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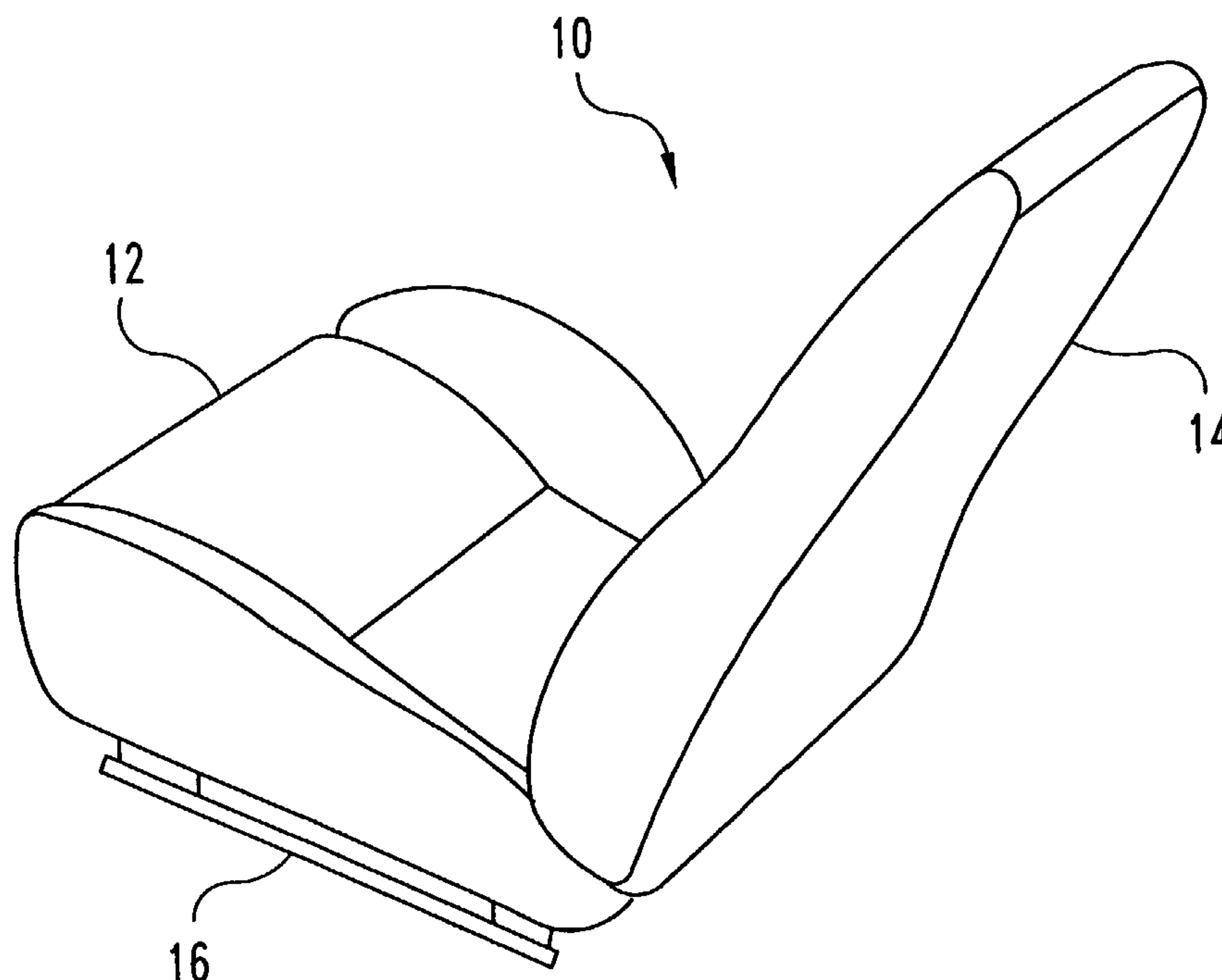
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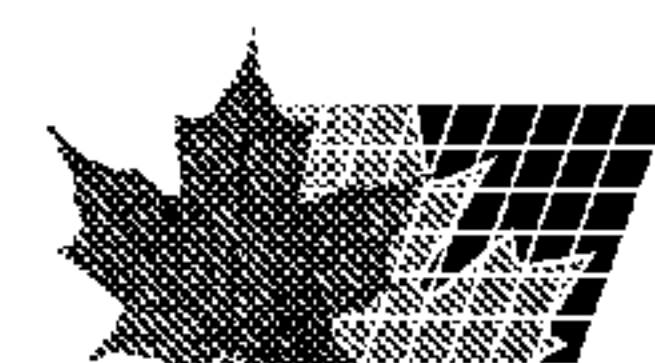
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(57) **Abrégé/Abstract:**

A fold-flat seat recliner mechanism (30, 50) for connecting the seat cushion (12) to the seat back (14) in a motor vehicle includes a lower plate assembly (51) attachable to the seat cushion frame (22, 122) and an upper plate (32, 55) interconnecting the seat back and the lower plate assembly (51) are interconnected by a parallelogram linkage that provides a range of reclining positions for the seat back (14) relative to the seat cushion (12) and allows the seat back to be folded flat relative to the seat cushion from any recline angle. During folding, the linkage retains its previous geometry so that the seat back (14), when unfolded, returns to its previously set recline angle. The mechanism (30, 50) is used in pairs, one on each side of the seat. On one side the mechanism (30, 50) includes means for adjusting the seat back recline angle and a latch operable to inhibit or allow folding of the seat back.



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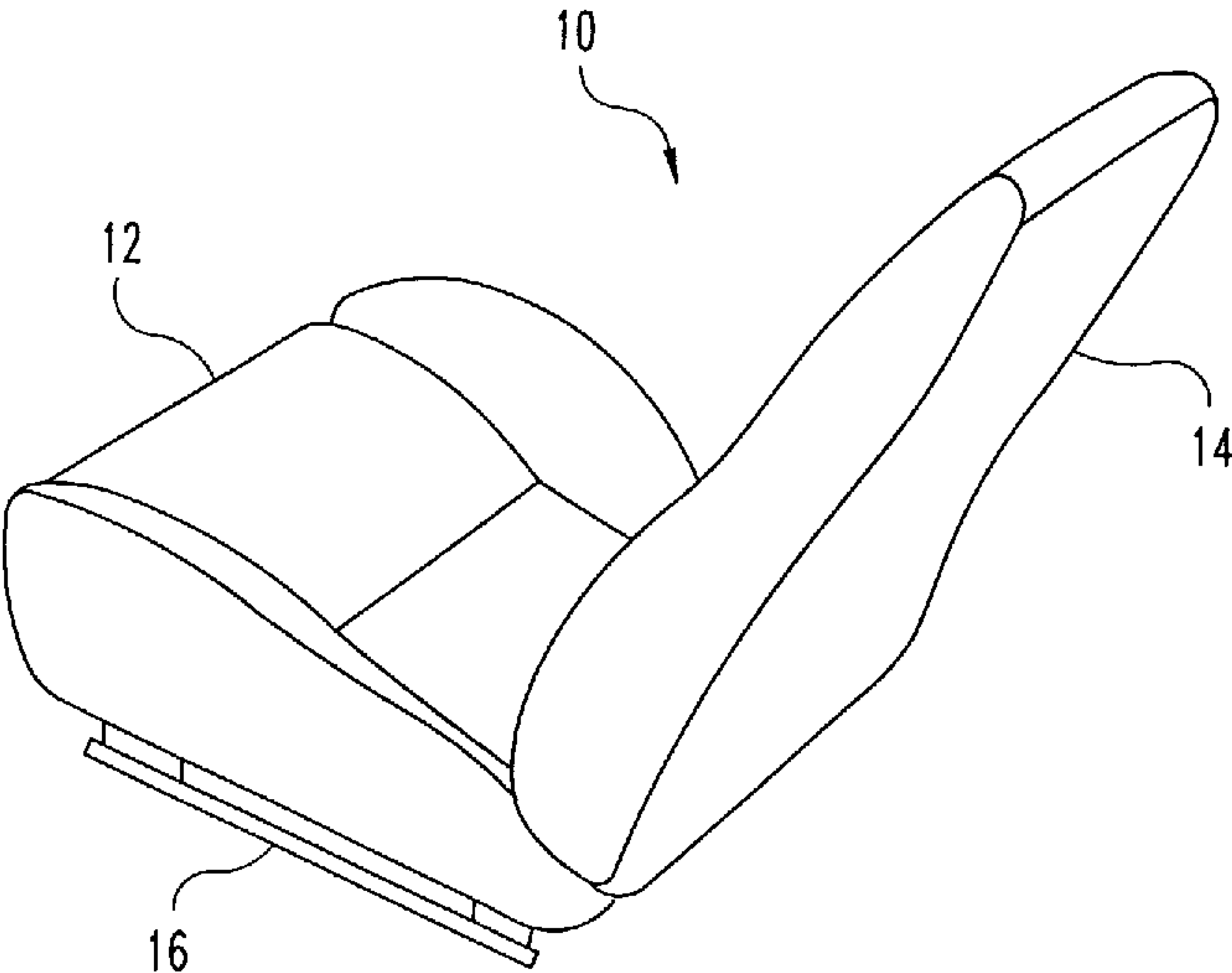
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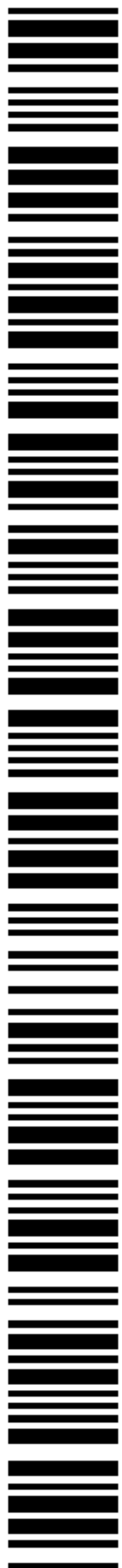
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WO 02/036386 A3

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FOLD-FLAT RECLINING MECHANISM FOR A VEHICLE SEAT

BACKGROUND OF THE INVENTION

The present invention relates to reclining and fold-flat mechanisms for the
5 passenger seats in a vehicle. More specifically the invention relates to a mechanism
that allows a seat to be folded flat from any recline angle and to maintain or
remember the previously set recline angle when the seat is returned to its upright
position.

Many seat reclining mechanisms are known and used in the automotive
10 industry. In some applications, a fold-flat feature is provided that allows the seat
back to be folded to a position substantially parallel to the seat bottom. This is
particularly useful for carrying cargo and is commonly found in vans and sport utility
vehicles. Some amount of fold over is also required in two door vehicles for access
to the rear seat or rear compartment area. In addition, it is desirable to provide some
15 degree of recline adjustment, at least for front seat occupants; however, some vans
and SUV's also include this feature in the rear seats.

Current fold-flat systems are of two general types. One, the dedicated fold-
flat mechanism, provides no recline function. The other is the rotary recliner with
extended forward travel to a fold-flat position. The dedicated fold-flat mechanism is
20 typically used in second or third row seating where the lack of a recline feature is less
detrimental. Typical rotary recliner systems reposition the seat back to its
forwardmost recline position during the fold-flat process thus requiring the recline
angle of the seat back to be readjusted after the seat back is returned to an upright
position. This shortcoming is particularly evident in those systems that combine the
25 recline and fold-flat operations in a single actuation means. In addition, these

systems also tend to require substantial manipulation to fold the seat back or restore the seat back to an upright position. As a result, systems have been developed that separate the seat recline feature from the fold-flat feature. These devices separate folding from the normal adjustments of the seat back so that the seat back does not
5 lose its predetermined angle of inclination. Optimally, the pivot point for folding the seat back flat is higher than the pivot point for reclining the seat back.

One example is shown by patent U.S. Patent No. 5,806,932, which is owned by the assignee of the present invention. The '932 patent relies upon a memory latch to establish the angle of inclination of the seat back. The memory latch is allowed to
10 pivot when the seat is operated in its dump mode. In this dump position, the seat back is in its forward-most position for ingress/egress to the back seat or rear compartment. When the dumping has been completed, the latch is restored to its locked position to thereby re-establish the seat back at its user set angle. While the system of the '932 patent provides significant benefits over the prior adjustment
15 mechanisms, there remains a need for improvements to seat adjustment and fold-flat mechanisms. For instance, most prior adjustment and fold-flat mechanisms rely upon relatively bulky stamped metal components that can be expensive and difficult to assemble.

