Sept. 1, 1953 R. C. PIERCE 2,650,550

SNUBBED BOLSTER TRUCK

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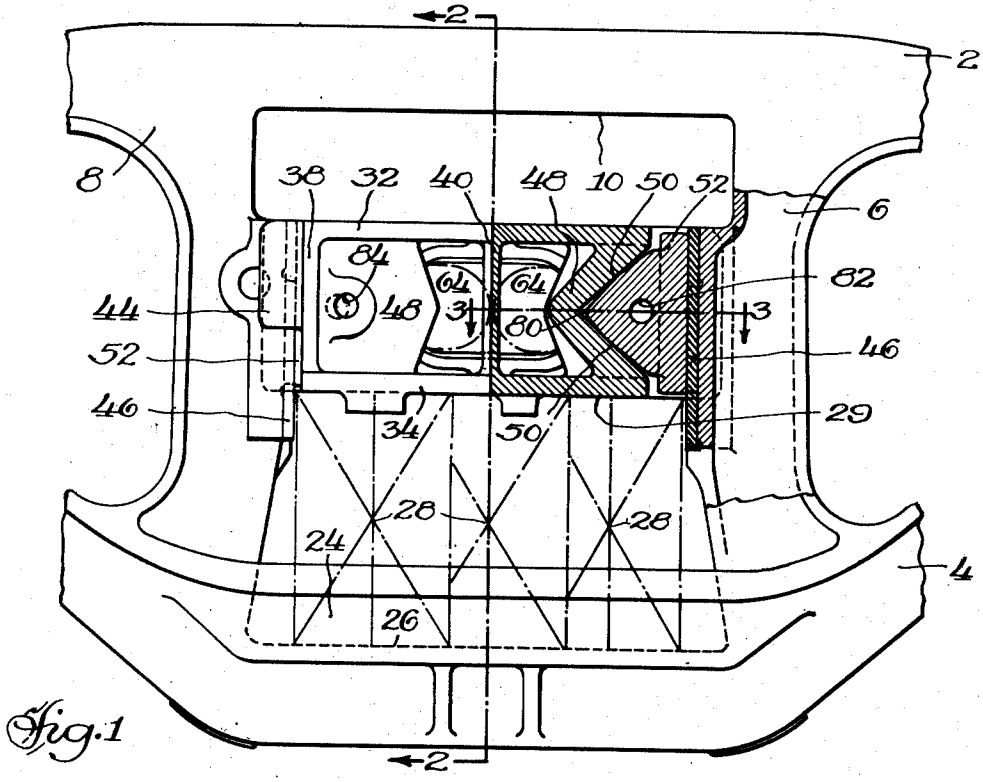


Fig. 1

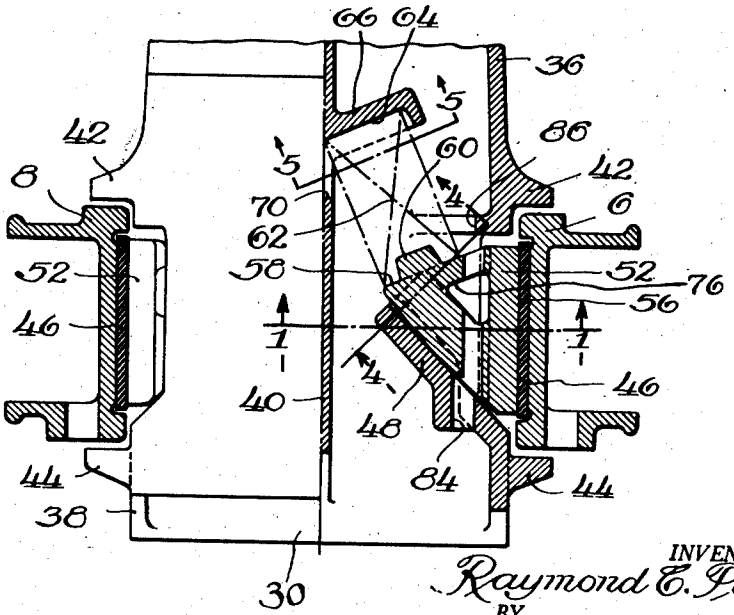


Fig. 3

INVENTOR.
Raymond C. Pierce,
BY
Orrin O. Garner
Atty.

