

Oct. 29, 1946.

C. E. E. LUNDQUIST

2,410,088

ADJUSTABLE CHAIR, BEDSTEAD, STRETCHER, OR THE LIKE

Filed Nov. 3, 1942

5 Sheets-Sheet 1

Fig. 1.

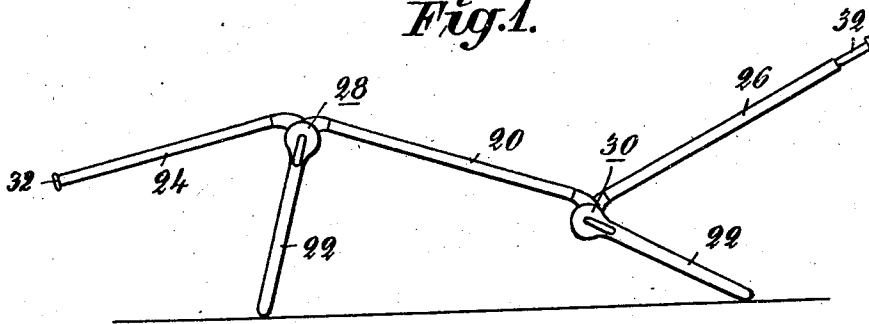


Fig. 2.

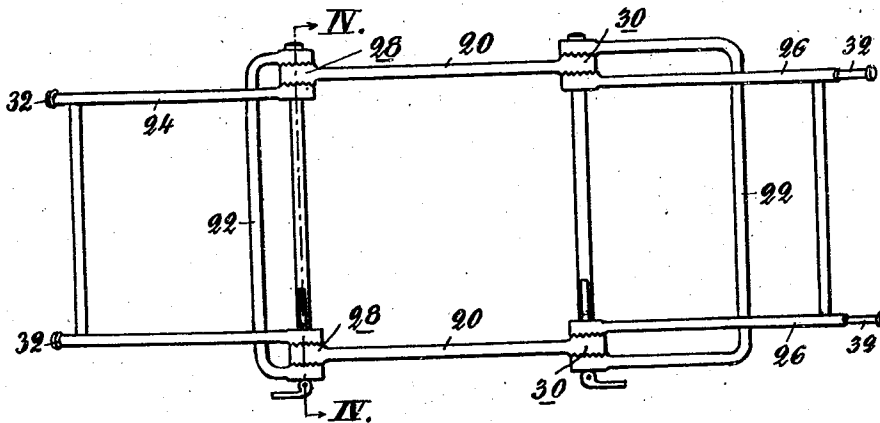
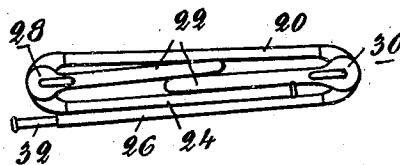


Fig. 3.



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Oct. 29, 1946.

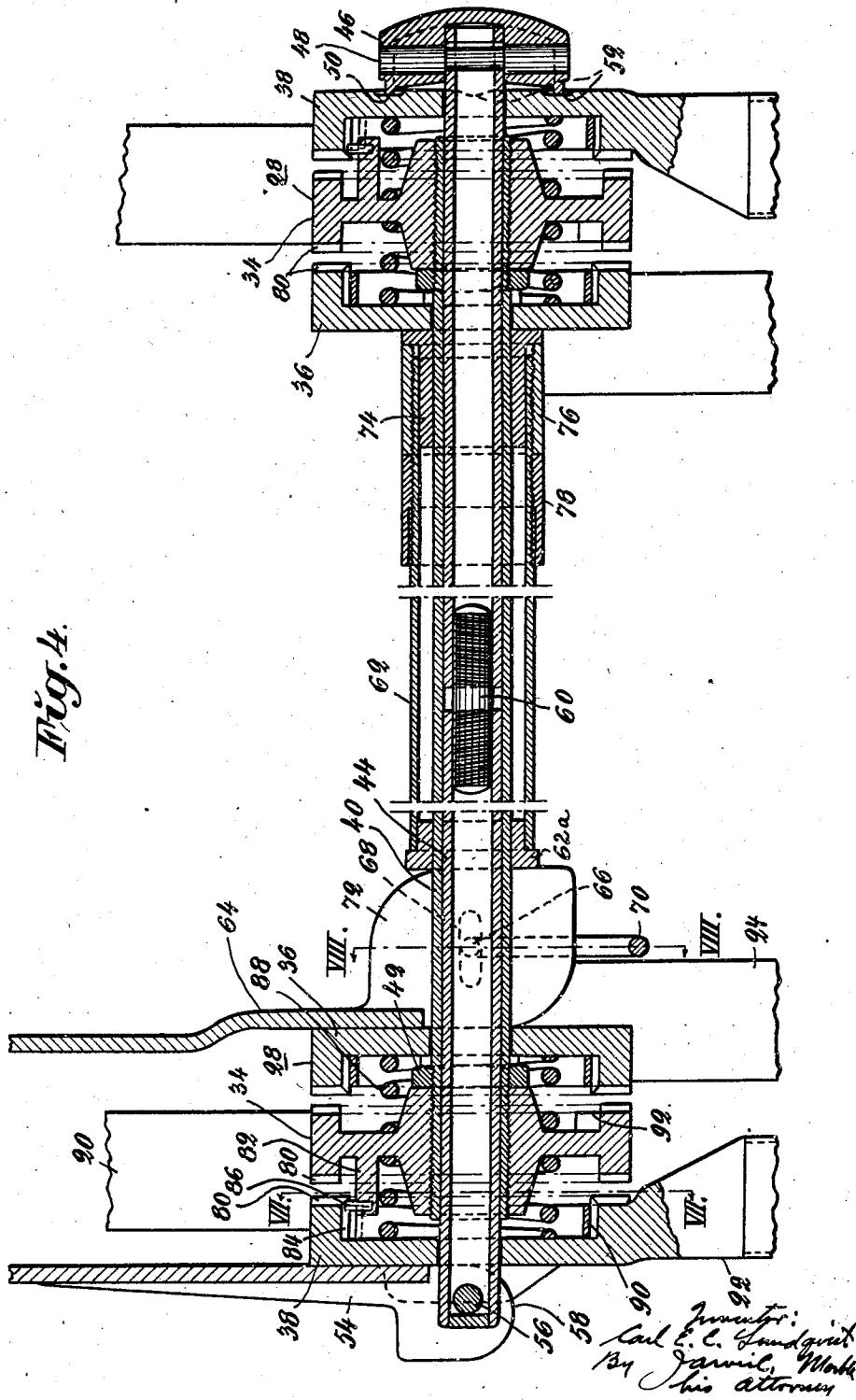
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Oct. 29, 1946.

