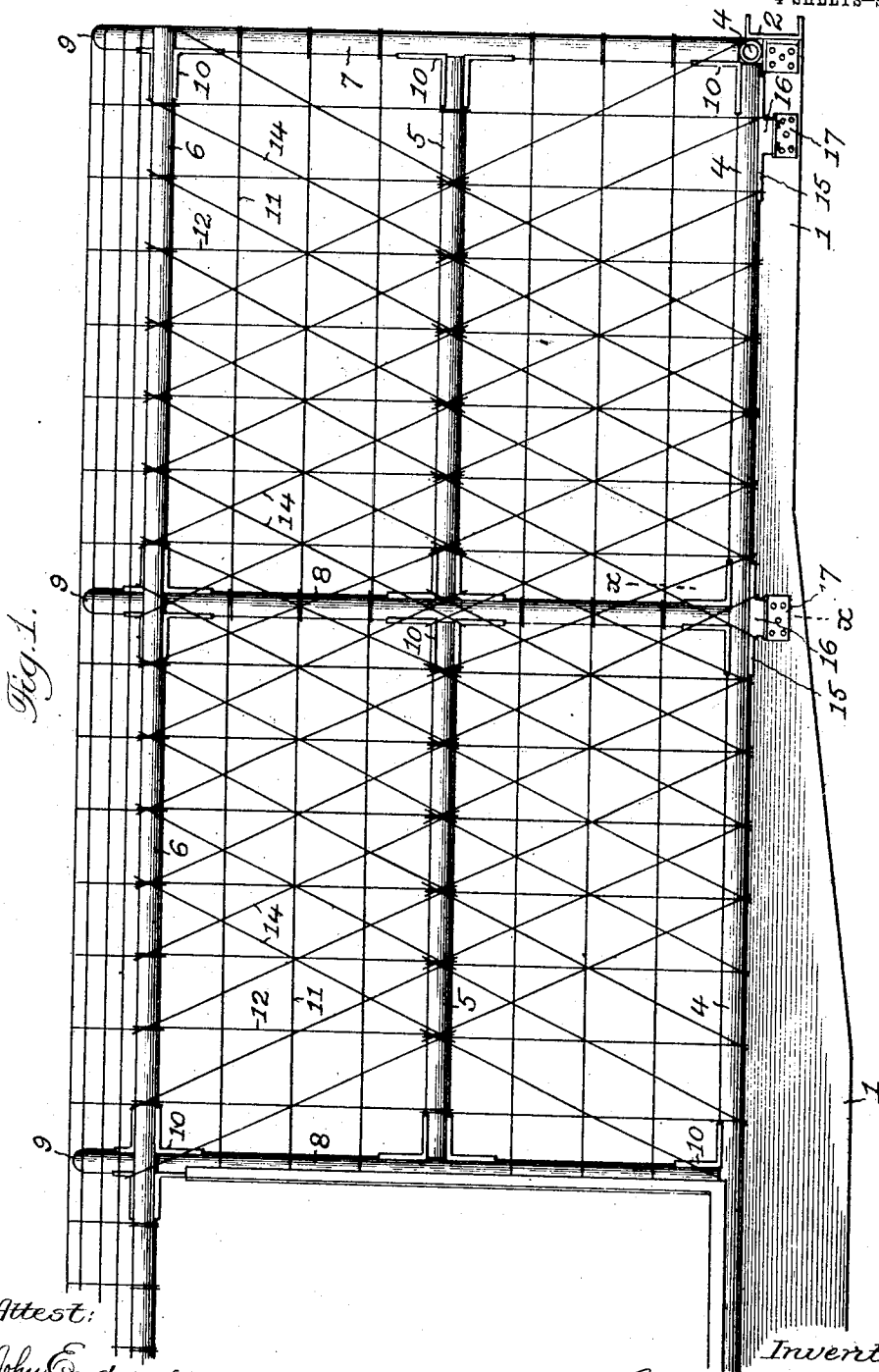


G. M. GRAHAM.
REINFORCED CONCRETE CAR STRUCTURE.
APPLICATION FILED APR. 21, 1909.

974,659.

Patented Nov. 1, 1910.

4 SHEETS—SHEET 1.



Attest:
John Enders
Henry W. W.

