PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A47C 1/022 — A1

(11) International Publication Number: **WO 00/15080**

(43) International Publication Date: 23 March 2000 (23.03.00)

(21) International Application Number: PCT/US99/19111

(22) International Filing Date: 20 August 1999 (20.08.99)

(30) Priority Data:
9803082-8 10 September 1998 (10.09.98) SE

(71) Applicant *(for all designated States except US)*: JONBER, INC. [US/US]; c/o Fasth Law Offices, 509 Queensferry Road, Cary, NC 27511 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: JONSSON, Bertil [SE/SE]; Vasteralnas 2032, S-894 91 Sjalevad (SE).

(74) Agent: FASTH, Rolf; Fasth Law Offices, 509 Queensferry Road, Cary, NC 27511 (US).

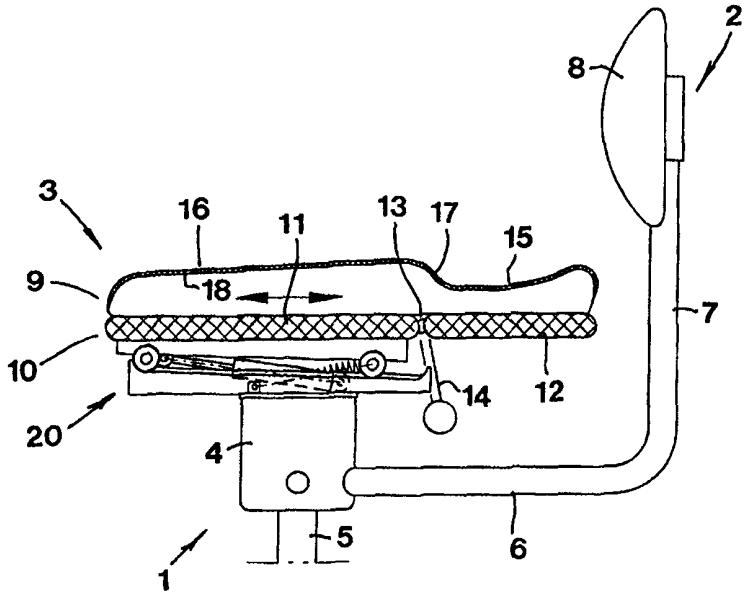
(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments

(54) Title: CHAIR



(57) Abstract

A chair that includes a frame (1), a seat (3), and a back support (2) that has a lumbar support device (8) to support the back bone of the user. The seat (3) includes a soft cushion (9) and a support panel (10) that includes a front and rear disc part (11, 12) of which the latter protrudes as a free end from the first and is not in contact with the back support. The cushion (9) has a rear seating area (15) that is recessed relative to a forward seating area (16) so that a transition area (17) is formed that provides a knob against which the user's sitting bones may bear against with a view to prevent forward gliding of the user's thigh bones along the seat. The rear disc part (12) is also lowerable from an upper starting position to enable a variation of the height level.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

CHAIR

Technical field of the invention

The invention relates to a chair that includes a frame, a back support that has a lumbar support device disposed a certain level above the frame to support the user's lumbar spine and/or the pelvis rim (cristae iliaca). The chair also includes a seat that is put together by a support panel that is supported by the frame. The support panel includes the front and back parts, and an upper soft cushion that has a seating area that is recessed relative to a front seating area.

Background of the invention

Chairs that are used for a variety of purposes, such as office chairs, chairs for home use, vehicle chairs or seats etc. sometimes include a special lumbar support device to support the lower back of the user. Usually this device is a softly rounded protrusion or cushion that is disposed on the front of the back support and a certain level above the seat. Below this protrusion, the sitting user may push in his pelvis so that the protrusion bears against the lower back so that the lower back is in an ergonomically desirable, sway-backed or bow shaped position.

A chair that has a support panel that is divided in a front and back part is already known by US 1 836 630. However, that chair has a back support that is non-rotatably attached to the rear part of the support panel. The rear part is non-rotatably attached to the frame of the chair. The fact that the rear part of the support panel and the back support are non-rotatably attached to one another has the consequence that the user risks to slide forwardly along the seat so that the bottom loses

is supporting contact with the back support in the area that is below the lumbar support device. In this way, the ergonomically desirable sway-back position of the spine is mediocre. In other words, the body posture of the user becomes wrong and tiresome which can easily create back pain.

A chair of the type described in ingress is also known in US 4 709 961. That chair includes a cushion that is included in the seat and a rear seating area that when the chair is used may be recessed relative to the front seating area. More particularly, by turning the front seating panel upwardly and adjusting its rearward/downward position with an adjustment mechanism against a rear support panel that is sloping. Even in this case, the rear part of the support panel is non-rotatably or unmovably attached to the frame and non-rotatably attached to the back support. This means that the risk for sliding forward along the seat is apparent.

