

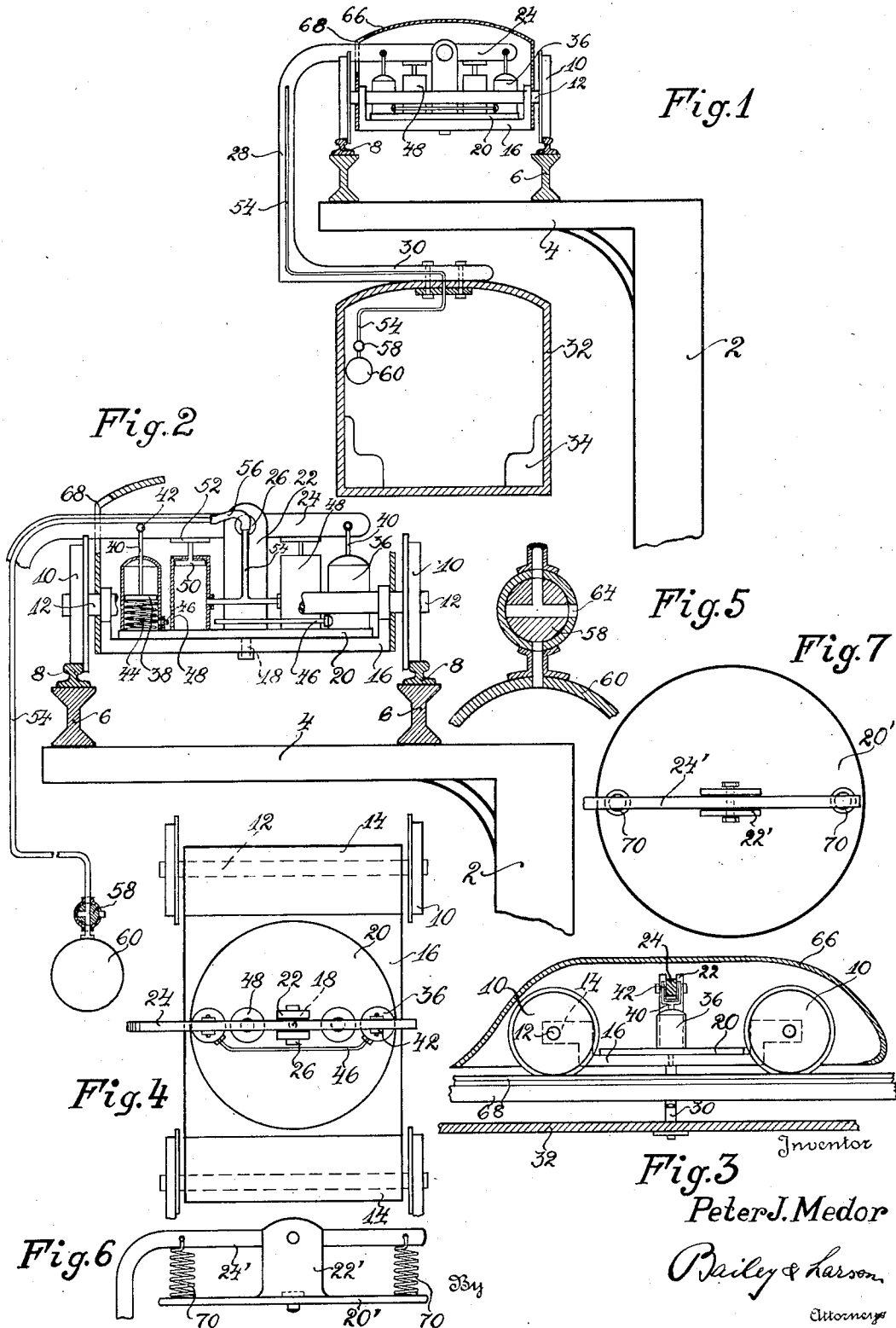
Jan. 16, 1934.

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1,944,100

SUSPENDED RAILWAY SYSTEM

Filed Aug. 30, 1933



## UNITED STATES PATENT OFFICE

1,944,100

## SUSPENDED RAILWAY SYSTEM

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Application August 30, 1933. Serial No. 687,487

12 Claims. (Cl. 104—89)

My invention relates to suspended railway systems and more particularly to a construction for stabilizing such systems.

I am aware that various types of suspended railway systems have been built and that some of these have been operated to a certain extent. However, in spite of its simplicity, cheapness and speed, this type of transportation has not gone into general use because of certain inherent disadvantages which it is the object of the present invention to overcome.

The principal objection to systems of this type is the rocking or lurching of the cars. Naturally, when the car is suspended below the track on which it runs, it is subjected to considerable centrifugal forces and to large wind pressure. These forces cause the car to rock and swing to such an extent that riding in a car of this type at any speed which would be satisfactory for rapid transportation is highly uncomfortable. Furthermore, such rocking is very dangerous as the car is likely to strike the supporting structure unless some means to check this swinging movement is provided.