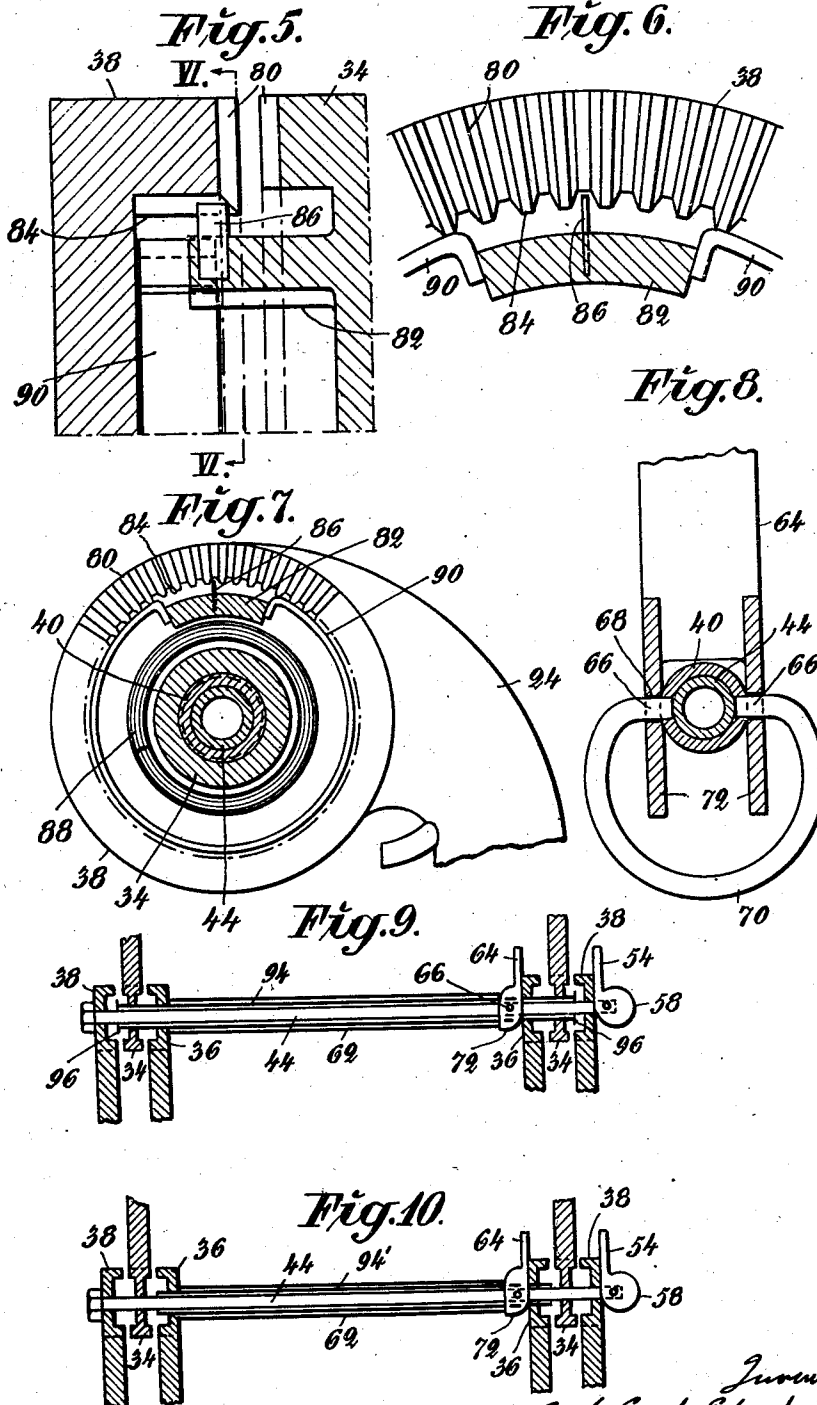
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ADJUSTABLE CHAIR, BEDSTEAD, STRETCHER, OR THE LIKE

