No. 756,309. PATENTED APR. 5, 1904.

W. N. WIGHT.

REINFORCED BEAM, &c., AND GRILLAGE THEREFOR.

APPLICATION FILED MAR. 30, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1.

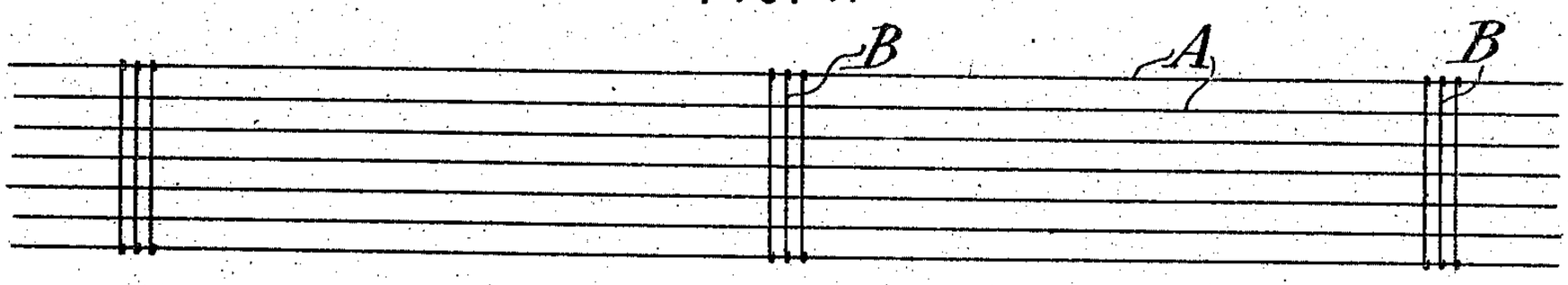


FIG. 2.

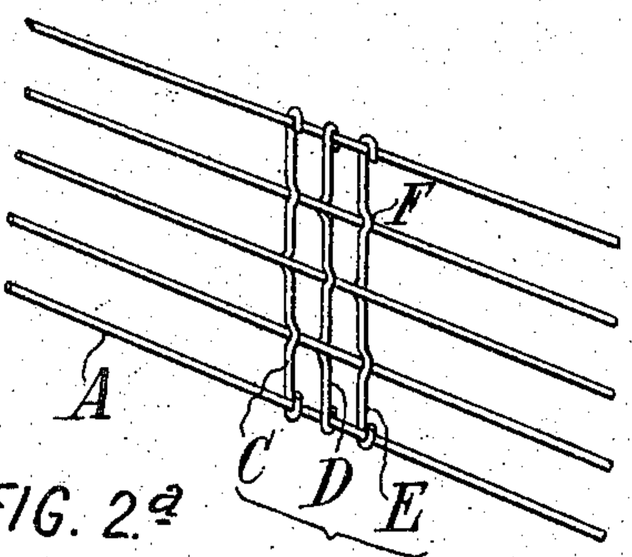


FIG. 2a.

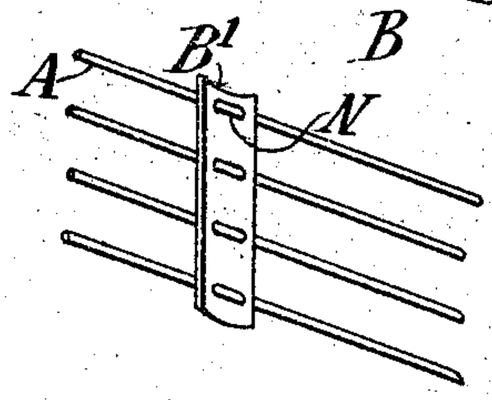


FIG. 5.

