No. 782,877. PATENTED FEB. 21, 1905.

W. H. RONEY.

CONCRETE METAL CONSTRUCTION.

APPLICATION FILED JAN. 25, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

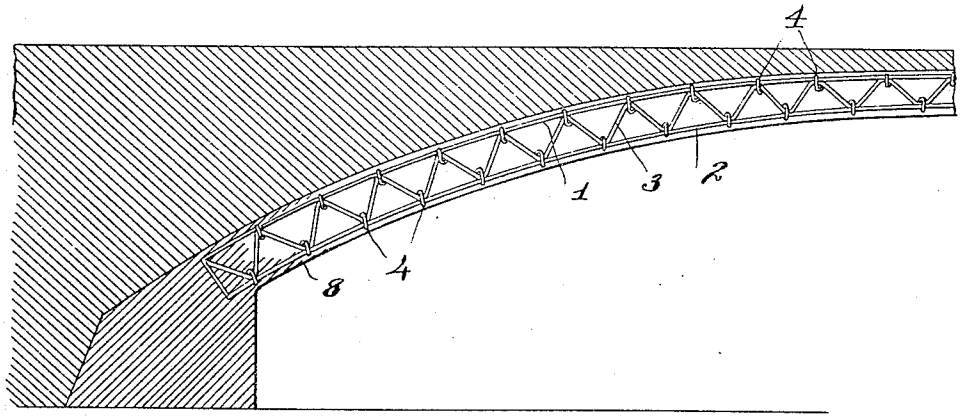


Fig. 2.

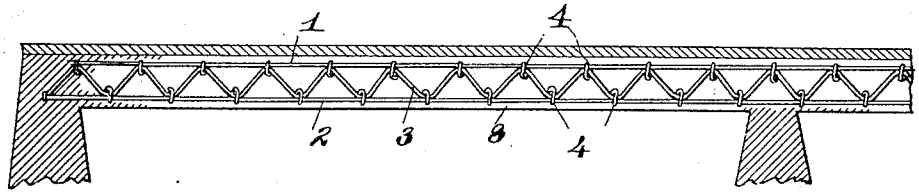
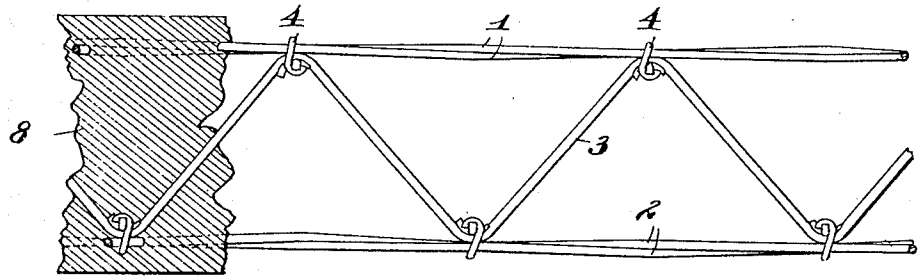


Fig. 3.



Witnesses.

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3 SHEETS—SHEET 2.

Fig. 4.