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5 Sheets-Sheet 3



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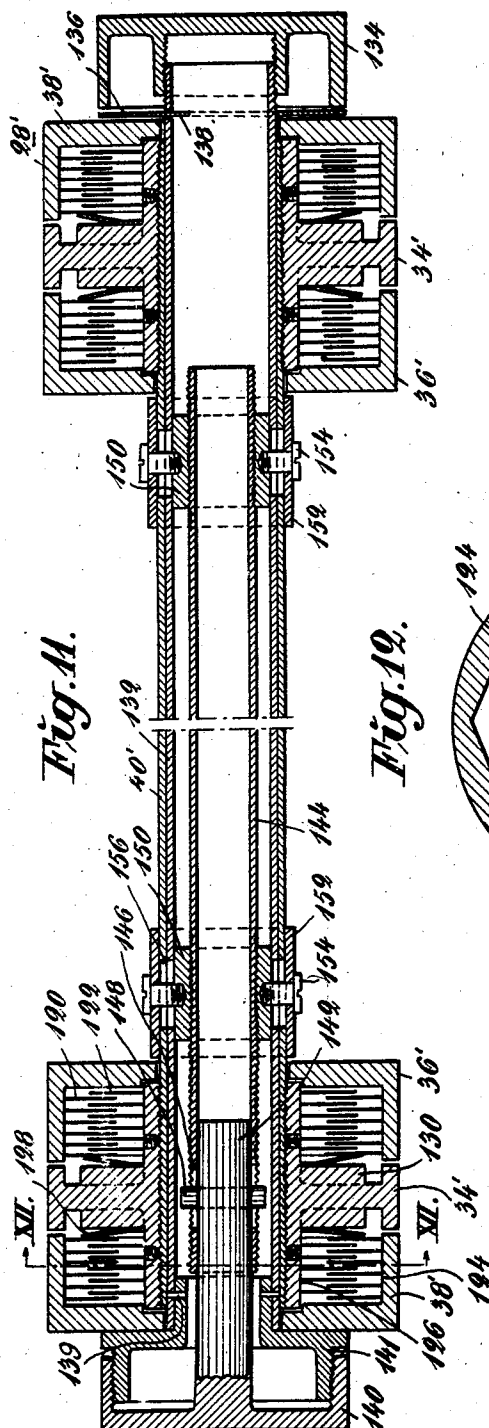
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ADJUSTABLE CHAIR, BEDSTEAD, STRETCHER, OR THE LIKE

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5 Sheets-Sheet 4



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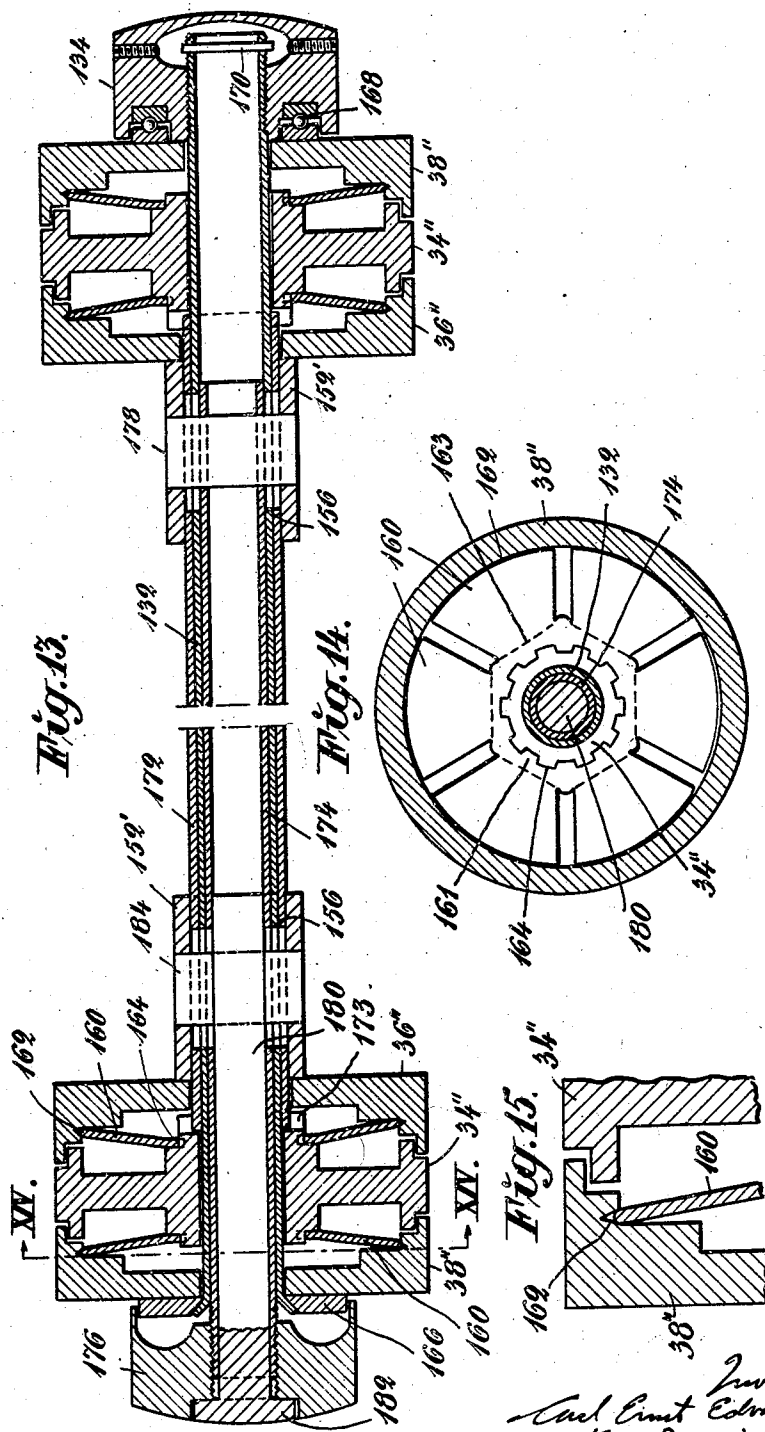
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ADJUSTABLE CHAIR, BEDSTEAD, STRETCHER, OR THE LIKE

Filed Nov. 3, 1942

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,410,088

ADJUSTABLE CHAIR, BEDSTEAD,
STRETCHER, OR THE LIKECarl Ernst Edvard Lundquist, Stockholm,
SwedenApplication November 3, 1942, Serial No. 464,373
In Sweden November 14, 1941

11 Claims. (Cl. 287-101)

1

My invention relates to chairs, bedsteads, stretchers, or the like comprising members or frames adjustable relatively to each other, such as seats, legs and backs having their joints combined in groups in spaced relation to one another. The main object of the invention is to provide joints of this type, by which said members or frames may be partially locked or loosened.