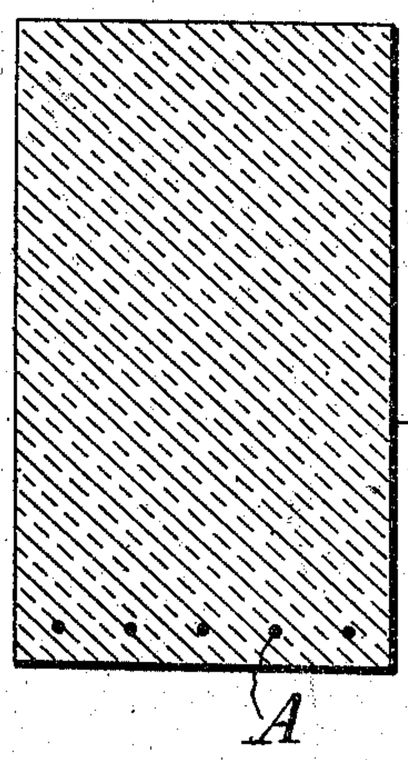


FIG. 6.

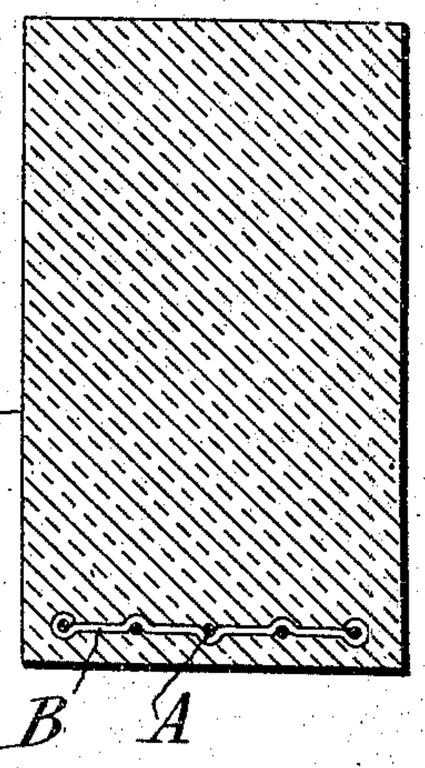


FIG. 3.

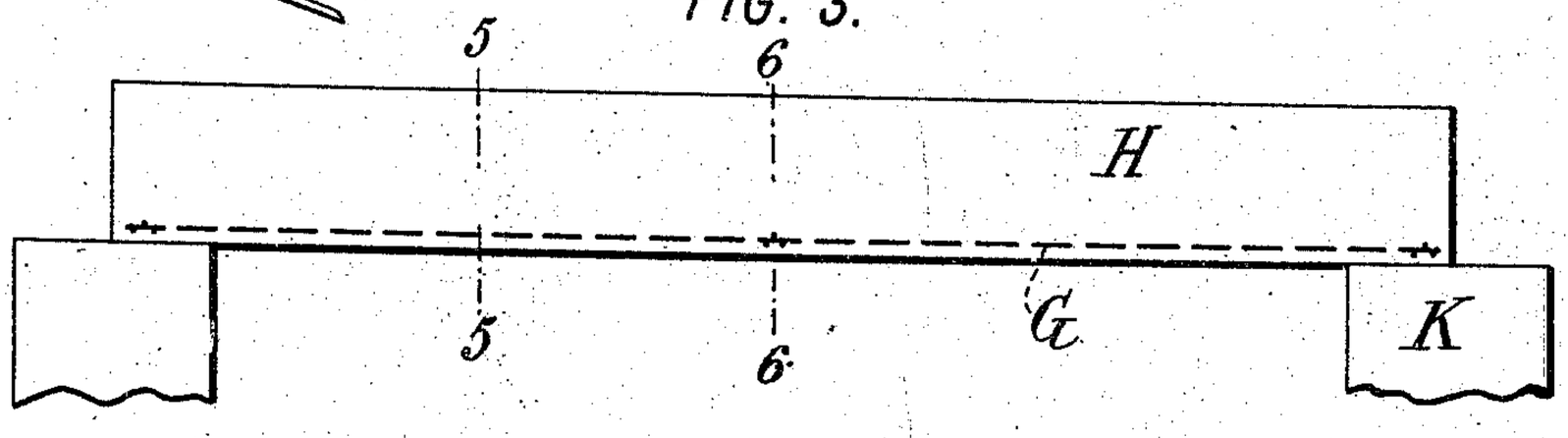
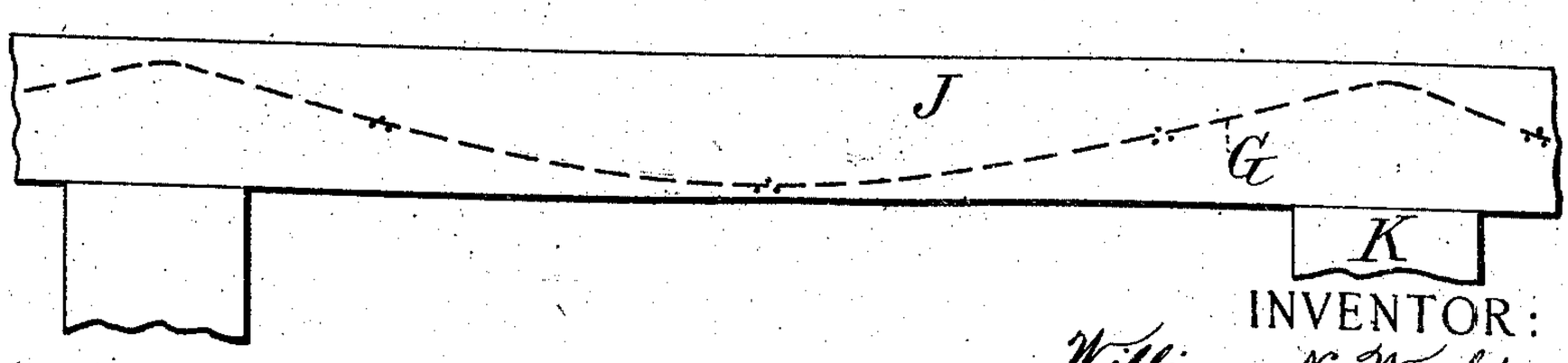


