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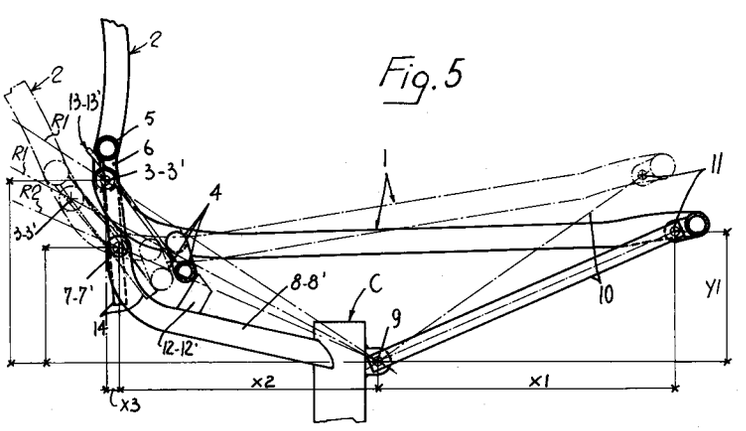
(54) Chair with reclining back.

(57) The chair according to the invention comprises a supporting base (C), a seat (1) and a back (2) operatively connected to the seat so as to be able to be moved from an upright position to a reclined position. The chair is of the type including a linkage system (3, 7, 9, 11) forming an articulated quadrilateral in which the seat (1) is supported by a substantially horizontal upper side and the back (2) is secured to a side articulated at one end (3) to said upper side and at the other end (7) to a lower side carried by the said supporting base (C). The said articulated quadrilateral is different from a parallelogram, i.e. it has at least two opposite sides which are not parallel to each other, whereby the movement of the back (2) to its reclined position will cause the rearward displacement and lifting of the front of the seat (1) and the rearward displacement and lowering of the rear of the said seat.

Fig. 5



EP 0 490 131 A1

The present invention relates to a chair comprising a supporting base, a seat and a back operatively connected to the seat so as to be able to be moved from an upright or rest position to a reclined position. The chair is of the type including a linkage system forming an articulated quadrilateral in which the seat corresponds to a substantially horizontal upper side and the back is secured to a side articulated at one end to said upper side and at the other end to a lower side carried by the said supporting base.

A chair of this type is described in EP-A-0 249 584, while in FR-A-2 045 120 there is described a chair in which the seat is supported by an articulated quadrilateral structure the movement of which is controlled by the back through a separate lever system.

In the mentioned prior art devices, the articulated quadrilateral is in fact a parallelogram, so that the movement of the seat, consequent to the reclining movement of the back, is a translatory movement, i.e. parallel to itself.

The object of the present invention is to provide a chair in which the reclining movement of the back promotes a rearward displacement and lifting of the front portion, and a rearward displacement and lowering of the rear portion of the seat which is operatively connected to the back. This is obtained by providing a linkage system in which the articulated quadrilateral is different from a parallelogram, i.e. at least two opposite sides are not parallel to each other.

Typically, a chair according to the present invention comprises:

- at least one first cylindrical joint connecting the lower portion of the back and the rear portion of the seat;
- at least one second cylindrical joint parallel to and arranged below said first joint connecting the lower portion of the back to a supporting structure secured to the top of the supporting base frame;
- at least one third cylindrical joint parallel to the first and second joints mentioned above, which connects the front side of the seat through at least one connecting rod to a fourth cylindrical joint parallel to the joints mentioned above and arranged at the top of the supporting base frame, the said third joint between the connecting rod and the seat being arranged at a suitably higher level than the said fourth joint between said rod and the supporting base frame;
- limit means which stop the seat and back in the rest position;
- limit means which stop the back at the rearmost reclined position;
- elastic means urging the seat and back to the rest position.

The characteristic features of the chair according to the invention and the advantages resulting therefrom will be apparent from the following description of a preferred embodiment, shown merely by way on non-limiting example in the attached drawings, in which:

Figure 1 is a perspective view of the chair in the rest position, without the cushion and covering elements;

Figure 2 is a perspective view of the chair from the top;

Figure 3 is a rear perspective view of part of the chair;

Figure 4 is an enlarged rear perspective view of one of the cylindrical joints connecting the seat to the back;

Figure 5 is a side view of the chair with parts in section, the section being taken along the median vertical plane of the seat, the chair being shown with the back in rest position and in reclined position;

Figure 6 is a perspective view of a modified construction of the chair.