There is therefore a need for a reclining mechanism with a memory feature
20 that allows the seat back to fold flat when folded, while preserving the recline angle of the seat back. In addition, there is a need for such a system that is easy to operate, lightweight, compact, and that can be manufactured at a reasonable cost.

SUMMARY OF THE INVENTION

In order to address the needs left unfulfilled by prior devices, the present invention contemplates a fold-flat recliner mechanism for use in a vehicle seat that allows the seat back to be folded to a flat position relative to the lower seat cushion.

5 In one embodiment, the mechanism includes an upper plate attached to the seat back frame and a lower member pivotably attached to the seat cushion frame. The upper plate is pivotably connected to the lower member. A pair of links also pivotably interconnect the lower member and the seat cushion frame forming a parallelogram linkage that maintains a fixed and substantially parallel relationship
10 between the seat back and lower seat cushion when the seat back is in a fold-flat position. The upper plate includes a stop pin that engages a stop area on one of the parallelogram links to stop the seat back in the substantially parallel position when the seat back is folded.

The mechanism also includes latch means to control folding of the seat back.
15 Here, the lower member can include a slot within which the pin on the upper plate travels. A pawl retains the pin against one end of the slot when the seat back is in an upright position. A release lever is biased against the pawl to prevent folding of the seat back.

In another embodiment of the invention, the lower member is an assembly
20 including left and right plates connectable to each other and pivotably connected to the seat cushion frame. An upper plate attached to the seat back is pivotably connected between the two lower plates. Links on either side of the assembly complete the formation of a parallelogram that maintains a fixed and substantially parallel relationship between the seat back and seat cushions when the seat back is
25 folded.

In this embodiment, a link pin passes through an arcuate slot in the lower plates connecting link members on the right and left sides of the lower assembly. The slot limits the reclining range of the seat back. The link pin also operates as a stop when the seat back is folded by engaging a stop notch at the end of the upper plate. A fastener connecting the left and right plates also acts as a stop when the seat back is raised to an upright position. Folding of the seat back is controlled by a release lever mounted between the lower plates. The release lever is biased by a spring in a position engaging the lower end of the upper plate to inhibit folding of the seat back. Raising the release lever allows the seat back to be folded.

10 In both embodiments, the mechanism “remembers” the last set recline angle and returns to that recline angle when the seat back is raised from the fold-flat position. Also, in both embodiments, a separate assembly for adjusting the recline angle attaches to the lower end of the lower member.

It is an object of the invention to provide an easy to use reclining mechanism that allows the seat back to fold flat relative to the seat cushion, while preserving the recline angle of the seat back. The ability to fold the seat back to a flat or substantially parallel relationship should be maintained throughout the range of reclining positions for the seat back.

This and other objects, advantages and features are accomplished according to the devices, assemblies and methods of the present invention.

DESCRIPTION OF THE FIGURES

FIG. 1 is a perspective view of a typical seat for a motor vehicle.

FIG. 2 is a side elevational view of a seat frame with a fold-flat reclining mechanism according to one embodiment of the present invention.

FIG. 3A is a detail side elevational view of the fold-flat reclining mechanism depicted in Fig. 2.

FIG. 3B is a side elevational view of the fold-flat reclining mechanism of **FIG. 3A** showing the upper plate in a folded position.

FIG. 3C is a side elevational view of the fold-flat reclining mechanism of **Fig. 3A** at a greater recline angle.

FIG. 3D is a side elevational view of the fold-flat reclining mechanism of **FIG. 3C** showing the upper plate in a folded position.

FIG. 4 is an exploded view of the fold-flat reclining mechanism shown in **FIG. 3A**.

FIG. 5A is a side elevational view of a fold-flat reclining mechanism according to another embodiment of the present invention.

FIG. 5B is a side elevational view of a fold-flat reclining mechanism of **FIG. 5A** showing the upper plate in a folded position.

FIG. 6 is an exploded view of the fold-flat reclining mechanism shown in **Fig. 5A**.

FIG. 7A is a side elevational view of the mechanism of **FIG. 5A** in a seat structure with the seat back reclined.

FIG. 7B is a side elevational view of the mechanism and structure of **FIG. 7A** with the seat back in a folded position.

FIG. 8A is a side elevational view of the mechanism and structure of **FIG. 7A** with the seatback in an upright position

FIG. 8B is a side elevational view of the mechanism and structure of **FIG. 8A** with the seat back in a folded position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. The inventions includes any alterations and further modifications in the illustrated devices and described methods and further applications of the principles of the invention which would normally occur to one skilled in the art to which the invention relates.

In a vehicle application, the fold-flat recliner mechanism of the present invention would preferably be used in pairs, one on each side of the seat. The mechanisms would be identical with the exception that one side would include the added feature of a release lever to control folding of the seat back. This description is directed to the version including this release lever component.

A seat for a vehicle is depicted in **Fig. 1**. The seat **10** includes a bottom cushion **12** and a cushioned seat back **14**. The seat **10** is attached to the vehicle floor through the seat track **16**. Turning to **Fig. 2**, the seat framework **20** is shown. The bottom cushion **12** is supported by a bottom frame **22** that attaches to the seat track **16**. The seat back frame **24** is connected to the bottom frame **22** by a fold-flat recliner mechanism **30**. Rod **26** is a recline adjuster actuating rod for adjusting the recline angle of the seat back. The rod **26** is connected between the recliner mechanism **30** and the bottom frame **22**.

The fold-flat recliner mechanism **30** (**Fig. 2**) is shown in more detail in **Figs. 3-4**. According to a preferred embodiment of the invention, the mechanism **30** includes an upper plate **32** to which the seat back frame **24** is mounted. A lower

member **34** is pivotably attached to the bottom frame **22** at attachment point **22A**
(**Fig. 4**). A first link **36** is pivotably attached to the bottom frame **22** at attachment
point **22B**. These attachments can be made using pivot bolts, rivets or any equivalent
fastener. Similarly, a second link **37** pivotably connects the first link **36** to the lower
5 member **34** at point **34A**. These attachments likewise can be made using rivets, pivot
bolts or the like. The bottom frame between attachment points **22A** and **22B**, along
with the lower member **34** and links **36** and **37**, define a four-bar parallelogram
linkage, with bottom frame attachments **22A** and **22B** defining a fixed pseudo-link
22AB. This parallelogram is pivotable about the fixed link **22AB**. Furthermore, the
10 element formed by the second link **37** remains parallel to the fixed link **22AB** on the
bottom frame **22**, and consequently substantially parallel with the bottom cushion **12**.
This is the basis of the fold-flat mechanism of the present invention.

The lower member **34** also includes a curved slot **35** centered on the point of
attachment **34A** of the upper plate **32** to the lower member **34**. A stop pin **33** is
15 attached to the upper plate **32** and extends into the slot **35** on the lower member **34**.
In **Fig. 3A**, the mechanism is representative of the seat back being in an upright
seating position. In this position, stop pin **33** engages the end of slot **35** as show in
Fig. 3A. A pawl **44** is pivotably attached to the lower member **34**, sandwiched
between the upper plate **32** and the lower member **34**. The pawl **44** has a reaction end
20 **48** configured to hold the stop pin **33** against the end of slot **35**, thereby holding the
seat back in an upright position.

A release lever **42** is also pivotably attached to the lower member **34**. The
release lever **42** has an engagement end **46** configured to react against an engagement
surface **45** portion of pawl **44** so that the release lever **42** holds pawl **44** against stop
25 pin **33** thus holding the upper plate **32** and therefore the seat back in an upright

position. When the release lever **42** is raised, pawl **44** is free to move away from stop pin **33** which allows the upper plate **32** and the seat back to rotate to a fold-flat position. Spring **43** operates between the release lever **42** and the lower member **34** to bias the release lever against the pawl **44** thereby holding the upper plate in its
5 upright position.

The second link **37** includes a stop surface **38** that limits the rotation of the upper plate **32** relative to the lower member **34**. In a preferred embodiment, the stop surface **38** is in the form of a notch as shown most clearly in **Fig. 4**. The orientation of the seat back relative to the bottom frame in the folded position can be determined
10 by the configuration of link **37** and stop surface **38**. In a preferred embodiment of the invention, stop surface **38** is configured so that when the upper plate **32** is in the fold-flat position, the seat back will be parallel to the lower seat cushion or folded flat.

The parallelogram linkage determines the recline angle of the seat back. The lower extension of the lower member **34** includes an attachment point **39** for a recline
15 adjuster. The recline adjuster can take any of several forms. One such adjuster is described in U.S. Patent No. 5,441,129, which is owned by the assignee of the present invention and is hereby included by reference. However, the present invention could be adapted to work with any adjuster that operates by a rod or other member connected to the recliner mechanism. Operating the adjuster pivots the lower
20 member **34** about the point **22A**, which then changes the orientation of the parallelogram linkage. Upper plate **32** rotates with the upper end of lower member **34** about attachment point **22B** as the adjuster moves the lower extension **39**. Upper plate **32** moves or rotates forward or rearward opposite to the direction of movement of lower extension **39**. This forward and rearward rotation of upper plate **32**
25 determines the recline angle of the seat back. This is shown in **Figs. 3C** and **3D**

where the mechanism is depicted at a greater recline angle relative to that of Figs. 3A and 3B.

When the release lever 42 is raised, the pawl 44 is released so that it no longer inhibits movement of stop pin 33 so that the upper plate 32 can be rotated in the direction of arrow R to a fold-flat position as depicted in Figs. 3B and 3D. In the fold-flat position, the stop pin 33 engages stop surface 38 on second link 37 to stop the upper plate 32 in a position parallel or flat relative to the bottom frame. The second link 37 retains its relationship relative to connecting points 22A and 22B on the bottom frame 22 throughout the reclining range due to their relative positions in the parallelogram linkage. This feature maintains the parallel relationship between the seat back and the bottom cushion in the preferred embodiment when the seat is in a fold-flat position.

Another embodiment of the invention is shown in Figs. 5-8. In the mechanism 50, of Fig. 5A, with detail shown in Fig. 6, the lower member is a two-part assembly 51 made up of a left plate 52 and a right plate 53 that can be connected together using fasteners 76, 76' and 76''. Rivets, pivot bolts or any other equivalent fasteners could be used to connect plates 52 and 53. In this embodiment, the upper plate 55 is pivotably attached to the lower assembly 51 and positioned between the left plate 52 and right plate 53. This embodiment also includes the parallelogram linkage and can have multiple links outside the lower assembly 51 providing one linkage on each side interconnected to each other. The interconnection can be accomplished by sizing link pin 78 and pivot sleeves 65 and 66 so that they extend through the lower plates 52 and 53 interconnecting links 60 and 60', 58 and 58', and 59 and 59' through their respective bores. This is depicted in detail in Fig. 6.

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The upper plate 55, to which seat back frame 124 (Fig. 7A) is mounted at points 55A and 55B, is pivotably connected between lower plates 52 and 53 using a pivot sleeve 66 or equivalent fastener. Lower plates 52 and 53 are pivotably attached to the bottom frame 122 (Fig. 7A) using a second pivot sleeve 65 or equivalent fastener. Second parallelogram links 59 and 59' are pivotably connected at one end externally to the lower plates 52 and 53 at the upper plate connection using the upper plate pivot sleeve 66. First parallelogram links 58 and 58' are pivotably connected at one end to the other end of second links 59 and 59' respectively and at their other end to the bottom frame (see FIGS. 7A-8B) thus completing the parallelogram. Here again, the second links 59 and 59' remain in a parallel relationship to the bottom frame attachment points 122A and 122B (FIGS. 7A-8B) as the mechanism moves. This is demonstrated in Figs. 7A and 8A which show the mechanism of Fig. 5A interconnecting partial bottom and seat back frames. As an optional feature, additional reinforcing links 60 and 60' (Fig. 6) can be added. These links interconnect the main pivot of the lower plates 52 and 53 with first links 58 and 58' at their connections to the bottom frame.

Lower plates 52 and 53 also define arcuate slots 72 and 72' centered on the upper pivot sleeve bore where at upper plate 55 is attached. Link pin 78 extends through slots 72 and 72' to interconnect links 58 and 59 with links 58' and 59'. The length of slots 72 and 72' determine the range of rotation of the parallelogram linkage. Upper plate 55 also defines a relief slot 67 configured to receive the link pin to allow greater seat back recline angles to be used. The link pin 78 also operates as a fold-over stop when the seat back is folded. Upper plate 55 defines a notch 69 configured to engage the link pin 78 to stop the seat back when in the fold-flat position. In the preferred embodiment, the notch 69 is positioned so that the seat

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back will be parallel to the seat cushion when in the fold-flat position. This is depicted in Fig. 5B. The fastener 76 at the upper connection of plates 52 and 53 also acts as a stop to limit the travel of the seat back when the seat back is raised back to a seating position.

