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A. LOCKWOOD

ELEVATED RAILWAY

Filed Oct. 16, 1925

3 Sheets-Sheet 1

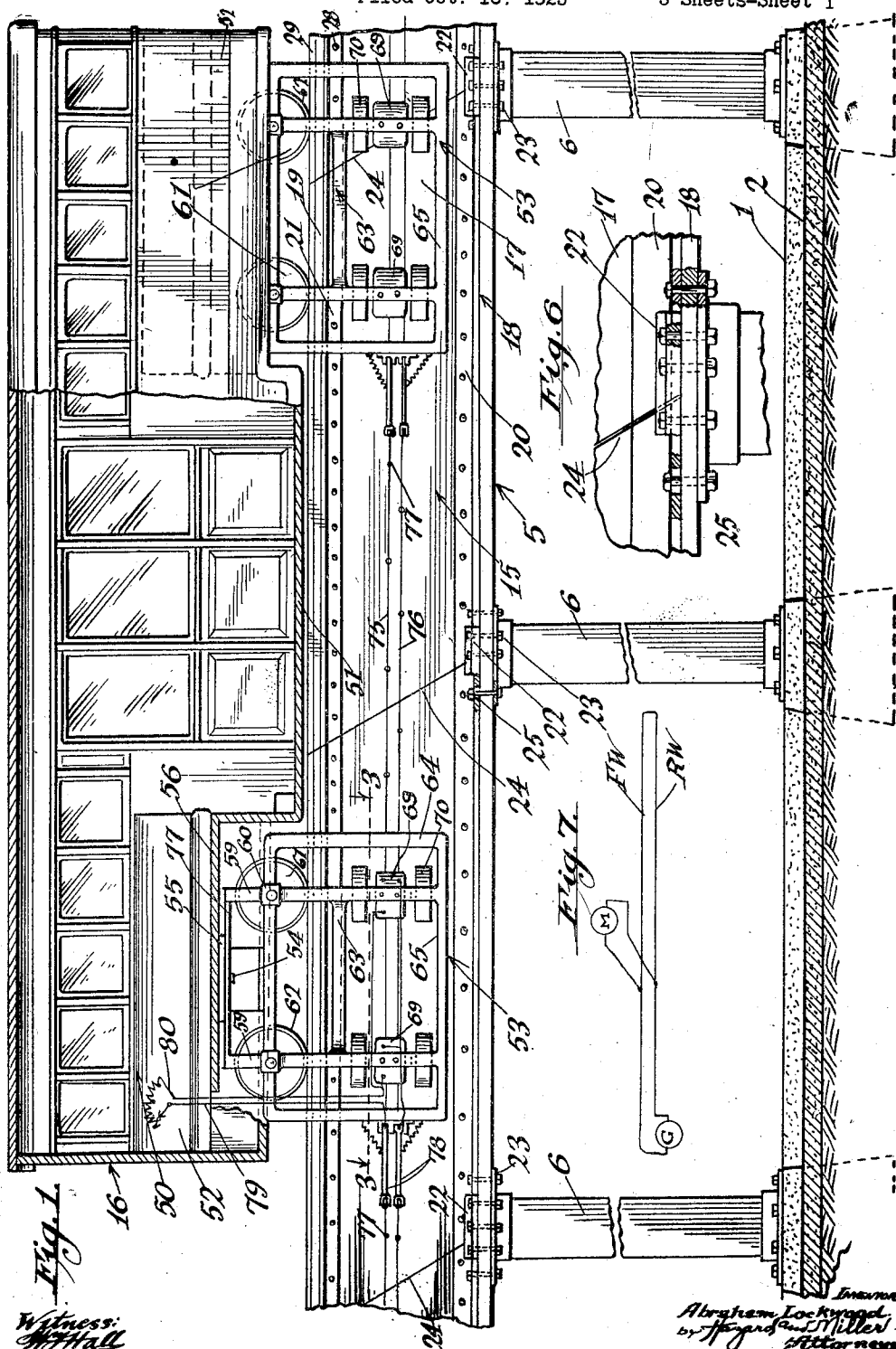


Fig. 1  
Witness:  
W. Hall

Inventor:  
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Sept. 21, 1926.

