metal rods **12** which join the sheets of a common panel are formed with hooked ends **16** and **17** so as to engage with the opposing inside surfaces of sheets **10** and **11** and are anchored thereto by bonding material **15** and **18** located in recesses binding them to the surfaces of sheets **10** and **11** so as to firmly lock sheets **10** and **11** into a rigid unit.

As shown in FIG. **2,** the panels are filled with concrete **14'** which is allowed to set in place. For additional strength, reinforcing steel members **13** may be added, prior to pouring the concrete.

In practice, the wall panels **19** may be prefabricated and shipped to the job, since they are essentially of light weight construction, and the size of the panels of the preferred embodiment has been found to be compatible with conventional means of transport. At the job site, groups of panels may be joined together and held in place by notches **14,** and reinforcing steel added in the interior spacing between panel sheets. Concrete is poured as the final step in erecting a building wall. The panel sheets act to retain the concrete until it hardens, and remain as the permanent exterior surfaces of the finished wall.

In FIG. **3,** it can be seen that the joint formed between adjacent panels is achieved by registering or mating the notched edge marginal regions of adjacent panels. The upper panel is shown in broken lines while the lower is shown in solid lines.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

What is claimed is:

**1.** A panel for forming composite concrete-reinforced walls comprising:

a pair of parallel sheets composed of pressed composition material having opposing wall surfaces in fixed spaced apart relationship defining an open space therebetween;

a plurality of rigid rod members extending between said sheet opposing wall surfaces maintaining said pair of sheets in their fixed parallel relationship;

each of said sheets having top and bottom edge marginal regions incorporating an elongated notch so as to provide a registering means for mating with and bearing against similar adjoining panels;

a concrete core occupying said open space between said sheet opposing wall surfaces so as to form an interlocking composite wall structure of rod members, said sheets and said concrete core;

additional steel reinforcements extending normal to said rod members and interlocked by said concrete core;

bonding means attaching the opposite ends of said rod members to the respective wall surfaces of said sheets; and

each opposing wall surface of said sheets is provided with a plurality of aligned pairs of recesses for insertably receiving the opposite respective ends of each of said rod members and for holding said bonding means.

**2.** The invention as defined in claim **1** wherein:

each of said rod members includes hooked portions integrally carried on each end embedded in said bonding means for anchoring to said respective sheet.

**3.** The invention as defined in claim **2** wherein:

said notches on the top edge of said pair of sheets face outwardly and said notches on the bottom edge of said sheets face inwardly.

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