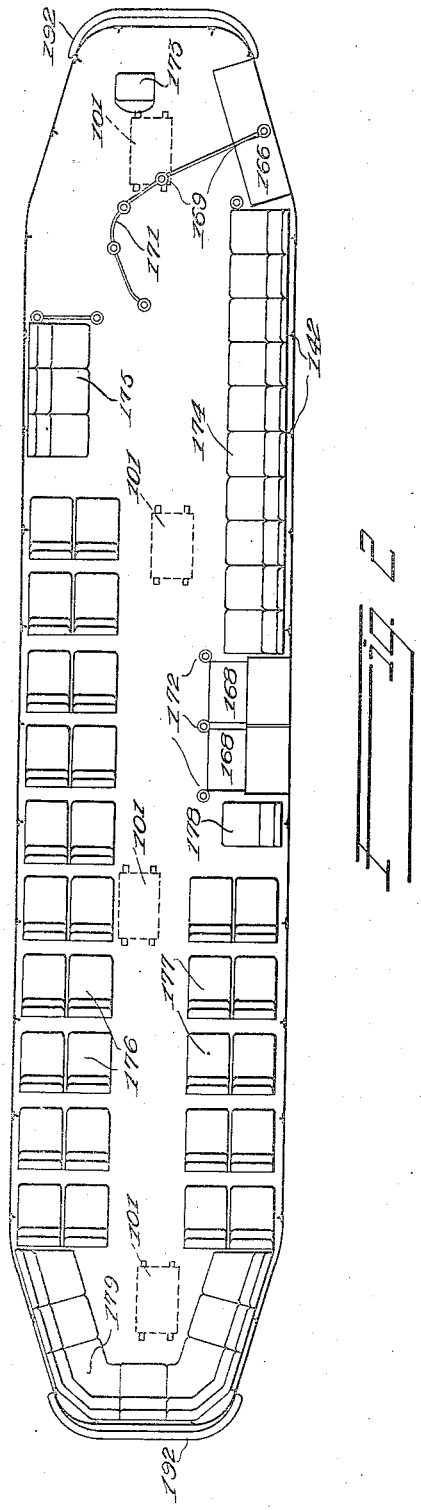
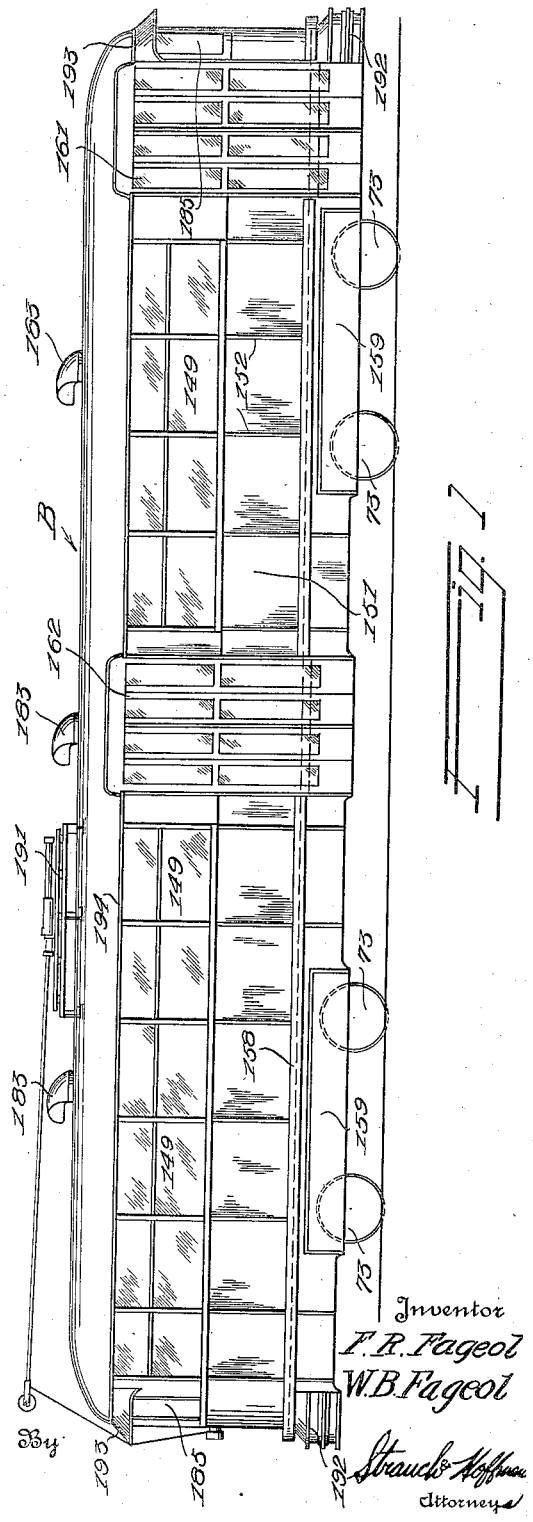
July 4, 1933. F. R. FAGEOL ET AL 1,916,469

