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None

(58) Field of search
UK CL (Edition J) **B7L LUJ LUK**
INT CL⁴ **B61F 5/00**

(54) Locomotive and motorized self-steering radial truck therefor

(57) An arrangement for locomotives and other railway vehicles having steerable or self-steering railway trucks (12), particularly motorized locomotive trucks, which incorporates axle height transfer of loads from the axles (24, 26, 27) to the frame (14) through connecting rods (43, 44) and steering beams (40, 42) connecting with the end axles (24, 27). The steering beams (40, 42) are interconnected through upstanding torque tubes, cranks (49, 50) and a high level diagonal link (51) extending over intermediate traction motors (35) or other equipment. A bolsterless suspension of rubber pads (31, 32) supports the car-body with traction and braking loads being transferred through linkage including a car-body post (56) carrying a short pivotally mounted car-body beam (58) attached by connecting rods (66) to an adjacent transom (18) of the truck frame (14). The arrangement provides a compact and efficient force transfer system with low axle weight transfer whilst permitting inter-related self-steering action of the front and rear axles (24, 27), but is also adaptable to forced steering truck arrangements.

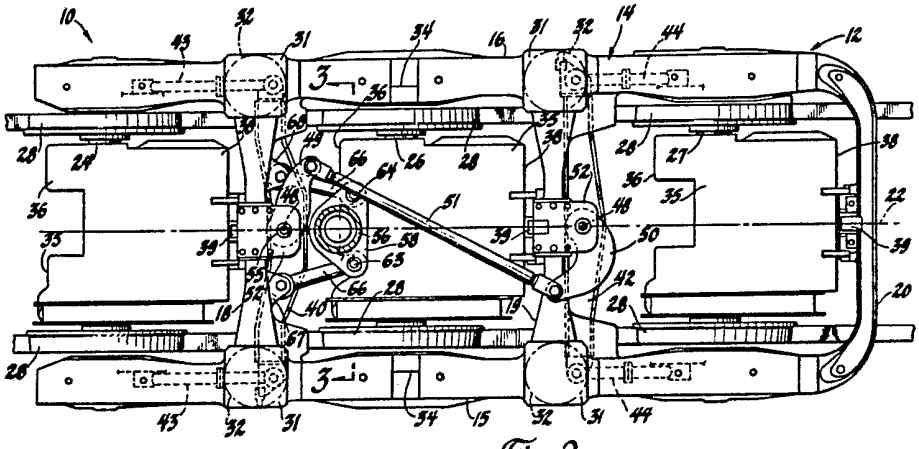


Fig.2

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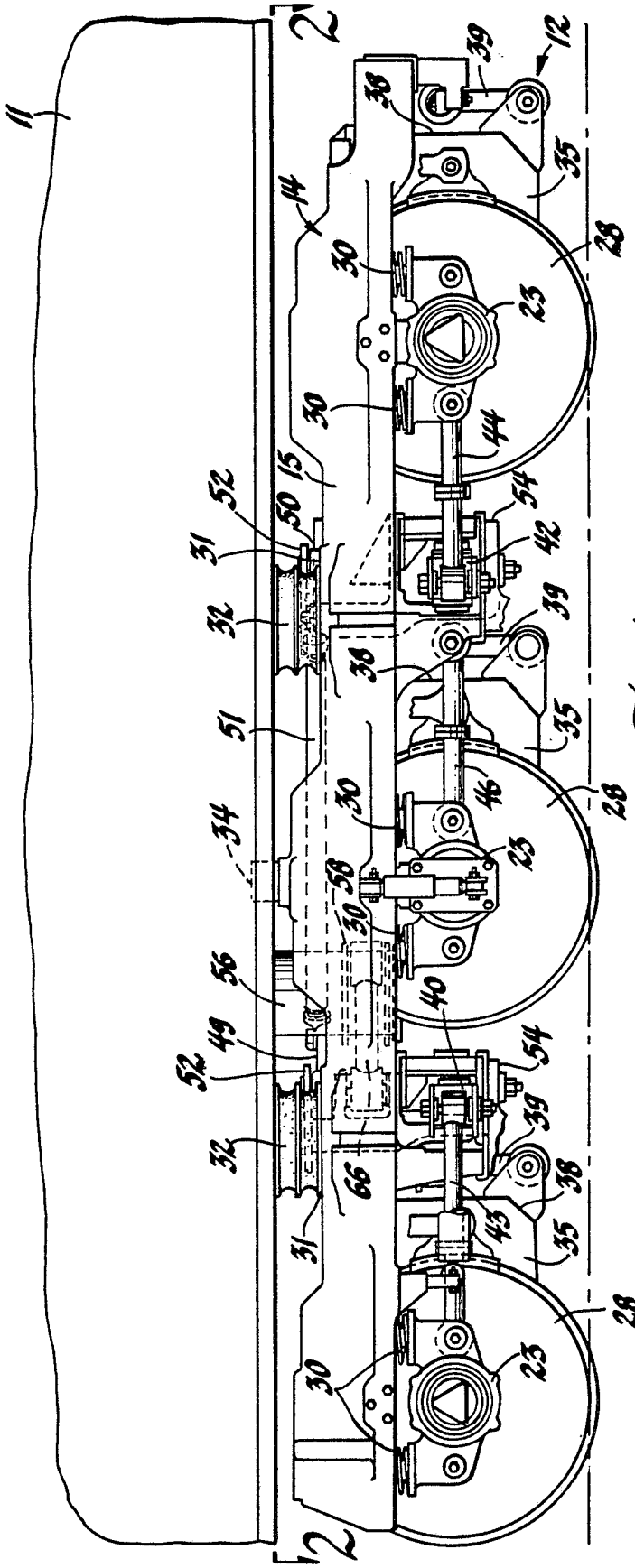