Figs. 7B and 8B show the seat structures of Figs. 7A and 8A respectively in the fold-flat position. The folding of the seat back is controlled by release lever 62. This lever is mounted between the lower plates 52 and 53 and pivots on fastener 76'. Release lever 62 has a reaction end 64 that engages a stop face 68 on upper plate 55 to hold the upper plate 55 and the seat back in an upright seating position. A return spring 63 is attached to lower plate 53 to bias the release lever in an engaged position. In a preferred embodiment, the spring 63 is a coil spring with an arm extending through spring slot 79 so that as the release lever 62 is raised, the end of the spring 63 is pushed downward loading the spring. The spring 63 returns the release lever 62 to its engaged position when the release lever 62 is released.

As previously discussed, the recline angle of the seat back is determined by a separate recline adjuster attached to the lower end of the lower assembly at attachment 73. Again, the recline adjuster can take any of several available forms. Preferably the adjuster described in U.S. Patent No. 5,441,129 would be the type that would be used. However, any suitable adjuster could be employed.

It should be noted that the folding and reclining operations are independent of each other. That is, when the seat back is folded, the recline angle is not disturbed so that when the seat back is returned to its upright position, it returns to the last set recline angle. Likewise, the recline angle of the seat back can be adjusted with the seatback in either the upright or folded positions. However, the recline angle is only observable when the seat back is upright.

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Depending on load carrying requirements, the components for the fold-flat recliner herein described could be made of metal, such as steel. Although not described, washers or bushings could be used at the pivot points in the mechanism to reduce friction between the components.

5 While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character. It should be understood that only the preferred embodiments have been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

- 13 -

1. A fold-flat seat recliner mechanism (30, 50) for use in a vehicle seat having a bottom frame (22, 122), a seat back (14), and a recline adjuster (26) for adjusting the recline angle of the seat back relative to the bottom frame, said mechanism characterized by a lower member (34, 52, 53) pivotably connected to the bottom frame (22, 122) and including a lower portion (39) connectable to the recline adjuster (26) so that said lower member pivots relative to the bottom frame in response to movement of the recline adjuster within a range of reclining positions; an upper member (32, 55) mountable to the seat back (14) and pivotably connected to said lower member (34, 52, 53) so that the seat back is in folding rotation relative to the bottom frame (22, 122); and a linkage (36, 37, 58, 59) connected between the bottom frame (22, 122) and said lower member (34, 52, 53) operatively connected to said upper member (32, 55) to limit pivoting of said upper member relative to said lower member as a function of recline angle.

2. The fold-flat seat recliner mechanism of claim 1 characterized in that said linkage includes a first link (36, 58) pivotably attached at one end to the bottom frame (22, 122); a second link (37, 59) pivotably connected to said lower member (34, 52, 53) at one end and pivotably connected at an opposite end to an opposite end of said first link (36, 58); said lower member (34, 52, 53), said first (36, 58) and second links (37, 59) and the bottom frame (22, 122) defining a parallelogram linkage and said parallelogram linkage being rotatable relative to the bottom frame (22, 122) in response to the recline adjuster (26) within said range of reclining positions.

3. The fold-flat seat recliner mechanism (30) of claim 2 characterized by a stop pin (33) attached to said upper member (32) at one end and wherein said

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- 14 -

second link (37) defines a stop area (38) configured to engage said stop pin to stop the upper member in a predetermined orientation relative to the bottom frame (22) when the seat back (14) is placed in a folded position from any recline angle within said range of reclining positions.

4. The fold-flat seat recliner mechanism (30) of claim 3 characterized in that said lower member (34) defines an arcuate slot (35) and said stop pin (33) has a free opposite end disposed within said slot so that said stop pin engages an end of said slot when the seat back (14) is in a seating position and wherein said slot and said second link (37) cooperate to limit rotation of said upper member (32) as a function of recline angle.

5. The fold-flat seat recliner mechanism (30) of claim 4 characterized by a latch operable from an engaged position inhibiting folding of the seat back (14) to a disengaged position permitting folding of the seat back, said latch including a pawl (44) pivotably attached to said lower member (34), said pawl having a reaction end and disposed so that said reaction end (48) engages said stop pin (33) when the seat back (14) is in said seating position; a release lever (42) pivotably attached to said lower member (34) and operable between a first position wherein said lever is engaged with said pawl (44) urging said pawl against said stop pin (33) thereby inhibiting rotation of the seat back (14), and a second position whereby said lever is disengaged from said pawl and said pawl freely pivots to enable rotation of the seat back to said folded position; and a spring (43) between said lever (42) and said lower member (34) to bias said lever against said pawl (44).

6. The fold-flat seat recliner mechanism (50) of claim 2 characterized in that said lower member includes a left plate (52) and a right plate (53) connectable

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- 15 -

to said left plate, said left and right plates defining upper and lower pivot sleeve bores; upper (66) and lower pivot sleeves (65) receivable in said corresponding upper and lower pivot sleeve bores; a plurality of fasteners (76) for connecting said left and right plates; and the bottom frame (122) defining a pivot bore (122A) for passage of said lower pivot sleeve (65) therethrough for attachment of said lower member to the bottom frame and a lower portion of said upper member (55) being disposed between said left (52) and right (53) plates and defines a pivot bore for passage of said upper pivot sleeve (66) therethrough for attachment of said upper member to said lower member.

7. The fold-flat seat recliner mechanism (50) of claim 6 characterized by a latch (62, 63) operable from an engaged position inhibiting folding of the seat back to a disengaged position permitting folding of the seat back (14).

8. The fold-flat seat recliner mechanism (50) of claim 7 characterized in that said lower portion of said upper member (55) defines a stop face (68); and said latch including a release lever (62) disposed between said left (52) and right (53) plates and pivotably attached to at least one of said left and right plates and operable between a first position wherein said lever is engaged with said stop face (68) thereby inhibiting rotation of the seat back (14), and a second position whereby said lever is disengaged from said stop face to enable rotation of the seat back to a folded position; and a spring (63) between said lever (62) and one of said left (52) and right (53) plates to bias said lever against said stop face (68).

9. The fold-flat seat recliner mechanism (50) of claim 6 characterized in that said lower member defines an arcuate slot (72) and said first (58) and second (59) links are connected by a link pin (78) extending through said slot

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AMENDED SHEET

- 16 -

whereby said slot determines the range of rotation of said parallelogram linkage, thereby determining said range of reclining positions for the seat back (14).

10. The fold-flat seat recliner mechanism (50) of claim 9 characterized in that an upper portion of said upper member (55) defines a relief notch (67) configured to receive said link pin (78) to enable rotation of said linkage throughout said range of reclining positions for the seat back (14) and said lower portion of said upper member (55) defines a stop notch (69) configured to engage said link pin (78) to stop said upper member in a predetermined orientation relative to the bottom frame (122) when the seat back (14) is placed in said folded position.

11. The fold-flat seat recliner mechanism (50) of claim 10 characterized by a reinforcing link (60) having a first end pivotably attached by said lower pivot sleeve (65) to at least one of said left (53) or right (52) plates, and having a second end pivotably attached to said first link (58) at said end pivotably attached to said first link (58) at said end pivotably attached to said bottom frame (122).

12. A seat (10) for a vehicle having a bottom frame (22, 122); a seat back (14); and a recline adjuster (26), said seat characterized by a lower member (34) pivotably connected to said bottom frame (22, 122) and including a lower portion connectable to said recline adjuster so that said lower member pivots relative to said bottom frame in response to movement of said recline adjuster within a range of reclining positions; an upper member (32, 55) mountable to said seat back (14) and pivotably connected to said lower member (34) so that said seat back is in folding rotation relative to said bottom frame (22, 122); and a linkage (36, 37, 58, 59) connected between said bottom frame (22, 122) and said lower member (34)

SUBSTITUTE SHEET

AMENDED SHEET

- 17 -

operatively connected to said upper member (32, 55) to limit pivoting of said upper member relative to said lower member as a function of recline angle.

13. The vehicle seat (10) of claim 12 characterized by a first link (36, 58) pivotably attached at one end to said bottom frame (22, 122); a second link (37, 59) pivotably connected to said lower member (34) at one end and pivotably connected at an opposite end to an opposite end of said first link (36, 58); said lower member (34), said first (36, 58) and second (37, 59) links and said bottom frame defining a parallelogram linkage, and said parallelogram linkage being rotatable relative to said bottom frame (22, 122) in response to said recline adjuster within said range of reclining positions.

14. The vehicle seat (10) of claim 13 characterized by a stop pin (33) attached to said upper member (32) at one end, said second link (37) defining a stop area (38) configured to engage said stop pin to stop said seat back (14) in a predetermined orientation relative to said bottom frame (22) when said seat back is placed in a folded position from any recline angle within said range of reclining positions.

15. The vehicle seat (10) of claim 14 characterized in that said lower member (34) defines an arcuate slot (35) and said stop pin (33) has a free opposite end disposed within said slot so that said stop pin engages an end of said slot when said seat back (14) is in a seating position, said slot and said second link (37) cooperating to limit rotation of said seat back as a function of recline angle.

16. The vehicle seat (10) of claim 15 characterized by a latch (42, 43) operable from an engaged position inhibiting folding of said seat back (14) to a disengaged position permitting folding of said seat back, said latch including a pawl

SUBSTITUTE SHEET

AMENDED SHEET

- 18 -

(44) pivotably attached to said lower member (34), said pawl having a reaction end (48) and disposed so that said reaction end engages said stop pin (33) when said seat back (14) is in said seating position; a release lever (42) pivotably attached to said lower member (34) and operable between a first position wherein said lever is engaged with said pawl urging said pawl (44) against said stop pin (33) thereby inhibiting rotation of said seat back (14), and a second position whereby said lever is disengaged from said pawl to enable rotation of said seat back to said folded position; and a spring (43) between said lever (42) and said lower member (34) to bias said lever against said pawl (44).

17. The vehicle seat (10) of claim 13 characterized in that said lower member includes a left plate (52) and a right (53) plate connectable to said left plate, said left and right plates defining upper and lower pivot sleeve bores; upper (66) and lower (65) pivot sleeves receivable in said corresponding upper and lower pivot sleeve bores; a plurality of fasteners (76) for connecting said left (52) and right (53) plates; said bottom frame (122) defining a pivot bore (122A) for passage of said lower pivot sleeve (65) therethrough for attachment of said lower member to said bottom frame, a lower portion of said upper member (55) being disposed between said left (52) and right (53) plates and defining a pivot bore for passage of said upper pivot sleeve (66) therethrough for attachment of said upper member to said lower member.

18. The vehicle seat (10) of claim 17 characterized by a latch (62, 63) operable from an engaged position to inhibit folding of said seat back (14) and operable to a disengaged position to permit folding of said seat back.

SUBSTITUTE SHEET

AMENDED SHEET

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US0144895

- 19 -

19. The vehicle seat (10) of claim 18 characterized in that said lower portion of said upper member (55) defines a stop face (68); and said latch including a release lever (62) disposed between said left (52) and right (53) plates and pivotably attached to at least one of said left and right plates and operable between a first position wherein said lever is engaged with said stop face (68) thereby inhibiting rotation of said seat back (14), and a second position whereby said lever is disengaged from said stop face to enable rotation of said seat back to said folded position; and a spring (63) between said lever (62) and one of said left (52) and right (53) plates to bias said lever against said stop face (68).

20. The vehicle seat (10) of claim 17 characterized in that said lower member defines an arcuate slot (72) and said first (58) and second (59) links are connected by a link pin (78) extending through said slot whereby said slot determines the range of rotation of said parallelogram linkage, thereby determining said range of reclining positions for said seat back (14).

21. The vehicle seat (10) of claim 20 characterized in that an upper portion of said upper member (55) defines a relief notch (67) configured to receive said link pin (78) to enable rotation of said linkage throughout said range of reclining positions for said seat back (14), and said lower portion of said upper member (55) defines a stop notch (69) configured to engage said link pin (78) to stop said upper member in a predetermined orientation relative to said bottom frame (122) when said seat back (14) is placed in said folded position.

