D. M. PFAUTZ & J. L. LUCKENBACH.

TRANSVERSE TRUSS SYSTEM FOR ELEVATED STRUCTURES.

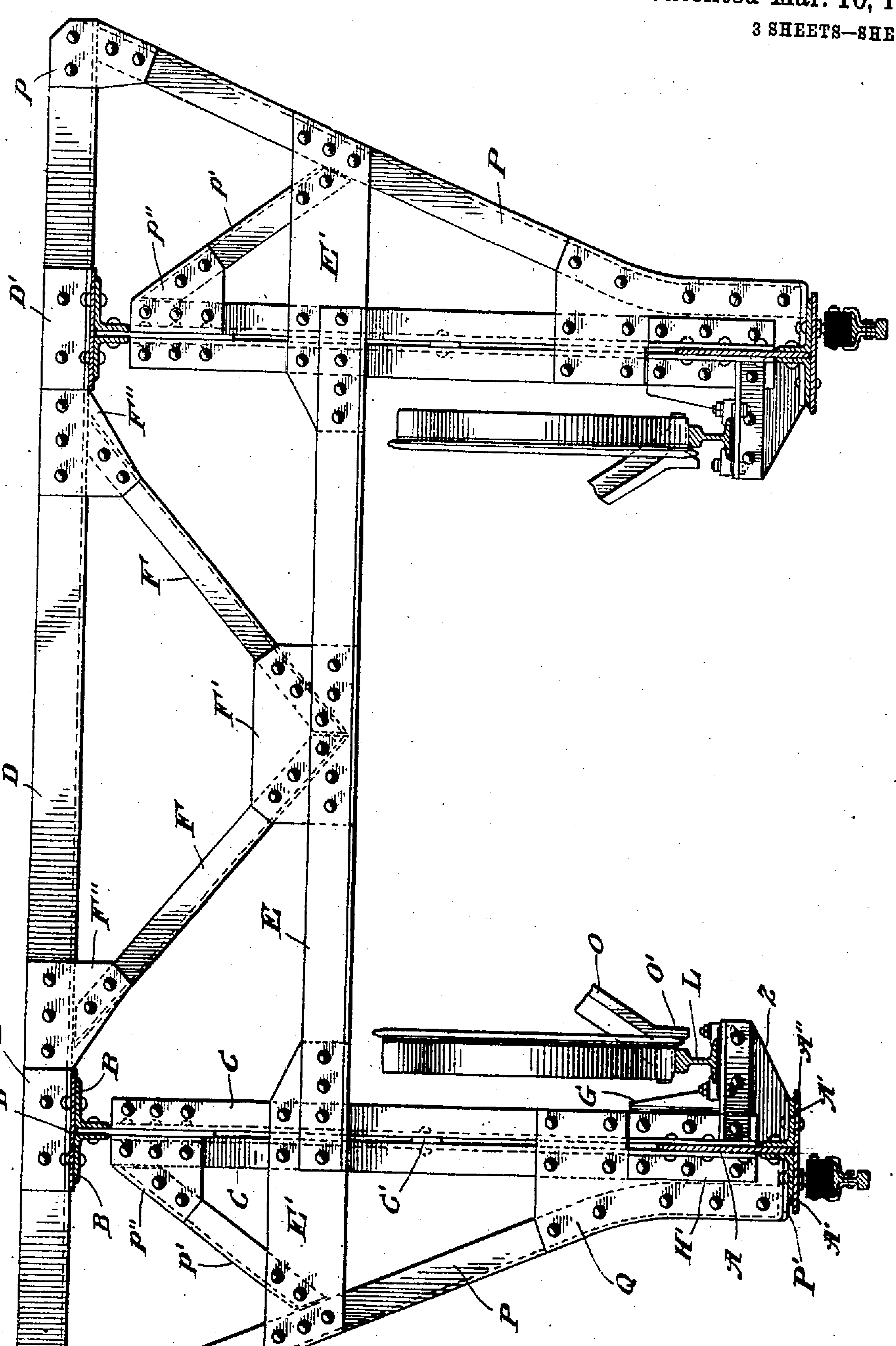
APPLICATION FILED JUNE 29, 1908.

915,378.

