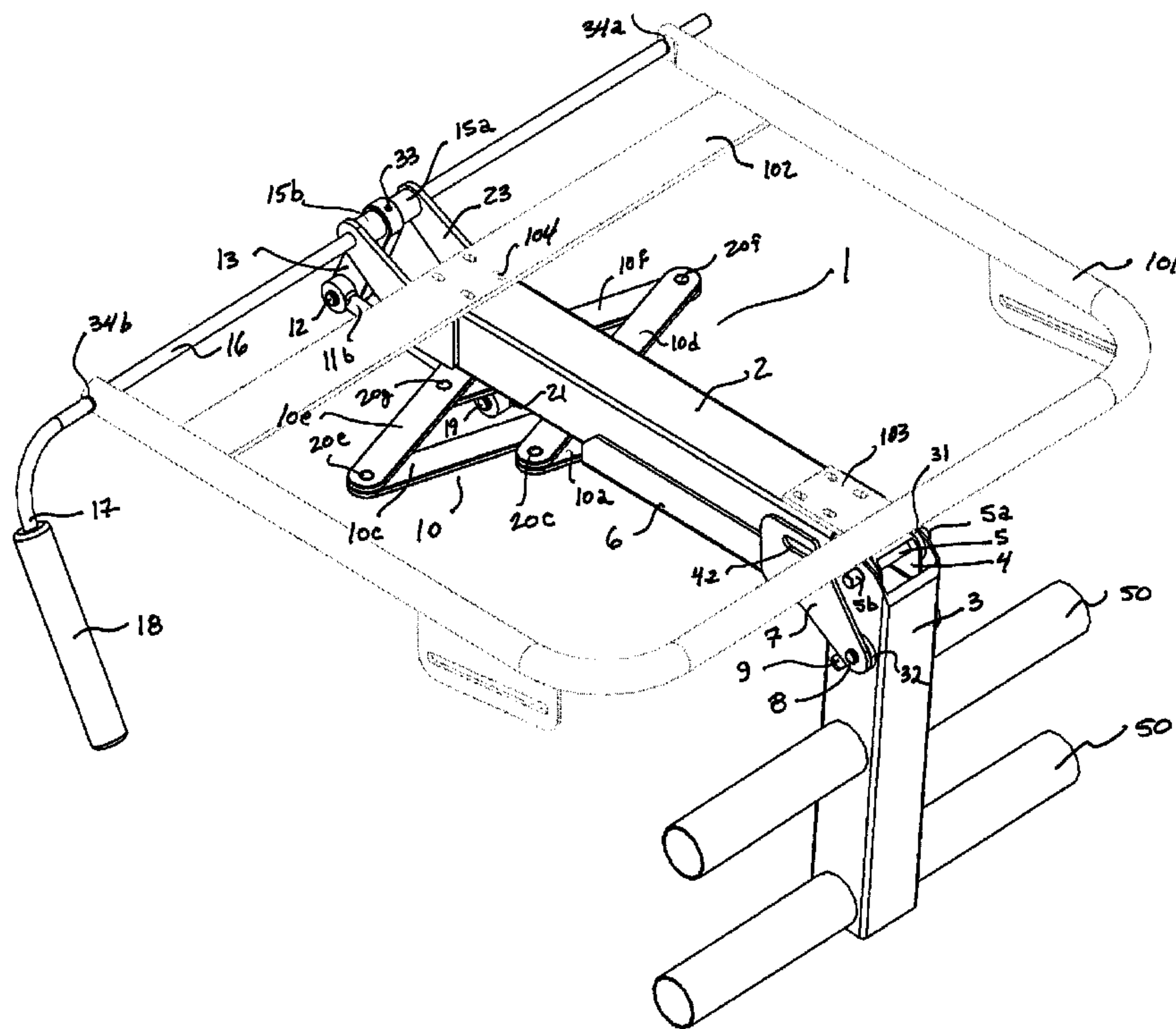




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(54) Titre : REPOSE-PIEDS ARTICULE A PROFIL BAS ET FAUTEUIL SUR GLISSIERES AINSI EQUIPE
(54) Title: LOW PROFILE ARTICULATED FOOTRESTS UNIT AND GLIDER ARMCHAIR USING SAME



LOW PROFILE ARTICULATED FOOTREST UNIT AND GLIDER ARMCHAIR
USING SAME

BACKGROUND OF THE INVENTION

1. Field of the invention:

The present invention relates to an articulated retractable footrest mechanism of the type usually incorporated to seating units such as armchairs. More particularly, the invention contemplates a compact low profile mechanism footrest unit suitable for installation on a broad range of seating units, and especially on glider and swivel chairs where limited clearance is available for installing such a device. The invention also relates to a glider armchair using the compact low profile footrest unit.

2. Brief description of the prior art:

Several systems have been developed for many years to provide seating units, and most often reclining armchairs, with a retractable footrest mechanism to improve the comfort of the occupant. The footrest extending/retracting mechanism is more generally coupled to the backrest reclining system of a recliner armchair. As a consequence, the occupant is not allowed to benefit from the optimal comfort of the footrest since the footrest mechanism is only fully extended at the fully reclined position of the backrest.

Furthermore, in most prior footrest designs, the footrest extension mechanism does not project the footrest plate far forwards from the seat, as a linear actuator could do for instance. Therefor, a large footrest plate must be used which, in its retracted position,

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projects downwards, generally orthogonally from the
armchair seat, thus closing most of the space between the
seat level and the floor at the front of the armchair. It
thus prevents the use of said space for storage and hinders
free movement of an occupant's feet. These footrest
mechanisms also generally use a high profile vertical
pantograph mechanism to provide the retraction/extension
movement of the footrest. Such mechanisms require a large
cavity of free space extending deeply beneath a seat frame
and behind the front end thereof, and would thus not be
suited for use on a seating unit with restricted
unobstructed space availability under the seat. This is the
case, namely, for many types of glider armchairs in which
cross-members at the base thereof leave a vertical
clearance of only a few inches below the seat frame.

A few technologies of the prior art have been
teaching solutions to overcome one or more of the above
shortcomings and limitations of the prior art footrest
mechanisms. For instance, US patent 4,696,512, issued to
Burnett et al. in Sept. 1987, discloses a low profile motor
driven screw/drive tube mechanism actuating the backrest
and footrest of a recliner chair. Although a relatively low
profile of the actuating system is provided by the screw
mechanism and enables some space saving, such a mechanism
needs an electrically powered motor which is expensive and
not practical for most chair applications. Furthermore, the
drive system projects far behind the back of the seat frame
and actuation of the footrest extension is coupled to the
backrest reclining actuation mechanism.

