(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 100 578 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.09.2009 Bulletin 2009/38

(51) Int Cl.:
A61G 7/05 *(2006.01)* ***A47C 21/08*** *(2006.01)*

(21) Application number: **09250678.1**

(22) Date of filing: **11.03.2009**

(84) Designated Contracting States:
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 SE SI SK TR
Designated Extension States:
AL BA RS

(30) Priority: **12.03.2008 US 46666**

(71) Applicant: **Hill-Rom Services, Inc.**
Wilmington, DE 19801 (US)

(72) Inventors:
- **Sleva, Michael Z.**
  Atlanta, GA 30308 (US)
- **Heimbrock, Richard H.**
  Cincinnati, OH 45238 (US)
- **Huster, Keith A.**
  Sunman, IN 47041 (US)
- **Hornbach, David W.**
  Brookville, IN 47012 (US)
- **McNeely, Craig**
  Columbus, IN 47203 (US)
- **Newkirk, David C.**
  Lawrenceburg, IN 47025 (US)

(74) Representative: **Findlay, Alice Rosemary**
Reddie & Grose
16 Theobalds Road
London
WC1X 8PL (GB)

(54) **Adjustable siderail and lock therefor**

(57) A bed, includes a frame **11**, a deck **12** connected to the frame and a siderail **16, 17, 18, 19** supported by either of the frame and the deck. The siderail includes a base **22, 162** and an extension **23, 163.** The extension has a retracted position adjacent the base and at least one deployed position spaced further from the base. A lock **30**, **200** resides in the base is selectively engageable with and disengageable from the extension for resisting or enabling movement of the extension relative to the base.

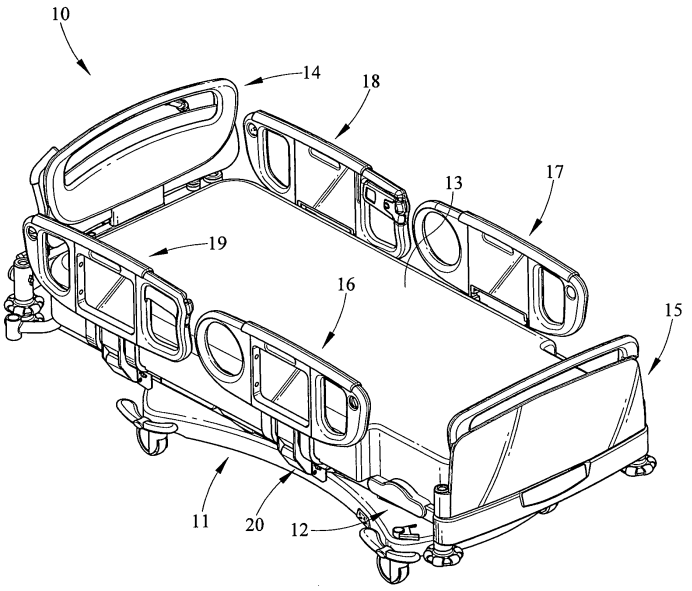

FIG. 1

EP 2 100 578 A2

Description

[0001] The subject matter of the present application relates to siderails for a patient support apparatus, such as a bed, and more particularly to lockable, adjustable height and length siderails for a hospital bed.

[0002] Many patient support apparatuses, such as hospital beds, include a frame, a deck, and a support surface, such as a mattress, supported by the deck. Such beds may also include siderails. The siderails can be lowered to facilitate patient movement into and out of the bed. The siderails can also be raised to safeguard the patient. When the siderails are raised, they typically extend higher than the support surface of the bed by an amount Δh.

[0003] From time to time an overlay may be placed on top of the support surface, or a thicker than normal mattress may be substituted for a mattress of customary thickness. Either way, it is desirable for the siderail to be adjustable to maintain the same Δh as with a standard mattress. Moreover, it is desirable to be able to easily adjust the siderail to any desired height and to be able to easily lock the siderail in a desired position and unlock it for further adjustment.

[0004] A bed in accordance with the present invention includes a frame, a deck connected to the frame, a siderail supported by the frame or the deck, a siderail extension having retracted and deployed positions and a lock residing in the base. The lock is selectively engageable with and disengagable from the extension for resisting or enabling movement of the extension relative to the base.

The invention will now be further described by way of example with reference to the accompanying drawings, in which:

[0005] FIG. **1** is a perspective view of a patient support apparatus with a frame, a deck, a patient support surface, siderails and a vertically extendable siderail extension shown in a retracted position.

[0006] FIG. **2** is a perspective view of the siderail of FIG. 1 showing a siderail base and the extension in a deployed position.

[0007] FIG. **3** is a view similar to that of FIG. **2** showing the siderail extension separated from the siderail base.

[0008] FIG. **4** is a view similar to that of FIG. **2** with a portion of the base cut away to reveal the relationship between the siderail extension and a rotary lock for the siderail extension.

[0009] FIG. **5** is a perspective view of a corner of the siderail showing the rotary lock residing in a bore of the siderail base.

[0010] FIG. **6** is a view similar to FIG. **5** showing the rotary lock partially exploded.

[0011] FIG. **7** is a view similar to FIG. **5** showing the rotary lock nearly fully exploded.

[0012] FIG. **8** is a view similar to that of FIG. **4** with a grip handle removed from the lock to reveal additional components of the lock.

[0013] FIGS. **8A** and **8B** are side elevation views showing the rotary lock in an engaged state and a disengaged state respectively.

[0014] FIG. **9** is a perspective view of the assembled rotary lock.

[0015] FIG. **10** is a perspective view of a D-rod and an end cap of the rotary lock.

[0016] FIG. **11** is a perspective view of the teeth of the lock engaging a toothed siderail extension.

[0017] FIG. **11A** is a side elevation view showing a ratchet arrangement.

[0018] FIG. **12** is a side view of a siderail having a linear lock engaging a leg of a siderail extension.

[0019] FIG. **13** is a view similar to that of FIG. **12** showing a notched siderail extension.

[0020] FIG. **14** is a view similar to that of FIG. **13** showing a ratchet arrangement.

[0021] FIG. **15** is a side view of a siderail assembly having a base and a horizontally extendable extension shown in its retracted position.

[0022] FIG. **16** is a view similar to that of FIG. **15** showing the extension in a deployed position.

[0023] FIG. **17** is a side elevation view of the horizontal extension of FIGS. **15** and **16.**

[0024] FIG. **18** is a view similar to that of FIG. **15** showing the base with the extension removed.

[0025] FIG. **19** is a view showing portions of the siderail base, a siderail extension, and a vertical linear lock.

[0026] FIG. **20** is a view similar to that of FIG. **19** showing a siderail extension with a notched leg.

[0027] FIG. **21** is a view similar to that of FIG. **20** showing a variant of the notched leg.

[0028] FIG. **22** is a view similar to that of FIG. **20** but showing a ratchet arrangement.

[0029] Referring to FIG. **1**, a patient support apparatus, such as a hospital bed **10** includes a frame **11,** a deck **12,** a headboard **14** and a footboard **15.** The deck supports a patient support surface **13** such as a mattress. The support surface includes multiple sections such as a head section, a seat section, a thigh section, and a foot section, all of which are configured to articulate and move relative to one another in a manner known to those skilled in the art. The patient support apparatus **10** also includes foot end siderails **16** and **17** and head end siderails **18** and **19,** all of which may be carried or supported by frame **11** or deck **12.** Each of the siderails **16, 17, 18,** and **19** is mounted to either the frame **11** or the deck **12** by a mounting device **20,** which is a mounting device for foot end siderail **16.** Mounting device **20** includes a mechanism for raising or lowering the foot end siderail **16** with respect to the frame **11** and deck. Similar mounting devices are also present for siderails **17, 18,** and **19.** Other types of mounting devices such as clocking mounting devices may also be used.

[0030] FIGS. **2-5** depict one variant of a siderail such as siderail **17.** Siderail **17** includes a base **22** and an extension **23.** The extension approximately defines a plane and includes a top rail **21** and extension legs **24,**

25, 26. Apertures **27, 28,** and **29** in the base **22** translatably receive the extension legs so that the extension **23** is extendable, i.e. adjustable between a retracted position (e.g. FIGS. **1**, **5**) and one or more deployed positions, one of which is shown in FIG. **2.** At the retracted position, the rail **21** is adjacent the base. As used herein, "adjacent" means that rail **21** is in the lowest position, (i.e. as close to the base) intended by design. The adjacent condition includes conditions in which the top rail **21** is flush with the base, is in contact with the base (e.g. FIGS. **1, 5)** and is separated from the base by a minimum prescribed distance. At a representative deployed position (e.g. FIG. **2),** the rail **21** is spaced further from the base **22** than it is when retracted. Movement of the extension between the retracted and deployed positions occurs substantially along the plane defined by the extension.