The object and distinctive features of the invention

The present invention has the object of solving the above-mentioned problems associated with the earlier known chairs as mentioned above and to create an improved chair. A fundamental object of the invention is thus to create a chair that ensures a lasting and satisfactory support contact between the bottom of the user and the lower part of the back support. Another object is to create a chair that provides a complete support of the user's back against the lumbar support of the back support without requiring that the user must intentionally push in the bottom against the lower part of the back support that is situated below the lumbar support device.

According to the invention, at least the fundamental object is achieved in the distinctive feature mentioned in claim 1. Preferably embodiments of the present invention are further defined in the dependent claims.

Brief description of the attached drawings

In the drawings:

Fig. 1 is a schematic, partly cross-sectional side view showing the chair according to the invention, wherein a support panel that is included in the seat of the chair is shown in a first functional position;

Fig. 2 is an analog side view showing the support panel of the seat in a second functional position;

Fig. 3 is a side view that corresponds to Fig. 1 illustrating an alternative embodiment of the chair seat;

Fig. 4 is an analog side view showing support panel of the seat in a functional position that is different from the position in Fig. 3;

Fig. 5 is a bottom view of the chair seat according to Figs. 1-4;

Figs. 6-7 are simplified side views showing a third alternative embodiment of a seat for the chair;

Fig. 8 is a side view showing the chair according to Figs. 1 and 2 during use, wherein the seat is shown in a forward end position; and

Fig. 9 is an analog side view showing the same seat in a rearward end position.

Detailed Description of Preferred Embodiments of the Invention

The chair shown in Figs. 1 and 2 includes a frame that, as a whole, is referred to with reference numeral 1, a back support 2 and a seat generally referred to with 3. This chair is exemplified in the form of an office chair which frame 1 includes a cylinder shaped support 4 that is disposed on a member 5 that may contain a gas cartridge. The gas cartridge may be attached to a support member on wheels (not shown). The back support 2 has a protrusion 6 that extends from the support 4 and transforms, at its rear end, to a vertical post 7 on which a lumbar support device 8 is mounted. The device 8 is preferably a soft pillow that has a curved front surface.

The seat 3 includes an upper soft cushion 9 and an below is a support panel generally indicated with 10. The support panel 10 includes a front part 11 and a back part 12. Of these parts, the front part is mounted to a member 20 included in the frame 1. The construction and function of the member 20 will be described below. The member 20 is mounted on and is supported by the cylindrical support 4.

As is clearly shown in Figs. 1 and 2, the back part 12 protrudes backwardly as a free end from the rear edge of the front part 11 and the back part 12 does not have any direct contact with the back support 2. Therefore, the back support is attached to the frame 1 which in turn is attached to and support the front part 11 of the seat, but not the back part 12. This means that the back part is vertically movable relative to the back support. The embodiment illustrated in Figs. 1 and 2, the possibility of vertical movement is realized because the back part 12 is rotatable relative to the front part 11. More particularly, it has been contemplated that the back part 12 is rigidly formed and attached to the front part with one or many mechanical hinges 13 so that both parts and lockable relative to one another at a desired angle with the assistance of a locking mechanism that is not shown in detail but is indicated as a lever 14. In practice, the rear part 12 may be swingable between an upper starting position in which it is situated as a linear extension of the front part that is in one and the same horizontal plane as the front part (as shown in Fig. 1) and in a turned down position (as shown in Fig. 2). The maximum rotational angle is preferably between 50-60 degrees. However, other angles, both greater and smaller, may be used. Although the rotational angle is shown at about 25 degrees in Fig. 2, an angle of about 45 degrees is preferred in practice. As shown in Figs. 1 and 2, the rear part is shorter than the front part. In practice, the length of the rear part should be about 20-50%, preferably, 25-40% of the whole length of the

support panel 10 between the opposite, front and rear end edges.

Both parts 11, 12 of the support panel 10 may be made of suitable materials that are of a rigid nature such as plastic, metal or wood (such as plywood). The softer cushion 9 that lays on top may be made of a variety of materials that should have the characteristic of being elastically resilient to provide sit comfort. In practice, it is preferable to use foam rubber.

