(No Model.) 4 Sheets—Sheet 1.

W. F. SHERMAN.

SUPERSTRUCTURE OF ELEVATED RAILWAYS.

No. 318,213. Patented May 19, 1885.

Fig. 1.

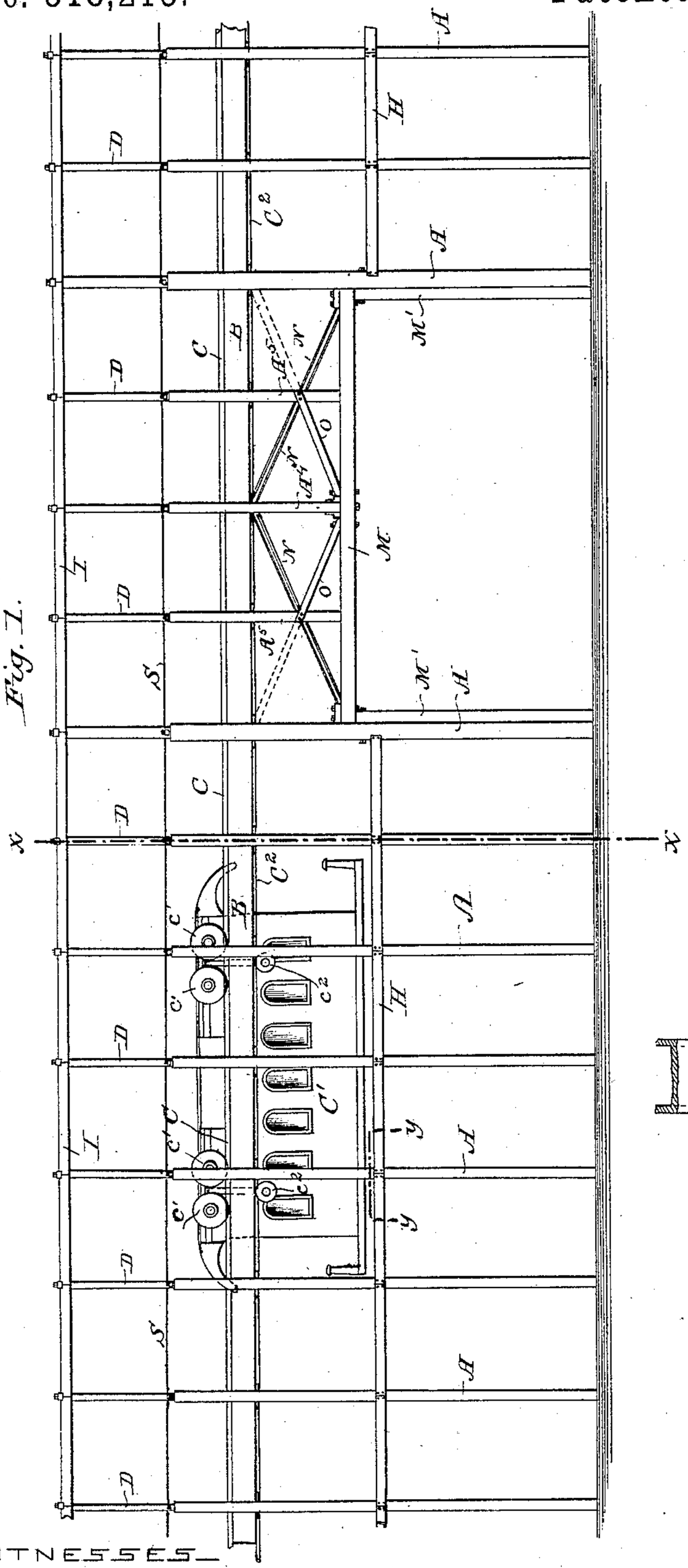
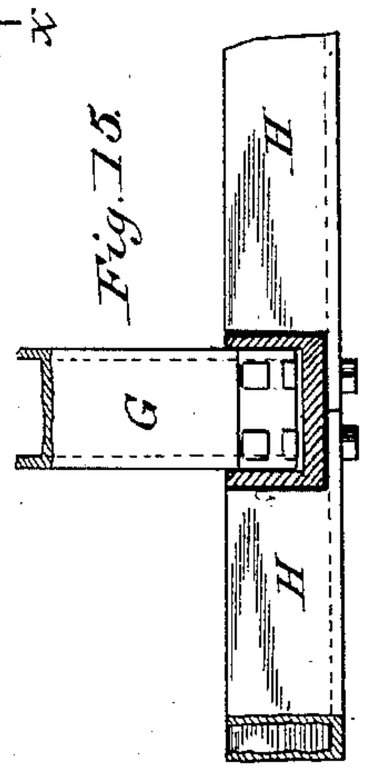


Fig. 15.



