

(11) (21) (C) **2,044,102**  
(22) 1991/06/07  
(43) 1991/12/16  
(45) 2000/11/14

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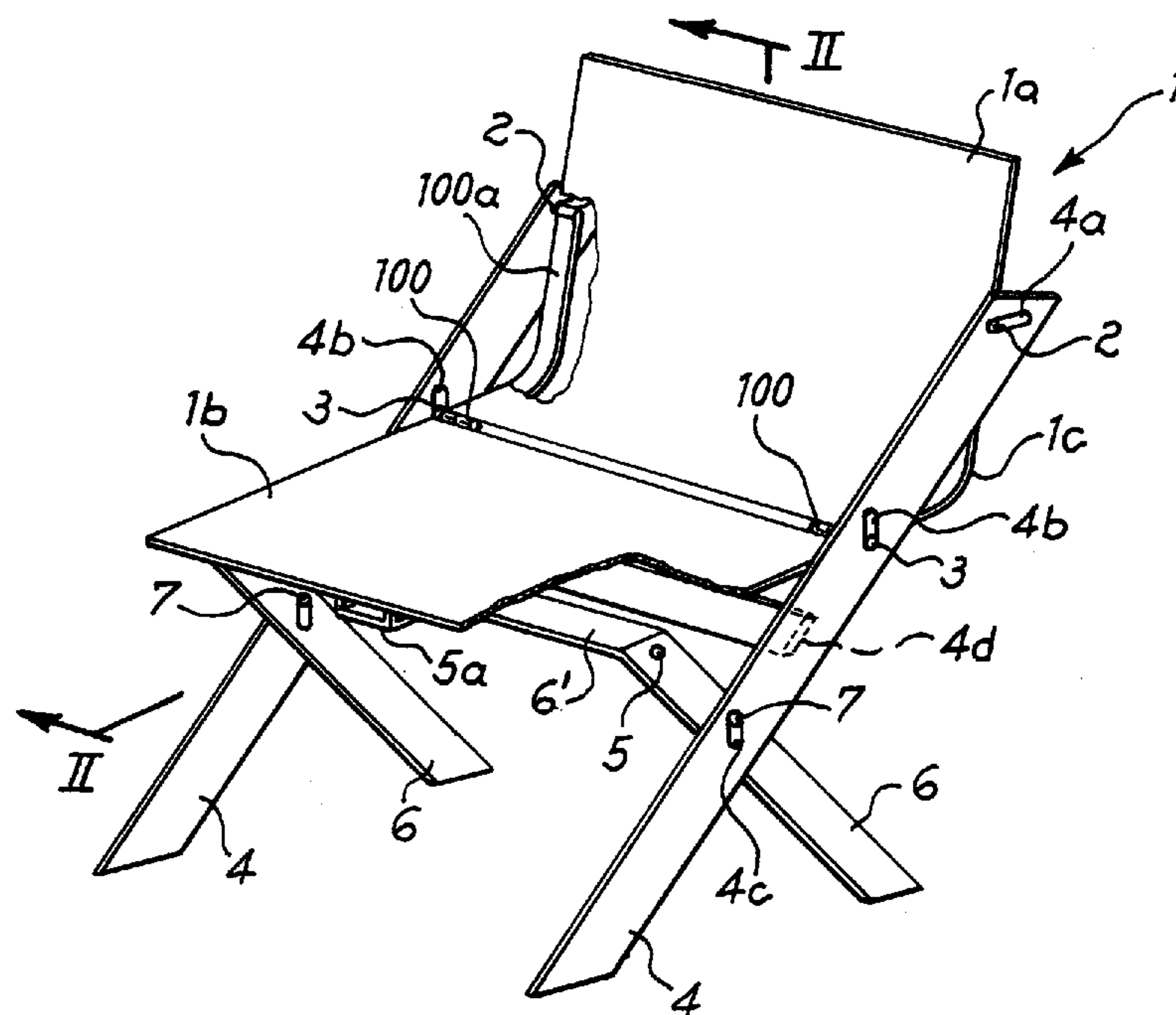
(51) Int.Cl.<sup>5</sup> A47C 1/032

(30) 1990/06/15 (094.742) IL

(30) 1991/05/30 (MI91A 001481) IT

(54) **CHAISE PLIANTE A COMPENSATION CONTINUE DE  
MOUVEMENT DE REPLIAGE**

(54) **FOLDING CHAIR WITH CONTINUOUSLY VARIABLE SELF-  
BALANCED TILTING ACTION**



(57) Chair comprising a seating unit (1) and two pairs of legs (4,6) made slidably integral by means of couplings (2,3) attached to seating unit (1) and designed to engage the relevant inserts (4a,4b) located in such first pair of legs (4), which are made to slide in relation to the second pair of legs (6) by further couplings (7) located in further inserts (4c) provided on such legs (4), such couplings being designed to allow substantially continuous tilt adjustment of the seat and of the backrest relative to the seat, as a result of the relevant pushing action exerted by the user, the various positions assumed being stably balanced by the same action which has determined them.



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FOLDING CHAIR WITH CONTINUOUSLY VARIABLE SELF-BALANCED TILTING  
ACTION

ABSTRACT

Chair comprising a seating unit (1) and two pairs of legs (4,6) made slidably integral by means of couplings (2,3) attached to seating unit (1) and designed to engage the relevant inserts (4a,4b) located in such first pair of legs (4), which are made to slide in relation to the second pair of legs (6) by further couplings (7) located in further inserts (4c) provided on such legs (4), such couplings being designed to allow substantially continuous tilt adjustment of the seat and of the backrest relative to the seat, as a result of the relevant pushing action exerted by the user, the various positions assumed being stably balanced by the same action which has determined them.

FOLDING CHAIR WITH CONTINUOUSLY VARIABLE SELF-BALANCED TILTING  
ACTION

5 The object of this invention is a folding chair especially intended for office use, designed for continuous tilt adjustment of the seat and backrest to assume at all times stable settings automatically balanced by the same action which has brought about such adjustment.

It is known that there is an increasing need to alter the setting of chair, armchair and similar seats in relation to the various positions assumed by the user throughout the day.

