E. FREYSSINET.

REINFORCED CONCRETE.

APPLICATION FILED JUNE 6, 1918.

1,389,942. Patented Sept. 6, 1921.

Fig. 1.

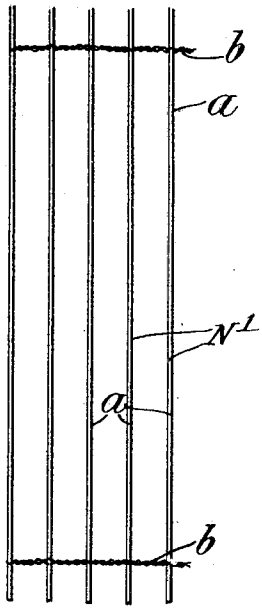


Fig. 2.

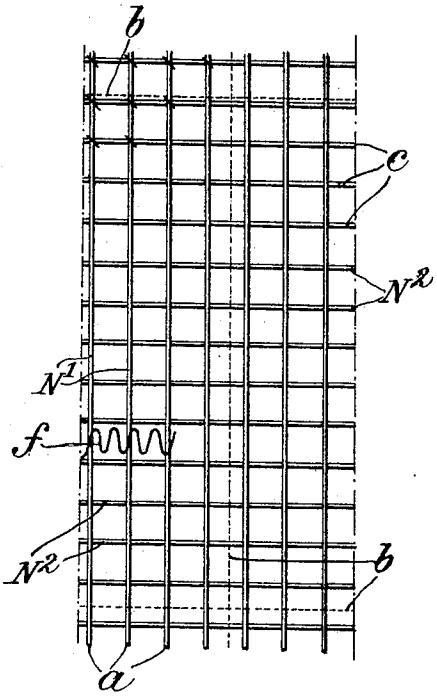


Fig. 3.

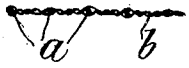


Fig. 4.

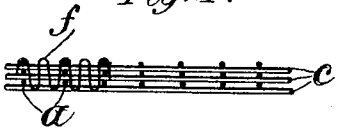
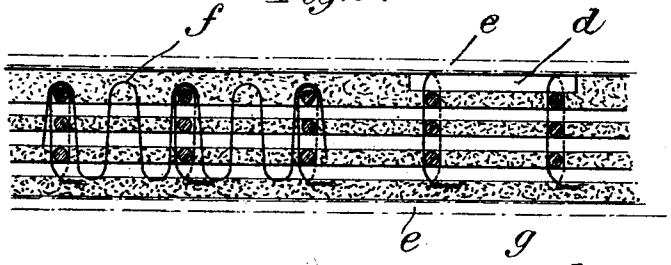


Fig. 5.



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UNITED STATES PATENT OFFICE.

EUGÈNE FREYSSINET, OF PARIS, FRANCE, ASSIGNOR TO SOCIETE DES NAVIRES EN CIMENT ARMÉ, OF PARIS, (SEINE,) FRANCE.

REINFORCED CONCRETE.

1,389,942. Specification of Letters Patent. Patented Sept. 6, 1921.

Application filed June 6, 1918. Serial No. 238,579.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, EUGÈNE FREYSSINET, a citizen of the Republic of France, residing in Paris, France, have invented certain new and useful Improvements in Reinforced Concrete, of which the following is a specification, for which I have filed an application for patent in France, on May 29, 1917, Patent No. 485,811.

This invention relates to the construction of metal reinforcements for reinforced concrete plates or partitions. The reinforcement is applicable for plates or partitions of large dimensions and of shaped surface, the resistance and homogeneity of which, together with the speed of manufacture are superior to those of plates constructed in the ordinary manner.

These results are obtained by using as metal reinforcement continuous elements grouped in the form of sheets or layers, in which the reinforcing elements are parallel to each other and connected together by fine metal wires twisted together; this arrangement is preferably completed by adding elements arranged perpendicularly to the surface of the construction for the purpose of binding the concrete.

The sheets or layers, which are obviously flexible in the direction of the connecting wires, may easily be curved in the direction of the reinforcing elements; they are placed in successive layers in such a manner that two consecutive layers have their elements at right angles to each other or at a certain predetermined angle, the whole forming the skeleton of the plates or partitions.

The elements perpendicular to the surface, which generally have the form of windings, are then inserted throughout the reinforcement in such a manner that their turns or loops enter the interspaces of the network formed by the sheets or layers of reinforcing elements; they prevent the increase of the thickness of the plates or bulging under the effect of compressive strains parallel to their surface, or bending, and impart to the concrete a high capacity for deforming before rupture.

