July 4, 1933. F. R. FAGEOL ET AL 1,916,470

RAILWAY ROLLING STOCK

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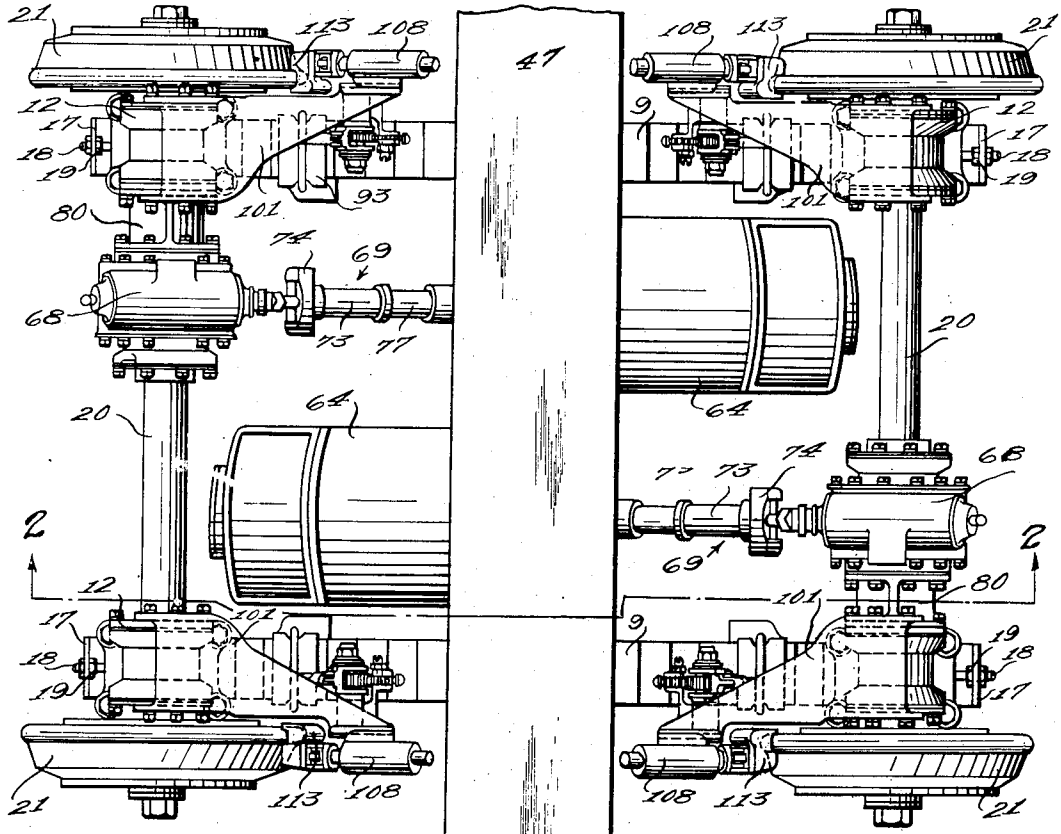


FIG. 1

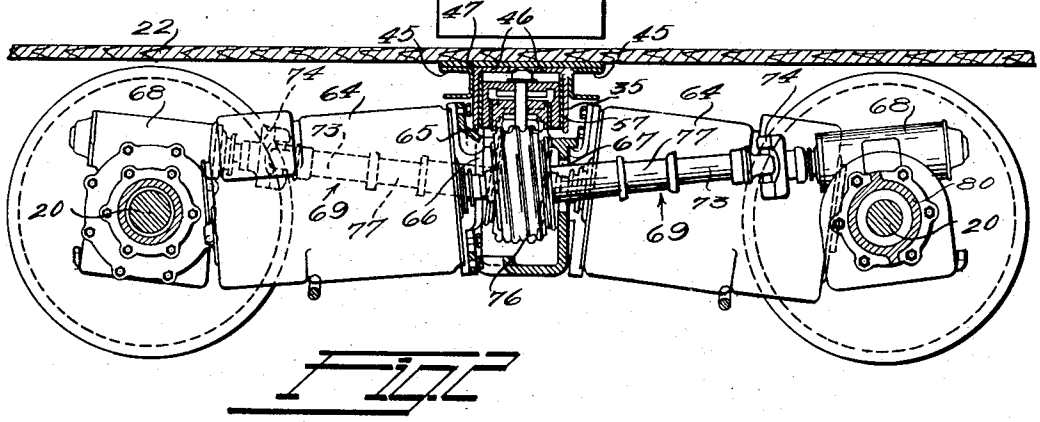


FIG. 2

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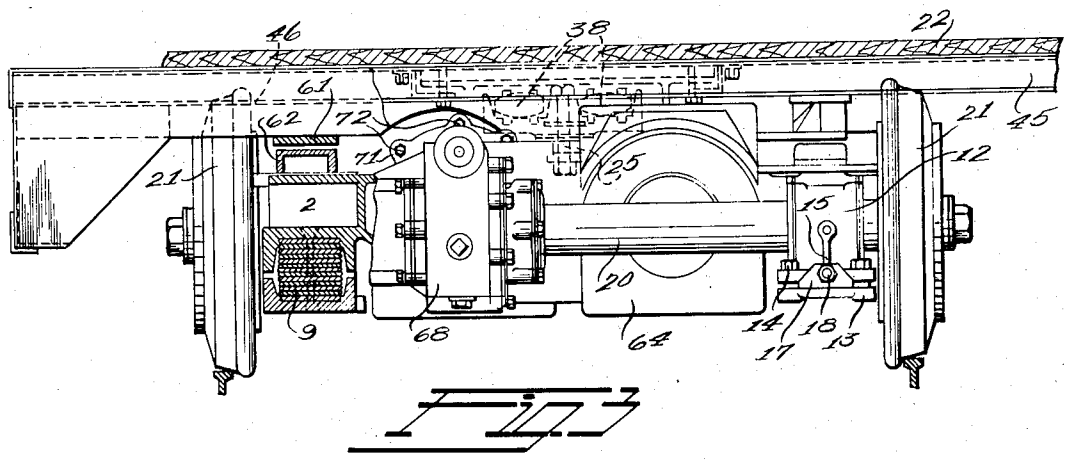