22. The vehicle seat (10) of claim 21 characterized by a reinforcing link (60) having a first end pivotably attached by said lower pivot sleeve (65) to at least

SUBSTITUTE SHEET

AMENDED SHEET

- 20 -

one of said left (53) or right (52) plates, and having a second end pivotably attached to said first link (58) at said end pivotably attached to said bottom frame (122).

23. The fold-flat seat recliner mechanism (50) of claim 10 characterized in that said stop notch (69), said link pin (78) and one of said fasteners (76) cooperate to limit rotation of said upper member as a function of recline angle.

24. A fold-flat seat recliner mechanism (30) for use in a vehicle seat (10) having a bottom frame (22), a seat back (14), and a recline adjuster (26) for adjusting the recline angle of the seat back relative to the bottom frame, said mechanism characterized by a lower member (34) pivotably connected to the bottom frame (22) and including a lower portion connectable to the recline adjuster so that said lower member pivots relative to the bottom frame in response to movement of the recline adjuster within a range of reclining positions; an upper member (32) mountable to the seat back (14) and pivotably attached to said lower member (34) so that the seat back is in folding rotation relative to the bottom frame (22); and a latch mechanism (42, 43, 62, 63) operable between a latched position locking said upper member (32) to said lower member (34) to inhibit pivoting thereabout and an unlatched position allowing rotation of said upper member relative to said lower member; and a linking member (37) coupled to the bottom frame, said linking member having a stop surface (38) engageable by said upper member such that said linking member provides a single limit of rotation of said upper member relative to said bottom frame within said range of reclining positions.

25. The fold-flat seat recliner mechanism (30) of claim 24 characterized in that said latch mechanism includes a stop pin (33) attached to said upper member (32) at one end; a pawl (44) pivotably attached to said lower member (34), said pawl

SUBSTITUTE SHEET

AMENDED SHEET

- 21 -

having a reaction end (48) and disposed so that said reaction end engages said stop pin (33) when the seat back (14) is in a seating position; a release lever (42) pivotably attached to said lower member (34) and operable between a first position wherein said lever is engaged with said pawl (44) urging said pawl against said stop pin (33) thereby inhibiting rotation of the seat back (14) relative to said lower member, and a second position whereby said lever is disengaged from said pawl and said pawl freely pivots to enable rotation of the seat back relative to said lower member to a folded position without disturbing the recline angle of the seat back; and a spring (43) between said lever (42) and said lower member (34) to bias said lever against said pawl (44).

26. The fold-flat seat recliner mechanism (30) of claim 25 characterized in that said recliner mechanism further includes a linkage (36, 37, 58, 59) connected between the bottom frame and said lower member, said linkage including said linking member; and said lower member (34) defines an arcuate slot (35) and said stop pin (33) has a free opposite end disposed within said slot so that said stop pin engages an end of said slot when the seat back (14) is in a seating position and wherein said slot and said linkage (36, 37, 58, 59) cooperate to limit rotation of said upper member (32) as a function of recline angle such that a single limit of rotation of said upper member relative to said frame bottom is provided.

27. A fold-flat seat recliner mechanism (30, 50) for use in a vehicle seat (10) having a bottom frame (22, 122); a seat back (14), said mechanism characterized by a recline mechanism including a lower member (34, 52, 53) connected to said bottom frame (22, 122) and including a lower portion connectable to a recline adjuster (20) so that said lower member pivots relative to said bottom

SUBSTITUTE SHEET

AMENDED SHEET

- 22 -

frame in response to movement of said recline adjuster within a range of reclining positions, a first link (36, 58) pivotably attached at one end to said bottom frame (22, 122), a second link (37, 59) pivotably connected to said lower member (34, 52, 53) at one end and pivotably connected at an opposite end to an opposite end of said first link, said lower member, said first and second links and said bottom frame defining a parallelogram linkage, and said parallelogram linkage being rotatable relative to said bottom frame in response to said recline adjuster within said range of reclining positions; and a folding mechanism (36, 37, 58, 59) attached to the recline mechanism operable to fold said seat back relative to said bottom frame independent of said recline mechanism.

28. The fold-flat seat recliner mechanism (30) of claim 27 characterized in that said folding mechanism includes an upper member (32) mountable to said seat back (14) and pivotably attached to said lower member (34) so that said seat back is in folding rotation relative to said bottom frame (22); a stop pin (33) attached to said upper member (32) at one end and wherein said second link (37) defines a stop area (38) configured to engage said stop pin to stop said upper member in a predetermined orientation relative to said bottom frame (22) when said seat back (14) is placed in a folded position from any recline angle within said range of reclining positions; and a latch mechanism (42, 43) operable between a latched position locking said upper member (32) to said lower member (34) to inhibit rotation thereabout and an unlatched position allowing rotation of said upper member (32) relative to said lower member (34).

29. The fold-flat seat recliner mechanism (30) of claim 28 characterized in that said latch mechanism includes a pawl (44) pivotably attached to said lower

SUBSTITUTE SHEET

AMENDED SHEET

- 23 -

member (34), said pawl having a reaction end (48) and disposed so that said reaction end engages said stop pin (33) when said seat back (14) is in a seating position; a release lever (42) pivotably attached to said lower member (34) and operable between a first position wherein said lever is engaged with said pawl (44) urging said pawl against said stop pin (33) thereby inhibiting rotation of said seat back (14) relative to said lower member (34), and a second position whereby said lever is disengaged from said pawl and said pawl freely pivots to enable rotation of said seat back relative to said lower member to a folded position without disturbing the recline angle of said seat back; and a spring (43) between said lever (42) and said lower member (34) to bias said lever against said pawl (44).

30. The fold-flat seat recliner mechanism (30) of claim 28 characterized in that said lower member (34) defines an arcuate slot (35) and said stop pin (33) has a free opposite end disposed within said slot so that said stop pin engages an end of said slot when said seat back (14) is in a seating position.

31. A fold-flat seat recliner mechanism (30, 50) for use in a vehicle seat (10) said mechanism characterized by a bottom frame (22, 122) including a bottom cushion (12); a lower member (34, 52, 53) connected to the bottom frame (22, 122); a recline adjuster connected to said lower member so that said lower member pivots relative to said bottom frame (22, 122) in response to movement of said recline adjuster within a range of reclining positions; a seat back (14) having a back cushion and pivotably connected to said lower member at a pivot point positioned so that said seat back can be folded with said back cushion in a substantially horizontal position relative to said bottom cushion (12); a first link (36, 58) pivotably attached at one end to said bottom frame; a second link (37, 59) pivotably connected to said

SUBSTITUTE SHEET

AMENDED SHEET

- 24 -

lower member at one end and pivotably connected at an opposite end to an opposite end of said first link; said lower member, said first and second links and said bottom frame defining a parallelogram linkage; and said parallelogram linkage being rotatable relative to said bottom frame within a range of reclining positions.

32. The fold-flat seat recliner mechanism of claim 31 characterized in that said seat back (14) includes an upper member (32, 55) mountable to said seat back and pivotably attached to said lower member (34, 52, 53) at a pivot point positioned so that said seat back can be folded to a substantially horizontal position.

33. The fold-flat seat recliner mechanism (30) of claim 32 characterized by a stop pin (33) attached to said upper member (32) at one end and said second link (37) defining a stop area (38) configured to engage said stop pin to stop said seat back (14) in a substantially horizontal position when said seat back is placed in a folded position from any recline angle within said range of reclining positions; and a latch mechanism (42, 43) operable between a latched position locking said upper member (32) to said lower member (34) to inhibit rotation thereabout and an unlatched position enabling rotation of said upper member relative to said lower member.

34. A fold-flat seat recliner mechanism (30, 50) for use in a vehicle seat (10) having a bottom frame (22, 122); a seat back (14), said mechanism characterized by a recline mechanism (26) for adjusting the recline angle of said seat back relative to said bottom frame; a lower member pivotably connected to said bottom frame and said recline mechanism; an upper member (32, 55) mountable to said seat back (14) and pivotable connected to said lower member so that said seat back is in folding rotation relative to said bottom frame; a first link (36, 58)

SUBSTITUTE SHEET

AMENDED SHEET

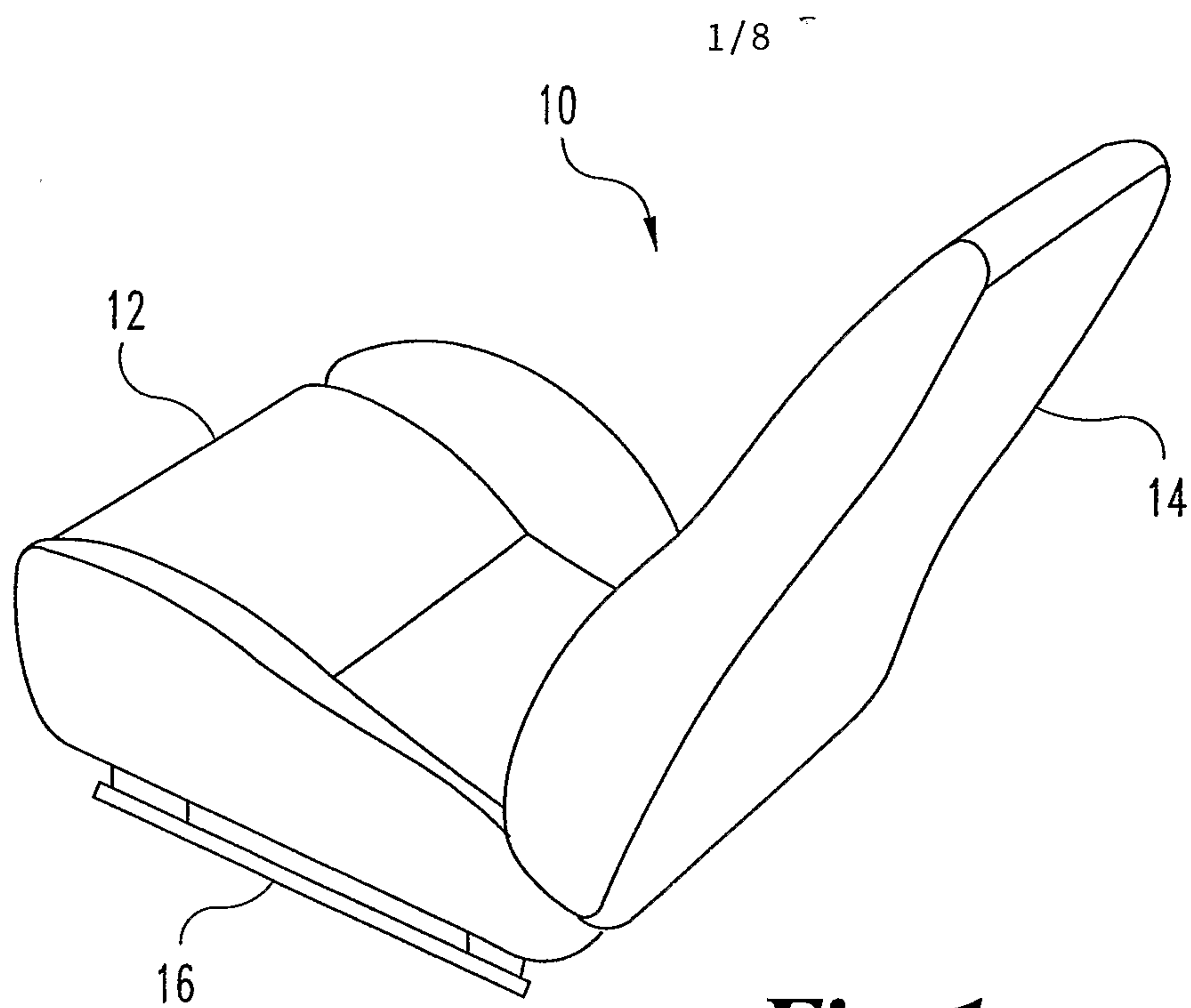
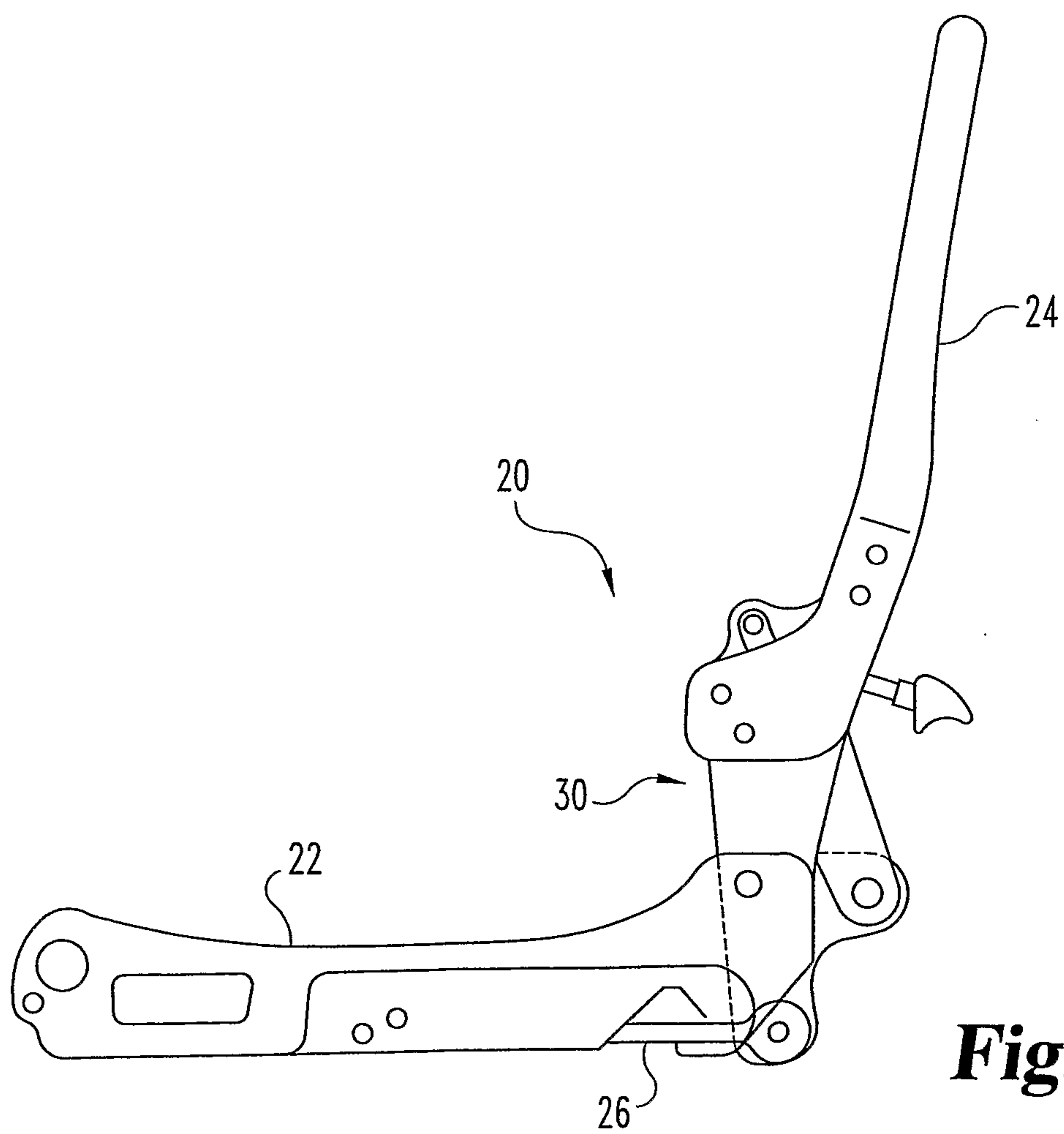
- 25 -

