United States Patent

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[54] HIGH-SPEED RAILWAY VEHICLE SUSPENSION

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[52] **U.S. Cl.** .....**105/164,** 105/197 R, 105/190 R

[51] **Int. Cl.** **B60g 21/06**

[58] **Field of Search** 105/190, 164, 197, 199, 198, 105/203; 280/6, 112

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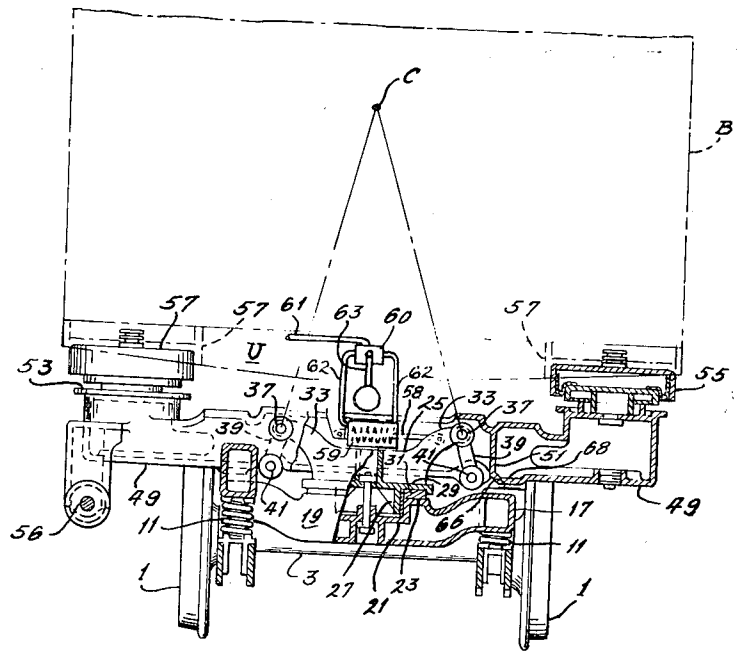
[57] **ABSTRACT**

A suspension is provided for railway passenger cars, to enable such cars to round curves at extremely high speeds without undue discomfort to passengers by providing power means for tilting the car body transversely about a longitudinal axis at a high level, well within the car body, the angle of tilt being responsive to car speed and track curvature. The suspension comprises a yoke mounted on wheel supported truck framing to swivel about a vertical axis and spring support means supported from the yoke by transversely swingable hangers inclined such that their projections intersect at the desired axis of tilt of the car, the body of which is supported on high and widely spaced springs seated on the spring support means and arranged to provide vertical and lateral cushioning independently of the tilting. Transverse movements of the spring support structure on the yoke and consequent tilting of the spring support structure and the car body are effected by transversely acting power means mounted between the yoke and the spring support structure. In a modified form of the invention, the yoke supports separate spring support elements at each of its ends by transversely spaced upwardly converging swing hangers, and transversely acting power means is connected to the yoke and both spring seats to cause the latter to move transversely and tilt correspondingly about the axis of their convergence, thereby causing corresponding tilting of the vehicle body.

