

No. 890,036.

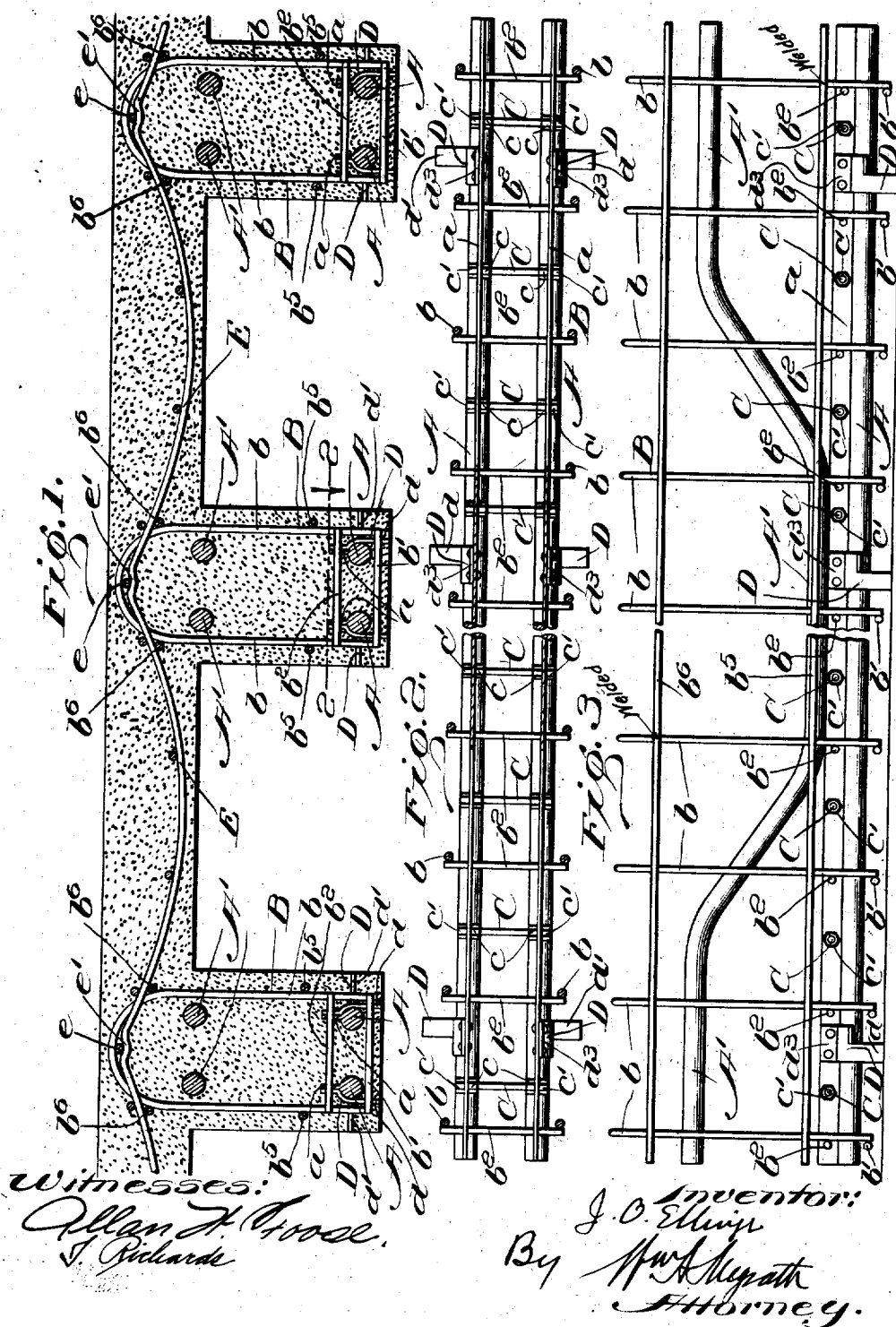
J. O. ELLINGER.

PATENTED JUNE 9, 1908.

REINFORCEMENT FOR CONCRETE CONSTRUCTION.

