No. 788,570. PATENTED MAY 2, 1905.

W. N. WIGHT & F. E. TOWNSEND.

TRESTLE.

APPLICATION FILED MAR. 9, 1903.

3 SHEETS—SHEET 1.

FIG. 1.

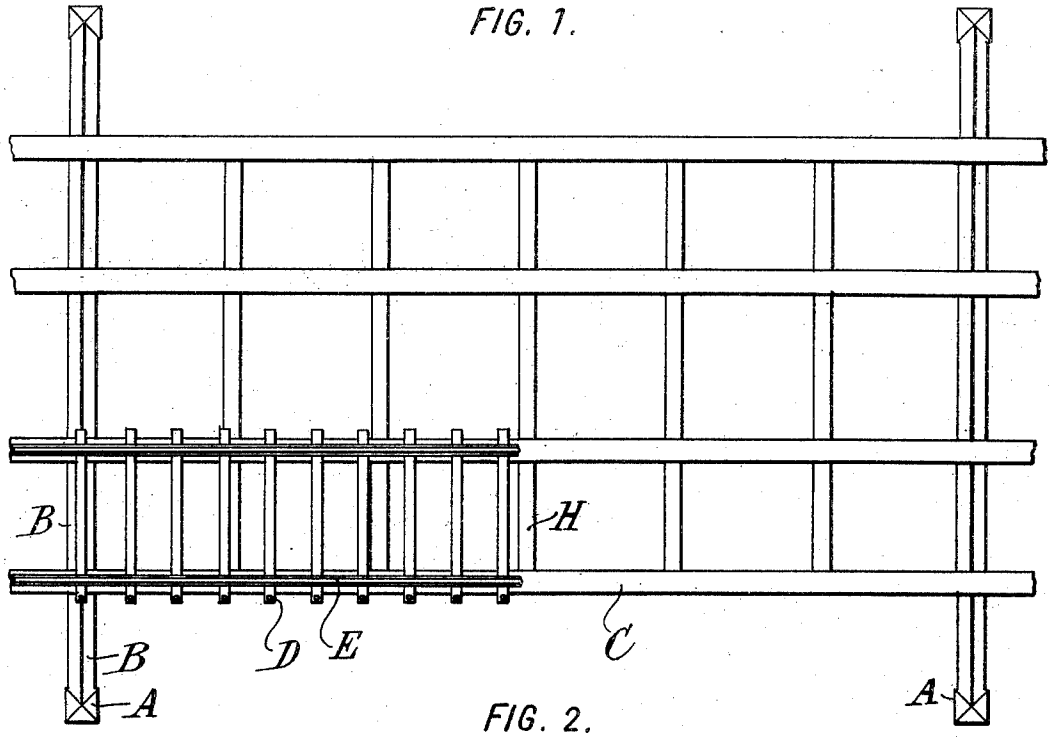


FIG. 2.