While various methods have been attempted to accomplish this result, these have been unsatisfactory. Some proposed arrangements do not actually prevent such rocking. Others, because of the high friction involved, retard the movement of the train to such an extent that any satisfactory speed is impossible. In other cases the stabilizing devices wear out so quickly that the cost of replacement is prohibitive.

The primary object of the present invention is to provide a construction for a suspended railway system in which any unpleasant or dangerous rocking is prevented. A further object of the invention is to produce a simple and inexpensive construction for accomplishing this result.

Furthermore, the arrangement according to my invention is not subjected to any heavy friction or wear and is therefore very durable. It does not affect the speed of the car or increase the friction resisting the movement of the same in any manner. For this purpose, I prefer to mount my stabilizing device on the carriage which supports the car, and to permit a yieldingly retarded rocking movement between the arm which supports the car from the carriage and the carriage itself.

The invention is particularly applicable to the type of car which is supported from a carriage running on two rails.

Still another object of my invention is to pro-

vide means which can be controlled either automatically or by the operator of the car for overcoming any rocking motion which may have occurred and for positively moving the car to an upright position at any time, as for example, when the train is approaching a station. The clearance in stations is so small that some device of this type is necessary for satisfactory operation.

A combination of factors enters into the question of producing a practical arrangement of this type. A transportation system to be used in cities must run high enough to permit vehicles to pass beneath it. The car itself must be as low as is practically possible so that passengers can reach the system with a short climb from the street level. The supporting structure should be as low as is practical in order both to reduce the expense of the system and to cut off as little light as possible from buildings on the street. Finally, the riding comfort of the passengers is of great importance. This can be accomplished only if the seats or floor of the car do not tilt to sharp angles. In my arrangement this result is accomplished by having the car swing on a long radius so that any lateral movement of the car will result only in a slight angular movement. I accomplish this result by pivoting the arm which supports the car on the top of the carriage and above the track.

An arrangement of this type permits the track to be arranged just above the car, thereby cutting off little light from the street and reducing the cost of the system, while at the same time the passengers are able to ride in comfort in the cars.

Other objects and advantages of the invention will appear more fully from the following description when taken in conjunction with the accompanying drawing which forms a part thereof.

In the drawing:

Fig. 1 is a front view of my system with the car and carriage casing in section;

Fig. 2 is an enlarged view of the carriage portion of the same with the axle broken away;

Fig. 3 is a side elevation of the carriage with the casing cut away;

Fig. 4 is a top plan view of the carriage with the casing removed;

Fig. 5 is a detail cross section through the control valve for the levelling device;

Fig. 6 shows in front elevation a second form of stabilizing mechanism, and

Fig. 7 is a top plan view of the same.

My system is primarily intended to be supported on uprights 2 which extend sufficiently high to permit the passage of other traffic along a street beneath the cars. These uprights are provided with horizontal arms 4 on which are carried longitudinal supporting members 6 which support the rails 8, thus forming a track.

The carriage comprises wheels 10 mounted on axles 12, each carriage preferably having two such axles. Mounted on these axles are the raised end portions 14 of a frame, the central portion 16 of which is bent downwardly almost to the plane of the rails. Pivoted at 18 on the flat portion 16 is a disc 20, this disc being thus permitted to turn about a vertical axis.

On top of the disc 20 is an upstanding post 22 comprising two spaced upright members. An arm or lever 24 is pivoted at 26 between these uprights about an axis extending in the direction of travel of the carriage. This arm extends on each side of its pivot and, on the side opposite the supporting upright 2, extends outwardly beyond the carriage and the horizontal support 4. The arm is then provided with a downwardly extending vertical portion 28 and a further horizontal portion 30 extending beneath the track and supports. A car 32 provided with seats as at 34 is secured to the horizontal portion 30 in such a manner that the center of gravity of the whole system lies in a vertical plane extending through the center of the carriage and the pivot 18. The car is thus able to swing or rock to a certain extent with respect to the carriage.

In order to retard and resist such rocking movement, cylinders 36 are mounted on the disc 20 on opposite sides of the post 22 and preferably at equal distances therefrom. Slidably mounted in these cylinders are pistons 38 the rods 40 of which extend upwardly and are pivoted at 42 to the lever 24 at equal distances from its pivot. Springs 44 or hydraulic shock absorbers are preferably provided in the cylinders below the pistons. The lower ends of the cylinders are connected by a pipe 46 of reduced dimensions.