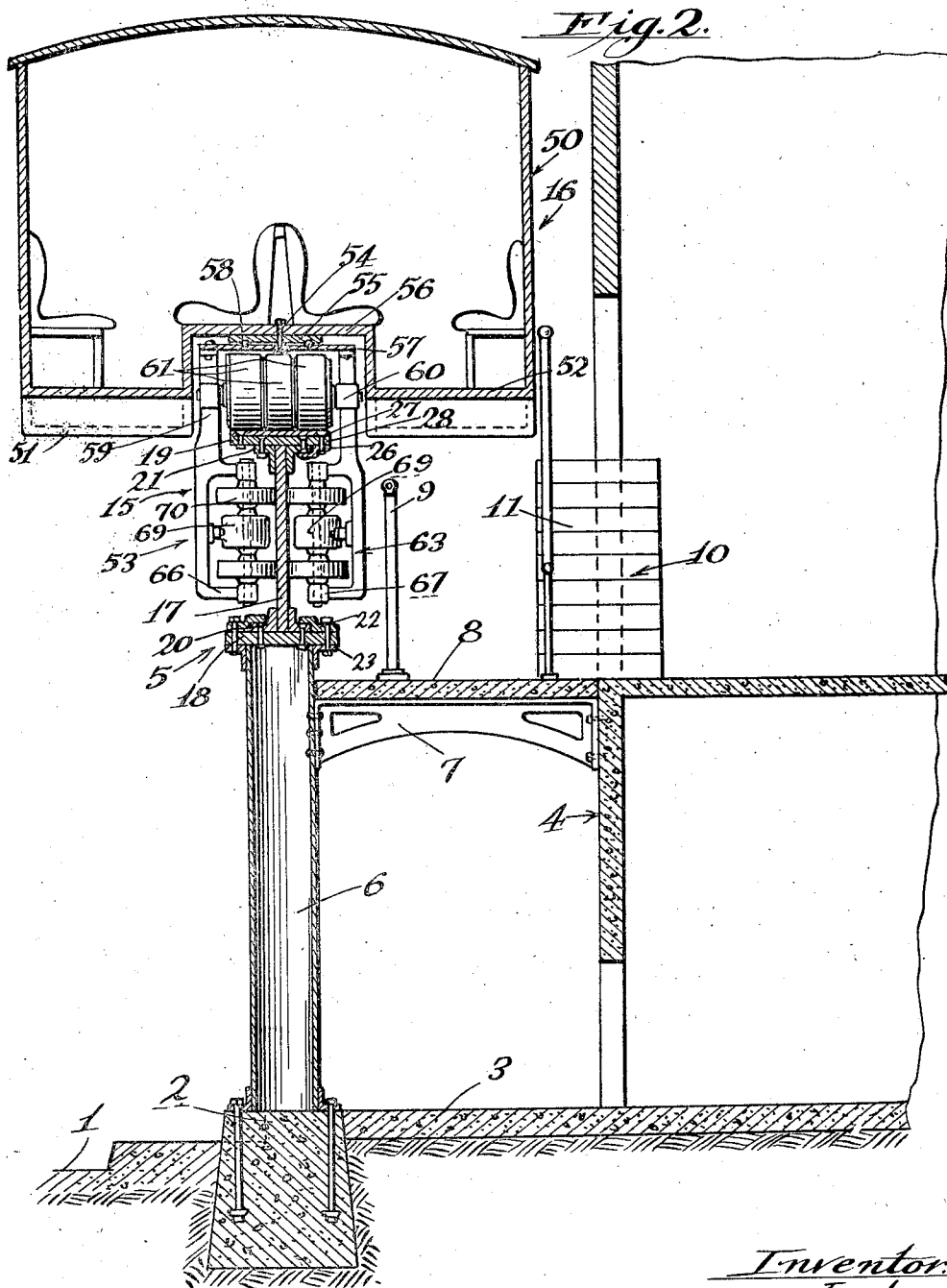
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3 Sheets-Sheet 2