Further objects and advantages of the invention will be apparent from the following description considered in connection with the accompanying drawings which form a part of this specification, and of which:

Figs. 1 and 2 are a side view and a top view, respectively, of a frame of a collapsible chair made in accordance with the invention;

Fig. 3 is a side view of said frame when shut up;

Fig. 4 is a section on the line IV-IV of Fig. 2 on an enlarged scale;

Fig. 5 shows a detail of Fig. 4 in the same section but on still further enlarged scale;

Fig. 6 is a view partly sectioned on the line VI-VI of Fig. 5;

Figs. 7 and 8 are sections on the lines VII-VII and VIII-VIII, respectively, of Fig. 4;

Figs. 9 and 10 show two alternative embodiments by way of more or less diagrammatic representation;

Fig. 11 is a section corresponding to that of Fig. 4 through a still further embodiment of the invention;

Fig. 12 is a section on the line XII-XII of Fig. 11;

Fig. 13 is a longitudinal section through a further embodiment of the invention;

Fig. 14 is a cross section on the line XIV-XIV of Fig. 13;

Fig. 15 shows a detail of Fig. 13 in the same section but on an enlarged scale.

The chair frame illustrated in Figs. 1-8 comprises two frame members 20 forming the seat side bars of the chair, frame members 22 forming legs, foot-rest members 24 and back frame members 26. The frame members, which may preferably consist of metal tubes, are pivotally connected to each other by means of joints, which in the embodiment shown are combined into two front groups and into two rear groups designated generally by 28 and 30, respectively. The joints of each group 28 and 30 are located on opposite sides of the chair. Connected to each group are three frame members. The frame members 20, 24 and 26 each may be bent adjacent to the joints, as will appear from Figs. 1 and 3, so that the

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chair frame may be folded up so as to occupy but a very small space. In the embodiment shown, the frame members 24 and 26 are at the ends provided with handles formed by telescoped tubular members 32, it being understood that the chair may also be used as a stretcher or bedstead. The frame is intended to be covered by a sheet of fabric, cane or the like (not shown).

Each group of joints comprises a hub element 34 (Fig. 4) which is connected to the frame members 20 of the seat of the chair, and two hub elements 36, 38 provided one on each side of the element 34. The elements 36 and 38 of the joints 28 are connected to the foot-rest 24 and to the front legs 22 while the elements 36 and 38 of the joints 30 are connected to the back rest 26 and to the rear legs 22. The central hub elements 34 of each group are threaded onto a hollow shaft 40, as will be seen from Fig. 4, and may be locked by means of a nut 42, if desired. The axial distance between the hub elements 34 is thus fixed.

On the other hand, the hub elements 36, 38 are axially movable relatively to the central hub element 34 so as to permit the frame members of the chair to be rotated relatively to each other and to be locked in the desired position. An internal hollow shaft 44, which is preferably made in two parts, extends between and through the elements of each joint, such as 28, and on one end thereof, outside the outermost hub element 38, it is connected to an abutment, preferably a knurled knob 46 or the like, the connection being effected, for instance, by means of a pin 48 extending through the knob and the shaft. Said pin may then have a somewhat smaller diameter at its central portion located within the shaft 44 than on either side thereof, so that the pin will be retained in its position. The knob 46 bears on the external surface of the hub element 38, and may be provided with projections 50 separated from each other in the peripheral direction, said projections corresponding to recesses 52 in the hub elements. A tightening member, such as an operating arm 54, is secured by means of a bolt 56 to the opposite end of the shaft 44 outside the hub element 38 situated thereat, and is formed with one or two eccentric cam disks 58 bearing on the hub element 38. To decrease the friction, the cam disk may bear on a roller (not shown), for example. When the operating arm 54 is turned by 180° from the position shown in Fig. 4 the two hub elements 38 will be moved in a direction toward the central hub element 34. The two parts of the hollow shaft 44 are preferably secured together by means of a bolt 60, which

is threaded into the end portions of said parts by right and left hand threads. Therefore, when the knob 46 is rotated, the length of the shaft 44 will be altered, it being thus possible in this way to adjust the length thereof, and consequently to vary the force by which the hub elements 33 are tightened against the central hub elements 34.

If desired, the knob 46 may be replaced by a tightening device having the same function as the locking arm 54 to be used alternately with the latter for the sake of convenience.

Arranged on the outside of the shaft 40 and between the two innermost hub elements 36 is a variable distance and locking device which preferably consists of a hollow shaft or sleeve 62 and a tightening device, such as a locking arm 64, cooperating therewith in the axial direction. The locking arm 64 is rotatable about two pins 66 (see particularly Fig. 8), which preferably engage an axially oblong slot 68 in the shaft 40, and which may constitute the end portions of a strap 70. The locking arm 64 is provided with two cam disks 72 having eccentric surfaces bearing on a bushing 62a secured to the end of the shaft 62 and on the lateral surface of the adjacent hub element 36. Bushing 62a also serves to center this end of shaft 62 with respect to shaft 40. When the locking arm 64 is turned by 90° from the position shown in Fig. 4, the two innermost hub elements 36 are forced at the same time to move in a direction toward the central hub elements 34.

