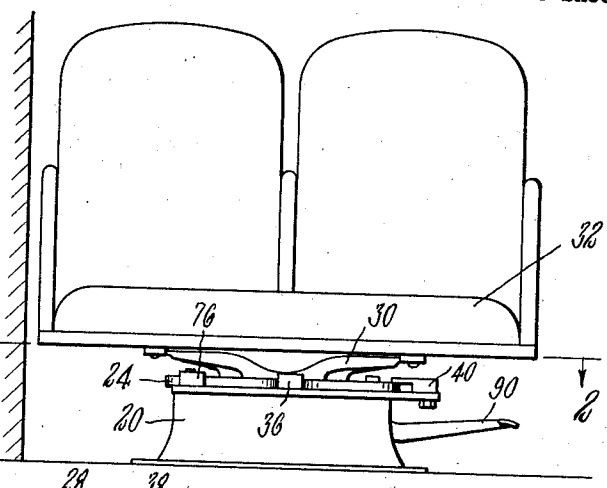
June 11, 1940. O. E. HILL 2,204,218

REVERSING CAR-SEAT BASE

Filed Dec. 24, 1937 3 Sheets-Sheet 1

Fig. 1.



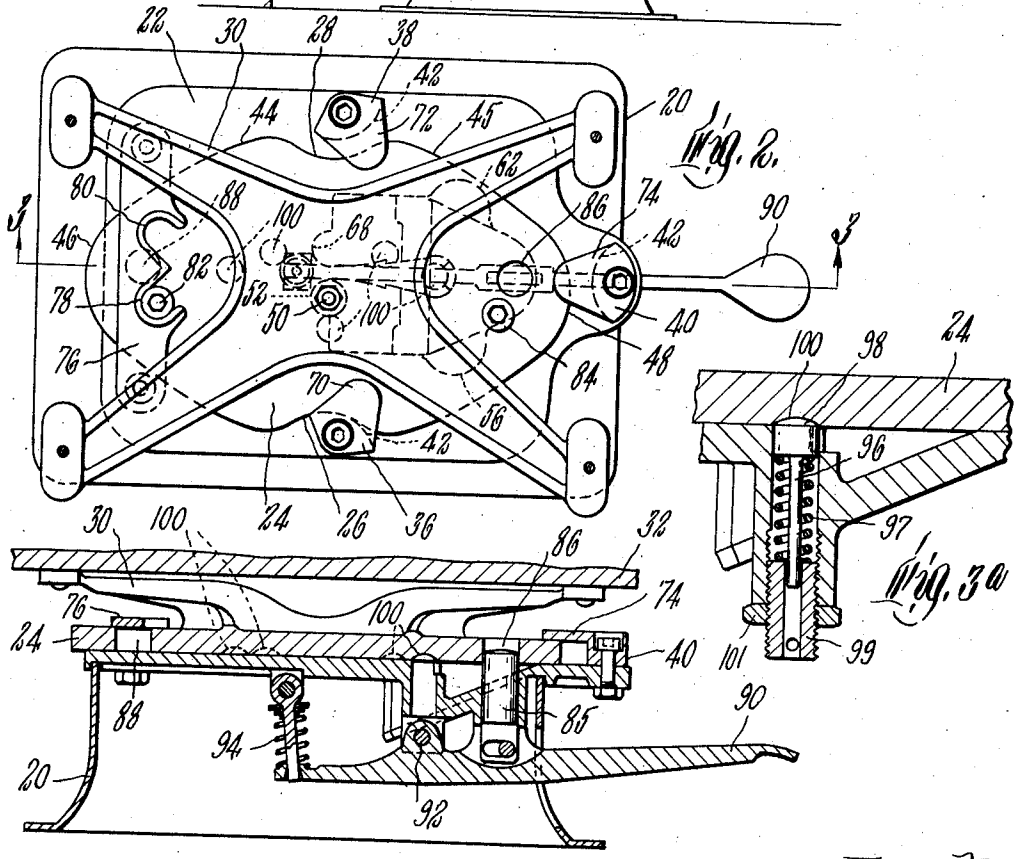


Fig. 2.

