

Nov. 3, 1942.

A. F. HICKMAN

2,300,422

FLOATING CHAIR TYPE SEAT

Filed April 9, 1941

3 Sheets-Sheet 1

Fig. 1.

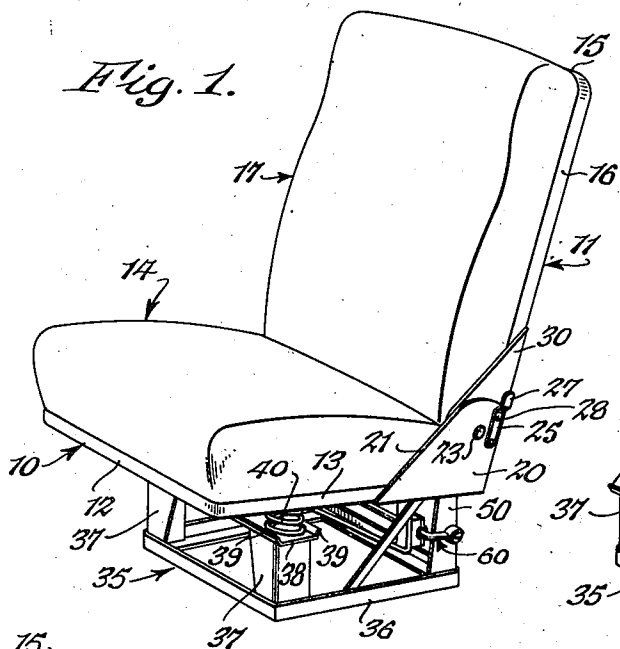


Fig. 3.

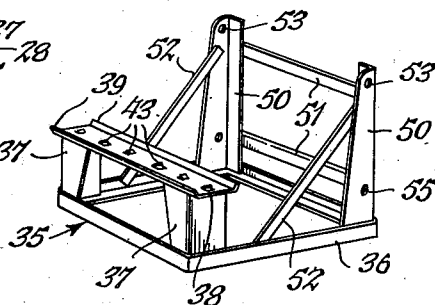


Fig. 2.

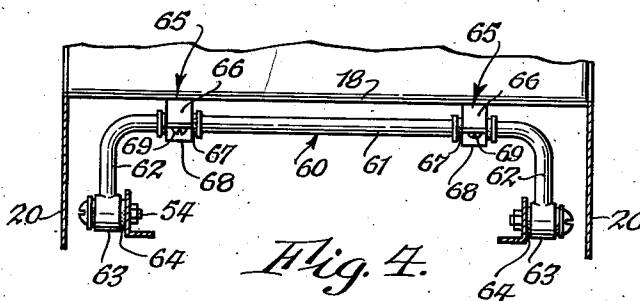
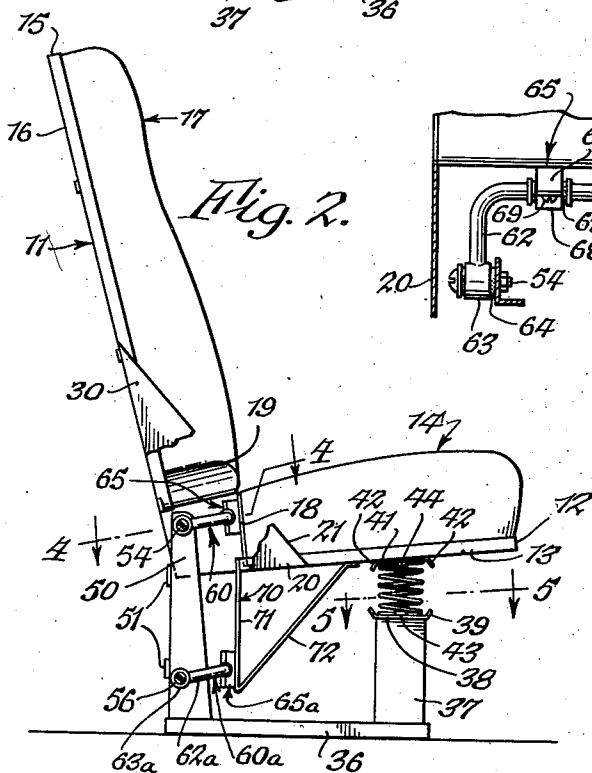
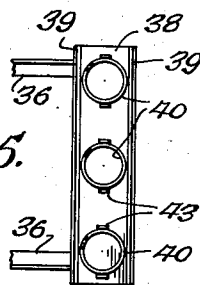


Fig. 4.

Fig. 5.



INVENTOR
Albert F. Hickman
BY
Pope and Pope
ATTORNEYS

Nov. 3, 1942.

A. F. HICKMAN

2,300,422

FLOATING CHAIR TYPE SEAT

Filed April 9, 1941

3 Sheets-Sheet 2

Fig. 9.