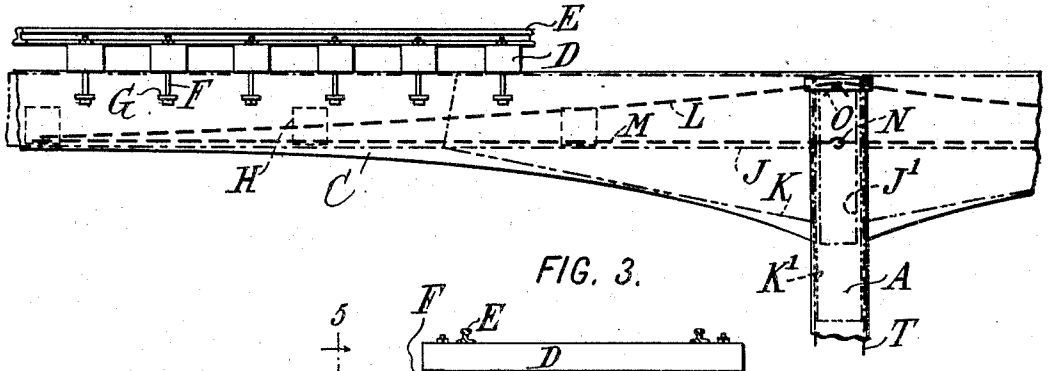
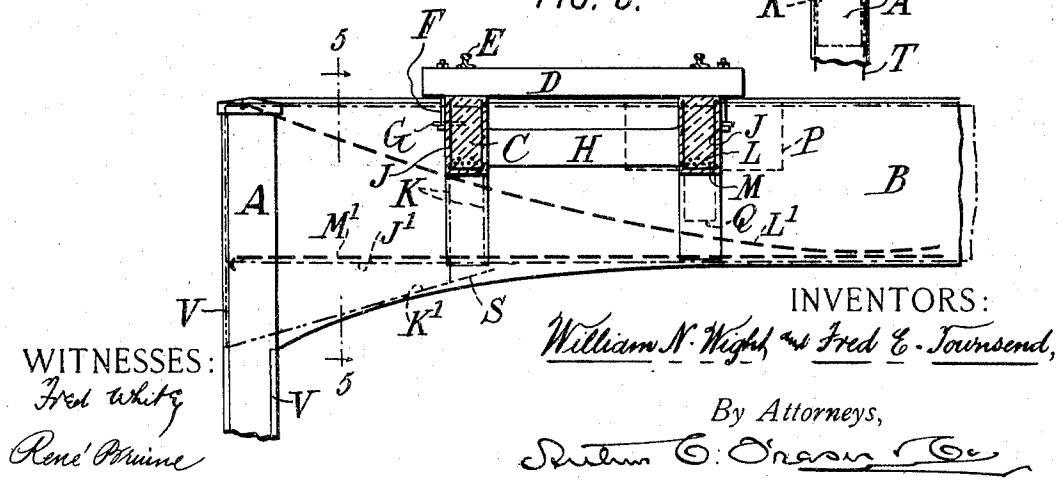


FIG. 3.



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3 SHEETS—SHEET 2.

FIG. 4.