FIG. 4.



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NO MODEL. 2 SHEETS—SHEET 2.

FIG. 7.

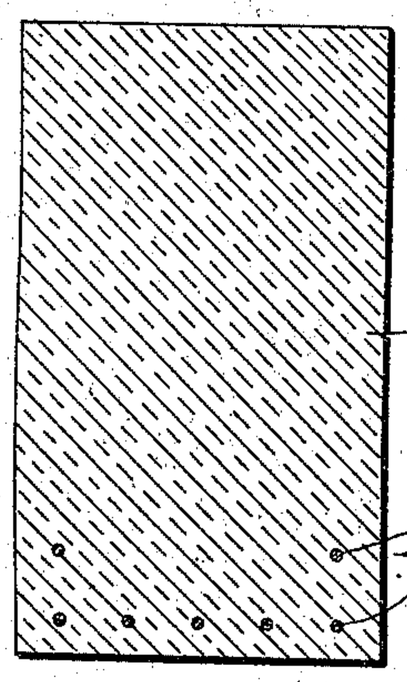


FIG. 8

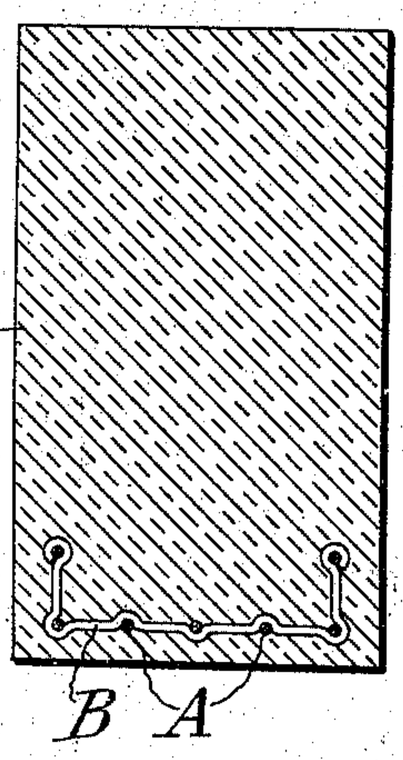


FIG. 9.

