July 23, 1940. C. BREER ET AL 2,208,628

RAILWAY VEHICLE

Filed Nov. 8, 1937 2 Sheets-Sheet 1

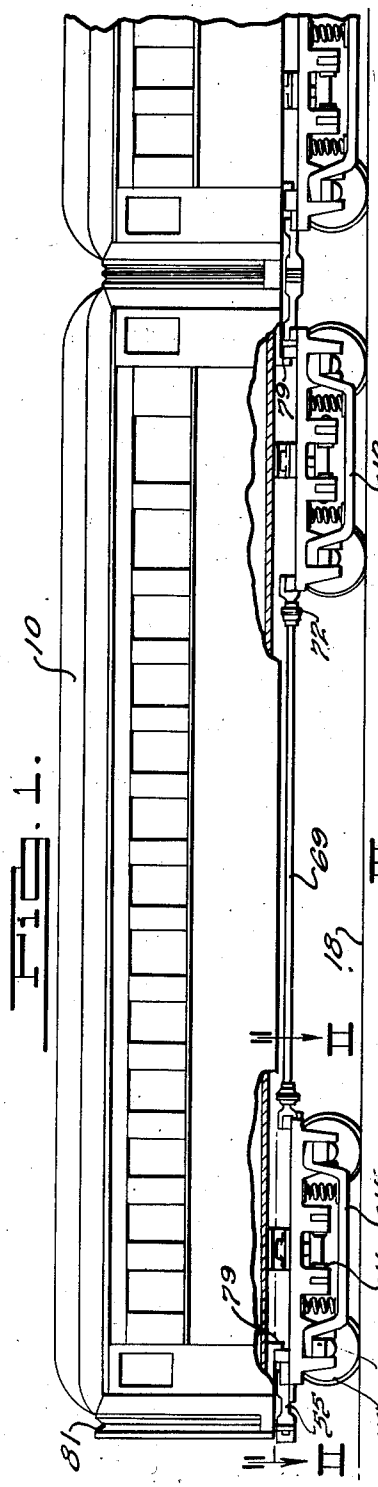


Fig. 1.

