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(71) Applicant (for all designated States except US): **THE FOLDING COMPANY** [GB/GB]; London NW6 2JG (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **MAINSTONE, Marion** [GB/GB]; c/o THE FOLDING COMPANY LIMITED, London NW6 2JG (GB).

(74) Agent: **MUTTOCK, Neil**; No.6 Aztec Row, London N1 0PW (GB).

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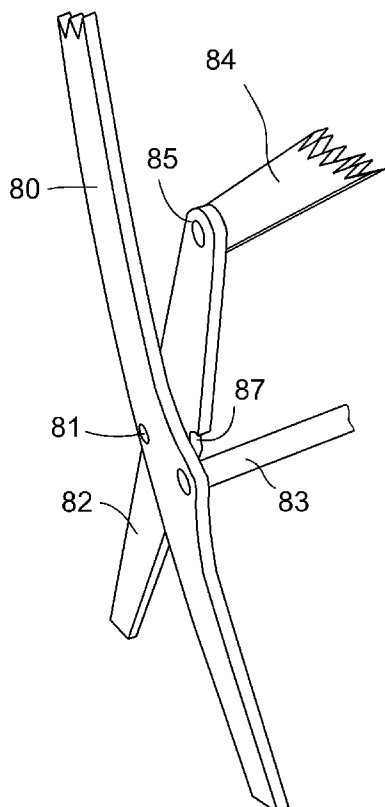
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(54) Title: FOLDING ARTICLES



(57) Abstract: A linkage mechanism for a folding article includes a first strut and a second strut which are joined by a pivot, the linkage mechanism moving between a first position where the first strut is either aligned or at a first angle to the second strut and a second position where the first strut is at a second larger angle to the second strut. Also provided is stop member attached to the first strut close to the pivot such that the second strut abuts against it when the second position is reached and the second larger angle cannot be exceeded. The second angle is ideally approximately perpendicular. The first and second struts each extend in both directions beyond the pivot. Third and fourth struts may also be provided, pivotally joined to the first strut and second strut in a closed loop configuration, the third strut being substantially aligned with the first strut to form a first leg, the second strut forming a second leg, and the fourth strut forming a seat.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## Folding Articles

The present invention relates to folding articles, particularly, but not exclusively, to chairs and stools, and similar articles of furniture.

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There are many designs of folding chair comprising a configuration of struts joined to each other by pivots. In some chairs such as that shown in US4456294, one of the struts releasably engages with another strut in the open position, for example by locating in a groove, and this may serve to  
10 lock the chair in position. In other chairs, the connections joining the struts to one another are all permanent pivots, so the chair linkage must be designed such that in the open position at least one strut (or of course and extension of the strut) must interfere with another in order to limit the extent of the linkage's movement.

15

In US4456294 for example, the chair is essentially a closed four bar linkage, with two struts forming the back leg. The upper strut of the back leg extends downwards past the pivot point and terminates with a flange. When the struts come into alignment in the open position, the flange abuts  
20 the lower strut of the back leg and further movement is prevented.

This flange must be quite strong in order to stand the force exerted from the lower strut of the back leg that results from someone sitting on the chair. Such flanges are inconvenient to incorporate into the manufacture of  
25 the chair leg components. This also applies to other stop members, such as extending pins which act in a similar way to the flange.

It is an object of the present invention to provide a configuration for folding articles that allows their open position to be constrained in a convenient manner.

5           According to the present invention there is provided a linkage mechanism for a folding article including a first strut and a second strut which are joined by a pivot, the linkage mechanism moving between a first position where the first strut is either aligned or at a first angle to the second  
10           strut and a second position where the first strut is at a second larger angle to the second strut, wherein there is provided stop member attached to the first strut close to the pivot such that the second strut abuts against it when the second position is reached and the second larger angle cannot be exceeded.

15           The invention will now be described, by way of example, with reference to the drawings, of which;

Figure 1 shows a side elevation of a folding chair in an open position;

20           Figures 2 and 3 show side elevations of the folding chair in intermediate positions;

Figure 4 shows a side elevation of the folding chair in a closed position;

25           Figure 5 shows a perspective view of a folding stool in an open position;

Figures 6 and 7 show perspective views of the folding stool in intermediate positions;

Figure 8 shows a perspective view of the folding stool in a closed position;  
and

Figure 9 shows a perspective view of part of another embodiment of a  
5 folding stool in an intermediate position.

The principles of the co-operating stop parts may be incorporated in different configurations of folding articles. Referring to figure 1, a folding chair 20 is shown. The mechanism of the chair's folding will first be  
10 briefly described, before examining the stop parts themselves. Considered from the side, the chair 20 essentially comprises six bars. It will be seen of course that many of the bars will be duplicated on each side of the chair, whilst other bars will stretch to the corresponding bar on the opposite the side of the chair to form a single member such as a seat or back. A back leg  
15 of the chair comprises an upper strut 28 and a lower strut 30, joined by a pivot 23. The front leg of the chair is also made up of two struts, upper strut 24 and lower strut 26, which are joined by pivot 44. A seat 21 is joined to the back leg's upper strut 28 and the front leg's upper strut 24 by pivots 34 and 42 respectively. The lower strut of the back leg 30 and the  
20 lower strut of the front leg 26 are joined by pivot 38. A constraining strut 32 is attached to the front leg's lower strut 26 by a pivot 40, and to the seat 21 and back leg's upper strut 28 by pivot 34. A back strut 22, which is an upper extension of the front leg's upper strut 24 (i.e. they form a single rigid member), is joined to the seat 21 by pivot 42.