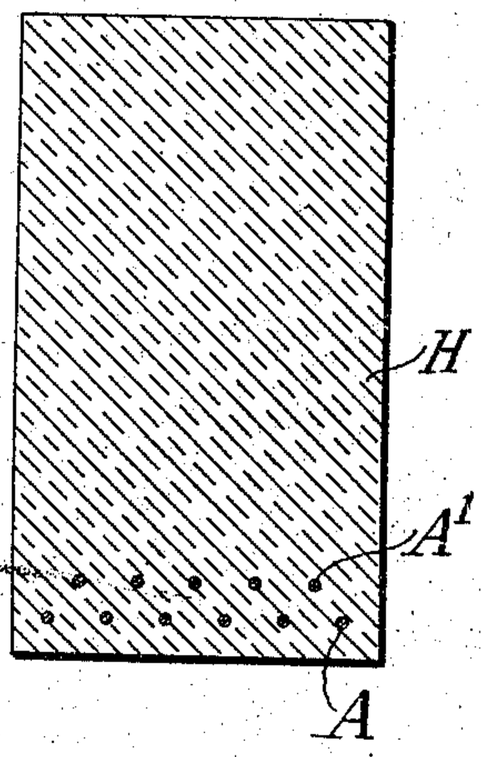


FIG. 10.

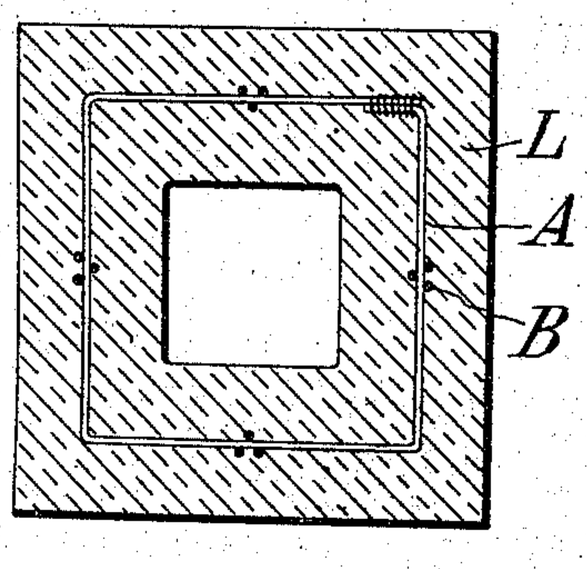


FIG. 11.

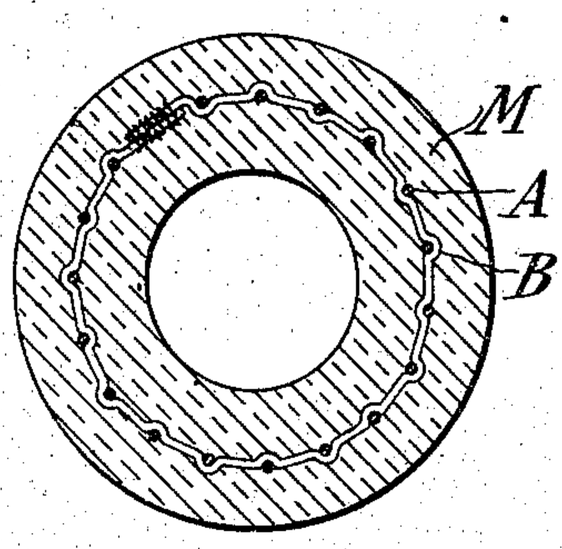


FIG. 12.

