

Chair, in particular Office Chair

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The invention relates to a chair, in particular an office chair, with a synchronizing mechanism.

10 Modern high-end office chairs typically are provided with a synchronizing mechanism that ensures that the sitting area moves synchronously with the backrest. The synchronization mechanism is typically embodied in a backrest support that is attached to a central support frame and movably connected to the seat. The movements of
15 the backrest support are thus translated to the seat as synchronous movements. Various options are available for the design of the synchronizing mechanism. For example, an office chair is found in DE 101 22 948 C1, the sitting area of which tilts toward the backrest when the backrest
20 is tilted backward. An office chair is found in DE 42 19 599 C2, the sitting area of which, in contrast, tilts forward when the backrest is tilted backward. For both of the chairs shown, it is necessary to adjust the counterforce that must be overcome to tilt the backrest
25 according to the weight of the seated person.

An office chair is known from US 6,709,058 B1 in which the force of the backrest that resists tilting is mechanically adjusted to the weight of a seated person.
30 The backrest support is bent upwards via a fulcrum on the support frame under the sitting area. Due to this bending, in combination with the fulcrum, a backward tilting movement of the backrest is translated into an

upward movement of the sitting area via the backrest support. Since the supporting point of the backrest support that acts on the sitting area makes a rotational movement, the force applied by the backrest to the seated person depends on the absolute tilt position of the backrest.

The object of the invention is to disclose a chair of the type indicated above that features an alternative mechanism to automatically adjust the force applied by the backrest to resist tilting to the weight of the seated person.

This object is achieved according to the invention by a chair, in particular an office chair, comprising a backrest that is hinged to a load-bearing frame via a backrest support, and a sitting area which is moveable in synchrony with the backrest and is pivotally connected to the load-bearing frame in a supporting point via a seat guide, where the backrest support and the seat guide are rotatably fixed to the load-bearing frame, and a connecting rod movably connects the seat guide to the backrest support in such a way that a rearward tilting movement of the backrest is translated into an upward swivelling movement of the sitting area at the supporting point.

In a first step the invention is based on the idea that the weight load of a seated person is directed vertically downward. If the tilting or rotating movement of the backrest is directly coupled to the sitting area via an appropriately designed backrest support, then only that component of the weight load that is tangential to the

rotary movement at the supporting point can act. However, the counterforce applied to the seated person by the backrest is then dependent on its tilt.

5 In a further step, the invention is based on the idea that, in order to overcome this disadvantage, a seat guide that guides the sitting area is movably connected to the backrest by means of a connecting rod. The rotary movement of the backrest, and thus of the backrest support, is then translated via the connecting rod into a rotary motion of the seat guide. The linkage via the connecting rod provides additional mechanical degrees of freedom, compared to a direct linkage, which allow the tilt of the backrest to be translated into a desired upward motion of the sitting area in a certain range. These mechanical degrees of freedom include the length of the connecting rod, the location of the connecting rod attachment points on the backrest and the seat guide, and the relative position of the backrest to the seat guide. 10 The fundamental principle in effect here is based on the fact that for a linkage of a rotary movement with a moveable connecting rod, the movement induced parallel to the connecting rod for a given rotary angle is, in turn, dependent on the absolute rotational position. The linkage between the seat guide and the backrest via a connecting rod, as described, can thus be used to compensate for the described undesired dependence of the sitting area lift generated by the backrest for a given differential angle on the absolute tilt angle of the backrest. 15 20 25 30

The backrest is advantageously rotatably attached to the load-bearing frame by means of a rotary bearing, and

features a rotary bearing that rotatably bears the connecting rod, where the rotary bearing that bears the connecting rod is in front of, relative to the backrest, and above, relative to the seat guide, the rotary bearing
5 by means of which the backrest is attached. With this geometry, a backward tilting movement of the backrest starts to cause displacement of the connecting rod, starting at the beginning. A beneficial path for raising the sitting area can be achieved in this manner, via the
10 linkage between the connecting rod and the seat guide that guides the sitting area.

