May 8, 1962 C. McAFEE 3,033,511

VERTICALLY ADJUSTABLE CHAIRS

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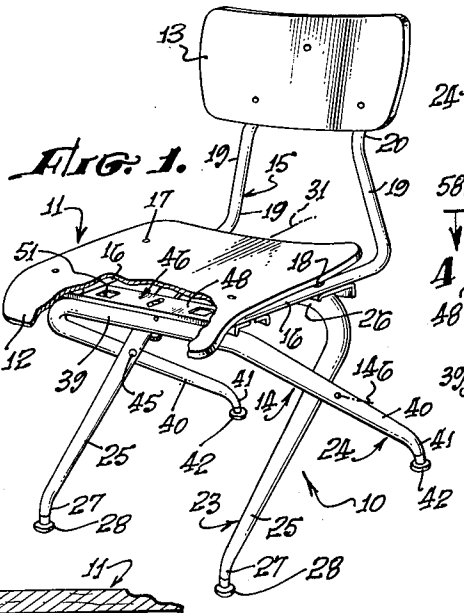


FIG. 1.

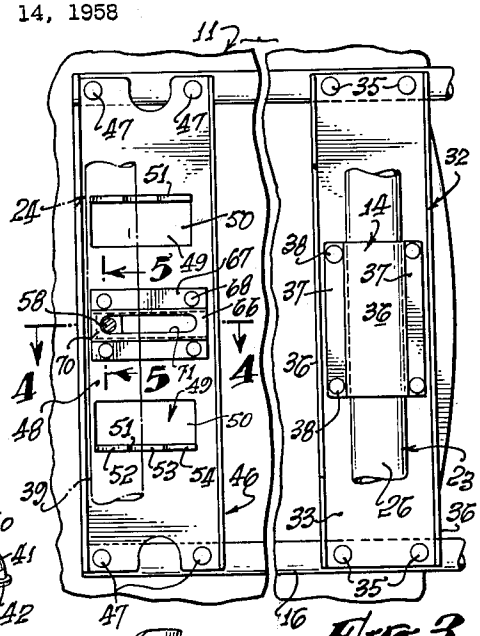


FIG. 3.

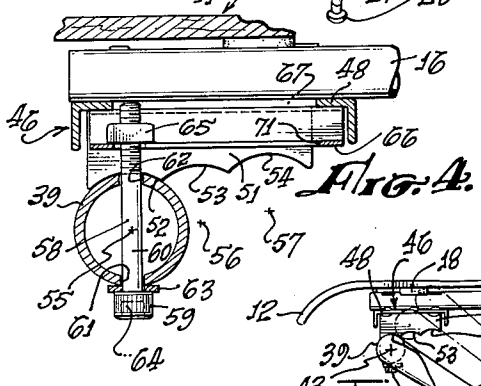


FIG. 4.

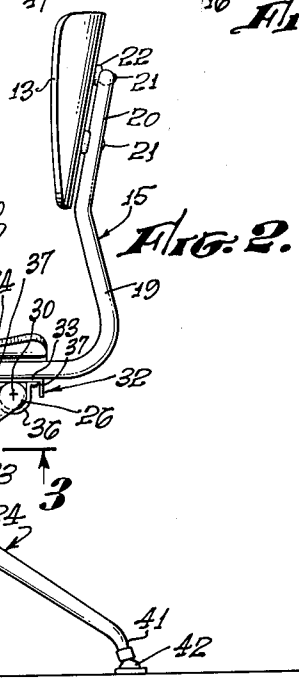


FIG. 2.

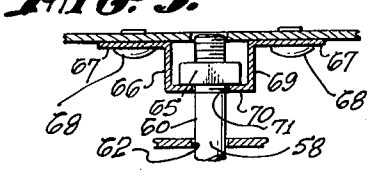


FIG. 5.

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VERTICALLY ADJUSTABLE CHAIRS

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This invention relates to improved adjustable chairs which are particularly adapted in certain respects for use as classroom chairs.

In designing the seating accommodations for a schoolroom, one of the most bothersome problems encountered is that of always providing enough different sizes of chairs in each classroom to properly accommodate the different size students that are to use the chairs. This problem is of course complicated by the fact that the number of students of each size in a certain classroom varies in a completely unpredictable manner from one year to the next, and even during a particular school year.

