Sept. 15, 1964 S. B. HENDRICKSON 3,148,916

THEATRE CHAIR WITH SPRING BIASED SEAT

Filed Feb. 21, 1961 3 Sheets-Sheet 1

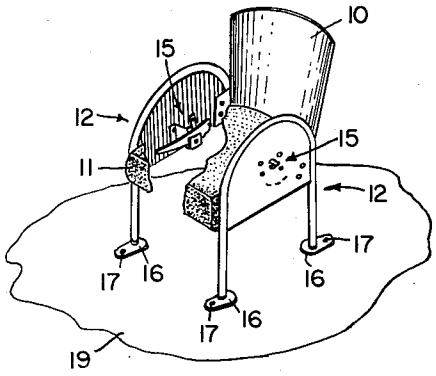


Fig. 1

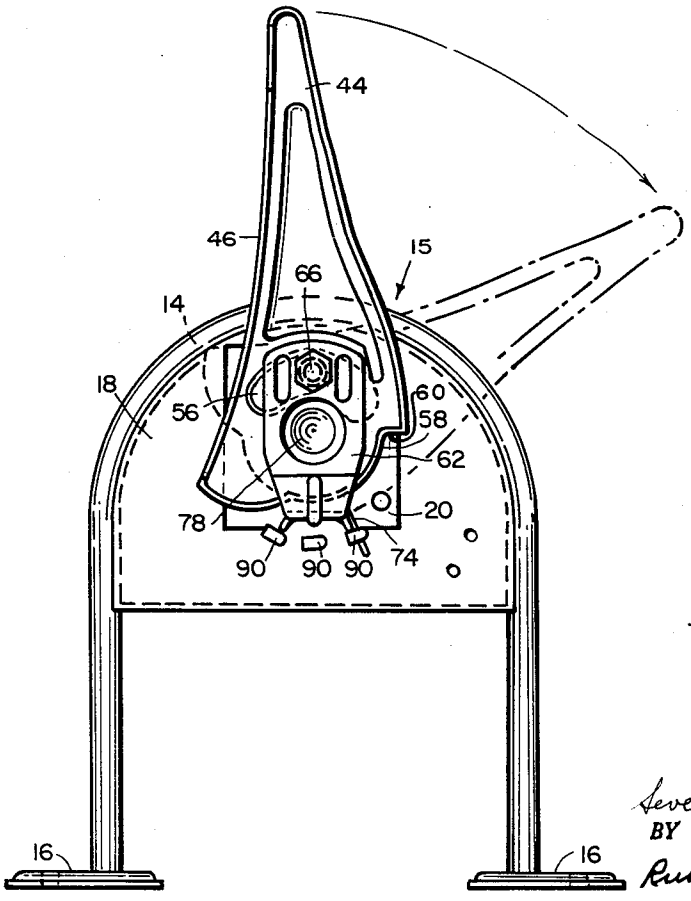


Fig. 2

INVENTOR.
Severin B. Hendrickson
BY
Russell, Chittick & Pfund
ATTORNEYS

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Filed Feb. 21, 1961 3 Sheets-Sheet 2