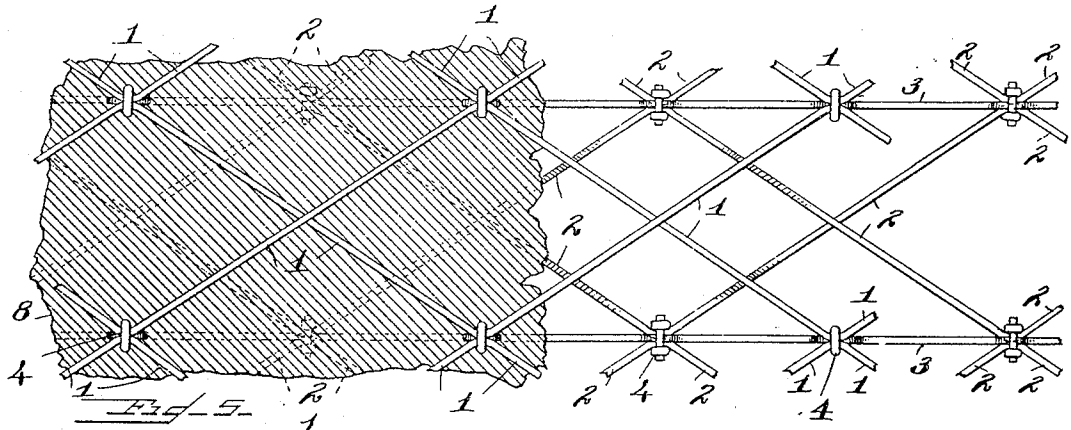


Fig. 5.

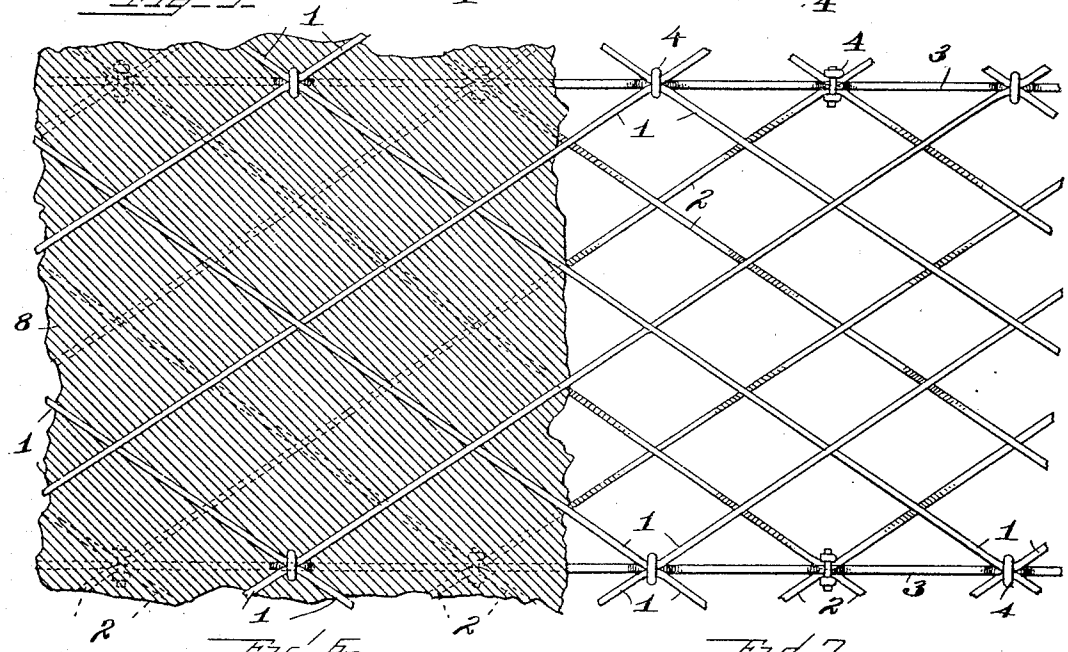


Fig. 6.

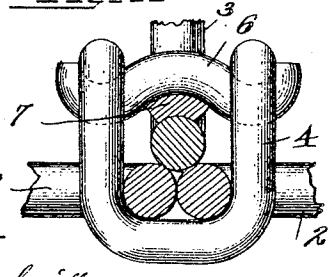
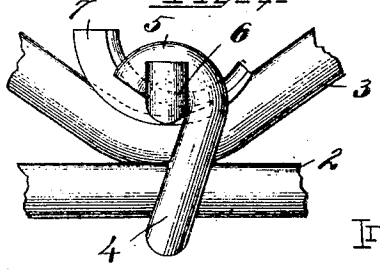


Fig. 7.



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3 SHEETS—SHEET 3.

Fig. 8.