[0031] Referring additionally to FIGS. **6-10,** siderail base **22** has a bore **33** with an axis **34.** A rotary lock **30** occupies in the bore. The lock includes a number of components serially distributed along the bore axis. These components include an end cap **80** with a blind hole **100** having a part-circular or D-shaped cross-section (FIG. **10)** an interior spacer **70** with a central circular hole **71,** an oblong locking cam **68** with a D-shaped hole **75** and a socket **69.** Teeth **82** extend along at least a portion of the periphery of the cam. The lock also includes an indexed spacer **66** having a socket **67.** A lug **73** extends radially from the spacer and into groove **61** in the siderail bore **34** to render the spacer non-rotatable. The lock also includes a grip handle **40.** The grip handle, like the end cap **80,** includes a blind hole, not visible in any of the illustrations, with a D-shaped cross-section. The lock also includes a coil spring **62** having a spacer end **63** and a cam end **65.** When the lock is fully assembled, socket **69** of cam **68** receives cam end **65** of the spring while socket **67** of spacer **66** receives spacer end **63** of the spring (FIG. **8).** Spring end **65** is referred to as a displaceable end because it moves along with socket **69** when cam **68** rotates about axis **34.** Spring end **63** is referred to as a fixed end, because it is trapped or mechanically grounded in socket **67** of spacer **66.**

[0032] The lock also includes a D-rod **64** having a laterally outer end **83** and a laterally inner end **84.** When the lock is fully assembled, the inner end **84** is captured in blind hole **100** of the end cap (FIG. **10**) while outer end **83** is captured in the similar blind hole of the grip handle. The D-rod extends through the center of the coil spring **62,** and through holes **75** and **71** in the cam and interior spacer. Because cam hole **75** mimics the cross-sectional shape and size of the D-rod, rotation of the grip handle **40** causes the cam to rotate. The D-Rod and grip handle serve as a means for rotating the cam from the locked state to an unlocked state.

[0033] The lock is selectively engageable with and disengageable from the extension for resisting or enabling movement of the extension relative to the base. The lock has an engaged state in which the lock is engaged with the siderail extension **23** (FIGS. **8, 8A**) and a disengaged state in which the lock is disengaged from the extension (FIG. **8B).** When the lock is engaged it secures the extension in any of multiple deployed positions. In the engaged state, the force exerted by spring **62** rotates the cam **68** so that the toothed portion of the cam contacts extension leg **24.** Friction between the cam and the extension leg resists movement of the extension leg, and therefore of the entire extension **23** relative to the base **22.** Moreover, any influence tending to urge the siderail to a lower elevation will also tend to rotate the cam clockwise (as seen in FIGS. **8, 8A**), which, because of the oblong shape, causes the cam to bear even more tightly against the leg **24.** The engaged state is the default state. The disengaged state is achieved through operator intervention. Specifically, an operator grasps the handle **40** and rotates it in a direction counter to the spring force (counterclockwise as seen in FIGS. **7** and **8-8B** or clockwise as seen in FIG. **11**). Because the cam is oblong, such rotation moves the cam periphery out of contact with the extension leg so that the extension **21** can be easily raised or lowered. Because the spring force biases the lock to its engaged state, the operator continually grasps the handle **40** to exert a counterforce on the spring to keep the cam periphery out of contact with the extension leg. After the operator has satisfactorily positioned the extension **23,** the operator releases the handle **40** so that the spring can urge the cam back into contact with the extension leg **24** to prevent further movement of extension **23.** Depending on how tightly the cam bears against the extension, it may be possible for the operator to merely pull up on the extension without first having to independently disengage the lock.

[0034] When the extension **24** is in its retracted position, it is at a retracted elevation relative to the top surface of the mattress **13.** When the extension is at any of its deployed positions, it is at a deployed elevation relative to the top surface of the mattress **13.** The deployed elevation is greater than the retracted elevation.

[0035] The illustrated lock also shows the use of teeth **82** to facilitate engagement of the cam with the extension leg. Alternatively, a friction enhancing treatment such as a friction tape or a coating could be applied to the periphery of the cam. In addition, the periphery of the cam could be left in a smooth state provided the coefficient of friction between a smooth cam and the extension leg is sufficient to secure the extension in the desired position.

[0036] The variant of the lock and siderail extension illustrated in FIG. **11** includes teeth **91** on extension leg **24.** Teeth **82** on the cam periphery engage the teeth **91** on the extension leg to help secure the extension leg in a desired position. Alternatively, teeth could be provided on the extension leg but not on the cam periphery.

[0037] FIG. **11A** shows an arrangement similar to that of FIG. **11** but in which extension leg **24** has a number of curved teeth **86** defining notches that form a ratchet arrangement. The ratchet arrangement dispenses with the need to independently disengage the lock prior to raising the extension from its retracted position to a de-

ployed position or from one deployed position to a higher deployed position. Instead, the caregiver simply pulls up on the siderail extension **23** to raise it to a desired location. During such upward movement the teeth push back against the cam so that the extension leg can be raised. Once the operator is satisfied that the extension has been raised to the desired position, it is necessary only for the operator to cease pulling up on the extension. The spring load on the cam will then urge the cam into tight engagement with the extension leg. To lower the siderail extension, it is necessary to first turn the rotary lock to disengage the cam teeth from the extension leg. Once the siderail extension has been lowered to the desired height, the caregiver releases the handle **40** allowing the spring to urge the cam teeth **82** back into engagement with the ratchet thereby preventing further vertical movement of the extension.

[0038] The above described configuration employs a spring to continuously urge the cam into contact with the extension leg. However a latch that holds the lock in the disengaged state may be used in conjunction with the spring or substituted for the spring. If a latch is used in conjunction with the spring, partial rotation of the handle would suffice to disengage the lock from the extension leg, and additional rotation of the handle in the same direction would engage the latch. Once latched, the operator may release his or her grip on the handle without the spring force urging the cam back into contact with the extension leg.

[0039] FIGS. **12-21** illustrate linear locks. The linear locks, like the rotary lock described above, are selectively engageable with and disengageable from the extension for resisting or enabling movement of the extension relative to the base. Referring to FIG. **12,** lock **130** resides in siderail base **22** and comprises a pull pin having a handle **132,** a piston **131,** a plunger 136 and a spring **138.** A force exerted by spring **138** urges the plunger **136** into contact with extension leg **24** to resist movement of the leg. Plunger **136** may include a friction pad **133** or other feature to increase the coefficient of friction between the plunger and the extension leg **24.** Vertical movement of extension leg **24** is resisted until an operator pulls on the handle **132** to disengage the plunger from the extension leg. The extension can then be raised or lowered to a desired position and the handle can then be released allowing the plunger **136** to move back into contact with the extension leg, thereby resisting further movement of the extension.

[0040] FIG. **13** shows an arrangement similar to that of FIG. **12** using an alternative style handle **142** and an alternative extension leg **24** featuring multiple notches **144** along its length. Lock **140** resides on siderail base **22** and comprises a pull pin having handle **142,** a piston **141,** a plunger **146** and a spring **148.** A force exerted by spring **148** urges the plunger **146** into contact with extension leg **24** to resist movement of the leg. Vertical movement of extension leg **24** is resisted until an operator pulls on the handle **142** to disengage the plunger from the teeth. The extension can then be raised or lowered to a desired position and the handle can be released allowing the plunger **146** to move back into one of the notches, thereby resisting further movement of the extension.

[0041] FIG. **14** shows an arrangement similar to that of FIG. **13** but in which extension leg **24** has a number of curved notches **154** that form a ratchet arrangement. This ratchet arrangement, in contrast to the notches of FIG. **13,** dispenses with the need to pull on handle **152** to disengage plunger **156** from the extension leg prior to raising the extension from its retracted position to a deployed position or from one deployed position to a higher deployed position. Instead, the caregiver simply pulls up on the siderail extension **23** to raise it to a desired location. To lower the siderail extension, it is necessary to first pull the handle **152** to withdraw plunger **156** from teeth **154.** Once the siderail extension has been lowered to the desired height, the caregiver releases the pull pin handle **152** allowing the spring to urge the piston **156** back into a teeth **154** of the ratchet arrangement and prevent further vertical movement of the extension.

[0042] The principles disclosed above in the context of a siderail with a vertically deployable extension are also applicable to a siderail with a horizontally deployable extension. Referring first to FIGS. **15-19,** siderail **160** includes siderail base **162,** a siderail extension **163,** and extension legs **164, 166.** Apertures **168, 170** in the base **162** translatably receive siderail extension legs **164, 166.** Lock **200** resides on siderail base **162** and comprises a pull pin having a handle **202,** a piston **201,** a plunger **206** and a spring **208.** A force exerted by spring **208** urges the plunger **206** into contact with extension leg **24** to resist movement of the extension leg. Plunger **206** may include a friction pad to **10** or other feature to increase the coefficient of friction between the plunger and the extension leg **24.** Horizontal movement of extension leg **24** is resisted until an operator pulls on the handle **202** to disengage the plunger from the extension leg. The extension can then be translated horizontally to a desired position and the handle can then be released allowing the plunger **206** to move back into contact with the extension leg, thereby resisting further movement of the extension.