FIG. 3

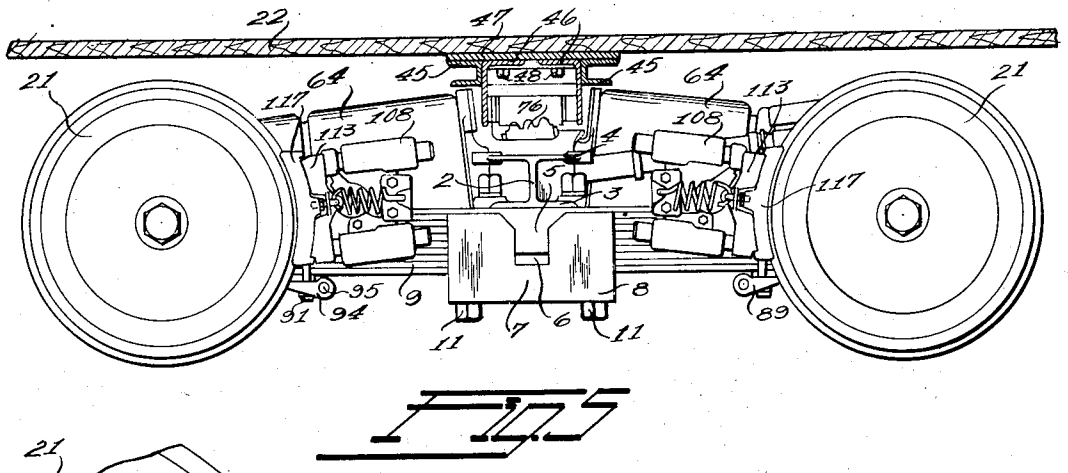


FIG. 4

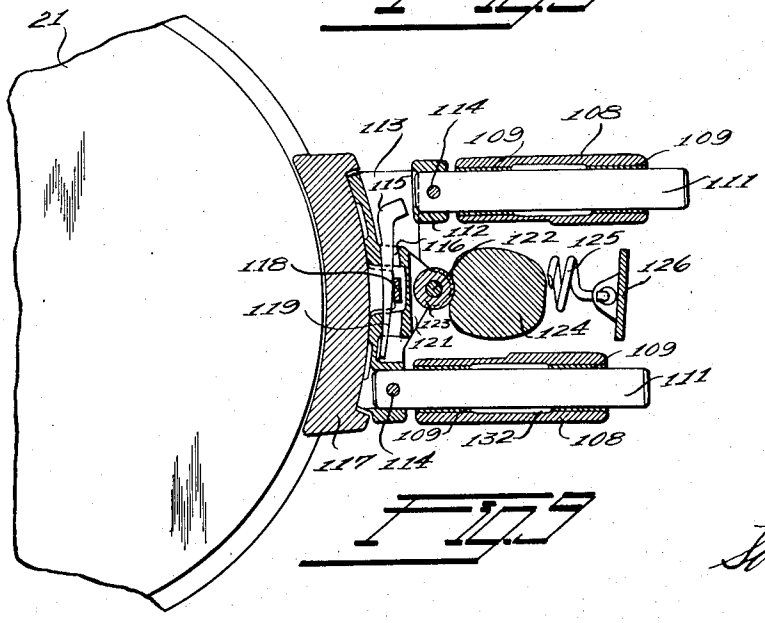


FIG. 5

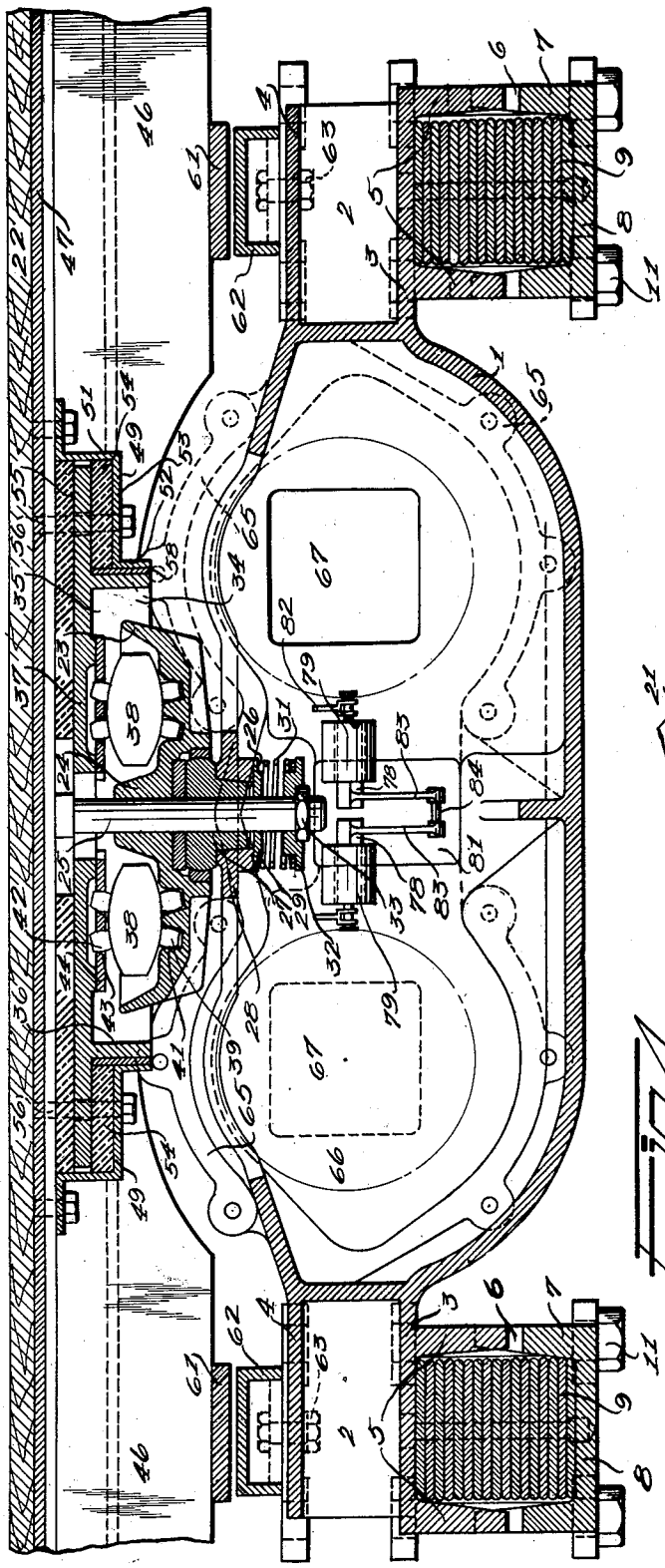
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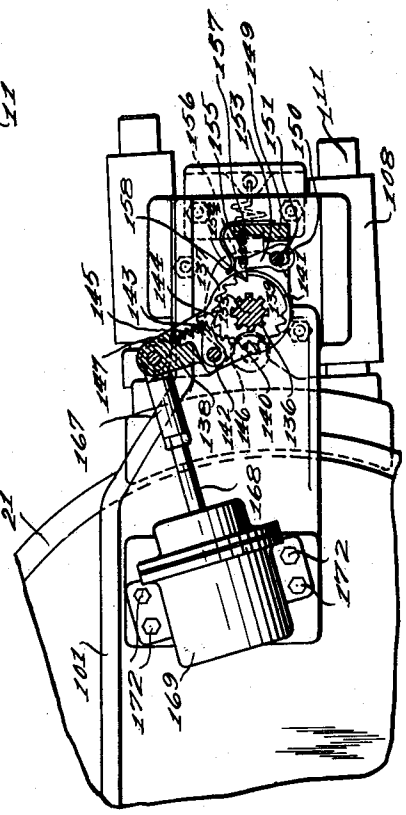
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RAILWAY ROLLING STOCK