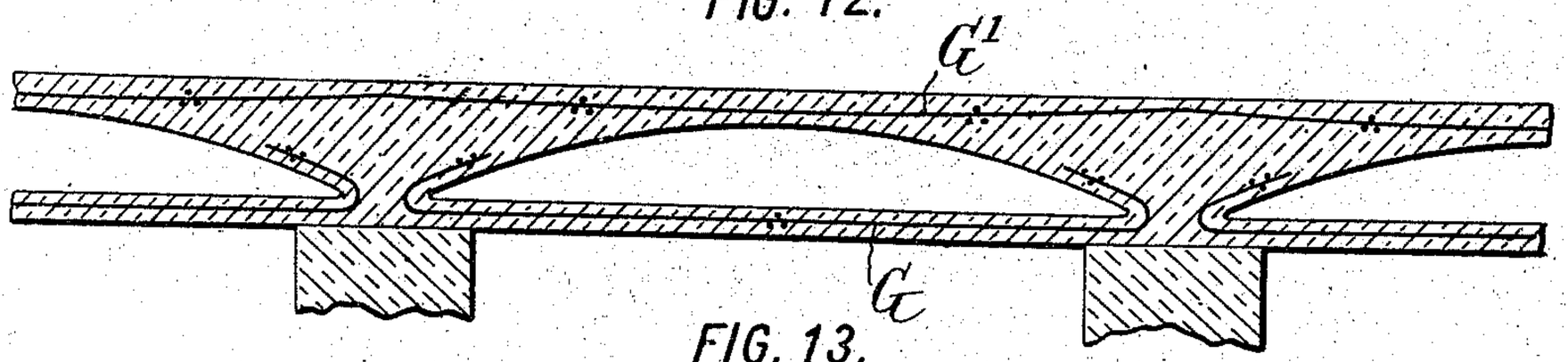
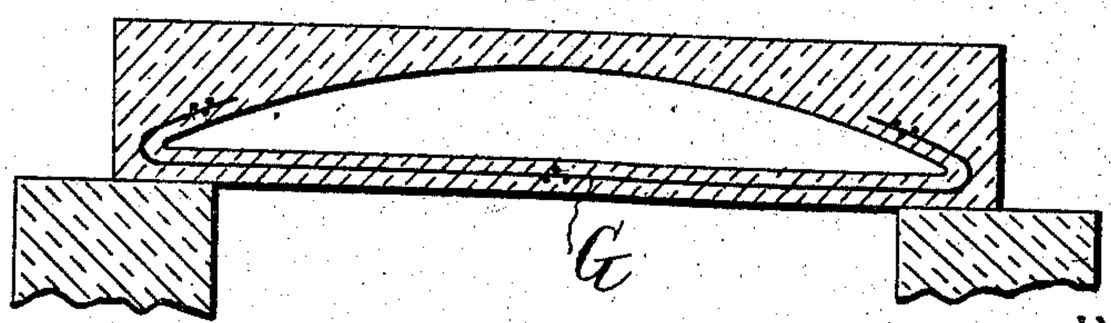


FIG. 13.



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No. 756,309. Patented April 5, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM N. WIGHT, OF NEW YORK, N. Y.

REINFORCED BEAMS, &c., AND GRILLAGE THEREFOR.

SPECIFICATION forming part of Letters Patent No. 756,309, dated April 5, 1904.

Application filed March 30, 1903. Serial No. 150,270. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM N. WIGHT, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Reinforced Beams and the Like and Grillage Therefor, of which the following is a specification.

In the building of concrete beams, girders, ribs, columns, pipes, or other structures of similar shape and subjected to transverse strains it is common to form the body of the structure of concrete and to reinforce the same, especially in the portions subjected to tensile strains, by the embedding of metal. Various styles of metal reinforce for such structures have been used and proposed. Wire cables have been used for this purpose; but investigation has shown that for the protection of iron embedded in concrete the iron should be completely enveloped by the concrete to avoid rusting, and where cables are used the interior wires are not so protected, and the irregular surface of the cable causes numerous voids in the concrete, with the bad effect stated. Instead of cables it has been proposed to use heavy rods. These lack the flexibility and length and the consequent facility of application of cables. They are more especially objectionable, however, because the large mass of material induces a great distortion under a rapid application of heat and breaks up the concrete in case of fire. Both the systems described require careful work to insure the proper location of the reinforcement, there being generally no firm connection between the strands before setting them in place.

