

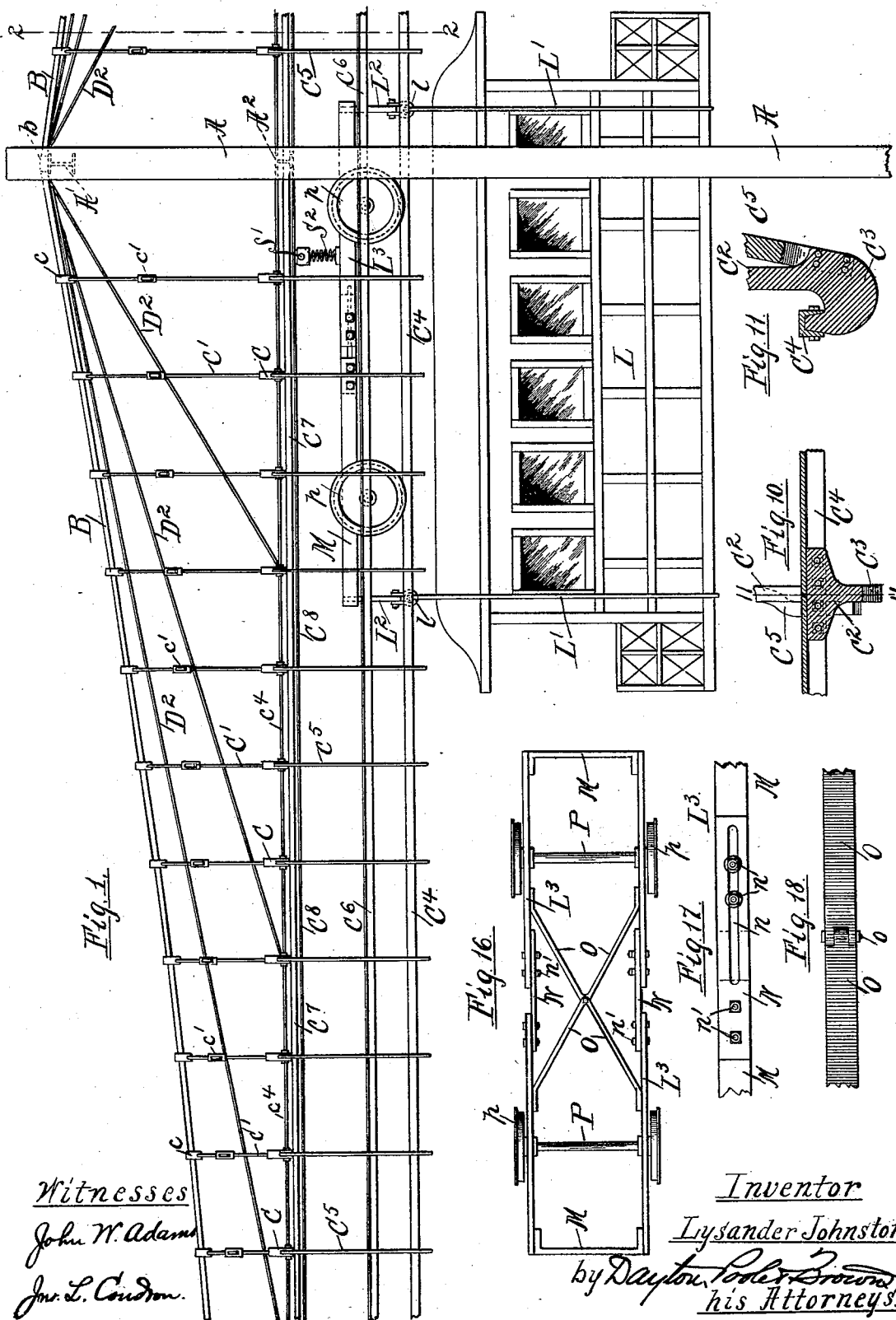
(No Model.)

5 Sheets—Sheet 1.

L. JOHNSTON.
ELEVATED RAILWAY.

No. 508,478.

Patented Nov. 14, 1893.



Witnesses

John W. Adams

Jno. L. Condon.

Inventor

Lysander Johnston.

by Dayton, Podes & Brown
his Attorneys.

