April 26, 1960 L. M. APPLEGATE 2,934,027

RAILWAY TRUCKS

Filed Oct. 17, 1955

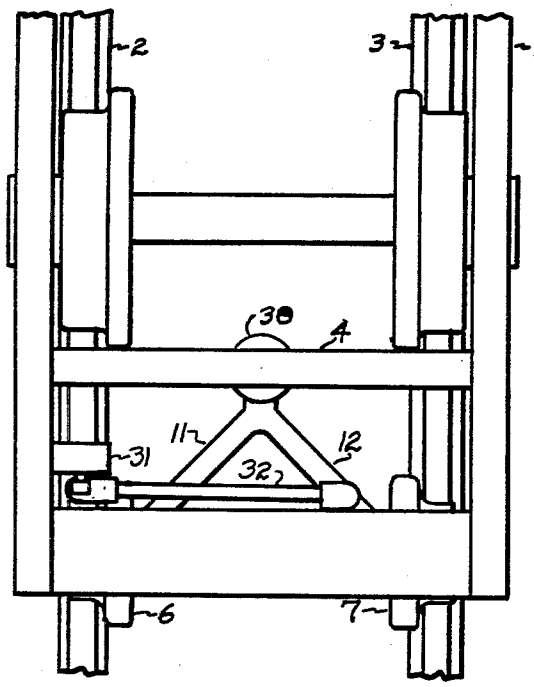


FIG 1

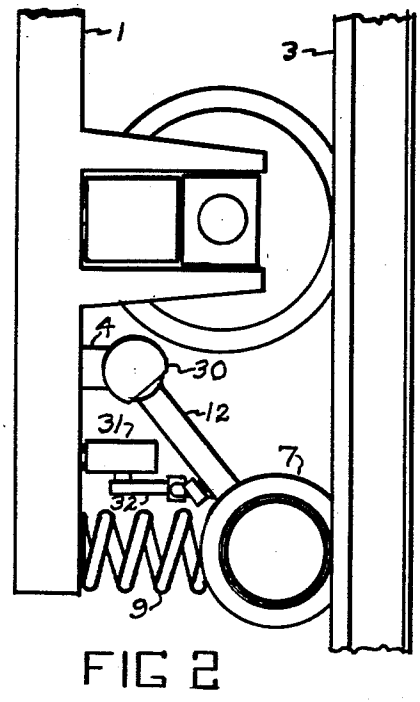


FIG 2

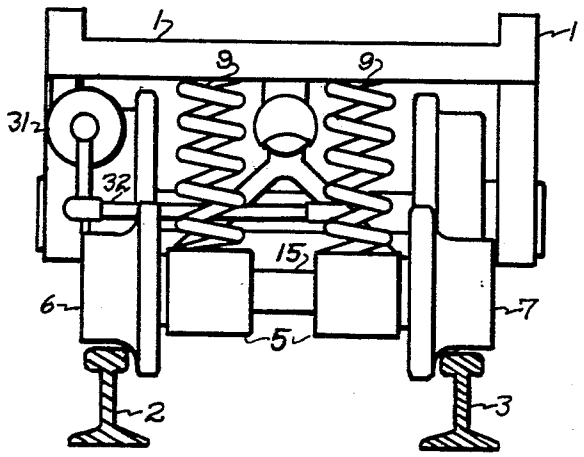


FIG 3

INVENTOR:

Lindsay M. Applegate

United States Patent Office 2,934,027
Patented Apr. 26, 1960

2,934,027

RAILWAY TRUCKS

Lindsay M. Applegate, Oswego, Oreg., assignor to Wayne M. Mann, Citrus Heights, Calif.

Application October 17, 1955, Serial No. 540,664

10 Claims. (Cl. 105—183)

This invention is related to my Patent Number 2,728,304 issued Dec. 22, 1955 for Railway Trucks. The principal object of my present invention is the mechanical adaptation of the principles of my Patent No. 2,728,304 to conditions of operation in which guide rails on railway switch frogs are used to assure correct tracking of the wheels on railway trucks running through rail switches.

The normal operation of railway trucks on frogs with guide rails requires solid axles or equivalent means connecting each pair of wheels. My invention as specified in my Patent No. 2,728,304 described the principles of suppressing lateral oscillation of railway trucks on rails by methods using independent auxiliary wheels with flanges held against the upper inside edges of the rails. Independent wheels, while satisfactory on ordinary track may encounter difficulty in negotiating track frogs of small angle. This difficulty is overcome by interconnecting each pair of wheels by a solid axle so that the wheel in the frog is held on the correct course by the flange of the opposite wheel under restraint by the guide rail inside the rail opposite the frog. An object incidental to the principal object mentioned above is to accomplish the dimensional and other modifications of the invention described in my patent required for solid axle operation.