According to my invention I propose to use for the reinforcement of concrete or other plastic material a sort of grillage having a number of longitudinal strands and spacing means at comparatively long intervals to hold the strands firmly connected to each other in proper relative position. A grillage of this sort may be easily constructed and can be set in place with much greater facility and accuracy than the reinforcements previously proposed. Since beams are supported only at their ends, the spacers extending transversely of the beam do not take any of the strain in the finished structure, but, in fact, form transverse lines of weakness in the concrete. For this reason and also to reduce the weight and cost of the grillage as much as possible the spacing means are placed at long intervals, preferably just sufficiently close together to maintain the longitudinal strands properly spaced in the handling and setting of the grillage in place. Preferably each of the longitudinal strands consists of a single fine flexible wire and preferably of high-carbon steel, which may also be galvanized for additional security against rusting. These longitudinal strands or wires are spaced apart from each other sufficiently to permit the complete envelopment of each one separately by the concrete. The spacing means which I prefer consists of strands interwoven transversely across the longitudinal wires and either holding the same in place by the interweaving or by additional binders or any other suitable means or methods, as hereinafter described in detail. Such a grillage may be made in a continuous sheet or roll of great length from which portions can be readily cut to the length of the beam to be built. Such a grillage effects a great economy in first cost, being easily made by machinery and transported to the point of use and in the labor of manipulating the grillage and building the beam. The transverse spacing or connecting means are of sufficient strength to keep the grillage in shape under very rough handling during transportation or in use without serious deformation. I thus provide a ready-made portable grillage which is well adapted to stand the rough usage necessarily incident to rapid work.

The grillage described, though peculiarly adapted for such structures as beams which are supported only at their ends, might also be advantageously employed in structures which are supported both at the ends and sides—such as floors, pavements, and the like—and it may be so used without departure from my invention. It may also be used with or without other reinforcement.

The accompanying drawings illustrate embodiments of the invention.

Figure 1 is a plan of a grillage containing

seven longitudinal wires. Fig. 2 is an enlarged view illustrating the application of a spacing-strand of three wires close together. Fig. 2ª is a similar view with a different spacer. Fig. 3 is a side elevation of a simple beam with a grillage embedded near its base. Fig. 4 is a side elevation of a continuous beam with a grillage embedded in the form of successive catenaries. Figs. 5 and 6 are cross-sections, on an enlarged scale, of Fig. 3 on the lines 5 5 and 6 6. Figs. 7 and 8 are cross-sections of similar beams with the grillage somewhat differently arranged. Fig. 9 is a cross-section of a similar beam with a double grillage. Figs. 10 and 11 are cross-sections of columns with the grillage embedded therein in different positions. Figs. 12 and 13 are cross-sections of hollow beams, respectively continuous and simple, showing a suitable application of the grillage to such structures.

Referring now to the embodiment of the invention illustrated, the grillage shown in Fig. 1 comprises the longitudinal reinforcing-strands A, each comprising a single wire, and the spacing means consisting of strands B, consisting of three wires C, D, and E, Fig. 2, interwoven transversely across the longitudinal reinforcing-wires. The wires C D E of each of the spacing-strands B are arranged as close together as possible, having due regard for the thickness of concrete needed between the individual wires. The closer the wires C D E can be arranged to each other the more firm is the joint. The interweaving of the wires C D E of the crossing strand with the longitudinal strands or wires A holds the latter firmly spaced apart straight and parallel; but any other suitable spacing means may be substituted for the strands B. Preferably the wires C D E are hooked around the outer longitudinal strands A and are crimped, as at F, where they cross the intermediate longitudinal strands, so as to more firmly lock the latter against lateral movement. Any suitable binder might be employed in connection with the transverse strand to lock the longitudinal strands against lateral movement; but the construction illustrated is thought to be preferable as permitting of the bringing of the longitudinal strands closer together and forming a less bulk of metal. In comparison with the close spacing of the wires C D E of each crossing strand the consecutive crossing strands B are arranged at long intervals from each other, being preferably only as frequent as is necessary to maintain the longitudinal strands A straight and parallel during the handling and laying of the grillage or fabric and the ramming of the concrete. The longitudinal strands A may each consist of one or more wires without sacrificing all the advantages of the invention; but for the best results I prefer to make each strand a single wire, as shown. The interval between the separate longitudinal strands will depend upon the calculated strain to which the grillage is to be subjected and the width of the space available for its embedment and also on the size of the wire used. The other conditions being fixed, I can vary the interval between the strands by varying their size and consequent strength. Preferably the interval between them is sufficient to permit the free passage of concrete therethrough and to insure that in the finished structure there is sufficient concrete between two strands to have its full strength notwithstanding the adjacent holes in which the wires lie.