[0043] FIG. **20** illustrates a horizontally adjustable arrangement similar to the vertically adjustable arrangement of FIG. **13.** Extension leg **164** has a plurality of notches **212** along its length. Lock **200** includes a pull pin whose plunger **206** extends into notches **212** to resist movement of the extension leg **164** in a horizontal direction. In operation, a caregiver pulls up on pull pin **200** to withdraw the plunger from its host teeth and enable horizontal movement of siderail extension **164** relative to the siderail base.

[0044] FIG. **21** shows an embodiment similar to that of FIG. **20.** However, notches **212** are on the side of the extension leg rather than on its top and the pull pin **200** is oriented horizontally rather than vertically.

[0045] FIG. **22** shows a horizontally adjustable ar-

rangement similar to that of FIG. **20** but with a ratchet arrangement not unlike the one show in FIG. **14.**

[0046] A latch that holds the linear lock in the disengaged state may be substituted for or used in conjunction with the spring or other device. If a latch is used in conjunction with the spring loaded pull pin, partial translation of the plunger would suffice to disengage the lock from the extension leg, and additional movement of the handle would engage the latch. Once latched, the operator may release his or her grip on the handle without the spring force urging the cam back into contact with the extension leg.

[0047] In view of the preceding descriptions, additional aspects of the extendable siderail can now be appreciated.

[0048] Although the illustrated variants have two or three extension legs, more or fewer extension legs could be used. Further, as shown in FIGS. **3, 17** and **18,** because siderail extension **23** or **163** is removable from siderail base **22** or **162,** other types or styles of extension could be used with the same siderail base **22.**

[0049] Although the illustrated locks disclose the use of a spring to urge the cam or plunger into engagement with the extension leg **24,** forces resulting from the use of alternative devices, for example electromagnetic devices, could also be employed.

[0050] In the illustrated arrangements, the lock is situated so that it engages exactly one of the extension legs, specifically extension leg **24** or **164.** However it could also be situated to engage one of the other extension legs. Alternatively, locks could be associated with two or more of the extension legs. Such multiple locks could be interconnected so the operation of any of the locks concurrently operates the other locks.

[0051] It will further be appreciated by those of ordinary skill in the art that patient support apparatus **10** may include a bed or patient support apparatus suitable for use in any care facility, including homes, hospitals, medical clinics or centers, rehabilitation centers, healthcare or medical facilities, nursing homes, surgical centers, or other patient care provider facilities.

Claims

1. A bed, comprising:

a frame;
a deck connected to the frame;
a siderail supported by either of the frame and the deck, the siderail including a base and also including an extension having a retracted position adjacent the base and at least one deployed position spaced further from the base; and
a lock residing in the base and being selectively engagable with and disengagable from the extension for resisting or enabling movement of the extension relative to the base.

2. The bed of claim **1** wherein the extension is securable by the lock in multiple deployed positions.

3. The bed of either claim **1** or claim **2** wherein the lock has an engaged state in which the lock is engaged with the extension and a disengaged state in which the lock is disengaged from the extension and wherein the engaged state is a default state and the disengaged state is achieved through operator intervention.

4. The bed of any preceding claim wherein the extension includes at least one extension leg translatably received in an aperture of the base and the lock is engagable with and disengagable from at least one extension leg for selectively resisting and enabling movement of the extension between the retracted and deployed positions.

5. The bed of any preceding claim, wherein movement between the retracted position and the deployed position is substantially vertical or movement between the retracted position and the deployed position is substantially horizontal.

6. The bed of any preceding claim, further comprising a mattress having a top surface, the extension being at a retracted elevation relative to the top surface when the extension is retracted and at a deployed elevation relative to the top surface when the extension is deployed, the deployed elevation being greater than the retracted elevation.

7. The patient support apparatus of any preceding claim, wherein the extension includes at least one notch for receiving a mating element of the lock.

8. The bed of claim **7** wherein the notch is configured as a ratchet.

9. The bed of any preceding claim wherein the extension includes teeth.

10. The bed of any preceding claim wherein the lock is a rotary lock.

11. The bed of any preceding claim, wherein the lock includes a cam movable between a locking position that resists movement of the extension relative to the base and an unlocking position that enables movement of the extension relative to the base.

12. The bed of any preceding claim, wherein the lock includes an oblong member having a periphery with teeth occupying at least a portion of the periphery.

13. The bed of any one of claims **1** to **10** wherein the siderail base includes a bore having an axis, the lock

resides in the bore and includes a cam rotatable with respect to the bore, a spring having a displaceable end connected to the cam and a mechanically grounded end, and wherein the spring biases the cam into a locked state.

14. The bed of claim **13** including an indexed spacer residing in the bore axially adjacent the cam, the spacer having a lug received in a groove of the bore to resist rotation of the spacer, the grounded end of the spring being received in a socket of the spacer.