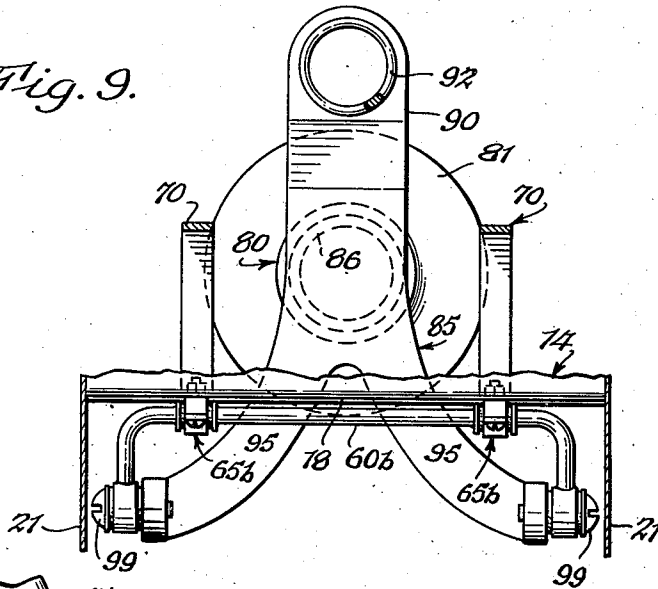


Fig. 10.

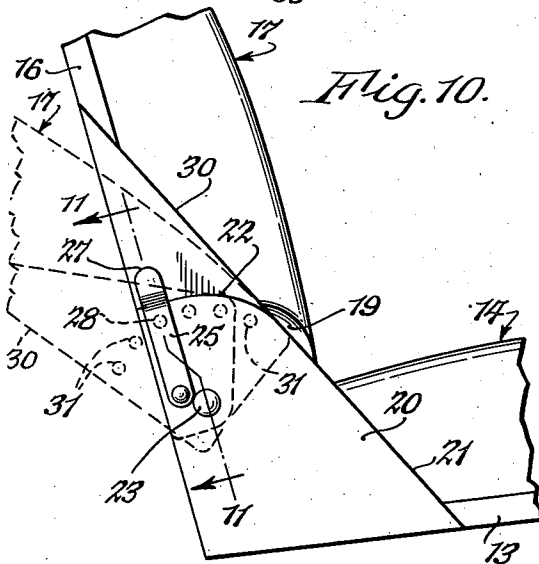
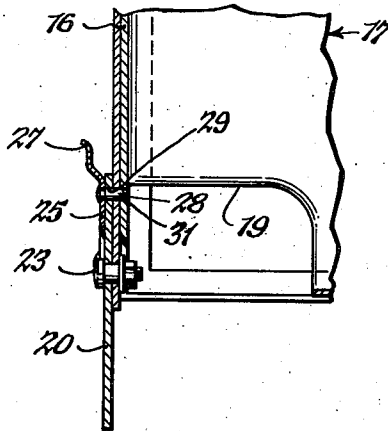


Fig. 11.



INVENTOR
Albert F. Hickman
BY
Pope and Pope
ATTORNEYS

Nov. 3, 1942.

A. F. HICKMAN

2,300,422

FLOATING CHAIR TYPE SEAT

Filed April 9, 1941

3 Sheets-Sheet 3

Fig. 6.

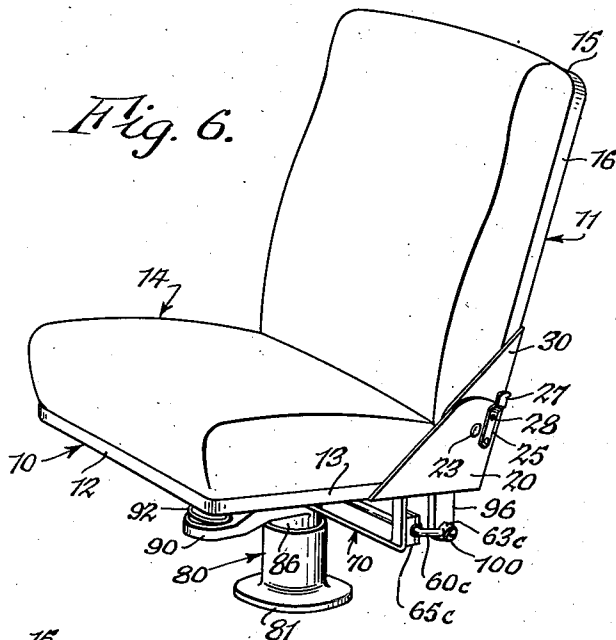


Fig. 8.

