Aug. 27, 1963 W. GRUBE 3,101,678

SUSPENSION RAILWAY

Original Filed March 19, 1957 2 Sheets-Sheet 1

Fig. 3

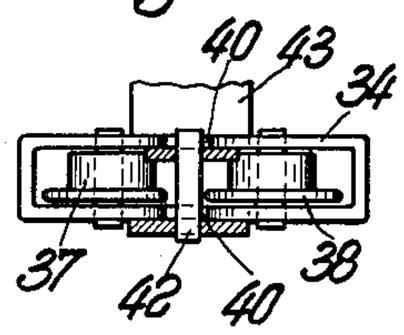

Fig. 2

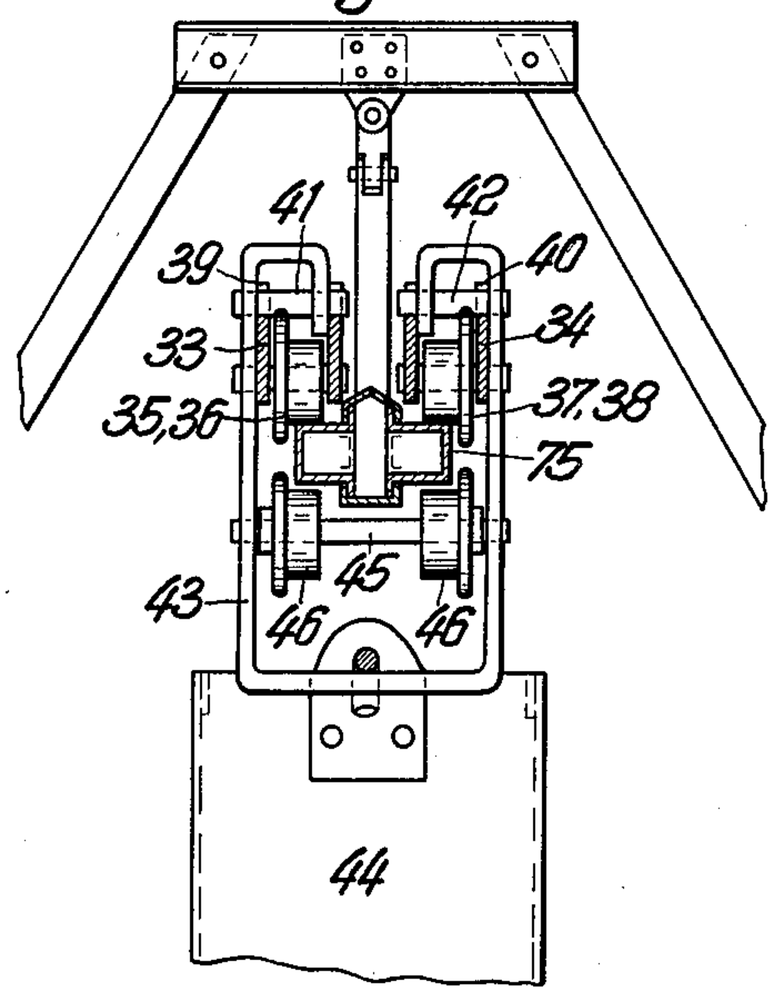

Fig. 1

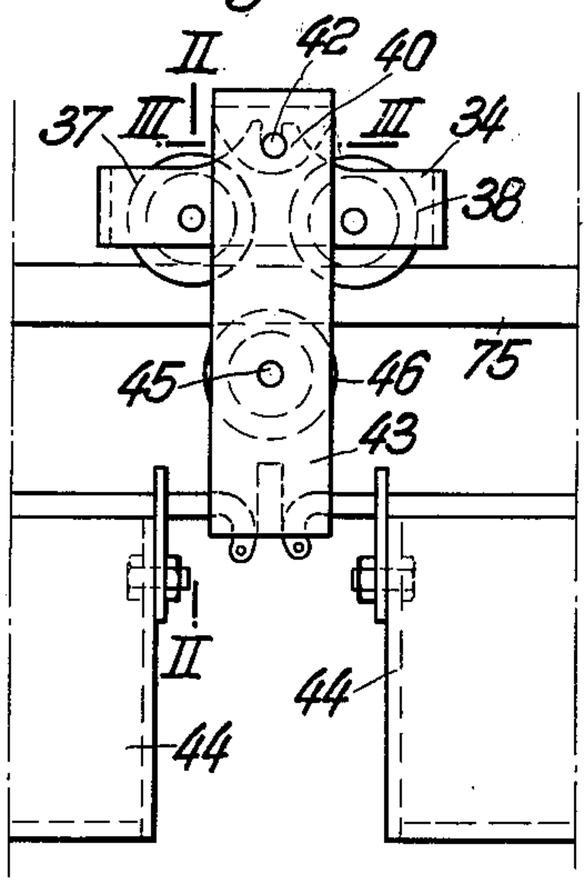

Fig. 4

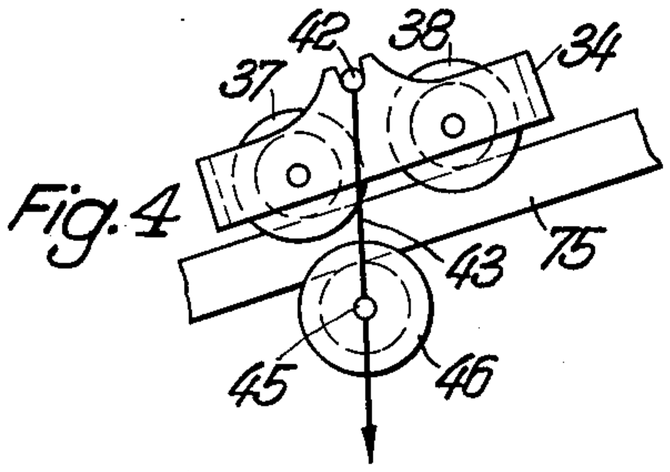

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Fig. 5

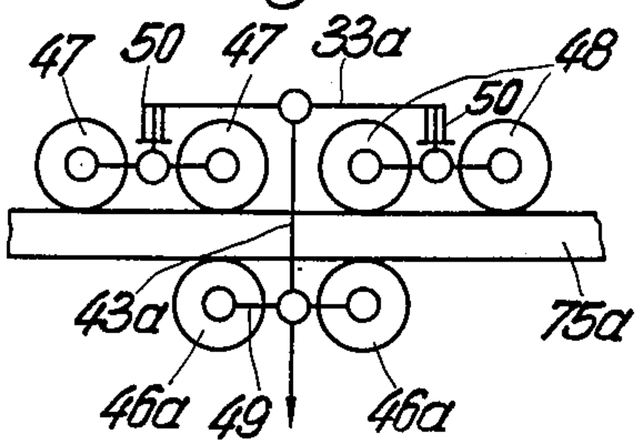


Fig. 6

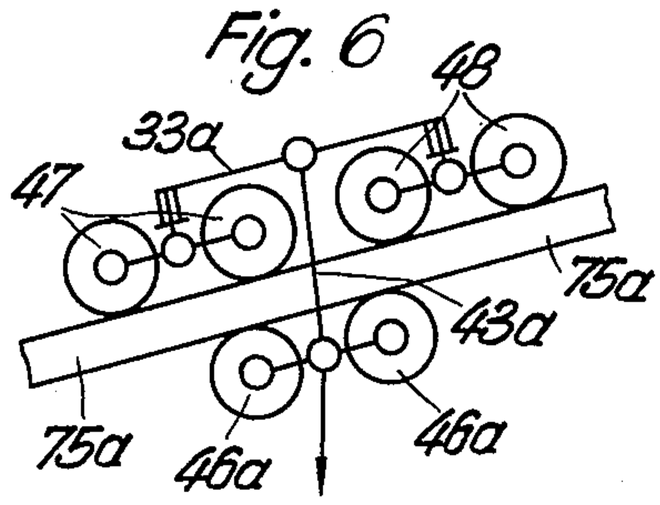


Fig. 7

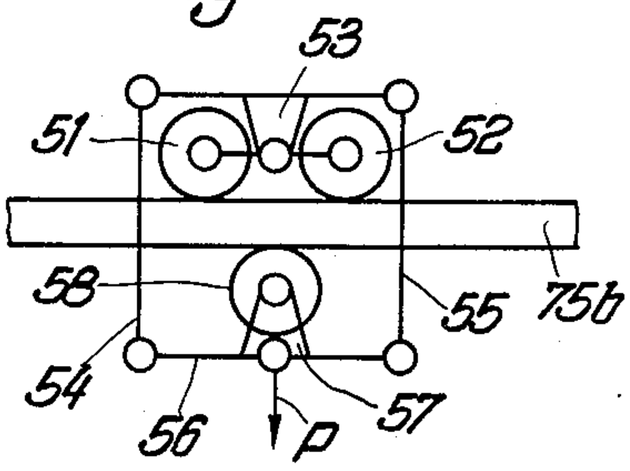


Fig. 8

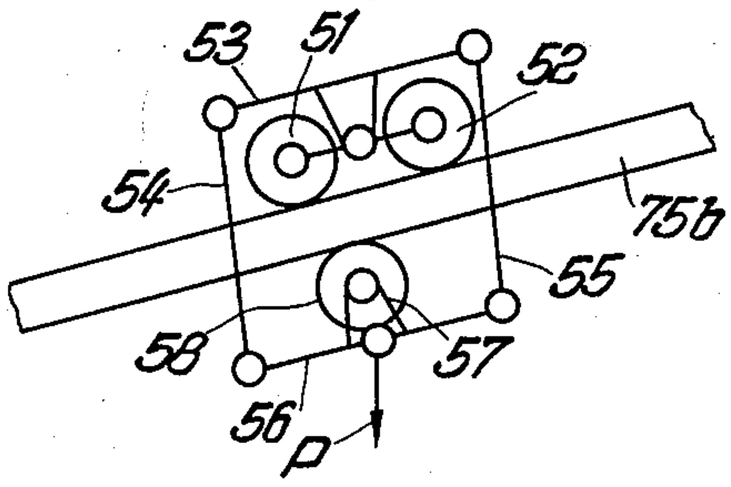


Fig. 9

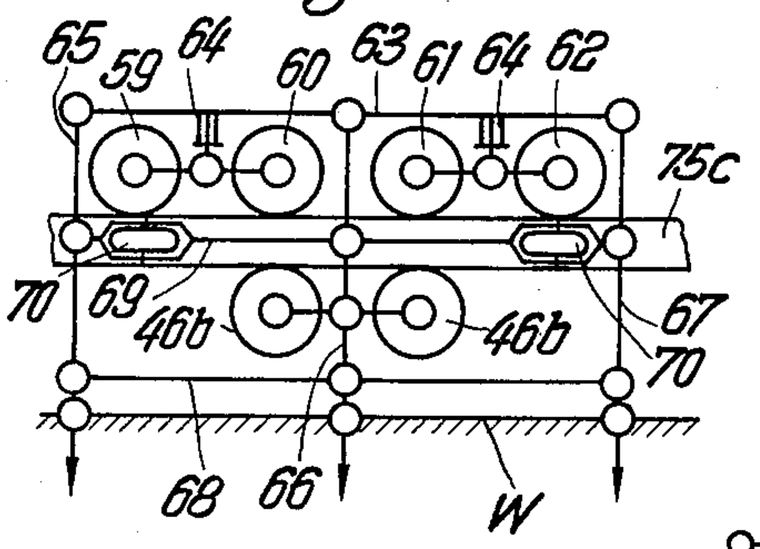


Fig. 10

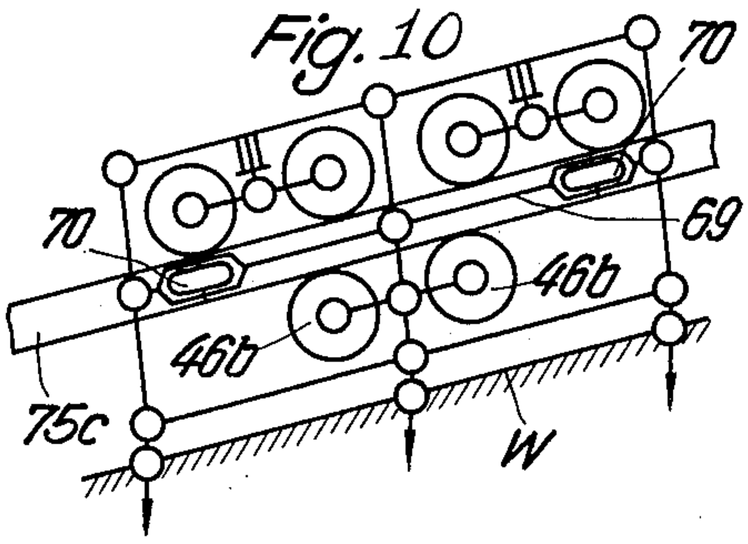