EIGHT-WHEEL RAIL CAR

Filed March 7, 1930 9 Sheets-Sheet 1



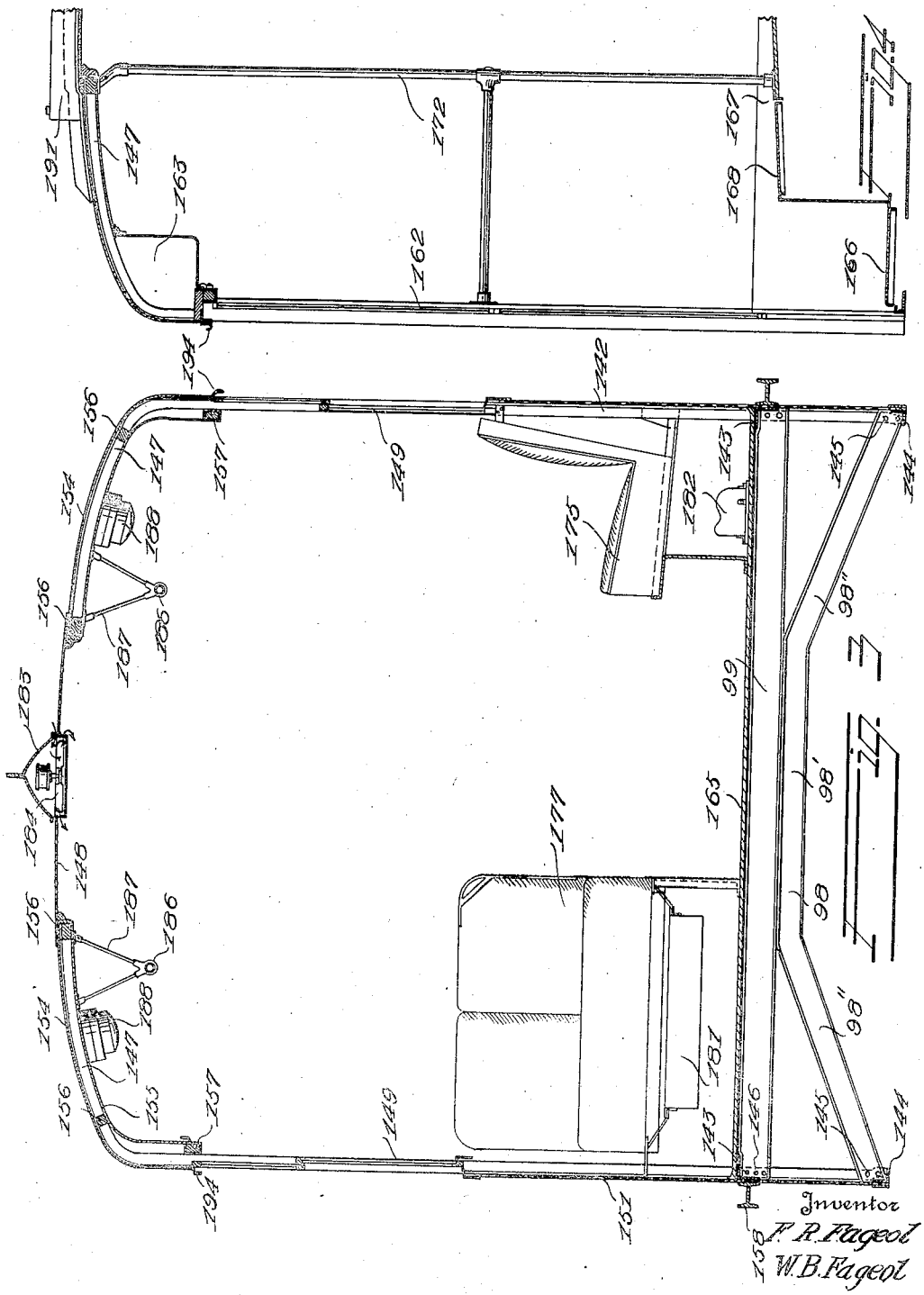


Inventor
F. R. Fageol
W. B. Fageol
By Strauch & Hoffman
Attorneys

July 4, 1933. F. R. FAGEOL ET AL 1,916,469

EIGHT-WHEEL RAIL CAR

Filed March 7, 1930 9 Sheets-Sheet 2



July 4, 1933. F. R. FAGEOL ET AL 1,916,469

EIGHT-WHEEL RAIL CAR

Filed March 7, 1930 9 Sheets-Sheet 3

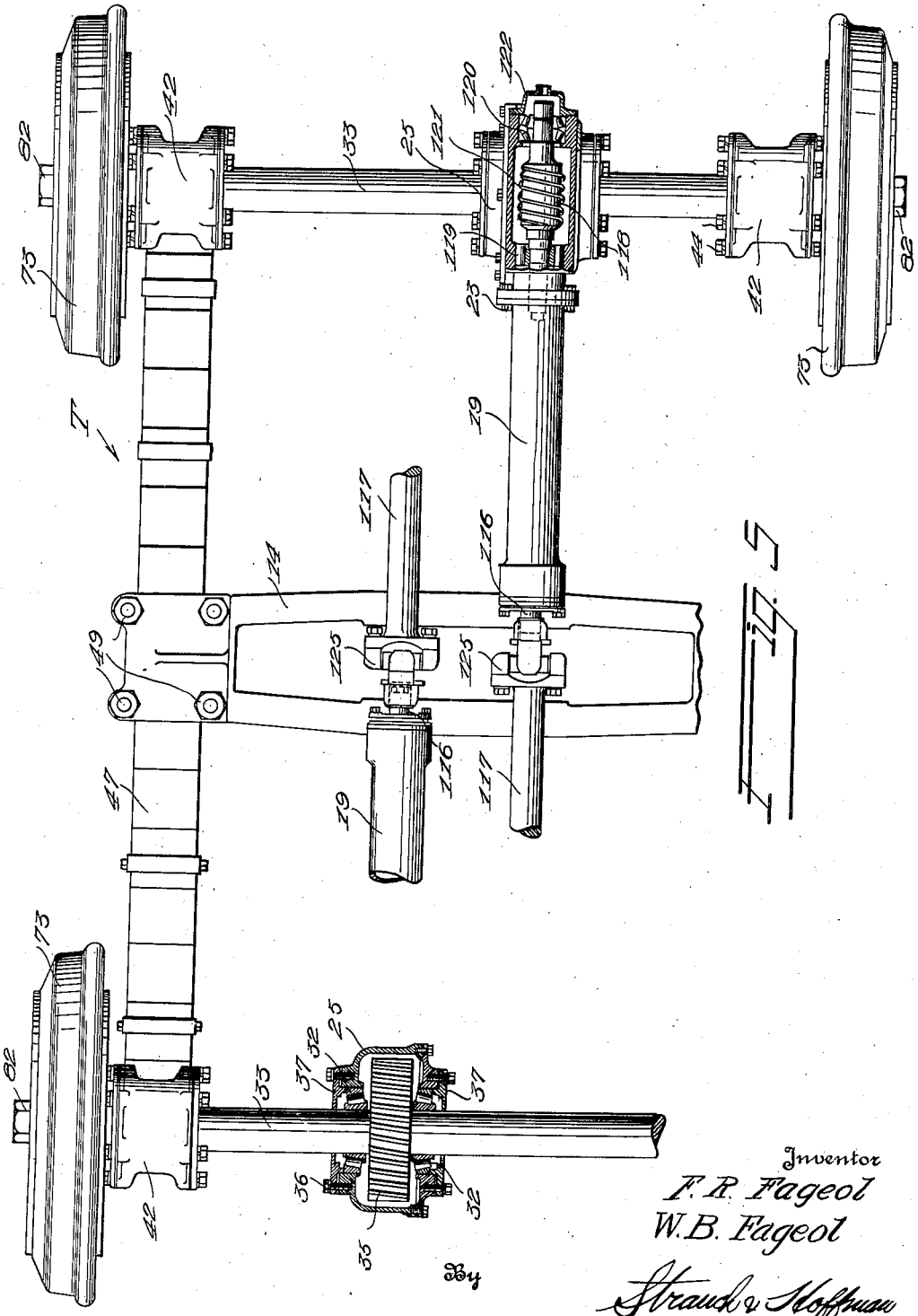


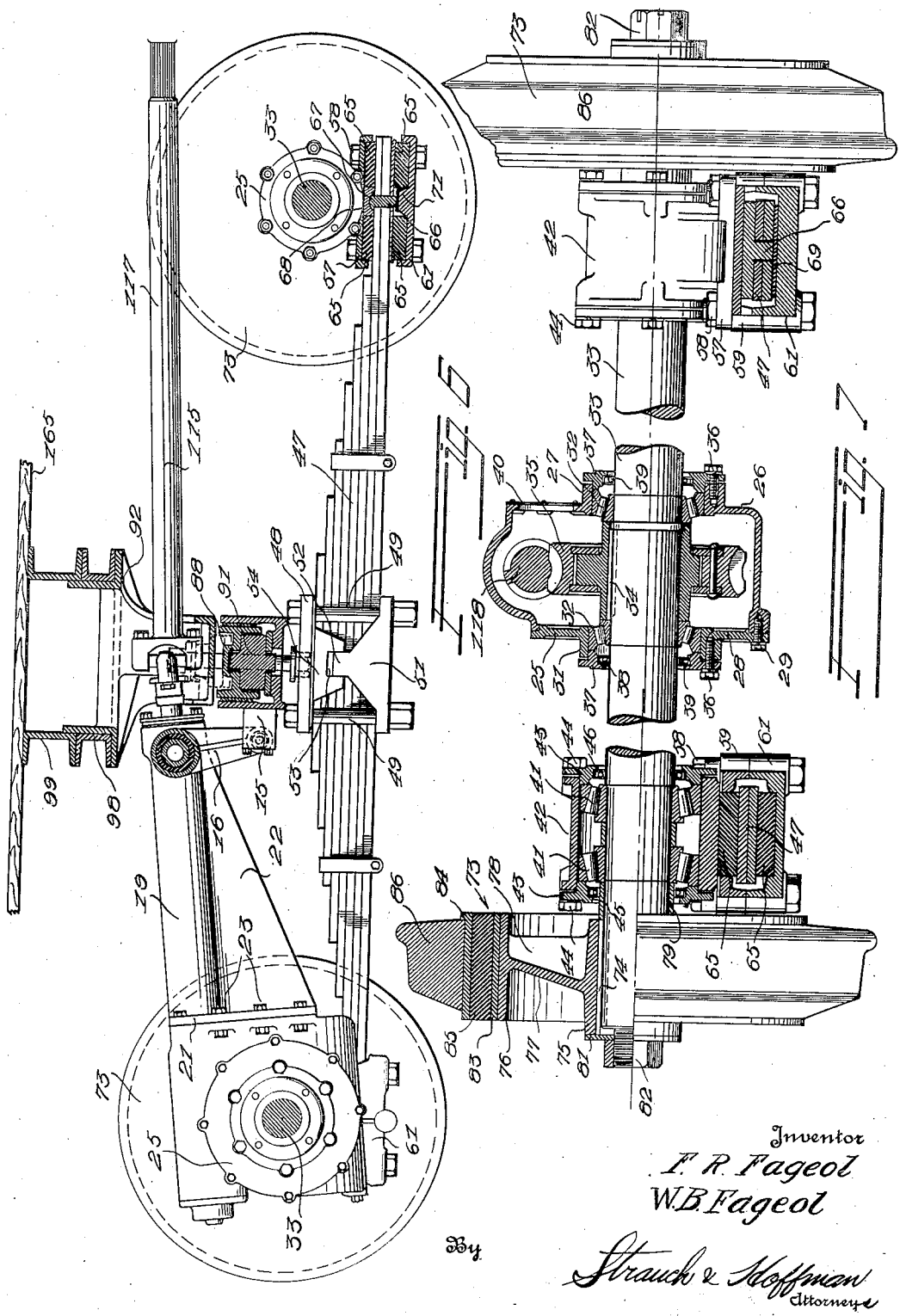
Fig. 7

Inventor
F. R. Fageol
W. B. Fageol
By Strauch & Hoffman