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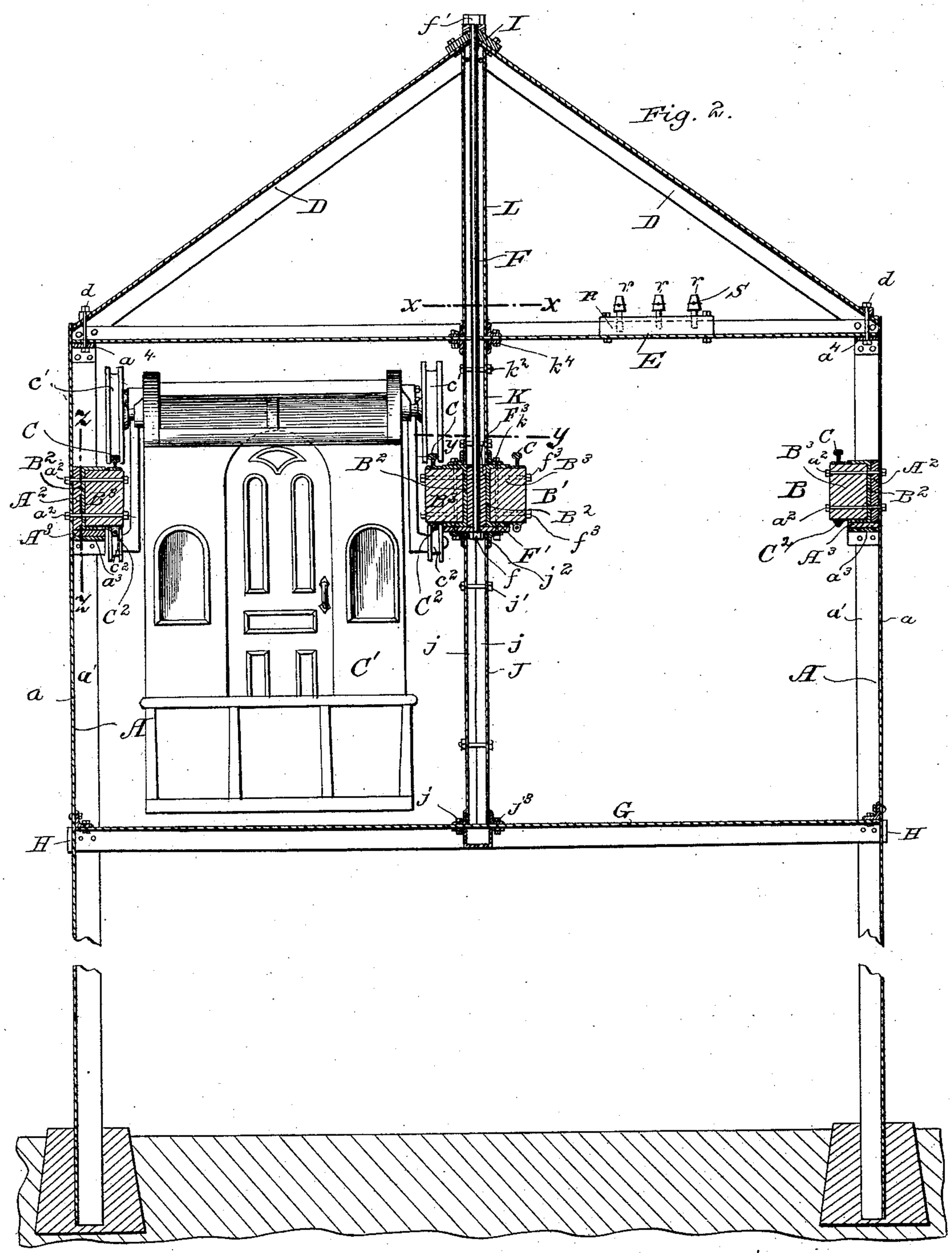
W. F. SHERMAN.

SUPERSTRUCTURE OF ELEVATED RAILWAYS.

No. 318,213. Patented May 19, 1885.

Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

W. F. SHERMAN.

SUPERSTRUCTURE OF ELEVATED RAILWAYS.

No. 318,213. Patented May 19, 1885.

Fig. 3.

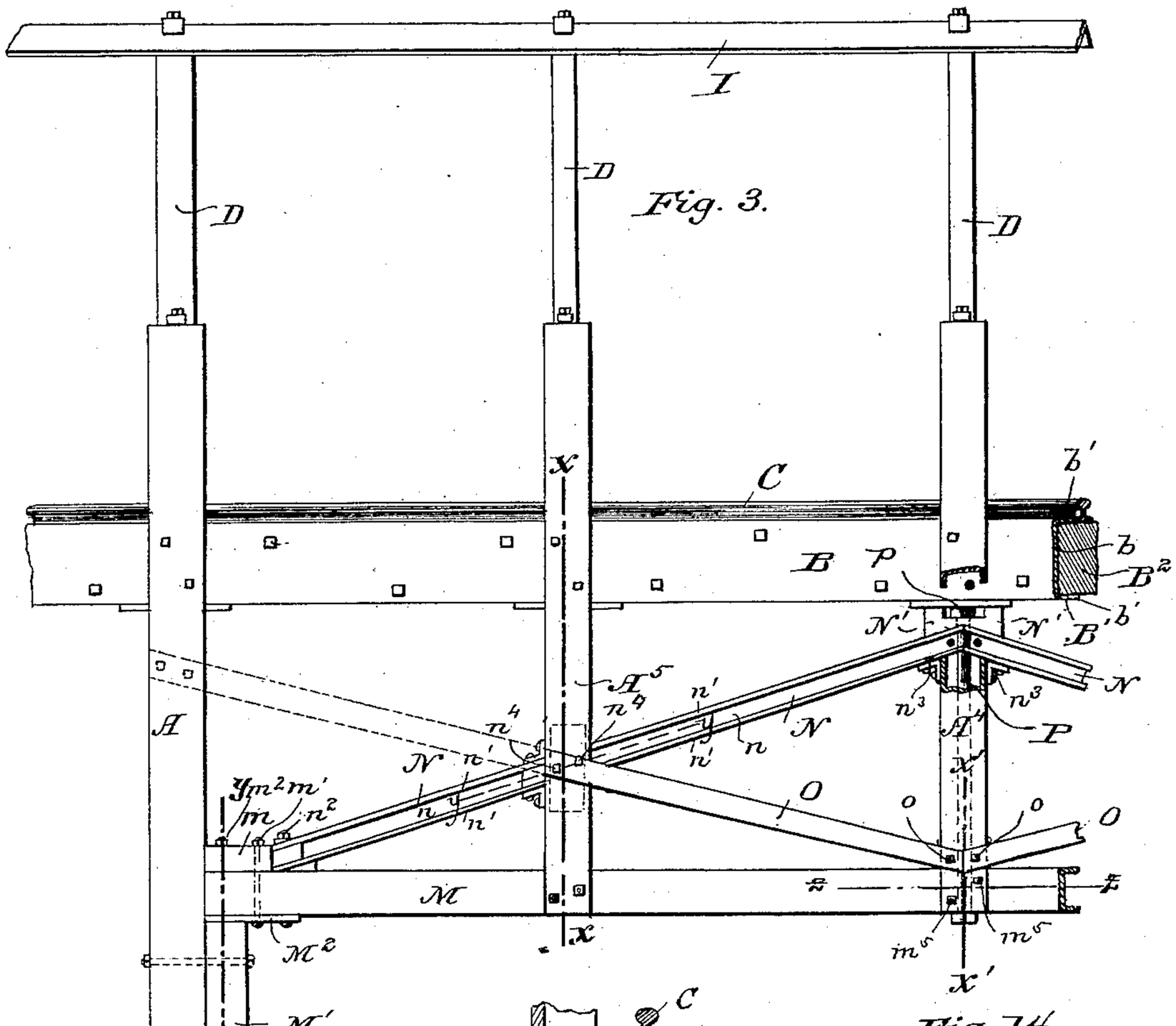


Fig. 11.