In the past because of this variation in size of the students, it has been customary in most schools to maintain a storeroom full of extra chairs of various different sizes, so that a janitor can then move chairs from this storeroom into any classroom whenever necessary to satisfy the requirements of a new class or new student. Under such an arrangement, however, the school is required to maintain many more chairs on hand than will ever be used under any particular set of circumstances, with the result that the seating costs are considerably greater than necessary, and with considerable inconvenience to the janitor or other person who has to very frequently move chairs into and out of different classrooms to satisfy varying requirements.

The general object of the present invention is to provide an extremely simple type of vertically adjustable chair, which can be actuated to any of different heights in order to be usable by students of different sizes, to thus obviate the necessity for maintenance of the above discussed very large stock of different sized chairs in a school storeroom. In actual practice, it is contemplated that a certain percentage of the chairs in every class room can be of this adjustable type, with the other chairs in that room being of a fixed height corresponding to the average size of student in that particular grade. This combination of adjustable and non-adjustable chairs will then be flexible enough to allow for the proper seating of the different combinations of students which may use the chairs, and all of this will be achieved without the necessity for ever moving any chair into or out of the room. The adjusting mechanism is such as to allow for adjustment of the chair height very rapidly and easily, and the mechanism is structurally so simple and inexpensive as to make it completely feasible from a practical standpoint to utilize several of the adjustable chairs in each class room, as discussed above.

In order to achieve the above results, a chair embodying the invention has an adjustable height leg or supporting structure, which includes two legs or leg units which are pivoted together intermediate their upper and lower ends to form an X shaped assembly. One of these leg units is pivoted at its upper end to the seat of the chair, while the other leg unit or leg is adapted to be attached in any of different adjusted positions to the seat structure. Adjustment of this second leg or leg unit to its different settings varies the relative angularity of the two legs or leg units in a manner changing the height of the chair seat. In each of its different settings, the upper end of the adjustable leg unit may be receivable within a recess or notch formed in the underside of the seat structure, and may be retained rigidly in the recess by a suitable fastener, preferably a bolt extending upwardly through an upper horizontal portion of the leg unit. Desirably,

each of the leg units is of U-shaped configuration, to form a pair of essentially parallel downwardly projecting spaced legs, interconnected at their upper ends by a horizontal upper portion of the leg unit.

The above and other features and objects of the present invention will be better understood from the following detailed description of the typical embodiment illustrated in the accompanying drawing in which:

FIG. 1 is a perspective view, partially broken away, of a vertically adjustable class room chair constructed in accordance with the invention;

FIG. 2 is a side view of the FIG. 1 chair;

FIG. 3 is an enlarged fragmentary view taken on line 3—3 of FIG. 2;

FIG. 4 is an enlarged vertical section taken on line 4—4 of FIG. 3; and

FIG. 5 is a vertical section taken on line 5—5 of FIG. 3.

Referring first to FIGS. 1 and 2, the chair **10** includes an essentially horizontally extending seat **11**, which may be contoured slightly as shown, and which may curve downwardly at its forward edge **12**. The chair **10** also includes a back **13**, suitably contoured to fit the back of a person using the chair. Both the seat **11** and back **13** may be formed of wood or any other rigid material. For supporting the seat **11** and back **13** in any of several different settings, there is provided a vertically adjustable leg assembly which is represented at **14** in FIGS. 1 and 2.

The back **13** is attached rigidly in fixed position relative to seat **11** by means of a rigid frame member **15**, which preferably takes the form of a metal tube deformed to the configuration represented in FIGS. 1 and 2. More particularly, this tube **15** may have two parallel end portions **16**, extending horizontally and in a front to rear direction along the underside of seat **11**, and rigidly attached to that seat. For effecting such rigid attachment of the arms or portions **16** of tube **15** to the underside of seat **11**, there may be a pair of bolts, rivets, or other fasteners **17** extending through each of the two portions **16** of tube **15**, and extending through seat **11** to secure these parts together. Also, the rigidity of the connection may be increased by interposition between each of the portions **16** and seat **11** of a pair of locating elements **18**, which bear upwardly against the underside of the seat, and whose bottom surfaces are curved to embrace or extend partially about portions **16** of tube **15**. At the rear ends of two portions **16** of tube **15**, this tube extends upwardly at **19**, and may form an inverted U-shaped portion **20** of tube **15** at the rear of back element **13**. This portion **20** may be rigidly secured to the back by screws or rivets **21** and elements **22**, corresponding to parts **17** and **18** of the seat structure.