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The chair is folded from the open position shown in figure 1 by picking up the cross member at pivot 44 where the front leg 26 joins the back 22, which causes the back leg's lower strut 30 to swing forward, and

the back leg's upper strut 28 and constraining strut 32 to rotate towards seat 21, as shown in figure 2. It will be seen in figures 3 and 4 that as the chair is raised and the struts allowed to pivot freely, they eventually come to a closed position where all the struts are in general alignment with the chair in its most compact, closed, form.

The back leg's lower strut 30 has a shaped notch 48. The front leg's lower strut 26 has a raised portion 36 which includes a lower surface 36 having a profile corresponding to that of the shaped notch 48. Both the notch 48 and the surface 36 are situated a relatively short distance from the point 38 about which the lower front leg strut 26 and lower back leg strut 30 pivot. Starting from figure 4 and working backwards through to figure 1, it will be seen that as the chair is unfolded from the closed position and the lower front leg strut 26 and lower back leg strut 30 rotate relatively to one another from an substantially aligned state to an approximately perpendicular state in figure 1, the notch 48 and the surface 46 are brought together until they abut, at which point the lower front leg strut 26 and lower back leg strut 30 can rotate no further. This limitation of the lower front leg strut 26 and lower back leg strut 30 also stops any further movement of the other struts of the chair, and so locks the chair's position.

The principle is not limited to a chair having two similar linkages on each side. Referring to figure 5, a stool comprises a seat 58 pivotally joined to two front legs 52, 54 and pivotally joined to upper struts 64, 65 of a back leg, the upper strut 64 being pivotally joined to a lower strut 56 of the back leg. As for the previous embodiment, the principle at the stool's folding will first be described before describing the arrangement of the constraining members.

The seat 58 is pivotally joined to two front legs 52, 54 by a bar 70 which engages in downwardly extending lugs 68, 69. and pivotally joined to upper struts 64, 65 of a back leg, the upper strut 64 being pivotally joined to a lower strut 56 of the back leg. The front legs 52 are joined to the back leg 56 by a bar 51 that extends between the front legs. A board 53 is mounted on the front legs 52, 54, this board includes support members 55, 57 through which the pivot bar 51 freely rotates. The support members 55, 57 are situated either side of the back leg 56 and serve to prevent lateral movement of the back leg 56. The back leg 56 is pivotally joined to the two upper struts 64, 65 by a bar 72, the upper struts being either side of the back leg to further prevent lateral movement. The upper struts 64, 65 are pivotally joined to the seat by a bar 74 which extends between to downwardly extending lugs 76, 78.

15

Referring to figure 6, in order to fold the stool from the open position shown in figure 5, the stool is picked up by the bar 70 (although other places such as a handle formed in the seat 58 at a position close to the bar may also be utilised). The lower strut 56 of the back leg swings into alignment with the front legs 52, 54, the upper struts 64, 65 of the back leg pivoting towards the seat. Referring also to figure 7, the front legs pivot about bar 70 towards the seat 58. Eventually the front legs 52, 54, the upper struts 64, 65 of the back leg and the lower strut 56 of the back leg become approximately aligned with the seat 58 resting against them as shown in figure 8.

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Referring to figures 5 to 7, a board 60 extends between the front legs 52, 54, the board including a stop member 62. As the stool is unfolded

from its closed position shown in figure 8, the lower strut 56 of the back leg pivots about bar 51 to move from a substantially aligned position to an approximately perpendicular position as shown in figure 5. As the lower strut 56 of the back leg approaches a perpendicular position, the back leg  
5 bears against the stop member 62, which limits any further rotation about bar 51. This in turn limits any further movement in the other struts of the stool, and the stool is locked in the open position (since the stool's weight and that of any load placed on the seat acts to press the rear leg 56 against the support member 62). The support member 62 is arranged to abut the  
10 lower strut of the back leg 56 along a relative large length of the lower strut of the back leg in order to reduce the strain experienced by either member. Similarly, the board 60 is attached along a relatively large length of the front legs 54, 56 in order to spread the load transferred from the support member 62. Since the loads are spread this way, the struts making up the  
15 legs in this design can conveniently be fabricated with a uniform cross-section.

Figure 9 shows part of a stool having a front leg strut 80, pivotally joined at 81 to a lower back leg strut 82, the lower back leg strut 82 being  
20 pivotally joined at 85 to an upper back leg strut 84. The front leg strut 80 and the back leg strut 84 are both pivotally joined to a seat (not shown). This linkage is duplicated on the other side of the stool. A bar 83 extends between front leg strut 80 and the front leg strut on the other side of the stool. The manner of folding the linkage is essentially the same as the  
25 previously described stool. In this embodiment however, as lower back leg strut 82 rotates about 81 from the closed position substantially aligned with the front leg strut 80 to the open position approximately perpendicular to the front leg strut 80, a notch 87 in the lower back leg strut 82 comes to



bear against the bar 83. This limits the rotation of the lower back leg strut 82 relative to the front leg strut 80, and so locks the position of the stool. The notch 87 is circular in shape to accept the curve of the bar 83. In this embodiment the lower back leg strut 82 includes a widened portion (when  
5 considered in the side elevation) around the notch 85, and the front leg strut includes a widened portion around the bar 83. As weight on the stool tends to try to rotate the struts 80, 82 further, the strain on the front leg strut 80 and lower back leg strut 82 acts particularly around the bar 83 and notch 87.

10           Rather than a widening when considered in the side elevation, a local thickening or strengthening of the struts near the bar or other stop member may be employed.

15           It will be realised that the limiting system according to the principles herein described may be included in folding linkage where two struts in an X-configuration are pivotally joined and there is a need to limit the relative rotation of the struts.