In Figures 1 to 5, reference numeral 1 indicates the seat and 2 indicates the back which are made, for example, from tube lengths bent into U-shape and hinged to each other at their ends by means of equal and aligned cylindrical joints 3-3'.

At a suitable and short distance from the joints 3-3', the seat and back are provided with respective stiffening crosspieces 4 and 5 for the purpose specified below. The crosspiece 5 of the back has secured thereto, with symmetrical arrangement, a fork which is formed by a pair of equal projections 6-6' directed downwards, suitably inclined forwards and articulated at their lower ends at joints 7-7' to a fork which is formed, for example, by a pair of arms 8-8' presenting a slight L-shaped profile (Figure 5), projecting from the top portion of a conventional column C supported by a conventional base B.

The joints 7-7' are aligned with each other and parallel to joints 3-3'. The joints 7-7' lie on an imaginary vertical plane which may also contain the other joints 3-3' or, as shown in the drawings, said joints 3-3' are located rearwardly with respect to said imaginary vertical plane, so that when the back is reclined rearwards, the rear portion of the seat is caused to move rearwards and to be lowered slightly, but it is never lifted up.

Oppositely to the arms 8-8' and angularly equispaced therefrom, the column C carries the joint 9 for a connecting rod 10 which, in turn, is articulated at its other end at joint 11 to the center of the front of seat 1. The joints 9 and 11 are parallel to each other and to the previously mentioned joints. The joint 11 is located at a higher

level than the joint 9.

When the chair is in rest position, as shown in Figures 1 and 2 and as shown by solid lines in Figures 5, the crosspiece 4 of the seat rests on the abutment projections 12-12' of the supporting arms 8-8'. This condition is ensured by a pair of helical flexure springs 13-13' which are mounted on extensions of the axes of joints 3-3', as shown with more detail in Figure 4, and which act on the crosspieces 4 and 5, to urge the seat and back towards each other. As a result of the connection of the seat to the connecting rod 10 and connection of the back to the fixed arms 8-8', the crosspiece 4 of the seat is urged forwards against said projections 12-12'.

The springs 13-13' are preferably of different characteristics. Only one of them is pre-loaded to act on the seat and back in the rest condition of the chair. The other spring will act subsequently, when the back is reclined rearwards and its action is added to the action of the other spring when said back is about to undergo the last part of said rearwards movement.

The chair is completed by an abutment member for limiting the rearward movement of its back, comprising, for example, a finger 14 secured centrally of the crosspiece 5, directed downwards and forwards and of such a length as to interfere with the crosspiece 4. When the chair is in the rest condition, the finger 14 is suitably spaced from the crosspiece 4.

Between the sides of the frames which form the seat and back there will be anchored the ends of elastic strips 15 to support the cushion and covering of the seat and back according to any conventional art.

The operation of the chair thus conceived is simple and is apparent from Figure 5. When the user sits down, his weight, loaded in whatever way on the seat 1, does not cause any modification in the trim of said seat or of the back. When the user leans onto the back 2 and pushes it rearwards, said back will be rotated about the joints 7-7' and, due to the connection to the seat at 3-3', it drags the latter rearwards and causes the seat to be lifted up only at its front portion, due to the action of the connecting rod 10 (see part of Figure 5 illustrated by dash-and-dot lines). Simultaneously, the rear portion of the said seat (see, in Figure 5, the joints 3 -3' in the two indicated positions) will be caused to move rearwardly and downwardly, with a slight "diving" movement. The weight of the user's body bearing on the seat and the elastic reaction of one and then of both springs 13-13', counteract the rearwards rotation of the back, partly balancing the force whereby the user can cause said rotation. During the rearwards rotation of the back, the imaginary straight line R1 passing through the joint 9 and the joints 3-3', progressively approaches the imaginary stationary straight line R2 passing through said joint 9 and joints 7-7', though it never reaches nor it passes over this latter straight line R2. The maximum rearward rotation of the back is determined by the abutment of the finger 14 against the crosspiece 4 of the seat, as shown in Figure 5 by dash-and-dot lines.