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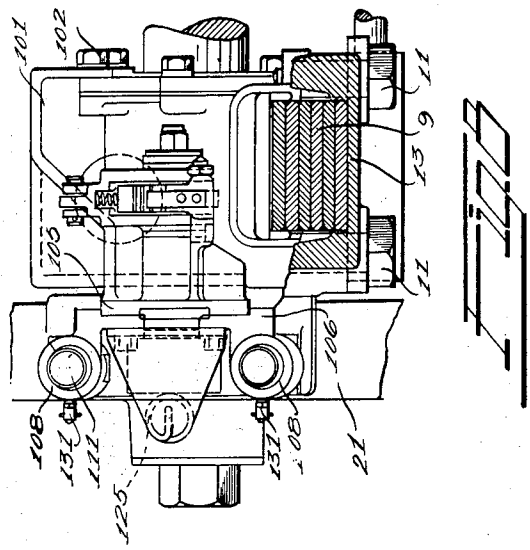
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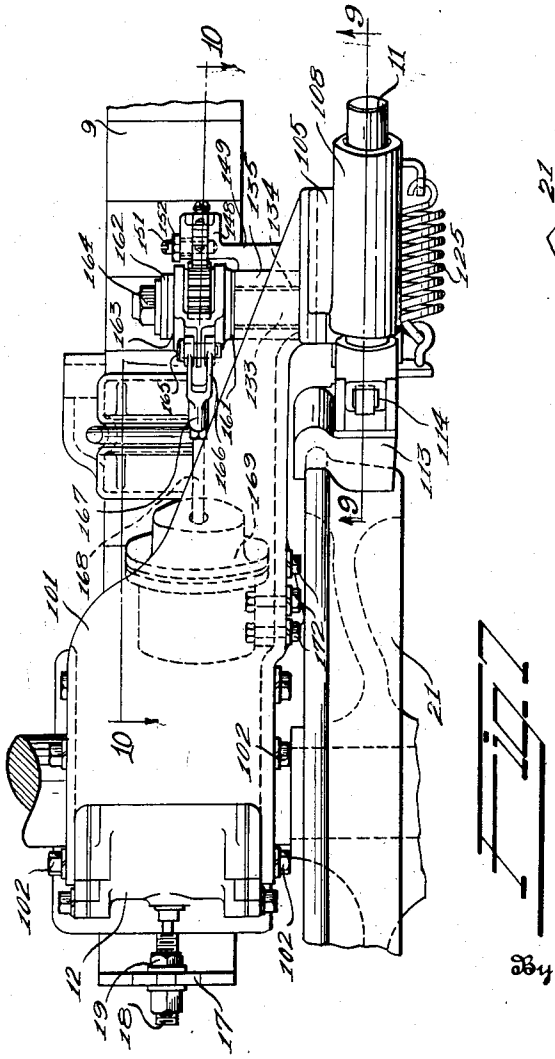
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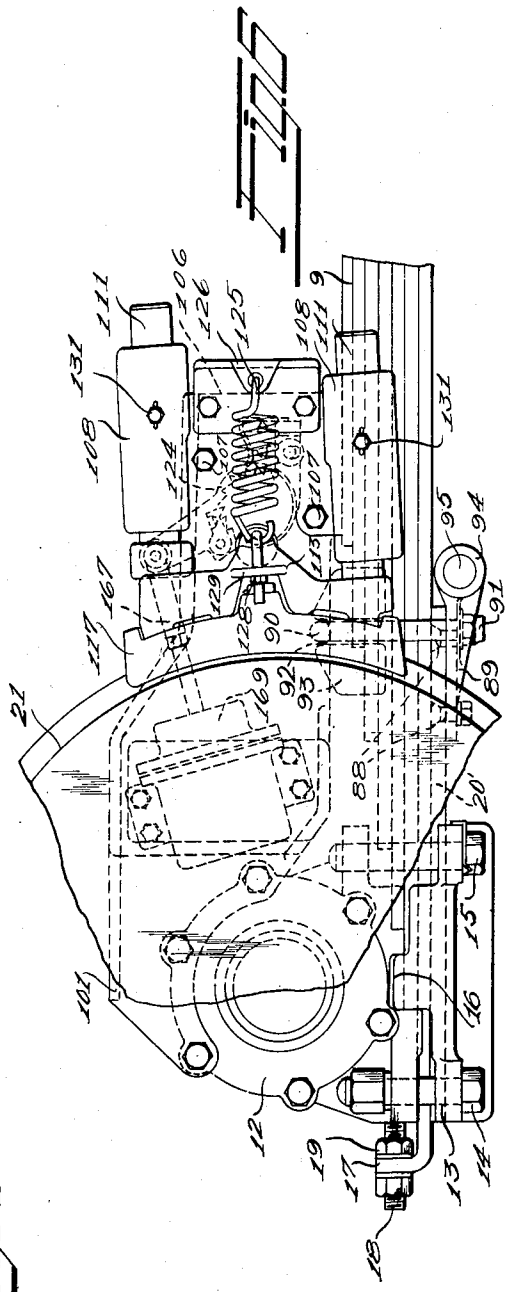
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RAILWAY ROLLING STOCK