In Japanese application JP11253270A, (Wada
Masaki Azuma Akhiro - Sept. 1998), a substantially
horizontal moving-forward/backward footrest mechanism is
disclosed. The system features a relatively low profile and
the extension sliding means allows a small footrest panel

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to project forwards from the seat to provide adequate support for the occupant's legs. Therefor, only a small vertical clearance under the seat frame is required to house the system and enable the footrest panel to retract in its vertical position. Storage space could also be provided under the seat. However, that system also relies on a screw/tube drive mechanism, needing to be either motor or crank powered, which constitutes a major drawback for many potential applications, namely in usual glider chairs.

An example of a footrest system adapted to a glider chair is provided in US patent 6,059,367 granted to Rodgers in May, 2000. However, the mechanism connecting the footrest plate to the chair uses a vertical pantograph linkage and requires a cavity of at least eight inches high under the seat assembly in its fully retracted position. It is also worth mentioning that the disclosed glider seating unit does not provide full control of the gliding motion stability during extension of the footrest, such that the occupant may experience uncomfortable feelings and safety may be compromised.

A footrest mechanism comprising a portion linearly projected forwards from an armchair seat through a horizontal pantograph-type linkage is disclosed in US patent 5,782,535, issued to Lafer in July, 1998. Nevertheless, the linearly displaceable flat frame portion is mounted on a main portion of the footrest mechanism articulated with the front end of the support frame of the seat and angularly displaceable from a non-operative position, inferiorly adjacent to said support frame, to an operative position projecting forwards from the seat. The extension and retraction of the footrest is advantageously accomplished by the occupant by simply operating a short lever. Although the main portion of the footrest can be made shorter because of the addition of a linearly actuated

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portion, the angular displacement of the main portion still requires a free space underneath the seat of height and depth at least equal to the length of said angularly displaceable footrest portion. Therefore, such a system could not be adapted to a seating unit having small vertical clearance or a narrow cavity under the seat, or would prevent the use of a major part of eventually available space as useful storage space.

Although the above examples show that different types of footrest mechanisms adapted to seating units exist, the footrest mechanisms of the prior art are nevertheless lacking important features to constitute a readily installable low profile modular unit for providing a wide range of seating units with a compact, simple, efficient and safe footrest system. Also, no practical solution is found in the prior art to properly fit and safely use an articulated footrest system into a glider, swivel and reclining chair having only a few inches of vertical clearance under the seat.

There is thus a need for a novel low profile articulated footrest unit which can be installed on a wide range of seating units, including glider chairs in general, and operate simply and safely. There is also a need for a glider armchair incorporating a low profile articulated footrest system which can be operated safely and comfortably, independently from a backrest reclining system, and preserves free movement of the occupant's feet.

SUMMARY OF THE INVENTION

More specifically, in accordance with the invention as broadly claimed, there is provided a low profile articulated footrest unit comprising an outer cylinder to

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be assembled to a seat support frame, an inner cylinder sliding inside said outer cylinder and being terminated at a front end thereof by a first pivot and a pivoting arm connected thereto, said pivoting arm being destined to support a footrest panel. The pivoting arm is further interconnected through a second pivot to an elongated sliding member coextending with the outer and inner cylinders to rotate said pivoting arm about said first pivot, between a retracted generally downwardly projecting position and a forwardly projecting extended position. The inner cylinder and the coextending elongated sliding member are actuated in a synchronised motion through a pantograph linkage assembly, in turn actuated between a retracted position and an extended position through a push/pull rod assembly connected to an axle rotated through a hand actuated lever.

There is further disclosed a glider seating unit for seating an occupant, comprising a stationary base assembly, a main frame suspended to the stationary base assembly, a seat support frame, a glide motion preventing lock device connected between the stationary base assembly and the suspended main frame, and an articulated footrest unit assembled to the seat support frame, comprising a sliding mechanism actuated through a pantograph linkage assembly coupled to a lever for actuation by the occupant. In operation, actuation of the lever by the occupant to extend the footrest unit in a usable position, simultaneously locks the main frame to prevent the gliding motion.

As will become more apparent from reading of the following detailed description, the present invention overcomes the limitations and drawbacks of the above mentioned solutions of the prior art, and amongst other advantageous features the following can be enlighten:

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- The instant invention provides a low profile articulated footrest independently operable between a retracted position and an extended position in which an occupant's legs are supported in a comfortable position and at appropriate support points.
- The present invention provides a low profile articulated footrest unit wherein the extending/retracting mechanism that can be fitted in a cavity of about two inches high under a seat, excluding footrest plate and mounting arm, which makes it adaptable to seat frames of a wide range of seating unit types. Furthermore, a maximum of free space can be preserved underneath the seat to provide for storage space, clearance for an occupant's feet or to enable installation of a seat close to the floor.
- The present invention provides a low profile articulated footrest unit wherein the footrest plate is projected linearly forwards which enables a narrow footrest plate to be used to leave an open cavity at the lower-front end of the seating unit when the footrest is in its retracted position.
- The present invention further provides a gliding seating unit comprising a locking device to prevent a glider chair from gliding when the footrest is activated, for optimal stability and safety, said locking device providing automatic adjustment to the current inclination of the seating unit, to provide maximum comfort to the occupant.
- The present invention provides a low profile articulated footrest unit that is activated by the occupant through easy operation of a short lever and is not interlocked with a backrest reclining system.

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- The present invention further provides a low profile articulated footrest unit of simple and sturdy construction, that requires no maintenance, no energy but human power for operation, and is economical to manufacture;
- The present invention still further provides a glider seating unit comprising a low profile articulated footrest unit as contemplated in the present invention, and a glide motion preventing lock device, both mechanisms being simultaneously actuated through operation of a single lever.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a front-lateral perspective view of a preferred embodiment of the low profile articulated footrest unit in its retracted position, assembled to a seat support frame of a seating unit (not shown).

Figure 2 represents a similar view to Figure 1, however showing the low profile articulated footrest unit in its extended position.

Figure 3 is a rear-lateral perspective view of a preferred embodiment of the low profile articulated footrest unit in its retracted position, as seen from underneath a seat support frame to which it is assembled.

Figure 4 represents a similar view to Figure 3, however showing the low profile articulated footrest unit in its extended position.

Figure 5 is a cross-sectional rear-lateral perspective view of a preferred embodiment of the low

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profile articulated footrest unit in its retracted position.

Figure 6 represents a similar view to Figure 5, however showing the low profile articulated footrest unit in its extended position.

Figure 7 is a side elevation view of a glider armchair of the present invention, incorporating a low profile articulated footrest unit shown in its retracted position, and a glide motion preventing lock device.

Figure 8 represents a similar view to Figure 7, however showing the armchair with the footrest in its extended position.

