Feb. 17, 1925. 1,526,470

H. F. FREASE

STRUCTURAL MATERIAL

Filed Oct. 1, 1923 2 Sheets-Sheet 1

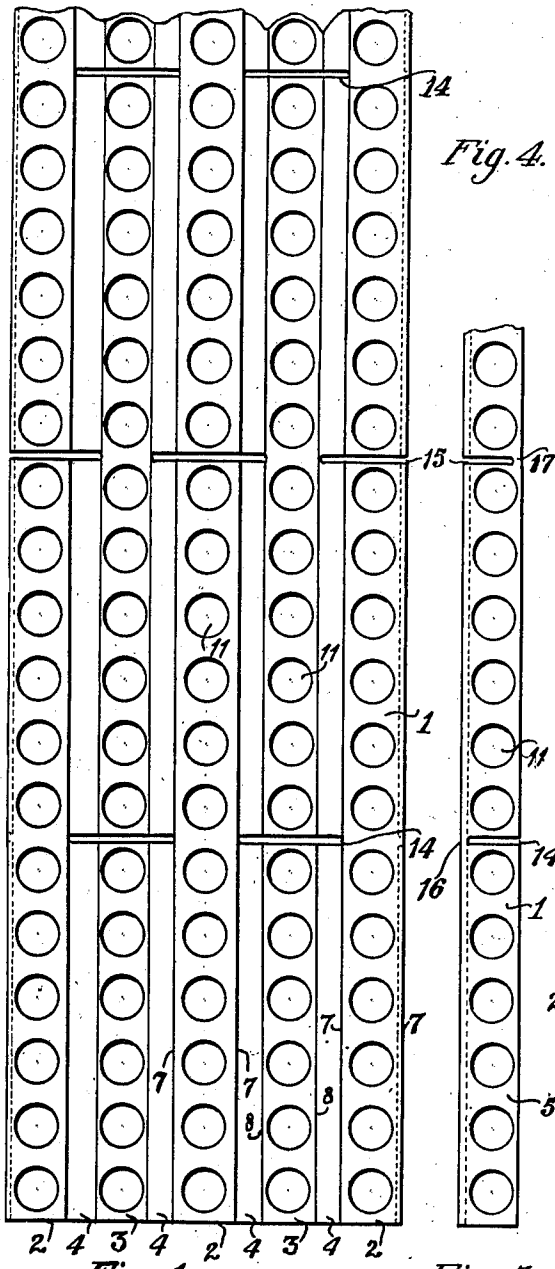


Fig. 1.

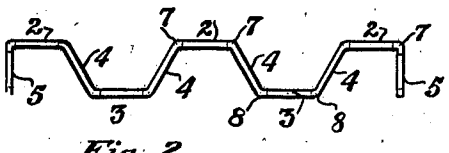


Fig. 2.

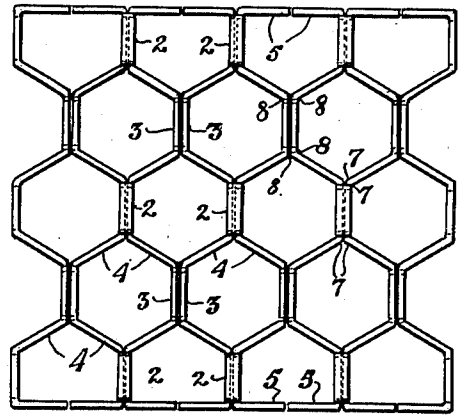


Fig. 4.

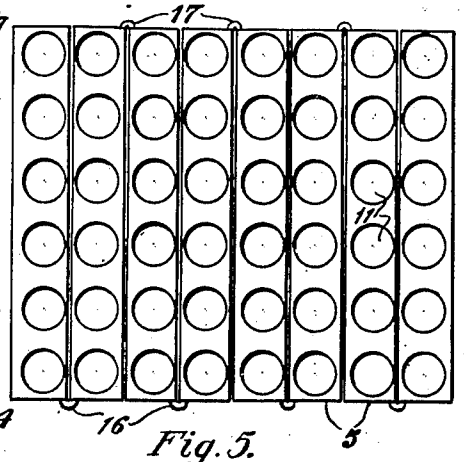


Fig. 5.

Fig. 3.

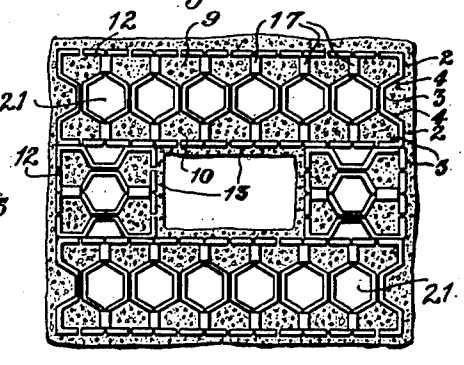


Fig. 6.