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Fig. 2

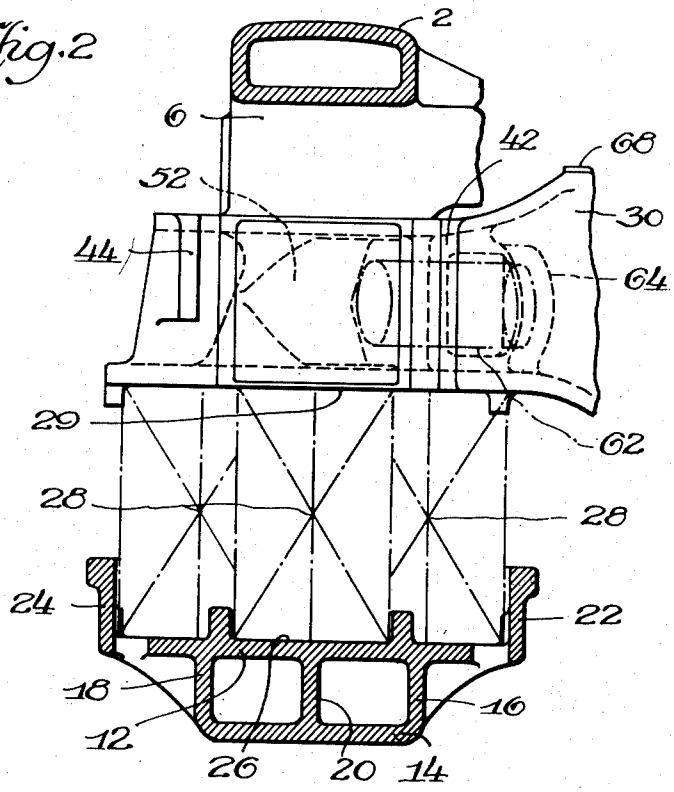
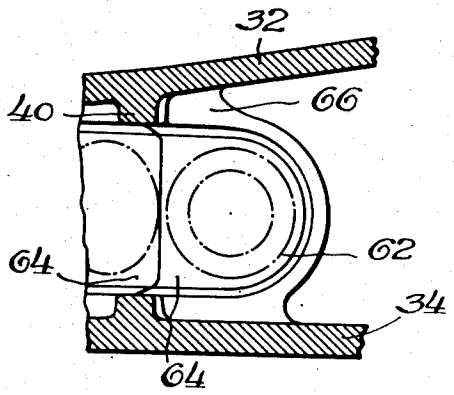


Fig. 5



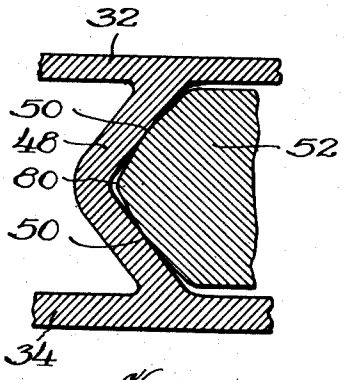


Fig. 4

INVENTOR.
Raymond C. Pierce
BY
Orin O. Garner
Atty.

Sept. 1, 1953 R. C. PIERCE 2,650,550

SNUBBED BOLSTER TRUCK

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Fig. 9

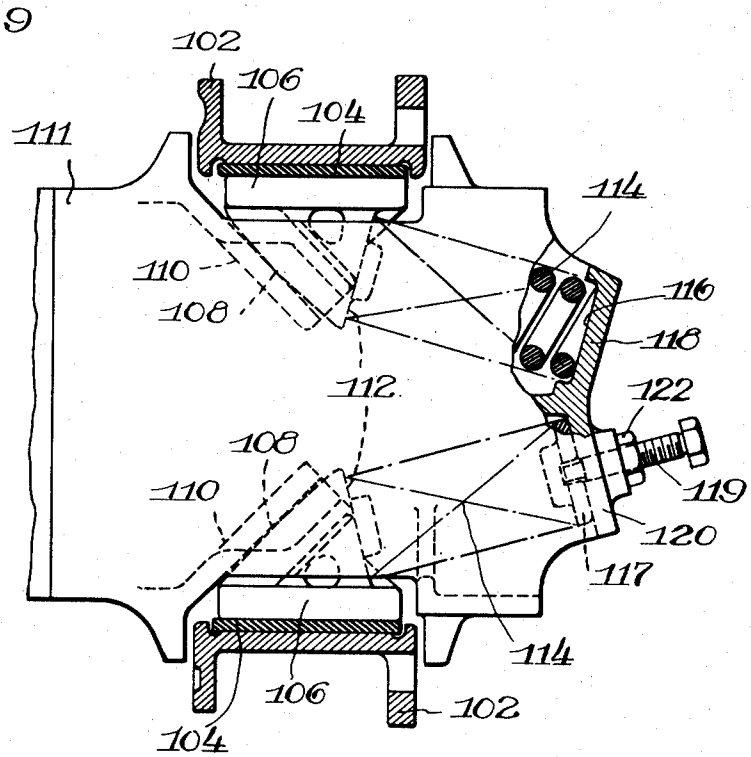


Fig. 8

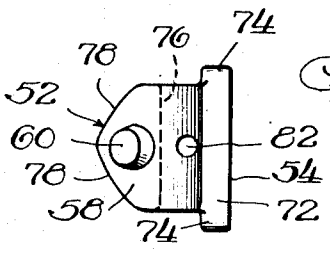
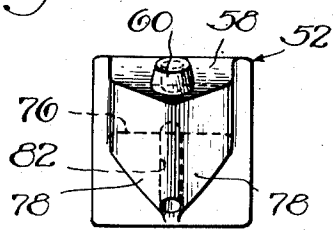


Fig. 6



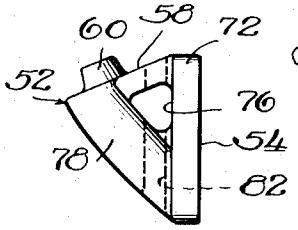


Fig. 7

INVENTOR.
Raymond C. Pierce
BY
Orin O. Turner Atty.