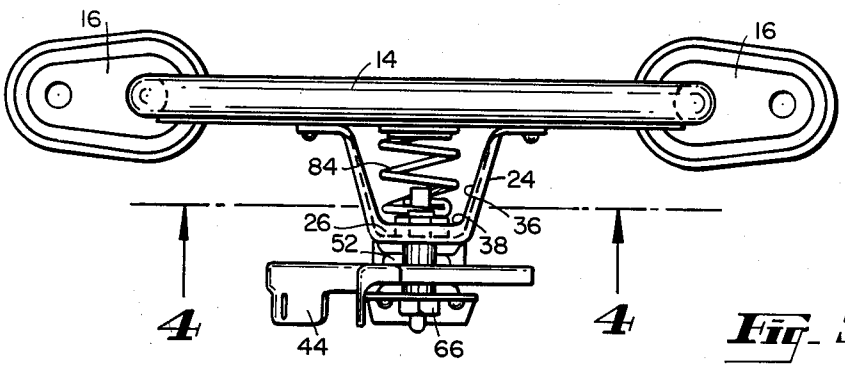


Fig. 3

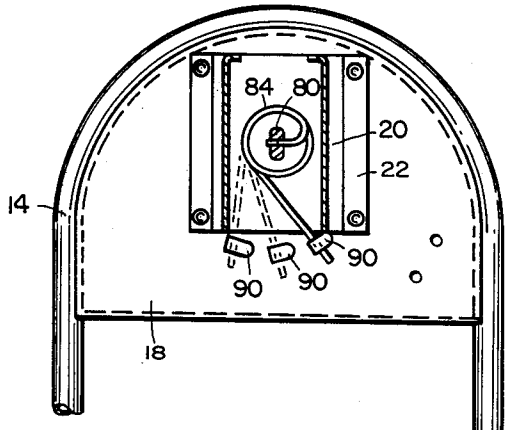


Fig. 4

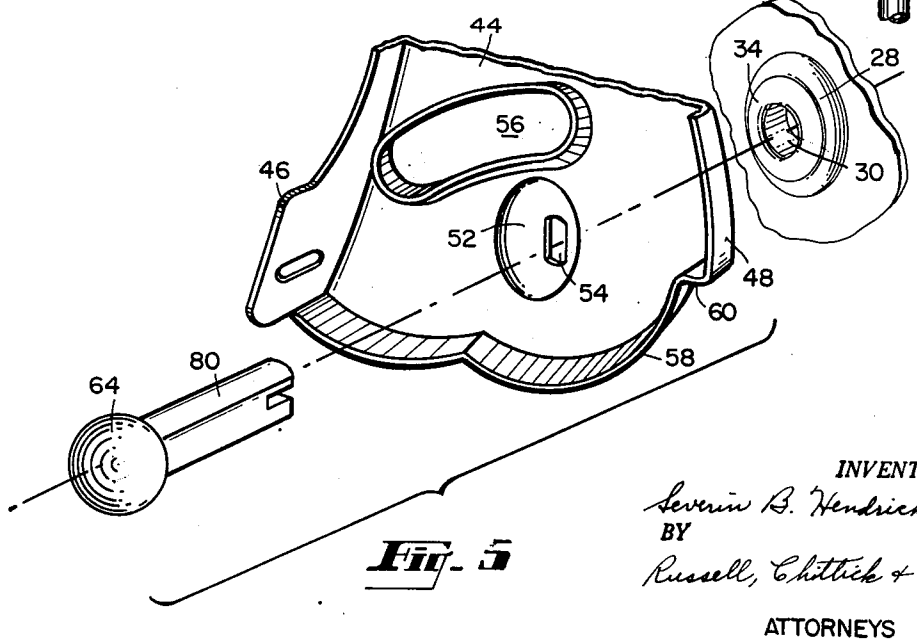


Fig. 5

INVENTOR.
Severin B. Hendrickson
BY
Russell, Chittick & Pfund
ATTORNEYS

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Filed Feb. 21, 1961 3 Sheets-Sheet 3