Patented Mar. 16, 1909.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

M. C. Lyddane

Frederic B. Wright

Inventors

Daniel M. Pfautz and

John Lewis Luckenbach

By Joshua R. H. Potts

Attorney

D. M. PFAUTZ & J. L. LUCKENBACH.

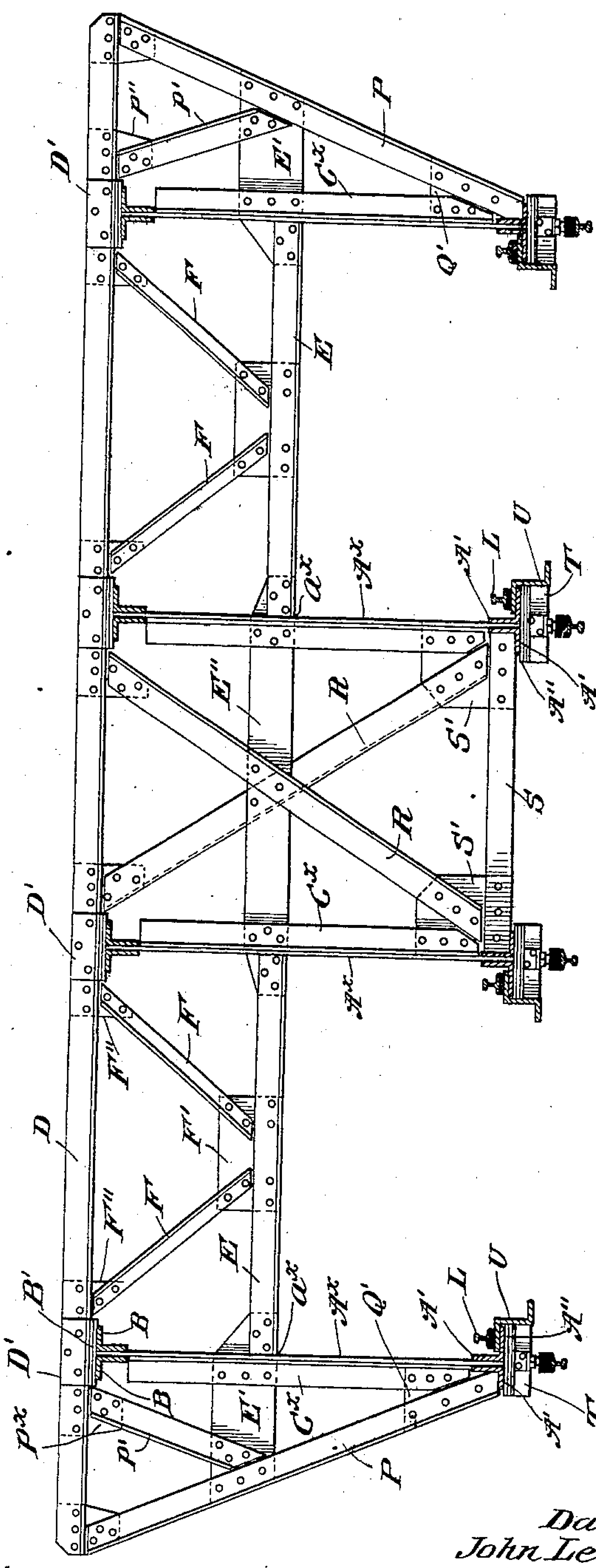
TRANSVERSE TRUSS SYSTEM FOR ELEVATED STRUCTURES.

APPLICATION FILED JUNE 29, 1908.

915,378. Patented Mar. 16, 1909.

3 SHEETS—SHEET 2.

Fig. 2.