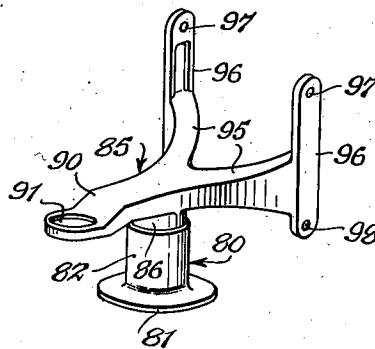
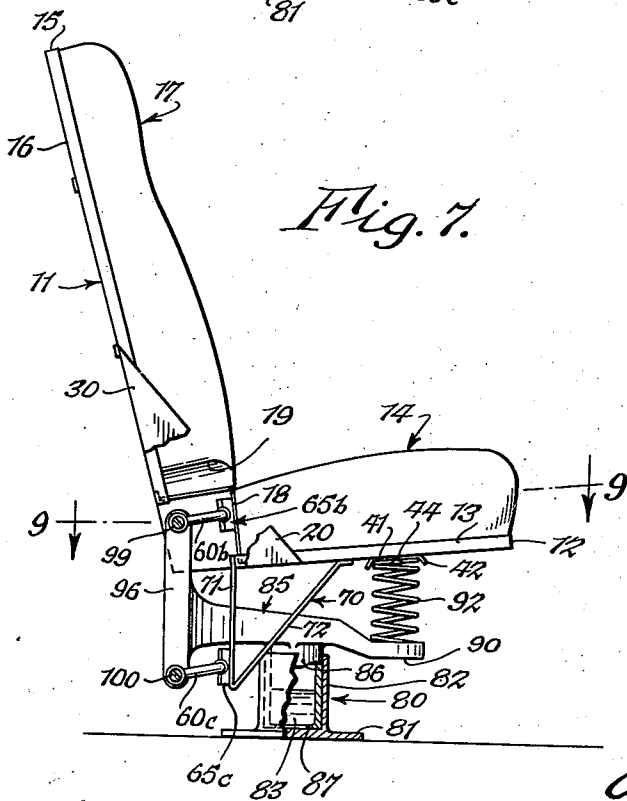


Fig. 7.



INVENTOR
Albert F. Hickman
BY
Pope and Pope
ATTORNEYS

UNITED STATES PATENT OFFICE

2,300,422

FLOATING CHAIR TYPE SEAT

Albert F. Hickman, Eden, N. Y., assignor to Hickman Pneumatic Seat Co., Inc., Eden, N. Y., a corporation of New York

Application April 9, 1941, Serial No. 387,642

7 Claims. (Cl. 155—9)

This invention relates to a seat and more particularly to a resiliently mounted floating chair type seat particularly adapted for use in vehicles such as busses, passenger railroad cars, and passenger airplanes to cushion the passengers against objectionable or harmful shocks, jars and vibrations caused by the vehicle passing over uneven roads or rails.

The present invention is an improvement on the general type of resiliently suspended seats described and claimed in my prior United States Patents Nos. 1,774,009 and 1,929,023, granted August 26, 1930, and October 3, 1933, respectively, and in my copending application for patent Serial No. 373,273, filed January 6, 1941.

It is the principal object of this invention to provide a resiliently-mounted floating chair type seat having the superior ride characteristics of the seats shown in my said patents and copending application and at the same time designed for use in common carriers, such as passenger busses, where space between the seats is at a premium but where the seats are mounted at a higher elevation than in trucks or pleasure cars, for example.

Another object of the invention is to provide such a resiliently mounted floating chair type seat having its spring suspension arranged essentially underneath the seat which adequately prevents objectionable jars and vibrations of all frequencies from being transmitted to the body of the seated passenger and in which the spring suspension yieldingly prevents undue movement of the seat and has rapid loading and unloading characteristics beyond the normal range of movement of the seat.

Another object of the invention is to provide such a resiliently mounted floating chair type seat having its spring suspension arranged essentially underneath the seat; in which the spring suspension controls the direction of movement of the seat frame and in which the springing means is in the form of inexpensive metal springs thereby to permit the quantity production of seats embodying the invention at very low cost.

Another object is to provide a floating, guided and resiliently mounted floating chair frame type seat which is so constructed as to permit its use in the horizontally curtailed space provided in a bus, passenger car or passenger airplane for such seats, which is strong and durable and will operate smoothly and easily without attention, which is light in weight to permit its use in airplanes and in which the moving parts are ade-

quately guarded so that there is no danger of the passenger suffering injury while riding on the seat.

Another object is to provide such a floating guided and resiliently mounted chair frame which is swivelly mounted so as to be capable of being rotated about a vertical axis and thereby permit the passenger to adjust the chair frame to suit any direction he may desire.

Another object is to provide such a resiliently mounted floating chair type seat having its spring suspension arranged essentially underneath the seat in which the back part of the chair frame is capable of being adjusted to any desired angle of inclination relative to the seat part thereof thereby to permit the passenger to adjust it to either an erect or any desired reclining position.

Another object is to provide such a floating chair type seat in which adequate cushioning is provided with a very small vertical movement of the chair frame and in which friction shock absorbers are unnecessary to the proper operation of the seat.

Other objects of the invention are to provide such a floating chair type seat which is simple and inexpensive in construction, is composed of few parts which are not liable to get out of order, which does not require frequent servicing, and which will not develop objectionable squeaks or noises even when subjected to conditions of severe and constant use.

