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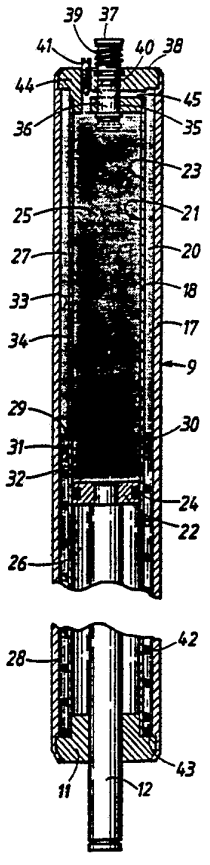
(54) Title: AN ARRANGEMENT FOR STEPLESS VERTICAL ADJUSTMENT OF A CHAIR SEAT

(57) Abstract

An arrangement for stepless vertical adjustment of a chair seat (1), which is carried by a chair base, comprising a pillar (3) with at least two members which are vertically movable relative to one another. An externally adjustable valve (35) is located in a fluid channel (45) between two concentric cylindrical spaces (20, 21) and is arranged to be switched between an open position, in which fluid may flow in the fluid channel between two spaces in one direction of flow or the other depending on the balance of forces on two pistons, one in each cylindrical space, and a closed position, in which communication is broken between the two spaces. A spring element (42) acts on the one piston to move it in its one direction and the second piston is anchored by means of a piston rod in said second one of the two members of the base which aremovable relative to one another. Means are arranged in the fluid channel (45) to maintain the rate of flow in the one direction of flow reduced relative to the rate in the opposite direction.



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Title:

An arrangement for stepless vertical adjustment of a chair seat.

Technical field:

The present invention relates to an arrangement for stepless vertical adjustment of a chair seat, which is supported by a chair base, including a pillar with at least two members which, relative to one another, are vertically movable, of which the one member is arranged generally to maintain a chosen vertical position and of which the other member is provided at its upper end to support the chair seat and, together with it, to be adjusted vertically, whereby one of the members which are movable relative to one another is arranged as two cylindrical units, which are securely fastened to one another and are mainly concentric, enclosing in part a cylindrical space in which an inner piston is movable, and in part a space having an annular cross-section, located between the walls of the two cylindrical units, in which space an outer, annular piston is movable, whereby the cylindrical space on the one side of the inner piston and the annular space on the other side of the annular piston contains a pressure fluid, and a fluid channel extends between said spaces, in which an externally adjustable valve is located and is provided for adjustment between an open position, in which fluid can flow in the fluid channel between the said two spaces in one direction of flow or the other in accordance with the balance of forces on the two pistons, and a closed position, in which communication between the two spaces is broken, whereby a spring element is provided to act on the one piston for motion

in its one direction, and the other piston , by means of a piston rod, is anchored in the said other one of the two relatively movable members of the base.

Background Art:

Pneumatic, hydraulic, and completely mechanical adjustment mechanisms for vertical adjustment of chair seats are previsously known. Prior solutions have generally been relatively complicated, and have carried with them a risk of too rapid adjustment motions when lowering the seat, which can lead to sudden changes in position and result in a risk of injury to the person sitting. Especially gas springs have proven to be dangerous since they have even exploded, with the subsequent risk of personal injury.

The object of the present invention is to provide an arrangement which is simple and reliable, and which enables a slow adjustment motion, especially when lowering a chair seat.

The Solution:

The said object is achieved by means of an arrangement which is characterized in that elements for maintaining the flow velocity in the one flow direction reduced relative to the rate in the opposite direction are arranged in said fluid channel.

Description of the Drawings:

An exemplifying embodiment of the invention will now be described in greater detail with reference to the accompanying drawings, in which Figure 1 schematically illustrates the chair seat and the base, including an exemplifying embodiment of an arrangement according to the invention; and Figure 2 shows a longitudinal section of the arrangement according to the invention, whereby remaining parts of the chair seat have been removed for the sake of clarity.