Fig. 3a

Fig. 3.

Inventor
Otha E. Hill
by Wright, Brown, Quinby & May
Attys

June 11, 1940. O. E. HILL 2,204,218

REVERSING CAR-SEAT BASE

Filed Dec. 24, 1937 3 Sheets-Sheet 2

Fig. 4.

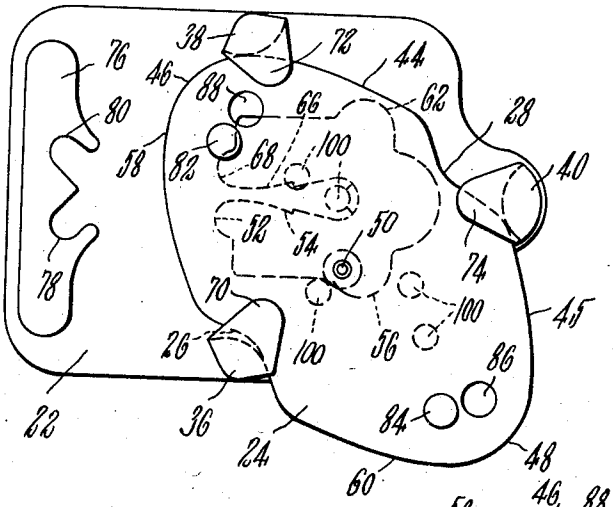


Fig. 5.

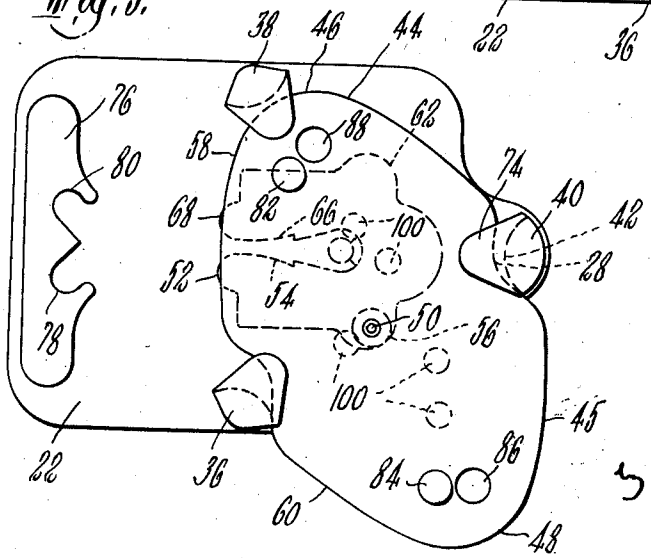
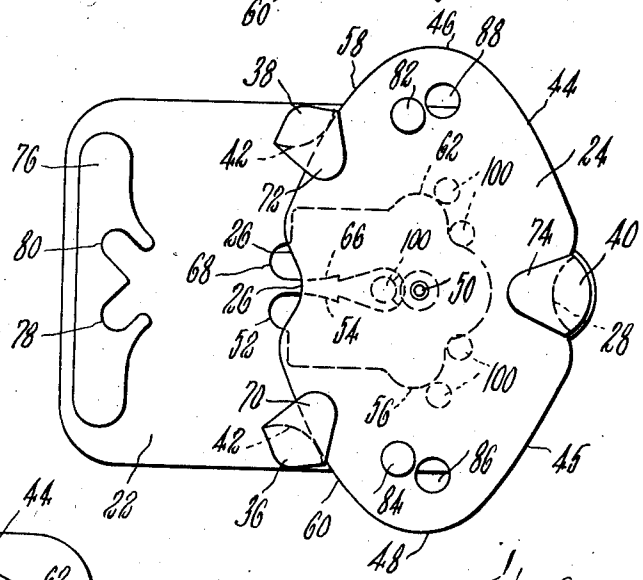


Fig. 6.



Inventor
Oiva E. Hill
by Wright, Brown, Quinby & May
Attys.

