



(11) **EP 2 981 195 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:

07.06.2023 Bulletin 2023/23

(21) Application number: **14801645.4**

(22) Date of filing: **21.05.2014**

(51) International Patent Classification (IPC):

A47C 17/207 ^(2006.01)

(52) Cooperative Patent Classification (CPC):

A47C 17/2076; A47C 7/402; A47C 17/134;

A47C 17/2073; A47C 17/225

(86) International application number:

PCT/US2014/038908

(87) International publication number:

WO 2014/190012 (27.11.2014 Gazette 2014/48)

(54) **SEATING UNIT CONVERTIBLE TO BED**

IN EIN BETT UMWANDELBARE SITZEINHEIT

UNITÉ D'ASSISE POUVANT ÊTRE CONVERTIE EN UN LIT

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **22.05.2013 US 201313900311**

21.11.2013 US 201361907038 P

05.02.2014 US 201414173513

(43) Date of publication of application:

10.02.2016 Bulletin 2016/06

(73) Proprietor: **Ultra-Mek, Inc.**

Denton, North Carolina 27239 (US)

(72) Inventors:

• **MURPHY, Marcus L.**
Lexington, North Carolina 27292 (US)

• **HOFFMAN, D. Stephen**
High Point, North Carolina 27265 (US)

(74) Representative: **Yeadon IP Limited**

Nexus
Discovery Way
Leeds LS2 3AA (GB)

(56) References cited:

EP-A2- 1 913 846	AT-U1- 7 969
GB-A- 371 110	GB-A- 626 821
US-A- 1 690 797	US-A- 4 045 829
US-A1- 2009 235 452	US-A1- 2011 010 846

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 2 981 195 B1

Description**Field of the Invention**

[0001] The present invention relates generally to furniture, and more specifically a furniture unit that is convertible into a bed.

Background of the Invention

[0002] Furniture units that are convertible into beds are popular with consumers because of their multifunctionality. Many consumers find it very convenient to have a sofa or chair that can provide a bed for a guest, as such a unit can eliminate the need for an additional, separate bed. One popular sofa-bed design includes its own complete mattress that is folded within the cavity of the sofa during periods of non-use. One such example is illustrated in U.S. Patent No. 4,200,941 to Gill et al. This type of sofa-bed can be quite heavy, and typically requires not only the separate mattress, but also a relatively intricate mechanism to control the unfolding and folding of the mattress.

[0003] Other furniture units lack a complete mattress, but instead are constructed of separate sections that serve as support surfaces of the sofa and unfold to form a flat, mattress-like sleeping surface. Different examples of this basic concept are shown in U.S. Patent No. 2,740,131 to Vogel et al., U.S. Patent No. 5,195,194 to Bradley, U.S. Patent No. 7,547,182 to Murphy, and U.S. Patent No. 8,438,676 to Murphy. The bed shown in the latter of the Murphy patents includes three separate sections that serve as the mattress of the bed: a seat section; an intermediate section; and a head section. A folding mechanism controls the movement of the head, intermediate and seat sections between a folded position, in which the head, intermediate and seat sections are positioned in a vertically stacked relationship, with the head section below the intermediate section and the seat section above the intermediate section, and with the head and intermediate sections being positioned in the cavity of the housing and the seat section serving as the "seat" for the sofa, and an unfolded position, in which the head, intermediate and seat sections are horizontally disposed and serially aligned to form a sleeping surface.

[0004] Other sofa beds are described in AT 007 969 U1 and GB 371 110 A.

[0005] In spite of the existence of these different foldable beds, it may be desirable to offer additional furniture units that can house foldable beds.

Summary of the Invention

[0006] There is provided a seating unit that includes a foldable bed according to claim 1. A selection of optional features is set out in dependent claims.

Brief Description of the Figures

[0007]

Figure 1 is a side view of a seating unit according to embodiments of the present invention, with the bed shown in its folded position and the backrest shown in a lowered position.

Figure 2 is a side view of the seating unit of **Figure 1** with the backrest in a raised position.

Figure 3 is a side view of the seating unit of **Figure 1** with the bed in an intermediate position between the folded and unfolded positions.

Figure 4 is a side view of the seating unit of **Figure 1** with the bed in its unfolded position.

Figure 5 is a top view of the seating unit of **Figure 1** with the bed in the unfolded position of **Figure 4**.

Figure 6A is a side view of the unfolding mechanism of the seating unit of **Figure 1**, with the mechanism in the folded position of **Figures 1** and **2**.

Figure 6B is a side view of the unfolding mechanism of **Figure 6A**, with the mechanism in the intermediate position of **Figure 3**.

Figure 6C is a side view of the unfolding mechanism of **Figure 6A**, with the mechanism in the unfolded position of **Figure 4**.

Figure 6D is a top view of one half of the unfolding mechanism of **Figure 6A** shown in the unfolded position of **Figure 4**.

Figure 7 is a rear perspective view of one of the front legs of the seating unit of **Figure 1** shown in the folded position of **Figures 1** and **2**.

Figure 8 is a front perspective view of the front leg of **Figure 7**.

Figure 9 is a front, bottom perspective view of one of the rear legs of the seating unit of **Figure 1** shown in the intermediate position of **Figure 3**.

Figure 10 is a front, bottom perspective view of the rear leg of **Figure 9** shown in the unfolded position.

Figure 11 is a rear, bottom perspective view of the rear leg of **Figure 9** shown in the folded position of **Figure 10**.

Figure 12 is a rear, bottom perspective view of the rear leg of **Figure 11** shown in the intermediate position of **Figure 9**.

Figure 13 is a rear, bottom perspective view of the rear leg of **Figure 11** shown in the unfolded position of **Figure 10**.

Figure 14 is a top view of the seating unit of **Figure 1** with the bed shown in its folded position and the cushions removed for clarity.

Figure 15 is a top view of the seating unit of **Figure 2** with the bed shown in its unfolded position and the cushions removed for clarity.

Figure 16 is a bottom perspective view of the seat section showing the seat frame with its subframes and sinuous springs.

Detailed Description of Embodiments of the Invention

[0008] The present invention will be described more particularly hereinafter with reference to the accompanying drawings. The invention is not intended to be limited to the illustrated embodiments; rather, these embodiments are intended to fully and completely disclose the invention to those skilled in this art. In the drawings, like numbers refer to like elements throughout. Thicknesses and dimensions of some components may be exaggerated for clarity. Well-known functions or constructions may not be described in detail for brevity and/or clarity.

[0009] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0010] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. As used herein the expression "and/or" includes any and all combinations of one or more of the associated listed items.

[0011] In addition, spatially relative terms, such as "under", "below", "lower", "over", "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "under" or "beneath" other elements or features would then be oriented "over" the other elements or features. Thus, the exemplary term "under" can encompass both an orientation of over and under. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0012] Referring now to the figures, a seating unit, designated broadly at 10, is illustrated in Figures 1-13. Referring first to Figures 1 and 5, the seating unit 10 includes a base 11 having a front wall 12, a rear wall 13 with a backrest 13a, and opposed side walls 14 with arms

14a (see Figure 5); these walls 12, 13 14 define a cavity 17. A foldable bed 15 includes a seat section 16 with an underlying seat frame 18, an intermediate section 20 with an underlying intermediate panel 22, and a head section 24 with an underlying head panel 26. The intermediate and head panels 22, 26 are planar panels, typically formed of wood, that underlie most or all of cushions that provide a comfortable surface for sleeping. The seat frame 18 comprises two open square subframes and is described in some detail below and in co-assigned and co-pending U.S. Patent Application No. 13/900,311, filed on May 22, 2013.

[0013] Referring to Figures 14-16, the seat frame 18 comprises two open square subframes 302 that are attached in side-by-side relationship via cross-members 304a, 304b. In each subframe 302, vertical panels 305, 306, 307 extend downwardly from the edges of a U-shaped main panel 310, and a vertical panel 308 spans the open end of the main panel 310 to form a generally square opening 311. The cross-members 304a, 304b are mounted to the underside of reinforcing panels 312 that underlie the "legs" of each main panel 310. In some embodiments, the opening 311 measures between about 14 and 26 inches from back to front. Sinuous springs 314 extend between the vertical panels 305, 307 to span the opening 311 of the subframe 302. Cushions 316 are then fixed to the upper side of the main panel, with upholstery applied to the vertical panels 305, 306, 307, 308 and over the cushions 316 to provide an aesthetically pleasing seat cushion assembly.

[0014] The bed 15 is movable between a folded position, in which the seat and intermediate sections 16, 20 are generally horizontally disposed and positioned in vertically stacked relationship, and the head section 24 is generally vertically disposed and positioned adjacent the rear wall 13 and backrest 13a of the base 11 (see Figures 1 and 2), and an unfolded position, in which the seat, intermediate and head sections 16, 20, 24 are horizontally disposed and serially aligned to form a sleeping surface (see Figures 4 and 5).

[0015] The movement of the sections 16, 20, 24 of the bed 15 is controlled by a pair of bed folding mechanisms 30, which will be described in greater detail below. The bed folding mechanisms 30 are mirror images of each other about a vertical plane P (Figures 5 and 14) that bisects the seating unit 10 normal to the front wall 12; as such, only one bed folding mechanism 30 will be described herein, with the understanding that the description is applicable to the other mechanism also. Two leg folding mechanisms 100 are also mirror images of each other about the plane P, such that only one will be described in detail hereinbelow.

[0016] For the sake of clarity, the bed 15 will be described initially in the unfolded position of Figures 4 and 5; movement to the folded position of Figures 1 and 2 will then follow. As used herein to describe the relative positions of components, the terms "lateral", "outward" and derivatives thereof indicate the directions defined by

a vector beginning at the vertical plane **P** that bisects the seating unit **10** normal to the front wall **12** and extending toward either side wall **14**. Conversely, the terms "inward", "inboard" and derivatives thereof indicate the direction opposite the "outward" direction. Together, the "inward" and "outward" directions comprise the "transverse" axis of the seating unit **10**. The "rear" of the unfolded bed **15** is located at the end of the bed **15** nearest the rear wall **13** and backrest **13a** of the base **11** (i.e., toward the head section **24**), and the "front" of the bed **15** is located at the end nearest the seat section **16**. The "front" and "rear" directions comprise the "longitudinal" axis of the bed **15**.

[0017] In addition, some components of the bed folding mechanisms **30** are illustrated herein as a series of pivotally interconnected links. Those skilled in this art will appreciate that the pivots between links or other components can take a variety of configurations, such as pivot pins, rivets, bolt and nut combinations, and the like, any of which may be suitable for use with the present invention. Also, the shapes and configurations of the links themselves may vary, as will be understood by those skilled in this art. Further, some links may be omitted entirely in some embodiments, and additional links may be included in some embodiments.

[0018] Referring now to **Figures 4, 5, 6C** and **6D**, the bed folding mechanism **30** includes a front mounting bracket **41** that is fixed to the inner surface of the side wall **14**. A serpentine rear mounting bracket **40** is fixed to a rear portion of the front mounting bracket **41**. An L-shaped head section link **42** is connected to the rear mounting link **40** at a pivot **44**; the head section link **42** extends upwardly from the pivot **44**, then forwardly, where it is fixed to a head section bracket **43** that is in turn fixed to the lateral edge of the head panel **26**. The pivot **44** provides an axis about which the head section **24** rotates in moving between the folded and unfolded positions.

[0019] The front mounting bracket **41** includes two arcuate slots **41a, 41b**. An angled extension **46** is mounted generally vertically to the forward end of the front mounting bracket **41**. An intermediate section bracket **48** is fixed to the underside of the intermediate panel **22** and is attached to the upper end of the extension **46** at a pivot **50**. The pivot **50** defines an axis about which the intermediate section **20** rotates in moving between the folded and unfolded positions.

[0020] A connecting link **52** is attached to the head section link **42** at a pivot **54** and extends forwardly therefrom to a pivot **56** with the intermediate section bracket **48**. The connecting link **52** ties together the movements of the head section **24** and the intermediate section **20** in moving between the folded and unfolded positions.

[0021] The seating unit **10** includes two different linkages that can assist the user in folding and unfolding the bed **15**: an unfolding assist assembly **60** and a folding assist assembly **72**. Referring to **Figure 6C**, the unfolding assist assembly **60** includes a spring **62** that is attached

at its forward end to the vertex of the extension **46**. A spring link **64** is attached at its forward end to the intermediate section bracket **48** at the pivot **56** and extends downwardly and rearwardly to attach to the rear end of the spring **62**. A control link **68** is attached to the lower end of the extension **46** at a pivot **69** and extends upwardly to a pivot **67** with the spring link **64**. The control link **68** also includes a pin **68a** that is received in the forward end of the slot **41a** of the front mounting bracket **41**. In the unfolded position of **Figures 4** and **6C**, the spring **62** is substantially, if not entirely, relaxed.