The length of the shaft 62 is adjustable. For this purpose the other end portion of the shaft 62 has two sleeves 76 and 78 threaded thereon. The sleeve 76 is intended to bear on a flanged pipe 74 slidable in hollow shaft 62, which, in turn, bears on the hub element 36 while being axially movable relatively to the shaft 62. By rotating the sleeve 76 in the one or the other direction, the length of the shaft 62 together with the flanged pipe 74 may be adjusted. The other sleeve 78 serves to lock the sleeve 76 in the desired position. The external thread of the shaft 62 may, as will appear from Fig. 4, run freely for a distance in that portion of the sleeve 78 which is opposite from the sleeve 76 said portion of the sleeve 78 being undercut.

The hub elements 34, 36, 38 are formed, in the embodiment according to Figs. 1-8, with circular toothed rims 80 on the adjacent lateral sides thereof, the teeth of said rims engaging one another when the hub elements are moved axially against each other to be locked as described above. The teeth of the rims 80 may be of trapeziform. The central hub element 34 is preferably provided with projections 82 extending axially toward the hub elements 36, 38. In Figs. 4 and 5 there is shown the projection 82 which extends towards element 38. A similar projection extends from the other side of central element 34 toward element 36, but does not appear in Fig. 4 as it is ahead of the section. Elements 36 and 38 are formed with an inner toothed rim 84 inside the toothed rim 80, the rim 84 forming a continuation of the rim 80 at an angle of 90° relatively thereto. A resilient strip 86 is secured to the projection 82 and enters between the teeth of this toothed rim 84. When the hub elements are out of locking engagement, the resistance of the resilient strip 86 is overcome during a turning of the frame members of the chair relatively to each other. The strip 86 will then ensure that the teeth 80 of the one element are located right

opposite the spaces between the teeth of the other element after the frame members have been adjusted, so that the teeth will always engage one another when the locking arms 54 or 54 are moved into locking position.

Preferably, helical springs 88 of the same strength are inserted between the central hub element 34 and the two hub elements 36, 38 located on opposite sides thereof, so that the hub elements will be moved apart when the locking arms 54 and 64 are moved out of locking position. A spring 90, preferably of sheet metal, is adapted to press on the inner cylindrical peripheral portion of the hub elements 36 and 38, in the present case the toothed rims 84, with a certain initial tension. The ends of the spring 90 are adapted to bear on the projections 82 of the central hub element 34 (see Figs. 6 and 7). At an adjustment of the relatively angular position of the frame members, the frictional resistance between the cylindrical contact surfaces of the spring 90 and of the elements 36 and 38 respectively, must consequently be overcome. This resistance is suitably determined so that a sufficient braking resistance is set up to prevent the chair from collapsing, for instance through the weight of the frame members, when the locking devices are loosened. The spring 90 offers at the same time practically no resistance at all to the axial displacement between the hub elements, when the latter are to be brought into the locking position. To prevent the spring 90 from being brought out of its proper position, a number of peripherally distributed bosses 92 may be arranged opposite the spring 90 in the central hub element 34. Spring brakes of this type are described more fully in my copending patent application Ser. No. 447,968, now Patent No. 2,361,853 issued October 31, 1944.

As will be seen from the above, two hub elements, for instance the hub elements 36 connected with the foot-rest 24 or with the back 26, may, according to the invention, be locked simultaneously to the hub elements 34 of the seat frame members 20 by a single hand-movement with the aid of the locking arm 64 and independently of the third hub element comprised in two groups belonging to each other, such as the element 38. In spite of the fact that the joints for the legs as well as for the back are built together into common groups, it will thus be possible according to this form of embodiment of the invention to alter the angular position of said back, while the occupant is still sitting or lying in the chair, or, vice versa, it will be possible to alter the angular position of the chair legs while the back is still subjected to loading, which is of importance in cases where the chair is adapted as a stretcher for motor car transports, the legs having then to be shut up underneath the stretcher in consideration of space, without it being necessary to lift the occupant from the same.

In the embodiment according to Fig. 9, as in the other embodiments, the same reference numerals have been used as in Figs. 1-8 for equivalent parts. In place of the shaft 40, which rigidly carries the hub elements 34 according to the preceding embodiment, there is provided a shaft 94, relatively to which the central hub elements 34 of the joints are movable in an axial direction. The shaft 94 is provided with abutments 96 on the outside of the hub elements 34, said abutments limiting the axial freedom of movement of the hub elements in a direction from one another. When the locking arm 64 is turned into the locking position

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about the pins 66 which engage slots in shaft 94, similar to the construction used in the first embodiments and illustrated in Figs. 4 and 8, it presses the inner hub elements 36 outwardly into contact with the hub elements 34 and which, in turn, are brought to bear on the abutments 96. The frame members connected to the hub elements 34, 36 will thus be locked relatively to each other, but the hub elements 38 will not be locked. Now, if the locking arm 54 is also turned into its locking position, it displaces the hub elements 38 inwardly and into engagement with the elements 34 to thereby effect a rigid locking connection between the parts connected with the elements 34 and 38. If the locking arm 64 is now turned back into the initial position (the position shown in the figure), the hub elements 34 and 36 may move inwardly on the shaft 94 and hence the locking effect between all of the hub elements ceases; if it is then moved into its locking position, all of the hub elements will again be locked in cooperation with locking arm 54 (in locking position), the shaft 44 and the abutment provided at the other end of the shaft. In the embodiment according to Fig. 9 it will thus be possible to loosen and to lock all hub elements comprised in a group by a single hand-movement. While the locking arm 64 is in its locking position, the front and rear sets of hub elements 34 and 38 may also be loosened independently from each other and be locked independently to each other, as will be seen from the above. As the element 38 is connected, for instance, with the rear pair of legs of the chair, the angular position of this pair of legs may consequently be varied, without it being necessary to unload the back, which is of importance when the chair is adapted as a stretcher. At the same time the locking arm 64 ensures convenient mounting and demounting of the chair by a single hand-movement.