The backrest advantageously features an angled swing arm that rotatably bears the connecting rod. By means of an
15 angled swing arm, the angle between the connecting rod and the tangent of the rotary movement of the backrest at the attachment point, in the initial or resting position of the chair, can be defined so as to save material.

20 The seat guide is conveniently rotatably attached to the sitting area. This allows the orientation of the sitting area to be maintained when the seat guide rotates relative to the load-bearing frame.

25 In an advantageous embodiment of the invention, the seat guide is constructed as a linkage element, in particular as a linkage plate, with a first, a second, and a third rotary bearing. The sitting area is connected to the load-bearing frame via the first and second rotary
30 bearing. The connecting rod is attached via the third rotary bearing. This design is both cost-effective and allows a mechanically simple, movable attachment between the sitting area and the load-bearing frame.

The rotary angle of the linkage element for a given displacement of the connecting rod can be adjusted by means of the distance between the third rotary bearing and the other two rotary bearings. The ratio between the effected rotary angle and the connecting rod displacement, in turn, depends on the absolute rotary position of the linkage element.

10 In a further advantageous embodiment of the invention, the sitting area is guided by means of a seat-guiding element mounted in a bearing on the load-bearing frame at an additional supporting point that is offset from the supporting point, such that an upward swinging movement
15 of the sitting area at the supporting point results in an overall tilt of the sitting area toward the backrest. For such a design, the increasing pressure exerted in a forward direction by the seated person as the backrest is increasingly tilted is borne by the associated induced
20 tilt of the sitting area. Slippage of the seated person is thus prevented. Guiding the sitting area by means of the seat-guiding element at an additional support point thereby allows great freedom in designing the desired synchronous movement of the sitting area relative to the
25 deflection of the backrest.

The seat guide and the seat-guiding element conveniently work together such that, for a backward tilting movement of the backrest, the supporting point is raised, and the
30 additional supporting point is moved upward and backward. Because the supporting point is raised in a rotary movement and the additional supporting point is shifted

by the rotary movement, it is easy to design the lift of the sitting area with a desired tilt path.

5 The seat-guiding element is advantageously designed as a connecting link guide. The connecting link guide allows a rotary movement as a degree of freedom, in addition to guiding along the predetermined cam shape. This allows the movement of the sitting area to be influenced and prespecified, within certain limits, in a simple manner.

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The connecting link guide advantageously features a curved guide. The curvature allows adjustment of the progression of the lift of the additional sitting area supporting point. This, together with the upward swinging movement of the front supporting point, allows the movement path of the sitting area as such to be prespecified.

20 In another expedient embodiment, the connecting link guide has a linear guide. Such a guide is easy to produce. Progression of the upward movement of the additional supporting point can also be realized for a linear guide, via the interplay with the movement path of the front supporting point, such that the sitting area tilts when the backrest is displaced and is also altogether lifted even more as the displacement of the backrest increases.

30 For a counterforce that is perceived by the seated person to be constant, independent of the displacement of the backrest, it is advantageous if the line between the third rotary bearing and the first rotary bearing is at close to a right angle with the line between the third

rotary bearing and the rotary bearing that bears the connecting rod, and the line between the rotary bearing that bears the connecting rod and the third rotary bearing forms an angle of more than 90° , in particular of more than 120° , with the line between the rotary bearing that bears the connecting rod and the rotary bearing that bears the backrest support. This arrangement saves space and allows beneficial translation of the tilting movement of the backrest to a desired upward movement of the sitting area.

In a further structurally strong variant, the synchronization mechanism is arranged symmetrically on both sides of the sitting area. It is thereby particularly expedient to construct the linkage elements as flat linkage plates.

Application examples of the invention are described in more detail by means of a drawing. Shown are in:

- Fig. 1 a schematic side view of an office chair with a weight mechanism in the rest position, where the sitting area is supported on a load-bearing frame by means of a seat guide, and
- Fig. 2 a schematic side view of the office chair as in Fig. 1, in the displaced position, and
- Fig. 3 a schematic side view of an office chair with a weight mechanism in the rest position, where a linear connecting link guide is intended.