APPLICATION FILED JULY 5, 1907.

3 SHEETS—SHEET 1.



No. 890,036.

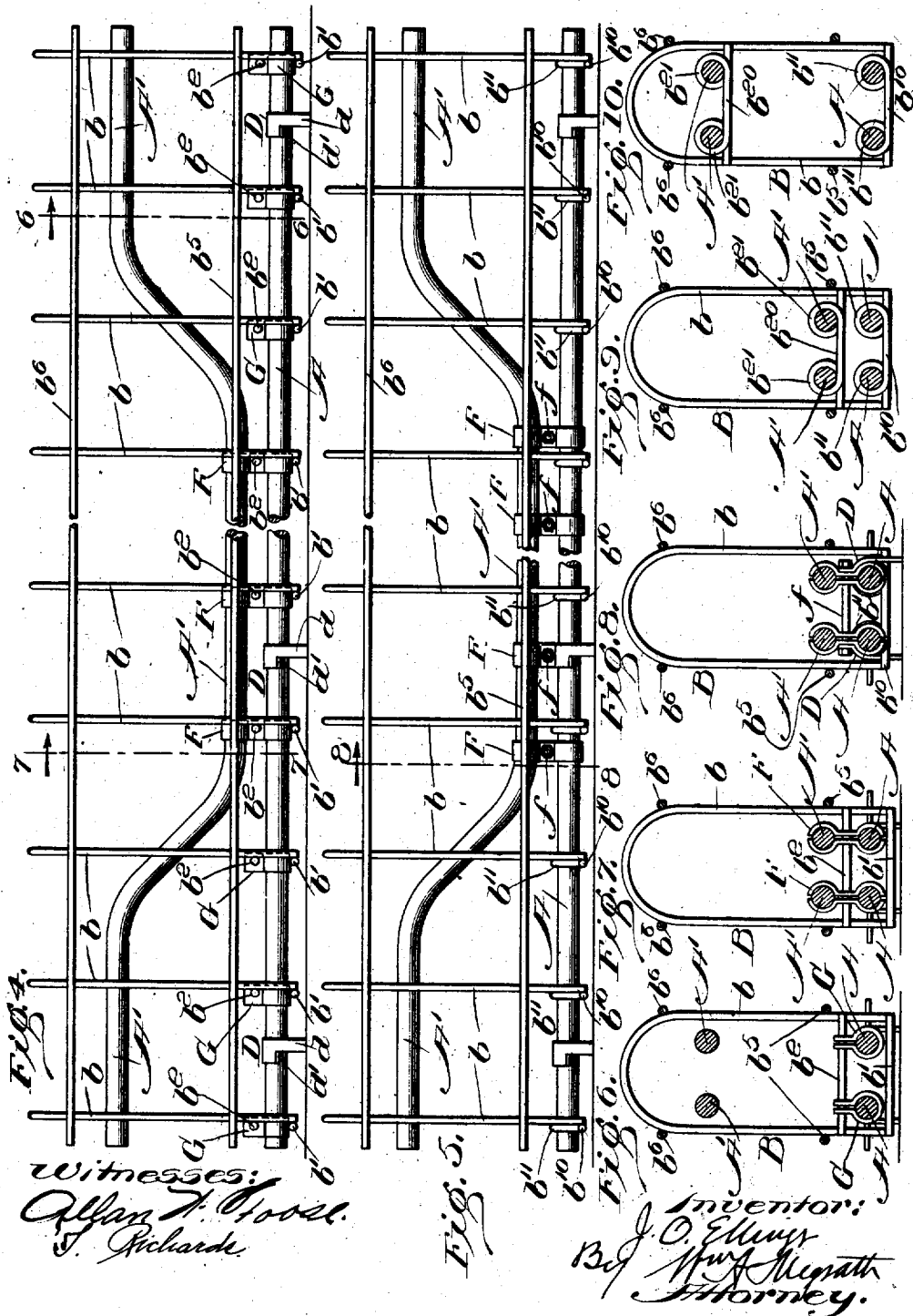
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APPLICATION FILED JULY 6, 1907.