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SNUBBED BOLSTER TRUCK

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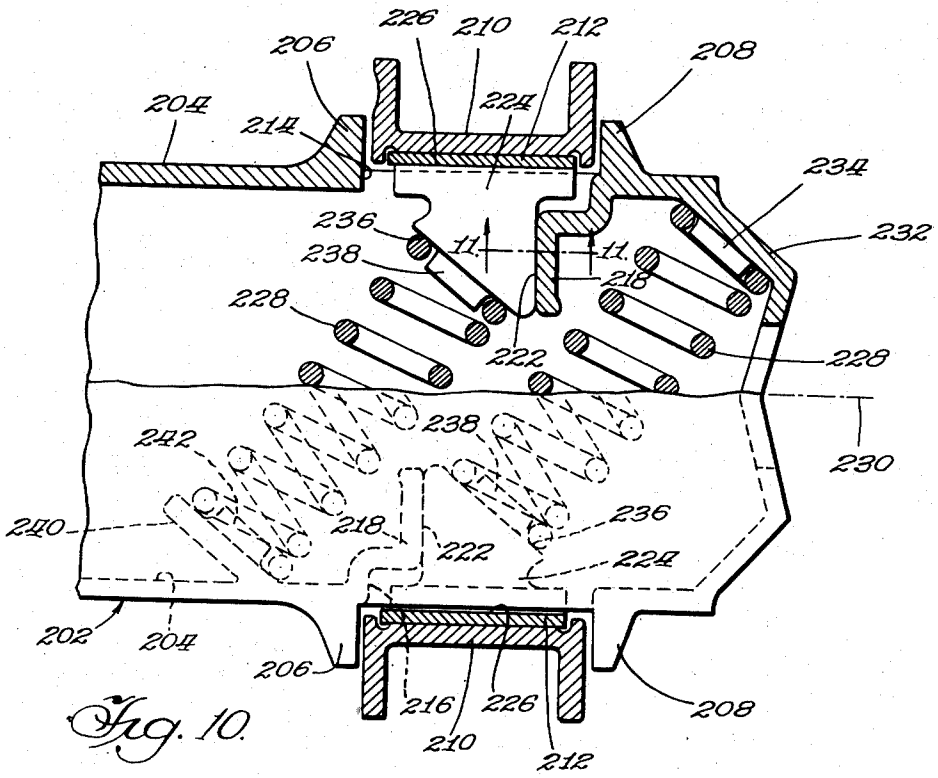


Fig. 10.

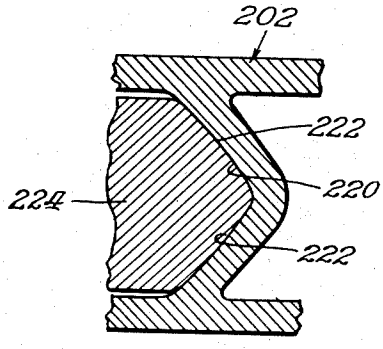


Fig. 11.

INVENTOR.
Raymond E. Pierce
BY
Wm. O. Garner
Atty.

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2,650,550

UNITED STATES PATENT OFFICE

2,650,550

SNUBBED BOLSTER TRUCK

Raymond C. Pierce, Chicago, Ill., assignor to American Steel Foundries, Chicago, Ill., a corporation of New Jersey

Application July 8, 1948, Serial No. 37,540

22 Claims. (Cl. 105—197)

1

My invention relates to a railway car truck and more particularly to such a truck of quick wheel change type wherein the bolster structure is of composite form incorporating snubbing means for engagement with the side frame columns.

The instant application is a continuation-in-part of my co-pending application, Serial No. 565,638, filed November 29, 1944, in the United States Patent Office, now abandoned.

One of the objects of my invention is to devise such a truck in which the friction means mounted in the ends of the bolster are so constructed and arranged as to result in equal development of friction on strokes in both directions, that is, both up and down, and therefore to afford equivalent snubbing effects in both directions.

My invention also contemplates such an arrangement as that described wherein the friction means are so housed in the bolster as to accommodate a horizontal arrangement of the resilient means which actuates the friction shoes, said horizontal arrangement permitting a size of spring which may be varied within wide limits to accommodate a variety of conditions.

Another object of my invention is to so arrange the snubbing means within the bolster that vertical movement between the friction shoes and the bolster is substantially eliminated. When the shoe is thus fixed in its position within the bolster against relative vertical movement therein, the shoe is not subjected to such great stresses nor, indeed, is the bolster, as commonly results. In my novel arrangement, movement of the shoes with respect to the bolster is permitted only in the horizontal direction as long as the resilient means associated with each shoe is properly functioning.

