Nov. 15, 1955 W. T. ROSSELL 2,723,628

BOLSTER ASSEMBLY

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FIG. 2

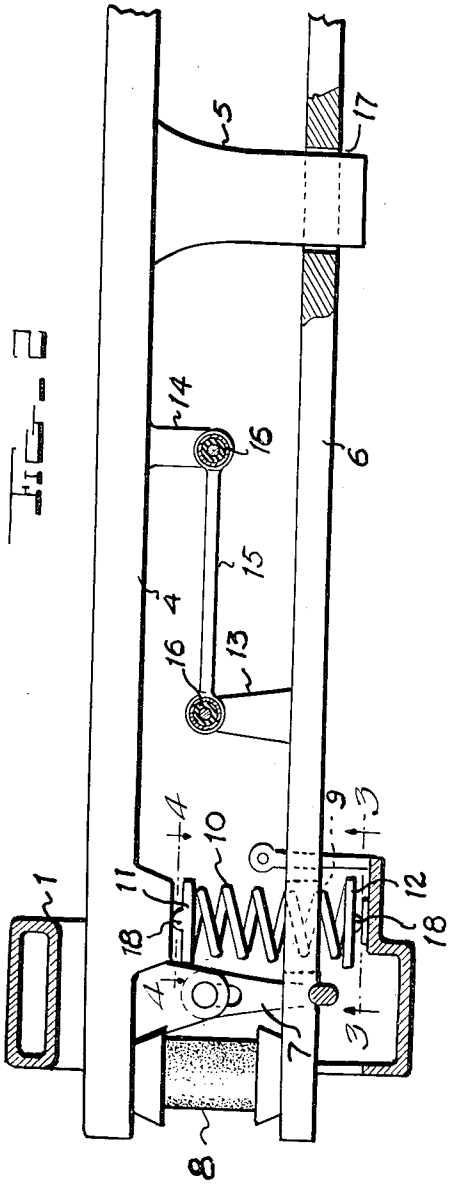



FIG. 1

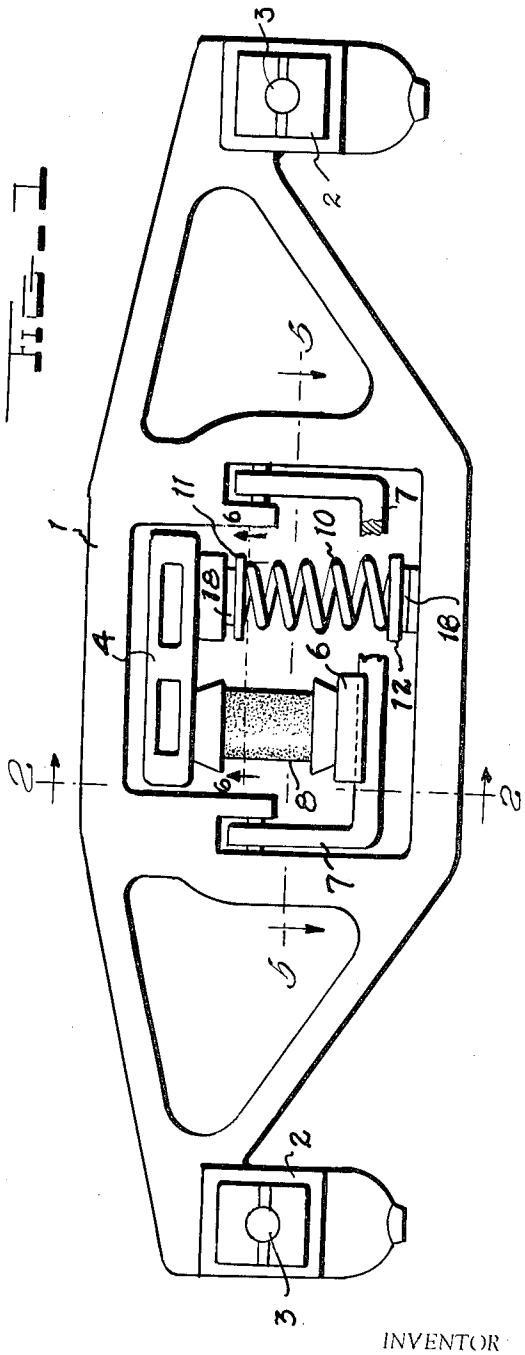
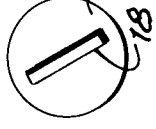