The embodiment according to Fig. 10 differs from the preceding one only in that the shaft 94' limits the movement of the central hub elements inwardly instead of outwardly. Conditions will therefore be reversed to those indicated hereinabove, inasmuch as the locking arm 64 is adapted in cooperation with the spacer member constituted by the shaft 62 to loosen and to lock the hub elements 36 only. If the element 36 is connected, for instance, to the back or foot-rest of the chair, the angular position of the back or foot-rest respectively may thus be varied, without it being necessary to unload the chair legs, that is to say, while a person is still lying in the chair, which is of special importance when it is being used as an easy-chair for sick persons and convalescents, who may then adjust it even themselves. Manipulation of the locking arm 54 makes possible complete locking and unlocking of all the hub elements by a single hand-movement. Otherwise, the embodiments according to Figs. 9 and 10 may be constructed with respect to the details thereof in accordance with the description referring to Figs. 1-8.

For sake of clearness, Figs. 9 and 10 show both locking arms (64, 54) out of locking position, although this obviously does not occur in normal use (in contradistinction to the conditions prevalent in the embodiment according to Fig. 4). If, namely, as is assumed here, the locking engagement is effected by means of toothed rims, and the depth of the teeth would be 2 millimeters, for example, then, if the embodiment according to Fig. 9 is first considered, the displacement effected by the cam disk of the locking arm 54, which

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equals the rise of the curve measured from the center of rotation thereof, must be at least 4 millimeters, while the displacement effected by the cam disk of locking arm 64 must be at least 8 millimeters, inasmuch as all of the hub elements are released by means of this locking arm. Thus, starting from the condition that both locking arms are in locking position, the locking arm 54 being subsequently opened, then the sleeve 94 with its abutments 96 shall lie against the outside of the hub elements 34; if the locking arm 64 is further opened (the use of the locking arms in this sequence is senseless, however), there will be added a "play" which is twice as large as that introduced by the locking arm 54, that is to say 8 millimeters; the result is that by reason of the equalizing effect of the helical springs (supposed to be arranged according to Fig. 4) the total play (4+8 mm.) will be distributed uniformly so that the elements 34 will consequently move somewhat in a direction from the abutments 96 (as shown in Fig. 9). In Fig. 10, the reverse holds true, that is the play introduced into the cam disk of the locking arm 64 should be at least 4 millimeters and the play introduced into the cam disk of the locking arm 54 at least 8 millimeters.

In the embodiment according to Figs. 11 and 12, the central hubs 34' are rigidly connected to the shaft 40', as in the embodiment according to Figs. 1-8, so that the axial distance between them is constant. On the other hand, the locking of the hub elements is effected with the aid of disks or laminae 120 and 122 which are alternately locked in the peripheral direction to the central element 34' and to the elements 36' and 38' adjacent said central element. This peripheral locking may be effected by the laminae 120 being of non-circular configuration at their outer periphery, such as polygon-shaped, and fitting into a correspondingly shaped recess 124 in the hub elements 36' and 38'. The disks 122 are of non-circular configuration at their inner periphery, or polygon-shaped, and they engage the external surface 126 of the element 34' of the same shape. On the other hand, the disks 120, 122 are movable in the axial direction relatively to each other. A somewhat conical, preferably slotted spring washer 128 is inserted between the central hub elements 34' and the disks 120 and 122, said washer ensuring the provision of a sufficiently great peripheral braking moment between the hub elements when the latter are out of locking position, so that the frame members become self-arresting so as not to fall down by their own weight. The spring washer 128 may then bear on radially extending ridges 130 on the element 34'.

A hollow shaft 132 arranged within the shaft 40' extends at one end outside one outer hub element 38' and is connected to a tightening device, preferably a knob 134 threaded onto the end portion of the shaft. Disposed between the knob 134 and hub element 38' is a plate 136 with a projection 138 extending into a slot in the shaft 132. At its opposite end, the shaft 132 may be rigidly connected with an abutting plate 141 arranged outside the other hub element 36' and bearing thereagainst, said connection being effected by means of a pin 139 or the like. Therefore, if the knob 134 is rotated in such a direction that its threaded engagement with the shaft 132 causes the knob to move axially to the left, as viewed in Fig. 11, an axial displacement of the two outermost hub elements 38' towards the respective control elements 34' will take place, thus frictionally engaging the discs 120 and 122 so as to lock the

elements 38' against rotation relative to the central elements 34'. Rotation of the hub 134 in the opposite direction releases the frictional engagement of the discs and hence unlocks the elements 38'.

A knob 140 threaded onto the abutting plate 141 carries a central shaft 142, the end portion of which has an inner hollow shaft 144 loosely telescoped thereover. The shaft 144 is provided with axial slots 146 receiving a pin 148 secured in the shaft. The shaft 144 is thus caused to follow the knob in the rotating movement thereof, but is at the same time displaceable in the axial direction relatively to the knob 140 so as to permit the axial displacement of the two outer hub elements 38' caused by the knob 134 turning on shaft 132. Two pipe sockets 150 are threaded in opposite directions to one another onto the pipe shaft 144. Arranged on the outside of the outer shaft 40' are two pipe sockets 152 which are rigidly connected with the inner pipe sockets 150 by means of screws 154 or the like, which latter extend through the shafts 40' and 132 while being axially displaceable in oblong slots 156 relatively to the same. By rotating the knob 140, the outer pipe sockets 152 can be moved in a direction from each other, whereby they are caused to press against the inner hub elements 36' so as to ensure the locking of the latter.