[0022] Referring still to **Figure 6C**, the folding assist assembly **72** includes a spring **74** that is attached to the rear end of the rear mounting bracket **40** and extends forwardly therefrom. A spring link **76** is attached at its lower end to the spring **74** and at its upper end to the forward end of the rear mounting bracket **40** at a pivot **78**. The spring link **76** includes two pins **76a, 76b**; the pin **76a** is received in the slot **41b** of the front mounting bracket **41**. A slotted link **80** has a slot **80a** that receives the pin **76b** at its rear end. A control link **82** is attached to the front mounting bracket **41** at a pivot **84** and extends generally upwardly therefrom; the slotted link **80** is attached to a central portion of the control link **82** at a pivot **83**. A transition link **86** is attached at its rear end to the upper end of the control link **82** at a pivot **88** and extends downwardly and forwardly therefrom to a pivot **90** with the connecting link **52**. In the unfolded position of **Figures 4** and **6C**, the spring **74** is in tension.

[0023] Referring now to **Figures 7-13**, the bed **15** includes two generally U-shaped legs **94**. The legs **94** are mounted below the seat section **16** and move between a folded position, in which the uprights **95** of the legs **94** extend transversely toward each other and are generally horizontally disposed beneath the seat section **16**, and an unfolded position, in which the uprights **95** of the legs **94** are vertically disposed beneath the seat section **16** and rest on an underlying surface to provide support for the seat section **16** from underneath. In the illustrated embodiment, the distance between the uprights **95** of the legs **94** is between about 16 and 24 inches.

[0024] Folding of the legs **94** is controlled by two leg folding mechanisms **100** as noted above (only one of which will be described herein). Each leg folding mechanism **100** includes a front intermediate section bracket **102** that is mounted beneath the foot end of the intermediate section **20**; the front intermediate section bracket includes a vertical flange **102a**, on which is mounted a cam **103** (**Figure 13**). A seat section bracket **104** with a side flange **104a** and an end flange **104b** is mounted below the seat section **16**. The brackets **102, 104**, which are connected at a pivot **105**, are adjacent to each other when the bed **15** is in the unfolded position of **Figures 10** and **13**.

[0025] Referring to **Figures 9** and **10**, a gear drive link **106** is mounted to the front intermediate section bracket **102** at a pivot **108** and extends forwardly therefrom. A gear **110** with teeth **112** is mounted to the seat section

bracket **104** at a pivot **116** to rotate about a transverse axis. The gear drive link **106** is attached to the gear **110** at a pivot **114**. A sprocket **120** with an extension **126** is fixed to one of the uprights **95** of the leg **94** and is attached to the end flange **104b** of the seat mounting bracket **104** at a pivot **124** that defines a longitudinal pivot axis. The teeth **122** of the sprocket **120** mesh with the teeth **112** of the gear **110**.

[0026] Seen best in **Figures 11-13**, a stop link **130** has a horizontal panel **130a** and a vertical panel **130b**. Two slots **130c**, **130d** are present in the vertical panel **130b** and receive, respectively, pins **104c**, **104d** mounted to the inner surface of the vertical flange **104a** of the seat section bracket **104**. A tab **132** extends forwardly from the horizontal panel **130a**. A mounting extension **138** is fixed to and extends inwardly from the seat section bracket **104**. A pin **138a** extends downwardly from a horizontal panel of the mounting extension **138** and engages a recess in the rearward edge of the horizontal panel **130a** of the stop link **130**. The vertical panel of the mounting extension **138** has an aperture **138c** through which the tab **132** extends. A brace **134** is pivotally attached to the sprocket extension **126** at a pivot **136**. The opposite end of the brace **134** has a pin **134a** that extends into a slot **138b** in the vertical panel of the mounting extension **138**. The brace **134** also has a projection **134b** that engages the tab **132** when the bed **15** is in the unfolded position (see **Figure 10**). A spring **140** is mounted to the side flange **104a** of the seat section bracket **104** via the pin **104d** and to the forward end of the stop link **130** at a post **130e**.

[0027] Referring now to **Figures 7 and 8**, a bracket **150** is mounted to the underside of the foot end of the seat section **16**. A vertical panel **151** is fixed to the bracket **150** and includes a quarter-circular slot **150a**. A tab **150c** extends inwardly; a post **150d** is mounted on the tab **150c**. An extension member **152** is mounted to an upright **95** of the leg **94** and extends to a pivot **160** with the vertical panel **151**. A branch of the extension member **152** extends laterally and includes a pin **152a** that is received in the slot **150a**. (Another embodiment of this portion of the leg folding mechanism is described in U.S. Patent Application No. 13/900,311, *supra*).

[0028] Referring back to **Figures 2, 4 and 5**, the bed **15** also includes a center leg assembly **180** which, as can be seen in **Figure 5**, is mounted toward the center of the bed. The center leg assembly **180** includes a mounting bracket **184** fixed to the underside of the intermediate panel **22**. Two center legs **182** are mounted to the mounting bracket **184** at pivots **186**. Respective pneumatic cylinders **188** are attached to the mounting bracket **184** at pivots **189** and to the center legs **182** at pivots **190**. A cross-member **192** spans lower portions of the center legs **192**.

[0029] The seating unit **10** also includes a backrest cushion assembly **200**, which can be seen in **Figures 1 and 2**. The backrest cushion assembly **200** includes a mounting bracket **202** fixed to the side panels of the back-

rest **13a**. Upper and lower swing links **204**, **208** are attached to the mounting bracket **202** at, respectively, pivots **206**, **210**. A mounting bracket **212** is attached to the upper and lower swing links **204**, **208** at pivots **216**, **218**. A backrest plate **213** (on which is mounted one or more backrest cushions **214**) is fixed to the mounting bracket **212**. A spring **220** is attached to the upper swing link **204** and the mounting bracket **212**.

[0030] To move the bed **15** from the unfolded position of **Figures 4, 5, 6C and 6D** to the folded position of **Figures 1 and 2**, a user lifts the front end of the seat section **16** and moves it rearwardly. This action also lifts the intermediate section **20**, which, supported by the intermediate section bracket **48**, begins to pivot relative to the base **11** (counterclockwise from the vantage point of **Figures 2-4**) about the pivot **50**. As can be seen in **Figure 3**, the seat section **16** remains generally horizontal as the intermediate section **20** pivots relative to it about the pivot **105**. The rotation of the intermediate section **20** also forces the connecting link **52** rearwardly, which drives the head section **24** to rotate counterclockwise about the pivot **44**. This motion continues until a pin **42a** on the head section link **42** contacts the lower edge of the connecting link **52** (see **Figure 6A**), at which point the head section **24** has reached its rearmost position within the cavity **17** and is generally upright (see **Figure 2**). Rotation of the intermediate section **20** about the pivot **50** ceases when it reaches an inverted orientation within the cavity **17** (**Figure 2**). The seat section **16** completes its motion in a generally horizontal but slightly pitched orientation (**Figure 2**) in which a rail **18a** mounted under the front end of the seat frame **18** rests atop the front wall **12**.

[0031] The first portion of the folding action is assisted by the folding assist assembly **72**. It can be envisioned from examination of **Figures 3, 4, 6B and 6C** that, as connecting link **52** drives the head section **24** about the pivot **44**, the connecting link **52** also drives the transition link **86** rearwardly. This motion causes the control link **82** to rotate counterclockwise about the pivot **84**. Rotation of the control link **82** forces the slotted link **80** rearwardly, such that the spring link **76** is drawn clockwise about the pivot **78** by tension in the spring **74**. Thus, this portion of the folding movement is assisted by the tension in the spring **74**; assistance ceases when, as shown in **Figure 3**, the pin **76a** of the spring link **76** reaches the rear end of the slot **41b**.

[0032] It can further be seen in **Figures 2, 3, 6A and 6B** that, as the intermediate section **20** rotates counterclockwise about the pivot **50** and drives the connecting link **52** rearwardly, the spring link **64** of the unfolding assist assembly **60** is driven rearwardly and rotates slightly counterclockwise about the pivot **67** relative to the control link **68**; in addition, the control link **68** rotates slightly counterclockwise about the pivot **69**. However, the spring **62** develops very little tension during this initial portion of the folding action. Once the folding assist assembly **72** has ceased to assist folding (**Figures 3 and 6B**), continued rearward movement of the connecting link **52** forc-

es the spring link **64** rearwardly, which continues the counterclockwise rotation of the control link **68**. Rotation of the control link **68** stretches the spring **62**, thereby generating some resistance to folding of the bed **15** (which can help to prevent dropping or "slamming" of the bed **15** as it closes due to its weight). Rotation of the control link **58** ceases when the pin **68a** reaches the rear end of the slot **41a** (**Figures 2 and 6A**).

[0033] Referring now to **Figures 7-13**, folding of the legs **94** will be described. As can be seen in **Figures 9, 10 and 13**, in the unfolded position, the uprights **95** of the legs **94** extend downwardly away from the seat section **16**. At the forward end of the legs **94**, the pin **152a** of the extension **152** is positioned in the upper end of the slot **150a**. At the rearward end of the legs **94**, and as seen in **Figures 9, 10 and 13**, the stop link **130** is positioned forwardly (held in that position by the cam **103**), such that the pins **104c, 104d** are positioned in the rear ends of the slots **130c, 130d**, which places the spring **140** in tension. The tab **132** extends through the aperture **138c** of the mounting extension **138**; engagement of the tab **132** with the projection **134b** prevents the pin **134a** from moving inwardly in the slot **138b**, which in turn prevents the sprocket **120** and attached leg **94** from rotating about the pivot **124**. Such rotation is also prevented by the engagement of the teeth **122** of the sprocket **120** with the teeth **112** of the gear **110**.

[0034] As an operator lifts the seat section **16** to move the bed **15** to the folded position, the pivoting of the intermediate section **20** relative to the seat section **16** about the pivot **105** rotates the cam **103** relative to the stop link **130**, which enables the spring **136** to contract to draw the stop link **130** rearwardly, thereby drawing the tab **132** of the stop link **130** rearwardly in the aperture **138c** of the mounting extension **138**. After the tab **132** is sufficiently withdrawn to clear the projection **134** (**Figures 9 and 12**), the sprocket **120** and adjoined leg **94** are free to rotate about the pivot **124**. The continued relative rotation of the intermediate section **20** and the seat section **16** draws the gear drive link **106** forwardly, which action rotates the gear **110** clockwise (from the vantage point of **Figure 9**) about the pivot **116**. Rotation of the gear **110** rotates the sprocket **120** about the pivot **124** such that the uprights **95** of the leg **94** pivot along a longitudinal axis and extend inwardly to fold underneath the seat section **16** and above the intermediate section **20** (**Figures 2 and 11**). During this rotation, the post **134a** of the brace **134** moves inwardly in the slot **138b** of the mounting extension **138**. Rotation of the foot end upright **95** also rotates the extension **152** relative to the vertical panel **151** of the foot bracket **150** about the pivot **160**, such that the pin **152a** moves downwardly within the slot **150a**, which provides stability and smoothness to the movement of the leg **94**.

[0035] Unfolding of the bed **15** from the folded position of **Figure 1** to the unfolded position of **Figures 4 and 6** is initiated by lifting the front edge of the seat section **16** and pulling it away from the base **11** of the seating unit

10. The bed folding mechanisms **30** and the leg folding mechanisms **100** reverse the movements described above to enable the bed **15** to unfold, with the legs **94** being fully extended downwardly when the gear drive link **106** is fully forward (approximately the position of **Figures 3, 9 and 12**) and becoming locked in the vertical disposition when the tab **132** enters the aperture **138c** of the mounting extension **138c** and engages the projection **134b** of the brace **134** (**Figures 4, 10 and 13**). Movement ceases when the rear edge of the head section link **42** strikes a pin **40a** on the rear mounting bracket **40** (**Figure 6C**). The folding resist assembly **60** assists in the unfolding operation until the control link **68** rotates clockwise sufficiently that the tension in the spring **62** is substantially absent (approximately the point in the movement shown in **Figures 3 and 6B**). At essentially that point in the movement, the unfolding resist assembly **72** begins to resist the unfolding. The forward movement of the connecting link **52** draws the slotted link **80** forward, which rotates the spring link **76** counterclockwise about the pivot **78** and generates tension in the spring **74**. This biasing of the bed **15** away from the unfolded position can prevent the bed **15** from slamming down into the unfolded position due to its weight.