FIG. 3

FIG. 4

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BOLSTER ASSEMBLY

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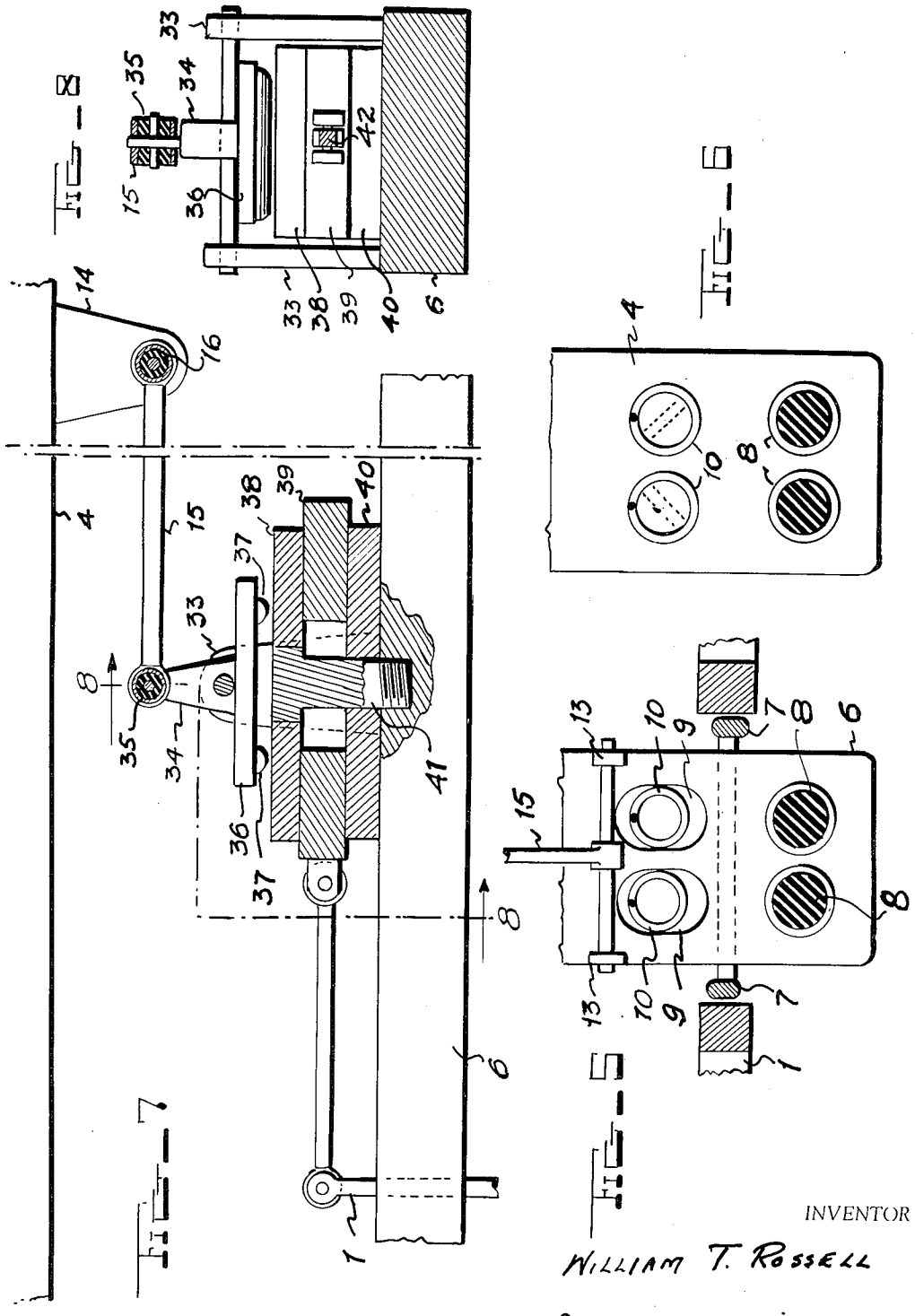