The rear seat area 15 is, at least when the chair is used, recessed relative to the top side 16 of the rest of the cushion. In this way, the rear seat area 15 is transformed to the front seat area 16 via an upwardly protruding transformation surface 17 that forms a counter point against which the user's sitting bones (tuber ischii) may rest in order to prevent a forward sliding of the thigh bones along the seat and also backward rotation of the pelvis. Preferably, the transformation surface 17 is situated in an area that is vertically above or closely behind the hinge 13 disposed between the rear and front parts 11, 12 of the support panel. This means that the front and rear seating areas 16, 15 on the cushion 9 are provided with substantially the same length as the front part 11 and the rear part 12, respectively. The difference in levels between the seat areas 15 and 16 may vary but should in practice be in the interval 1-40 millimeters, preferably 5-30 millimeters.

It is important that the mentioned seat areas 15, 16 have a level difference in connection with the situation when the user sits on the seat. However, when the seat is not used, it is not necessary that there is any level difference between the seat areas. This means that the cushion member 9 may be made is different ways. Thus, not only is it possible to shape the cushion so that a pronounced and visible rear recess exits when the seat is not loaded but the cushion may also be formed with a rear material portion that has a lower density than the material in the front portion of the cushion so that the

area 15 is recessed relative to the area 16 only when the user sits on the seat.

According to a preferred embodiment of the present invention, the upper side or the outside of the cushion is at least partially covered with a cover 18 that has the characteristic that is creates a resistance to sliding in a forward direction along the cushion but not in the opposite direction. Preferably, plush fabric may be used for this purpose that has fiber elements pointing in a backward direction.

With reference to Figs. 3 and 4, an alternative embodiment of the seat 3 of the chair is illustrated. In this case, the support panel 10' of the seat is not put together by two separately made and disc parts that are held together by a hinge. Rather, panel 10' is one continuous disc with a rear part 12' that simply protrudes outwardly as a free end from the front disc part 11' which under side is supported by a stiff body that includes the member 20 or the frame 1. The panel 10' is preferably made to have a tapered shape so that it is gradually thinner in a direction towards in rear end. By selecting, in a suitable manner, an elastic resilient material for the panel, the free end and rearwardly protruding part 12' may resiliently bend downwardly from an upper starting position according to Fig. 3 in which the panel as a whole is plane (unloaded position) to a position according to Fig. 4 in which the rear edge of the panel is lowered (loaded position).

Figs. 6 and 7 schematically illustrate a support panel 10 that has a substantially even thickness and includes two disc parts or portions 11", 12" that are separated by an indented middle portion 19 that enables the rear disc part 12" to bend downwardly from its original position by being elastically deformed in the material at the middle portion 19.

In this connection, it should also be pointed out that the support panel of the chair seat may have the same thickness along its entire length but be made so that its ability to support is linearly reduced in a

backward direction. In this way the rear part may be turned downwardly through a gradual elastic deformation.

According to a preferred embodiment of the present invention, the seat 3 is movable relative to the frame between a forward starting position, on the one hand, in which the seat is at a maximum distance from the back support 2 and this is the normal position of the seat when nobody is sitting on it. On the other hand, the seat may be in a rear end position in which the seat is closer to the back support. More particularly, this position has the purpose of partially pushing the user's pelvis against or under the lumbar support device of the back support. In practice, the movements of the seat between the forward and rear end positions may be done in a substantially horizontal plane although a pronounced slanting plane of movement is possible.

According to the embodiments shown in Figs. 1-4, the above mentioned movements of the seat, the member 20, that is mentioned above, includes a first unit 21 that is associated with support panel 10 of the seat, more particularly the front disc part 11 and an other unit 22 that is associated with the frame 1, more particularly the cylinder shaped support 4. The lower unit 22 includes a sliding plane that at least partially generally slopes in a rearward/downward direction relative the horizontal plane. In the embodiments shown, this sliding plane is realized in the form of straight tracks 23 (also see Fig. 5) and a pair of wheels 24 that are movable therealong. The wheels 24 are preferably rotatably attached to the unit 21. Because the tracks 23 are sloping in the rearward/downward direction relative to the horizontal plane, the seat will, similar to a cart, roll in the backward direction when a user sits on the same. In connection with this, it should also be pointed out that other arbitrary member may be used to provide an automatic movement of the seat in the direction towards the rear end position, such as sliding plates that have a low friction at the contact surfaces or a pair of links between the seat and the frame.

In order to bring back the seat 3 to the unloaded position that is the forward end position, one or many springs 25 may be used that has one end attached to the stationary unit 22 and the opposite end is attached to the movable unit 21. The illustrated embodiment has mechanical pull springs. Gas springs may also be used though.