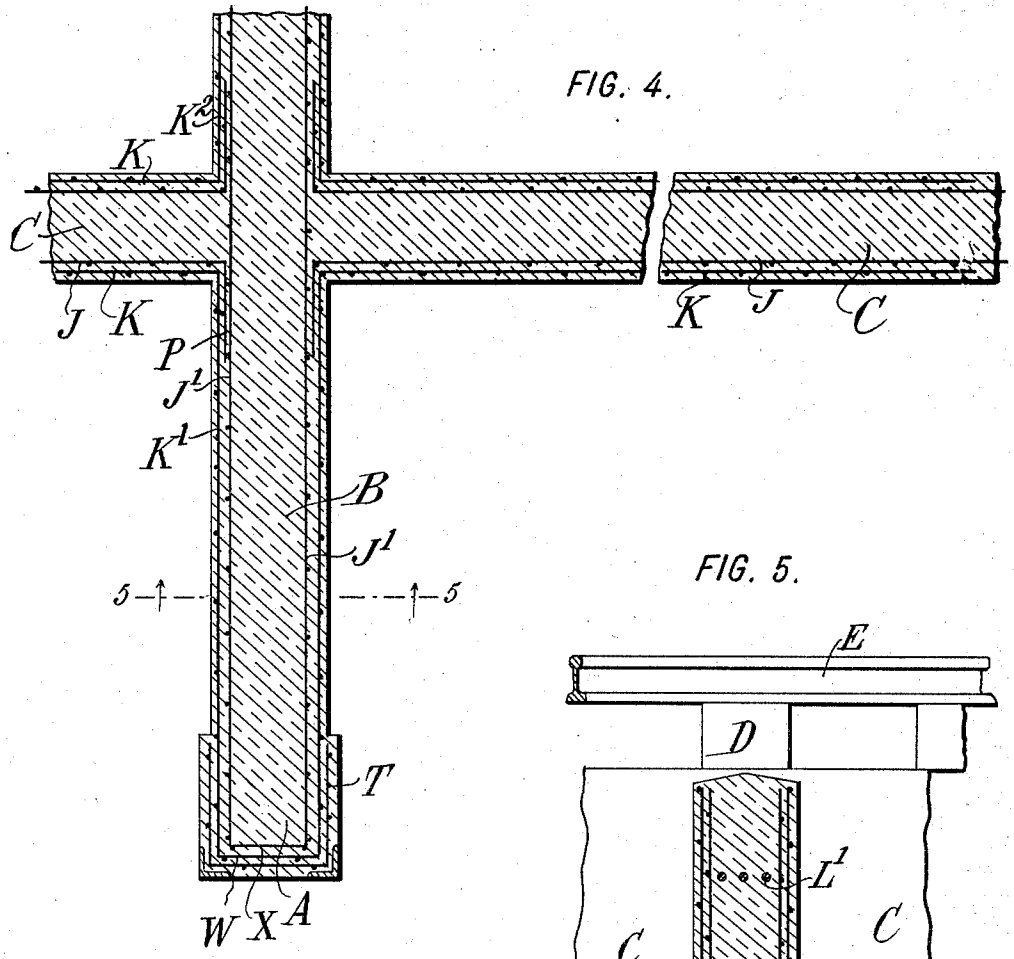


FIG. 5.

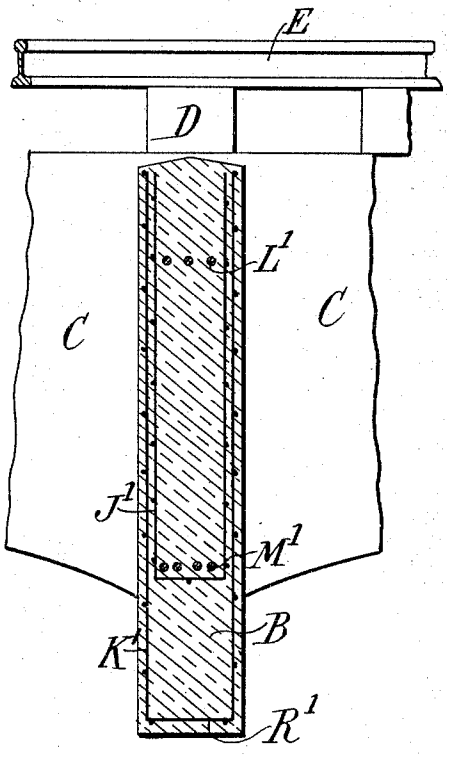
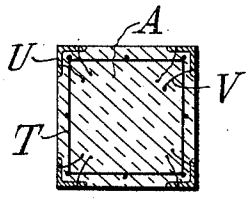


FIG. 6.



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3 SHEETS—SHEET 3.

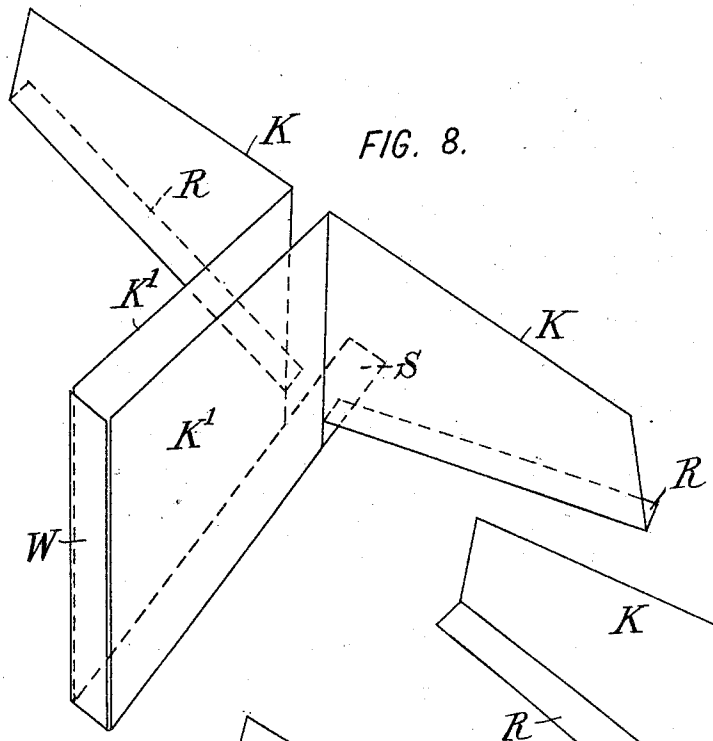

FIG. 8.

