

R. PETERSEN.
SUSPENDED RAILWAY.
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935,859.

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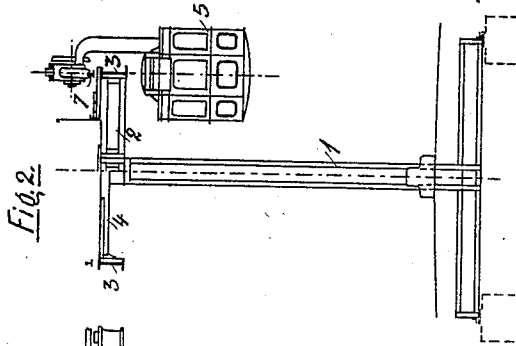


Fig. 2.

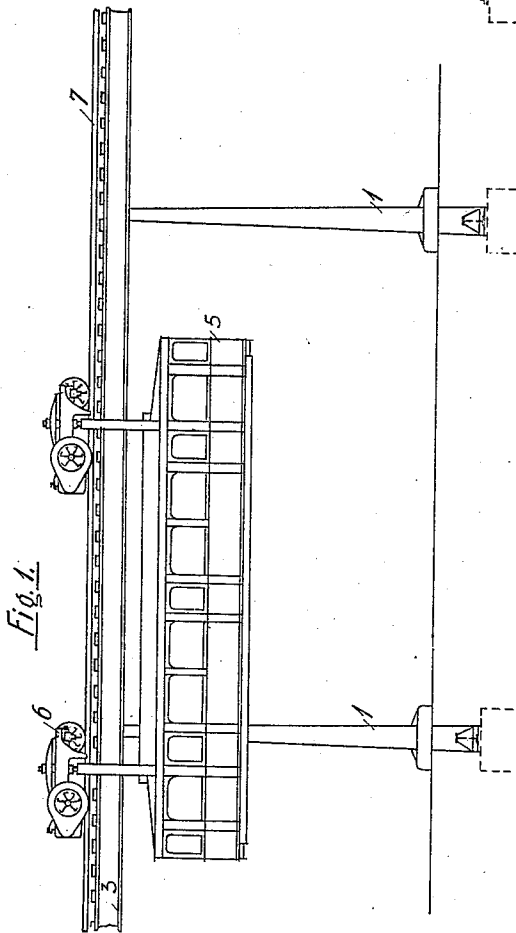


Fig. 1.

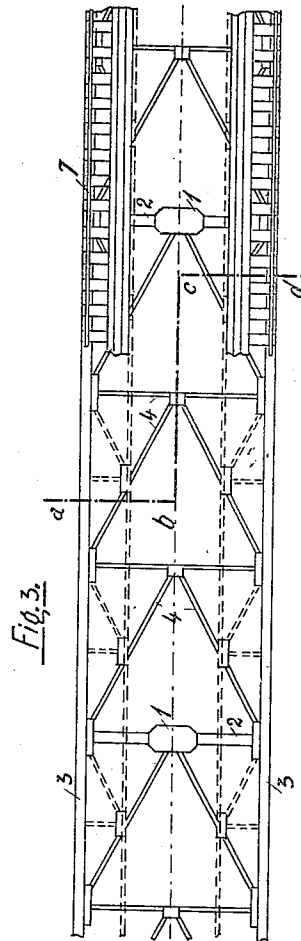


Fig. 3.

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UNITED STATES PATENT OFFICE.

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SUSPENDED RAILWAY.

935,859.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, RICHARD PETERSEN, a subject of the German Emperor, and residing at Berlin, Germany, have invented certain new and useful Improvements in Suspended Railways, of which the following is a specification.

My invention relates to elevated railways of the known kind in which a tramway, supported by a series of single columns, has its frame for the rails supported upon the capitals of the columns, and a primary object is to provide an elevated railway viaduct having a flat, horizontal girder forming the tramway which is so stiff that not only is a firm and safe support occupying but comparatively small space provided, but which is also so rigid that it does not bend appreciably horizontally owing to the forces acting upon it due to one-sided loads and to the oscillatory motions of the vehicle suspended therefrom.

For a suspended car to travel more smoothly than a surface railway-car it is necessary to provide a much more exact track, since, in consequence of the possibility of the car swinging out freely laterally, the irregularities in the track cause oscillatory motions of the vehicle in so far as such irregularities are sudden alterations in the radius of curvature of the track.

The difficulty of constructing a suspended railway viaduct having central supports was that, having regard to the street traffic, the central supports had to be kept as narrow as possible, but, on the other hand, when the breadth of these supports is limited, owing to the supports bending in consequence of a one-sided load, the distance which the heads of the supports move laterally increases. In the calculated estimates this lateral bending attained an amount which was inadmissible for the smooth running of the suspended railway. Further, when endeavoring to replace the high lattice bridge-girders by low solid-sided or rolled girders, it was found that these would bend too much if they were constructed as simple beams which are interrupted at each support, or the height of girders would be too great for them to be able to be arranged advantageously under the rails having regard to the construction of the cars. Also the strains on the vertical principal girder would be too great if they were arranged passing over several supports, in consequence of the vertical movability of the

points of support which is connected with the head of the support yielding laterally. All these contradictions in the constructional conditions are avoided when, in accordance with the invention, the heads of the supports are coupled with one another by one broad horizontal lattice-girder in such manner that one individual support cannot bend laterally by itself, but the adjacent supports must participate in its movement.