## CLAIMS

- 5 1. A linkage mechanism for a folding article including a first strut and a second strut which are joined by a pivot, the linkage mechanism moving between a first position where the first strut is either aligned or at a first angle to the second strut and a second position where the first strut is at a second larger angle to the second strut, wherein there is provided stop  
10 member attached to the first strut close to the pivot such that the second strut abuts against it when the second position is reached and the second larger angle cannot be exceeded.
2. A linkage mechanism according to claim 1 wherein the second angle  
15 is approximately perpendicular.
3. A linkage mechanism according to any previous claim wherein the first and second struts each extend in both directions beyond the pivot.
- 20 4. A linkage mechanism according to claim 3 wherein there is provided at least a third strut and a fourth strut pivotally joined to the first strut and second strut in a closed loop configuration, the third strut being substantially aligned with the first strut to form a first leg, the second strut forming a second leg, and the fourth strut forming a seat.
- 25 5. A linkage mechanism according to claim 3 wherein there is provided at least a third strut and a fourth strut pivotally joined to the first strut and second strut in a closed loop configuration, the third strut being

substantially aligned with the second strut to form a first leg, the first strut forming a second leg, and the fourth strut forming a seat.

6. A linkage mechanism according to any previous claim wherein the  
5 second strut has a shaped portion to engage with the stop member of the first strut.

7. A linkage mechanism according to any previous claim wherein the  
first and/or second struts are strengthened in the region where the stop  
10 member acts.

8. A linkage mechanism according to claim 7 wherein strengthening is achieved by locally thickening or widening the struts.

9. A linkage mechanism according to any previous claim wherein the  
15 linkage forms part of a folding article having at least the first strut repeated on each side of the article, and the stop member is formed by an element extending between the each first strut.

10. A linkage mechanism according to any previous claim wherein the  
20 linkage forms part of a folding article having at least the first strut repeated on each side of the article, and the stop member is formed by an element extending between the each first strut.

11. A linkage mechanism substantially herein described and illustrated in  
25 figures 1 to 9.

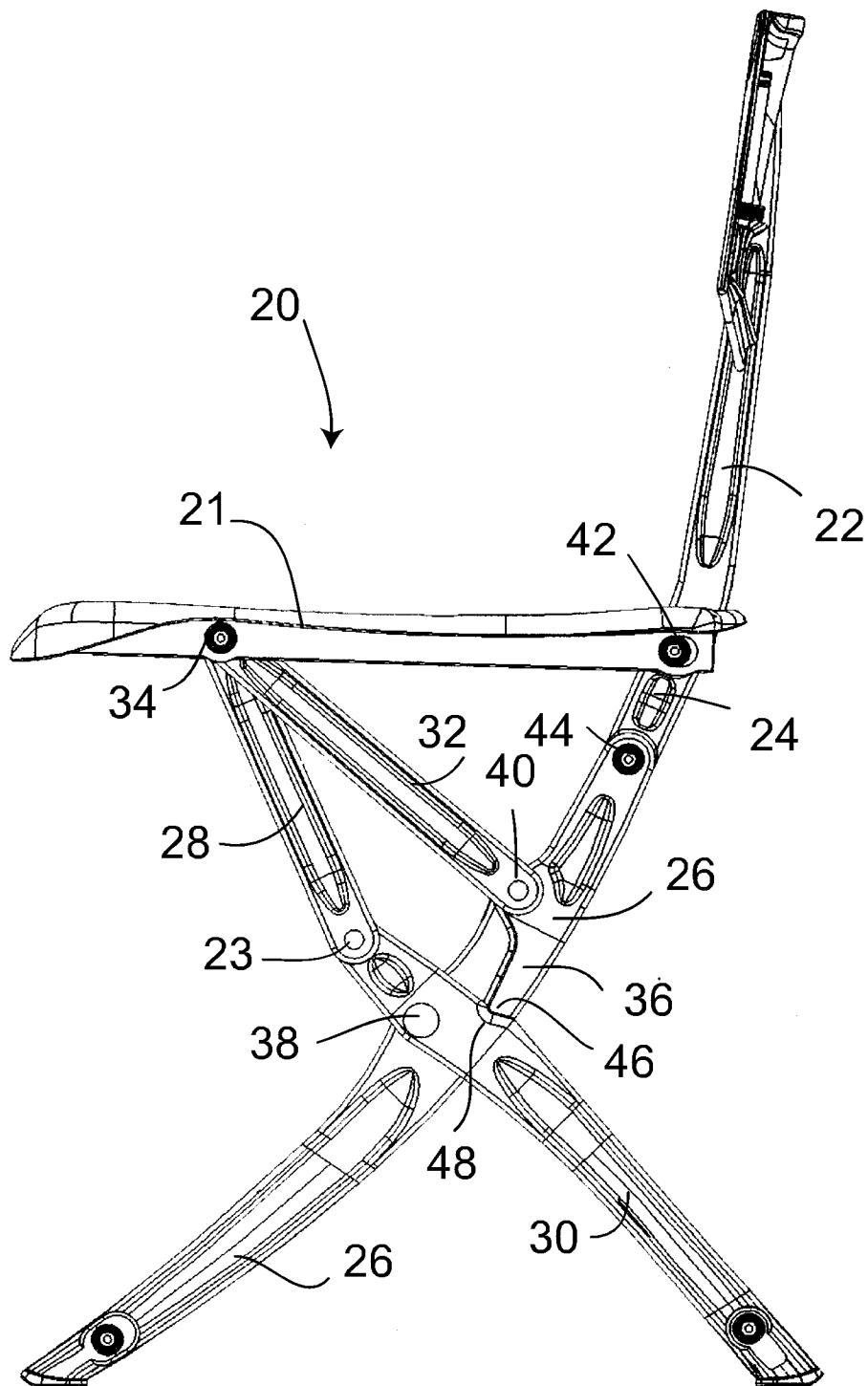
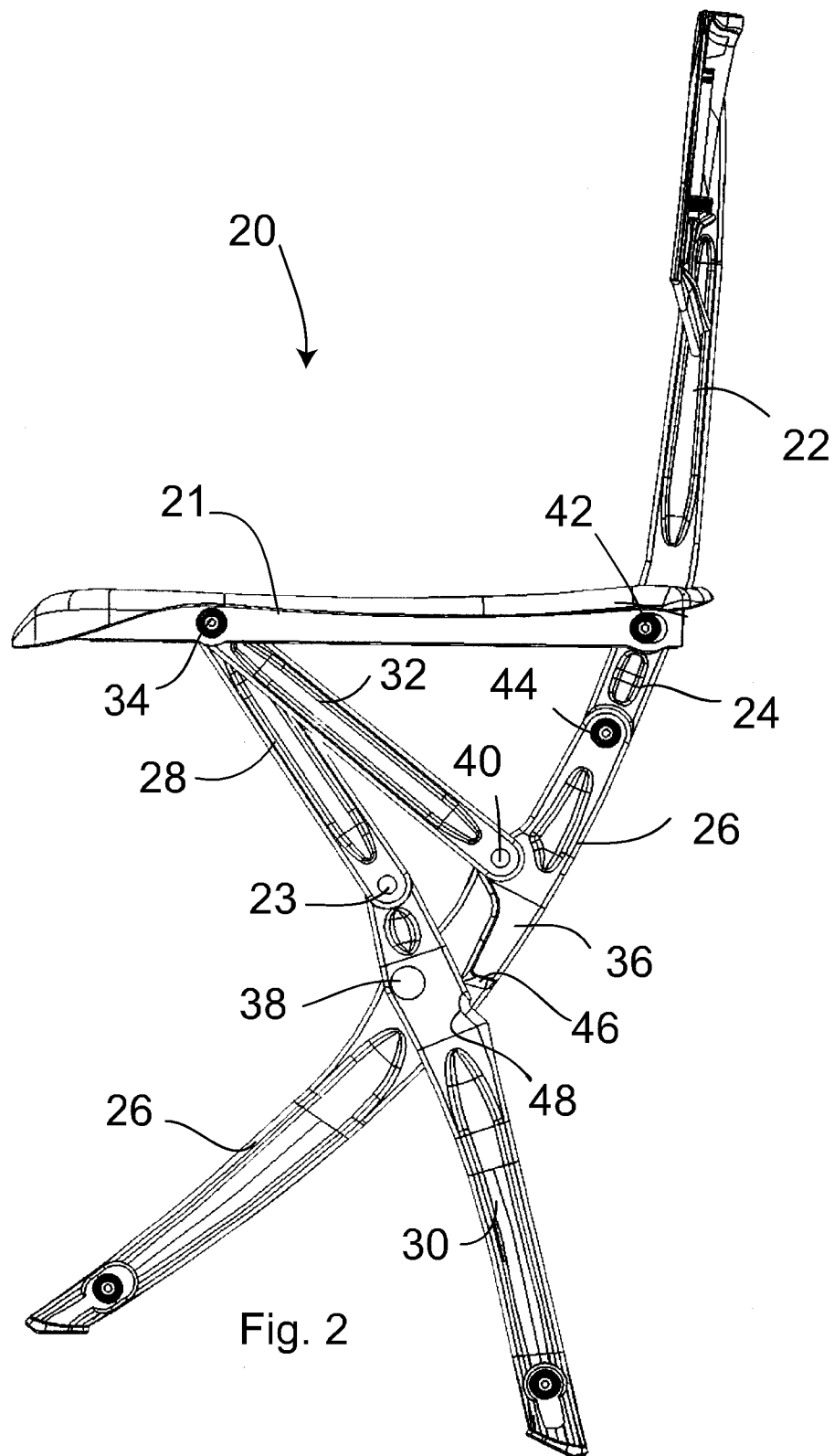


