M. FLETCHER.

METHOD AND MEANS FOR FORMING CONCRETE STRUCTURAL MEMBERS.

APPLICATION FILED MAY 28, 1917.

1,241,945.

Patented Oct. 2, 1917.

2 SHEETS—SHEET 1.

Fig. 1.

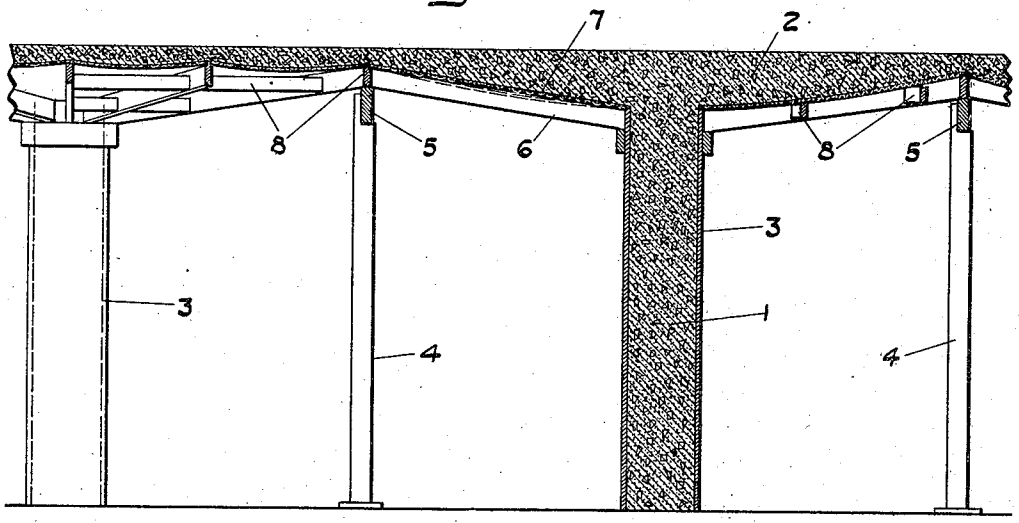
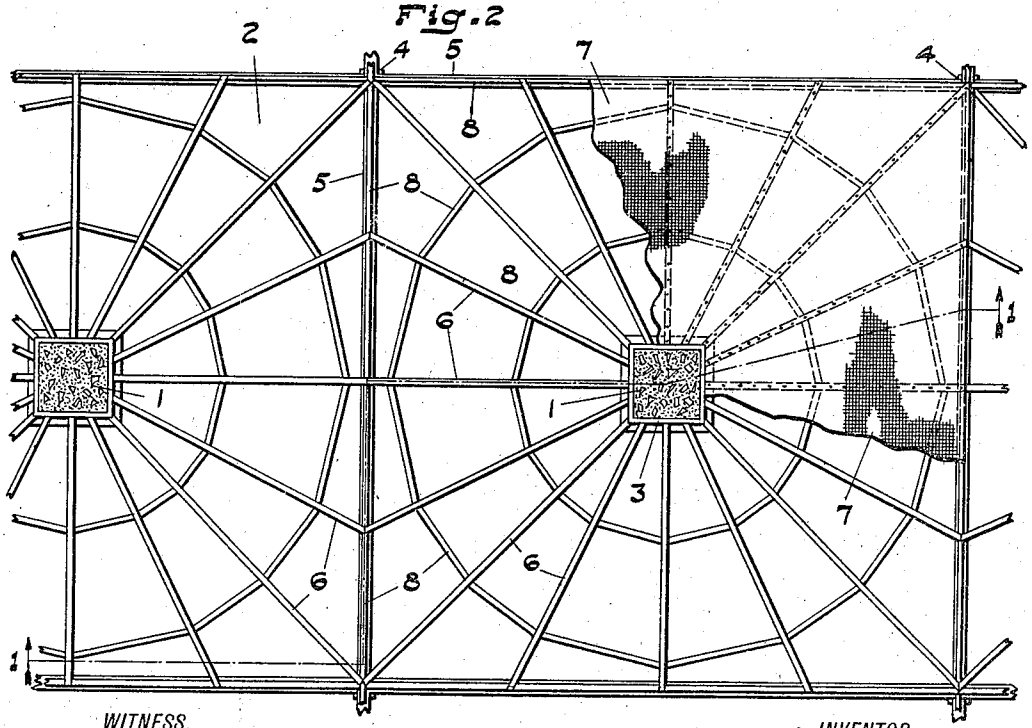


Fig. 2



WITNESS.

