March 4, 1941. C. R. GIFFORD 2,234,114

COMPOSITE CONSTRUCTION MEMBER

Filed April 1, 1937 2 Sheets-Sheet 1

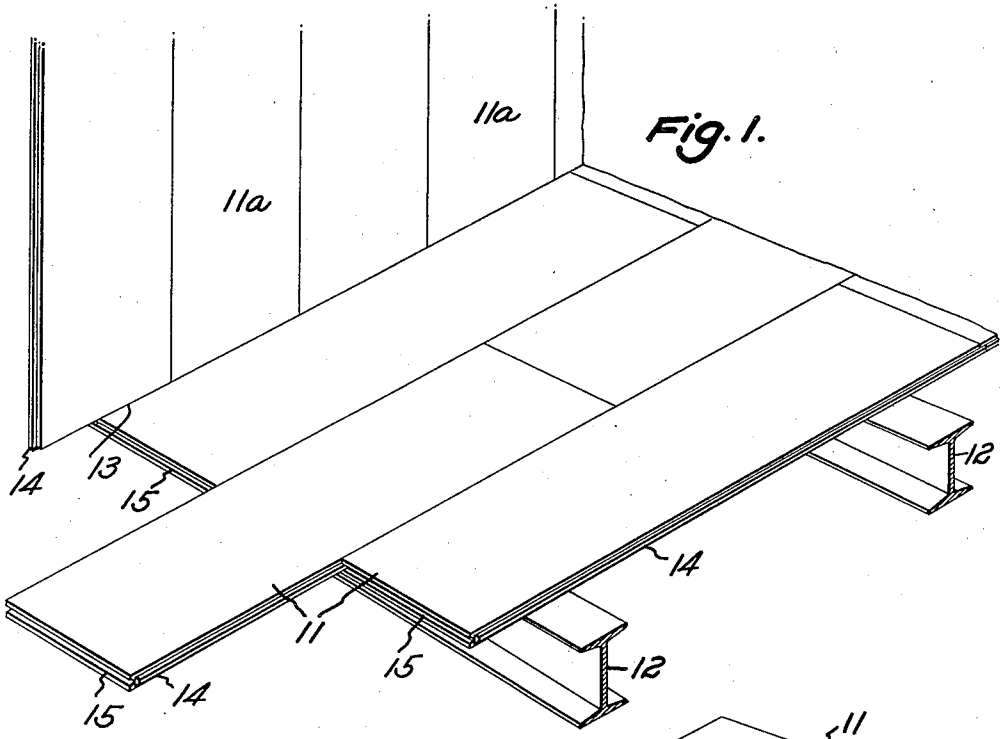

Fig. 1.

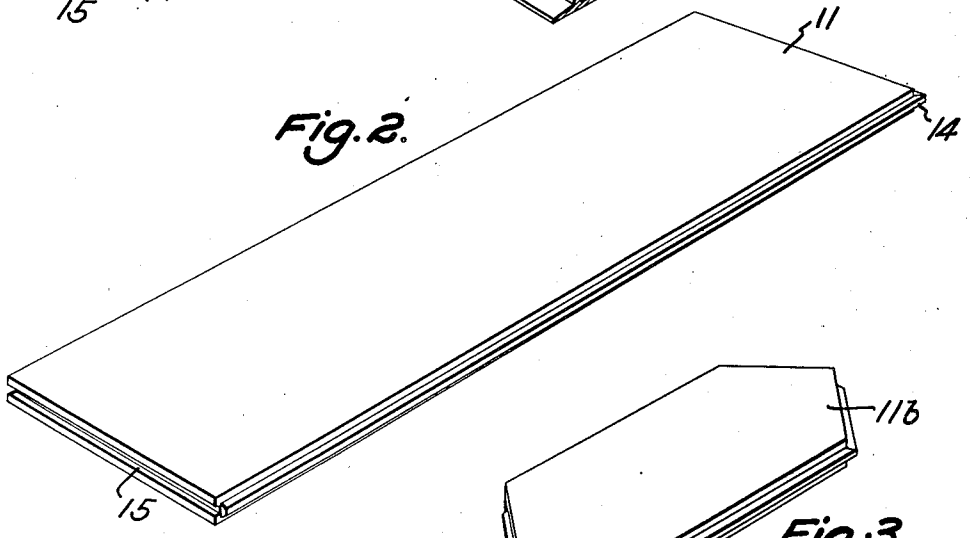

Fig. 2.

Fig. 3.

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Fig. 4.