A more definite object of my invention is to devise a quick wheel change truck wherein the composite bolster structure incorporates friction means for engagement with the adjacent side frame columns an in which certain friction means consists of shoes pocketed at each side of the bolster and arranged to slide along horizontal V-shaped surfaces on said bolster under the force applied thereto by resilient means under compression between each shoe and a portion of said bolster. In my novel arrangement the resilient means are diagonally positioned within the bolster for purposes more clearly set forth hereafter.

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Another definite object of my invention is to provide a composite bolster end structure wherein friction shoes are housed for engagement with adjacent side frame columns in such manner that a resilient means associated with each friction shoe may be so positioned within the bolster as to afford a satisfactory component of spring pressure to urge the shoes outwardly against the columns and at the same time maintain the shoes against vertical movement with respect to the bolster.

In the drawings,

Figure 1 is a fragmentary side elevation of a railway car truck embodying my invention, half in section, the section being taken approximately in the longitudinal vertical plane bisecting the side frame as indicated by the line 1—1 of Figure 3.

Figure 2 is a fragmentary sectional view through the truck structure shown in Figure 1, approximately in the vertical plane bisecting the truck transversely, as indicated by the line 2—2 of Figure 1, with the end of the bolster shown in side elevation.

Figure 3 is a fragmentary sectional view through the truck structure shown in Figures 1 and 2, the section being taken approximately in the transverse horizontal plane indicated by the line 3—3 of Figure 1 with the left half of the bolster end being shown in top plan.

Figure 4 is a further fragmentary sectional view taken through the composite bolster structure approximately in the diagonal vertical plane indicated by the line 4—4 of Figure 3.

Figure 5 is another fragmentary vertical section through the bolster structure approximately in the diagonal plane indicated by the line 5—5 of Figure 3.

Figures 6, 7, and 8 illustrate in detail my novel form of friction shoe, Figure 6 being a view in elevation taken from the right as seen in Figure 7, Figure 7 being a top plan view thereof, and Figure 8 an end view looking down from the top of Figure 7.

Figure 9 is a fragmentary sectional view of a car truck embodying a modified form of my invention, the section being taken in a plane comparable to that in the view of Figure 3 except

that only a fragmentary portion of the bolster end is shown in section.

Figures 10 and 11 illustrate a further modification of the invention, Figure 10 being a top plan view with the side frame broken away at the columns and one-half of the bolster broken away, and Figure 11 being a sectional view on the line 11—11 of Figure 10.

Describing my novel structure in detail, the side frame is of well known cast steel truss type including the compression member 2 and the tension member 4 with intervening spaced columns 6 and 8 defining with said members the central bolster opening 10 widened somewhat at the top portion thereof in well known manner in order to accommodate the quick wheel change feature. The tension member 4 beneath the bolster opening is of box section with the top chord 12, the bottom chord 14, inboard and outboard vertical walls 16 and 18, and the center rib 20, said top chord 12 being widened and formed with upstanding inboard and outboard flanges 22 and 24 defining the spring seat 26 on which there may be positioned a plurality of coil springs diagrammatically indicated at 28, 28. On said springs may be positioned as at 29 the end of the bolster, generally designated 30, said bolster having a box-shaped end portion with the top wall 32, the bottom wall 34, side walls 36 and 38, and a vertical central rib 40. Integrally formed along the side walls in the usual manner may be the inboard and outboard vertical guide lugs 42 and 44, said outboard lugs having a restricted depth, as well seen in the side elevation view of Figure 1, to accommodate removal of the side frame from the bolster when elevated into the uppermost position of the bolster opening. Each side frame column may have a central guide portion supporting a wear plate 46 which may be secured thereto in any convenient manner.

My novel composite bolster structure contemplates an end portion including a diagonally arranged web 48 V-shaped in vertical section, as well seen in Figure 4, and affording a slidable seat along its respective faces as at 50, 50 for the friction shoe 52 which may present an outer vertical frictional face 54 for engagement as at 56 with the before-mentioned wear plate 46 at the adjacent column. The friction shoe 52 is a structure of triangular form in plan as seen in Figure 7 and the third face thereof affords a spring seat 58 with centrally arranged spring positioning means 60, and against said seat may be positioned one end of a coil spring diagrammatically indicated at 62 (Figure 3), the opposite end thereof being afforded a rigid seat at 64 on the diagonally arranged vertical web 66 integrally formed with the bolster approximately under one end of the side bearing 68 (Figure 2). A good view of the spring seat web 66 is afforded in Figure 5 where it may be seen that said web is contoured to conveniently accommodate seating the adjacent spring while the upper and lower extremities of said web are merged respectively with the top and bottom bolster walls 32 and 34. Adjacent the inner edge of the web 66 the center rib 40 is cored away to form an opening 70 therein to avoid interference with the springs 62, 62 at opposite sides thereof.

