

Nov. 3, 1925.

1,559,837

O. ALLEN

REINFORCEMENT WORK FOR CONCRETE CONSTRUCTION

Filed June 30, 1924

2 Sheets-Sheet 1

Fig. 1.

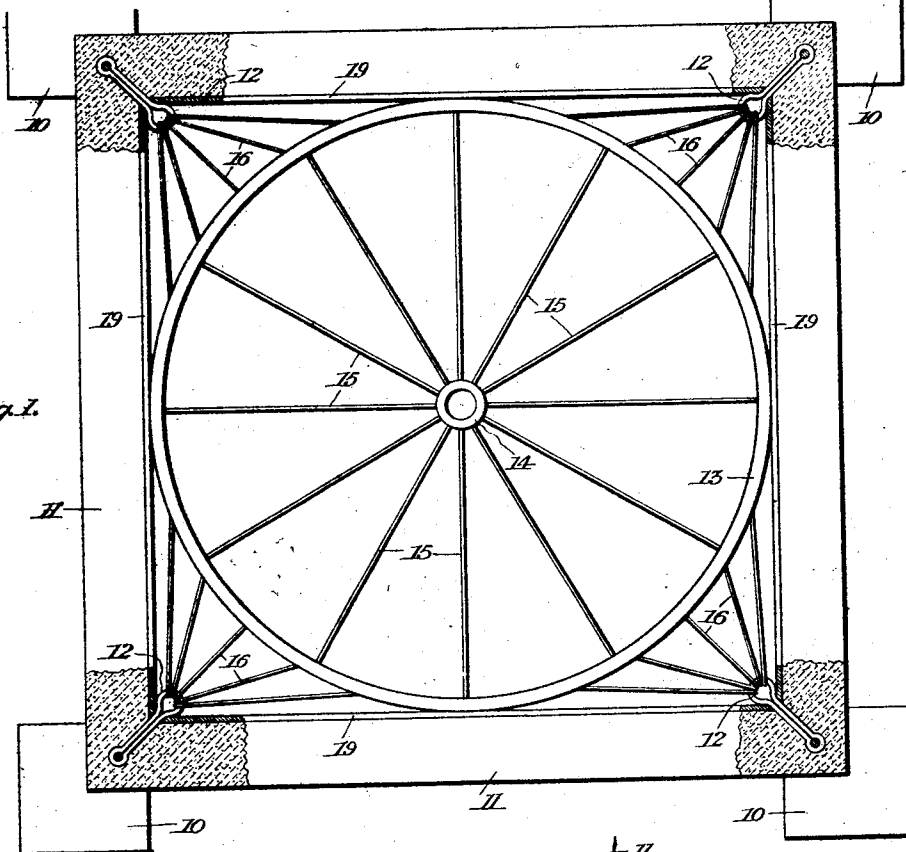


Fig. 7.

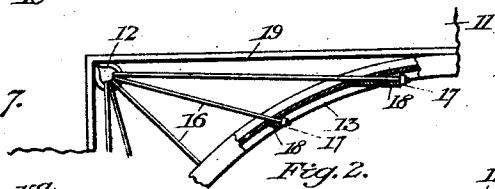
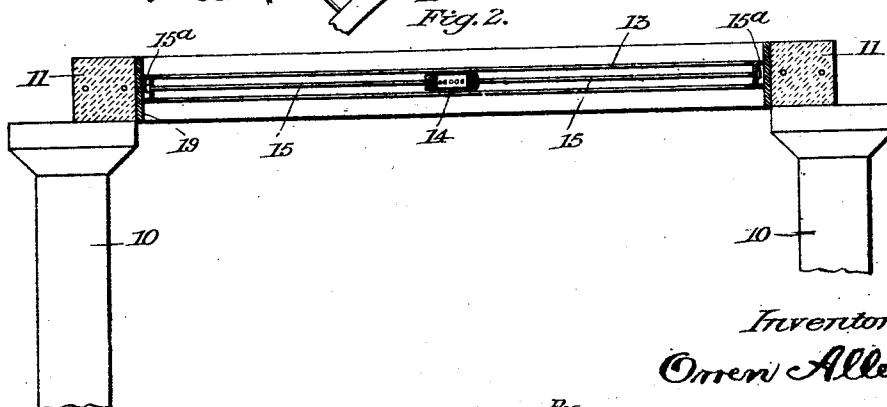


Fig. 2.



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Fig. 3.