Fig. 1



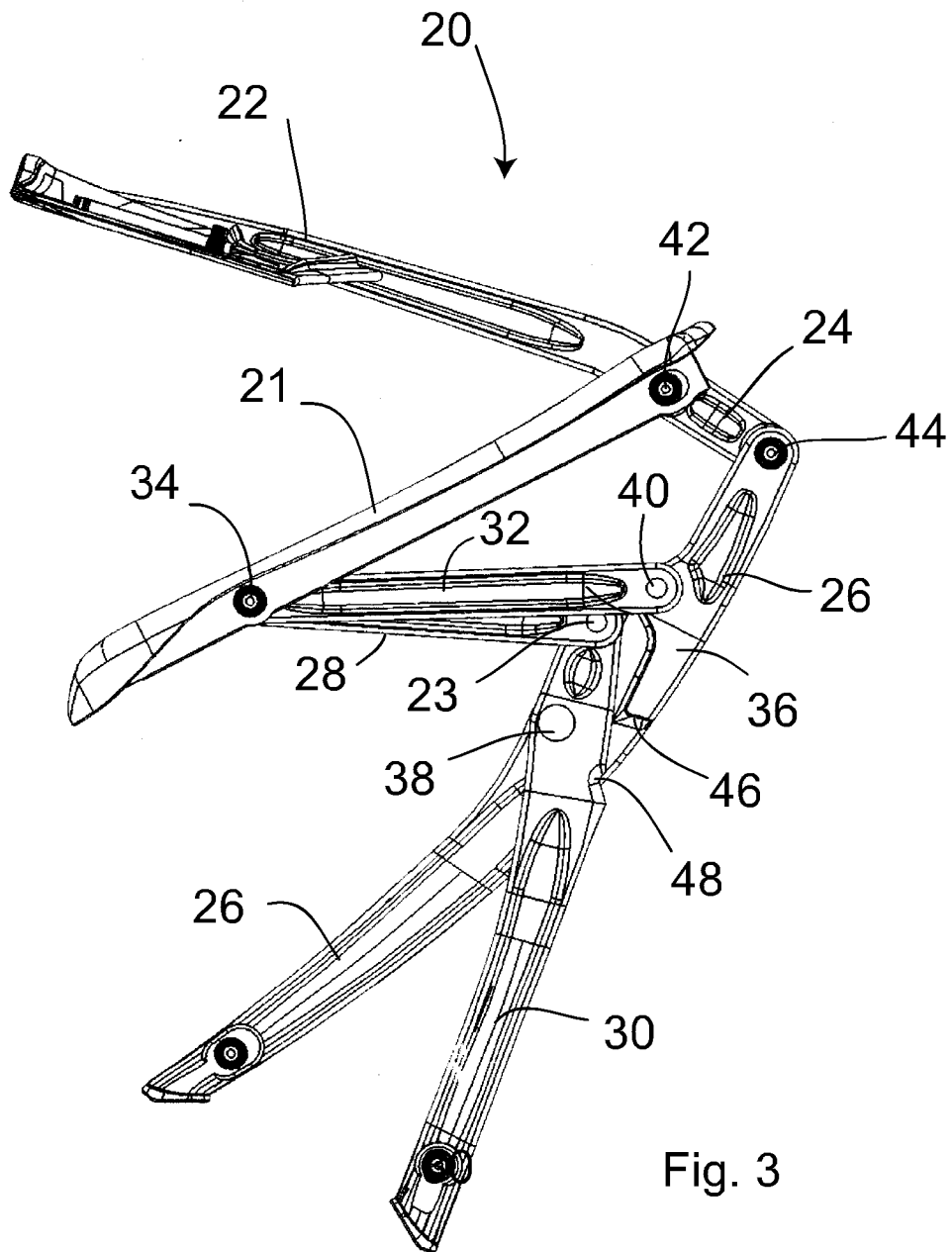


Fig. 3

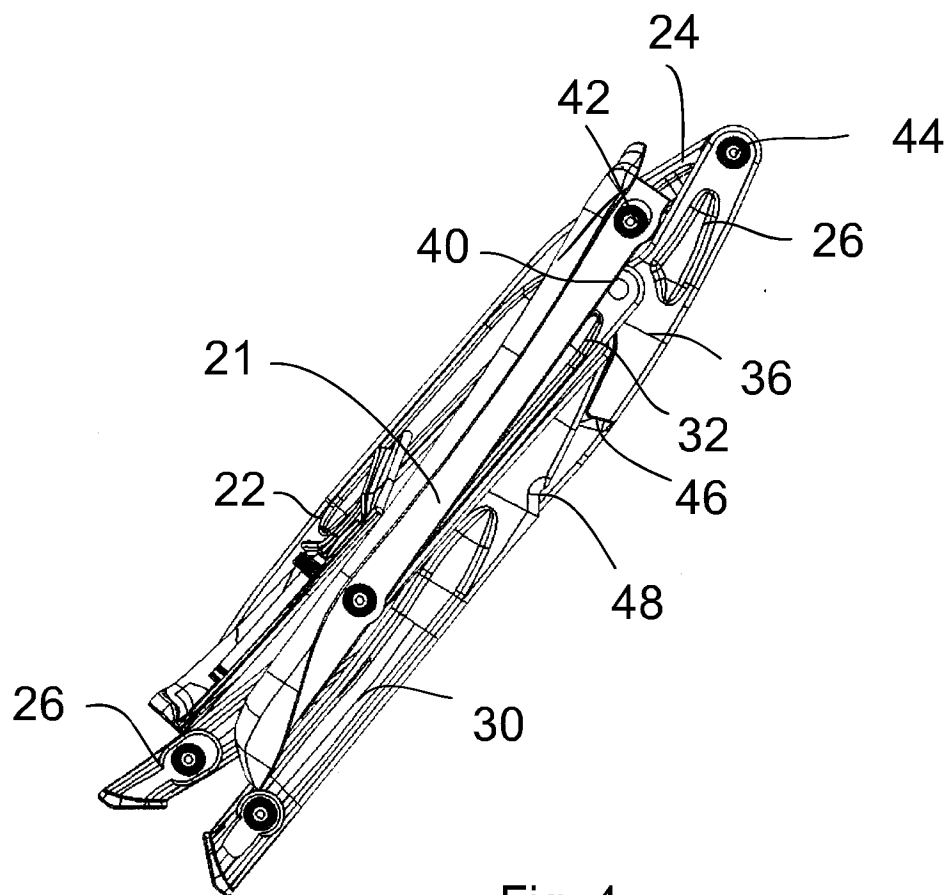


