April 24, 1934. W. E. WINE 1,956,336

SPRING UNIT AND ASSEMBLY FOR RAILWAY CAR TRUCKS

Filed Feb. 8, 1932 4 Sheets-Sheet 1

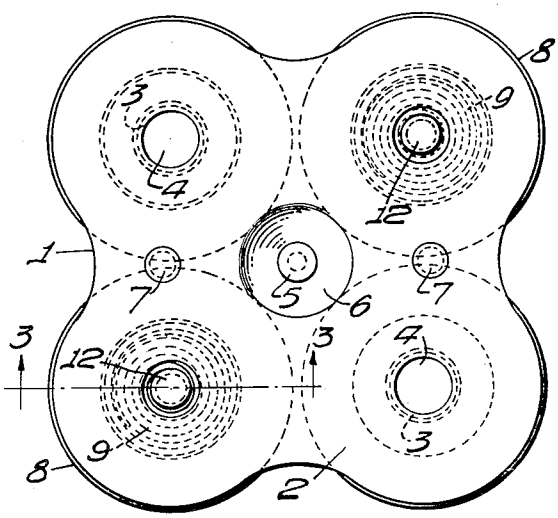


Fig. 1.

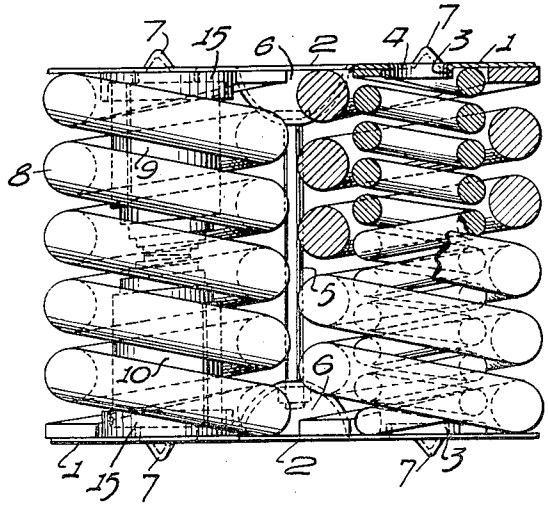


Fig. 2.

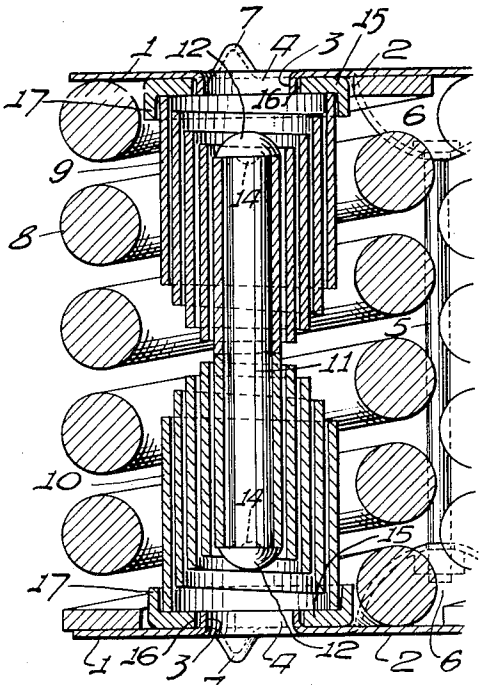


Fig. 3.

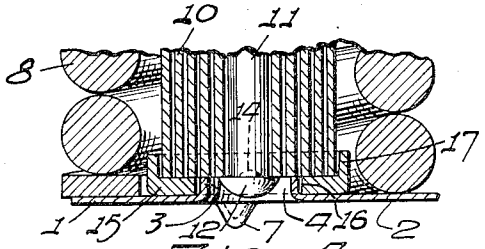


Fig. 4.

INVENTOR
William E. Wine
BY Ritter & Mechlin
ATTORNEYS

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SPRING UNIT AND ASSEMBLY FOR RAILWAY CAR TRUCKS

Filed Feb. 8, 1932 4 Sheets-Sheet 2

Fig. 5.

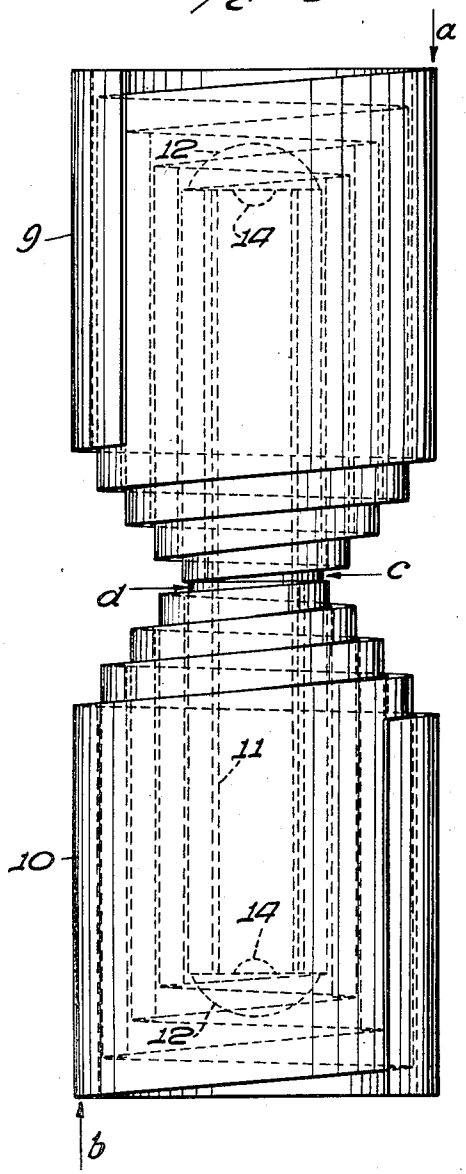


Fig. 6.