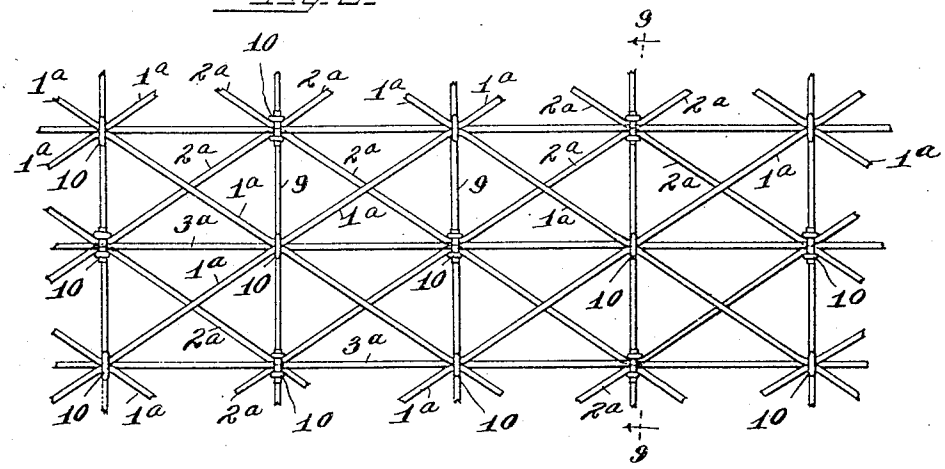


Fig. 9.

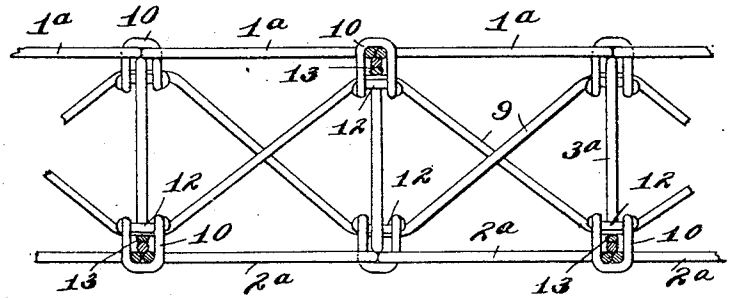


Fig. 10.

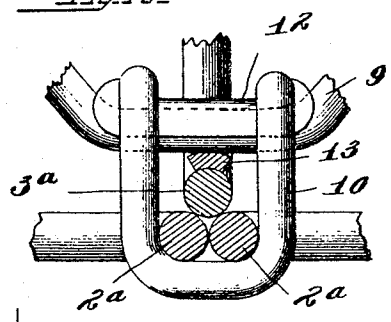
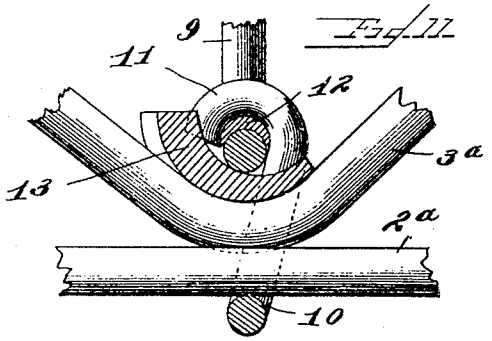


Fig. 11.



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No. 782,877. Patented February 21, 1905.

UNITED STATES PATENT OFFICE.

WILLIAM H. RONEY, OF CHICAGO, ILLINOIS.

CONCRETE-METAL CONSTRUCTION.

SPECIFICATION forming part of Letters Patent No. 782,877, dated February 21, 1905.

Application filed January 25, 1904. Serial No. 190,580.

To all whom it may concern:

Be it known that I, WILLIAM H. RONEY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Concrete-Metal Construction, of which the following is a specification.

This invention relates to a structure in which steel or other material of great tensile strength is inclosed or embedded in concrete, cement mortar, artificial stone, brick, terra-cotta, glass, or other structural substance of a less tensile strength.

The invention refers particularly to the combination and interrelation of metal rods, bars, or wires secured at suitable intervals by shackles or clamps in such manner as to transmit the resultant stresses from one metal member to another in a transverse direction, and, further, to the embedment of said metal skeleton or framework in concrete, cement mortar, or any of the other substances hereinbefore mentioned to form a complete structure capable of resisting compressive, tensile, and shearing stresses in all directions.