17 Claims, 7 Drawing Figures



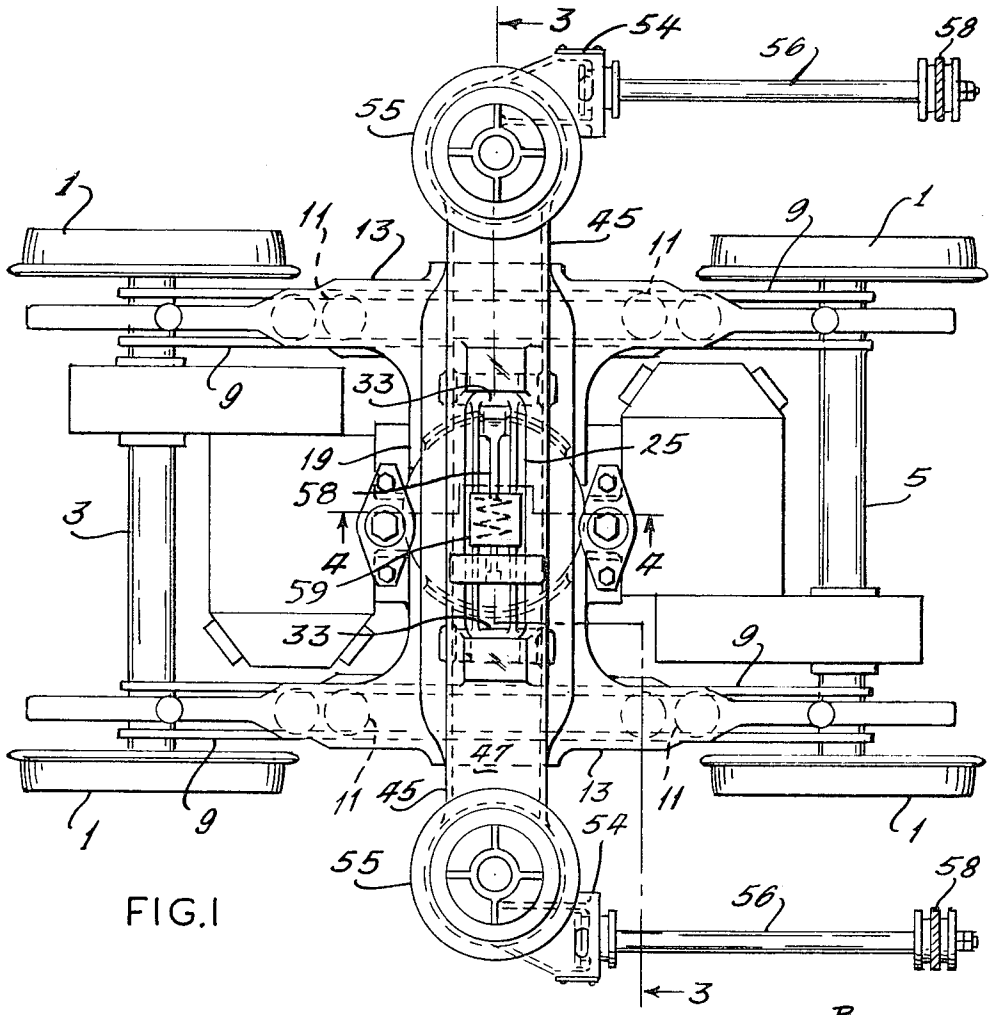


FIG. 1

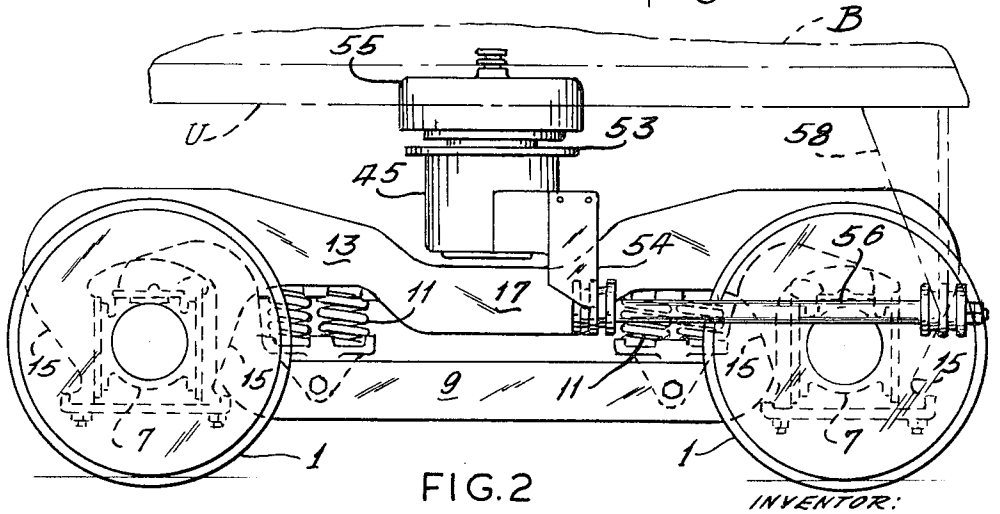