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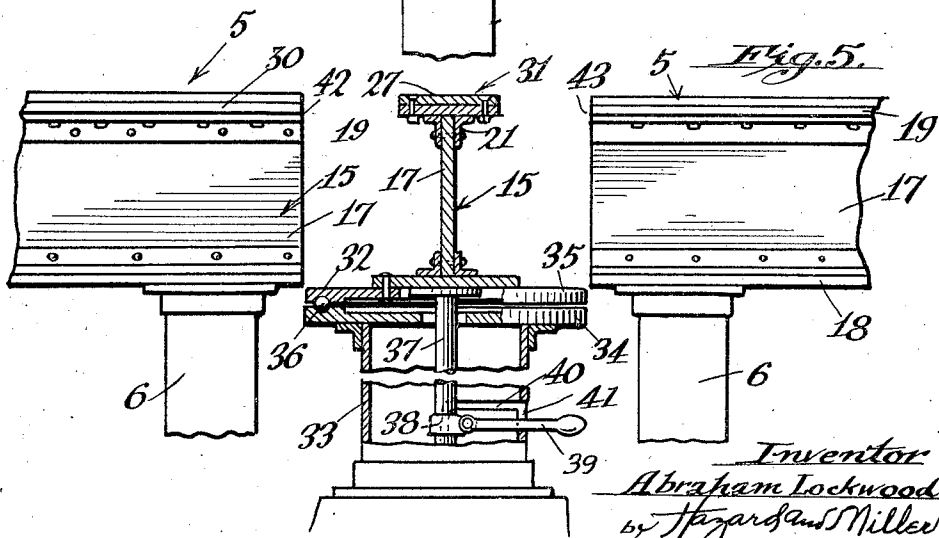
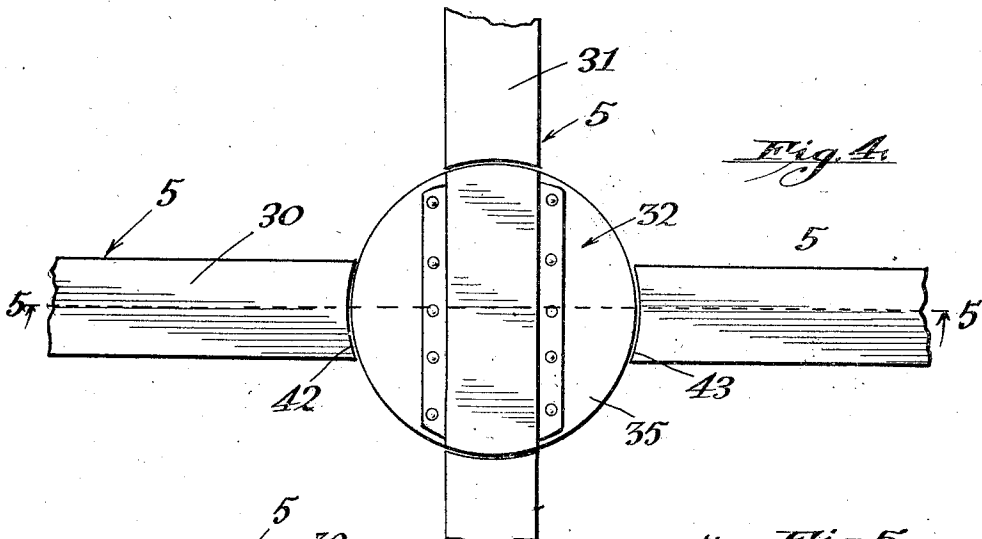
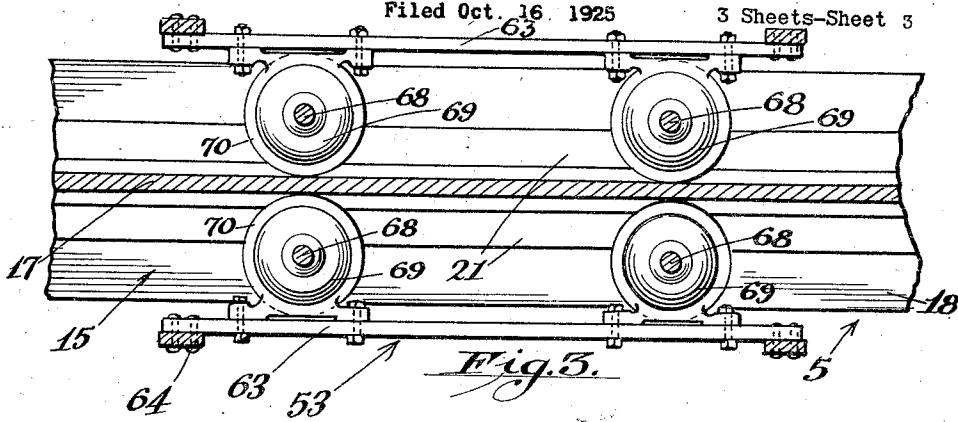
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3 Sheets-Sheet 3