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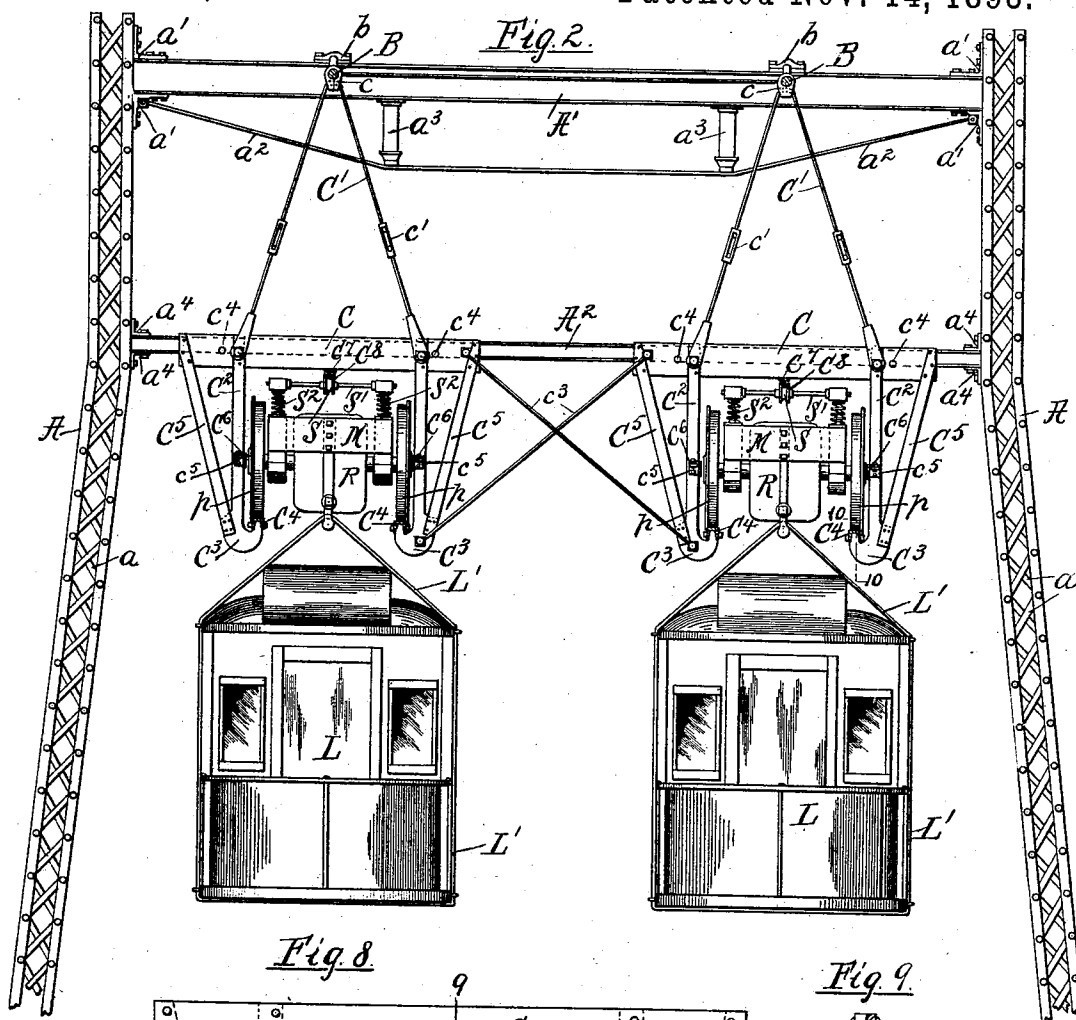