Fig. 4

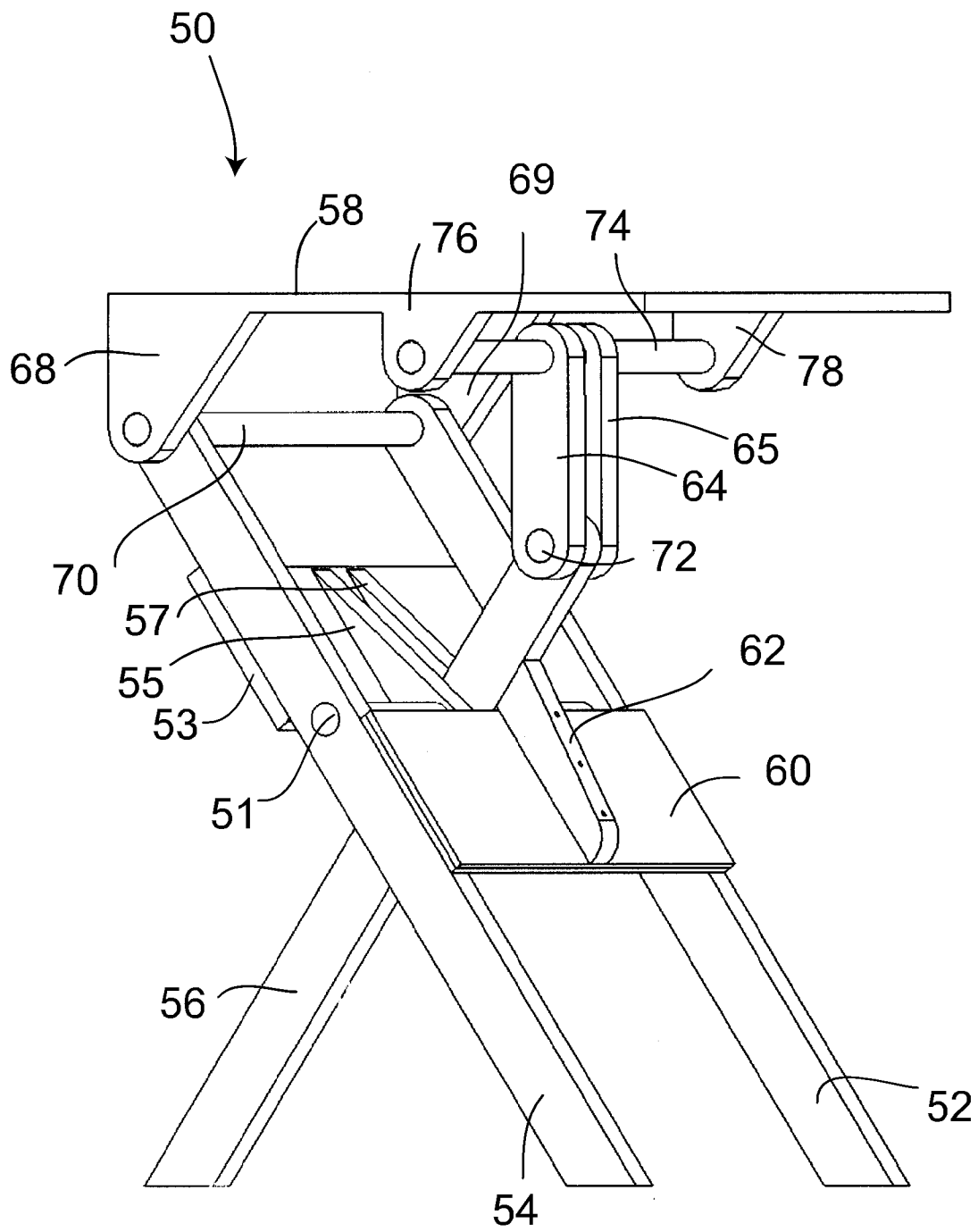


Fig. 5