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# UNITED STATES PATENT OFFICE.

ABRAHAM LOCKWOOD, OF LOS ANGELES, CALIFORNIA.

## ELEVATED RAILWAY.

Application filed October 16, 1925. Serial No. 62,781.

My invention pertains to elevated rail-  
ways and embodies the features of the con-  
struction of the track system and a street  
installation as well as the particular type  
5 of running and driving gear for the cars.

An object of my invention is the develop-  
ment of an elevated railway structure which  
may be utilized in congested cities, utilizing  
the elevated structure to support a foot path  
10 above the ground level sidewalk, whereby  
the foot path may be located at substantial-  
ly the second stories of buildings and the  
cars may be boarded from special loading  
and unloading platforms reached from the  
15 said foot paths.

Another feature of my invention in the  
elevated structure is the running track for  
the cars, utilizing a single rail system and  
car support, whereby the running track may  
20 be mounted directly on the top of a series  
of columns, these columns being placed at  
substantially the curb line of the street. The  
elevated structure thus leaves the roadway  
entirely clear of obstructions and forms two  
25 foot paths, one on the roadway level, the  
other elevated at a convenient position to  
have access to the second stories of build-  
ings and allow convenient loading and un-  
loading of the cars. On account of the single  
30 track system the cars may overhang the  
elevated pedestrian foot path.

Another object of my invention is in the  
car mounted on a single track and the drive  
system therefor. This comprises mounting  
35 the cars on a single track with single wheels  
in line run on the top of the track and with  
driving wheels or discs engaging the oppo-  
site side of the web of the track. The cars  
are thus supported above the track and the  
40 center of gravity of loaded cars is above  
the track. In this construction the loading  
may be proportioned between the car struc-  
ture and the driving gear and by lowering  
the car seats in regard to the supporting  
45 wheels to have the center of gravity below  
or on substantially a level with the support-  
ing track.

A feature of my combined equipment of  
the elevated track construction and the spe-  
cial cars with the central supporting wheels  
and depending driving wheels is to allow  
50 travel at very high speeds with safety.

Another feature is to utilize a type of sup-  
porting wheel and lateral driving discs or  
55 wheels, preferably having rubber tires to  
form a quiet traction system.

My invention will be more readily under-  
stood from the following description and  
drawings, in which—

Figure 1 is a side elevation of my ele- 60  
vated track structure with a car mounted  
thereon, showing in partial section the run-  
ning gear and lateral driving discs depend-  
ing from the car;

Fig. 2 is a vertical cross section through 65  
my elevated track structure and through a  
car in a position intersecting the running  
gear; and also indicating the manner of  
loading the track structure to form elevated  
foot paths and loading platforms; 70

Fig. 3 is a detail horizontal section on the  
line 3—3 of Figure 1 in the direction of  
the arrows, showing the type of driving  
discs for driving the car, the discs being  
shown engaging the opposite sides of the 75  
track rail;

Fig. 4 is a plan view of a cross over show-  
ing a turntable type of crossing;

Fig. 5 is a longitudinal section of the cross  
over on the line 5—5 of Fig. 4 in the direc- 80  
tion of the arrows, indicating the control de-  
vice for the turntable mounted in a column.

Fig. 6 is an enlarged elevation in detail  
of the type of rail joints for supporting the  
rail having a high web; 85

Fig. 7 is a diagrammatic illustration of a  
two way electric circuit supplying power to  
the motors on the cars.