10 In the office environment particularly, following the widespread introduction of computer and word processing systems on desks, it is necessary to provide a chair enabling a comfortable and ergonomically correct position to be achieved both when writing normally at a table or desk and when using a computer keyboard, such keyboards usually being placed in a lower position relative  
15 to the desk top; it is also necessary to provide a slight backward tilt to the so-called active rest position.

There is therefore posed the technical problem of developing a chair capable of allowing forward swivel of the seating unit as well as controlled swivel of the backrest relative to the seat so  
20 that the user may assume either a more favourable position for writing and/or typing or a slight backward tilt to the rest position.

A further aim of this invention is to provide a chair capable of allowing substantially continuous adjustments to the setting of

- 2 -

the seat and backrest as a result of the different positions assumed by the user at various times.

5 The chair should moreover be of extremely compact dimensions and comprised of a small number of parts capable of being easily assembled and dismantled to facilitate routine or special maintenance tasks, and it should be capable of being folded when not in use in order to reduce its overall dimensions and facilitate both storage in a concealed position by the user and warehousing and transport by the manufacturer.

10 Such results are obtained from the present invention, which provides a chair comprising:

a support including:

a first pair of elongated legs spaced from one another, said legs being formed with respective top portions;

15 a second pair of elongated legs transverse to said first pair of legs and formed with respective top and bottom sides, said top portions of said legs of the first pair extending above said top sides of said legs of said second pair;

a seat unit mounted on said support and comprising:

20 a seat extending generally in a horizontal plane in a normal position of said seat unit and formed with a top surface and a bottom surface, said bottom surface being operatively connected with said top sides of said second pair of legs;

25 a back extending upwardly from said seat and lying generally in a vertical plane in said normal position, said back and said seat being operatively connected with and movable relative to one another;

a first pair of elongated slots each formed on a respective top portion of said first pair of legs and extending transverse to a vertical;

30 a second pair of elongated slots each formed on a respective leg of said first pair of legs below the respective slot of said first pair of slots and extending generally parallel to a vertical;



- 2a -

a third pair of elongated slots each formed on the respective leg of said first pair below the respective slot of said second pair of slots and extending generally parallel to a vertical;

5 first coupling means for slidably connecting said back with said first slots guiding said back rearwardly from said normal position toward a rest position of said seat unit upon leaning back of a user;

second coupling means for slidably mounting said seat on said second pair of slots guiding the seat upwardly toward the rest position of said seat unit; and

10 third coupling means for slidably mounting said second pair of legs on said third pair of slots, a front of the seat being movable angularly downwardly from said normal position of said seat unit toward a working position of the seat unit upon movement of said bottom sides of said second pair of legs rearwardly and displacement of a center of gravity of the user  
15 toward said front of said seat.

Further, this invention provides a chair comprising:

a support including:

20 a first pair of legs spaced from one another and lying in parallel planes, each of said legs being formed with a respective rear portion extending rearwardly upwardly with respect to a vertical, and

a second pair of legs each formed with respective front portions, said rear portions of the first pair of legs extending above said front portions of said legs of the second pair;

25 a seat unit mounted on said support and comprising:

a seat extending generally in a horizontal plane in a normal position of said seat unit and formed with a front operatively connected with said front portions of said second pair of legs; and

- 2b -

a back extending upwardly from said seat and lying generally in a vertical plane in said normal position, said back and said seat being operatively connected with and movable relative to one another;

5 a first pair of elongated slots formed on the respective rear portions of each of said first pair of legs and extending transverse to a vertical;

a second pair of elongated slots formed on each of said legs of said first pair below the respective slot of said first pair and extending generally parallel to a vertical;

10 first coupling means for slidably mounting said back in said first pair of slots, said back being movable outwardly toward a rest position of said seat unit upon displacement of a centre of gravity of a user toward said rear portion of said first pair of legs; and

15 second coupling means for slidably connecting said seat with said second pair of slots, said seat being guided upwardly along said slots of said second pair toward said rest position upon displacement of the centre of gravity of the user.

More particularly, provision is made for such coupling facilities to be substantially comprised of pins respectively integral with

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the backrest and the seat and projecting therefrom in a substantially horizontal direction, at least one pair of such pins constituting also the swivel pin of the hinge, the upper arm of which has its end rotationally integral with the other pair of pins.

Further details will be apparent from the following description, with reference to the attached drawings in which are shown:

In figure 1 : a perspective view in oblique projection of the chair according to the invention;

In figure 2 : a partial diagrammatic section on plane II-II of figure 1;

In figure 3 : a side view of the chair in fig. 1;

In figure 4a: the chair in fig. 1 tilted forward;

In figure 4b: the chair in fig. 1 with its backrest tilted rearward;

In figure 5 : a diagrammatic side view of the chair in fig. 1 with the various movements depicted by broken lines and dotted lines for seat and backrest tilt respectively;

In figure 6 : the chair in fig. 5 mounted on wheels;

In figure 7 : an alternative version of the chair in fig. 1, and

In figure 8 : a further alternative version of the chair in fig 1.

As shown in figure 1, the chair according to the invention is substantially comprised of a seating unit 1 consisting of a slablike member folded along a curved line 1c to provide a substantially vertical backrest 1a and a substantially horizontal



plane of seat 1b. Such seat 1b and backrest 1a are made rotationally integral with one another by means of a pair of hinges 100 consisting of two arms 100a and 100b respectively attached to backrest 1a and seat 1b.

5 More particularly, the upper end of each arm 100a ends in a circular insert containing a pin 2 partly protruding from the edge of backrest 1a, whilst there protrudes from seat 1b the swivel pin 3 of hinge 100.

10 Such pins 2 and 3 are designed to be inserted in a known manner into the appropriate slots 4a and 4b of a first pair of legs 4, located obliquely relative to seating unit 1, which are thus made slidably integral with both backrest 1a and seat 1b; such legs 4 are then joined together by a crossbar 4d to form a substantially H-shaped first frame.

15 Slots 4a and 4b are furthermore respectively located as follows: the first 4a is substantially inclined upward and rearward, and the second 4b is substantially vertical.

