

F. W. SKINNER.
METHOD OF CONSTRUCTING AND ERECTING REINFORCED CONCRETE BEAMS, GIRDERS,
AND ARCH RIBS.

939,642.

APPLICATION FILED FEB. 20, 1908.

Patented Nov. 9, 1909.

2 SHEETS—SHEET 1.

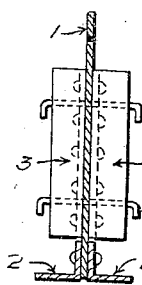


Fig. 1

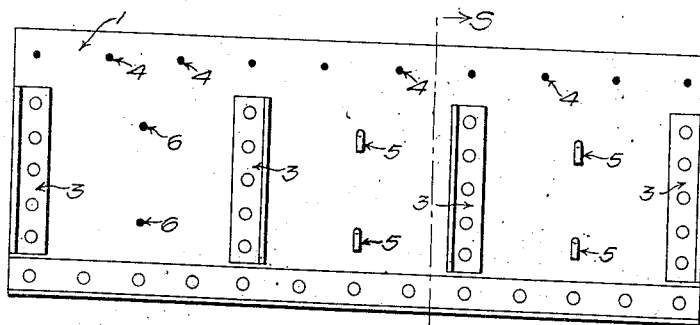


Fig. 2

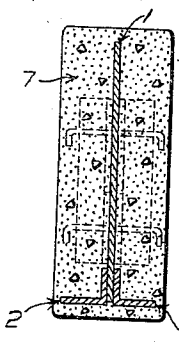


Fig. 3

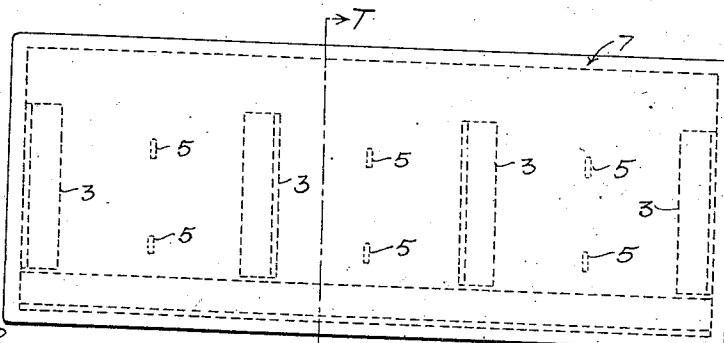


Fig. 4

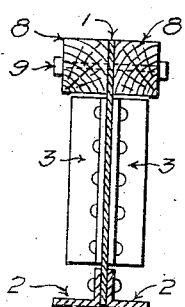


Fig. 5

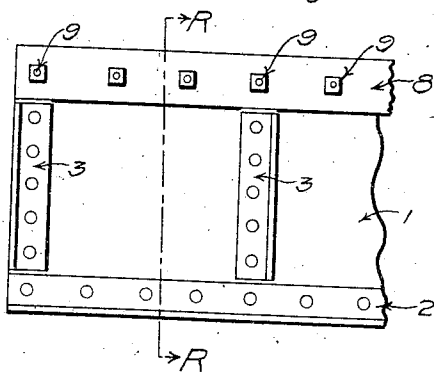


Fig. 6

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2 SHEETS—SHEET 2

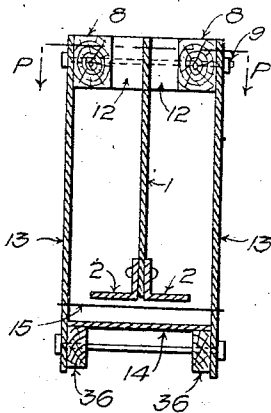


Fig. 7.

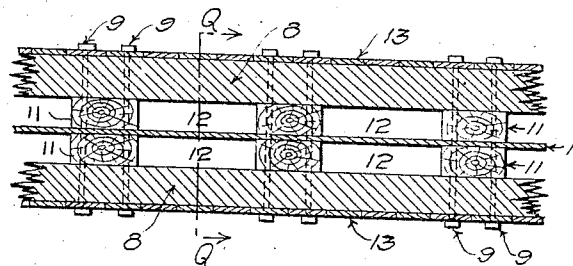


Fig. 8.

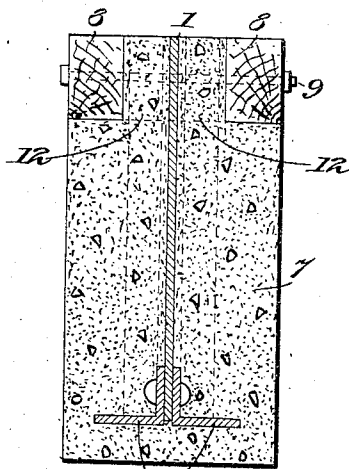


Fig. 9.