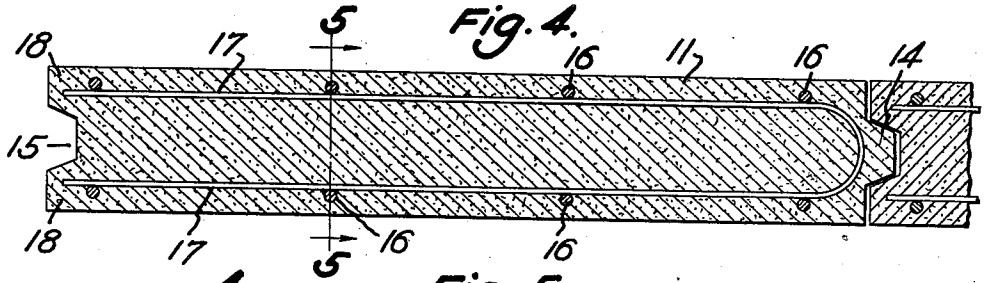


Fig. 5.

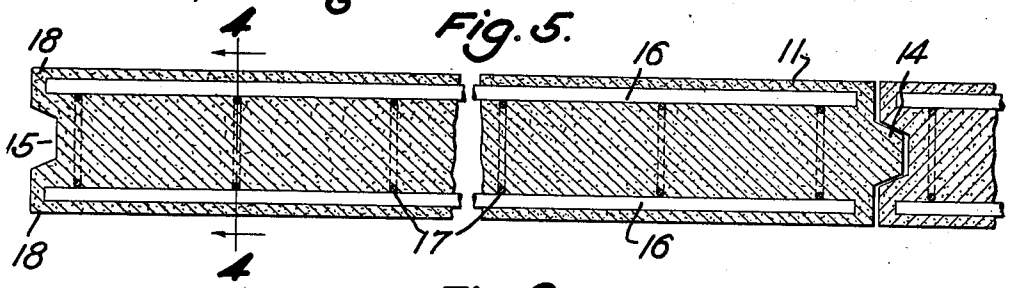


Fig. 6.

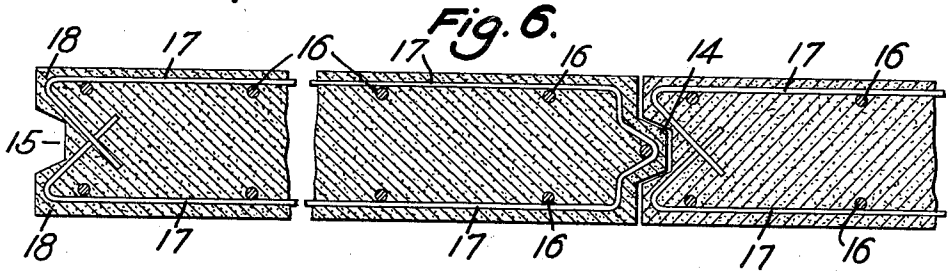


Fig. 7.

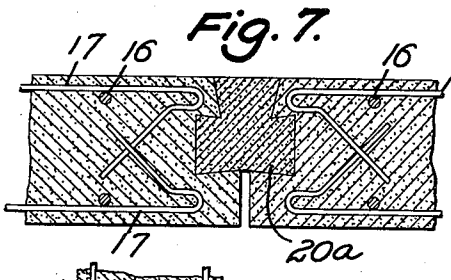


Fig. 8.

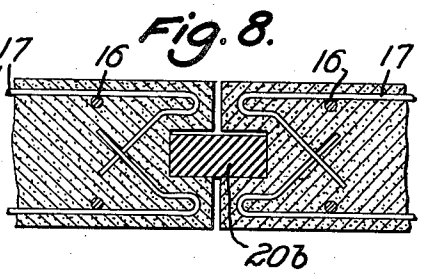


Fig. 10.

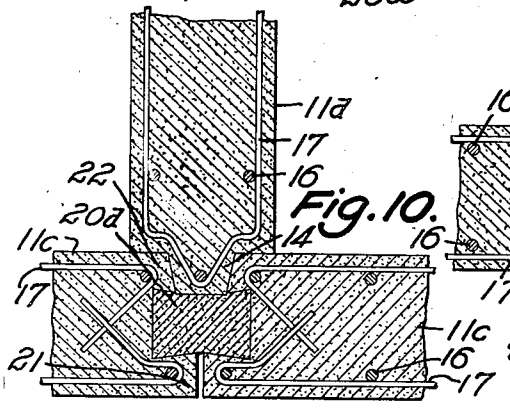
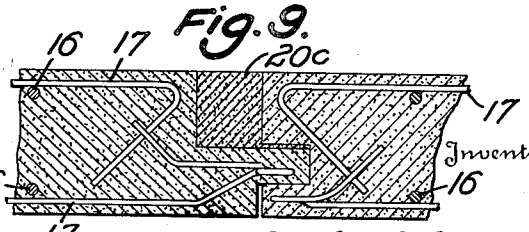


Fig. 9.