FIG. 2

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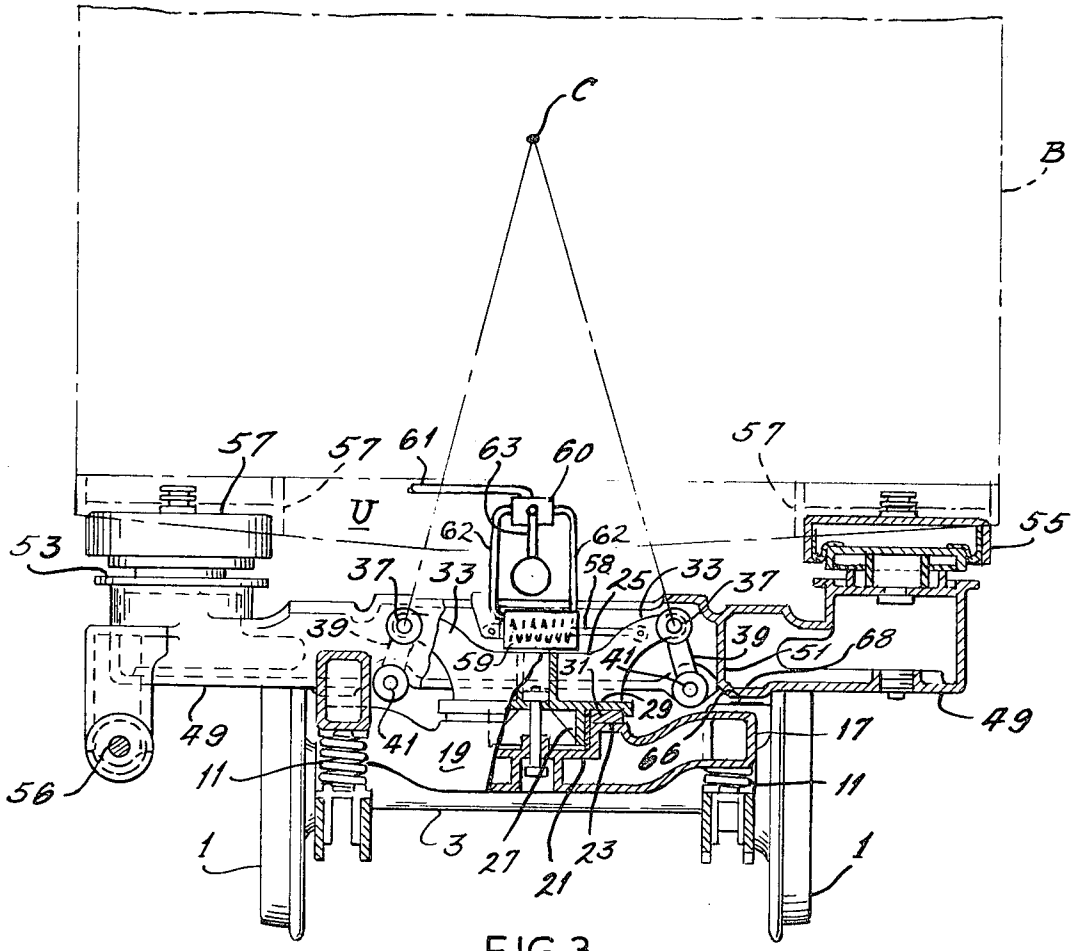