Attorneys

July 4, 1933. F. R. FAGEOL ET AL 1,916,469

EIGHT-WHEEL RAIL CAR

Filed March 7, 1930 9 Sheets-Sheet 4



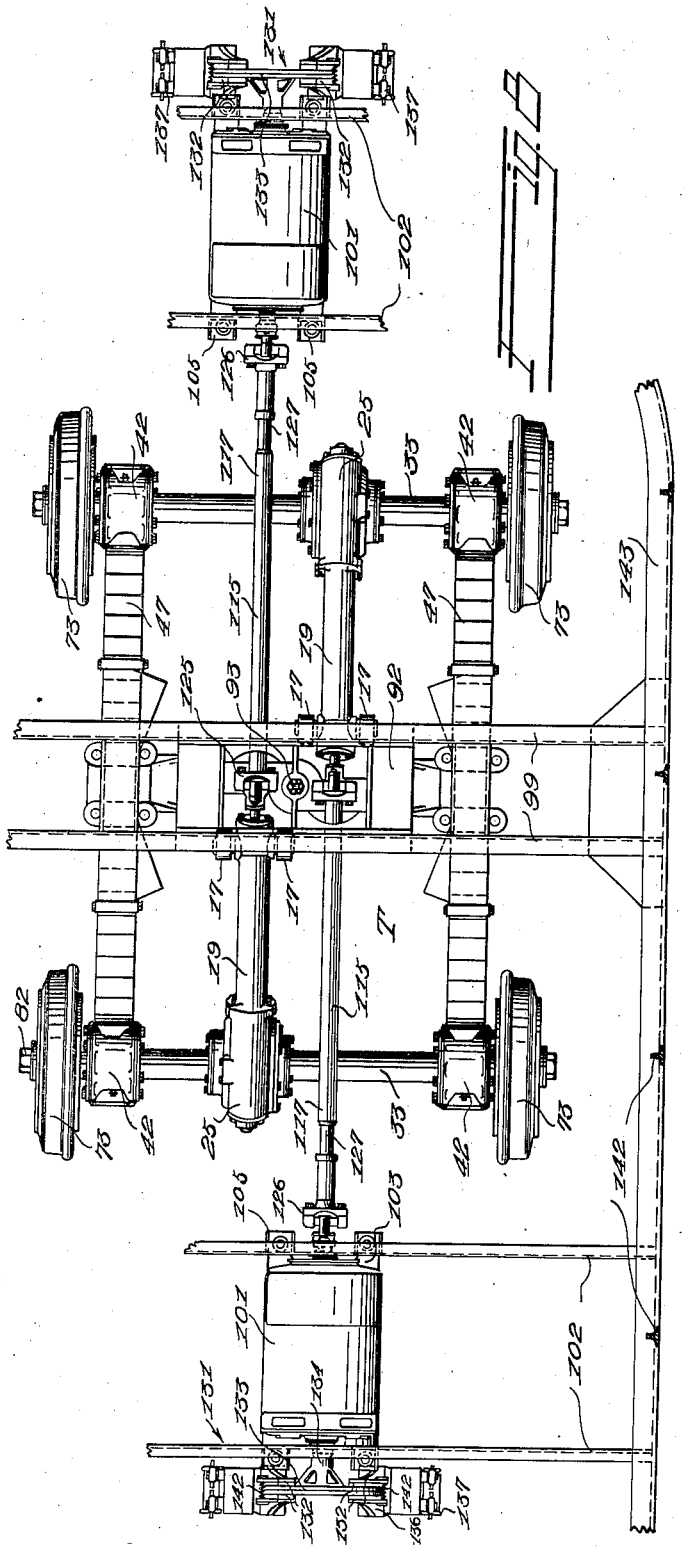
Inventor
F. R. Fageol
W. B. Fageol

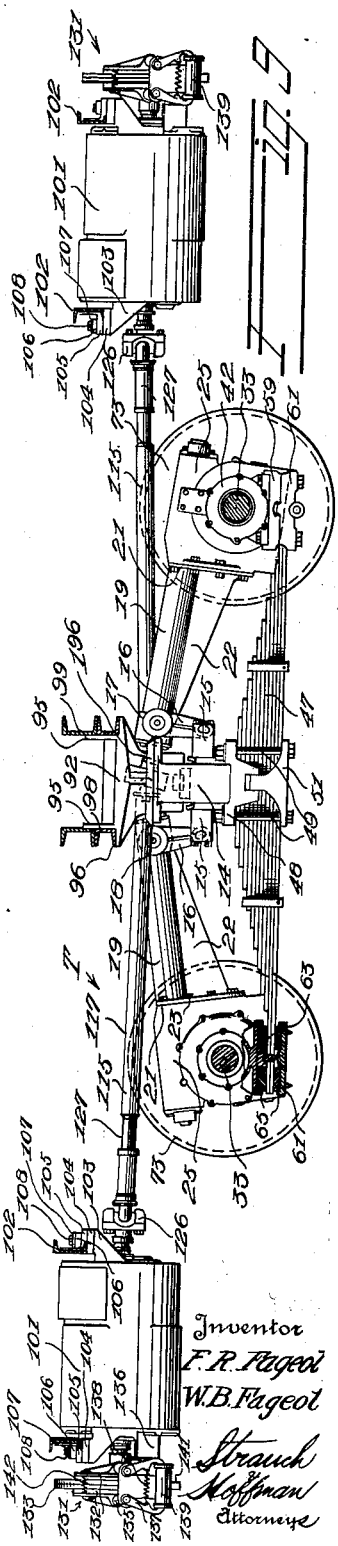
By Strauch & Hoffman
Attorneys

July 4, 1933. F. R. FAGEOL ET AL 1,916,469

EIGHT-WHEEL RAIL CAR

Filed March 7, 1930 9 Sheets-Sheet 5



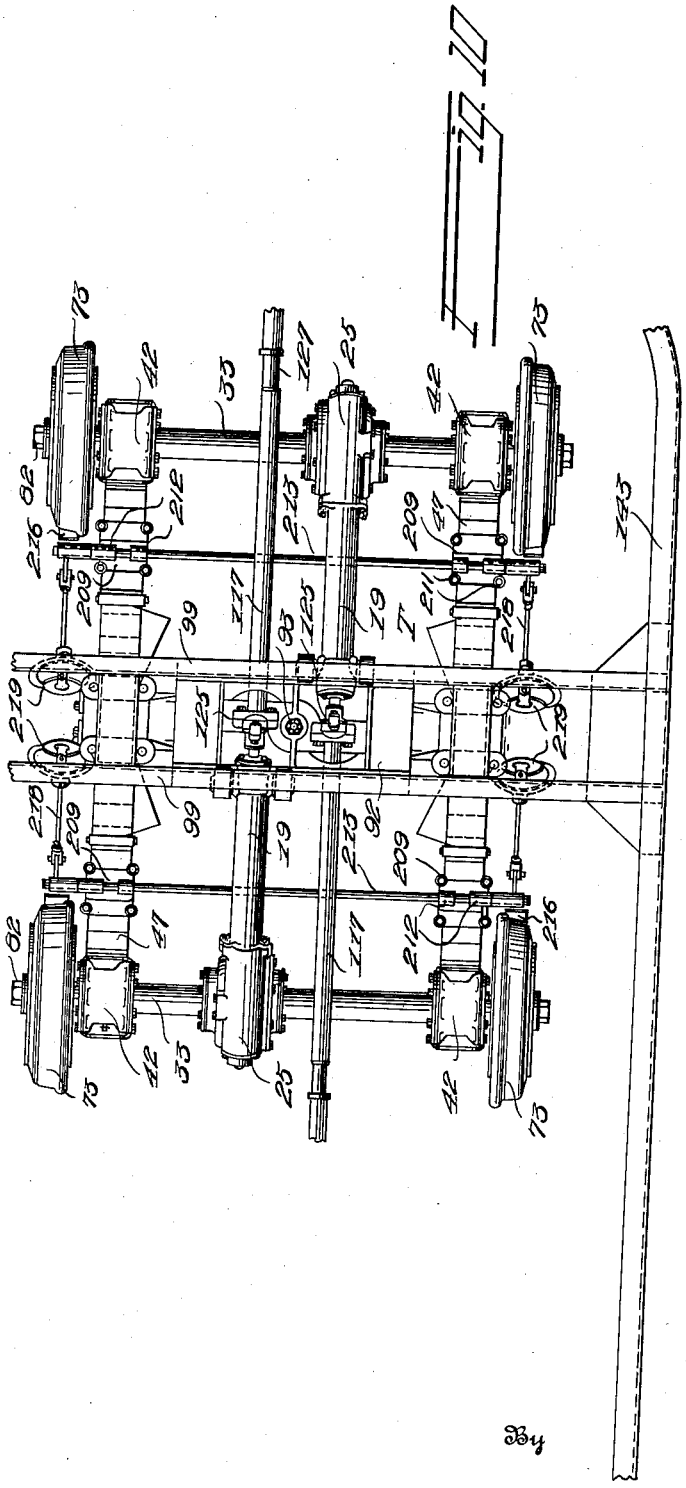


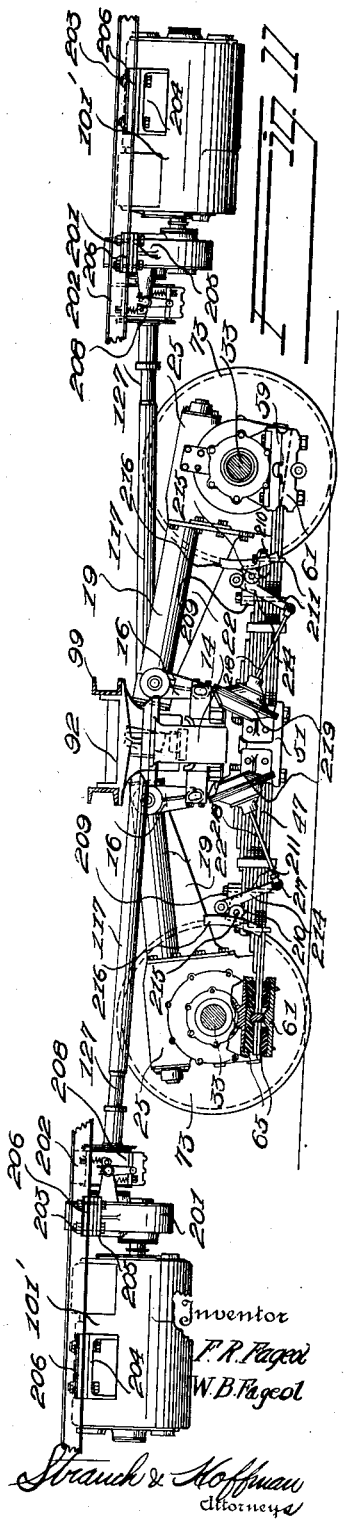
Inventor
F. R. Fageol
W. B. Fageol
Strauch & Hoffman
Attorneys