Witnesses

M. C. Lyddane

Frederic B Wright

Inventors,

Daniel M. Pfautz and

John Lewis Luckenbach

By Joshua R. H. Potts

Attorney

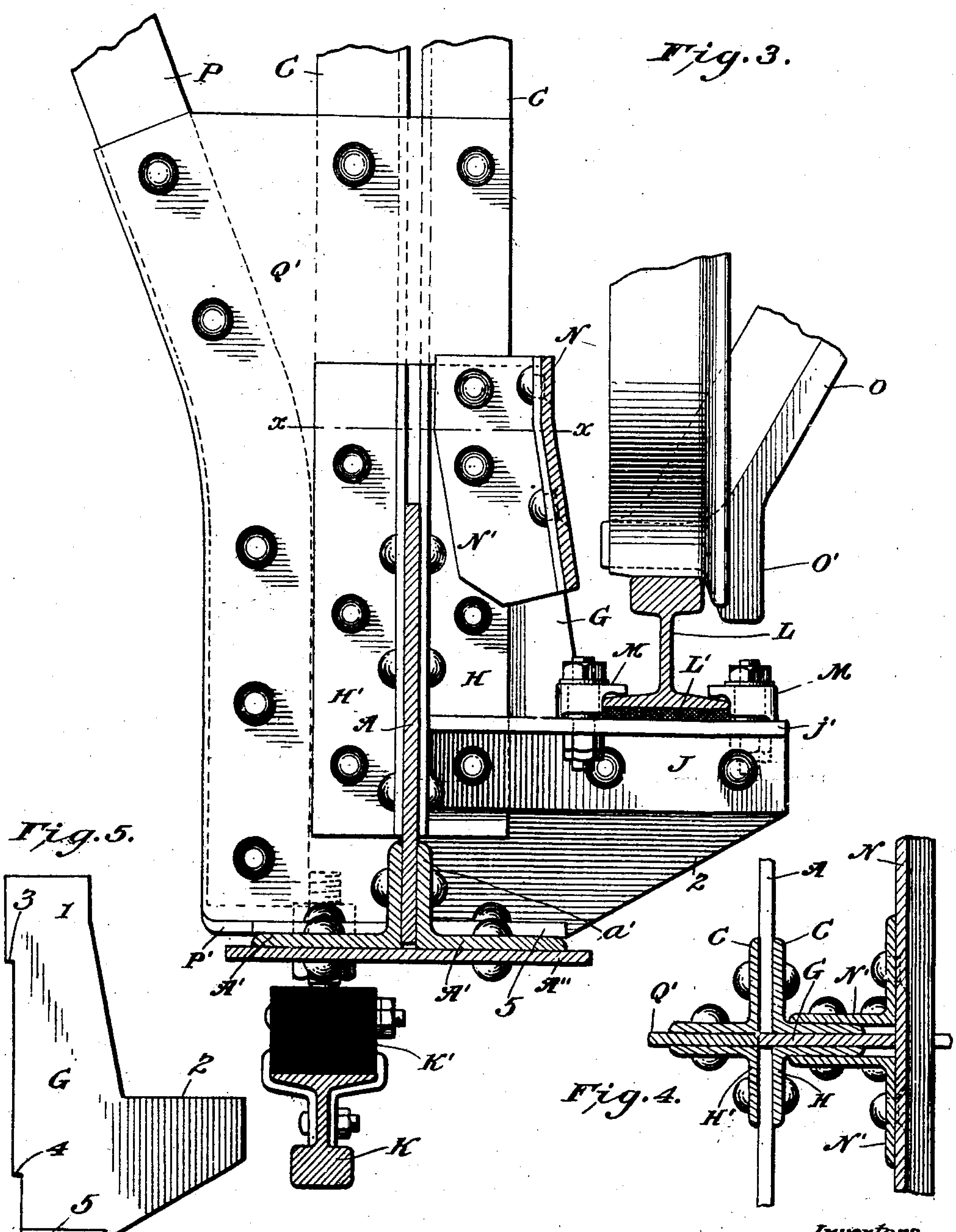
D. M. PFAUTZ & J. L. LUCKENBACH.

TRANSVERSE TRUSS SYSTEM FOR ELEVATED STRUCTURES.

APPLICATION FILED JUNE 29, 1908.

915,378. Patented Mar. 16, 1909.

3 SHEETS—SHEET 3.



Witnesses:

M. C. Lyddane

Frederic B. Wright

Inventors

Daniel M. Pfautz

John Lewis Luckenbach

By Joshua R. H. Potts

Attorney

UNITED STATES PATENT OFFICE.

DANIEL M. PFAUTZ AND JOHN LEWIS LUCKENBACH, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO THE AMERICAN SUSPENSION RAILWAY COMPANY, OF PHILADELPHIA, PENNSYLVANIA.

TRANSVERSE-TRUSS SYSTEM FOR ELEVATED STRUCTURES.

No. 915,378. Specification of Letters Patent. Patented March 16, 1909.

Application filed June 29, 1908. Serial No. 440,811.

To all whom it may concern:

Be it known that we, DANIEL M. PFAUTZ and JOHN LEWIS LUCKENBACH, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Transverse-Truss Systems for Elevated Structures, of which the following is a specification.

Our invention relates to elevated railroad structures designed to support suspended cars, such a structure as is shown in Patent No. 840,801, granted to Daniel M. Pfautz, on January 8, 1907, and particularly to the arrangement of parts and the constructional elements whereby the elevated rails are supported and the structure braced against lateral and vertical strains and thrusts.