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H. F. FREASE

STRUCTURAL MATERIAL

Filed Oct. 1, 1923 2 Sheets-Sheet 2

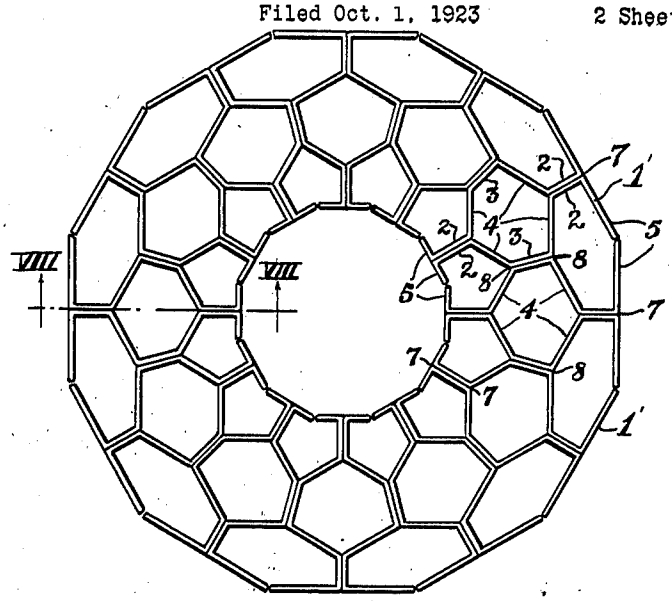


Fig. 7.

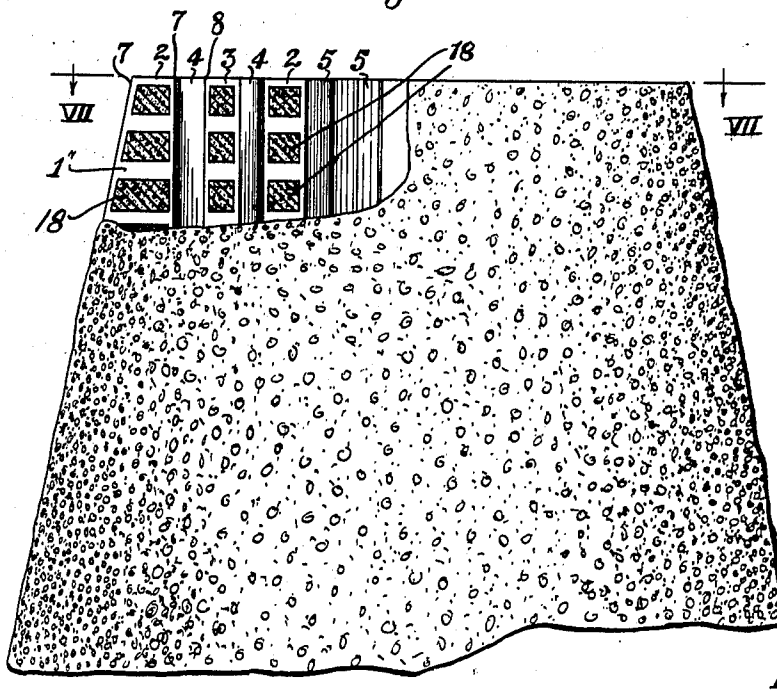


Fig. 8.

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Patented Feb. 17, 1925. 1,526,470

UNITED STATES PATENT OFFICE.

HURXTHAL FIELD FREASE, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO GEORGE HIVES DAWSON, OF BOSTON, MASSACHUSETTS.

STRUCTURAL MATERIAL.

Application filed October 1, 1923. Serial No. 665,880.

To all whom it may concern:

Be it known that I, HURXTHAL FIELD FREASE, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Structural Materials, of which the following is a specification.

My invention relates to improvements in structural materials of the unit class, whereby a plurality of similar sheet units may be combined to build up cellular structures having a formation similar to that of a honeycomb, and preferably comprising a plurality of elongated cells which are designed to be used among other things as combined forms and reinforcing for concrete construction.

The objects of my improvement are: First, to provide a sheet cellular unit capable of economical production and assemblage, and of universality of use;

Second, to provide a unit, which when used repetitively for concrete forms and reinforcing, will eliminate the necessity for wooden forms;

Third, to provide a concrete form and reinforcing which shall be a permanent part of the completed structure, and which will enable the proper disposition of the materials used in order to attain maximum strength with minimum volume of materials;

Fourth, to provide a concrete form and reinforcing unit which may be used at one end the same time as studding and lath;

Fifth, to provide a concrete form and reinforcing unit which will enable the construction of hollow, straight or tapered, columns, beams, or walls;

Sixth, to provide a concrete form and reinforcing which when used for the construction of structural members such as beams and columns enables the concrete to absorb by compression the tension stresses set up in the members by deflecting forces; and

Seventh, to provide a convenient means for assembling the fundamental sheet units used to build up the cellular structures, so that the resulting cellular structure will be made of one integral piece of sheet material.