Walter H. Troemel.

INVENTOR

Matthews Fletcher.

BY

Bradford & Dodge

ATTORNEYS

M. FLETCHER.

METHOD AND MEANS FOR FORMING CONCRETE STRUCTURAL MEMBERS.

APPLICATION FILED MAY 28, 1917.

1,241,945.

Patented Oct. 2, 1917.

2 SHEETS—SHEET 2.

Fig. 3

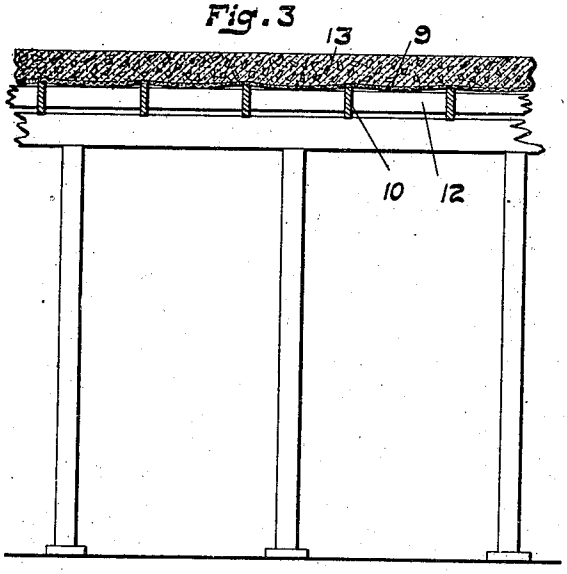


Fig. 4.

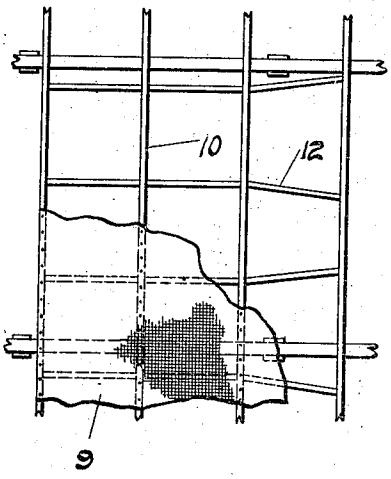


Fig. 5.

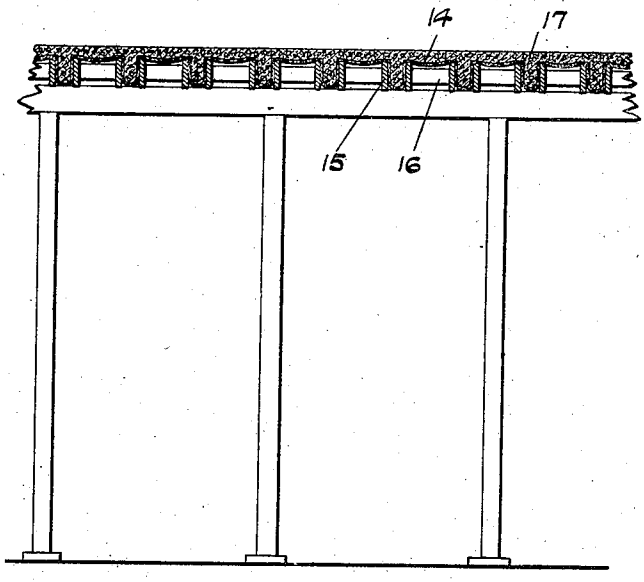
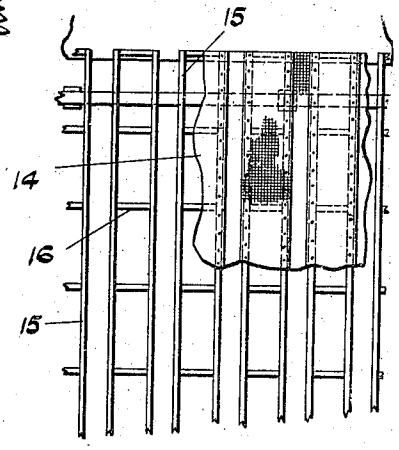


Fig. 6.