In the preferred embodiment, the member 20 includes a device to delay the initialization of the movement of the seat against the rear end position for a certain time period after the user has sat down on the seat. In the embodiments illustrated, this device is a pneumatic or hydraulic piston 26 which has opposite ends that are connected with the stationary units 21, 22, respectively. The velocity of the protrusion of the pistons out of the cylinders may be at a maximum of 50 millimeters/minute. However, higher velocities are possible. By using the piston, it is ensured that the user is not uncomfortable because the seat immediately and quickly moves from the original position to the rear end position as soon as he sits on the seat. Thus, the piston ensures a slow and controlled movement of the seat in the direction towards the rear end position.

With reference to Figs. 8 and 9, the chair's function during use is illustrated. Fig. 8 shows the seat 3 of the chair in the forward end position that is the position of the chair is in, as long as the chair is not in use or just in the moment when the user sits down on the chair. Fig. 8 further shows sitting bones 27 that are positioned above the rear disc part 12 and behind the transition area 17 between the rear and front seating areas 15, 16. Fig. 8 also indicates how the lumbar spine 28 of the user lacks a satisfactory contact pressure against the lumbar support device of the back support. This means that the support members do not provide the desired sway back of the spine. Fig. 9 shows how the seat, after being automatically moved to the rear end position, as a consequence of the weight of the sitting user, ensures that the bottom and the sitting bones 27

are placed closed to the back support in the sear below the lumbar support device 8 so that the lumbar support device will, in a distinct and active way, support the lumbar spine/pelvis rim 28 so that it is in an optimal ergonomical, sway back position.

Advantages of the Invention

An important advantage of the present invention is that the user, after an ergonomically optimal body posture has been found, can maintain the body posture for a long time because the seat of the chair effectively prevents the tendency of the thigh bone to slide forwardly along the seat. Also, any backward rotation of the pelvis is prevented in a physiologically desirable way. These desirable effects are obtained regardless if the chair is made to require the user to intentionally shift the bottom against the back support in the area below the lumbar support device or if the chair is designed to provide this backward shifting with the help of the preferred features described above. The latter embodiment is particularly preferable because the user automatically is provided with a complete support of the back as soon as he sits on the seat.

Possible modifications of the Invention

The invention is not limited to the embodiments that have been described above and shown in the drawings. Thus, it is possible to vary the embodiments in many ways regarding the support panel of the seat and its cushion in connection with the geometrical shape and the selection of material of the components. For example, it is possible, via at least one or many, to use a deep transverse groove to divide the cushion into separate cushion parts. Preferably, such a groove is disposed adjacent to the hinge between the front and rear disc part of the support panel. Within the scope of the invention, the rear, free end of the support panel should be able to move in a vertical direction at its rear end. It is also possible to design the disc in many different ways as indicated above. For example, a vehicle seat

that includes three or four point seat belts may be designed so that the rear end of the cushion and the support panel of the seat are provided with an additional downward direction of movement in connection with a head on collision or a hit from behind the vehicle to activate the seat belts. When the vehicle is hit from behind, this additional direction provides a reduced vertical compression along the spine and the surrounding substances which in turn reduces the risk for whiplash injuries. If the vehicle is subjected to a head on collision the lowering of the bottom of the user at the rear portion of the seat provides an improved contact between the thigh/bottom and the sliding protection of the seat. This reduces the risk that the user will slide down below the hip seat belt during a head on collision. It should be further pointed out that the automatic rearward shifting of the seat as a whole may be realized in other ways than to rely on the weight of the user.

Thus, it is possible to realize the movements between the front and rear end positions of the seat with a motor such as an electric motor. In such cases, the invention is preferably used in connection with vehicle seats. However, the invention has been exemplified with a seat that has a front starting position that is movable backwardly in the direction towards the back support. It is also possible to design the chair so the back support moves from a rear starting position forwardly towards a stationary seat. It is important to create a relative movement between, on the one hand, the seat and, on the other hand, the back support and the frame attached thereto to achieve the desired sway back. In practice, the distance from the front edge of the sat to the lumbar support device 8 may be adjustable. It is also possible to make the lumbar support device 8 height adjustable relative to the back support, which is known. Furthermore, it is possible to design the chair with a seat 3 that is adjustable in different angles relative to the movable unit 21 of the frame. In such cases, the seat is provided with a geometrical hinge axle that is

disposed adjacent the front edge so that the front disc part of the seat is provided with a device for raising and lowering the rear edge of the front disc part. This embodiment is particularly suitable for so called stand-support sitting and requires a higher seat height and a more open hip angle compared to conventional sitting. The chair may also be provided with a rocking function for, for example, work that requires a backward sloping body posture.