Inventor:
George M. Graham.
by Robert Burns
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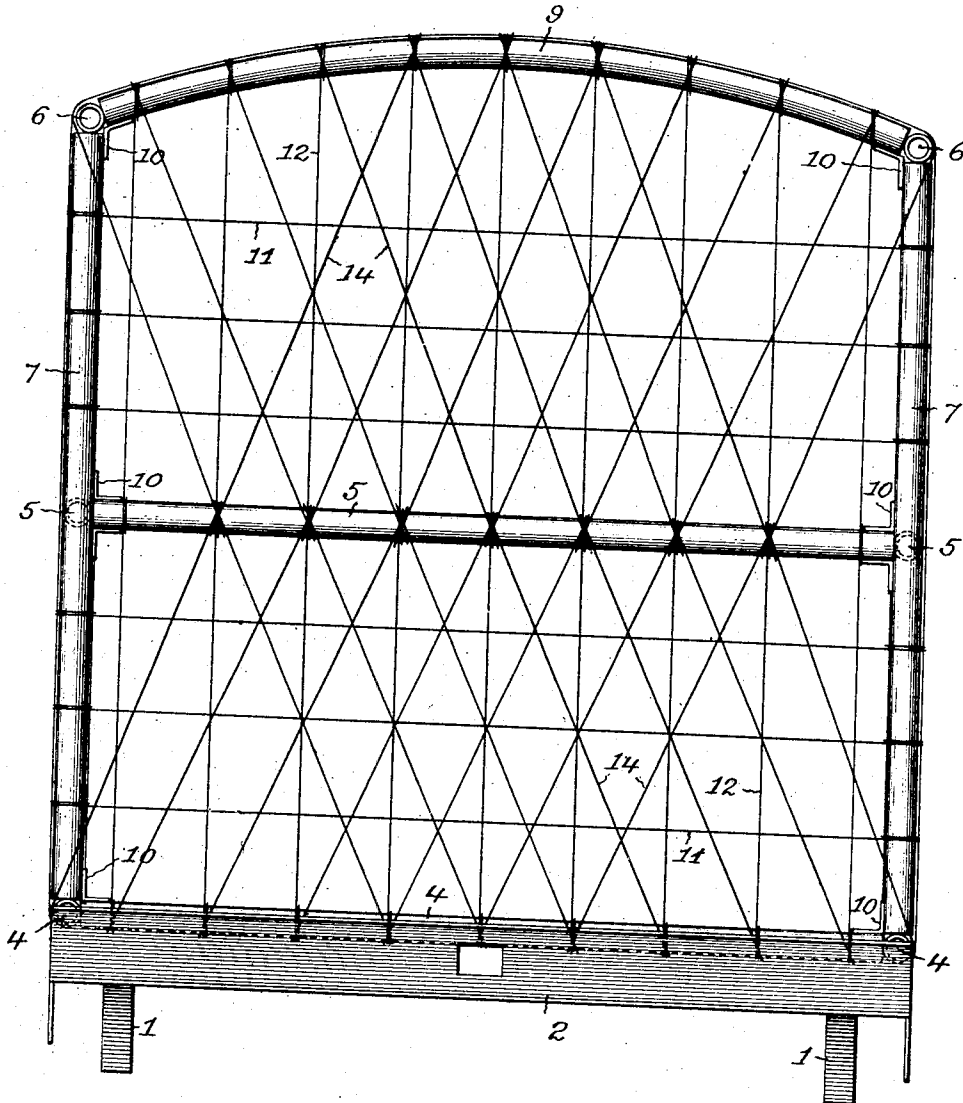
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4 SHEETS-SHEET 2.

Fig. 2.