The details of my novel friction shoe are shown in Figures 6, 7, and 8. The main friction face 54 covers the entire surface of the rectangular vertical wall 72, said wall extending somewhat above and below the central body portion of said shoe, as well seen at 74, 74 (Figure 8).

Said central body portion, generally triangular in plan, may have an opening 76 cored vertically therethrough and may present at one side therethrough and may present at one side thereof a wedge formed with arcuate top and bottom faces 78, 78 which may seat at 50, 50 against the adjacent flat faces formed on the respective top and bottom portions of the V-shaped bolster web 48 (Figures 1 and 4). The shoe wedge member is afforded clearance from the web 48 at the apex thereof as seen at 80, and also clearance from the top and bottom chords or walls 32, 34 of the bolster, the arcuate faces on the shoe wedge accommodating some slight rocking movement of the bolster with respect to the side frame while permitting the full friction face 54 of the shoe to bear against the adjacent column wear plate 46. Each shoe 52 may have an opening 82 cored horizontally through the walls thereof for reception of pin means which may position said shoe in assembled relationship with the bolster when said shoe has been compressed into its receded position where clearance will be afforded from the adjacent side frame column. Each V-shaped web 48 is formed with an opening 84 (Figure 3) for accommodation of said shoe retaining pin and the inner extremity of the pin may seat as at 86 on a ledge provided on the side wall of the bolster for that purpose. When desired, aligned openings may be provided in the top and bottom walls of the bolster so positioned as to permit the shoe positioning pin to be extended therethrough and pass through the before-mentioned vertical opening 76 in each shoe. Each shoe, therefore, is arranged to accommodate a vertical securing pin or a horizontal securing pin.

It may be noted that the longitudinal or compressional axis of each spring 62 is disposed at acute angles to the related friction shoe seats 50 of the adjacent web 48 and to the longitudinal vertical center line of the bolster which bisects the center rib 40, as best seen in the right half of Figure 3. By means of this arrangement, the shoe 52 is held tightly against the web 48 to prevent chattering of the shoe under vertical bolster oscillations. The shoe is also maintained against such chattering by the converging shoe seats 50 of the web 48 which limit movement of the shoe relative to the bolster to a single non-vertical plane which is preferably horizontal as in illustrated embodiment; however, it will be understood that the spring 62 is preferably disposed in such an angular relationship with respect to the web 48 as to develop greater friction at 50 than at 56. In such an arrangement, the channel defined by the converging seats 50, 50 may be eliminated by forming these seats in a coplanar relationship and the shoes may still be held against chattering by the frictional engagement with the web 48; however, as above discussed, the converging seats 50 are preferred to afford positive anti-chattering means for the shoe.

In Figure 9 I have illustrated a modified form of my invention. In this modification the side frame columns, 102, 102 are shown in horizontal section approximately in the plane of the sectional view of Figure 3 with the wear plates 104, 104 thereon for engagement with the adjacent friction shoes 106, 106 at opposite sides of the bolster opening. Each friction shoe 106 is generally similar to that described for the previous modification with the wedge face engaging as at 108 the adjacent diagonally arranged V-section web 110

of the bolster 111 in manner similar to that of the previous modification except that the position of the shoe is reversed so that the spring seat face 112 thereof works outwardly of the bolster end instead of inwardly thereof. Against the shoe may be seated a resilient member diagrammatically indicated at 114 and the opposite end of the spring 114 may seat as at 116 against the adjacent diagonal bolster end wall 118. At the bottom of Figure 9 is illustrated a modified seating arrangement for the spring 114. This modified arrangement affords an adjustable seat 117 for the outer end of the spring 114 and said seat 117 may be afforded suitable guides on the walls of the bolster to admit of its being adjustably positioned depending upon the compression desired in the spring 114. For this purpose an adjusting screw 119 may have threaded engagement with the diagonal bolster end wall 120 and said adjusting screw 119 may be fixed in any desired position by the nut 122 which may be threaded thereon. The arrangement just described and illustrated at the lower portion of Figure 9 will permit adjustment of the spring 114 to compensate for such wear as may take place on the friction shoe, it being understood, of course, that as wear takes place on the column engaging friction face of the shoe, some sliding movement may occur along the V-shaped bolster web where the wedge fact of the shoe is seated. Some sliding movement will also occur along that web as lateral movement of the bolster takes place with respect to the side frame columns. Such lateral movement of the friction shoes with respect to the bolster, however, will not result in relative vertical movement between the shoe and the bolster and the pressure against the respective columns will be quickly equalized. Moreover, there will be no lost motion between the bolster and the friction shoe as they both move up and down in the normal oscillations occurring in service conditions.

It will be observed that in both modifications above discussed I have shown a distinctly improved form of composite bolster end structure arranged to incorporate friction means for engagement with adjacent side frame columns. My novel arrangement permits the use of adequate spring pressures for the fritcion shoes without reducing the strength of the bolster end structure which may retain the usual center rib and full strength top and bottom walls.