June 11, 1940. O. E. HILL 2,204,218

REVERSING CAR-SEAT BASE

Filed Dec. 24, 1937 3 Sheets-Sheet 3

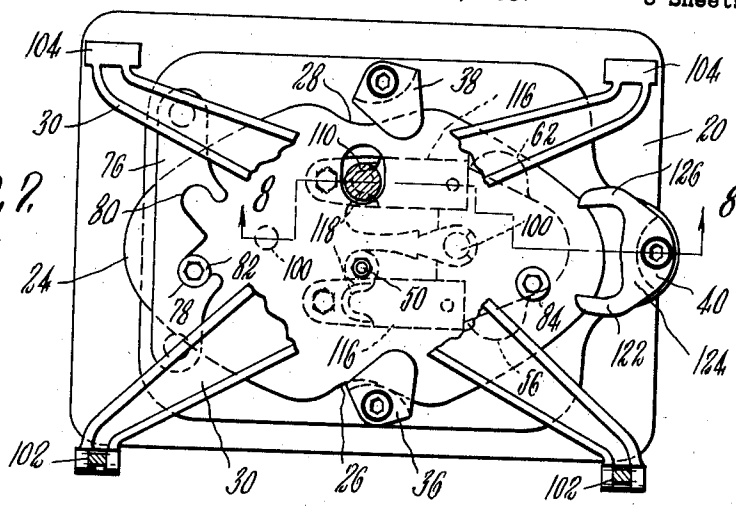


Fig. 7.

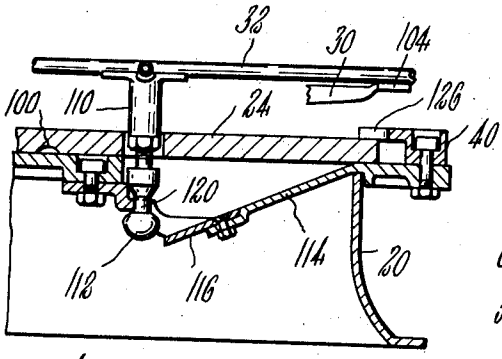


Fig. 8.

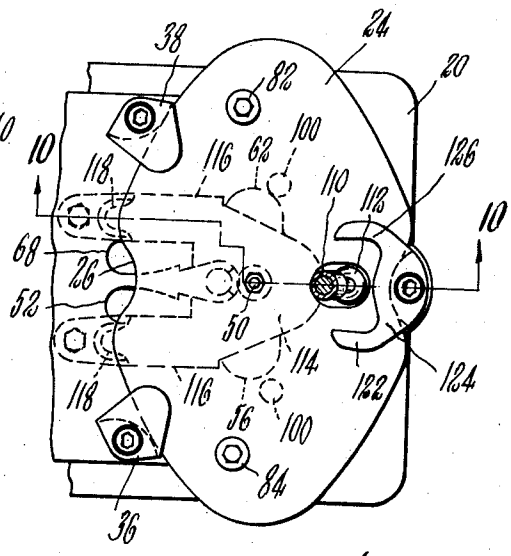


Fig. 9.

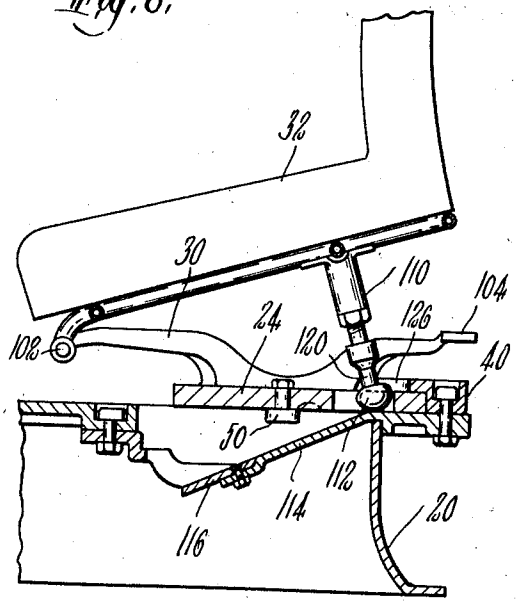


Fig. 10.