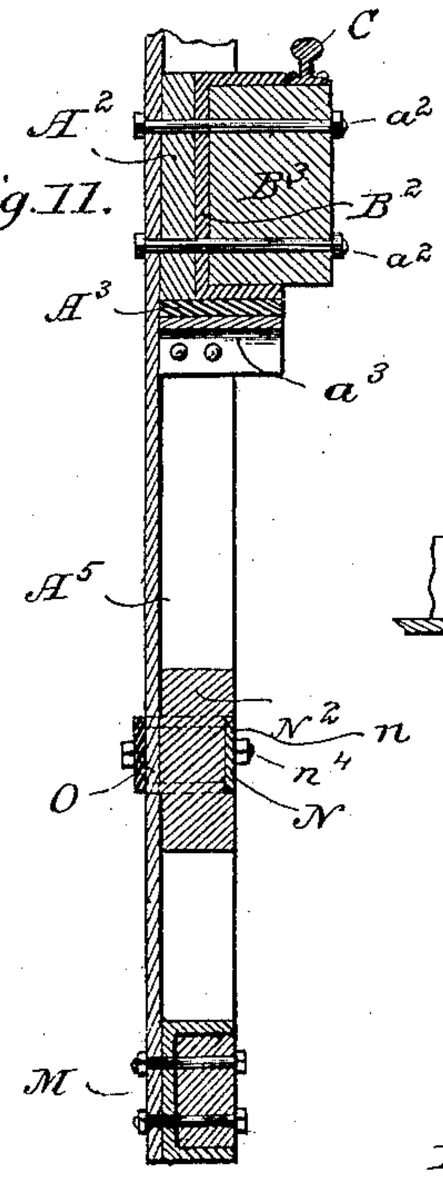


Fig. 12.

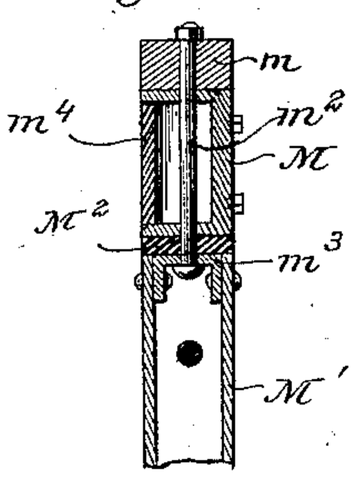


Fig. 14.

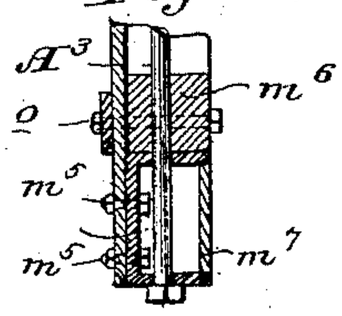
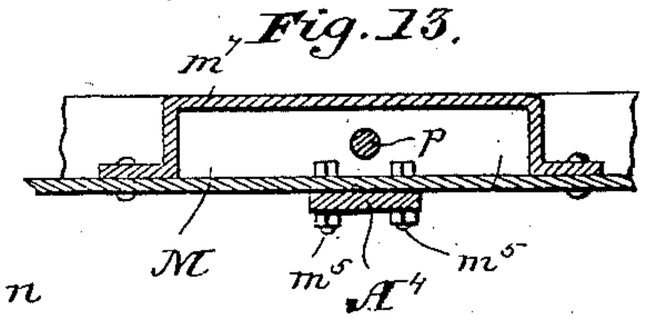


Fig. 13.



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(No Model.) 4 Sheets—Sheet 4.

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SUPERSTRUCTURE OF ELEVATED RAILWAYS.

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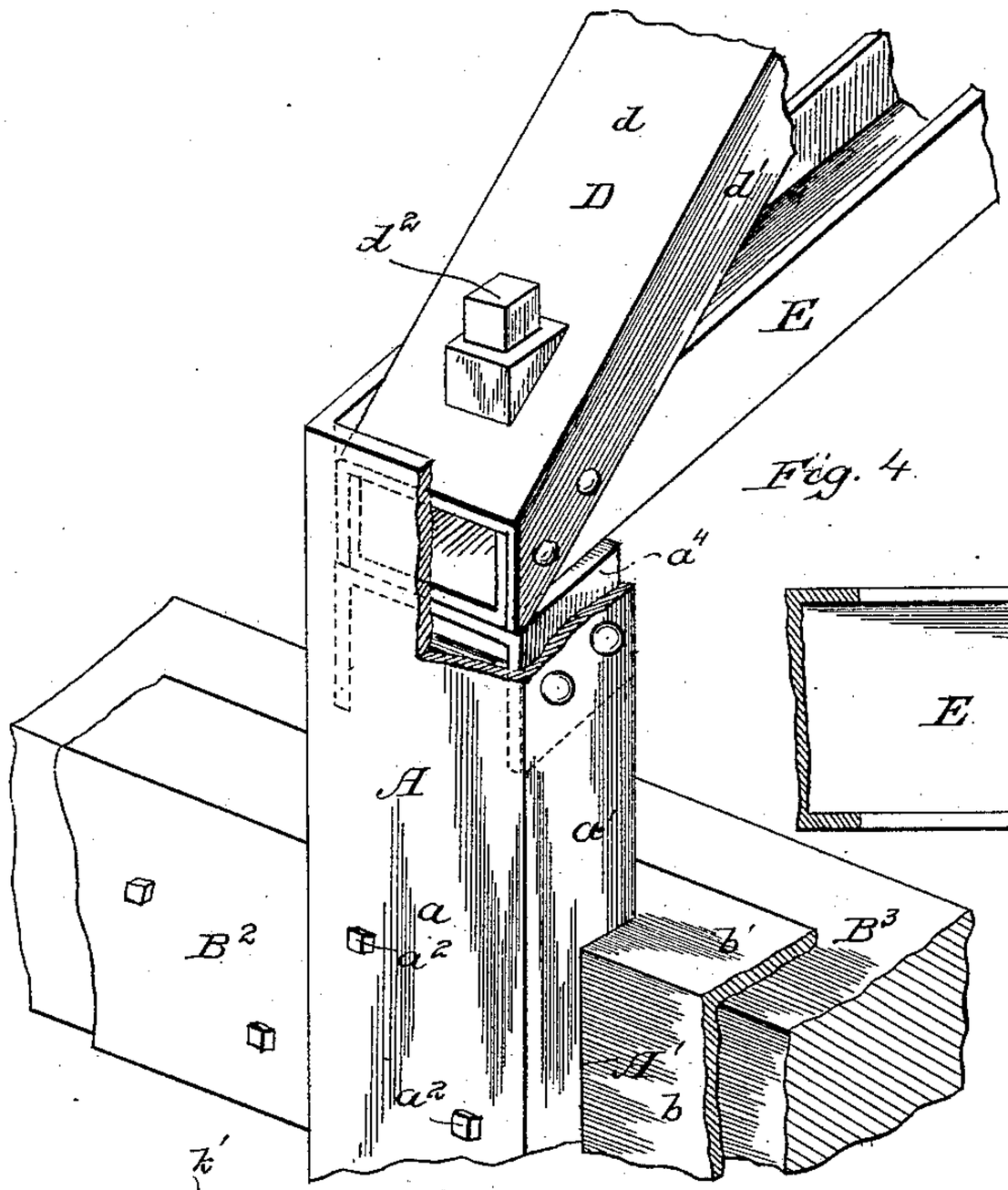