15. The bed of any one of claims 1 to 9 wherein the lock is a linear lock.

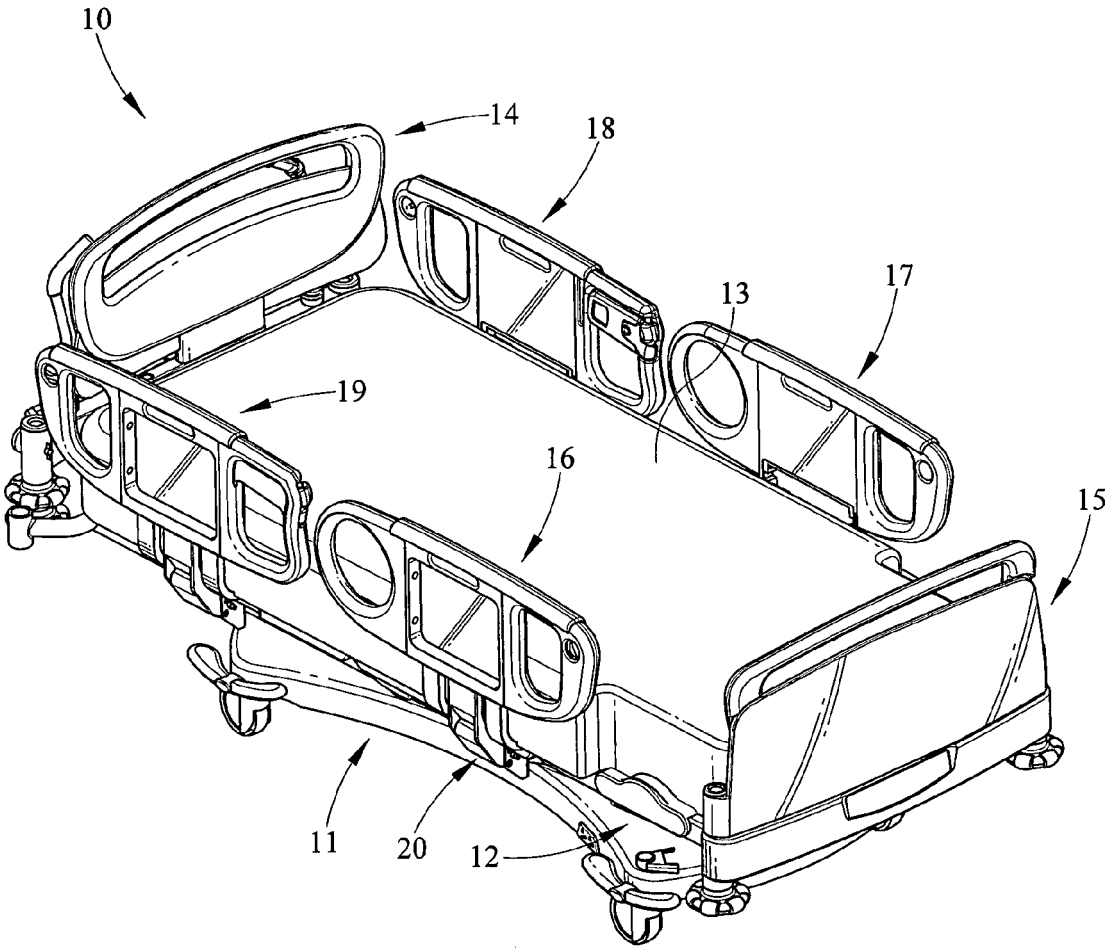

FIG. 1

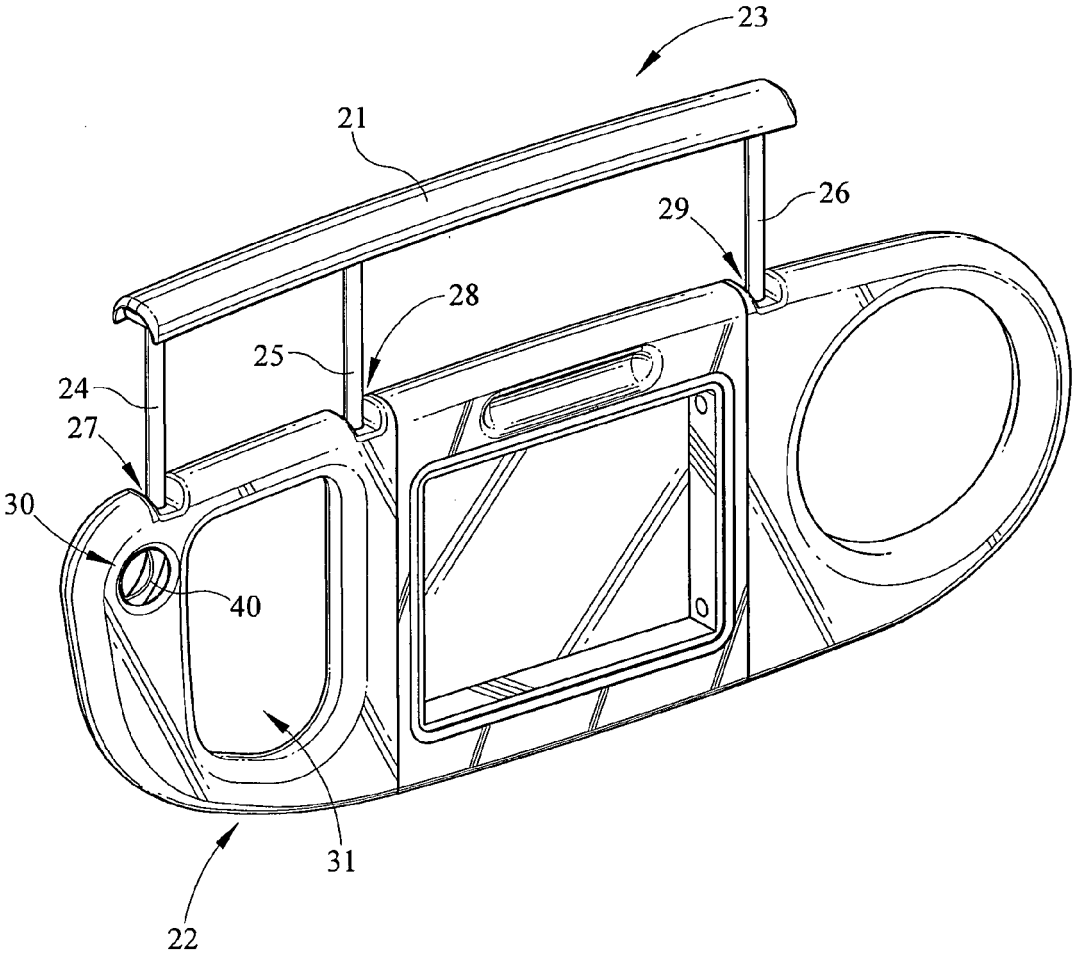

FIG. 2