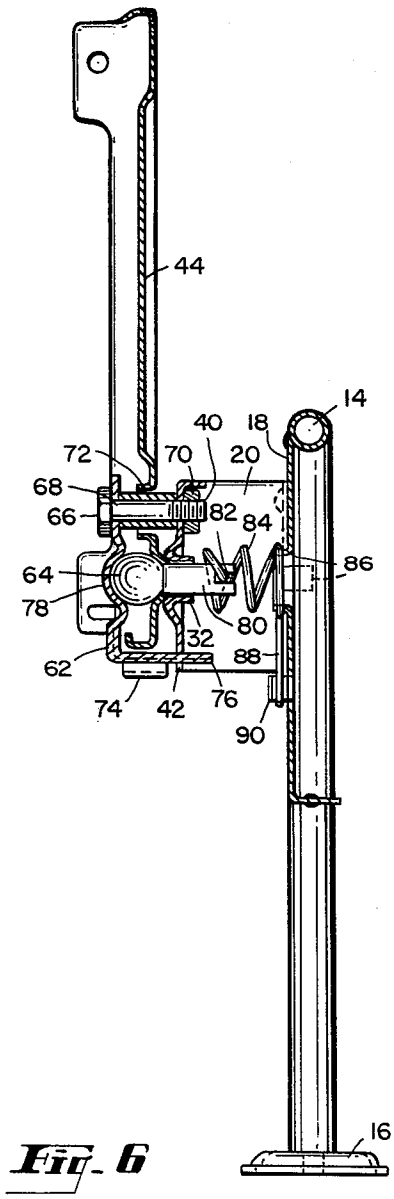


Fig. 6

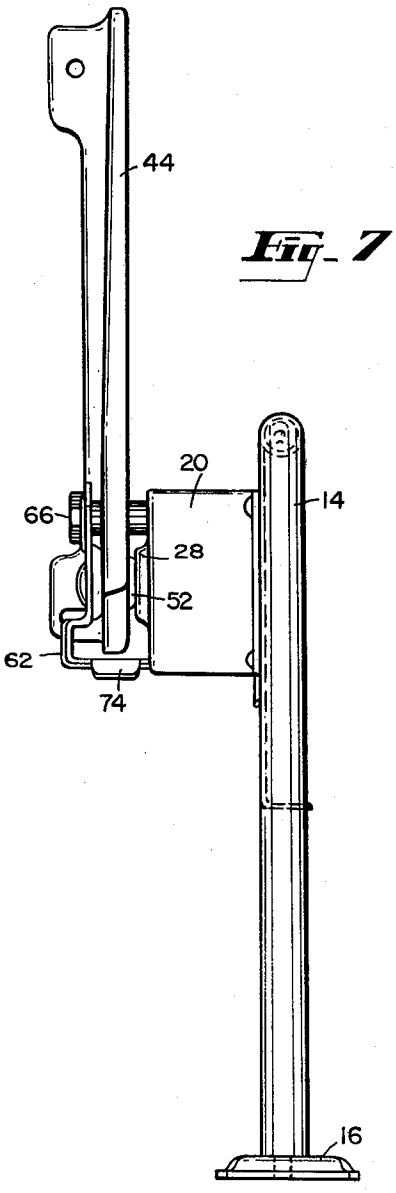


Fig. 7

INVENTOR.
Severin B. Hendrickson
BY
Russell, Chittick & Pfund
ATTORNEYS

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THEATRE CHAIR WITH SPRING BIASED SEAT

Severin B. Hendrickson, Templeton, Mass., assignor to Heywood-Wakefield Company, Gardner, Mass., a corporation of Massachusetts

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1 Claim. (Cl. 297—333)

This invention relates to chairs and more particularly to hinge members for pivotally mounting the seat portion of chairs used in theatres or the like.

It is common in the construction of theatres to provide seats securely affixed to the floor. By employing such "permanent" seats, several vital advantages are secured to the proprietor, among them, certain numbering of the seats and a fixed attractive appearance.

A plurality of permanent seats does, however, present problems, especially where the rows of seats are spaced relatively closely. One major difficulty inherent in such permanent seating arrangements is that it is usually desirable to pivot the seat portion of the chair upwardly to permit the easy passage of persons between rows. It is also usually necessary for patrons to fold up the seat in which they are sitting to permit others to pass by them. It is, therefore, customary to provide theatre seats which, when unoccupied, automatically assume a folded position. Seats of this design have several defects as constructed under the prior art. They frequently fold up with such force that an unpleasant noise is created when the hinge member comes to rest against its support. The hinge members are often a relatively complex system of levers, etc. which require repairs. Repairs are, however, generally difficult to accomplish where the seats are positioned adjoining each other in rows.

Accordingly, it is an object of my invention to provide a theatre seat incorporating hinges which operate quietly and which employ a simple construction having a minmum of moving parts.

In the preferred embodiment of my invention, I provide a theatre chair having a spring-biased seat pivotably suspended between a pair of fixed standards, which do not necessarily need to be parallel to each other. The pivotable suspension of the seat is accomplished by means of two hinge assemblies each including a pair of complementary ball-and-socket joints on either side of the seat, the first of the joints being disposed between one of the standards and the seat and the second of the joints being disposed between the other standard and the seat. Thus, the seat may be pivoted even though all the elements of the complementary ball-and-socket joints are not physically aligned with each other. The spring biasing of the seat is accomplished through a pair of biasing springs on either side of the seat, each spring being operative through its adjacent ball-and-socket joint on a side of the seat. At the same time, I provide a means for independently adjusting the tension on each of the springs and mechanical stops to limit rotational movement of the seat within adjustable limits.