[0036] Also, during unfolding of the bed **15**, the center leg assembly **180** unfolds the center legs **182**. In the folded position of **Figure 2**, the center legs **182** are generally parallel with the intermediate section **20**, and the pneumatic cylinders **188** are retracted. As the intermediate section **20** rotates away from the seat section **16**, the pneumatic cylinders **188** force the center legs **182** to rotate about the pivots **186**. Early in the unfolding action, the center legs **182** press against the seat panel **18** of the seat section **16**; because the pneumatic cylinders are biased toward their extended positions, the contact of the center legs **182** against the seat panel **18** assists the bed **15** in unfolding. The center leg assembly **180** is fully extended when the pneumatic cylinders **188** are extended (**Figure 4**).

[0037] Further, as shown in **Figures 2-4**, the cushion **24a** of the head section **24** has a front edge that slopes rearwardly from top to bottom, and the cushion **20a** of the intermediate section **20** has a rear edge that slopes forwardly from bottom to top. The rear edge of the cushion **24a** meets the front edge of the cushion **20a** to form a seam therebetween that is "tighter" than would be the case if the mating edges did not slope as described.

[0038] It should also be noted that, in **Figures 2-4** that illustrate the folding and unfolding of the bed **15**, the backrest cushion assembly **200** is in a raised position. In this position, the spring **220** is in tension. As such, it maintains an "over-center" condition between pivots **206, 210 and 218**, which maintains the backrest cushion assembly **200** in the raised position. As can be seen in **Figure 1**, the backrest cushion **214** can be lowered by applying a downward force to the backrest cushion **214** and/or backrest plate **213**, which causes the upper and lower swing links **204, 208** to rotate clockwise about the pivots **206, 210**.

The upper and lower swing links **204, 208** rotate through an "on-center" condition (when the links **204, 208** are generally horizontal) after which the spring **220** biases the backrest cushion assembly **200** in the lowered position shown in **Figure 1**. The assembly **200** typically remains in this position for much of the time the seating unit **10** is in use, only being raised when the bed **15** is to be unfolded.

[0039] Some advantages of the seating unit are described in U.S. Patent Application No. 13/900,311, *supra*. For example, one of the advantages of the arrangement and movement of the legs **94** can be understood with reference to **Figure 14**. In prior foldable beds that fold and unfold similarly (*i.e.*, the seat and head sections maintain their orientation in both the folded and unfolded positions, and the intermediate section is inverted in the unfolded position from its orientation in the folded position), such as that discussed in U.S. Patent Publication No. 2011/0010847 to Murphy, solid panels were included below the cushions of the seat, intermediate and head sections to provide support. While the combination of solid panel and cushion typically provided an acceptable sleeping surface, it often did not provide a comfortable surface for a seated occupant when the bed was in its folded position, as the weight of the seated occupant could "bottom out" the cushion, thereby forcing the occupant to feel the hard surface of the seat panel as support. By including open subframes **302** upon which the cushions of the seat section **16** are mounted, the seat section **16** can provide a seating surface that resembles that of a conventional seating unit. The uprights **95** of the legs **94** are positioned near the vertical panels **305, 307** of the subframes **302**, and therefore do not significantly impact the seating comfort provided by the cushions **316** and springs **314**.

[0040] In addition, a typical seating unit would have sufficient width that multiple people could be seated thereon (*e.g.*, a love seat would have two spots for sitting, a couch would have three spots, etc.). However, prior multi-seat seating units would include only a single wide cushion that covered the entire seat section. This provided an appearance that was undesirable for some consumers. However, the seat section **16** can provide a multi-cushion appearance for multi-seat seating units, which may be more desirable to consumers.

[0041] Those skilled in this art will appreciate that seating units according to embodiments of the present invention may take a number of different forms. For example, while legs supporting the seat section in the unfolded position and pivoting about a longitudinal axis may be employed with seating units that fold in the manner described, such legs may also be employed with seating units of different varieties. For example, the seating units described in U.S. Patent Nos. 2,740,131; 4,200,191; and 4,737,996 and in U.S. Patent Publication Nos. 2007/0283491 and 2011/0010847 may be suitable for use with the present invention. In addition, either or both of the folding assist unit and the folding resist unit may

be omitted as desired.

[0042] In addition, embodiments of the seated unit discussed and illustrated herein can provide additional advantages. For example, by positioning the head section **24** in a vertical orientation in the folded position, the designer may have more flexibility with the design of the cushions used in the seat, intermediate and head sections. Thicker cushions can be used for these sections, as only two sections (the seat and intermediate sections) are vertically stacked within the cavity of the base when the seating unit is in the folded position. This may provide more comfortable seating and/or more comfortable sleeping for occupants, and may enable a foldable bed of this type to be used in conjunction with a wider variety of sofas, including "off-the-floor" styles.

[0043] Also, by including the backrest cushion assembly **200**, the designer has the flexibility to use any thickness cushion, rather than being confined to a certain thickness in the event that the head section of the bed also serves as the backrest. Moreover, in some furniture units the backrest cushions are removed and laid aside before the bed is unfolded. The backrest cushion assembly **200** keeps the backrest cushions in a neatly organized fashion even when the bed is unfolded.

[0044] In addition, the presence of the center leg assembly **180** can add stability to the bed **15** after it is unfolded and supporting an occupant. Further, the use of pneumatic cylinders or other means that bias the intermediate and seat sections toward the unfolded position when they are folded can assist in the act of unfolding the bed.

[0045] Those skilled in this art will appreciate that seating units according to embodiments of the present invention may take a number of different forms. For example, either or both of the folding assist unit and the folding resist unit may be omitted as desired. In addition, the mechanism employed to rotate the legs that support the seat section may vary. For example, rather than inducing rotation in the legs via intermeshing gears, the mechanism may employ a series of pivoting links. Also, while the illustrated embodiment is configured such that the legs are essentially fully unfolded by the intermediate position shown in **Figures 3, 9 and 10**, the mechanism may be configured so that the legs unfold either earlier or later in the movement of the bed.

[0046] Further, the configuration of the legs themselves may vary. For example, although each of the legs is illustrated as a single generally U-shaped member, it may be configured instead as a U-shaped loop. Alternatively, the seating unit may include four separate leg members, each a straight member, rather than two legs with two upright each. In other embodiments, only two or three uprights may be included rather than four. Other configurations may be apparent to those of skill in this art.

[0047] Finally, in some embodiments either or both of the center leg assembly **180** and the backrest cushion assembly **200** may be omitted.

[0048] The foregoing is illustrative of the present in-

vention and is not to be construed as limiting thereof. Although exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

Claims

1. A seating unit (10) that includes a foldable bed, the seating unit comprising:

a base (11) with an internal cavity (17) and a rear wall (13);

a foldable bed that includes separate and distinct head, intermediate and seat sections (24, 20, 16), wherein the intermediate section (20) and the seat section (16) are pivotally attached to each other, wherein in a folded position, the intermediate and seat sections (20, 16) are generally horizontally disposed and positioned in vertically stacked relationship, and the head section (24) is generally vertically disposed and positioned adjacent the rear wall (13) of the base with a support surface facing rearwardly, and wherein in an unfolded position, the head, intermediate and seat sections (24, 20, 16) are generally horizontally disposed and in serial alignment with each other, with the support surface of the head section (24) facing upwardly; and a bed folding mechanism that is attached to the base (11) and the head, intermediate and seat sections (24, 20, 16) that controls the movement of the bed between the folded and unfolded positions.

2. The seating unit defined in Claim 1, wherein:

the head section (24) pivots relative to the base (11) about a single pivot axis in moving between the folded and unfolded positions; or
the head section (24) includes a cushion with a sloped front edge, and the intermediate section (20) includes a cushion with a sloped rear edge.

3. The seating unit defined in Claim 1 or Claim 2, comprising a backrest cushion assembly (200) attached to the base (11) that is movable between raised and lowered positions.

4. The seating unit defined in any preceding Claim, comprising: (a) a leg (94) pivotally attached to the seat section (16) and (b) a leg folding assembly (100)

mounted to the intermediate section (20) and the seat section (16), wherein the leg (94) is configured to reside between the intermediate and seat sections (20, 16) when the seating unit is in the folded position and under the seat section when the seating unit is in the unfolded position.

5. The seating unit defined in Claim 4 wherein the leg (94) pivots about a generally horizontal axis that is parallel with the longitudinal direction of the seating unit (10).

Patentansprüche

1. Sitzeinheit (10), die ein Klappbett umfasst, wobei die Sitzeinheit Folgendes umfasst:

eine Basis (11) mit einem inneren Hohlraum (17) und einer Rückwand (13);

ein Klappbett, das einen Kopf-, einen Mittel- und einen Sitzabschnitt (24, 20, 16), die getrennt und voneinander verschieden sind, umfasst, wobei der Mittelabschnitt (20) und der Sitzabschnitt (16) schwenkbar aneinander befestigt sind, wobei in einer zusammengeklappten Stellung der Mittel- und der Sitzabschnitt (20, 16) allgemein horizontal angeordnet und in vertikal gestapelter Beziehung positioniert sind und der Kopfabschnitt (24) allgemein vertikal angeordnet und der Rückwand (13) der Basis benachbart positioniert ist, sodass eine Auflagefläche nach hinten weist, und wobei in einer aufgeklappten Stellung der Kopf-, der Mittel- und der Sitzabschnitt (24, 20, 16) allgemein horizontal angeordnet sind und sich miteinander fluchtend in Reihe befinden, sodass die Auflagefläche des Kopfabschnitts (24) nach oben weist; und einen Bettklappmechanismus, der an der Basis (11) und dem Kopf-, dem Mittel- und dem Sitzabschnitt (24, 20, 16) befestigt ist, der die Bewegung des Betts zwischen der zusammengeklappten und der aufgeklappten Stellung kontrolliert.

2. Sitzeinheit nach Anspruch 1, wobei:

der Kopfabschnitt (24) bei der Bewegung zwischen der zusammengeklappten und der aufgeklappten Stellung relativ zu der Basis (11) um eine einzige Schwenkachse schwenkt; oder
der Kopfabschnitt (24) ein Polster mit einer schrägen Vorderkante umfasst und der Mittelabschnitt (20) ein Polster mit einer schrägen Hinterkante umfasst.

3. Sitzeinheit nach Anspruch 1 oder Anspruch 2, umfassend eine an der Basis (11) befestigte Rücken-

lehnenpolsteranordnung (200), die zwischen einer angehobenen und einer abgesenkten Stellung bewegbar ist.

4. Sitzeinheit nach einem der vorangehenden Ansprüche, umfassend: (a) einen Fuß (94), der schwenkbar an dem Sitzabschnitt (16) befestigt ist, und (b) eine Fußklappanordnung (100), die an dem Mittelabschnitt (20) und dem Sitzabschnitt (16) angebracht ist, wobei der Fuß (94) dazu konfiguriert ist, sich zwischen dem Mittel- und dem Sitzabschnitt (20, 16) zu befinden, wenn die Sitzeinheit in der zusammengeklappten Stellung ist, und unter dem Sitzabschnitt, wenn die Sitzeinheit in der aufgeklappten Stellung ist.
5. Sitzeinheit nach Anspruch 4, wobei der Fuß (94) um eine allgemein horizontale Achse schwenkt, die zu der Längsrichtung der Sitzeinheit (10) parallel ist.

Revendications

1. Unité formant siège (10) incluant un lit pliant, l'unité formant siège comprenant :

une base (11) comportant une cavité intérieure (17) et une paroi arrière (13) ;
un lit pliant qui comprend des sections de tête, intermédiaire et d'assise (24, 20, 16) séparées et distinctes, la section intermédiaire (20) et la section d'assise (16) étant attachées l'une à l'autre de manière pivotante ; dans une position pliée, les sections intermédiaire et d'assise (20, 16) étant disposées globalement de façon horizontale et placées en empilement vertical l'une sur l'autre, et la section de tête (24) étant disposée globalement de façon verticale et placée de manière adjacente à la paroi arrière (13) de la base avec une surface de support orientée vers l'arrière ; et dans une position dépliée, les sections de tête, intermédiaire et d'assise (24, 20, 16) étant disposées globalement de façon horizontale et en alignement l'une à la suite de l'autre, la surface de support de la section de tête (24) étant orientée vers le haut ; et
un mécanisme de pliage de lit qui est attaché à la base (11) et aux sections de tête, intermédiaire et d'assise (24, 20, 16), qui commande le déplacement du lit entre les positions pliée et dépliée.