Figure 9 represents a top plan view of the glider armchair of Figure 8.

Similar reference numerals refer to similar parts throughout the various Figures.

DETAILED DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the low-profile articulated footrest unit and associated glider seating unit according to the present invention will now be described in detail referring to the appended drawings.

Referring to Figure 1, there is illustrated a low profile articulated footrest unit generally identified by numeral **1**, comprising an outer cylinder, preferably a rectangular tube **2**, assembled to a cross-member **102** and a tab **103** on the underside of a seat support frame **101** of a seating unit. The footrest unit is shown in its retracted

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position, with the panel mounting arm **3** projecting downwards. Arm **3** may be provided with optional transversal members such as **50** to help mounting and supporting a cushioned footrest plate (not illustrated). Arm **3** is pivotally assembled to a front end of an inner cylindrical member, preferably a rectangular tube **4**, through a centre pin **5** inserted in mating pairs of holes in arm **3** and rectangular tube **4** respectively. Washers such as **31** are used between adjacent moving surfaces to control friction and wear in the mechanism. It should be noted that both ends of pin **5** are extending beyond the surface of arm **3** by a certain length to provide stops **5a** and **5b** for a purpose to be explained later. Arm **3** further comprises elongated slots such as **9** in each side wall thereof to receive a pin **8** thus providing a second pivoting/sliding joint connecting arm **3** to U-shape connecting portion **7** of elongated sliding member **6**, coextending with outer tube **2** and sliding along the outer lower surface thereof. Again, washers such as **32** are used between adjacent moving surfaces. The U-shape connecting portion **7** of elongated sliding member **6** is provided with two symmetrical notches such as **42** to abut against stops **5a,b** for limiting the lift of arm **3** to a predetermined level, for proper positioning of the footrest plate in the extended position of the footrest unit, when in use in a seating unit.

As better seen from Figure 3, providing an underside view of the assembly of Figure 1, sliding member **6** is connected to the front end of pantograph linkage assembly **10**, through pivot **20a**, while pivot **20b** connects to the rear end of inner tube **4** through slot **22** of outer tube **2**. Other pivots **20c** to **20j** are used to interconnect the eight link members **10a** to **10h** of the pantograph linkage assembly **10** together. The rear end of pantograph assembly **10** is assembled to outer tube **2** through pivot **20j**, and pivot **20i** connecting link members **10g** and **10h** also connects

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to a connector **21** to which a pair of push/pull connecting rods **11a,b** are pivotally assembled using centre pin **19**. The other ends of connecting rods **11a,b** are pivotally assembled to a first end of connecting arm **13** using centre pin **12**. A set screw **14** is used to lock pin **12** in place in a drilled hole in connecting arm **13**.

Turning again to Figure 1, it can be seen that outer tube **2** is terminated by a U-shape connecting portion **23**, in which axle **16** is pivotally inserted and interconnects with a second end of connecting arm **13**. A set screw **33** is used to lock arm **13** on axle **16** and prevent relative movement. Spacers **15a,b** are used to set arm **13** in the centre of connecting portion **23** and provide appropriate control of the friction between moving parts. A self lubricating material such as Nylon[®] or brass, can be used for instance for spacers **15a,b**. Axle **16** is terminated at one end by a lever **17** constituted by an orthogonally bent portion of the axle **16**, said lever being terminated by a handle **18**. It is worth mentioning that in the illustrated embodiment of the footrest unit **1**, axle **16** is shown inserted across the rear end of seat support frame **101** through holes **34a,b**, to serve as a pivot for articulating a backrest to the seat frame of a seating unit, as illustrated in Figure 9. However, extremities of axle **16** could be supported otherwise, independently from any operational system of the seating unit. For instance, perforated tabs could be attached to seat support frame **101** or independent brace members extending from outer tube **2** could be used.

Figures 2 and 4 represent similar views to Figures 1 and 3 detailed in the foregoing description, however showing the low profile articulated footrest unit in its fully extended position.

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In Figures 5 and 6, there is represented a partial cross-sectional view of the unit, to show the details of the assembly inside tubes **2** and **4**. It can be seen that a first skid **24** is mounted on top of inner tube **4** while a second skid **25** is mounted to the lower internal face of inner tube **2**, said skids being made of low friction material (ex.: Nylon[®], Teflon[®], etc.) to minimise wear, noise, as well as the force required to impart a sliding movement to inner tube **4** in tube **2**. It can be further observed that pivot **20i** is assembled to outer tube **2** through slot **22** and comprises a washer **26** located inside outer tube **2** in contact with the lower inner surface thereof, so to enable free sliding of said pivot into said slot while limiting its vertical displacement. Similarly, pivot pin **20b** is provided with a large flat head **27** to limit its vertical displacement and is assembled through slot **22** and through a hole provided in the lower wall of inner tube **4**. A low friction spacer **28** is assembled between the lower walls of tubes **2** and **4** to provide a third skid to facilitate the sliding of inner tube **4** in outer tube **2**. Finally, it can be more clearly seen that pivot **20j** is pivotally assembled through a hole provided in the lower wall of outer tube **2** and washer **29** prevents any significant vertical displacement of said pivot. In a like manner, pivot **20a** connect link members **10a** and **10b** together and is pivotally assembled in a hole provided at the end of sliding member **6**, opposed to the U-shape portion **7** thereof.

The operation of the low profile articulated footrest unit will now be described referring mainly to Figures 1 through 6. Starting with the footrest unit in its retracted position (Figures 1, 3, 5), pulling lever **17** approximately 45 degrees upwards through handle **18** imparts a counter-clockwise rotation to axle **16**, which in turn rotates connecting arm **13** and projects push/pull connecting

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rods **11a,b** forwards in a nearly linear path. Connector **21** is thereby advanced linearly in slide **22**, extending pantograph linkage assembly **10**. The respective lengths of links **10a** through **10h** and locations of pivots **20a** through **20j** of said linkage assembly are so designed that a short displacement of connector **21** and short links **10g** and **10h**, at the rear end of pantograph linkage assembly **10**, produces a much longer displacement of pivot **20b**, connected to inner tube **4**, which is even less than the displacement of pivot **20a** connected to the sliding member **6**, at the front end of pantograph linkage assembly **10**. Therefor, inner tube **4** is projected forwards by several inches, bringing along footrest plate support arm **3**. Since sliding member **6** is projected still further forwards, the resulting force applied at pivot **8** by connecting portion **7** produces a rotation torque on support arm **3** about pivot **5**, which causes the lift of support arm **3** until notches **22a,b** abut against stops **5a,b**. The extended position is thereby positively defined according to the desired extension stroke and final angle of inclination of the footrest plate support arm **3**.