The lower surface of the front end of seat 1b is moreover supported on a crossbar 6' for the attachment of a further pair of legs 6, the assembly of which forms a substantially "inverted U"-shaped second frame, linked in a sliding manner to seat 1b by means of a rail 5a or similar made integral with the lower surface of seat 1b and in which slides crossbar 6'.

20 Legs 6 of such second pair are likewise linked in a sliding manner to the first pair of legs 4 by means of pins 7 inserted in a known manner into slots 4c which are provided in appropriate positions on legs 4.

25 As is apparent from figures 1 and 2, the chair as used under



normal conditions has its seat 1b located substantially horizontal, its backrest 1a substantially vertical and pins 2, 3 and 7 positioned respectively at the inner, lower and upper ends in slots 4a, 4b and 4c.

5 When the user wishes to change his position he shifts his own centre of gravity so as to exert, with his own weight, a pushing action on the front end of seat 1b, thus bringing about a corresponding action on pins 7 which slide towards the lower end of slots 4c, whilst swivel pins 3, constituting the neutral axis, maintain their position relative to the lower end of slots 4c-6c.  
10 On the other hand, should the user wish to assume an active rest position with the backrest tilted rearward, it will be sufficient to exert pushing action on backrest 1b which, rotating on pins 3 of hinge 1d, will tilt rearward to shift pins 2 from the front end setting to the rear end setting of slot 4a and pins 3 themselves to the upper end setting of slot 4b.  
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For a better understanding, figure 4 shows the various positions which may be assumed by the chair, namely: normal position with seat 1b horizontal and backrest 1a vertical, indicated by a continuous line; working position with seat 1b tilted forward but  
20 no change in the relative position of backrest 1a and seat 1b, indicated by a broken line; rest position with seat 1b horizontal and backrest 1a tilted rearward, indicated by a dotted line. It is furthermore apparent that pins 2, 3 and 7 may be positioned, within the relevant slots 4a, 4b, 4c, in any intermediate setting  
25 between the two end settings, as a result of the pushing action exerted by the user; all the settings are stable since they are

balanced by the user's own weight and by the position assumed by his centre of gravity.

The chair according to the invention may also be folded after use, to be placed, for example, in a less conspicuous position or in a cupboard; in order to reduce its overall dimensions seat 1b is swivelled clockwise, whereupon it moves upward and causes pins 5 to slide within guides 5a toward backrest 1a, thus causing legs 6 to swivel on pins 7 and to close in a position parallel to legs 4, whilst seat 1b is folded onto the backrest thus substantially reducing the chair to a parallelepiped the thickness of which is substantially contained within the width of legs 4.

Figure 6 shows a first alternative version of the chair according to the invention in which the entire supporting structure is mounted on a column 8 which in turn is mounted on a star base (9) fitted with castors 10. In this case the lower ends of legs 4 and 6 are, in a known manner not described herein, made integral with column 8 by means of hinges 9a to enable backrest 1a and seat 1b to assume the same various positions previously described.

Figure 7 shows in turn a second alternative version of the chair according to the invention in which legs 4 and 6 are replaced by a frame 104, substantially of channel section, with a first end still hinged at 5 and a second end extended upward and rearward to form an arm 110, which still includes slots 104a and 104b between which slide pins 2 and 3. In this case also it is possible to adjust both the rake of backrest 1a rearward and, in a limited manner, the forward tilt of seat 1b by elastic deformation around link 107, the movement of the pins within the slots being entirely similar to that previously described for the

chair in fig. 1. The chair in fig. 7 may also be provided with two flat members constituting the sides of an armchair still made integral with seating unit 1 by means of pins 2, 3 and slots 4a, 4b, the operation required for tilt adjustment remaining unchanged.

Figure 8 shows a further alternative version of the chair in which backrest 1a and seat 1b form a one-piece shell of suitable section to enable backrest 1a to swivel relative to seat 1b.

In this case the chair can no longer be folded but seat adjusting movements can still be carried out as shown in figure 5.

It is therefore apparent that the chair according to the invention makes it possible to obtain different settings of the seat and of the backrest as a result of the different positions assumed by the user and that such settings, which can be substantially adjusted in a continuous manner, are all substantially stable because they are balanced by the action exerted by the actual user.

Many alternatives may be introduced in the technical development of the constructional details of the chair according to the invention without thereby departing from the scope thereof as far as its general features are concerned. In particular, it will be possible to alter the length and arrangement of the various slots in order to change the extent to which the seat and backrest can be moved from the rest position and/or the higher or lower sliding friction of the pins in the slots determining the dynamic characteristics of movement, i.e. the greater or lesser ability of the chair to adjust the settings of the seat and backrest.



**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE  
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

- 5     1.     A chair comprising:  
          a support including:  
              a first pair of elongated legs spaced from one another, said legs being  
formed with respective top portions;  
              a second pair of elongated legs transverse to said first pair of legs and  
10    formed with respective top and bottom sides, said top portions of said legs of the  
first pair extending above said top sides of said legs of said second pair;  
          a seat unit mounted on said support and comprising:  
              a seat extending generally in a horizontal plane in a normal position  
of said seat unit and formed with a top surface and a bottom surface, said bottom  
15    surface being operatively connected with said top sides of said second pair of legs;  
              a back extending upwardly from said seat and lying generally in a  
vertical plane in said normal position, said back and said seat being operatively  
connected with and movable relative to one another;  
              a first pair of elongated slots each formed on a respective top portion  
20    of said first pair of legs and extending transverse to a vertical;  
              a second pair of elongated slots each formed on a respective leg of  
said first pair of legs below the respective slot of said first pair of slots and  
extending generally parallel to a vertical;  
              a third pair of elongated slots each formed on the respective leg of  
25    said first pair below the respective slot of said second pair of slots and extending  
generally parallel to a vertical;  
          first coupling means for slidably connecting said back with said first  
slots guiding said back rearwardly from said normal position toward a rest position  
of said seat unit upon leaning back of a user;

- 9 -

second coupling means for slidably mounting said seat on said second pair of slots guiding the seat upwardly toward the rest position of said seat unit; and

third coupling means for slidably mounting said second pair of legs on said third pair of slots, a front of the seat being movable angularly downwardly from  
5 said normal position of said seat unit toward a working position of the seat unit upon movement of said bottom sides of said second pair of legs rearwardly and displacement of a center of gravity of the user toward said front of said seat.