FIG.3

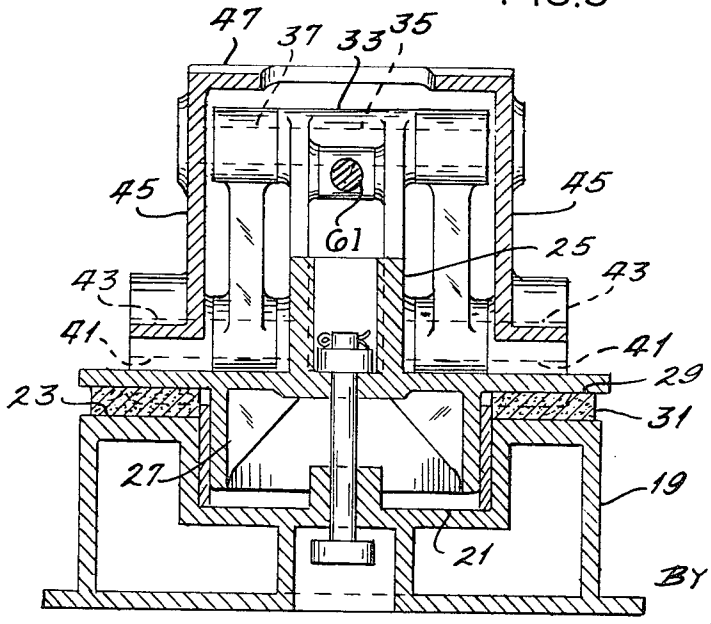

FIG.4

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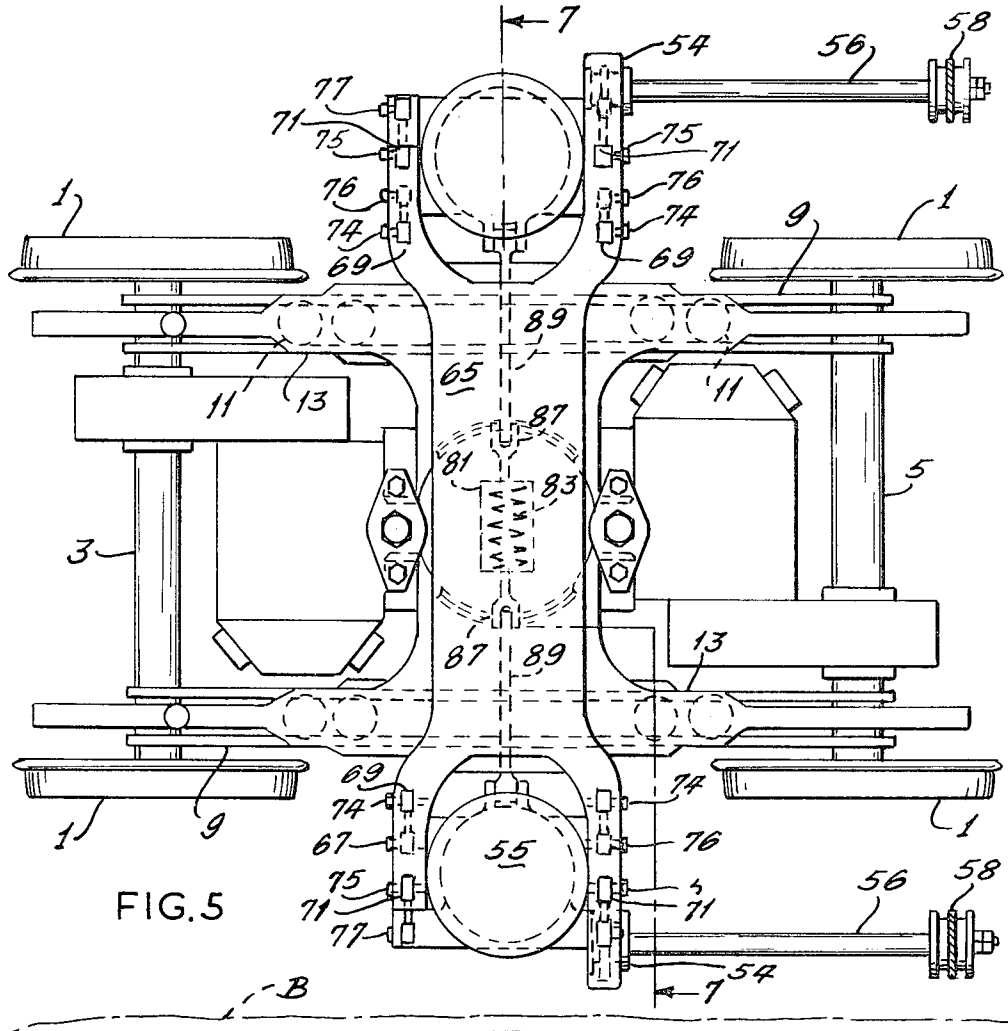