By way of exemplification, the linkage provided by the various joints (3, 7, 9, 11) can be assimilated to an articulated quadrilateral in which at least two opposite sides are not parallel (in the present case, each side is different from the others), so that the rearward movement of the side actuated by the back will promote the simultaneous lifting of one end (front portion) and lowering of the other end (back portion) of the side corresponding to the seat: it is to be made clear that this particular situation is not to be confused with the situation of an articulated parallelogram where (as shown in the prior art) the movement of the side corresponding to the seat will be a translatory movement (i.e. parallel to itself).

Thanks to a suitable dimensioning of the mechanism described above, and thanks also to the sliding friction of the various articulated joints of said mechanism, persons having different weights can cause the rearward rotation of the back of the chair by a force which is proportioned to their physical characteristics, and the positioning imparted to the back in each case will be substantially stable, i.e. the user shall not make any noticeable effort to maintain this position. In order to return the chair to the rest condition, the user shall just lift his back to relieve the force against the back of the chair and transfer the biggest load onto the seat. The return of the parts 1 and 2 to the rest condition will also be ensured by the action of the springs 13-13'.

Just by way of example and without intending any limitation, with reference to Figure 5, we will now indicate some dimensions which permitted to obtain a good performance of the mechanism described above. Assuming the joint point 9 as the "zero" reference, the horizontal distances X1-X2 between said point 9 and the joint points 11 and 7-7' are about 194 mm and 170 mm, respectively. The horizontal distance X3 between the joints 7-7' and the joints 3-3' is about 8 mm. The vertical distances Y1-Y2-Y3 between the point 9 and the joints 11, 7-7' and 3-3' are respectively about 85 mm, 74 mm and 118 mm.

The embodiment of Figure 6 differs from the just described embodiment in the feature that the seat 1 and the back 2 are of reduced dimensions. In this modification, the joints 103, 103' (corresponding to joints 3, 3') have been arranged inwards of the joints 107, 107' (corresponding to joints 7, 7').

Claims

1. A chair comprising a supporting base (C), a seat (1) and a back (2) operatively connected to the seat so as to be able to be moved from an upright rest position to a reclined position, of the type including a linkage system (3, 7, 9, 11) forming an articulated quadrilateral in which the seat (1) is supported by a substantially horizontal upper side and the back (2) is secured to a side articulated at one end (3) to said upper side and at the other end (7) to a lower side carried by the said supporting base (C),
characterized by the fact that
the said articulated quadrilateral has at least two opposite sides which are not parallel to each other, whereby the movement of the back (2) to its reclined position will cause the rearward displacement and lifting of the front of the seat (1) and the rearward displacement and lowering of the rear of the said seat.

2. A chair according to claim 1, characterized by the fact of comprising:
   - at least one first cylindrical joint (3, 3') connecting the lower portion of the back (2) and the rear portion of the seat (1);
   - at least one second cylindrical joint (7, 7') parallel to and arranged below said first joint (3, 3') connecting the lower portion of the back to a supporting structure (8, 8') secured to the top of the supporting base frame (C, B);
   - at least one third cylindrical joint (11) parallel to the first and second joints mentioned above, which connects the front side of the seat (1) through at least one connecting rod (10) to a fourth cylindrical joint (9) parallel to the joints mentioned above and arranged at the top of the supporting base frame (C-B), the said third joint (11) between the connecting rod (10) and the seat (1) being arranged at a suitably higher level than the said fourth joint (9) between said rod and the supporting base frame;
   - limit means (4, 12) which stop the seat and back in the rest position;
   - limit means (4, 14) which stop the back (2) at the rearmost reclined position;
   - elastic means (13-13') urging the seat and back to the rest position.

3. A chair according to claim 2, characterized by the fact that the said first and the said second cylindrical joints (3, 3' - 7, 7') are arranged on the same ideal vertical plane.

4. A chair according to claim 2, characterized by the fact that the said first cylindrical joints (3, 3) are arranged rearwardly with respect to the ideal vertical plane containing the said second cylindrical joints (7, 7').

5. A chair according to claim 2, characterized by the fact that the said first cylindrical joints (3, 3') are two, arranged each one at the sides of the chair, and the said second cylindrical joints (7, 7') are two, arranged internally with respect to the said first joints.