Therefor, one can contemplate that the low profile articulated footrest unit **1**, according to the present invention, amongst other features, is compact and installable in a very limited space, is easily operated by a seat occupant without external source of power, to provide a comfortable footrest once a cushioned footrest plate is assembled to support arm **3**, and can be designed with a short footrest plate support arm to provide maximal clearance to access the cavity under the seat of a seating unit, from the front end thereof, or to install a seat close to a supporting surface.

Turning now to Figures 7 to 9, a gliding seating unit, more specifically a reclining and pivoting

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glider armchair, advantageously using the low profile retractable footrest unit **1** of the foregoing description, will now be described. Figure 7 and 8 represent side elevational views with the incorporated footrest respectively shown in its retracted and extended position. These views provide more details about the integrated glide motion preventing lock device. Figure 9 is a top view of the glider armchair presenting details about the relative positioning of the footrest unit **1** shown in its extended position.

The glider armchair generally identified by numeral **100** is shown without the cushions, and comprises a stationary base **105** comprising a centre tower **125**, a H-shape base crown **107** pivotally mounted on top of said centre tower, a suspended frame **106**, suspended to said pivoting H-shape base crown **107** through pivotally assembled symmetrical rear glide link **108** and front glide link **109**, a seat support frame **101** provided with a tab **103** and a plurality of cross-members such as **102** (only one illustrated), and a low profile articulated footrest unit **1** assembled to said tab **103** and at least one of said cross-members **102**, and holes **34a,b** (illustrated on Figures 1 through 4) of seat support frame **101**. Details of the low profile articulated footrest unit **1** have been described hereinabove. It can thus be seen that the suspended frame **106**, to which the seat support frame **101** is connected, is free to glide forwards and backwards and can be freely and infinitely rotated in any direction with respect to the stationary base **105**. Said stationary base **105**, as illustrated, preferably has an octagonal perimeter to contact a supporting surface while providing optimal clearance and stability.

As can be more particularly contemplated from Figure 9, the low profile articulated footrest unit **1** is

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fitted within a space of only about two inches underneath seat support frame **101**, such that it may clear cross-member **127** of front glide linkage **109** and cross-member **126** of suspended frame **106** and cross-member **107c** of H-shape pivoting crown **107** respectively.

The glider armchair **100** further comprises a reclining backrest **110** pivotally assembled to seat support frame **101** and suspended frame **106**. Firstly, a right side member **110a** of backrest **110** is assembled to right portion **106a** of frame **106** through pivot **111a** and left side member **110b** is assembled to left portion **106b** through pivot **111b** (See Figure 9). Secondly, the lower portion of each of said backrest side members **110a,b** is pivotally assembled to the rear portion of seat support frame **101**, using axle **16** of footrest unit **1**, thus providing a two point rear articulated connection of said seat support frame **101** to suspended frame **106**. Seat support frame **101** is further provided with right and left slotted flanges **112a,b**, (slots **113a,b**) for articulated connection to the front end of portions **106a** and **106b** of suspended frame **106**, through a pivot inserted in each slot (not shown). Therefore, seat support frame **101** and backrest **110** form a seat assembly connected to the suspended frame **106** through four articulated points such that the relative angular position of the backrest with respect to the seat can be varied at will by an occupant. When a desired angular position is reached, a lock device (not shown) can be activated to lock the seat assembly in said position, independently from the gliding motion of the armchair and from the articulation of the footrest unit **1**.

In order to prevent an occupant from experiencing uncomfortable feelings and being subjected to unsafe situations due to sudden changes in the position of the centre of gravity of the occupied glider armchair, a

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glide motion preventing lock device is further provided to simultaneously and automatically prevent the gliding motion of a glider chair unit when the low profile articulated footrest unit **1** is extended. Said glide motion preventing lock device comprises a notched lock plate **114**, comprising notches such as **124**, connected to the H-shape pivoting base crown **107**, a pivoting lock arm **115** connected to tab **120** of suspended frame **106** through pivot pin **119**, said lock arm **115** comprising an orthogonally projecting lock pin **116** and a transversal hole **117**, a pull arm **121** fixedly assembled at a first end thereof to axle **16** to follow the rotation of lever **17**, said pull arm **121** comprising a transversal hole **122** at a second end thereof, and a spring or elastomeric member **118** connected between hole **117** of lock arm **115** and hole **122** of pull arm **121**. Preferably, a rigid sleeve **123** covers spring **118** in order to provide a positive downward force to extract lock pin **116** of lock arm **115** from notch **124** in lock plate **114** when lever **17** is pushed downwards to retract the footrest unit and, consequently, unlock the glide motion preventing device.

It can thus be seen that pulling lever **17** to extend the footrest unit **1** simultaneously rotates pull arm **121** upwards, in turn pulling lock arm **115** upwards and bringing lock pin **116** in contact with the lower edge of lock plate **114** under the force of the thereby extended spring **118**, such that any subsequent motion of the gliding system will be stopped by the abutment of pin **116** in the nearest notch of lock plate **114**. Therefor, the suspended frame and gliding system are locked in their current position and any further gliding movement is then prevented, until lever **17** is operated again in the opposite direction to retract the footrest unit, thus returning all the elements of the gliding motion lock device to their original non-activated position.

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One can easily appreciate that the above described embodiments of the present invention provide effective and practical solutions for the installation of an articulated footrest system on a broad range of seating units with unmatched functional and economic performance.

Therefor, it can be seen that the low profile articulated footrest unit according to the present invention can be advantageously used in miscellaneous applications, including retrofit to existing seating units and implementation into a specific and innovative reclining glider armchair application, with numerous advantages over the solutions of the prior art.

Although the present invention has been described by means of a preferred embodiment thereof, it is contemplated that various modifications may be made thereto without departing from the spirit and scope of the present invention. Accordingly, it is intended that the embodiment described be considered only as illustrative of the present invention and that the scope thereof should not be limited thereto but be determined by reference to the claims hereinafter provided and their equivalents.