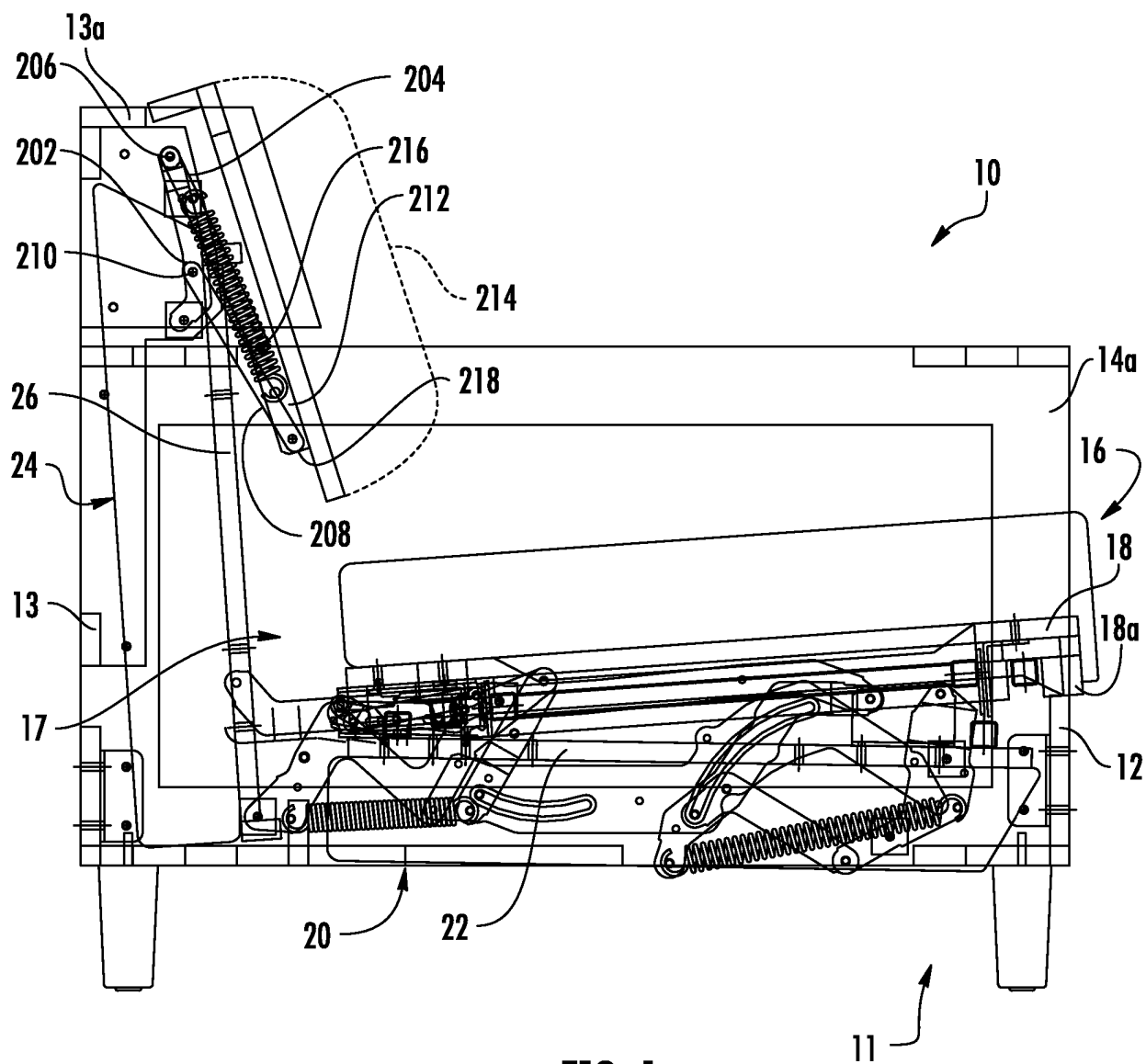
2. Unité formant siège selon la revendication 1, dans laquelle :

la section de tête (24) pivote par rapport à la base (11) autour d'un axe de pivotement unique lors du déplacement entre les positions pliée et

dépliée ; ou

la section de tête (24) inclut un coussin comportant un bord avant incliné, et la section intermédiaire (20) inclut un coussin comportant un bord arrière incliné.

3. Unité formant siège selon la revendication 1 ou la revendication 2, comprenant un ensemble coussin de dossier (200) attaché à la base (11) qui est déplaçable entre des positions relevée et abaissée.
4. Unité formant siège selon l'une quelconque des revendications précédentes, comprenant : (a) un pied (94) attaché de manière pivotante à la section d'assise (16) et (b) un ensemble de pliage de pied (100) installé sur la section intermédiaire (20) et la section d'assise (16), le pied (94) étant conçu pour être situé entre les sections intermédiaire et d'assise (20, 16) lorsque l'unité formant siège se trouve dans la position pliée et sous la section d'assise lorsque l'unité formant siège se trouve dans la position dépliée.
5. Unité formant siège selon la revendication 4, dans laquelle le pied (94) pivote autour d'un axe globalement horizontal qui est parallèle à la direction longitudinale de l'unité formant siège (10).