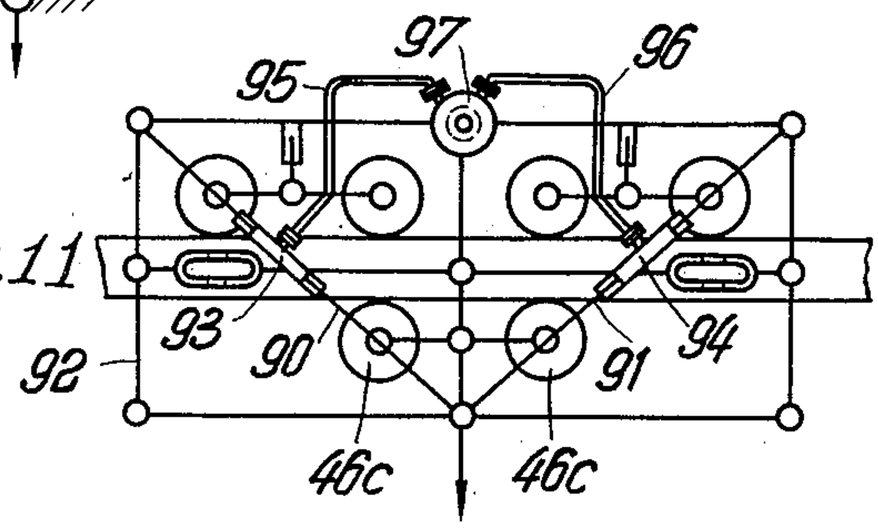


Fig. 11



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SUSPENSION RAILWAY

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Original application Mar. 19, 1957, Ser. No. 647,060, now Patent No. 2,974,608, dated Mar. 14, 1961. Divided and this application Jan. 10, 1961, Ser. No. 81,792

1 Claim. (Cl. 104—95)

The present invention relates to a suspension railway consisting of at least one over-head rail track composed of a plurality of rail sections which are suspended on suitable supporting elements which, in turn, are mounted on cables or a latticed framework connecting the supporting pillars of such railway with each other, and on which persons or goods may be transported by means of traveling trucks, each of which is provided with at least one check wheel which may be pressed upwardly against the lower surface of the rail track.

This application is a divisional application of my application Serial No. 647,060 filed on March 19, 1957, now Patent No. 2,974,608.

The check wheels of the traveling gears of known suspension railways always engage with the rail track under pressure from below not only when the track is inclined but even when it extends horizontally. Therefore, such check wheels always exert a considerable frictional retarding force which then has to be overcome by an increase in driving force.

An object of the present invention is, therefore, to provide a traveling truck for an over-head-rail track which is provided with at least one check wheel adapted to be entirely disengaged from the lower surface of the rail track along horizontal portions of the track, or, at any rate, to engage these portions only loosely and without considerable friction. The check wheel is adapted to engage with the lower side of the rail track when the latter is upwardly or downwardly inclined at a pressure depending upon the degree of inclination of the track and the weight of the load which depends from the traveling gear.