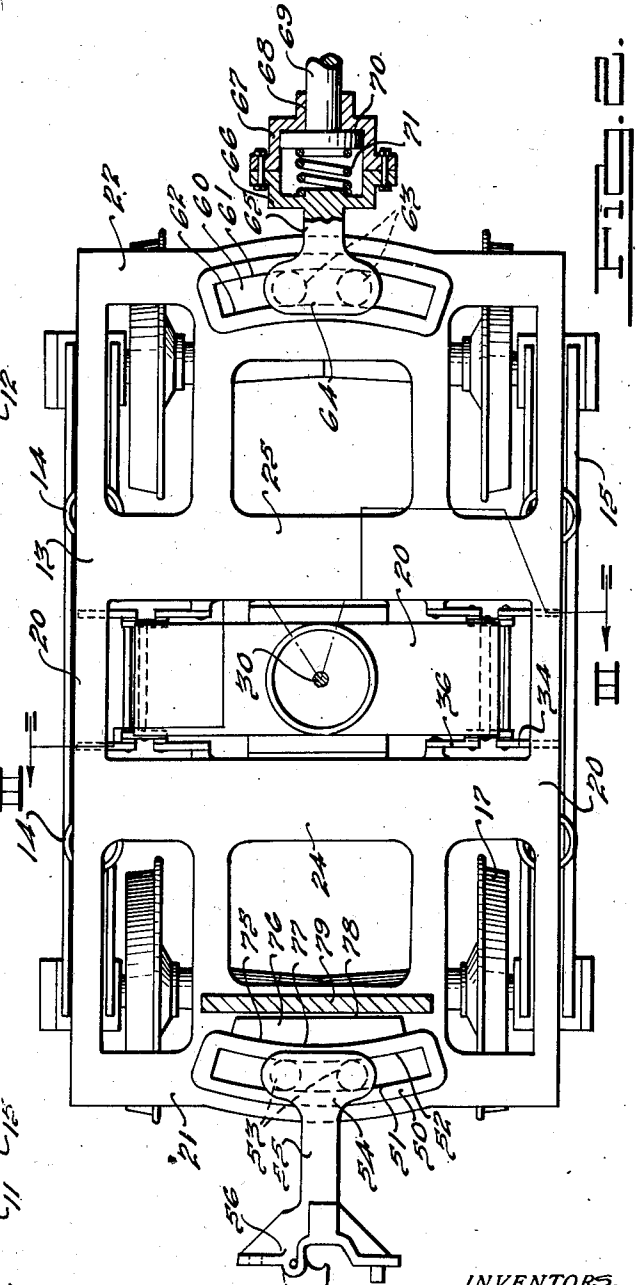


Fig. 2.

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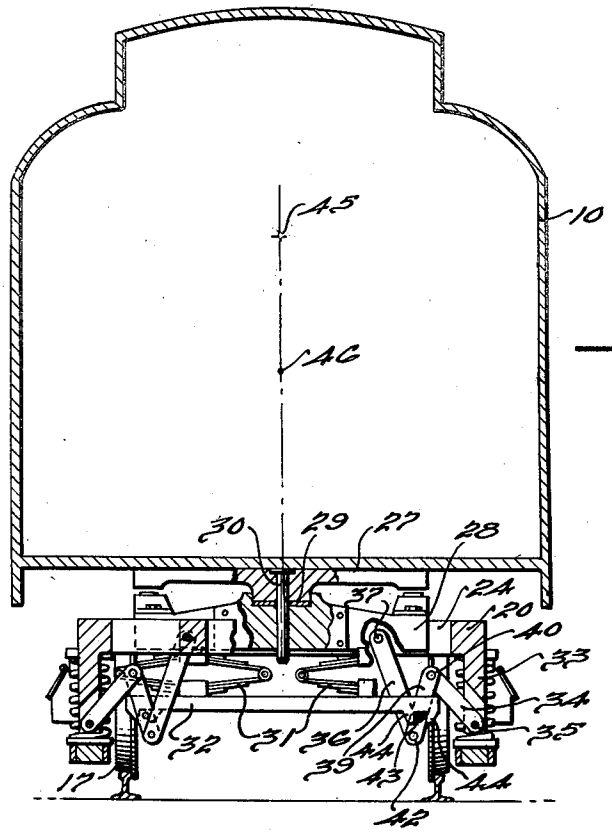


Fig. 3.

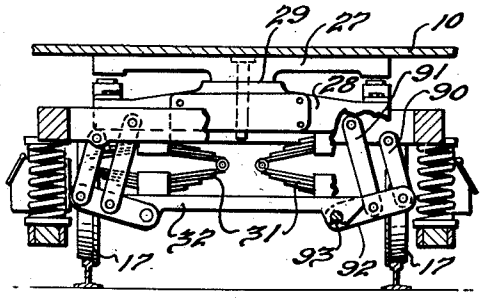


Fig. 4.

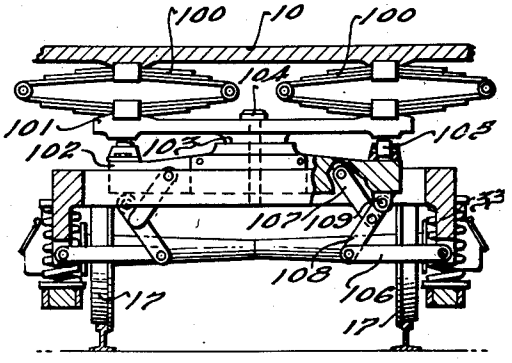


Fig. 5.

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UNITED STATES PATENT OFFICE

2,208,628

RAILWAY VEHICLE

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Application November 8, 1937, Serial No. 173,294

9 Claims. (Cl. 105—190)

Our invention relates to vehicles and it has particular relation to vehicles adapted to be drawn or propelled over rails or tracks for the purpose of transporting passengers and merchandise, particularly the former.