Moreover, it may be noted (Figure 3) that each spring seat 64 is disposed at an acute angle with respect to the web 48 and the wedge surfaces 50 as seen in horizontal cross section thereby accommodating the placing of the spring 62 in a position at an acute angle with respect to the web 48 so that a greater component of spring pressure is available to urge the shoes against the side frame columns than would otherwise be the case. As a result, less pressure is imposed on the wedging surfaces of the web 48 and the shoe although, of course, it must be sufficient to hold the shoe firmly in position with respect to the bolster and prevent relative vertical movement therebetween. As will be readily understood from a consideration of Figures 3 and 9, the reaction of the shoe actuating springs against the side frame columns is substantially in the line of force parallel to the longitudinal center line of the frame as indicated, for example, by the line I—I of Figure 3. Thus if the contacting friction surfaces between the shoes and the columns wear in service, there is no tendency to push the side frame either inboardly or outboardly, in action which would seriously impair the journal bearings (not shown) at the ends of the frame. It may be noted that the shoe actuating springs 62, of Figures 1–8 converge inwardly of the bolster, that is toward its longitudinal vertical center plane; and in the embodiment of Figure 9, the shoe actuating springs 114 also converge inwardly of the bolster, toward its longitudinal vertical center plane. However, in Figures 1–8 the shoe seats 50 are disposed outboardly of the spring seats 64 and in Figure 9 the shoe seats 108 are disposed inboardly of the spring seats 116 and 117.

Figures 10 and 11 illustrate a further modification of the invention wherein the bolster is generally designated 202 and comprises spaced side walls 204 having inboard and outboard gibs 206 and 208 respectively, for cooperation with the side frame columns 210 which are provided with wear plates 212. The side walls of the bolster are cored away to define friction shoe pockets 214 and 216. The pocket 214 is defined at its outboard end by a bolster wall 218 and the pocket 216 is defined at its inboard end by a similar bolster wall 218, each of said walls having a V-shaped channel 220, as best seen in Figure 11, defined by converging friction shoe seats 222 formed and arranged for engagement with complementary surfaces of a friction shoe 224 having a friction surface in frictional engagement as at 226 with the adjacent liner 212.

Each friction shoe 224 is actuated by a diagonal spring 228, the compressional axis of which is arranged at acute angles to the friction shoe seats 222 of the related shoe 224 and to the longitudinal vertical center line of the bolster 230, as best seen in Figure 10. The outboard spring 228 is seated against a bolster web 232 having spring positioning means 234 and seated against a spring seat 236 on the related shoe 224 in engagement with positioning means 238. The inboard spring 228 is seated against a diagonal web 240 connected to the adjacent side wall 204 and having spring positioning means 242 and the spring reacts against a spring seat 236 on the related shoe 224 and is positioned by a spring positioning lug 238 thereon.

It may be noted that the spring seats on the webs 232 and 240 are preferably approximately parallel and the compressional axes of the springs 228 are approximately parallel, both axes being arranged at acute angles to the bolster center line 230 and to the friction shoe seats 222, as best seen in Figure 10, to afford a force component against the seats 222 holding the shoes tightly thereagainst thereby preventing vertical chattering of the shoes under vertical bolster oscillations. This anti-chattering feature is preferably facilitated by forming the shoe seats 222 in coverging relationship, as seen in Figure 11, thereby forming a channel 220 limiting relative movement between the shoe and bolster to a single non-vertical plane. However, as will be readily understood by a consideration of Figure 11, the seats 222 may be formed as coplanar vertical surfaces eliminating the channel 220.

The modification of Figures 10 and 11 permits the use of a longer shoe actuating spring than the arrangements of the previously described embodiments inasmuch as the shoe actuating spring 228 crosses the longitudinal vertical center line of the bolster and thus utilizes

the maximum space available for spring housing.

It is to be understood that I do not wish to be limited by the exact embodiments of the device shown which are merely by way of illustration and not limitation as various and other forms of the device will, of course, be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

I claim:

1. A railway car truck comprising a side frame with spaced columns, a bolster spring-supported by said frame between said columns, and friction means associated with at least one column comprising top and bottom bolster wedge surfaces converging toward each other and also extending diagonally outwardly from the longitudinal vertical center plane of the bolster toward said column, a spring seat in said bolster arranged at an acute angle to said surfaces as seen in horizontal cross section, friction shoe means engaging said surfaces and a friction surface on said column, and spring means extending between and compressed against said seat and said shoe means for tightly wedging the latter between all of said surfaces, the compressional axis of said spring means being angularly related to said wedge surfaces and to the longitudinal vertical center plane of the bolster.