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RAILWAY ROLLING STOCK

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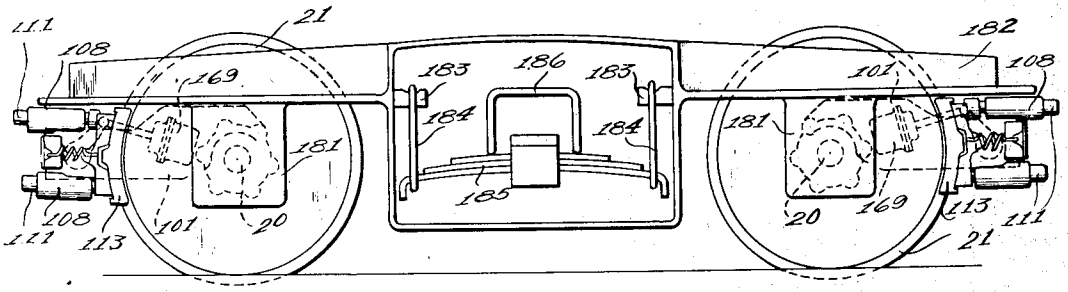


Fig. 11

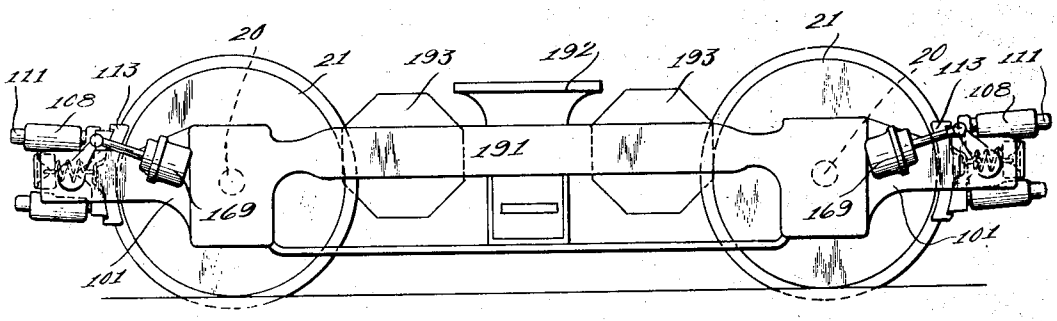


Fig. 12

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UNITED STATES PATENT OFFICE

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RAILWAY ROLLING STOCK

Application filed October 20, 1930. Serial No. 490,042.

This invention relates to railway rolling stock, and more particularly to railway brake and truck constructions. The present application is a continuation in part of copending application Serial No. 434,048, filed March 7, 1930.

Trucks for railway rolling stock, 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. As a result railway rolling stock now in common use is generally extremely noisy in operation, in strong contrast to the modern buses and automotive types of vehicles.

We have found that railway rolling stock, and particularly electrically driven rail cars need not partake of the heavy constructions now generally employed, and that it is entirely feasible to construct a rail car truck having a degree of resilience in the connections between the various parts that serve to support the car body 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 and to thereby permit safe operation with considerably lighter parts than has heretofore been deemed feasible. We have found by effecting a substantial reduction in the weight of the construction, by providing proper resilience between the axles and the truck frame, by providing novel brake constructions, and by cushioning the connections between the parts of the vehicle, that it is practical 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 and use of our novel brake mechanisms further results in a lowered initial cost of the construction, materially lowers the cost of operation of the vehicle in operation, and permits speeding up of safe operation due to improved acceleration and deceleration that becomes for the first time attainable.

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. We have 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 body construction heretofore not regarded as feasible in rail car constructions.

We have discovered that the braking system is a factor of primary importance in permitting reduced weights, higher speed, and less noisy operation of railway rolling stock. In prior rail car braking constructions it has been common practice to pivotally mount brake shoes on swinging link mechanism which swings the shoes on an arcuate path into engagement with the flanged peripheries of the wheels. With such mechanisms the brakes are irregularly applied, wear unevenly, and tend to grip and lock against the wheels. As a result considerable power is required to free the locked brakes in starting a car or train moving after the brakes have been applied, and the brake shoes and wheels wear unevenly requiring costly service and replacements, while ample material still remains in the shoes for long service if the wear had been evenly distributed.

The unevenness of brake application and tendency to lock against the wheels when the brakes are applied in the prior constructions results in inefficient braking, noisy operation, a substantial waste of power required to initially free the wheels from the brake, reduced

practicable safe speeds of operation, and reduced sizes of the trains that can be handled by locomotive and power cars.

Accordingly a primary object of the present invention is to provide novel braking arrangements for railway rolling stock in which the brake shoes are uniformly, evenly and effectively applied upon application of the braking power, and instantly and positively released when the application of braking power is discontinued, and in which the tendency for the brake shoes to chatter and lock, and irregular wear of the shoes and wheels is completely eliminated.

Another object of our invention is to provide brake constructions for railway rolling stock which reduces materially the amount of power required to handle railway rolling stock permitting operation at higher speeds, and of larger size trains; assures uniform application of braking power on each wheel with attendant smoother operation and increased comfort and safety to passengers and freight; and assures maximum uniform life of brake shoes with minimum maintenance and service. While our improved braking arrangement was devised especially for use in the improved electrically driven trucks hereinafter disclosed, it is applicable to all forms of railway equipment at present in use, either as initial or replacement equipment and application thereof to all types of railway rolling stock is contemplated as within the scope of the present invention as will more fully hereinafter appear.

Still another object of this invention is to provide a rail car truck construction 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, without causing inefficient or undesirable operation of the driving means or braking means when the parts of the vehicle move relative to each other.

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 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.

Another 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.

Still another 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 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.