FIG. 5

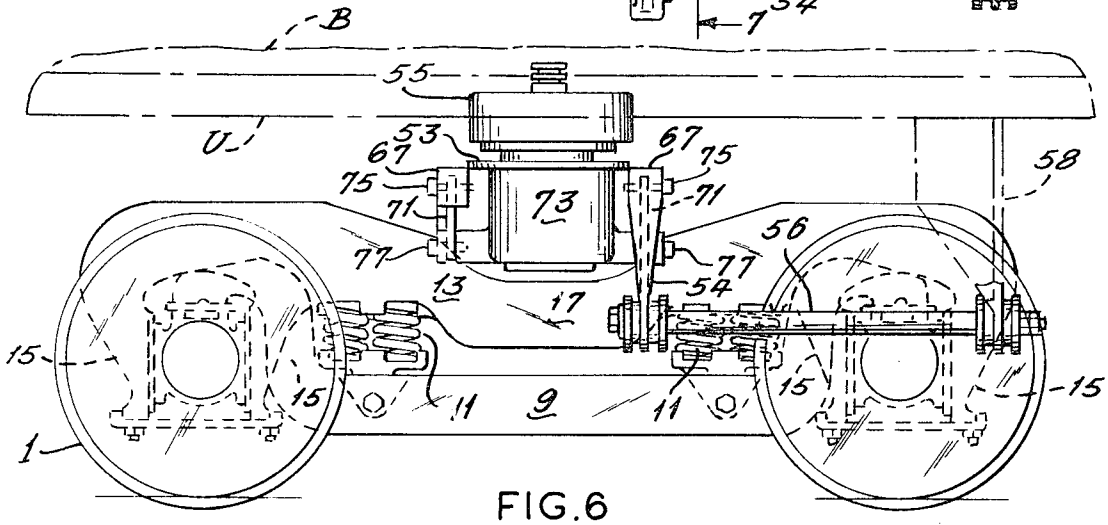

FIG. 6

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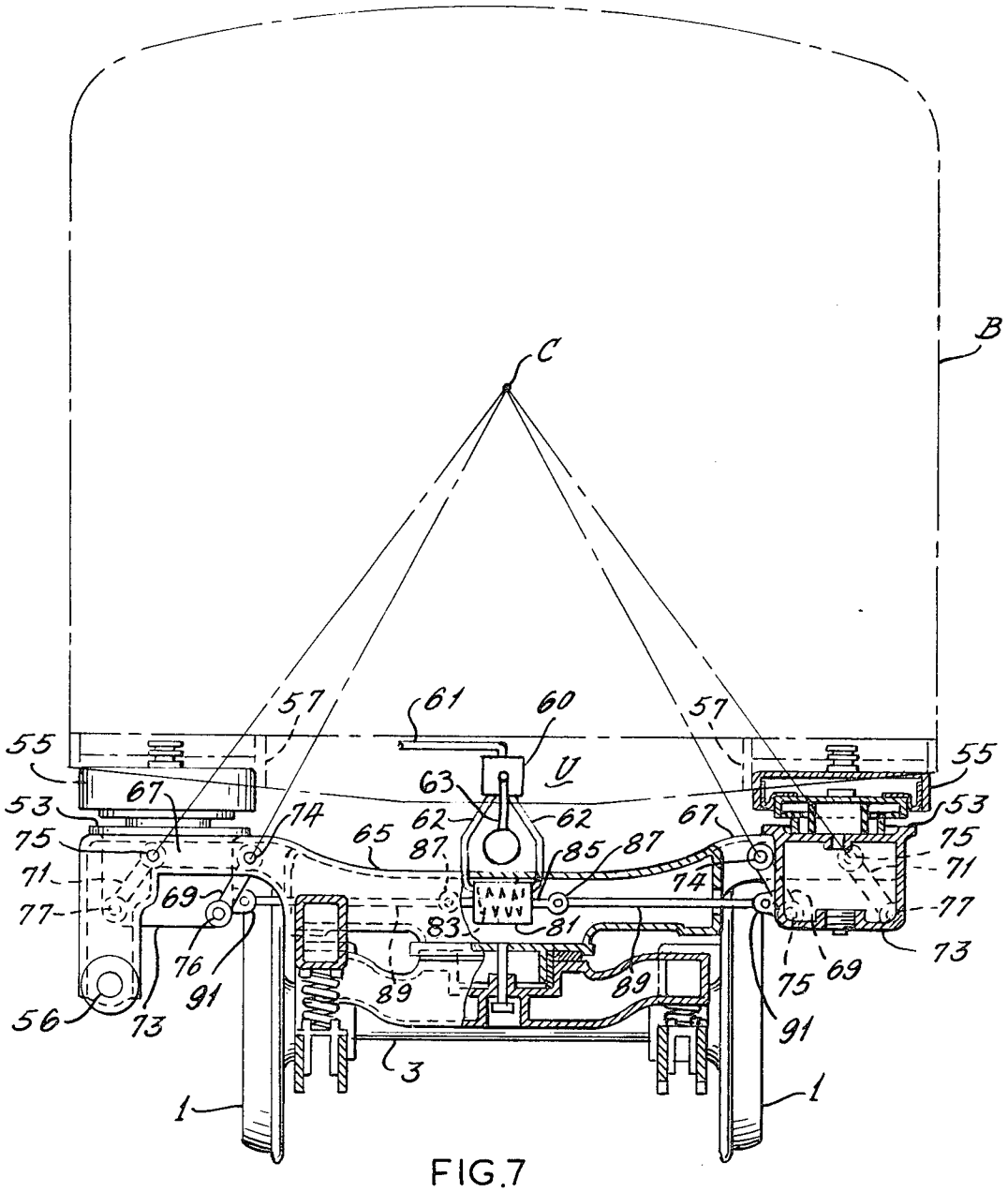

FIG.7

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HIGH-SPEED RAILWAY VEHICLE SUSPENSION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to railway rolling stock and consists particularly in a truck for high-speed passenger cars having power means for tilting the body transversely about a high-level longitudinal axis when rounding curves.