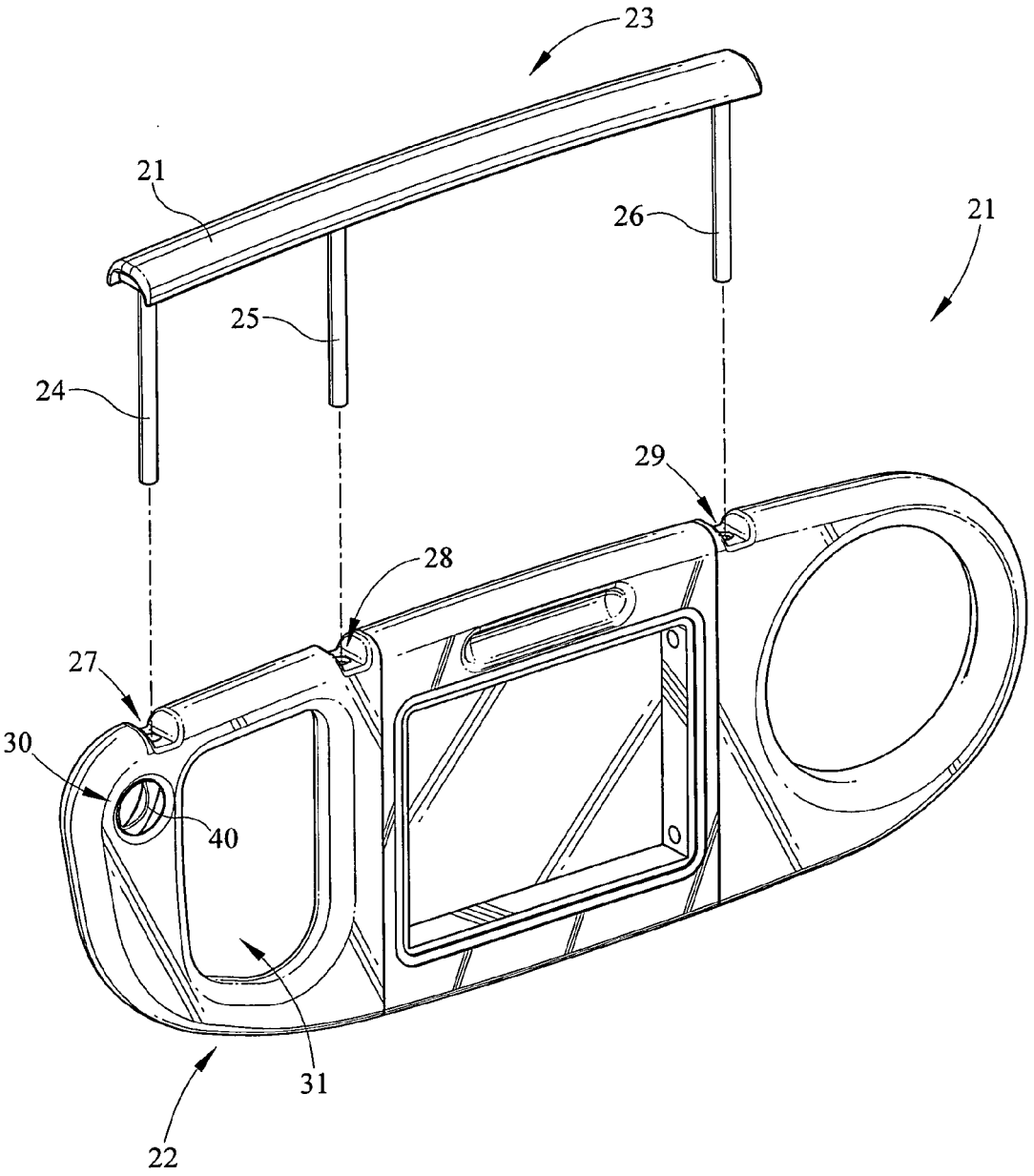

FIG. 3

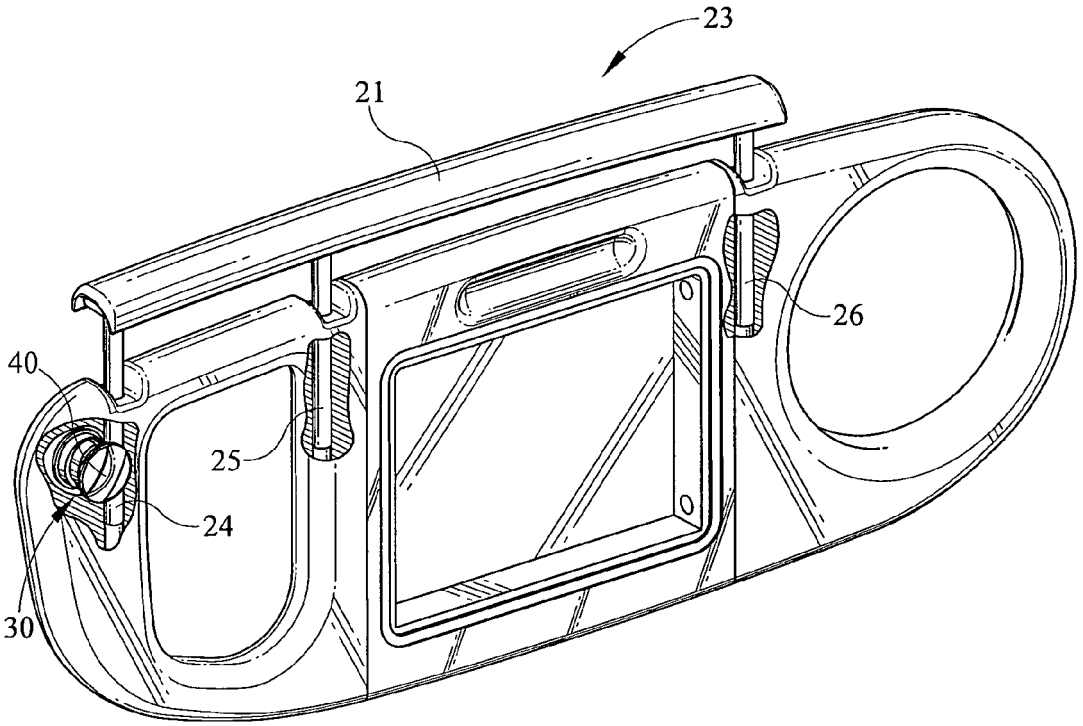

FIG. 4

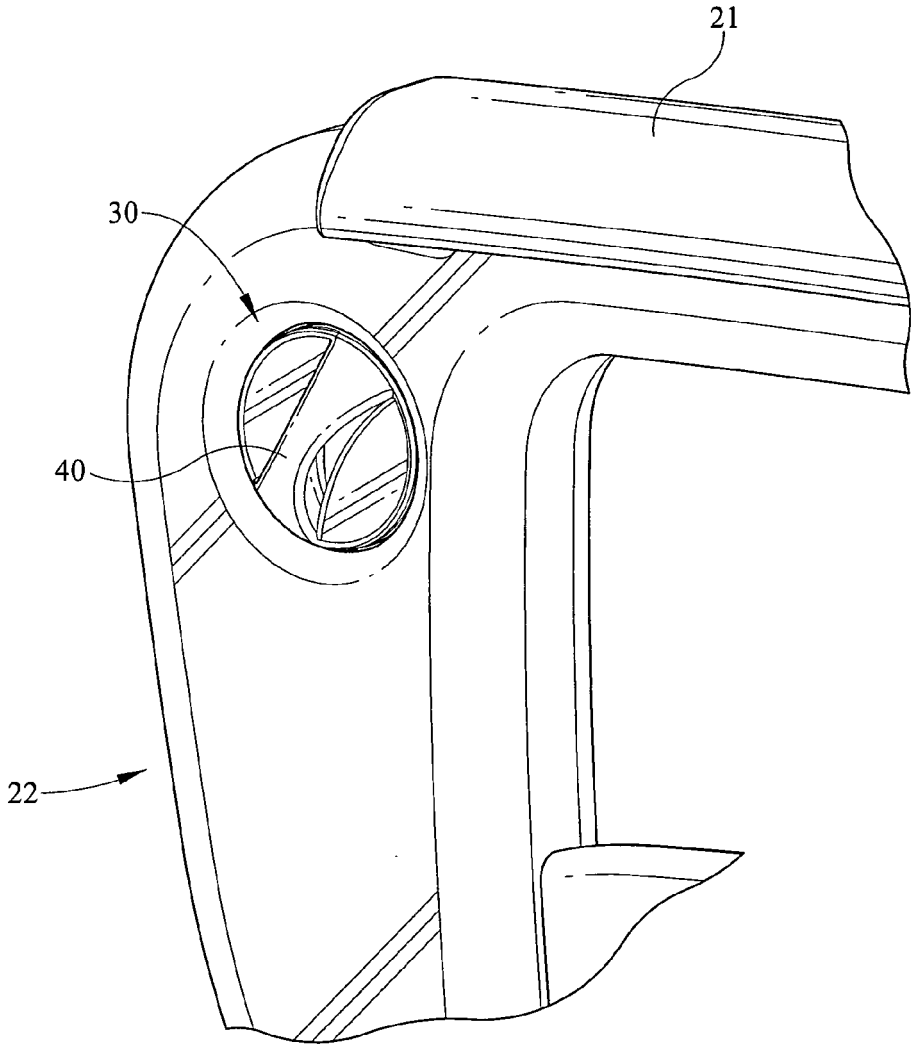

FIG. 5

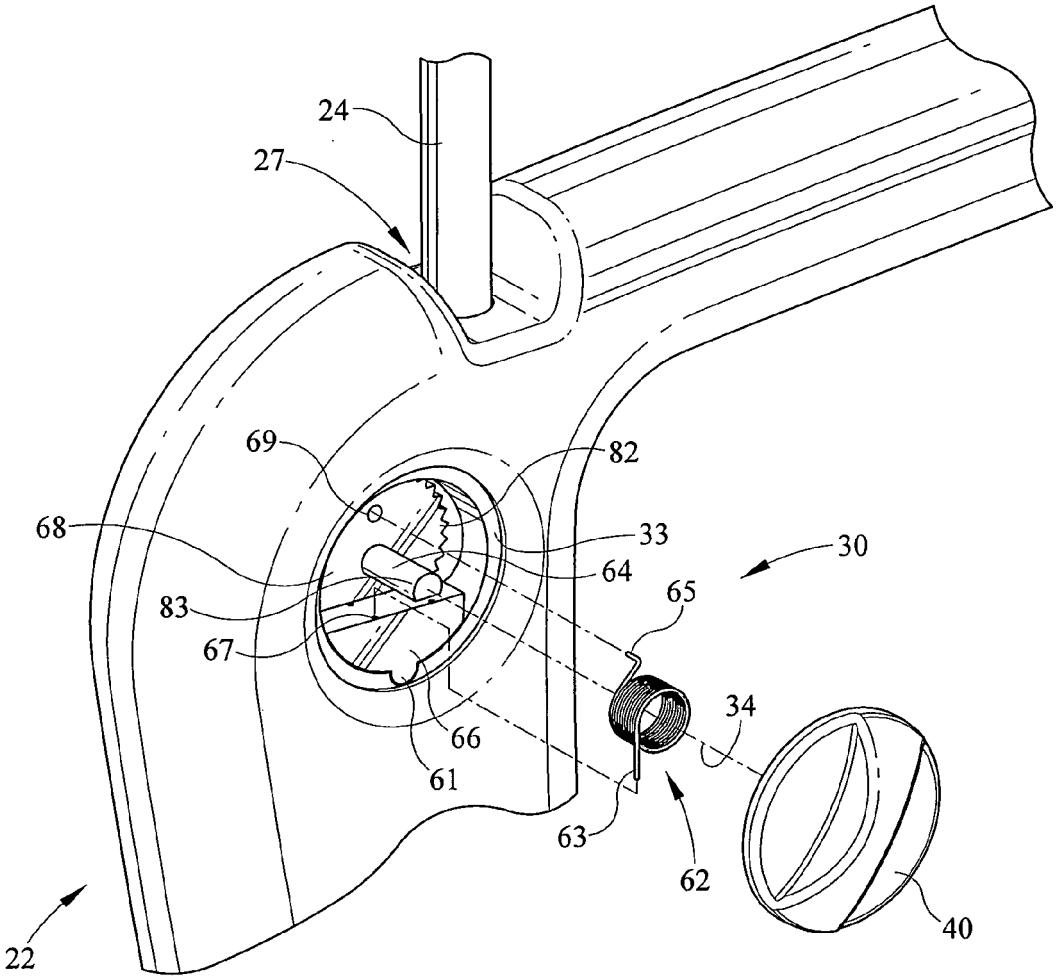