Heretofore, some effort has been made, by the designers of railroads, to permit higher speeds of trains operating on tracks by banking the curves in the tracks, that is, placing the outer rail of the curve at a higher level than the inner rail. The banking of the tracks provides a certain amount of neutralizing effect, with respect to the lateral component of centrifugal force acting on the train, while passing around the curve but, as the degree of banking necessary is dependent upon the radius of curvature of the track and the speed of the train, it is obvious that any banked curve can provide complete neutralization of the unbalancing effect of centrifugal force for only one particular speed of any train. As trains operate over the same track at different speeds, varying from the speed of a slow freight to a fast modern passenger train, and as trains sometimes stop on the banked curves of the tracks it is apparent that banking of the track provides only a partial solution of the problem of neutralizing centrifugal force and, in addition, provides certain advantages when the train is stopped on the track.

By our invention we have eliminated all of the shortcomings of banked tracks and have provided means for insuring that each individual car of the train will assume the proper degree of inclination at all times, taking into account the radius of curvature of the track and the speed of each individual train. In addition, it compensates for any angle of banking which is improper for the speed of our particular train. It further prevents any undue discomfort on the part of the passengers, or of any injury to produce or merchandise being carried by the train due to shifting thereof, in the event of the train stopping on a curve banked track.

One object of our invention is to improve the riding qualities of railroad cars employed in the haulage of both passengers and merchandise.

A second object of our invention consists in providing means whereby each car body will automatically adjust its angle of inclination with respect to the horizontal to compensate for improperly banked tracks, varying speeds and radius of curvature of the track so as to neutralize the effect of centrifugal force and of uneven tracks on the passengers and on any merchandise being carried thereby.

An additional object of our invention consists in providing a simple, durable and inexpensive construction for accomplishing the aforementioned objects, which is automatic in operation and substantially trouble-proof throughout its life.

For a better understanding of our invention reference may now be had to the accompanying drawings, of which:

Fig. 1 is a side elevational view, with portions thereof broken away in the interest of clarity, of one complete railroad car and a portion of the second car, both embodying our invention.

Fig. 2 is a plan view of one of the trucks illustrated in Fig. 1, the view being taken along the line II—II thereof.

Fig. 3 is a cross-sectional view of the structure illustrated in Figs. 1 and 2, the section being taken along the line III—III of Fig. 2.

Fig. 4 is a fragmentary cross-sectional view, somewhat similar to Fig. 3, of another form which our invention may assume.

Fig. 5 is a cross-sectional view of a portion of a railway vehicle, somewhat similar to Fig. 3 of a third form which our invention may assume.

In the drawings we have illustrated a railway car 10 provided at each end with a supporting truck 11 and 12. Each supporting truck comprises a truck frame 13 which supports the weight of the car body in a manner to be hereafter described and which in turn rests upon compression springs 14 which rest upon equalizer bars 15 resting, at their ends, upon journal bearings 16 mounted on the ends of the axles of wheels 17 which roll on the customary railroad rails 18. Each truck frame 13 consists of two longitudinally extending side members 20, which rest on the springs 14, a transversely extending front portion 21, a transversely extending rear portion 22 and two longitudinally spaced transversely extending central members 24 and 25 commonly known as transoms.

As illustrated in Fig. 3, the car body 10 is supported by means of a body bolster 27 secured thereto which rests upon and is pivotally secured to a truck bolster 28 by means of a center bearing 29 and locking center pin 30. The truck bolster rests upon two full elliptical leaf springs 31 which in turn rest upon a spring plank 32 at points adjacent each end thereof.