Best Mode of Carrying Out the Invention:

Figure 1 shows a chair seat 1, which may be of a conventional type with or without a back, which back is indicated by a rail 2 for carrying the back support. This rail may be fastened either in the chair seat 1 or in the base. The base 3 has a pillar 4, which, at its upper end, has an attachment member 5 for the chair seat and, at its lower end, is fastened to a number, e.g. five, sideways extending legs 6 which, in certain cases, each have a castor wheel 7. In many cases the ends of the legs 6 form feet, which rest directly against a floor. The pillar 4 is of the telescoping type and, in the illustrated example has an outer tube which is securely joined to the feet 6 which forms a lower telescoping tube 8, and an upper, inner telescoping tube 9, which carries the chair seat 1 via the attachment member 5. A maneuvering member 10 in the shape of a lever is rotatably journalled in the attachment member 5, and by means of the maneuvering member adjustment may be made between different vertical positions. A piston rod 12, which at its lower end is axially generally immovably secured in the lower end wall 13 of the lower telescoping tube 8 extends through a central opening in the lower end wall 11 of the upper tube 9. It is, however preferrably installed by being rotatably journalled in the end wall. The upper telescoping tube stabilizes itself and moves relative to the lower telescoping tube 8 through cooperation with a generally cylindrically sleeve 14, e.g., of an elastic material. The attachment member 5 is made as a mainly rotationally symmetric piece with a mounting flange 15, to which the underside of the seat 1 is fastened. At its lower end the attachment member has a mainly cylindrical portion 16, by which the attachment member is securely mounted, for example by welding, on the upper end of the upper telescoping tube 9.

Figure 2 shows the construction of the arrangement according to the invention, which is built into the upper telescoping tube 9. This consists of two securely joined concentric cylindrical units 17, 18 with an inner cylindrical unit 18 disposed within an outer cylindrical unit 17. The two cylindrical units 17, 18 are fastened to a common upper cap piece 44 and to the said lower end wall 11, which is similarly comprised of a cap piece which is common to the two cylindrical units. The two cylindrical units 17, 18 are dimensioned and located in such a way that a space 20 with an annular cross section is formed between these cylindrical units. The inner cylindrical unit 18 encloses a cylindrical space 21, in which a piston 22 is provided, which contacts the enveloping wall 23 of the cylindrical space 21 in sealing engagement. The piston 22 has a gasket 24, for example in the shape of an O-ring, of an elastic material. The piston rod 12 is fastened to the piston 22. The piston divides the cylindrical space 21 into two chambers 25, 26, whose volume varies as the piston 22 moves in the cylindrical space 21. The one chamber (in the illustrated example, the upper chamber 25) is intended to be filled, preferrably with a hydraulic fluid such as hydraulic oil, which mainly completely fills the cylindrical space 21 when the piston 22 is in its lower dead position, and which is mainly completely pressed out of the space when the piston 22 is in an upper dead position at the upper cap piece.

The annular space 20 is furthermore similarily divided into two annular chambers 27, 28 by means of an annular piston 29 which, by means of sealing rings 30, 31, 32, sealingly engages in part the inwardly facing surface 33 of the outer cylindrical unit, and in part the outwardly facing surface 34 of the inner cylindrical unit 18. The upper annular space 27 is filled with a pressure fluid, which is also contained in the cylinder

chamber 25, whereby the inner cylinder chamber 25 and the annular chamber 27 are provided to be brought into communication with one another via a fluid channel 45, which is provided in the upper cap piece in the illustrated example. This fluid channel 45 is, however, arranged so as to normally be closed by means of a valve 35 provided in the cap piece, but upon activation to be able to be switched to an open position, in which the fluid channel 45 is open and maintains communication between the two chambers 25, 27. In the illustrated example, the valve 35 consists of a mainly cylinder-shaped valve body 36, which extends through a bore in the cap piece and which has a maneuvering portion 37 which sticks out of the cap piece. The maneuvering portion is thereby shaped as a flange, whereby a compression spring 39 is located between the flange and the outer surface 38 of the cap piece, so that the spring 39 biasses the valve body into the postition shown by solid lines in Figure 2. The valve body also has a communication channel 40, which is for example formed by an annular groove in the valve body or by a bore through it, the communication channel being arranged, in the closed position shown in Figure 2, to be displaced from the channel 45, but upon activation to be brought to the level of the channel, thereby opening communication. This position is shown in Figure 2 by dashed lines. A screw 41 comprising a filling screw, may also be adjusted into different positions extending into the channel 45, but this adjustment is normally made only one or a few times.

The said means for putting the two chambers 25, 27 into temporary communication with each other further has means for maintaining different rates of flow between the chambers in the two opposite directions of flow in the channel 45. This is for example brought about by means of a valve element which is provided for maintaining maximally open communication in one

direction of flow, but for choking this flow to a certain degree in the opposite direction of communication even when the valve 35, which is activated manually, is switched to the open position. This valve element may for example be placed in the valve body 36 for changing the cross-sectional area of the channel 40 which passes through it. The valve element may also be provided in the channel 45, for example in the form of a return valve having reduced flow in the one direction of flow.

