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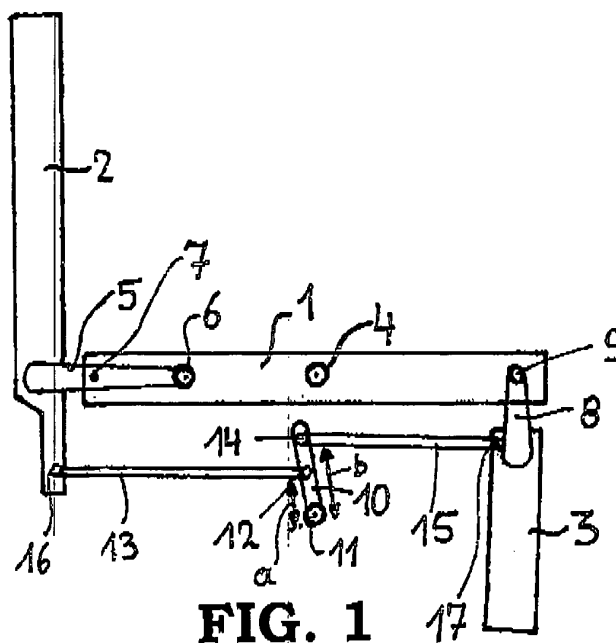
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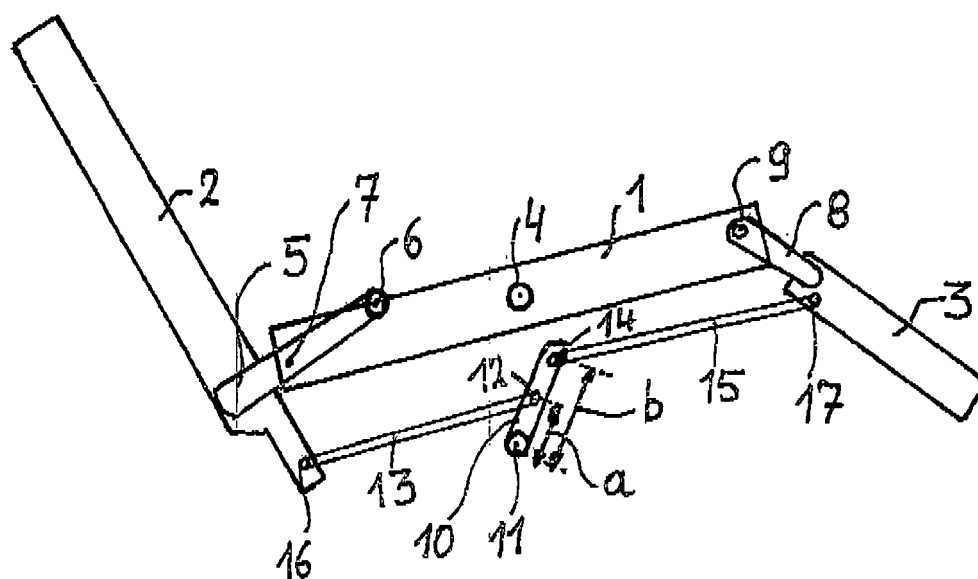
(54) **Seating unit**

(57) This invention relates to a seating unit, in particular a relaxing chair, comprising a seat part (1), a backrest (2) which can be placed in a sitting position and a reclining position and a footrest (3) which can be placed in a folded-in and in a folded-out position, and a mechanism for transmitting the movements of the backrest (2) to the seat part (1) and to the footrest (3) so that, by moving the backrest (2) to the reclining position, the seat part (1) is tilted and the footrest (3) is moved to the folded-out position, in which the movements of the backrest (2)

are transmitted to the footrest (3) via a transmission mechanism (10-15) with a transmission ratio ( $b/a$ ) greater than 1, in which the seat part (1) and the backrest (2) are rotatable about respective fixed shafts (4), (6) while the seat part (1) and the backrest (2) are directly connected to one another so that a rotation of the backrest (2) causes a rotation of the seat part (1). Such a mechanism can be of compact design in terms of height and allows a virtually unlimited creativity in terms of design, while at the same time limiting the load on the points of rotation.



**FIG. 1**



**FIG. 2**

## Description

**[0001]** This invention relates to a seating unit, comprising a seat part, a backrest which can be placed in a sitting position and a reclining position and a footrest which can be placed in a folded-in and in a folded-out position, in which a mechanism is provided in order to transmit the movements of the backrest to the seat part and to the footrest so that, by moving the backrest from the sitting position to the reclining position, the angle of inclination of the seat part is changed and the footrest is moved from the folded-in to the folded-out position, and in which the movements of the backrest are transmitted to the footrest via a transmission mechanism with a transmission ratio greater than 1.

**[0002]** This patent application relates in particular to a relaxing chair. Chairs or seats which are intended for use as garden furniture (inter alia garden chairs) or for use in the nursing profession (nursing homes, hospitals and the like) or for use in connection with a medical or paramedical profession, or for installation in a means of transport (e.g. buses, trains, aeroplanes and the like) are also covered by the scope of the invention.

**[0003]** In this patent application, the term seating unit is used in its broadest sense to denote any device on which an individual can sit and/or lie. Therefore, chairs, sofas and beds are also within the scope of the invention.