The side members 20 of the truck frame 13 are each provided with downwardly extending projections 33 to the lower end of each of which is pivoted a first link 34 by means of a pivot pin 35. A second link 36 is pivotally secured, by

means of a pivotal pin 37, to the transom 24, constituting a part of the truck frame 13. A third and intermediate link 39 is pivotally secured at one end, by means of a pivot pin 40, to one end of the first link 34, and is pivotally secured at the other end, by means of a pivot pin 41, to the lower end of the second link 36. Mounted on the third link 39 and intermediate the ends thereof, but closer to pivot pin 42, is mounted a pivot pin 43 which rests between downwardly projecting portions 44 of the spring plank 32. Each spring plank 32 therefore rests at each end on two linkage mechanisms, one on each side of the truck frame, which linkage mechanisms transfer the weight of the car body carried by the spring plank 32 to the truck frame 13.

By virtue of the construction described in connection with Fig. 3, the car body with its associated body bolster, truck bolster and spring plank may tilt, with respect to the truck frame on which it is supported about an axis extending longitudinally of the car body. This is rendered possible by movement of the cooperating linkage mechanisms by means of which the axis of tilting of the body may be placed at any desired point within reasonable limits. I have found it desirable to place this point within the car body in the central plane thereof at a point directly above an axis extending longitudinally of the car body and passing through the center of gravity thereof. By reason of this allocation of the tilting axis with respect to the axis of the center of gravity, when the car passes around a curve in the tracks, the lateral component of the centrifugal force exerted on the car body will cause a tendency for the lower part of the car body to move outwardly with respect to the curve in the tracks about the axis 45 within the car body. This causes the spring plank 32 to move in the same direction, outwardly of the curve in the tracks, causing an extension or expansion of the linkage mechanism illustrated in the left hand side of Fig. 3 and causing a contraction of the linkage mechanism illustrated on the right hand side of Fig. 3, the two linkage mechanisms being identical.

The expansion of the linkage mechanism on the left hand of this figure causes the supporting pivotal pin 43 there located to move transversely and to a lower horizontal level and the contraction of the linkage mechanism on the right hand side of Fig. 3 causes the supporting pivotal pin 43 to move outwardly with respect to the railroad tracks and at the same time to a higher level, thus causing a tilting of the car body about the axis 45. This tilting of the car body in response to centrifugal force exerted thereon causes the body to assume an angle with respect to the horizontal which is dependent directly on the radius of curvature of the track and the speed of the train. It will, of course, be modified if the tracks are banked so as to always maintain the floor of the car in such position that the effect of the unbalancing or lateral component of the centrifugal force will not be noticeable to the passenger riding within the car. In addition, it will prevent the spillage of liquids and moving of merchandise and the like in response to the unbalancing force, as all the forces then acting on the car body will be perpendicular to the floor thereof.

In the previously described construction it will be apparent that a linkage mechanism of this character would not permit rotation of the car body about the axis 45 to an angle which is excessive but we have found that with present day equipment a tilting movement of six degrees with respect to the horizontal is ample to neutralize the unbalancing effect of centrifugal force on the present railroad tracks at present speeds under normal conditions and that, even under unusual conditions, an angle of eight degrees is not exceeded. The linkage mechanisms described permit a rotative movement about the axis 45 which is sufficiently close to a body rotative movement that it is impossible for the passenger to detect any departure from the body rotative movement within the degree of movement necessary for this purpose.

In order to permit freedom of movement of each car body about its axis 45 I have found that it is necessary to eliminate the car body as a means of transmitting the usual tensional and compressional forces throughout the train. With this object in mind I have provided, on the end 21 of the truck frame, a guiding member 50 which is provided with an internally facing surface 51 and an externally facing surface 52. Both of these surfaces are arcuate in horizontal cross-section and represent segments of cylinders the axis of which occurs at the axis of the locking pin 30. Between the surface 51 and 52 are two roller members 53, which are slightly smaller in diameter than the distance between the surfaces 51 and 52, and which are journaled in a supporting member 54. The supporting member 54 has secured thereto a draw bar 55 on the outer end of which is mounted a coupling 56, adapted to be secured to a corresponding coupling and draw bar of an adjacent car.