What constitutes my present invention is described in the specification following in reference to the accompanying drawing and is succinctly defined in the appended claims. In the drawing, Figure 1 is a plan view of the essential elements of my present invention in a convenient form of embodiment. Figure 2 is a side elevation of the subject matter of Figure 1. Figure 3 is a front view of the structure of Figure 1.

The structural elements in the drawing are indicated by numerals which are the same as the numerals used for corresponding elements shown in my Patent No. 2,728,304. The basis principles of operation in the present invention are identical with those in the above mentioned patent. These are essentially the absorption of energy in frictional and elastic elements and the consequent production of forces therein which oppose the lateral movement of the truck with respect to the rails.

The principal difference between my present invention and that of my issued patent is that the direct actions of springs applying axial forces are used to hold the flanges of the auxiliary wheels in contact with the inside edges of the rails in the patent, whereas in my present invention the flanges of the auxiliary wheels are held in contact with the inside edges of the rails by spring action applied radially to the auxiliary wheels combined with the effect of friction and the inclined surfaces between the auxiliary wheels and the rails. This is illustrated especially in Figure 4 of the present drawing.

The operation of my present invention except for the method of holding the auxiliary wheels in contact with the rails is as described in my Patent No. 2,728,304. In the drawing a conventional truck frame 1 carries the

usual four or six truck wheels, two or three axles, bearings and springs conventionally mounted and spring-loaded as indicated in outline in Figures 1, 2 and 3. A pair of auxiliary wheels 6 and 7 are in contact with the rails 2 and 3. A shaft or axle 15, continuous between wheels 6 and 7, is held in bearings in the housing 5. Housing 5 is connected rigidly to extentions 11 and 12 which terminate at a flexible anchorage or universal joint 30 which is supported on frame member 4. This flexible anchorage holds wheels 6 and 7 at constant radial distance from frame member 4 and permits them to move vertically, laterally and torsionally with respect to the truck frame 1. This anchorage could be in any convenient combination of hinges to permit corresponding degrees of freedom.

Springs 9 between frame 1 and housing 5 holds wheels 6 and 7 in contact with the rails 2 and 3. The configuration an dimensions of the flange and tread curvatures of wheels 6 and 7 may be such that the forces applied by springs 9 produce a resultant component of axial force between the flanges of wheels 6 and 7 and the upper inside edges of rails 2 and 3.

When frame 1 moves relative to tracks 2 and 3, there is a resultant movement between frame 1 and wheels 6 and 7. This causes housing 5 and extensions 11 and 12 to move relatively to frame 1. The axial clearances in the bearings in housing 5 are kept small so that lost motion between wheels 6 and 7 and housing 5 is held to a minimum. An energy absorber 31 shown as a conventional shock absorber with radial lever arm is mounted on frame 1. A linkage 32 with closely fitted bearings is connected between absorber 31 and housing 5 through extension 11. The dimensional and angular design of linkage 32 is such as to minimize the movement in absorber 31 in response to vertical movement of housing 5 relative to frame 1, and to assure a virtually direct and complete response of absorber 31 to lateral movement of housing 5.

There needs to be some clearance between the flange 26 of wheel 7 and rail 3 to provide for error and accidental variation in track gage. This is of the order of one fourth of an inch between the rails on main line tracks.

To summarize the operation of my present invention, auxiliary wheels 6 and 7 being of gage and configuration to ride on the upper inside edges of the rails as shown in Figure 3, are held in contact with the rails by an axial component of force resulting from friction or radial force acting on wheels 6 and 7 in contact with the rails 2 and 3. Lateral and/or angular movement of the truck 1 relative to rails 2 and 3 cause wheels 6 and 7 to move laterally with respect to energy absorber 31 and to produce therein forces opposing the movement which causes the forces. The absorption of energy in the energy absorber 31 and the forces produced therein and reacting between the truck 1 and energy absorber 31 through the linkage 32, oppose the lateral and angular movement of truck 1 on rails 2 and 3 and suppress periodic repetition of angular and lateral displacements thereby preventing resonant oscillation of the truck on the rails.

It will be obvious that axle 15 holding wheels 6 and 7 a fixed distance apart could be replaced by an equivalent restraining arrangement extending from the outer ends of wheels 6 and 7 around the outside of the pair of wheels. The continuous conventional axle 15 between the wheels is shown for convenience and because it is usually the most economical construction. In referring, for example in claims, to the connection of wheels 6 and 7 by an axle it will be understood that any other mechanical arrangement for holding wheels 6 and 7 a fixed distance apart could be substituted without change other than mechanical design.