Fig. 1

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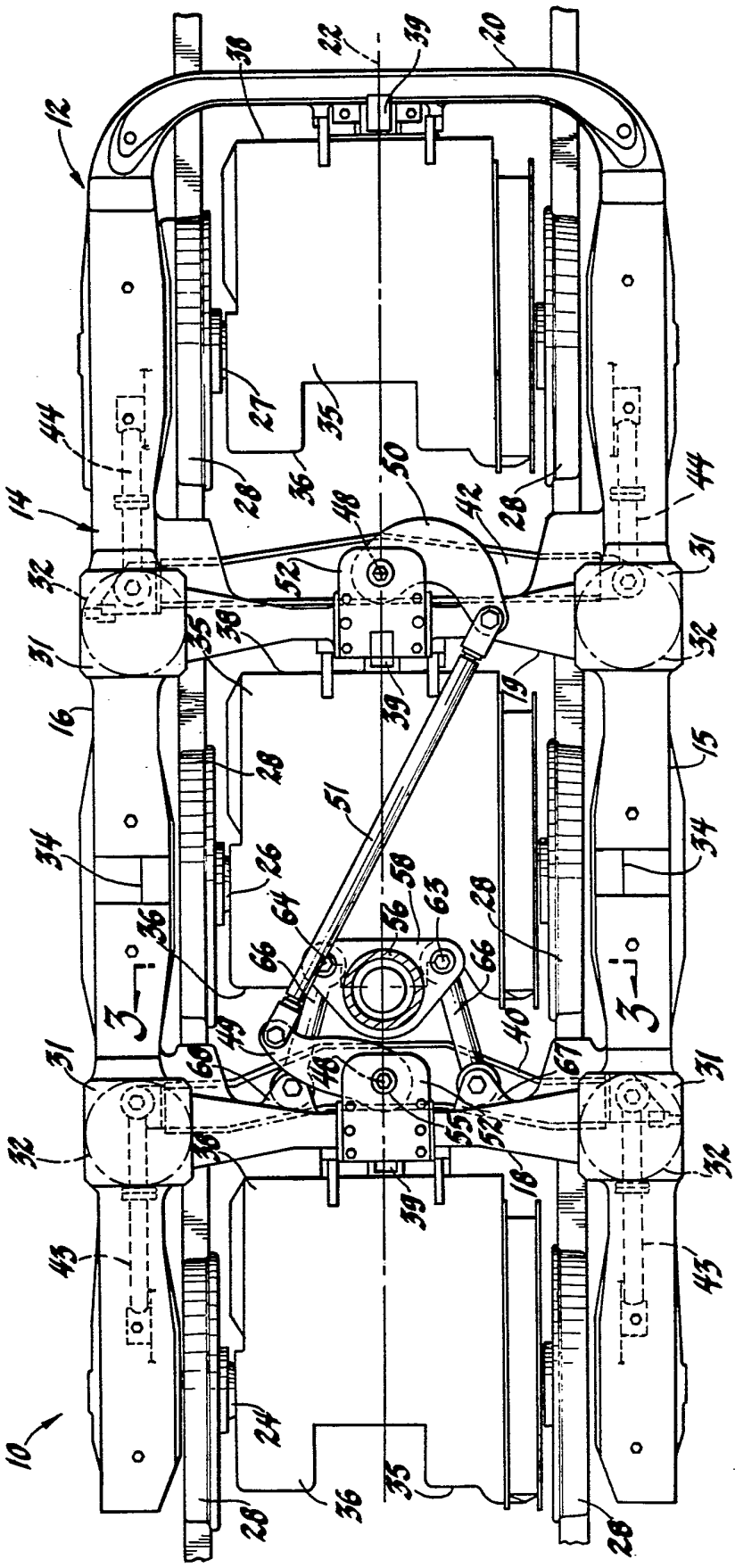