6. A chair according to claim 2, characterized by the fact that said first cylindrical joints (103, 103') are two, arranged each one at the sides of the chair, and the said second cylindrical joints (107, 107') are two, arranged externally with respect to said first joints.

7. A chair according to any one of claims 2 to 6 characterized by the fact that the structure of the back (2) is provided in its lower portion, with symmetrical arrangement, with a downwardly directed fork (6-6') which is connected, by means of the said second cylindrical joints (7 7'), to the ends of a fork (8-8') secured to the supporting base frame (C-B).

8. A chair according to any one of claims 2 to 7, characterized by the fact the elastic means urging the seat (1) and the back (2) to the rest position consist of helical flexure springs (13, 13') mounted on the extensions of the axes of the cylindrical joints (3, 3') connecting the seat to the back and acting on portions of the said seat and of the said back.

9. A chair according to claim 8, characterized by the fact that one of said flexure springs (13-13') is pre-loaded and exerts its action also when the back is at rest, while the other spring becomes active only when the back is about to move through the last portion of its rearward movement.

10. A chair according to any one of claims 2 to 9, characterized by the fact that the limit means which stop the seat and back in the rest position consist of a crosspiece (4) provided at the rear of the seat (1) abutting against limit projections (12-12') arranged on the stationary fork-like structure (8-8') carrying the said second joints (7-7').

11. A chair according to any one of claims 2 to 10, characterized by the fact that the limit means for stopping the back at the rearmost reclined

position consist of a finger (14) provided at the lower end portion of the back (2), which finger, when said back reaches the end of its rearward oscillation, abuts against a stationary portion of the seat.

12. A chair according to any one of claims 2 to 11, characterized in that, assuming as a zero reference the said fourth joint (9) which by means of the connecting rod (10) connects the seat to the supporting base frame (C), the horizontal and vertical distances between the various joints are as follows:

- the distance between said fourth joint (9) and the opposite third joint (11) is about 194 mm in the horizontal direction (X1) and is about 85 mm in the vertical direction (Y1);
- the distance between said fourth joint (9) and the said second joint (7-7') connecting the back to the supporting base frame (C) is about 170 mm in the horizontal direction (X2) and is about 74 mm in the vertical direction (Y2);
- the distance in the horizontal direction (X3) between the said second joint (7, 7') and the said first joint (3-3') is about 8 mm, while the vertical distance (Y3) between the said first joint (3-3') and said zero reference is about 118 mm.