The object of the invention is to provide a simple and yet rigid constructional arrangement of trusses to be used intermediate to and in the space between certain column-supported trusses which form part of another application for patent Serial No. 440,810 of even date herewith. The trusses forming the subject of the present application extend transversely of the line of the railroad and support the rails thereof.

The invention consists in a peculiar track supporting bracket, the means whereby the track supporting bracket is suspended from the truss, and the peculiar arrangement of truss elements and constructional details shown in the accompanying drawings and particularly specified in the appended claims.

In the drawings Figure 1, is a face view of a transverse supporting truss for a one track elevated structure. Fig. 2, is a like view of a transverse truss for a two track structure. Fig. 3, is an enlarged fragmentary face view of the lower end of one of the track supporting elements, the lower longitudinal chord of the structure and the rail being in section. Fig. 4, is a section taken on line x—x of Fig. 3. Fig. 5, is a face view of one rail-supporting bracket detached.

Like reference characters throughout the several views designate like parts.

As before stated, the trusses forming the subject of this application are those which are supported upon the intersecting longitudinal upper and lower chords of the elevated structure and which are located intermediate of other transverse trusses which are supported directly upon columns from the ground. These column-supporting trusses are not shown as they do not form part of our present invention. The intermediate trusses are not only supported upon the upper and lower chords of the elevated structure, but tie these chords together and brace them against lateral strain as well as forming a support upon which the rails are clamped.

The type of railway for which this truss is designed has a superstructure supporting hanging cars. This arrangement compels the solution of the following problem: The rails of the track must be carried on the inside of the lower chords of longitudinally extending parallel trusses. In order to accommodate the truck, the wheels attached thereto and the car suspension arrangement, space must be left betwen the longitudinal trusses and of course between the rails carried thereby. This necessitates that the lower half of the longitudinal trusses shall be left unconnected with each other and unbraced from each other, and hence makes it necessary to devise some way of connecting and tying together the upper portion of the longitudinal trusses, not only so as to brace them laterally, but so that the comparatively free lower portion of the trusses shall also be braced against lateral thrust of the train. In addition to the problem above laid down, there has to be considered the proper supporting of the rails from the longitudinal trusses, and the arrangement of transverse trusses in such manner that they shall be supported by the longitudinal trusses which if braced shall not be subjected to shearing strains. Our invention has for its object the solution of these problems.

It will be understood that both longitudinal elements of the structure are alike and hence the description of one track supporting section is equally applicable to the opposed track supporting section. Describing one of these sections then, A, designates a longitudinally extending beam which forms the lower chord of the structure. The lower margin of the beam is reinforced by the opposed longitudinal angle irons A′, A′, and the stiffening plate A″. These also form part of the lower chord. The beam A, of the lower chord is connected to the opposed angle beams B, B, which form the upper chord by the opposed vertical angle irons C, C, see Fig. 4. The flanges of these angle irons C, are riveted to the beam A, as shown in Fig. 4, and are spaced apart at the lower end by said beam and at the upper end by a spacing plate c', to which the flanges of the angle irons are riveted. The longitudinal angle irons B, are held in relation to each other and braced by a longitudinal stiffening plate B′, riveted thereto.

It will be seen that the elements A, B and C, above described form practically a skeleton or compound I-beam or longitudinal element extending along both sides of the elevated structure, and these longitudinal compound beams as before described are supported at intervals by columns,—the wheels of a train moving on rails which are carried on the lower inside margins of the longitudinal elements.

In order to laterally brace the opposed longitudinal elements we provide the truss system now to be described. In general, the longitudinal compound beams formed by the parts A, B and C, are tied to each other, and braced against lateral movement by an intersecting truss, which itself comprises an upper element, a lower element and a skeletonic web portion between the two. This transverse truss is all above the neutral axis of the longitudinal truss. Thus a space is left between the parallel longitudinal elements and the lower members of the transverse truss for the wheels of a truck, this truck supporting a suspended car.