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METHOD OF CONSTRUCTING AND ERECTING REINFORCED-CONCRETE BEAMS, GIRDERS,
AND ARCH-RIBS.

939,642.

Specification of Letters Patent.

Patented Nov. 9, 1909.

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To all whom it may concern:

Be it known that I, FRANK W. SKINNER, a citizen of the United States, residing at No. 50 Sherman avenue, Tompkinsville, in the county of Richmond and State of New York, have invented a new and useful Method of Constructing and Erecting Reinforced-Concrete Beams, Girders, and Arch-Ribs, of which the following is a specification.

Heretofore the beams, girders, and platform slabs of concrete floors, roofs, and similar structures, have been reinforced with bars of steel usually designed only to resist the tensile and shearing stresses in the finished member, and not adapted for auxiliary service in the preliminary operations of construction and erection, for which additional temporary provision must be made at a considerable expense.

In straight beams and girders the reinforcement generally consists of a plurality of small bars, more or less flexible, which have little resistance to bending and must be supported during the construction of the member, and are difficult to adjust and maintain in the required position. The connection between tension and shearing members is usually poor and difficult to make or maintain.

Nearly or quite all the reinforced concrete beams and girders heretofore in use require the construction of falsework or other supporting devices to carry the weight of the reinforcement steel, the wet concrete and the forms, until the steel and concrete become united by the setting of the latter and the members develop self supporting strength.

In some instances reinforced concrete beams and girders have been cast in forms on the surface of the ground, thus obviating the necessity of falsework, and afterward assembled together as separate units of the structure. On account of the great weight this method is liable to produce dangerous and injurious stresses and requires a powerful plant to handle and erect the beams and girders.

In my invention the steel reinforcement necessary to resist the tensile stresses in the finished concrete members are adapted, without increase of weight or expense, to utilize their strength in the support of the members during construction and erection, before the concrete becomes serviceable, thereby effect-

ing great economy and promoting the rapidity and convenience of the work.

The different portions of the reinforcement intended to resist the tensile and shearing stresses are joined together much more rigidly, positively, accurately, and efficiently than by other methods, and all the reinforcing steel is in a compact and rigid form which is easily and accurately adjusted, and maintained without difficulty, in the required position in the form.

In the construction of beams and girders the permanent reinforcement steel is combined with temporary compression pieces which enable it to develop its full tensile and shearing strength to resist erection stresses and eliminate falsework, and the forms for the concrete are attached directly to the self supporting steelwork, thus providing very simple construction, and sometimes the steelwork is utilized to constitute a part or all of the form.

The principal elements of my invention include special forms of reinforcement steel, in girders, beams, and arch ribs; and the combination of permanent steel tension members with temporary compression members.

Figure 1 is a cross section at S S, Fig. 2 and Fig. 2 is a side elevation of the reinforcement steel for a reinforced concrete girder. Fig. 3 is a cross section at T T, Fig. 4 and Fig. 4 is a side elevation of the finished girder. Fig. 5 is a cross section at R R, Fig. 6 and Fig. 6 is a part side elevation of the steel portion of the girder, as shown in Figs. 1 and 2, temporarily reinforced with compression pieces to resist erection stresses. Fig. 7 is a transverse vertical section at Q Q, Fig. 8 and Fig. 8 is a horizontal section at P P, Fig. 7 of the permanent steel reinforcement of a girder temporarily reinforced with compression pieces 8 8, forming a top flange, as in Figs. 5 and 6, and also showing a convenient arrangement of forms and pouring holes for concreting. Fig. 9 is a transverse section through a beam, girder or arch rib, showing the combination of the concrete, the metal reinforcement and the separated top flange pieces.

In all cases, the same reference numbers are used to designate the same or corresponding parts of different figures.

In Figs. 1 and 2 the reinforcement corresponds to an ordinary plate girder without the top flange, and with very light web stiff-

ener angles, and is calculated to resist all the tensile or lower flange stresses, and part of the shear developed in the completed girder in service, and to insure the exact arrangement and location of the tension metal, its proper connection to the compression member, and the distribution of stresses throughout the finished girder. The flange angles 2, 2, are designed to take all the tension due to the moment of flexure. The web plate 1, is designed to resist shear, to connect the tension pieces 2, 2, with the temporary compression member not here shown, and to engage the concrete with a strong bond by means of the small vertical angles 3, 3. It is provided with open holes 4, 4, and 6, 6; and with transverse rods 5, 5, the latter designed to give additional bond between the steel web plate and the concrete, but it is obvious that the holes 6, 6, rods 5, 5, and angles 3, 3, may be omitted if sufficient adhesion is otherwise secured between the steel and concrete.