2. A composite bolster structure comprising a box section end portion having top and bottom chords and side walls, diagonal webs at each side of said end portion defining with a cored opening in the adjacent side wall a pocket for friction means, said friction means comprising a friction shoe in engagement with one of said webs for horizontal movement therealong, resilient means compressed along an axis thereof between said shoe and the other web, and abutting means on said one web and said shoe to prevent relative vertical movement therebetween and to maintain said shoe in a position intermediate said top and bottom chords and spaced therefrom, the axes of the resilient means associated with respective friction shoes defining an acute angle.

3. In a composite bolster assembly adapted to be spring-supported between the columns of a side frame; the combination of a bolster structure having top and bottom walls and having a pair of shoe seats converging toward the longitudinal vertical center plane of said structure, said seats being disposed respectively at opposite sides of said plane and being adapted to move in unison with said walls during vertical oscillation of said structure, said structure comprising a pair of spring seats disposed respectively at opposite sides of said plane and converging toward the same, said spring seats being adapted to move in unison with said walls and shoe seats during vertical oscillation of said structure, one pair of said seats being disposed inboardly of the other pair of said seats, each seat of one pair facing outboardly and arranged at an acute angle to the adjacent seat of the other pair, as seen in horizontal cross section, friction shoes engaging the respective shoe seats, and spring means compressed between each shoe and the related spring seat for urging the shoe along the engaged shoe seat into frictional engagement with one of said columns.

4. A composite railway car truck bolster structure comprising a bolster and independent friction means housed in opposite sides thereof, each of said friction means comprising a shoe having top and bottom converging bearing areas engaged with complementary top and bottom converging bolster surfaces, and a spring extending lengthwise of the bolster and compressed at one end against the shoe and at the other end against a spring seat in the bolster, the compressional axis of said spring being angularly related to said areas and being at one side of the longitudinal vertical center plane of the bolster.

5. A railway car truck comprising a side frame structure having spaced column portions, a bolster structure spring-supported by said frame structure between said portions, and friction means associated with at least one of said column portions, said friction means comprising upper and lower wedge surfaces converging toward each other and carried by one of said structures, a friction surface carried by the other of said structures, said wedge surfaces extending diagonally relative to said friction surface, a spring seat carried by said one structure and arranged at an acute angle to said wedge faces as seen in horizontal cross sectional view, friction shoe means engaging said wedge and friction surfaces, and spring means compressed against said seat and said shoe means for tightly wedging the latter between all of said surfaces, the compressional axis of said spring means being angularly related to said wedge surfaces.

6. A composite bolster structure comprising a box section bolster end portion housing friction means at each side thereof, each of said friction means comprising a friction shoe and associated resilient means, said shoe and resilient means bearing against each other and at their remote ends bearing against webs arranged at an acute angle with respect to each other in said bolster, said shoe being substantially horizontally slidable along the adjacent web and having a face for bearing against an adjacent side frame column, and interengaging means on said shoe and said adjacent web substantially limiting movement of said shoe to a single substantially horizontal plane.

7. A bolster structure comprising a box section end portion with a top chord, a bottom chord, and side walls, column guide lugs on each side of said end portion, a diagonal web at each side of said end portion intermediate the adjacent lugs and having a channel affording a seat for an associated friction shoe housable in said end portion, and a spaced diagonal web in said end portion affording a seat for resilient shoe actuating means, said last-mentioned diagonal web being adjacent the side bearing portion of said bolster.

8. A bolster structure comprising a box section end portion with a top chord, a bottom chord and side walls, column guide lugs on each side of said end portion, a diagonal web at each side of said end portion intermediate the adjacent lugs and having a channel affording a seat for an associated friction shoe housable in said end portion, and a web at the extremity of said bolster affording spaced seats at opposite sides of said end portion for spring means housed therein and associated with said shoes respectively.

9. A bolster structure comprising a box section end portion with a top chord, a bottom chord, side walls, and a vertical center rib, column guide lugs on each side of said end portion, a V-shaped diagonal web at each side of said end portion intermediate adjacent lugs and having a substantially horizontal channel affording a seat for an associated friction shoe housable in said end portion, and an opposed vertical diagonal web in said

end portion lying in a plane at an acute angle to said channel and affording a spring seat.

10. A railway car truck comprising a side frame structure, a bolster structure spring-supported by said frame structure, and friction means for damping vertical oscillations of said bolster structure, said friction means comprising a web carried by one of the structures, said web being substantially V-shaped as seen in vertical cross sectional view, a friction surface carried by the other structure, friction shoe means engaging said web and friction surface, and spring means compressed against said shoe means and said one structure for tightly wedging the shoe means against the web and friction surface, whereby said web is effective to restrain relative vertical movement between said friction shoe means and said one structure during vertical oscillation of the bolster structure.

11. A composite bolster structure comprising a box section end portion having top and bottom chords and side walls, diagonal webs at each side of each end portion defining with a cored opening in the adjacent side wall a pocket, a friction shoe and associated coil spring in said pocket, and means secured on a web of said bolster for adjusting the compression of said coil spring, the axes of said coil springs at opposite sides of the bolster being arranged at an acute angle to each other.