July 4, 1933. F. R. FAGEOL ET AL 1,916,469

EIGHT-WHEEL RAIL CAR

Filed March 7, 1930 9 Sheets-Sheet 6





Inventor
F. R. Fageol
W. B. Fageol

By Strauch & Hoffman
Attorneys

July 4, 1933. F. R. FAGEOL ET AL 1,916,469

EIGHT-WHEEL RAIL CAR

Filed March 7, 1930 9 Sheets-Sheet 7

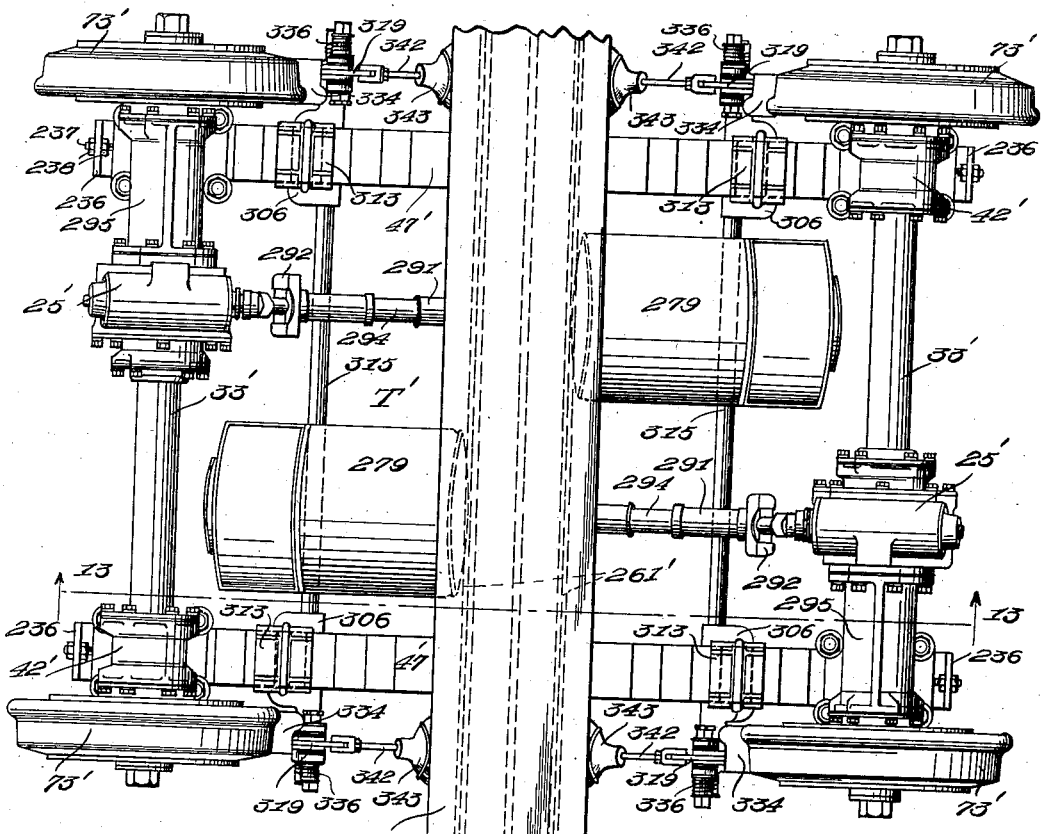


FIG. 12

FIG. 13

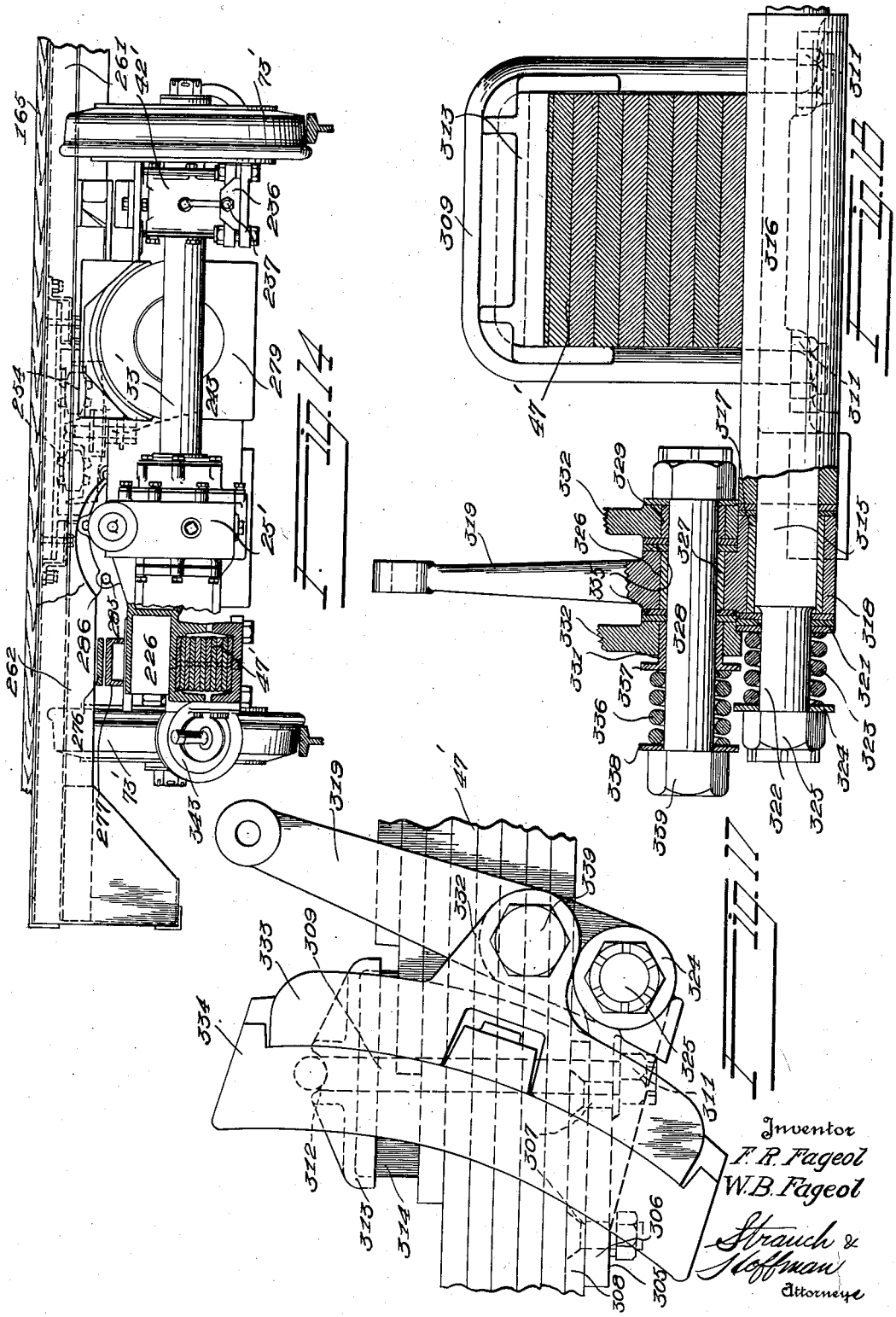
Inventor
F. R. Fageol
W. B. Fageol

By Strauch & Hoffman
Attorneys

July 4, 1933. F. R. FAGEOL ET AL 1,916,469

EIGHT-WHEEL RAIL CAR

Filed March 7, 1930 9 Sheets-Sheet 8

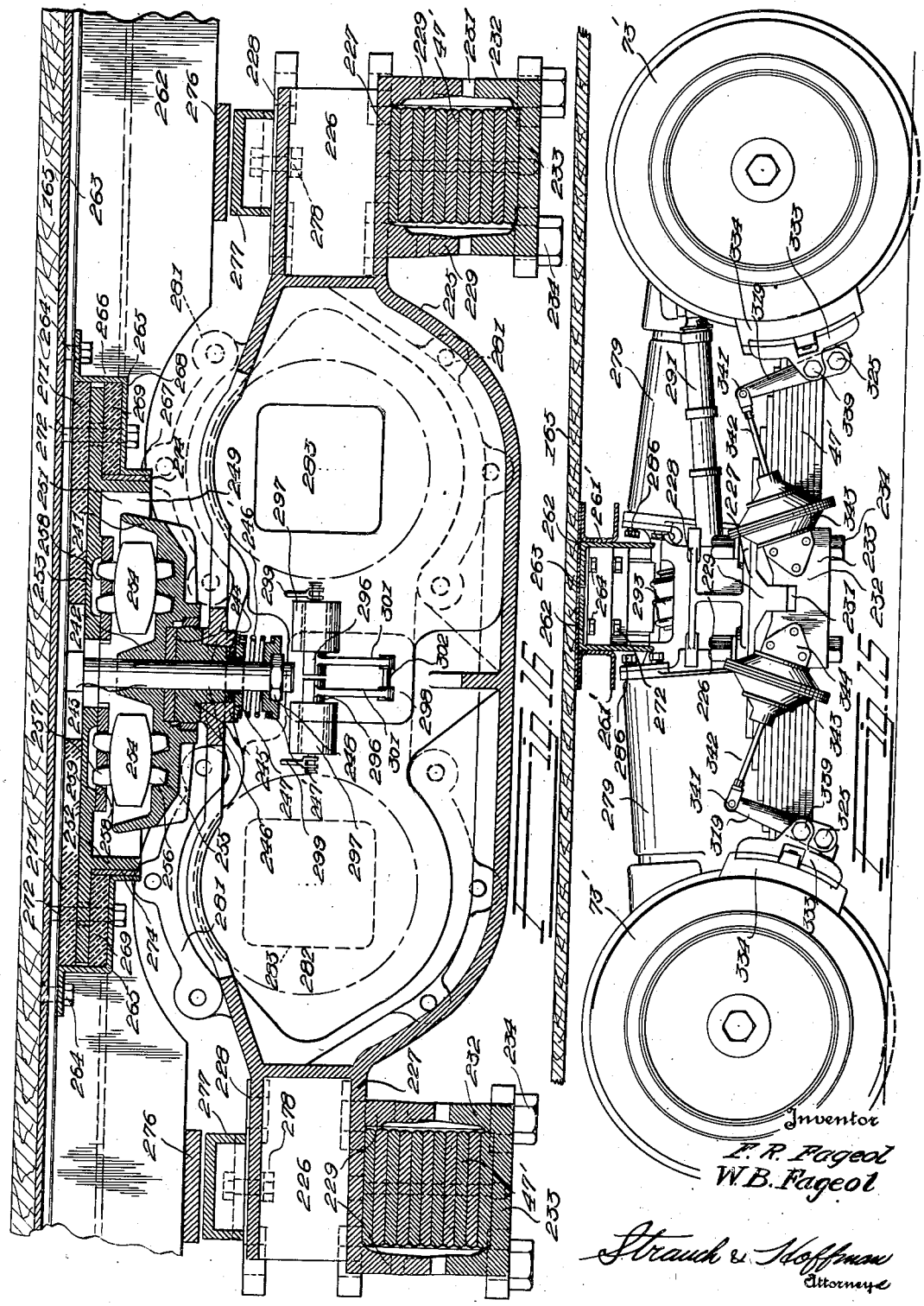


Inventor
F. R. Fageol
W. B. Fageol
Strauch & Hoffman
Attorneys

July 4, 1933. F. R. FAGEOL ET AL 1,916,469

EIGHT-WHEEL RAIL CAR

Filed March 7, 1930 9 Sheets-Sheet 9



Inventor
F. R. Fageol
W. B. Fageol
Strauch & Hoffman
Attorneys

Patented July 4, 1933 1,916,469

UNITED STATES PATENT OFFICE

FRANK R. FAGEOL AND WILLIAM B. FAGEOL, OF KENT, OHIO, ASSIGNORS TO TWIN COACH COMPANY, OF KENT, OHIO, A CORPORATION OF DELAWARE

EIGHT WHEEL RAIL CAR

Application filed March 7, 1930. Serial No. 434,048.

This invention relates to a rail car of the type that includes a body supported at each end by a truck consisting, preferably, of four wheels. More particularly the invention relates to rail cars of the type just stated embodying motors electrically driven from a power plant located at a remote point.

Cars of this type, now in general use, are of heavy construction, and include substantially no means for resiliently interconnecting the various heavy parts that enter into the construction thereof. In view of these facts electrically driven rail cars now in common use are generally extremely noisy in operation, in strong contrast to the modern buses with which such cars are now generally operated in competition.

It has been found that rail cars of the type under consideration need not partake of the heavy constructions now generally employed, and that it is entirely feasible to construct a rail car having a degree of resilience in the connections between the various parts that serve to support the body thereof, and to very greatly reduce the weight of the car. The reduction in weight results in more silent operation, even in the absence of the resilient connections between the supporting elements of the car body. However, such resilient interconnections serve to further cushion the shocks and impact between the parts entering into the car body construction, when the rail car moves over relatively uneven road beds. It has been found that it is feasible, by effecting a substantial reduction in the weight of the construction, by providing proper resilience between the axles and the truck frame, and by cushioning the connections between the parts of the vehicle to produce a rail car that operates with a silence comparable with that by which motor buses are being operated at the present time.

The reduction of the weight of the rail car further results in a lowered initial cost of the construction, and lowers the cost of operation of the vehicle in its unloaded condition.

The provision of a substantial degree of resilience between the wheels and axles permitting yielding of said elements with respect to the frame and with respect to each other introduces a degree of relative motion that is not present in rail cars now in common use, and such relative motion introduces factors requiring a definite correlation of the driving and braking connections used to propel and control the car so that disarrangement thereof causing improper application of the brakes and losses of power due to "whipping" of the drive shafts, etc., does not result during the normal operation of the car while the parts thereof are moving relative to each other. It has been found, that it is entirely feasible by properly designing the braking and driving arrangements to permit a degree of flexibility between the supporting parts of the rail car and the body heretofore not regarded as feasible in rail car construction.

The primary object of this invention is accordingly to overcome the objections just pointed out in present day constructions, and to provide a rail car of relatively light weight, compared to the heavy constructions now in general use, and embodying flexible and resilient interconnections between the running gear and the body of the car, and between the various parts of the running gear, that will enable the car to be operated silently over even irregular rails, without causing inefficient operation of the driving means or braking means when the parts of the vehicle move relative to each other.

A further important object of the invention is to provide a rail car embodying a truck in which the axles are spaced apart by leaf spring assemblage, as distinguished from rigid truck frame members, adding great weight to the truck construction and serving to restrict the free movement of the axles with respect to each other and with respect to the truck bolster.

A further object of the invention is to provide a rail car including a truck in which leaf spring assemblies are relied upon to space the axles apart and to resiliently connect them to the frame members, and in which the wheels as well as the connections between the springs and the axles are provided with cushioning elements, minimizing, so far as possible, metal to metal contact at the points of connection, providing a construction that

operates silently over even poorly aligned tracks, and that will possess superior riding qualities in view of the absorption of the vibration of the parts of the body in the resilient cushions.

A further object of the invention is to provide a rail car construction including a truck in which the axles are spaced apart by means of leaf spring assemblies and in which the leaf spring assemblies are alone relied upon to serve this function, in which the torque reactions due to the driving force are transmitted from the axles to the bolster in a manner so as not to interfere with the free movement of the axles permitted by the springs that connect them to the bolster. In other words, the torque resisting connections are arranged to effectively resist the torque reactions by being relatively rigid in planes necessary to effect this function, while at the same time having degrees of flexiblity of all other directions so as to interfere with the yieldingly resisted movements of the axles.

A still further object of the invention is to provide a rail car including trucks having a high degree of flexibility and light weight, and embodying motors and drive shafts so disposed as to minimize losses of power due to changes in the angularity of the drive shafts permitted by the flexibility of the construction.

A further object of the invention is to provide a rail car having a body supported by trucks having a high degree of flexibility, in which the body is mounted on the truck for movement about substantially vertical axes in such manner as to provide a stable support for the body during its movement and at the same time cushion and yieldingly resist the tendency of the body to move with respect to the pivot about which the trucks are free to swing.

A further object of the invention is to provide a rail car supported at each end by a truck that is secured to the body for pivotal movement about a substantially vertical axis, and in which the axles of each truck are driven by motors that are suspended from the body and are provided with drive shafts interconnecting the motors in the axles that are so arranged with respect to the pivotal mounting for the trucks as to minimize the effect of the changes in angularity between the truck and the body under normal operating conditions, and to provide such drive shafts with flexible joints disposed to permit the movement of the body with respect to the truck without introducing substantial travel of the spline ordinarily included in flexible drive shafts.

A still further object of the invention is to provide a rail car including a truck consisting of a bolster and a pair of axles spaced laterally from the bolster by springs that constitute the sole means for effecting this function, and in which the motors for individually driving the axles are mounted on the bolster independently of the axles so that free movement of the axles with respect to the bolster is permitted.

A still further object of the invention is to provide a rail car having a truck consisting of bolsters and axles held in spaced relation by leaf spring assemblies in which axles are individually driven by motors that each are attached to the side of the bolster remote from that nearest to the driven axle, whereby longer drive shafts may be employed to couple each axle and its motor permitting substantial movement of the axle with respect to the motor without causing the drive shaft to move through large angles when the axles move with respect to the bolster, since the amplitude of angular movement of the shaft is a function of the length of the shaft.

A still further object of the invention is to provide a rail car, the body of which is supported by a truck having a high degree of flexibility and capable of swinging with respect to the car body about axes that are substantially vertical, in which the wheels of the truck are provided with brakes, the application of which is substantially unaffected by virtue of the wheel movement permitted because of the fact that the construction is relatively flexible.

A still further object of the invention is to provide a rail car, supported by drive trucks that are pivotally connected to the body for movement about vertical axes in which emergency brakes are provided on the motor shaft carried by the truck bolsters and in which the mechanism for operating the brakes is so associated with the truck, that the trucks are free to swing as the car rounds turns without introducing disarrangement of the braking mechanism and the introduction of factors that may result in an improper application of the brakes caused by changes in position of the parts as the vehicle is rounding a curve.

Still further objects of the invention will appear as a description thereof proceeds with reference to the accompanying drawings in which:

Figure 1 is a side elevational view of an eight wheel rail car constructed in accordance with a preferred embodiment of the invention.

Figure 2 is a horizontal sectional view of the car body, disclosed in Figure 1, particularly illustrating the seating arrangement, the entrance and exit doors together with the relative disposition of the motors indicated in dotted lines.

Figure 3 is a transverse sectional view of the car body, particularly disclosing the relatively light body base frame construction to which the supporting and propelling mechanism, later described, is directly secured.

Figure 4 is a fragmentary transverse sec-

tional view of the car body particularly disclosing the exit door step arrangement.

Figure 5 is a broken view, partly in top plan and partly in horizontal section, of one of the novel four wheel truck constructions embodied in the present invention.

Figure 6 is a view, partially in side elevation and partially in longitudinal vertical section, of the construction disclosed in Figure 5.

Figure 7 is a broken and foreshortened view, partly in elevation and partly in vertical longitudinal section, of one of the drive axles, associated wheels, and drive mechanism for the axle.

Figure 8 is a top plan view of one of the truck constructions, together with the driving motors therefor, which are supported by the body base frame construction, a fragmentary portion of which is also indicated.

Figure 9 is a side elevational view partly in section of the construction illustrated in Figure 8.

Figures 10 and 11 are views respectively corresponding to Figures 8 and 9 disclosing a modified embodiment of the invention.

Figure 12 is a top plan view partly broken away of a truck construction in accordance with further modified and at present preferred embodiment of my invention.

Figure 13 is a longitudinal section substantially on line 13—13 in Figure 12, the figure further including the central bolster pivotal connection as well as illustrating a portion of the car body with which the truck construction is directly associated.

Figure 14 is a view, partially in end elevation and partially in transverse section, of the truck construction illustrated in Figure 12.

Figure 15 is a side elevational view of the truck construction illustrated in Figure 12.

Figure 16 is a substantially longitudinal central sectional view of the bolster, particularly disclosing the pivotal and oscillating connections between the bolster and the body and also the connections of the leaf spring assemblies with the opposite ends of the bolster.

Figure 17 is a broken side elevational view of one of the spring assemblies disclosing the association therewith of one of air and fluid actuated service brake constructions.

Figure 18 is a transverse sectional view of the construction illustrated in Figure 17 with certain parts shown in elevation.

Referring to the drawings by reference characters in which like characters designate like parts, B (Fig. 1) designates the car body which as hereinafter described is built up of relatively light structural elements providing a light weight construction. The body is supported by a pair of truck assemblies T (Fig. 5) which as will hereinafter appear are secured directly to the body construction.