2. The Prior Art

Conventional railway passenger car trucks incorporate a transverse bolster, supported from the truck frame by transversely inwardly inclined swing hangers so arranged that when rounding curves the centrifugal force urging the car body radially outwardly will also cause the body to tilt transversely toward the inside of the track curve. While at lower speeds, the conventional centrifugal force responsive means is sufficiently responsive to eliminate some passenger discomfort; at higher speeds, e.g., in excess of 100 miles per hour, it is not sufficiently responsive to changes in track alignment to oppose adequately the effect of centrifugal force on the passengers themselves.

SUMMARY OF THE INVENTION

The invention provides a railway passenger car suspension in which lateral and vertical forces received by the wheels from the track are cushioned by lateral and vertical deflection of high and widely spaced springs, thus avoiding objectionable body roll as in conventional trucks wherein lateral forces are cushioned solely through swinging movements of inclined swing hangers, which also produces objectionable body roll.

Solely to provide sufficient tilting of the car body about a longitudinal axis at a high level whereby to compensate for the effect on passengers of centrifugal forces when the car rounds a curve, the truck incorporates a transverse beam mounted on the truck frame to swivel about a vertical axis, and spring support structure supported from the transverse beam by transversely swingable hangers inclined so that their projections intersect at a higher level preferably at the center of gravity of the car, and the spring support structure is connected to the transverse beam by transversely acting power means arranged to hold the spring support structure against relative lateral movement except when rounding curves and to cause the same to move transversely of the transverse beam when rounding curves, responsive to train speed and radius of track curvature, thereby causing the swing hangers to tilt the spring support structure and the body about the center of gravity.

Thus the lateral cushioning and tilting functions are separated, so that objectionable roll does not occur in connection with lateral cushioning and controlled tilting, fully responsive to changes in track alignment, is provided on curved track.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of a railway car suspension system embodying the invention.

FIG. 2 is a side elevational view of the suspension system illustrated in FIG. 1.

FIG. 3 is a transverse vertical sectional view along line 3—3 of FIG. 1.

FIG. 4 is an enlarged vertical sectional view of the transom, yoke and bolster along line 4—4 of FIG. 1.

FIG. 5 is a top view of a modified embodiment of the invention.

FIG. 6 is a side elevational view of the embodiment of FIG. 5.

FIG. 7 is a transverse vertical sectional view along line 7—7 of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The numeral 1 denotes flanged railway wheels mounted on the ends of longitudinally spaced parallel axles 3 and 5. Inboard of each wheel the axles are rotatably received in their journal boxes 7. At each side, longitudinally extending equalizer beams 9 may be supported at their ends on boxes 7, and longitudinally inwardly from the supporting boxes, beams 9 mount longitudinally spaced groups of upright springs.

A rigid truck frame includes transversely spaced longitudinally extending side members 13 supported on spring groups 11 and formed at their ends with pairs of depending pedestal legs 15 vertically slidably embracing journal boxes 7, so as to hold the axles in parallel relation with each other and in right angle relation with frame side members 13, while permitting the frame to move vertically on spring groups 11 and equalizers 9 at opposite sides of the truck to tilt individually in their longitudinal vertical planes with respect to the frame to accommodate to vertical irregularities in the track rails.

Intermediate spring group 11, frame side members are depressed, as at 17, to a much lower level than their end portions, and the depressed portions 17 are connected to each other by a transverse transom member 19.

To support a vehicle body and permit swivel of the truck with respect thereto for rounding curves, transom 19 is formed with a central bearing comprising a circular vertical axis recess 21 surrounded by an upwardly facing horizontal annular surface 23, and a yoke 25 is formed with a mating depending cylindrical boss 27 and downwardly facing horizontal annular surface 29, which rests on an annular pad 21 of friction material seated on surface 23, with boss 27 rotatably received in recess 21.

Yoke 25 extends transversely of the truck and is provided at its sides, on both sides of the central bearing, with outwardly and upwardly projecting brackets 33, the outer ends of which are formed with cylindrical apertures 35 extending longitudinally of the truck, and pins are journaled in apertures 35 with both ends protruding from the apertures to mount short depending switch hangers 39.

At their lower ends, swing hangers 39 mount pins 41, also extending longitudinally of the truck, and the latter in turn are journaled in bearing apertures 43 in the sidewalls 45 of transversely extending inverted channel section bolster having a top wall 47. Bolster swing hanger bearings 43 are spaced-apart transversely of the truck a slightly greater distance than the yoke bearings 33 so that the swing hangers are inclined inwardly and upwardly transversely of the truck and their projections intersect at a point C well above the bolster, preferably at the center of gravity of the supported car body B.