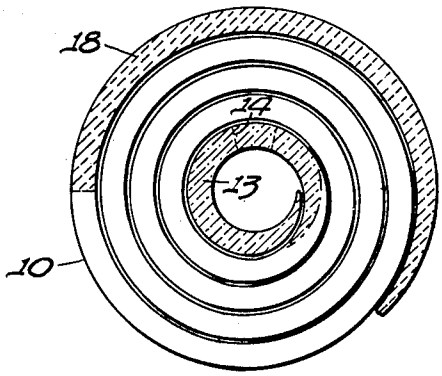
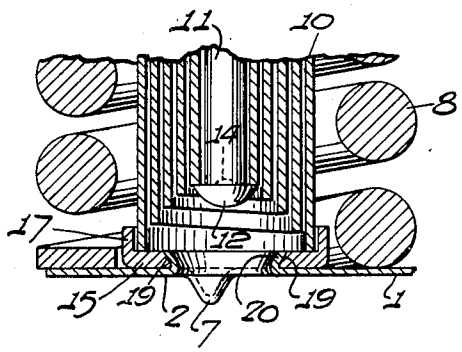


Fig. 7.



INVENTOR
William E. Wine
BY Ritter & Macklin
his ATTORNEYS

April 24, 1934. W. E. WINE 1,956,336

SPRING UNIT AND ASSEMBLY FOR RAILWAY CAR TRUCKS

Filed Feb. 8, 1932 4 Sheets-Sheet 3

Fig. 8.

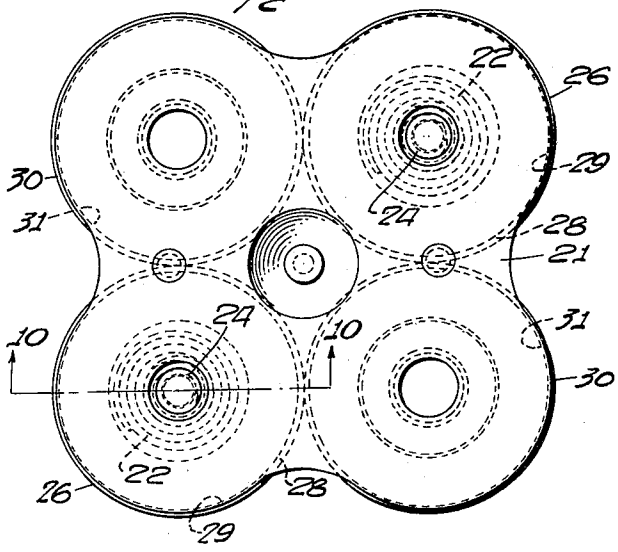


Fig. 10.

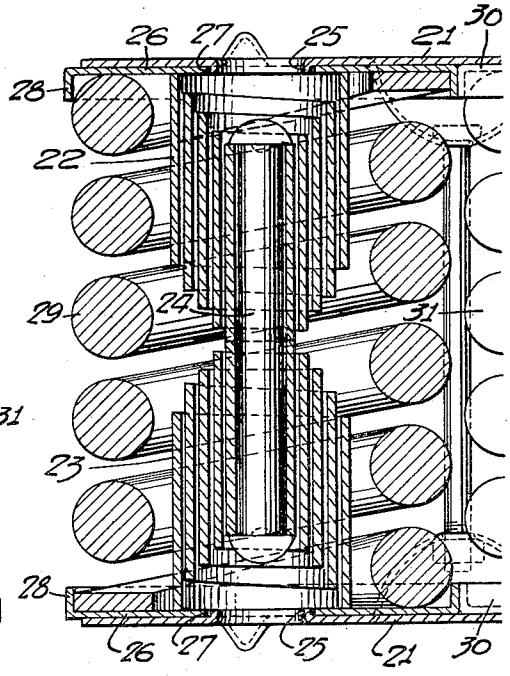
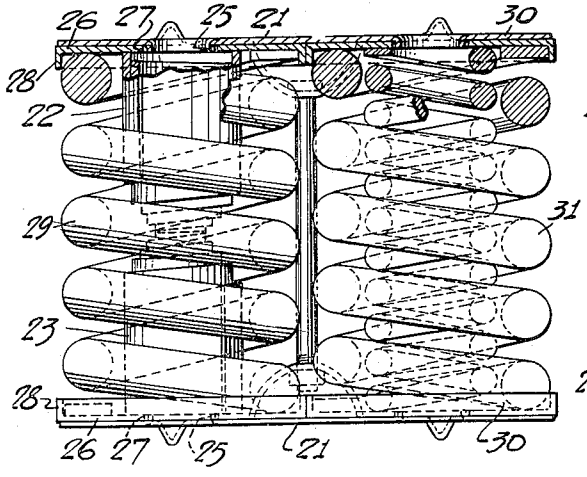


Fig. 9.



INVENTOR
William E. Wine
BY
Ritter & Macklin
ATTORNEYS

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SPRING UNIT AND ASSEMBLY FOR RAILWAY CAR TRUCKS

Filed Feb. 8, 1932 4 Sheets-Sheet 4

Fig. 11.

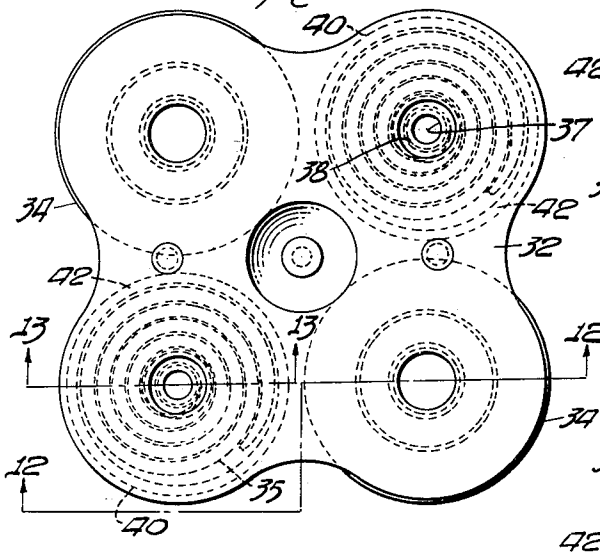


Fig. 13.