Inventor

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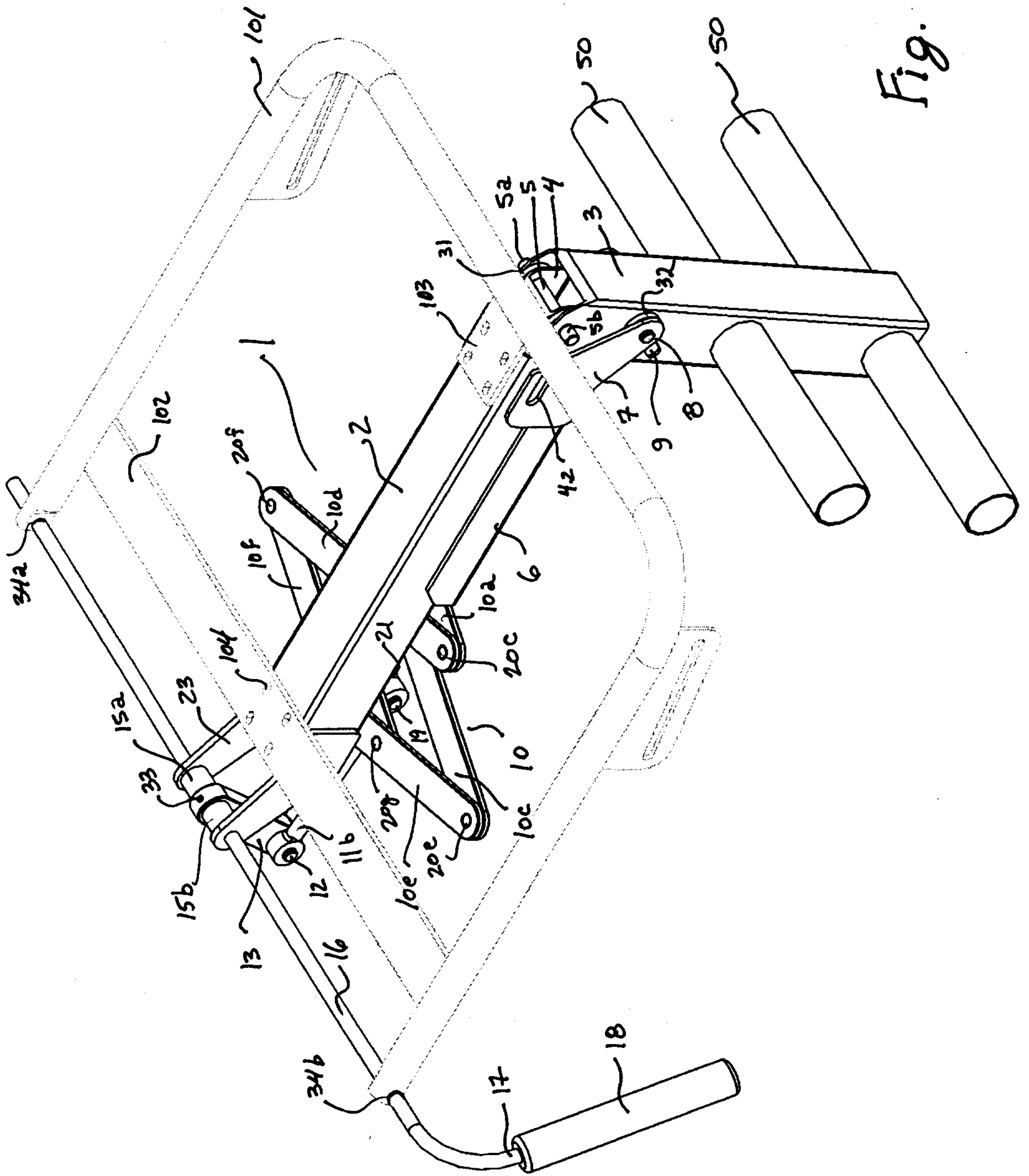


Fig. 1

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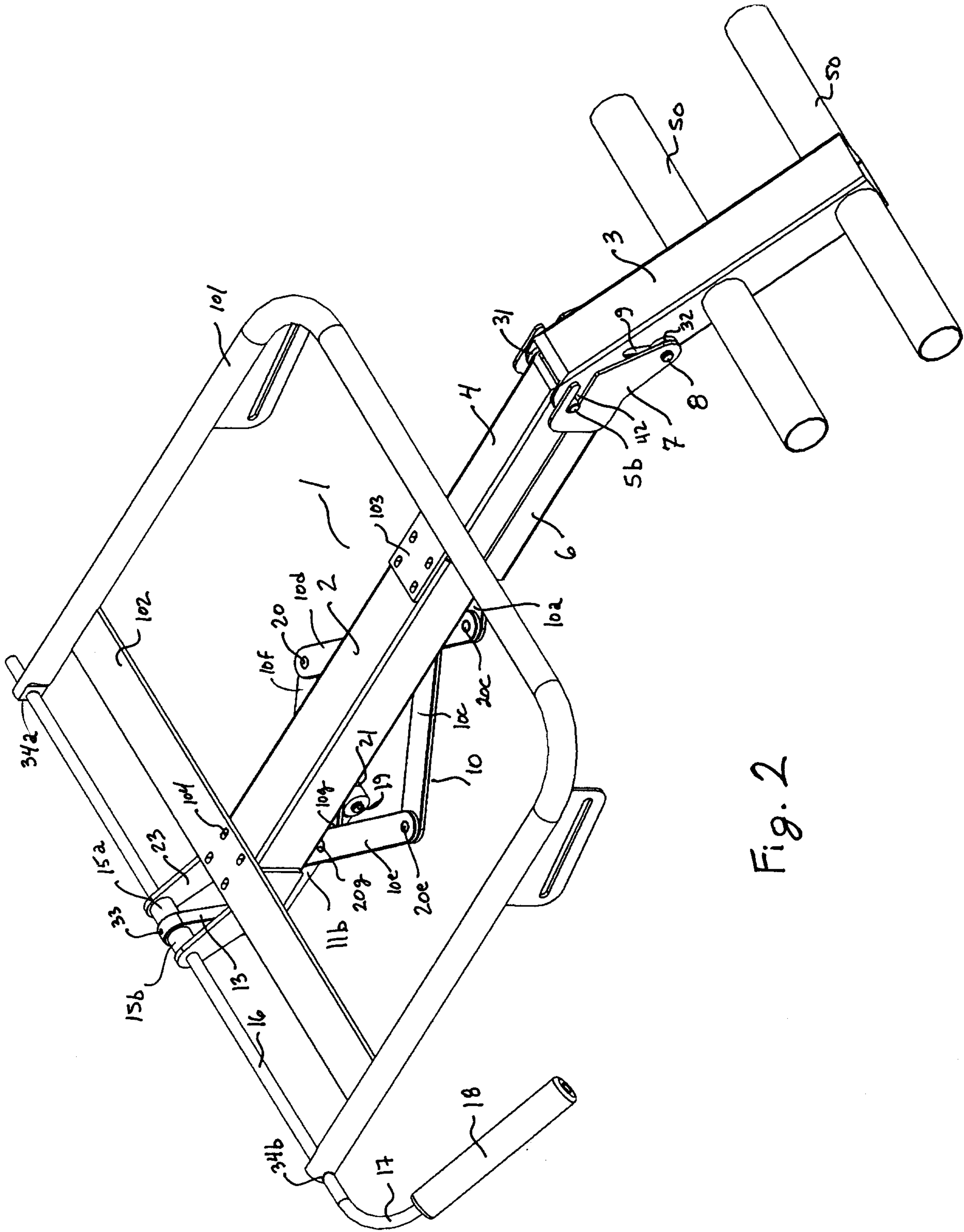