The method of applying the grillage in use may be varied in a very large number of ways, as will be apparent to engineers or others skilled in the art. I have illustrated a view of the simplest applications.

In Figs. 3, 5, and 6 the grillage, which I designate as a whole by the letter G, lies flat and horizontal near the base of a simple beam H.

In Fig. 4, J is a continuous beam of concrete extending not only between, but over and beyond the supports. K. The tensile strains in such a construction are somewhat differently distributed, being at the lower portion of the beam intermediate between the supports and at the upper portion of the beam immediately over the supports, and for such a case the grillage G may be suspended in a succession of catenaries, as shown.

It is preferable to arrange all of the metal reinforce as near the plane of maximum tension of the beam as possible, as illustrated in Figs. 5 and 6; but where a greater number of reinforcing-strands is desired and there is not sufficient lateral space to properly distribute them over the lowest plane the grillage may be bent up along the sides of the beam, as indicated in Figs. 7 and 8, which show one wire at each edge of the beam turned up vertically, or where still greater reinforcing strength is required I may provide, as in Fig. 9, two grillages, one above the other, or, it may be, one grillage folded over. The longitudinal strands of one grillage, A, and those of the other grillage, A′, are preferably staggered relatively to each other, so as to avoid the formation of vertical cleavage planes in the concrete. This arrangement, therefore, substantially doubles the tensile strength of the beam without weakening the concrete as much as would be the case if longitudinal wires of double weight were used.

Figs. 10 and 11 illustrate the use of the grillage in columns. The column may be of any shape in cross-section. I have illustrated one square column L and one round one M. They may be solid or hollow, as shown, and obviously a hollow pipe could be constructed in the same way, preferably with a modification of the thickness of the concrete. The longitudinal strands of the grillage may run in either direction. In Fig. 10 I show the longitudinal strands A running around the col-

umn and the transverse strands B running up and down the column. In Fig. 11 I show the longitudinal strands A running up and down and the transverse strands B running around the column.

Figs. 12 and 13 illustrate the application of the grillage in a beam or floor of a very excellent type invented by me and claimed in my application for patent, Serial No. 125,361, filed September 30, 1902. Fig. 12 shows the beam continuous, and Fig. 13 shows a simple beam. The beam or each span thereof where it is continuous is hollow, the upper portion being in the shape of an arch. The reinforcement—in this case the grillage G—extends throughout the lower portion and is turned up and back at its ends and embedded in the upper portion, so that the strains in the upper arched portion are transmitted at the ends of the latter to the reinforce G, which resists them, and thus converts the entire beam into practically a truss, relieving the end supports of any lateral pressure. Where the beam is continuous, as in Fig. 12, I prefer also to introduce a grillage G′ in the upper portion and which may also be arranged in the form of a catenary of very slight depth, because of the comparatively slight depth of concrete at the center.

My invention is capable of almost universal application in concrete or other plastic constructions and is believed to present the first ready-made portable grillage of longitudinal strands especially adapted for the reinforcing of concrete beams and the like. Though I have described with great particularity of detail a construction embodying my invention, yet it is to be understood that the invention is not limited to the specific construction or applications thereof illustrated. Various modifications may be made by those skilled in the art without departure from the invention. The grillage can be made very rapidly and cheaply by machinery in standard or special sizes and may be kept in stock, so as to be available at any time, and can be very quickly laid in place without the exercise of any great care or skill and without delay.