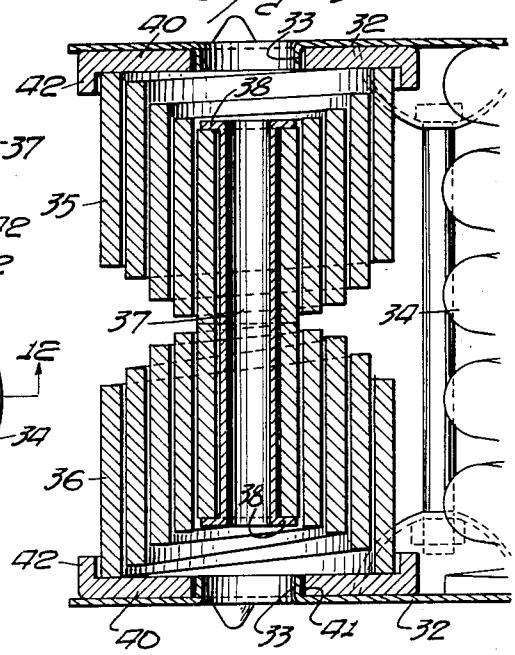


Fig. 12.

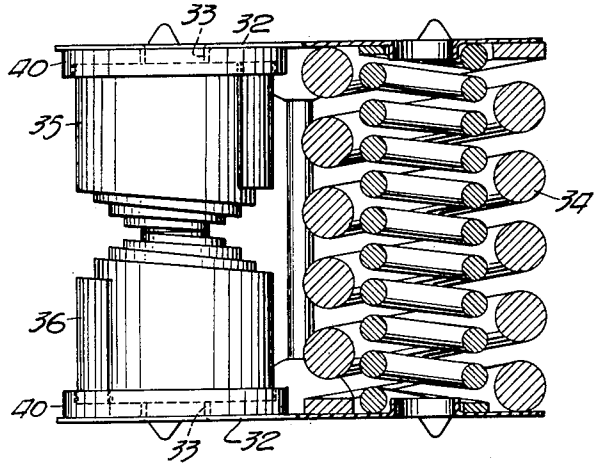


Fig. 14.

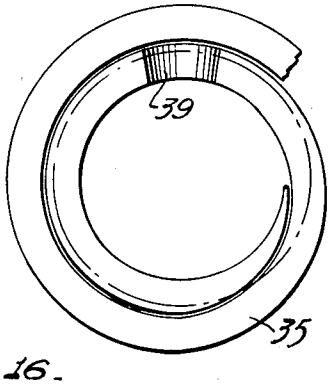


Fig. 15.

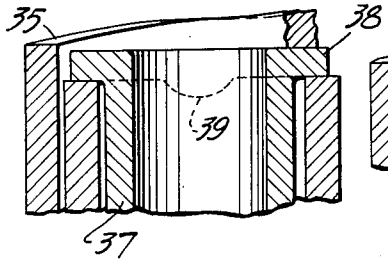
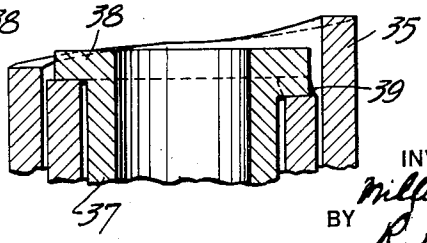


Fig. 16.



INVENTOR
William E. Wine
BY
Ritter & Mechlin
ATTORNEYS

Patented Apr. 24, 1934

1,956,336

UNITED STATES PATENT OFFICE

1,956,336

SPRING UNIT AND ASSEMBLY FOR RAILWAY CAR TRUCKS

William E. Wine, Toledo, Ohio

Application February 8, 1932, Serial No. 591,712

29 Claims. (Cl. 267—4)

My invention relates to spring units and assemblies for association with railway car truck side frames to support the truck bolsters.

In standard railroad practice it is customary to provide a spring assembly comprising a plurality of helical springs disposed within the window opening of a truck side frame for supporting the truck bolster, the number of springs employed depending upon the capacity of the car with which they are associated. The springs are usually disposed between spring caps or plates and the approved practice is to arrange some of the springs in nested relation with others so that a maximum number may be used within a minimum space.

Although helical spring assemblies have been in use for a number of years, with the increased speed at which railway cars now travel, particularly freight cars, certain inherent disadvantages have been found to exist in the use of these springs. It is known that springs of this type have a definite period of vibration which synchronize with one another and which if synchronized with the passage of the truck wheels over the rail joints will cause vertical displacement of the car body to such an extent that if continued for an appreciable length of time, as is often the case, will result in derailment of the truck wheels.

It is one of the principal objects of the invention to provide a spring assembly of American Railway Association (hereinafter called A. R. A.) standard with one or more volute spring units which, as is known, do not have a definite period of vibration.

Another object of the invention is to so design the volute spring units so that they may, if desired, be disposed in nested relation with standard A. R. A. helical springs.

Still another object of the invention is to provide means for adapting the volute spring units to spring caps or plates of standard A. R. A. design.

A further object of the invention is to provide an improved spring unit involving two volute springs.

A principal feature of the invention consists in providing a spring unit including two substantially conical volute springs each of which has a plurality of overlapping convolutions, the springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other and being rigidly connected by a member which extends axially of the innermost convolutions and is provided with portions respectively overlapping the inner ends of the latter.

Another feature of the invention consists in rigidly connecting the two conical volute springs which are arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other by a rigid member which extends axially of the innermost convolutions and has its ends upset so as to overlap the inner ends of the innermost convolutions.