Fig. 8

Fig. 9

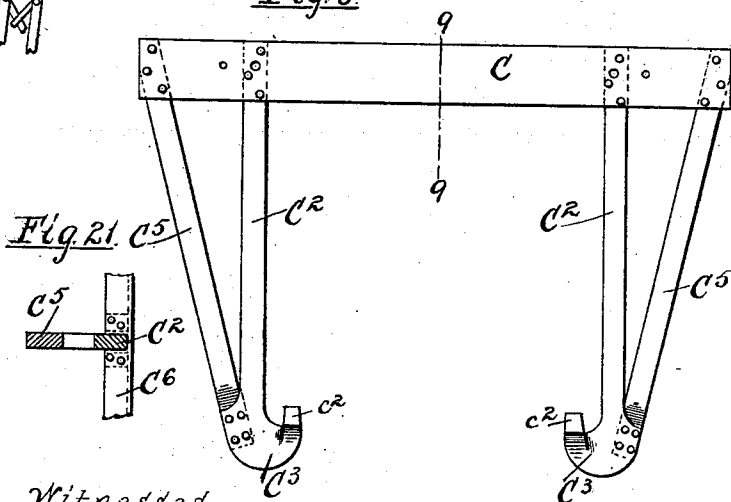


Fig. 21

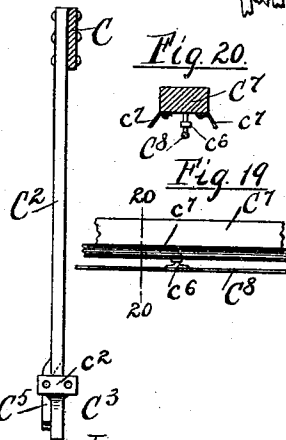


Fig. 20

Fig. 19

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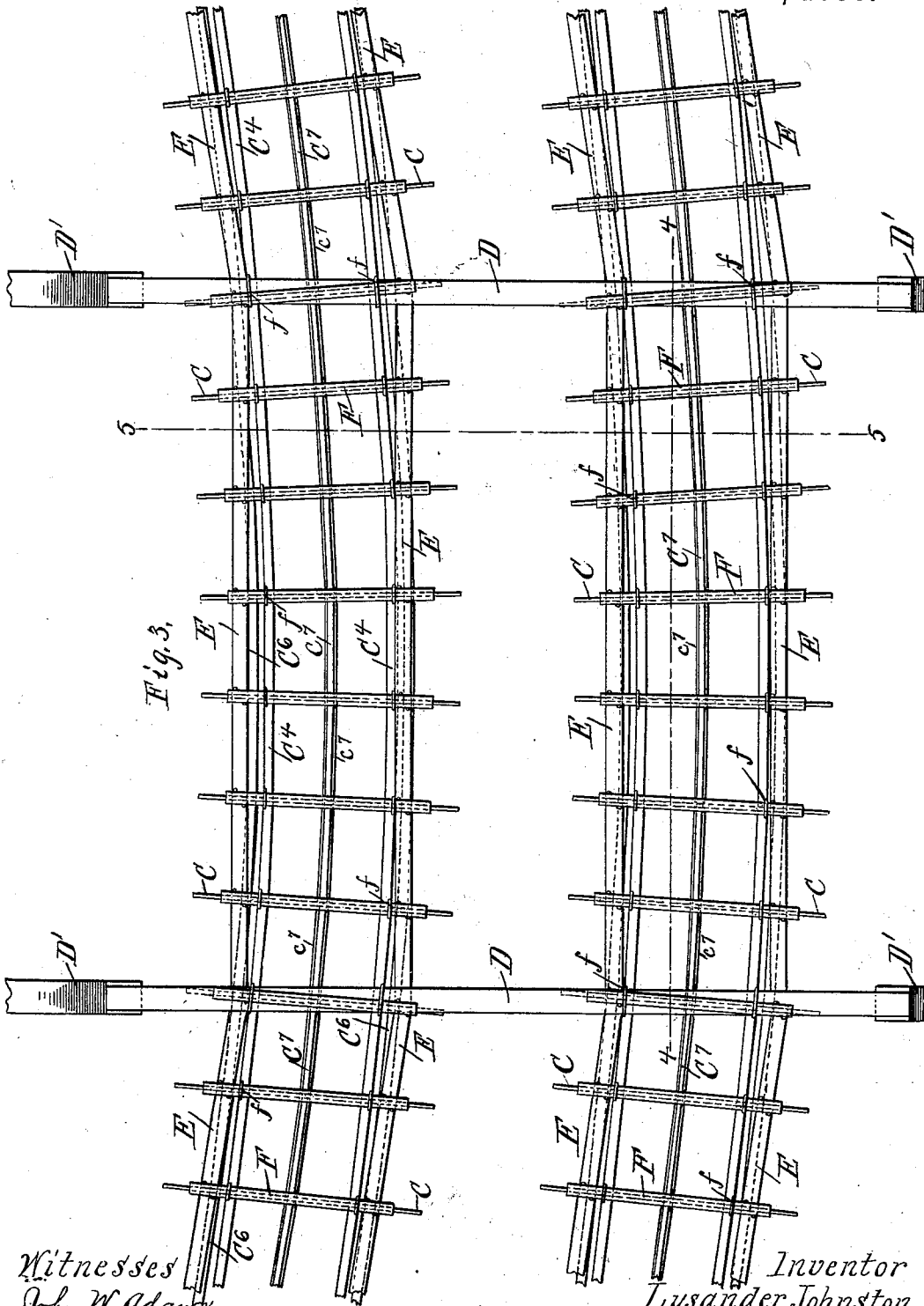


Fig. 3.

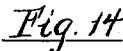
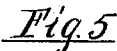
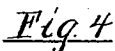
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No. 508,478.

Patented Nov. 14, 1893.