Each of the truck assemblies for the car as illustrated in detail in Figures 5 to 9, comprises a main cross supporting bolster 14, which is of rigid construction and preferably of hollow formation, as more particularly indicated in Figures 5 and 6. The bolster 14 is provided on each side thereof with a pair of lugs 15, which, as indicated in Figure 8, are arranged slightly offset longitudinally of the bolster in closely spaced relation to the transverse center of the bolster. Pivotally secured to lugs 15 at the inner ends thereof are corresponding pairs of links 16, which, at the outer ends thereof, are provided with apertured bosses 17, between each pair of which is pivotally secured, adjacent an end thereof, as indicated at 18, a torque tube 19. Each torque tube 19 at the opposite end thereof is provided with an apertured flange 21, as well as with a tube bracing web 22. Flange 21 is detachably secured, as by means of bolts 23, to a gear housing 25.

Each gear housing 25, as is more clearly shown in Figure 7, comprises a main portion 26 embodying an integral hub portion 27 and a removable end portion 28, detachably secured to portion 26 by bolts 29, and embodying an integral hub portion 31 corresponding to hub portion 27. Supported within each hub portion 27 and 31 is a roller bearing assembly 32, in which is rotatably journaled intermediate its ends a solid drive axle 33, to which is keyed for rotation therewith, as indicated at 34, within housing 25, a worm gear 35. Said gear may be inserted within housing 25 upon removal of housing portion 28. Detachably secured to each hub portion 27 and 31, by means of stud bolts 36 is a cap 37, provided with a central opening 38 through which axle 33 projects. The caps 37 removably maintain bearings 32 in position. Supported within each cap 37 is an oil seal ring 39 of any suitable form. The housing 25 is provided with a removable door 40 to permit application of lubricant to the housing.

The axles 33, adjacent the opposite ends thereof, are rotatably journaled in double roller bearing assemblies 41 removably disposed within bearing housings 42. Each housing 42 is provided with end caps 43, removably secured in position by bolts 44, each cap being provided with an axle receiving opening 45, in which is removably disposed an oil seal ring 46.

The two pairs of axle bearing housings 42 are yieldably connected with bolster 14 by means of a pair of relatively long leaf spring assemblies 47, which spring assemblies are connected with bolster 14 midway of their ends whereby the axles 33 are disposed at equal distances from bolster 14. In other words, bolster 14 is disposed centrally of axles 33 and in parallel relation therewith, and the springs are used to space the axles from the bolster and to secure them thereto avoiding

the use of heavy longitudinal truck frame members heretofore used.

The connection between bolster 14 and springs 47 comprises flanges 48 on the opposite ends of bolster 14, which define spring seats for engagement by the shortest leaves of the spring. The springs are rigidly bound to the seats by means of bolts 49 extended through openings in flanges 48, as well as through vertically alined openings in spring supporting saddles 51 which saddles are provided with extensions 52 for interlocking position in slots 53 of vertical extensions 54 of flanges 48.

The opposite ends of springs 47 are detachably secured in underslung relation to the bearing boxes or housings 42 through rubber insulated cushioning connections. Such connections comprise spring end confining cages 56, which are removably secured to flanges 57 on housings 42 by means of vertically disposed bolts 58.

Each cage 56 comprises a pair of hollow castings 59 and 61 in abutting engagement and provided with end slots 62 in the end walls for passage of the ends of the springs. The castings 59 and 61 jointly provide an interior space of appreciable depth as indicated at 63 in Figure 9. Disposed within such space are two longitudinally spaced pairs of vertically alined rubber blocks 65, between which the ends of springs 47 extend, and are tightly clamped by bolts 58. The spring leaves are disposed intermediate the pair of blocks 65 in each cage and are interconnected by means of a member 66, provided with an outer cylindrical bearing surface 67 in rocking engagement with a corresponding convex bearing surface in a central block spacing web 68 embodied in casting 59. The lower end of member 66 is provided with a convex surface and rockably engages a rubber strip 69, which may be separate or integral with the lower block 65 and is supported by a central raised portion 71 of lower casting 61.

A rubber cushioned rail engaging wheel 73 is secured to each end of each axle 33 preferably in close proximity to bearing housing 42, the wheels being preferably force fitted to the ends of the axle as well as keyed thereto, as indicated at 74 in Figure 7.

Each wheel 73 is preferably a casting comprising a hub portion 75, a felly portion 76 concentric with hub portion 75 and integrally united therewith by a conical disk portion 77, the wheel being reinforced by radial webs 78 integral with portions 75, 76 and 77 on the inner side of the wheels. In assembled position the inner end of hub portion 75 engages one end of a spacing sleeve 79 whose opposite end engages the outer roller bearing assembly 41. The outer end of hub portion 75 is engaged by a washer 81 in turn engaged by a nut 82 threadedly engaged with the end of axle 33, whereby hub portion 75 is drawn into tight engagement with the end of axle 33.

Suitably secured, as by force fit, to felly portion 76 is an inner rim 83 between which and a normally concentric outer rim 84 is molded a rubber cushion ring or block 85 of substantial thickness. Suitably secured to the outer rim 84, as by force fit, is a metallic flanged rail engaging tread member 86. By molding the ring or block 85 between rims 83 and 84 a substantially integral structure is provided.

The rail car forming the subject matter of the present invention is, as hereinafter described, electrically driven and consequently the inner and outer rims 83 and 84 are connected by suitable bonds such as disclosed in the copending application of W. B. Fageol Serial Number 339,720 filed Feb. 13, 1929. Said application also discloses a cushioned rail wheel, which, if desired, may be substituted for the construction herein disclosed.

It will be seen from the foregoing disclosure that a four wheel truck construction is provided which is comparatively simple, as well as highly cushioned and flexible as each drive axle 33 is journaled intermediate its ends in a gear housing having a pivotal connection with bolster 14 through tube 19. The axles are further journaled adjacent their ends in bearing housings 42 which are connected with bolster 14 by means of spring assemblies 47 which yieldably resist vertical swinging movement of the gear housings.

It will also be seen that the springs, secured adjacent their ends to the bearing housings 42 are, due to the rubber blocks 65, permitted yielding movement relative to the housings and by the provision of the spring leaf connecting members 66 the springs are permitted rocking movement intermediate the pairs of rubber blocks 65. Furthermore by providing the rubber pads 69 the springs have a complete rubber cushioned connection with the bearing housings 42.

It will be observed further that the truck just described is of light weight compared to car trucks in common use in view of the fact that it does not include rigid heavy longitudinal side frame members, since the springs 47 take the place of said members. The reduction in weight, the resilience of the springs that take the place of the side frame members, the cushioned connections between the springs and axles, and the resilient cushions between the rims and hubs of the wheels all contribute to present a truck that is of a high degree of flexibility, and at the same time provide a construction that may be operated, even over unevenly disposed rails and over the joints of poorly alined rails with a minimum of noise. The latter is a desideratum especially sought in the operation of rail cars on city streets.

The bolster 14 of each truck assembly T is provided with a side sway ocillator 88 (Fig. 6), movably disposed within the hollow bolster 14, which oscillator is supported in bolster 14 by rocking members 91 of the character disclosed in said copending application, whereby oscillator 88 is permitted limited side sway movement. The oscillator 88 is pivotally connected centrally thereof as well as centrally of bolster 14 and between adjacent torque tubes 19 to a substantial body supporting member 92 by a bolt or pin 93, as indicated in Figure 6.

Each body supporting member 92 is in the form of a casting and is provided with parallel vertical flanges 95 which with a flat outer base portion 96 thereof defines seats 97 on which are supported channel truss members 98 of parallel transversely disposed channel members 99 which enter into the body construction hereinafter described, the members 98 being rigidly secured to flanges 95 and base portions 96.

It will accordingly be seen that the truck assemblies T are connected with the body B for free movement thereof relative to the body for traversing curved sections of track and that the entire truck assembly comprising bolsters 14, torque tubes 19, axles 13 with wheels 73 supporting same together with springs 47 turn as a unit relative to the body supporting members 92 about pins 93.

Each axle 33 is driven by an individual electric motor 101 which may be removably supported by a pair of parallel transversely disposed relatively light channel bars 102 also forming a part of the body construction.

The motors 101 have a rubber cushioned connection with bars 102 whereby jars and vibrations are substantially absorbed. The connections comprise lugs 103 integral with the motors 101. Disposed on lugs 103 are rubber cushion blocks 104 between which and the bases of angular outwardly channelled brackets 105 are disposed the base flanges of bars 102 as indicated in Fig. 9. Disposed in the channel of each bracket 105 is a rubber cushion block 106 on the outer face of which is disposed a plate or washer 107. The cushion blocks 104 and 106 as well as the brackets 105 are secured to lugs 103 by bolts 108 extending vertically downward through washers 107, blocks 106, brackets 105, blocks 104 and lugs 103. The connection disclosed provides a substantially yieldable connection between motors 101 and bars 102 and the vertical extensions of brackets 105 position motors 101 against longitudinal displacement.

As is indicated in Figures 8 and 9, each motor 101 may be disposed in substantial spaced relation to each end of each truck assembly T with the axis of the motor armature shafts and the torque tube 19 of the respectively opposite axles 33 normally in vertical planes disposed relative close to the trunnion or pivot 93 for purposes hereinafter described.

Each axle 33 is driven by a motor 101 disposed on the opposite side of bolster 14, the axle being driven by a through drive shaft 115 embodying a section 116 rotatably journaled in the respective torque tube 19, and a section 117.

The inner end of the drive shaft section 116 has a removable driving connection with the front end of a worm shaft 118 (Fig. 5) which shaft is rotatably journaled adjacent its front and rear ends in roller bearing assemblies 119 and 120 in housing 25, and is provided with a worm 121 for meshing engagement with the corresponding worm gear 35. Housing 25 is provided with a removable cap 122.

The shaft section 116 is rotatably journaled adjacent the outer end thereof in a bearing cap 123 removably secured to the forward end of torque tube 19. The adjacent ends of drive shaft sections 116 and 117 are operatively connected through universal joints 125 which universal joints are disposed within the hollow pivotally mounted body supporting member 92 close to and on opposite side of pivot pin 93, as indicated in Fig. 8. It will be seen from this construction that joints 125 are disposed substantially in the transverse plane of pivot pin 93. Shaft section 117 is connected with the motor armature shaft through a universal joint 126 and may be provided adjacent the joint with a splined telescoping joint 127.

Thus it will be seen that the drive axles 33 of each truck assembly T are driven by individual electric motors which are supported by body B clear of the truck assembly, and that the body channel members 99 and 102 to which the truck assemblies and motors are secured are arranged such that the axles 33 are entirely free to rise and fall in response to road irregularities encountered by the wheels supporting same.

It will be noted from Figure 9 that motors 101 are normally disposed a substantial distance above the axles 33, but by the construction disclosed in which the further axle is driven by each motor by the through drive shaft 115, the drive shafts are normally disposed at small angularities, and, although the torque tubes 19 as well as shaft sections 116, are normally disposed at a slight angle to the shaft sections 117 the through drive is readily accomplished by the provision of the universal joints 125.

Furthermore, by the provision of the universal joints 125 and 126 and telescoping joints 127 the truck assemblies T are free for pivotal movement relative to body B without substantially adversely affecting the efficiency of the driving connection. And in view of the fact that the universal joint 125 is disposed close to the vertical trunnion of

the truck the swinging of the truck about said trunnion will merely have the effect of flexing the shaft at said joint, and such flexure as well as the spline travel will be of slight degree since the amplitude of movement is a function of the distance of the shaft from the truck trunnion.

Each of the motors 101 is provided with an armature shaft brake 131, which comprises two pairs of brake shoes 132 for frictional engagement with opposite faces of a disk 133 carried by an armature shaft extension 134. The brake shoes 132 of each pair are pivotally supported on cranks 135 which cranks are journaled in bracket extensions 136 of motor 101. Keyed or otherwise fixed to each crank 135 is a lever 137 with the levers of each pair thereof having their free ends yieldingly maintained by a spring 138 in engagement with the opposite ends of a pneumatic expansion member 139 with the expansion members of each pair interconnected as indicated at 141 which interconnections are in communication with a controllable pneumatic pressure source. The brake shoes 132 are normally urged out of engagement with disk 133 by means of springs 142.

By the simple provision of brakes associated with the driving motors as disclosed, a relatively large frictional contact area is provided in that the shoes 132 are of an arcuate extent substantially equal to one fourth of the circumference of disk 133 and due to the high speed of disk 133 moisture collected thereby is thrown off by centrifugal force thus providing for a uniform efficient braking action.