Several practical means of attaining these objects are illustrated by the accompanying drawings, in which—

Figure 1 is a plan view of one form of the fundamental sheet cellular unit;

Fig. 2, an end elevation of the same;

Fig. 3, a side elevation of the same;

Fig. 4, a plan view of a cellular structure built up by the use of a plurality of the fundamental units;

Fig. 5, a front elevation of the same;

Fig. 6, a plan view of a hollow walled structure made up of the combination of the built-up cellular structure and a poured or otherwise applied plastic substance capable of setting or hardening after application;

Fig. 7, a plan view, which may be at VII—VII, Fig. 8, showing the use of a modification of the fundamental unit as in the erection of a hollow approximately cylindrical cellular structure which may or may not have straight walls; and

Fig. 8, a fragamentary side elevation having a fragmentary sectioned portion which may be at VIII—VIII, Fig. 7, and which shows the application of modified units together with a plastic material capable of setting or hardening for the purpose of constructing hollow tapered cellular structures.

Moreover, Figs. 1, 2, 3, 4, 5, and 6, illustrate the means by which convenient assemblage of the individual cellular units is attained; so that the completed cellular structure may be folded from an integral sheet unit having certain portions slit or cut for the purpose.

Similar numerals refer to similar parts throughout the several views.

The fundamental sheet unit 1, or its modifications 1′, or 1″, consists essentially of alternately disposed abutment walls 2 and 3 joined by connecting walls 4, the unit having when desired face flanges 5, the purpose of the face flanges being to form face walls for the cellular structures.

The abutment walls with the connecting walls of each unit thus form one or more salient ribs on one side of the sheet and two or more salient ribs on the other side of the sheet, which ribs are arranged to abut corresponding salient ribs of like units to form cells.

It is preferable that all the salient ribs have like abutment faces 2 and 3, so that when the units are being assembled it makes no difference which side of a given unit abuts the next adjacent unit.

As illustrated in Figs. 1, 2, 3, 4, 5, and 6, a simple form of the fundamental unit is attained by disposing the abutment walls 2

and 3 in parallel planes, and by making the line joints 7 between walls 2 and 4, and 2 and 5, and the line joints 8 between walls 3 and 4, all parallel each with the others; but desirable modifications of the fundamental unit are attained by disposing walls 2 and 3 in non-parallel planes as in Figs. 7 and 8, and by making the line joints 7 non-parallel with each other or with line joints 8 at certain intersections, such as those illustrated in the fragmentary cross-section of Fig. 8.

Figs. 4, 5, 6, 7, and 8 illustrate how cellular structures may be built up from a plurality of the fundamental units by merely joining the walls 2 and 2, and 3 and 3 together, as by spot-welding or the like, so that the line joints 7 and 7, and 8 and 8 of the abutting units register each with each. Thus by the use of unpierced sheet units, cellular sheet structures may be made.

It is hence possible by the use of the present invention to form a plurality of adjacent and abutting polygonal cells of any desired length, the length being preferably greater than the diameter of the cell. Where it is desired to fill certain of the cells thus formed, as 9 and 10 in Fig. 6, with a plastic or pourable substance such as concrete which hardens upon setting; and in order to join the cells thus filled, each with the next abutting or adjacent to form a monolithic structure; abutment walls 2 and 3 may be perforated as by means of apertures 11 which are designed to register when the similar abutment walls 2 and 2, and 3 and 3 are joined; and which apertures may also be made in the flanges 5 for the purpose of permitting the plastic material to seep through from the poured cells to form the outer surfaces 12 and 13 of the hollow cellular monolithic structure thus formed, illustrated in Fig. 6.

On the other hand one side flange 5 of a unit 1″ may be left unperforated as shown in Fig. 8.

Likewise, connecting walls 4 may be left unperforated as illustrated, or may be perforated if for any reason it is desired, for instance, that the total volume between surfaces 12 and 13 of Fig. 6 be filled with a plastic, hardening material.

Equally spaced transverse cuts 14 and 15 across the channel sheet unit 1, leaving parallel bonds 16 and 17, provide a ready means whereby the so formed equal lengths of unit 1 may be folded at bonds 16 and 17 back and forth to form the integral cellular structure shown in Figs. 4, 5 and 6. In certain cases it may be desirable to space the transverse cuts 14 and 15 at unequal distances from each other, as for instance, in making the forms and reinforcing for the end wall of the building having a sloping roof.