One object of such a traveling gear is to prevent any detrimental effect upon the universal flexibility of the connections between the adjacent rail sections as may be caused by the continuous pressure and friction of the check wheels of the traveling gear upon the lower surface of the rails, and further to attain a considerable saving in the energy required to drive the suspension railway by reducing the usual friction of the check wheels on the rail track when the traveling gear runs along a horizontal portion.

Another object of such a traveling gear is to increase the pressure and friction of both the running and check wheels thereof upon the upper and lower surfaces of the wheel track when the traveling gear runs along an upwardly and downwardly inclined track. Thus, when the traveling gear runs downwardly, such wheel pressure upon both sides of the rail or rails exerts a braking action upon the downward movement, while when it runs upwardly, the pressure of the check wheels upon the lower rail surface increases the pressure of the running wheels on the rail track so as to enable the driving means to overcome the gradiant more easily. In the present case the term "check" is used to denote braking action or reduction in speed although this term is one of convience and should be considered to include all wheels which are applied to the rail in a direction opposite to the force applied by the running wheels.

These objects and advantages of the present invention may be attained according to the invention by supporting the adjacent rail sections of the track so that they are substantially freely movable relative to their location bearing

supports which, in turn, are mounted on the supporting elements connecting supporting pillars via a latticed framework or cable structure. The ends of the adjacent rail sections of each track are connected with each other by a ball-and-socket joint. These objects and advantages of the invention are further attained by the provision of a suspension-railway truck which is adapted to roll on wheels or rollers along the rail track and forms a flexible frame on which a load of any kind, consisting of persons or material, may be suspended, and which is provided with at least one check wheel roller which is adapted to engage from below against the rail track or rail tracks. While on a horizontal track, such flexible frame retains its normal shape, and the check wheels will not or will only loosely engage the lower side of the track. The weight of such a load, which always acts upon the flexible frame perpendicularly thereto, will, when the traveling gear moves along an upwardly or downwardly inclined track, deform the frame and thereby reduce the distance between the running wheels and check wheels so that the latter will then engage the lower side of the track and both sets of wheels will run on the track with an increased frictional retarding force while the wheels press against the track from opposite sides.

A further object of the present invention is to provide a traveling gear and truck of the type described above with an additional mechanism which permits a positive engagement of the check wheels upon the rail track regardless of any inclination thereof so as to control the braking action of such check wheels when the traveling gear runs along an inclined track, and to permit such braking action to be applied when the traveling gear runs along a horizontal track.

These and still further objects, features and advantages of the present invention will be apparent from the following detailed description and the accompanying drawing in which:

FIG. 1 is a side view of a simple traveling gear according to the invention;

FIG. 2 is a cross-sectional view taken along line II—II of FIG. 1;

FIG. 3 is a cross-sectional view taken along line III—III of FIG. 1;

FIG. 4 is a simplified side view of the traveling gear according to FIG. 1 on an inclined rail track;

FIG. 5 is a diagrammatic illustration of a modification of the traveling gear, according to the invention, on a horizontal track;

FIG. 6 is a view similar to FIG. 5 of the traveling gear on an inclined track;

FIG. 7 is a diagrammatic illustration of another modification of the traveling gear according to the invention on a horizontal track;

FIG. 8 is a view similar to FIG. 7 of the traveling gear on an inclined track;

FIG. 9 is a diagrammatic illustration of a further modification of the traveling gear according to the invention on a horizontal track;

FIG. 10 is a view similar to FIG. 9 of the traveling gear on an inclined track; and

FIG. 11 is a diagrammatic illustration of still another modification of the traveling gear according to the invention provided with a hydraulic control mechanism for operating the check wheels.