Fig. 1 shows a schematic side view of an office chair 1 comprising a sitting area 3 and a backrest 5. The chair 1 further comprises a central chair post 7 that is mounted

on - not shown - a foot frame, in particular a rotary frame with rollers. A central load-bearing frame 8 is attached to the chair post 7, to which the sitting area 3 and the backrest 5 are hinged via a seat guide 9 and a backrest support 10.

To construct a synchronizing mechanism, the backrest support 10 is rotatably attached to the load-bearing frame 8 via the rotary bearing 11. The sitting area 3 is also rotatably attached in a first rotary bearing 17 to the load-bearing frame 8 via the seat guide 9, which is constructed as a linkage element 13. The linkage element 13 comprises, in addition to the first rotary bearing 17, a second rotary bearing 18 and a third rotary bearing 19. The sitting area 3 is mounted at the supporting point 15 in the second rotary bearing 18, such that the sitting area 3 can altogether execute a swinging movement relative to the load-bearing frame 8.

A connecting rod 22 is attached to the third rotary bearing 19 of the linkage element 9, the other end of which is connected to an angle swing arm 25 of the backrest 10 via the rotary bearing 23. The sitting area 3 is connected to the load-bearing frame 8 at an additional supporting point 27 via a connecting link guide 30.

The functionality of the office chair 1 is evident by comparing Fig. 1 and 2. While Fig. 1, as indicated, shows the office chair 1 in the rest position, Fig. 2 shows the office chair 1 in the displaced position.

If, starting from the rest position of the office chair 1 as in Fig. 1, the backrest 5 is tilted backwards, the

swing arm 25 is moved upward to the right due to the mounting of the backrest 10 in the rotary bearing 11. This movement is translated to the linkage element 13 via the connecting rod 22. The displacement of the connecting
5 rod 22 causes linkage element 13 to rise, due to the mounting of linkage element 13 in the first rotary bearing 17. The supporting point 15 of the sitting area 3 thereby moves in an upward swinging movement. The sitting area 3 is thus lifted altogether, and simultaneously
10 moved to the right into the position shown. The additional supporting point 27 of the sitting area 3 thereby moves in a type of swinging movement as well, according to the curved connecting link guide 30, upward and to the right. The curvature of the connecting link
15 guide is thus dimensioned such that the sitting area 3 tilts altogether toward the backrest 5 as the movement progresses.

If the rotary or swinging movement executed by the
20 linkage element 9 and the supporting point 15, the swing arm 25 and the rotary bearing 23, and the additional supporting point 27 is observed relative to a theoretical clock face with 12 hours, then, starting from the rest position of the office chair 1 as in Fig. 1, the
25 supporting point 15 initially moves from 9 o'clock in the direction of the 11 o'clock position in Fig. 2. The connecting rod 22 thereby initially acts approximately tangentially relative to the rotary movement of the linkage element 13 in the third rotary bearing 19. The
30 angle of the connecting rod 22 to the radius of the rotary movement running through the first rotary bearing 17 and the third rotary bearing 19 is approximately 90° . Relative to this rotary movement of the linkage element

13, the swing arm 25 moves, according to the tilt executed by the backrest 5, by about one hour. Thus, at the end of the movement, according to the position of the office chair 1 occupied in Fig. 2, the connecting rod 22
5 is oriented tangentially to the rotary movement of the swing arm 25.

In other words, starting from the rest position of the office chair 1 shown in Fig. 1, at the beginning of the
10 movement, the same displacement angle of the backrest 5 leads to a smaller displacement of the connecting rod 22 than at the end of the movement, according to the displaced position of the office chair 1 in Fig. 1. In addition, the same displacement of the connecting rod 22
15 at the beginning of the movement causes a smaller rotational angle of the linkage element 9 than at the end of the move, according to the position of the office chair 1 in Fig. 2. The design shown has the overall effect that a person seated on the office chair 1
20 experiences a nearly constant counterforce regardless of the tilt position of the backrest 5. Compensation for the tilting movement of the backrest 5 is thereby possible, in that the weight of the seated person that acts additionally on the backrest when it is tilted a lot is
25 taken into consideration. The greater the tilt of the backrest 5, the more the tilt of the sitting area 3 is raised per degree of angle. The counterforce thereby automatically adjusts to the body weight of the seated person via the synchronization mechanism.