Fig. 4

Fig. 16.

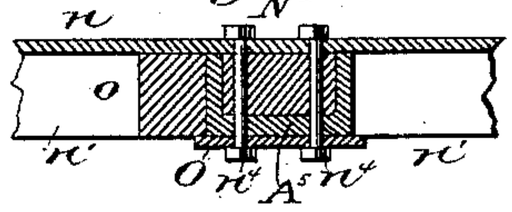


Fig. 5.

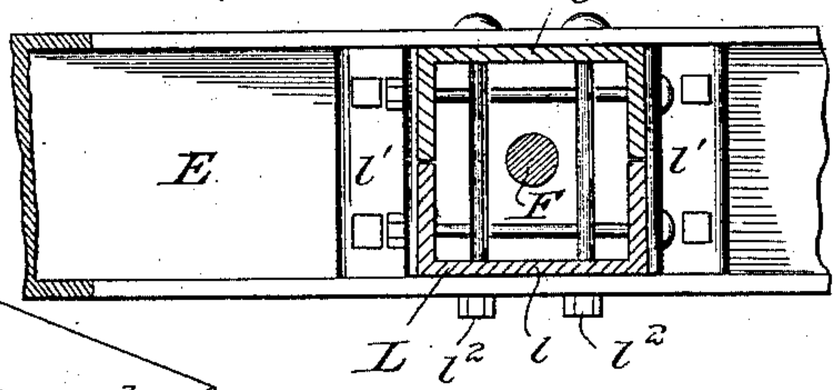


Fig. 6.

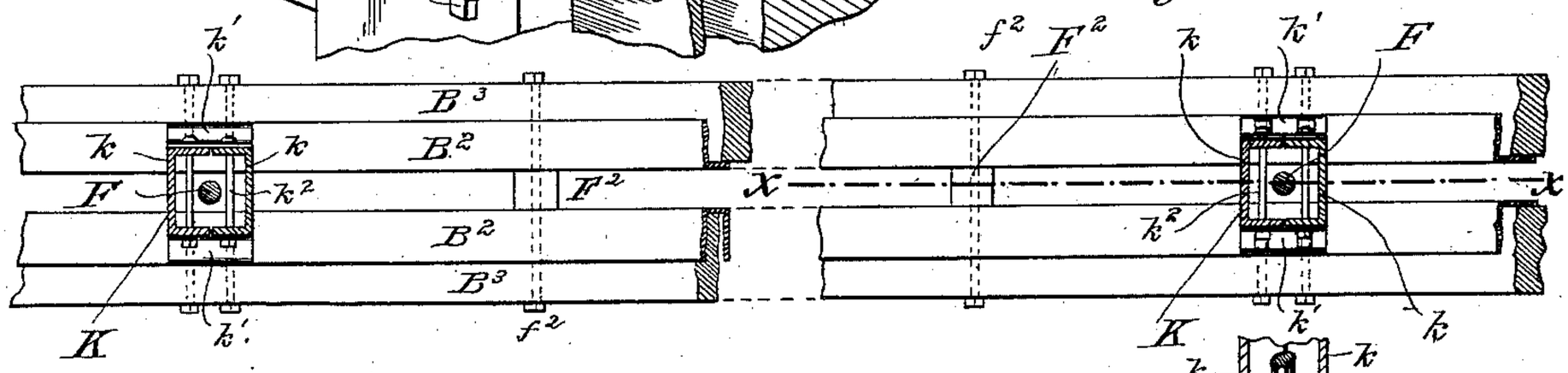


Fig. 8.

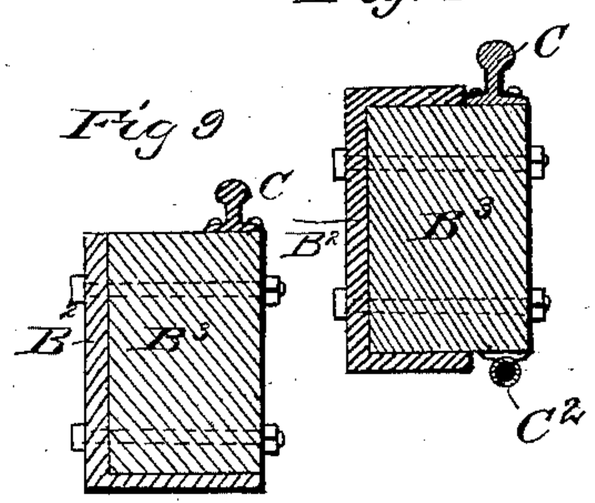


Fig 9

Fig. 7.