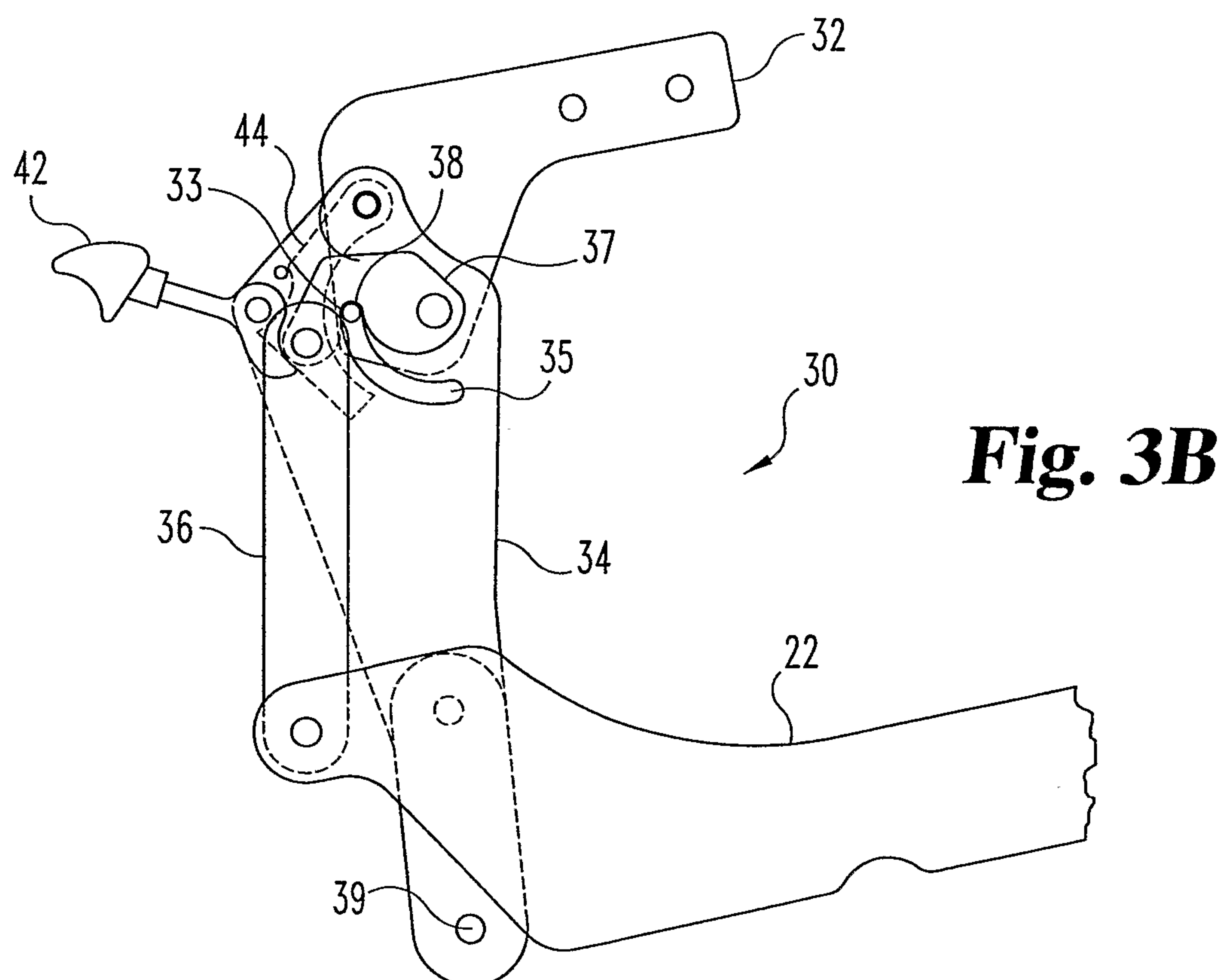
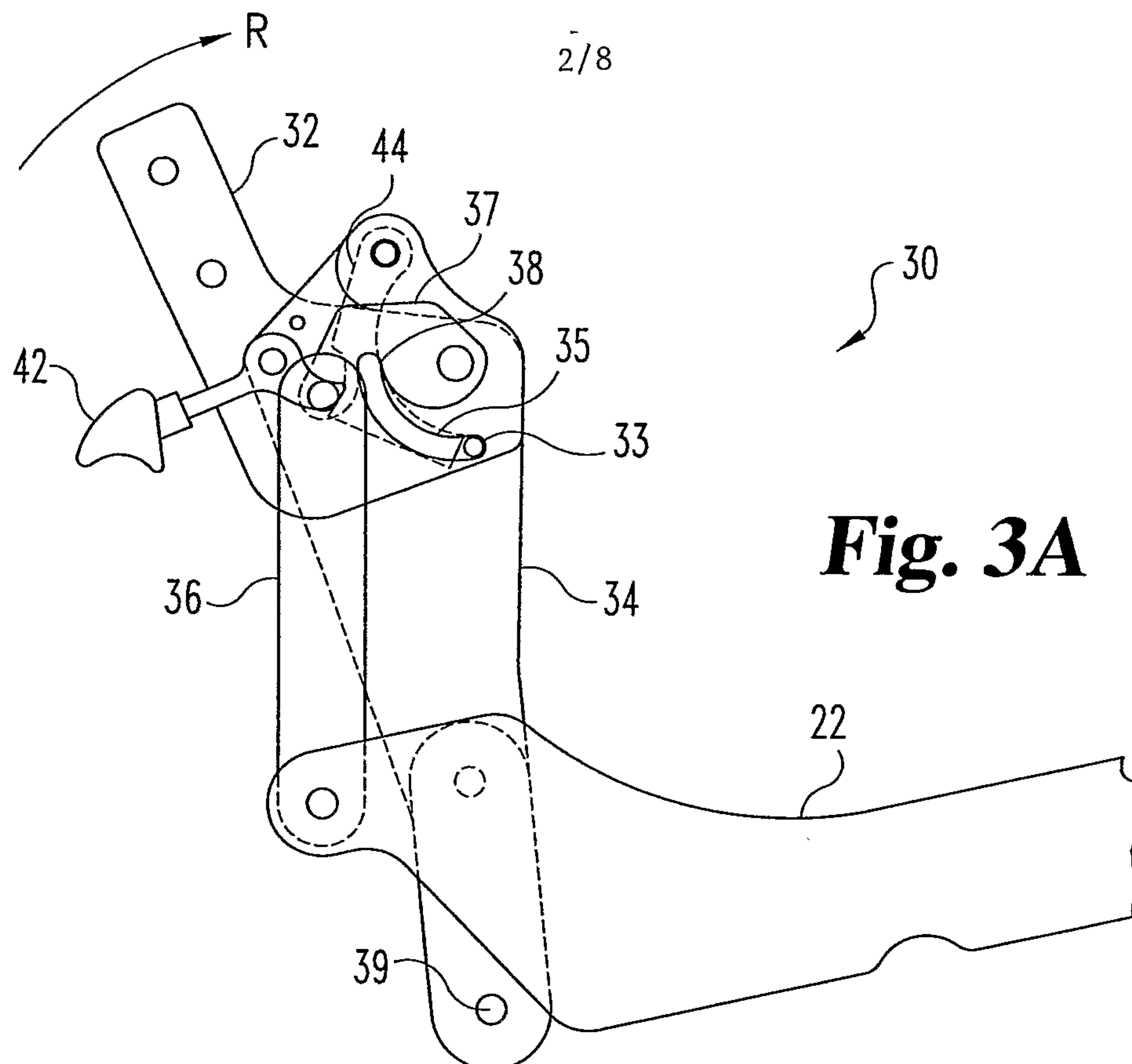
pivotably attached at one end to the bottom frame; and a second link (37, 59) pivotably connected to said lower member at one end and pivotably connected at an opposite end to an opposite end of said first link.