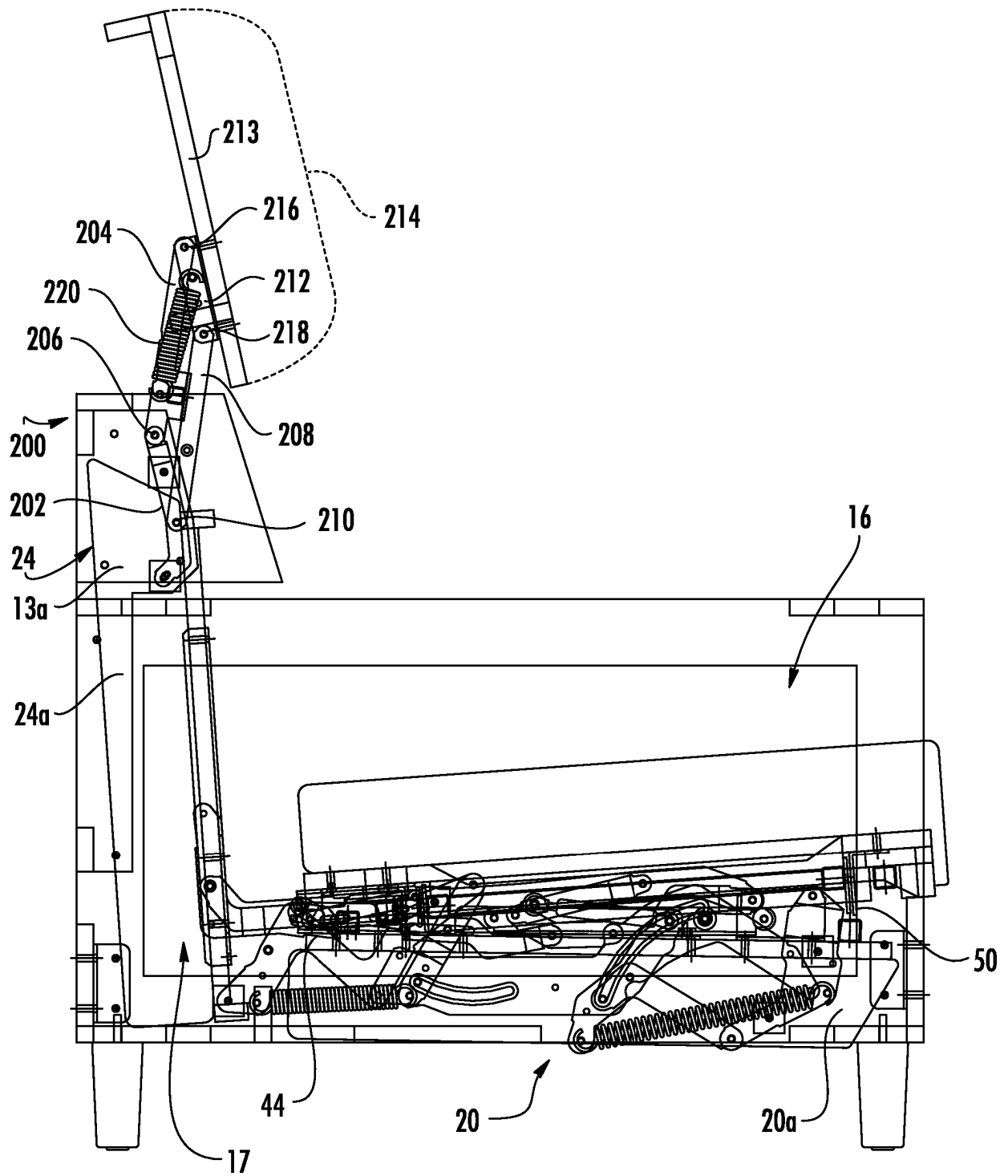


FIG. 2

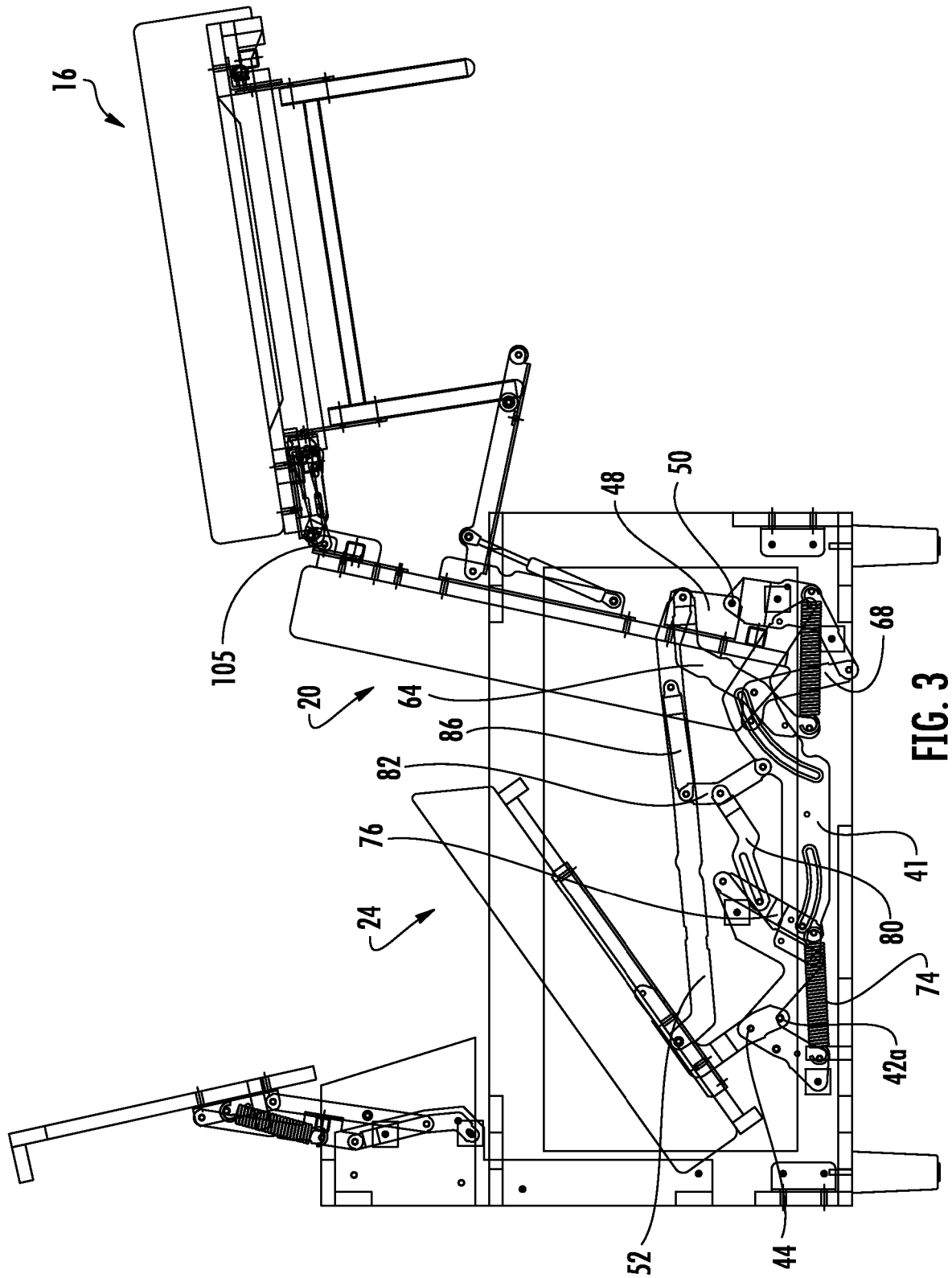
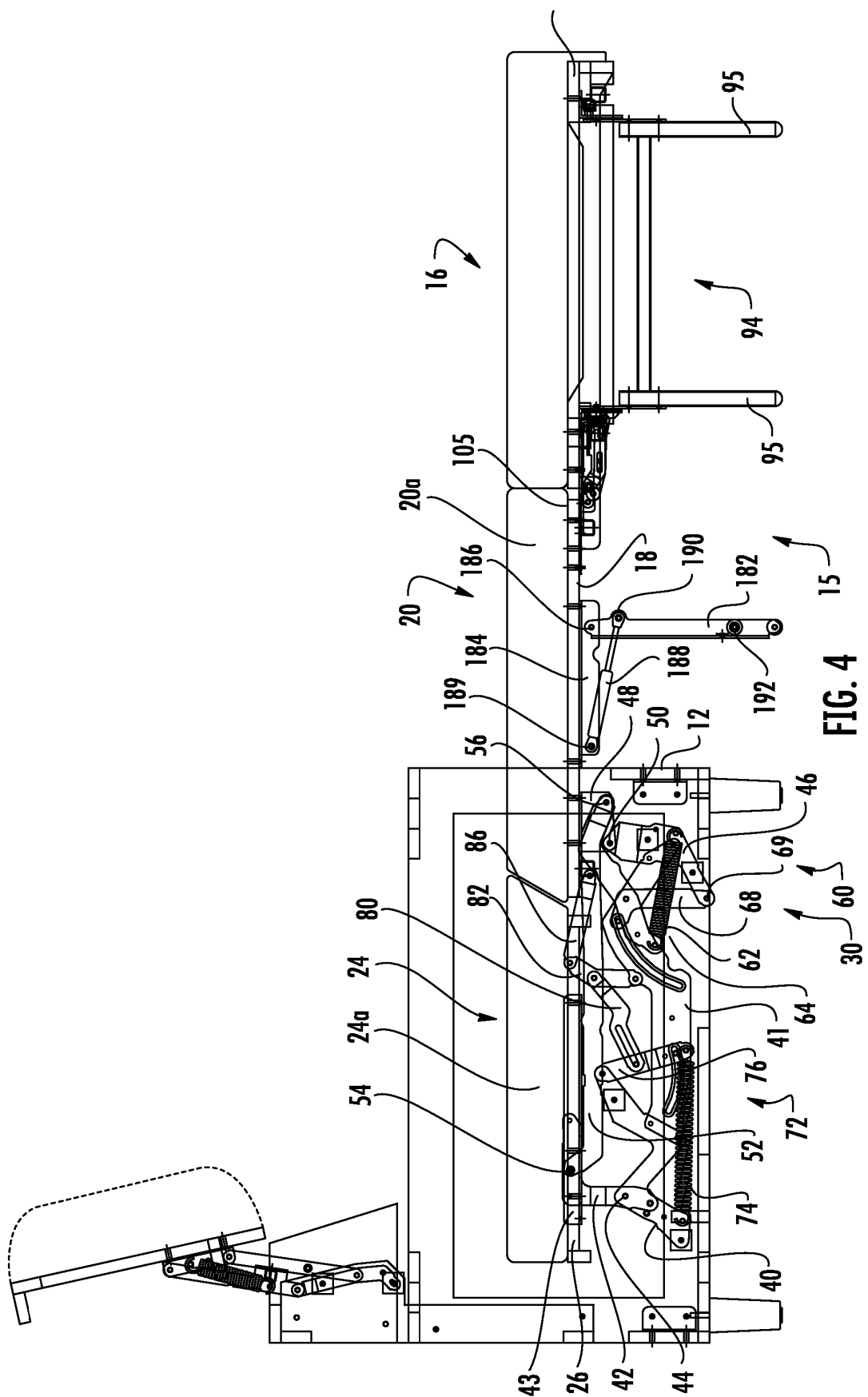
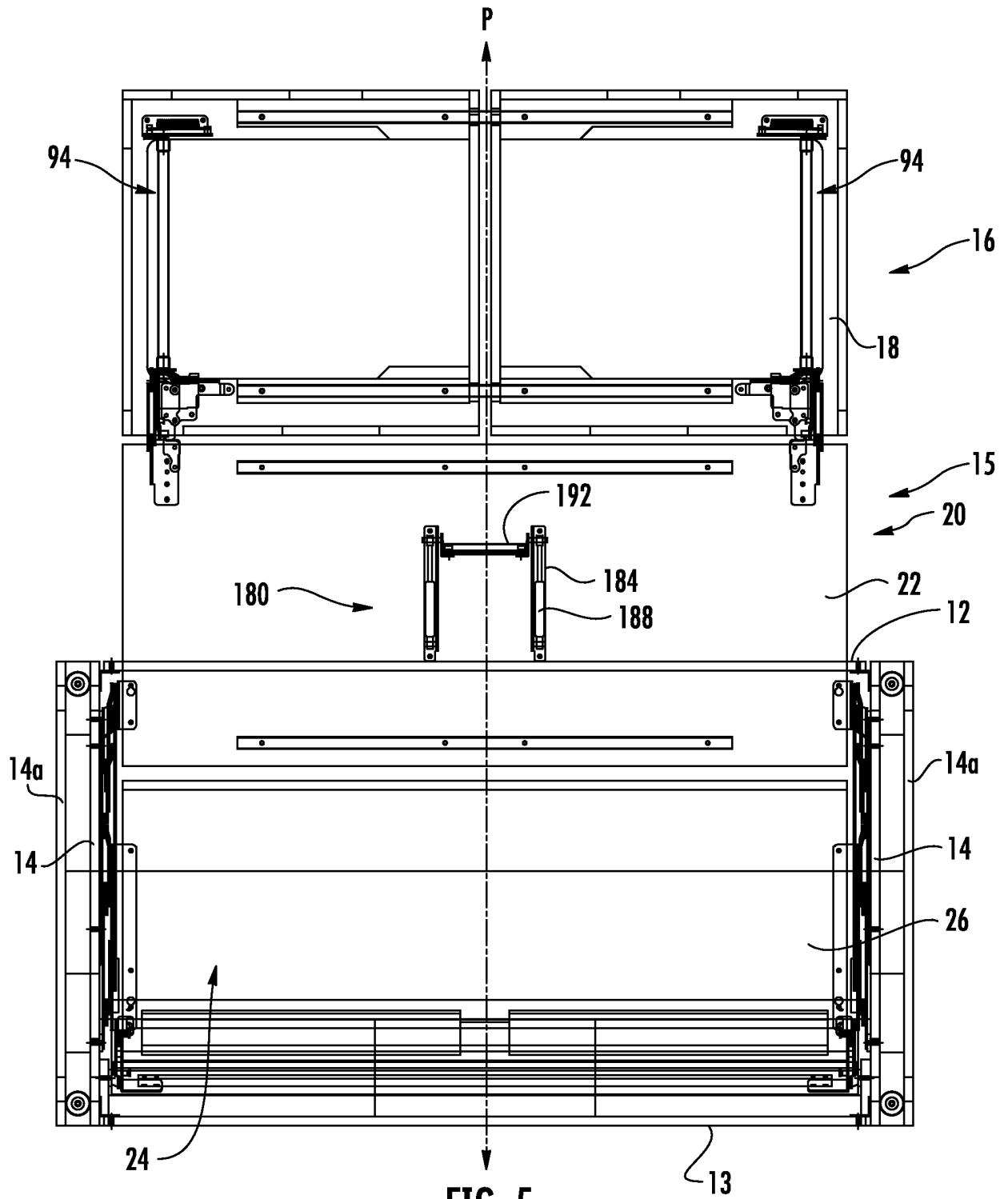