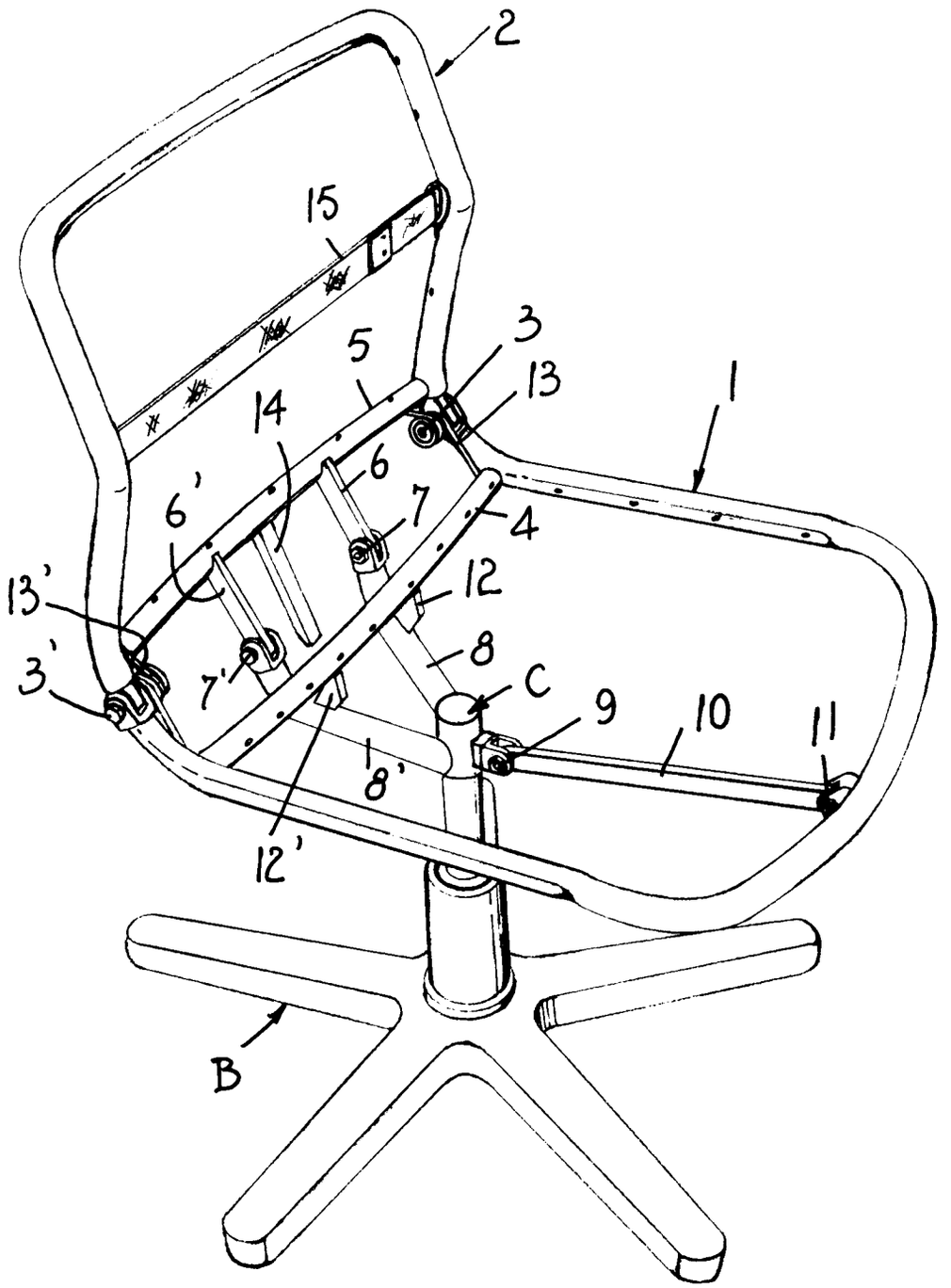


Fig. 1

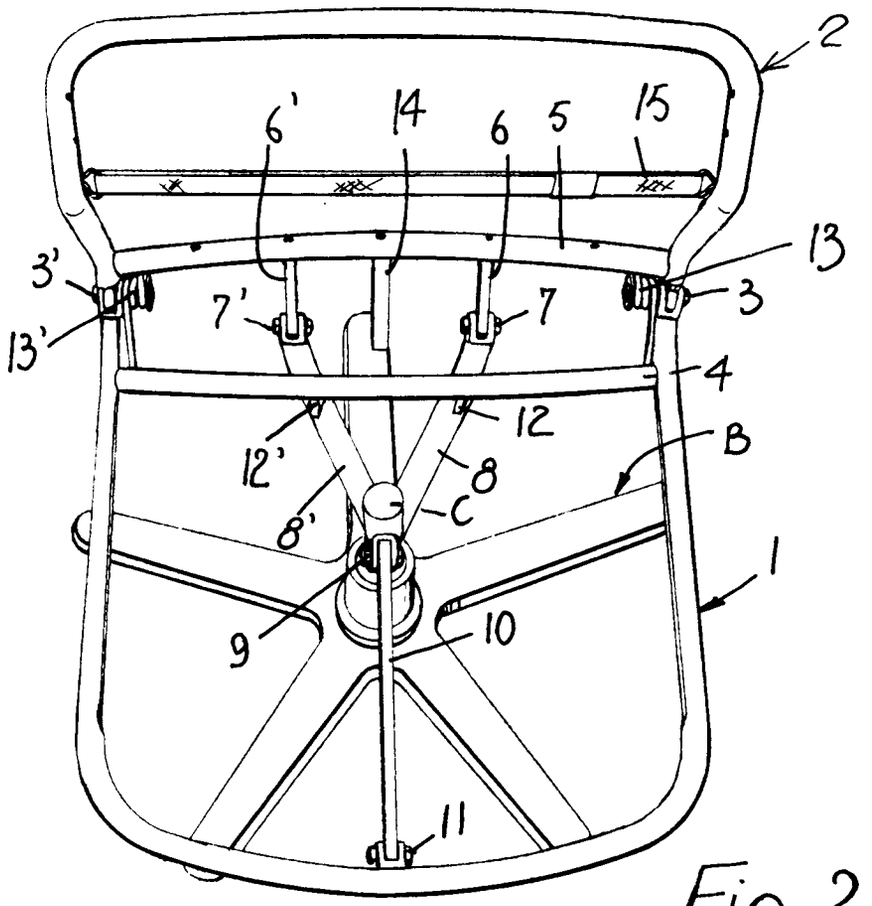
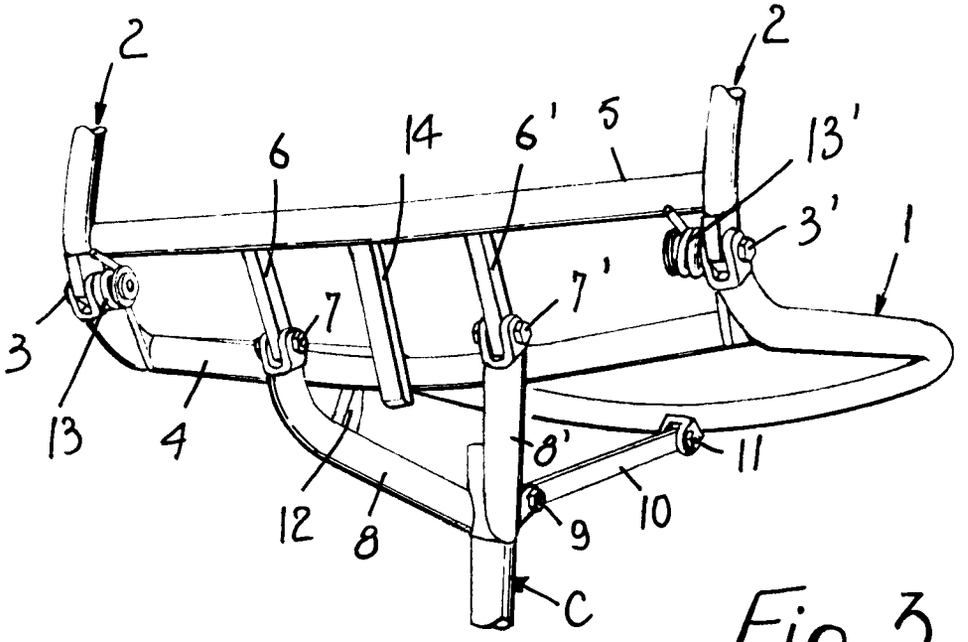

2
6'
14
6
5
15
13
3'
3
7'
7
13'
4
12
12'
B
8
8'
C
1
9
10
11

Fig. 2


2
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14
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Fig. 3