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FIG. 9

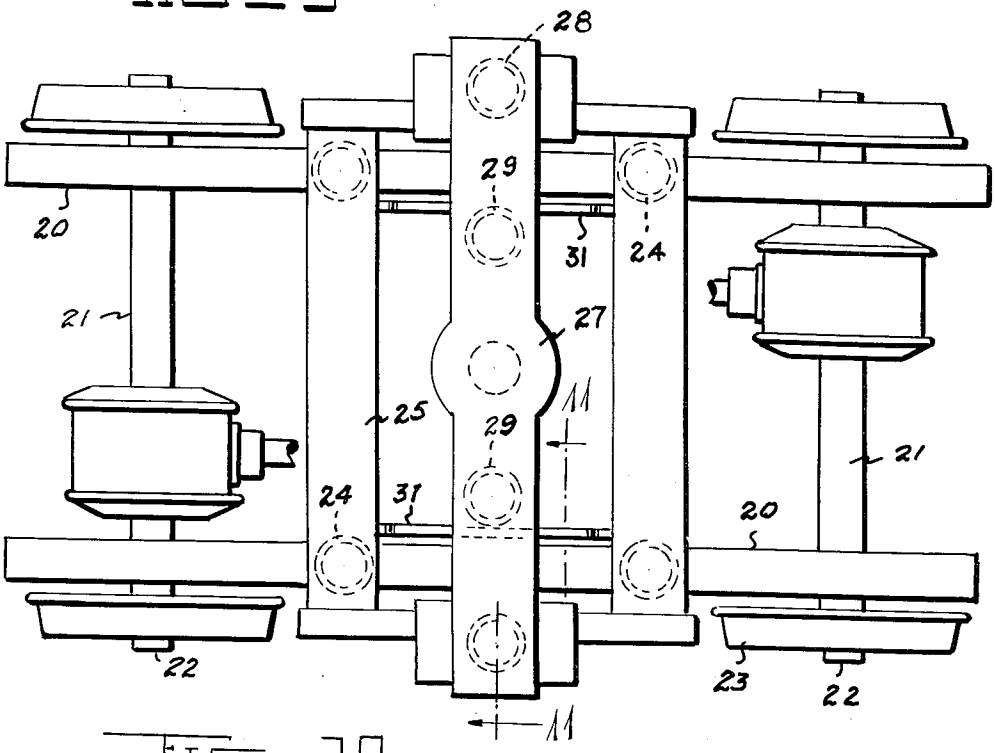
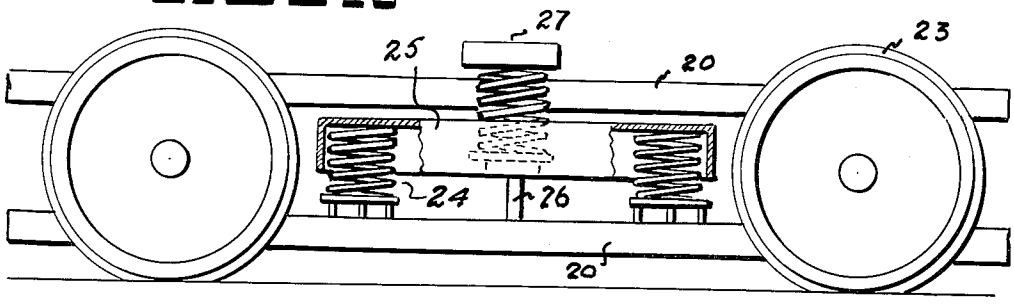



FIG. 10



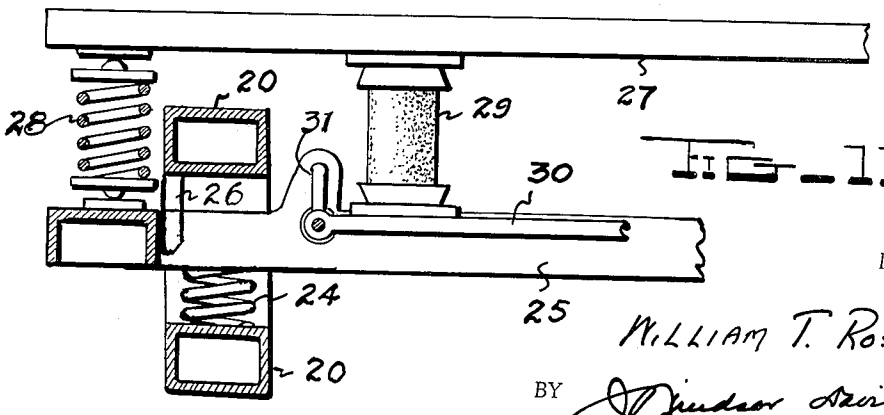




FIG. 11

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2,723,628

# BOLSTER ASSEMBLY

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Application February 4, 1952, Serial No. 269,699

9 Claims. (Cl. 105—190)

This invention relates to rail trucks and has for its object to provide a bolster supporting system which will substantially improve the riding quality thereof and more particularly to provide a bolster which will have natural frequencies of oscillation both laterally and vertically which are constant under varying body loads.