2. The chair defined in claim 1, further comprising mounting means for  
10 coupling said seat and back flexibly with one another, said mounting means being a pair of hinges, each of said hinges being formed with respective arms respectively connected with said back and seat of said seat unit.

3. The chair defined in claim 1 wherein each of said first, second and third  
15 coupling means includes respective pins extending along respective mutually parallel pivotal horizontal axes and being received by the respective first, second and third pairs of slots.

4. The chair defined in claim 1 wherein said top sides of the second pair of legs  
20 are bridged by a cross bar operatively connected with said bottom surface of said seat.

5. The chair defined in claim 1 wherein said seat unit is a one-piece shell made  
of a flexible material.

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6. The chair defined in claim 5 wherein said first and second pair of legs are bridged by a third pair of legs spaced downwardly from the seat, so that first, second and third pair of legs constitute a frame formed with respective channel-like portions.

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- 10 -

7. The chair defined in claim 1, further comprising:  
a base provided with a plurality of casters;  
a vertical column extending upwardly from said base; and  
hinge means for pivotally mounting said first and second pair of legs on said  
5 base.

8. The chair defined in claim 1, further comprising guiding means mounted on  
said bottom surface of the seat for sliding said top sides of said second pair of legs  
therealong so that said chair can be completely folded.

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9. A chair comprising:  
a support including:  
a first pair of legs spaced from one another and lying in parallel planes, each  
of said legs being formed with a respective rear portion extending rearwardly  
15 upwardly with respect to a vertical, and  
a second pair of legs each formed with respective front portions, said rear  
portions of the first pair of legs extending above said front portions of said legs of  
the second pair;

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a seat unit mounted on said support and comprising:  
a seat extending generally in a horizontal plane in a normal position  
of said seat unit and formed with a front operatively connected with said front  
portions of said second pair of legs; and  
a back extending upwardly from said seat and lying generally in a  
25 vertical plane in said normal position, said back and said seat being operatively  
connected with and movable relative to one another;  
a first pair of elongated slots formed on the respective rear portions  
of each of said first pair of legs and extending transverse to a vertical;



- 11 -

a second pair of elongated slots formed on each of said legs of said first pair below the respective slot of said first pair and extending generally parallel to a vertical;

first coupling means for slidably mounting said back in said first pair  
5 of slots, said back being movable outwardly toward a rest position of said seat unit upon displacement of a centre of gravity of a user toward said rear portion of said first pair of legs; and

second coupling means for slidably connecting said seat with said  
second pair of slots, said seat being guided upwardly along said slots of said second  
10 pair toward said rest position upon displacement of the centre of gravity of the user.



