

SPECIFICATION

Ergonomic chair

The present invention relates to an ergonomic chair.

- 5 Chairs designed from the ergonomic point of view aim primarily at supporting the body of the user of the chair in such a way that the body suffers as little fatigue as possible, even in different postures of the body. This presupposes
- 10 that the chair has means which can be adapted to the movements and the anatomy of the human body so that the person sitting in the chair can select the correct seat for his particular requirements or in order that the seat may be
- 15 brought into a relationship which is at least substantially correct for the body in relation to the back-rest. For this purpose, a number of constructions are already known wherein a correct body support is intended to be achieved by means
- 20 of lever mechanisms and spring means which are fixed and connected in series or parallel or which can be adapted by manual actuation. Examples of such mechanisms can be seen from the CH—PS 524 982 and DE—OS 27 33 322. It is
- 25 characteristic of these chairs that with freely movable spring means, the adaptation of the relative position between seat and back rest, caused by the arrangement of the pivot points and
- 30 points of action of the seat in relation to the seat or chair column, is effected depending both on the seat load and the back-rest load. This can result in a swinging of the body supporting parts of the chair. The required position of equilibrium and "hardness" can be selected by suitable
- 35 adjustment of the spring means, which is preferably a gas spring. Meanwhile it was recognized that, for comfortable sitting, it is undesirable for the adjustment and spring mechanism to start moving on initial loading of the
- 40 seat and of the back-rest, because with frequent standing up and sitting down, the user of the chair becomes fatigued rather than having a feeling of relief.

- The object of the invention is therefore to
- 45 construct a chair with seat and back-rest adjusting mechanism such that even with free spring means the seat can be loaded without immediately beginning a resilient downward movement of the rear section of the seat. In other words, one should
- 50 be able to sit on the chair as on a work chair with a seat which is stable in inclination and be able to load its rear portion situated behind the point of action of the chair column without a change in inclination occurring. Instead, this should only
- 55 occur when the back-rest is urged downwards by the user, overcoming a certain force threshold, in which case the proportional adjustment of the seat and back-rest inclination usual in ergonomically designed chairs results. When
- 60 pressure against the back-rest is relieved, the back-rest will be restored to its initial position with synchronous movement of the seat. The chair or its adjustment mechanism should be able to be locked selectively in required positions.

- 65 The present invention accordingly provides an ergonomic chair having chair column which is adjustable in height, a supporting arm fitted to the upper end of the chair column, a seat supporting frame which is pivoted near its front end for
- 70 movement about a horizontal axis to the outer end of the supporting arm, a back-rest frame which carries a back-rest and is pivoted to the rear end of the seat supporting frame, a movement guiding and return mechanism which connects the back-
- 75 rest for movement with and also relative to the seat supporting frame so that an alteration in the inclination of the back-rest automatically causes a proportional alteration in the inclination of the seat supporting frame, the movement guiding and
- 80 return mechanism comprising (a) a first unit including a two-armed lever which is pivoted at its rear end to the back-rest frame, an intermediate point of which is connected through a first pair of pivoted links to the supporting arm and the front
- 85 end of which is connected through a second pair of pivoted links to the seat supporting frame, and (b) a second unit constituted by an adjustable compression spring device which is effective
- 90 between the back-rest frame and the supporting arm and which urges the back-rest into its most upright position, and a movement limiting stop which prevents pivoting of the back-rest forwardly
- 95 beyond its most upright position, which is effectively between the first unit and the supporting arm and which is so positioned that, when at least one of the first pair of pivoted links abuts against it, the first and the second pair of pivoted links lie either parallel to one another or
- 100 diverge upwardly, in order to form a locking mechanism which is automatically effective to resist vertical loads acting on the seat supporting frame and which can be released by swinging back the back-rest.