Another feature of the invention consists in rigidly connecting two volute springs which are arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, the remote edges of the outermost convolutions of the springs being each provided with intersecting portions respectively extending obliquely and normal to the axes of the springs, the points of intersection of said portions of the springs being respectively disposed on opposite sides of the means connecting the springs.

Another feature of the invention consists in providing in combination with spaced spring caps of the type adapted to receive between them a plurality of nests of helical springs and which are provided with a plurality of pairs of inwardly projecting portions respectively adapted to extend within the opposite ends of the helical spring nests for centering them, a plurality of spring nests interposed between the spring caps one of which comprises a nest of helical springs and another of which involves two volute springs arranged in end to end relation, and members respectively interposed between the spring caps and the respectively adjacent ends of the volute springs for centering the latter with respect to one of the pairs of inwardly projecting portions of the spring caps, each of said members having a portion for receiving the adjacent projecting portion of the spring cap and having portions overlapping opposite sides of the outer surface of the associated volute spring.

Another feature of the invention consists in providing, in combination with spaced spring caps of the type adapted to receive between them a plurality of nests of helical springs and which are provided with a plurality of pairs of inwardly projecting portions adapted to extend within the opposite ends of the helical spring nests for centering them, a plurality of spring nests interposed between the spring caps, one of which involves a helical spring and a volute spring disposed within the latter, and members

respectively cooperating with the ends of the last-named nest of springs for centering the latter with respect to one of the pairs of projecting portions of the spring caps, each of said members having a portion for receiving the projecting portion of the spring cap adjacent thereto and having portions disposed in overlapping relation with the outer side of one of the springs of the nest.

Another feature of the invention consists in providing, in combination with spaced spring caps of the type adapted to receive between them a plurality of nests of helical springs and which are respectively provided with a plurality of pairs of inwardly projecting portions respectively adapted to extend within the opposite ends of the spring nests for centering them, a plurality of nests of springs interposed between the spring caps, at least one of said nests involving a helical spring and a volute spring disposed within the latter, and plate-like members respectively interposed between the spring caps and the respectively adjacent ends of the volute springs for centering the latter with respect to one of said pairs of projecting portions of the spring caps, each of the plate-like members having an aperture for receiving the projecting portion of the spring cap adjacent thereto and having portions overlapping the outer surface of the volute spring, the last-named portions of the plate-like members respectively extending between the volute spring and the helical spring associated therewith and serving as means for centering the latter with respect to the volute spring.

A further feature of the invention consists in providing a spring assembly for a truck side frame comprising spaced spring caps and a plurality of nests of springs interposed between the latter, one of the spring nests involving a helical spring and volute spring means disposed within the latter, the spring caps being respectively provided with projecting portions extending between the helical and volute springs for restraining lateral movement of the springs with respect to the spring caps and serving to center the helical spring with respect to the volute springs.

A still further feature of the invention consists in providing a spring cap having an inwardly projecting annular flange adapted to extend within a helical spring for centering the latter with a member for centering a volute spring, the annular flange of the spring cap being bent to secure the volute spring centering member rigidly thereto.

Other and more specific features of the invention residing in advantageous forms, combinations and relations of parts will hereinafter appear and be pointed out in the claims.

In the drawings illustrating different embodiments of the invention:

Figure 1 is a plan view of a spring assembly illustrating the preferred embodiment of the invention.

Figure 2 is a side elevational view of the assembly shown in Figure 1, parts thereof being in section.

Figure 3 is an enlarged sectional view taken on line 3—3, Figure 1.

Figure 4 is a sectional view similar to Figure 3 of the lower portion of the spring nests showing the relative position of the springs when the nest is fully compressed.

Figure 5 is an enlarged side elevational view of the volute spring unit.

Figure 6 is an end view of one of the volute springs, the end portions of the innermost and outermost convolutions of the spring, which are disposed in planes substantially normal to the longitudinal axis of the spring to afford seats therefor, being shaded.

Figure 7 is a vertical sectional view of the lower portion of a volute and helical spring nest illustrating a modified form of the invention.

Figure 8 is a plan view of a spring assembly illustrating a modified form of the invention.

Figure 9 is a side elevational view of the spring assembly illustrated in Figure 8, portions of the spring being shown in section.

Figure 10 is an enlarged sectional view taken on line 10—10, Figure 8.

Figure 11 is a plan view of a spring assembly illustrating still another modified form of the invention.

Figure 12 is a view partly in section and partly in elevation taken on line 12—12, Figure 11.

Figure 13 is a sectional view taken on line 13—13, Figure 11.

Figure 14 is an enlarged end elevational view of the innermost convolutions of one of the helical springs of the form of the invention shown in Figures 11 to 13 inclusive.

Figure 15 is an enlarged vertical sectional view illustrating the manner in which the volute spring connecting means cooperates with the inner end of the innermost convolution of one of the volute springs.

Figure 16 is a vertical sectional view similar to Figure 15 being taken at right angles thereto.

Referring more particularly to the drawings, 1 designates top and bottom spring caps of standard American Railway Association design which are, as is well known, identical in construction. The caps illustrated are of the customary shape for use in connection with a cluster of four spring nests but it will be appreciated as the specification proceeds that the invention is applicable to caps which are designed for use in connection with any number of spring nests. Each of the caps has a main body portion 2 and a plurality of inwardly extending annular flanges 3 which are adapted to extend within the adjacent end of the associated spring nest for centering it and restraining it from lateral movement with respect to the spring cap. As the caps are preferably formed of sheet metal and the annular flanges are formed by being stamped therefrom the latter define or border openings 4. As is usual, the spring assembly is held together by a bolt 5 which passes through openings formed in inwardly projecting centrally disposed depressed portions 6. Moreover, as is usual, the spring caps are formed with outwardly extending projections or bosses 7 for cooperating with adjacent portions of the side frame (not shown) to prevent lateral movement of the spring assembly with respect to the latter.