**[0004]** With a number of known relaxing chairs, the footrest is folded out independently of the movement of the backrest into the reclining position. As a result, this kind of seating unit is less user friendly. Many known relaxing chairs have a direct mechanical connection between the backrest and the footrest so that the footrest folds out when the backrest is moved into the reclining position. When designing a relaxing chair of this type, this connection has to engage at a relatively great distance from the pivot point of the backrest and/or at a relatively small distance from the pivot point of the footrest. All this in order to achieve a rotation of the footrest by means of the tilting motion of the backrest which is sufficient to move it from the folded-in position to the folded-out position. In general, the aim is to achieve a rotation of approximately 95° of the footrest by rotating the backrest through an angle of approximately 35°.

**[0005]** However, if the connection engages near the pivot point of the footrest, this pivot point has to absorb a relatively large load. Consequently, this pivot point will be more susceptible to wear and/or defects resulting from the excessive load. On the other hand, as a result of the fact that the connection engages at a great distance from the pivot point of the backrest, a mechanism is produced which takes up a relatively large amount of space in terms of height. As the mechanism should be incorporated into the chair in such a manner that it is invisible, the seat part will have to be made relatively high. This considerable limits the freedom of design of new seating unit models.

**[0006]** The points of engagement of the connection

thus have to be selected as a function of the desired angular displacement, so that adverse effects relating to the overall height and the load on the pivot point cannot be prevented or can only be prevented to an insufficient degree.

**[0007]** With a number of known relaxing chairs, the seat part is incorporated into the mechanism in such a manner that it is moved backwards if the backrest is brought into the reclining position. By moving the seat part backwards, the footrest is moved into its folded-out position. If the backrest is returned to the sitting position, the seat part is moved forwards again. The disadvantage of this kind of mechanism is that the various movements of the seat part lead to a forward or backward shift of the centre of gravity. In order to be able to guarantee the stability of the chair at each point in time, this should be taken into account when designing a seating unit of this type.

**[0008]** German patent DE 10 73 175 B describes a chair having the features described in the first paragraph of the present description. Via a connecting rod, the backrest is connected to a rotatable arm, which is in turn connected to the footrest via a first rod and to the seat part via a second rod. The mechanism which is situated underneath the seat part thus comprises three rods and a rotatable arm, so that there is a relatively large mechanism underneath the seat part of this known chair. This limits the freedom of design if the mechanism is to be incorporated into the seat part in such a manner that it is invisible.

**[0009]** The movements of the backrest are transmitted to the seat part and to the footrest via the same rotatable arm, as a result of which the pivot point of the rotatable arm is also subjected to a relatively great load. The distance between the point of engagement of the connecting rod and the pivot point of the rotatable arm also has to be sufficiently large to enable the required force to develop in order to move both the seat part and the footrest, as a result of which the installation of the mechanism into a seat part of limited height is difficult to achieve.

**[0010]** It is an object of the invention to provide a solution to the abovementioned drawbacks by providing a seating unit of the above-described type, the mechanism of which is not only simple and user friendly and functions in an efficient and reliable manner, but is also relatively compact in terms of height, results in a low load of the points of rotation of the mechanism and does not require any special measures in order to ensure stability.

**[0011]** This object is achieved by a seating unit having the features indicated in the first paragraph of this patent application in which the seat part and the backrest are directly connected to one another and are rotatable about respective fixed shafts which are spaced apart, so that a rotation of the backrest causes a rotation of the seat part.

**[0012]** Such a mechanism can be of compact design in terms of height and the mechanism may be arranged at a small distance from the bottom of the seat.

**[0013]** As a result of the direct connection between the backrest and the seat part, the mechanism can be designed such that it has fewer parts and is consequently simpler, inter alia compared to the mechanism known from DE 10 73 175 B. In addition, it is sufficient for the transmission mechanism to develop a smaller force. If this mechanism is designed to have a rotatable arm, the pivot point of said arm is also subjected to a smaller load and the mechanism can be designed to have a limited height.

**[0014]** In the context of this invention, a 'direct connection between the seat part and the backrest' has to be understood as meaning a connection in which the seat part and the backrest are not connected to one another via an intermediate mechanism or via one or more intermediate rotatable connecting elements. In so far as necessary, it should be stressed here that a part or element which is fixedly connected to (is secured to) the backrest or the seat part is regarded as being a part which forms part of this backrest or this seat part. The direct connection referred to here may thus also be achieved by connecting the one part (the seat part or the backrest) to an element or intermediate piece which is fixedly connected to (forms part of) the other part (the backrest or the seat part).

**[0015]** The additional advantage resulting from the fact that the transmission ratio is greater than 1 is that the movement of the backrest is amplified, as a result of which the location of the points of engagement of the mechanical connection on the backrest and the footrest no longer has to be chosen based on the angular rotations of the backrest and footrest, but instead these points of engagement can now be chosen freely, based on the desired overall height of the mechanism and of the load on the pivot points.

**[0016]** Such a mechanism allows a virtually unlimited creativity in terms of design, while at the same time limiting the load on the points of rotation. In addition, the seat part can only be rotated about a fixed shaft and is not displaceable in a forward or backward direction, so that there is no need to take a shift of the centre of gravity into account when designing such a seating unit.

**[0017]** With several known seating units, the footrest is not hingedly connected to the seat part and folding out is effected by a separate mechanism. This mechanism moves forward during the folding out and a number of rods thereof become visible. This is not only disadvantageous from an aesthetic point of view, but since these rods are also accessible, these systems also leave something to be desired from the point of view of safety.

**[0018]** In order to also overcome this disadvantage, the seating unit is preferably provided with a footrest which is hingedly connected to the seat part.