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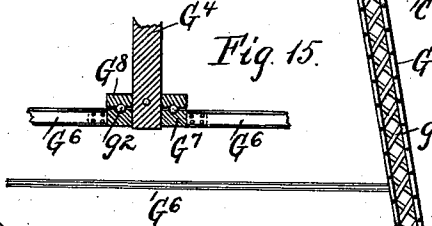
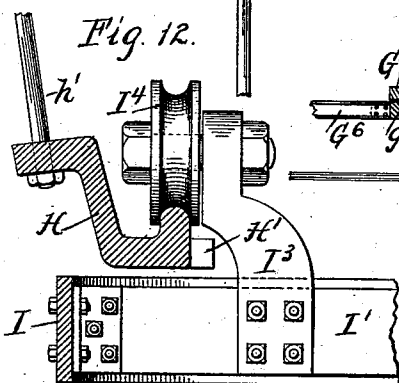
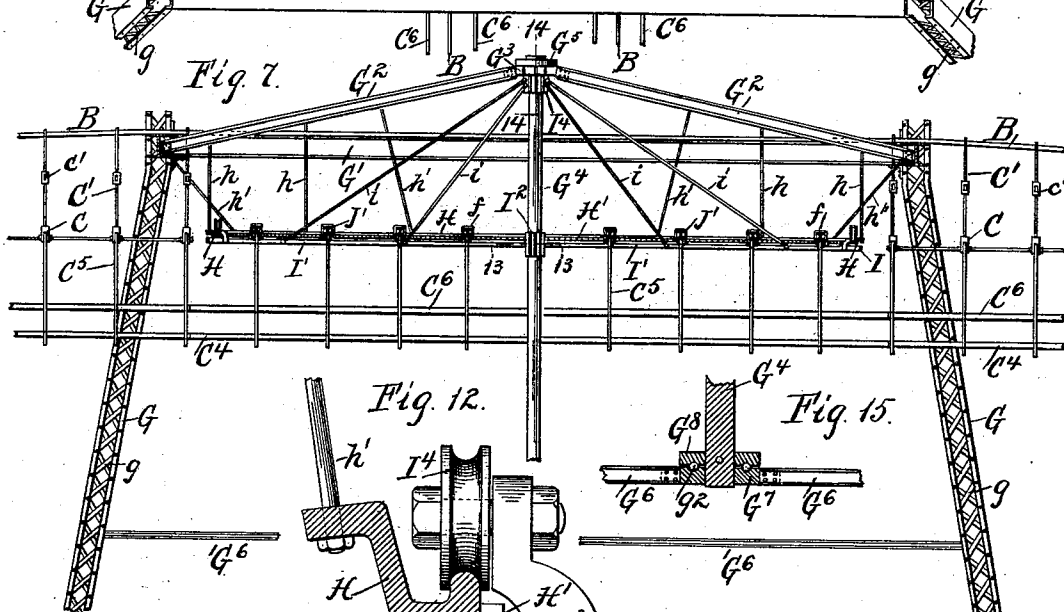
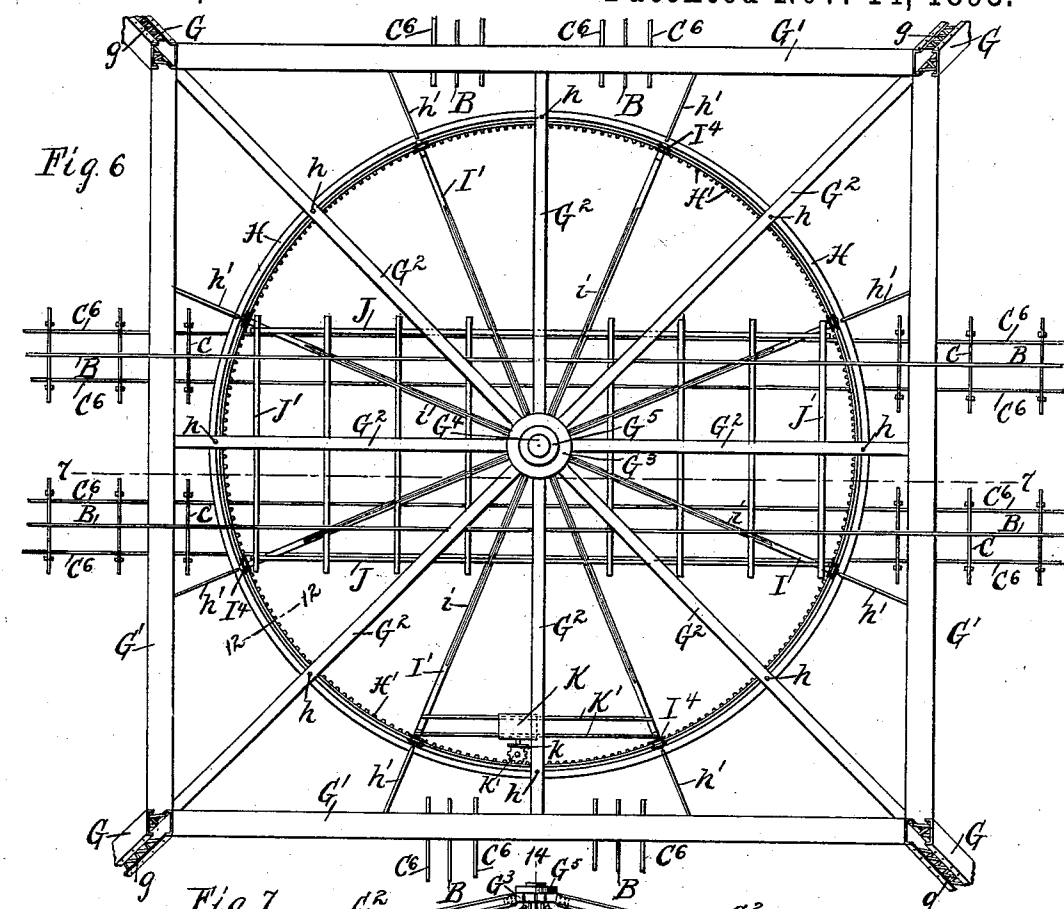
(No Model.)

5 Sheets—Sheet 5.

L. JOHNSTON.
ELEVATED RAILWAY.

No. 508,478.

Patented Nov. 14, 1893.



Witnesses
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UNITED STATES PATENT OFFICE.

LYSANDER JOHNSTON, OF CHICAGO, ILLINOIS.

ELEVATED RAILWAY.

SPECIFICATION forming part of Letters Patent No. 508,478, dated November 14, 1893.

Application filed November 26, 1892. Serial No. 453,294. (No model.)

To all whom it may concern:

Be it known that I, LYSANDER JOHNSTON, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in 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.

My invention relates to that class of elevated or overhead railways in which the rails or tracks are supported in position principally by structural devices of the suspension type, and in which the cars or vehicles are suspended below the tracks or rails; these features of construction and arrangement enabling the railways to be operated along crowded thoroughfares without obstructing the latter, and also without interfering with surface travel.

My invention also relates to overhead or elevated railways in which the rails or tracks are supported in position partly by trestle-work, and in which also, revolvable platforms or turn-tables are employed for conveying the cars or vehicles from a main line to crossing or branch lines of tracks, and vice versa.

The objects of my invention are, first, to produce an elevated railway which shall be simple, strong and durable in its construction and the stresses or strains in which, whether due to the dead weight of structural parts, or to the shifting weight of moving vehicles, shall be perfectly distributed throughout the supporting structure so as to in no wise lessen or in any way objectionably affect the stability of the structure; secondly, to so construct the supporting parts as to avoid all lateral vibrations or swaying of the structure even during the passage of heavy and swiftly moving loads; also to prevent derailment of the vehicles, and to render curved portions of the roadway equally as strong and stable as the straight portions thereof; furthermore, to so construct the turn-tables or revolvable platforms as to insure the utmost strength and also rigidity of construction together with the utmost lightness, so that the minimum amount of power shall be sufficient to revolve the platforms or turn-tables.