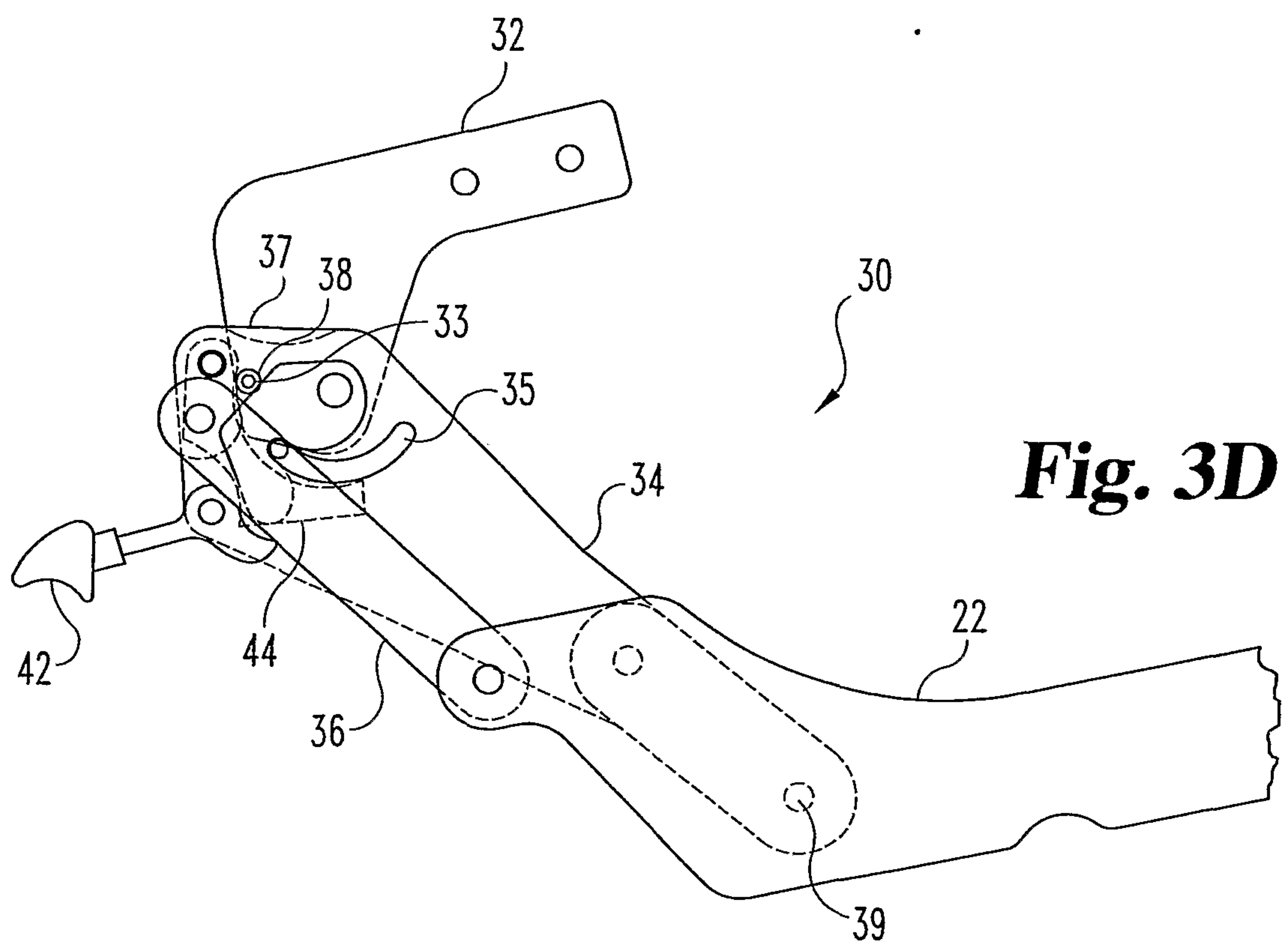
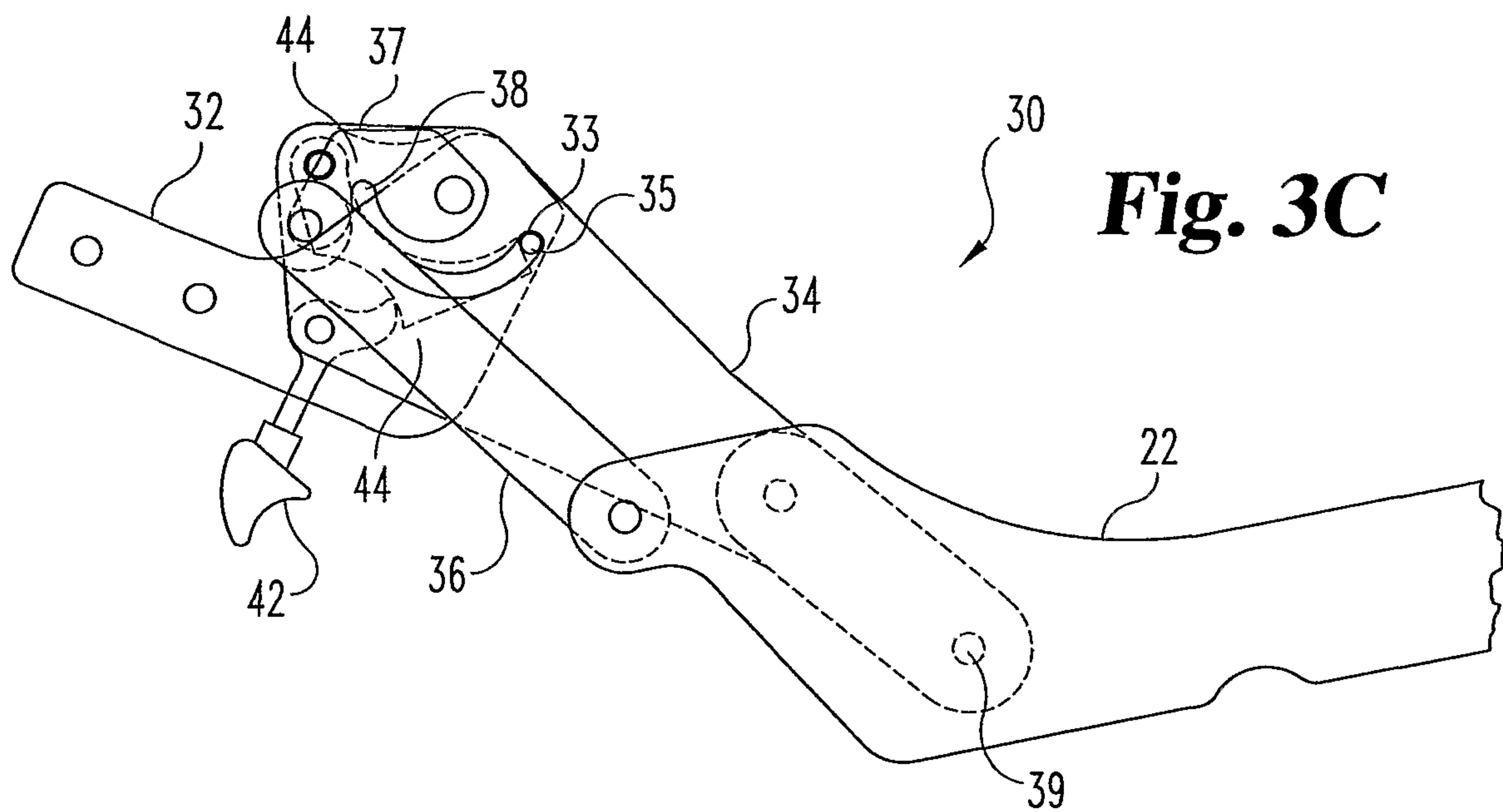
35. The fold-flat seat recliner mechanism of claim 34, characterized in that said bottom frame, said lower member, said first link (36, 58), and said second link (37, 59) cooperate to form a parallelogram linkage; said lower member and said first link define rocker links; said bottom frame defines a coupler link; said second link defines a frame link; and said second link translates parallel to said seat frame as said recline mechanism reclines said seat back (14).