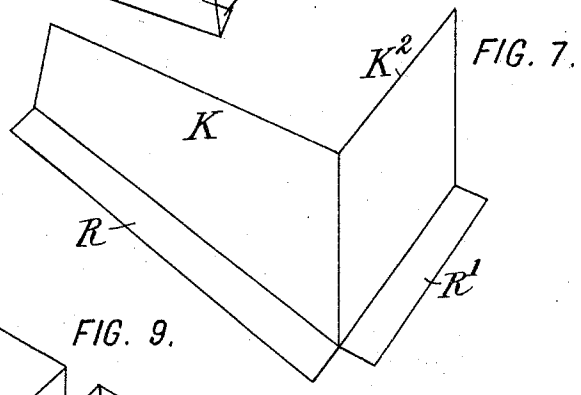

FIG. 7.

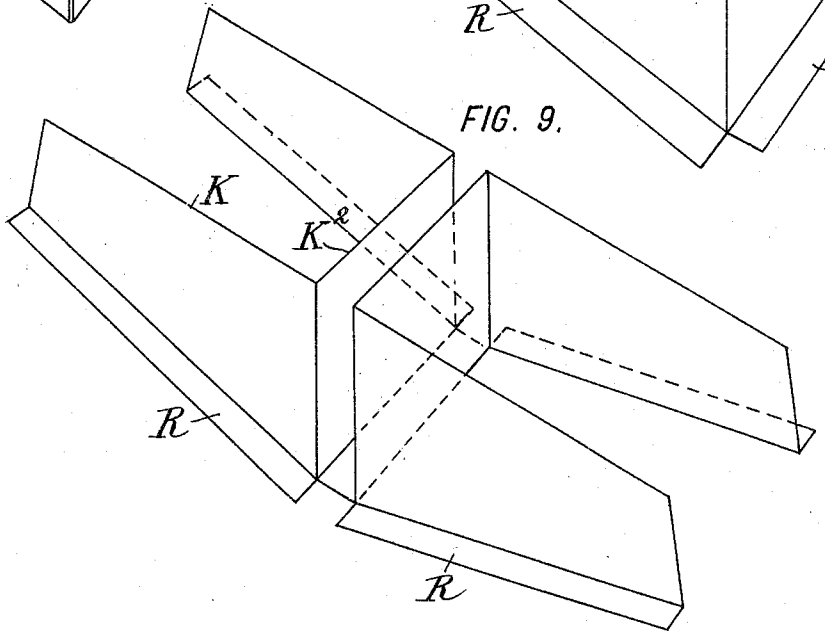

FIG. 9.

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No. 788,570. Patented May 2, 1905.

UNITED STATES PATENT OFFICE.

WILLIAM N. WIGHT AND FRED E. TOWNSEND, OF NEW YORK, N. Y.

TRESTLE.

SPECIFICATION forming part of Letters Patent No. 788,570, dated May 2, 1905.

Application filed March 9, 1903. Serial No. 146,906.

To all whom it may concern:

Be it known that we, WILLIAM N. WIGHT, residing in the borough of Manhattan, county of New York, and FRED E. TOWNSEND, residing in the borough of Brooklyn, county of Kings, city and State of New York, citizens of the United States, have jointly invented certain new and useful Improvements in Trestles, of which the following is a specification.

Our invention aims to provide certain improvements in trestles whereby they may be built of concrete of equal strength and having great advantages as compared with the steel and iron structures now commonly used.

The trestle of our invention is designed to support elevated railways, viaducts, aqueducts, and all similar structures. It is more lasting than steel and does not require the frequent painting and inspection which are necessary with steel structures. In fact, it is practically everlasting. Various other advantages in detail are referred to hereinafter.

The accompanying drawings illustrate a structure embodying our invention and adapted to carry an elevated railroad.

Figure 1 is a plan showing a portion of the railroad-track in position. Fig. 2 is a side elevation of half of one of the longitudinal girders extending between adjacent columns. Fig. 3 is an elevation of one-half of one of the transverse girders, showing also the longitudinal girders in section. Fig. 4 is a horizontal section through one of the columns and the intersecting point of a longitudinal and a transverse girder. Fig. 5 is a section of one of the transverse girders, being a section on the line 5 5 of Fig. 3. Fig. 6 is a transverse section of one of the columns below the girders. Figs. 7, 8, and 9 are isometric views of the fabric used in reinforcing the joints of the girders.