Fig. 2

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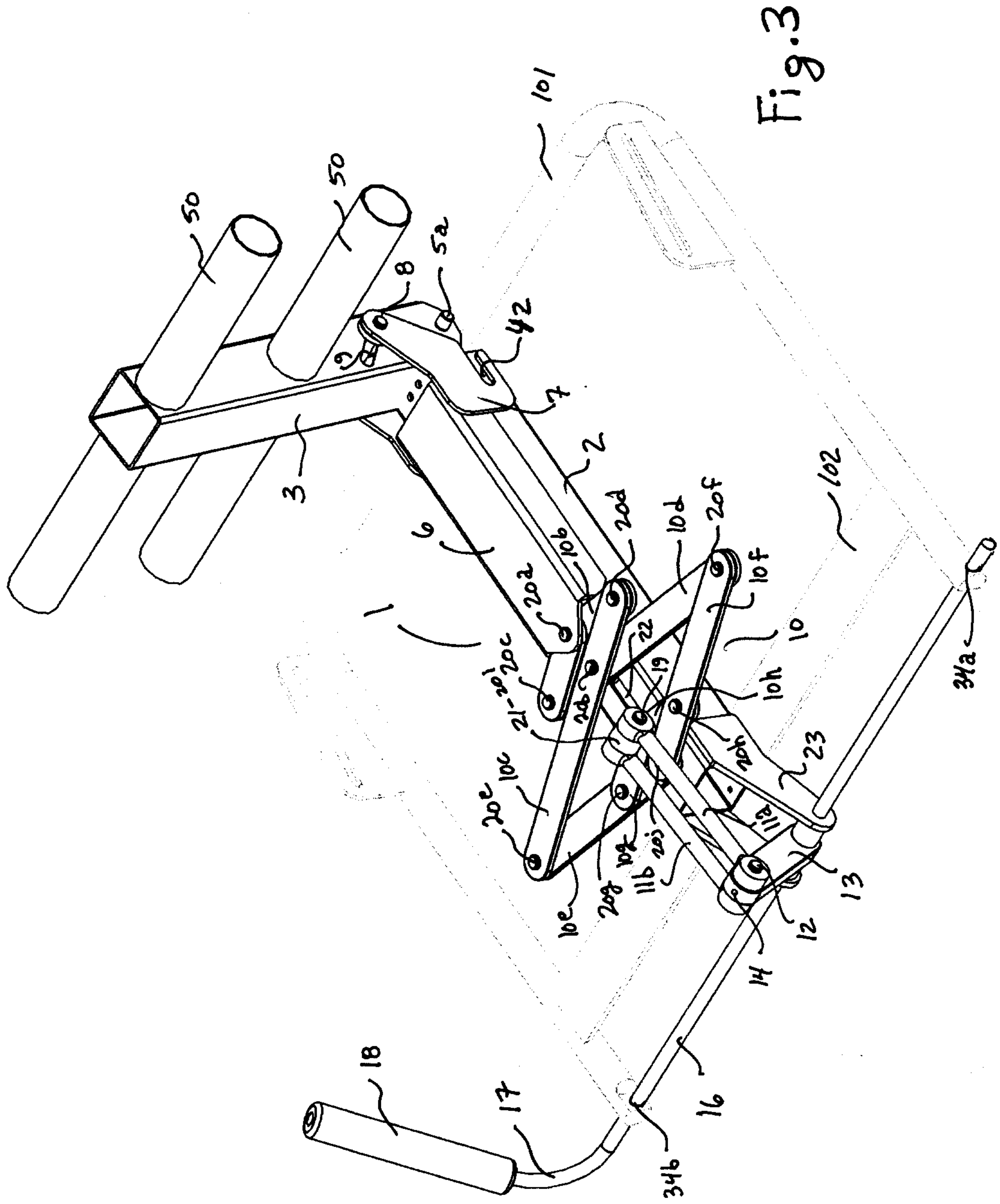


Fig.3

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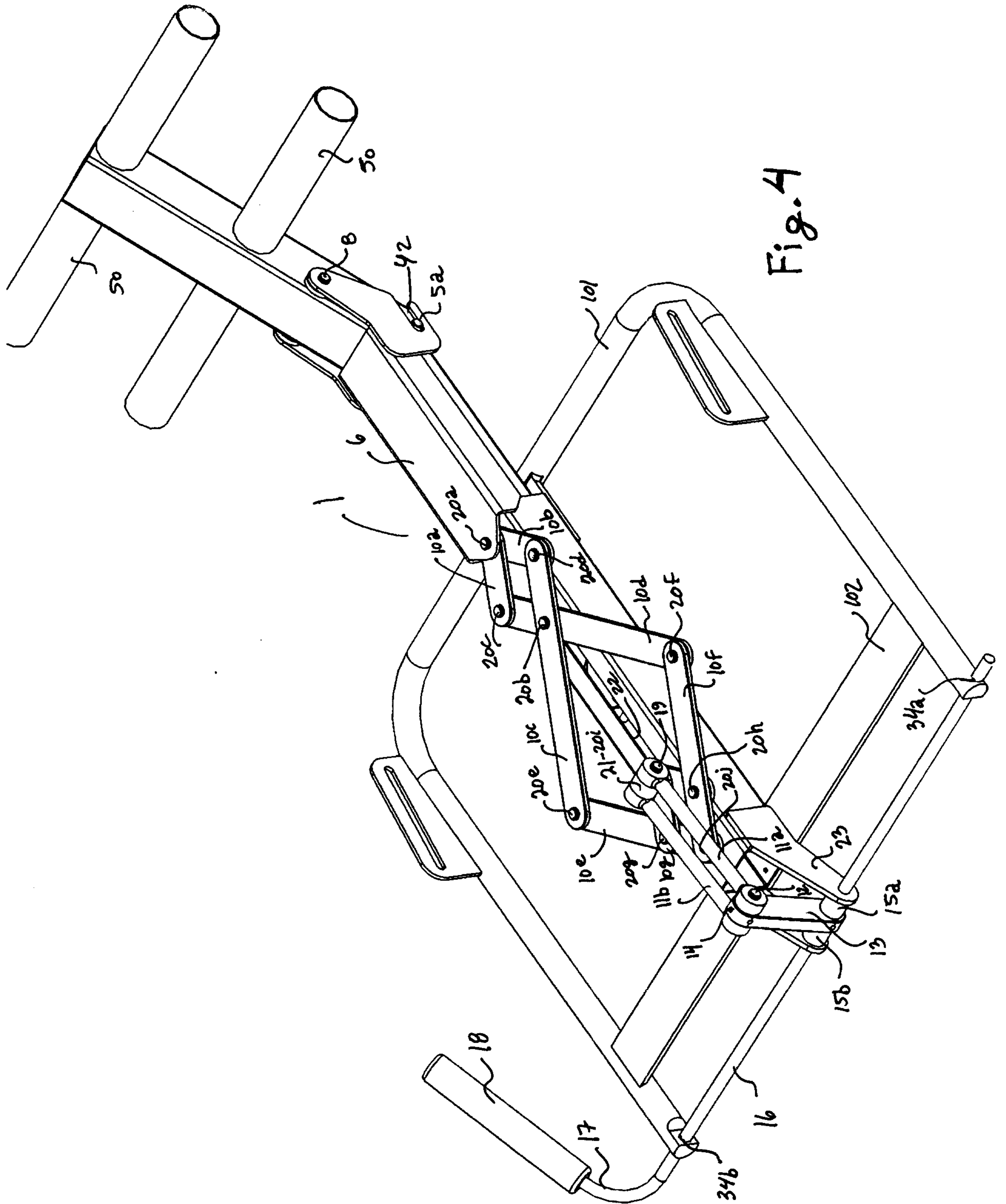