FIG. 6

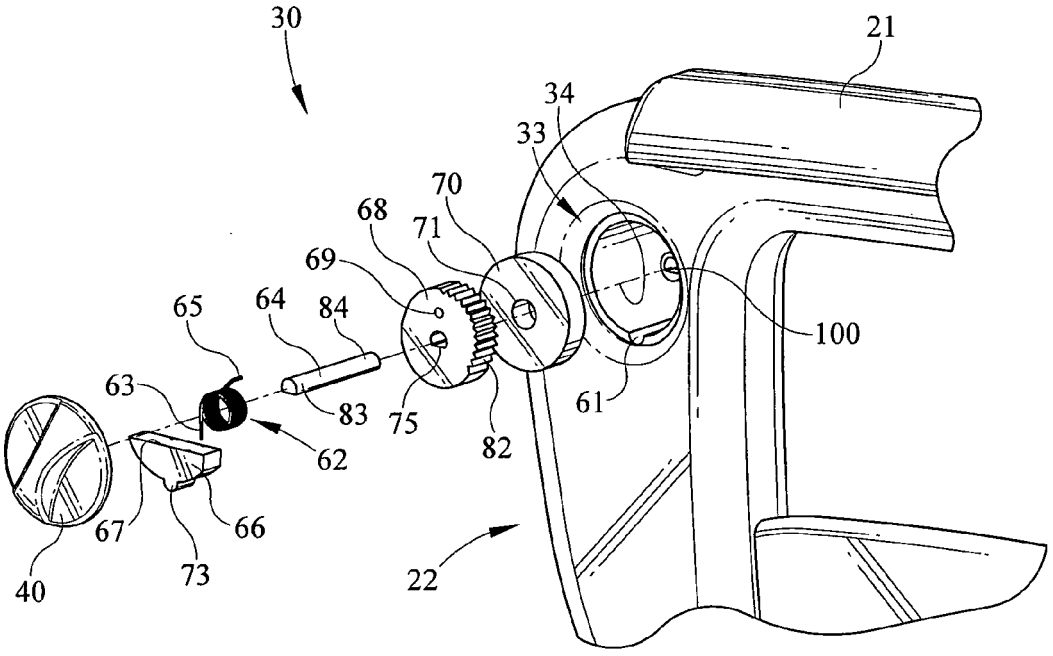

FIG. 7

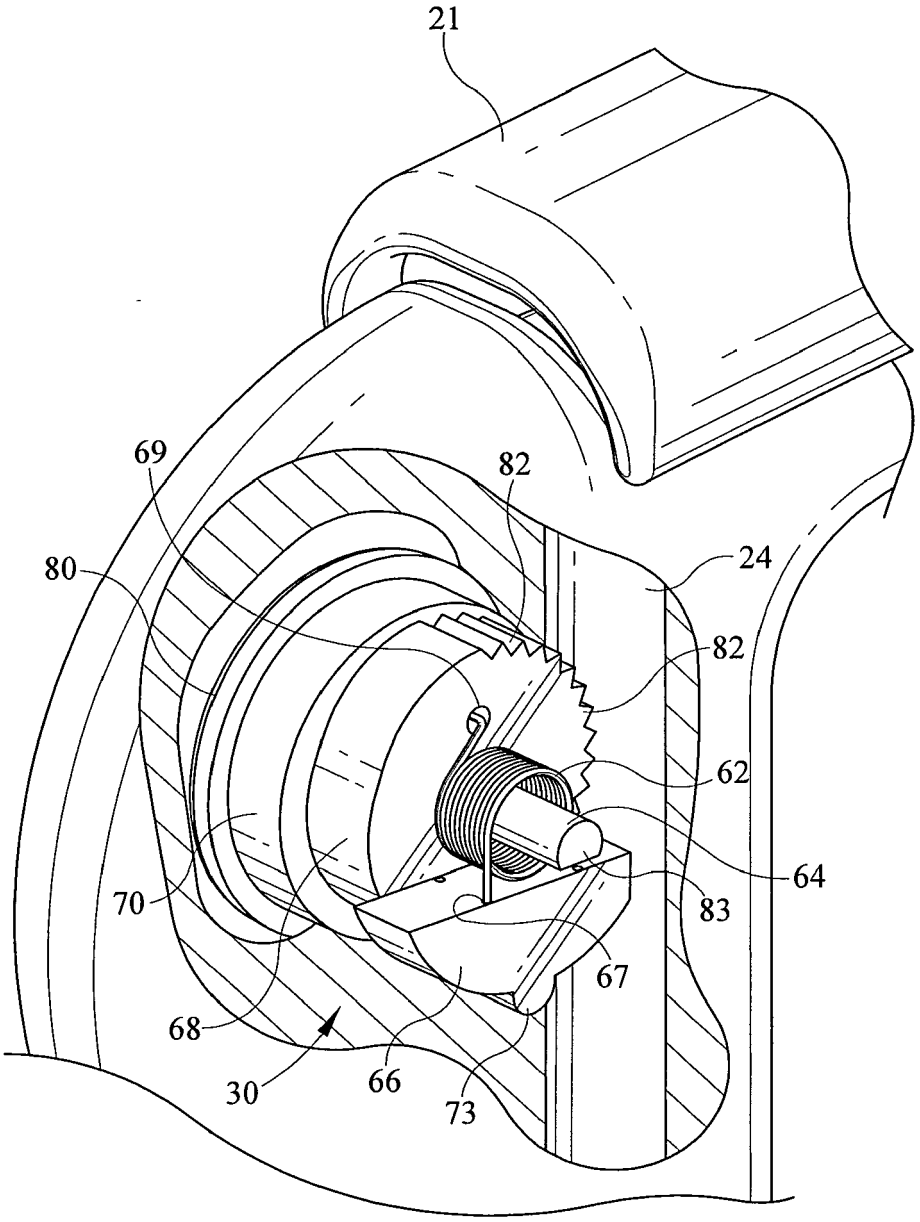

FIG. 8

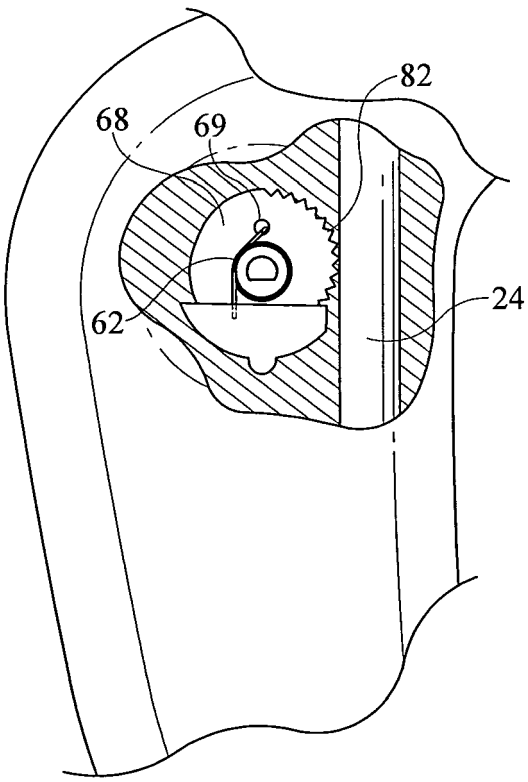

FIG. 8A