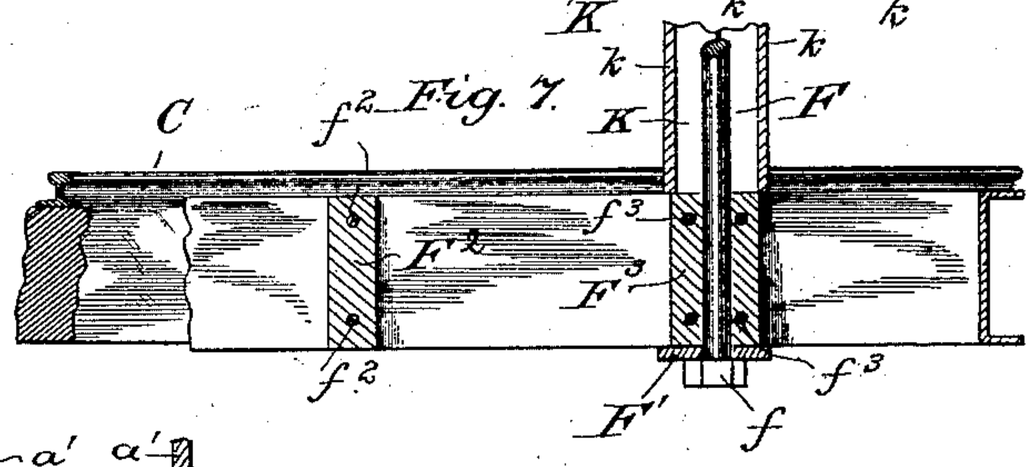
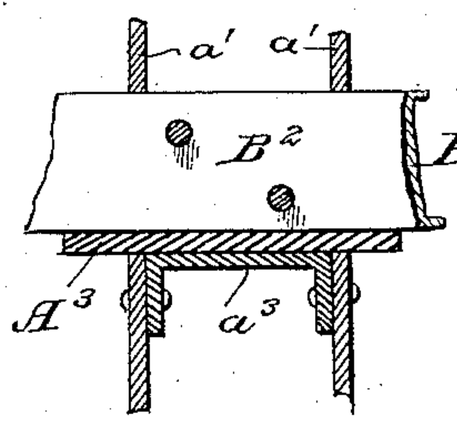


Fig. 10.



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UNITED STATES PATENT OFFICE.

WILLIAM F. SHERMAN, OF CHICAGO, ILLINOIS.

SUPERSTRUCTURE OF ELEVATED RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 318,213, dated May 19, 1885.

Application filed October 8, 1883. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. SHERMAN, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Superstructures for Elevated Railways; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The object of this invention is to provide an improved construction in track-supporting structures for elevated railways; and it consists in the matters hereinafter described, and pointed out in the claims.

The track-supporting structure illustrated in the accompanying drawings as embodying my invention is more particularly intended for that class of elevated railways having suspended cars, or cars in which the supporting-wheels project beyond the sides of the car-body and are placed at or near the top of the car, and in which the portion thereof in which the passengers or commodities to be carried are placed hangs below the track-rails.

In the accompanying drawings, Figure 1 is a side view of a portion of elevated track-structure, including a truss for supporting the tracks over an intersecting street or road, constructed as proposed by my invention. Fig. 2 is a vertical transverse section taken upon line *x x* of Fig. 1. Fig. 3 is a fragmentary view showing a portion of the longitudinal track-stringers and of the truss shown in Fig. 1. Fig. 4 is a detail perspective view of the upper end of one of the vertical supporting-posts of the track-structure and parts connected therewith. Fig. 5 is a detail sectional view taken upon line *x x* of Fig. 2. Fig. 6 is a detail sectional plan view of the two adjacent track-supporting stringers at the center of the structure, taken upon line *y y* of Fig. 2. Fig. 7 is a detail section taken upon line *x x* of Fig. 6. Fig. 8 is a detail cross-section of the track and track-supporting stringers. Fig. 9 is a similar section of a modified form of the same. Fig. 10 is a detail vertical section taken upon line *z z* of Fig. 2. Fig. 11 is a detail vertical section taken upon line *x x* of Fig. 3. Fig. 12 is a detail vertical section taken upon line *y y* of Fig. 3. Fig. 13 is a detail horizontal section taken upon line *z z* of Fig. 3. Fig. 14 is a detail vertical section taken upon line *x' x'* of Fig. 3. Fig. 15 is a detail horizontal section taken upon line *y y* of Fig. 1. Fig. 16 is a detail sectional view taken upon line *y' y'* of Fig. 3.

A A are vertical posts or uprights, by which the several portions of the structure are supported from the ground, and B and B' are longitudinal girders or stringers which are supported from the said posts A, and upon which the track-rails C are placed.

C' is a car adapted for use upon the structure shown, which is provided with supporting-wheels *c'*, secured to axles mounted in bearings supported upon the frame of the car at its top, the body of said car being arranged to hang between the rails and partially below them.

The structure shown in the accompanying drawings is arranged to support a double-track road, four track-rails, C, and longitudinal stringers for supporting them being used, the stringers B, which are located at the outside of the track-structure, being supported from the posts A, and the two adjacent stringers B', at the center thereof, being upheld by means of transverse trusses supported at their ends upon the posts A. The said trusses, as shown and as preferably constructed, consist of two inclined struts, D, which are connected at their outer and lower ends by horizontal tension-members or tie-beams E, and which are joined at their upper ends and connected at their point of juncture with suspension-rods F, to the lower ends of which the said stringers B' are secured.

The trusses formed by the struts D and beams E, as above described, form a series of cross-braces between the upper ends of the posts A, above the track-rails, and said posts are also connected by girts G, which are located below the track-rails and a sufficient distance below the beams E to permit the passage of the cars traveling upon said rails be-

tween said girts and beams. In the track-structure shown the stringers B are placed near the top of the posts A, and said posts, in addition to being braced longitudinally by the said stringers B, are connected by girts H, preferably placed in the same horizontal plane with the girts G. The upper ends of the struts D, at their meeting-points, are also joined by longitudinal girts I, preferably consisting of angle-beams, which are placed with their salient angles upward and attached at their ends to the ends of the said struts by rivets or bolts.

The intermediate stringers, B′, are upheld, as above described, by means of tension-rods F from the truss composed of the struts D and tie-beams E, and in order to support said stringers rigidly in position and to prevent lateral motion therein they are connected with the said tie-beams by means of vertical beams or struts K, and with the girts G, which are below them, by means of similar beams, J.

Additional rigidity is also given to the structure by means of struts or beams L, located between the upper ends of thé struts D and the center of the tie-beams E, and secured at their ends to said struts and beams.