In the accompanying drawings, Figure 1 is a view taken in longitudinal section through one side of an arch embodying the features of my invention. Fig. 2 is a similar view showing the invention applied to a flat arch or beam. Fig. 3 is a view showing in side elevation and on a somewhat larger scale the metal structure illustrated in the preceding figures. Fig. 4 is a top plan view of a portion of the metal fabric of my invention, showing a part of said fabric embedded in cement. This figure illustrates the simple construction. Fig. 5 is a view similar to the last preceding one, showing an arrangement of the parts comprising the metal structure which I have denominated the "compound" construction. Fig. 6 is a face view of the shackle employed by me in joining together the steel rods or wires at their meeting places. Fig. 7 is an edge view of the shackle illustrated in the last preceding figure. Fig. 8 is a top plan view illustrating a metal structure in which a transverse strand or "web" is employed. Fig. 9 is a section on dotted line 9 9 of Fig. 8. Fig. 10 is a face view, and Fig. 11 an edge view, of the shackle employed to join together the metal rods or wires of the structure illustrated in Figs. 8 and 9.

The metallic structure of this invention is made up of sections of any desired width, (see Figs. 4 and 5,) each of which sections comprises upper chord members 1 and lower chord members 2, which chord members extend longitudinally of the structure not in a right line, but from side to side of the section in a zigzag course. In the simple form of section (shown in Fig. 4) two upper chord members and two lower chord members are employed; but in the compound section (illustrated in Fig. 5) three upper chord members and three lower chord members are used. A greater or less number of these chord members may be employed, according to the strength of structure desired. At the side margin of each section or between adjacent sections a longitudinally-extending vertical web member 3 is placed, which web member passes alternately from the upper to the lower chord members, meeting said members at the angles produced by their zigzag form. These angles in the upper chord members of one section are made to coincide with the similar angles of the upper chord members in the adjacent section, and so with corresponding lower chord members, and at their point of meeting the corresponding chord members of adjacent sections and the longitudinal vertical web member 3 are secured together by a shackle, which will next be described. Each of said shackles for joining the chord members of adjacent sections and the longitudinal vertical web members comprises a bow 4, formed of metal, the ends of which bow are bent to form hooks 5. The hooks 5 are adapted to engage a yoke-bar 6, curved upward at its middle portion and its ends to form seats for the hooks 5. The bow 4 is of a size just sufficient in width to contain the two chord members 1 1 or 2 2, lying side by side, and the longitudinal vertical web member 3, lying in contact with and midway between said chord members. A curved wedge 7, in cross-section concave upon its under side and convex upon its upper side, is adapted to be inserted between the yoke 6 and the longitudinal vertical web member 3, and

when said wedge is driven firmly into position the chord members 1 1 or 2 2 and the longitudinal vertical web member 3 are held securely within the bow 4. All the chord members of any two adjacent sections are secured to the longitudinal vertical web member 3 common to said sections in the manner just described.

When a metallic structure of the desired form has been completed in the manner hereinbefore described and has been put into the position in which it is to be used, concrete, cement mortar, or other similar plastic material 8 is packed about said structure, molds previously erected confining said plastic material, holding it upon the metallic structure and giving said material a suitable outward form. As soon as the plastic material sets and becomes sufficiently hard the molds may be removed. In forming arches the ends of the structure are usually made higher vertically than the intermediate portions, and in forming other structures the proportions of the metallic structure may be varied to properly carry the load which the structure is intended to support.