Fig.2

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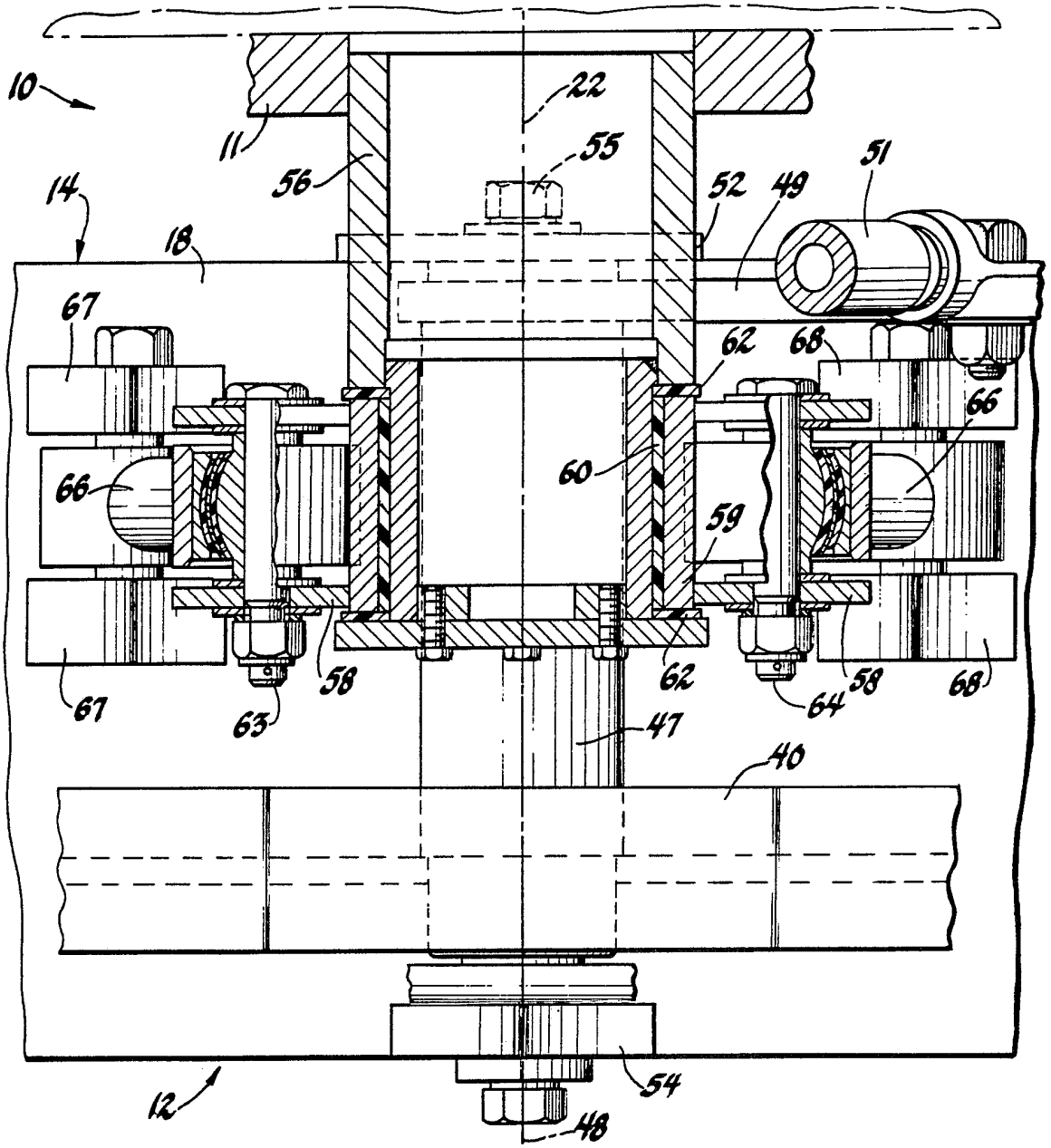


Fig. 3

LOCOMOTIVE AND MOTORIZED SELF-STEERING RADIAL TRUCK THEREFOR

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Technical Field

This invention relates to railway vehicles and steering trucks therefor and, more particularly, to railway locomotives and motorized self-steering radial trucks for locomotive use.