There are three general types of swing bolster supports in general use. One involves the suspension of the bolster by swing links, in which case a force applied to the bolster to cause it to swing causes one side of the supported body to be lifted against gravity. The vertical lift then becomes the lateral restoring force and imparts a restoring rate based on the law of the pendulum. According to this law the rate varies directly with the load, which is the principal requirement for a construction according to which the bolster will have a constant natural lateral frequency. However, even though the frequency is constant it may be of too high an order to give riding comfort, particularly at high speeds, which is always the case due to inherent limitations on the length of the swing links.

The second type of bolster support involves the use of springs, generally of the steel coil type, which support the bolster directly from the side rails of the truck frame. These springs must be selected first for their ability to deflect in response to vertical loads in such manner as to give a constant frequency of vertical oscillations. Upon being subjected to lateral forces their lateral distortion results in a restoring force dependent upon their lateral spring rate modified by an equation representing the overturning movement due to vertical loading during lateral displacement, which movement occurs in a direction opposite to that of the restoring force. The lateral spring rate is constant for all loads, while the overturning moment increases with increasing loads. The net rate of the two moments thus decreases with increasing load with the result that a car body thus supported may ride well when heavily loaded but will ride very noticeably poorer under light loading. If such a car is operated at high speed the differences in riding quality may become extremely discomforting.

The third type bolster support is the spring plank construction wherein swing links supoprt a spring plank which carries springs which, in turn, support the bolster. The effect is to soften the action of the swing links but the means for accomplishing this cause a partial loss of the highly desirable advantage inherent in their construction, which is constant natural frequency of oscillation. The reasons for this loss are seen from the foregoing explanation of the spring supported bolster. Attempts to modify the action of the springs are usually found in some means for limiting the possible deflection of the spring laterally, but this results in an abrupt action solely by the swing links at some point in the lateral movement. Resort is then had to shock absorbers and various types of snubbers, none of which can correct the improper frequencies but merely damp the amplitude of the oscillations.

The main object of this invention is to provide a bolster supporting means which will have a natural vertical and



a natural lateral frequency of oscillation which will be constant (but not necessarily the same in the two directions) and which will be of such low order that it will give riding comfort at all speeds for which a rail vehicle is expected to operate.

More specifically, it is the object of this invention to provide a spring plank supported by swing links and a plurality of springs for supporting each end of a bolster, at least one of the springs resting upon the plank and at least one of the springs resting upon the truck frame in such manner that it will modify the action of the swing links. As will be more fully explained hereinafter, the springs supported directly by the frame are equipped with spring caps having rockers outwardly thereof so that their action on the bolster is similar to that of a toggle spring and since these springs measure the vertical load on the bolster they may be so arranged as to weaken the returning restoring force of the bolster in proportion to the load thereon. By adjusting the lateral effect of these springs, by proportioning the load supported by these springs with respect to that supported by the springs carried by the spring plank, and by adjusting the length of the swing links, all of which will be hereinafter more fully explained, the net rate of the forces acting to return the bolster may be made to vary directly with the vertical load and hence provide constant natural lateral oscillations of a low order.

In order to damp the lateral oscillations of the bolster, a further object of the invention is to provide a friction snubbing device, useable or not at the wishes of a purchaser of a truck built in accord with the foregoing objects, which will set up a resistance proportional to the intensity of the lateral forces acting to displace the bolster.

Other objects and advantages will become hereinafter more fully apparent as reference is had to the accompanying drawings wherein my invention is illustrated, by way of example and in which:

Figure 1 is a side elevation of a rail truck constructed according to my invention, a part of the spring plank and swing support therefor being broken away for purposes of illustration,

Figure 2 is a transverse vertical section taken along the line 2—2 of Figure 1,

Figures 3 and 4 are detailed sections taken horizontally along the lines 3—3 and 4—4, respectively, of Figure 2 showing the construction and position of the caps of one bolster spring,

Figure 5 is a horizontal section taken along the line 5—5 of Figure 1 particularly showing one end of the spring plank,

Figure 6 is a horizontal section taken along the line 6—6 of Figure 1 particularly showing the bottom of one end of the bolster,

Figure 7 is a side elevation of a portion of the bolster and spring plank equipped with my improved snubbing means which is illustrated in vertical section,

Figure 8 is a vertical transverse section taken along the line 8—8 of Figure 7,

Figure 9 shows a different type of truck constructed according to my invention,

Figure 10 is a side elevation of the truck of Figure 9 with a portion of the intermediate frame broken away, and

Figure 11 is a transverse vertical section taken along the line 11—11 of Figure 9.