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Patented Mar. 4, 1941 2,234,114

UNITED STATES PATENT OFFICE

2,234,114

COMPOSITE CONSTRUCTION MEMBER

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Application April 1, 1937, Serial No. 134,437

9 Claims. (Cl. 72—68)

This invention relates to composite construction members, and particularly to building slabs or planks and to a building construction including preformed slabs or planks.

A principal object of the invention is to provide prefabricated planks for the construction of buildings which combine high strength and light weight, and which can be readily and cheaply transported, and can be quickly installed without special skill or appliances.

A further object of the invention is the provision of prefabricated planks which require a minimum of supporting members in building construction and the like, and which can be erected into structures of satisfactory strength and load-carrying capacity.

Another object of the invention is the provision of prefabricated planks which can be installed with a minimum of regard for the position of supporting members.

These and other objects of the invention are obtained by providing a composite construction member having a length substantially greater than its width and a width substantially greater than its thickness and comprising a body of light-weight porous concrete composition, and a plurality of substantially parallel wire elements extending lengthwise of the plank adjacent each of the flat surfaces thereof.

The porous concrete provides a light-weight elastic body which serves to maintain the wire elements in the predetermined position adjacent the flat surfaces of the plank so that the composite plank acts like a beam having its substance concentrated at the surfaces of the beam. In this way the strength-imparting elements of the member are maintained in a position where they are most effective in imparting the maximum of strength to the composite member, while the porous concrete composition provides a light-weight elastic medium for maintaining the strength-imparting elements in their most effective position and for transmitting to them in a most effective manner the forces exerted on the composite member.

In order to provide for the effective transfer of forces between the planks in the building structure, they are provided on their edges with interlocking elements, preferably with a tongue on one edge and end, and a corresponding groove on the other edge and end. By providing tongues and grooves in the preferred manner, the planks are reversibly positionable and interlock one with the other to form a strong safe structure of high load-carrying capacity.

For some purposes separate interlocking elements may be used for joining the construction members of the invention.

In the preferred method of manufacturing the construction member of the invention, a plurality of attenuated metallic members, preferably steel wires, are positioned in a rectangular mold, for example, by means of transverse spacing wires, so as to form a layer of wires adjacent each of the large faces of the mold. A suitable light-weight porous concrete composition containing a light-weight aggregate such as cinders or the like and aerated before pouring so that the air dried composition will have a weight of from about 40 to about 90 pounds per cubic foot, is poured into the mold.

The molds are preferably constructed, in the interest of economy of labor and floor space, so that a plurality of composite members may be poured at one time. This may be advantageously effected by the use of multiple molds, the base member of which carries a plurality of spaced septa which are positioned in proper spaced relation by means of end members, cooperating with the base member and the septa to form a plurality of rectangular cells with their large sides vertical and open at the top along a long edge of the cell. The spaced attenuated metallic members are preferably positioned in these cells before the concrete composition is poured into the cells.

The composite members are removed from the molds after the concrete has taken its initial set and the molded planks or other members are strong enough to be handled. The green planks are then cured by piling them on their flat sides in such a manner that free circulation of air is hindered so that the moisture content of the concrete is retained for a considerable period of time. In this manner a slow and effective curing is obtained. Other methods of obtaining satisfactory curing conditions known to the concrete art may also be used.

The curing of the planks made in accordance with the above-described method may be effected with a surprising absence of volume shrinkage, hair cracking and warping and the resulting product is of the highest utility in the construction of buildings, especially for floors and roofs, but also for other structural purposes.

For the purpose of illustration the invention will be more fully described with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a portion of a structure including the construction members of the invention;

Fig. 2 is a perspective view of a construction member of the invention;

Fig. 3 is a perspective view of a modified form of construction member;

Fig. 4 is a transverse section on line 4—4 of Fig. 5 and Fig. 5 is a longitudinal section on line 5—5 of Fig. 4, of a structural member of the form illustrated in Fig. 2;

Fig. 6 is a transverse section through a modification of the construction member of the invention; and

Figs. 7, 8, 9 and 10 are sections showing modifications in the form of joints between the construction members of the invention.

In the structure shown in Fig. 1, a plurality of slab or plank members 11 of the form shown in Fig. 2 are laid on supporting members 12 to form a floor. The slabs 11 are laid without consideration of the location of the supporting members 12 up to at least five-sixths of the length of the slabs.