The above-mentioned second annular space 28 between the two cylindrical units 17, 18 encloses a spring element 42, having, in the example shown, the shape of a helical spring, in particular a compression spring, which winds about the inner cylindrical unit 18 and is tensioned and mounted between the annular piston 29 and a spring seat 43 which is formed by a shoulder of the lower cap piece 11.

Positional adjustment of the member, whose position is to be adjusted, is made by changing the position of the upper telescoping tube 9 relative to the piston rod 12. Because of the limiting position in the Figures 1 and 2, with the upward placement of the telescoping tube 9 and the piston rod 12 being fastened below in the base, and with a suitably chosen spring force in the compression spring 42, the upper telescoping tube 9, because of its own weight and because of the load caused by the chair seat 1 and also by a sitting person, tends to be lowered, i.e., the cylinder chamber 25 tends to decrease in volume. When the valve 35 is in the closed position, which is its normal position, communication between the two chambers 25, 27, which are filled with a pressure medium, is broken, which means that the piston 22 is locked into the chosen adjustment position, especially where the pressure medium is a liquid and is thus incompressible.

When one wishes to change the position, the valve 35 is opened by the person sitting rotating the maneuvering lever 10 by lifting its outer end upward towards the seat 1, whereby the maneuvering end 43 of the maneuvering lever 10 is lowered and thereby presses against the maneuvering portion 37 of the valve body 36 in such a way that the valve body is displaced axially against the force of the compression spring 39 until the communication channel 40 of the valve body is lowered to the lever of the fluid channel 34 and opens it. Provided that the said load exceeds the opposing force created by the compression spring 42, the pressure medium is thereby pressed out of the cylinder chamber 25 and flows through the fluid channel 45 to the annular chamber 27. Because of the force on the annular piston 29, which thus exceeds the opposing force from the oppositely acting compression spring 42, the annular piston will be pressed downwards and will compress the compression spring 42 so that the volume in the upper annular chamber 20 increases at the same time as the volume in the inner cylinder chamber 25 decreases and the entire telescoping tube 9 is lowered because of the relative motion of the piston 22 upwards relative to the inner cylinder unit 18. By means of the influence of the above-mentioned valve member the channel 45 will, however, not be opened for maximum through-flow, but through-flow with choking action takes place in such a way that the sinking motion of the chair unit 1 occurs relatively slowly, which means that when the adjustment is completed, there will be no sudden stop which may be injurious or at least uncomfortable. When the desired vertical position has been assumed, the person sitting releases the maneuvering lever 10, which thereby rotates back to its initial position, and the valve 35 is once again returned to its closed position. The maneuvering lever 10 preferrably has a spring (not shown), e.g., a spring around the pivot axle 44 of the maneuvering lever, which biasses the maneuvering end 43 of the lever

into contact against the end 37 of the valve body 35.

The force of the spring member 42 is preferrably chosen, as was described above, so that a lowering motion can take place when the person sits on the chair with his feet providing some support against the floor. This force should furthermore be chosen so that, when the person unloads the chair, for example by supporting himself forcefully with his feet against the floor or by rising from the chair, the spring member overcomes the opposing force from the load caused by the chair seat and by the upper telescoping tube 9. When one wishes to raise the chair seat, it is done as has been described above by lifting the lever 10 against the chair seat, and thereby opening the valve 35, whereby the annular piston 29 will, under the influence of the spring member 42, move upwards into the annular space 20, and will thereby decrease the volume of the upper annular chamber 27, whereby pressure medium is forced out through the fluid channel 45 and the communication channel 40 in the valve 35 without the above-mentioned choking action, which arises in the opposite direction of flow, whereby the cylinder chamber 25 seeks to expand, thereby lowering the piston 22 relative to the associated cylindrical unit 18, with the result that the upper telescoping tube 9 as a whole, and thereby the seat 1 carried by it, performs a rising motion, which ceases as soon as the lever 10 is released and the piston 22 is thereby locked into place. It is, however, possible to rotate the chair seat about the longitudinal axis of the pillar 3 since the upper telescoping tube 9 may rotate relative to the lower telescoping tube 8, since the lower end of the piston rod 12 is rotatably mounted in the lower telescoping tube 8. The piston 22 is in itself also rotatable within the corresponding cylindrical unit 22, but in order to minimize wear this rotation is preferrably avoided.