The chord members 1 and 2 and the web members 3 are illustrated in the drawings as being formed from round bars or wires. However, square or flat bars or bars of any other cross-section may be used, although usually preference is given to round bars or to bars having an oval section or round corners, for the reason that in most cases the concrete or other material in which the metal fabric is embedded can be brought into a closer contact with the round bars, a stronger bond of adhesion thus being formed between the metal and the concrete. The use of round bars also lessens the tendency to cleave the embedding material. On the other hand, square bars or bars of many other forms of cross-section have a greater surface in proportion to their cross-sectional area, and therefore present a greater proportion of surface for the adhesion of the embedding material. The use of twisted bars, either of square form or other forms of cross-section and bars with corrugations or other forms of projections and also bars whose cross-section changes at intervals, gives a shearing resistance in addition to the adhesive value of the embedding material while under stress. This shearing resistance, however, tends to split the embedding material.

The longitudinal vertical web members 3 are represented as being formed from a single rod connecting the chord members of adjacent sections at their meeting places in the margin of said sections, said web member 3 passing alternately from top chord members 1 to bottom chord members 2 throughout the length of the structure. The purpose of the longitudinal vertical web member 3 is to resist the shearing strains resulting from the action of external forces exerted through tensile stress in certain parts of the structure and compressive stress in certain other parts. Part of either kind of strain is resisted by the embedding material and a part by the web 3. In practical work the strength of the metal parts and the cement or other covering material is proportioned as nearly as may be to the strains they are able to bear.

The vertical web members 3 of adjacent sections need not coincide with vertical planes parallel to each other, but may diverge, being wider apart at one end than at the other or wider apart at the middle than at either end—as, for instance, in the construction of domes, groined arches, and like structures.

In structures designed to withstand considerable transverse strains I employ a modification of the metal fabric shown in Figs. 3, 4, and 5, which modified structure comprises one upper chord member 1^a, one lower chord member 2^a, a longitudinal web member 3^a, and a transverse vertical web member 9, extending through adjacent sections. Where the structure is to receive extraordinary transverse strains, I place the transverse vertical web members 9 at frequent intervals, Fig. 8. As will be seen from an inspection of Figs. 8, 9, 10, and 11, the transverse vertical web members 9 are shackled alternately to a meeting point of upper chord members and a meeting point of lower chord members in the plane of the transverse web member. As will be noted, a different form of shackle is required to bind together the chord members, the longitudinal web member, and a transverse web member. In this shackle, Figs. 10 and 11, a bow 10 is provided with hooked upper ends 11, and a saddle 12 concave upon its lower face and convex upon its upper face is provided for carrying the transverse web member 9, said saddle being adapted to receive the hooks 11 of said bow. The longitudinal chord members (the lower chord members 2^a are illustrated in Fig. 10) lie side by side in the bow 10. The longitudinal vertical web member 3^a lies upon and between said chord members, and a curved wedge 13, the upper side of which is flat and the lower side concave, is inserted between the transverse vertical web member 9 and the longitudinal vertical web member 3^a. As the wedge 13 is driven into place the shackle is drawn tight and the members therein are held firmly in place. This construction is of course intended to be covered by plastic material, as hereinbefore described.

While I have characterized the chord members as longitudinal, it is clear that in floor construction and in other similar applications of the invention the longitudinal webs 3 might be of equal length with the transverse webs 9.

The object of the shackles hereinbefore described is to bind and secure the different members of the structure together to keep them firmly in position during the erection

of the structure and while the embedding material is being properly packed in place and when the structure is completely embedded to transmit the strains from one member to another and from one section to the next adjacent section of the structure. In the arrangement of parts herein shown stresses applied locally are distributed over the entire structure, so that each member contributes its part to the support of the whole.

In building bridges, floors, &c., it is practical to construct the entire metal fabric in its proper position for embedment in concrete or other embedding material. Should the concrete be deposited in longitudinal sections, as is frequently the case in practice, the parts of the upper and lower chord members and the shackles will intersect any longitudial joint between one section of the embedding material and an adjacent section subsequently deposited and bind the two together. The peculiar form and construction of the metal fabric is such that no two parts of any member or combination of members lie in a plane perpendicular to the outer surfaces of the structure. This open construction readily admits the embedding material, insuring a perfect contact and adhesion between the metal at all points and the embedding material.