3 SHEETS—SHEET 2.



Witnesses:
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Fig. 5.

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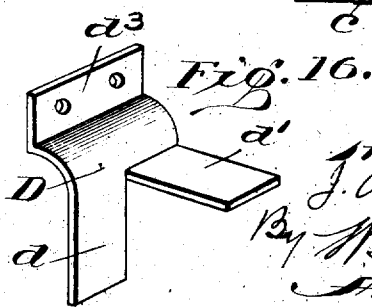
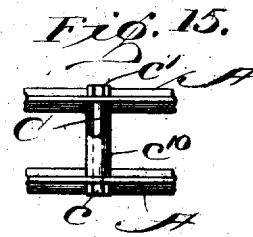
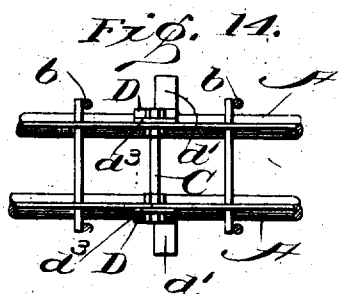
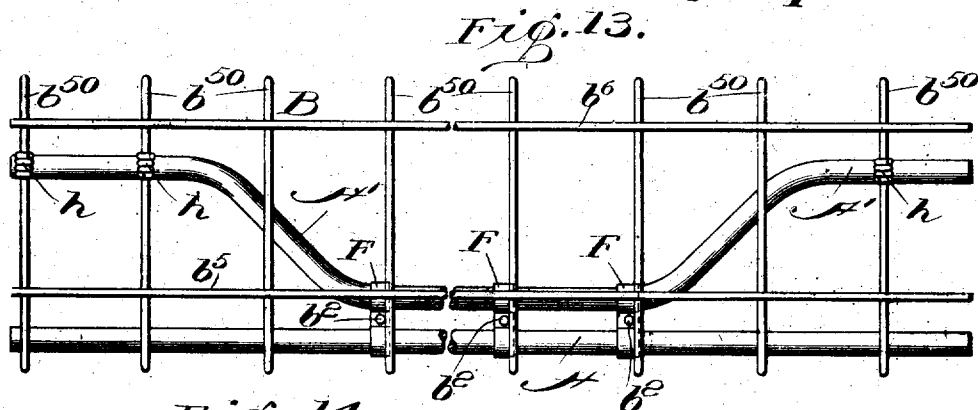
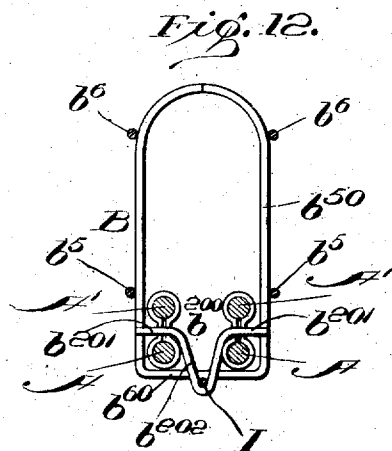
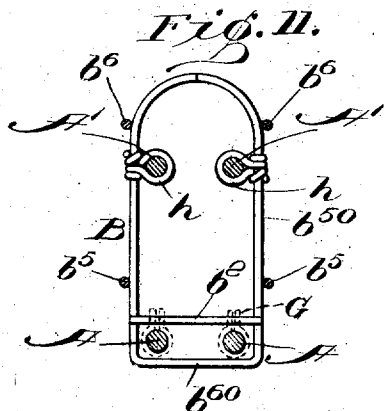
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APPLICATION FILED JULY 5, 1907.

3 SHEETS—SHEET 3.



Witnesses:
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UNITED STATES PATENT OFFICE.

JULIAN O. ELLINGER, OF NEW YORK, N. Y.

REINFORCEMENT FOR CONCRETE CONSTRUCTION.

No. 890,036.

Specification of Letters Patent.

Patented June 9, 1908.

Application filed July 5, 1907. Serial No. 382,155.