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Fig. 3

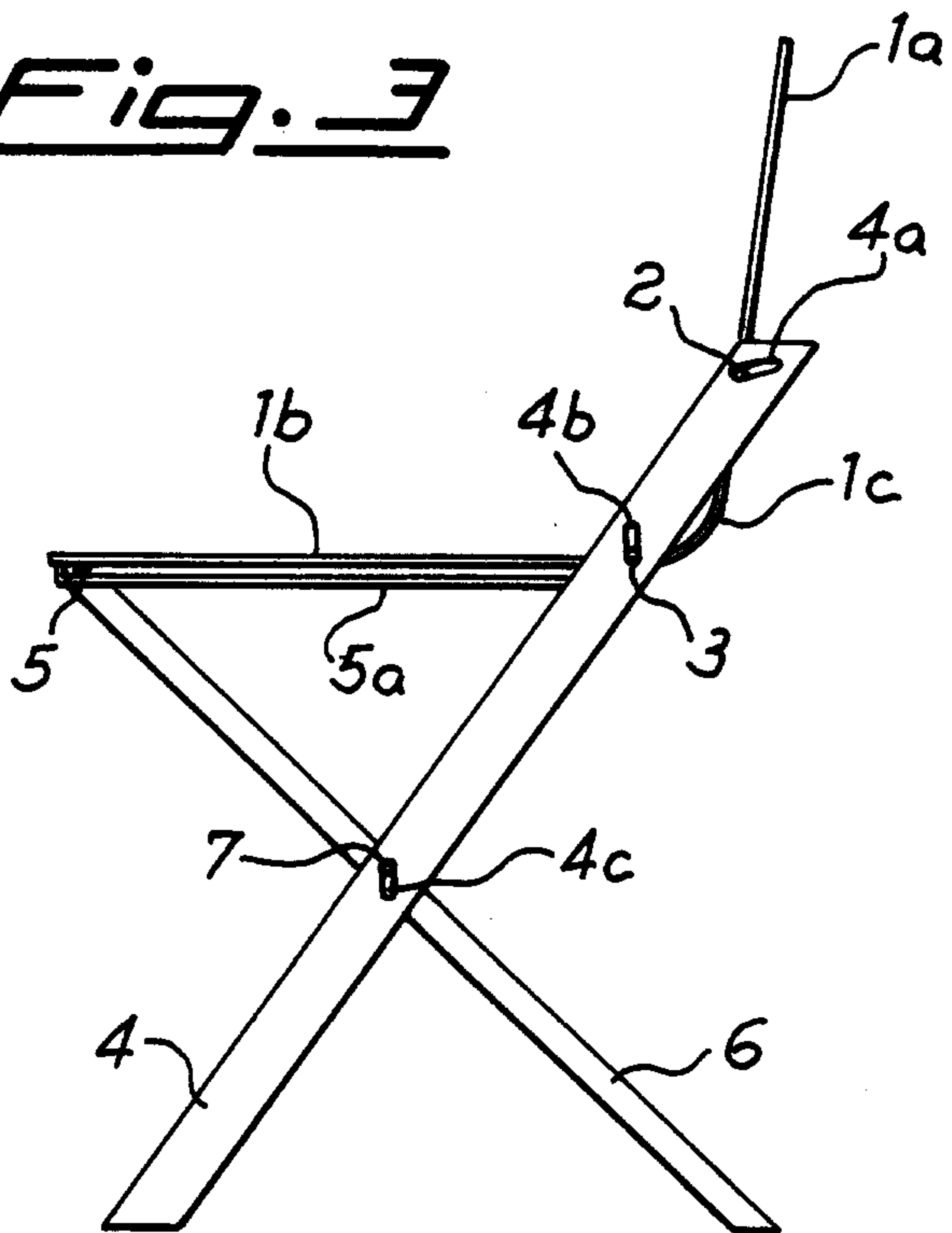


Fig. 4a