In Figs. 3 and 4, the reinforcement is shown permanently inclosed in a mass of concrete 7, adapted to resist the compressive stresses in the finished girder and to furnish complete insulation and protection for all the reinforcement steel. This obviates all necessity for painting the steel and nearly or quite eliminates any labor or expense for the maintenance of the girder after construction. The concrete below the flange angles 2, 2, may require anchorage to them, or it may be wholly omitted, leaving only the lower horizontal surfaces of the angles exposed. If anchors are used, they may be similar to bars 5—5, Fig. 1.

In Figs. 5 and 6 the upper part of the permanent steel web, 1, of Figs. 1 and 2, is shown temporarily reinforced by compression pieces 8, 8, secured to it by bolts 9, 9, through the holes 4, 4. The pieces 8, 8, act as compression flanges and complete the girder with sufficient strength to support its own dead load and that due to the floor system, until the structure is nearly completed, and derives permanent compressive strength from the addition of nearly all of the concrete 7, Fig. 3, which makes it self sustaining and allows the pieces 8 8, to be removed and saved for use in the erection of other girders, thus effecting a great convenience and economy.

In Figs. 7 and 8, the temporary compression pieces corresponding to 8 8, in Figs. 5 and 6, are spaced out from the web plate 1, by filler pieces 11 11, which are arranged with spaces 12 12, between them at short intervals providing for the filling in of concrete in the form of which the side pieces 13 13, are secured to the compression pieces 8 8 and the bottom pieces 14 are attached to 13 13, below the flange angles 2 2, thus allowing space for concrete to inclose the lower

sides of the flange angles. It is obvious that, if it is not deemed essential to inclose the lower surfaces of the flange angles 2 2, with concrete the side pieces 13 13, can be moved closer together so as to be in contact with the edges of 2 2, and can be secured together by wires 15, or by other means, and the bottom pieces 14 may then be dispensed with.

In Fig. 9, the detachable top chord pieces 8—8, are shown embedded in the concrete 7, 75 and the filler pieces 12—12, which separate the top chord pieces from each other and from the web 1, are indicated by dotted lines, being hidden behind the concrete.

I claim,

1. The process of construction of a reinforced concrete beam, girder, or arch rib, by the following steps; the assembling of the reinforcement metal with temporary compression members adapted to make with it a complete, efficient girder, the erection of this girder in its final position in the structure and its connection to the structure, the inclosure of the metal reinforcement with a form or mold, the filling of the form or mold with a plastic material, the removal of the temporary compression member after the concrete has developed a set and strength to resist the compression stress in the girder.

2. The process of construction of a reinforced concrete girder, arch rib, or beam by a combination of the following steps, assembling a temporary top flange member to the web, so as to form a complete girder efficient to support its own weight and additional erection loads during construction, supporting the ends of the girder in position required for the finished structure, inclosing the bottom flange and web members by a form or mold, filling the form or mold with a plastic material, removing the top flange member, and any temporary portions of the form or mold after the concrete has developed a set and strength to resist the compression stress in the girder.

3. The process of construction of a reinforced concrete girder, beam, or arch rib, by a combination of the following steps, riveting together a web plate, bottom flange angles and shearing and bonding angles transverse to the flange angles, assembling top flange pieces and separators to the web plate, attaching a form or mold to the top flange pieces, connecting the web plate to supports at the end adapted to carry the weight of the girder and its load, filling the form or mold with concrete, removing the top flange pieces and any temporary portions of the fillers and form after the concrete has developed a set and strength to resist the compression stress in the girder, and filling with concrete any cavities left by the removal of temporary pieces.

4. The process of construction of a reinforced concrete beam, girder, or arch rib,

by a combination of the following steps, assembling together the permanent metal reinforcement required to provide for tension and shearing stresses, with a temporary compression member adapted to combine with the permanent metal and form a complete girder efficient to resist construction stresses by the development of the strength of the permanent steel and the temporary compression member, acting together before the development of compressive strength in the concrete; inclosing the permanent reinforcement metal by a form supported by the

girder; supporting the girder at the ends only, without intermediate supports or false-work; filling the form with concrete; and removing the temporary compression member after the concrete has developed strength to resist the compression stresses in the girder.

Signed at New York city, this 19th day of February 1907.

FRANK W. SKINNER

Witnesses:

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