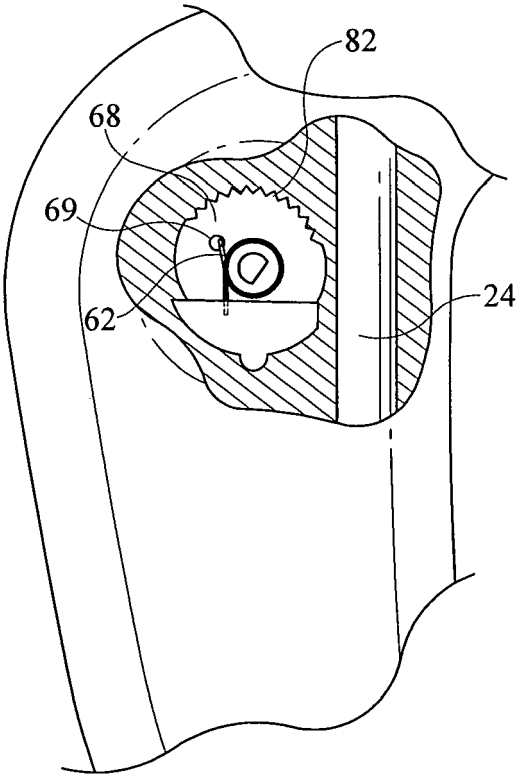

FIG. 8B

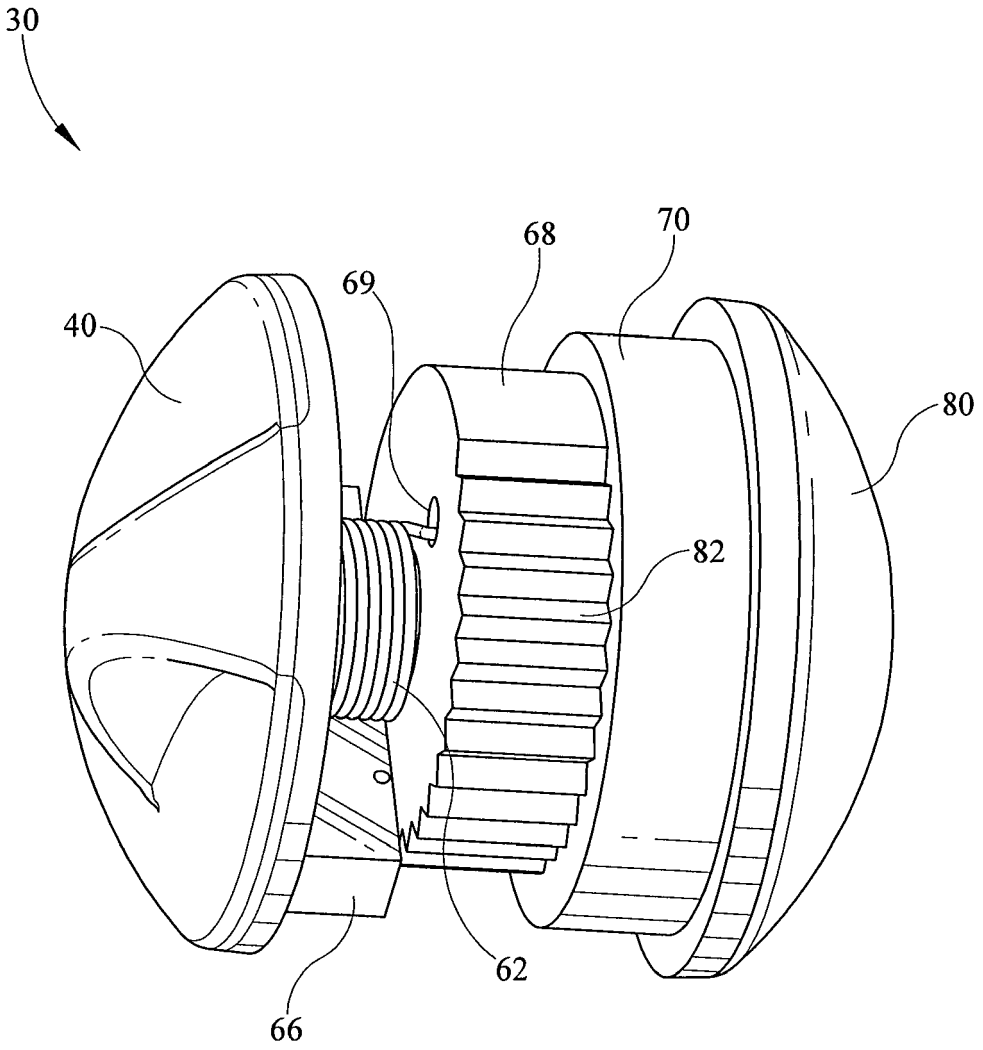

FIG. 9

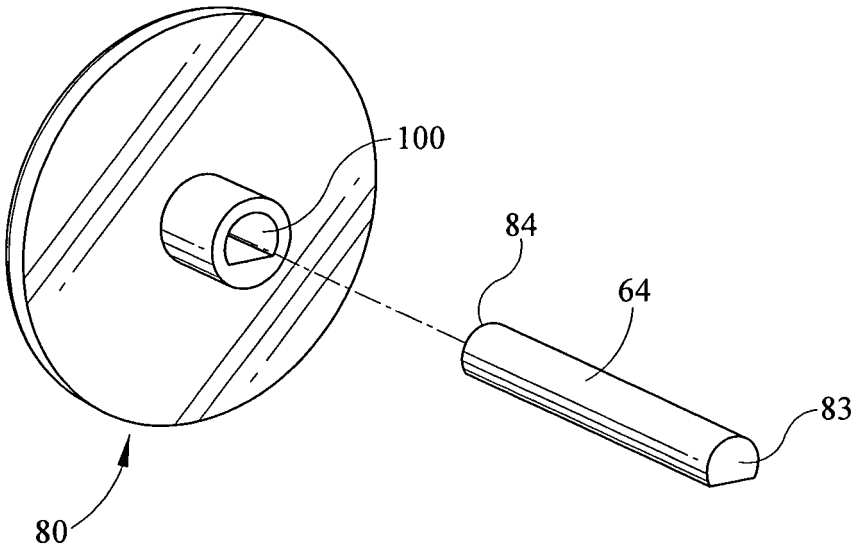

FIG. 10

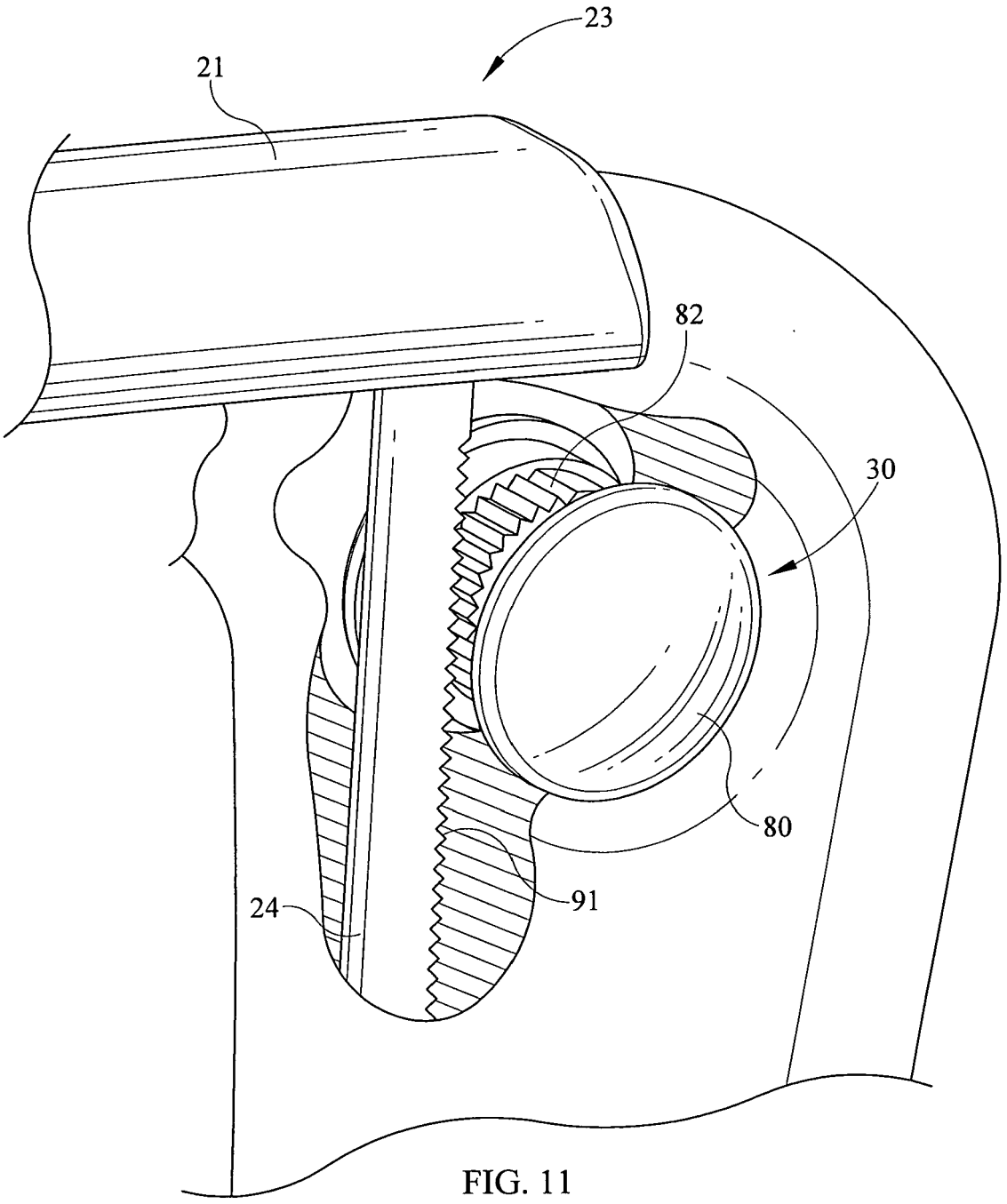