In the accompanying drawings:

Fig. 1 is a perspective view of one form of resiliently mounted chair type seat embodying my invention.

Fig. 2 is a side elevation thereof showing parts broken away.

Fig. 3 is a perspective view of the subframe for the seat.

Figs. 4 and 5 are fragmentary, generally horizontal sections, taken on the correspondingly numbered lines on Fig. 2.

Fig. 6 is a view similar to Fig. 1 showing a modified form of the invention in which the seat is capable of swiveling or rotating about a vertical axis.

Fig. 7 is a side elevation similar to Fig. 2 and showing the modified form of the invention shown in Fig. 6.

Fig. 8 is a perspective view, similar to Fig. 3, showing the subframe used in the form of the invention shown in Figs. 6 and 7.

Fig. 9 is an enlarged horizontal section, taken on line 9—9, Fig. 7, and showing parts broken away.

Fig. 10 is an enlarged fragmentary side elevation of the seat frame used with both forms of the invention illustrated and showing the manner in which it can be made to recline at any desired angle.

Fig. 11 is a fragmentary vertical section, taken on line 11—11, Fig. 10.

In both forms of my invention illustrated in this application, the seat is composed of a cushioned chair-like seat frame having a back part which is rigidly, but adjustably, connected with a seat part, a subframe, and a resilient spring suspension between the chair-like seat frame and the subframe which resiliently supports the chair-like seat frame and permits resilient, guided movement of the seat frame relative to the subframe. As the same construction of chair-like seat frame is used with both forms of the invention shown, its construction will be first described, this description applying, of course, to both forms of the invention illustrated.

The cushioned chair frame or seat frame is shown as comprising a seat part 10, rigidly, but adjustably, connected with a back part 11. The frame of the seat part 10 is shown as composed of an angle iron bent to provide a horizontal front cross bar 12 and side bars or legs 13 which extend rearwardly from the extremities of the front cross bar 12. These bars are arranged so as to form a continuous upwardly extending side flange and a continuously extending bottom flange thereby to provide a recessed frame for the reception of a removable seat cushion 14. This seat cushion can be of any suitable type but is preferably of the unvented type described in detail in my said copending patent application for Floating chair type seat, Serial No. 373,273, filed January 6, 1941.

The frame of the back part 11 of the seat frame is shown as composed of an angle iron bent to provide a horizontal upper cross bar 15 and side bars or legs 16 which extend downwardly from the extremities of this upper cross bar. These bars are arranged so as to form a continuously extending back flange and a continuously extending side flange thereby to provide a recessed frame for the reception of a removable back cushion 17. This seat cushion can be of any suitable type but is preferably of the vented type described in detail in my said copending patent application.

To accommodate the spring suspension, hereinafter described, the rear end of the seat cushion 14, as best shown in Figs. 2 and 7, terminates at its point of meeting with the front lower edge of the back cushion 17 and abuts against a vertical cross plate 18 which is shown as welded at its ends to the rear ends of the side legs or bars. To accommodate the levers attached to this plate 18, which levers form a part of the spring suspension for the chair frame, the lower corners of the rear seat cushion are recessed, as indicated at 19.

The frames 10 and 11 of both the seat part and the back part can be otherwise cross braced in any suitable manner and are shown as connected to each other by an adjustment mechanism which permits the back part 11 to be adjusted to any desired reclining position relative to the seat part 10 to suit the choice of the occupant. For this purpose, as best shown in Figs. 10 and 11, a plate 20 is rigidly secured to the rear extremity of each of the side bars or legs 13 of the seat part of the chair frame and to the corresponding end of the plate 18 and

extends upwardly therefrom. The front edge 21 of this plate 20 preferably inclines upwardly and rearwardly and terminates in an upper rounding edge 22. Concentric with this rounding edge 22, each of the plates 20 is shown as carrying a pivot bolt 23, the pivot bolts at opposite sides of the chair frame being axially in line with each other. The plate 20 also carries a locking finger 25 which is shown as riveted to this plate 20 at its lower end and as extending upwardly therefrom. The upper end 27 of this locking finger projects above the upper end of the plate 20 and is formed to provide a fingerpiece. This locking finger 25 is made of spring metal and the fingerpiece 27 is formed to permit the manual movement of the spring finger 25 outwardly. Near its upper end this spring finger 25 carries a pin 28 which is arranged within a hole 29 provided in the plate 20. This spring locking finger 25 can be provided at one or both sides of the seat.

Each of the pivot bolts 23 extends through a plate 30 which is secured to the lower end of the side legs or bars 16 of the back frame 11. This plate extends forwardly from its leg 16 and is provided with an annular series of holes 31 which are arranged concentric with the pivot bolt 23 and in register with the pin 28 of the spring locking finger 25 so that this pin can enter any one of these holes 31. It will therefore be seen that the pivotally connected plates 20 and 30, together with the locking finger 25, provides a very simple means which permit the adjustment of the back to any desired inclination.