To all whom it may concern:

Be it known that I, JULIAN O. ELLINGER, a citizen of the United States, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Reinforcement for Concrete Construction, of which the following is a specification.

This invention relates to certain improvements in reinforcements for beams, girders, etc., having their body portions composed of concrete or analogous plastic materials.

It particularly relates to the type of reinforcements commonly known as unit bars or frames.

One of the objects of the invention is to produce a unit bar frame which will be of maximum efficiency.

Another object is to produce such a frame that will keep its shape during transportation and also while and after being placed in the mold around which the concrete is filled in.

Other objects will appear from the herein-after description.

In pursuance of these objects I have produced a unit bar or frame having elements so distributed and connected that they will act most effectually to take care of the tensile, shearing and compressive stresses and strains, and which bar or frame is so constructed that it may be produced at a minimum expense, the arrangement of the parts, their relation to each other and the manner of their connection with each other being specially such as to reduce the cost of the bar to a minimum, and at the same time enable it effectually to resist all stresses and strains which, unless corrected, will produce cracks in the concrete.

The invention is not restricted to details and permits within its spirit and scope many changes of more or less radical nature, several of which are herein shown. It is thus to be understood at the outset that many changes in the forms herein illustrated, and many apparently widely different variations of the invention may be made without departing from the spirit of the invention, for which reason the forms herein described or illustrated in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

In a general way the invention may be said to consist in certain novel combinations of elements, and in certain peculiarities in the construction and arrangement of parts

substantially as described and particularly pointed out in the subjoined claims.

In the accompanying drawings illustrating the present invention: Figure 1 is a section of a floor reinforced by a frame embodying my present improvements. Fig. 2 is a longitudinal section of a girder frame taken on the plane of the line 2—2 of Fig. 1. Fig. 3 is a side elevation of the girder frame. Fig. 4 is a side elevation of a modification thereof. Fig. 5 is a side elevation of another modification. Fig. 6 is a cross section on the line 6—6 of Fig. 4. Fig. 7 is a cross section on the line 7—7 of Fig. 4. Fig. 8 is a cross section on the line 8—8 of Fig. 5. Figs. 9, 10, 11 and 12 are cross sections of other modifications of the girder frame. Fig. 13 is a side elevation of the form of girder frame of which Fig. 11 is a section. Fig. 14 is a plan view of a portion of a girder frame showing a modified means for securing the centering members to the girder frame. Fig. 15 is a detail of a modified bracing member for spacing the side elements of the tension member the proper distance apart and holding the same rigid with relation to each other. Fig. 16 is a detail perspective of one of the centering members.

In all of the forms herein shown, the reinforcing frame is illustrated as having each of its side members provided with two longitudinally extending bars or rods arranged one above the other in planes which diverge from each other near the ends of the bars. This form, which is well known in these frames or reinforcements, enables the bars to resist tensile stresses, as well as the combined tensile and shearing stresses which, unless resisted, cause diagonal cracks to appear near the supports. These bars or rods are uniformly designated A and A', being in so far as they themselves are concerned, of the same construction throughout the several forms illustrated, though they are variously connected in the different forms. In all the forms illustrated there are also shown supports for the rods or bars by which the same are connected with each other and held in predetermined relation not only after the concrete body of the girder has been formed around the reinforcement, but also prior thereto, the construction illustrated being such that all the elements of the reinforcement are designed, built, delivered, and erected with all parts securely held together so that none will be inadvertently omitted.

when the concrete is molded around the same, and when it is to be put on the job in the frame it will be the same shape as when assembled. The rods or bars are hooped completely around the concrete so as to effectually resist shears. These supports are also of a nature which enables them to take care of shearing stresses and to transmit strains to the tension rods or bars, and they are shown as comprising a series of longitudinal, transverse and perpendicular elements connected with each other and with the tension rods or bars so as most effectually to accomplish the several purposes stated. The supports also comprise elements by which the frame is centered horizontally and laterally in the mold which is used in the process of molding the concrete around the same. It is hereinafter, in its entirety, designated the shear member B of the frame or reinforcement. A netting E is also provided and this netting is shown as connected at various points of junction with the shear member B.