In the embodiment according to Figs. 11 and 12, the locking of the hub elements is effected, as will appear from the above, through the friction between the laminae 120 and 122.

In the embodiment according to Figs. 13-15, the hub elements 34'', 36'' and 38'', respectively, are adapted to cooperate with pressing members, such as segments or tabs 160, the outer portions of which are preferably pressed radially outwards, when the hub elements are moved axially toward each other so as to lock these elements relatively to each other by a peripherally directed frictional force. The segments or tabs 160 are preferably interconnected at their inner portions so as to form parts of radially slotted plates 161. Each of these plates is preferably formed with an inner toothed recess 164, which in cooperation with the hub element 34'' locks the plate peripherally relatively to said element. The tabs 160 may be bent angularly along lines 163 near the inner hub portion of the respective plate, and therefore extend obliquely between the hub elements. Furthermore, the central portions of the plates bear on hub elements 34'', while their outer portion abuts against hub elements 36'' and 38'', respectively, in an axial direction so that, when the hub elements are moved toward one another, the tabs are turned about the lines 163 so as to be pressed with their outer edges into frictional engagement with internal surfaces on the hub elements 36'' and 38'', respectively. These surfaces may be formed by wedge-shaped grooves 162 (Fig. 15), the external edges of the tabs being then preferably somewhat rounded or bevelled. Hereby the frictional moment in the contact surfaces between the tabs and the wedge-groove 162 will be very great relatively to the axial force required for the locking of the hub elements. The plate 161 with its tabs 160 may be made from resilient material, and may bear with a certain initial tension on the hub elements 36'' and 38'' and on their wedge-grooves 162, respectively, so that a suitably adapted peripheral braking moment will be maintained between the hub elements when they are out of locking position.

As in the preceding embodiment, a tightening device arranged outside one external hub ele-

ment 38'', preferably a knob 134, is threaded onto a shaft 132 extending outside the hub element 38'' of the other group, the end portion of the shaft 132 being preferably bent outwardly thereat about an abutting washer 166. The knob 134 abuts against the first-mentioned hub element 38'', if desired over a bearing 168. A pin 170 prevents the knob from being unscrewed from the shaft 132. The central hub elements 34'' are displaceable in the axial direction in this embodiment, but their freedom of movement in a direction toward one another is limited by a sleeve 172 which is always locked against rotary movement relatively to the hub elements 34'' by means of projections 173. By rotating the knob 134 in one direction or the other the hub elements 34'' and 38'' are loosened or locked, respectively by the tabs 160 as described above, regardless of the position of elements 36''.

A shaft 174, which is preferably arranged inside the shaft 132, extends outside the hub element 38'' on the opposite side of the knob 134, and is here preferably connected to a tightening device, a knob 176, into which it is threaded. A carrier pin 178, which may have an oblong cross section, is rigidly connected with said shaft. This pin extends with axial play through recesses 156 in the two externally located shafts 132 and 172, and is preferably rigidly connected to an outer pipe socket 152' which may be caused to bear on the hub element 36'' located to the right in Fig. 13. Inside the shaft sleeve 174 is arranged a shaft 180 extending through the knob 176, and this shaft may be formed with a head-shaped portion 182 on the outside of the knob, said head-shaped portion abutting against the knob 176. Rigidly connected with the shaft 180 is a pin 184 of the same shape as that of the pin 178. The pin 184 is axially movable in slots 156 in all externally located shafts 172, 132, 174. The pin 184 is rigidly connected to a pipe socket 152' beside the hub element 36'' located to the left in Fig. 13.

By turning the knob 176 its threaded connection with the shaft 174 moves the latter to the right, as viewed in Fig. 13, while at the same time the knob is moved to the left so as to bear against 182 on the shaft 180, thus moving the shaft to the left. Hence, the sockets 152' are moved in a direction away from each other and toward the respective hub elements 36'', thus locking the elements 36'' relatively to the central hub elements 34'', provided the hub 134 has been turned to locking position to thus prevent outward axial displacement of the elements 34'' and 38''. Turning of the knob in the other direction permits the sockets 152' to move toward each other to thereby unlock the elements 36''.

Here, as in the embodiment according to Fig. 10, the one locking member, that is to say the knob 134, may bring all of the hub elements into and out of locking engagement with each other provided the knob 176 and hence the sockets 152' are in locking position. While the knob 134 and thus the hub elements 34'' and 38'' remain in locking position, it will be possible with the knob 176 to loosen and lock only the hub elements 34'' and 36'' relatively to each other. For this reason, the hub elements 36'' are preferably connected with the back and the foot-rest of the chair or stretcher.

While more or less specific embodiments of the invention have been shown, it is to be understood that the same are for purpose of illustration only, and that the invention is not to be limited there-

by, but its scope is to be determined by the appended claims viewed in the light of the prior art.

What I claim is:

1. In a pair of axially aligned rotatable joints, each joint including an inner, middle and outer element rotatable with respect to each other, a first hollow shaft, the middle element of each joint being fixed to said shaft, expansible structure disposed between the inner elements of said joints, means for expanding said structure for forcing said elements into locking engagement with said middle elements, contractable structure extending through said hollow shaft and engageable with the outer surfaces of said outer elements, and means for contracting said last mentioned structure to force said outer elements into locking engagement with said middle elements.