Thus, the occupant, by the use of the fingerpiece 27, can move the spring locking finger 25 outwardly so as to release its pin 28 from the engaged hole 31 and can thereupon place the back part of the seat at any desired inclination as indicated by the dotted lines in Fig. 10 and re-engage the pin 28 with the corresponding one of the annular series of holes 31.

The chair type seat frame, as above described, is shown as supported by either the form of subframe and spring suspension illustrated in Figs. 1-5 or by the modified swivel type of subframe and spring suspension illustrated in Figs. 6-9. In the form of subframe and spring suspension shown in Figs. 1-5 the subframe, indicated generally at 35, is shown as composed of sheet metal parts suitably welded together. These parts comprise a rectangular base 36 made of angle irons and having one horizontal flange adapted to be secured to the floor of the passenger bus, passenger airplane or passenger railroad car. To each of the front corners of the base 36 is secured a front corner post 37 which is shown as being L-shaped in horizontal section. These posts support the opposite ends of a sheet metal cross plate 38, the front and rear edges of which are formed to provide upturned flanges 39. These flanges 39 are so spaced as to hold or cradle the lowermost coils of a row of helical compression springs 40.

The chair frame is shown as supported on three of these helical springs 40 and the upper coils of these springs bear against a cross plate 41 secured at its opposite ends to the side legs 13 of the seat part 10 of the chair frame, this cross plate being formed at its front and rear edges to provide downturned flanges 42 which cradle and hold the upper coils of the springs 40 against fore and aft displacement. To hold the springs 40 individually against lateral displacement, a central row of retaining fingers 43 are struck upwardly from the lower cross plate 38, these

fingers being arranged in pairs to engage the opposite sides of the lowermost coil of each helical spring 40. Similarly a central row of retaining fingers 44 are struck downwardly from the upper cross plate 41, these fingers 44 being arranged in pairs to engage the opposite sides of the uppermost coil of each helical spring 40.

The subframe 35 also includes two rear posts 50 which are shown as being of angle form in cross section and as secured to and rising from the rear corners of the base 36. These posts 50 are shown as being cross braced by horizontal connecting bars 51 which are welded to the rear sides of these posts and the posts 50 are also shown as being braced by diagonal bars 52 which extend forwardly and downwardly and each of which is secured at its lower end to the corresponding side of the base 36. Each of the posts 50 is provided at its upper end with a hole 53 which is adapted to receive a bolt 54, these bolts 54 being axially in line with each other. Similarly each of the posts 50 is provided near its lower end with a hole 55 which is adapted to receive a bolt 56, these bolts being axially in line with each other.

The chair frame is guided to move in a generally vertical direction by a pair of yokes which are preferably constructed and secured to the subframe and the chair frame as follows:

The seat part 10 of the chair frame is connected, through its vertical cross plate 18, to the upper ends of the posts 50 by an upper yoke 60, which is in the form of a cross rod 61 having an integral rearwardly extending arm 62 at each of its ends. At its rear end each of these rearwardly extending arms 62 is formed to provide an enlarged eye or collar 63, these collars or eyes being in line with each other and their axis being parallel with the axis of the cross rod 61. Each of these eyes 63, as best shown in Fig. 4, embraces the corresponding bolt 54. Each of these bolts 54 carries a rubber bushing 64 which is tightly confined between the bolt 54 and the corresponding eye 63, this rubber bushing being flexed to provide the necessary rocking movement of the eyes 63 around the stud bolts 54. The head of each of the bolts 54 confines the rubber bushing 64 in position and also serves to retain the corresponding eye 63 in position.

Each end of the cross rod 61 of the yoke 60 is supported for rocking movement in a rubber bushed bearing 65, each of these bearings being secured to the rear face of the vertical plate 18 of the seat part 10 of the chair frame. As these rubber bushed bearings are identical a description of one will be deemed to apply to both.

Each of these bearings 65 is shown as comprising a front half bearing made of a wooden block 66 and as having a horizontally extending half round socket in its rear face for the reception of a bushing 67 of resilient yielding material, such as rubber. This bushing surrounds the adjacent portion of the cross rod 61 and is held firmly in engagement with this rod and with the socket in the half bearing 66 by a rear half bearing plate 68 which is formed at its center to provide a horizontally extending socket embracing the rear half of the rubber bushing 67. The rear half bearing plate 68 and the front half bearing block 66 are secured to the corresponding end of the vertical plate 18 of the seat part 10 of the subframe by a pair of bolts 69. As with the eyes 63 the rubber bushings 67 are tightly confined between the two half bearings

so that the rubber is flexed to provide the necessary rocking movement in the bearings 65.