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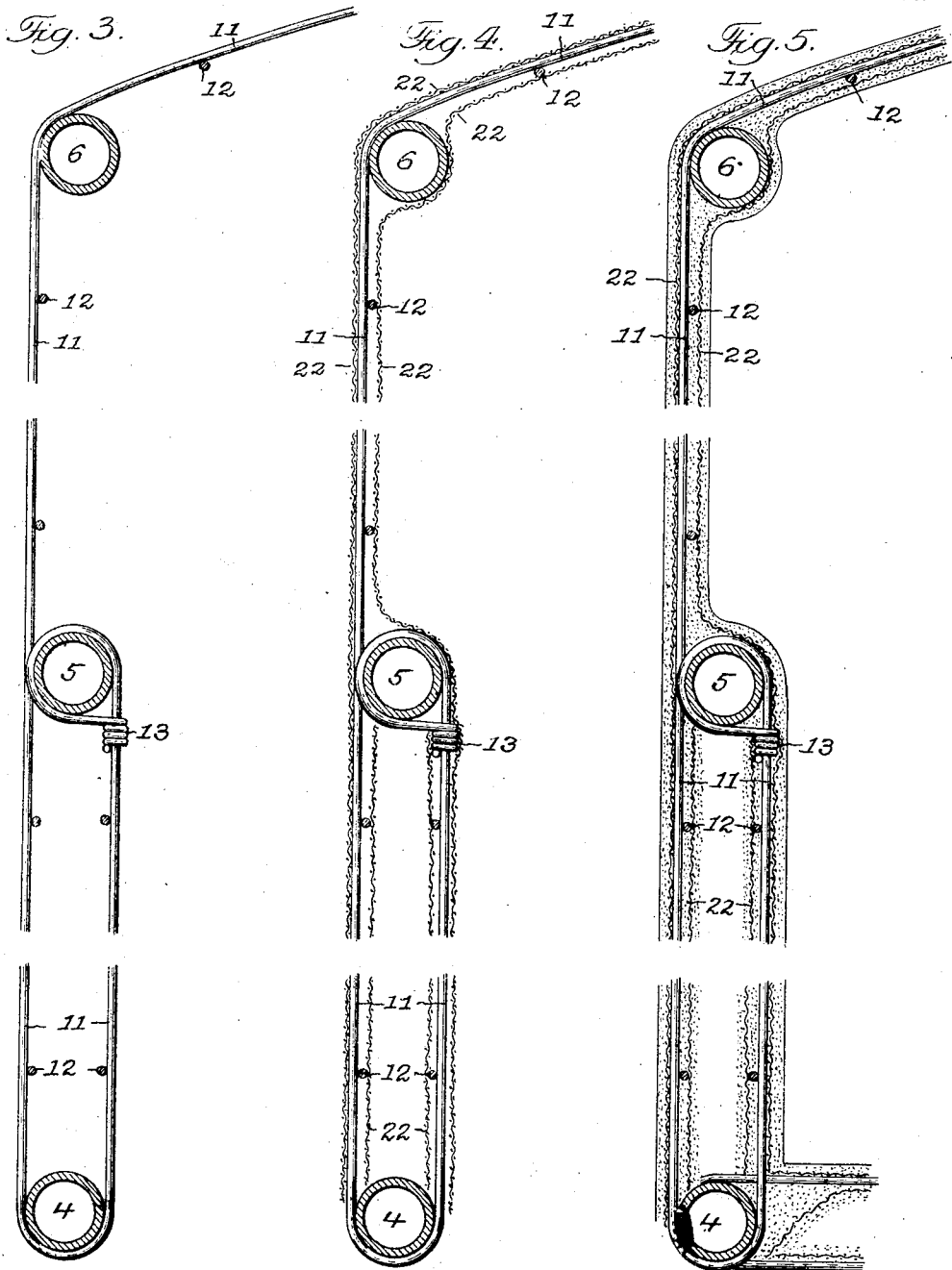
by Robert Burns
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4 SHEETS—SHEET 3.



Attest:

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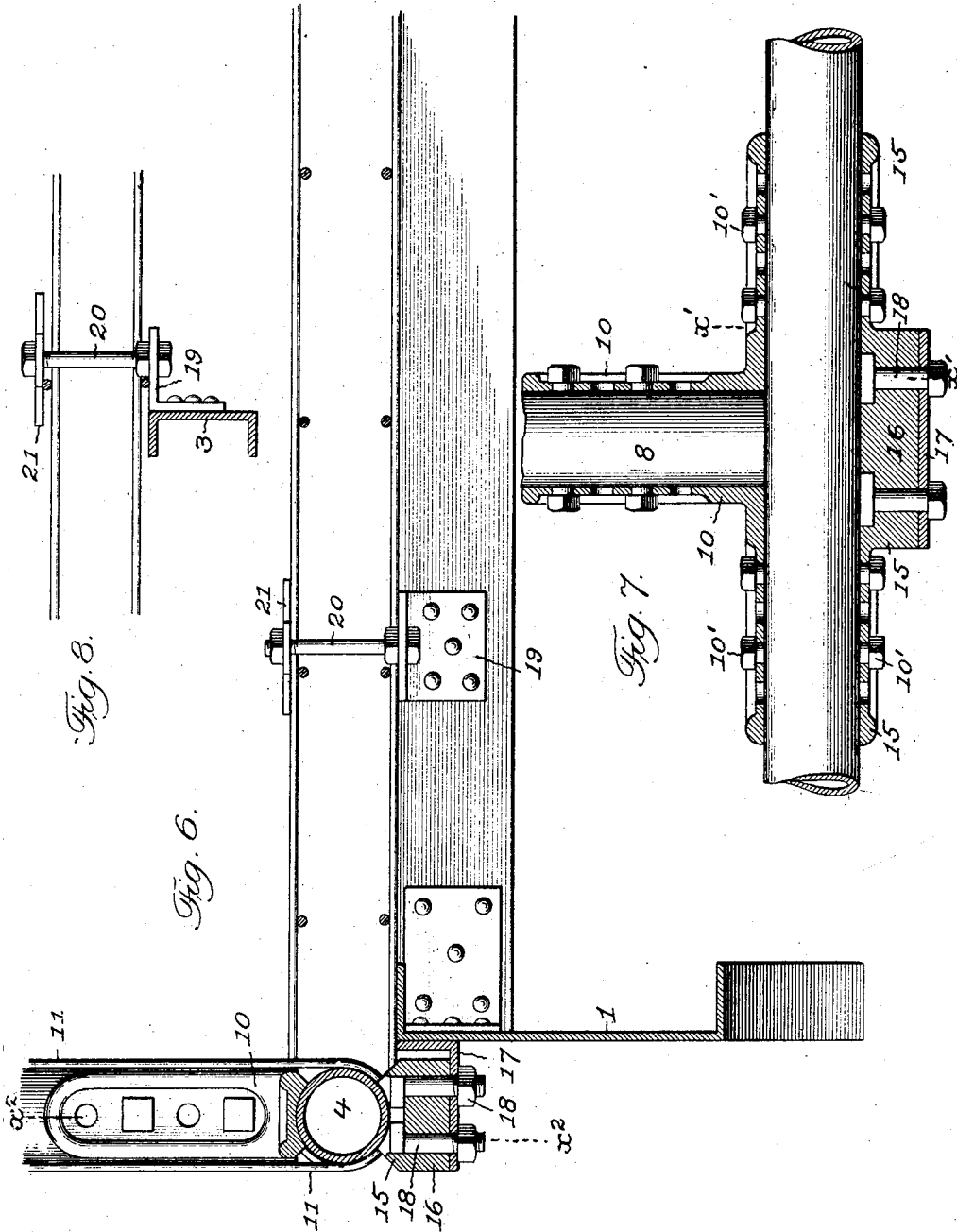
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4 SHEETS-SHEET 4.



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UNITED STATES PATENT OFFICE.

GEORGE M. GRAHAM, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
SUSPENSION STEEL CONCRETE COMPANY, A CORPORATION OF DELAWARE.

REINFORCED CONCRETE CAR STRUCTURE.

974,659.

Specification of Letters Patent.

Patented Nov. 1, 1910.

Application filed April 21, 1909. Serial No. 491,348.

To all whom it may concern:

Be it known that I, GEORGE M. GRAHAM, a citizen of the United States of America, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Reinforced Concrete Car Structures, of which the following is a specification.

This invention relates to certain improvements on the subject matter of my prior Letters Patent No. 865,490, issued September 10, 1907, for reinforced concrete construction, and has for its object to provide a simple and efficient structural arrangement and combination of parts, more especially adapted for use in the formation of car bodies, boat hulls and like portable structures, requiring lightness and great strength combined, all as will hereinafter more fully appear.