Other objects of the invention will appear as a description thereof proceeds and from the terms of the appended claims.

As shown in the drawings:

Figure 1 is a top plan view partly broken away of a preferred truck construction embodying our invention.

Figure 2 is a longitudinal section substantially along line II—II of Figure 1, and including the central bolster pivotal connection

as well as illustrating a portion of a car body with which the truck construction may be directly associated.

Figure 3 is a view, partially in end elevation and partially in transverse section, of the truck construction illustrated in Figure 1.

Figure 4 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 5 is a side elevational view of the truck construction illustrated in Figure 1.

Figure 6 is a fragmental side elevation showing our improved wheel brake arrangement as applied to the driven form of truck disclosed in Figures 1 to 5.

Figure 7 is a plan view of the brake mechanism shown in Figure 6.

Figure 8 is an end view partially in section of the brake mechanism shown in Figures 6 and 7.

Figure 9 is a fragmental vertical sectional view taken along line 9—9 of Figure 7.

Figure 10 is a fragmental side elevation, partly in section, taken along line 10—10 of Figure 7, showing the details of the brake operating and slack adjusting mechanism.

Figure 11 is a more or less diagrammatic side view showing the application of our improved brake mechanism to one form of standard railway truck.

Figure 12 is a more or less diagrammatic side elevation showing the application of our improved rail brake arrangement to a form of standard electrical driven street car truck.

The improved truck assembly of the present invention comprises a bolster 1 which, as more particularly indicated in Figure 4 may be constructed in the form of a casting of hollow boxlike formation. Bolster 1 at each end thereof is of substantial I-formation in end elevation, as indicated in Figure 5, each including a vertical central web 2 and integral bottom and top flanges 3 and 4 respectively. The bottom flanges 3 are provided with laterally spaced central ears or lugs 5, which operatively engage recesses 6 in laterally spaced flanges 7 of a plate or cap 8. The flanges 3 and caps 8 with their respective ears 5 and flanges 7 provide housings to receive and position the intermediate portions of leaf springs 9, the leaves of which are rigidly clamped in position by bolts 11 extending through flanges 3 and caps 8, as clearly indicated in Figure 5.

The opposite ends of springs 9 are connected beneath the axle bearing housings 12 by means of clamping members 13, securing bolts 14 and studs 15 which extend through and are threaded in suitable bosses, of housing 12. It will be noted that clamping members 13 are provided with tongues 16 that rest in and interlock with suitable recesses formed in housings 12. Each end of the lower or longest leaf of each spring 9 is bent upwardly in the form of a flange 17 in spaced relation to the associated housing 12. Each flange 17 is apertured for reception of a threaded adjusting extension 18 projecting from related housing 12. Threaded on each extension 18 is a nut 19 on each side of flange 17, whereby upon adjustment of the nuts an abutment is provided between springs 9 and housings 12 for resisting torque reactions on axle housings, and for adjusting axles 20 into parallel alignment. Interposed between members 13 and the lower leaf of each spring 8 is a strip 20′ the purpose of which will more fully hereinafter appear.

Housings 12 and clamping members 13, it will be noted, cooperate to form a spring end supporting cage located from the spring ends by adjusting nuts 19 on extensions 18. If desired moulded brake lining, rubber or other suitable shock and vibration absorbing material may be interposed between the spring ends, the supporting cage formed by housing 12 and member 13, and between extension 18, nuts 19 and flange 17.

Axles 20 are rotatably journaled in any well known manner adjacent their opposite ends and support bearing housings 12. Rigidly secured on the outer ends of axles 20 are flanged rail wheels 21 which may be of any usual construction or of the construction shown in said copending application.

Bolster 1 is pivotally secured centrally thereof to a side sway oscillator construction which in turn is yieldably supported beneath the floor 22 of the car body. The oscillator construction comprises a base member 23 of pan-like formation, through a control boss 24 of which extends a pivot or kingpin 25. Kingpin 25 projects through a washer 26 and a bearing thimble 27. The washer 26 and outer enlarged portion of thimble 27 rest in suitable recesses in the base of member 23, as indicated in Figure 4, with the lower reduced portion of thimble 27 disposed in an aperture in a boss 28 formed on bolster 1. The inner end of pin 25 is encircled by a washer 29 yieldably held in engagement with the inner face of boss 28 by coil spring 31 whose inner end is engaged by a washer 32 which in turn is engaged by a nut 33 threaded on the inner end of pin 25 whereby the member 23 is connected with bolster 1 for pivotal movement relative thereto.

Member 23 is disposed in an inwardly facing channel 34 defined by inwardly directed side and end walls 35 and 36 respectively of an elongated plate 37. Disposed between member 23 and plate 37 are toothed rocking members 38 with the lower teeth 39 in rocking engagement with convex walled recesses 41 in member 23 and with the outer teeth 42 in rocking engagement with similar recesses

43 provided in plates 44 extending transversely of walls 35. The rocking members 38 provide for side sway movement between member 23 and plate 37, and in order to reduce friction to a minimum, antifriction plates are suitably disposed between walls 35 and the opposite sides of members 23, as is clearly indicated in Figure 2.

Plate 37 has a yieldable connection with the floor 22, preferably provided in the following manner. Suitably secured to the opposing faces of oppositely directed body supporting channel members 45 are the vertical flanges of angle irons 46, the horizontal flanges of which together with the outer horizontal flanges of channel members 45 are suitably secured to a body floor engaging and supporting plate 47. Secured as by bolts 48 to the horizontal flanges of members 46, as well as to plate 47, adjacent each end of plate 37, are angular plate members 49 each embodying laterally spaced vertical portions 51 and 52 and a horizontal portion 53 integrally connecting said vertical portions.

The opposite ends of plate 37 are disposed intermediate plate 47 and portions 53 of plates 49 and disposed on the lower side of plate 37 adjacent each end thereof, between the plate and the portions 53, are yieldable, preferably rubber, blocks 54 and disposed above plate 37 is a transversely continuous cushion block 55. A bolt 56 projects vertically through aligned apertures in opposite ends of plate 37 as well as blocks 54 and 55. By this construction plate 37 is connected with the vehicle body in such manner that it is capable of yieldable vertical movement. To reduce friction to a minimum suitable antifriction plates 57 are disposed between walls 35 and the vertical flanges of members 46, as is clearly indicated in Figure 2, which antifriction plates may be extended or additional plates provided between flanges 52 of plate 49 and walls 36 of plate 37, as indicated at 58 in Figure 4.