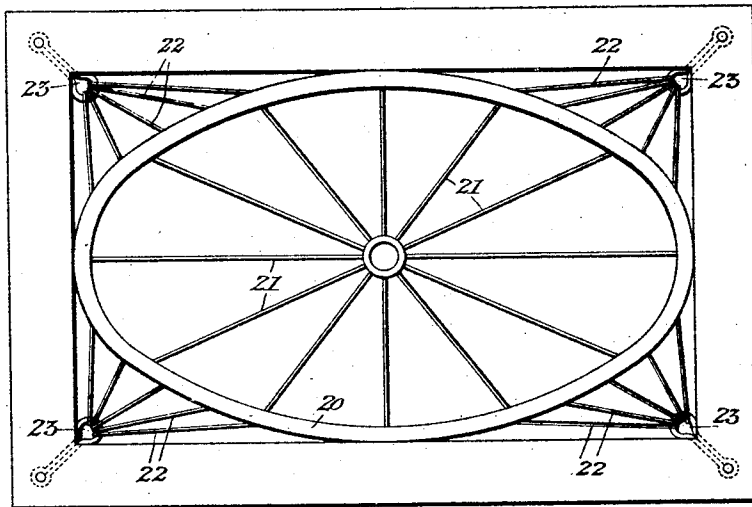


Fig. 4.

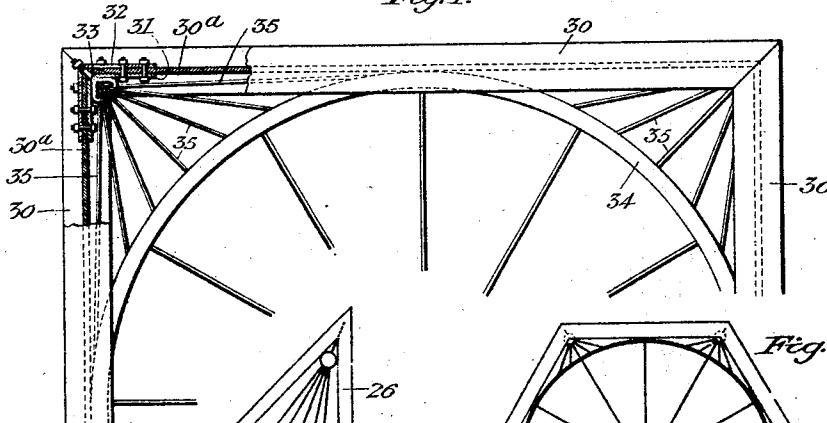


Fig. 5.

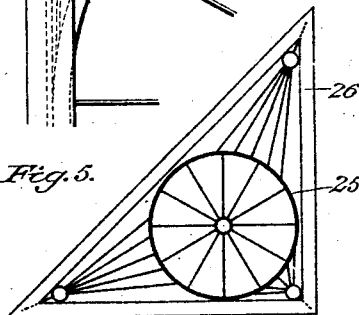
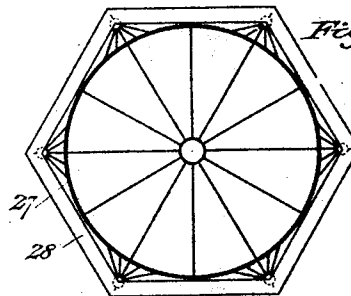


Fig. 6.



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UNITED STATES PATENT OFFICE.

ORREN ALLEN, OF DENVER, COLORADO.

REENFORCEMENT WORK FOR CONCRETE CONSTRUCTION.

Application filed June 30, 1924. Serial No. 723,246.

To all whom it may concern:

Be it known that I, ORREN ALLEN, a citizen of the United States of America, residing at the city and county of Denver and State of Colorado, have invented a new and useful Reenforcement Work for Concrete Construction, of which the following is a specification.

This invention relates to the reenforcement of concrete construction work.

The principal object of the invention is to provide reenforcing structures, more particularly for ceilings, floors or other parts in which forces normally act transversely thereof, which for a given mass afford a maximum of resistivity or which for a required resistivity require a minimum mass of material.

Another object is to provide a reenforcing system by which the mass of the reenforcing construction for ceilings, floors or the like may be very materially reduced without sacrificing strength or rigidity of the construction as a whole.

The invention, its characteristic features, its mode of application and the advantages thereof, will be more fully described in connection with the drawings forming a part thereof, and the points of novelty will be particularly pointed out in the claims.

In the drawings, Fig. 1 is a plan view illustrating an embodiment of the invention, parts being broken away to show some detail;

Fig. 2 is an elevational view of a construction including the invention, which itself is shown in section;

Fig. 3 is a plan view similar to Fig. 1, showing a modification;

Fig. 4 is a fragmentary plan view, partly in section, of another modification;

Figs. 5 and 6 are diagrammatic plan views illustrating the general applicability of the invention; and

Fig. 7 is a fragmentary view on an enlarged scale, showing a detail.