FIG. 3





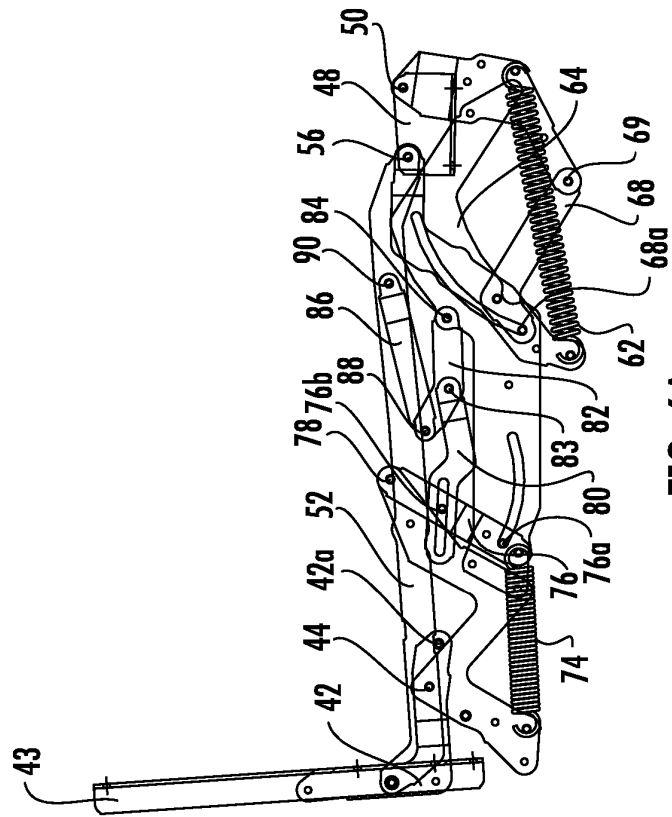


FIG. 6A

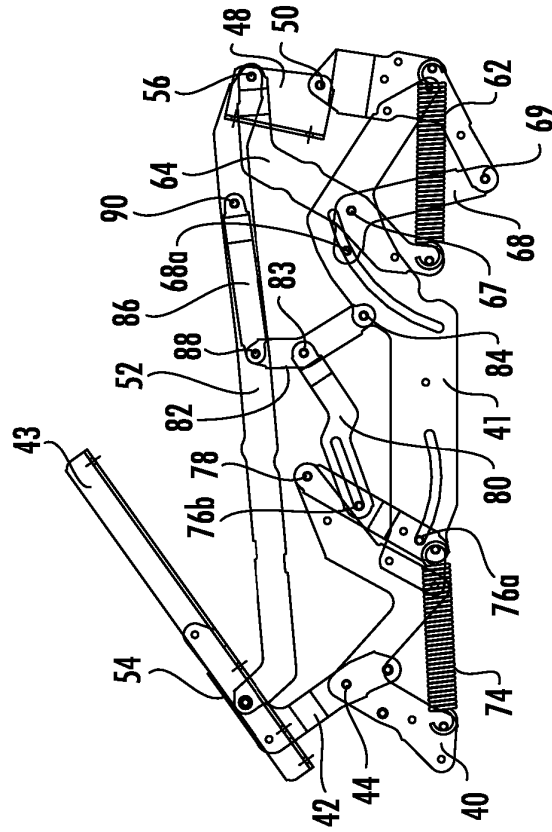
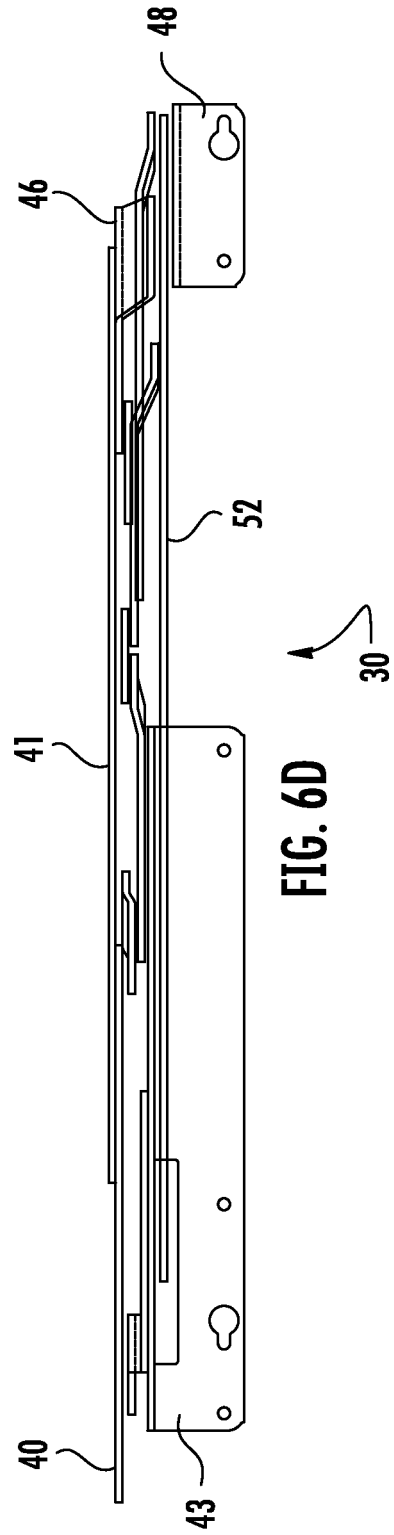
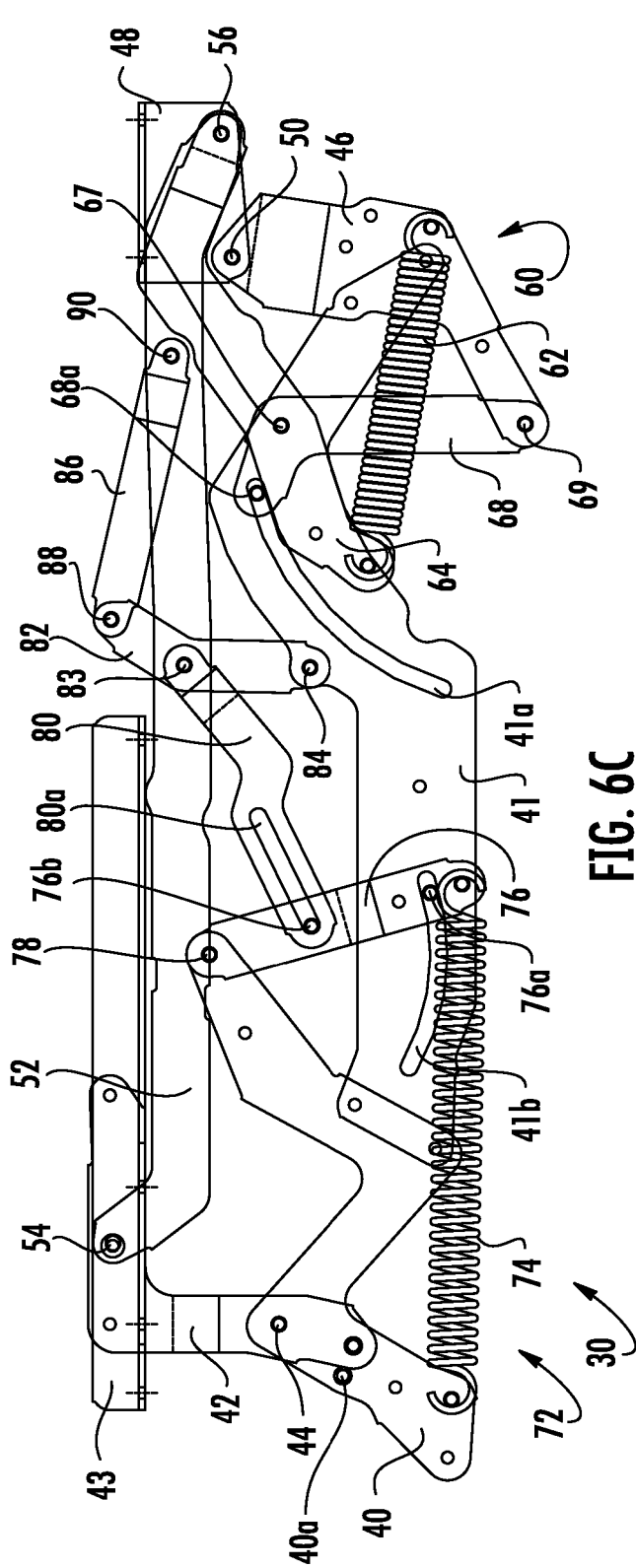
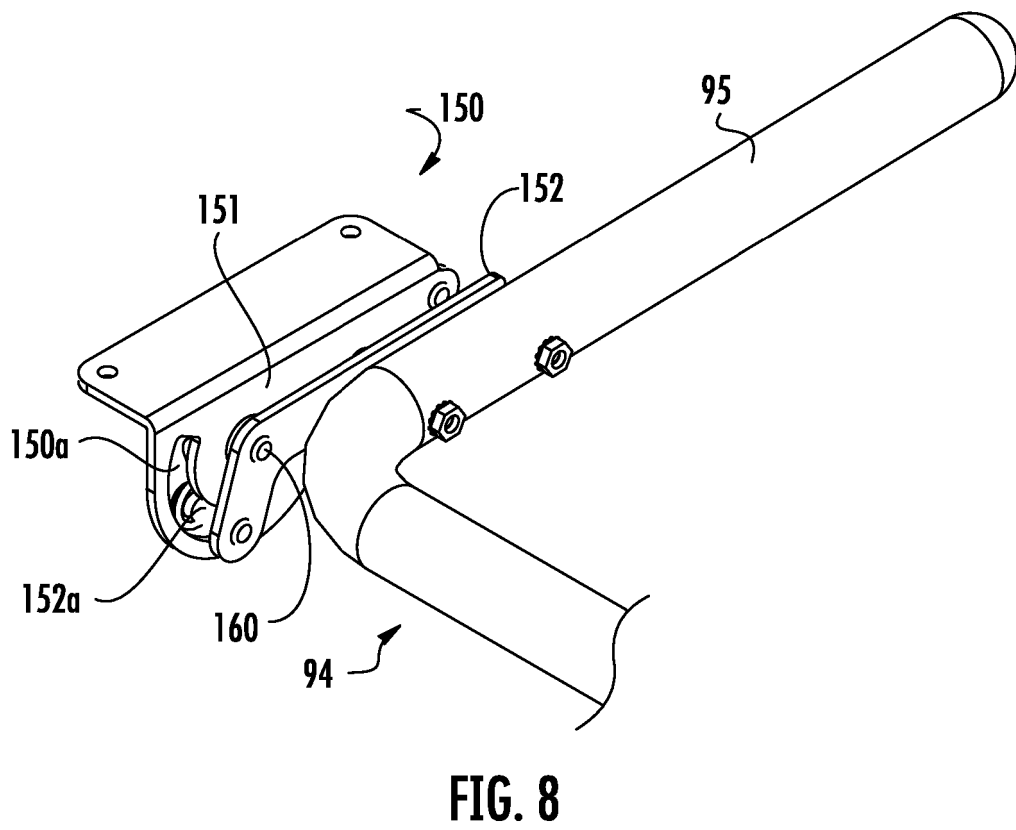
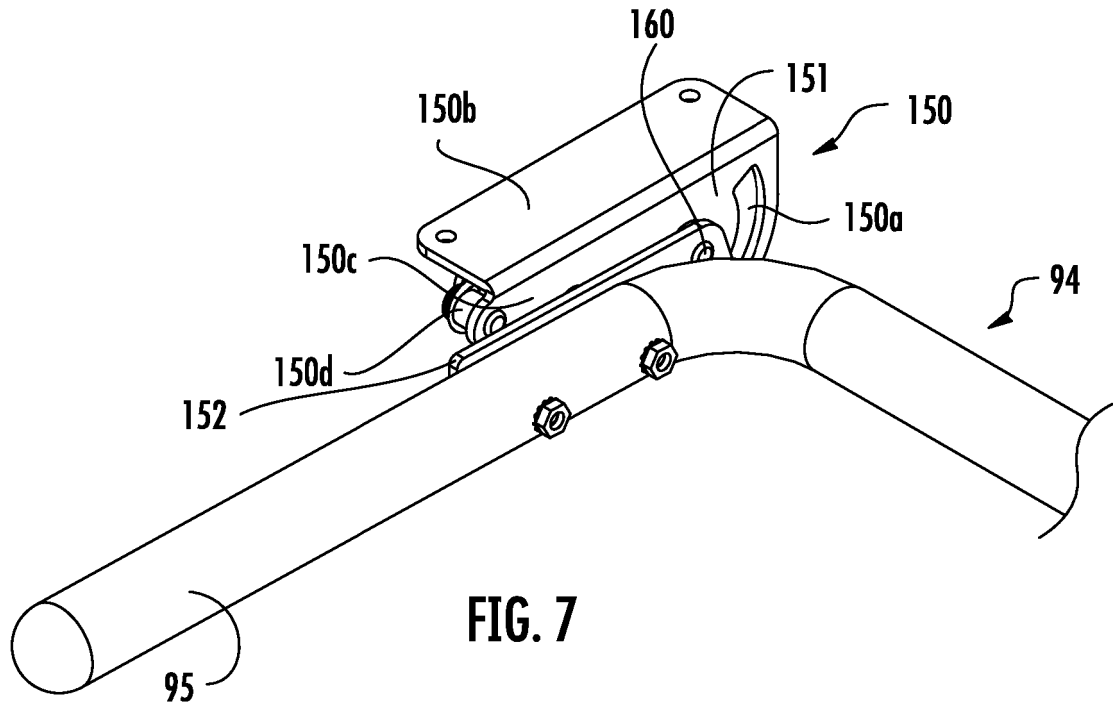