The purpose of the swinger hanger support of bolster 45, 47 on yoke 25 is to provide controlled tilting or banking of the car body when rounding curves to provide a radially inwardly directed force component to oppose the tendency of passengers to be forced radially outwardly by the centrifugal force.

At its ends which extend transversely outboard of the truck frame side members, the bolster is formed with bottom walls 49, which with cross walls 51 define air reservoirs in the bolster end portions, their tops being circular in plan to form seats 53 for pneumatic springs 55, the tops of which are received in suitable pockets in car body underframe U.

Springs 55 are transversely as well as vertically resilient whereby to cushion the supported underframe and body from transverse as well as vertical impacts received by the truck wheels from the rail surfaces.

For transmitting traction and braking forces from the truck to the vehicle underframe U, the ends of the bolster are provided with rigid depending brackets 54, to which are pivotally secured longitudinally extending anchor links 56, the other ends of which are pivotally secured to brackets 58 rigidly depending from underframe U.

For maintaining the body upright on tangent track (as shown in FIG. 3) by preventing swinging movements of hangers 39, and for providing banking of the body on curves through tilting of bolster 45, 47, 49, 51 on swing hangers 39, a double-acting motor 59 which may be of the pneumatic screw type is mounted within the bolster by pivotal securement to the top wall thereof, and its transversely extending output rod 58 is connected to one of yoke brackets 33 so that, when the

vehicle enters curved trackage, motor 59 will be energized to move the output rod 58 in a direction outward radially of the curve, and thereby cause the bolster to move transversely of the truck in that direction, causing corresponding tilting of the bolster about a longitudinal axis generally coincident with the point of intersection of the converging swing hangers 39, and banking the body accordingly. During operation on tangent track, motor 59 is stabilized in centered position, as shown in FIG. 3, thus maintaining the bolster transversely centered and level and the body correspondingly upright.

Means for energizing and deenergizing the motor 59 may include a reversing valve 60, connected to a source of compressed air by conduit 61 and to pneumatic motor 59 by conduits 62, and a sensing device preferably comprising a damped pendulum, shown schematically at 63, responsive to vehicle speed, direction and degree of track curvature, and amount of track superelevation. Sensing device 63 is operatively connected to valve 60 to cause the same to maintain output rod 58 of motor 59 centered when the car is operating on tangent track, and to cause the output rod to move radially outward with respect to the direction of track curvature when the car is on curved track.

To prevent excessive tilting of said bolster, frame side members 13 are provided in their depressed center portions 17 with upwardly facing horizontal surfaces 66 and the underside of the bolster is formed with vertically spaced opposing surfaces 68, which are adapted to engage in the event the bolster tilts excessively.

A second embodiment of the invention is illustrated in FIGS. 5–7 in which the truck structure from wheels 1 up to and including the central bearing is identical to that of the first embodiment. In the embodiment of FIGS. 5–7, a yoke 65 incorporates central bearing parts 27 and 29 in its lower portion and is thereby swivelly supported on transom 19. Yoke 65 is elongated transversely of the truck and outwardly of truck frame side members 13 the end portions of the yoke are slightly elevated and bifurcated to form pairs of brackets 67 spaced apart from each other longitudinally of the truck.

Each bracket 67 pivotally mounts respectively at 74 and 75 a pair of depending transversely swingable hangers 69 and 71, the bottom ends of which are pivotally connected respectively at 76 and 77 to the lower portion of cylindrical air reservoirs 73 and, in their normal or tangent track position, hangers 69 and 71 at both sides are inwardly and upwardly inclined from their bottom pivots 77 and 79, to converge in the region of the center of gravity of car body B, as shown in FIG. 7, the underframe U of which is formed with pockets 57 receiving pneumatic springs 55, which are seated on seats 53 formed by the top of individual reservoirs 73.

For maintaining the spring seats 53 and hangers 69 and 71 in the position shown while the car is operating on tangent track, a transversely double-acting motor 81, which may be of the pnuematic screw type, is mounted within yoke 65 by securement to its top wall. The normally centered screw 83 is provided with an output rod 85 which projects from both ends of motor 81 and has at its terminals clevises 87, to which transverse links 89 are pivotally connected at their inner ends, their outer ends being pivotally connected, on axes longitudinal of the truck, to inboard clevis brackets 91 on air reservoirs 73.