The adjustable leg assembly or support assembly **14** includes two crossed leg units **23** and **24**, which form together an essentially X-shaped structure as seen from the side of the chair (see FIG. 2). Describing first the leg unit **23**, this unit is of essentially U-shaped configuration, forming two parallel downwardly projecting legs **25** which are interconnected at their upper ends by a horizontally extending cross piece or connector portion **26**. This entire U-shaped leg unit **23** may be formed as a rigid metal tube, with the upper horizontal portion **26** of the tube desirably being externally cylindrical and of uniform diameter, and with the downwardly projecting parallel legs **25** preferably being of downwardly tapering configuration, and typically having downturned portions **27** at their lower ends. A pair of shiftable feet elements **28** may be carried by the lower ends of the two legs **25**, for engaging the floor surface **29** on which the chair rests.

The first of the two leg units **23** is pivotally connected at its upper end **26** for swinging movement about an axis

30 relative to seat 11 and the rest of the seat structure attached to the under side thereof. This axis 30 extends directly transversely of the front to rear axis 31 of the chair, and axis 30 is desirably horizontal and coincides with the axis of the upper horizontal cylindrical portion 26 of leg unit 23. To mount the leg unit 23 for this swinging movement, there is provided at the under side of seat 11 a rigid preferably metal frame element 32, which may take the form of a downwardly facing channel rigidly attached to the underside of the two portions 16 of element 15. This channel 32 may have an upper horizontal portion 33, elongated transversely of the chair, and typically secured to portions 16 of part 15 by rivets represented at 35 (see FIG. 3). The front and rear edges of channel element 32 may be turned downwardly to form flanges 34. Between the two flanges 34, there is attached to the underside of portion 33 of channel 32 a rigid bearing or strap element 36, which curves semi-cylindrically about the underside of portion 26 of leg unit 23, and fits closely about that portion 26 in a manner confining leg unit 23 for only the desired pivotal movement about axis 30 relative to the seat. This strap element 36 extends upwardly at both the front and rear of portion 26 to form a pair of connector flanges 37 which are rigidly riveted at 38 to portion 33 of channel 32. The strap element 36 holds portion 26 of leg unit 23 upwardly against horizontal portion 33 of channel element 32, but is sufficiently loose to allow for the mentioned swinging movement of leg unit 23 about axis 30.

The second leg unit 24 is essentially very similar to leg unit 23, being formed of a rigid metal tube deformed to a U-shaped configuration, to have an upper horizontally extending uniform diameter cylindrical portion 39, and two parallel downwardly tapering leg portions 40 turned downwardly at 41 and carrying shiftable feet 42. The horizontal axis 43 of upper portion 39 of leg unit 24 preferably extends directly parallel to pivotal axis 30 of leg unit 23. Also, the two parallel downwardly projecting legs 40 formed by unit 24 are pivotally connected at 44 and 45 to the two corresponding legs 25 respectively of unit 23. The pivotal axis 46 of connection 44 coincides with the pivotal axis of connection 45, and extends horizontally and directly parallel to the two previously mentioned axes 30 and 43. I find it preferable for the portions of the legs 25 which are located beneath pivotal connections 44 and 45 to be substantially equal in length to the portions of the legs 40 which are located beneath connections 44 and 45. However, it is preferred that the portions of the legs 40 which are located above connections 44 and 45 be somewhat shorter than the portions of the legs 25 which are located above those connections, as seen clearly in FIG. 2, in order to allow for the proper horizontal positioning of seat 11 under all of the different adjusted conditions of the chair.

The upper horizontal portion 39 of leg unit 24 is not attached to the seat structure in any fixed position, but rather is adjustable relative to the seat structure, and toward and away from the upper portion 26 of leg unit 23. In the drawings, the portion 39 has been illustrated as being adjustable to any of three different settings. For locating the portion 39 in any of those different settings, there is provided at the forward ends of portions 16 of element 15 a second rigid metal channel member 46, similar to the previously described channel 32, and extending transversely of the seat at the underside of portions 16. The opposite ends of channel member 46 are rigidly secured to portions 16 in any suitable manner, as by rivets represented at 47 (see FIG. 3). At two locations spaced apart longitudinally of channel member 46, the horizontal portion 48 of this channel member is cut and deformed to form a pair of downwardly projecting parallel rigid flanges 51, which lie in parallel vertical planes extending in a front to rear direction with respect to seat 11 (and which leave apertures 49 where the material of member 46 is cut to form flanges 51). The bottom edges of flanges 51 are shaped to form three arcuate downwardly facing notches or recesses 52, 53 and 54 in each of the flanges, with the recesses in one flange being aligned transversely of the chair with the recesses in the other flange. These arcuate recesses are centered about horizontal axes 55, 56 and 57 (see FIG. 4), which axes are parallel to the other axes 30, 43 and 46 of the chair. The radii of curvature of the three recesses 52, 53 and 54 correspond to the radius of curvature of the outer surface of upper horizontal portion 39 of leg unit 24. Thus, in one setting of the leg assembly, the upper portion 39 of leg unit 24 fits or nests closely within recesses 52 of the two brackets 49, while in two other settings of the leg assembly, the portion 39 nests within recesses 53 and 54 respectively. As seen in FIG. 4, the recesses 53 may be slightly above the level of recesses 52, and the recesses 54 may be slightly above the level of recesses 53.