The fragmentary section in Fig. 8, illustrates a rectangular form of perforation and clearly shows the bonds 18 of hardened plastic material which join at intervals the several individual hardened monolithic polygonal lengths which have been made by pouring a plastic material into the adjacent and abutting cells and permitting the material to set.

The use of the invention thus permits the formation of hardened monolithic cellular structures having hardened monolithic material at and near surfaces such as 12 and 13 in Fig. 6, thus most efficiently meeting the demands of form and strength; and at the same time having air spaces 21 between the rows of hardened monolithic material.

While the drawings for convenience of illustration show only sheet material plain or perforated, the use of expanded material such as metal lath is contemplated to form the units of the present invention.

The fact that the present invention may be used in the construction of monolithic beams or columns so that all tension stresses set up in the structural member so constructed will be absorbed by compression in the monolithic material of the member is obvious from an examination of Figs. 4, and 5.

Let the longitudinal axes of the polygonal cells be substantially parallel to the direction of deflection of the member. If there be no monolithic material in these cells, tension will tend to cause displacement away from each other of cell walls disposed across the line of action of the tension forces, and towards each other of cell walls disposed along the line of action of the tension forces. Obviously the presence of a monolithic material in the cells will cause a resistance to any sort of displacement whatever of the cell walls. This resistance will in all cases be compression upon the monolithic material in the cells.

I claim:

1. A cellular structure comprising a plurality of units combined to form a plurality of elongated polygonal cells, each unit having spaced rows of spaced abutment walls and connecting walls therefor, the spaced abutment walls of the units registering and abutting with each other to form the cellular structure.

2. A sheet unit comprising spaced rows of spaced abutment walls and connecting walls therefor, the abutment walls being all alike to abut and register with like walls of other units to form elongated cells.

3. A cellular structure comprising a plurality of elongated cells formed from a plurality of units, each unit having one set of spaced abutment walls in one plane, another set of spaced abutment walls in another plane, and walls connecting the one set with the other set, the spaced abutment walls of adjoining cell units registering and

abutting with each other to form the cellular structure.

4. A sheet unit comprising one set of spaced abutment walls in one plane, another set of spaced abutment walls in another plane, and walls connecting the one set with the other set, the abutment walls of the unit being all alike to abut and register with like walls of other units to form elongated cells.

5. A cellular structure having disposed face walls and a plurality of cells between the face walls, the cells and face walls being formed from a plurality of units, each unit comprising one set of spaced abutment walls in one plane, another set of spaced abutment walls in another plane, walls connecting the one set with the other set, and face flanges on the outermost spaced abutment walls, the abutment walls and face flanges of the unit abutting and registering with the abutment walls and face flanges of other units to form the cells and face walls of the cellular structure.

6. A sheet unit comprising one set of spaced abutment walls in one plane, another set of spaced abutment walls in another plane, walls connecting the one set with the other set, and face flanges on the outermost spaced abutment walls, the abutment walls and face flanges of the unit abutting and registering with like walls of other units to form a cellular structure having face walls.

7. A sheet unit comprising one set of spaced abutment walls in one plane, another set of spaced abutment walls in another plane, and walls connecting the one set with the other set, some of the abutment walls having apertures therein, the abutment walls of the unit abutting and registering with the like walls of other units to form elongated cells.

8. A sheet unit comprising one set of spaced abutment walls, another set of spaced abutment walls, walls connecting the one set with the other, and spaced cuts alternating across one set of spaced abutment walls and the connecting walls and across the other set of spaced abutment walls and the connecting walls, the distance between the spaced cuts being such that the joined abutment walls may be alternately bent back and forth upon themselves to form a plurality of elongated cells.

9. A cellular structure comprising a plurality of separate units, each unit including spaced rows of spaced abutment walls and connecting walls therefor, the spaced abutment walls of the units registering and abutting with each other to form elongated cells, there being apertures in some of the abutment walls and a bonding material in some of the cells which is continuous through the apertures and bonds the cells together.

10. A cellular structure comprising a plurality of elongated cells formed from a plurality of units, each unit having spaced rows of spaced abutment walls and connecting walls therefor, the abutment walls of the units abutting and registering with each other to form the cellular structure, there being means fastening the units together.

11. A cellular structure comprising a plurality of elongated cells formed from a plurality of sheet units, each sheet unit having one or more salient ribs on one side and two or more salient ribs on the other side abutting like ribs of other units to form the cellular structure.

12. A sheet unit formed with one or more salient ribs on one side and two or more salient ribs on the other side, the salient ribs having faces for abutment with like salient rib faces of other units to form elongated cells.

13. A sheet unit formed with one or more salient ribs on one side and two or more salient ribs on the other side, all the ribs having like abutment faces for abutting like rib faces of other units to form elongated cells.

In testimony that I claim the foregoing, I hereunto set my hand.

HURXTHAL FIELD FREASE.