Patent claims:

1. A chair that includes a frame (1), a back support (2) with a lumbar support device (8), that is positioned a certain level above the frame, to support the lumbar spine and/or pelvis rim (cristae iliaca) of the user, and a seat (3), that is composed of a lower support panel (10) that is supported by the frame, the support panel includes front and rear parts (11, 12) and an upper, soft cushion (9) that has a rear seating area (15) that, at least when the chair is used, is recessed relative to a front seating area (16) characterized therein,

the front disc part (11) is attached to and supported by the frame (1), so that the rear disc part (12) protrudes outwardly as a free end from the front part without being in direct contact with the back support (2), a front portion of the rear seating area (15) is transformed to the higher situated front seating area (16) via a protruding transition area (17) that forms a knob against which the user's sitting bone may bear against with a view to preventing a forward sliding movement of the user's thigh bone along the seat and/or backward rotation of the pelvis, and the rear disc part (12) is at least partially lowerable from an upper starting position to enable a variable adjustment of the level of the back edge of the rear seating area not only relative to the front portion of the cushion but also relative to the back support (2) and its lumbar support device (8).

2. The chair according to claim 1, characterized therein that the rear disc part (12') is at least partially elastically yielding to be able to downwardly bend from the starting position.

3. The chair according to claim 1 or 2, characterized therein that the protruding transition area (17) between the front and rear seating areas (16, 15) of the cushion (9) is disposed in an area above or behind a

zone that separates the front and rear parts (11, 12) of the support panel.

4. The chair according to any of the preceding claims, characterized therein an upper side of the cushion is at least partially covered with a cover (18), such as plush fabric that provides a resistance against sliding in a forward direction along the plush fabric but not in the opposite direction.

5. The chair according to any of the preceding claims, wherein the seat (3) and the frame (1) are movable relative to one another between first and second end positions, characterized therein that the chair includes a means (23, 25) to hold the seat in the starting position in the form of the first end position and it is remote from the back support and which is normally the position when the seat is not used by a sitting person; to trigger a relative movement towards the second end position in which the seat and the back support are closer to one another, more particularly with the purpose of bringing the pelvis of the sitting person to partially shift in against or below the lumbar support device (8, 8"); and to provide a return of the seat and the frame to the starting position relative to one another when the sitting person leaves the seat.

6. The chair according to claim 5, characterized therein that the chair includes a means (26) to delay the initialization of the movement of the seat (3) against the second end position after a certain time period after a user has sat down on the seat to provide a controlled movement velocity towards this end position.