This construction is sufficient to stabilize the car and to prevent any unpleasant or dangerous rocking. As the car is subjected to various forces tending to swing it away from a vertical position, it will be permitted to swing to a certain extent, but the rate of such swinging motion will be retarded by the slow movement of the fluid in the cylinders 36 through the pipe 46. The diameter of this pipe is made so small that the fluid can only pass from one cylinder to the other, as it must do because of its incompressibility when the car tends to swing, at a relatively slow rate. Since the car cannot swing suddenly, any jerking or sudden swaying motion is avoided and the only movement is a very slow swinging action. As the forces acting on the car do not continue for a sufficient length of time to move the car any very considerable distance at this very slow rate, the car never swings far enough to strike the supporting structure. Furthermore, such swinging is resisted by the hydraulic shock absorbers or springs 44 and by the natural tendency of the car to return because of gravity to its vertical position. My arrangement is therefore sufficient to do away with the large and sudden swinging motions which have been the great objection to the use of such systems in the past.

When coming into a station, however, it is desirable to have the car exactly in its normal vertical position. In the average station the clearance between the car and the platform is

only about two inches and the car should be permitted to swing during its normal travel considerably more than this. Some means must therefore be provided for exerting a positive pressure on the arm 24 to return the car to its normal position.

I prefer to accomplish this result by placing additional cylinders 48 on each side of the post 22. Slidably mounted in these cylinders are pistons 50 having piston rods with enlarged heads 52 at their upper ends. These heads lie directly beneath the arm 24 and the length of the piston rods and pistons is such that the heads 52 when the pistons are at the upper ends of the cylinders will just touch the arm when the same is in its horizontal position, or when the car is vertical. The lower ends of the two cylinders are connected by a pipe 54 including a flexible portion 56 adjacent the pivot of the arm to a valve 58 which is preferably located in the carriage. The other side of this valve is connected to a tank 60 or other source of fluid under pressure, this being for instance the air used in braking the vehicle. The pipe 54 preferably runs along and is supported by the arm 24 and its extensions 28 and 30.

The construction and operation of the valve 58 should be clear. When it is in the position shown in Fig. 5, any air or other pressure fluid in the cylinders 48 may escape freely through the opening 64. If the valve is turned 90° in a counter-clockwise direction, however, pressure fluid will be admitted from the source 60 through the pipe 54 to the pistons 48. These pistons will then be pushed upwardly. Supposing that the car has swung to the right in Figs. 1 and 2, the member 52 of the right hand cylinder will rise to its highest position without resistance. The head 52 on the left hand piston, however, will strike the downwardly inclined part of the arm and will exert a pressure which will not be counter-balanced until the arm reaches its horizontal position.

Obviously the valve 58 may be controlled either automatically or by the operator of the vehicle. When coming into a station it is turned to admit air under pressure to the cylinders 48 and the car is gradually and yet quickly restored to its vertical position. Too rapid movement of the car is obviously prevented by the cylinders 36.

Preferably the frame 16 and the stabilizing and levelling mechanism, are enclosed by a casing 66 which is provided with a slot 68 through which the arm 24 extends. This casing may be stream lined so as to reduce the air resistance of the carriage.

Figs. 6 and 7 show a different type of mechanism for resisting movement of the car supporting arm. In this arrangement a disc 20' carries an upstanding post 22' in which is pivoted an arm 24'. On either side of the disc and at equal distances from the post 22' are arranged compression coil springs 70 between the arm 24' and the disc 20'. These springs will resist and retard movement of the arm 24' and will thus tend to hold the car against rocking and to return it to its normal vertical position.

While I have described my invention primarily as one for commercial use for carrying passengers or other transportation services, I wish it to be clearly understood that the invention is likewise applicable to toys in which simulated railway cars or other objects are suspended beneath a track. Therefore, when the claims recite a "suspended railway system", I intend to cover

not only commercial railways but also toys of this type.

While I have described herein some embodiments of my invention, I wish it to be understood that I do not intend to limit myself thereby except within the scope of the appended claims.

I claim:

1. In a suspended railway system, a carriage adapted to travel on a two-rail track, an arm pivoted on the upper side of said carriage about an axis parallel to the direction of travel of the carriage and extending therebeneath, a car carried by said arm beneath said carriage at a relatively short distance below said track whereby said car is arranged close to said track but swings on a relatively long radius, and means mounted on said carriage and substantially fixed with respect to the plane of the track for yieldingly resisting rocking of said arm.

2. In a suspended railway system, a carriage adapted to travel on a two-rail track, an arm pivoted on said carriage at a point above said track about an axis parallel to the direction of travel of the carriage and extending therebeneath, a car carried by said arm beneath said carriage at a relatively short distance below said track whereby said car is arranged close to said track but swings on a relatively long radius, a pair of cylinders mounted on said carriage, pistons slidable in said cylinders, piston rods connected to said pistons and to said arm, a liquid in said cylinders, and a tube of reduced dimensions connecting said cylinders.