It will accordingly be seen that a yieldable pivotal connection between bolster 1 and floor 22 of the car body to permit alinement of wheels on curved sections of track is provided, and that said connections further provide for side sway of the car body relative to the bolster 1 as the entire assembly confined within plates 49 is bodily movable with the vehicle body, but plate 37 due to the cushioned blocks 54 and 55 is capable of yieldable vertical movement, whereby the car body may move laterally a limited amount on rocking members 38, but due to the fact that plate 37 can move vertically against the yieldable resistance of blocks 55 the side movement of the body will not be accompanied by vertical raising thereof.

As is more clearly indicated in Figures 2 and 3 channel members 45, angle members 46 and plate 47 extend the full width of the car body and the vertical flanges of members 46 have connected therewith shoes 61 in substantial vertical alinement with springs 9, adapted for cooperation with abutments 62 suitably secured by bolts 63 to the outer flanges 4 at the opposite ends of bolster 1 to limit transverse tilting movement of the car body.

Bolster 1 is further utilized as a support for a pair of electric motors designated at 64 one for driving each axle 20. Bolster 1 is accordingly provided on each opposite vertical face thereof at laterally opposite sides of pivot pin 25 with a series of motor head securing lugs 65 disposed about openings 66, and the respective opposite side walls of bolster 1 are provided with openings 67 in substantial alinement with openings 66. As will be seen upon inspection of Figures 2 and 4 bolster 1 is relatively low thus necessitating a downward inclination of driving gear housings 68 for axles 20 toward the bolster and to bring the motor armature shafts in parallel alinement with the propeller shafts 69 mounted in gear housings 68 and driving axles through suitable worm or other gearing in well known manner. The securing lugs 65 for the respective motors 64 are correspondingly inclined so that motors 64 in assembled position will have their armature shafts in substantial axial alinement with the respective propeller shafts 69.

Securing lugs 65 are constructed so that electric motors of standard makes may be utilized. The motors however must be provided with special heads for attachment to lugs 65 which as indicated in Figure 3 preferably comprise apertured lugs 71 similar to and matching lugs 65, and through the mating apertures of which bolts 72 extend firmly securing motors 64 to the bolster 1 independently of the axles. With this construction 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 9 that alone connect the axles to the bolster.

Each motor 64 is secured to bolster 1 on the side thereof opposite to the axle 20 driven thereby, and each motor is operatively connected with corresponding propeller shaft 69 gear housing 68 by a relatively short drive shaft section 73 which extends through openings 66 and 67 in the opposite vertical walls of bolster 1 as clearly indicated in Figure 2. Each shaft section 73 is furthermore provided with a universal joint 74 adjacent housing 68 and a second universal joint within a drive shaft brake drum 76 carried by the shaft section and disposed within hollow bolster 1. Each shaft section 73 is further provided with a telescoping joint 77 of well known form.

To resist the driving torque reactions on

gear housings 68, these housings and the adjacent axle bearing housings 12 are preferably rigidly connected by flanged tubular connecting members 80 surrounding the axles 20 so that the driving torque reactions are transmitted through housings 12 and are resisted by springs 9.

From the foregoing disclosure it will be seen that motors 64 are supported by bolster 1 in such manner that relatively short drive shafts are required and that the motors move with bolster 1 and the axles thus maintaining shafts 73 against lateral angularity. Accordingly shafts 73 can effectively be driven at a speed as high as four thousand revolutions per minute, or directly at the planning speed of high speed motors. Furthermore the disposition of the motors relative to the bolster is such that the drive shaft brake drums 76 are disposed within bolster 1 opposite pivot pin 25, which not only houses the brake drums but permits convenient operation of propeller shaft brakes from the body in a manner substantially unaffected by the truck movements with relation to the body.

Our improved propeller shaft brake operating means comprises a pair of laterally alined shafts 78 rotatably journaled in similarly alined bearing lugs 79 rigidly supported from extensions 81 of opposite side walls of bolster 1 in such manner that the adjacent ends of shafts 78 are disposed immediately below pivot pin 25. Each shaft 78 has a link connection 82 with a respective braking arrangement of any well known construction cooperating with one of the drums 76. Each shaft 78 between lugs 79 is provided with a rigid arm 83. Arms 83 are relatively close at equal distances from an extended axis of pin 25 as indicated in Figure 4. The inner ends of arms 83 are connected by an equalizing bar 84 to which a link (not shown) is pivotally connected at one end as by a suitable universal connection, and whose other end is pivotally connected with an actuating rod (not shown) 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 no affect the braking mechanism, and the propeller shaft 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 substantial 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 the present invention. Furthermore it will be noted that by the provision of the equalizers 84 an equalized braking action is provided for the pair of brake drums 76 included in each truck assembly.

Secured to the inner end of each short plate or spring leaf 20′ (Fig. 6) by means of countersunk head bolts 88 or in any other suitable manner is a casting 89 through which the threaded ends of U-bolts 90 extend and on the ends of which securing nuts 91 are threaded. The legs of U-bolt 90 span spring 9 and the bight portion thereof nests in a depression 92 in casting 93 of a rubber snubber assembly of well known construction and comprising a rubber block the lower face of which is shaped for engagement with a plurality of consecutive leaves of spring 9, the nuts 91 being sufficiently drawn up to firmly bind the block between casting 93 and spring 9. Formed on the end of casting 89 are tubular members 94 in which the ends of cross bracing rod 95 are secured, it being understood from the drawings that the cross bracing rods 95 extend from one snubber assembly to the snubber assembly on the opposite side of the truck, to tie the two together.

While any suitable wheel brake construction may be applied to the truck arrangement so far described, preferably the improved wheel brake construction shown in detail in Figures 6 and 10, inclusive is utilized.

In this form of construction as shown in Figures 1, 5, 6 and 7, a brake supporting arm or bracket 101 is secured by means of bolts or studs 102 to the end flanges of the axle supported journal box housing 12.