The body B includes the transverse channel bars 99 and 102 (Fig. 8) which enter into the body base frame construction, there being a pair of the relatively closely spaced channel bars 99 substantially midway of each end of body B. Each pair of bars 99 is arranged over one of the truck assemblies T and pivotally connected thereto as hereinbefore described. A pair of the relatively lighter channel bars 102 is disposed to support each motor 101, as above described, thus providing effective body floor supports, with the further function of serving as connections for the trucks and electric motors. To this end the outer surfaces of all the channel bars are in a common horizontal plane, as indicated in Figure 9.

The body B, as indicated in detail in Figures 3 and 4, further comprises a plurality of vertically disposed T-iron body posts 142, which are secured by an angle iron 143 which angle iron has the horizontal flange thereof seated in recesses in the opposite ends of bars 99 and 102 for providing a level unobstructed floor support. The angle iron 143 is preferably continuous and formed to define the horizontal contour of the body.

The T-iron posts 142 project substantially below the angle iron 143, and are rigidly united at their inner ends to a body circumscribing angle bar 144. The channel bars 99 as hereinbefore referred to may be trussed and diagonally braced by the angular channels 98, as indicated in Figure 3, and to which the body supporting members 92 of trucks T are secured. The bars 98 as indicated in Figure 3 comprise central horizontal portions 98′ to which said members 92 are secured and further comprise opposite and downwardly inclined portions 98″, the terminals of which are secured to the inner ends of adjacent T-iron posts 142, as indicated at 145. The opposite ends of channel bars 99 and 102 are also rigidly secured at their ends to adjacent posts 142, as indicated at 146, in Figure 3.

The T-iron posts 142 are curved at their outer ends as indicated at 147 for providing an arched roof formation, and are joined at their ends to the margin of a ply metal roof center section 148.

The posts 142 are so spaced longitudinally of the body as to provide spaces for windows 149 and the posts below the window line are completely paneled preferably with one-fourth inch ply metal 151, the panel effect being provided by vertically disposed strips 152 secured outwardly of posts 142.

Above the windows 149 the curved portions 147 of posts 142 are covered with plate steel 154 and lined inside with aluminum 155 the steel and aluminum coverings 154 and 155 being secured to longitudinally disposed strips 156, with the inner edges of covering 155 secured to bars 157.

This construction provides an all metal roof structure so constructed that it forms one continuous dished piece of great strength, whereby the roof acts as a strengthening member, longitudinally and crosswise, thus very materially assisting in carrying the end overhang of the car and permitting of lighter construction below the floor line.

The body sides 151 as well as the ends are provided with a continuous bumper rail 158, which is riveted to the body opposite the angle bar 143 and immediately below rail 158 removable doors 159, as indicated in Figure 1, are provided opposite each end of each truck T for facilitating access thereto.

The body construction is composed of relatively light structural members covered with metallic or similar sheet material that are continuous as far as possible, as just described, providing a rigid box-like structure in which the roof and side walls serve as a truss for the base frame, enabling relatively tight members to be employed in the construction of said frame.

The body is provided with an entrance door 161, located at the right hand side and closely adjacent the front of the body and an

exit door 162 located on the same side substantially midway of the length of the body as is clearly indicated in Figures 1 and 2. Each of the doors 161 and 162 is of the two leaf fold-in type and is air operated with a door engine of ample capacity mounted above the door in housing 163 as indicated in Figure 4, which housings are provided with hinged covers providing ready access thereto.

A flooring 165, preferably comprising "flexolith" anchored to a sheet aluminum base is supported on bars 99 and 102, and is interrupted adjacent doors 161 and 162 for providing recesses in which are disposed suitable door steps 166 for both doors, the step 166 for the entrance door 161 being preferably located at a suitable stepping distance below the floor 165 while the step 166 for the exit door 162 is preferably disposed a suitable stepping distance below an angular gangway 167 in which may be disposed door actuating treadles 168 of any type.

A plurality of stanchions 169, arranged within door 161, are interconnected by a curved guardrail 171 for controlling passenger movement. Inwardly of the exit door a plurality of stanchions 172 are provided which as indicated in Figure 2 provide a pair of passageways. Each door may be operated by a treadle 168.

The body interiorly thereof, as indicated in Figure 2, may be provided with a seating arrangement for the accommodation of a maximum number of passengers, while maintaining sufficient floor space for the movement of passengers upon loading and unloading, the seating arrangement preferably comprising an operator's seat 173 located adjacent the front of the body, such that the operator may readily observe the entering passengers, while still in convenient reach of the various control mechanism. The seating arrangement further comprises a relatively long longitudinally disposed side facing seat 174 at the right hand side extending from door 161 to door 162, a longitudinally disposed side facing seat 175 at the left side of the body near the front thereof, a multiplicity of transversely disposed forwardly facing two passenger seats 176 extending from seat 175 to adjacent the rear end of the body, seats 177 similar to seats 176 on the right hand side of the body rearwardly of door 162, a side seat 178 similar to seat 174 immediately to the rear of door 162, and a built in seat 179 completely around the rear end of the body.

This arrangement provides ample aisle space between the doors 161 and 162 and immediately adjacent thereto so as to avoid, so far as possible, congestion between the seats preventing the movement of passengers to the rear of the car.

The seats are preferably of the semi-bucket car type, and the arrangement as disclosed is capable of seating 52 passengers, though a relatively wide aisle is provided as just stated, providing ample standing room, if needed.

A plurality of electric heaters 181 and 182 may be suitably arranged under the seats, as indicated in Figure 3, for effective heating of the car body. Supported on the car roof, as indicated in Figures 1 and 3, are a plurality of ventilating casings 183, within each of which is a motor driven fan 184, which forces air into and diffuses it throughout the car body, thus providing rapid air movement but preventing drafts in any one location. By the provision of such ventilating means during cold weather, or when the windows are closed, the car body will be maintained under slight pressure so that when the doors are opened warm air will rush out accordingly preventing the entrance of cold air. By this arrangement the cool air enters at the top and circulates naturally toward the bottom of the body, preventing the accumulation of the heated air adjacent the roof as in systems generally in use. The body is further provided with front and rear drop sash 185, which may provide additional ventilation when needed.

The body is provided with a hand or strap rail 186, adjacent each side thereof, supported by suitable brackets 187 from the car roof, and suitable lights 188 are provided for furnishing sufficient illumination.

Electric energy is conveyed to motors 101 through a collector assembly 191 supported on the car roof through rubber insulations, which assembly is preferably of the construction disclosed in the copending application above referred to.

The body is further provided with the usual external accessories such as bumpers 192, visors 193, and drip ledges 194 which are provided above the windows, doors and visors thus giving drip protection around the entire edge of the roof.

As will be seen upon inspection of Fig. 9, the bolster 14 is provided at each end thereof above the spring seat 48 with a body rocking limiting support 196 adapted for engagement by suitable anti-friction rollers supported by the body.

It will be seen from the foregoing disclosure that a rail car is provided which comprises a relatively light body construction to which is directly secured for pivotal movement relative thereto, a pair of four wheel truck assemblies each of which comprises a center supporting bolster, a solid drive axle rotatably journalled in a pair of bearing housings at equal distances from each opposite side of said bolster, which housings are yieldably connected to said bolster by a pair of leaf spring assemblies and that each drive axle is further journalled in a gear housing

having a pivotal connection with said bolster through a torque tube. Each drive axle is moreover driven by an individual electric motor supported by the body through a flexible drive shaft disposed so as to minimize spline travel and angularity of the drive shaft.

It will be seen that the rail car constructed in accordance with the present invention is in comparison to the size thereof constructed of relatively few simple and comparatively light parts in that same generally comprises only the body B, trucks T, and motors 101 all of which as above described are of minimum weight consistent with required strength, and it will further be seen that all parts tending to create jars or vibrations are rubber cushioned thus providing a rail car construction which is simple, relatively light and substantially noiseless in operation.

In Figs. 10 and 11 is disclosed a modified embodiment of the invention wherein the drive arrangements between the motors 101′ and axles 33 are modified such that slower drive shaft rotation is provided, so that the deleterious effect of angularity of the drive shaft and spline travel in such shaft is further minimized.

As indicated in said figures, each motor 101′, comprises a suitably housed gear reduction 201 embodying a gear driven by the motor armature shaft and meshing with a larger gear operatively connected with the adjacent drive shaft 115.

By this provision, a substantially reduced speed of rotation is imparted to drive shafts 115 under normal motor speed, which as above stated is highly desirable in the construction disclosed. Furthermore, by the provision of the reduction gearing 201 the motor armature shafts and drive shafts 115 are substantially vertically offset, as indicated in Fig. 11, as a result of which the body floor 165 can be lowered a substantial distance amounting approximately to the vertical distance between the centers of the armature shafts and drive shafts 115.

In accordance with this embodiment of the invention, the motors 101′ and reduction gearings 201 are preferably mounted between longitudinally disposed channels 202 which may span a pair of transverse channels 102 as disclosed in the form of the invention first described.

The motors 101′ and reduction gear housings 201 are secured to channels 202 by bolts 203 extending through the channels as well as through brackets 204 and 205 in motors 101′ and gear casings 201 respectively, and also through rubber pads 206 on opposite faces of the channel flanges for yieldably supporting the motors and gear housings from the channels.

In accordance with this embodiment of the invention the motor armature shaft brakes are eliminated, and a drive shaft brake 208 is substituted therefor within which the universal joint 126 is disposed.

Additional braking arrangements are provided which cooperate with wheels 73 and which as indicated comprise supports 209 yieldably supported on springs 47 adjacent the opposite ends thereof through suitable rubber cushions engaged with upturned ends 210 of individual spring leaves and supports 209 are maintained in position by U-bolts 211.

Supported in cars 212 on supports 209 with the opposite ends projecting laterally therefrom are transverse rods 213 on each projecting end of which is pivoted a bell crank lever 214 each of which levers is further pivotally connected as at 215 to a wheel engaging brake shoe 216.

The free end of each lever 214 is pivotally connected, as indicated at 217, to the adjacent end of a rod 218 whose opposite end is operatively connected to a fluid brake operating chamber 219, the pair of chambers 219 at each side of the truck being suitably supported by spring saddle 51, and adapted to be operated by fluid such as air.

By the provision of this brake construction, the possibility of setting of the brakes upon vertical movement of the axles is substantially avoided since the brakes are carried by the springs closely adjacent the ends thereof and accordingly same will rise and fall substantially simultaneously with that of axles 33.

The wheel brake constructions herein disclosed is equally applicable to the first form of the invention.

While in accordance with the above disclosed embodiments of my invention relatively little angularity of the drive shafts is occasioned upon pivotal movement of the truck assemblies relative to the car body upon rounding curved sections of track, I have found that under certain conditions the motors may be arranged with further improved results by disposing them so that the shafts are relatively short and to this end are carried by the truck bolster in order that the movements of each axle with respect to the motor that drives it are due only to the flexible connections between said axle and the bolster.

The embodiment of the invention disclosed in Figures 12 to 18 provides a construction of the latter type in which the power means are supported by the bolster, whereby relatively short drive shafts are utilized, which shafts are not liable to assume angular positions as a result of pivotal movement of the truck assembly, thus providing a construction for association with a car body having a substantially low floor, and in which the drive shafts can be driven at the same speed as the motor shaft without causing excessive whipping of the drive shaft.

In accordance with this embodiment of the invention each truck assembly T' comprises a bolster 225, which, as more particularly indicated in Figure 16, may be constructed in the form of a casting of hollow boxlike formation. The bolster 225 at each end thereof is of substantial I-formation in end elevation, as indicated in Figure 15, each including a vertical central web 226 and integral bottom and top flanges 227 and 228 respectively. The bottom flanges 227 are provided with laterally spaced central ears or lugs 229, which operatively engage recesses 231 in laterally spaced flanges 232 of a plate or cap 233. The flanges 227 and caps 233 with their respective ears 229 and flanges 232 provide housings for receiving and positioning the intermediate portions of leaf springs 47', the leaves of the springs being rigidly clamped in position by bolts 234 extending through flanges 227 and caps 233, as is clearly indicated in Figure 16.