The roller members 53 are free to rotate upon the surface 51 of the guide member 50 when tensional forces are being exerted through the drawbar 55, and are free to roll over the surface 52 when compressional forces are being exerted thereby. As the surfaces 51 and 52 represent arcs about the axis of the center bearing it will be apparent that, when the train is passing around curves in the track, or when, for any other reason, the forces are being transmitted from one car to another and not exerted on a line extending longitudinally of the car body, the roller members 53 will roll on the surfaces 51 or 52 to a point which brings the drawbar 55 into alignment with the center bearing of the truck to which it is secured and the center bearing of the next adjacent truck of the adjoining car to which it is coupled. For this purpose it is desirable that the coupling member 50 be of the tight-locking variety so that the two coupling members and associated drawbars will constitute a rigid unit which is incapable of bending when compressional forces are being exerted thereon.

At the opposite end of each truck frame I have mounted a guide member 60 provided with an internally facing surface 61 and an externally facing surface 62, which are likewise segments of cylinders and represent arcs drawn about the axis of the center bearing of the truck. Roller members 63, which are likewise of slightly smaller diameter than the distance between the surfaces 61 and 62, are adapted to roll on those surfaces and are journaled on a supporting member 64. The supporting member 64 has mounted thereon a short drawbar 65 to the end of which is secured a cup-shape member 66. The cup-shape member 66 has secured thereto by bolts, or other suitable securing means, a cup-shape member 67 of equal diameter which is provided at its opposite end with a centrally disposed opening 68. A shaft or beam 69 extends through the opening

68 and has secured on its inner end a piston member 70 which is adapted to slide within the cylinder formed by the cup-shape members 66 and 67. A compression spring 71 is mounted within the cylinder and is so arranged as to exert a pressure on the end of the piston 70 tending to hold the piston 70 at the extreme end of the cup-shape member 67. The spring member 71 is pre-loaded to any desired degree so as to exert a pressure on the piston 70 even when it is disposed at the end of its stroke. The beam 69 extends longitudinally of the car body and has mounted on its opposite end a corresponding cylinder 72 which, in turn, is mounted on a short drawbar adapted to move within a guide member mounted on the front end of the frame of the rear truck 12.

As a result of this construction, any tensional force exerted on the car from the next adjacent car is transmitted from the drawbar 55 to the face 51 of the guide member 50 and thence to the truck frame. It is transmitted from the truck frame to the guide member 60 and through the face 61 and the roller 63 to the drawbar 65. From the drawbar 65 it is transmitted to the cylinder or cup-shape member 66 and 67 and thence directly to the piston member 70 and through it to the beam 69 to the cylinder 72 by which it is transmitted directly to the front end of the rear truck and through it to a coupling member and associated drawbar disposed at the rear end of the truck and adapted to be connected to the next trailing car.

Compressional forces exerted on the car are transmitted through the drawbar 55 and the rollers 53 to the surface 52 of the guide member 50 and thence to the truck frame. From the truck frame they are transmitted through the surface 62 to the rollers 63 thence to the drawbar 65. From the drawbar 65 they are transmitted to the compression spring 71 to the piston 70 and thence to the beam 69 and through the compression spring located in the cylinder 72 to the frame of the rear truck and thence to the coupling at the opposite end of the rear truck. The spring 71 is of sufficient rigidity to transmit all of the normal compression forces transmitted through the train but any excessive force exerted thereon will cause a compression of the spring 71 and movement of the piston 70 within the cylinder 66, 67. When this occurs additional means are provided to take the excess force through the car body so as not to overload the beam 69. This permits of using a relatively light beam 69 to transmit both tensional and normal compressional forces without having them in any way pass through the car body, thus leaving the car body free to tilt about its axis 45 in response to the lateral component of centrifugal forces exerted thereon.