In reference to the energy absorbed 31 and the linkage 32 connecting thereto, it will be obvious that the function of energy absorption can be accomplished by any frictional member responsive to lateral and/or angular displacement of wheels 6 and 7 relative to the truck. For example, a ball type of universal joint 30 can be designed to resist angular displacement in the horizontal plane, or all planes, by the addition of frictional elements between the ball and the socket in order to combine in a single assemblage the functions of longitudinal restraint and frictional resistance to lateral movement. Reference, as in the claims, to a frictional member or an energy absorber will be understood to include any convenient means of applying frictional restraint to the lateral and/or angular movement of wheels 6 and 7 relative to the truck.

In designing wheels 6 and 7 it will be recognized that the radius of curvature of the curved part 28 between the flange 26 and tread 27 of the wheels should be made as small as is consistent with good operation. It will be observed from the exaggerated Figure 4 that an unnecessarily large radius of curvature 28 may cause the wheel 7 to ride at an excessively steep angle on the inner edge of rail 3 and thus accelerate wear on the flange 26 of wheel 7. The loading of springs 8 and 9 on wheels 6 and 7 is necessarily large enough to hold them in contact with the rail and to avoid bouncing in operation. This may amount to several thousand pounds and accordingly, the flatter the angle between the top of rail 3 and the part of curve 28 riding on the rail, the less rapid the wear.

There is another practical factor that makes for favorable bearing of the thread 27 of wheel 7 on rail 3. This is the friction between the tread 27 of wheel 7 and the top of rail 3. It will be obvious from Figure 1 that the lateral freedom of movement between truck 1 and wheels 6 and 7 permitted by universal joint 30 will result in a small angular displacement at joint 30 whenever truck 1 moves laterally or angularly with respect to rails 2 and 3, even if wheels 6 and 7 are subject to no lateral restraint between rails 2 and 3 other than the friction of the treads 27 of wheels 6 and 7 on the rails. Thus under some conditions it will be feasible to operate satisfactorily with normal configuration and flange clearance of wheels 6 and 7 with respect to rails 2 and 3, depending only on friction between the tread 27 and the top of rail 3, for example, without any special configuration of the curved surface 28 of wheel 7.

A precaution to be observed in the design of bearings 5, axle 15, the wheels 6 and 7 is to assure sufficient rigidity and strength of arms 11 and 12 and associated structural members to maintain close clearances between the ends of bearings 5 and the bearing surfaces of wheels 6 and 7. This is to assure full and immediate response and movement of bearings 5 and arms 11 and 12 relative to the truck when there is lateral displacement of wheels 6 and 7 relative thereto. End play between bearings 5 and wheels 6 and 7 will tend to permit unopposed horizontal angular movement of wheels 6 and 7 relative to the truck. Effective operation is facilitated when such movements are communicated immediately through the mechanical linkage 32 to energy absorber 31.

In further reference to the longitudinal restraining member 11, 12 shown in Figures 1 and 2, and the universal joint 30, it should be understood that the essential requirement is that wheels 6 and 7 and axle 15, together with bearing housings 5, shown in Figure 3, be arranged so that they can move laterally relative to truck frame 1 while being restrained longitudinally. This can be accomplished, obviously, by a plurality of universal joints 30 connected through parallel longitudinal arms to bearing housings 5 if provided with the necessary flexibilities and restraints. The essential relative freedom of movement of housings 5 relative to frame 1 is lateral. A construction which introduces angular movement, as around universal joint 30, resulting from the lateral movement of housings 5 relative to frame 1 is a matter of mechanical convenience. Any construction that allows freedom of lateral movement of housings 5 relative to frame 1 and provides coupling for energy-absorbing means responsive to the lateral movement between housings 5 and frame 1 as with energy absorber 31 will fulfill the functional requirements.

I claim:

1. A railway truck having a frame and at least three axles and pairs of flanged wheels, at least two of said axles being conventionally mounted and spring-loaded in said frame, at least one other axle being supported in bearings spring-loaded by the frame and connected thereto by radial arms attached at one end to said bearings and at the other end to a universal joint attached to said frame and an energy absorber mounted on said frame, and operatively connected to said bearings through mechanical linkage to be responsive to horizontal angular and lateral displacements between said other axle and frame for absorption of energy from said displacement and the production of forces opposing said displacement.