To the seat part 10 is also secured a depending bracket 70 which is of generally V-shaped form, each of these brackets having a vertical leg 71 welded at its upper end to the end of the corresponding side leg or bar 13 of the seat part 10 of the chair frame and having a forwardly and upwardly extending front leg 72 which is welded to the underside of the corresponding side leg or bar 13 adjacent its center. The lower ends of the brackets 70 are connected to the lower ends of the rear posts 50 of the subframe by a second yoke 60a. This yoke is identical in construction with the upper yoke 60 and hence the same reference numerals have been employed to designate similar parts, these numerals being distinguished by the suffix "a." Similarly, each end of the cross rod 61a of the yoke 60a is supported by a rubber bushed bearing 65a, each of these bearings being secured to the lower extremity of the vertical leg 71 of the corresponding bracket 70. These rubber bushed bearings 65a are identical with the bearings 65 and hence the same reference numerals have been applied and distinguished by the suffix "a."

The rear end of each of the arms 62a is connected to the corresponding stud bolt 56 by a rubber bushed bearing formed by eyes 63a provided at the ends of its arms 62a. As these bearings are identical in construction to the bearings provided for the yoke 60, the same reference numerals have likewise been applied to similar parts and distinguished by the suffix "a."

In the modified form of subframe and spring suspension shown in Figs. 6-9 the base portion of the subframe comprises a casting 80 which comprises a circular base 81 having a large upward tubular extension or sleeve 82 providing a cylindrical bore or well adapted to contain a body of oil 83. This base 80 supports a subframe in the form of a casting 85 which is formed to provide a central post 86 which is received in the bore of the casting 80. This post is preferably hollow and open at its bottom so that a substantial body of oil 83 is contained within this post for the purpose of insuring lubrication of the swivel joint provided by this post and the casting. The lower extremity of the post 86 is preferably flanged inwardly, as indicated at 87, so as to provide adequate bearing for the post against the circular bottom 81 of the casting 80.

The casting 85 is formed, at the upper end of the post 86, to provide a forwardly projecting arm 90, the extremity of which is provided with a circular recess 91 on its upper side. In this recess is fitted the lower coil of a helical compression spring 92, the upper end of which is secured to the center of the plate 41 by the retaining fingers 44 in the same manner as with the form of the invention shown in Figs. 1-5. Inasmuch as one spring 92 supplants the three helical compression springs 40 of the form of the invention shown in Figs. 1-5, this spring 92 is, of course, heavier.

The casting 84 is also formed to provide two arms 95 which extend rearwardly and laterally from the upper end of the post 86, as best shown in Fig. 8. The extremity of each of these arms 95 is formed to provide a post 96, each of these posts having an opening 97 at its upper end and an opening 98 at its lower end. The openings 97 are axially in line with each other and the same is also true of the openings 98. The openings

97 each receives a bolt 99 and the openings 98 each receives a bolt 100.

As with the form of the invention shown in Figs. 1-5 the upper bolts 99 of the posts 96 are connected to the vertical plate 18 of the seat part 10 of the chair frame by a yoke 60b. This yoke and its rubber bushed bearings is identical in construction with the yoke 60 and the bearings for this yoke and hence the description is not repeated, the same reference numerals having been applied to designate identical parts and distinguished by the suffix "b." Similarly, the lower pair of bolts 100 are connected to the lower extremities of the brackets 70 by a yoke 60c which is identical in construction and in the construction of its bushings with the yokes 60 and 60a and the description of this yoke 60c is therefore not repeated, the same reference numerals having been applied and distinguished by the suffix "c."

In the operation of either type of floating chair type of seat shown, when installed, for example, in a passenger bus, railroad car or airplane, the occupant is enabled to adjust the back part 11 of his seat to any desired inclination by withdrawing the spring finger 25 so as to release its pin 28 from the corresponding one of the series of annular holes 31 of the plate 30. This permits the operator to adjust this back part to any inclination, as indicated by dotted lines in Fig. 10, following which he can release the spring finger and permit its pin 28 to reengage one of the holes 31, which engagement will hold the back at the selected inclination.

With particular reference to the form of the invention shown in Figs. 1-5, the occupant, upon sitting on the seat cushion 14, depresses the entire seat frame to a position in which the rearwardly extending arms 62, 62a are in an approximately horizontal position, these yokes flexing the rubber bushings 67, 67a and 64, 64a in the eight rubber bushed bearings 65, 65a and 63, 63a of these yokes. The weight of the occupant is primarily supported on the helical compression springs 40 interposed between the seat part 10 of the chair frame and the cross plate 38 of the supporting structure or subframe 35.

In traveling along, if a violent impact is transmitted to the vehicle, the chair frame is depressed, this impact being largely absorbed by the helical springs 40 which are compressed. The eight rubber bushings for the upper and lower yokes 60, 60a are also stressed to a greater degree by such violent upward impacts of the vehicle and the subframe. The arms 62, 62a of the yokes 60, 60a form, in effect, two sides of a jointed parallelogram and it will therefore be seen that the movement of the chair frame is downward and rearward. These arms 62, 62a are of substantially the same length and it will therefore be seen that this movement of the chair frame is along substantially a straight line and that all parts of the seat move in the same direction. This avoids any tipping or "rocking chair" movement of the chair frame. It will be seen that the length of these arms 62 and 62a of the yokes 60, 60a has a vital bearing on the movement of the chair and seat frame and on securing adequate resilient cushioning of the chair frame with the minimum vertical fore and aft movement thereof. It has been found that with a floating chair type seat as shown for use in vehicles the effective length of each of the levers 62, 62a, that is, from its axis of pivotal connection on the subframe 35 to its axis of piv-

otal connection on the chair frame, must not exceed five inches. With these arms of this length or less, the chair frame is properly guided in its movement and the weight of the chair frame and its occupant is adequately carried by the light compression springs 40 and the rubber bushings shown.