More particularly, 1 indicates the main side frame of a rail truck having journal boxes 2 at each end thereof to receive the usual axles 3. The truck is composed, essentially, of two side frames 1 connected by two axles 3, the wheels (not shown) and the bolster assembly to be hereinafter described. The novelty resides in the bolster assembly which may be adapted

to numerous types of truck frames, the general type frame 1 being simply chosen for illustrative purposes. The side frames are duplicates or counterparts of each other, so that description will be made of one frame and one end of the bolster assembly, it being understood that the other end of the bolster will be equipped with a duplicate bolster assembly.

The frame 1 has a large central opening therethrough through which the end of a bolster 4 projects. The bolster receives the weight of the car body (not shown) at its center bearing 5 located intermediate the ends of the bolster, as is conventional. Below the bolster a spring plank 6 is supported at each end by swing links 7 which are pivotally mounted in the side frame 1, suitably in the sides of the large opening through which the bolster projects. Two rubber springs 8 rest upon the spring plank 7 and accept the weight of the bolster 4.

The spring plank has two elongated openings 9 therethrough, as best shown in Figures 2 and 5, through which two additional springs 10 freely extend. These springs have spring caps 11 and 12 at the top and bottom thereof, respectively, the caps 11 accepting the weight of the bolster 4 while the caps 12 transmit the weight of the springs 10 to the main frame 1. The springs 10 thus support the weight of the bolster 4 jointly with the spring 8.

The combined vertical spring rates of the springs 8 and 10 determine the vertical springing characteristics to which the bolster 4 is subjected. I recommend that some of these springs be of the coil spring type and the others be made of rubber, or that all be made of rubber enclosed by coil springs, since by this combination it is possible to obtain substantially consequent natural frequencies of vertical oscillations under variable loads, which is the essential and controlling consideration in choosing the type, materials and sizes to be used.

The lateral motions and control of the bolster will now be described. In order that the bolster 4 and the spring plank will move laterally together, I provide a bracket 13 which is fixedly secured to the spring plank and a bracket 14 which is fixedly secured to the bolster. A link or pitman 15 is pivotally connected at each end to one of said brackets, preferably through a mass of rubber 16. If the bolster 4 moves laterally it will thus force an exact corresponding movement of the spring plank or a lagging, following movement of the spring plank dependent upon the size and softness of the rubbers 16. In addition to or in place of the pitman 15 and its brackets, I provide an opening 17 through the plank 6 through which the center bearing 5 depends. The clearance therebetween may be made to any extent desired but it is recommended that it be very small or non-existent so that the bolster and swing plank will move almost or entirely in unison. Many designers prefer that the bolster be permitted to move through one-fourth to one-third of its possible swinging movement before causing the spring plank to follow it, but with the controls herein provided the advantage gained by this lost motion largely, if not entirely, disappears.

Each spring cap 11 and 12 has a rocker 18 outwardly thereof. These rockers 18 may be positioned parallel to the directions of truck travel in which case the springs 10 will offer no resistance to outward swinging movements but will, by a toggle action, encourage such movements and oppose return movements. In this case the lateral spring rate becomes zero; or they may be positioned parallel to the direction of the swinging movements of the bolster in which case the springs 10 will offer full resistance to the swinging movements so that their lateral rate will become maximum; or the rockers 18 may be rotated to any position between the two extreme positions just described. If the rockers at the ends of the same spring are rotated through equal angles in opposite directions there will be no tendency for



that spring to tilt angularly with respect to the direction of bolster swing.

With the structure described, when the bolster 4 supports a car body and the body and the frames 1 are subjected to relative lateral movements, the bolster will swing with respect to the frames 1. This swinging causes the swing plank to move with the bolster. The resistance offered to the swinging movement and the restoring forces set up thereby will then depend upon the distribution of weight on the springs 8 with respect to the springs 10, the positions of the rockers 18 and the length of the swing links 7. In order to operate in optimum fashion these organs should be so proportioned as to give the net result of constant natural lateral frequency regardless of variations in loading on the bolster. Just what these proportions should be depends upon the weight of the body, the proportion of the passenger load to body load, the amount of vertical deflection of the springs under running conditions, which is dependent in large measure on the intended speed and upon the general type of truck design to which this bolster suspension is applied. If they are properly proportioned constant natural lateral frequency can be obtained, using springs 8 and 10 which give constant natural frequency of oscillations vertically.