It is a feature of my invention that the spring-loaded pivot members of my chairs provide optimal bearing surfaces regardless of the deviation, within large limits, of the standards from a parallel relationship.

It is another feature of my invention that the tension of the spring means associated with each pivot member in my chair may be adjusted independently and easily.

It is a further feature of my invention that assembly and disassembly of a theatre chair incorporating my hinge is extremely simple.

It is yet another feature of my invention that means are provided for quieting the operation of the hinges of a theatre chair and for selecting the angular distance through which the seat may move.

These and other objects and features of my invention will appear as the description proceeds with the aid of the accompanying drawings, in which:

FIG. 1 is a perspective view of a theatre chair, partially broken away, to show a hinge assembly according to my invention;

FIG. 2 is side elevation of a hinge assembly according to my invention mounted for operation;

FIG. 3 is a plan view of the mounted hinge of assembly FIG. 2;

FIG. 4 is a cross-section along the line 4—4 of FIG. 3;

FIG. 5 is a fragmentary exploded view of my invention showing the manner in which the rotatable joint is assembled;

FIG. 6 is a vertical section of the mounted hinge assembly of FIG. 2; and

FIG. 7 is an end view of the mounted hinge assembly of FIG. 2.

Referring now to the accompanying drawings, it may be seen that a threatre chair incorporating my invention comprises a back rest **10** rigidly affixed to a pair of standards **12** and a seat **11** pivotably mounted between the standards **12** by means of hinge assemblies **15**. In passing, it should be noted that the shape and constructional details of the back rest **10** and the seat **11** are not critical to my invention, provided only that each of the elements be adapted to connection with the pair of standards **12**. It should also be noted that I have chosen, for simplicity, to show a single theatre chair, it being understood that many chairs similar to the one illustrated would ordinarily be mounted side by side to make up rows of chairs in a theatre, the adjacent chairs in each row sharing standards.

Each standard **12** is preferably fabricated as shown in FIG. 2. That is, a tubular frame member **14** is bent to a U shaped configuration and a foot **16** is affixed in any convenient way, as by welding, to each end of the tubular frame member **14**. Each foot, before assembly to the tubular frame member **14** is stamped, or otherwise worked, to provide bolt holes to receive a number of bolts **17** to attach the completed standard **12** to a floor **19**. A plate **18** is attached, again as by welding, to the tubular frame member **14** to complete assembly of the standard **12**. Preferably, the plate **18** is worked so as to provide the various illustrated mounting holes and tabs in and on the plate **18** before the plate **18** is affixed to the tubular frame member **14**. In addition, an arm rest (not shown) is attached to the tubular frame member **14** in the ordinary case.

One of the hinge assemblies **15** is shown in detail in FIGS. 2 through 7. It will be understood that the hinge assembly not illustrated is identical to the illustrated one except that the elements thereof are reversed to be adapted to use on the side of my chair opposite to the illustrated hinge assembly **15**. Since such adaptation is obvious to one having skill in the art, only one hinge assembly will be described herein for the sake of simplicity of explanation.

A bracket **20**, which may be considered to be the base element of the hinge assembly **15**, is riveted to the standard **12**, as shown. The bracket **20** preferably is a stamped metallic element having outwardly extending feet **22** (through which the rivets joining the bracket **20** to the plate **18** pass), and a pair of converging walls **24** rising from the outwardly extending feet **2**, the outer ends of the inclined walls **24** being joined by a substantially flat section **26**. A boss **28** is formed centrally of the flat section **26** so that the boss **28** projects a short distance outwardly from the surface of flat section **26**. A round opening **30** is punched, or otherwise formed, centrally of the boss **28** and material surrounding the round opening **30** is rolled back through the round opening **30** as indicated