In this downward movement of the chair frame relative to the subframe, it will be seen that the upper ends of the posts 50 and the rear ends of the arms 62 of the yoke 60 enter the recesses 19 provided in the lower corners of the back cushion 17, these recesses being provided for this purpose.

In the recoil or upward movement of the chair frame, the helical compression springs return the chair frame to the original loaded position in which the arms 62, 62a of the yoke 60, 60a are in a horizontal position, or slightly higher. It has been found that with the seat constructed as shown, the spring suspension has extremely rapid loading and unloading characteristics, thereby providing rapidly increasing resistance to vertical impacts of the vehicle frame and rapidly damping the rebound of the seat.

As with the seat shown in my said copending patent application Ser. No. 373,273, filed January 6, 1941, the seat cushion 14 is unvented, whereas the back cushion 17 is vented, thereby to obtain the superior ride characteristics as set forth in greater detail in my said copending patent application.

With the form of the invention shown in Figs. 6-9 it will be seen that the spring suspension, that is, the rubber bushed yokes and the helical compression spring, is of substantially the same construction and arrangement as in the form of the invention shown in Figs. 1-5 and in this regard the form of the invention shown in Figs. 6-9 operates in the same manner as the preferred embodiment of this invention and hence a description of this invention is not repeated. It will be seen, however, that the subframe of the form of the invention shown in Figs. 6-9 is essentially a cast structure as distinguished from the fabricated sheet metal welded structure shown in Figs. 1-5 and it will also be seen that in the form of the invention shown in Figs. 6-9 the entire seat frame is capable of swiveling around a vertical axis, its post 86 being revolvably mounted in the base casting 80 for this purpose. Further, this swivel joint is adequately supplied with lubricant by the large body 83 of lubricant retained in this base casting and post.

It will be noted that in both forms of the invention the yokes are secured to the seat portion 10 of the floating chair frame and are arranged well under the seat. While this requires a somewhat higher mounting for the seat, as compared, for example, in my said prior patents and application, a slightly higher mounting of the seat is desirable where the seat is to be used in a passenger bus, railroad train or airplane. At the same time by mounting the spring suspension essentially under the seat rather than partly in rear as well as partly under the seat, the seats are enabled to be placed closer together, the horizontal space between the seats being, of course, at a premium with seats arranged in rows as in a passenger bus, railroad car or airplane.

From the foregoing it will be seen that the present invention provides a floating chair type seat of simple and inexpensive construction, in which the resilient support is obtained primarily by inexpensive metal springs and which has the

proper ride characteristics for use in passenger busses, railroad cars or airplanes, particularly in absorbing jars and vibrations of all violence and frequencies and in moving in a substantially straight line downwardly and rearwardly from its normally loaded position, thereby to avoid any lurching or undesired action of the seat. Further, the seat is so constructed as to have a very small vertical movement of its chair frame and at the same time is capable of adequately absorbing violent jars or shocks thereby permitting the use of the seat in the extremely confined space permitted in a passenger bus, railroad car or airplane. The seat can also be adjusted as to the angularity of its back to suit each passenger and the seat is entirely free from squeaks or other noises and requires little servicing or attention even under conditions of severe and constant use. It will further be seen that with the arrangement of the spring suspension essentially under the seat the seats can be placed close together, as is desirable in a row arrangement, and it will further be seen that no part of one seat interferes with the freedom of movement of the legs of the occupant of an adjacent seat.

I claim as my invention:

1. A floating chair type seat, including a chair frame comprising a seat part and a back part rigidly connected to said seat part, a subframe including a pair of transversely spaced posts rising from its rear end and arranged directly under the lower part of said back part, means arranged directly under the lower part of said back part and connecting said posts with said chair frame and guiding said chair frame in its vertical movements and preventing said chair frame from tipping and twisting, comprising a pair of horizontally disposed yokes arranged one above the other and each having a horizontal cross part and a pair of laterally extending generally horizontal arms, means pivotally connecting said horizontal cross part of each yoke at two transversely spaced points to said chair frame and means pivotally connecting the said arms of each yoke to said posts and means interposed between said subframe and said chair frame for resiliently restraining vertical movements of said chair frame.