2. A railway truck including a frame and at least three axles and pairs of flanged wheels, at least two of said axles being mounted and spring-loaded in said frame in the usual fixed angular relationship to the frame, at least one other axle being supported in bearings spring-loaded by the frame and attached to one end of a radial arm universally connected to a universal joint on the frame permitting said other axle to move laterally relative to said frame through a horizontal angle, and an energy absorber on the frame and connected to said radial member through a mechanical linkage whereby lateral and angular movement of said frame relative to said other axle produces a displacement and energy loss in said energy absorber.

3. In combination with a railway truck including a frame and at least two axles carrying pairs of flanged wheels conventionally mounted and spring-loaded in the frame, a third axle and pair of wheels mounted in bearings loaded by springs between said bearings and frame, and connected thereto through a universal joint and a longitudinally restraining radial member between said joint and said bearings, an energy absorber connected between said bearings and frame responsive to lateral displacement of said frame relative to said third axle whereby lateral oscillation of the frame relative to said third axle produces displacement in said energy absorber to develop forces damping said oscillation.

4. A six-wheel railway truck comprising a frame, two axles and four wheels conventionally mounted and spring-loaded in said frame, a third axle and pair of wheels mounted in bearings loaded by springs between the bearings and the frame and connected to the frame by congitudinally restraining means permitting lateral movement of said third axle relative to the frame, and energy-absorbing means responsive to lateral movement of the frame relative to said third axle and bearings connected by a mechanical linkage between said bearings of said third axle and the frame, whereby lateral displacements of said frame relative to said third axle are subjected to resistance and absorption of energy in said energy-absorbing means producing thereby forces resistant to said relative lateral displacement.

5. A multi-axle railway truck comprising a frame, at least two axles and pairs of wheels conventionally mounted and spring-loaded in said frame, at least one other axle and pair of wheels loaded through bearings by springs connected to said frame, said bearings being connected to the frame by longitudinally restraining means permitting lateral, vertical, and tortional displacement of said other axle relative to the frame, and energy-absorbing means mechanically connected between the bearings of said other axle and the frame whereby lateral

displacements of said other axle relative to the frame are subjected to resistance and absorption of energy.

6. Means in a railway truck for opposing lateral oscillation of the truck on the rails comprising a truck frame, at least two axles and pairs of wheels mounted and spring-loaded in the frame, at least one other axle connected through spring-loaded bearings to the frame by longitudinally restraining means permitting said other axle to move laterally with respect to the frame, and frictional means for resisting said lateral movement mechanically connected between said bearings and the frame whereby lateral oscillation of the truck on the rails produces relative displacements between the bearings of said other axle and the frame which are resisted by displacement and energy absorption in said frictional means.

7. A railway truck including a frame, at least two axles and pairs of wheels mounted and spring-loaded in the frame, at least one other axle and pair of wheels in bearings connected to the frame by loading springs, at least one flexible joint and at least one longitudinal member universally connected at one end to said joint and at the other end to said bearings maintaining substantially fixed longitudinal distance between said other axle and said two axles and allowing freedom of said bearings for lateral movement relative to the frame, and energy-absorbing means, responsive to said lateral movement connected between said bearings and frame by a mechanical linkage.

8. A railway truck including a frame, at least two axles and pairs of wheels conventionally loaded and mounted in the frame, at least one other axle and pair of wheels loaded by the frame and connected thereto with longitudinal restraints providing for lateral movement of said other axle relative to the frame, and energy-absorbing means resistive to said lateral movement mechanically connected between the frame and said other axle.

9. A railway truck including a frame, at least two axles and pairs of wheels conventionally spring-loaded in said frame, at least one other axle and pair of wheels, connected to and loaded by the frame, restrained longitudinally with latitude for lateral movement relative to the frame, and frictional means connected between the frame and said other axle and arranged to resist said lateral movement.

10. A railway truck including a frame, at least two axles and pairs of wheels conventionally loaded by the frame, at least one other axle and pair of wheels, connected to and loaded by the frame, restrained longitudinally with latitude for lateral movement relative to the frame, and energy-absorbing means responsive to said lateral relative movement whereby lateral movement of the frame relative to said other axle produces displacements in said energy-absorbing means, thereby opposing said lateral movement for the suppression thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

496,145	Williams	Apr. 25, 1893
1,656,902	Buchli	Jan. 24, 1928
2,604,857	MacVeigh	July 29, 1952
2,705,926	Burdick	Apr. 12, 1955
2,728,304	Applegate	Dec. 27, 1955
2,756,690	Miller et al.	July 31, 1956