SUBSTITUTE SHEET

AMENDED SHEET

**Fig. 1****Fig. 2**





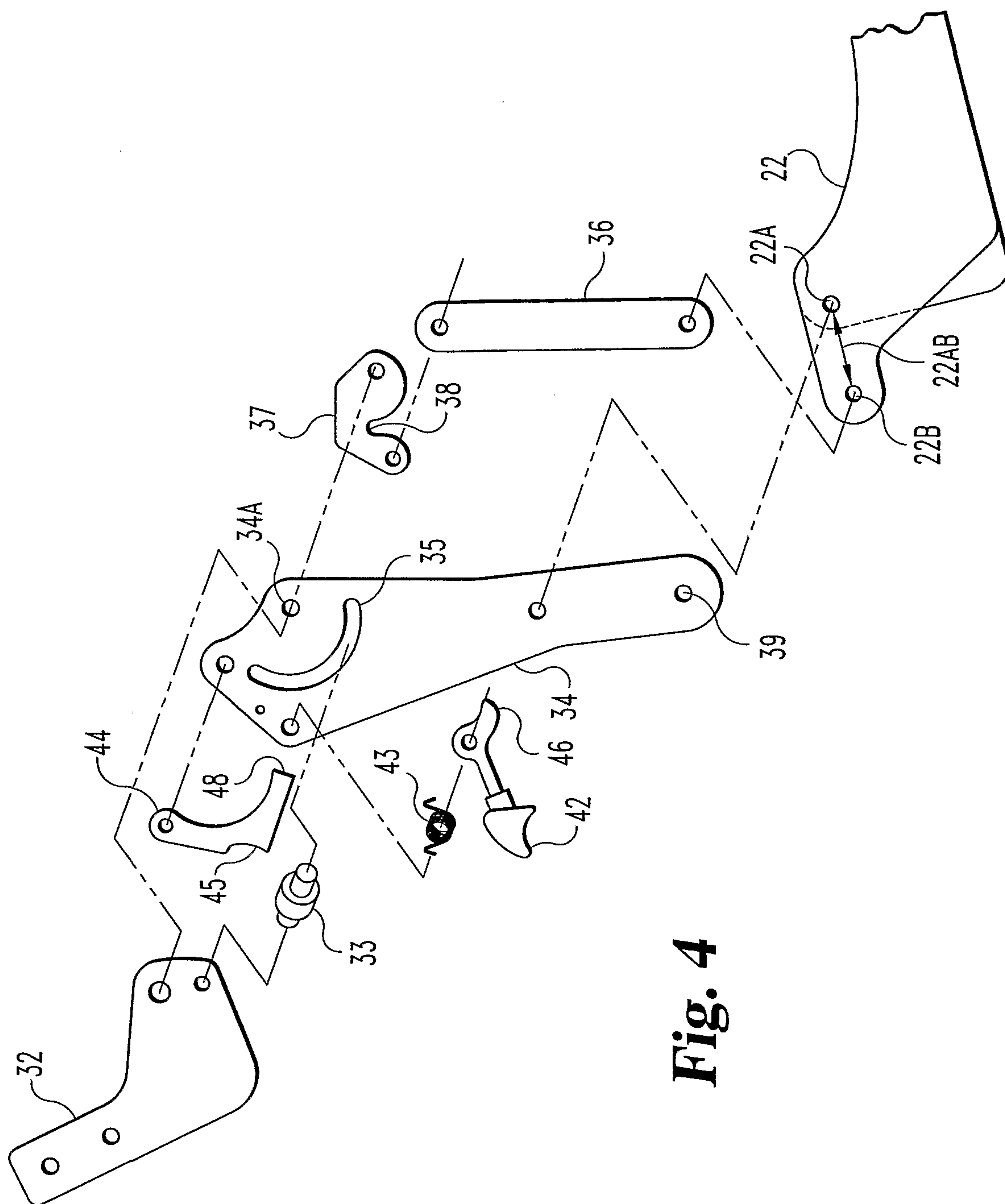


Fig. 4

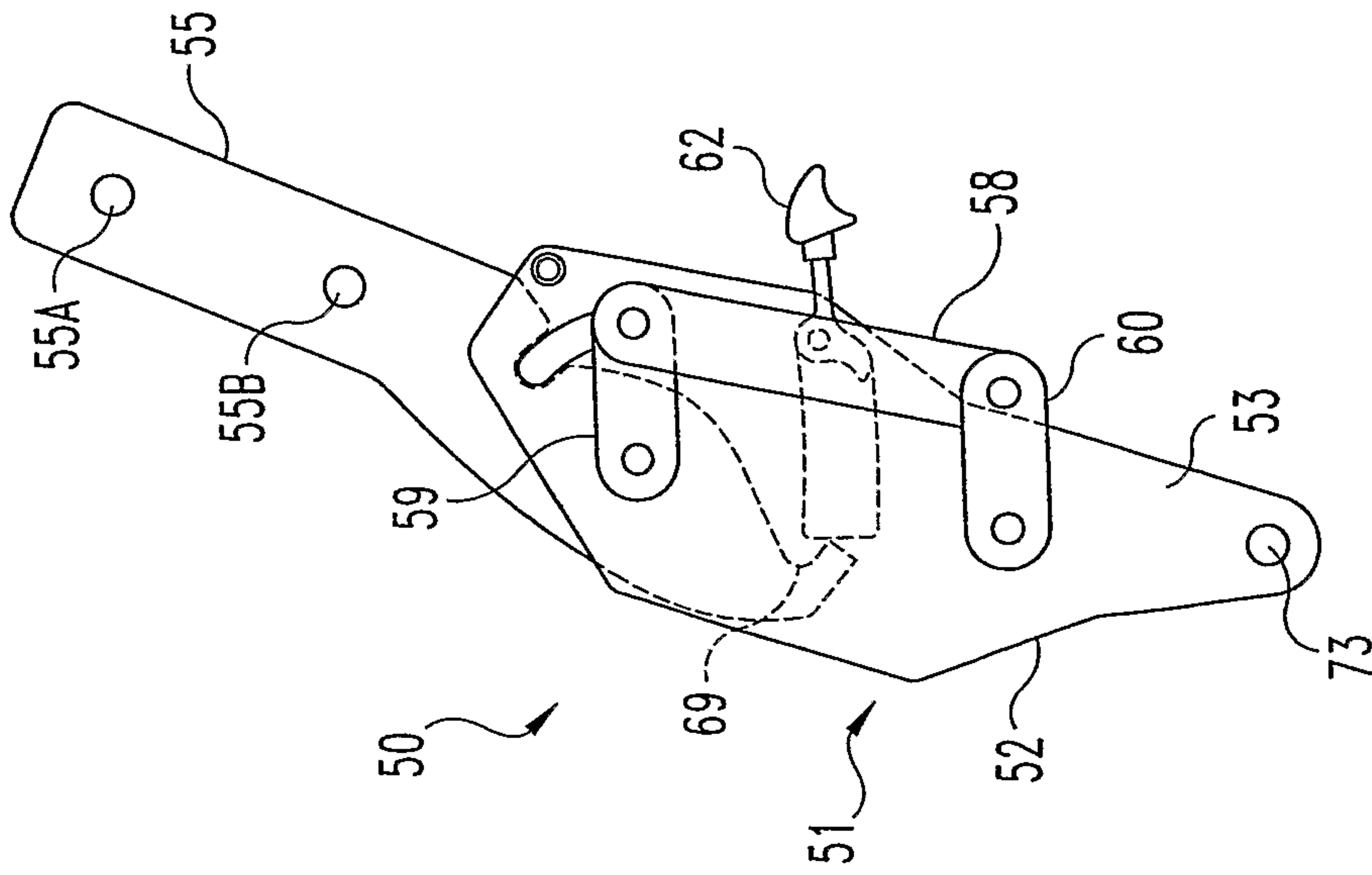


Fig. 5A

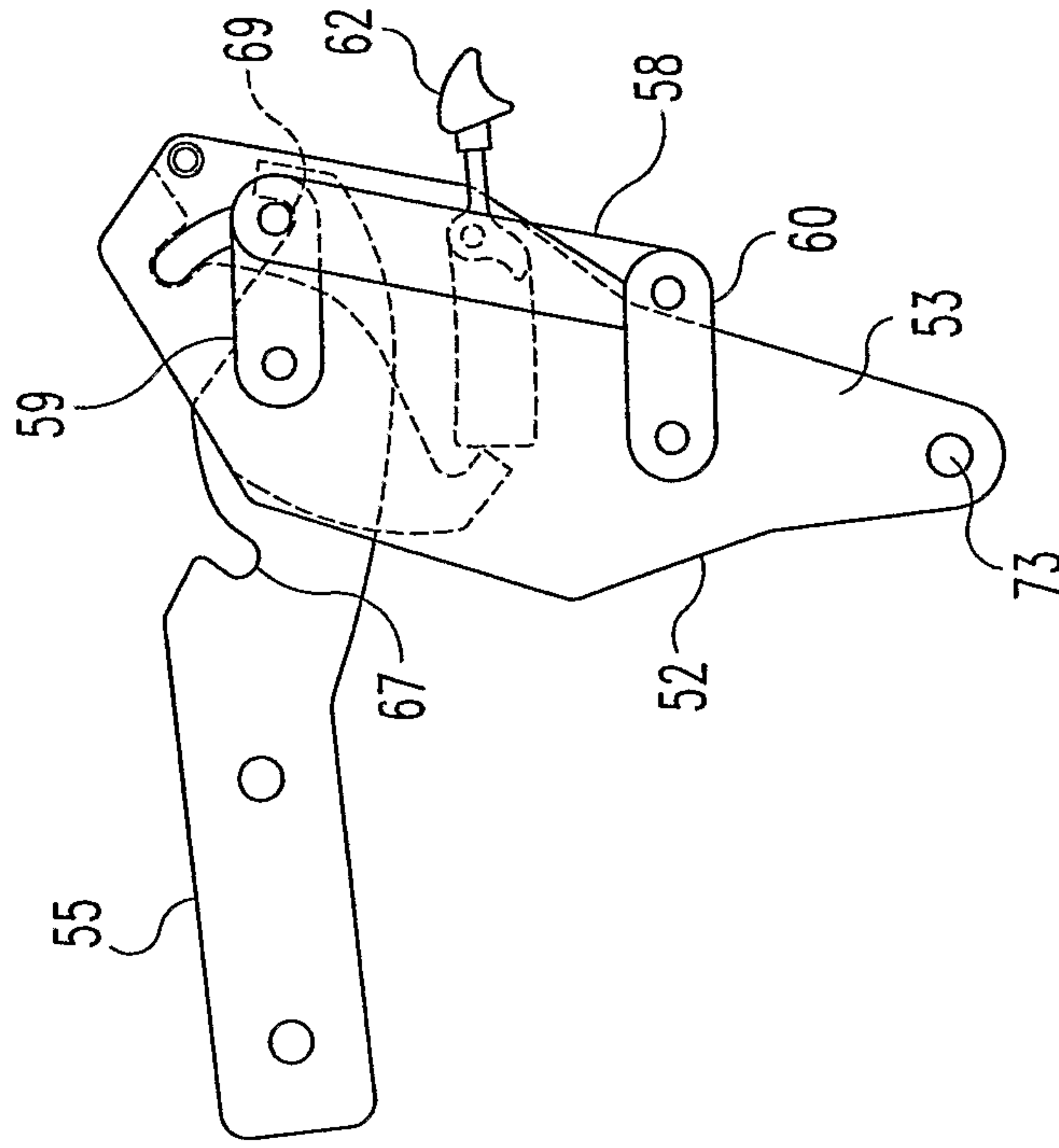


Fig. 5B

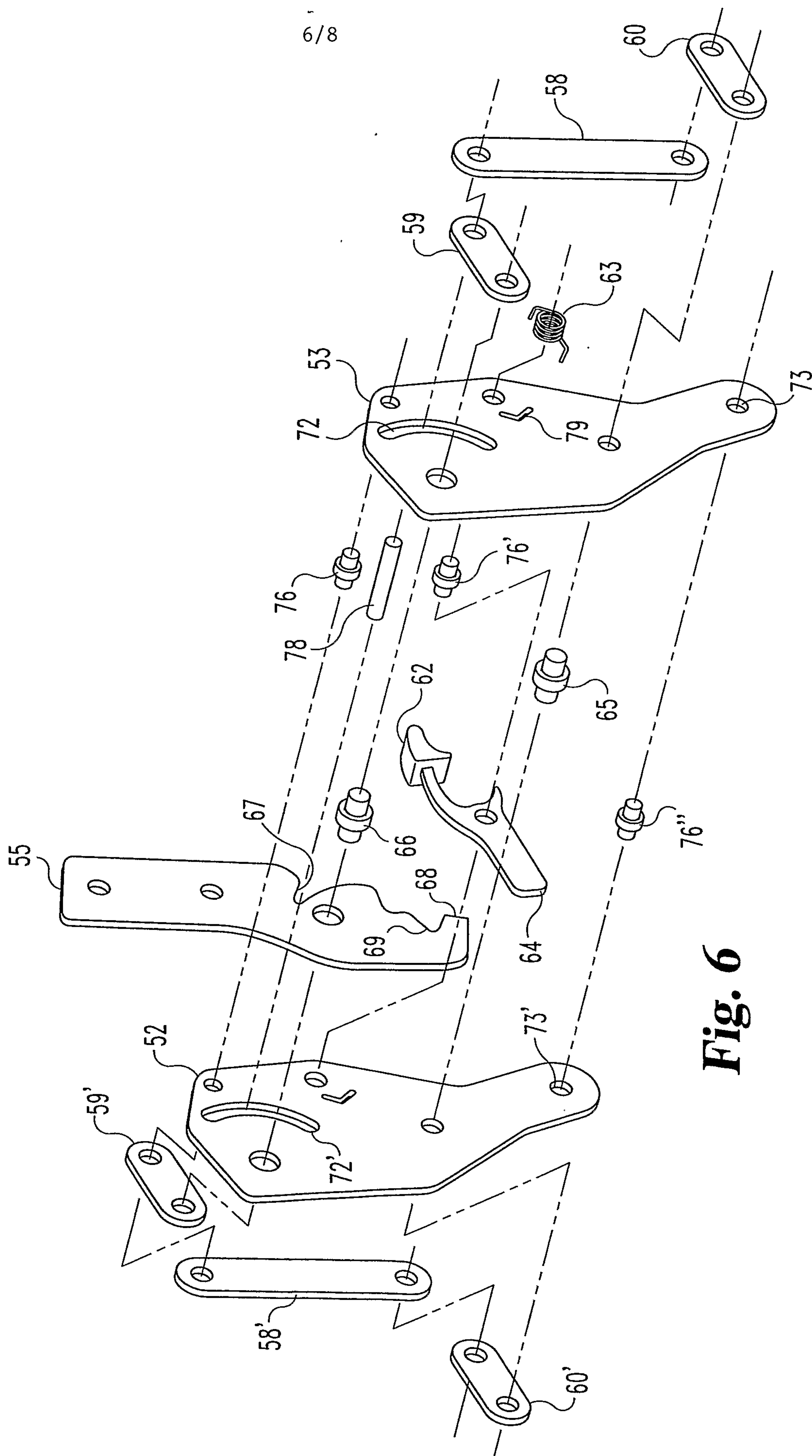