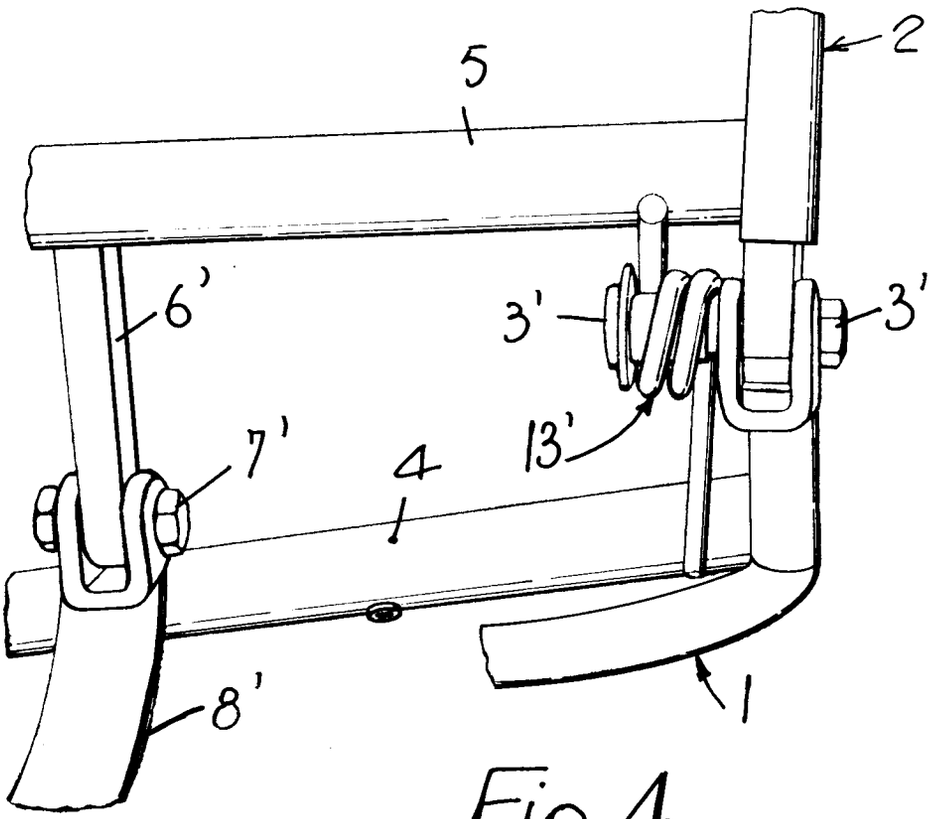

Fig.4

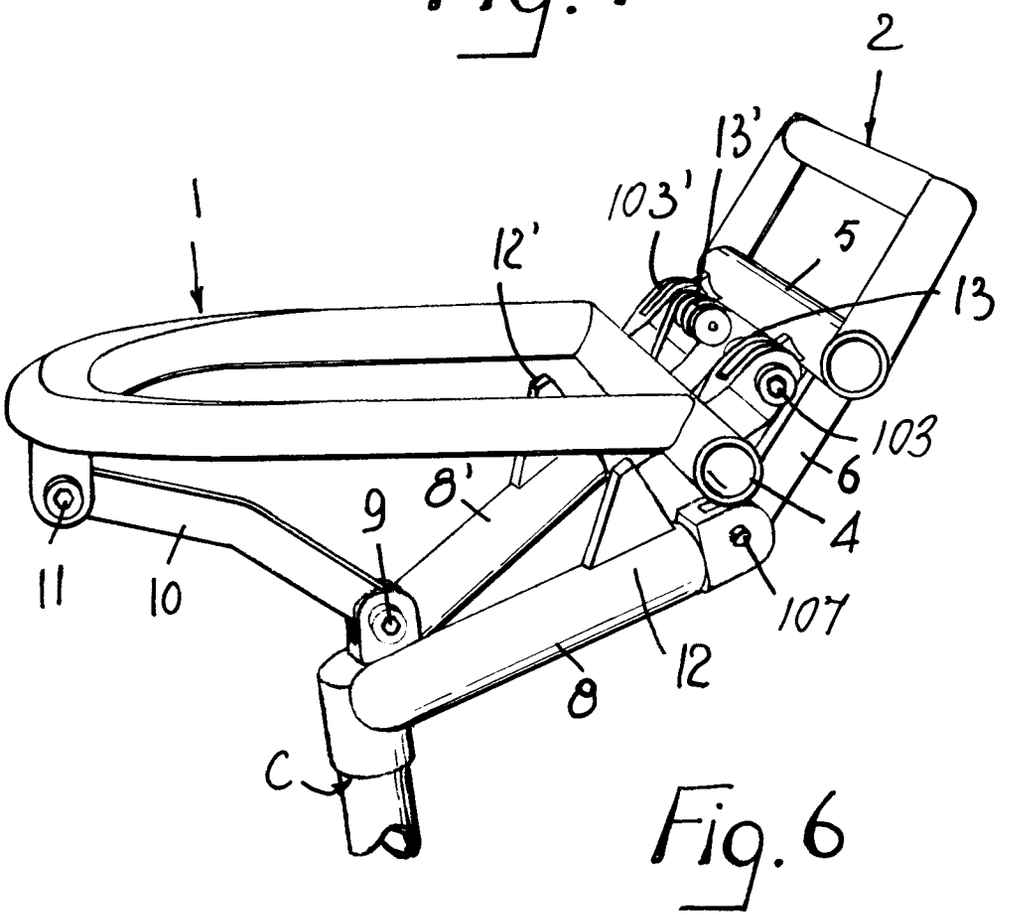

Fig.6

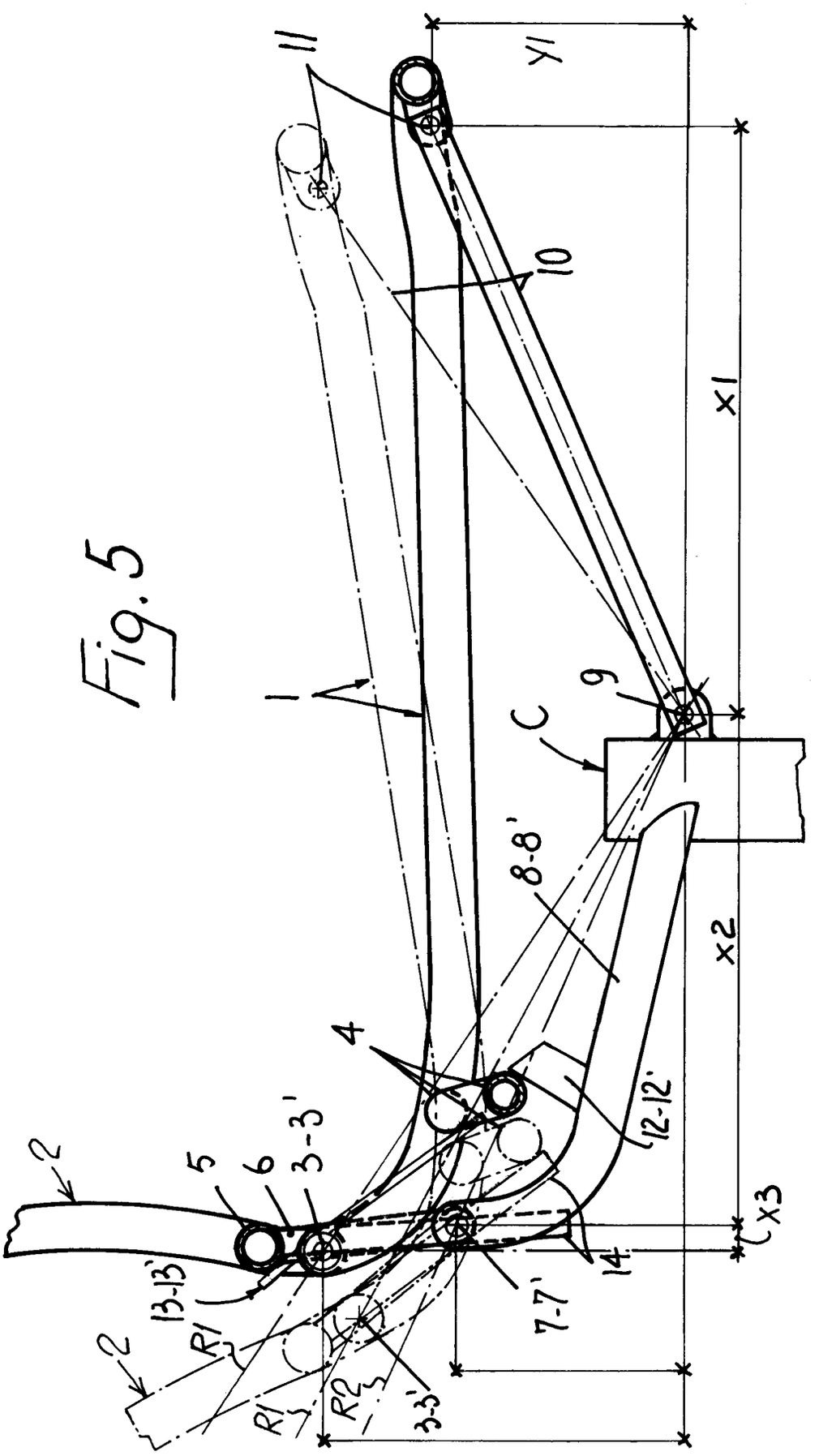

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number

EP 91 11 9795

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 271 600 (C.O.M. COOPERATIVA OPERAI MOBILIERI) * column 1, line 6 - line 19; figures 2,5 *	1	A47C1/032
A	EP-A-0 247 312 (DRABERT SÖHNE GMBH) * figures 1,2 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

A47C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 FEBRUARY 1992	MYSLIWETZ W.P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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