For rigidly and tightly retaining portion 39 of leg unit 24 in any of its three different settings, there is provided a locking screw or fastener 58, having a lower enlarged head 59, and having a shank 60 which projects upwardly through apertures 61 and 62 formed in the center of the upper portion 39 of leg unit 24. Between head 59 and the underside of portion 39, there may be provided a washer as represented at 63. Also, head 59 is adapted to be actuated by any suitable type of tool, preferably by an Allen wrench which is receivable within a non-circular Allen wrench recess 64 formed in the underside of head 59.

The upper end of shank 60 is threaded, and engages a desirably externally square nut 65, which is movably confined within a guide bracket 66 attached to the under side of portion 48 of forward channel member 46. Element 66 is desirably elongated in a front to rear direction, and has the transverse cross-sectional configuration represented in FIG. 5. More particularly, this element 66 may have a pair of upper horizontal flange portions 67 which are riveted to the under side of channel element 46 at 68. At opposite sides of nut 65, element 66 may form a pair of parallel vertical side walls 69, which engage the nut in a manner preventing rotation thereof, while permitting front to rear movement of the nut except when bolt 58 is in its tightened condition. At the under side of nut 65, bracket 66 has a horizontally extending bottom wall 70, which retains the nut against downward movement, but which contains a slot 71 elongated in a front to rear direction and of a width sufficient to pass the shank of bolt 58 downwardly through bottom wall 70. At opposite sides of this slot 71, the bottom wall 70 engages nut 65 in any adjusted position of the nut, to support the nut against downward movement. The front to rear length of slot 71 is sufficient to allow for shifting movement of the bolt and nut with portion 39 of leg unit 24 between any of the three previously mentioned different adjusted positions of leg unit 24.

To now describe the manner of use of the chair illustrated in the drawing, assume first that the chair is initially in the setting or condition in which it is represented in FIGS. 2, 3, and 4. That is, the portion 39 of leg unit 24 is received in the forwardmost pair of recesses 52, and bolt 58 is tightened relative to nut 65 in a manner tightly holding portion 39 upwardly within those recesses. This rigidly locks the leg assembly in the condition of FIGS. 2, 3 and 4, in which condition the seat 11 is in its lowermost position. If it is then desired to raise seat 11 to one of its two other positions, the screw 58 is loosened relative to nut 65, to allow the upper portion 39 of leg unit 24 to be shifted rearwardly into the recesses 53 (for an intermediate position), or into the recesses 54 (for the highest position), following which screw 58 is again tightened with respect to nut 65 to secure the leg assembly rigidly in the changed condition. Thus, the chair may be very easily converted to

any of different heights, for use by students or persons of different sizes. At the same time, the adjusting mechanism is structurally so simple as to render it completely practical to utilize a substantial number of these chairs in every class room within a school.

I claim:

1. A vertically adjustable chair comprising a seat structure, two generally parallel first legs pivotally connected at their upper ends to said seat structure and extending downwardly therefrom at an inclination, two generally parallel downwardly projecting second legs inclined oppositely from said first legs and crossing said first legs respectively at locations intermediate the upper and lower ends of said first and second legs to form therewith two generally parallel and generally X-shaped leg assemblies, means pivotally connecting said first and second legs together at said vertically intermediate locations for relative pivotal adjusting movement to positions of different angularity, a rigid cross piece extending generally horizontally between the upper ends of said second legs and interconnecting them for swinging movement as a unit, said cross piece and upper ends of the second legs being shiftable relative to the seat generally horizontally toward and away from the upper ends of said first legs and between a plurality of different settings to adjust the height of the seat above a floor surface, means mounted to said seat forming a notched structure engageable with said cross piece and containing a plurality of downwardly facing notches within which said cross piece is at least partially received and confined in said different settings respectively, a first threaded element mounted to the seat structure for horizontal adjusting movement relative to said notched structure and generally toward and away from the upper ends of said first legs, and a second threaded element threadedly engaging said first element and positioned to tighten said cross piece upwardly into any of said different notches and to thereby lock the cross piece in any of said different settings upon relative tightening of the two threaded elements, said cross piece being free, upon loosening of said second threaded element, for movement downwardly relative to said seat structure and relative to said notched structure far enough for the cross piece to move downwardly out of a first of said notches and then upwardly into a different notch upon subsequent retightening of the second threaded element.