**[0019]** The seating unit according to the invention is preferably designed such that the said transmission mechanism is situated in a central zone under the seat part.

**[0020]** Consequently, this mechanism is very well hid-

den under the seat part and is not visible when looking at the seating unit from the side, and can thus not adversely affect the aesthetic design of the seating unit.

**[0021]** The said transmission mechanism preferably comprises a lever arm rotatable in a fixed point, in which a first and a second rod are connected to this lever arm at different distances from this fixed point, and in which the rod is connected to the backrest with the connection point which is closest to the fixed point of rotation while the other rod is connected to the footrest.

**[0022]** Such a transmission mechanism is particularly simple and yet sufficiently reliable and efficient.

**[0023]** The said transmission ratio is preferably less than 3 and, in a particularly preferable embodiment of the invention, is between 2.3 and 2.7. A transmission ratio of approximately 2.5 is particularly advantageous.

**[0024]** Preferably, the seating unit is designed such that the backrest comprises at least one arm which forms an angle with the plane of the backrest, that this arm is rotatable about a fixed shaft, and that the arm is rotatably connected to the seat part at a connection point which is situated on the side of the backrest relative to the fixed shaft.

**[0025]** Each rotation of the backrest is consequently transmitted to the seat part by means which are very simple to produce. By suitable selection of the connection point, it can be ensured that the maximum displacement of the backrest corresponds to an appropriate inclination of the seat part.

**[0026]** In one preferred embodiment, the seating unit according to the invention comprises a resilient element which exerts a force on the backrest, as a result of which the latter is forced into the sitting position. Consequently, a user of the seating unit can move effortlessly from the reclining position into the sitting position, thus creating a very user-friendly seating unit.

**[0027]** The said resilient element is, for example, a gas spring which can be placed in a locking position in order to keep the movable parts of the seating unit in a fixed position. Preferably, a manually operable lever is provided in order to move the gas spring in and out of its locking position.

**[0028]** In its most preferred embodiment, the seating unit according to the present invention is a relaxing chair or a chair or seat for use as garden furniture (inter alia garden chairs), for use in the nursing profession or for use in connection with a medical or paramedical profession or for installation in a means of transport for people.

**[0029]** In the following description, a relaxing chair according to the present invention is described in more detail. This description serves only to explain the features of the seating unit according to the present invention in more detail and should therefore not be regarded as a limitation to the protection claimed in the claims of this patent application, or to the field of application thereof.

**[0030]** In this description, reference numerals are used to refer to the attached figures. These figures are:

Figs. 1 and 2, which show a diagrammatic representation of the seat part, the backrest, the footrest and the mechanism of a relaxing chair according to the invention, in a sitting position and in a reclining position, respectively;

Fig. 3, which shows a perspective view of the mechanism of a first preferred embodiment of a relaxing chair according to the invention;

Figs. 4 and 5, which show perspective views of an underframe with a mechanism and a backrest of a relaxing chair according to a second preferred embodiment of the invention, in a sitting position and in a reclining position, respectively; and

Fig. 6, which shows a side view of the relaxing chair depicted in Fig. 5.

**[0031]** In Figs. 1 and 2 the mechanism of a chair according to the invention is shown in greatly simplified form in order to illustrate its operational principle. The chair comprises three movable parts, i.e. a seat part (1), a backrest (2) and a footrest (3), which are attached to a fixed supporting structure or frame (not shown in Figs. 1 and 2).

**[0032]** The seat part (1) is rotatable about a fixed shaft (4). The backrest (2) comprises a fixed supporting arm (5) which is secured to and thus forms part of the backrest (2), and extends towards the front of the chair and is itself rotatable about a second fixed shaft (6). The backrest (2) is consequently rotatable about the fixed shaft (6).

**[0033]** Furthermore, this fixed supporting arm (5) is also connected to the seat part (1) at a point (7) located between the fixed shaft (6) and the backrest (2), so that the backrest (2) and the seat part (1) are directly connected to one another.

**[0034]** When the backrest (2) is rotated about the fixed shaft (6), the point (7) will move down and cause a rotation (with the same direction of rotation) of the seat part (1) about the fixed shaft (4).

**[0035]** The footrest (3) is hingedly connected to the seat part (1) via an arm (8) which is rotatably connected at a point (9) on the front of the seat part (1). A lever arm (10) which is rotatably connected at a fixed point of rotation (11) is situated under the seat part (1). At a first point (12), the lever arm (10) is connected to a first rod (13) which is connected to the backrest (2) at a point (16). At a second point (14), the lever arm (10) is connected to a second rod (15) which is connected at a point (17) to the footrest (3). The distance (b) between the said second point (14) and the fixed point of rotation (11) is greater than the distance (a) between the said first point (12) and this point of rotation (11), so that a specific displacement of the first rod (13) is converted into a greater displacement of the second rod (15) by means of the lever arm (10). The lever arm (10) thus acts as a transmission mechanism with a transmission ratio greater than 1.

**[0036]** Preferably, the ratio (b/a) of, on the one hand, the distance (b) between the second point (14) and the fixed point of rotation (11) and, on the other hand, the distance (a) between the first point (12) and the fixed point of rotation (11) is approximately 2.5.

**[0037]** In the following description, reference is made to the Figures 3, 4, 5 and 6 which illustrate a first (Fig. 3) and a second embodiment (Figs. 4, 5 and 6) of a relaxing chair according to the present invention.

**[0038]** In these figures, parts which have the same function as a part which is diagrammatically represented in Figs. 1 and 2, are denoted by the same reference numerals as those used in Figs. 1 and 2.