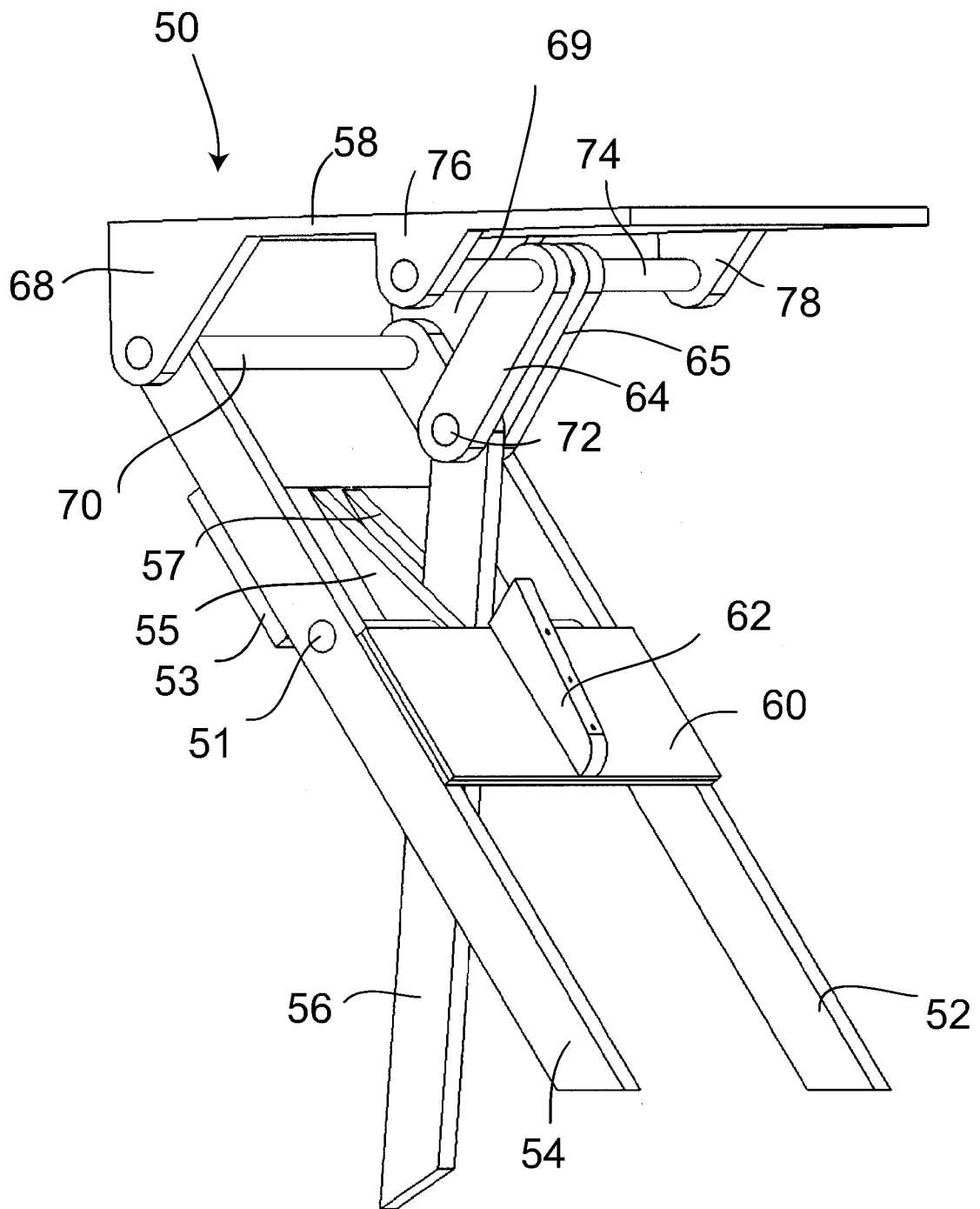


Fig. 6

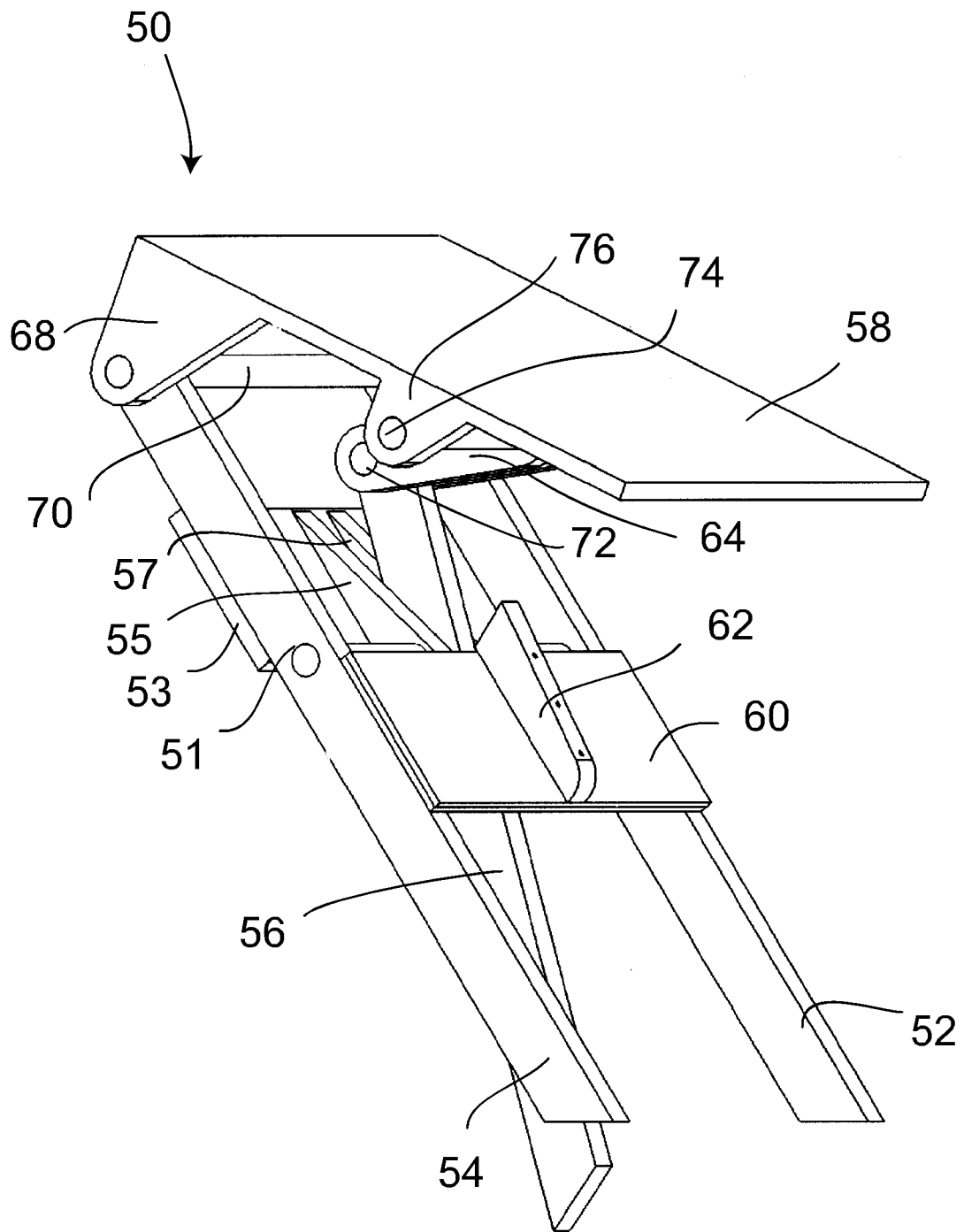


Fig. 7