2. A floating chair type seat, including a chair frame comprising a seat part and a back part rigidly connected to said seat part, a subframe including a base part and a structure projecting upwardly from the rear part of said base part and arranged directly under the lower part of said back part, a depending structure secured to the rear part of said seat part of said chair frame and projecting downwardly therefrom, means arranged directly under the lower part of said back part and interposed between said upwardly projecting structure of said subframe and said depending structure of said chair frame and guiding said chair frame in its vertical movements and preventing said chair frame from tipping and twisting, comprising a pair of horizontally disposed yokes arranged one above the other and each having a horizontal cross part and a pair of laterally extending generally horizontal arms, means pivotally connecting said horizontal cross part of each yoke at two transversely spaced points to one of said structures, and means pivotally connecting the said arms of each yoke to the other of said structures and means interposed between said subframe and said chair frame for

resiliently restraining vertical movements of said chair frame.

3. A floating chair type seat, including a base casting having a central vertical bore forming a cylindrical well adapted to contain a body of lubricant, a subframe comprising a casting including a central post revolvably mounted in said bore to swing about a vertical axis, a forwardly projecting arm, a pair of horizontally spaced rearwardly projecting arms and a post rising from the rear end of each of said rearwardly projecting arms, a chair frame comprising a seat part and a back part rigidly connected with said seat part, means arranged directly under the lower part of said back part and interposed between said posts and said chair frame and guiding said chair frame in its vertical movements and preventing said chair frame from tipping and twisting, comprising a pair of horizontally disposed yokes arranged one above the other and each having a horizontal cross part and a pair of laterally extending generally horizontal arms, means pivotally connecting said horizontal cross part of each yoke at two transversely spaced points to said chair frame and means pivotally connecting the said arms of each yoke at two transversely spaced points to said posts, and means interposed between said forwardly projecting arms of said subframe and said chair frame for resiliently restraining vertical movements of said chair frame.

4. A floating chair type seat, including a subframe, a chair frame comprising a seat part and a back part rigidly connected with said seat part, means interposed between said subframe and said chair frame for guiding said chair frame for vertical movements and preventing said chair frame from tipping and twisting, comprising a pair of horizontally disposed yokes arranged one above the other directly under the lower part of said back part of said chair frame and each having a horizontal cross part and a pair of laterally extending generally parallel arms arranged in a generally horizontal plane in the normal loaded position of said chair frame, means for pivotally connecting said horizontal cross part of each yoke at two transversely spaced points to one of said frames and means pivotally connecting the ends of said arms of each yoke at two transversely spaced points to the other of said frames, the connection between said yokes and chair frame being with the seat part of said chair frame and means for resiliently restraining vertical movements of said chair frame.

5. A floating chair type seat, including a subframe, a chair frame comprising a seat part and a back part rigidly connected with said seat part, means interposed between said subframe and said chair frame for guiding said chair frame for vertical movements and preventing said chair frame from tipping and twisting, comprising a pair of horizontally disposed yokes arranged one above the other directly under the lower part of said back part of said chair frame and each having a horizontal cross part and a pair of laterally extending generally parallel arms arranged in a generally horizontal plane in the normal loaded position of said chair frame, means pivotally connecting said horizontal cross part of each yoke at two transversely spaced points to one of said frames and means pivotally connecting the ends of said arms of each yoke at two transversely spaced points to the other of said frames, the connection between said yokes and chair frame

being with the seat part of said chair frame and spring means arranged directly under said seat part of said chair frame and interposed between said subframe and said seat part of said chair frame for resiliently restraining vertical movements of said chair frame.

6. A floating chair type seat, including a subframe, a chair frame comprising a seat part and a back part rigidly connected with said seat part, means interposed between said subframe and said chair frame for guiding said chair frame for vertical movements and preventing said chair frame from tipping and twisting, comprising a pair of horizontally disposed yokes arranged one above the other directly under the lower part of said back part of said chair frame and each having a horizontal cross part and a pair of laterally extending generally parallel arms arranged in a generally horizontal plane in the normal loaded position of said chair frame, means pivotally connecting said horizontal cross part of each yoke at two transversely spaced points to said seat part of said chair frame and means for pivotally connecting the end of each of said arms to said subframe and means interposed between said subframe and said chair frame for resiliently restraining vertical movement of said chair frame.

7. A floating chair type seat, including a chair

frame comprising a seat part and a back part rigidly connected with said seat part, a subframe including a pair of transversely spaced posts rising from its rear end and arranged directly under the lower part of said back part of said chair frame, means interposed between said subframe and said chair frame for guiding said chair frame for vertical movements and preventing said chair frame from tipping and twisting, comprising a pair of horizontally disposed yokes arranged one above the other directly under the lower part of said back part of said chair frame and each having a horizontal cross part and a pair of laterally extending generally parallel arms arranged in a generally horizontal plane in the normal loaded position of said chair frame, means pivotally connecting said horizontal cross part of each yoke at two transversely spaced points to one of said frames and means pivotally connecting the ends of said arms of each yoke at two transversely spaced points to the other of said frames, the connection between said yokes and chair frame being with the seat part of said chair frame and the connection between said yokes and subframe being with said posts and means for resiliently restraining vertical movements of said chair frame.

ALBERT F. HICKMAN.