It will be observed that in the form of the invention shown on the first sheet of the drawing, the two rods or bars A, A', of each side member are formed integral with a web a, the ends of which are split at the places where the rod or bar A' is to be bent upwardly. This form may be employed, but a separately formed and different means of connecting the two rods or bars of each side member is preferred and will hereinafter be described.

In all the forms of the tension member its perpendicular element b is of strap or arch form, and has its limbs connected with each other so that it may extend around the top, bottom and two sides of the concrete and thus form a hoop to inclose the same. While this element has thus far been referred to as "perpendicular" it is not intended thereby to state or imply that it must be vertical, or at right angles with the horizontal or longitudinal elements of the frame. It would not be a departure from the spirit of the invention to arrange some or all of these arched rods at an inclination.

Referring now particularly to the construction shown on Sheet 1 of the drawing, it will be observed that the arched rods b of the shear member B extend over the outside of the side member A and are fastened together at their lower ends by the transverse rods b' which pass under the lower rods A of said side member. These rods b are shown as welded to the rods b' but this mode of securing them together is only preferable, as they may be twisted around each other or connected in any desirable manner. The shear frame thus formed is attached to the tension member by means of transverse rods b' which are located above the rods b and extend through the webs a of the side members

A. These rods are welded or otherwise secured in any desirable manner to the rods b and to the webs a whereby the shear member B is held rigidly on the side members A.

C are brace rods extending transversely of the frame and through the webs a thereof. These rods are provided with nuts c located on the inner sides of the webs a and nuts c' located on the outside of said webs. By means of these nuts the members A are adjusted the proper distance apart.

D are the centering members which are best shown in Fig. 16 and are secured to the frame by rivets extending through the webs a and flanges d' of said member.

The girder frames are connected together by means of a netting E which extends from one frame to the other and between the several arched rods, and is tied to the latter by means of rods e which extend longitudinally of the frame in spaces formed between contiguous portions of the under surface of the arched rods and the upper surface of the netting, the latter being preferably bent, as shown at e' to form a recess constituting a seat for the rod, which assists in preventing its displacement. This rod may be welded or otherwise rigidly secured to the netting or arch rod, or both.

In Fig. 4 the webs a are dispensed with and clips F are substituted therefor. These clips consist of a plurality of parts and are held together around the upper and lower rods A and A' of the tension members, by the rods b', which extend therethrough. This form of frame is also provided with other clips G which are secured on the lower rods A at the points where the upper rods A' are bent upwardly. The rods b' extend through these clips G.

In the form shown in Fig. 5 the rods b' are dispensed with and the members F are secured together by bolts f. In this construction the clips are also dispensed with, and the rods b¹⁰ (corresponding to the rods b' of the previous forms) are bent to form eyes b¹¹ through which the bars A, A', may be slipped. This form of rod b¹⁰ is also utilized in the form shown in Fig. 9, which most clearly shows the construction of the rod b¹⁰ and its relation to the members A, A', which latter may be welded to the walls of the eyes b¹¹, if desired. In the form shown in Fig. 9, the upper rods b¹⁰ corresponding to the rods b' of the other forms, are similarly bent to form eyes b¹¹ through which the bars A', A' may be slipped in assembling the parts, and which may be welded to said bars A', A', if desired.

In Fig. 10 the rod b¹⁰ is shown as placed on the portions of the upper bars A', A', which are bent upward from the lower bars A, A'.

In the form shown in Figs. 11 and 13, the arched rods instead of being formed separate from the lower transverse rods b', are shown as formed in one piece therewith and as b¹⁰.

ing its ends joined together at any place, by welding or otherwise. In this form the arched rod is designated b^{50} and the transverse element is designated b^{60} . The rods b^{50} are secured to the upper bars A' by eyes h , the ends of which are bent around said rods. In this construction the rods b^2 are used and the clips G may be used if desirable.