As an improved construction in the longitudinal track-supporting girders B and B′, said girders, as shown more clearly in Fig. 8, consist of metal channel-beams B^2 and wooden beams or stringers B^3, which are fitted into the hollow interior of said beams, and are secured thereto by bolts or otherwise. The said channel-beams B^2 are secured upon the posts A of the supporting structure with their web portions *b* in a vertical plane, and their flanges *b′* horizontal, and the timber B^3, which is preferably made of greater horizontal width or thickness than the said channel-beam, is inserted between the flanges *b′*, and projects beyond or outside of them a sufficient distance to afford support upon its upper horizontal surface for the track-rails C. The stringers B and B′, as shown, are attached to the inner faces of the vertical posts A, and to the suspension-rods F, with the flanges of the channel-beams B^2, and the projecting portions of the timbers B^3 toward the center of the tracks, so that the track-rails C are supported upon the said timbers adjacent to the inner faces of the stringers.

An important advantage of the construction described is that the timber filling to the beam upon which the track-rails rest forms a cushion for said rails, and serves to decrease the jar in the structure and cars passing over it, and thereby lessen greatly the wear and tear both upon the said structure and the rolling-stock. The wooden timbers also afford a convenient means of attaching the rails in place, and by the construction shown, in which the rails are located near the inner edges of the stringers, the side of the car may be placed near the rails at either side thereof, and the supporting-wheels may therefore be placed nearer together, and the entire structure made of less width than would otherwise be necessary.

The construction in the stringers above described also provides a convenient means of securing a second or auxiliary rail (indicated by C^2) to the lower edge of the stringer. The auxiliary rail mentioned is preferably secured to the lower projecting edge of the timber B^3 vertically beneath the rail C, and is engaged by guard or safety wheels c^2 upon the car, so as to prevent the possibility of accidental derailment thereof.

In Fig. 9 a modified form of the stringer is shown, in which the metal beam has a lower flange only, which is placed under the wooden filling-timber. In this case the timber performs the same function in acting as a cushion for the rail, as before described, and the rail may be placed at any point desired upon the upper surface of the timber.

The compound beam or stringer described may be used otherwise than in elevated roads—as, for instance, for supporting the track-rails in surface roads over openings of moderate span.

As a preferable means of securing the compound beam B to the vertical posts A, when the latter are in the form of channel-beams, as shown, the web portion *a* of said beams is placed outwardly, and the inwardly-projecting flanges *a′* thereof are provided with notches A′, (shown more clearly in Fig. 4,) constructed to partially admit the channel-beam B^2. The said beam B^2 and the timber B^3 are secured to the posts A by bolts a^2, which are inserted horizontally through the channel-beam and timber and through the web of the post A, and are secured in place by nuts upon their ends. The notches A′ are preferably extended only partially through the flanges *a′*, in order that the posts A may not be weakened by such notches to any considerable extent, and the space between the outer surface of the beam B′ and the inner face of the web *a* of the post A is filled by a block, A^2, said block being held in place by means of the bolts a^2, which pass through it, as shown.

In order to prevent the said beams B′ from resting at their lower portions directly upon the edges of the side flanges *a* of the notches A′, a short piece or bearing-block, A^3, preferably of metal, is interspersed between the lower margins of the said notch and the lower edge of said beam, said block preferably extending some distance at either side of the posts, as shown more clearly in Figs. 3, 10, and 11. Additional strength may be given to the parts by inserting between the flanges *a′* a cross-piece, a^3, having downturned ends which are riveted to the said flanges, and the upper portions of which are flush with the lower edges of the notches A′, so as to afford an extended bearing for the said piece A^3, as shown more clearly in the detail sections, Figs. 10 and 11.

The compound stringers B′, which support

the two inner track-rails, and which are upheld by the suspension-rods F, as above described, are preferably connected to the said rods by means of cross-bars F′, arranged transversely beneath the said stringers, and provided with central apertures, through which the lower ends of the rods are passed, and secured by means of heads or nuts *f*. Said stringers B′ are placed a short distance apart, so as to permit the rod F to pass between them, and a series of blocks, F^2, are preferably interposed between said stringers at short intervals, bolts f^2 being inserted horizontally through the said stringers and the blocks F^2, so as to hold them rigidly together. Blocks F^3 are also, as shown, placed between the stringers at the point of intersection of the suspension-rods F therewith, said rods preferably passing through a central aperture in said blocks, and the blocks being secured by means of bolts f^3 inserted horizontally through the stringers and blocks on either side of the rod, as shown more clearly in Fig. 7.

The strut J, by which the stringers B′ are connected with the girts G, may be constructed of a metal beam of any desired or preferred construction; or it may consist, as shown, of two channel-beams, *j*, secured together by bolts *j′* and attached to the stringers B′ and girts G by means of angle-plates j^2 and j^3 riveted to said channel-beams and to the said stringers and girts, respectively.

The struts K are, as shown in Fig. 6, constructed in a manner similar to the struts J, said struts K being composed of two channel-beams, *k*, placed with the edges of their flanges together around the suspension-rod F, and secured at their lower ends to the channel-beams B′ of the inner girders by means of angle-pieces *k′*, which are, as shown, riveted to the said channel-beams and secured to the stringers by bolts K^3 passing vertically through said angle-plates and stringers and through the angle-plates j^2. The said beams *k* may be attached together intermediately of their ends by horizontal bolts K^2, as shown, and to the tie-beams E by means of angle-plates k^4, or otherwise. The beams L are, as shown, constructed and secured at their ends in a manner similar to that of the girts K, as shown; but such struts may be constructed in any other desired or preferred manner.

The struts D, forming part of the trusses by which the stringers B′ are supported, preferably consist of channel-beams, which are placed with their web portions *d* upward, and the tie-beams E of said truss may also consist of channel-beams which are placed, as shown, with their flanges upward, and are connected at their ends with the lower ends of the struts D by means of rivets or bolts inserted through the overlapping flanges of the said tie-beams and struts, the tie-beam being made narrower than the struts, so that the flanges of the former fit between those of the latter, as illustrated in Fig. 4.