To the above purposes my invention consists in certain peculiar and novel features of construction and arrangement, as herein-
after described and claimed.

In order that my invention may be fully understood, I will proceed to describe it with reference to the accompanying drawings, in which—

Figure 1 is a side elevation of a straight portion of a suspension-railway embodying my invention; this figure also showing a passenger-car suspended from the railway. Fig. 2 is a transverse vertical section of the same, taken on the line 2—2 of Fig. 1. Fig. 3 is a plan view of a curved portion of the railway embodying my invention. Fig. 4 is a vertical longitudinal section of the railway, taken on the line 4—4 of Fig. 3. Fig. 5 is a transverse vertical section of the railway, taken on the line 5—5 of Fig. 3. Fig. 6 is a plan view of a turn-table constructed in accordance with my invention. Fig. 7 is a vertical section of the turn-table, taken on the line 7—7 of Fig. 6. Fig. 8 is an enlarged view, in side elevation, of one of the rail-supporting yoke-frames, in detached condition. Fig. 9 is a transverse vertical section of the same, taken on the line 9—9 of Fig. 8. Fig. 10 is an enlarged vertical longitudinal section of one of the bearing ends of the yoke-frame, and of a portion of one of the rails, taken on the line 10—10 of Fig. 2. Fig. 11 is a transverse vertical section of the same, taken on the line 11—11 of Fig. 10. Fig. 12 is an enlarged transverse vertical section of a portion of the turn-table, taken on the line 12—12 of Fig. 6. Fig. 13 is a horizontal section of a part of the turn-table, taken on the line 13—13 of Fig. 7. Fig. 14 is a transverse vertical section of a portion of the turn-table, taken on the line 14—14 of Fig. 7. Fig. 15 is a central transverse vertical section of the lower end of the turn-table standard, and the parts immediately adjacent thereto; this view showing the bearing for the standard. Fig. 16 is a detached plan view of a flexible truck-frame embodying my invention. Fig. 17 is a side elevation of the middle portion of one side of the truck-frame. Fig. 18 is a side elevation of the central pivot-joint of the truck-frame. Fig. 19 is a detached view, in side elevation, of a portion of one of the line-wire

supporting stringers and also of a part of a line-wire, and the connections for attaching the wire to the stringer. Fig. 20 is a transverse vertical section of the parts shown in Fig. 19; the section being taken on the line 20—20 of said Fig. 19. Fig. 21 is an enlarged longitudinal sectional view of one of the yoke-bar hangers, taken on the line 21—21 of Fig. 5.

In the said drawings, A designates a number of posts or columns which are intended to be set, at their lower ends, firmly into the ground and which rise at each side of the track-way; these posts or columns being of metal and having preferably each its outer portions braced together by lattice-bars *a*, and the lower portions of said columns being preferably inclined upwardly and inwardly, as shown in Fig. 2, for affording additional stability to the structure as a whole. These columns are preferably placed in pairs at opposite sides of the rail-way structure, and are prolonged vertically upward at their upper end-portions. The upper ends of the two opposite columns are braced together by horizontal cross-beams *A'*, which are preferably metal I-beams, and the ends of which are confined between upper and lower L-shaped brackets *a'*, bolted to the inner sides of the columns and also to the upper and lower sides of the brace beams *A'*. In order to further strengthen the cross or brace beams *A'*, they are shown in Fig. 2 as provided with truss-rods *a²* extending longitudinally beneath the cross-beams and bolted at their ends to the lower brackets *a'*; said truss-rods being strained beneath struts *a³* which are pendent from the under sides of the cross-beams. The two opposite columns *A* are also shown as further braced together by horizontal cross-beams *A²*, which are also preferably in the form of I-beams, and which are placed considerably below the cross-beams *A'*; these lower cross-beams *A²* being secured at their ends to the columns *A*, at the points of juncture of the vertical upper end-portions of the columns with the inclined lower portions of the same. The ends of the cross-beams *A²* are shown in Fig. 2 as bolted to upper and lower L-shaped brackets *a⁴* which are in turn bolted to the inner sides of the columns *A*, at the points mentioned.

B designate suspension cables of which there may be one or two or any greater number, according as the railway is a single-tracked or a double-tracked road, or has more than two lines of tracks. Each of these suspension cables *B* is carried over the upper cross-beams *A'* and is retained in position thereon by saddles *b*, these saddles being bolted or otherwise secured against movement upon the cross-beams *A'*. The cables *B* depend in loop-like or festoon form between each two succeeding cross-beams *A'*, in the usual manner of suspension cables, and from said cables are suspended, at suitably frequent intervals, horizontal yoke-frames *C*

which carry the traction rails as hereinafter explained. Each yoke frame consists of a straight metal bar forming the upper or body portion of the yoke-frame. To this bar, at points near its ends, are bolted the lower ends of a suspension-rod *C'* which extends upward and is bent midway of its length, through a shackle *c*, each of said shackles being firmly clamped about the suspension cable *B*.