The weakest points of steel trestles are the connections, which by reason of the vibration to which they are subjected are constantly working loose. In our improved trestle we improve the joints by forming the members joined in a monolith of concrete. Certain advantages may be secured by making only the joints between the girders monolithic or by making only the joints between the columns and the girders which are directly supported therefrom monolithic; but preferably the entire structure consisting of columns, transverse girders supported therefrom, and longitudinal girders supported from the transverse girders is made in substantially a single block of concrete, thus making the structure elastic as a whole and not more yielding at the joints than at other parts. Preferably the concrete is reinforced by embedded metal, and such metal may be arranged in any suitable manner. The embedded metal is preferably arranged only to relieve the internal strains within the concrete and not to receive directly any great part of the strains induced by the load to be carried. The concrete is intended as a substitute for the usual metal load-carrying elements, and the metal reinforce is merely an accessory part of the complete concrete elements. The metal reinforce preferably extends continuously from one to the other of the girders or from the girder to the column which supports it, so as to more effectively tie the parts together and make the structure continuous. The character, relative position, and arrangement of the several parts are not material as long as the continuous monolithic features are preserved.

In the embodiment of the invention illustrated the structure is supported, primarily, by columns A. Across the line of the structure and between opposite columns extend transverse or primary girders B, which in turn carry secondary longitudinal girders or track-beams C. This combination of columns and girders is especially adapted for elevated railways in cities, the columns being spaced far apart to provide room for a railway-track underneath and the longitudinal girders C being properly spaced to take directly the weight of the trains on the rails. A track structure may be built directly on these longitudinal girders and may consist of cross-ties D, carrying the rails E and held down by means of bolts F passing through plates G, embedded in the track-beams at the time of their formation. The columns A and girders B and C are molded in a single structure of concrete, as indicated best in Fig. 4. Preferably at the same time there are molded between the track-

beams horizontal stiffeners H, of small bars of concrete, reinforced by wire-netting or not, as desired. These bars stiffen the beams against the lateral shocks due to the moving trains. The girders of the two systems are preferably made deeper at their points of support where the shearing strain is greatest, and this portion of extra depth forms a sort of bracket to stiffen the joint.

The concrete may be reinforced in a variety of ways. We preferably use for this purpose a wire fabric having longitudinal and transverse wires crossing each other and bound together at their crossing-points to prevent accidental displacement of the wires, one set of wires being preferably straight and the fabric being laid with these straight wires longitudinal of the girder. Such a fabric is described in detail in the application for patent of William N. Wight, Serial No. 114,868, filed July 9, 1902. We have illustrated an arrangement of the reinforcing material which is especially adapted to the structure under consideration. The general arrangement of the sheets of fabric is indicated best in Figs. 2 and 3, only the outlines of the sheets being indicated. In the longitudinal girder, Fig. 2, a rectangular sheet J is embedded, extending the full length of the girder. At the end portions of each of the girders C is a supplementary sheet of fabric K, its lower edge extending approximately parallel to the lower edge of the girder and its upper edge extending along near the upper edge of the girder similarly to the main reinforce J. The sheets of fabric J and K are preferably U-shaped in cross-section, as indicated in Fig. 3, extending along the sides and bottom of the girder. In addition the girder is reinforced by two sets of tension rods or wires. The upper set of rods L extend from the upper part of the ends of the girders and are depressed at intermediate points in the form of a catenary, so as to transmit the tensile stresses to the upper part of the primary girders. Similar rods or wires M extend horizontally near the lower portion of the girder and transmit the tensile strains to a lower point of the primary girder. Preferably the wires L and M are continuous from one span to the next of the longitudinal girders, and where the rods are not sufficiently long for that purpose those of one span may be hooked or otherwise united to those of the adjacent span, as indicated at N, Fig. 2. The upper wires L may be supported at the ends of the spans upon metal bearing-pieces O, set in the concrete.