I claim as my invention—

1. A metal structure adapted to be embedded in concrete and the like, having an upper zigzag longitudinal chord member, a lower zigzag longitudinal chord member, and a longitudinal web member at each side of said structure extending alternately from said upper chord member to said lower chord member, and joining said members together at the angles produced by their zigzag form.

2. A metal structure adapted to be embedded in concrete and the like, comprising a plurality of sections, each section having an upper zigzag chord member and a lower chord member, the two chord members of each section lying in different planes and being connected together, the upper chord members of two adjacent sections meeting at and being secured together at the angles produced by their zigzag form.

3. A metal structure adapted to be embedded in concrete and the like, comprising two longitudianl sections, each section having an upper, zigzag, longitudinal chord member and a lower longitudinal chord member, the two chord members of each section lying in different planes and being connected together, the upper chord members of two adjacent sections meeting at the angles produced by their zigzag form, and means for securing said members together at their meeting points.

4. A metal structure adapted to be embedded in concrete and the like, comprising two longitudinal sections, each section having an upper, zigzag, longitudinal chord member and a lower chord member, said upper chord members of two adjacent sections meeting at the angles produced by their zigzag form, means for securing said upper chord members together at their meeting points, and means for connecting the upper and the lower chord member of each section.

5. A metal structure adapted to be embedded in concrete and the like, comprising two longitudinal sections, each section having an upper, zigzag, longitudinal chord member and a lower chord member, said upper chord members of two adjacent sections meeting at the angles produced by their zigzag form, means for securing said upper chord members together at their meeting points, and a longitudinal web member for connecting the upper and the lower chord member of each section.

6. A metal structure adapted to be embedded in concrete and the like, which structure is made up of a plurality of sections, each section having an upper chord member and a lower chord member, a web member on the line of meeting of adjacent sections extending alternately from upper to lower chord members of said sections, and means for securing corresponding chord members of adjacent sections and said web member together.

7. A metal structure adapted to be embedded in concrete and the like, which structure is made up of a plurality of sections, each section having an upper chord member and a lower chord member, a web member on the line of meeting of adjacent sections extending alternately from upper to lower chord members of said sections, means for securing lower chord members of adjacent sections and said web member together, and means for securing upper chord members of adjacent sections and said web member together.

8. A metal structure adapted to be embedded in concrete and the like, having two upper, zigzag, longitudinal chord members, two lower zigzag, longitudinal chord members, and a longitudinal web member extending alternately from said upper chord members to said lower chord members and being secured to said chord members at the angles produced by their zigzag form.

9. A metal structure adapted to be embedded in concrete and the like, comprising two longitudinal sections, each section having an upper chord member, a lower chord member, and a transverse web member extending transversely through the sections and joining together the upper chord member of one section and the lower chord member of the other section.

10. A metal structure adapted to be embedded in concrete and the like, comprising two longitudinal sections, each section having an upper chord member, a lower chord member, a transverse web member extending transversely through the sections and joining together the upper chord member of one section

and the lower chord member of the other section, and means for connecting the upper and the lower chord member of the respective sections.

11. A metal structure adapted to be embedded in concrete and the like, comprising two longitudinal sections, each section having an upper chord member, a lower chord member, a longitudinal web member at the adjacent edges of the sections and extending alternately from upper to lower chord members of said sections, and a transverse web member extending transversely through the sections and joining together the upper chord member of one section and the lower chord member of the other section.

12. In a metal structure, in combination, two bars or strands lying side by side; a third bar or strand lying upon said first-mentioned bars or strands; a yoke; a bow adapted to receive all of said bars or strands, said bow having hooked ends adapted to engage said yoke; and a wedge adapted to be inserted between said bow and the upper bar or strand.

13. In a metal structure, in combination, two bars or strands lying side by side; a third bar or strand lying upon said first-mentioned bars or strands; a yoke having hooked ends; a bow adapted to receive all of said bars or strands, said bow having hooked ends adapted to engage the hooked ends of said yoke; and a curved wedge adapted to be inserted between said bow and the upper bar or strand.

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Witnesses:
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