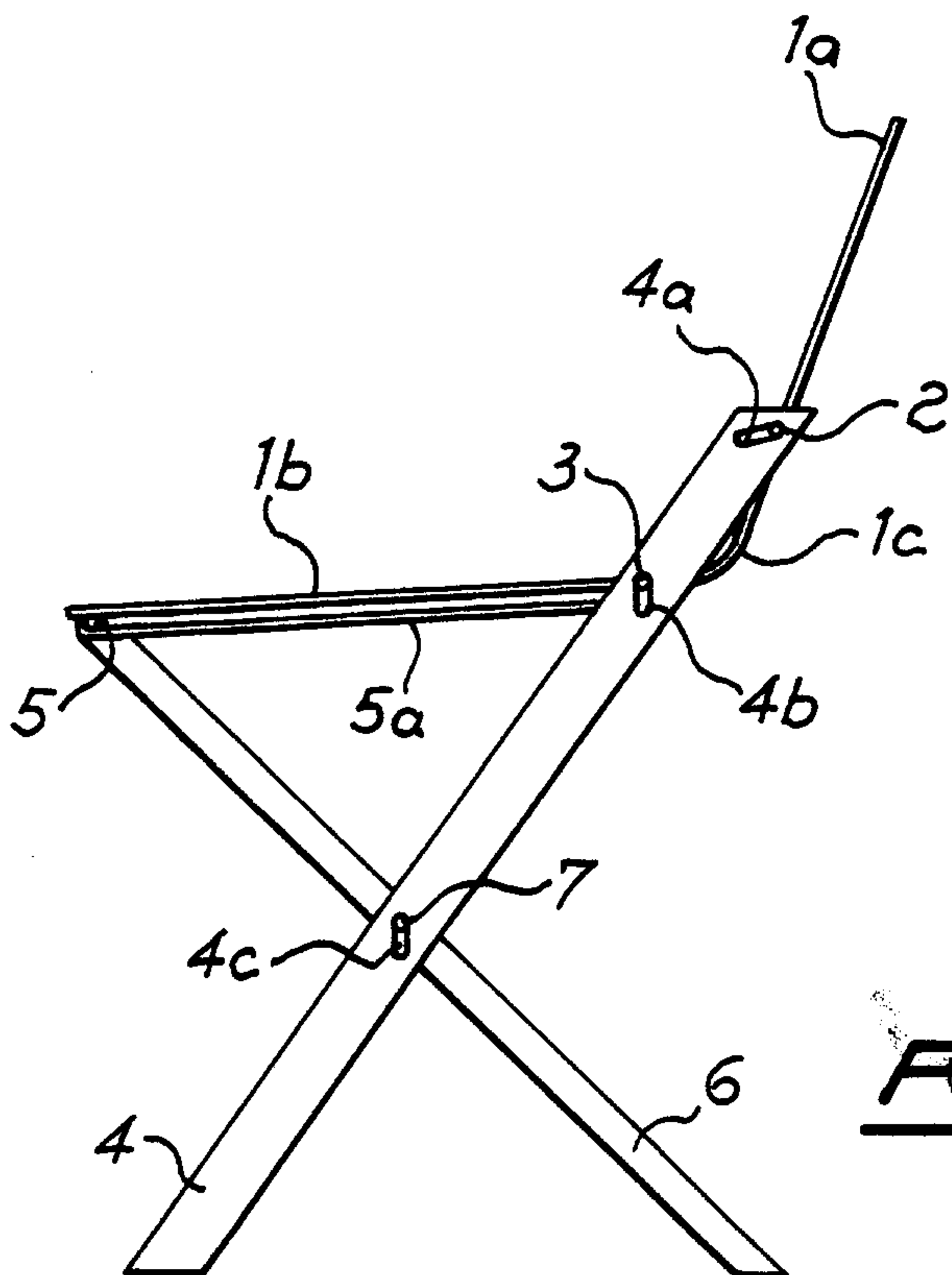
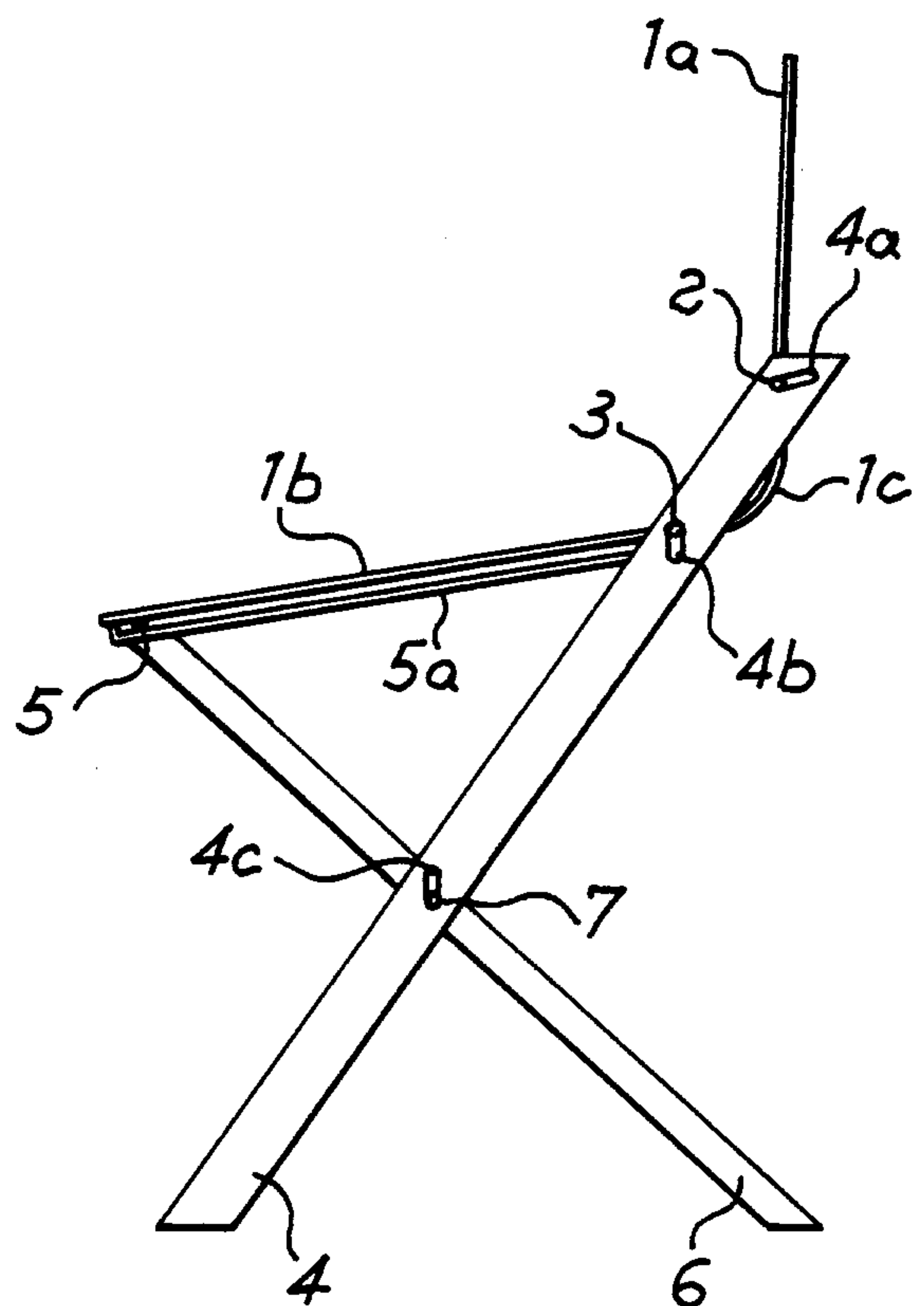
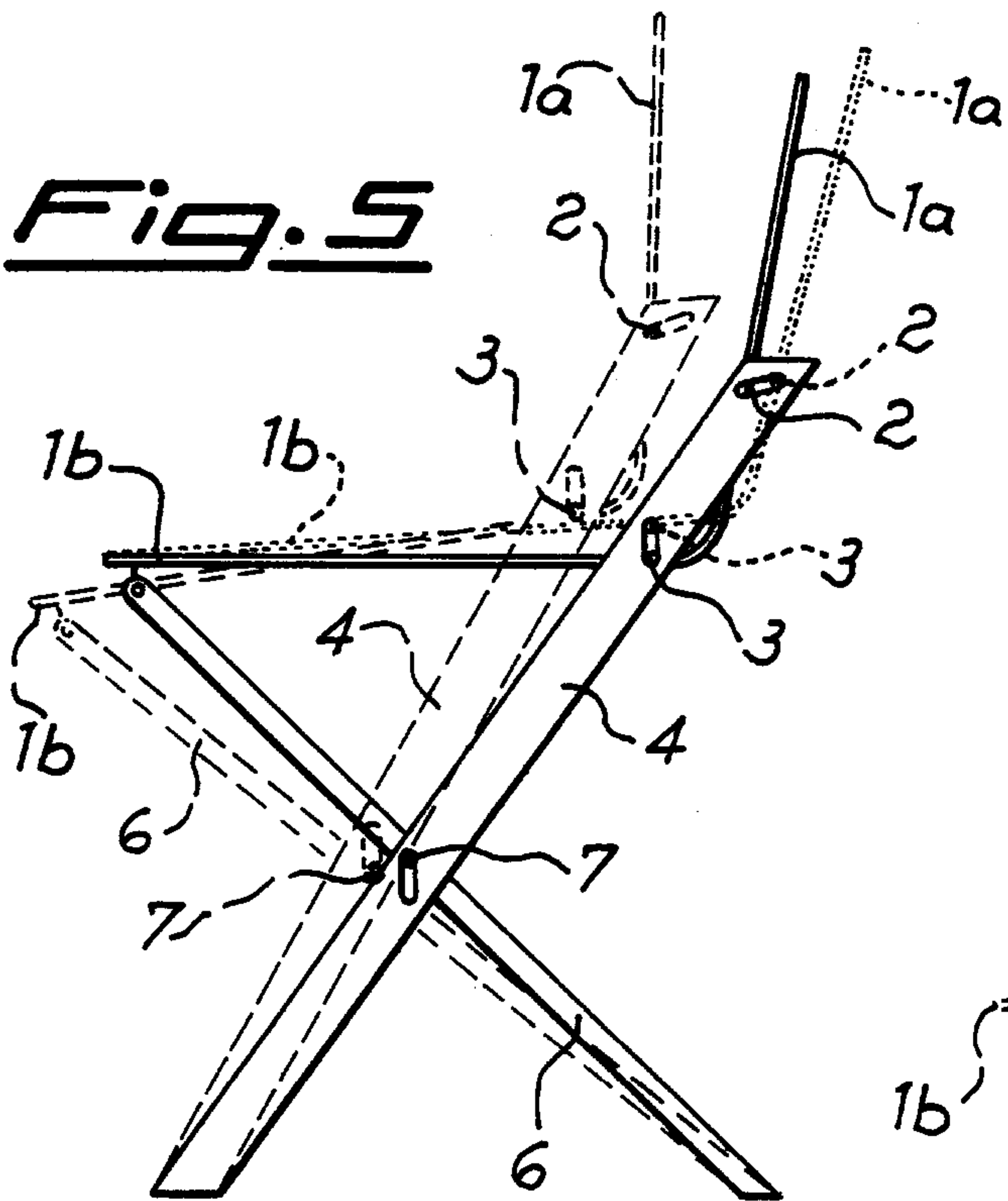