The accompanying drawings illustrate the invention.

Figure 1 is a plan of one of the reinforcement sheets.

Fig. 2 is a plan of the reinforcement formed by superimposing several sheets or layers.

Figs. 3 and 4 are cross sections of Figs. 1 and 2 respectively.

Fig. 5 is a cross section drawn to an enlarged scale of a finished plate or partition.

The sheets N^1, N^2 together form a trellis. The first sheet N^1 consists of steel wires *a* placed at short distances apart and connected at suitable distances along their length by fine wires, such as *b* twisted together and forming strands, the elements of which encircle wires *a* where they come in contact with them. The wires *a* which constitute the reinforcing parts of the skeleton are continuous from edge to edge of the plate. They may be easily bent and curved as each sheet is put in position as may be required for producing a proper profile.

The sheet N^2, which is the lower in Fig. 2, has its wires *c* at right angles to the wires *a* of sheet N^1 and generally the sheets are placed on each other so that the elements are at right angles to each other or at a certain other angle. The number of the sheets is a function of the gage of the wires and of the thickness of the piece to be constructed and in order that the external faces of the finished structure may be parallel to the metallic net-work, the first and the last sheets are furnished with keys, such as *d*, placed here and there, and forming a point of support on the molding boards *e*.

The keys, such as *d*, may be intercalated between two net-works within the thickness of the same piece so as to economize the material placed in the middle of the slab, which material does not lend itself to bending. Finally, there are generally inserted wires, such as *g*, connecting together the wires of all the sheets of one slab for the purpose of insuring that they are parallel and preventing any displacement in the course of construction owing to their weight, vibrations or the like. When the several sheets of a reinforcement have been connected together there are introduced elements, such as *f*, for the purpose of producing a binding effect, imparting to the concrete the power of suffering considerable deformation without rupture.

It has been found that the several modes

of binding which have hitherto been used, do not lend themselves to rapid and economic use sufficiently to be industrially practical in large constructions. Moreover, they have a very unequal action on the surfaces of the construction.

In the present instance the elements *f* are introduced between the wires *a a* of the sheets, their loops being supported upon the wires of the first sheet as shown in Figs. 4 and 5. The elements preferred according to this invention are continuous helices obtained by winding on a very flattened cylinder wires which may be curved into successive U's, presenting in the neighborhood of each face equal surfaces of action, regularly distributed, which retain the concrete and prevent increase of volume, thus providing a very uniform binding.

All the elements entering into the composition of the plates or partitions may be made beforehand and mechanically manufactured in great lengths and by simple means. There is thus great economy of manual labor and the possibility of employing unskilled labor. Moreover, errors of work are avoided and uniformity of thickness is insured so that the thickness may be sensibly reduced.

From the point of view of strength the plates thus formed are superior to those obtained by known methods, because they are constituted by wires extending from one end to the other which may be firmly anchored at their ends, whence there is consequent reduction of internal action by adhesion; this peculiarity has again the effect of enabling steel of very high strength to be used with benefit. It is to be noted that this use, in combination with that of concrete which is more adapted for deformation than those generally used, or of any other suitable plastic material, involves the benefit of the high elasticity of special steels showing very high coefficients; this gives a great suppleness to the construction and is particularly advantageous when the latter must necessarily be subjected to shock.

It is to be noted that the foregoing indications are only by way of example, modifications of detail being possible to suit the particular requirement. The invention can be well adapted for the construction of beams and generally of any piece capable of being built up of reinforced concrete.

What is claimed is—

Metallic reinforcements for concrete consisting of sheets or layers each formed of wires conforming in shape to the surface of the finished structure and extending from end to end of the finished structure whereby the tenacity of the metal itself of which the wires are formed comes into play immediately upon any stress being imparted to said wires, bonds connecting the said wires at suitable distances along their length so as to form a trellis, the said sheets being superimposed so that the wires of each sheet form an angle with those of contiguous sheets, connections between the superimposed sheets, curved metal wires arranged in a direction generally normal to the surface of the finished structure and presenting equivalent elements on two lines equidistant from the surfaces and parallel to their general direction, the said elements being inserted in the interspaces of the said wires extending from end to end of the structure and adapted to exert in the neighborhood of the internal and external surfaces an equal and uniform resistance to lateral expansion of the concrete for the purpose of increasing greatly its capacity for deformation without rupture.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

EUGÈNE FREYSSINET.

Witnesses:
CHAS. P. PRESSLY,
GABRIEL BELLIARD.