2. A vertically adjustable chair comprising a seat structure, two generally parallel first legs pivotally connected at their upper ends to said seat structure and extending downwardly therefrom at an inclination, two generally parallel downwardly projecting second legs inclined oppositely from said first legs and crossing said first legs respectively at locations intermediate the upper and lower ends of said first and second legs to form therewith two generally parallel and generally X-shaped leg assemblies, means pivotally connecting said first and second legs together at said vertically intermediate locations for relative pivotal adjusting movement to positions of different angularity, a rigid cross piece extending generally horizontally between the upper ends of said second legs and interconnecting them for swinging movement as a unit, said cross piece and upper ends of the second legs being shiftable relative to the seat generally horizontally toward and away from the upper ends of said first legs and between a plurality of different settings to adjust the height of the seat above a floor surface, means mounted to said seat and forming two notched structures engageable with said cross piece at two spaced locations and each containing a plurality of downwardly facing notches within which said cross piece is at least partially received and confined in said different settings respectively, a shiftable fastener assembly positioned essentially between said two locations at which said notched structures engage said cross piece and acting to releasably lock said cross piece in said different settings, said fastener assembly including a first threaded element mounted to the seat structure essentially between the locations of said two notched structures and for horizontal adjusting movement relative to said notched structures and generally toward and away from the upper ends of said first legs, and a second threaded element threadedly engaging said first element and positioned to tighten said cross piece upwardly into any of said different notches and to thereby lock the cross piece in any of said different settings upon relative tightening of the two threaded elements, said cross piece being free, upon loosening of said second threaded element, for movement downwardly relative to said seat structure and relative to said notched structures far enough for the cross piece to move downwardly out of a first pair of said notches and then move upwardly into a different pair upon subsequent retightening of the second threaded element, and means forming a guideway at the underside of said seat and essentially between said two notched structures and guiding said first threaded element for horizontal adjusting movement but holding it against downward movement relative to the seat.

3. A vertically adjustable chair comprising a seat structure, two generally parallel first legs pivotally connected at their upper ends to said seat structure and extending downwardly therefrom at an inclination, two generally parallel downwardly projecting second legs inclined oppositely from said first legs and crossing said first legs respectively at locations intermediate the upper and lower ends of said first and second legs to form therewith two generally parallel and generally X-shaped leg assemblies, means pivotally connecting said first and second legs together at said vertically intermediate locations for relative pivotal adjusting movement to positions of different angularity, a rigid cross piece extending generally horizontally between the upper ends of said second legs and interconnecting them for swinging movement as a unit, said cross piece and upper ends of the second legs being shiftable relative to the seat generally horizontally toward and away from the upper ends of said first legs and between a plurality of different settings to adjust the height of the seat above a floor surface, means mounted to said seat and forming two notched structures engageable with said cross piece at two spaced locations and each containing a plurality of downwardly facing notches within which said cross piece is at least partially received and confined in said different settings respectively, a shiftable fastener assembly positioned essentially between said two locations at which said notched structures engage said cross piece and acting to releasably lock said cross piece in said different settings, said fastener assembly including a first threaded element mounted to the seat structure essentially between the locations of said two notched structures and for horizontal adjusting movement relative to said notched structures and generally toward and away from the upper ends of said first legs, and a second threaded element threadedly engaging said first element and positioned to tighten said cross piece upwardly into any of said different notches and to thereby lock the cross piece in any of said different settings upon relative tightening of the two threaded elements, said cross piece being free, upon loosening of said second threaded element, for movement downwardly relative to said seat structure and relative to said notched structures far enough for the cross piece to move downwardly out of a first pair of said notches and then move upwardly into a different pair upon subsequent retightening of the second threaded element, and means forming a guideway at the underside of said seat and essentially between said two notched structures and guiding said first threaded element for horizontal adjusting movement but holding it against downward movement relative to the seat, said two second legs and said cross piece all being formed of a single piece of tubing bent to essentially an inverted U-shaped configuration, said first threaded element being a nut slidably confined in said guideway, and said second threaded

element being a screw threadedly engaging said nut and extending essentially vertically and diametrically through the portion of said tubing which forms said cross piece.

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