Fig. 4b

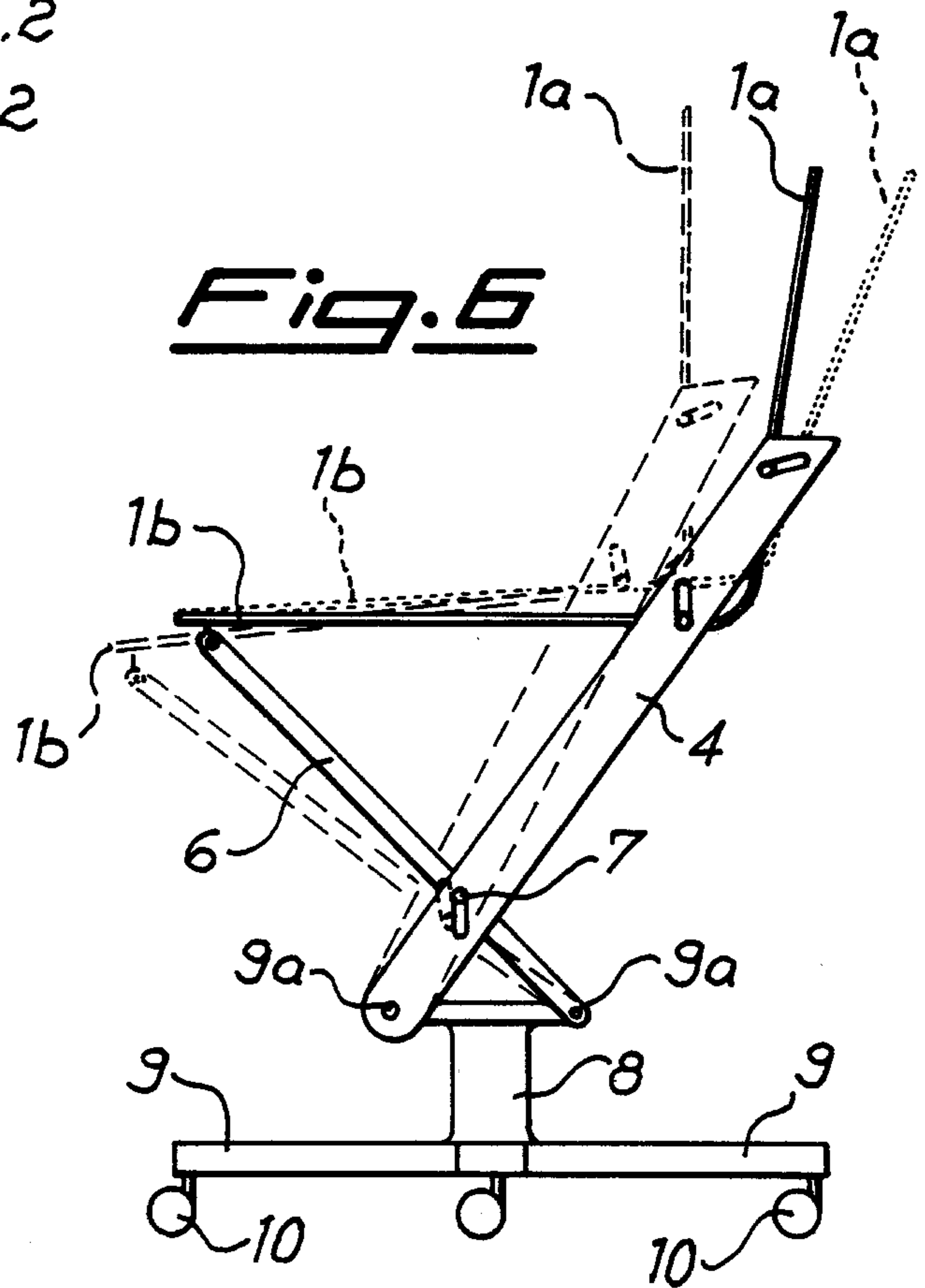
Sim: H. G. G. G.