**[0039]** In a first embodiment (see Fig. 3), the relaxing chair comprises a fixedly connected supporting construction with two side panels (20) which extend on both sides of the seat part (1). Furthermore, the chair also comprises a shaft (4) which extends in the width direction of the chair, between the side panels (20).

**[0040]** The seat part (1), of which only the frame is illustrated here, is rotatable about this fixed shaft (4). At the front of the frame of the seat part (1), two forwardly directed slats (21) having upwardly directed end parts are provided. On the end part of each slat (21), an arm (8) is pivotably attached, each arm (8) in turn being provided in order to be connected to the footrest (3) (not shown in this figure). The arms (8) are hingedly connected to the slat (21), so that the footrest (3) can be rotated from a folded-in position to a folded-out position, and vice versa.

**[0041]** Furthermore, the shaft (4) also supports two fixed supports (22) which extend backwards near the ends of the shaft (4). A horizontally extending profiled section (23) of rectangular cross section, provided in order to be connected to the backrest (2), comprises two forwardly directed arms (5) which are hingedly connected to the respective supports (22). The arms (5) are pivotably connected to the frame of the seat part (1) by means of a cylindrical intermediate piece (24), which is in line with the profiled section (23). This connection is denoted with reference numeral (7).

**[0042]** Furthermore, the shaft (4) also has two parallel legs (25) which are directed obliquely downwards. Each leg (25) is connected, near its bottom end, to a respective lever arm (10), in such a manner that the two legs (25) are situated between the two lever arms (10). The lever arms (10) are pivotably mounted on a shaft (11) extending between the lever arms. This shaft (11) is thus a fixed pivot point of the lever arms (10). Each of these lever arms (10) is furthermore connected to a first (13) and a second rod (15). The first (13) and the second rods (15) are pivotably connected at a first point (12) and at a second point (14), respectively, the latter being located further from the shaft (11), of the lever arms (10).

**[0043]** For example: the distance between the shaft (11) and the connecting points (12) of the first rods (13) is approximately 4 cm, while the distance between the shaft (11) and the connecting points (14) of the second

rods (13) is approximately 10 cm, so that the transmission ratio is approximately 2.5.

**[0044]** At a pivot point (16), the other ends of the first rods (13) are pivotably connected to the downwardly directed parallel platelets (26) which are fixedly connected near the centre of the said profiled section (23). The other ends of the second rods (15) are provided in order to be connected to the footrest (3) via a pivot point (17).

**[0045]** A pin (16) runs between the downwardly directed platelets (26) which are provided on the profiled section (23), on which pin (16) the body of a gas spring (27) is mounted. The movable part of this gas spring (27) is mounted on the fixed shaft (11) of the lever arms (10). As a result of the spring force, the backrest (1) is forced into the sitting position. By means of a manually operable lever (28) on both sides of the chair, the gas spring (27) can be brought into and out of the locking position and the chair can be retained in the sitting position or the reclining position or in any desired intermediate position.

**[0046]** The most significant difference between the second embodiment shown in Figs. 4, 5 and 6 and the first embodiment according to Fig. 3 is that the shaft (4) with the backwardly directed supports (22) has been omitted in the second embodiment. The chair's supporting structure now comprises a fixed bridging plate (29) which extends from the one side to the other side underneath the seat part (1) and has an upright flank on both sides. The fixed pivot points (4), (6) are provided on the upright flanks of this bridging plate (29).

**[0047]** Two parallel legs (30) extending obliquely upwards are provided on the centre section of the bridging plate (29). The fixed pivot point (11) of the lever arms (10) is located on a respective leg (30) provided on the bridging plate (29).

**[0048]** In this embodiment, the movable part of the gas spring (27) is rotatably mounted on a pin (31) which connects the top ends of the legs (30) provided on the bridging plate (29). The footrest (3) is directly connected to the seat part (1) at the pivot points (32).

**[0049]** For the remainder, the mechanisms of the two embodiments are virtually identical. The relaxing chair according to Fig. 3 is suitable for use in the medical profession or the nursing profession (rest homes and the like), while the other embodiment (according to Figs. 4 to 6) is more suitable for use as a typical relaxing chair.

**[0050]** In Figs. 5 and 6, the chair from Fig. 4 is shown with a partially reclined backrest (2).

**[0051]** The action of the mechanism is identical in both embodiments: when the gas spring (27) is not in the locking position, the backrest (2) can be tilted backwards, this backrest (2), including the profiled section (23), rotating about the fixed pivot point which is denoted by reference numeral (6). The point (7) where the backrest (2) is connected to the seat part (1) is in this case moved down, so that the seat part (1) is entrained and will rotate about the fixed shaft (4) (Fig. 3) or the fixed pivot points (4) (Fig. 4 to 6) with the same direction of rotation. Consequently, the seat part is moved to a position where it

is inclined downwards towards the back (see Figs. 5 and 6).

**[0052]** At the same time, the rotation of the profiled section (23) will lead to the connecting points (16) being moved forward, and, via the rods (13), this movement will be transmitted to the lever arms (10) which will start to rotate about their fixed pivot point (11) in the forward direction. This will result in the rods (15) also being displaced in the forward direction, so that the footrest (3) connected to these rods (15) will rotate about the pivot points (9) into the folded-out position. In this case, the displacement of the latter rods (15) will be greater (approximately 2.5 times greater) than the displacement of the former rods (13), due to the different distances (10 cm and 4 cm) between their points of engagement (12), (14) and the fixed point of rotation (11) of the lever arms (10).