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Fig. 3 shows a schematic side view of an office chair 1', where the additional supporting point 27 of the sitting area 3 moves to the right in a linear connecting link

guide 30' when the backrest support 10 is displaced. The linear connecting link guide 30' is thereby designed such that the sitting area 3 tilts toward the backrest 5 as the displacement increases, and is altogether
5 increasingly raised.

Label List

	1, 1'	Office chair
	3	Sitting area
5	5	Backrest
	7	Chair post
	9	Seat guide
	11	Rotary bearing
	13	Linkage element
10	15	Supporting point
	17	First rotary bearing
	18	Second rotary bearing
	19	Third rotary bearing
	22	Connecting rod
15	23	Rotary bearing
	25	Swing arm
	27	Additional supporting point
	30, 30'	Connecting link guide

Claims

1. Chair, in particular office chair (1, 1') comprising
a backrest (5) that is hinged to a load-bearing frame
5 (8) via a backrest support (1), and a sitting area
(3) which is moveable in synchrony with the backrest
(5) and is pivotally connected to the load-bearing
frame (8) in a supporting point (15) via a seat guide
(9), in which the backrest support (10) and the seat
10 guide (9) are rotatably fixed to the load-bearing
frame (8) and a connecting rod (22) movably connects
the seat guide (9) to the backrest support (10) in
such a way that a rearward tilting movement of the
backrest (5) is translated into an upward swivelling
15 movement of the sitting area (3) at the supporting
point.
2. Chair according to claim 1, in which the backrest
support (10) is pivotally connected to the load-
20 bearing frame (8) via a rotary bearing (11) and
comprises a rotary bearing (23) to which the
connecting rod (22) is pivotally attached, which is
arranged in front of, relative to the seat guide (9),
and above, relative to the sitting area (3), the
25 rotary bearing (11).
3. Chair according to claim 1 or 2, in which the
backrest support (10) comprises an angled swing arm
(25) to which the connecting rod (22) is pivotally
30 attached.

4. Chair according to one of the preceding claims, in which the seat guide (9) is pivotally attached to the sitting area (3).
- 5 5. Chair according to one of the preceding claims, in which the seat guide (9) is constructed as a linkage element (13), in particular as a linkage plate, with a first (17), a second (18), and a third rotary bearing (19), where the sitting area (3) is connected
10 to the load-bearing frame (8) via the first (17) and second rotary bearing (18).
6. Chair according to one of the preceding claims, in which the sitting area (3) is guided in an additional
15 supporting point (27) at some distance from the supporting point (15) via a seat-guiding element mounted on the load-bearing frame (8), such that, when the sitting area (3) is moved upward at the supporting point, the sitting area (3) tilts
20 altogether toward the backrest (5).
7. Chair according to claim 6, in which the seat guide (9) and the seat-guiding element work together such that a rearward tilting movement of the backrest (5)
25 raises the supporting point (15), and the additional supporting point (27) is moved upward and rearward.
8. Chair according to claim 6 or 7, in which the seat-guiding element is constructed as a connecting link
30 guide (30).

9. Chair according to claim 8, in which the connecting link guide has a curved guide.
- 5 10. Chair according to claim 8, in which the connecting link guide has a straight guide.
- 10 11. Chair according to one of the claims 5 through 10, in which the line between the third rotary bearing (19) and the first rotary bearing (17) forms approximately a right angle with the line between the third rotary bearing (19) and the rotary bearing (23) that bears the connecting rod (22), and where the line between the rotary bearing (23) that bears the connecting rod (22) and the third rotary bearing (19) forms an angle
15 of more than 90° , in particular of more than 120° , with the line between the rotary bearing (23) that bears the connecting rod (22) and the rotary bearing (11) that bears the backrest support (10).