FIG. 6B





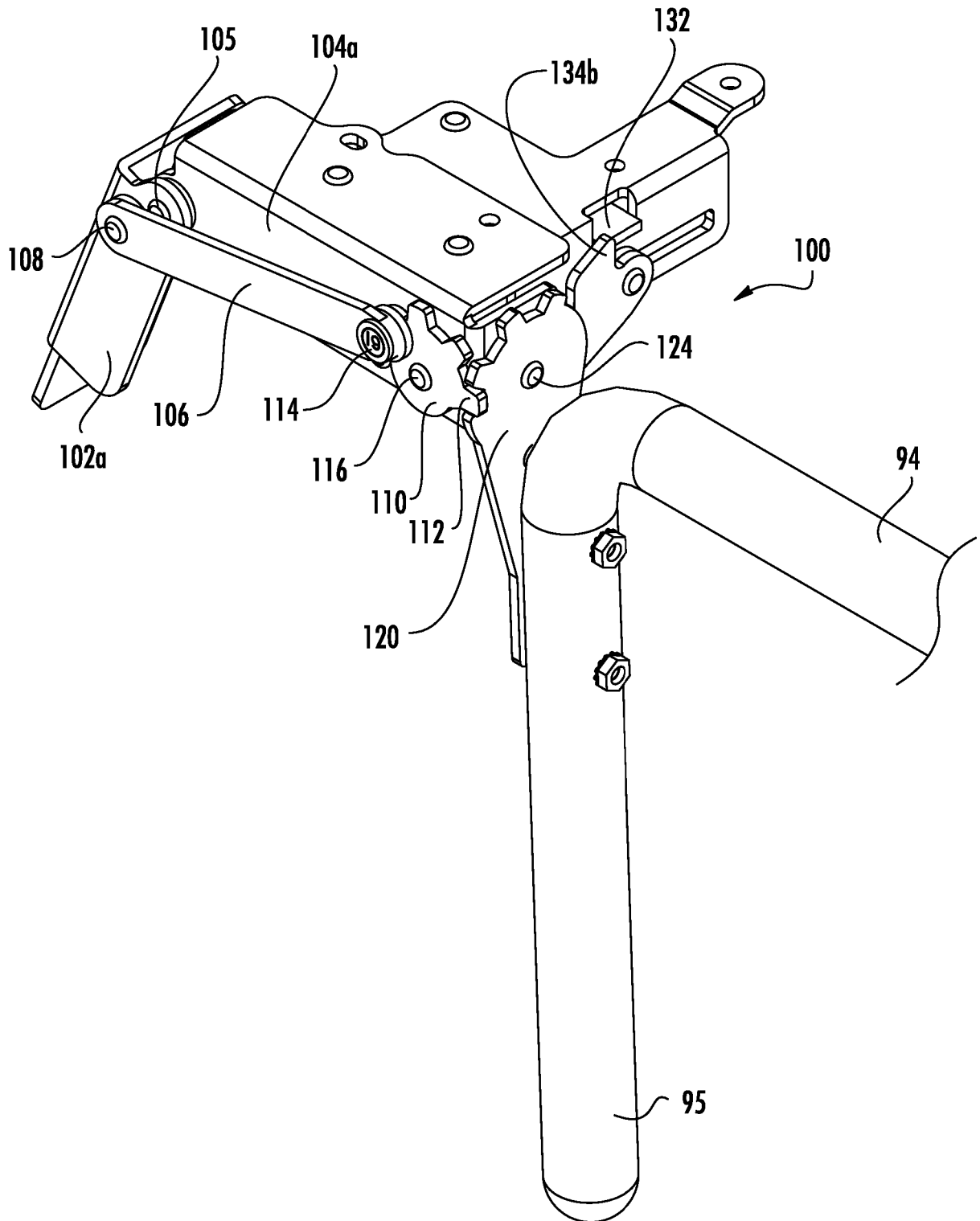


FIG. 9

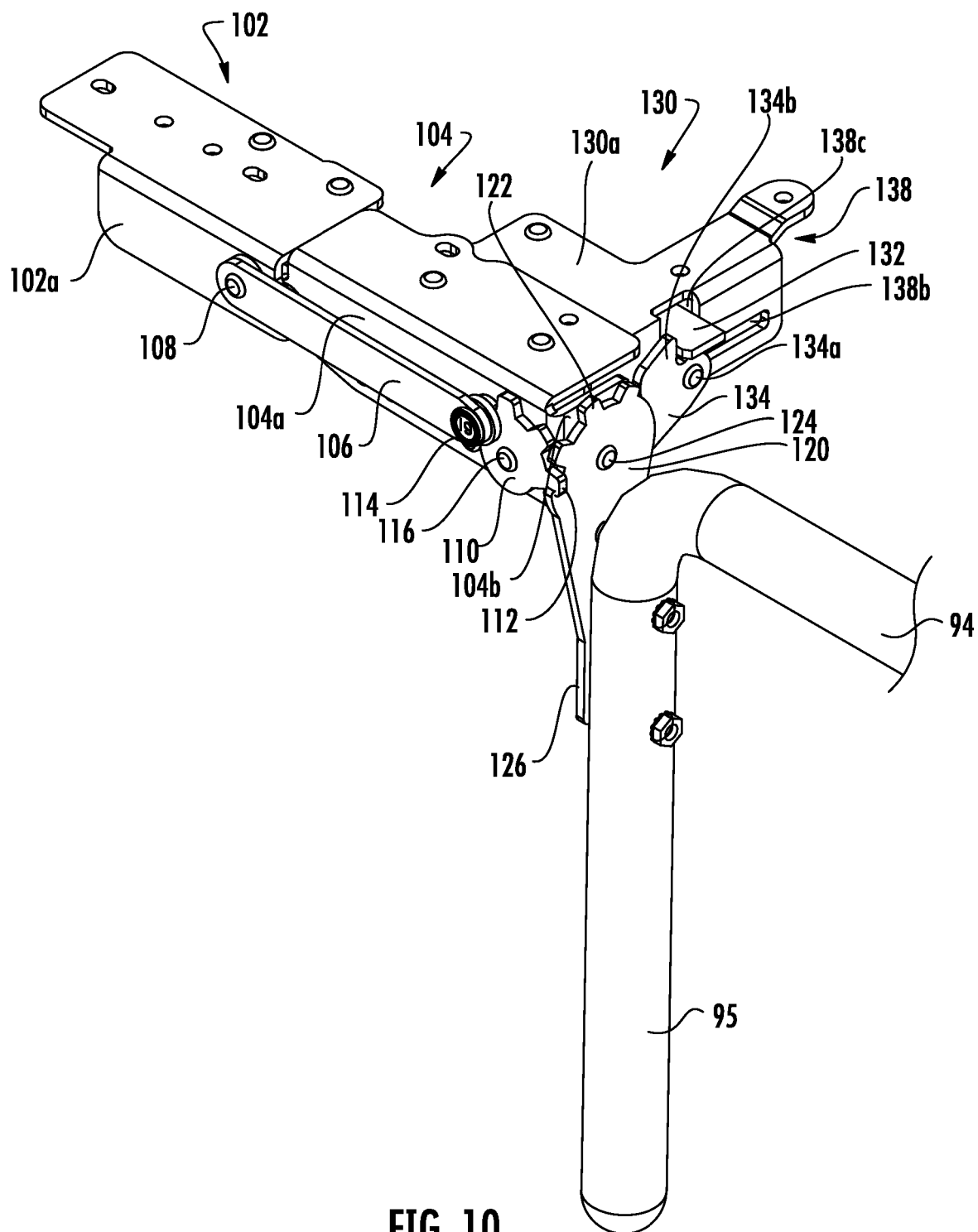


FIG. 10

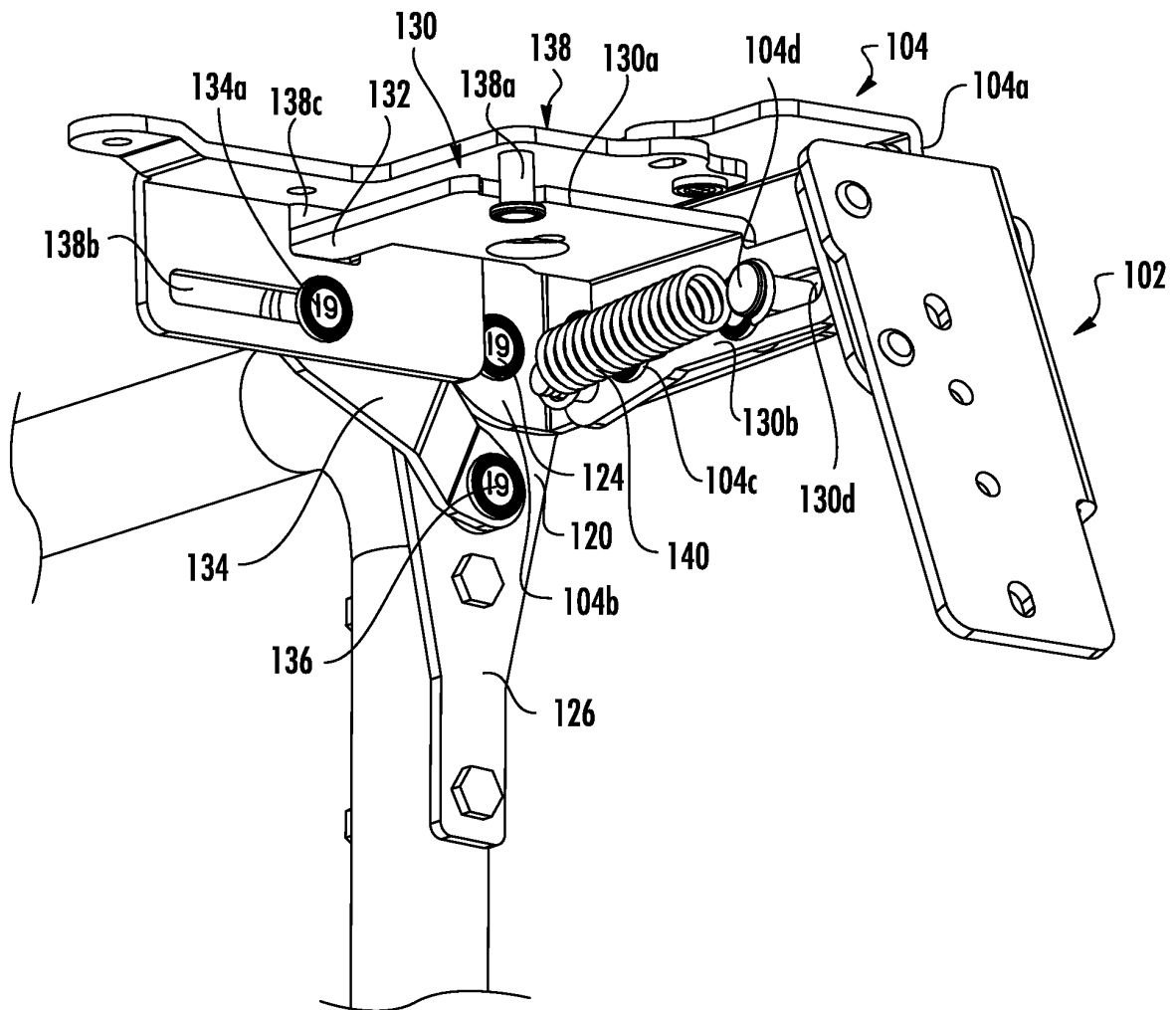
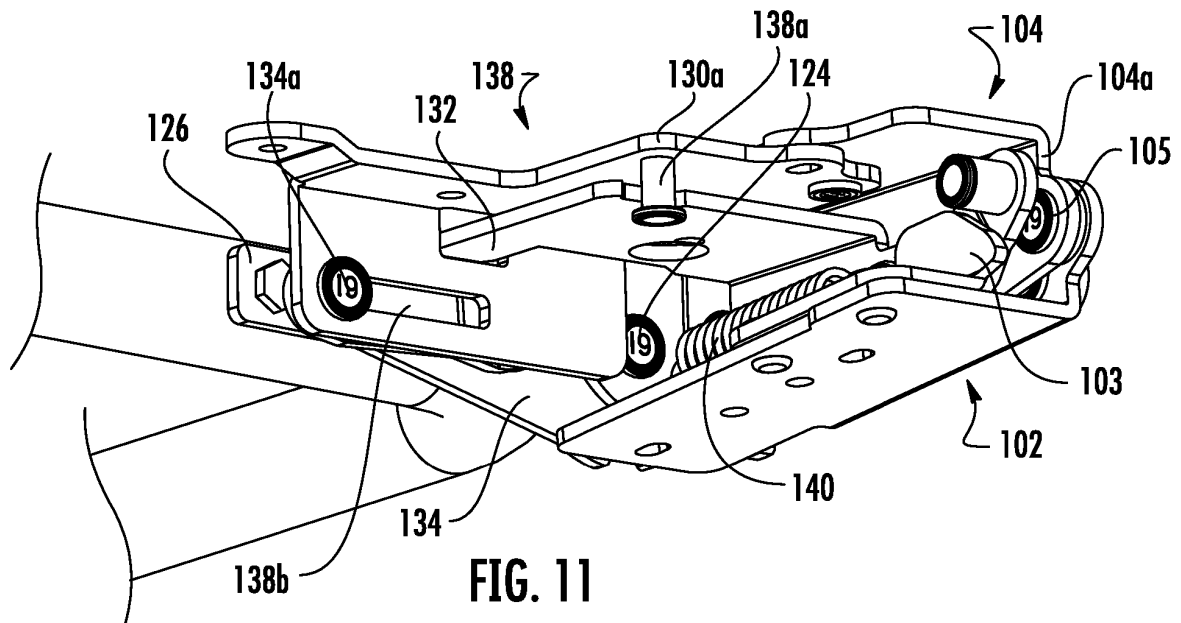