In carrying out the present invention one or more of the usual helical spring nests is replaced by a spring device which involves two substantially conical volute springs. In the preferred form of the invention, namely, that shown in Figures 1 to 6 inclusive, this spring device includes a helical spring 8 and two volute springs 9 and 10 respectively, the volute springs being disposed within the helical spring in nested relation therewith. Each of the volute springs has

a plurality of overlapping convolutions and the springs are arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other. By arranging the springs in this manner and by forming them from stock of suitable thickness and width, it has been found that they may have substantially the same travel and be of substantially the same outside diameter as the inside helical spring of a standard A. R. A. nest and yet have greater capacity than the latter. It follows, therefore, that a spring assembly which is composed entirely of nests of helical and volute springs will be of considerably greater capacity than a spring assembly composed only of nests of helical springs. The invention, however, is not limited to the number of nests of volute and helical springs employed because it has been found that if only one of the standard helical spring nests is replaced by a nest of helical and volute springs this one volute spring will function sufficiently to prevent the undesirable amplification of the vibratory period of the remaining helical spring nests. In the drawings it will be observed that two of the standard helical spring nests have been replaced by combined volute and helical spring nests and it will, therefore, be appreciated that this spring assembly will be of greater capacity than a standard A. R. A. spring assembly of the same number of spring nests.

The volute springs 9 and 10 are rigidly connected and maintained in axial alinement by a post or pin 11 which extends through the innermost convolutions thereof. In the principal form of the invention this pin is in the form of a round bar and its opposite ends are upset as at 12 to form heads which respectively overlappingly engage the inner ends of the innermost convolutions. To provide an extended bearing area between the outer ends of the innermost convolutions each is preferably disposed, as indicated at 13 by the shaded area in Figure 6, in a plane substantially normal to the longitudinal axis of the spring. Moreover, the inner ends of the outermost convolutions are also respectively disposed in planes substantially normal to the axis of the springs so as to afford substantially level areas for cooperating with the headed portions 12 of the pin 11 and so that the latter may be quickly and easily formed by a riveting tool or the like. To prevent rotation of the volute springs with respect to the connecting pin 11, the inner ends of the innermost convolutions are formed with recessed portions 14 into which portions of the pin 11 will flow when its ends are upset to form the heads 12. In this manner the pin and springs are firmly interlocked to form a volute spring unit.

Interposed between the spring caps and the respectively adjacent ends of the volute spring unit are members 15 for centering the latter with respect to the inwardly projecting annular flanges 3 of the spring caps adjacent thereto. Each of these centering members is of plate form and has a centrally disposed opening 16 for receiving the adjacent annular flange 3 and an annular marginal flange 17 which encircles or surrounds the outermost convolution of the adjacent volute spring. The annular flanges 17 of the members 15 extend between adjacent portions of the volute and helical springs and thereby serve to center the latter with respect to the volute springs and consequently with respect to the cooperating annular flanges 3 of the spring caps. By providing the members 15 with not only center the nest or volute and helical springs with respect to the annular flanges 3 but also prevent lateral movement of this nest with respect to the spring caps, it will be observed that no change or modification of the standard A. R. A. spring cap is necessary and that, therefore, should an emergency repair become necessary a standard nest of helical springs could be inserted in place of the nest of volute and helical springs.

To provide an extended bearing area between each volute spring and the associated centering member 15, the outer end of the outermost convolution of the spring is formed with a portion 18 which is substantially normal to its longitudinal axis. As may be seen from the shaded area in Figure 6, this portion 18 extends for approximately 225° of the convolution but it will be readily appreciated that it may extend for a greater or less amount depending upon the capacity and travel of the spring. The point at which the normal edge of the outermost convolution intersects with the oblique edge thereof or broadly, the point at which the oblique edge inclines away from whatever abutment is provided for the spring, is termed the "heel" and it has been found that when a volute spring is being compressed it tilts or inclines away from its heel. The heel of the upper volute spring shown in Figure 5 is indicated by the arrow *a* while the heel of the lower spring is indicated by the arrow *b* and it is to be observed that the heels are respectively disposed on opposite sides of the connecting pin 11 so that the springs will tend to tilt in opposite directions. The directions in which the upper and lower springs tend to tilt is respectively indicated by the arrows *c* and *d*. By arranging the springs in the manner described it will be appreciated that the connecting pin, instead of being subjected to bending strains as would be the case if the heels were arranged on the same side of the pin, is only subjected to shearing strains.

Upon referring to Figure 4, it is to be observed that when the volute springs are fully compressed the headed ends 12 of the pin 11 do not project beyond the spring caps 1, but are disposed within the openings defined by the annular flanges 3. If it should be desired to rigidly connect each of the members 15 to the associated spring caps, the portion of the member which borders the opening 16 thereof may be inclined or bevelled as at 19 and the cooperating annular flange 3 of the adjacent spring cap bent outwardly as shown at 20 in Figure 7. In this manner the members 15 are rigidly clamped to the spring caps but should it become necessary, for any reason, to disconnect these parts it will be appreciated that this may be accomplished by merely rebending the annular flanges 3 into upright position.

In Figures 8 to 10 inclusive of the drawings a slightly modified form of the invention is illustrated. In this form as well as in the preferred form, the spring assembly comprises standard A. R. A. spring caps between which are interposed a plurality of spring nests, two of which involve helical springs and the other two, volute and helical springs. The volute springs which are designated by the numerals 22 and 23 are of the same construction as those shown in the preferred form of the invention and are likewise connected by a pin or post 24. As pointed out above, any number of nests of helical and volute springs may be employed without departing from the scope or spirit of the invention. As the spring caps illustrated are of standard A. R. A. design, they are

formed with a plurality of pairs of inwardly projecting annular flanges 25 respectively adapted to extend within the opposite ends of the nests of helical springs with which the spring caps are designed to cooperate.