An example of a modified form of spacer is illustrated in Fig. 2ª. The spacer Bʌ in this case is a strip of sheet metal having two rows of perforations in line with the longitudinal strands A of the grillage. The plate is bent so as to permit the threading of the longitudinal strands through the holes and then springs back toward its original flat shape and not only locks the longitudinal strands against lateral movement, but also by the strong frictional engagement holds itself against longitudinal movement. The amount of bend given the plate may be sufficient to permit the concrete to pass between the portions N of the longitudinal wires and the adjacent face of the plate, so as to thoroughly embed the whole of the longitudinal strand. Instead of a doubly-perforated strip I may use a strip with single perforations, which will satisfy at least the prime requisite of maintaining the spacing of the longitudinal strands, or any other spacer of wire, sheet metal, or suitable material may be used.

I claim as my invention—

1. A beam or the like comprising in combination a body of concrete and a reinforcing-grillage embedded therein at the portion subjected to the principal tensile strains, said grillage being composed of flexible longitudinal strands or wires (as distinguished from stout rigid rods or bars), and spacing or connecting means at comparatively long intervals maintaining the relative positions of said longitudinal strands.

2. A beam or the like comprising in combination a body of concrete and a reinforcing-grillage embedded therein at the portion subjected to the principal tensile strains, said grillage being composed of flexible longitudinal strands or wires (as distinguished from stout rigid rods or bars), and spacing or connecting means at comparatively long intervals maintaining the relati e positions of said longitudinal strands, a ber of said longitudinal strands being ai d in a substantially horizontal plane extending longitudinally of the beam.

3. A beam or the like comprising in combination a body of concrete and a reinforcing-grillage embedded therein at the portion subjected to the principal tensile strains, said grillage being composed of flexible longitudinal strands or wires (as distinguished from stout rigid rods or bars), and spacing or connecting means at comparatively long intervals maintaining the relative positions of said longitudinal strands, a number of said longitudinal strands at the central portion of the grillage lying in a substantially horizontal plane extending longitudinally of the beam and the longitudinal strands at the sides of the grillage lying in vertical planes extending longitudinally adjacent to the sides of the beam.

4. A beam or the like comprising in combination a body of concrete and a reinforcing-grillage embedded therein at the portion subjected to the principal tensile strains, said grillage being composed of fine flexible wires (as distinguished from stout rigid rods or bars), each of said longitudinal wires being separately enveloped by the concrete, and spacing-strands interwoven transversely across said longitudinal wires at comparatively long intervals to maintain the relative positions of said longitudinal wires.

5. A beam or the like comprising in combination a body of concrete, a number of reinforcing-wires extending longitudinally of the beam and each separately enveloped by the concrete, and spacing-strands each comprising at least three wires interwoven close together transversely across said reinforcing-wires to

maintain the relative positions of said wires, said strands being arranged at comparatively long intervals so as to minimize the number of transverse lines of weakness in the concrete.

6. A ready-made, flat, portable grillage for the reinforcing of concrete beams and the like, formed in a continuous strip or sheet and composed of flexible longitudinal strands or wires (as distinguished from stout rigid rods or bars), and spacing or connecting means arranged at comparatively long intervals to maintain the relative positions of said longitudinal strands and adapted to permit handling and transportation of said grillage without deformation.

7. A ready-made, flat, portable grillage for the reinforcing of concrete beams and the like, formed in a continuous strip or sheet and composed of fine, flexible, longitudinal wires (as distinguished from stout rigid bars or rods), said wires being spaced at comparatively short intervals from each other sufficient to permit the complete envelopment of each wire separately by the concrete, and spacing-strands interwoven transversely across said longitudinal wires at comparatively long intervals to maintain the relative positions of the longitudinal wires, said transverse strands being adapted to permit handling and transportation of said grillage without deformation.

8. A grillage for the reinforcing of concrete beams and the like, comprising in combination longitudinal wires spaced at comparatively short intervals from each other sufficient to permit the complete envelopment of each wire separately by the concrete, and spacing-strands each comprising at least three wires interwoven close together transversely across said longitudinal wires to maintain the relative positions thereof, said strands being arranged at comparatively long intervals so as to minimize the number of transverse lines of weakness in the concrete.

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

WILLIAM N. WIGHT.

Witnesses:
DOMINGO A. USINA,
FRED WHITE.