The transverse girders B may be similarly reinforced by rectangular sheets of fabric J′ extending throughout their length and by additional sheets K′ at the deeper end portions and having their edges approximately parallel to the upper and lower edges of the girder at this point. This girder is also shown as reinforced by wires L′, suspended from the tops of the girders at its ends and arranged in a catenary, so that its central portion is near the bottom of the girder, and by horizontal wires M′, extending along near the bottom of the girder.

The mode of making the reinforce continuous from one girder to the other at their point of intersection may be varied considerably, as by tying the reinforces of the crossing girders to each other or by extending the reinforces of one into the other in various styles. Fig. 4 indicates a suitable arrangement. In this figure the main reinforcing fabric J′ of the transverse or primary girder B extends continuously in a straight line from end to end of the girder without interruption at the crossing-point. The main reinforce J of the longitudinal girder extends from end to end of such girder and at its ends is bent at right angles to form lateral portions P and downwardly-projecting portions Q, Fig. 3, embedded in the transverse girder B a slight distance outside of the fabric J′. This reinforce J′ embedded in both the girders and extending continuously from one to the other, would alone give a sufficient metallic bond between the crossing girders. We prefer, however, to similarly extend the auxiliary reinforcing-sheets K and K′ continuously from one to the other of the girders, so that these two parts of the reinforce are, in fact, one sheet of fabric. At the inner side of the longitudinal girder this may be done by bending the fabric in the shape shown in Fig. 7, with the two parts K K^2 (the latter being, in effect, a continuation of K′) at right angles to each other and preferably with flaps R R′ along their lower edges adapted to extend across the bottoms of the girders and to form, with the corresponding reinforce on the opposite side, the U-shaped reinforce previously referred to. For the outer side of the longitudinal girder the fabric may be cut and bent in the shape shown in Fig. 8, in which the portions K for the longitudinal girder C taper at the ends identically with those on the opposite side of the girder, and the portions K′ are enlarged toward the end to a shape corresponding approximately with that of the end portion of the primary girder B. A flap S may also be provided which will lie in the main girder and below the secondary girder, as indicated in Fig. 3. The reinforces for the connections of the two intermediate longitudinal girders may all be made of the shape shown in Fig. 7.

The columns illustrated are especially designed for the monolithic structure above described, with the continuous reinforce extending into both the girder and column. Fig. 6 illustrates the cross-section of the column below its connection with the girder, and Fig. 4 illustrates the same at the point where it is united with the girder. The body of the column is of concrete, preferably solid, as shown,

and near the face thereof is a reinforcing fabric T. Preferably the same fabric above described is used with the straight wires extending circumferentially of the column, so as to resist buckling strains. The corners of the column are reinforced and protected by metal, preferably in the form of angle-bars U, which may be anchored by any suitable anchors V, extending into the concrete body of the column. These corner-pieces not only reinforce the strength of the column, but are especially useful in railways in cities to protect the corners of the column from being chipped by passing vehicles. The inside corner-pieces may extend only from the base to the lower edge of the girders B, as indicated in Fig. 3, the outside corner-pieces being preferably extended clear to the top of the column. Thus there is no break in the monolithic character of the united column and girder.

The reinforcing fabric J′ of the girder B extends also into the column, as shown, and thus constitutes a reinforce embedded in and extended continuously from one to the other of said parts, and this sheet of fabric alone may be depended upon to secure the desired continuity of metal. It is convenient, however, and preferable to extend the reinforce K′, which is in the deeper end portions of the girder, into the column. (See Fig. 4.) Where the length of the girder B from the first longitudinal girder C to the column is not very great, the fabric cut and bent, as in Fig. 8, may extend continuously into the three component parts of the structure—namely, the columns and the primary and secondary girders. The fabric T, which is embedded throughout the length of the column, may be cut away at the inner face of the column where the latter joins the girder. The fabrics J′ and K′ then extend, as shown, parallel with the sides of the girder and nearly to the outer face of the column. The end of the fabric shown in Fig. 8 may be bent up to form a flap W, and the end of the fabric J′ may be similarly bent up to form a flap X, Fig. 4, to reinforce the column near its outer face.