Inventor
Orva E. Hill
by Wright, Brown, Quinby & May
Attys.

Patented June 11, 1940 2,204,218

UNITED STATES PATENT OFFICE

2,204,218

REVERSING CAR-SEAT BASE

Oiva E. Hill, Gardner, Mass., assignor to Heywood-Wakefield Company, Gardner, Mass., a corporation of Massachusetts

Application December 24, 1937, Serial No. 181,546

9 Claims. (Cl. 155—96)

This invention relates to a reversible car-seat base by which the seat supported by the base may be reversed rotatively through 180° from one position of use to a reversed position in which the seat faces in the opposite direction.

When seats are installed in vehicles such as busses or railway coaches, it is desirable to locate them as close as possible to a side wall of the vehicle so that a maximum width of aisle can be had with a given width of vehicle and width of seat. If the seat is located close against the wall, it must move away from the wall when it begins to turn so that its corners clear the wall. Furthermore, if the seats on the same side of the car are spaced close together so as to get as many as possible into the car, it may be necessary or desirable for the seat to tilt forward during the initial portion of its turn so that the back of the seat will clear the back of the next adjacent seat which may be facing in the opposite direction.

Various mechanisms have been devised to attain the foregoing objectives. It is an object of the present invention to provide a reversing mechanism of the cam type which has advantageous features resulting in improved operation. According to the present invention, cam mechanism is provided by which the seat is caused to swing about a series of spaced turning axes when being reversed from one position to the other. This mechanism is such as to make possible improved hold-down means whereby the sliding carriage on which the seat is mounted is efficiently held down upon a stationary pedestal of the base by elements which overlap the margin of the carriage and which are at all times effective at at least three widely spaced points along such margin. The chair is thus maintained effectively against wabbling when in the process of being reversed, and the posibility of the cam elements binding or sticking by reason of skew forces acting on the members when the chair is pulled around manually from one position to the other is greatly reduced.

The invention may also include means for locking the carriage in either of its reversed positions; and also means for holding the carriage in intermediate positions and means for tilting the seat forward during reversing movement. The latter means is useful and desirable for enabling the backs of adjacent chairs to clear each other when being reversed.

For a more complete understanding of the invention, reference may be had to the description thereof which follows and to the drawings of which

Figure 1 is a front elevation of a car seat embodying the invention.

Figure 2 is a plan view of the seat base shown in Figure 1.

Figure 3 is a section on the line **3—3** of Figure 2, showing a treadle-operated locking device.

Figure 3*a* is a fragmentary section on the line **3—3** of Figure 2, showing another form of locking device.

Figures 4, 5 and 6 are diagrammatic plan views showing the seat carriage in successive positions during the reversing movement.

Figure 7 is a plan view of a modified form of the invention.

Figure 8 is a section on the line **8—8** of Figure 7.

Figure 9 is a fragmentary plan view of the mechanism shown in Figure 8, the carriage being in an intermediate position.

Figure 10 is a section on the line **10—10** of Figure 9.

The reversing seat-back mechanism illustrated in Figures 1, 2 and 3 comprises a stationary pedestal **20** having a smooth plane upper surface portion **22** which is preferably machined smooth so as to be a suitable surface on which the seat carriage may slide. The carriage includes a plate **24** which is oval in shape and has a pair of marginal recesses **26** and **28** at the ends of its minor diameter. As indicated in Figure 2, the major diameter of the oval plate **24** is parallel to the long axis of the pedestal **20** when the seat is in either of its reversed positions of use. In addition to the oval plate **24**, the seat carriage also may comprise a spider or frame **30** mounted on the plate **24** and having four arms on the ends of which is secured the seat or chair **32**.