Similar slab members 11*a* are vertically positioned to form a wall. The joint 13 between the lower ends of members 11*a* and members 11 may be advantageously formed as shown in Fig. 10.

Other structural features such as roofs, ceilings and the like may be constructed in the manner indicated in Fig. 1.

Fig. 2 shows the construction member of the invention in the form of a rectangular slab or plank 11, having a tongue 14 on one side and end, and a groove 15 on the opposite side and end.

The construction member 11*b* shown in Fig. 3 is similar in construction to that of Fig. 3, except that the ends are angular.

Figs. 4 and 5 show the preferred composite structure of the plank member of Fig. 2 and the method of interlocking it to adjacent members in the construction of buildings and the like. The longitudinal wires 16 are spaced by transverse members 17, which are preferably spot-welded thereto so as to form a layer of attenuated metallic elements adjacent each of the faces of the plank. The metallic elements are preferably extended somewhat into tongues 14 and into flanges 18 forming grooves 15 in order to add to the strength of these portions of the plank.

In the form of the invention shown in Fig. 6, the metallic elements are shown extending further into the tongues 14 and flanges 18 in order to distribute the stresses in these portions of the plank more fully to the two layers of metallic elements.

In the forms of the invention shown in Figs. 7, 8 and 9 reinforcing members 20*a*, 20*b*, and 20*c* are inserted in the joints between the planks. These reinforcing members may be preformed particularly in the form shown in Fig. 8 or they may be formed in situ by pouring in a concrete composition or other plastic substance. The forms shown in Figs. 7 and 9 are particularly adapted for the latter method of construction.

Fig. 10 shows one method of joining constructional elements at right angles, such as walls and floors and the like. In this form planks 11*c* are formed with adjacent grooves having one flange 21 longer than the other flange 22. A reinforcing element 20*d* is fitted or cast into the space formed by the grooves of adjacent planks 11*c* leaving a groove adapted to receive tongue 14 of plank 11*d*.

The building slabs or planks of the invention may be varied widely in length, width, thickness, porosity of concrete, and number, position and size of the wire elements. In practical operation, of course, it is desirable to standardize upon a definite number of stock forms designed to meet usual constructional demands. The following specific examples are illustrative of forms which have been found useful.

Example 1.—For the construction of a roof, in a fire-resistant building, which is required to support a load of 55 to 110 pounds per square foot with a factor of safety of 8 to 4, respectively, the supporting steel beams to be spaced 6 feet on centers, each of the planks of the invention may weigh 17 pounds per square foot (measured on one flat surface), and measure 6 feet to 10 feet long by 16 inches wide by 2¾ inches thick. One end and one edge would have a tongue, the other end and other edge would have a groove, as shown in Fig. 2. Each plank would be provided with seven No. 8, U. S. steel and wire gage, galvanized wires spaced 2 inches on centers, positioned longitudinally adjacent each face of the plank, and No. 11 U. S. steel and wire gage, galvanized wires spaced 10 to 12 inches on centers, positioned transversely adjacent each face.

Example 2.—For the construction of a floor, in a fire-resistant building, which is required to support a load of 320 to 160 pounds per square foot with a factor of safety of 4 to 8, respectively, the supporting steel beams to be spaced 24 inches on centers, each of the planks of the invention may weight 12 pounds per square foot (measured on one flat surface), and measure from 3 feet to 9 feet long by 16 inches wide by 2 inches thick. One end and one edge would have a tongue, the other end and the other edge would have a groove, as shown in Fig. 2. Each plank would be provided with four No. 8, U. S. steel and wire gage, galvanized wires spaced 4 inches on centers, positioned longitudinally adjacent each face of the plank, and No. 12 U. S. steel and wire gage, galvanized wires spaced from 10 to 12 inches on centers, positioned transversely adjacent each face.

The wires, especially the longitudinal ones, may advantageously have their ends folded back upon themselves for a distance of about 2 to 4 inches, this feature being of assistance in minimizing slippage of the wires within the porous concrete, when the planks are subjected to strains suddenly applied. Since these light-weight planks are nailable, when comprised of porous concrete made as outlined above, metal clips may be nailed to the edges and used for anchoring the planks to steel supports or the like. Also, shingles of any composition may be nailed to the slabs of the present invention, a desirable feature whenever a shingled surface is to be placed upon these slabs in a roof construction. Moreover, floor coverings such as linoleum, rubber tile, asphalt tile, or the like, may be applied directly over the slabs without any special preparation being applied to the surface of the planks; and wooden flooring may be nailed directly to the plank, or it may be stuck down with an adhesive composition as desired.