Referring first to Fig. 2, the general ele-  
vated structure in regard to city streets is 90  
substantially as follows:

The roadway is designated by the numeral  
1 having a curb 2, a sidewalk 3 at the side  
thereof, the front walls of buildings being  
designated by the numeral 4. An elevated 95  
track structure designated generally by the  
numeral 5 is supported on a series of col-  
umns 6 placed adjacent the curb. Brackets 7  
bridge between the columns and the front  
walls of the buildings and support an ele- 100  
vated foot path 8, which has railings 9 to  
keep the pedestrians away from the cars.  
The loading platforms 10 are preferably  
reached by a series of steps 11 or stairways  
from the second story of the buildings. The 105  
elevated structure would preferably be de-  
signed so that the foot path 8 would be on  
substantially a level with the second stories  
of the buildings and the loading platforms  
10 at a sufficient height so that pedestrians 110  
can walk underneath.

The supporting track ways are indicated

generally by the numeral 15 and are carried to a sufficient height to elevate the cars designated generally by the numeral 16, a sufficient distance above the foot path 8 so that pedestrians may walk underneath the overhanging sides of the cars.

It will thus be seen that with the elevated structure as above described, the roadways are left completely clear, the ground level sidewalk is unobstructed and is roofed over, the elevated foot paths are in a convenient position adjacent the second stories of buildings, the loading platforms are in a convenient position relative to the elevated platforms and to the second stories of the buildings, and the cars may overhang the elevated foot paths without causing inconvenience to the pedestrians thereon. It will be noted also that my elevated structure does not interfere with the lighting of the roadways or of the second stories of the buildings, the only obstruction being by the elevated foot path, which forms a cover for the sidewalk.

The structural details of the elevated tracks is substantially as follows:

As above mentioned a series of columns 6 are spaced along the roadways at substantially the curb line and carry the supporting track ways 15 on the tops of the columns. These track ways comprise a heavy vertical web 17 with flange plates 18 and 19 secured to the top and the bottom of the webs by continuous angles 20 and 21, these elements being riveted together in the ordinary manner of building up an I beam type of girder. At each column angular fish plates 22 are secured to the top of the flange plate 18 outside of the angles 20 and are riveted or bolted to angles 23, the latter being riveted to the columns adjacent the tops thereof. In this manner the track girder is supported from the columns and is of such depth as required by the driving mechanism that the columns may be spaced a considerable distance apart, as it is intended that a track girder will form a complete span from one column to the next.

In order to make a proper joint for the driving gear of the cars, as hereafter described, and to allow for contraction and expansion, the webs at each end form a bevel joint 24, the fish plates are formed on one side of the joint with a slot 25 to allow the whole track girder to expand and contract with changes of temperature, it being understood that one end of each girder would be bolted solid and the other end being supported to have sufficient longitudinal movement for expansion and contraction. The top flange plate 19 at each joint is provided with a fish plate 26 somewhat similar to the fish plates 22, one end of which will be fixed to one track girder and having a slight sliding relation to the other track girder. The

purpose of the upper fish plates is to assure at all times a proper vertical alignment of the web sections of the adjacent rail girders.

In this type of track girder construction it will be understood that as the girders are of a considerable height compared to the width of the web they must be securely riveted to the tops of the columns and carefully aligned to give vertical webs with the upper flange plate 19 being horizontal. A tread plate 27 is secured to the flange plate 19 by countersunk bolts or rivets 28 and forms a run way for the wide wheels of the cars, as hereafter described. This tread plate is designed to be removable when worn, and may thus be readily replaced. These plates would have a type of joint overlapping the breaking joint with the track girders and therefore giving substantially a continuous support for the cars, preventing any action at the joints, as is common with the ordinary type of rails supported on ties.

A type of cross over is illustrated in Figs. 4 and 5 and indicates a right angular crossing of two tracks designated respectively as a main track 30 and a cross over track 31. A turntable 32 is supported on a turntable column 33, which has a bearing plate 34 secured to the top thereof carrying a supporting plate 35 on anti-friction bearings 36. This supporting plate carries the track ways 15. A shaft 37 extends downwardly through the column from the supporting plate 35 and has a collar 38 at the lower end thereof with a pivoted arm 39 extending laterally therefrom. This arm may operate through the slot 40 in the column, the slot having angular offsets 41 to assure that the track is turned the proper amount and is in accurate alignment with either of the three tracks.