The opposite ends of springs 47' are yieldably connected beneath the axle bearing housings 42' substantially in the manner above disclosed with reference to the previous forms of the invention. In this form of the invention, however, each end of the lower or longest leaf of each spring 47' is bent upwardly in the form of a flange 236 in spaced relation to the associated housing 42', each of which flanges is apertured for the reception of a stud bolt 237 projecting from housing 42' and engaged with each bolt 237 is a nut 238 on each side of flange 236, whereby upon adjustment of the nuts an abutment is provided between springs 47' and housings 42', particularly for resisting torque reactions on housings 42'.

The adjusting bolts 237 further function to cause each pair of axles to fall into parallel alignment.

The axles 33' are rotatably journaled adjacent their opposite ends in housings 42' in the manner above disclosed and axles 33' are provided with wheels 73' of the character disclosed in Figure 7.

The bolster 225 is pivotally secured centrally thereof to a side sway oscillator construction which in turn is yieldably supported beneath the floor 165 of the car body. The oscillator construction, which is similar to that disclosed in the aforesaid copending application, comprises a base member 241 of pan-like formation, through a control boss 242 of which extends a pivot or kingpin 243, which pin further projects through a washer 244 and a bearing thimble 245. The washer 244 and outer enlarged portion of thimble 245 rest in suitable recesses in the base of member 241, as indicated in Figure 16, with the lower reduced portion of thimble 245 disposed in an aperture in a boss 246 formed on bolster 225. The inner end of pin 243 is encircled by a washer 247 yieldably held in engagement with the inner face of boss 246 by coil spring 246' whose inner end is engaged by a washer 247' which in turn is engaged by a nut 248 threaded on the inner end pin 243 whereby the member 241 is connected with bolster 225 for pivotal movement relative thereto. The member 241 is disposed in an inwardly facing channel 249 defined by inwardly directed side and end walls 251 and 252 respectively of an elongated plate 253. Disposed between member 241 and plate 253 are toothed rocking members 254 with the lower teeth 255 in rocking engagement with convex walled recesses 256 in member 241, and with the outer teeth 257 in rocking engagement with similar recesses 258 provided in plates 259 extending transversely of walls 251. The rocking members 254 provide for side sway movement between member 241 and plate 253, and in order to reduce friction to a minimum, anti-friction plates 261 are suitably disposed between walls 251 and the opposite sides of member 241, as is clearly indicated in Figure 13.

The plate 253 has a yieldable connection with the floor 165, which is preferably provided in the following manner. Suitably secured to the opposing faces of oppositely directed body supporting channel members 261' are the vertical flanges of angle irons 262, the horizontal flanges of which together with the outer horizontal flanges of channel members 261' are suitably secured to a body floor engaging and supporting plate 263. Secured as by bolts 264 to the horizontal flanges of members 262, as well as to plate 263, adjacent each end of plate 253, is an angular plate member 265 each embodying laterally spaced vertical portions 266 and 267 and a horizontal portion 268 integrally connecting said vertical portions. The opposite ends of plate 253 are disposed intermediate plate 263 and portions 268 of plates 265 and disposed on the lower side of plate 253 adjacent each end thereof, between the plate and the portions 268, are yieldable, preferably rubber, blocks 269 and disposed above plate 253 is a transversely continuous cushion block 271. A bolt 272 projects vertically through aligned apertures in opposite ends of plate 253 as well as blocks 269 and 271. By this construction plate 253 is connected with the vehicle body in a manner such that same is capable of yieldable vertical movement and in order to reduce friction to a minimum suitable anti-friction plates 273 are disposed between walls 251 and the vertical flanges of members 262, as is clearly indicated in Figure 13, which anti-friction plates may be extended or additional plates provided between flanges 267 of plate 265 and walls 252 of plate 253, as indicated at 274 in Figure 16.

It will be seen from the foregoing that the connections heretofore disclosed provide a pivotal connection between bolster 225 and

floor 165 of the car body B for alinement of wheels 73′ yieldably supported from bolster 225 with curved sections of track and that said connections further provide for side sway of the car body relative to the bolster 225 as the entire assembly confined within plates 265 is bodily movable with the vehicle body, but plate 253 due to the cushioned blocks 269 and 271 is capable of yieldable vertical movement, whereby the car body may move laterally a limited amount through rocking members 254, but due to the fact that plate 253 can move vertically against the yieldable resistance of blocks 271 the side movement of the body will not be accompanied by vertical raising thereof.

As is more clearly indicated in Figures 12 and 14 channel members 261′, angle members 262 and plate 263 extend the full width of the car body and the vertical flanges of members 262 have connected therewith shoes 276 in substantial vertical alinement with springs 47′, which shoes are adapted for cooperation with abutments 277 suitably secured as by bolts 278 to the outer flanges 228 at the opposite ends of bolster 225 for limiting transverse tilting movement of the car body.

The bolster 225 is further utilized as a support for a pair of electric motors designated at 279 one for operative driving engagement with each of the axles 33′. The bolster 225 is accordingly provided on each opposite vertical face thereof at laterally opposite sides of pivot pin 243 with a series of motor head securing lugs 281 disposed about a substantially large opening 282 and the respective opposite side walls of bolster 225 are provided with openings 283 in substantial alinement with openings 282. As will be seen upon inspection of Figures 13 and 15 bolster 225 is relatively low thus necessitating a downward inclination of the opposite gear housings 25′ toward the bolster disposed intermediate same and each motor armature shaft must be in parallel alinement with the respective housings 25′. The securing lugs 281 for the respective motors 279 are correspondingly inclined such that motors 279 in assembled position will be in parallel alinement with the respective gear housings 25′ associated with axles 33′ as is clearly indicated in Figure 13.

The securing lugs 281 are constructed, so that electric motors of standard makes, such as indicated in 279 may be utilized. The motors however must be provided with special heads for attachment to lugs 281 which heads as indicated in Figure 14 preferably comprise apertured lugs 285 similar to lugs 281 and through the mating apertures of which are disposed bolts 286 for firmly securing the motors to the bolster 225 independently of the axles, so that the motors move as a unit with the bolsters and shift their position as the truck shifts its position in a manner entirely uninfluenced by movement of the axles within the range of movement thereof permitted by the springs that alone connect the axles to the bolster.

Each motor 279 is secured to bolster 225 on the side thereof opposite to the axle 33′, which is driven by the respective motor and each motor is operatively connected with the drive worm in gear housing 25′ by a relatively short drive shaft 291, which extends through openings 282 and 283 in the opposite vertical walls of bolster 225 as clearly indicated in Figure 13. Each shaft 291 is furthermore provided with a universal joint 292 adjacent housing 25′ and a second universal joint within a drive shaft brake drum 293 carried by the shaft and disposed within the hollow bolster 225. Each shaft 291 is further provided with a telescoping joint 294 of known form.

In order to resist the driving torque reactions on gear housings 25′ which in this form of the invention is not resisted by torque tubes, as in the previous forms of the invention, housings 25′ and the adjacent bearing housings 42′ are preferably rigidly connected by common tubular extensions surrounding the axles as indicated at 295, whereby the housings 42′, which are firmly secured to springs 47′, resist the torque on housings 25′.

From the foregoing disclosure it will be seen that motors 279 are supported by bolster 225 in such manner that relatively short drive shafts are required due to which, together with the fact that motors 279 move commensurate with housings 225, thus maintaining shafts 291 against lateral angularity the shafts can be driven at a speed as high as 4000 revolutions per minute, or at the planing speed of the motors. Furthermore the disposition of the motors relative to the bolster is such that the drive shaft brake drums 293 are disposed within bolster 225 opposite the pivot pin 243, which not only houses the brake drums but provides ready means of attachment for the brake operating means.

The brake operating means comprises a pair of laterally alined shafts 296 rotatably journaled in similarly alined bearing lugs 297, which are rigidly supported from extensions 298 of the opposite side walls of bolster 225, in such manner that the adjacent ends of shafts 296 are disposed immediately below the pivot pin 243. Each shaft 296 has a link connection 299 with a respective braking arrangement cooperating with one of the drums 293. Each shaft 296 between lugs 297 is provided with a rigid arm 301 which arms are relatively close and at equal distances from an extended axis of pin 243 as indicated in Figure 16. The inner ends of arms 301 are connected by an equalizing bar 302 to which a link is pivotally connected at one end as by a suitable universal connection, and whose other end is pivotally connected with an actu-

ating rod operatively connected with the emergency brake lever mounted on the body in any well known manner.

Inasmuch as the connection between the body carried brake actuating mechanism and the truck carried braking means is made at a point directly below the vertical axis about which the truck swings, it is apparent that swinging of the truck will not affect the braking mechanism, that is the brakes will be as effectively applied when the car rounds a curve as when it is moving over straight sections of track because there is no relative motion between the body and the truck at or vertically below the axis about which the truck swings. This arrangement constitutes an important characteristic of this invention. Furthermore by the provision of the equalizers 302 an equalized braking action is provided for the pair of brake drums 293 included in each truck assembly.

This embodiment of the invention also includes fluid or air actuated service brakes similar to those disclosed in Figure 11. The service brake construction in accordance with this embodiment of the invention comprises a support 305 (Figs. 12, 17, 18) which embodies a rectangular plate 306 secured, as indicated at 307, to a short spring leaf 308 adjacent each end of each spring 47'. The plate 306 is further maintained in position and stabilized by a U-bolt 309 the legs of which extend through plate 306 and are terminally engaged by nuts 311. The legs of U-bolt 309 span the spring 47' and the bight portion thereof extends through a depression 312 in a cap 313, in which cap is seated the outer end of a cushion block 314, whose inner end is of stepped formation for engagement with a pair of consecutive leaves of spring 47', as indicated in Figure 17, the nuts 311 being sufficiently drawn up to firmly bind block 314 between cap 313 and spring 47'. The plates 306 are further stabilized by mounting bars or shafts 315 one of which connects each laterally disposed pair of plates 306 with the opposite ends thereof disposed in tubular members 316 integral with plates 306.

The opposite ends of shafts 315 extend beyond tubular members 316, as indicated in Figure 18, and rotatably journaled on each of the extensions of shafts 315 through a bearing sleeve 317, is the hub portion 318 of a brake shoe supporting and actuating lever 319. The levers 319 are maintained on bars 315 by washers 321 disposed over reduced extensions 322 of shafts 315, which washers are yieldably maintained in engagement with hub portions 318 by coil springs 323, which are, in turn, engaged by washers 324 which are maintained on extensions 322 by nuts 325.

Each lever 319 outwardly of its pivotal connection with shaft 315 is apertured, as indicated at 326, in which aperture is disposed a bearing sleeve 327. Disposed within sleeve 327 is a bolt 328 on which is rotatably journaled on opposite sides of lever 319, through suitable bearing members 329 and 331, ears 332 of a brake shoe support 333, to which support is suitably secured a brake shoe 334 of suitable form for braking engagement with the respective wheel 73'. Preferably washers 335 are disposed between lever 319 and ears 332 while washers 335 are yieldably held in engagement with each other and with lever 319 by a coil spring 336 one end of which engages a flange 337 on bearing sleeve 331 and the opposite end of which engages a washer 338 disposed on bolt 328, and which is in turn engaged by a nut 339. The coil springs 321 and 336 not only maintain the parts in engagement but function as anti-rattling means.

Pivotally secured as at 341 (Fig. 15) to the outer end of each of the levers 319 is one end of a brake shoe actuating rod 342 whose opposite end is operatively connected with a fluid or air operating chamber 343 of known form which chambers are secured to caps 233, as indicated at 344 substantially in the same manner as indicated in Figure 11.

By disposing the brakes as disclosed the shoes oscillate substantially with the wheels 73', thus maintaining the same relation between the shoes and wheels under all operating conditions and accordingly substantially uniform braking efficiency.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What I claim and desire to secure by United States Letters Patent is:—

1. A rail car comprising a bolster arranged to support the car body for pivotal movement about a substantially vertical axis, a pair of drive axles disposed within axle housings arranged at each side of said bolter, springs to space said axle housings from said bolster, drive shafts for said axles, and torque tubes secured to said axle housings and through which said drive shafts extend, said torque tubes being connected to said bolster so as to be flexible in directions other than necessary to resist the driving torque reactions.

2. A rail car truck comprising a bolster arranged to support the car body, a pair of axles, a pair of bearing boxes for each axle, leaf springs secured between their ends to said bolsters and connected at their ends to said bearing boxes so as to space said axles

from said bolster to form the truck and drive shafts for said axles rigid from said axles to a point adjacent said bolster.