In order to bring about movement of the plate **24** toward the aisle end of the pedestal when the seat begins a reversing movement, three fulcrum elements **36**, **38**, **40** are mounted on the pedestal. Each of these elements has an upstanding curved cam surface **42**, the curvature of which corresponds to the concave curvature of the recesses **26** and **28**. These fulcrum elements are adapted to be engaged in succession by one or the other of the recesses while the plate swings through a substantial angle of rotation about the center of curvature of the fulcrum element with which it is temporarily in engagement. The seat **32** is preferably mounted on the carriage in such a way that the recess **26** is beneath the front of the seat and the recess **28** is beneath the rear of the seat. Thus, in Figure 2, the front of the plate **24** is shown in engagement with the ful-

crum element 36. When reversing movement of the seat carriage is commenced, the plate 24 swings about the center of curvature of the cam surface of the fulcrum element 36 as a center, the fulcrum element 38 being sufficiently spaced from the recessed edge portion 28 of the plate so as not to interfere with the swing of the plate about the fulcrum element 36. The convexly curved edge portion 44 of the plate is so shaped as to slide plast the fulcrum element 38 with only a slight clearance until the end 46 of the plate has passed the fulcrum element 38 as indicated in Figure 5. In like manner the convexly curved edge portion 45 of the plate slides by the fulcrum element 40 with only a slight clearance. The effect of this arrangement is to keep the recess 26 substantially in engagement with the fulcrum element 36 during the greater part of the swing of the plate about the element 36 as a pivot, the angle of swing of the plate about this pivot being approximately 50°. The fulcrum element 40 is then engaged by the recess 28 of the plate and acts as a pivot while the plate swings through an angle of 40°. When the end 48 of the plate passes the fulcrum element 36, the recess 26 moves into engagement with the fulcrum element 38 which acts as a pivot about which the plate swings approximately 50° to reach its fully reversed position.

Auxiliary guiding means are provided for holding the plate against the fulcrum element 36 during its initial swing until the convex edge portions 44 and 45 are effective to maintain such engagement, and also to shift the plate from one fulcrum element to the next. To this end, the top 22 of the pedestal is cut away, as indicated in Figures 2, 4, 5 and 6, to form an opening having edge portions which act as cams when engaged by a pin 50 which projects down from the plate 24 to bear laterally against certain portions of the edge of the opening. When the plate is in the position illustrated in Figure 2, the pin 50 is disposed in a notch or recess 52. During the initial movement of the plate from the position shown in Figure 2, the pin 50 rides along a curved cam edge 54 which serves to maintain the recess 26 in engagement with the fulcrum element 36 until the edges 44 and 45 of the plate begin to function as guides. When the plate reaches the position illustrated in Figure 4, the convex edge portion 45 moves clear of the fulcrum element 40. At the same time, the pin 50 slides along a concave curved cam edge 56. This prevents the plate 24 from moving off the pedestal between the fulcrum elements 36 and 40 and causes the plate to shift toward the aisle end of the pedestal so as to bring the recess 28 into engagement with the fulcrum element 40. During the transition from the fulcrum 36 to the fulcrum 40, the plate rotates about 20°. By this time, the end 46 of the plate has cleared the fulcrum element 38 and the plate thereupon swings through an angle of about 40° about the fulcrum element 40 as a center of rotation, the recess 28 being held against the fulcrum element by convex edge portions 58 and 60 which slide past the fulcrum elements 38 and 36, respectively. The swing of the plate 24 about the fulcrum element 40 causes the pin 50 to move from the concave edge portion 56 to a similar concave edge portion 62. This prevents the escape of the plate from the pedestal between the fulcrum elements 38 and 40 and causes the plate to shift over so that the recess 26 engages the fulcrum element 38, the plate rotating about 20° during this transition. The edge portion 44 of the plate at once starts to slide past the fulcrum element 40 and the convex edge portion 45 of the plate starts to slide past the fulcrum element 36, these edge portions serving to maintain the recess 26 in engagement with the fulcrum element 38 during the final portion of the reversing movement of the plate. As the edge portions 44 and 45 recede from the fulcrum elements 40 and 36, just before the plate reaches its extreme reversed position, the pin 50 comes in contact with a cam edge portion 66 and takes on the function of maintaining the recess 26 in engagement with the fulcrum element 38 as the plate completes its reversing movement, the pin 50 then engaging in a notch 68 symmetrical with the notch 52.