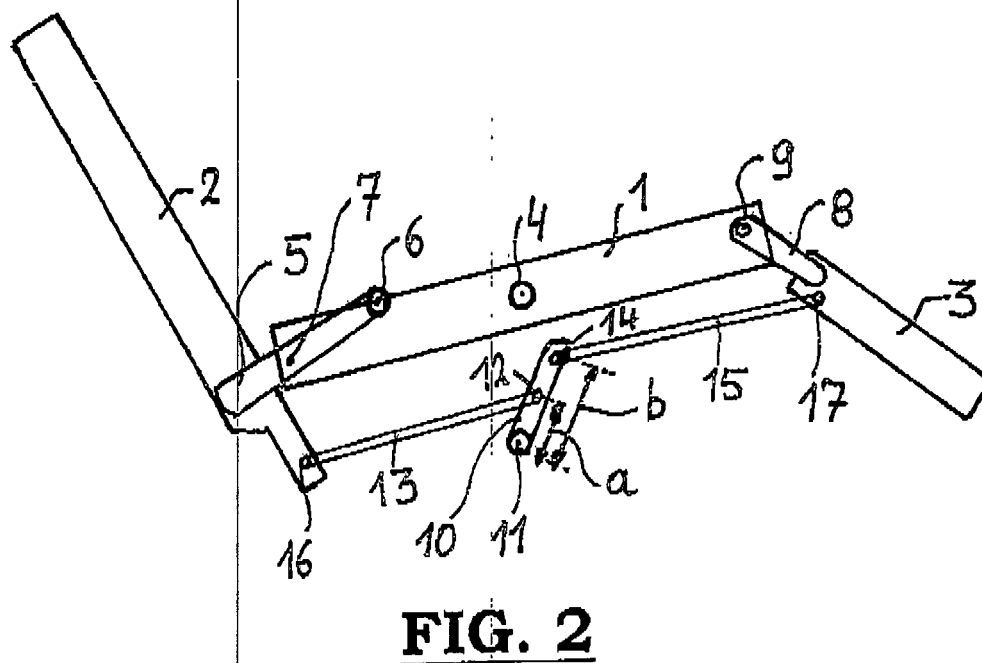
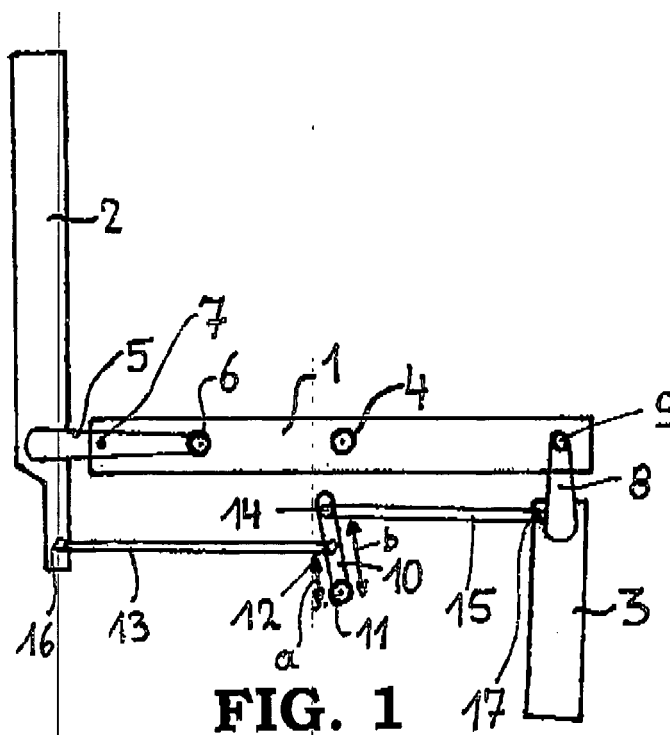
**[0053]** By placing the gas spring (27) in the locking position, the connection point (16), where the body of the gas spring (27) is connected to the movable backrest (2), is kept at a fixed distance relative to the fixed point (11), (31) to which the movable part of the gas spring (27) is connected. As a result, each further movement of the backrest (2), and consequently also of the footrest (3) and the seat part (1), is rendered impossible, thus making it possible to retain the chair in any possible position.