In the form shown in Fig. 12, the shear member is shown as attached to the tension member, so as to be held thereby, by a rod b^{200} which is used in lieu of the eyes h and rods b^2 or b^{50} of the other forms. This rod b^{200} is bent downwardly intermediate of its approximately horizontal ends b^{201} so as to extend below the plane of the lower transverse element or rod b^{60} , as shown at b^{202} . This form of the device, preferably though not necessarily, has the lower rod b^{60} integral with the arched rod b^{50} . When the parts are assembled, the horizontal ends b^{201} are attached to the arched rods by welding or otherwise and extend through the webs of the clips, and the intermediate part b^{202} extends downwardly between the bars A , A , and forms seats for a fastening rod I which extends longitudinally of the beam within said seats and below the transverse rods or elements b^{60} .

On the drawings each centering member D consists of a plate having its body part split longitudinally to form two limbs d and d' , one of which (as d') is bent laterally to form an element which is adapted to engage the side of the form while the other depends and engages the bottom of the form. This plate is also bent between its top and bottom whereby it may extend partly around the lower bar A , to the web or clip connecting bars A and A' , its upper portion may be secured, as by rivets extending through its flange d^3 . Instead, however, of thus riveting it to the web or clip, it may be attached to or connected with such connecting means by mounting it on the bolt f , when the latter is used, as shown in Fig. 8. Again, as seen in Fig. 14, it may be attached to the web a by the brace rods C . It will be seen that a series of these centering devices are arranged at intervals along the length of each side element of the tension member, and they constitute a most effective and inexpensive means for the purpose intended.

A modification of the last referred to bracing means is shown in Fig. 15 in which, instead of using the inner nuts c , a distance sleeve c^1 of length adapted to extend from one side element of the tension member to the other is employed. By employing sleeves of different lengths and selecting the one having the length of the distance apart it is desired to space said side members, the latter will be effectively maintained at such distance when the outer nuts, or other suitable clamping means employed, are adjusted to

clamp the side members against the ends of the sleeves.

In addition to the foregoing elements, each beam frame is provided with a plurality of longitudinally extending rods or elements b^3 and b^6 , one above another, which are welded or otherwise fastened to the arched rods and perform very important functions in the structure.

It will be apparent from the foregoing that the present structure embodies many features, which give it important advantages. Among these should be noted the facts that I aim to give maximum strength to the concrete and to protect the same against destruction by fire. In pursuance of these purposes I provide a frame which comprises a series of hoops which inclose the main portion of the concrete, extending over the top and along the bottom and two sides thereof, so as to engage a maximum area thereof in compression and increase the value of the concrete to resist vertical shear. The hooping of the girders and beams is continuous throughout the entire length of the frame, so that the concrete may be worked at a maximum compressive strength. It may be mentioned here that by thus hooping the concrete the value of the vertical members of the reinforcement does not depend upon their adhesion to the concrete.

The series of hoops are connected with each other by rods or arms which among others of their very important purposes form with the hoops a mesh or netting which serves in case of fire to hold the concrete in place. In fact the whole frame is so constructed that the concrete inclosed in and surrounding the same will be held in place by the net work and that part of the concrete inside the frame is properly protected in case of fire and the concrete surrounding the frame will not become loosened from the frame during the progress of a fire. The portion of the concrete surrounding the frame may become dehydrated and of no further value, but the concrete within the area of the frame will maintain its initial strength. The exposed, dehydrated portion of the concrete may easily be clipped off and replaced with new concrete. This may be done by plasterers, as the mesh will act as an anchor to hold the new concrete in place. The mesh also protects the steel members against the influence of air by preventing the cracking of the exterior concrete by expansion and contraction.

The several parts of the frame are connected in such manner as to make the frame transportable as a unit, in transit and at the building site; the frame is of maximum strength, and strains are effectually transmitted throughout from one hoop, loop or stirrup to another throughout the entire series and from the metal in the floor slab to the tension member in the beam.

The attachment between the members of the mesh or netting is such that when the concrete is poured, a bond between said members is secured through the wedge like action of the concrete connection at or adjacent to the places of contact of the hoops and longitudinal rods. A mechanical bond between the horizontal tension members and the concrete is thus secured.