By reason of the surfaces 60 and 62 of the guide member 60 being arcuate and representing arcs about the center bearing of the truck on which they are mounted the beam 69 is free to move laterally of the trucks when the trucks rotate about their center bearings in passing around curves in the track. With this construction the beam 69 will always occupy a position in alignment with the center bearings of the two trucks of the car on which it is mounted, this being essential owing to the fact that the length of the beam 69 is a fixed quantity and it retains the central points of the two truck frames at fixed distances at all times.

In order to assume the excessive portion of the compression loads to which trains are subjected the guide member 50 is provided with an internal face 75 which likewise represents a segment of a cylinder the axis of which is in the center of the frame of the truck. Resting loosely on the truck frame I have provided a floating block 76 the outer surface 77 of which is cylindrical and represents an arc about the center of the truck frame as an axis so as to conform exactly with the surface 77 of the guide member 50. The opposite face 78 of the block 76 is vertical and normally extends directly transversely of the truck frame. We have also provided the car body with a downwardly extending projection or stop member 79 at each end of the car body. This stop member is rigidly secured to the bottom of the car body or to a supporting beam thereof, and extends downwardly into the plane of the block member 76, its surface facing the block member 76 being vertical and extending transversely with respect to the car body so as to correspond with the surface 78 of the block member 76. The contacting surface 78 of the block member 76, the guide member 50 and the stop member 79 are all accurately ground and well lubricated in any desired manner so that when the spring 71 is compressed by compressional forces being exerted through the train the block 76 engages both the face 75 of the guide member 50 and the face of the stop member 79 and immediately assumes any compressional forces exerted through the car in excess of those carried by the spring 71 and the beam 79.

By reason of the fact that the cooperating surfaces 77 and 77 are arcuate, rotative movement of the truck frame with respect to the car body, particularly in passing around curves in the track, may still occur without excessive friction therebetween. Likewise, vertical movement of the car body, or lateral movement thereof, will cause movement between the vertical face 78 of the block 76 and the vertical face of the stop member 79, which, being lubricated, will permit movement therebetween without excessive friction. In like manner, tilting of the car body 10 with respect to the truck frame will cause relative movement between the vertical surface 78 of the block 76 and the corresponding face of the stop member 79 without excessive friction. As a result, any type of movement between the truck frame and the car body may occur without interfering with the contact of the block 76 with the guide 50 and the stop member 79 and without preventing the transmission of forces from the truck frame to the car body while at the same time permitting freedom of movement of the car body with respect to the truck frame. It is desirable that the lower face of the stop member 79 be curved, representing an arc about the axis 45 so as to prevent contact between the stop member 79 and the upper face of the truck frame when tilting movement of the car body with respect to the truck frame occurs.

In connection with this construction we desire that the drawbar 55 and the coupling member 56 at each end of the car body be of such length as to prevent engagement of the ends of the car bodies which are coupled together as such engagement, especially when a truck is passing around a curve in the track, always results in the transmission or initiation of disturbing forces of one character or another between the car bodies. In addition, we desire that the vestibule curtain, as shown at 81, and which is adapted to connect the car bodies in such manner as to prevent injury to

passengers passing between the cars, be of such material as to be incapable of transmitting any forces whatsoever between the interconnected car bodies.

In the structure illustrated in Fig. 4 the car body 10 is provided with a body bolster 27 pivotally mounted upon a truck bolster 28 by means of the center bearing 29. The truck bolster 28 is mounted upon the spring plank 32 by means of the elliptical springs 31 as described in connection with Fig. 3. In this construction a first link 90 and a second link 91 are both pivotally mounted on the transom 24 at slightly different heights. A third link 92 is pivotally secured at its end to the opposite end of the link 90 and at an intermediate point is pivotally secured to the link 91. The free end of the link 92 is provided with a pivotal pin 93 which constitutes a support for one end of the spring plank 32 as described in connection with Fig. 3. With this construction lateral movement of the lower part of the car body in response to centrifugal force is permitted by movement of the pivoted linkages which, with this arrangement, will cause a movement about the predetermined axis 45 which is sufficiently close to an arcuate movement that it will be impossible for passengers riding on the car body to detect any departure from the truly arcuate movement and they will be unconscious of the fact that the car body is tilting while passing around a curve in the railroad track. In the event that the car should stop on a banked track the car body will, during the deceleration of the car, gradually move to a position where the floor is horizontal irrespective of the angle of banking of the track. This is due to the fact that as the centrifugal force decreases with the deceleration of the train the center of gravity of the car body tends to move to a point directly beneath the axis 45 as only gravitational forces are now operative, thus restoring the car body to a horizontal position. This is likewise true of the structure illustrated in Figs. 3 and 5.