In order to hold the plate 24 upon the upper surface of the pedestal during reversing movement of the seat as well as when the seat is in either position for use, a number of hold-down elements are provided to overlap the margin of the plate at spaced points. Three such hold-down elements comprise horizontal arms 70, 72 and 74 which project from the fulcrum elements 36, 38 and 40, respectively. As indicated in Figures 2, 4, 5 and 6, these hold-down elements are effective at all times regardless of what position the plate may be in, whether at rest or in the course of reversing movement. A fourth hold-down element 76 is mounted on the pedestal opposite the aisle end thereof. This may consist of a flat horizontal bar sufficiently elevated above the surface of the pedestal to overlap the margin of the plate in either of its reversed positions. This hold-down element is not effective during reversing movement of the plate but the other three hold-down elements are so spaced from each other as to prevent wabbling of the seat and carriage during reversing movement, and also to overcome any tendency on the part of the plate 24 to bind or stick during reversing movement as might arise from skew stresses on the plate when the seat is being pulled around manually from one position to the other. As indicated in Figure 2, the hold-down elements 70 and 72 are approximately in line with the minor diameter of the plate when the latter is in either of its reversed positions. At such times, the ends of the plate are overlapped respectively by the hold-down elements 74 and 76. Owing to this arrangement of the hold-down elements, there is never as much as half of the circumference of the plate between any two of these hold-down elements.

The element 76, in addition to acting as a hold-down element when the plate is in its reversed positions, also acts as a limit stop to determine the position of rest of the plate. To this end, the element is provided with a pair of recesses 78 and 80 to receive a pair of pins 82 and 84 which project upwardly from the plate 24. Figure 2 shows the pin 82 engaging in the recess 78. When the plate is reversed, the pin 84 engages similarly in the recess 80. In order to lock the plate in its reversed positions, a plunger 85 may be provided to project up through the top of the pedestal and to enter one or the other of a pair of holes 86 and 88 in the plate 24. This plunger, as indicated in Figure 3, may be attached to a treadle 90 which is pivotally mounted as at 92 within the pedestal and is provided with a spring mechanism 94 arranged to push the plunger 85 upwardly. When the seat is to be reversed, the projecting treadle 90 is pressed by the foot of the operator so as to move the plunger 85 clear of the plate 24, this motion being against the compression of the spring 94. The seat is then swung around to its reversed

position, whereupon the plunger **85** is pushed up into the hole **88** by the spring **94**, thus locking the plate securely in its opposite reversed position.

Owing to the rotative movement of the plate about three different consecutive pivots, the path described by the center point of the plate during a reversing movement roughly resembles a triangle the sides of which are concave arcs. The initial swing of the chair and its carriage about an axis of rotation which is well in front of the mid-point of the chair carries the center-point of the plate toward the aisle, that is, away from the adjacent wall of the vehicle. This movement toward the aisle is rapid so that the corner of the chair readily clears the wall. In addition to this movement, there is also a certain amount of shifting forward, owing to the location of the initial axis of rotation, which helps to prevent interference between the seat backs and the backs of adjacent seats. The second portion of the reversing movement, namely, about the fulcrum **40**, shifts the center-point of the plate across the median of the pedestal. The third and final portion of the reversing movement is the exact reverse of the first portion.

When the plate **24** reverses from one position to the other, its long axis shifts from one side of the median of the pedestal to the other, that is, the plate is offset forward as may be seen from the fact that the recess **26** (at the front edge of the plate) is in engagement with the fulcrum **36** or the fulcrum **38**, the rear recess **28** being spaced from the fulcrum **38** or the fulcrum **36**. If the seat **32** is mounted on the frame **30** so as to be centered with respect to the plate **24**, it will be forwardly offset from the median of the pedestal when in either of its reversed positions. This helps to avoid interference between the backs of adjacent seats and thus permits a closer spacing of the pedestals.