The cost of the construction is reduced to a minimum, as plain round rods may be used without the objections incident to the prior use thereof, for the reason that, as already stated, a mechanical bond is secured between the tension members and the concrete; the frame once fabricated is a unit in itself and is, as such, absolutely independent of connections adjusted thereto after the frames are placed in position in the forms; and the process of building up these frames is entirely a mechanical one, the entire frame being fabricated by machine, so that duplicates identical with each other in all respects may be furnished.

It will of course be understood that the use of the term "concrete" as used in this application is intended to be interpreted as merely exemplary and as including any cementitious or plastic materials which may be employed.

From the foregoing the construction and advantages of my improved reinforcing frame for concrete and other plastic material will be apparent, and it will be seen that the objects in view have been fully accomplished hereby.

It will be understood that many forms other than those herein set forth, and many apparently widely different variations of the invention may be made without departing from the spirit of the invention, for which reason, as already fully stated, the forms of the invention herein described or shown in the accompanying drawings, shall be interpreted merely as illustrative and not in a limiting sense.

I desire it also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements, or matter relating to or bearing upon the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A reinforcement for concrete comprising longitudinal members at the sides thereof, and a series of continuous hoops, each extending transversely of the reinforcement and adapted to inclose the main portion of the concrete and attached to the side members, and means connecting the hoops with each other and extending longitudinally of

the reinforcement and fixedly united to said hoops.

2. A reinforcement for concrete comprising longitudinal members at the sides thereof, loops or stirrups connected with said members and located outside thereof and extending transversely of the reinforcement, each of said loops or stirrups having means which connects its limbs with each other, forming hoops adapted to inclose the main body of the concrete on all four sides, and means extending longitudinally of the reinforcement, arranged on each side thereof and fixedly united to the side limbs of the hoops and forming therewith a mesh or netting.

3. A reinforcing frame for concrete, comprising a pair of rods or bars extending longitudinally of the frame and arranged at each side thereof, one rod or bar of each pair having its ends bent to a plane above that of the other rod or bar thereof, to form compression elements, and shear elements comprising hoops which extend transversely of the frame and are adapted to inclose the main body of the concrete on all four sides and are fixedly connected with the longitudinal rods or bars and with the compression elements, said shear elements provided with longitudinal connecting rods which are fixedly united to the hoops and are arranged at each side of the frame.

4. A reinforcing frame for concrete, comprising a plurality of rods or bars at the sides of the frame, a series of hoops extending transversely of the frame and adapted to inclose the main body of the concrete on four sides, and having eyes which connect them with the rods or bars, and means connecting the hoops with each other and fixedly united thereto and extending longitudinally of the frame.

5. A reinforcing frame for concrete, comprising a plurality of rods or bars at each side thereof extending longitudinally of the frame, means connecting the rods or bars at the respective sides of the frame with each other, and shear members having limbs which are arranged at the sides of said rods or bars and are provided with transverse elements which extend through said connecting means, said shear members being closed on four sides and extending above and below the longitudinal rods or bars and adapted to inclose the main portion of the concrete.

6. A reinforcing frame for concrete, comprising a plurality of rods or bars extending longitudinally of the frame and arranged at each side thereof, means connecting the rods or bars at each side of the frame with each other, and shear members having limbs which are arranged at the sides of said rods or bars and are provided with transverse elements which extend through said connecting means, said shear members being closed on four sides and extending above and below the

longitudinal rods or bars and adapted to inclose the main portion of the concrete and means extending longitudinally of the frame and connecting the shear members with each other at each side of the frame.

7. A reinforcing frame for concrete, comprising a plurality of rods or bars at each side of the frame, extending longitudinally thereof, means connecting with each other the rods or bars at each side of the frame, arched rods arranged transversely of the frame and provided with transverse devices attached thereto and forming therewith hoops which are adapted to inclose the main portion of the concrete on four sides, and means for connecting the hoops with the longitudinal rods or bars, comprising eyes to receive the latter and transverse devices which extend from the hoops through the connecting means of the rods or bars.