It is only necessary that the opposite ends 42 and 43 of the tracks be separated a sufficient distance to allow the driving gear of the cars to pass between and clear such ends. Therefore the turntable and the turning portion of the track may be made comparatively small compared with the size of the cars and the size of the track. Although the cross over is shown as of the right angular type, it will be understood that acute and obtuse angles of cross overs may be formed in the same manner, merely requiring different sizes of turntables to give the proper clearance. A somewhat similar type of turntable may be utilized in switching the cars from one track to another, merely having the tracks on such curvature as the running gear of the cars will allow.

The cars and their supporting and driving gear are substantially as follows, having reference particularly to Figs. 1, 2 and 3.

The car and gear complete is designated

generally by the numeral 16 and comprises a body structure 50, which preferably has a dropped center section 51 and raised end sections 52. The type of car illustrated does not detail the particular seating accommodation or interior arrangement as this may be subject to considerable change, in accordance with the requirements of different elevated railways. The running and driving gear for supporting the cars is designated as a unitary structure by the numeral 53, and is preferably in the form of a pair of trucks at each end of the car. These are mounted to have a slight swivelling action and the swivelling arrangement is more or less diagrammatic, comprising a king bolt 54, a fixed disc 55 secured to the floor 56 of the car body and the disc engaging a supporting plate 57 having anti-friction bearings 58 therebetween. The truck frames 59 hang downwardly from the plate 57 being secured thereto in any suitable manner. These frames carry an axle 60 extending from side to side, on which is journaled the supporting wheels 61, the latter being covered by wide rubber tires 62. The wheels and axles may be mounted in any suitable manner, preferably on anti-friction roller bearings.

The truck frames 59 are illustrated as having depending motor frames 63, each having vertical bars 64 and longitudinal connecting rails 65. These frames are provided with inturned brackets 66 extending inwardly between the web plate 17 of the track system. The brackets 66 are provided with vertical journals 67, in which are mounted the driving axles 68, the latter being connected to the motors 69. For the sake of simplicity the connection is shown direct, although the axles may be provided with gears driven by pinions from motors mounted on the motor frames. The driving axles 68 carry driving discs or wheels 70, which are preferably rubber covered and are positioned to bear against opposite sides of the track web 17.

From the above description it will be seen that the car is carried by a pair of trucks at each end, each of these trucks having a slight swivelling movement in relation to the car body and that the weight of the cars is carried on wheels having a wide tread, this being of sufficient width to allow use of rubber tires, hence giving a quiet and to a certain extent resilient action to the supporting wheels. Although in the design shown the car body is now shown as spring supported, it is to be understood that spring suspension may be introduced if desired, and necessary, the springs being omitted to simplify the illustration.

The driving wheels or discs bear against opposite sides of the track web and would preferably have a driving surface of in-

flated tires, in order to always have contact with the web and to maintain a resilient bearing thereon. On account of the type of tires used, the driving discs will always have contact with either one side or the other of the web and allow for the slight and unpreventable side sway of the car.

The balancing of the car may be very accurately adjusted in regard to the positioning of the center of gravity in regard to the supporting wheels and track system. It will be understood that the driving trucks must be of considerable weight which is necessarily below the track surface and the floor of the car need only be at a slight elevation above the wearing track in order to clear the cross overs. However, if desired the body of the car may extend below the track surface, this merely necessitating wider cross overs to accommodate the full width of the car.

The cars may be driven by any suitable system, that shown being by the two line type of feed and return circuits. In the illustration the power is carried by trolley wires 75 and 76 supported from the track web by insulators 77 properly designed to allow the trolleys 78 to bear against the wires without pressing the wires against the metal web. The electric leads 79 are indicated diagrammatically from the trolley through a controller 80 indicated diagrammatically to the motors and hence to the return circuit. It will be understood that the power feed may be through rails suitably supported in any conventional manner.

The general type of electric circuit is indicated in Fig. 7, in which G. indicates a generator, F. W. feed wire, R. W. return wire and M. the motor on a car.