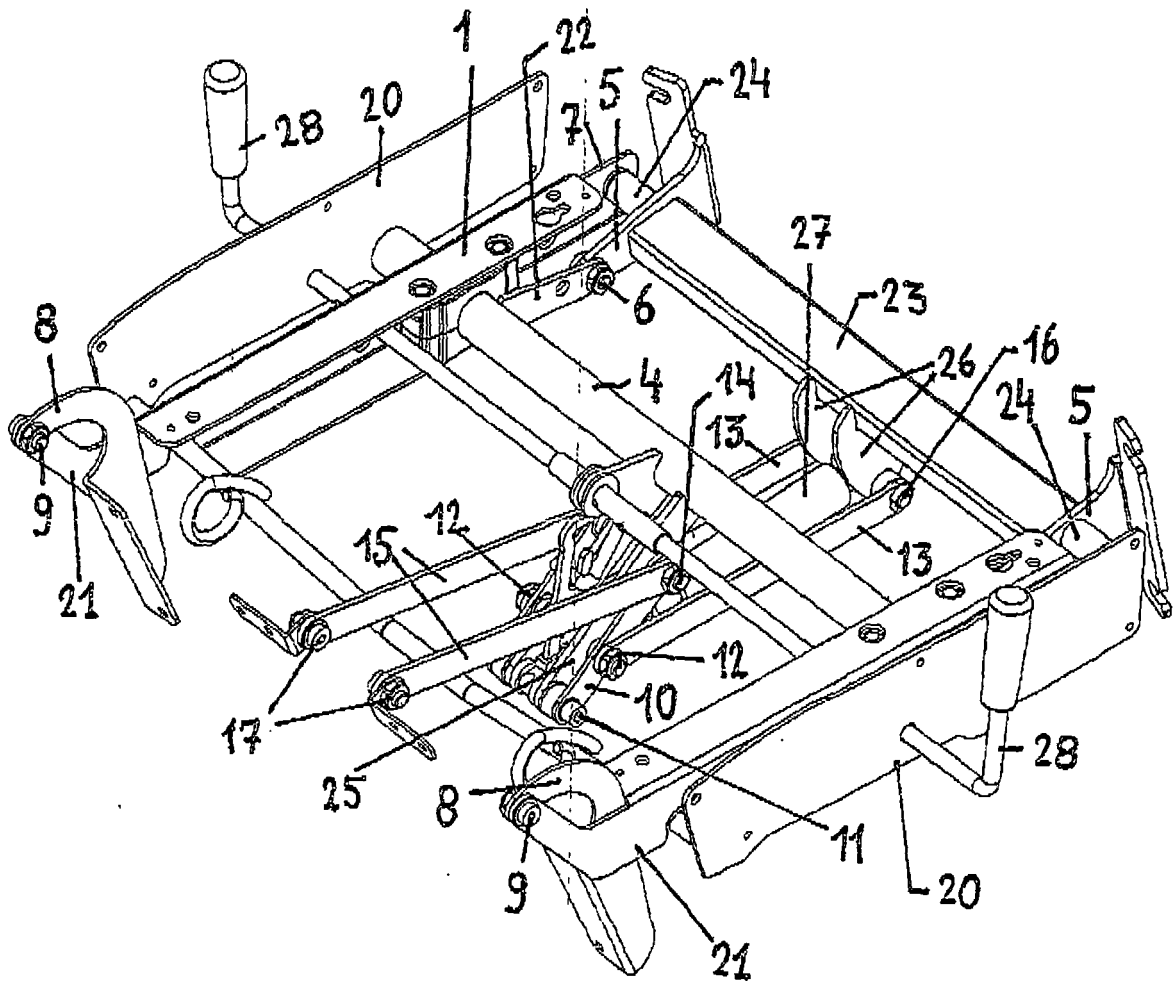
**[0054]** When the gas spring (27) is taken out of the locking position, this gas spring (27) will exert a force in order to move the backrest (2) into the sitting position, enabling the user to return to the sitting position effortlessly.

## Claims

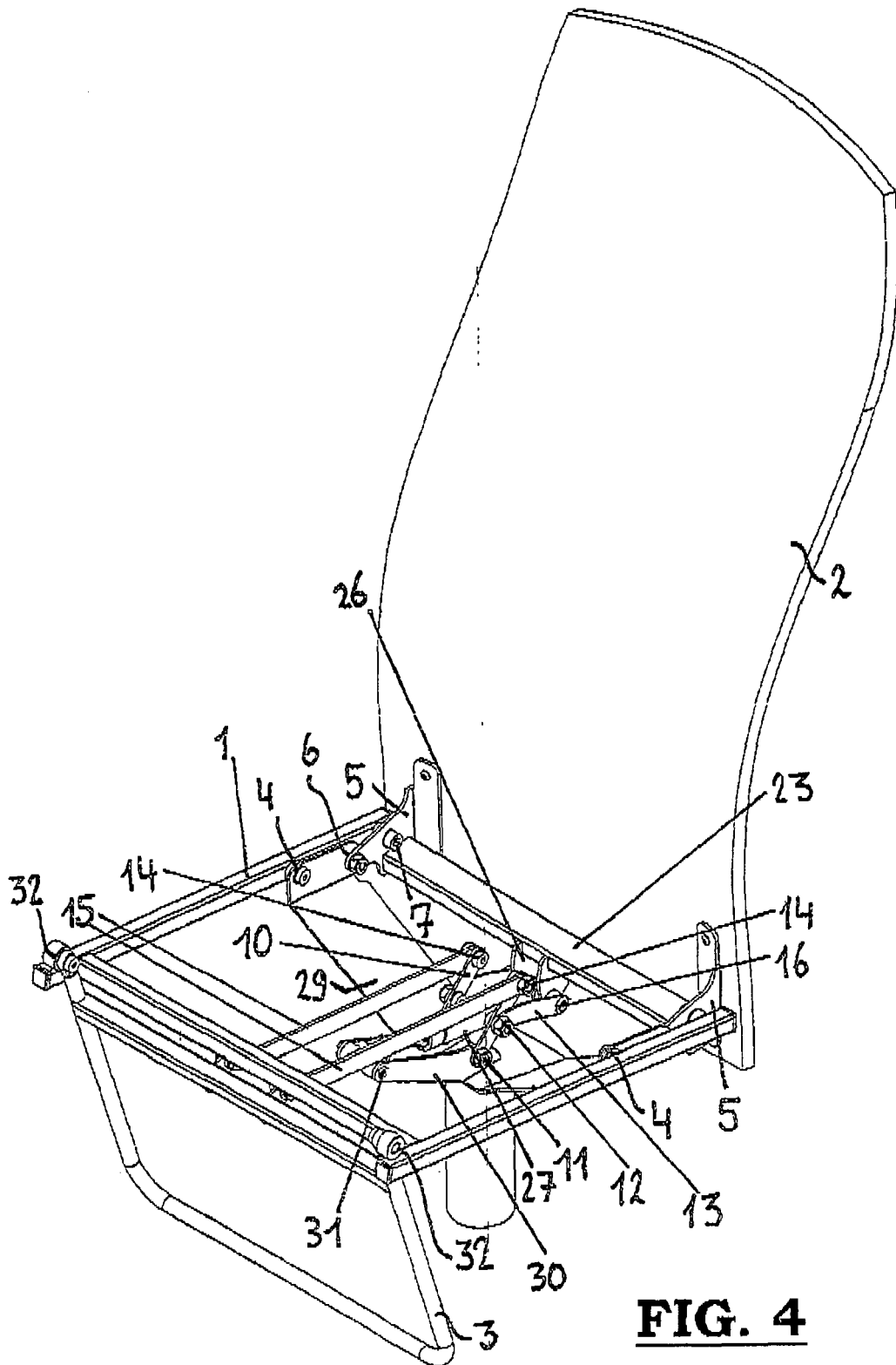
1. Seating unit, comprising a seat part (1), a backrest (2) which can be placed in a sitting position and a reclining position and a footrest (3) which can be placed in a folded-in and in a folded-out position, in which a mechanism is provided in order to transmit the movements of the backrest (2) to the seat part (1) and to the footrest (3) so that, by moving the backrest (2) from the sitting position to the reclining position, the angle of inclination of the seat part (1) is changed and the footrest (3) is moved from the folded-in to the folded-out position, and in which the movements of the backrest (2) are transmitted to the footrest (3) via a transmission mechanism (10-15) with a transmission ratio (b/a) greater than 1, **characterized in that** the seat part (1) and the backrest (2) are directly connected to one another and are rotatable about respective fixed shafts (4), (6) which are spaced apart, so that a rotation of the backrest (2) causes a rotation of the seat part (1).
2. Seating unit according to Claim 1, **characterized in that** it is provided with a footrest (3) which is hingedly connected to the seat part (1).