Instead of a treadle-operated locking plunger **85**, other means may be provided for holding the seat releasably in one or more intermediate positions. To this end, a detent or plunger **96**, pressed by a spring **97**, may be mounted within the base, as shown in Figure 3*a*, the top of the plunger being rounded as at **98** so as to ride in and out of two or more shallow depressions **100** formed in the under face of the plate **24**. The plunger **96** holds the seat in any one of a number of positions corresponding to the various recesses **100**. The spring **97** seats on a screw-threaded plug **99** by which the compression of the spring may be adjusted. A lock nut **101** is provided to secure the plug **99** in adjusted position. When a sufficient turning force is impressed on the seat and its carriage, the surfaces of the depressions **100** have a camming action on the rounded top of the plunger **96** to force it down flush with the top of the pedestal and release the seat for turning movement. Recesses **100** are provided to hold the seat in each of its reversed positions. Additional recesses may be provided according to the intermediate positions in which it may be desired to hold the seat. As indicated in Figures 4, 5 and 6, the recesses **100** are so arranged as to hold the seat in positions differing approximately by about 45°.

It is sometimes desirable to have the seats tilt forwardly as they begin to move from one reversed position to the other. For instance, when the seats are arranged as close as possible so as to economize space within a bus or railway car, the sloping backs of the seats are liable to interfere with each other when the seats are being reversed. Such interference can be largely avoided by tilting the seats forward. Figures 7 to 10, inclusive, illustrate a form of the invention which provides for automatic tilting of the seat during reversing movement thereof. As hereinbefore described, the carriage for the seat may include a plate **24** on which is mounted a spider **30** consisting of four arms extending outwardly from the central portion of the table. The forward arms are provided with hinge elements **102** at their extremities, the seat being hinged to the carriage at these points. The rear of the seat rests upon the ends **104** of the rear arms, this connection between the seat and its carriage permitting forward tilting of the seat. As indicated in Figure 8, the plunger **110** projects downwardly from the seat **32**, this plunger terminating at its lower end in a ball **112** which is adapted to ride upon an inclined trackway **114**. This trackway is supported by and may be a part of the pedestal **20**. The trackway also includes a pair of members **116**. Each of these members is provided with a recess **118** which receives the neck or reduced portion **120** of the plunger **110** immediately above the ball **112** so as to hold the seat against tilting movement when it is in either of its positions for use. The plate **24** is provided with marginal recesses **26** and **28**, as hereinbefore described, to engage fulcrum elements **36**, **38** and **40**. When the seat is reversed, the plunger **110** moves clear of the recess **118** and the ball **112** thereupon rides up on the inclined face of the members **116** and **114**, causing the seat to tilt forward. In order to prevent interference between the plunger **110** and the hold-down element on the second fulcrum element **40**, a hold-down element **124** is provided with a pair of spaced horns **122** and **126** so arranged that the plunger **110** moves freely in the space between the horns during the mid-portion of the reversing movement of the seat. The horns are of sufficient length to overlap the margin of the plate **24** for any position of the plate, so that this hold-down element, like the hold-down element **74** (Figure 2), is effective at all times. During reversing movement of the chair, the tilt increases until the chair is half-way around, as shown in Figure 10. The ball **112** then slides down the inclined faces of the member **114** and the other member **116** until the neck **120** of the plunger enters the other recess **118**.

It is evident that various modifications and changes may be made in the embodiments of the invention herein shown and described, without departing from the spirit or scope of the invention as defined in the following claims.

I claim:

1. A reversible seat-base mechanism comprisprising a stationary pedestal with a plane upper surface portion, a carriage slidable on said surface portion for reversing movement, three spaced fulcrum elements on said pedestal engageable successively by edge portions of said carriage as it is reversed, and means for maintaining said carriage in contact with said fulcrum elements in succession during portions of the rotative movement of the carriage.

2. A reversible seat-base mechanism comprising a stationary pedestal with a plane upper surface portion, a carriage including a plate slidable on said surface portion for reversing movement, said plate having a recess in its front edge and another recess in its rear edge, three spaced fulcrum elements on said pedestal engageable by one or the other of said recessed edge portions

of the plate, and means including said fulcrum elements for maintaining said fulcrum elements in succession in engagement with a recessed edge portion during a substantial angle of swing in the reversing movement of said carriage.