12. A railway car truck comprising a frame with spaced columns, a bolster structure spring-supported therebetween, and friction means associated with at least one column comprising a shoe seat and a spaced spring seat in the bolster structure arranged at opposite sides, respectively, of its longitudinal vertical center plane and movable in unison therewith during normal vertical oscillation thereof between said columns, shoe means engaging the column and shoe seat, and spring means compressed between the shoe means and spring seat, the compressional axis of said spring means being substantially horizontal and being diagonal with respect to said plane.

13. A railway car truck comprising a side frame structure, a bolster structure spring-supported thereby, and friction means carried by one of the structures comprising friction shoe means in engagement therewith along shoe seats of said one structure converging toward each other as seen in vertical cross sectional view, a friction surface on the other structure in converging relationship to said shoe seats as seen in top plan view, and spring means compressed between said one structure and said friction shoe means for urging the latter along said seats into frictional engagement with the friction surface, whereby said shoe seats are effective to restrain relative vertical movement between said shoe means and said one structure as the bolster structure oscillates vertically relative to the frame structure.

14. A box section bolster comprising an end portion having side walls, top and bottom walls, spaced webs arranged at an acute angle with respect to each other at each side of the bolster end for respective abutment of an associated spring and friction shoe, one of said webs providing converging upper and lower shoe seats defining a channel for guidable engagement of said shoe to permit slidable movement of said shoe along said channel in a single plane and clear of said top and bottom walls.

15. A box section bolster comprising an end portion having side walls, top and bottom walls, and a pair of spaced webs between said top and bottom walls at each side of the bolster end for respective abutment of an associated spring and friction shoe, said webs being positioned at an acute angle with respect to each other, one of said webs affording a horizontal channel for slidable engagement of said shoe.

16. A railway car truck comprising a side frame with spaced columns, a bolster spring-supported between said columns, friction shoes carried by said bolster, and actuating means for said shoes comprising a pair of spring means carried by the bolster and compressed against said shoes for urging the latter against said columns, the axes of respective spring means being approximately parallel and being diagonal with respect to the vertical longitudinal center plane of the bolster.

17. A composite bolster structure comprising a box section bolster end portion housing friction means at each side thereof, each of said friction means comprising a friction shoe and associated resilient means, said shoe and resilient means bearing against each other and at their remote ends bearing against angularly arranged webs in said bolster, said shoe being substantially horizontally slidable along the adjacent web and arranged for abutment of an adjacent side frame column, said shoe and adjacent web having interengaging means limiting movement of said shoe to a single substantially horizontal plane along said web clear of the top and bottom walls of said box section.

18. A railway car truck bolster structure comprising spaced shoe seats arranged at opposite sides thereof, one of said seats facing inboardly and the other facing outboardly, and spaced spring seats at opposite sides of said structure, one of said spring seats facing inboardly and the other facing outboardly, each spring seat facing one of said shoe seats and arranged at an acute angle thereto.

19. In a car truck, a side frame having spaced columns and a window therebetween, a hollow bolster resiliently supported in the window and having side walls and other walls dividing the bolster into compartments at opposite sides of its longitudinal vertical center plane, said bolster having noncompressible surfaces in respective compartments extending outwardly toward respective columns, friction shoes housed in said compartments with capacity for lateral movement therein, said bolster having spring seats converging toward said center plane, said shoes having spring seats approximately parallel to the related bolster spring seats and entirely disposed between planes defining the remote surfaces of said side walls, and spring means for urging the shoes against respective surfaces and respective columns comprising a pair of coil springs converging inwardly of the bolster toward said center plane, having their inner ends seated against the respective bolster spring seats, and having their outer ends seated against the respective shoe spring seats, said springs being compressed on axes nonparallel to the respective surfaces and being so arranged that certain force components of said springs hold the shoes in contact with the bolster surfaces and other force components of the springs hold the shoes in contact with the columns, said axes defining an included angle greater than 10°.

20. A car truck according to claim 19, wherein the noncompressible bolster surfaces and the bolster spring seats are integral parts of the bolster.

21. A car truck according to claim 19, wherein

one of the bolster spring seats is separable relative thereto.

22. A railway car truck comprising a side frame with a friction surface, a bolster adjacent said surface, a friction shoe engaging two surfaces of the bolster and said friction surface, both of said bolster surfaces being approximately perpendicular to the friction surface, and a spring compressed between the bolster and shoe on an axis diagonal with respect to all of said surfaces.

RAYMOND C. PIERCE.

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2,257,109	Davidson	Sept. 30, 1941
2,278,012	Maatman	Mar. 31, 1942
2,333,921	Flesch	Nov. 9, 1943
2,352,693	Davidson	July 4, 1944
2,365,198	Lehrman	Dec. 19, 1944
2,378,414	Light	June 19, 1945
2,378,415	Light	June 19, 1945
2,392,597	Lehrman	Jan. 8, 1946
2,434,838	Cottrell	Jan. 20, 1948