Pneumatic motor 81 preferably is controlled by a valve 60 operated by a damped pendulum 61 as in the first embodiment so that, when the car enters a curve, air is admitted to motor 81 through one of the conduits 62 to urge output rod 85, links 89 and reservoirs 73 transversely outwardly radially of the curve, causing radially outer swing hangers 69 and 71 to raise outer reservoir 73, spring 55 and the corresponding side of body B while causing radially inner swing hangers 69 and 71 to lower inner reservoir 73, springs 55 and the corresponding inner side of body B, the effect being to tilt the body inwardly with respect to the curve, about an axis through point C.

Independently of the tilting or banking action, impacts from lateral irregularities in the track rails are partly absorbed by lateral resiliency of springs 55.

The invention may be modified in various respects as will occur to those skilled in the art and the exclusive use of all modifications as come within the scope of the appended claims is contemplated.

I claim:

1. A railway vehicle body suspension comprising wheeled axles, truck framing supported on said axles, a transverse yoke supported on said framing to swivel about a vertical axis, swing hangers supported at their upper ends from said yoke on longitudinal axes spaced apart transversely of the vehicle, spring supporting structure supported from the lower ends of said swing hangers on longitudinal pivot axes spaced apart transversely of the truck a greater distance than said upper end pivot axes whereby said swing hanger projections converge at a substantially higher level than said spring support structure, power means connecting said spring support structure and said yoke for selectively retaining the same against relative transverse movements and for moving said spring support structure transversely of said yoke whereby to tilt said spring support structure through operation of said swing hangers, and transversely spaced body support springs seated on said spring support structure and yieldable vertically and transversely of the vehicle.

2. A railway vehicle suspension according to claim 1 including a sensing device mounted on the vehicle for sensing vehicle speed and the degree and direction of track curvature, and means connecting said sensing device to said power means whereby to actuate said power means to maintain said spring supporting structure transversely centered on tangent track and to move said spring supporting structure radially outwardly on curved track a distance proportional to vehicle speed and radius of track curvature.

3. A railway vehicle suspension according to claim 1 wherein said spring support structure comprises a rigid transverse bolster.

4. A railway vehicle suspension according to claim 3 including draft transmitting devices at the ends of the bolster adapted for connection to a supported body.

5. A railway vehicle suspension according to claim 3 wherein the central portion of said bolster is open and said yoke is nested therein.

6. A railway vehicle suspension according to claim 5 wherein said spring means are flexible-wall pneumatic cushions and the end portions of said bolster are hollow and define sealed surge chambers communicating with said pneumatic cushions.

7. A railway vehicle suspension according to claim 1 including mating central bearing elements on said framing and said yoke forming the sole support of said yoke on said framing.

8. A railway vehicle suspension according to claim 7 including downwardly facing surfaces on the end portions of said bolster and opposing upwardly facing surfaces on said framing normally vertically spaced from said downwardly facing surfaces and adapted for engagement therewith only when normal tilting movements of said bolster are exceeded.

9. A railway vehicle suspension according to claim 1, wherein said spring-supporting structure comprises separate spring support elements spaced apart transversely of the vehicle framing and supported independently of each other by said swing hangers.

10. A railway vehicle suspension according to claim 9 wherein there are pairs of said swing hangers spaced-apart transversely of the vehicle at each side of the vehicle, said separate spring support elements being supported by the pairs of swing hangers an their respective ends.

11. A railway vehicle suspension according to claim 10 wherein said separate spring support elements are held against substantial transverse movement with respect to each other.

12. A railway vehicle suspension according to claim 11 wherein the end portions of said yoke are bifurcated to form pairs of brackets spaced apart longitudinally of the vehicle, said separate spring support elements being positioned respectively between said brackets of each pair.

13. A railway vehicle suspension according to claim 12 wherein said brackets provide the pivots for said pairs of swing hangers.

14. A railway vehicle suspension according to claim 13 wherein said bifurcated end portions of said yoke lie substantially outboard transversely of said truck framing.

15. A railway vehicle suspension according to claim 11 wherein said power means is connected to both said separate spring support elements.

16. A railway vehicle suspension according to claim 11 wherein said power means comprises a transversely acting motor mounted on said yoke, and links connecting said motor to both said separate spring support elements.

17. A railway vehicle suspension according to claim 9 wherein said separate spring support elements are individual pneumatic spring reservoirs, and said body support springs are pnuematic springs seated on said reservoirs and communicating with the same.

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