3. A reversing seat-base mechanism comprising a stationary pedestal having a plane upper surface portion, a carriage for the seat including an oval plate slidable on said surface portion, and means for guiding and constraining the reversing movement of said carriage, three spaced fulcrum elements engageable successively by the edge of said plate to serve as temporary pivots for the plate, and auxiliary cam means for causing said plate to shift from each said fulcrum element to the next during its reversing movement.

4. A reversing seat-base mechanism comprising a stationary pedestal with a plane upper surface portion, a seat carriage including an oval plate slidable on said surface portion for reversing movement and having a pair of marginal recesses at the ends of its minor axis, three fulcrum elements mounted on said pedestal for engagement in succession with one or another of said recesses, and means for stopping reversing movement of said carriage when the seat reaches either of its positions for use.

5. A reversing seat-base mechanism comprising a stationary pedestal with a plane upper surface portion, a seat carriage including an oval plate slidable on said surface portion for reversing movement and having a pair of marginal recesses at the ends of its minor axis, three fulcrum elements mounted on said pedestal for engagement in succession with one or another of said recesses, a spring-pressed detent mounted on said pedestal and pressed upwardly against the under face of said plate, said plate having shallow recesses therein to receive the upper end of said detent when the carriage reaches predetermined positions in its reversing movement, and means for stopping said carriage when it reaches either of its extreme positions.

6. A reversible seat-base mechanism comprising a stationary pedestal with a plane upper surface portion, a carriage for the seat including an oval plate slidable on said surface portion for reversing movement, said plate having its major diameter parallel to the long axis of the pedestal when the seat is in either position for use, said plate also having front and rear recesses in its margin at the ends of its minor diameter, and three fulcrum elements mounted on said pedestal, one in front of said plate, the second at the end of the pedestal remote from the aisle end, the third at the rear of the plate, the location of the fulcrum elements and the curvature of the edge of the plate being such that, during the first portion of a reversing movement of the carriage the front recessed portion of the edge of the plate bears against the front fulcrum element and convex portions of the rear edge of the plate slide past the other fulcrum elements, during the mid-portion of the reversing movement the rear recessed edge portion bears against the end fulcrum element while portions of the front edge of the plate slide past the front and rear fulcrum elements, and during the final portion of the reversing movement the front recessed edge portion bears against the rear fulcrum element while the convex portions of the rear edge slide past the front and end fulcrum elements.

7. A reversible seat-base mechanism comprising a stationary pedestal having a plane upper surface portion, a carriage for the seat including a plate slidable on said surface portion, and means constraining said plate to swing about an axis near the mid-point of the front edge of said pedestal during a substantial initial portion of the reversing movement and to swing about an axis at an end of said pedestal during a substantial mid-portion of the reversing movement and to swing about a third axis near the mid-point of the rear edge of the pedestal during a substantial final portion of the reversing movement.

8. A reversing seat-base mechanism comprising a stationary pedestal having a plane upper surface portion and an inclined trackway, a carriage including an oval plate having marginal recesses at the ends of its minor diameter and slidable on said surface portion for reversing movement, a seat tiltably mounted on said carriage, a plunger projecting down from said seat to ride on said trackway and tilt said seat forward during reversing movement of said carriage, three fulcrum elements mounted on said pedestal for successive engagement by one or another of said recesses during reversing movement of the carriage, and hold-down elements on said fulcrum elements arranged to overlap the margin of said plate at all times without interfering with the travel of said plunger.

9. A reversible seat-base mechanism comprising a stationary pedestal having a plane upper surface, a seat carriage including an oval plate slidable on said surface to reverse the carriage from positions in which the minor diameter of the oval plate is in a front-to-rear direction, a pair of fixed fulcrum elements adjacent to the ends of said minor diameter of the plate, a third fulcrum element adjacent to an end of the major diameter of the plate, hold-down elements projecting from said fulcrum elements to overlap marginal portions of said plate, and means for restricting the movement of said plate on said surface so that the plate engages said fulcrum elements in succession during a reversing movement.

OIVA E. HILL.