As shown in Fig. 2, the lower part of each arm of each of the suspension-rods *C'* is divided, and the two parts thus formed are connected together by a turn-buckle *c'*, so that the height of the yoke-frame *C* can be accurately adjusted, by manipulations of the turn-buckles *c'* so as to level the tracks as desired.

As shown in Fig. 4, each of the suspension-cables *B* is carried downward at its end-portions and anchored at each end to a horizontal cross-beam *D* (which is preferably a metal I-beam) and which is bolted at its ends to metal posts or columns *D'*; these columns *D'* forming the supports of trestle-work approaches to the suspension structure, and being shown as having their outer portions connected together by lattice-bars *d*. From the ends of the yoke-bars *C* depend bracket arms or hangers *C²*, the lower ends *C³* of which are extended upward and inward into approximately U-form. A head *c²* is formed at the inner end of each of the U-shaped portions *C³* and to said heads are bolted the rails *C⁴*; these rails being shown as in the form of inverted channel-irons, or, in other words, as of inverted U-form in cross-section. The rails *C⁴* are preferably so laid that their abutting ends shall rest upon the heads and be bolted thereto; the heads thus serving as internal fish-plates for the rail-joints. The bracket arms or hangers *C²* are braced laterally, against outward springing, by brace-rods *C⁵* the upper ends of which are bolted to the ends of the yoke-bars *C* and each of which extends obliquely downward and is bolted at its lower end to the lower end of the corresponding hanger *C²*. In the drawings I have shown a double-tracked rail-way, and in order to prevent any longitudinal swaying of the yoke-frames *C*, a number of brace-rods *c³* are crossed between each adjacent pair of yoke-frames; said rods being shown as bolted at their upper ends to the upper ends of the brace-bars *C⁵* and at their lower ends to the lower ends of said brace-rods. Lateral swaying of the yoke-frames is also prevented by longitudinal tie-rods *c⁴* which connect the yoke-frames of each set of rails, at points near the ends of the yoke bars *C*, as is clearly shown in Figs. 1 and 2. Between their upper and lower ends each pair of hangers carries two guard-rails *C⁶*, each of which is shown as of inverted L-shape, and as bolted to brackets *c⁵* which are in turn bolted to the sides of the hangers *C²*; the outer edges of the upper or horizontal flanges of the rails *C⁶* being notched, as shown in Fig. 21, so as to

receive the middle portion of the hanger C²; the vertical flanges of the rails C⁶ thus lying flatly against the inner edges of the hangers. To the under sides of the yoke-bars C are secured stringers C⁷, there being one of such stringers for each pair of rails C⁴, and beneath each stringer C⁷ is laid a line wire C⁸, for conducting an electric current; each line wire being suspended from its stringer by insulated hangers c⁶ and each of the wires C⁸ being protected from above, against the weather, by oblique guards or shields c⁷ secured to the under sides of the stringers, near the opposite sides thereof and extending outward and downward therefrom.

The posts D' of the trestle-work approaches to the suspension structure, above described, do not extend above the cross-beams D; and the roadway of the trestle-work, and also the roadway of the suspension structure, are braced and stiffened by a number of suspension-rods D² which are secured at their ends to certain of the yoke-bars C, and which are carried upward over the upper cross-beams A' of the posts A. Between each pair of cross-beams D of the trestle-work are interposed a number of pairs of parallel longitudinal stringers E which are preferably in the form of metal I-beams; there being but a single pair of said stringers E in a single-tracked road, two pairs of such stringers in a double-tracked road, and so on. These stringers E are shown as bolted at their ends to L-shaped brackets e which are in turn bolted to the sides of the cross-beams D and also to the cross-beams A², and upon the upper sides of each pair of stringers E are laid a number of horizontal short cross-beams or suspension ties F, which either simply rest by their own weight upon the stringers, as shown, or which may be suitably bolted or otherwise secured to the stringers. Horizontally beneath each suspension-tie is placed one of the yoke-bars C, each of which is connected to the suspension tie by a pair of pendent stirrups f. Each of these stirrups is bent midway of its length in such manner as to extend transversely over the suspension tie; the remaining portions of the stirrups extending downward so as to embrace the sides of the ties. The lower ends of the stirrups f also embrace the yoke bars C at points near their ends; and are securely bolted to said yoke-bars. In the case of a straight section of track, the yoke-frames C are hung parallel with each other and precisely transverse of the stringers E, but in the case of a curved section of track, the suspension ties F are laid and the yoke-frames are hung in alignment with the radii of the curvature of the track, or, in other words, said ties and yoke-frames diverge from each other, from the inner rail of the track toward the outer rail thereof, as is clearly shown in Fig. 3. In the case of a curved section of track, also, the rails C⁴ and C⁶ are of course bent laterally so as to conform to the curvature of the

track and the stirrups f are set or adjusted nearer to or farther from the ends of the suspension ties F, so as to bring the yoke-bars C and their hangers C² in proper position to accord with the curvatures of the rails C⁴ and C⁶.