WITNESS

Walter H. Trumel.

INVENTOR

Matthews Fletcher.

BY

Bradford & Dodge

ATTORNEYS

UNITED STATES PATENT OFFICE.

MATTHEWS FLETCHER, OF INDIANAPOLIS, INDIANA.

METHOD AND MEANS FOR FORMING CONCRETE STRUCTURAL MEMBERS.

1,241,945. Specification of Letters Patent. Patented Oct. 2, 1917.

Application filed May 28, 1917. Serial No. 171,540.

To all whom it may concern:

Be it known that I, MATTHEWS FLETCHER, a citizen of the United States, residing at Indianapolis, Marion county, and State of Indiana, have invented and discovered certain new and useful Improvements in Methods and Means for Forming Concrete Structural Members, of which the following is a specification.

My invention relates to means for forming concrete structural members, such as floor members, intended to support transverse loads, that is loads the resultants of which act in a direction transverse to, or at an angle to the longitudinal axis of the member; and its objects are to provide a method (and a form) whereby such members may be formed at greatly less cost and more expeditiously than under present practices, and in which structural concrete members, such, for instance, as beams, may be formed in shapes approaching the theoretical "beam of uniform strengths," and thus resulting in the saving of material and also dispensing with the use of forms of costly construction, such as are now necessary to be employed to obtain the varying section of a beam or other structural member of theoretical design.

The invention is illustrated in the accompanying drawings in which Figure 1, is a vertical cross-section on line 1—1 of Fig. 2 through what is known as a "mushroom" section cantaliver system for supporting floors or ceilings and having a slab running from the central column, which slab is of cantaliver form; Fig. 2, a plan view of the form used in molding the above construction; Fig. 3, a cross-section illustrating the application of the invention to what is known as a "solid slab system;" Fig. 4, a plan view partly broken away of the form of Fig. 3; Fig. 5, a cross-section what is known as a "beam and slab system;" and Fig. 6, a plan view partly broken away of the arrangement shown in Fig. 5.

Referring to the drawings, and first to Figs. 1 and 2, 1 indicates central columns adapted to support the radiating concrete slab 2, which as is herein shown is of the cantaliver type. The vertical columns may be formed by wooden forms 3, of the usual construction. Mounted at suitable intervals are vertical wooden braces 4, which are adapted to support cross beams 5, and on which are supported joists 6, preferably of wood, and which in connection with the structural member of the particular section illustrated in Figs. 1 and 2 are adapted to extend radially from the central column. Carried by these joists and attached thereto, preferably by nailing is a form sheathing 7, consisting of duck, canvas or other similar flexible and preferably textile material. These flexible sheaths and the joists to which they are attached constitute together an expansible and collapsible form in which the joists are adapted to be spread apart or moved together to stretch the flexible material to the necessary degree of tautness to properly support the horizontal body of concrete when the same is placed on the form and preserve the necessary rigidity of outline to obtain a member of the desired section with a minimum of waste, and yet at the same time to permit the sheathing to sag sufficiently to obtain sections in which the depending portions act to obtain additional stiffness and strength.

To obtain this spreading and stretching action of the form the same is provided with stretchers, spreaders, struts or wedges at intervals between the joists adapted to be forced against or retracted from adjacent joists. In the particular form of the invention illustrated in Figs. 1 and 2, cross struts 8 are employed between the joists at suitable intervals for the purpose of forcing the same apart to suitably stretch the canvas so as to effectively support the concrete when applied thereto. During the stretching operation the sheathing is left unnailed at some convenient joist so as to take up the sag and after it has been finally stretched the same is nailed to the last joist.

It will be seen that by this stretching of the canvas the same provides a sufficiently stiff and strong sheathing for a horizontal structural member. At the same time the great expense now incurred in forming concrete structures with wooden forms is avoided and this flexible, collapsible form may be very expeditiously erected and quickly knocked down after the structure has been formed.