Background

Various types of steering railway trucks have been proposed wherein the angular positions of the axles and their associated wheels are allowed, or forced, to adjust during curve negotiation to maintain more or less radial positions with respect to the curve. Such arrangements are generally proposed to reduce friction and wear of the wheels and rails by minimizing lateral creep forces. The use of such trucks has been considered both for non-powered railway cars and for locomotives with motorized axles.

An extended discussion of one such railway truck, intended primarily for locomotive application, may be found in United States patent 4,628,824, This patent also contains an extensive list of prior art references. United States patents setting forth additional features for self-steering railway trucks for use with locomotives and the like include patents 4,679,506 and 4,679,507.

U.S. patent 4,679,506 discloses an arrangement for powered three axle self-steering railway locomotive trucks. All axles are motorized and a steering beam pivoted on the frame is utilized as part of a linkage to interconnect the end axles for self-steering yaw motions of opposite sense and equal extent. This arrangement, together with that of patent 4,628,824 may be considered as representing earlier

arrangements in the development of the present invention.

Summary of the Invention

The present invention provides a railway truck, and, in a particular embodiment of the invention, a motorized self-steering railway locomotive truck, in association with a vehicle, or locomotive, car-body to provide additional features of construction and arrangement. These features may be useful in railway trucks generally and/or in self-steering railway trucks and motorized railway locomotive trucks of the forced-steering or self-steering types.

Among the features of the invention is a bolsterless construction in which the car-body is supported by resilient secondary suspension means directly on the railway truck frame and a force-transmitting linkage connecting the frame with the car-body includes a car-body post pivotally supporting a relatively short car-body beam having laterally opposite ends, or points, which are connected longitudinally with an adjacent transom of the truck frame.

In another feature of the invention, steering beams connected with the end axles include upstanding torque tubes pivotally mounted on adjacent transoms. The torque tubes carry cranks which are connected by a link extending diagonally over an intermediate traction motor to interconnect the steering beams and the end axles to require self-steering yaw motions of opposite sense and equal extent.

These and other features and advantages of the invention will be more fully understood from the

following description of a preferred embodiment of the invention taken together with the accompanying drawings.

Brief Drawing Description

In the drawings:

Figure 1 is a side elevational view of a railway locomotive having a car-body supported at one end by a three axle self-steering motorized railway truck with features in accordance with the invention;

Figure 2 is a cross-sectional view downwards towards the top of the truck from the plane indicated by the line 2-2 of Figure 1; and

Figure 3 is a transverse cross-sectional view showing the car-body and inter-axle connections from the plane indicated by the line 3-3 of Figure 2.

Detailed Description

Referring now to the drawings in detail, numeral 10 generally indicates a self-powered railway locomotive having a car-body 11 supported at each end by a motorized three axle self-steering railway truck generally indicated by numeral 12 and only one of which is shown. The truck 12 includes a unitary frame 14 which may be fabricated, cast or otherwise manufactured. The frame 14 includes a pair of generally parallel laterally-spaced longitudinally-extending side frames 15, 16 interconnected by three longitudinally-spaced transversely-extending transoms 18, 19, 20. A central longitudinal vertical plane 22 is located equi-distant from the side frames 15 and 16.

At longitudinally-spaced locations along the side frames 15, 16, the truck frame 14 is supported by primary suspension means. These include roller bearing

adapter housings 23 which are rotatably supported on the ends of front, centre and rear axles 24, 26, 27 respectively carried by rail-engageable wheels 28.

The wheels 28 are arranged in laterally-spaced pairs, each connected by one of the axles 24, 26, 27 to form longitudinally-spaced wheel and axle assemblies. Preferably, the longitudinal spacing of the wheel and axle assemblies is equal, as illustrated, and the axles 24, 26, 27 are longitudinally spaced at equal distances from the transoms 18, 19, 20, respectively.