8. A reinforcing frame for concrete, comprising a plurality of longitudinal rods or bars at the sides thereof, a plurality of hoops extending transversely of the frame and adapted to inclose the main portion of the concrete on four sides, and means for securing the hoops to the longitudinal rods or bars, said means being secured to the hoops and having eyes through which the longitudinal rods or bars extend.

9. A reinforcing frame for concrete, comprising a plurality of rods or bars extending longitudinally of the frame and arranged at each side thereof, means connecting the rods or bars at each side of the frame with each other and arched rods arranged transversely of the frame and provided with transversely extending devices which extend through the connecting means, said rods also provided with eyes through which a pair of the longitudinally extending bars extend.

10. A reinforcement for concrete, comprising a pair of longitudinally extending rods or bars at each side thereof, means connecting the members of each pair with each other, and a shear frame, comprising a series of arched rods arranged transversely of the reinforcement, and a series of longitudinally extending rods connecting the arched rods with each other and a series of transversely extending elements connecting the limbs of the arched rods with each other and extending through said connecting means of the longitudinal rods or bars.

11. A reinforcing frame for concrete comprising a plurality of longitudinally extending tension members, shear members having side limbs and supporting devices connected with the tension members and bent between the same, and means connecting the bent portions of the supporting devices with the shear members.

12. A reinforcing frame for concrete, comprising a plurality of longitudinally extending tension members, a series of hoops ex-

tending transversely of the frame and adapted to inclose concrete on four sides, and means for connecting the hoops with the tension members comprising a series of transversely extending devices the ends of which are attached to opposite side limbs of the hoops, said devices engaging the tension members and bent between the latter and having their bent portions attached to lower limbs of the hoops.

13. A reinforcing frame for concrete, comprising a plurality of longitudinally extending tension members, a series of hoops extending transversely of the frame and adapted to inclose the main body of the concrete on all four side, a series of rods connecting the hoops with each other and forming therewith a mesh or netting, means for connecting the hoops with the tension members, comprising a series of transversely-extending devices the ends of which are attached to opposite side limbs of the hoops, said devices engaging the tension members and bent between the latter to a plane approximately that of lower limbs of the hoops, and a rod extending longitudinally of the frame and fastening the bent portions of said devices to said lower limbs of the hoops.

14. A reinforcing frame for concrete, comprising a plurality of rods or bars extending longitudinally of the frame and arranged at each side thereof, separately formed clips connecting with each other the rods or bars at each side of the frame, and shear members having transverse supporting elements which extend through said clips.

15. A reinforcing frame for concrete having at each side thereof a plurality of tension rods or bars, separately formed clips connecting with each other the tension rods or bars at each side of the frame, means extending through said clips and connecting the rods or bars at one side of the frame with those at the other side thereof and shear members connected with the tension members.

16. A reinforcing frame for concrete having at each side thereof a plurality of tension rods or bars, separately formed clips connecting with each other the tension rods or bars at each side of the frame, means extending through said clips and connecting the rods or bars at one side of the frame with those at the other side thereof and shear members connected with the tension members, said shear members consisting of a series of hoops arranged transversely of the frame and provided with a series of connecting rods extending longitudinally of the frame, means for connecting the shear members with the tension members and means extending across the frame and through the clips and connecting the tension members at one side of the frame with those at the other side thereof.

17. A reinforcing frame for concrete, having tension rods or bars at opposite sides

thereof, shear elements connected to said tension rods or bars, and means extending across the frame between the tension rod or bars for adjustably fixing the same in predetermined relation with each other.

18. A reinforcing means for concrete, comprising a plurality of spaced reinforcing frames, each having tension and shear members secured together, said shear members comprising hoops which are adapted to inclose the main body of the concrete on all four sides and are provided with connecting

rods extending longitudinally thereof and fixedly united to the hoops and forming there-with a mesh or netting, and a netting secured to said arched rods and extending from one frame to another. 15

In witness whereof I have hereunto set my hand at the city, county and State of New York, this 27th day of June, 1907.

JULIAN O. ELLINGER.

In presence of:

I. RICHARDS,
ALLAN W. FOOSE.