- The main advantage in comparison with the
- 105 former chairs constructed from ergonomic points of view lies in the fact that the spring member now no longer lies in a series or parallel connection in relation to the actual movement mechanism but is installed directly between a
- 110 component which does not participate in the adjustment movement of the chair and the back-rest. The spring member therefore no longer needs to be dimensioned according to the mechanical requirements of the adjusting mechanism. As a
- 115 result, there are eliminated difficulties in adjustment which often arose in determining the adjustment forces to be adapted to the weight of the user of the chair. The standard installation of overdimensioned and/or complicated spring
- 120 members can be eliminated because of the relatively simple connecting up of easily adjustable additional springs. The spring members, which are in danger of wear, are relatively easy to
- 125 replace because only this one component is affected by their dismounting. With the use of gas springs there is the additional advantage that problems of space and cost can be solved considerably more favourably by the use of smaller units. Above all the smaller space

requirements not only for the spring members but also for the actual movement mechanism, renders possible a considerably better formation.

An embodiment of the invention will now be more particularly described by way of example and with reference to the accompanying drawings, in which:

Fig. 1 shows a diagrammatic perspective illustration, the seat supporting frame, the back-rest articulation and the connecting elements between chair column, seat frame and back-rest;

Figs. 2a, b, c, show sections taken along the lines A—A, B—B and C—C of Fig. 1 with the chair unloaded or the back-rest unloaded and at an upright angle with the seat supporting frame lying relatively level;

Figs. 3a, b, c, show sections taken along the lines A—A, B—B and C—C of Fig. 1 with the chair loaded or the back-rest loaded and inclined towards the rear and the seat supporting frame inclined towards the rear; and

Figs. 4a, b, show respectively a section taken along the line D—D in Fig. 1 and a plan view in the direction of the arrow C in Fig. 4a to illustrate the back-rest connection to the articulation and spring mechanism of the chair.

In the diagrammatic perspective illustration in Fig. 1, 1 designates in general a seat supporting frame which is pivotally mounted in pivots 5 on a supporting arm 4 which is placed to be adjustable in height on the head end 2 of a central chair column 3. This is shown here in a simplified manner but in reality is divided up as Figs. 2a, 2b, 3a, 3b. The seat supporting frame 1 has a flat front portion 1.1 which is provided with reinforcing ribs and apertures, not designated and of which the central portion is broken away, and a rear portion which is equipped with two fork carriers 1.2. On the ends of the carriers 1.2, the back-rest frame 7 of the back-rest 8 is pivotally mounted on a shaft 6. The pivots 5 are hollow stub shafts which are secured in cast eyes (not shown) of the seat supporting frame and guide in their bores control linkages 9 and 10, indicated

diagrammatically by broken lines, of an adjusting mechanism which will be described in more detail. The main components of this adjusting mechanism, which render possible a pivotal movement of the seat supporting frame and back-rest construction both in relation to one another and in relation to the chair column 3, are, on the one hand a guide and locking linkage device 11 illustrated in Figs. 2a and 3a and on the other hand a compression spring mechanism 12 shown more precisely in Figs. 2c and 3c. While the guide and locking linkage device 11 consisting of a plurality of lever members 13, 14 and 15 described below is connected on the one hand through a pivot pin 16 (see also Fig. 4b) to the lower end of the back-rest frame 7 and on the other hand through a pivot pin 17 to the supporting arm 4 (see also Figs. 2a, 3a) and a pivot pin 18 to the seat supporting frame 1, the spring mechanism 12 lies between the pivot pin 16 traversing the back-rest frame 7 and a

connection block 19 present on the supporting arm 4, on which it is anchored by a suspension structure 20 not shown in more detail, with a pivot pin 21. In this connection see also Figs. 2c and 3c.

From this it follows that a forward-backward pivotal movement of the back-rest simultaneously leads to an alteration in the inclination of the seat supporting frame 1 in relation to the supporting arm 4. The spring mechanism 12 is only effective between the supporting arm 4 and the back-rest frame 7. It may further be mentioned that the spring mechanism 12 in the example shown is shown as a gas spring which is adjustable with regard to its piston stroke and which can be used both as a spring element and as a locating member for fixing the inclination of the seat supporting frame and back-rest.