The invention as thus described has been made in connection with a type of truck employing the bolster springs as the sole springing system of the truck. Figures 9, 10 and 11 illustrate the invention as applied to a truck having an intermediate frame. In this case the main frame consists of dual side frames 20 which connect the two axle housings 21. Axles 22 are journalled in axle housings and are supported by wheels 23. The lower ones of the dual side frames 20 support spaced springs 24 on each side of the truck and an intermediate frame 25 is supported by the springs 24. The frame 25 is prevented from moving laterally with respect to the side frames by the stops 26. It supports the bolster assembly.

As best seen in Figure 11, each end of the bolster 27 is supported jointly by the spring 28 which is supported, in turn, by the intermediate frame 25, and the spring 29 which is supported by a spring plank 30. The spring plank is pivotally mounted on swing links or swing hangers 31 pivotally supported by the frame 25.

The operation in this case is exactly the same as has been previously described, it being here remembered that the springs 24, 28 and 29 jointly participate in the vertical springing and that they should be selected and designed to give a joint or net rate vertically, which varies directly with the vertical load so that the bolster will have a constant natural frequency for vertical oscillations, and secondly, it is to be noted that the springs 24 do not deflect laterally.

The bolster 27 and the spring plank 30 may be caused to move substantially in unison by constructions such as the pitman 15 and its brackets 13 and 14, or by a construction similar to the center bearing 5 acting against the wall of an opening 17 in the spring plank 6, as illustrated in Fig. 2. Or, they may be required to operate substantially in unison by a lateral snubbing device as will now be described in connection with the showings of Figures 1 and 2.

Figures 7 and 8 show the bolster 4 which is equipped with the bracket 14, a rubber bushing 16 and the pitman 15. The spring plank is equipped with brackets 33 which pivotally support a rocking lever 34. The outer end of this lever has a rubber bushing 35 which is received in the end of the pitman 15. This outer end is integral with a plate 36 having two protrusions 37 on the bottom thereof which are very slightly spaced from a friction element 38 when the bolster 4 is in centered position.

The element 38 rests freely vertically on a second friction element 39 which, in turn, rests on a third friction

element 40. The elements 38 and 40 are restrained against lateral movements by a post 41 which is fixed in the swing plank 6. A link 42 is pivotally conneced at one end to the element 39 and at its other end to the main frame.

The operation is as follows: as the bolster 4 swings, it pushes or pulls the pitman 15, depending on the direction of swing, which causes tilting of the rocking lever 34 so that a protrusion 37 is pressed into contact with the element 38 with a force proportionate to the force applied to the bolster 4. The elements 38, 39 and 40 are thus subjected to a pressure which resists lateral movement of the plate 39. Since the plate 39 moves in accordance with relative movement between the frame 1 and the swing plank 6, the friction which opposes this relative movement depends upon the force exerted on the pitman 15 by the relative forces existing between swing plank and the bolster.

What I claim is:

1. In a rail truck, a truck frame, a spring plank supported by swing links from said frame, a swing bolster and a plurality of springs supporting each end of said bolster, at least one of said springs at each end of said bolster resting on said spring plank, said spring plank having a slot therethrough near each end thereof, at least one other of said springs at each end thereof extending freely through each of said slots and resting on said frame, and a link between said bolster and said plank resiliently connected thereto at its ends compelling said bolster and said plank to swing substantially in unison.

2. In a rail truck, a truck frame, a spring plank supported by swing links from said frame, a swing bolster and a plurality of springs supporting each end of said bolster, at least one of said springs at each end of said bolster resting on said spring plank, said spring plank having a slot therethrough near each end thereof, at least one other of said springs at each end thereof extending freely through each of said slots and resting on said frame, the springs which rest on said frame being rockably mounted with respect to said frame whereby they tilt axially in response to swinging movements of said bolster, the last named springs when tilted encouraging outward swinging movement of said bolster and opposing return swinging movements thereof.