In the structure illustrated in Fig. 5 the car body 10 is mounted on two elliptical springs 100 which in turn rest upon a body bolster 101. The body bolster is pivotally mounted upon a truck bolster 102 by means of a center bearing 103 and a locking center pin 104. Side roller bearings 105 of the usual type mounted on the truck bolster 102 prevent excessive tilting of the body bolster 101 with respect to the truck bolster. In this construction a first link 106 is pivotally mounted on the downwardly projecting side flange 33 of the truck frame and a second link 107 is pivotally mounted at its upper end on the transom 24. An intermediate or third link 108 is pivotally secured at its lower end to the end of the link 106 and is pivotally secured at an intermediate point to the end of the link 107. The opposite or upper end of the link 108 is pivotally secured as illustrated at 109 to the truck bolster 102, thus supporting the bolster and permitting movement thereof about a predetermined axis 45 as described in connection with Fig. 3. This mechanism is capable of permitting movement of the supported car body about a predetermined point which movement is substantially arcuate within the range for which it is designed, namely, six to eight degrees on either side of normal, and will permit tilting of the car body throughout that range in such manner as to neutralize the unbalancing effect of the lateral component of the centrifugal force exerted upon the car body while passing around the curves in the track.

Although we have illustrated several forms which our invention may assume and have described a single application thereof, it will be apparent to those skilled in the art that it is not so limited but that various modifications and changes may be effected therein without departing from the spirit of our invention or from the scope of the appended claims.

We claim:

1. In a railway vehicle, two spaced supporting trucks, a car body, and means for supporting said car body on said trucks comprising a pair of linkage mechanisms on each side of each truck, each of said linkage mechanisms comprising two links of different lengths pivotally connected to said truck at points of different elevation and a third link pivotally connected to both of said previously mentioned links and to said car body, said links and points of pivotal connections directly between said links and between the latter and said truck and car body being so constructed and arranged as to cause tilting of said car body under the influence of centrifugal force exerted thereon to occur about a stationary axis extending substantially longitudinally of said car body.

2. In a railway vehicle, two spaced supporting trucks, a car body, and means for supporting each end of said car body on one of said trucks comprising a pair of said linkage mechanisms on each side of said truck, each of said linkage mechanisms comprising two links of different lengths each pivotally connected at one end to said truck at points of different elevation, and a third link pivotally connected at one end to the end of one of said links, at an intermediate point to the end of the other link and at its opposite end to a supporting structure for said car body, whereby said car body is permitted to tilt about a stationary axis extending parallel to the longitudinal axis of said car body in response to centrifugal force exerted on said body.

3. In a railway vehicle, two spaced supporting trucks, a car body, and means for supporting said car body on said trucks comprising a pair of linkage mechanisms on each side of each truck of generally N form, each of said linkage mechanisms comprising two links of different lengths each pivotally connected at one end to said truck at points of different elevation, one of said links depending from said truck and being disposed toward the center thereof, and a third link pivotally connected at its ends to the opposite ends of said two links and at a point intermediate its ends and nearest its lower end to a supporting structure for said car body, whereby said car body is permitted to tilt about a stationary axis extending parallel to the longitudinal axis of said car body in response to centrifugal force exerted on said body.