In detail, the upper opposed longitudinal chords B, B, are braced and connected to each other by the single-flanged angle iron D, which extends transversely from one upper chord B, to the other. This angle iron D, not only connects these parallel chords, but extends beyond them as shown for a purpose hereafter described. The transverse angle irons D, are connected to the beams B, by angle irons D′, riveted to the vertical web of D. To the horizontal flanges of the beams C, C, somewhat above the neutral point of the vertical element C, are placed the transverse bracing beams E, L-shaped in section, the flange of the beam extending outwardly in direction reverse to that of beam D. This forms the lower element of the transverse truss. The ends of the vertical flange of beam E, are riveted to the transverse projecting flange of the vertical elements C, as shown, thus tying the two opposed vertical elements together and holding the vertical beams from lateral thrust in either direction. Diagonally extending truss rods F, F, of angle irons connect the middle of the transverse beam E, with the beam D, at its juncture with the vertical elements. A connecting plate F′, is riveted to the middle of beam E, to which the truss rods F, are riveted. At their upper ends, the truss rods are riveted to plates F″, F″, which in turn are riveted to the beam D. It will be also noted that the butt of the angle iron rods F, extend up against the underside of angle beam D, and the lower ends of the rods meet and abut against each other. These elements as before described together form a compound transverse beam, the lowest portion of which is above the neutral line of the longitudinal trusses. Is will thus be seen that none of the elements so far described are subjected to shearing strain, and that the upper transverse beam D, is supported on the body of the upper chord while the vertical elements C, are supported upon the lower chord.

The tracks L, are supported on brackets G, one of which is shown in Fig. 5, whose connection to the structure is shown most clearly in Fig. 3. The bracket is L-shaped in general form, having a vertical portion 1, which engages with the supporting elements of the structure and an outwardly projecting portion 2, which immediately supports the rail. It is of course understood that these brackets are spaced along the track and form the immediate track supports. The bracket abuts at its rear edge upon the web A, and is therefore cut out on its rear edge to form a shoulder 3, which engages over the top of the web A. The rear edge is again cut away toward its lower end to form a shoulder 4, which engages over the top of the flange a', of angle iron A′. The lower end of the bracket is bent or flanged as at 5, to rest upon and be riveted to the upper face of angle iron A′, thus the bracket is supported on the beam A, with as little shearing strain on the rivets as possible.

As shown in Fig. 4, the bracket is supported between angle iron C, and an opposed short angle iron H, riveted thereto. The angle iron H, does not extend down to the face of the bracket but abuts against the upper edge of flange a'. The upper edge of the projecting portion 2, of the bracket is braced by an oppositely disposed angle iron J, whose flange j', supports the sound-deadening pad L′, on which the rail L, is carried. Rail clamping devices M, M, which form the subject of another application Serial No. 440,809 of even date herewith, hold the rail to the bracket and angle irons J. A wheel guiding guard N, is supported by angle irons N′, from the irons C and H. An arm O, carrying a shoe O′, extends downward from the wheel truck and prevents the wheel from leaving the track, all as described in another application as above noted filed by us. The wheel truck has two of these downwardly extending arms, one on each side engaging with each rail. Their object also is to support the wheel truck in case the wheel axle breaks, and to prevent the wheel running off

R, at its ends to the transverse projecting flanges of the angle irons $C^{\times}$, and at its extremities to the upwardly projecting flanges of bars E. Thus, all the vertical elements are braced against and tied to each other just above the neutral axis of the entire truss system.

The track rail supporting construction shown in Fig. 2, is somewhat different from the construction heretofore described and shown in Fig. 1. The lower flanges of the angle irons A′, are connected by stiffening plates A″, as before described and located transversely across the underside of the stiffening plate and riveted thereto immediately beneath the vertical element $A^{\times}$, is the angle iron T, to which the third-rail is connected in any suitable manner, the preferred form of connection however being shown in another application filed by us resting upon the inwardly projecting flange of the angle iron A′, is an angular plate U, the upper flange of which is located beneath the rail L, and the lower flange of which extends inwardly and forms a longitudinal guard plate or rail to prevent the car or truck from rising off the rails L.

It will be seen that in the main the construction shown in Fig. 2, forms but a duplication of that shown in Fig. 1, the lateral thrusts being counteracted and transmitted by the diagonal trusses P and R. The transverse truss as a whole is supported directly upon the longitudinal elements A and B, while the rails are carried upon brackets attached to the lower chords of the structure.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. In an elevated railway structure of the class described, parallel longitudinal trusses, intersecting transverse trusses tying the longitudinal trusses together above the neutral axis thereof and supported on said longitudinal trusses, said transverse trusses being extended in a horizontal line on both sides beyond the longitudinal trusses, the ends of said transverse trusses being connected to the lower chords of the longitudinal trusses and bracing the latter below their neutral line against sidewise thrust.