3. In a suspended railway system, a carriage adapted to travel on a two-rail track and including a plurality of axles, a frame mounted on said axles, a post supported by and extending upwardly from said frame, an arm pivoted on said post about an axis perpendicular to the axis of said axles, said arm extending outwardly beyond the side of the carriage, then downwardly and then beneath the carriage, a car secured to said arm beneath the carriage at a relatively short distance below said track whereby said car is arranged close to said track but swings on a relatively long radius, and means on said carriage and substantially fixed with respect to the plane of the track for yieldingly resisting rocking of said arm.

4. In a suspended railway system, a carriage adapted to travel on a two-rail track and including a plurality of axles, a frame mounted on said axles, a post supported by and extending upwardly from said frame, an arm pivoted on said post about an axis perpendicular to the axes of said axles, said arm extending outwardly beyond the side of the carriage, then downwardly and then beneath the carriage, a car secured to said arm beneath the carriage at a relatively short distance below said track whereby said car is arranged close to said track but swings on a relatively long radius, said arm extending on both sides of its pivot, and hydraulic means connected to said arm on each side of its pivot to retard rocking of said arm in either direction.

5. In a suspended railway system, a carriage adapted to travel on a two-rail track and including a plurality of axles, a frame mounted on said axles, a post supported by and extending upwardly from said frame, an arm pivoted on said post about an axis perpendicular to the axes of said axles, said arm extending outwardly beyond the side of the carriage, then downwardly and then beneath the carriage, a car secured to said arm beneath the carriage at a relatively short distance

below said track whereby said car is arranged close to said track but swings on a relatively long radius, said arm extending on both sides of its pivot, cylinders mounted on said frame on either side of said post, a liquid in said cylinders, a piston in each cylinder connected to said arm on either side of said post, and a tube of reduced size connecting said cylinders.

6. In a suspended railway system, a carriage adapted to travel on a two-rail track and including a plurality of axles, a frame mounted on said axles, a disc pivoted on said frame about a vertical axis, a post mounted on and extending upwardly from said disc, an arm pivoted on said post about an axis perpendicular to the axes of said axles, said arm extending outwardly beyond the side of the carriage, then downwardly and then beneath the carriage, a car secured to said arm beneath the carriage at a relatively short distance below said track whereby said car is arranged close to said track but swings on a relatively long radius, said arm extending on both sides of its pivot, cylinders mounted on said disc on either side of said post, a liquid in said cylinders, a piston in each cylinder connected to said arm on either side of said post, and a tube of reduced size connecting said cylinders.

7. In a suspended railway system, a carriage adapted to travel on a track, a car, means to suspend said car beneath the carriage normally at a point in substantially vertical alignment with its connection to the carriage in such a manner as to permit said car to rock with respect to the carriage out of its normal position during travel, means to retard rocking of said car, and selectively operable means to restore said car to its normal position.

8. In a suspended railway system, a carriage adapted to travel on a track, a car, means to suspend said car beneath the carriage normally at a point in substantially vertical alignment with its connection to the carriage in such a manner as to permit said car to rock with respect to the carriage out of its normal position during travel, and manually controlled means to restore said car to its normal position and hold it rigid with said carriage in such normal position.

9. In a suspended railway system, a carriage adapted to travel on a track, a car, means to suspend said car beneath the carriage normally at a point in substantially vertical alignment with its connection to the carriage in such a manner as to permit said car to rock with respect to the carriage out of its normal position during travel, means to retard rocking of said car, and normally inoperative means independent of said retarding means for positively returning said car to its normal position.

10. In a suspended railway system, a carriage adapted to travel on a track, an arm pivoted on said carriage and extending therebeneath, a car carried by said arm beneath said carriage normally at a point in substantially vertical alignment with the pivot of said arm, said arm permitting said car to rock with respect to said carriage out of its normal position during travel, means on said carriage to retard rocking movement of said arm in either direction, and normally inoperative means independent of said retarding means for positively returning said arm to its normal position.

11. In a suspended railway system, a carriage adapted to travel on a track, an arm pivoted on said carriage and extending therebeneath, a car carried by said arm beneath said carriage normal-

ly at a point in substantially vertical alignment with the pivot of said arm, said arm permitting said car to rock with respect to said carriage out of its normal position during travel, means on said carriage to retard rocking movement of said arm in either direction, and normally inoperative means independent of said retarding means for positively returning said arm to its normal position, said last means comprising cylinders, means to supply fluid under pressure to said cylinders, pistons mounted in said cylinders, and means on said pistons engaging said arm.

12. In a system as claimed in claim 6, other cylinders on said disc on either side of said post, pistons mounted in said last named cylinders, means on said last named pistons engaging said arm on either side of its pivot, and manually controlled means to supply fluid under pressure to said cylinders.

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