An exceedingly suitable construction is obtained when the principal chords of this lattice-girder are formed by the solid vertical rail-carrying girders, whereby a horizontal girder of such stiffness is formed that the horizontal deformations of the track are so flat that they can no longer exercise any injurious influence on the smoothness of the running of the car.

In order that the invention may be clearly understood, reference will be made to the accompanying drawing in which one constructional form of viaduct for a suspended railway is represented by way of example, and in which:—

Figure 1 is a side elevation, Fig. 2 a transverse sectional elevation in two different planes, and Fig. 3 a plan, the left-hand side of Fig. 2 being a section in the plane *a—b* and the right-hand side a section in the plane *c—d* in Fig. 3.

Referring to the drawing, the central supports 1 are provided with heads 2, to which are attached the rail carriers 3. The latter are girders of suitable length to which are attached the members 4. The latter together with the rail carriers 3 and the heads 2 of the central support form one flat horizontal lattice-girder, the principal chords of which are the girders 3, the entire lattice-girder being carried by the central supports 1. The car 5 is suspended in known manner from the truck frames 6 which run on the rail 7 carried by the girder 3.

As mentioned above, the horizontal girder comprising the heads 2 of the supports 1, the principal chords 3, and the interconnecting members 4 is made so stiff that the horizontal deformations of the rail 7 from the rectilinear or from the curvature originally given to it are so slight that the smooth running of the car is not injuriously affected. Now owing to the reciprocal displacement of the heads of the supports becoming limited to a very small amount, the advantage is simultaneously obtained that the re-

5 ciprocal vertical displacement of the points of support of the vertical rail carriers becomes so small that these can now be looked upon practically as continuous girders on almost rigid supports. Accordingly it is possible to reduce the height of these girders to such an extent that they can be used with the customary construction of car without their bending too much vertically.

10 In known suspended railways which have been built heretofore the individual bridge-girders are constructed as simple beams between the supports. In consequence of the horizontal movement of the supports in the transverse plane of the viaduct owing to
 15 their bending when they are loaded on one side, the line representing the position of the rails forms beside the curvilinear bend of the individual bridge-girders a polygonal line passing through the junctions of the
 20 bridges, the points of the angles of which are situated under the loaded supports. Correspondingly, in the constructional form of viaduct according to the present invention
 25 the individual sections of the viaduct between each two expansion joints form members of a polygon, the shape of which varies when the viaduct is loaded on one side. The shorter the individual members
 30 are, the more injurious is the effect of the bending of the supports in the transverse plane. In order to make this influence non-injurious, it is desirable to make the connected lengths of viaduct as long as possible.
 5 The length is limited on the one hand by the necessity of providing the above mentioned expansion joints at certain intervals, but still more by the circumstance that the narrow central supports cannot be arranged
 40 as a pivoted pendulum in the longitudinal direction of the railway, because the forces which occur at the bottom end of the shaft of the column are much too great for a practical articulated construction to be possible.
 45 If the supports are made very stiff in the longitudinal direction of the viaduct, however, having regard to the secondary tensions which occur, the length of continuous viaduct which is present in each case could
 50 be only small.

The idea of making the central supports

in the longitudinal direction of the railway as flexible as possible and of constructing between two expansion joints always only one support as a fixed yoke gives, in connection with the principal feature of the invention, a technically very suitable arrangement of the railway viaduct which is distinguished by comparatively small cost of material.

What I claim as my invention and desire to secure by Letters Patent is:

1. An iron elevated railway viaduct for suspended cars comprising in combination a plurality of sections, each section consisting of more than two central supports each having a head, and a flat, uninterrupted, horizontal, rigid lattice-girder, substantially as shown, connected rigidly with the heads of said supports, said sections being connected one with another by expansion joints, as set forth.

2. An iron elevated railway viaduct for suspended cars comprising in combination a plurality of sections, each section consisting of more than two central supports each having a head, two continuous principal chords of a lattice-girder connected with said heads, and interconnecting members, substantially as shown connecting said principal chords, said sections being joined one to another by expansion joints, as set forth.

3. An iron elevated railway viaduct for suspended cars, comprising in combination a plurality of sections, each section consisting of more than two central supports each having a head, and a flat, uninterrupted, horizontal, rigid lattice-girder, substantially as shown, connected rigidly with the heads of said supports, said sections being connected one with another by expansion joints, the moment of inertia of the cross-section of the supports with regard to the transverse plane of the viaduct being as small as is permissible having regard to security from bending, for the purpose specified.

In testimony whereof, I affix my signature in the presence of two witnesses.

RICHARD PETERSEN.

Witnesses:

EDWARD E. HAEMMEL,
JOHANNES F. H. GRUMMEL.