By referring to Fig. 1 it will be seen that

another advantage of this method is that it enables a bending stress resisting member, such as cantaliver beams to be constructed as a beam of uniform strength and one that approximates the true theoretical shape for such members. Thus it will be seen that the arms of the cantaliver are tapered in thickness from end to end. In the ordinary method of forming such structures it is necessary to provide separate stepped sections having angular walls between the same in order to permit of the formation of such a beam with a wooden form. A beam of "uniform strength" (technically so-called) is one in which the dimensions of the cross sections are varied in such a manner that the greatest intensity of compression at each cross section is the same, and also the greatest intensity of tension at each cross section is the same. In a reinforced concrete beam this uniformity may be accomplished by varying the cross-sectional dimensions of the reinforcing steel or the concrete, or of both. The dead weight of a concrete member being an important element in the calculation of its strength it is desirable to eliminate as much unnecessary weight as possible. Elimination of unnecessary steel is often impracticable and results in any case in very small reduction in dead weight. Elimination of unnecessary concrete, however, often results in great reduction in the dead weight of the member. While this economy has been recognized it is not generally put into practice because of the prohibitive cost of constructing a form in which to mold such a shape. In the case of a cantaliver floor beam designed to carry a uniform load, for instance, the total compression in the concrete is greatest at the support, diminishing to nothing at the extreme end. It is, of course, unnecessary and wasteful to use the same cross-sectional area of concrete at the end of this beam as is required next the support. It has been found impracticable to build rigid forms to accomplish this saving, hence they are seldom used, and at best accomplish only part of possible economies. By the use of a flexible sheathing, however, it becomes possible to mold such a concrete member accurately and economically by alining the sheathing along the true theoretical line joining the support, and the extremity of the beam, or in such relation to such theoretical line as to avoid a formation having material in excess of the necessary amount to give the required strength to support a certain load.

Between the joists, of course, the canvas will tend to sag somewhat but this sagging is not objectionable except in the formation of certain types of ceilings, and in fact with some cross sections it is desirable to permit the canvas to purposely sag to provide a rounded section. Also, such capacity to sag may be utilized in some longitudinal sections in forming a varying cross section to avoid the use of unnecessary concrete material without the loss of stiffness or strength.

In mounting the form, the canvas or other textile material may be first attached to the joists and then later mounted upon the vertical supports and then the struts or wedges driven between the joists to stretch the canvas to the desired extent and the concrete poured upon the flexible sheathing. Or the joists may first be mounted in place on the vertical supports and then the canvas stretched over the joists and nailed or otherwise attached thereto and the stretching of the same effected by the suitable spreader members.

In Figs. 3 and 4, the invention is shown applied to the construction of a floor or ceiling employing what is known as the "solid slab system." In this arrangement 9 is the flexible sheathing, 10 the joists to which the same is attached and 12 wedging struts between the joists adapted for spreading the same to stretch the canvas. 13 indicates the body of concrete adapted to be formed on the flexible material to constitute the horizontal supporting member.

In Figs. 5 and 6 the invention is shown as applied to the construction of a structural member constituting part of what is known as a "beam and slab system." In this arrangement 14 is the flexible sheathing, 15 the joists and 16 the spreader members and 17 indicates the body to be formed. In this arrangement it will be noticed that the flexible sheathing is permitted to sag between the joists and this sagging will produce a rounded lower face which will prevent spawling at the corners.

Having thus described my invention, what I claim is:—

1. The method of forming substantially horizontally projected concrete structural members which consists in forming the member with an unbroken base line intermediate the ends thereof by stretching a flexible supporting body in a substantially horizontal plane between supports at such tension as to produce a molding surface for a member of true theoretical shape for obtaining the maximum strength with minimum material, and then placing concrete thereon.

2. A form for structural concrete members comprising a flexible sheathing, rigid supports for said sheathing and stretching members for the sheathing intermediate the supports.

3. A form for concrete structures adapted for collapsibility and adjustment and consisting of sheathing supporting joists, joist supporting uprights and textile material attached to a number of the joists, and spreader members between the joists adapted

to be driven against the same to force the joists apart and stretch the textile material to thereby provide a flexible support for the concrete, which determines the form of the base of the section and permits of collapsibility of the form.

In witness whereof, I have hereunto set my hand and seal at Indianapolis this 23d day of May, A. D. nineteen hundred and seventeen.

MATTHEWS FLETCHER. [L. S.]

Witnesses:
H. P. DOOLITTLE,
M. L. SHULER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."