The components participating in the adjustment of the seat supporting frame 1 in relation to the back-rest 8 or its frame 7 and their supporting and receiving members can be seen in greater detail from Figs. 2a-c and 3a-c. The parts of the Figures designated by the letters a, b and c correspond to section illustrated with more detail on the lines A—A, B—B and C—C in Fig. 1, and Figs. 2a-c show the components in the position of rest or initial position of the chair (normally upright back-rest) and Figs. 3a-c show the same components in the position of the back-rest at a position most inclined towards the rear. Like parts are provided with the same reference numerals in all the Figures.

In Figs. 2a-c and 3a-c, 1 again designates the seat supporting frame, the front end 1.1' of which is pivotally mounted on the supporting arm 4, for example of frame-shaped construction, by means of the hollow pivots 5 visible only in Figs. 2a, 3a. The supporting arm 4 has at its inner end a seat cap 4.1 with a slightly tapered bore. The seat cap 4.1 surrounds the adjustable head end 2 of the chair column 3 or a gas spring (not shown) which is installed in this for adjustment in height. Thus the supporting arm 4 has a defined position with respect to the chair column, which does not alter even when the seat portion of the chair is turned about the column axis X—X. Furthermore, the front portion 1.1 of the seat supporting frame 1 is supported on the supporting arm 4 by means of a powerful helical spring 23 centered in a spring seat 22 at its top. The frame 1 is provided with another spring seat 24 to receive the other end of the spring. The spring 23 is so dimensioned that it is capable of transmitting a great proportion of the body weight of the user of the chair directly from the seat supporting frame to the supporting arm and so of relieving the guide and locking linkage device.

The rear (forked) end 1.2 of the seat supporting frame 1 carries, by means of the shaft 6, the back-rest frame 7 shown diagrammatically in Figs. 2a-c and 3a-c together with the back-rest 8. Details are described later with reference to Fig. 4. At the lower end of the frame which is there shown likewise fork-shaped, one end of the two-armed lever 13 is connected to the pivot pin 16. Its pivot point

situated near the other end of the lever is the center of a pivot 25 which engages in the receiving bore of one of the lever links 14, of which a pair is provided (only one being shown for simplicity), at its ends projecting at both sides beyond the steering-lever faces. The links of this first pair of links comprise, at their other end, a second receiving bore, through which the lever 13 is articulately mounted to the supporting arm 4 by means of the lever links 14 and the pivot pin 17. At the end of the shorter lever arm of the lever 13, this comprises a further bore to receive a pivot pin 26 which engages, at its ends projecting beyond the lever faces at both sides, in the receiving bore of each of the lever links 15. The other end of the links of this second pair of links comprise a second receiving bore through which they are articulately mounted on the seat supporting frame 1 through the pivot pin 18. The system formed by the pivot members 6, 16, 25, 17, 26, 18 and the lever sections of the guide and locking linkage device 11 situated in between renders possible a downward movement of the rear portion of the seat supporting frame on pivoting of the back-rest 8 in clockwise direction, as can be seen from Fig. 3a. In order to avoid pivoting of the back-rest 8 in clockwise direction on mere loading of the seat supporting frame 1, the axes of the pivot pins 17, 18, 25, 26 of the first and second pairs of links 14, 15 must be arranged initially so in relation to one another that a self-locking results through these pairs of links. This is the case when the longitudinal axes of the pairs of links lie parallel in Fig. 2a, or diverge upwards, that is to say towards the seat. In this case, at least one of the links 14 bears against a stop 27 connected to the supporting arm 4, which limits the pivoting of the pair of links 14 in clockwise direction and so determines the maximum steep position of the back-rest. It also leads to a stable position of the seat supporting frame 1 in relation to the supporting arm 4 in the initial position or position of rest. It should be noted that with this a relatively low constructional height of the construction of the locking mechanism rendering possible the guide and linkage device lies in front of the vertical column axis X—X on the chair.

If the back-rest 8 or its frame 7 becomes pivoted in a clockwise direction about the shaft 6 by the application of a force P, as shown in Fig. 3a, then the lever 13 is displaced towards the left through the pivot pin 16, as a result of which the position of the longitudinal axes of the pairs of links 14, 15 alters beyond the parallel position into directions converging upwards. In the course of this the locking action of the pairs of links 14, 15 is cancelled. At the same time, the seat supporting frame 1 pivots about the pivot 5 in the region of its front end 1.1 in relation to the supporting arm 4 and the frame plane is inclined backwards and downwards.