3. Seating unit according to Claim 1 or 2, **characterized in that** the said transmission mechanism (10-15) is situated in a central zone under the seat part (1).  
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4. Seating unit according to one of the preceding claims, **characterized in that** the transmission mechanism (10-15) comprises a lever arm (10) rotatable in a fixed point (11), **in that** a first (13) and a second rod (15) are connected to this lever arm (10) at different distances (a), (b) from the fixed point of rotation (9), and **in that** the rod (13) is connected to the backrest (2) with the connection point (12) which is closest to the fixed point of rotation (9) while the other rod (15) is connected to the footrest (3).  
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5. Seating unit according to one of the preceding claims, **characterized in that** the said transmission ratio is less than 3.  
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6. Seating unit according to one of the preceding claims, **characterized in that** the said transmission ratio is between 2.3 and 2.7 and is preferably approximately 2.5.  
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7. Seating unit according to one of the preceding claims, **characterized in that** the backrest (2) comprises at least one arm (5) which forms an angle with the plane of the backrest (2), **in that** this arm (5) is rotatable about a fixed shaft (6), and **in that** the arm (5) is rotatably connected to the seat part (1) at a connection point (7) which is situated on the side of the backrest (2) relative to the fixed shaft (6).  
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8. Seating unit according to one of the preceding claims, **characterized in that** it comprises a resilient element (27) which exerts a force on the backrest (2), as a result of which the latter is forced into the sitting position.  
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9. Seating unit according to Claim 8, **characterized in that** the resilient element (27) is a gas spring which can be placed in a locking position in order to keep the movable parts (1), (2), (3) of the seating unit in a fixed position.  
45
10. Seating unit according to one of the preceding claims, **characterized in that** it is a relaxing chair or a chair or seat for use as garden furniture or for use in the nursing profession or for use in connection with a medical or paramedical profession or for installation in a means of transport for people.  
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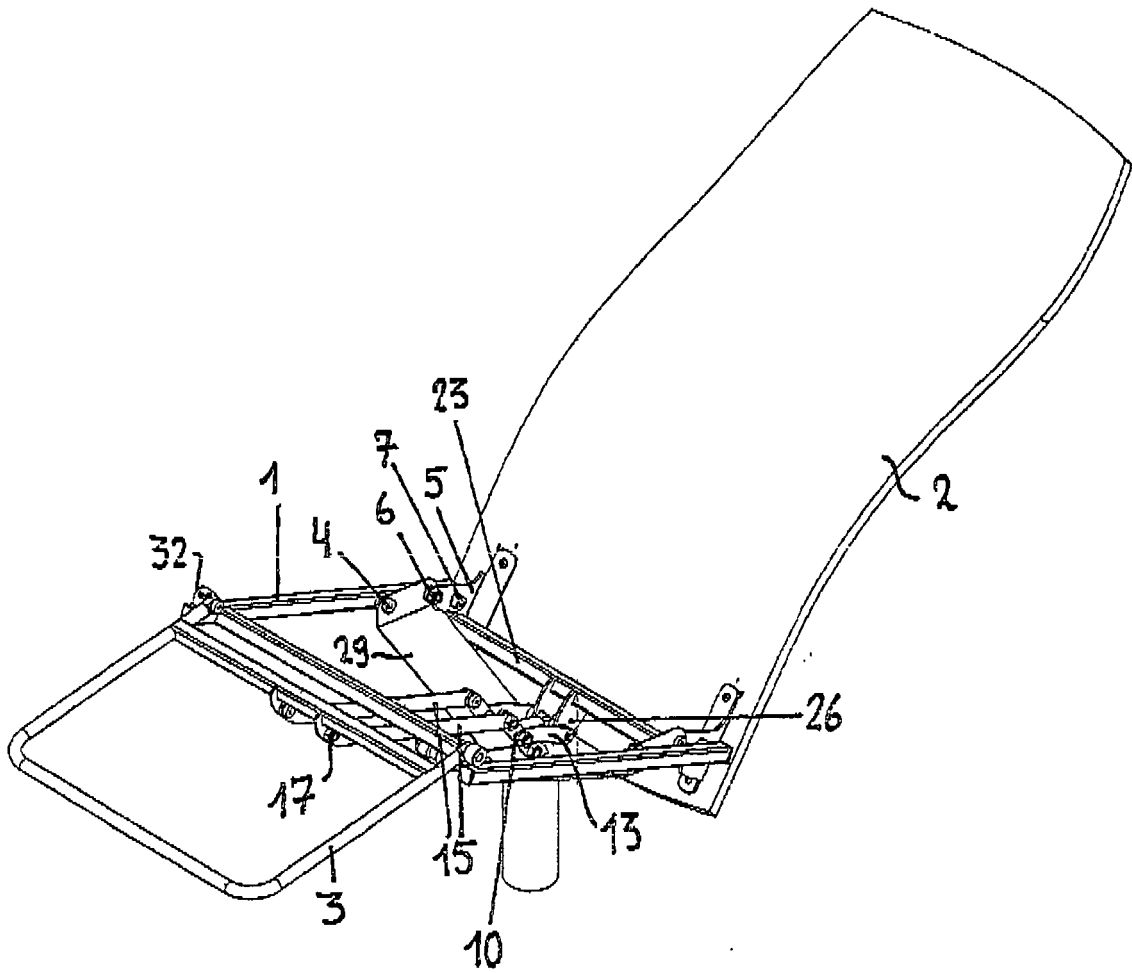