Fig. 4

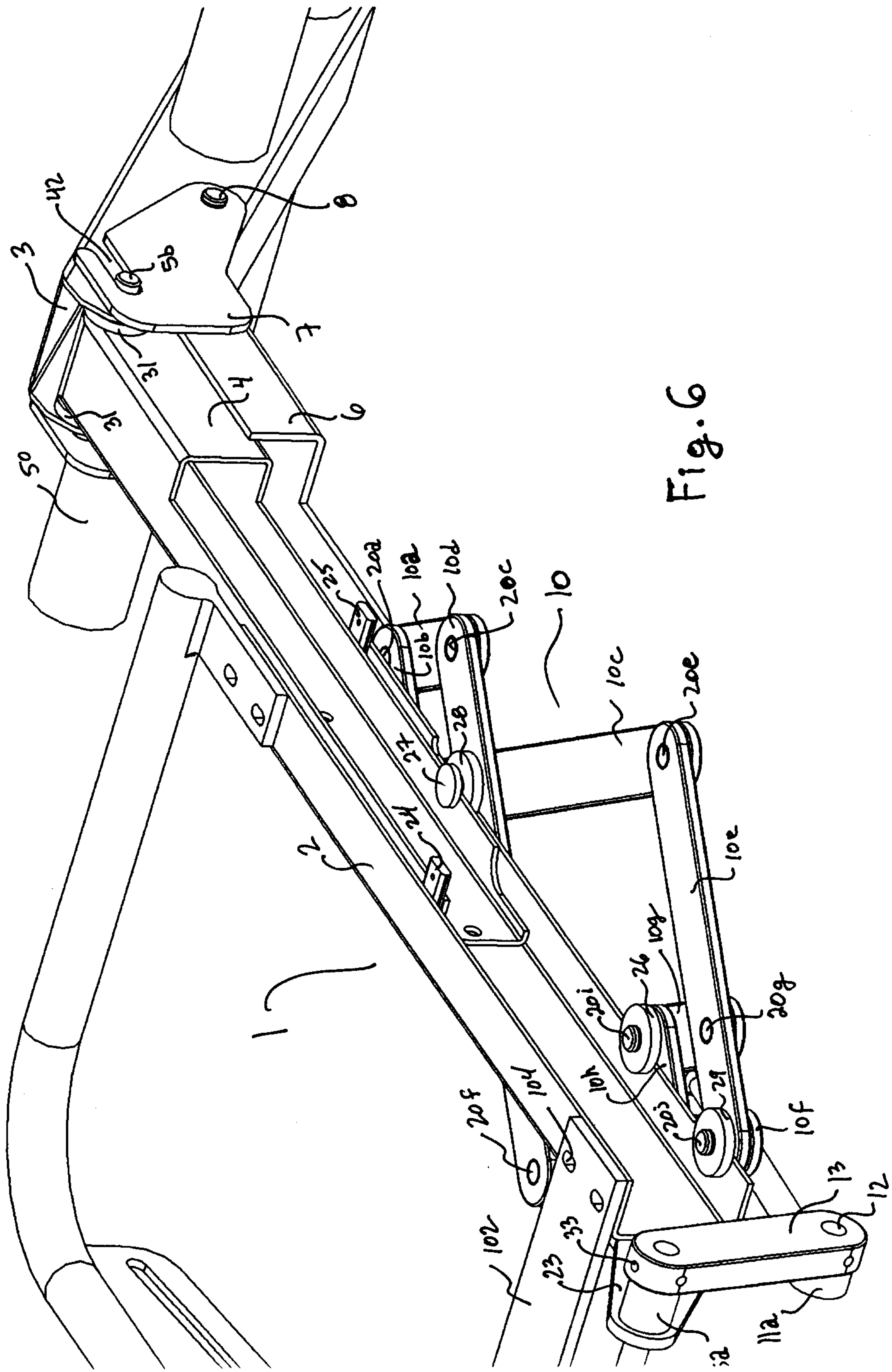


Fig. 6

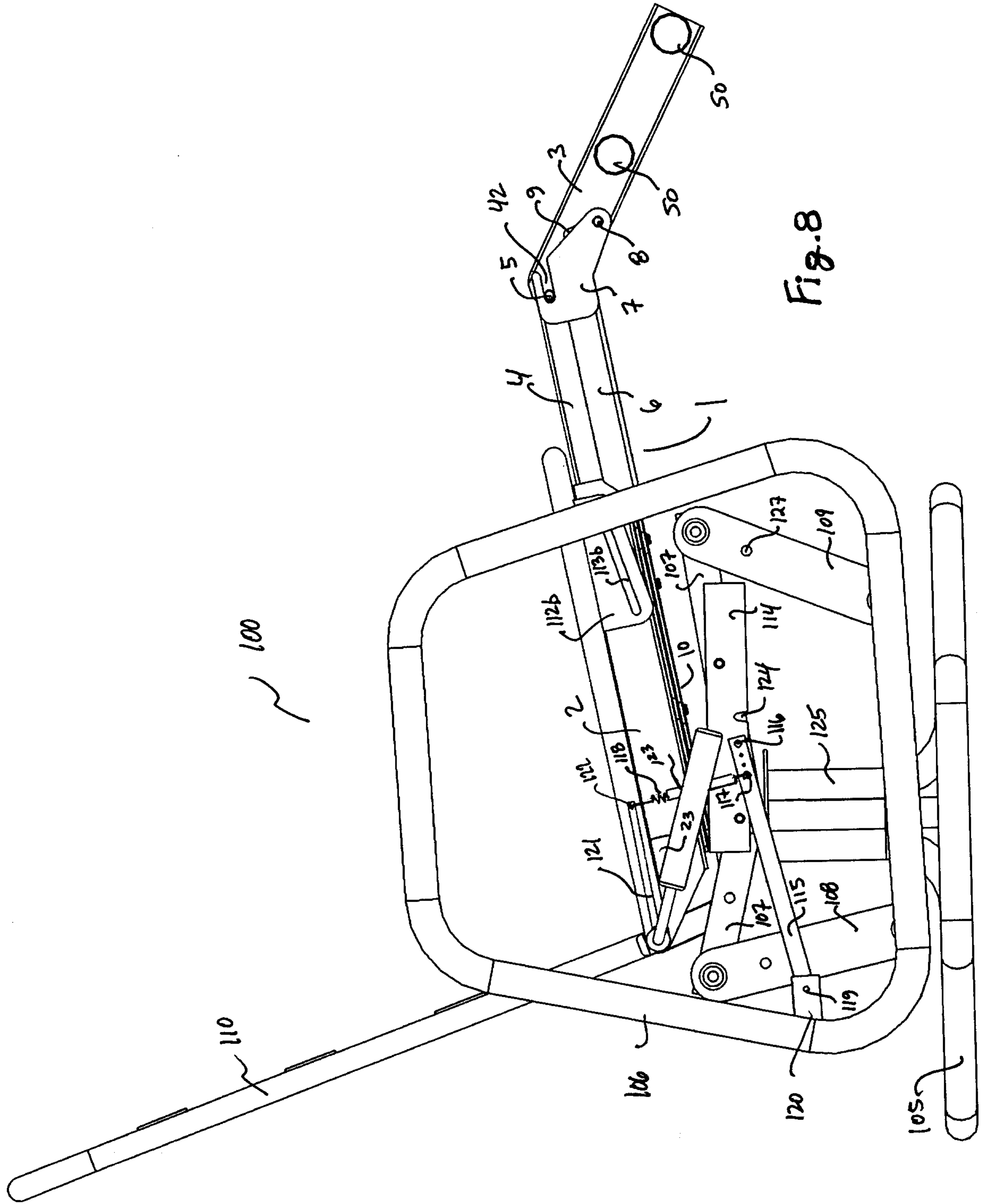


Fig. 8