by the numeral 32. The just-described working of the material of the bracket 20 surrounding the opening 30 results in the formation of a socket 34 having the opening 30 at its vertex. In passing, it should be noted that I prefer to strengthen my bracket by forming appropriately shaped ribs 36, 38 along the edges of the converging walls 24 and the flat section 26, as shown most clearly in FIG. 4. It will be immediately recognized, however, that the shape and disposition of any strengthening ribs for my bracket may be varied within wide limits. To complete the bracket 20, a bolt hole 40 is formed through the flat section 26 adjacent one of the open ends thereof and the opposite open end of the flat section 26 is cut away so as to form a notch 42 between upper ends of the inclined walls 24, for a purpose to be described hereinafter.

A seat support arm 44 is rotatably mounted on the bracket 20. The seat support arm preferably is formed from a flat piece of metal and shaped to provide a bearing and connecting surface 46 complementary to the particular seat 11 to be supported. At least a pair of openings 47, 47A are provided so that screws (not shown) may be used to connect the seat 11 to the seat support arm 44. As is customary, the seat support arm 44 is provided with appropriately shaped strengthening ribs 48. A portion of the material of the seat support arm 44 adjacent one end thereof is shaped, as by stamping, to form a section of a sphere (hereinafter called the "ball" 52). A rectangular opening 54 is formed in any convenient manner through the vertex of the ball 52. An arcuate opening 56 is formed through the seat support arm 44, the center of curvature of the arcuate opening 56 corresponding with the vertex of the ball 52. A section 58 of the edge of the seat support arm 44 opposite to the arcuate opening 56 is curved, center of curvature of that section also corresponding with the vertex of the ball 52. The seat support arm 44 further is shaped as shown so as to provide a surface 60 substantially perpendicular to the section 58.

It is now obvious that, if the socket 34 and the ball 52 are properly dimensioned, the seat support arm 44 may be placed in rotatable relationship with the bracket 20 by nesting the ball 52 in the socket 34. After the ball 52 is nested in the socket 34, permanent positioning of the two elements is attained by operation of a bearing plate 62 and a ball bearing 64, the ball bearing 64 pressing on the inner surface of ball 52 and the bearing plate 64 being attached to the bracket 20. (As will be made clear hereinafter, the bearing plate 62 also provides stop means for limiting the rotational movement of the seat 11.)

The bearing plate 62 consists of a stamped substantially L shaped piece of metal having its top end rigidly attached to the bracket 20 by means of a bolt 66 passing through a bolt hole 68 in the bearing plate 62, the arcuate opening 56 in the seat support arm 44 and the round opening 40 in the bracket 20. The free end of the bolt 66 is held by a nut 70. It should be noted here that a plastic sleeve 72, made for example from nylon, is slipped over the shank of the bolt 66 and that the width of the arcuate opening 56 is greater than the outside diameter of the plastic sleeve 72. The horizontal portion of the bearing plate 62 is so dimensioned that it slips in the notch 42 in the bracket 20, lips 74, 76 being formed in the bearing plate 62 to cooperate with the ends of the converging walls 24 so as to hold the lower end of the bearing plate 62 in place on the bracket 20. A portion of the bearing plate 62 is formed into a spherical section 78, preferably a section having the same curvature as the ball 52. Therefore, after the ball bearing 64 is positioned between the ball 52 and the bearing plate 62, tightening of the nut 70 on the bolt 66 results in the ball 52 being firmly held in position in the socket 34. Consequently, the seat support arm 44 may be rotated with respect to the bracket 20 and standard 12. Since the ball 52 and socket 34 together make up a species of ball-and-socket joint and the plastic sleeve 72 does not ordinarily touch the seat support arm 44, the plane in which the seat

arm 44 rotates may be varied within rather wide limits. This feature, of course, is of great importance even when it is desired to assemble straight rows of my chairs, since rather large errors in positioning of the standards may be tolerated. The importance of this feature obviously is even greater, if possible, when it is desired to assemble curved rows of my chairs, as for example in a theatre having a round stage, since identical chairs may be used without modification for such purpose almost independently of the curvature of the rows of chairs to be installed.