Grouting is preferably used in the joints made by tongues and grooves or adjacent planks, thereby making the planks cooperate as a monolithic structure. Only a small amount of grouting is thus used, for the reason that these non-

warping planks leave but little free space in the joints. It will be apparent that although the ends of the planks preferably extend beyond their supports, the ends may be placed over such supports wherever occasion makes this desirable. This is possible because of the double reinforcing of the planks, enabling them to take cantilever strains; and the staggering of the planks in conjunction with the interlocking of their edges, and also the grouting of the joints, effectively distributes the strains to the extent of making the planks act as a continuous beam.

It is an outstanding feature of the planks that they are reversible positionable, which eliminates all danger from improper position of the planks during construction, since all positions of the plank which will fit into the adjacent plank are equivalent.

This application is a continuation-in-part of application Serial No. 48,836 filed November 8, 1935.

I claim:

1. A load sustaining composite member for building construction comprising a body of light-weight porous concrete having a weight not substantially greater than ninety pounds per cubic foot having a length substantially greater than its width and a width substantially greater than its thickness and a plurality of attenuated metallic element positioned by said concrete within said body and adjacent each face of said body, said metallic elements extending lengthwise of said body and the effective strength of the metallic elements adjacent each of the two faces of the member being substantially the same, whereby the member is rendered reversibly positionable.

2. A load sustaining composite member for building construction comprising a body of light-weight porous concrete having a weight not substantially greater than ninety pounds per cubic foot having a length substantially greater than its width and a width substantially greater than its thickness and a plurality of substantially parallel wire elements positioned by said concrete within said body and adjacent each face of said body, said wire elements extending lengthwise of said body and the effective strength of the wire elements adjacent each of the two faces of the member being substantially the same, whereby the member is rendered reversibly positionable.

3. A load sustaining composite member for building construction comprising a body of light-weight porous concrete having a weight not substantially greater than ninety pounds per cubic foot having a length substantially greater than its width and a width substantially greater than its thickness and a plurality of substantially parallel wire elements extending lengthwise of said body within said body and adjacent each face of said body.

4. A load sustaining composite member for building construction comprising a body of light-weight porous concrete having a weight not substantially greater than ninety pounds per cubic foot having a length substantially greater than its width and a width substantially greater than its thickness, a plurality of substantially parallel wire elements extending lengthwise of said body within said body and adjacent each face of said body and a plurality of substantially parallel wire elements extending transversely of said first mentioned wire elements and forming therewith a grid within said body and adjacent each face of said body.

5. A load sustaining composite member for building construction comprising a body of light-weight porous concrete having a weight not substantially greater than ninety pounds per cubic foot having a length substantially greater than its width and a width substantially greater than its thickness, a plurality of substantially parallel wire elements extending lengthwise of said body within said body and adjacent each face of said body and a plurality of substantially parallel wire elements extending transversely of said first mentioned wire elements and welded thereto to form a grid within said body and adjacent each face of said body.

6. A load sustaining composite member for building construction comprising a body of light-weight porous concrete having a weight not substantially greater than ninety pounds per cubic foot having a length substantially greater than its width and a width substantially greater than its thickness and a plurality of longitudinally extending attenuated metallic elements positioned by said concrete within said body and adjacent each face of said body, said body having integrally formed tongues and grooves respectively on each opposite edge thereof.

7. A load sustaining composite member comprising a body of porous concrete having a length substantially greater than its width and a width substantially greater than its thickness and a plurality of longitudinally extending steel wires positioned by said porous concrete within said body and adjacent each face of said body, said body having integrally formed tongues and grooves respectively on each opposite edge thereof, the effective strength of the wires adjacent each of the two faces of the member being substantially the same, whereby the member is rendered reversibly positionable.

8. A load sustaining composite member for building construction comprising a body of light-weight porous concrete having a weight not substantially greater than ninety pounds per cubic foot having a length substantially greater than its width and a width substantially greater than its thickness and a plurality of substantially parallel wire elements extending lengthwise of said body adjacent each face of said body, the ends of said wire elements being formed to provide anchoring means within said body.

9. A load sustaining composite member for building construction comprising a body of light-weight porous concrete having a weight not substantially greater than ninety pounds per cubic foot having a length substantially greater than its width and a width substantially greater than its thickness and a plurality of longitudinally extending attenuated metallic elements positioned by said concrete within said body and adjacent each face of said body, the ends of said metallic elements being formed to provide anchoring means within said body, said body having integrally formed tongues and grooves respectively on each opposite edge thereof.

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