The invention is not limited to the examplifying embodiment described above and shown in the drawings, but may be varied within the scope of the following patent claims. The valve 35 and the fluid channel 45 may for example be arranged and located in some other way, for example, disposed within the walls of the two cylindical units 17, 18 in connection with their upper end, although one must then see to it that the piston 22 does not come into conflict with the valve body. The lower telescoping tube 8 of the pillar 3 may be securely mounted in a floor or other base. The telescoping tube 8 may in principle be eliminated and replaced by a secure mounting of the piston rod 12 alone. It is also conceivable to flip the entire unit according to Figure 2 so that the telescoping tube 9 is disposed below and comprises the fixed member, which does not change its vertical position, whereas the piston rod comprises the movable member, which supports the seat. The pressure medium is preferably a hydraulic fluid, but it may for example also be combined, i.e., fluid with a small volume of gas, which provides less damping.

Claims:

1. An arrangement for stepless vertical adjustment of a chair seat (1), which is supported by a chair base, including a pillar (3) with at least two members which, relative to one another, are vertically movable, of which the one member is arranged generally to maintain a chosen vertical position and of which the other member is provided at its upper end to support the chair seat and, together with it, to be adjusted vertically, whereby one of the members which are movable relative to one another is arranged as two cylindrical units (17, 18), which are securely fastened to one another and are mainly concentric, enclosing in part a cylindrical space (21), in which an inner piston (22) is movable, and in part a space (20) having a annular cross-section, located between the walls (33, 34) of the two cylindrical units, in which space an outer, annular piston (29) is movable, whereby the cylindrical space on the one side of the inner piston and the annular space on the other side of the annular piston contains a pressure fluid, and a fluid channel (45) extends between said spaces, in which an externally adjustable valve (35) is located and is provided for adjustment between an open position, in which fluid can flow in the fluid channel between the of said two spaces in one direction of flow or the other in accordance with the balance of forces on the two pistons, and a closed position, in which communication between the two spaces is broken, whereby a spring element (42) is provided to act on the one piston for motion in its one direction, and the other piston , by means of a piston rod (12), is anchored in the said other one of the two relatively movable members of the base, c h a r a c t e r i z e d in that elements for maintaining the flow velocity in the one flow direction reduced relative to the rate in the opposite direction are arranged in said fluid channel(45).

2. An arrangement according to Claim 1, c h a - r a c t e r i z e d in that the inner piston (22) exhibits said piston rod (12) and in that the outer, annular piston (29), for movement in its one direction, is loaded by said spring element (42), which consists of a helical spring located in said annular space (20).