As the particular drive for cars is not a feature of my invention, these may be driven by storage batteries, internal combustion engines, or the combination internal combustion engine and electric drive.

I have not illustrated any particular type of braking system on the cars, but it will be understood that any type suitable for heavy trucks or motor stages will be satisfactory and would preferably act on drums secured to the load carrying wheels 61.

The type of car illustrated in Figure 1 is intended to disclose a light type of elevated car for frequent and rapid service, but it will be understood that the carrying capacity of the cars may be increased or diminished, in accordance with the requirements of the particular railway system. However there should be a sufficient number of supporting wheels so that these may have rubber tires without putting too great a load on the tires. For some types of cars the supporting wheels may have pneumatic tires of the type used in pairs on heavy trucks and motor stages. The equipment

may also provide for connecting the cars in trains controlled by a single motorman, if desired.

It will thus be seen that my total invention comprehends a simplified elevated track system placed in convenient locations with the least obstruction to the present surface travelling, provides conveniently positioned foot paths adjacent the second stories of buildings and interferes very little with the lighting of the streets and the sidewalks and ground floors of the buildings.

The type of car and the manner of supporting it and driving on the deep girders allows the use of resilient tire, thereby eliminating the chief source of noise in elevated structures. Moreover, on account of the engagement of the driving wheels with the web of the girder, derailment is prevented, unless the whole girder structure collapses. Therefore the cars and trains may be driven at a much higher speed than is now possible with the ordinary elevated railway system.

Other detail advantages will be seen from the above description and drawings.

It is manifest that my invention in its various aspects of elevated track structure and general city installation, the cars and running gear may be considerably changed to suit special requirements or circumstances and future development, without departing from the spirit of my invention, as set forth in the description, drawings and claims.

Having described my invention, what I claim is:

1. An elevated railway comprising in combination a single track railway supported on a series of columns, said columns being positioned at substantially the curb line of the street, having a roadway on one side of the columns and a sidewalk on the other, the track being in the form of a single deep girder of the I-beam type having a web of considerable depth compared to the width of the flanges, a foot path supported by the columns adjacent the second stories of buildings, the foot path being below the track and adapted to form a path for pedestrians substantially parallel and spaced from the web of the track, and loading platforms spaced along the foot path with steps leading from the foot path and from the second stories of buildings thereto.

2. An elevated railway as claimed in claim 1, having in addition cars supported on a single track, said cars having load supporting wheels bearing on the upper surface

of the track, having driving wheels bearing against the web of the track and motors connected to the driving wheels, said motors being mounted in a frame below the supporting wheels and positioned adjacent the web of the track.

3. An elevated railway as claimed in claim 1, having in addition cars supported on a single track, said cars having load supporting wheels bearing on the upper surface of the track and having driving wheels bearing against the web of the track, the driving wheels being driven by motors suspended below the upper surface of the track and adjacent the driving wheels, the body of the car extending sideways beyond the supporting wheels and overhanging the foot path.

4. An elevated railway comprising in combination a track structure in the form of an I type of girder having a web of considerable depth, a car structure having supporting wheels running on the upper flange of the girder, said car structure having a frame with driving wheels, said driving wheels engaging the web of the girder on opposite sides thereof and electric motors mounted in the frame below the upper flange of the girder, said motors being connected to the driving wheels.

5. In an elevated railway, a car having a car body, supporting wheels at each end centrally positioned and in alignment, said wheels being adapted to support the car on a single track, truck frames depending from the car body, driving wheels mounted in said frames, said driving wheels being positioned below the car body and adapted to engage opposite sides of a supporting track structure and a driving mechanism for said wheels mounted in the said frames and electric motors in the frames below the supporting wheels adjacent the sides of the supporting track structure, said motors being connected to the driving wheels.

6. In an elevated railway as claimed in claim 5, in which the driving wheels are vertically supported and adapted to engage the opposite sides of the flange of an I type of track girder, said wheels having a traction surface of pneumatic tires and the supporting wheels having flat treads adapted to engage the upper flange of an I type of girder, said tread having a resilient covering.

In testimony whereof I have signed my name to this specification.

ABRAHAM LOCKWOOD.