2. In a pair of axially aligned rotatable joints, each joint including an inner, middle and outer element rotatable with respect to each other, a first hollow shaft, the middle element of each joint being fixed to said shaft, a second hollow shaft surrounding said first shaft and disposed between the inner elements of said joints, cam means acting through said second shaft for forcing said inner elements into locking engagement with said middle elements, a third shaft extending through said first shaft and having means engaging the outer surface of one of said outer elements, and cam means acting through said third shaft for forcing said outer elements into locking engagement with said middle elements.

3. In a pair of axially aligned rotatable joints, each joint including an inner, middle and outer element rotatable with respect to each other, a first hollow shaft, said inner and middle elements being rotatably and axially movable on said shaft, abutment means carried by the ends of said shaft to limit axial movement of said middle elements in outward directions, expansible structure disposed between the inner elements of said joints and arranged to limit axial movement of said inner elements in inward directions, means to expand said structure to force said inner elements outwardly into locking engagement with said middle elements, contractable structure extending through said hollow shaft and engaging the outer surfaces of said outer elements, and said contractable structure including means for contracting the last mentioned structure to force said outer elements inwardly into locking engagement with said middle elements.

4. In a pair of axially aligned rotatable joints, each joint including an inner, middle and outer element rotatable with respect to each other, an inner shaft, said middle and outer elements being rotatably and axially movable on said shaft, a hollow shaft surrounding said inner shaft and disposed between said middle elements so as to limit axially inward movement thereof, means carried by said inner shaft for limiting outward movement of said outer elements and for forcing said outer elements into locking engagement with said middle elements, expandable structure disposed between said inner elements, and means for expanding said structure for forcing said inner elements outwardly into locking engagement with said middle elements and for forcing the latter outwardly into locking engagement with said outer elements.

5. In a rotatable joint, three adjacent elements rotatable with respect to each other, shaft means including a plurality of telescoped shafts, at least one of said shafts extending axially through all of said elements, a first member carried by said shaft means and having axially displaceable sur-

face, means responsive to axial displacement of said surface for locking the middle element to at least one of the outside elements, a second member carried by said shaft means and having axially displaceable surface, and means responsive to axial displacement of the surface on said second member for locking said middle element to at least the other outside element.

6. In a rotatable joint, three elements rotatable with respect to each other, shaft means including a plurality of telescoped shafts, at least one of said shafts extending through all of said elements, said elements having adjacent radial faces, a first member carried by said shaft means and having axially displaceable surface, means responsive to axial displacement of said surface for transmitting oppositely directed axial forces to at least the middle element and one of the outside elements, respectively, for clamping the adjacent radial surfaces thereof together, a second member carried by said shaft means and having axially displaceable surface, and means responsive to axial displacement of the surface on said second member for transmitting oppositely directed axial forces to at least said middle element and the other outside element for clamping the adjacent radial faces thereof together.

7. In a rotatable joint, at least three adjacent elements rotatable with respect to each other, shaft means including a plurality of telescoped shafts, at least one of said shafts extending through all of said elements, a first member carried by said shaft means and having axially displaceable surface, means responsive to axial displacement of said surface for locking all of said elements together, a second member carried by said shaft means and having axially displaceable surface, and means responsive to axial displacement of the surface on said second member for locking at least two and less than all of said elements together.

8. In a rotatable joint, three elements rotatable with respect to each other, shaft means including a plurality of telescoped shafts, at least one of said shafts extending through all of said elements, said elements having adjacent radial faces, a first member carried by said shaft means and having axially displaceable surface, means responsive to axial displacement of said surface for transmitting oppositely directed axial forces to the two outside elements to clamp their radial faces against the radial faces of the middle element, a second member carried by said shaft means and having axially displaceable surface, and means responsive to axial displacement of the surface on said second member for transmitting oppositely directed axial forces to the middle element and to one of the outside elements to clamp the radial faces of these two last mentioned elements together.

9. In a pair of axially spaced and aligned rotatable joints, each joint including three adjacent elements rotatable with respect to each other, shaft means including a plurality of telescoped shafts, at least one of said shafts extending through all of the elements of both of said joints, a first actuator carried by said shaft means and having axially displaceable surface, means responsive to axial displacement of said surface for locking the middle element of each joint to at least one of the outside elements of the respective joint, a second actuator carried by said shaft means and having axially displaceable surface, and means responsive to axial displacement of the surface on said second actuator for locking said

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middle element of each joint to at least the other outside element of the respective joint.

10. In a pair of axially spaced and aligned rotatable joints, each joint including three elements rotatable with respect to each other, shaft means including a plurality of telescoped shafts, at least one of said shafts extending through all of the elements of both of said joints, the elements of each joint having adjacent radial faces, a first actuator carried by said shaft means and having axially displaceable surface, means responsive to axial displacement of said surface for transmitting oppositely directed forces to at least the middle element and one of the outside elements of each joint to clamp the adjacent radial faces thereof together, a second actuator carried by said shaft means and having axially displaceable surface, and means responsive to axial displacement of the surface on said second actuator for transmitting oppositely directed axial forces to at least said middle element and the other outside element of each joint to clamp the adjacent radial faces thereof together.

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11. In a pair of axially spaced and aligned rotatable joints, each joint including three elements rotatable with respect to each other, shaft means including a plurality of telescoped shafts, at least one of said shafts extending through all of the elements of both of said joints, the elements of each joint having adjacent radial faces, a first actuator carried by said shaft means and having axially displaceable surface, means responsive to axial displacement of said surface for transmitting oppositely directed forces to the two outside elements of each joint to clamp their radial faces against the radial faces of the respective middle elements, a second actuator carried by said shaft means and having axially displaceable surface, and means responsive to axial displacement of the surface on said second actuator for transmitting oppositely directed axial forces to the middle element and to one of the outside elements of each joint to clamp the radial faces of the respective last mentioned elements together.

CARL ERNST EDVARD LUNDQUIST.