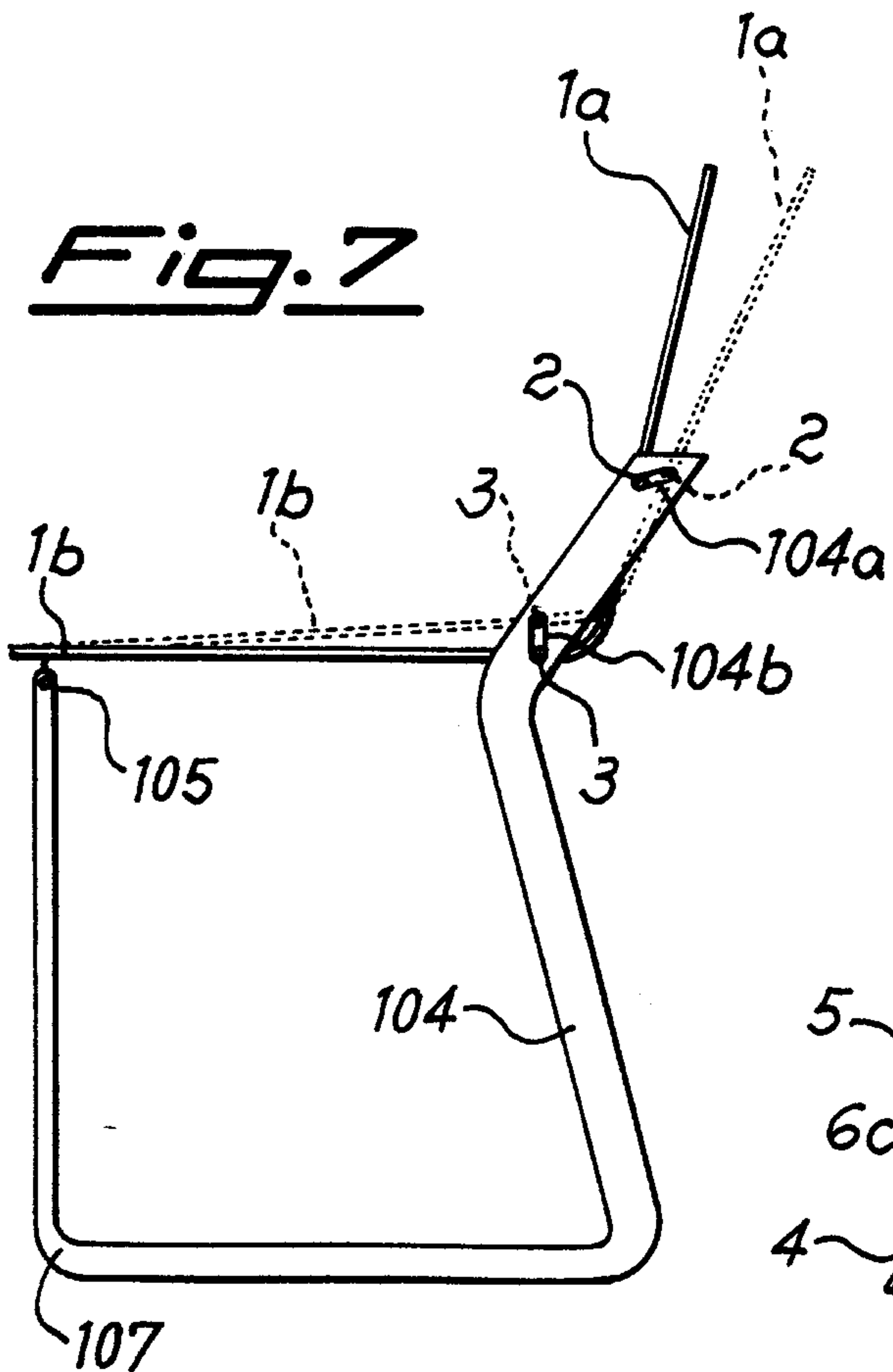
**Fig. 5**



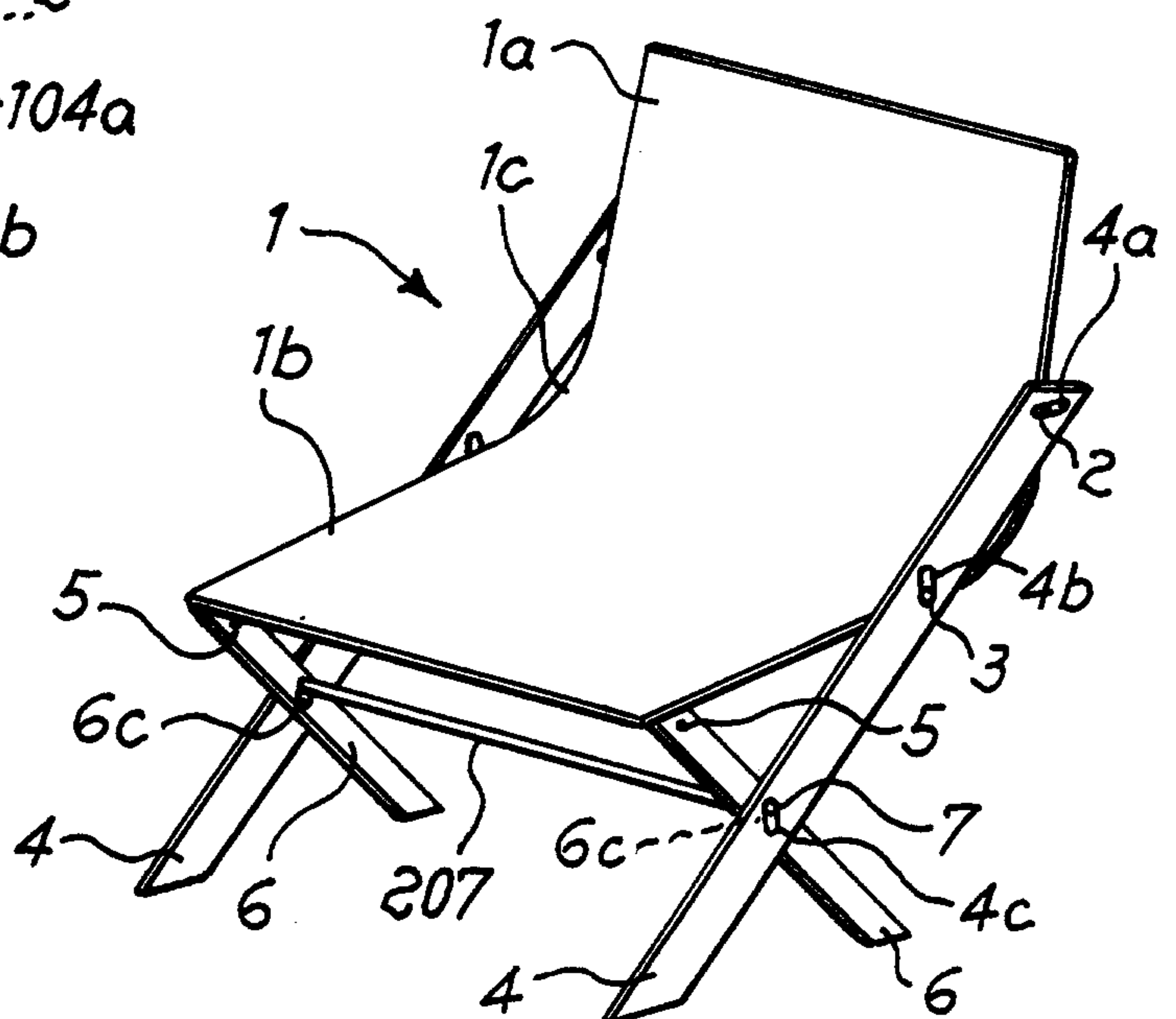
**Fig. 6**



**Fig. 7**



**Fig. 8**



*Sim: H. G. G. G.*