2. In an elevated railway structure of the class described, parallel longitudinal trusses, transverse trusses connecting said longitudinal trusses above the neutral axis thereof, the longitudinal trusses being unconnected below their neutral axis, and lateral bracing trusses having diagonal struts extending out from the lower chords of the longitudinal trusses, upward and outward to the ends of said lateral trusses, each of the said longitudinal trusses supporting a rail upon the inner side thereof at its lower edge.

3. A transverse truss for elevated railways of the character described, having upper and lower longitudinal oppositely-disposed truss chords intersecting said transverse truss and supporting the same, vertical beams connecting the upper and lower chords, a transverse beam forming the upper chord of the transverse truss, supported and bearing upon the upper side of said upper longitudinal chord and extending beyond the same at both ends, diagonal truss beams extending from the outer ends of the transverse beams downward and inward to the lower longitudinal chords, and inwardly projecting brackets supported on said lower longitudinal chords carrying track rails.

4. A transverse truss for elevated railways of the class described, having upper and lower longitudinal chords intersecting said transverse truss and supporting the same, vertical beams connecting the upper and lower longitudinal chords, a transverse beam supported and bearing upon the upper side of said upper chords and extending beyond the same at both ends, diagonal truss beams extending from the outer ends of the transverse beam downward and inward to the lower chords, a transverse tie beam extending between the said vertical beams above the neutral line of the latter and brackets supported on said lower longitudinal chord carrying track rails.

5. A transverse truss for elevated railways of the class described, having upper and lower longitudinal chords intersecting said transverse truss and supporting the same, vertical beams connecting the upper and lower chords, a transverse beam forming the upper chord of the transverse truss supported and bearing upon the upper side of said upper chord and extending beyond the same at both ends, diagonal truss beams extending from the outer ends of the transverse beam downward and inward to the lower longitudinal chords, a transverse tie beam extending between the said vertical beams above the neutral line of the latter, and diagonal struts, oppositely extending, connecting the center of said tie beam with the upper transverse beam.

6. A transverse truss for elevated railway structures of the class described, having upper and lower longitudinal chords intersecting said transverse truss and supporting the same, vertical beams connecting the upper and lower longitudinal chords, a transverse beam forming the upper chord of the transverse truss supported by and bearing upon the upper side of said upper longitudinal chord and extending beyond the same at both ends, diagonal truss beams extending from the outer end of the transverse beam downwardly and inwardly to the lower longitudinal chords, and a transverse tie beam extending between the said vertical beams above the neutral line of the latter, diagonal struts oppositely extending connecting the center of said tie beam

the track in case the flange of the wheel breaks. Beneath the lower chord A, is supported the third-rail K, from an insulating block K′, this also forms the subject of another application filed coincident herewith.

In order to brace the vertical members C, under lateral thrust and to prevent any lateral vibration of these members and of the rails, we provide lateral trusses on the outside of the vertical members which will act to resist the lateral thrust of a passing train. As stated before the beam D, extends beyond the upper chords B, and the ends of the beam are connected by inwardly extending diagonal angle irons P. The neutral axis of each being directed toward the neutral axis of beam A. At its upper end each beam is attached to the beam D, by a plate p. At its lower end the beam is curved and its lower extremity is bent to form a flange P′, which rests upon the angle iron A′. Connecting the truss iron P, with the vertical angle iron C, and with the bottom of the beam A, is the stiffening plate Q. This plate is cut away on one edge to accommodate the upwardly extending flanges of angle irons H, on the web A. Superposed upon this plate is the angle iron H′. Rivets pass through the angle iron H′, the plate P, and the angled vertical beam C, as shown in Fig. 4.

Forming a continuation of the transverse lower beam E, are the plates E′, E′. These overlap the ends of beams E, and are bolted to the transverse flanges of the vertical angle irons C, and extend to the diagonal truss bars P, to which they are riveted. Abutting against the inside edge of the truss bars P, are the struts p', p', which at their lower ends are riveted to the plates E′, E′, and extend upward to the upper ends of the vertical elements C, to which they are held by plates p'', p''.

It will be seen that by the peculiar arrangement of angle irons, ties and trusses before described, we have produced a structure of very great stiffness and wherein, while there is a minimum shearing strain, yet there is a maximum of rigidity. Lateral thrust on the lower chord is counteracted by the lateral trusses, the plates E′, and the trusses F; and the track is rigidly supported on the brackets G. Special attention is called to one advantage incident to this structure. The space between the brackets is empty, from the inner flange of the rail back to beam A, hence dirt, dust and other trash cannot accumulate between the rail and the beam A, as it otherwise would.