The traveling gear or truck to be used on an overhead-rail track as described in my above-mentioned patent for carrying any kind of load, either persons or materials, may be of different types, as illustrated, for example, in FIGS. 1–11. According to FIGS. 1–4, such traveling gear is designed for a double-rail track as shown in FIGS. 1–3 or 4–6 of this patent, respectively, may consist of

two regular frames 33 and 34 in each of which a pair of rimmed wheels 35 and 36 and 37, 38, respectively, is rotatably mounted. Each frame 33 and 34 is further provided at a central point above the wheels with a bearing 39 and 40, respectively, in each of which a pivot pin 41 or 42, respectively, is rotatably mounted. These pivot pins together carry a bracket 43 which is suspended on frames 33 and 34 like a pendulum. The lower end of bracket 43 supports the load which may likewise be pivotally suspended thereon and which, in the particular example illustrated in FIGS. 1 and 2, consists of containers 44 in which any kind of material may be transported. In place of such containers, suitable cabs or carriages may also be suspended on these brackets 43 for the transportation of persons. Underneath the double-rail track 75, a shaft 45 with wheels 46 thereon is rotatably mounted within bracket 43 which serve as check wheels and may at certain times engage with considerable friction against the lower surface of track 75 to exert a braking action upon the movement of the traveling gear. If the traveling gear runs along a substantially horizontal stretch of track 75, check wheels 45 will not engage, or will only loosely engage the lower surface of track 75, so that in such case only the friction of the running wheels 35–38 has to be overcome to drive the traveling gear. If, however, track 75 is upwardly or downwardly inclined, as shown in FIG. 4, which on a horizontal stretch of the track is suspended perpendicularly thereto, with pivot from said perpendicular position under the weight of its load 44 like a pendulum and thereby pivot check wheels 46 toward running wheels 35 and 37 or toward running wheels 36 and 38, respectively, thereby reducing the distance between check wheels 46 and these respective running wheels, so that both sets of wheels will then engage the upper and lower surfaces of track 75 with considerable friction, the strength of which depends upon the degree of angularity of track 75 and the weight of the load suspended on bracket 43. Thus, in a downward movement, check wheels 46 produce a braking action, while in an upward movement their action upon the lower side of track 75 produces a firm traction of the running wheels 35–38 upon the track.

The modification of the traveling gear as shown in FIGS. 5 and 6 differs from that shown in FIGS. 1–4 by the provision of two double-sets of running wheels 47 and 48 for supporting frame 33*a* on track 75*a*, and by the provision of vertical pivots 50 for balancing the traveling gear or adapting the same to a curved track. A bracket 43*a* is suspended on frame 33*a* and carries a flexible frame 49 which, in turn, carries a pair of check wheels 46*a*. The effect and operation of this traveling gear is otherwise similar to that as shown in FIGS. 1–10 and therefore does not need to be described again.

According to the modification of the traveling gear as shown in FIGS. 7 and 8, an upper frame 53 supporting the running wheels 51, 52 carries a normally rectangular but adjustable frame, forming a parallelogrammatic linkage, which is composed of a pair of parallel arms 54 and 55, the mentioned upper frame 53, and parallel to such upper frame a lower frame 56 on which the load P is suspended. The check rollers 58 are mounted vertically above load P in bearings 57 on the lower frame 56 so that, when the traveling gear moves along a horizontal stretch of track 75*b*, check rollers 58 will not engage, or will only loosely engage the lower side of track 75*b*. If track 75*b* is upwardly or downwardly inclined, as shown in FIG. 8, the weight of load P will change the angularity of parallelogram 53 and 56 so that check roller 58 will press with considerably increased traction against the lower surface of track 75*b*.