The primary suspension means further include resilient means, such as coil springs 30, which act between the bearing housings 23 and pockets in the truck frame 14 so as to support the truck frame. The springs 30 also allow limited relative motion of the wheel and axle assemblies with their bearing housings 23 whilst resiliently urging the housings and their wheel and axle assemblies into nominally centred non-curving longitudinally-aligned positions.

Along the top of the truck side frames at the ends of the intermediate transoms 18 and 19 are four support pads 31 on which rubber springs 32 are carried for supporting the car-body 11. The rubber springs 32, which could be replaced by any other suitable resilient suspension means, are made stiff in compression to provide a relatively hard secondary suspension between the truck frame and car-body. The springs 32 yield more freely in sheer to permit limited lateral motion as well as yawing motion of the truck frame relative to the car-body during normal curve negotiation. Car-body stops 34, provided on the truck frame, are arranged to

engage inner portions of the car-body to limit the amount of lateral car-body motion as required.

For powering the wheel and axle assemblies to drive the locomotive, the truck is provided with three traction motors 35, one driving each axle. Each motor has a forward side 36 supported by conventional bearing means on its respective axle and a rearward side 38 carried from one of the adjacent transoms by a depending link 39. The terms forward and rearward are used for descriptive purposes only, with respect to the drawings, as the truck may be operated equally well in either direction of operation. Each link 39 is flexibly or swivelly connected at its ends to allow a limited amount of both longitudinal and lateral motion between the traction motor and the adjacent transom member by which it is supported.

To provide for limited self-steering action of the wheel and axle assemblies whilst transmitting traction and braking forces between the wheel and axle assemblies and the truck frame, the truck is provided with suitable traction linkage formed in accordance with the invention. This traction linkage includes laterally-extending front and rear steering beams 40, 42, respectively, which are pivotally connected at their centres with the bottoms of the intermediate transoms 18, 19, respectively, as will be subsequently more fully described.

Laterally opposite ends of the front and rear steering beams 40, 42 are, respectively, connected with the bearing housings 23 of the front and rear axles 24, 27 by front and rear traction rods 43, 44, respectively. The bearing housings 23 of the centre

axle 26 are directly connected with the truck frame by centre traction rods 46 which allow lateral and vertical movement of the centre axle but prevent any yawing or turning motion thereof.

The steering beams 40, 42 are attached to respective upstanding torque tubes 47 (see Figure 3) which extend vertically upward about pivot axes 48 of the steering beams and connect, at their upper ends, with front and rear cranks 49, 50 respectively. These cranks extend in laterally opposite directions, the front crank 49 extending to the right and slightly backward from its steering beam pivot axis 48 and the rear crank 50 extending to the left and slightly forward from its steering beam pivot axis 48. The ends of the cranks are then interconnected by a link 51 which extends diagonally over the intermediate traction motor 35 which is located between the transoms 18, 19, is supported from the front side of the transom 19, and is drivingly connected with the centre axle 26.

To support the steering beams with their associated torque tubes 47 and cranks 49, 50, the central transoms 18, 19 are provided with upper and lower pivot plates 52, 54, respectively, carrying through bolts 55. These secure internal steel and rubber bushings, not shown, on which the torque tubes 47 are pivotally mounted.

The steering beams 40, 42, connecting rods 43, 44, cranks 49, 50 and link 51 are so arranged as to require equal and opposite yawing (steering) motions of the front and rear axle assemblies so as to provide efficient inter-related self-steering actions of the end axles. These components, together with the centre

traction rods 46 connecting the centre axle 26 with the frame, comprise first force-transmitting linkage which carry the traction and braking forces between the axles and the truck frame, as well as allowing equal and opposite self-steering of the end axles.

The locomotive is further provided with second force-transmitting linkage which connects the frame with the car-body to provide for the transfer of traction and braking forces therebetween. This linkage, or structure, includes a tubular car-body post 56 that depends from the car-body at a location centrally between the truck side frames and longitudinally disposed adjacent and slightly rearwardly of the front transom 18.

On the lower end of the post 56 there is pivotally carried a generally triangularly-shaped car-body beam 58 having a cylindrical centre 59 carried on a bearing bushing 60 and washers 62. The car-body beam 58 has pivot points 63, 64 at laterally opposite ends from which connecting rods 66 extend forwardly and outwardly to pivotal connections with ears 67, 68, respectively, located on the rear of the transom 18. The connecting rods are angled so as to allow yawing motions of the truck frame about the car-body post 56 to effectively take place approximately about a centre equi-distant from the four rubber springs 32 on which the car-body is supported.