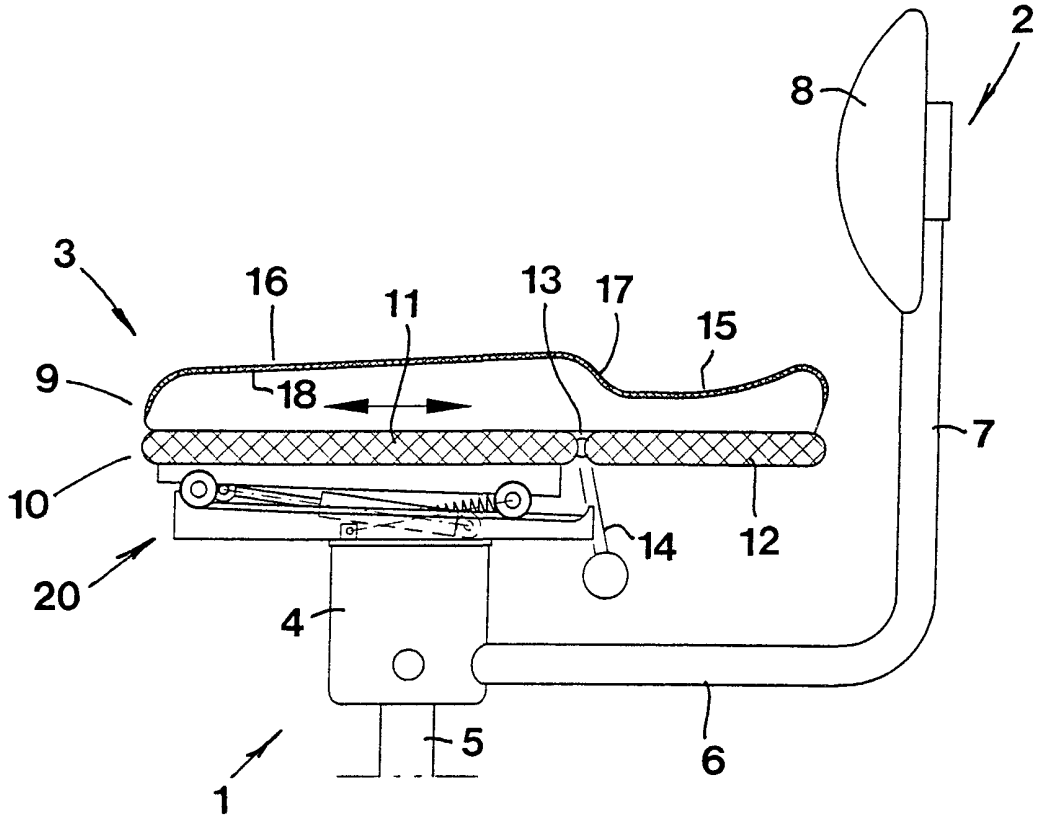


Fig 1

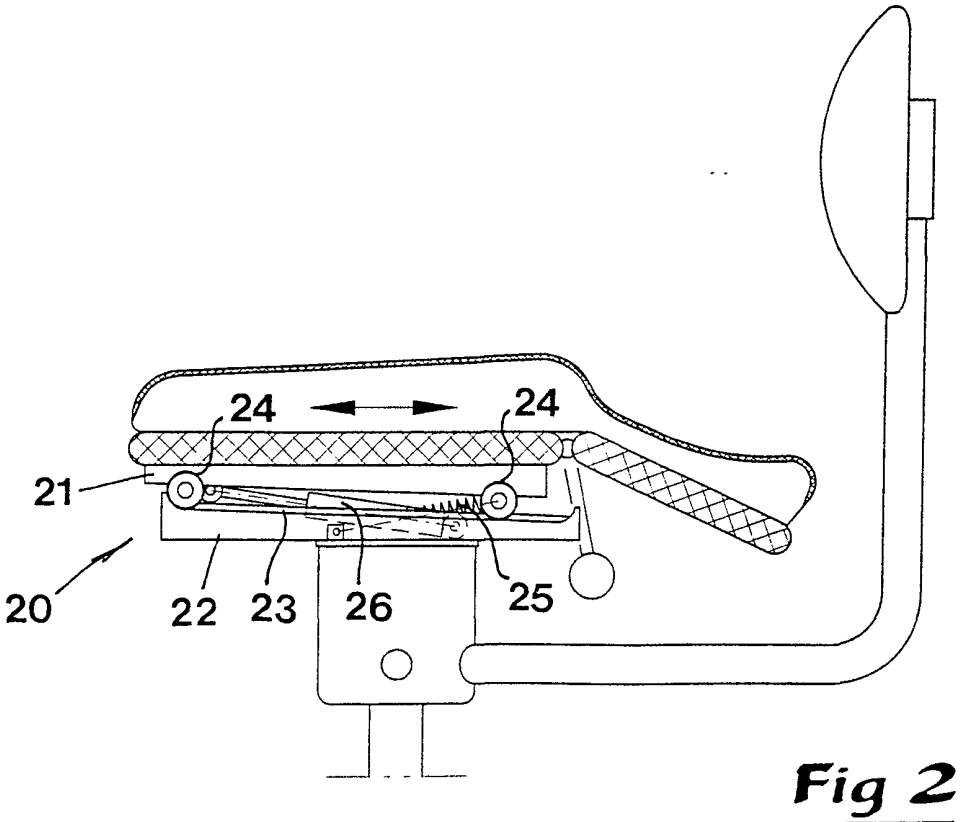


Fig 2

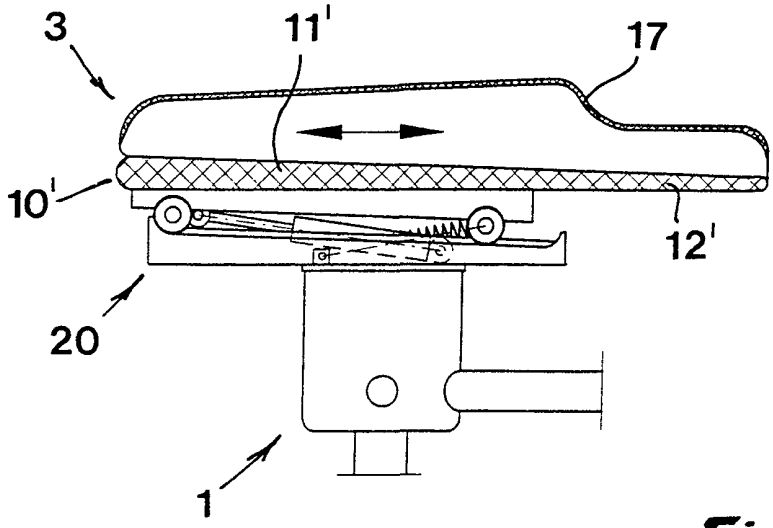


Fig 3

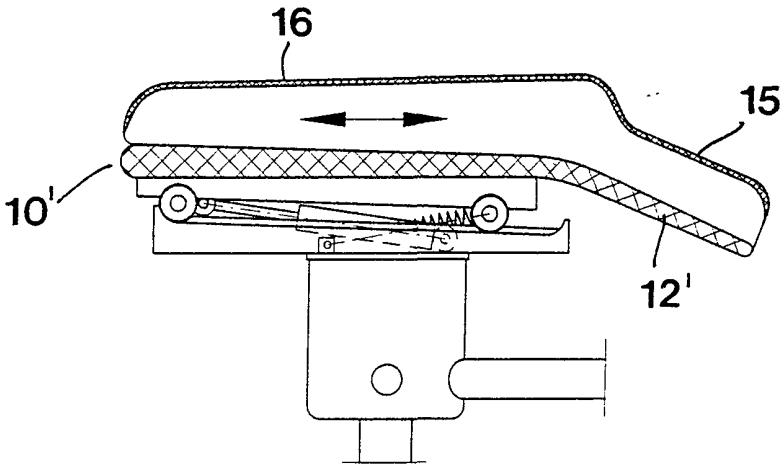


Fig 4

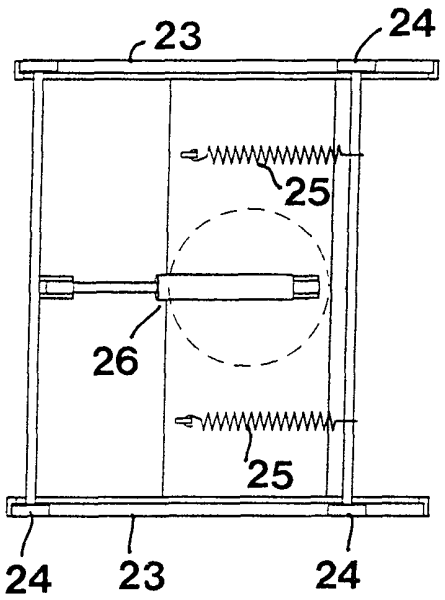


Fig 5

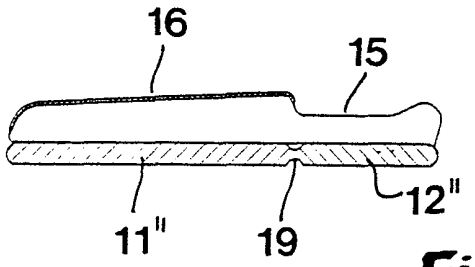


Fig 6

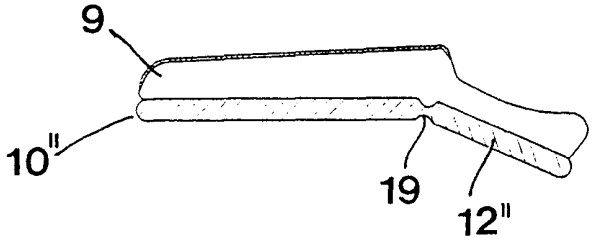


Fig 7

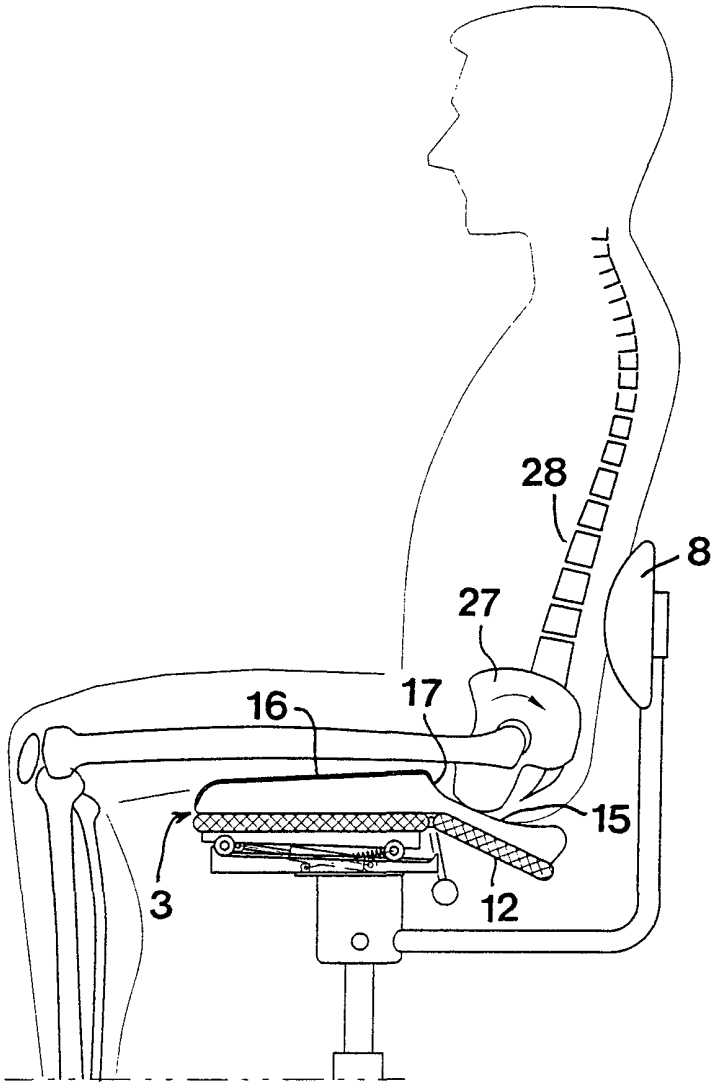


Fig 8

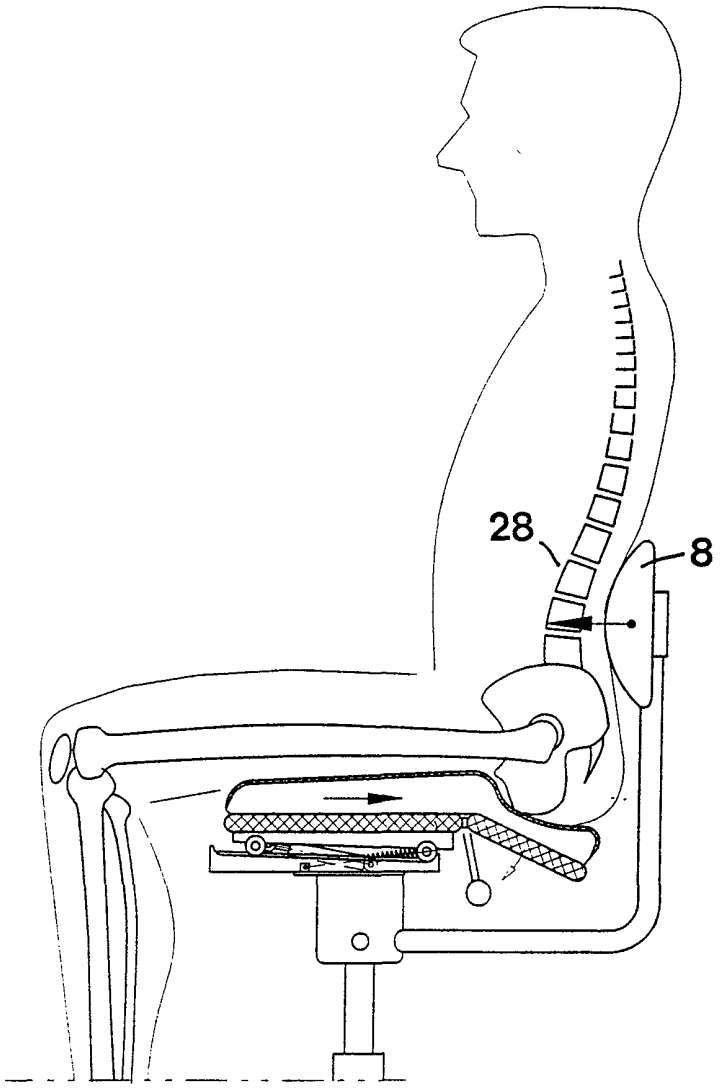


Fig 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/19111

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) :A47C 1/022
US CL :297/284.1, 312
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 297/284.1, 284.4, 312, 313, 322, 337-339

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 1,836,630 (THUM) 15 December 1931 (15.12.31), see fig. 1	1-3
A	US 4,574,901 A (JOYNER) 11 March 1986 (11.03.86), see fig. 5	1-3
A	US 1,698,344 A (MOTT) 08 January 1929 (08.01.29), see fig. 1	1
A	US 5,692,802 A (AUFRERE ET AL) 02 December 1997 (02.12.97), see figure 2	1

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search
01 DECEMBER 1999

Date of mailing of the international search report
27 JAN 2000

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. (703) 305-3230

Authorized officer
PETER BROWN
Telephone No. (703) 308-2103

Form PCT/ISA/210 (second sheet)(July 1992)★

INTERNATIONAL SEARCH REPORT

International application No
PCT/US99/19111

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3 ☒ Claims Nos.: 4-6
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.