The embodiment of the invention as shown in FIGS. 9 and 10 is similar to that shown in FIGS. 5 and 6 insofar as the number and arrangement of the carrying wheels and check wheels is concerned. However, the frame of the traveling gear also forms parallelogrammatic linkage

means. For this purpose, the two double sets of carrying wheels 59–62 carry a frame 63 by means of vertical pivots 64, and this frame is connected by three parallel arms 65, 66 and 67 to a lower frame 68 which extends parallel to frame 63 and on which a load W is suspended which is only indicated diagrammatically and may, for example, be a carriage or cab for transporting people. This load W is suspended on frame 68 at three different points and in such a manner that it is disposed perpendicularly below track 75*c* when such track extends horizontally, so that at such time the check wheels 46*b* which are mounted on the central arm 66 will be disengaged from the lower side of track 75*c*. If, however, track 75*c* is upwardly or downwardly inclined, as shown in FIG. 16, the angularity of the parallelogram-like frame will change under the action of load W, so that check wheels 46*b* will be applied with a considerable frictional pressure against the lower surface of track 75*c*.

In order to maintain the traveling gears, such as shown, for example in FIGS. 9 and 10, in proper engagement with track 75*c* also in a lateral direction thereof, intermediate frame members 69 may be provided with flexibly connected arms 65, 66 and 67 with each other laterally of track 75*c* and rotatably support guide wheels 70 which are adapted to engage the side walls of track 75*c*.

The running wheels and check wheels of each traveling gear may be provided with wheel flanges, as shown in FIGS. 1–4 so as to guide the wheels along the rails. They may, however, also be provided with elastic or pneumatic tires in which case the lateral guide wheels may also carry such tires.

In the event that it should be advisable or necessary to utilize the check wheels for braking purposes, regardless of whether the rail track extends horizontally or is either upwardly or downwardly inclined, a special mechanism may be provided to move these wheels positively toward or away from the lower side of the rails. A mechanism of this type is shown, for example, in FIG. 11 and may consist of diagonal frame members 90 and 91 which connect the upper end of frame 92 with the central lower point thereof, and of cylinders 93 and 94, respectively, which are interposed in these diagonal frame members and are connected by flexible tubing 95 and 96 to a pump 97 for supplying a hydraulic pressure fluid, either liquid or gaseous, to cylinders 93 and 94. Depending upon the direction of operation of pump 97, the hydraulic fluid will either be passed from cylinder 94 or vice versa, and the piston slidable in these cylinders thus will either be placed under pressure or will be released. Frame 92 will then by such hydraulic operation be either contracted or expanded, and check wheels 46*c* will thus be moved positively either toward or away from the rail track. In the normal operation of the traveling gear, pump 97 will be disconnected so that the pistons in cylinders 93 and 94 will slide therein freely and without being resisted by the hydraulic fluid.

The frame structure supporting the traveling gear according to FIG. 11 may be designed so that the angularity of the parallelogram forming the frame will change automatically as previously described in accordance with the inclination of the rail tracks and the weight of the load carried by the frame. However, if the check wheels are to exert an additional braking action when the traveling gear is running downwardly, or are to increase the friction of the running wheels on the rail tracks when running upwardly, the hydraulic control mechanism may be operated. This mechanism may, of course, also be operated on a horizontal track to reduce the speed of the traveling gear and even to serve as a brake to stop the movement.

Although the invention has been illustrated and described with reference to the preferred embodiment thereof, I wish to have it understood that it is in no way limited to the details of such embodiments but is capable of numerous modifications within the scope of the appended claims. Thus, for example, the control mecha-

nism may be of a different design than the one described above and illustrated in FIG. 11, and such control mechanism may also be of a type other than hydraulic, and may even be purely mechanical and adapted to be operated by hand.

Having thus fully described my invention, what I claim as new is:

A suspension-railway truck displaceable along an elevated track having an upper and a lower surface, comprising a first wheel support, a plurality of load-bearing wheels journaled to said first wheel support and rollingly engaging said upper surface, parallelogrammatic linkage means pivotally secured to said first wheel support for articulation about a substantially horizontal axis extending transversely to said track, a second wheel support pivotally connected to said linkage means for angular motion about a substantially horizontal axis extending transversely to said track, at least one check wheel journaled to said second wheel support, and means for connecting said linkage means to a load whereby said check wheel is

urged against said lower surface upon deviation of said track from a substantially horizontal position and consequent swinging movement of said second wheel support.

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