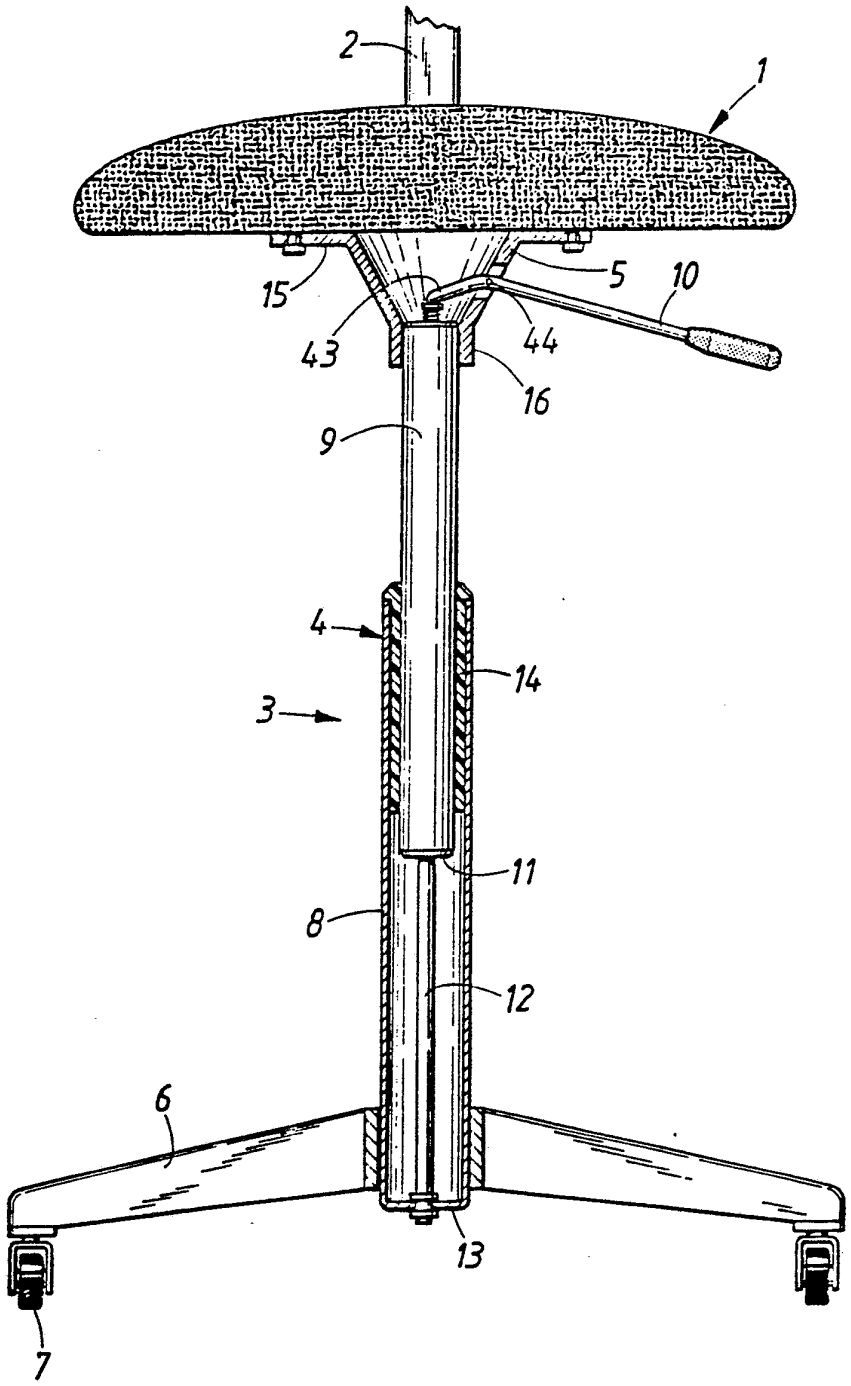

FIG. 1

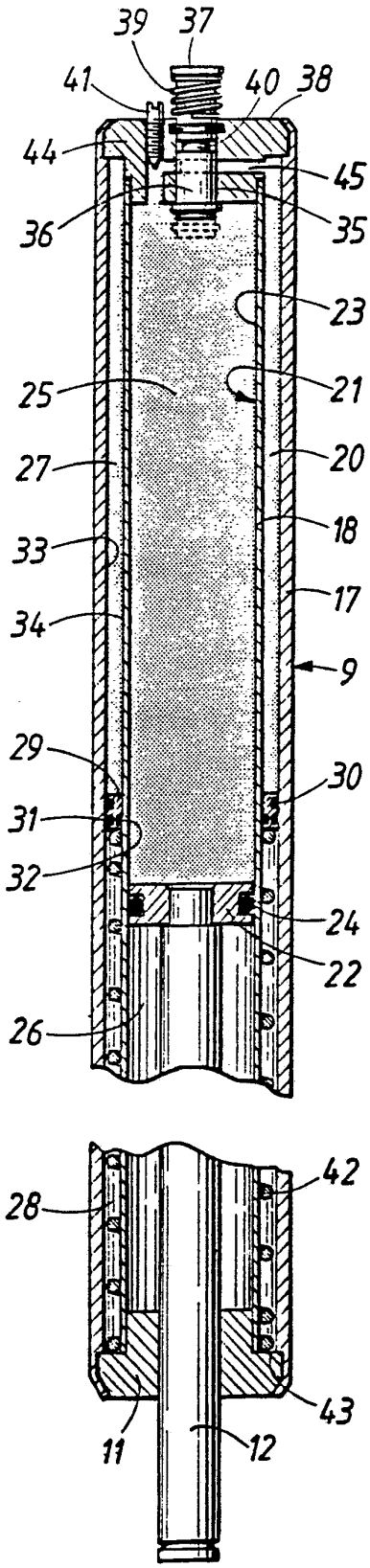
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FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE88/00104

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

A 47 C 3/30 // A 47 B 9/10

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	A 47 B 9/10; A 47 C 3/30
US Cl	108: 144, 147; 248: 188.5, 400, 404

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
E	SE, A, 8603755-3 (BENGT PETERSSON) 9 March 1988	1, 2
A	NO, B, 136 133 (REINHARD HÖRNLEIN K.G.) 1 July 1968	1
A	US, A, 3 381 926 (E.E. FRITZ ET AL) 7 May 1968	1, 2
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IV. CERTIFICATION

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1988-09-15	1988 -09- 21
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Swedish Patent Office	Nils Andersson

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