In the accompanying drawings: Figure 1, is a side elevation of one half of the skeleton reinforcing frame of a box car body, embodying the present invention. Fig. 2, is an end elevation of the same. Figs. 3, 4 and 5 are detail sectional elevations of a wall of the structure, and illustrating the series of steps employed in the erection of the same. Fig. 6, is an enlarged detail transverse sectional elevation on line $x-x$, Figs. 1 and 7, of the skeleton frame and means of attachment to the underframe of the car. Fig. 7, is a detail longitudinal sectional elevation on line $x'-x'$, Fig. 6. Fig. 8, is a detail longitudinal sectional elevation of the same on line $x''-x''$, Fig. 6.

Similar numerals of reference indicate like parts in the several views.

Referring to the drawings, 1 represents a longitudinal outer or side sill; 2 an end sill, and 3 a cross tie of an ordinary structural metal under or floor frame of a railway box car body, and which special construction is merely employed to illustrate a practical application of the present invention to a portable structure.

4 are the lower horizontal beams; 5 the intermediate horizontal beams; 6 the upper horizontal beams; 7 and 8 the corner and intermediate posts, and 9 the arched roof beams, all of which are formed of round tubing and secured together by coupling pieces 10, to constitute a skeleton frame

which supports the wire or rod skeleton centers. Hereinafter described, and the mass of concrete which forms the walls and other portions of the structure. The coupling pieces 10 just referred to, are preferably of the construction described in my companion application for Letters Patent, Serial Number 491,348 filed April 21, 1909.

As in my former patented construction, the skeleton wire or rod centers, above referred to, are formed by vertical and horizontal windings or strands 11 and 12, of wire or rod metal of the required diameter, arranged in crossed relation and spaced apart to form a mesh approximating twelve inches square, and as hereinafter more fully set forth.

In the present improvement each vertical wire or rod strand at the sides of the car body will be continuous as to both vertical side walls, and roof or upper and substantially horizontal portion of the structure and will be formed as follows:—One end of the wire or rod is looped around an intermediate horizontal beam 5, and secured upon the wire or rod by a coil splice 13; the wire is then carried down and around a lower horizontal beam 4 and thence up at the opposite side of the intermediate horizontal beam 5 aforesaid; thence up to the upper horizontal beam 6 and across to the opposite upper horizontal beam 6; thence down past the opposite intermediate beam 5 to the opposite lower horizontal beam 4 and around the same, then up to the aforesaid opposite intermediate horizontal beam 5, around which it is looped and its end formed into a final attaching coil splice 13 engaging the wire or rod strand at the opposite side of said beam. In like manner each vertical wire or rod strand at the ends of the car body will be continuous as to the end walls and the roof, or upper substantially horizontal portion of the structure, and will be formed in the same manner as above described in connection with the vertical side wall strands. And where the upper or roof portion of the structure is made of the curved or arch form shown in Fig. 2, the series of longitudinal strands of the skeleton center thereof, will be preferably arranged undermost in order to support the series of transverse strands aforesaid in the

required plane to constitute an embedded portion of the completed roof.

Each horizontal wire or rod strand between the lower and the intermediate beams 4 and 5 of the structure will be formed in a similar manner to that above described, with the exception that the winding will continue back in a reverse direction, and end and be attached at the same point at which commencement was made. In the case of a box car body, the subject of illustration in the present drawings, the aforesaid horizontal windings will commence at a vertical post 8 forming a jamb of the central doorway of the car body; from thence extend along the adjacent car side, across the car end, along the other car side, looped around the other jamb post at the other side of the car body, back again in the described course to the first mentioned jamb post from whence commencement was made, and a final attachment effected.

Each horizontal wire rod or strand between the intermediate and upper beams 5 and 6, will be formed in an identical manner to that above described in connection with the vertical windings, and will commence at a vertical post forming a jamb of the doorway, from thence extend along the adjacent car sides, across the car end, along the other car side to the jamb post at the other side of the car body, looped around said post and secured by a coil splice in the manner before described.

In both instances, two independent series of horizontal strands will be formed in the structure, each individual to a respective end portion of the car body, with the central doorways of the same constituting the line of separation.

The described series of steps in the application of each wire or rod strand will be effected under tension, so that when the winding is completed the same will be under a predetermined tensional stress. And said tension may be constantly maintained during the progress of the operation, or be applied, as a single tensioning operation, before the final loop, heretofore described, is made in the wire or rod strand and just previous to the formation of the final attaching coil splice 13.