Having reference to Figs. 1 and 2: 10 represents supporting members such as are commonly used in construction work for supporting ceilings. It is understood that these supporting members have no special significance in connection with the invention proper, but are generally representative of all forms of support, such as walls, partition walls, posts, etc.

On the members 10 is supported a frame

11 of reenforced concrete, as shown, in the corners of which are secured anchoring elements 12 for a purpose that will presently appear.

Within the frame is disposed a wheel-like frame which substantially touches the frame 11 at four points. The wheel has a hub 14, from which radiate spoke-like elements 15 extend to the rim portion 13. The spoke elements 15 are preferably rods screw-threaded at both ends, one end to screw into the hub and the other end to be engaged by a nut, whereby the rim portion 13 may be adjusted in substantially concentric relation about the hub.

The wheel is supported by the anchoring elements 12 by means of stress rods 16. As indicated, the rods 16 radiate from their common point of attachment at each corner to different points of the rim portion 13, each group of rods being applied to one quadrant of the rim portion.

Provisions are made whereby the wheel frame may be held in a substantially uniformly stressed condition. While there is considerable latitude as to the selection of means to this end, I prefer the simple arrangement indicated in Fig. 7. The rods 16 are screw-threaded at their free ends to receive a tensioning nut 17. Between the inner surface of the rim 13 and the nut 17 is disposed an angular form of washer 18, the inner surface of which conforms to the curvature of the rim and the outer surface of which is plane to form an abutment surface for the nut 17. The angular relation between the inner surface and the outer surface is in every instance such that the outer surface extends substantially at right angles to the rod. By this arrangement the nuts 17 can be drawn up until the wheel as a whole is suspended in a condition of substantially uniform static stress.

When the wheel frame has been secured in position and stressed in the manner described, due consideration having been given to the temperature conditions to be reckoned with in practical use, the concrete is applied in any suitable manner.

The practical significance of the arrangement is as follows:

Assume that the area circumscribed by the frame 11 is a sectional unit of a floor supported by a relatively large plurality of columns or posts or like supporting members. The weight carried by this area repre-

sents the forces that are transmitted to the reinforcing structure. Whether these forces are concentrated at one point or distributed over the whole area, they are transmitted to the four anchors and from these anchor points they are transmitted in the direction of length of the frame elements 11 and dissipated therein. The force acting upon each anchor point is divided into two components so that each of the four elements of the frame 11 is acted upon by opposing forces tending to compress it in the direction of its length.

The construction must be so worked out that the strains caused by the forces under practical conditions are well within safe limits of elastic deformation, so far as the reinforcing system is concerned. The computation of the dimensions of the reinforcing frame, on the one side, and of the frame 11 to safely withstand the effects of the compression load, on the other hand, is a matter of engineering skill, as is well understood.

The quintessence of the arrangement is the transmission of the forces in substantially all directions, with the important practical result that local concentration of forces is substantially avoided. The practical significance may be fully appreciated when note is made of the fact that the forces are not only transmitted substantially uniformly in the plane of the reinforcing construction as a whole, but, what is equally important, that the forces are substantially neutralized in the elements of the frame 11 acting in the direction of length thereof, with the result that the weight carried by the sectional unit is distributed substantially uniformly to all supports, be they columns such as represented by the numerals 10, or walls. Local concentration of weight upon one column or upon a single point of a wall is thus most effectively avoided. It is thus evident that the distribution of local stress such as may be due to the concentration of forces upon a single point of a sectional unit, permits a material reduction in the material necessary for the reinforcement and at the same time permits a reduction in respect to the material necessary for the supporting members.

Under some conditions it may be found desirable to provide expansion means, such as strips 19, between the rim portion 13 and the frame 11 to allow for some expansion and contraction of the reinforcing construction.

In the foregoing I have attempted to explain the broad principle of operation of the reinforcing construction, independently of details.

While I have shown a circular wheel-like construction, this is purely incident to the use of a substantially square sectional unit.

As shown in Fig. 3, an oblong reenforcing construction may be used in connection with a rectangular sectional unit which is not a square.

The rim portion 20 is oval or elliptical in appearance. The spoke members 21 are correspondingly of varying lengths. The stress rods 22 are applied in substantially the same manner, in the sense that they radiate out from common points of attachment 23.

In fact, as diagrammatically indicated in Figs. 5 and 6, the frame to which the reinforcing frame is anchored may have any angular configuration. Thus in Fig. 5, a circular reinforcing frame 25 is supported by and inscribed in a triangular frame 26, and in Fig. 6 a circular reinforcing frame 27 is supported by and inscribed in a hexagonal frame 28. So far as the construction in Fig. 7 is concerned, a circular reinforcing frame is but a logical thing. However, in connection with Fig. 5, the reinforcing frame could be modified to extend farther into the two acute angles. The reinforcing frame, in fact, may have any preferably curvilinear form in which no line tangent to it falls within the area circumscribed by it.