3. In a rail truck, a truck frame, a spring plank supported by swing links from said frame, a swing bolster and a plurality of springs supporting each end of said bolster, at least one of said springs at each end of said bolster resting on said spring plank, said spring plank having a slot therethrough near each end thereof, at least one other of said springs at each end thereof extending freely through each of said slots and resting on said frame, the springs which rest on said frame being rockably mounted with respect to said bolster whereby they tilt axially in response to swinging movement of said bolster, all of said springs resisting relative vertical movements of said bolster with respect to said frame, and means restraining relative lateral movements of said bolster with respect to said plank whereby lateral movements of said bolster with respect to said frame are modified by the springs which project through said plank.

4. In a rail truck, a truck frame, a spring plank supported by swing links from said frame, a swing bolster and a plurality of springs supporting each end of said bolster, at least one of said springs at each end of said bolster resting on said spring plank, said spring plank having a slot therethrough near each end thereof, at least one other of said springs at each end thereof extending freely through each of said slots and resting on said frame, the springs which rest on said frame being rockably mounted with respect to said bolster and said frame and being capable of tilting their axes both inwardly and outwardly with respect to the side rails of said frame in response to swinging movements of said bolster whereby they add a force to the outward swinging movements of said bolster in either direction and oppose return swinging movements thereof.



5. In a rail truck, a truck frame, a spring plank supported by swing links from said frame, a swing bolster and a plurality of springs supporting each end of said bolster, at least one of said springs at each end of said bolster supporting said bolster directly from said frame independently of said spring plank, the remainder of said springs supporting said bolster from said spring plank, and cooperating means carried by said bolster and said plank compelling said bolster and said plank to move substantially in unison throughout the major portion of the swinging movements of said bolster, said cooperating means allowing said bolster and said plank to move freely with respect to each other vertically.

6. In a rail truck, a truck frame, a spring plank supported by swing links from said frame, a swing bolster and a plurality of springs supporting each end of said bolster, at least one of said springs at each end of said bolster supporting said bolster directly from said frame independently of said spring plank, the remainder of said springs supporting said bolster from said spring plank, and linkage means compelling said bolster and spring plank to move substantially in unison laterally, said linkage means being pivotally connected to said bolster and to said spring plank whereby said bolster and said spring plank may move vertically with respect to each other.

7. In a rail truck, a truck frame, a spring plank supported by swing links from said frame, a swing bolster and a plurality of springs supporting each end of said bolster, at least one of said springs at each end of said bolster supporting said bolster directly from said frame independently of said spring plank, the remainder of said springs supporting said bolster from said spring plank, and linkage means compelling said bolster and spring plank to move substantially in unison laterally, said linkage means being pivotally connected to said bolster and to said spring plank whereby said bolster and said spring plank may move vertically with respect to each other, the springs which are supported by said frame being rockably mounted with respect to said bolster and said frame whereby they have a toggle action encouraging outward swinging movements of said bolster in either direction from center and opposing return movements thereof.

8. In a rail truck, a truck frame, a bolster, a spring plank, swing links pivotally supporting said plank from said frame for lateral swinging movements, and at least two springs jointly supporting each end of said bolster, one of said two springs being supported directly by said frame, the other of said two springs being supported by said plank, the first mentioned spring having a spring cap for at least one end thereof, a rocker on said spring cap outwardly of said spring rotatable to a position angularly disposed to the direction of swing of the bolster and with respect to the direction of travel of the truck whereby its resistance to lateral swinging of the bolster is weakened as the position of the rocker approaches parallelism with the direction of travel of the truck, said first spring carrying a substantial majority of the weight of the bolster under light vertical load conditions, said two springs and said swing links jointly having a restoring rate in response to lateral swinging of said bolster which varies directly with varying vertical loading on said bolster.

9. In a rail truck, a truck frame, a spring plank supported by swing links from said frame, a swing bolster, springs supporting said bolster at least partially from said spring plank and means connecting said bolster and spring plank controlling relative lateral movements thereof, said means comprising a stack of friction elements carried by said spring plank, a rocking lever pivotally mounted on said spring plank to rock one end against one of said elements and a linkage pivotally connected to said bolster and to the other end of said lever, said linkage acting to rock the first named end of said lever into contact with

its adjacent element in response to relative vertical movements of said spring plank and said bolster thereby imposing pressure between said elements in proportion to the extent of such lateral movements, said linkage compelling said bolster and spring plank to move laterally substantially in unison after rocking of said lever has been completed.


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