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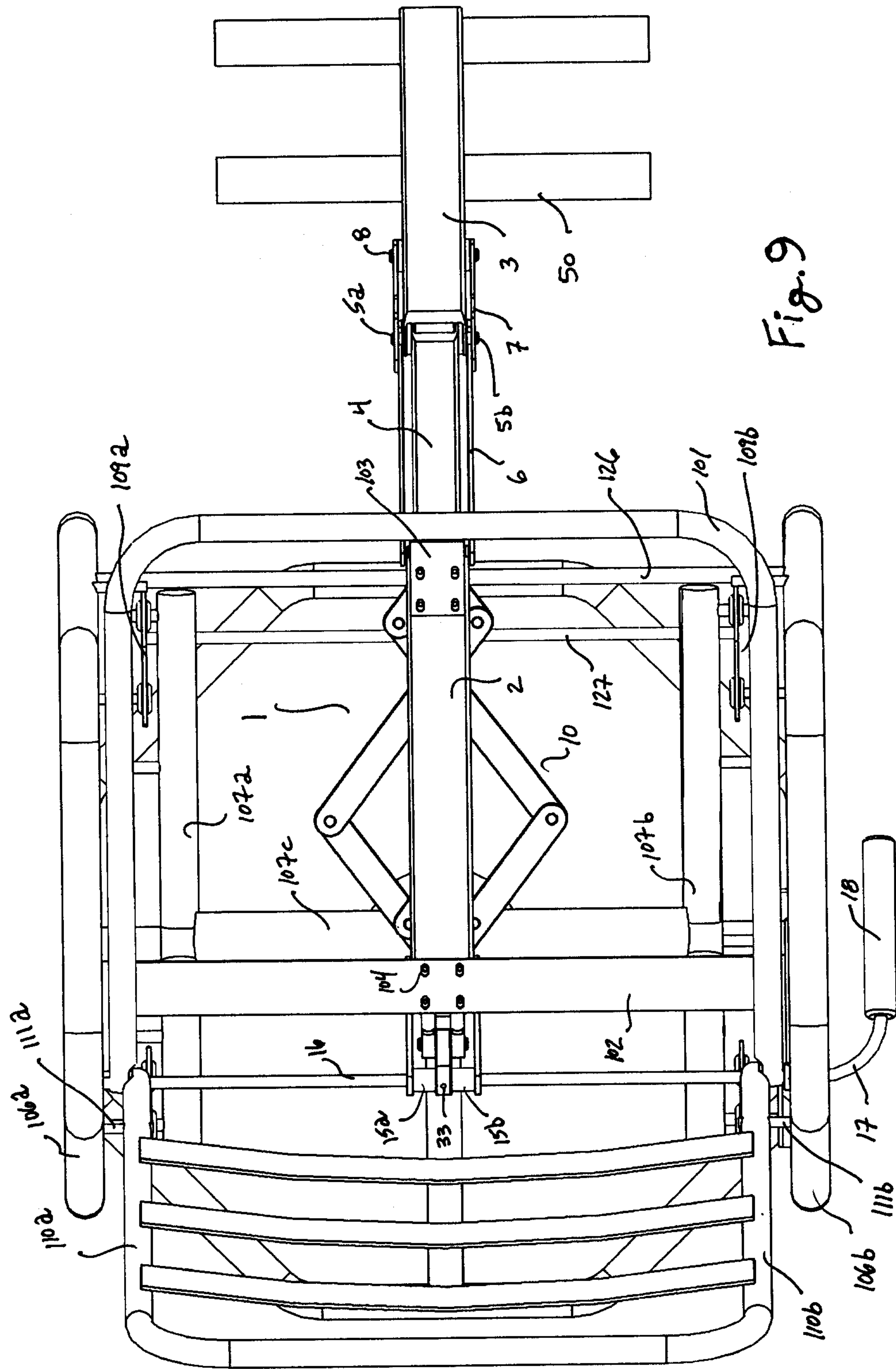


Fig. 9

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