Fig. 9 shows a shape for the sheet of reinforcing fabric, which forms, in effect, four of the sheets (shown in Fig. 7) combined in one and which is adapted for use between any two of the longitudinal girders. The rectangular portions K^2 will lie in the transverse girder at opposite sides thereof, forming together the U-shaped reinforce described, and the wings K will lie along the adjacent sides of the two longitudinal girders included and may be formed with or without the flaps R for connection with the reinforces at the opposite faces of the respective girders.

The wires or rods L M L′ M′ may be of any suitable style. They may, for example, be either separate wires, as shown, or they may be made up of bundles of smaller wires twisted together or not, or they may be narrow strips of fabrics formed by weaving or otherwise and either laid flat or twisted or rolled into a rod. In fact, a variety of forms are obviously applicable to the use described.

Though we have described with great particularity of detail a structure embodying our invention, yet it is to be understood that the invention is not limited to the specific embodiment shown.

Various modifications of the details and in the arrangement and combination of the parts may be made without departing from the invention.

What we claim is—

1. A trestle comprising in combination columns, primary girders supported therefrom, and secondary girders supported from said primary girders, and unconnected to said primary girders except at the points of support, said trestle being made of concrete arranged to directly receive and resist the principal strains of the structure, said concrete being reinforced by embedded metal subjected only to the internal strains occurring within the concrete and to substantially none of the principal strains in the structure.

2. A trestle comprising in combination columns, primary girders supported therefrom, and secondary girders supported from said primary girders, made of concrete arranged to directly receive and resist the principal strains of the structure, said concrete being reinforced by embedded metal subjected only to the internal strains occurring within the concrete and to substantially none of the principal strains in the structure, the metal reinforce being extended continuously from one to the other of said girders.

3. A trestle comprising in combination columns, primary girders supported therefrom, and secondary girders supported from said primary girders, and unconnected to said primary girders except at the points of support, said trestle being made of concrete arranged to directly receive and resist the principal strains of the structure, said concrete being reinforced by embedded metal subjected only to the internal strains occurring within the concrete and to substantially none of the principal strains in the structure, the metal reinforce being extended continuously from a column into a girder supported thereby.

4. A trestle comprising, in combination, columns, primary girders and secondary girders formed in a monolith of concrete with reinforcing metal embedded in and extending continuously from one to another of said parts.

5. A trestle comprising, in combination, columns, primary girders and secondary girders, formed in a monolith of concrete with a sheet of reinforcing metal embedded in and extending continuously into each of said parts.

6. A girder formed of concrete of greater

depth at its ends, a metal reinforce comprising a U-shaped fabric extending throughout said girder along its bottom and sides, and an additional metal reinforce comprising a similarly-shaped fabric at the end portions of said girder along the bottom and sides.

7. A girder formed of concrete of greater depth at its ends, a reinforcing fabric embedded in said girder throughout its length, and an additional reinforcing fabric embedded in the end portions of said girder.

8. A girder formed of concrete reinforced by sheets of metal fabric extending parallel to the sides thereof and by additional wires or rods extending between the supported ends of the girder.

9. A girder formed of concrete having a reinforcing fabric embedded therein adjacent to its sides, wires or rods embedded therein lying at their central portions in the lower part of the girder and at their ends in the upper part of the girder, and wires or rods extending throughout the girder adjacent to its lower portion.

10. In a trestle, in combination, a pair of girders at an angle to each other, and a metal reinforce comprising a sheet of fabric having portions K and K^2 embedded in said girders adjacent to the sides thereof and extending continuously from one to the other.

11. In a trestle, in combination, a column, a transverse girder supported thereon, a longitudinal girder at an angle to said transverse girder, and a metal reinforce comprising a sheet of fabric having portions K K′ embedded respectively in said longitudinal girder and in said transverse girder and column to form a continuous metallic union of said parts.

12. A girder formed of concrete reinforced by sheets of metal fabric embedded therein and extending parallel to the sides thereof and in addition by wires embedded therein extending in a catenary from the upper part of the ends of the girder through the lower part of the central portion of the girder.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

WILLIAM N. WIGHT.
FRED E. TOWNSEND.

Witnesses:
DOMINGO A. USINA,
FRED WHITE.