At intervals in the length of the roadway, as at points where crossing-lines traverse the main line, or where branch lines join the main line, suitable turn-tables of peculiar and novel construction are located and serve either to enable the cars or vehicles to travel farther along the main line or branch lines, or to be shunted from the main line upon the cross-line or branch line, or vice versa. I will describe one of these turn tables in connection with Figs. 6, 7, 12, 13, 14 and 15. In these figures, G designates four supports or columns the lower ends of which are placed firmly in the ground so as to form the four corners of a supporting frame work, the columns G each consisting preferably of two longitudinal portions connected together by laticed bars g, and also preferably being inclined upwardly toward each other in order to impart additional rigidity to the framework. At their upper ends these four columns G are braced together by four horizontal beams G' which are preferably metal I-beams and the ends of which are preferably bolted in suitable manner to the upper ends of the columns G. From the horizontal bars G extend, obliquely inward and upward, a number of radial bars G², which are preferably metal I-beams and the outer ends of which are securely bolted to the horizontal beams G' and also to the columns G, as indicated in Figs. 6 and 7. The upper or inner ends of the beams or bars G² are bolted to a horizontal plate G³ which surrounds the upper end-portion of a vertical pivot standard G⁴, and which is adapted to permit said pivot standard to rotate freely within said plate. The upper extremity of the pivot-standard G⁴ carries a bearing plate G⁵ which turns with the pivot-standard and which also bears upon the plate G³ and turns thereon; a number of anti-friction balls g' being shown as interposed between the plates G³ and G⁵, for the purpose of reducing friction between the parts. The lower end of the pivot standard G extends through a platform which is supported by horizontal I-beams G⁶ the outer ends of which are bolted to the columns G and the inner ends of which are bolted to a center-plate G⁷ through which the lower end of the pivot-standard passes and in which said standard is free to revolve. A bearing plate G⁸ is rigidly secured to the lower end of the pivot standard G⁴ and rests upon the center-plate G⁷ of the platform; anti-friction balls g² being interposed between the bearing-plate G⁸ and the center plate G⁷ so as to lessen the friction resulting from the movements of the bearing plate G⁸ upon the center plate G⁷.

H designates a horizontal circular rail or track which is located a suitable distance

above the platform of the turn-table supporting frame; this circular rail or track having on its inner side a circular toothed rack H', for a purpose to be hereinafter explained. This track or rail H is suspended from the turn-table supporting frame by rods *h* and *h'*; the lower ends of said rods being suitably secured to the track, and the upper ends of the rods *h* being secured to the beams G², while the upper ends of the rods *h'* are secured to the beams G'.

I designates a horizontal circular frame-piece which constitutes the body-portion of the turn-table proper. From this circular frame-piece I extend radially inward a number of brace-bars I', the inner ends of which are bolted to a collar I², which surrounds the pivot-standard G⁴ so as to rotate around the latter. To the outer ends of the radial bars I' are bolted bracket-hangers I³ which extend upward and outward from the bars I', and each of which carries at its upper end a traction-wheel I⁴; the said wheels resting and running upon the circular track H and supporting the circular frame-piece I, while at the same time permitting said frame piece to revolve. To the outer ends of the radial bars I' are secured rods *i* which extend radially upward and inward and the upper ends of which are bolted to a collar I⁴ which surrounds the upper part of the pivot-standard G⁴, so as to revolve freely around the same; this collar being shown as located just below the bearing-plate G³. Transversely of the turn-table extend a number of horizontal stringers J, there being two of said stringers for a single track, four for a double track, and so on, and the stringers of each pair extending parallel with each other. As shown there are two pairs of these stringers extending in the same direction across the turntable; it is to be understood that two other pairs of stringers J may be placed at right angles to the two pairs shown, or that any desired number of pairs of stringers may be so placed with relation to the stringers J. Transversely upon each pair of stringers are placed a number of suspension-ties J', from which are suspended yoke-bars C having hangers C² and braces C⁵, and carrying traction-rails C⁴ and guard-rails C⁶, as before; the yoke-bars C being also suspended, by stirrups *f*, from the ties J', as previously described. A suitable motor, indicated at K, is mounted upon two horizontal supporting-beams K' which rest upon certain of the radial beams I', said motor imparting motion to a beveled gear-wheel *k* which meshes with a double gear-wheel *k'*, the lower set of teeth of this gear-wheel *k'* meshing with the rack-teeth H' of the circular frame piece I. Thus it will be seen that, when the motor K is in operation, it will cause the turntable to revolve so as to carry the turntable tracks from alignment with one set of track-rails to alignment with the other set of tracks.

L designates the cars which are designed

to travel upon the railway above described; these cars being, so far as their precise general form and construction are concerned, either as shown, or of any other construction suitable to the traffic requirements of the road. At its ends, each of the car-bodies is embraced by a stirrup-frame L' which extends upward at the sides of the car-body, transversely beneath the bottom of said car-body, and also upward, in convergent position, above the roof of the car body. The upper portions of the stirrup-frames L' pass each through one of the shackles *l* which are secured to the lower ends of hangers L² which are pendent from the ends of a truck-frame L³. This truck-frame is shown as composed of two sections M M, each of which is of approximate U-shape in plan view and each of which forms one end and one half of each side of the truck-frame. At each side the two end sections M M of the truck-frame are connected by one of two longitudinal bars N, having each a longitudinal slot *n*; bolts *n'* being passed through the slots *n* and also through the side portions of the truck frame sections M. Thus the truck-frames are rendered flexible laterally, so as to the more readily travel over short curves, the bolts *n'* in such event moving toward and away from each other in the slots *n* of the connecting bars N. In order to stiffen and strengthen the flexible truck-frame, a V-shaped brace-bar O is interposed between the two longitudinal portions of the sections M M of the truck-frame; the bends or apexes of the brace-bars being presented toward each other at the middle of the truck-frame, and the ends of said brace-bars being bolted to the side portions of the truck frame sections M M. The bends of the brace bars O are knuckle-jointed to each other, a pin or bolt *o* forming the pintle of said joint. Axles P carrying flanged wheels *p* are journaled at the ends of the truck-frames; the wheels running upon the rails C⁴. The outer ends of the axles P abut against the guard-rails C⁶ and carry, at their ends, wheels the flanges of which are at the outer sides of the wheel-margins, as shown. Thus all possibility of derailment of the trucks is avoided, and it will be seen that the flanges of the wheels, by impinging upon the outer sides of the rails, prevent all possibility of spreading of said rails. A suitable electric motor R is shown as mounted upon each truck-axle P, and a trolley-wheel S is shown as carried by a shaft S' which extends horizontally and transversely above the truck-frame; the shaft S' being pressed upward by springs S² resting upon the truck-frame and serving to hold the trolley wheels S in contact with the line wires.