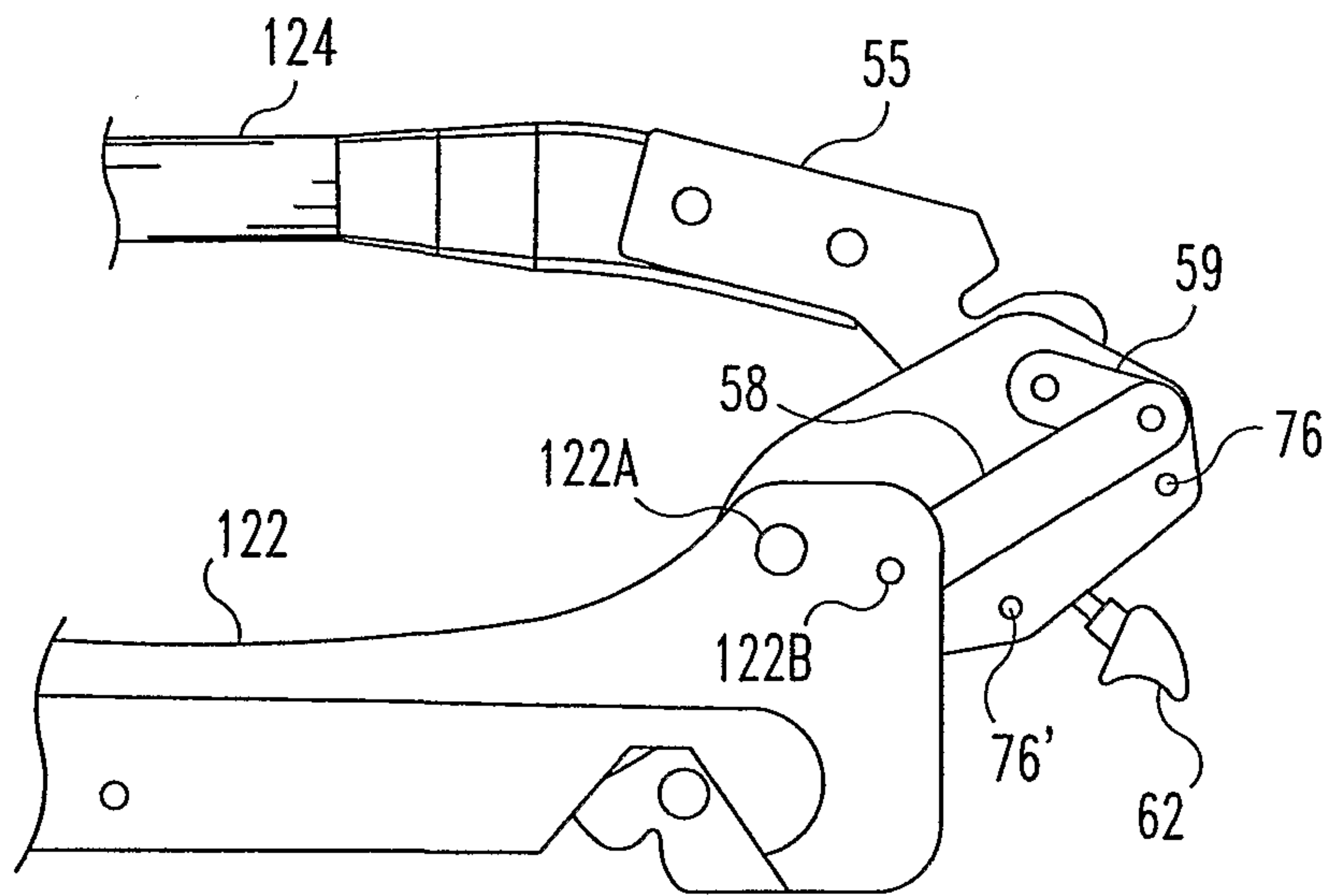
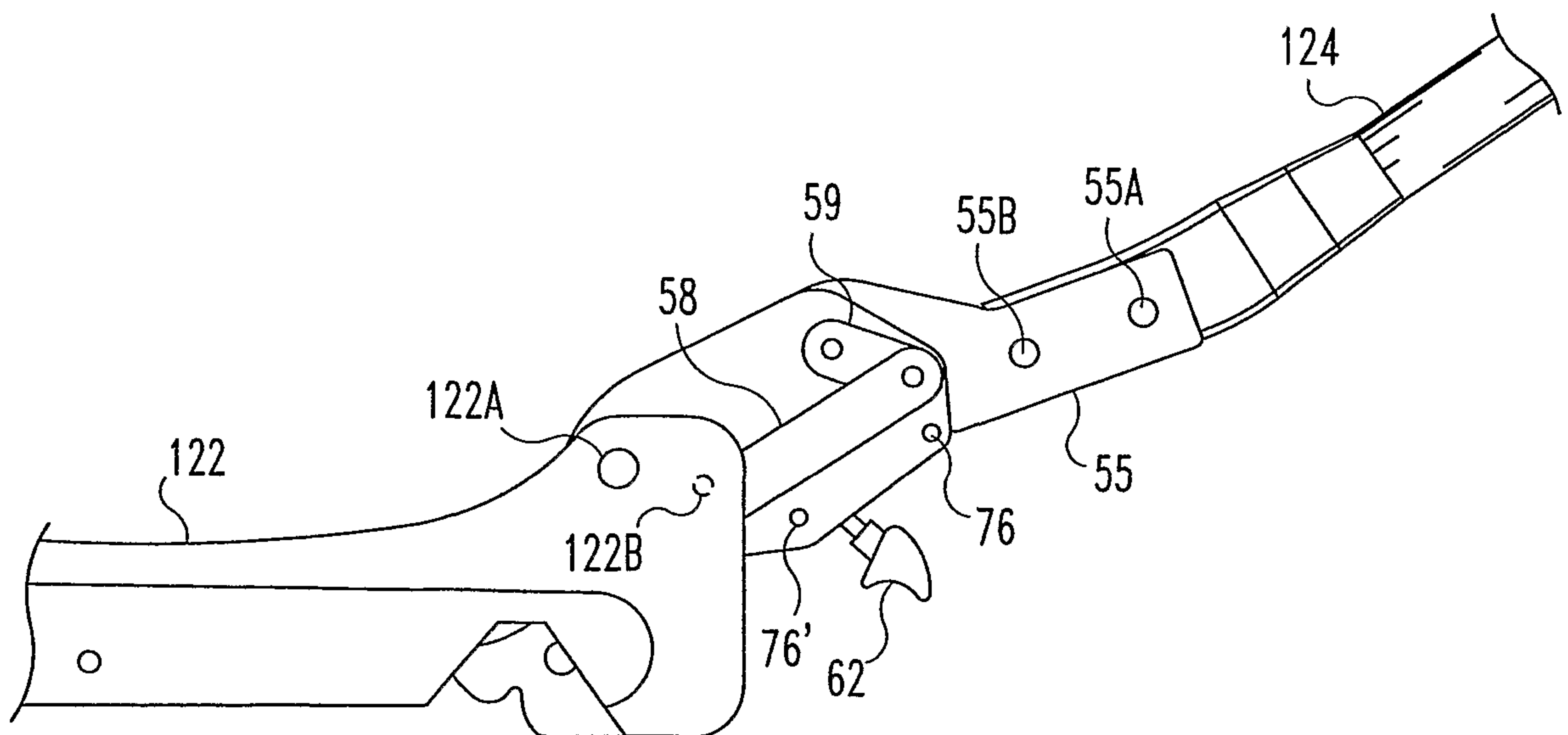
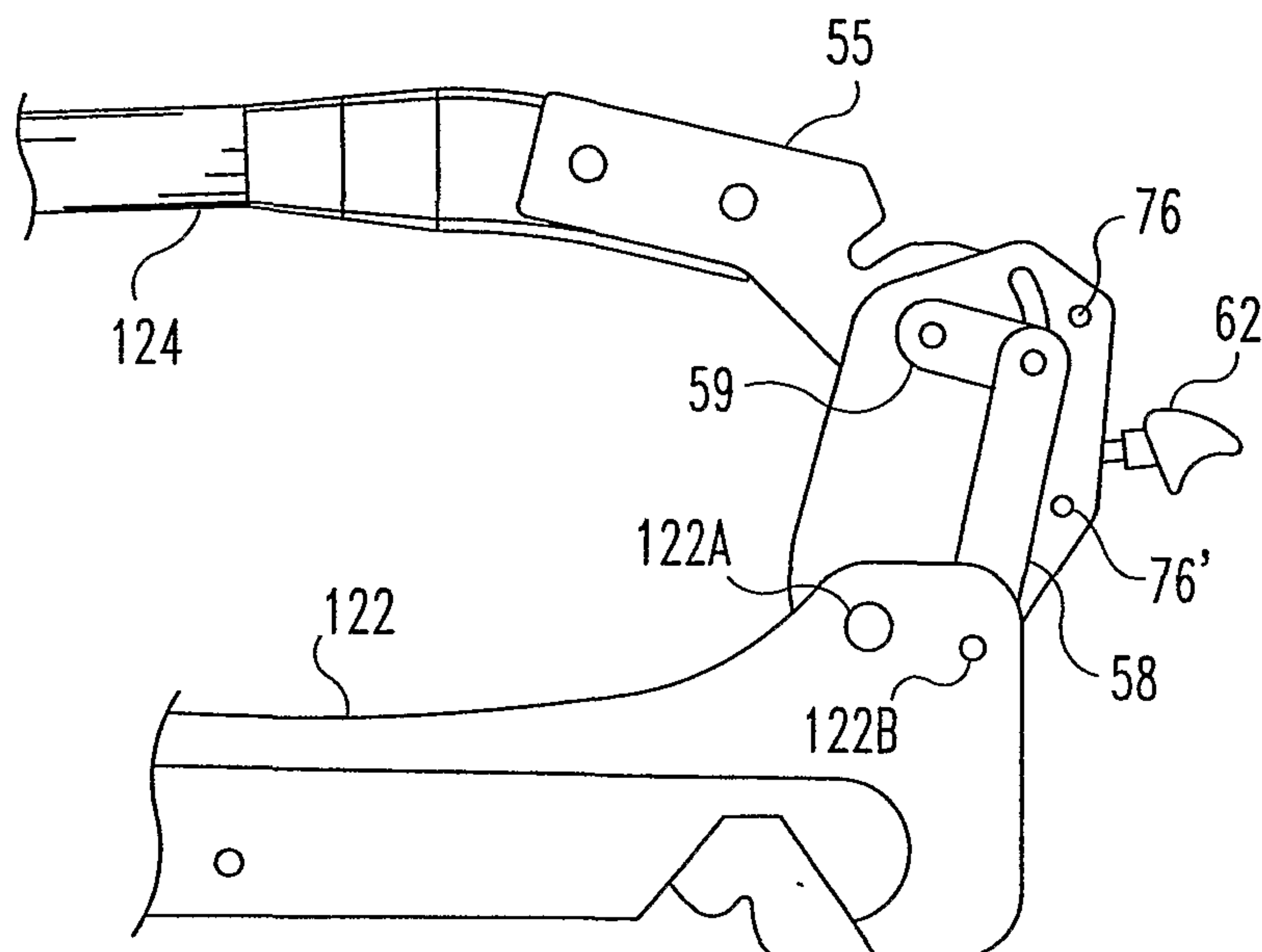
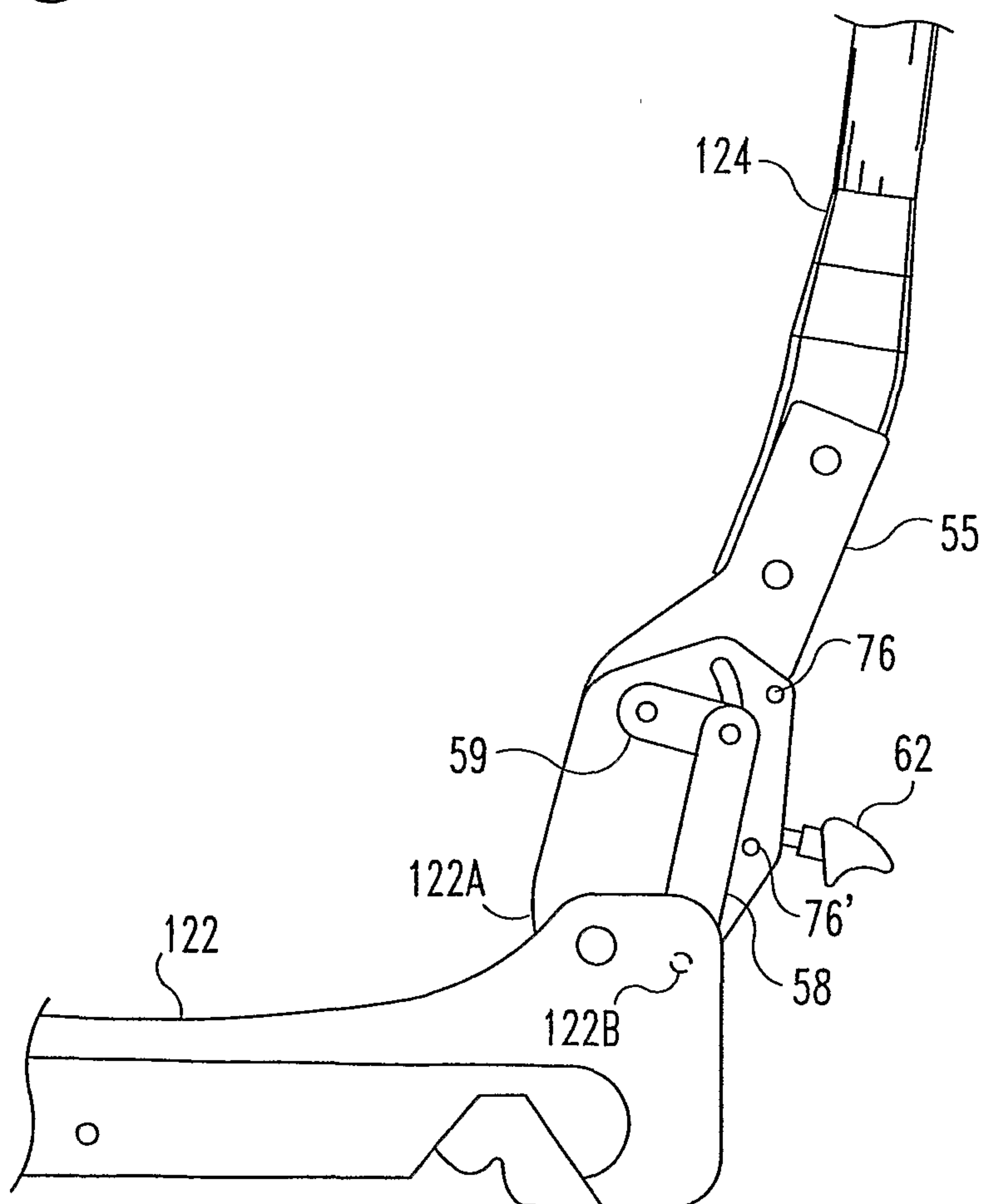


Fig. 6

**Fig. 7B****Fig. 7A**

8/8

**Fig. 8B****Fig. 8A**