To center the nests of helical and volute springs with respect to the adjacent pair of inwardly projecting flanges 25 of the spring caps, plate-like members 26 are interposed between the spring caps and the adjacent ends of the spring nests. Each of these plate-like members is formed with a centrally disposed opening or aperture 27 for receiving the adjacent annular flange 25 of the associated spring cap and with an annular marginal flange 28 which is disposed in overlapping relation to the outer side of the helical spring 29 surrounding the volute springs 22 and 23. It will thus be perceived that as the plate-like members are restrained from sliding along the spring caps and as they are formed with annular flanges 28 encircling the associated helical springs 29, the latter are centered with respect to the flanges 25 of the spring caps and are prevented from moving laterally. Moreover, as the volute springs 22 and 23 are disposed within the helical springs 29 in nested relation therewith, they are prevented from substantial lateral movement, the amount of such movement depending upon the clearance between the outermost convolutions of the volute springs and the inner side of the surrounding helical springs. As the plate-like members 26 are interposed between the ends of the helical springs 29 surrounding the volute springs, plate-like members 30 of identical construction are also interposed between the spring caps and the respectively adjacent ends of the helical spring nests designated by the reference numeral 31. By employing plate-like members 30 for centering the helical spring nests 31, the outside helical springs of the last-named nests can be of exactly the same free height as the helical springs 29 which surround the volute springs thereby making it unnecessary for the railroad to stock springs which could be used only in combination with the volute springs.

In Figures 11 to 16 inclusive, still another modified form of the invention is illustrated. As in the other forms of the invention, the spring assembly of this form includes standard A. R. A. spring caps 32 which are provided with a plurality of pairs of inwardly projecting annular flanges 33 respectively adapted to extend within the opposite ends of the helical spring nests 34 with which the caps are designed to cooperate. In this form of the invention one or more of the usual helical spring nests is replaced by a volute spring unit. For purposes of illustration two volute spring units have been shown in place of the standard helical spring nests but it is to be understood that the invention is not limited to the number of volute spring units used in place of the helical spring nests.

Each of the volute spring units involves two volute springs 35 and 36 respectively, which are arranged in end to end relation with the outer ends of the innermost convolutions of the springs adjacent each other. The springs of each unit are connected by a hollow tubular member 37 which extends axially of the innermost convolutions of the springs. To prevent axial movements of the springs away from each other, the ends of the connecting member 37 are upset or peened over to form outwardly projecting peripheral flanges 38 which overlappingly engage the inner ends of the innermost convolutions. The inner end portions of the innermost convolutions of the volute springs may be conveniently formed with recessed portions 39 for receiving portions of the connecting member when its ends are upset so as to interlock the latter with the flanges. In this manner, rotation of the springs with respect to each other and with respect to the connecting member 37 is effectively prevented. As explained in the principal form of the invention, it is preferred that the inner and outer ends of the innermost convolutions of each volute spring be disposed in planes substantially normal to the longitudinal axis of the spring.

As it is intended that the volute spring unit illustrated in the form of the invention shown in Figures 11 to 16 inclusive shall by itself and not in conjunction with a helical spring take the place of a standard helical spring nest, the stock from which the helical springs of this form of the invention are made is considerably wider and thicker than the stock from which the volute springs shown in the preferred form of the invention are made, and it has been found that a volute spring unit of substantially the proportions shown in this form of the invention and arranged in substantially the same manner will have the same or even greater capacity than the helical spring nest which it is to replace. Plate-like members 40 of substantially the same design as the plate-like members 15 are employed for centering the volute spring units of this form of the invention. These members are interposed between the spring caps and the ends of the volute spring unit and each is formed with a centrally disposed opening or aperture 41 for receiving the adjacent flange 33 of the spring cap and with an annular marginal flange 42 which surrounds the outer side of the outermost convolution of the adjacent volute spring. As the annular flanges 42 are concentric with the pair of annular flanges 33 of the spring caps adjacent thereto and as the members 40 are prevented from sliding along the spring caps, it will be readily perceived that simple and effective means is provided for centering the volute spring units and for preventing them from moving laterally.

From the foregoing, it will be perceived that I have provided a spring assembly adapted to be associated with a railway car truck having spring means for preventing amplification of the vibratory period of helical springs usually employed in standard spring assemblies. Moreover, I have designed simple and efficient means whereby volute spring units may be used with spring caps of the type designed to cooperate with helical springs without the necessity of modifying the caps in any way.

Furthermore, it will, of course, be appreciated that although the spring unit formed of two volute springs is especially adapted for use in railway car trucks, it is not limited to such use as it has been found to be adaptable to a great variety of uses especially where maximum spring capacity is desired in a limited space.

I claim:

1. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and means rigidly connecting the innermost convolutions of said springs, said means involving a rigid member extending axially of said last-named convolutions and provided with portions respectively overlapping the inner ends thereof.

2. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof in engagement with each other, and means rigidly connecting the innermost convolutions of said springs involving a member extending therethrough and provided with portions respectively overlappingly engaging the inner ends thereof.

3. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, the major portion of the inner ends of said innermost convolutions being respectively disposed in planes substantially normal to the axes of the springs, and means rigidly connecting said springs involving a rigid member extending axially of the innermost convolutions thereof and provided with portions respectively overlapping the inner ends of the latter.

4. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and rigid means extending axially of said innermost convolutions for rigidly connecting said springs, the opposite ends of said rigid means being upset to provide portions respectively disposed in overlapping relation with the inner ends of said innermost convolutions.

5. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, each end of the innermost convolution of each spring being disposed in a plane substantially normal to the longitudinal axis of the spring, and means extending through said innermost convolutions for rigidly connecting said springs, said means being provided with portions respectively overlapping the inner ends of said innermost convolutions.

6. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and means extending axially of said innermost convolutions for rigidly connecting said springs, said means being provided with portions preventing rotation of the springs with respect thereto and being also provided with portions respectively overlapping the inner ends of said innermost convolutions for preventing said convolutions from moving axially away from each other.

7. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and means extending axially of said springs provided with portions respectively overlapping the inner ends of said innermost convolutions for rigidly connecting the latter, the innermost convolution of each spring being provided with a recessed portion for cooperating with said rigid means to prevent rotation of the spring with respect to the latter.

8. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and a rigid member extending axially of said springs integrally provided with portions respectively overlapping the inner ends of said innermost convolutions thereof for connecting the springs, the inner ends of said innermost convolutions respectively having recessed portions and said rigid member having portions respectively disposed within said recessed portions for preventing relative rotation between said member and springs.

9. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and rivet means extending axially of the innermost convolutions of said springs for rigidly connecting the latter.

10. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions adjacent each other, and means for rigidly connecting said springs involving a tubular member extending axially of the innermost convolutions of said springs.

11. A spring unit including two substantially conical volute springs, each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the innermost convolutions thereof adjacent each other, and means involving a hollow tubular member extending through said innermost convolution for rigidly connecting said springs, the end portions of said member being offset and being respectively arranged in overlapping relation to the inner ends of said innermost convolutions.

12. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and means for maintaining said springs in substantially axial alinement, the remote ends of said springs respectively having edge portions extending obliquely to the axes of the springs and edge portions disposed substantially normal to said axes, the said oblique edge portion of one spring merging with the said normal portion thereof on one side of said alining means and the oblique edge portion of the other spring merging with the normal edge portion thereof on substantially the opposite side of the said means.

13. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and means for maintaining said springs in substantially axial alinement, the remote ends of said springs respectively having edge portions extending obliquely to the axes of the springs and edge portions disposed substantially normal to said axes and merging with the respectively adjacent oblique edge portions, the points of mergence of said edge portions being spaced with respect to each other circumferentially of the springs.

14. A spring unit including two substantially

conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and means for maintaining said springs in substantially axial alinement, the remote ends of said springs respectively having portions extending obliquely to the axes of the springs and edge portions disposed substantially normal to said axes, the oblique and normal edge portions of said springs respectively intersecting on diametrically opposite sides of said alining means.

15. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the innermost convolutions thereof adjacent each other, and means extending axially of said innermost convolutions for rigidly connecting said springs, the remote edges of the outermost convolutions of the springs being each provided with intersecting portions respectively extending obliquely and normal to the axes of the springs, the points of intersection of said portions of the springs being respectively disposed on opposite sides of said connecting means.

16. A spring unit including two substantially conical volute springs each having a plurality of overlapping convolutions, said springs being arranged in end to end relation with the innermost convolutions thereof adjacent each other, and means extending axially of said springs for rigidly connecting the latter, the major portion of the remote edges of the outermost convolutions of said springs being substantially normal to the axes of the latter and said outermost convolutions terminating on opposite sides of said connecting means.

17. A spring assembly for association with a railway car truck side frame to support a truck bolster, said assembly comprising spaced spring caps adapted to receive between them a plurality of nests of helical springs and provided with a plurality of pairs of inwardly projecting portions respectively adapted to extend within the opposite ends of said spring nests for centering them, a plurality of spring units interposed between the spring caps, at least one of said units comprising a nest of helical springs and another of said units involving two volute springs respectively having a plurality of overlapping convolutions, said volute springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and members respectively interposed between said spring caps and the ends of the volute springs respectively adjacent thereto for centering said volute spring unit with respect to one of said pairs of inwardly projecting portions, each of said members having a portion for receiving the said projecting portion adjacent thereto and having portions overlapping opposite sides of the outer surface of the associated volute spring.

18. A spring assembly for association with a railway car truck side frame to support a truck bolster, said assembly comprising spaced spring caps adapted to receive between them a plurality of nests of helical springs and provided with a plurality of pairs of inwardly projecting portions respectively adapted to extend within the opposite ends of said spring nests for centering them, a plurality of spring units interposed between the spring caps, at least one of said units comprising a nest of helical springs and another of said units involving two volute springs respectively having a plurality of overlapping convolutions, said volute springs being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, and plate like members respectively interposed between said spring caps and the ends of the volute springs respectively adjacent thereto for centering said volute spring unit with respect to one of said pairs of inwardly projecting portions, each of said members having an opening for receiving the said projecting portion adjacent thereto and having an annular flange surrounding the outer side of the associated volute spring.

19. A spring assembly for association with a railway car truck side frame to support a truck bolster, said assembly comprising spaced spring caps adapted to receive between them a plurality of nests of helical springs and provided with a plurality of pairs of inwardly projecting portions respectively adapted to extend within the opposite ends of said spring nests for centering them, a plurality of nests of springs interposed between the spring caps, at least one of said nests involving a helical spring and a volute spring disposed within the latter, and members respectively interposed between the spring caps and the respectively adjacent ends of the volute spring for centering the latter with respect to one of the said pairs of projecting portions of the spring caps, each of said interposed members having a portion for receiving the said projecting portion adjacent thereto and having portions overlapping the outer surface of the volute spring, said interposed members also constituting means for centering the associated helical spring with respect to said volute spring.

20. A spring assembly for association with a railway car truck side frame to support a truck bolster, said assembly comprising spaced spring caps adapted to receive between them a plurality of nests of helical springs and provided with a plurality of pairs of inwardly projecting portions respectively adapted to extend within the opposite ends of said spring nests for centering them, a plurality of nests of springs interposed between the spring caps, at least one of said nests involving a helical spring and a volute spring disposed within the latter, and plate-like members respectively interposed between the spring caps and the respectively adjacent ends of the volute spring for centering the latter with respect to one of said pairs of projecting portions of the spring caps, each of said plate-like members having an aperture for receiving the said projecting portion adjacent thereto and having portions overlapping the outer surface of the volute spring, said last-named portions of the plate-like members respectively extending between the volute spring and the helical spring associated therewith and serving as means for centering the latter with respect to the volute spring.