Formed on the outer end of brake supporting bracket 101 are securing and locating projecting surfaces 105 for brake shoe head bracket 106 which is provided with these suitable recessed complemental machined surfaces to fit over surfaces 105. Brake shoe head bracket 106 is secured to bracket 101 by means of securing bolts or machined screws 107. Formed integrally on head bracket 106 are tubular pilot members 108 bored to receive aligned pilot bushings 109 (Fig. 9) pressed into position, and in which cylindrical brake shoe head pilots 111 are slidably supported and guided. The ends of pilots 111 toward the wheel 21 individual thereto are nested snugly in bored holes 112 of brake shoe head 113, to which they are removably secured by means of the removable securing pins 114.

Removably secured to and supported by brake shoe head 113 by means of curved securing wedge or key 115 which extends through suitable holes 116 in the brake shoe head, is brake shoe 117 provided with securing extension 118 engaged by the curved wedging surface 119 of key 115.

Formed integrally with brake shoe head 113 is a pair of roller supporting ears 121 in suitable bearing holes of which actuating roller supporting spindle 122 is journaled.

Mounted on spindle 122 is a hardened brake actuating roller 123 which in operation is held against actuating cam 124 by brake shoe retracting spring 125. Spring 125 at one end is secured to a supporting bracket 126 secured to brake shoe head bracket 106 by means of the supporting screws 107. At its other end spring 125 is adjustably secured by means of eye bolt 127 and tension adjusting nuts 128 to extension 129 of brake shoe head 113. Eye bolt 127, it will be noted extends through a suitable hole formed in extension 129.

To provide free sliding movement of the brake shoe assembly under influence of cam 124 and spring 125 in operation, alemite lubricant fittings 131 are provided in guide members 108 by means of which lubricant may be injected under pressure into chambers 132 of members 108 to effectively lubricate the brake shoe pilots 111.

Actuating cam 124 is formed integrally on the end of actuating spindle 133, suitably journaled in a bushing 134, (Figure 7), pressed into suitably bored bearing section or boss 135 formed integrally on brake supporting arm or bracket 101. Shaft 133 beyond bearing section 135 is splined at 136 as shown in Figure 10, and journaled for rotation adjacent the ends of splined section 136 of spindle 133 are bifurcated ends 137 of the brake operating lever 138. Splined on section 136 and disposed between ends 137 of lever 138 is brake shoe ratchet wheel 139 provided with teeth 140 and the smooth sector 141. Pivotally mounted on lever 138 by means of pin 142 is lever pawl 143, the nose 144 of which is forced into engagement with ratchet teeth 140 by spring 145 the ends of which are disposed in suitable recesses 146 and 147 (Figure 10), formed in pawl 143, and lever 138 respectively.

Ears 148 (Figure 7) of extension 149 of brake shoe supporting bracket 101, support pivot pin 151 suitably threaded into ear 148 and locked in position by locknut 152. Pivotally supported on pin 151 by means of elongated slot 150 is slack adjusting pawl 153, the nose 154 of which is held in engagement with teeth 140 of ratchet 139 by means of spring 155, the ends of which are nested in suitable holes 156 and 157 formed in pawl 153 and extension 149 of bracket 101. A slack adjusting spring 158 secured to extension 149 holds bracket bar 153 downward with the upper end of slot 150 bearing against supporting pin 151 (Fig. 10).

Interposed between the outer end 137 of brake lever 138 and bearing 135, is a thrust washer 161. Spindle 133 together with brake operating cam 124 and lever 138 and the ratchet assembly are held in position by means of thrust collar 162 mounted on the reduced end section 163 of spindle 133, and by securing and adjusting nut 164 screwed on a suitably threaded end section of the spindle 133.

Secured to the upper end of brake lever 138 by means of pin 165 is bifurcated brake operating member 166. Member 166 is provided with a suitable end shank 167 threaded on the piston or diaphragm rod 168 of brake operating vacuum or air cylinder 169, and locked in position by means of locknut 171.

Brake operating cylinder 169 is secured by means of machine screws or studs 172 to suitably tapped holes formed in the brake arm or bracket 101.

In operation of the wheel brake mechanism so far described, spring 125 normally holds brake shoe head 113 and brake shoe 117 in the retracted position shown in the drawings. With the curved braking surfaces of the brake shoe uniformly spaced from the wheel periphery due to the guiding action of supporting pilot members 111.

When the brakes are to be applied, brake cylinder mechanism 169 is operated in well known manner to force actuating rod 168 to the right end in Figure 10, rotating brake operating lever 138 clockwise. This rotation of the brake lever 138 actuating nose 134 of pawl 133 and the engaged tooth 140 of ratchet wheel 139 rotates the ratchet wheel 139 in a clockwise direction. Wheel 139 through splined section 136 rotates spindle 133 and brake cam 124. Rotation of brake cam 124 forces roller 123 together with brake shoe support 112 and the brake shoe 117 guided by pilots 111 uniformly toward wheel 21 with the result that the braking surfaces of shoe 117 are forced with a parallel motion uniformly into contact with the periphery and flange of wheel 21, applying a uniform braking pressure to the wheel.

The brake reactions as a result of the application of pressure on wheel 21 through shoe 117 are transmitted through brake shoe pilots 111 to brake shoe bracket head 106 and bracket 101 to axle supported journal housing 12 and through the journal housing to spring 9.

Upon release of the application of pressure on cylinder 169, rod 168 is retracted or moved to the left in Figure 10, and brake lever 138 is moved counterclockwise relieving the pressure of pawl 143 on ratchet 139. As soon as the pressure of pawl 143 is relieved, brake shoe 117 is retracted from engagement of the wheel through the action of spring 145, the brake shoe assembly being retracted with a uniform parallel movement guided by pilots 111 while cam 124 is rotated counterclockwise to its unactuated position.

The uniform guided movement of brake shoe 117 toward and from the wheel, because of the mounting of brake supporting bracket 101 on the axle supported journal housing 12, is always along an axis that intersects the wheel center regardless of spring deflection, and the entire braking torque is absorbed in the supporting springs 9. As a result of this

uniform guided movement, there is no tendency for the brake shoe to lock against the surface of the wheel when the brake is applied and wear on the brake shoe as well as on the wheels is uniform.