It will be seen that generally stated, we have provided in the constructions so far described, longitudinal parallel trusses braced by intersecting transverse trusses located above the neutral line of the longitudinal trusses, the transverse trusses being extended beyond the longitudinal trusses and the lower portion of the longitudinal trusses being braced against sidewise thrust by diagonal elements coacting with the transverse trusses.

While in Fig. 1, we have shown a single track structure, in Fig. 2, we show a structure of the same general character as the one in Fig. 1, but supporting a double track system. As far as possible we shall use like reference characters to those in Fig. 2, to designate like parts. Thus, B, B, designate the opposed angle irons which form the upper chords of the structure, there being four of these longitudinal elements each composed of angle irons B, B. A′, A′, designate the longitudinal angle irons of the lower chords. Each upper and lower chord is connected by a vertical web or beam $A^{\times}$, which is stiffened by an angle iron $C^{\times}$, riveted thereto. Supported on the upper chord B, in the same manner as before described, is the transverse angle-iron beam D, attached to the upper longitudinal chords by angle irons D′. Located between each pair of vertical webs $A^{\times}$, is the transverse angle-iron E, the ends of which are supported in a recess formed in the edge of the beam $A^{\times}$, at $a^{\times}$. The vertical flange of the beam E, is riveted to a plate E′, as before described, which forms an extension thereof, the ends of the horizontal flange of the beam E, contacting with the vertical beams $A^{\times}$, $A^{\times}$. Diagonal truss bars P, are used as before described. These extend downward from the ends of the transverse elements D, to the lower chords where they engage with the outer angle irons A′. The stiffening plate Q′, connects the truss bars P, with vertical angle irons $C^{\times}$. The upper ends of the plates E′, are riveted to the transversely extending flange of the truss bar P, and riveted to this plate and extending upward therefrom to the beam D, are the inwardly inclined struts p, which in the construction now being described are attached directly to the transverse beam D, by plates $p^{\times}$.

We have above described the manner of bracing and supporting the outermost rails, which is practically the same as the means shown in Fig. 1. The two inner rail supporting members $A^{\times}$, $C^{\times}$, are slightly differently braced by diagonal, crossing angle irons R, the flanges of which are oppositely directed. The upper ends of these beams abut directly against the under flange of the beams D, while the lower ends of beams R, abut against the edge of a transverse flat beam S, which is interposed between the two inside rail supporting elements. The lower ends of the diagonal beams R, the ends of beam S, and the lower ends of the angle bars $C^{\times}$, are all riveted to corner plates S′. A transverse bracing plate E″, extends across one inside vertical element to the other inside vertical element and forms in fact a continuation of the transverse bracing beam E. This plate E″, is riveted at its middle to the diagonals with the upper transverse beam, outwardly and downwardly extending struts connected at their lower ends to the lateral upwardly extending diagonal truss beams and at the upper ends with the upper chords of the longitudinal trusses, and brackets supported on said lower chords carrying track rails.

7. A transverse truss for elevated railway structures of the class described, having upper and lower longitudinal chords intersecting said truss and supporting the same, vertical beams connecting the upper and lower longitudinal chords, a transverse beam supported by and bearing upon the upper side of the said upper chords extending beyond the same at both ends, diagonal truss beams extending from the outer ends of the transverse beam downward and inward to the lower chords, a transverse tie beam extending between said vertical beams above the neutral line of the latter, and outwardly and downwardly extending struts connected at their lower ends to the lateral upwardly extending diagonal truss beams and at their upper ends to the upper chords of the longitudinal trusses, said lateral truss beams being tied to the vertical beams on a level with the lower transverse tie beams, said lateral truss beam having diagonal struts extending upwardly and inwardly to the upper ends of the vertical beams.

8. In an elevated railway structure of the class described, parallel upper and lower longitudinal chords connected at intervals by vertical beams, said lower chords having inwardly projecting flanges, and bracket plates each having a vertical portion and an inwardly projecting portion, the vertical portion being bolted to the vertical beams and the inwardly projecting portion supporting a rail.