FIG. 12

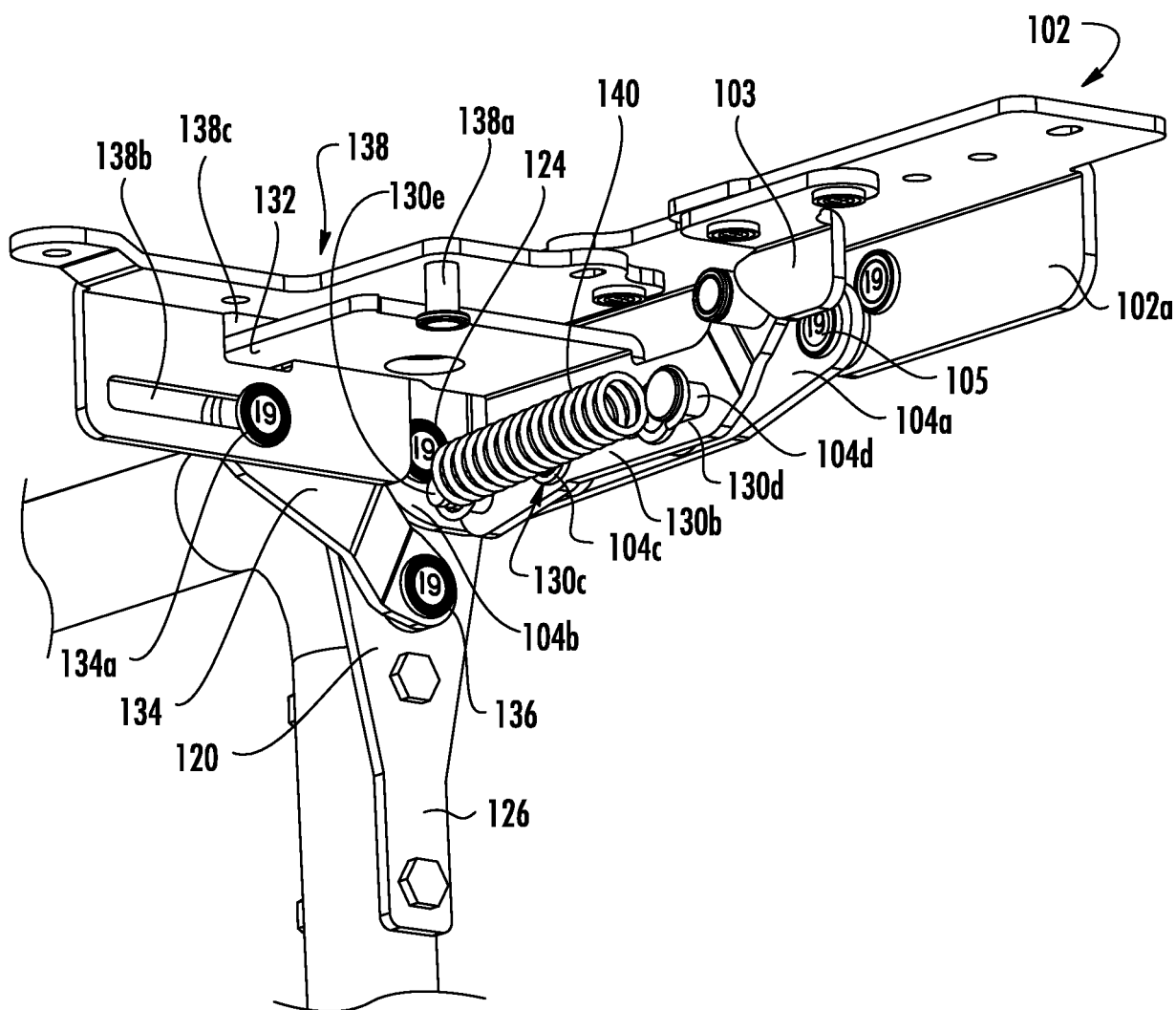


FIG. 13

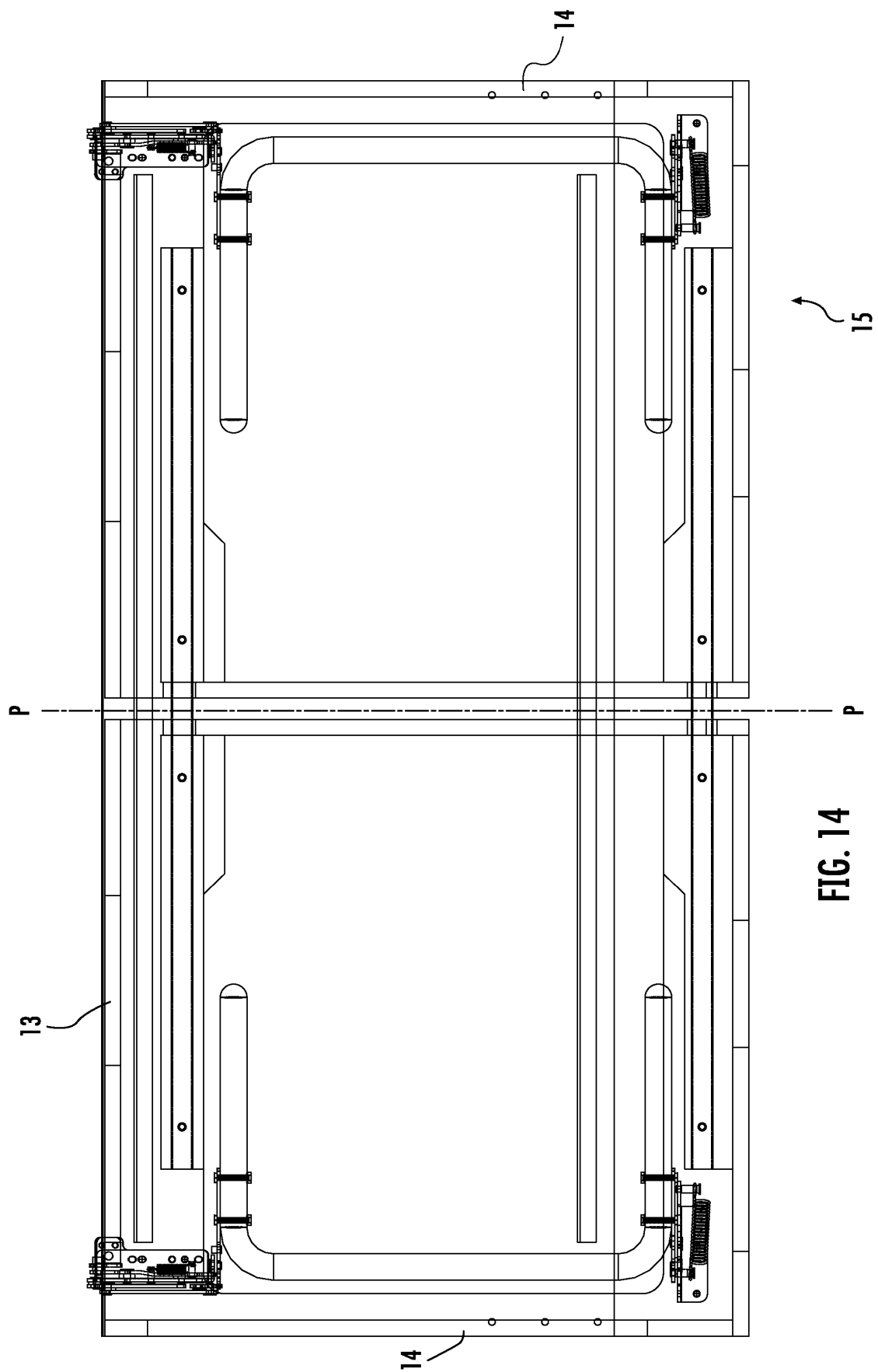
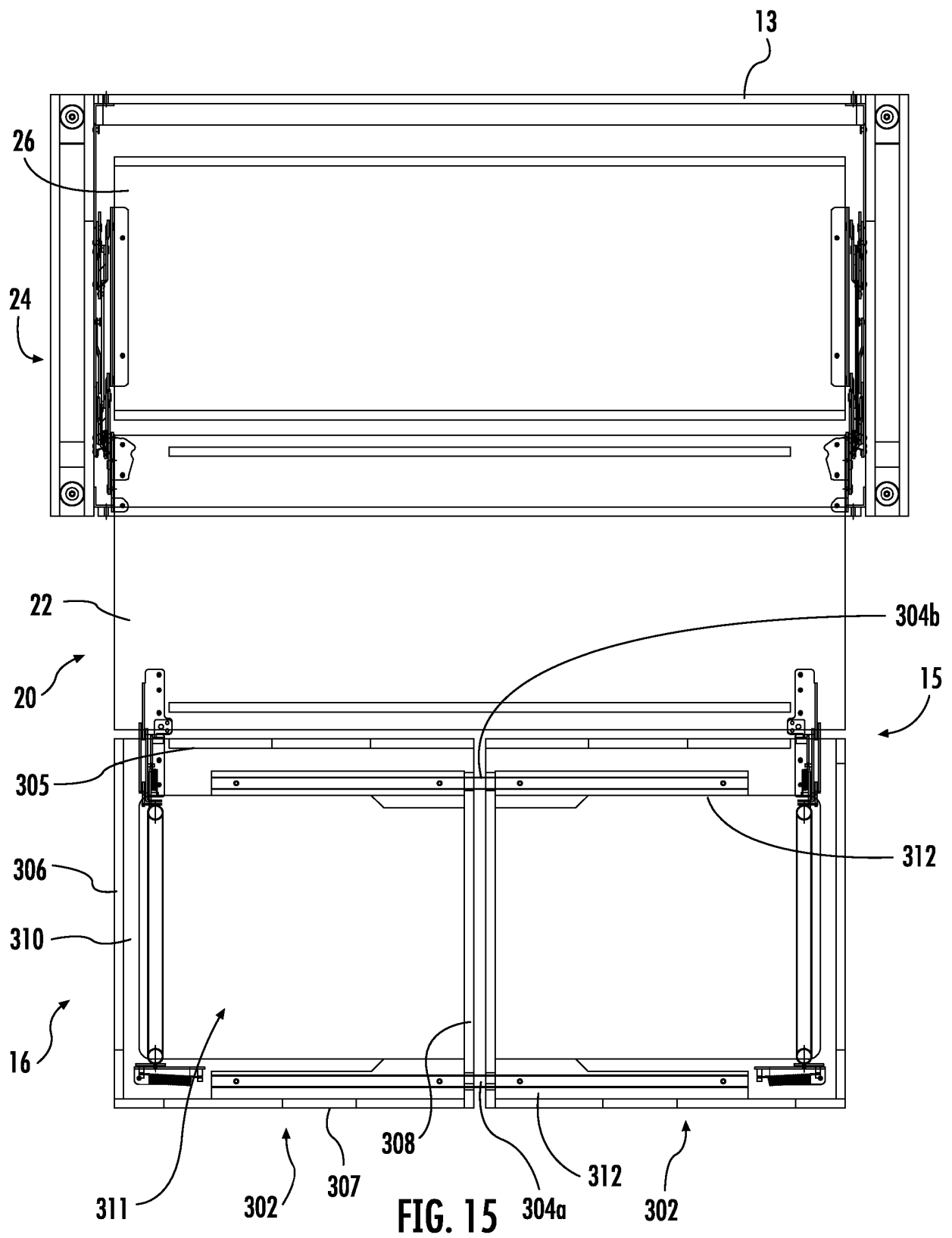


FIG. 14



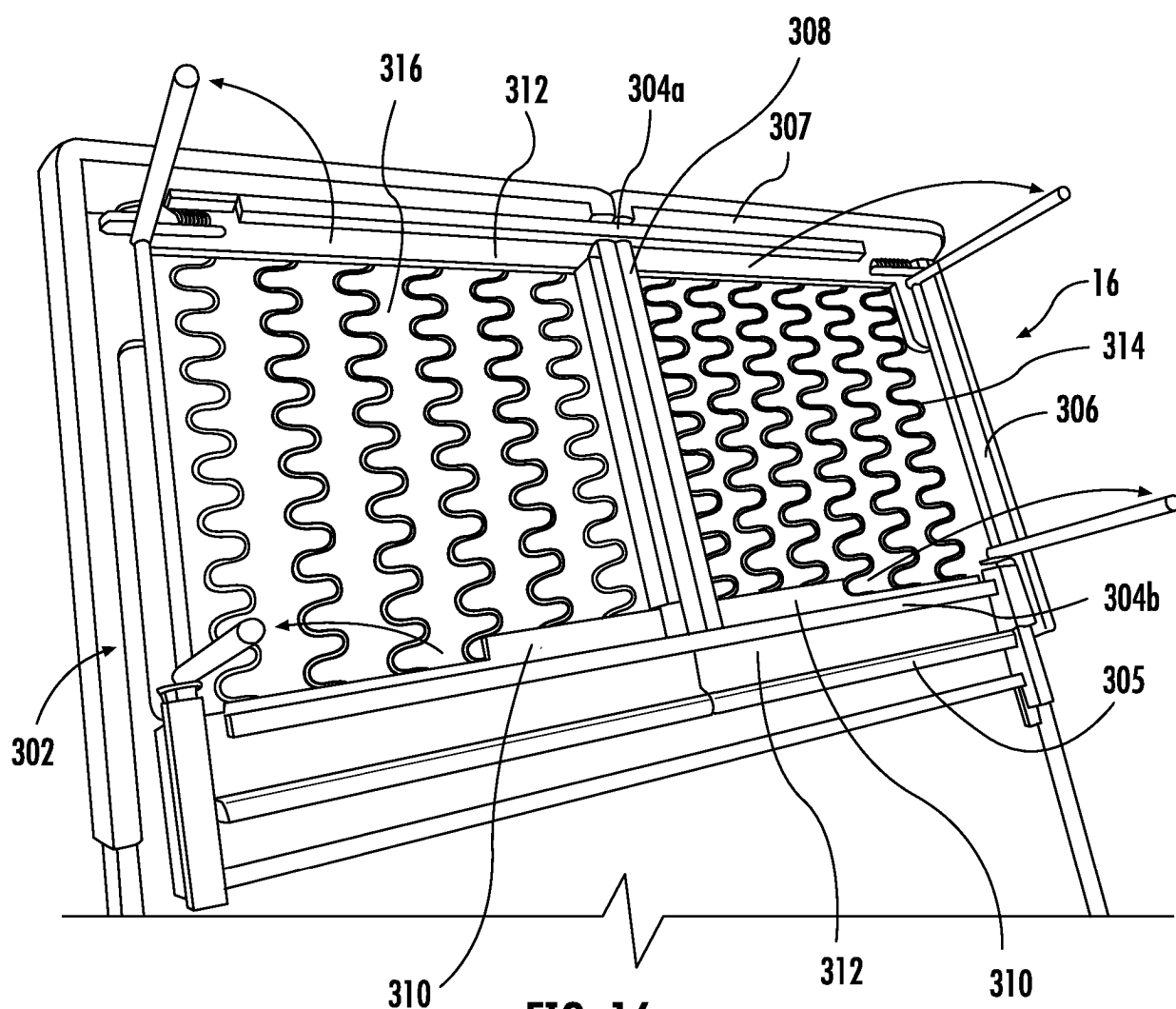


FIG. 16

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4200941 A, Gill [0002]
- US 2740131 A, Vogel [0003] [0041]
- US 5195194 A, Bradley [0003]
- US 7547182 B, Murphy [0003]
- US 8438676 B, Murphy [0003]
- AT 007969 U1 [0004]
- GB 371110 A [0004]
- US 90031113 [0012]
- US 900311 [0027] [0039]
- US 20110010847 A, Murphy [0039] [0041]
- US 4200191 A [0041]
- US 4737996 A [0041]
- US 20070283491 A [0041]