I claim as my invention—

1. An elevated railway structure comprising a plurality of yokes and supports therefor, said yokes being of inverted U-shape and provided at their lower ends with inwardly extending and upturned arms, and track-rails of inverted U-form, in cross-section

tion, resting upon and supported by the upturned lower ends of the said yokes, substantially as described.

2. An elevated railway structure, comprising suspending cables, supports therefor, and a plurality of yokes of inverted U-form suspended from said cables, said yokes being provided at their lower ends with inwardly extending arms, upturned at their lower ends, track-rails of inverted U-shape resting upon and attached to the said upturned inner ends of said arms, and longitudinal guide rails attached to the vertical sides of the yokes above the track-rails, substantially as described.

3. An elevated railway structure, comprising a plurality of yokes, and means for supporting the same, said yokes each consisting of a horizontal top piece, vertical side bars depending therefrom and attached to the top piece at points distant from the outer ends of the same, and inclined brace-bars extending from the outer ends of said top piece to the lower ends of the said vertical side-bars, said hangers being provided at their lower ends with inwardly extending arms and track-rails supported on said arms, substantially as described.

4. An elevated railway structure, comprising yokes and means for supporting the same, said yokes being of inverted U-form and being provided at their lower ends with inwardly extending arms provided with longitudinally arranged heads or lugs for attachment to track-rails, and channeled track-rails resting on and embracing said inwardly extending arms, substantially as described.

5. An elevated railway structure, comprising yokes and means for supporting the same, said yokes being of inverted U-form and being provided at their lower ends with inwardly extending arms provided with longitudinally arranged heads or lugs for attachment to track-rails, and channeled track-rails resting on and embracing said inwardly extending arms, said heads or lugs at the rail joints being elongated longitudinally to constitute internal connecting bars or fish plates for the rails, substantially as described.

6. An elevated railway structure, comprising a plurality of rigid metal yokes of inverted U-form, provided with inwardly extending rail-supporting arms at their lower ends, supports for said yokes and longitudinal guide rails attached to the side pieces of the yokes above the track-rails, said guide rails consisting of L-shaped angle irons having their vertical flanges extending continuously along the side pieces of the yokes inside of the latter and their horizontal flanges notched to receive the side pieces of the yoke, and angle plates for securing said guide rails to the yoke, substantially as described.

7. An elevated railway structure, compris-

ing suspension cables and supports therefor constituting the straight parts of the structure, and longitudinal girders and supports therefor constituting the curved parts of the structure, a plurality of rigid metal yokes of inverted U-form, track-rails supported on the lower ends of the yokes, the said yokes in the straight part of the structure being suspended from the suspension cables by means of cables or rods engaging said suspension cables, and the yokes on the curved part of the structure being supported from the said longitudinal stringers by means of transverse supporting pieces resting on the stringers, with which transverse pieces the said yokes are connected, substantially as described.

8. The combination with an elevated railway structure, embracing track supporting yokes having inwardly extending rail-supporting arms and rails resting thereon, of a turn-table comprising a revolving circular frame, a plurality of yokes suspended therefrom, track rails resting on the yokes, a circular stationary guide rail, and guide rollers on the revolving frame of the turn-table engaging said stationary guide rails, substantially as described.

9. The combination with an elevated railway structure comprising rigid metal stirrups or yokes of inverted U-form having inwardly extending arms at their lower ends and track rails resting on said arms, of a turn-table comprising a main frame or support, a central vertical shaft mounted therein, a revolving circular frame attached to the shaft, yokes or stirrups suspended from the said frame, and a circular guide rail attached to the main supporting frame, said revolving frame of the turn-table being provided with guide rollers engaging said circular guide rail, substantially as described.

10. The combination with an elevated railway structure comprising rigid metal stirrups or yokes of inverted U-form having inwardly extending arms at their lower ends and track rails resting on said arms, of a turn-table comprising a main frame or support, a central vertical shaft mounted therein, a revolving circular frame attached to the shaft, yokes or stirrups suspended from the said frame, and a circular guide rail attached to the main supporting frame, said revolving frame of the turn-table being provided with guide rollers engaging said circular guide rail, and said circular guide rail being suspended from the said main supporting frame by suspension rods, substantially as described.

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

LYSANDER JOHNSTON.

Witnesses:

C. CLARENCE POOLE,
G. W. HIGGINS, Jr.