4. In a railway vehicle, two spaced trucks each having a truck frame, a car body, car body bolsters adapted to support said car body, truck bolsters pivotally secured to said car body bolsters in supporting relationship, and means for supporting each of said truck bolsters on one of said truck frames comprising a pair of linkage mechanisms disposed on each side of said frame, each mechanism comprising two links of different lengths each pivotally connected at one end to said truck frame at points of different elevation, the higher of said points being nearer the center of said truck and a third link pivotally connected to the opposite ends of said two links and having a bolster supporting connection thereon pivotally attached to means for supporting said truck

bolster, said links being of such lengths and said pivotal connections being so constructed and arranged that said car body is permitted to tilt about a stationary axis extending parallel to the longitudinal axis of said car body in response to centrifugal force exerted on said car body.

5. In a railway vehicle, two spaced trucks each having a truck frame, a car body, car body bolsters adapted to support said car body, truck bolsters pivotally secured to said car body bolsters in supporting relationship, and means for supporting each of said truck bolsters on one of said truck frames comprising a pair of linkage mechanisms of generally N form disposed on each side of said frame, each mechanism comprising two links of different lengths, one depending from said truck frame and being disposed toward the center thereof and each pivotally connected at one end to said truck frame at points of different elevation and a third link pivotally connected at its ends to the opposite ends of said two links and at a point intermediate its ends and nearest its lower end to means supporting said truck bolster, whereby said car body is permitted to tilt about a stationary axis extending parallel to the longitudinal axis of said car body in response to centrifugal force exerted on said body.

6. In a railway vehicle, two spaced trucks each having a truck frame, a car body, car body bolsters adapted to support said car body, truck bolsters pivotally secured to said car body bolsters in suporting relationship, and means for supporting each of said truck bolsters on one of said truck frames comprising a pair of linkage mechanisms disposed on each side of said frame, each mechanism comprising two links of different lengths each pivotally connected at one end to said truck frame at points of different elevation and a third link pivotally connected at one end to the end of said links, at an intermediate point to the other end of the other link and at its opposite end to means supporting said truck bolster, whereby said car body is permitted to tilt about a stationary axis extending parallel to the longitudinal axis of said car body in response to centrifugal force exerted on said body.

7. In a railway vehicle, two spaced supporting trucks, a car body, and means for supporting said car body on said trucks comprising a pair of linkage mechanisms on each side of each truck, each of said linkage mechanisms comprising three links, two of which are of different lengths and are pivotally mounted on said truck at points of different elevations, the higher of said points being nearer the center of said truck and the third of which is pivotally connected to the other two links, and a supporting connection on said third link for sustaining body load, said links and said points of pivotal connections directly between said links and between the latter and said vehicle being so constructed and arranged as to cause tilting of said car body under the influence of centrifugal force exerted thereon to occur about a stationary axis extending substantially parallel to the longitudinal axis of said car body.

8. In a railway vehicle, two spaced supporting trucks, a car body, and means for supporting said car body on said trucks comprising a car body supporting element and a pair of linkage mechanisms on each side of each truck, each of said linkage mechanisms comprising three pivotally interconnected links, two of which are of different lengths and are pivotally mounted on said truck at points of different elevations, the higher of said points being nearer the center of said truck and the third of which is pivotally connected to the other two links and a body load supporting connection on said third link pivotally attached to said car body supporting element, said links and said points of pivotal connections directly between said links and between the latter and said trucks and car body supporting elements being so constructed and arranged as to cause tilting of said car body under the influence of centrifugal force exerted thereon to occur about a stationary axis extending parallel to the longitudinal axis of said car body.

9. In a railway vehicle, two spaced supporting trucks, a car body, and means for supporting each end of said car body on one of said trucks comprising a pair of linkage mechanisms on each side of said truck, each of said linkage mechanisms comprising two links of different lengths each pivotally connected at one end to said truck at points of different elevation, the higher of said points being nearer the center of said truck and a third link pivotally connected to the opposite ends of said truck connected links and having a body load sustaining connection thereon pivotally connected to said car body, whereby said car body is permitted to tilt about a stationary axis extending parallel to the longitudinal axis of said car body in response to centrifugal force exerted on said car body.

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