During this process, as a result of the downward movement of the seat supporting frame 1, the spring 23 is pressed in as shown in Fig. 3b. As already mentioned, this spring serves

to compensate for the greater part of the vertical component of the bearing weight on the chair, in order to relieve the spring mechanism 12.

The "Stable" position of the guide and locking linkage device 11, shown in Fig. 2a, is ensured by the spring mechanism 12, shown in more detail in Figs. 2c and 3c, which applies a compressive force between the pivot pin 16 traversing the back-rest frame 7 (see also Fig. 4) and the suspension pin 21 acting on the supporting arm 4 at the left-hand side front end of the spring mechanism. As a result, the connection construction 7 is loaded in counter-clockwise direction and so also the lever 13 (Figs. 2a, 3a) is pulled so far towards the right that the link 14 comes to bear against the stop 27.

In the present example, the spring mechanism 12 contains a gas spring 28 at the piston end of which the suspension structure 20, not shown in detail, is placed with an end member 29 to control the gas spring. The compressive force of the gas spring 28 can be simplified by a compression spring 30. Its initial force is infinitely variably adjustable by means of an adapter sleeve 31 engaging over the gas spring 28 and the compression spring 30 and mounted for rotation on a threaded spindle (not shown). The piston rod 32 of the gas spring 28 is freely movable or can be controlled in a locking position in known manner. In the example shown, the control linkage 9 which is mounted in the hollow pivot 5 (Fig. 1) serves for this, the actuating end of which is provided with a handle 33 projecting laterally beyond the seat supporting frame and a blocking slide 34 while its end at the spring side carries a cam 35 which acts on the control end member 29 of the gas spring (Figs. 2c, 3c).

The control means of the gas spring 28 as described permit, on the one hand the relative position between the surface of the seat or the seat supporting frame and the back-rest to be locked in any position in its range of movement and, on the other hand — with the piston rod freely movable — the inclination of the back-rest and the seat surface to be adapted automatically to the particular requirements by the user of the chair urging the back-rest back.

It is understood that the compression spring mechanism 12 can also be constructed otherwise. In particular, the arrangement shown is not restricted to the use of a gas spring, but may instead be provided with compression spring means which give the same or similar spring characteristics. The same also applies to the suspension and height adjustment construction in the chair column 3 which, in the example shown, is likewise directed to the use of a gas spring (not shown). Provided for its control, as shown diagrammatically in broken lines in Fig. 1 and in more detail in Figs. 2b and 3b, is the control linkage 10 which is provided at its actuating end (Fig. 1) with a handle 36 projecting laterally beyond the seat supporting frame. The other end of the control linkage 10 comprises, to act on the control pin 37 of the chair-column gas spring, a pressure lever 38 which is pivotally mounted on



the supporting arm 4 and on which there acts a cam 39 mounted on the control rod traversing the pivot 5 (Fig. 1). (Figs. 2b, 3b).

Provided for the mounting of the back-rest 8 on the forked rear end 1,2 of the seat supporting frame 1 is a connection construction as shown in Figs. 1 and 4, wherein an upwardly projecting connecting plate 41 to secure the back-rest and two downwardly directed fork carriers 42, 43 are welded onto a horizontal supporting tube 40. One pair of these fork carriers is intended for the connection of the guide and locking linkage device 11, the other for the connection of the spring mechanism 12. Bearing bushes 44 are inserted in the ends of the supporting tube 40 to centre the back-rest pivot shaft 6.

Although the connection of the linkage device 11 and of the spring mechanism 12 to the fork carriers 42, 43 may be effected in a simple manner by means of the pivot pin 16 inserted in through openings (or two pins associated with each fork carrier), it may be advisable to provide a coupling device which can be released without a tool for this. In this case, the fork carriers 42, 43 comprise instead of a pin bore (not shown) a fork groove 45 which is open towards the front and in which the pivot pin 16 is inserted from the front (arrow B). With this procedure, a clamping slide 46 which urges the pin 16 into the groove and which is mounted for displacement in a housing 47 is pushed upwards in the direction of the arrow C against the pressure of springs 48. The clamping slide 46 is held captive in the slide compartment 51 of the housing 47 by spring tongues 50 which can be brought into abutment with a housing edge 49.