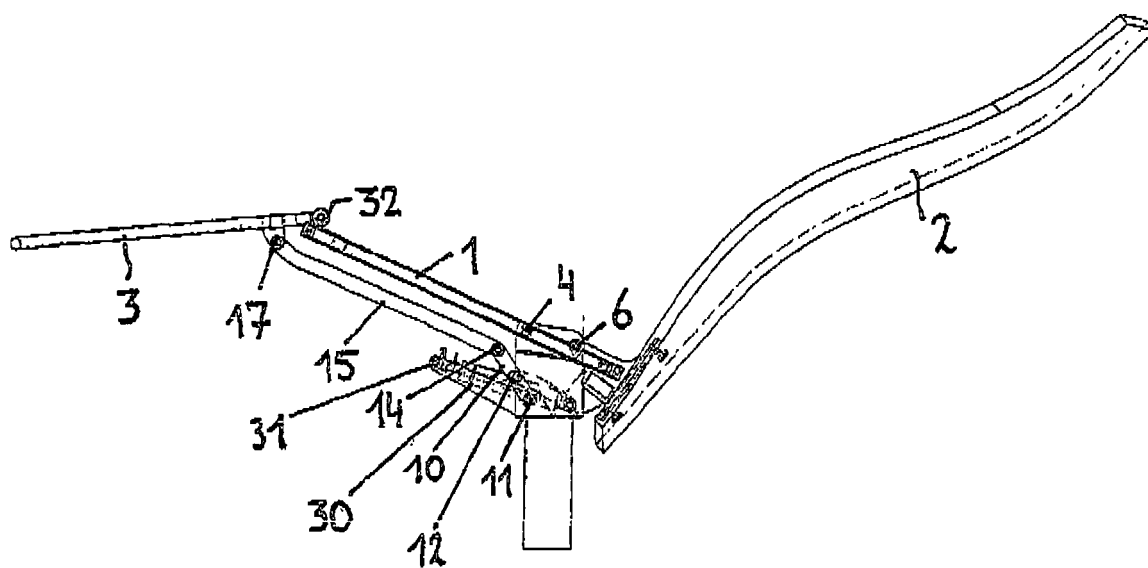
**FIG. 3**



**FIG. 4**



**FIG. 5**



**FIG. 6**



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 05 02 8305

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                 |                                                  |                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Citation of document with indication, where appropriate, of relevant passages                                                                                                   | Relevant to claim                                | CLASSIFICATION OF THE APPLICATION (IPC)    |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | GB 2 275 867 A (PRODUCTION TOOLS)<br>14 September 1994 (1994-09-14)<br>* page 3, line 24 - page 6, line 24;<br>figures 1-3 *                                                    | 1-3,5,7,<br>8,10                                 | A47C1/035                                  |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | * page 7, line 17 - page 8, line 7 *                                                                                                                                            | 4                                                |                                            |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | * page 5, line 15 - page 6, line 14 *                                                                                                                                           | 9                                                |                                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -----                                                                                                                                                                           |                                                  |                                            |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | FR 1 131 243 A (M. WASSILI LUCKHARDT)<br>19 February 1957 (1957-02-19)<br>* column 3, line 14 - line 47; figure 3 *                                                             | 1-3,5,10                                         |                                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -----                                                                                                                                                                           |                                                  |                                            |
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5

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