21. A spring assembly for association with a railway car truck side frame to support a truck bolster, said assembly comprising spaced spring caps adapted to receive between them a plurality of nests of helical springs and provided with a plurality of pairs of inwardly projecting annular flanges adapted to extend within the opposite ends of said spring nests for centering them, a plurality of nests of springs interposed between said spring caps, at least one of said nests involving a helical spring and a volute spring disposed within the latter, and members respectively interposed between the spring caps and the ends

of the volute spring respectively adjacent thereto for centering the latter with respect to one of said pairs of annular flanges of the spring caps, each of said interposed members having a portion for receiving the adjacent annular flange and also having an annular flange overlapping the outer face of the volute spring.

22. A spring assembly for association with a railway car truck side frame to support a truck bolster, said assembly comprising spaced spring caps adapted to receive between them a plurality of nests of helical springs and provided with a plurality of pairs of inwardly projecting annular flanges respectively adapted to extend within the opposite ends of the said springs nests for centering them, a plurality of nests of springs interposed between said spring caps, at least one of said nests involving a helical spring and a volute spring disposed within the latter, and plate-like members respectively interposed between the spring caps and the respectively adjacent ends of the volute spring for centering the latter with respect to one of said pairs of annular flanges of the spring caps, each of said plate-like members having a centrally disposed opening for receiving the adjacent annular flange and having an annular flange surrounding the portion of the volute spring adjacent thereto, said annular flanges of the plate-like members being interposed between said volute and the helical spring associated therewith and serving as means for centering the latter with respect to the volute spring.

23. A spring assembly for association with a railway car truck side frame to support a truck bolster, said assembly comprising spaced spring caps, and a plurality of nests of springs interposed between the spring caps, one of the nests of springs involving a helical spring and volute spring means disposed within the latter, said spring caps being respectively provided with projecting portions extending between said helical and volute springs for restraining lateral movement of said springs with respect to the spring caps and serving to center said helical spring with respect to said volute spring.

24. A spring assembly for association with a railway car truck side frame to support a truck bolster, said assembly comprising spaced spring caps, and a plurality of nests of springs interposed between the spring caps, one of the nests of springs involving a helical spring and volute spring means disposed within the latter, said spring caps being respectively provided with inwardly projecting annular flanges extending between said helical and volute springs, each of said flanges encircling the volute spring and serving as means for centering the helical spring with respect to the latter.

25. A spring assembly for association with a railway car truck side frame to support a truck bolster, said assembly comprising spaced spring caps, and a plurality of nests of springs interposed between the spring caps, one of said nests of springs involving a helical spring and a plurality of volute springs disposed within the latter, said volute springs respectively having a plurality of overlapping convolutions and being arranged in end to end relation with the outer ends of the innermost convolutions thereof adjacent each other, each of said spring caps having an inwardly projecting portion extending between the volute spring adjacent thereto and said helical spring, said projecting portions respectively serving to restrain lateral movement of the volute springs with respect to the spring caps and constituting means for centering the helical spring with respect to the volute springs.

26. A spring assembly for association with a car truck frame to support a truck bolster, said assembly comprising spaced spring caps adapted to receive between them a nest of helical springs and provided with a plurality of pairs of inwardly projecting annular flanges respectively adapted to extend within the opposite ends of said nests of springs for centering the latter, a plurality of nests of springs interposed between the spring caps, at least one of said nests involving a volute spring device, and members respectively interposed between the spring caps and the respectively adjacent ends of the spring device for centering the latter with respect to one of said pairs of annular flanges, said members having portions for respectively receiving said annular flanges and the latter having portions bent outwardly to clamp said members to the respective spring caps.

27. A spring assembly for association with a car truck side frame to support a truck bolster, said assembly comprising spaced spring caps adapted to receive between them a nest of helical springs and provided with a plurality of pairs of inwardly projecting annular flanges respectively adapted to extend within the opposite ends of said nests of springs for centering the latter, a plurality of nests of springs interposed between the spring caps, at least one of said nests involving a volute spring device, and members respectively interposed between the spring caps and the respectively adjacent ends of the spring device for centering the latter with respect to one of said pairs of annular flanges, each of said members having an opening for receiving the annular flange of the spring cap adjacent thereto and said annular flange being bent outwardly to overlappingly engage portions of said member for clamping the latter to the associated spring cap.

28. A spring assembly for association with a car truck side frame to support a truck bolster, said assembly comprising spaced spring caps adapted to receive between them a nest of helical springs and provided with a plurality of pairs of inwardly projecting annular flanges respectively adapted to extend within the opposite ends of said nests of springs for centering the latter, a plurality of nests of springs interposed between the spring caps, at least one of said nests involving a volute spring device, and members respectively interposed between the spring caps and the respectively adjacent ends of the spring device for centering the latter with respect to one of said pairs of annular flanges, each of said members having a portion for receiving the annular flange of the spring cap adjacent thereto and having portions overlapping opposite sides of the volute spring device, said members being respectively secured to said spring caps by said annular flanges.

29. A spring assembly for association with a car truck side frame to support a truck bolster, said assembly comprising spaced spring caps adapted to receive between them a nest of helical springs and provided with a plurality of pairs of inwardly projecting annular flanges respectively adapted to extend within the opposite ends of said nests of springs for centering the latter, a plurality of nests of springs interposed between the spring caps, at least one of said nests involving a volute spring device, and members re-

spectively interposed between the spring caps and the respectively adjacent ends of the spring device for centering the latter with respect to one of said pairs of annular flanges, each of said members having an opening for receiving the annular flange of the spring cap adjacent thereto, portions of the walls bordering said openings being inclined with respect to the axis thereof and and said annular flange being bent outwardly to overlappingly engage said inclined portion for securing said member to the associated spring cap.

WILLIAM E. WINE.