3. A rail car comprising a truck mounted for shifting movement about a substantially vertical axis with respect to the car body, and including a pair of driven axles connected together and held in spaced relation by springs, a motor for each axle supported by the car body, and a flexible drive shaft including a spline connecting each axle and motor, said drive shafts being arranged so as to minimize spline travel in each of said shafts when the truck swings with respect to said axis.

4. A rail car comprising a truck mounted for shifting movement about a substantially vertical axis with respect to the car body and including a pair of driven axles, a motor supported on the car body to drive each axle, each motor being located relatively remotely from the axle that it is to drive, and a flexible drive shaft including a spline connecting each axle and motor, said driven shaft being arranged so as to minimize spline travel in each of said shafts and so as to minimize angularity when the truck swings with respect to said axis.

5. A rail car comprising a truck mounted for shifting movement about a substantially vertical axis with respect to the car body and including a pair of driven axles, a motor for each axle supported on said body at a point remote to the axle that it is to drive, and a flexible drive shaft including a spline connecting each axle and motor, said drive shaft extending longitudinally of said body relatively close to said axis and being provided with a universal joint disposed closely adjacent to said axis.

6. A rail car comprising a body constructed of relatively light structural members in box-like form, a truck disposed beneath each end of said body for movement about substantially vertical axis, each of said trucks consisting of a pair of axles, a motor for each axle attached to said body beneath the base thereof, and flexible and extensible drive shafts operatively connecting each axle and a motor, said drive shafts being arranged with respect to the axes about which said trucks pivot so that angularity of the shaft and spline travel in said shaft is minimized.

7. A rail car comprising a body constructed of relatively light structural members in box-like form, a truck disposed beneath each end of said body for movement about a substantially vertical axis, each of said trucks consisting of a pair of axles connected together and spaced apart solely by springs, a motor for each axle attached to said body beneath the base thereof, and flexible and extensible drive shafts operatively connecting each axle and the motor, said drive shafts being arranged relatively close to the axis about which said trucks pivot and being of such length so that angularity of the shaft and spline travel in said shaft is minimized.

8. A rail car comprising a body frame, a truck including a bolster a pair of drive axles, and springs serving to space said axles from said bolster, a motor for each axle suspended from said car body, a drive shaft operatively connecting each motor and an axle, said drive shafts being offset above the motor shafts whereby the floor line may be lowered.

9. A rail car comprising a body frame, a truck including a bolster, a pair of drive axles and springs serving to space said axles from said bolster, a motor for each axle suspended from said car body, a motor shaft, a drive shaft for operatively connecting each motor and an axle, reduction gearing between each of said motor shafts and a drive shaft, said drive shaft being offset substantially above the motor shaft whereby the floor line of the car may be lowered.

10. A rail car truck comprising a bolster, a pair of axles, springs interconnecting said axles and bolster to space said axles from opposite sides of said bolster, a motor for each axle supported solely from opposite sides of said bolster, and flexible drive shafts operatively connecting each motor and one of said axles.

11. A rail car truck comprising a bolster, a pair of axles, longitudinally extending members interconnecting said bolster and axles to space the axles from opposite sides of said bolster, a motor for each axle supported solely from the side of the bolster opposite from the axle that said motor is designed to drive and a flexible drive shaft operatively connecting each motor and one of said axles.

12. A rail car truck comprising a bolster, a pair of axles, springs interconnecting said axles and bolster to space said axles from opposite sides of said bolster, and means for driving said axles supported on said truck solely by said bolster, and drive shafts connecting said axles and means, said drive shafts being flexible to permit the movement of said axles when said springs bend.

13. A rail car truck comprising a bolster, a pair of axles, springs interconnecting said axles and bolster to space said axles from opposite sides of the bolster, a motor for each axle attached to and supported solely by the side of the bolster that is opposite said axle independently of said axles, and flexible drive shaft operatively connecting each motor and one of said axles, said flexible drive shafts extending through said bolster, and carrying braking means arranged within the bolster.

14. A rail car comprising a body, a truck supporting one end of said body, a member carrying a vertical pivot arranged between said truck and body, a plate secured to said body for cushioned endwise movement, means between said pivot and member permitting limited lateral movement of said truck with

respect to said pivot, and means interconnecting said plate and member to support said body from said member and to cause lateral movement of said member to be resisted by endwise movement of said plate.

15. A rail car comprising a body a truck including a pair of drive axles and power means carried by said truck to drive said axles, means to connect said truck to said body for pivotal movement about a substantially vertical axis, braking means carried by said truck, brake actuating mechanism carried by said body, and interconnections between said braking means and brake actuating mechanism disposed so as to be substantially uninfluenced by the movement of said truck about said axis.

16. A rail car comprising a body, a truck supporting one end of said body, said truck being pivoted to said body for pivotal movement about a substantially vertical axis, a cushion around said pivot, and further means to cushion the lateral movement of said body with respect to said pivot.

17. In combination a rail car body, a truck supporting one end of said body, a member disposed between said truck and said body and connected to the truck for pivotal movement about a vertical axis, an elongated member disposed on said first named member and secured at its ends between cushioning elements that permit it to move slightly in a longitudinal direction, and toothed elements disposed between said members at opposite sides of said pivot and interconnecting said members so that lateral movement of said body with respect to said pivot is cushioned by said cushioning element.

18. A rail car comprising a truck consisting of a pair of axles, a bolster, and springs connecting the axles to said bolster, a short housing on each axle, driving gears arranged within said housing, and means connecting each housing to one of said springs so as to transmit the driving torque reactions from the housings directly to the springs.

19. A rail car comprising a truck consisting of a pair of axles, a bolster, and springs connecting the axles to said bolster, a shaft housing on each axle disposed to one side of the longitudinal center of the axle and a tube surrounding an axle and rigidly secured to a housing and connected to the nearest spring, whereby the torque reactions are transmitted from said shaft housing to the adjacent spring.

20. A rail car comprising a truck consisting of a plurality of pairs of wheels, each of which is yieldably mounted with respect to truck frame elements, and braking means for each wheel carried by the yielding mounting for the wheel so that the braking means and the wheels move substantially as a unit.

21. A rail car comprising a truck, consisting of a plurality of axles, a bolster, a pair of springs interconnecting said bolster and axle and constituting the sole means serving to space the axles from said bolster, a pair of wheels on each axle, and braking means for each wheel mounted upon the portion of the spring adjacent the periphery of the wheel so that the braking means and the wheels move substantially as a unit when the springs yield.

22. A rail car including a truck, consisting of a bolster, a leaf spring assembly secured between its ends to said bolster, and attached adjacent an end to an axle carrying a wheel disposed adjacent said spring end, a brake support attached to said spring adjacent the periphery of said wheel, a brake actuating lever pivoted to said support, a brake shoe attached to said lever and means to actuate said lever to apply said brake to the periphery of the wheel.

23. A rail car including a truck, comprising a bolster, a pair of axles, and leaf spring assemblies to attach the axles to the bolster to form the truck, a brake support for each wheel secured to a spring immediately adjacent the periphery of said wheel, a brake lever carried by said support, a brake shoe attached to said lever, and fluid-actuated brake operating means secured to said bolster, and operatively connected with each of said levers.

24. A rail car comprising a body, a truck to support each end of said body, each truck consisting of a pair of axles and a bolster extending transversely of the body and a pair of leaf spring assemblies extending longitudinally of the body and flexibly securing the bolster and axles together, means to pivotally secure the trucks to the body and cushioned connections between the truck pivots and the body including elements to yieldingly resist movements of the body with respect to said trucks.

25. A rail car comprising a body, a truck to support each end of said body, each truck consisting of a pair of axles and a bolster extending transversely of the body, and a pair of leaf spring assemblies extending longitudinally of the body and flexibly securing the axles and bolster together in spaced relation, cushioned connections between said leaf spring assemblies and each of said axles, means to pivotally secure the trucks to the body for swinging of the trucks with respect to the body about substantially vertical axes, and cushioned conections between the truck pivots and the body including elements to yieldingly resist movement of the body with respect to said trucks.

26. A rail car comprising a body, a truck connected to said body for pivotal movement about a substantially vertical axis, said truck including a pair of axles and a bolster arranged in parallelism and a pair of leaf spring assemblies constituting the sole means

to space and interconnect said axles and bolster whereby each axle is yieldingly connected to the bolster, a pair of wheels on each axle, and service and emergency brakes on said truck disposed so as to be substantially unaffected by the swinging of said truck about said axis or by the movement of the axles with respect to said bolster.

27. A rail car comprising a body, a truck connected to said body for pivotal movement about a substantially vertical axis, said truck including a pair of axles and a bolster arranged in parallelism, a pair of leaf spring assemblies constituting the sole means to space and interconnect said axles and bolster so that each axle is yieldingly connected to the bolster, a motor for driving each axle individually, each of said motors being secured to said bolster independently of said axles, and flexible drive shafts operatively connecting each of said motors and one of said axles.

28. A rail car truck comprising a bolster arranged to support a car body, a pair of axles, a pair of bearing housings for each axle; leaf springs secured between their ends to said bolsters and connected at their ends to said bearing housings so as to space said axles from said bolster to form the truck; and a wheel engaging brake assembly supported by one of said springs.

29. A rail car truck comprising a bolster arranged to support a car body, a pair of axles; a pair of bearing housings for each axle; a pair of wheels for each axle; leaf springs secured between their ends to said bolsters and connected at their ends to said bearing housings; and a wheel brake assembly supported through one of said springs.

30. A rail car truck comprising a bolster arranged to support the car body; a pair of axles; a pair of bearing housings for each axle; leaf springs secured between their ends to said bolsters and connected at their ends to said bearing housings; a brake supporting bracket supported through one of said springs; a wheel engaging brake shoe movably mounted on said bracket; and actuating means for said brake shoe.

31. A rail car truck comprising a bolster, a pair of axles; wheels supporting and driven by said axles; longitudinally extending members interconnecting said bolster and said axles; a motor for each axle supported from the side of said bolster opposite to the axle that said motor is designed to drive; a flexible drive shaft operatively connecting each motor and one of said axles; wheel brakes for each of said wheels; and means for imposing the torque reactions due to said wheel brakes and said drive shafts on said members.

32. A rail car truck comprising a bolster; a pair of axles; springs interconnecting said axles and bolster to space said axles from opposite sides of the bolster; a motor for each axle supported from the side of said bolster opposite the axle driven thereby; a flexible drive shaft operatively connecting each motor and one of said axles, said flexible drive shafts extending through said bolster, and carrying braking means arranged within the bolster; and braking means for said wheels connected to said springs.

33. In a railway truck, a pair of axles; a pair of wheels supporting said axles; a bolster; springs connecting the axles to said bolster; a driving gear housing on one of said axles; a wheel engaging brake assembly for the driven axle; and means connecting said housing and said brake assembly to one of said springs so as to transmit the driving and braking torque directly thereto.

34. A rail car comprising a body constructed of relatively light structural members, a truck disposed beneath each end of said body for movement about substantially vertical axis, each of said trucks comprising a pair of drive axles, a motor for each of said drive axles carried by said body beneath the base thereof, and flexible and extensible drive shafts operatively connecting each drive axle and a motor, said drive shafts being arranged with respect to the axes about which said trucks pivot, so that angularity of the shaft and spline travel in said shaft is minimized.

35. A rail car comprising a body constructed of relatively light structural members, motive power means carried by said body, a truck comprising body supporting means supporting an end of said body, a pair of driving axles having wheels thereon, longitudinal members operatively connecting said body supporting means and said axles, gear housings mounted on each of said driving axles and having flexible drive shafts extending therefrom and through said body supporting means and operatively connected to said motive power means.

36. A rail car comprising a body constructed of relatively light structural members, motive power means carried by said body, a truck disposed beneath each end of said body for movement about a substantially vertical axis, each of said trucks embodying a plurality of axles having wheels thereon, a bolster, longitudinal members operatively connecting said bolster and axles, a gear housing mounted on each of said axles and having a flexible drive shaft extending therefrom and over said bolsters and operatively connected to said motive power means.

In testimony whereof we affix our signatures.

FRANK R. FAGEOL.
WILLIAM B. FAGEOL.