As a preferable construction in the joint or connection between the posts A and the ends of the struts D and tie-beams E, the said beams are made narrower than the said posts, so that their ends may be inserted between the flanges *a′* of the latter, and cross-plates a^4 are secured between the said flanges *a′* thereof a short distance below their upper ends, upon which plates the said tie-beams and struts rest. The said cross-plates a^4 are, as shown, provided with downturned ends which are riveted or bolted to the side flanges of the posts, and the struts D and tie-beams E are secured to the posts by means of vertical bolts d^2 passing through said cross-pieces a^4 and the ends of the parts D and E, as shown. The struts D shown in the drawings are secured together at their upper ends by being bolted to the longitudinal angle-beams I, the suspension-rod F passing through said angle-beam and being provided with a nut, *f′*, upon its upper end.

An improved construction in a truss for supporting the stringers B and B′ over intersecting streets or roadways is illustrated in the drawings, Figs. 1 and 3. This truss consists, essentially, of a horizontal member or tie-beam, M, placed below and parallel with the outer stringer, B, of the track-structure, inclined struts N extending from the bolts of the tie-beam M to a point over the center thereof, a vertical suspension-rod, P, secured at its upper end to said struts and at its lower end to the tie-beam, one or more vertical posts, as A^5, connected with the said tie-beam and stringer and with the struts N, and a diagonal strut, *o*, placed between the said posts.

As illustrated in the drawings, the post A^4 is located at the center of the truss and rests at its lower end upon and is secured to the tie-beam M at the point at which said beam is attached to the suspension-rod P, said post being attached to the stringer B at a point above its intersection with the struts N. The struts O are, as shown, secured to the post A^4, at its point of connection with the tie-beam M, and intersect the struts N at a point midway between the vertical center post, A^4, and the end of the tie-beam, the vertical posts A^5 being located at the points of intersection of the struts O and N and secured to said struts, the tie-beam, and the stringers B. The posts A^4 and A^5 are preferably placed at the same distance apart as the posts A, and are connected with and support the track-stringers B in a manner similar to the said posts. Said posts A^4 and A^5 are also extended above said stringers and are connected with and support the transverse trusses, before described, by which the center track-stringers, B′, are supported. Inasmuch as the post A^4 does not form a member of the truss proper, such post may be dispensed with, the posts A^5 being, in case the post A^4 is omitted, disposed at proper distances apart to properly sustain the track-stringer and the transverse trusses of the structure.

The tie-beam M may be supported at its

ends upon the vertical posts A of the track structure which are adjacent to the opening spanned by said beam; or, as shown in the drawings, and preferably constructed, additional posts M′ are bolted to the sides of the posts A adjacent to the said opening, upon the tops of which the ends of the tie-beam M rest.

The connections between the lower ends of the struts N, the tie-beam M, and the vertical posts M′, as shown in the drawings, Figs. 3 and 12, are constructed as follows: A block, *m*, is secured to the tie-beam M at each end thereof, against which the lower ends of the struts abut, said blocks being held in place by vertical bolts *m′* and *m²* passing through said blocks and beam. The posts M′ preferably consist, as shown, of channel-beams placed with the edges of their flanges against the sides of the posts A, and between the flanges of said posts M at the upper ends thereof are placed cross-pieces *m³*, which are riveted to the inner faces of the flanges at their ends, and are provided with apertures, through which the lower ends of the bolts *m²* extend, so as to secure the ends of the tie-beam M to the said posts. A plate, M², may be placed between the upper ends of the posts M′ and the tie-beam M, as shown, and the space between the flanges of the said beam M near its ends may be filled by a block of wood similar to that indicated at N², Figs. 10 and 16, in order to prevent the lateral strain upon the said beam from crushing the flanges; or, as shown in the drawings, metal plates *m⁴* may be inserted between the edges of the flanges with the same result, said plates being preferably bent inwardly and secured to the web of the beam by rivets or bolts, in the manner illustrated in connection with similar plates, *m⁷*, at the center of said beam in Fig. 13.

The struts N preferably consist of channel-beams having their web portions *n* placed vertically and toward the inside of the structure, and their flanges *n′* projecting outwardly. Said struts are held in place at their lower ends by means of vertical bolts *n²*, which pass through the said struts near their ends, and through the tie-beam M and plate M², as shown. The upper ends of the struts N pass through notches cut in the flanges of the posts A⁴, and are constructed to abut against each other, a block, N′, being placed over the upper meeting ends of the struts, through a central aperture, in which block the upper end of the rod P is inserted, said rod being provided with a head or nut, P′, upon its end above said plate. The ends of the struts N may be secured to the posts A⁴, as shown, by means of angle-plates *n³*, bolted to said strut and posts, or in any other desired or preferred manner. The stringer B, as shown in Fig. 3, is immediately above and rests upon the block N′; but said stringer may be secured to the post A⁴ in the manner described in connection with the posts A, or otherwise, as preferred.

The struts N at their points of intersection with the posts A⁵ are preferably notched, so as to permit the said posts to pass through them, said notches being formed in the flanges *n′*, to the full depth thereof, and the web portion *n* of the struts being made continuous. The sides of the notches are fitted upon and rest against the sides of the posts A⁵, and a filling or block, N², is secured between the flanges of said posts for the purpose of relieving the said flanges from the compressive strain of the struts, as shown in Figs. 11 and 16, and in dotted lines in Fig. 3. The said struts are preferably secured to the posts A⁵ by means of horizontal bolts *n⁴* passing through the web portion of said strut N, the filling N², and the web portion of the post A⁵, as shown.

The struts O preferably consist of channel-beams placed with their flanges projecting inwardly, said struts being attached at their upper ends to the post A⁵ at the points of intersection of the struts N therewith, by having their web portions lapped over the said parts and secured thereto by bolts *n⁴*, the flanges of said struts being cut away at the ends thereof and arranged to abut against the sides of the said posts. The lower ends of the struts O are, as shown, secured to the post A⁴ by means of bolts *o* passing through said post and the web portion of the struts, the flanges thereof being cut away, so as to abut against said post, and the said web portions being arranged to overlap the posts and abut together at their ends, as shown. The parts A⁴ and A⁵ may be secured to the tie-beam M in any desired or preferred manner; but, as shown in the drawings, Figs. 13 and 14, the flanges of the posts A⁴ are cut away and the ends of said flanges rest upon the tie-beam, the web portion of said posts being arranged to overlap the beam, and being secured thereto by bolts *m⁵*, as shown. A suitable filling-piece, *m⁶*, is preferably placed between the edges of the flanges of the beam A⁴, and a filling-piece, *m⁷*, is placed between the flanges of the tie-beam M, in order to distribute the transverse strain of the suspension-rod P equally upon said flanges. The posts A⁵ are, as shown, connected at their lower ends to the beam M in a manner similar to that described in connection with the posts A⁴.