9. In an elevated railway structure of the class described, parallel upper and lower longitudinal chords connected at intervals by vertical beams, said lower chords having inwardly projecting flanges, and a bracket plate having a vertical portion and an inwardly projecting portion, the vertical portion being bolted to the vertical beams and having a flange at its lower end adapted to be attached to the projecting flange of the lower chord, the inwardly projecting portion of the bracket being adapted to support a rail.

10. In an elevated railway structure of the class described, parallel upper and lower chords connected at intervals by vertical beams right-angled in section, said lower chords having inwardly projecting flanges and a bracket plate having a vertical portion adapted to be riveted to the inwardly projecting flange of the vertical beam, said bracket plate having a flange at its lower end adapted to rest upon the flange of the lower chord, the inwardly projecting portion of the bracket being adapted to support a rail.

11. In an elevated railway structure of the class described, parallel upper and lower chords, said lower chords being formed by a longitudinal beam having oppositely disposed flanges at its lower edge, said chords being connected at intervals by vertical beams each L-shaped in cross section, said vertical beams engaged at their lower ends on each side of the longitudinal lower chord beam by a bracket plate having a vertical portion riveted to the outwardly projecting flange of one of the vertical beams, an angle iron disposed on the other face of said bracket and bearing against the bracket and said longitudinal chord beam and riveted thereto, said bracket having a bearing upon the inwardly projecting flange of the chord beam, the inwardly extending portion of the bracket being provided with means for supporting a rail.

12. In an elevated railway structure of the class described, upper and lower longitudinal chords, the lower chord being composed of a longitudinal beam having oppositely disposed flanges on its lower edge, said upper and lower chords being connected by vertical beams, a bracket plate having a vertical portion attached to said vertical beams and an outwardly extending portion adapted to support a rail, angle irons located on either side of said bracket and riveted thereto, said angle irons at their inner ends bearing against the longitudinal beam of the lower chord.

13. In an elevated railway structure of the class described, longitudinally extending parallel trusses having upper and lower chords, said chords being connected by vertical beams, a transverse truss connecting the parallel trusses above their neutral axis and projecting on both sides beyond said longitudinal trusses, a diagonal bracing beam connecting the transverse trusses with the lower chord of the longitudinal truss, in combination with a bracket plate attached to said lower chord and supported thereon, said bracket plate having an outwardly extending portion adapted to support a rail.

14. In an elevated railway structure of the class described, longitudinally extending parallel trusses having upper and lower chords, said chords being connected by vertical beams, a transverse truss connecting the parallel trusses above their neutral axis and projecting on both sides beyond said longitudinal truss, a diagonal bracing beam connecting the transverse truss with the lower chord of the longitudinal truss, a stiffening plate connecting the lateral truss beams with the vertical beams and with the flanges of the lower chord of the longitudinal truss, in combination with an L-shaped bracket resting upon the inside flange of the lower chord and attached to the vertical beams and to the longitudinal lower chord beam, the out-

wardly extending portion of said bracket being adapted to support a rail.

15. For use in an elevated railway structure of the class described, a bracket plate having a vertical body portion and a projecting portion at the lower end thereof adapted to support a rail, the rear edge of said bracket being cut out to engage over the top of a longitudinal supporting beam, the lower edge of said bracket having a flange adapted to engage with the flange of a supporting beam.

16. In an elevated railway structure of the class described, four parallel longitudinal trusses, an intersecting truss tying the longitudinal trusses together above the neutral axis thereof, said transverse truss extending on both sides laterally beyond the outermost longitudinal trusses and braces connecting the lower chords of the outermost trusses with the ends of the transverse truss thereby bracing the same against lateral movement, the middle pair of longitudinal trusses being braced by diagonal braces crossing each other and extending from the lower chord of one longitudinal truss to the upper chord of the opposite longitudinal truss.

17. In an elevated railway structure of the class described, four parallel longitudinal trusses, an intersecting transverse truss tying the longitudinal trusses together above their neutral axis, said transverse truss extending on both sides laterally beyond the outermost longitudinal truss, and trusses connecting the lower chords of the outermost trusses with the ends of the transverse truss thereby bracing the same against lateral movement, the middle pair of longitudinal trusses being braced by diagonal bars crossing each other and extending from the lower chord of one longitudinal truss to the upper chord of the opposite longitudinal truss and a transverse bracing piece located between the two inner longitudinal trusses above the neutral axis thereof.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

DANIEL M. PFAUTZ.
JOHN LEWIS LUCKENBACH.

Witnesses:
J. A. L. Mulhall,
Frederic B. Wright.