The structure for spring biasing the seat 11 into a raised position will now be described. A shaft 80 having a rectangular cross-section corresponding to the rectangular opening 54 in the ball 52 is disposed in that opening, one end of the shaft 80 being attached to the ball bearing 64 and the other end of the shaft 80 being notched as at 82 and lying at a point spaced from the plate 18, as shown. The shaft 80 passes through the round opening 30 but does not touch the bracket 20. (It should be noted here in passing that I have implied that the shaft 80 and the ball bearing 64 are two separate elements. Such an implication has resulted solely from the manner in which I have chosen to describe the illustrated embodiment of my invention. In a practical embodiment of my invention, I have preferred to form the ball bearing 64 and the shaft 80 integrally from a single piece of material.) One end of a helical spring 84 is placed in the notched end section of the shaft 80, the helical spring being of such length that its second end abuts the plate 18. A plurality of locating tabs 86 are formed integral with plate 18 so as to project into the helical spring 84 to prevent any sideways movement of the latter element. The free end 88 of the helical spring 84 is extended outwardly from the locating tabs 86 along the inner surface of the plate 18 passing under a selected one of a plurality of holding tabs 90.

In operation, the seat 11 is moved to its raised position and the helical spring 84 is wound so as to provide a force urging the seat 11 into such position. The free end 88 of the helical spring 84 is slipped under one of the holding tabs 90, thereby allowing the force of the helical spring 84 to be transmitted through the shaft 80 and the seat support arm 44 to hold the seat 11 in place. Of course, if it is desired for any reason to change or adjust the tension of the helical spring 84, the free end of the helical spring 84 may be moved to any other one of the tabs 90.

The travel of the seat upwardly preferably is limited so that when a number of my chairs are arranged in a row, the top of each unoccupied seat in the row is aligned, regardless of the tension of the helical springs in each chair. Limitation of travel is accomplished in the illustrated embodiment by properly selecting the length of the arcuate opening 56 in the seat support arm 44. When the seat 11 is raised to a desired upper limit, the plastic sleeve 72 over the bolt 66 engages the seat support arm 44 at the end of the arcuate opening 56. The use of nylon, or any other similar material, for the plastic sleeve 72 now is apparent since such a resilient material obviously will minimize the amount of noise resulting from sudden stopping of the upward movement of the seat support arm 44.

The travel of the seat 11 downward also must be limited so that the seat 11 may assume its proper position for occupancy. At the same time, the seat 11 must be capable of sustaining the weight of a person. Both these functions are attained when the surface 60 on the seat support arm 44 is moved into contact with the lip 74 on the bearing plate 62.

It will now be apparent to one skilled in the art that many advantages accrue from the use of a chair made according to my invention. For example, the structural elements of my hinge assemblies need not be accurately aligned in fixed relationship to each other, since positioning of the elements automatically is attained during assembly. Even assembly of my chair is simplified since it is possible to attach my hinges to chair standards after

the standards have been affixed to a floor. Further, my hinge assemblies are quiet and dependable in operation and require a minimum of maintenance.

It is my intention to claim all modifications and changes of the example of my invention herein chosen for purposes of disclosure which do not constitute departures from the spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

A chair comprising, a pair of side standards, a back rest connected to and supported by said side standards, a seat element mounted between and supported by said standards by means at each standard comprising: a base member mounted on said standard, a fixed bracket having an aperture extending therethrough mounted on and spaced inwardly from said base member, a shaft mounted for rotation in said aperture, a spherical head on said shaft at its inner extremity, a torsion spring connected between said base member and the outer extremity of said shaft for controlling the rotation thereof within said aperture, a support plate for said seat connected to the side of said seat, a concave hemispherical depression in said support plate mating with the outer hemisphere of said

spherical head on said shaft, a flat-sided slot in said support plate concentrically of said concave depression with said shaft fitting in said slot, said shaft also having flat sides fitting in cooperating relation with said support plate in said slot, and bearing means for retaining said spherical head in said mating relationship with said concave hemispherical depression, whereby said spring resists rotation of said shaft and hence rotation of said support plate by spring torsion, also whereby said standards may assume angular positions differing from said seat to accommodate a variety of curved seating arrangements in auditoriums.

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