In Fig. 4 is shown an embodiment of the invention in which the perimetric frame to which the reinforcing frame is anchored, is a steel construction. As indicated, I-beams are fitted together at the corners and joined together by interior angle plates 31 and exterior angle plates 32, which are bolted to the web 30^a of the beams. Anchoring elements 33 are secured to the corners in any suitable manner. The wheel 34 is secured by stress rods 35 in the way heretofore described.

While, as indicated in Fig. 2, the rim portion or curvilinear portion 13 of the reinforcing structure is preferably made of I-beam stock, other suitable construction material of standard or special stock may be used. I-beam construction has been referred to because it represents standard material available for the purpose of the invention.

If desired, additional rods 35 may be applied to interconnect opposite sides of the perimetric frame, as shown, for the sake of example, in Fig. 4. However, this is entirely a matter of expedience and does not affect in any essential aspect the subject matter of the invention.

The outstanding advantage of the invention as described is the elimination of excessive local strains, principally bending strains in the reinforcing frame and crushing strains in the supports such as walls or posts.

What I claim as my invention, is:

1. A structure for reenforcing concrete,

comprising a rim portion corresponding substantially to the largest circle-like geometrical figure that can be inscribed within the area to be reinforced, a hub portion, spoke-like elements radiating from the hub portion and secured to the rim portion, and stress-rods attached in substantially uniformly spaced relation to the rim portion along the whole length thereof and converging in groups to a plurality of points adjacent the perimeter of the area to be reinforced.

2. A structure for reenforcing concrete, comprising a rim portion corresponding substantially to the largest circle that can be inscribed within the area to be reenforced, a hub portion, spoke-like elements radiating from the hub portion and secured to the rim portion and stress-rods attached in substantially uniformly spaced relation to the rim portion along the whole length thereof and converging in groups to a plurality of points adjacent the perimeter of the area to be reenforced.

3. A structure for reenforcing concrete, comprising a rim portion corresponding substantially to the largest circle that can be inscribed within the area to be reenforced, a hub portion, spoke-like elements radiating from the hub portion and secured to the rim portion and stress-rods attached in substantially uniformly spaced relation to the rim portion along the whole length thereof and converging in groups to a plurality of points defining corners of the area to be reenforced.

4. A structure for reenforcing concrete, comprising a rim portion corresponding substantially to the largest circle that can be inscribed within the area to be reinforced, a hub portion, spoke-like elements radiating from the hub portion and secured to the rim portion and stress-rods attached in substantially uniformly spaced relation to the rim portion along the whole length thereof and converging in groups to a plurality of points defining a polygon substantially tangent to the rim.

5. In building construction, the combination with an angular frame, of means adjacent the angles of the said frame defining anchors, a unitary reenforcing structure including a hub member, spoke-like elements radiating therefrom, a rim substantially tangent to all the sides of the frame, and stress rods attached in spaced relation to

the rim, said stress rods converging in groups to said anchors and being secured thereto.

6. In building construction, the combination with an angular frame, of means adjacent the angles of said frame defining anchors, a unitary reenforcing structure including a hub member, spoke-like elements radiating therefrom, a rim substantially tangent to all the sides of the frame, stress rods attached in spaced relation to the rim and converging in groups to said anchors and secured thereto, and means for suspending the reinforcing structure under tension between said anchors.

7. In building construction, the combination with an angular frame, of means adjacent the angles of said frame defining anchors, a unitary reenforcing structure including a hub member, spoke-like elements radiating therefrom, a rim substantially tangent to all the sides of the frame, stress rods attached in spaced relation to the rim and converging in groups to said anchors and secured thereto, and means whereby the tension of each stress rod may be adjusted.

8. In building construction, the combination with an angular frame for supporting a structure having the character of a ceiling, of means adjacent the angles of said frame defining anchors, a unitary reenforcing structure including a hub member, spoke-like elements radiating therefrom, a rim substantially tangent to all sides of the frame and stress rods adjustably interconnecting the rim and the anchors, the stress rods being spaced along the rim and converging in groups to the said anchors.

9. In building construction, the combination with an angular frame for supporting a structure having the character of a ceiling, a reenforcing structure including a hub member, spoke-like elements radiating therefrom, a rim carried by the spokes, said rim being constructed and arranged to substantially contact with the sides of said angular frame, yieldable means between the rim and the sides of the angular frame constituting expansion joints, and stress rods converging from the rim to the angles of the angular frame and secured thereto.

In testimony whereof I affix my signature.

ORREN ALLEN.