The transfer of forces from the truck frame to the car-body through the connecting rods 66, car-body beam 58 and car-body post 56 permits a locomotive truck arrangement having the advantages of bolsterless construction and using rubber springs 32 to

support the vertical loads while allowing normal yawing and lateral motion of the truck frame relative to the car-body during operation. The additional provision of the steering linkage, utilizing connecting rods to transfer axle loads to the steering beams and the truck frame at axle level, combines with the vertically stiff secondary suspension to provide low weight transfer between axles during operation.

Interconnection of the axles through the steering beams by means of the upstanding torque tubes 47, cranks 49, 50 and link 51 provides the desired steering interconnection of the axles within space made available by the absent bolster. The high level of the diagonal link 51, positioned over or near the tops of the frame transoms 18, 19, allows it to extend over the top of the central traction motor 35. This avoids any need for increasing the overall width of the truck as is done in the linkage arrangement of U.S. patent 4,679,506, previously mentioned.

The traction motors are conventionally supported on their respective axles and on the front sides of the adjacent transoms 18, 19, 20. The steering beams 40, 42 and their associated torque tubes 47 are, accordingly, carried on the rear sides of the associated intermediate transoms 18 and 19, taking advantage of the available open sides opposite from the supporting points of the adjacent traction motors.

These various features provide a railway vehicle and supporting truck arrangement having self-steering capability, as described in the previously mentioned U.S. patents and with the further benefits of compactness and practicality for multi-axle

locomotive trucks, especially those having three or more axles. While the arrangement is disclosed in connection with self-steering trucks, it should be understood that features of the arrangement could also be applied to so-called "forced steering" railway trucks wherein the steering mechanism is interconnected directly with the vehicle or locomotive car-body to inter-relate the steering movements of the axles with the yawing motion of the truck frame relative to the car-body. Thus, while the described arrangement in the preferred embodiment is free of direct connections between the steering linkage and the car-body, the features of the invention are not so limited.

Claims:

1. A railway locomotive of the type comprising a car-body supported by a steering truck including a pair of wheel and axle members, a truck frame including a pair of parallel side frames interconnected by at least one laterally-extending transom, the truck frame being carried by the axles through primary suspension means permitting yawing for movement along curved track, first force-transmitting linkage connecting the axles with the frame and including a lateral steering beam connected with at least one of the axles and having a centre pivotally connected with the frame to allow steering of the axle connected therewith whilst carrying longitudinal forces between it and the frame, and second force-transmitting linkage connecting the frame with the car-body and including a car-body post depending from the car-body laterally between the truck side frames and longitudinally adjacent to said at least one transom, a car-body beam pivotally carried on the post and having laterally opposite pivot points, each lying between the post and one of the side frames, and movably attached connecting rods longitudinally connecting each of said car-body beam pivot points with the adjacent transom to carry traction and braking forces whilst allowing yawing and lateral motion of the truck frame relative to the car-body.

2. A railway locomotive according to claim 1, in which the car-body is supported on the truck frame by resilient secondary suspension means spaced laterally toward opposite sides of the truck frame, the truck includes at least three wheel and axle

members, the truck frame includes two of said transoms spaced one between each of the end axles and the remaining axles, and the first force-transmitting linkage includes a pair of said steering beams connected one with each of the end axles, means interconnecting said steering beams to require self-steering yaw motions of the wheel and axle members to be of opposite sense and equal extent and said interconnecting means includes a torque tube upstanding from each of the steering beams and pivotally mounted on one of the transoms with a crank on the tube above its respective steering beam, the cranks of the two beams extending in laterally opposite directions to one another, and a link connecting the two cranks for equal and opposite oscillation, said link extending diagonally over the portion intermediate the transoms to interconnect the steering beams.

3. A railway locomotive according to claim 2, in which traction motors are drivingly connected with the respective axles for driving the locomotive wheels, and said link extends diagonally over the at least one intermediate traction motor to interconnect the steering beams.

4. A railway locomotive according to claim 1, in which said primary suspension means comprise resilient suspension means nominally urging the axles into centred positions for motion along straight track but permitting yawing for movement along curved track, and the centre of said lateral steering beam is free from connection with the car-body to allow self-steering of its connected axle whilst carrying longitudinal forces between it and the frame.

5. A railway locomotive according to claim 2, in which said resilient secondary suspension means comprises rubber springs carried on support pads.

6. A railway locomotive substantially as hereinbefore particularly described with reference to Figures 1 to 3 of the accompanying drawings.

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