CLAIMS

1. An ergonomic chair having a chair column which is adjustable in height, a supporting arm fitted to the upper end of the chair column, a seat supporting frame which is pivoted near its front end for movement about a horizontal axis to the outer end of the supporting arm, a back-rest frame which carries a back-rest and is pivoted to the rear end of the seat supporting frame, a movement guiding and return mechanism which connects the back-rest for movement with and also relative to the seat supporting frame so that an alteration in the inclination of the back-rest automatically causes a proportional alteration in the inclination of the seat supporting frame, the movement guiding and return mechanism comprising (a) a

first unit including a two-armed lever which is pivoted at its rear end to the back-rest frame, an intermediate point of which is connected through a first pair of pivoted links to the supporting arm and the front end of which is connected through a second pair of pivoted links to the seat supporting frame, and (b) a second unit constituted by an adjustable compression spring device which is effective between the back-rest frame and the supporting arm and which urges the back-rest into its most upright position, and a movement limiting stop which prevents pivoting of the back-rest forwardly beyond its most upright position, which is effective between the first unit and the supporting arm and which is so positioned that, when at least one of the first pair of pivoted links abuts against it, the first and the second pair of pivoted links lie either parallel to one another or diverge upwardly, in order to form a locking mechanism which is automatically effective to resist vertical loads acting on the seat supporting frame and which can be released by swinging back the back-rest.

2. An ergonomic chair as claimed in claim 1, wherein a compression spring is installed between the seat supporting frame and the supporting arm whereby the movement guiding and return mechanism is relieved of a considerable proportion of the bearing load acting on the said supporting frame.

3. An ergonomic chair as claimed in either claim 1 or claim 2, wherein the seat supporting frame comprises a front section in the form of a plate provided with reinforcing ribs and a rear part having forked ends, and the back-rest frame comprises a horizontal supporting tube which is inserted pivotally between the forked ends of the seat supporting frame, the top of which carries a frame connection plate mounting the back-rest and the underside of which is provided with fork-shaped elements for connecting said first and second units to the back-rest frame.

4. An ergonomic chair as claimed in claim 3, wherein the fork-shaped connection elements are provided at their radially outer ends with receiving grooves with a groove bottom for the engagement of a pivot pin extending through the connection ends of the units and wherein a spring-loaded clamping member, which urges the pivot pin into the bottom of the groove, holds this in the fork-shaped connection elements.

5. An ergonomic chair substantially as hereinbefore described with reference to the accompanying drawings.



the supporting arm 4 and on which there acts a cam 39 mounted on the control rod traversing the pivot 5 (Fig. 1). (Figs. 2b, 3b).

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first unit including a two-armed lever which is pivoted at its rear end to the back-rest frame, an intermediate point of which is connected through a first pair of pivoted links to the supporting arm and the front end of which is connected through a second pair of pivoted links to the seat supporting frame, and (b) a second unit constituted by an adjustable compression spring device which is effective between the back-rest frame and the supporting arm and which urges the back-rest into its most upright position, and a movement limiting stop which prevents pivoting of the back-rest forwardly beyond its most upright position, which is effective between the first unit and the supporting arm and which is so positioned that, when at least one of the first pair of pivoted links abuts against it, the first and the second pair of pivoted links lie either parallel to one another or diverge upwardly, in order to form a locking mechanism which is automatically effective to resist vertical loads acting on the seat supporting frame and which can be released by swinging back the back-rest.

2. An ergonomic chair as claimed in claim 1, wherein a compression spring is installed between the seat supporting frame and the supporting arm whereby the movement guiding and return mechanism is relieved of a considerable proportion of the bearing load acting on the said supporting frame.

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5. An ergonomic chair substantially as hereinbefore described with reference to the accompanying drawings.