Normal wear of brake shoe 117 in service causes a slack in the operating mechanism to be developed that is taken up automatically by the improved ratchet and pawl operating mechanism for the cam operating spindle 133 as follows. When the wear becomes sufficient to require enough rotary movement of ratchet 133 so that the radial surface of a succeeding ratchet tooth 140 passes by the retaining surface of nose 151, pawl 153 will snap over the next succeeding tooth and when the braking pressure is next released cam 124 will be prevented from returning to its last preceding rest position by engagement of the retaining surface of nose 154 with the radial surface of the next succeeding ratchet tooth 140. The movement of brake shoe 117 away from wheel 21 will therefore be reduced by a distance corresponding to the difference in drop between the previous rest position of cam 124 and the newly established rest position, with the result that the slack due to the wear of the brake shoe is taken up a corresponding amount.

The construction is so arranged that slack is automatically taken up and effective braking pressure is maintained until the brake shoe 117 is completely worn out. The complete wearing out of the brake shoe is made possible by the guided and uniform application of the brake pressures. While a specific form of slack adjustment has been described it will be understood to those skilled in the art that any suitable form of automatic slack adjustment may be provided without departing from the spirit of the present invention.

In the form of invention shown in Fig. 11 a standard type of rail truck is disclosed in which axles 20, to which the flanged rail wheels 21 are secured in usual manner, are journalled in suitable axle or journal housings 181 of any well known construction. Side frame members 182 of the truck assembly may be slidably and yieldingly, or rigidly supported as is well known in the art. Suspended from projections 183 of members 182 are spring hangers 184 the lower ends of which support the ends of the leaf springs 185, which in turn support the usual bolster construction 186. Our improved wheel brake structure shown in detail in connection with Figures 6 to 10 inclusive is applied to each wheel 21 by securing the inner ends of the brake supporting bracket 101 with the brake carried thereby as heretofore described in detail, to housings 181 so that the brake shoes 118 will be guided by pilots 111 toward and from the wheels 21 in a straight line path parallel to and along an axis that intersects the wheel center regardless of the relative movement of side frame 182 with respect to the axles in the manner hereinbefore described in detail.

In the form of invention shown in Figure 12 a standard street car type of truck is disclosed in which axles 20 are suitably journalled in the side frame members 191 which support bolster 192 and driving motors 193 for axles 20 in well known manner. In this form of truck since the side frames are rigidly supported the supporting bracket 101 for our improved brake mechanism may be formed integrally with or rigidly secured to form extensions of the truck side frame members 191 in a manner obvious to those skilled in the art. As in the forms of invention heretofore described, brackets 101 support the brake operating mechanism in such manner that brake shoes 113 move toward and from the periphery of wheel 31 along a path parallel to an axis which intersects the center of the wheels engaged thereby at all times in operation as will be apparent from a reference to the detailed description in connection with Figures 6 and 10.

It will accordingly be seen that novel wheel brake constructions have been provided adaptable to any type of rail wheel, in which uniform efficient application of braking pressure is maintained throughout the full life of the brake shoe, prolonging the life of the shoe and minimizing the brake service necessary. Furthermore, because of the guided movement and accuracy of brake application, the braking pressure on each wheel of a truck may be accurately predetermined and equalized throughout railway rolling stock equipment, with the result that maximum efficiency of braking power is assured. Also due to the guided action and uniform withdrawal of the brakes immediately upon releasing of the braking pressure, loss of power due to locked brakes is eliminated permitting marked saving in power and increased speeds of operation with increased loads, train sizes, and efficiency of operation to be obtained on all types of rail equipment.

It will furthermore be seen that improved low cost electrically driven rail trucks of minimum weight and cost, and adapted for maximum efficiency of operation have been provided. Having described preferred embodiments only of our invention wide variations of detailed application without departing from the spirit of our invention will become apparent to those skilled in the art. Accordingly what is desired to be secured by Letters Patents and claimed as new is:

1. A railway brake assembly comprising means adapted to be supported adjacent one end on a railway axle; brake shoe supporting and guiding means slidably mounted on said first mentioned means; a wheel engaging brake shoe supported by said last mentioned

means and constrained thereby to move in a fixed path with relation to the center of the wheel engaged thereby; and actuating means for said brake shoe supported by said first mentioned means.

2. The combination as set forth in claim 1 in which said actuating means comprises a fluid operated brake cylinder.

3. The combination as set forth in claim 1 together with means connected to said first mentioned means for resisting the torque reactions imposed thereon by said brake shoe.

4. The combination as set forth in claim 1 together with means on said first mentioned means for pivotal connection of a torque resisting link thereto.

5. 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 solely from one of said housings.

6. 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 secured to one of said housings; a wheel engaging brake shoe movably mounted on said bracket; and actuating means for said brake shoe.

7. A rail car truck comprising a bolster, a pair of axles; bearing housings supported on said axles; wheels supporting and driven by said axles; longitudinally extending members interconnecting said bolster and said bearing housings; 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 a common means for imposing the torque reactions due to said wheel brakes and said drive shafts on said members.

8. A rail car truck comprising a bolster; a pair of axles; bearing housings supported by said axles; springs interconnecting said housings 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 housing.

9. 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 a common means connecting said housing and said brake assembly to one of said springs so as to transmit the driving and braking torque directly thereto.

10. In a railway truck a pair of wheels yieldably mounted with respect to the truck frame elements; and braking means for one of said wheels so connected to the yielding mounting for the wheel that said braking means maintains a predetermined substantially fixed relation with respect to its wheel center, as it moves with deflections of the mounting in operation.

11. In a railway truck, 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 one of said wheels connected to the adjacent spring; and means for maintaining the distance of said braking means from its wheel center substantially fixed when the springs yield.

12. In a railway truck, a bolster; a leaf spring 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; a brake actuating lever pivoted to said support; a brake shoe actuated by said lever; means on said support constraining the motion of said brake shoe to a path substantially along a straight line axis intersecting the wheel center; and means to actuate said lever to apply said brake shoe to the periphery of the wheel.

13. In a railway truck, a bolster, an axle; a leaf spring secured at its end to said axle; a brake support secured to said spring; a brake lever carried by said support; a brake shoe actuated by said lever; and fluid-actuated brake operating means secured to said support and operatively connected with said brake lever.

In testimony whereof we affix our signatures.

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