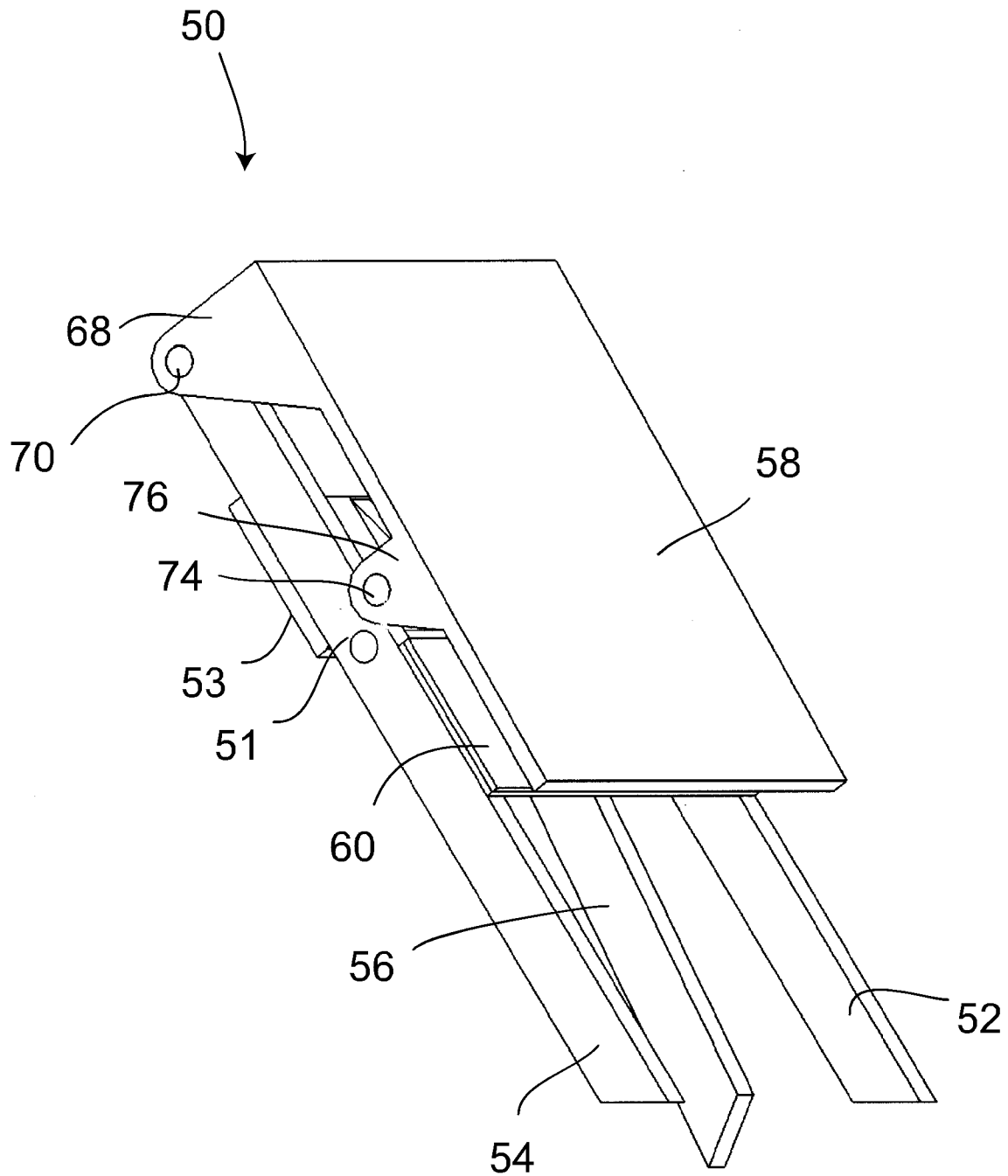


Fig. 8

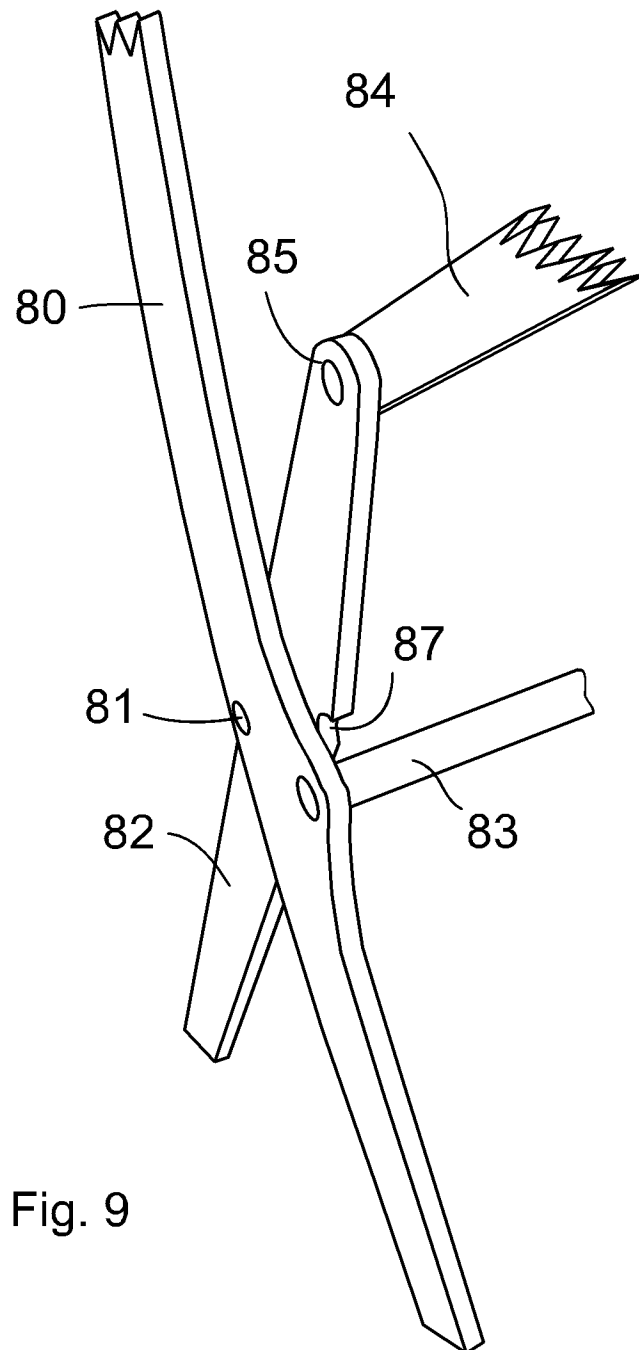


Fig. 9