The construction above described is intended for trusses of moderate span, and in longer or shorter trusses the number of vertical posts and intermediate struts is increased or diminished as found necessary.

The post A⁴ being attached to the struts N and the tie-beam M, and by making the fastening devices of sufficient strength, said post itself may form the vertical tension member of the truss in place of the rod P, and said rod in such case could be dispensed with. The strut O may be continued to the post A, as shown in dotted lines in Fig. 3, so as to form a counter-brace and to give additional rigidity to the posts.

An important advantage of the construction

described is that the vertical posts A^4 and A^5, which form the supporting-posts for the track-stringers and for the transverse trusses before described, are attached to and form part of the truss, and the several members of the truss and the track-supporting structure above it being rigidly connected together, a firm and rigid structure is formed, in which great strength is obtained with the use of a comparatively small quantity of material.

An advantage is gained in the construction by which the flanges of the struts N are arranged to abut against the posts A^5, for the reason that the said posts being secured both to the stringer and tie-beam tend to prevent any movement of the strut, so that said posts would have to yield or break before any considerable longitudinal movement in said strut could take place under the end pressure thereon, and considerable additional strength is thereby given the structure.

It will be observed that the tie-beams E over the tracks form a favorable means for the support for electric-conducting wires either for supplying electricity to a motor upon the car or for telegraphic or telephonic use. As shown in the drawings, bars R are secured between the flanges of the tie-beams E, upon which suitable insulators, *m*, are placed for supporting telegraph or telephone wires S. The proximity of the top of the car which is supported upon the track to the said tie-beams also furnishes a convenient means of access to the wires in placing them in position and in making repairs.

I claim as my invention—

1. The combination, with a metal beam provided with a horizontal flange upon its lower edge, of a wooden stringer secured to one side of the beam above the flange thereof and a track-rail secured upon the upper horizontal surface of the said wooden stringer independently of the metal beam, substantially as and for the purpose set forth.

2. The combination, with a track-rail, of a stringer consisting of a metal channel-beam and a wooden filling inserted between the flanges of said beam and constructed to project therefrom, so as to afford support for the rail upon its projecting portion, substantially as described.

3. The combination, with the vertical channel-beams A, provided with notches A′ in their flanges, of horizontal channel-beams B^2, located in said notches, and wooden stringers B^3, inserted and secured between the flanges of said beam B^2, substantially as described.

4. The combination, with the supporting-posts A, composed of channel-beams and provided with notches A′ in their flanges, of stringers B, secured in said notches, and plates A^3, interposed between the lower edges of the said beam and the posts, substantially as described.

5. The combination, with the vertical channel-beam A, provided with notches A′ in its flanges extending partially through the same, of a stringer, B, secured in said notches, and blocks A^2, interposed between the web of the beam and the stringer, substantially as described.

6. The combination, with the outer and inner track-stringers of a double-track elevated railway, of posts A, constructed to support the outer stringers, a transverse truss resting at its outer ends upon the said posts for supporting the inner stringers, and a suspension-rod, F, constructed to support the inner stringers from the center of the truss, substantially as described.

7. The combination, with the outer and inner track-supporting stringers of a double-track elevated railway, of posts A, constructed to support the outer stringers, inclined struts D, resting at their outer ends upon the said posts and meeting at the center of the structure, a tie-beam joining the said outer ends of the struts, and a suspension-rod constructed to support the inner stringers from the upper ends of said struts, substantially as described.

8. The combination, with the stringers B of a double-track elevated railway and supporting-posts A, constructed to uphold the two outer stringers, of a truss arranged transversely over the tracks and resting at its ends upon the said posts, said truss being provided with rigid tension member or tie-beam, E, a suspension-rod, F, constructed to support the two inner stringers from the said truss, girts G, joining the said posts at opposite sides of the structure below the stringers, and beams J and K, rigidly connecting the said stringers with the girts G and the tie-beams E, respectively, substantially as described.

9. The combination, with the stringer and supporting-posts of an elevated-railway structure, of a tie-beam, M, located below and parallel with said stringer, vertical posts A^5, secured to said tie-beam and stringer, inclined struts N, joined to the ends of the tie-beams and constructed to abut against the sides of the said posts A^5 at their points of intersection therewith, and a suspension-rod, P, constructed to support the center of the tie-beam from the upper ends of the struts, substantially as described.

10. The combination, with the stringers B and posts A, of a tie-beam, M, struts N, suspension-rod P, and a vertical post, A^4, connected with said tie-beam and struts, and constructed to support said stringers, substantially as described.

11. The combination, with the stringer B and supporting-posts A, of a horizontal tie-beam, M, struts N, connected with the end of said tie-beam, a suspension-rod, P, a post, A^4, connected with the said tie-beam and with the said stringer, posts A^5, located between the post A^4 and the end of the tie-beam and connected with the said tie-beam, the struts N, and the stringers and struts O, connected with the lower end of the suspension-rod and with the struts N and posts A^5, substantially as described.

12. The combination, with the stringer B

and the supporting-posts A, of the tie-beam M, the vertical posts A^4 and A^5, and the inclined strut N, extending between the end of the tie-beam M and the post A^4, and constructed to abut against the opposite sides of the post A^5, substantially as described.

13. The combination, with a vertical post, A, composed of a channel-beam, of a cross-piece, a^4, secured between the flanges of said post near its upper end, and a transverse truss constructed to rest at its end upon said cross-piece and between the flanges of the post which project above said cross-piece, substantially as described.

14. The combination, with the vertical post A, composed of a channel-beam, of a cross-piece, a^4, secured between the flanges of said post near its upper end, a tie-beam, E, and strut D, composed of channel-beams, and constructed to rest at their ends upon said cross-piece and between the flanges of the post, and means constructed to secure the said post, tie-beam, and strut together, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

WILLIAM F. SHERMAN.

Witnesses:
C. CLARENCE POOLE,
W. C. ADAMS.