When so desired loops may be formed in the different wire or rod strands and at the proper points by encircling the different horizontal and vertical beams with the wire or rod strands, and with a view to afford greater individual rigidity to the different skeleton centers of the open-frame panels formed by the beams aforesaid.

With the construction above described, a double skeleton center is formed at the lower portion of the sides and ends of the car body and is adapted to afford the added strength required in such portion of railway box cars.

While the upper portion of said sides and ends of the box car body are formed by a single skeleton center, and is adapted to afford the requisite lightness required in such upper portions of the car body.

The floor portion of the structure is preferably formed by crossed wire or rod windings applied in the manner set forth in detail in my former Patent No. 865,490, aforesaid, and in case such floor is made of reinforced concrete.

14 are bracing wire or rod strands extending in opposite diagonal directions on the sides and ends of the car body, from the lower beams 4 to the upper beams 6, and roof beams 7, and attached to the respective beams in immediately adjacent relation to the aforesaid vertical wire or rod strands 11, and preferably by the loops and coil splices described in connection with said vertical strands. In the preferred construction, said diagonal strands will loop around the intermediate beams 5, in adjacent relation to the loops of the vertical strands around said beams, with a view to attain a greater local bracing of the frame members in their proper position.

The skeleton frame with its skeleton centers arranged and connected together in the manner above described, is attached as a whole to the underframe of the railway car by the following means:—15 are elongated saddle pieces formed with upper concave channels which fit the curved under surface of the lower horizontal frame beams 4, and formed with central depending knees adapted to rest upon angle brackets 17, secured to the outer longitudinal sills 1 of the car body underframe aforesaid. 18 are bolts passing down through said knees and through the horizontal flanges of the angle brackets 17 and provided with attaching nuts on their lower ends as shown. In the preferred construction the upper headed ends of said bolts are arranged in recesses in the upper faces of the saddle pieces, so as to be clear of the lower beams 4 when in place, and not interfere with a proper assemblage of the parts. The side portions or wings of the saddle piece 15 are preferably of a counterpart construction to that of the members of the angle coupling pieces 10, heretofore described, in order that the same bolts which connect said coupling pieces to the beams 4 may be employed to secure the saddle pieces 15 to said beams, by passing the fastening bolts 10 through the respective coupling members, side wings and beams as illustrated in Fig. 7. 19 are angle brackets secured to the cross ties 3 of the car body underframe, with their horizontal flanges adapted to receive bolts which extend up and through washers or bearing plates 21 resting upon the skeleton metal center of a concrete floor to afford an

additional connection of the car body to the underframe at such points as may be found necessary or desirable.

22 are sheets of wire fabric arranged at opposite sides of, and directly against, the wire or rod centers 11, 12 aforesaid, and clipped thereto in any usual manner. Such sheets of wire fabric are of a fine mesh, and in practice the plastic mass of concrete is applied from one side by means of a trowel or plasterer's float, and forced through the nearest fabric sheet, around the skeleton rod center, and through the farthest fabric sheet. The concrete mass protruding through said last fabric sheet being subsequently smoothed down or left unfinished as the judgment of the builder may suggest.

With the described construction a very strong and extremely thin wall is provided in a rapid and economical manner. In the case of the double lower wall construction before described, the sheets of wire fabric need not be applied to the inner skeleton rod center until after the outer skeleton rod center has had its sheets of fabric and mass of concrete applied, in that the large mesh of the inner skeleton center will permit of the operator reaching, in a convenient manner, the inner surface of the outer wall to smooth down or otherwise manipulate said surface.

Having thus fully described my said invention what I claim as new and desire to secure by Letters Patent, is:—

1. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, and a skeleton center comprising in part, a series of vertical strands, each attached by a loop and fastening means to an intermediate horizontal beam and extending down and around a lower horizontal beam, thence to an upper horizontal beam and across to an opposite upper horizontal beam, thence down to a lower horizontal beam and around the same, thence up to an intermediate horizontal beam and secured thereto by a loop and fastening means.

2. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, and a skeleton center comprising in part a series of lower horizontal strands, each attached by a loop and fastening means to an intermediate post and extending to and around a corner post and across to an opposite corner post, thence to an opposite intermediate post and around the same, and thence back in a reverse direction to the first intermediate post and attached thereto by a loop and fastening means.

3. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, and a skeleton center comprising in part a series of upper horizontal strands, each attached by a loop and fastening means to an intermediate post and extending to and around a corner post and across to an opposite corner post, thence to an opposite intermediate post and secured thereto by a loop and fastening means.

4. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, and a skeleton center comprising in part, a series of vertical strands, each attached by a loop and fastening means to an intermediate horizontal beam and extending down and around a lower horizontal beam, thence to an upper horizontal beam and across to an opposite upper horizontal beam, thence down to a lower horizontal beam and around the same, thence up to an intermediate horizontal beam and secured thereto by a loop and fastening means, and a series of lower horizontal strands, each attached by a loop and fastening means to an intermediate post and extending to and around a corner post and across to an opposite corner post, thence to an opposite intermediate post and around the same, and thence back in a reverse direction to the first intermediate post and attached thereto by a loop and fastening means.

5. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, and a skeleton center comprising in part, a series of vertical strands, each attached by a loop and fastening means to an intermediate horizontal beam and extending down and around a lower horizontal beam, thence to an upper horizontal beam and across to an opposite upper horizontal beam, thence down to a lower horizontal beam and around the same, thence up to an intermediate horizontal beam and secured thereto by a loop and fastening means, and a series of upper horizontal strands, each attached by a loop and fastening means to an intermediate post and extending to and around a corner post and across to an opposite corner post, thence to an opposite intermediate post and secured thereto by a loop and fastening means.

6. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, and a skeleton center comprising in part, a series

of vertical strands, each attached by a loop and fastening means to an intermediate horizontal beam and extending down and around a lower horizontal beam, thence to an upper horizontal beam and across to an opposite upper horizontal beam, thence down to a lower horizontal beam and around the same, thence up to an intermediate horizontal beam and secured thereto by a loop and fastening means, a series of lower horizontal strands, each attached by a loop and fastening means to an intermediate post and extending to and around a corner post and across to an opposite corner post, thence to an opposite intermediate post and around the same, and thence back in a reverse direction to the first intermediate post and attached thereto by a loop and fastening means, and a series of upper horizontal strands, each attached by a loop and fastening means to an intermediate post and extending to and around a corner post and across to an opposite corner post, thence to an opposite intermediate post and secured thereto by a loop and fastening means.

7. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, and a skeleton center comprising in part, a series of vertical strands, each attached by a loop and fastening means to an intermediate horizontal beam and extending down and around a lower horizontal beam, thence to an upper horizontal beam and across to an opposite upper horizontal beam, thence down to a lower horizontal beam and around the same, thence up to an intermediate horizontal beam and secured thereto by a loop and fastening means, and a series of diagonal bracing rods attached to the upper and lower horizontal beams by loops and fastening means.

8. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, and a skeleton center comprising in part a series of horizontal strands each attached by a

loop and fastening means to the posts of the structure, and a series of diagonal bracing rods attached to the upper and lower horizontal beams by loops and fastening means.

9. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, and a skeleton center comprising in part, a series of vertical strands, each attached by a loop and fastening means to an intermediate horizontal beam and extending down and around a lower horizontal beam, thence to an upper horizontal beam and across to an opposite upper horizontal beam, thence down to a lower horizontal beam and around the same, thence up to an intermediate horizontal beam and secured thereto by a loop and fastening means, and a series of diagonal bracing rods, attached to the upper and lower horizontal beams by loops and fastening means and looped around the intermediate horizontal beams.

10. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, a skeleton center therefor, a series of saddle pieces having depending knees, an underframe, angle brackets secured to the side sills of said underframe, and means for securing the saddle pieces to said angle brackets.

11. In a reinforced concrete car body or like structure, the combination of a skeleton frame formed by a series of round vertical posts and upper, lower and intermediate round beams connected together, a skeleton center therefor, an underframe, angle brackets secured to a cross tie of said underframe and bearing plates and bolts connecting the skeleton centers of the floor with said brackets.

Signed at Chicago, Illinois, this 12th day of April 1909.

GEORGE M. GRAHAM.

Witnesses:

ROBERT BURNS,
L. HOLDEN.