FIG. 11

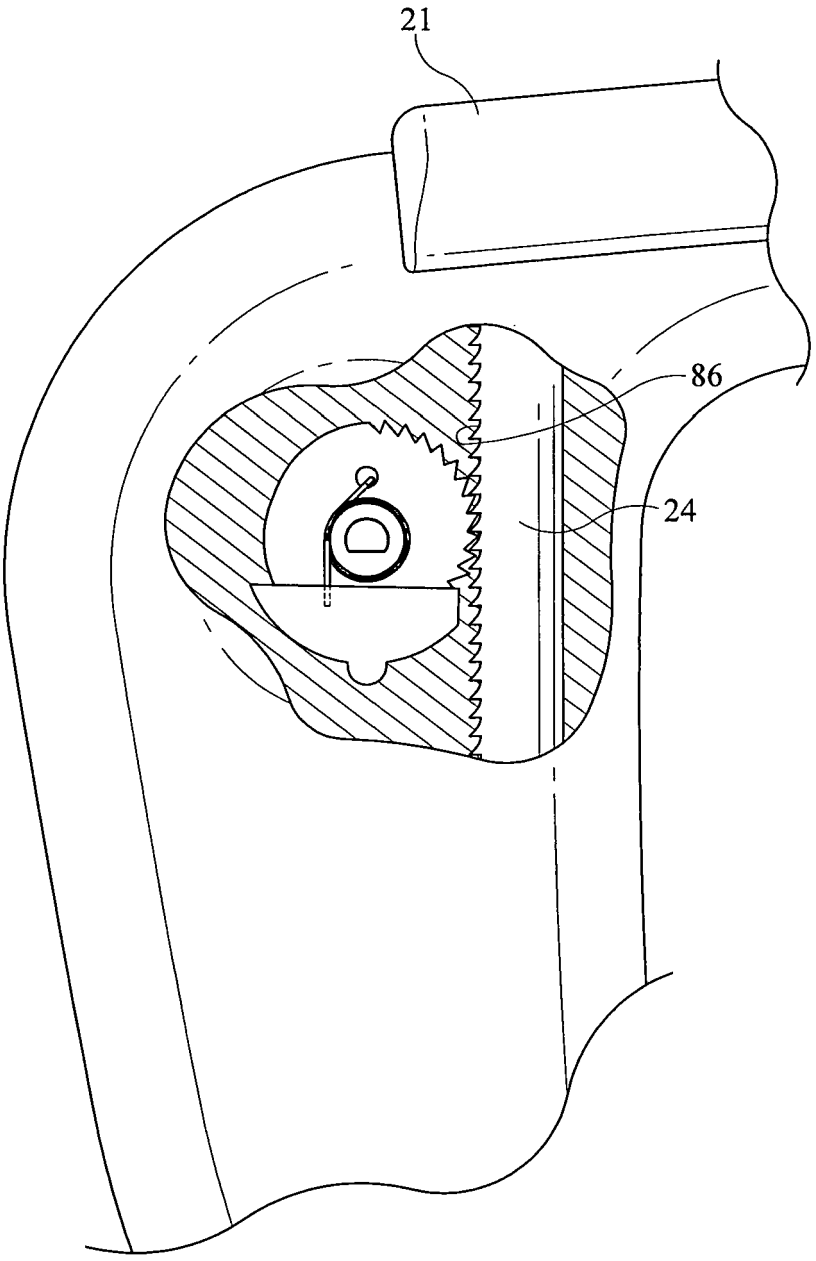

FIG. 11A

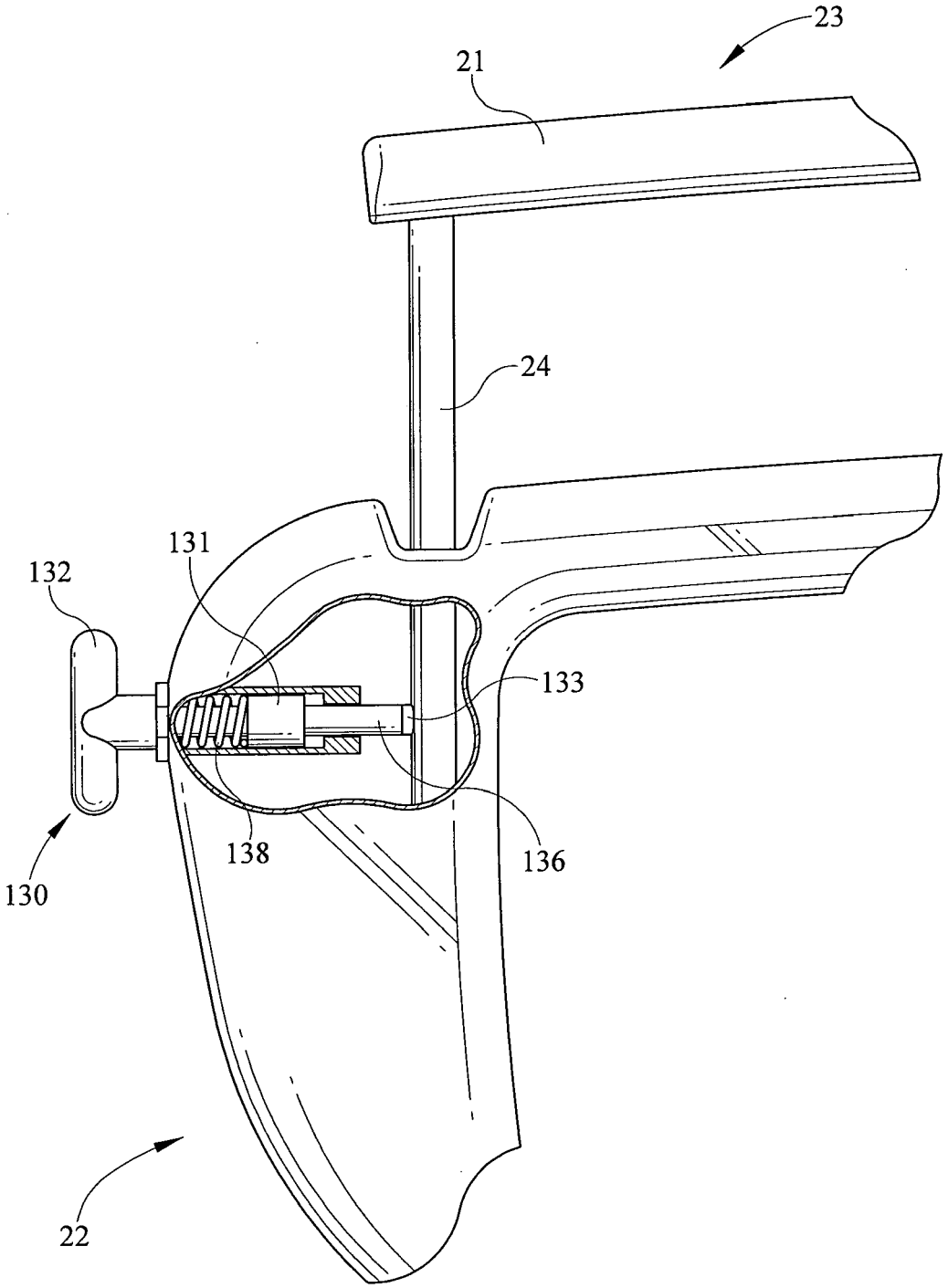

FIG. 12

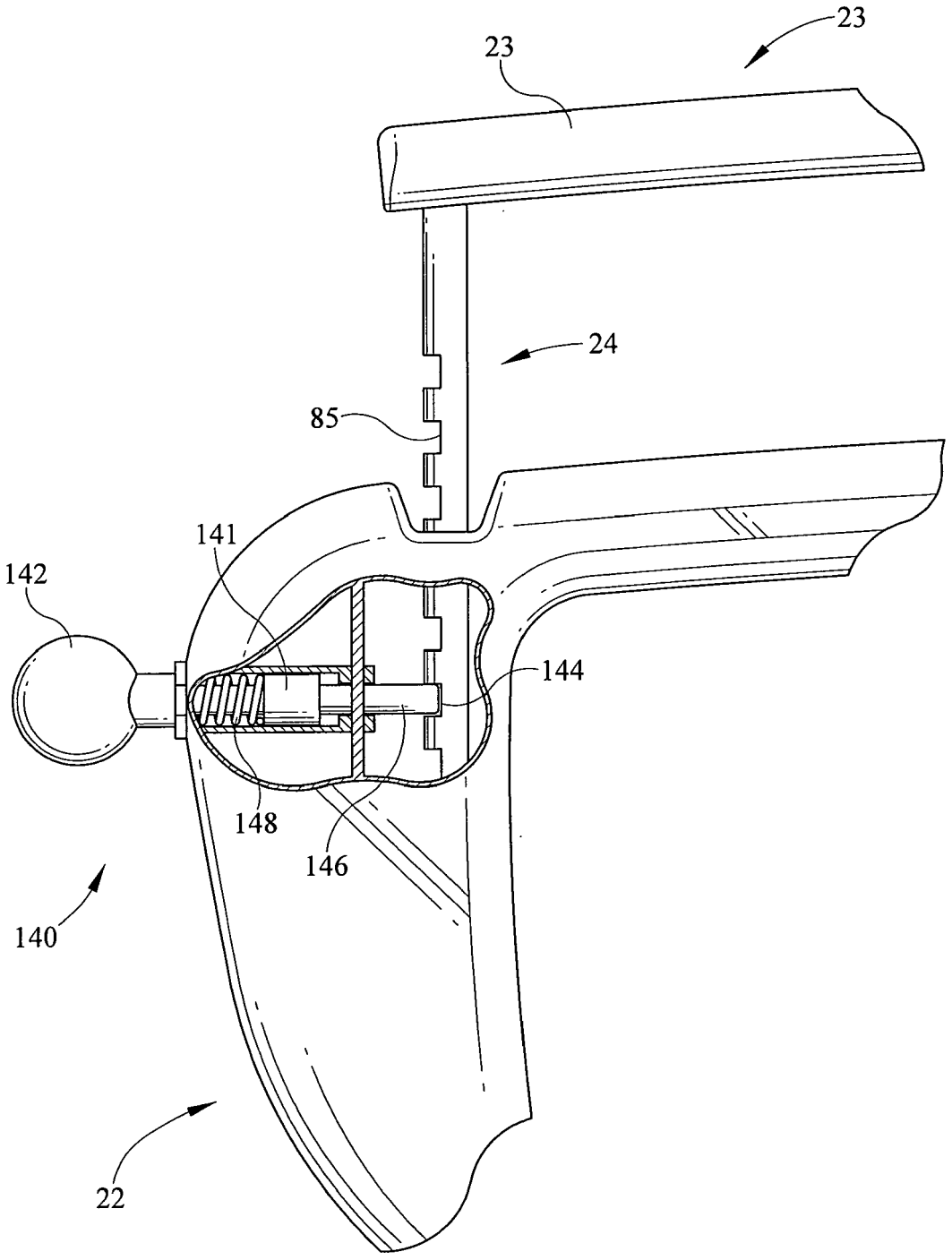

FIG. 13

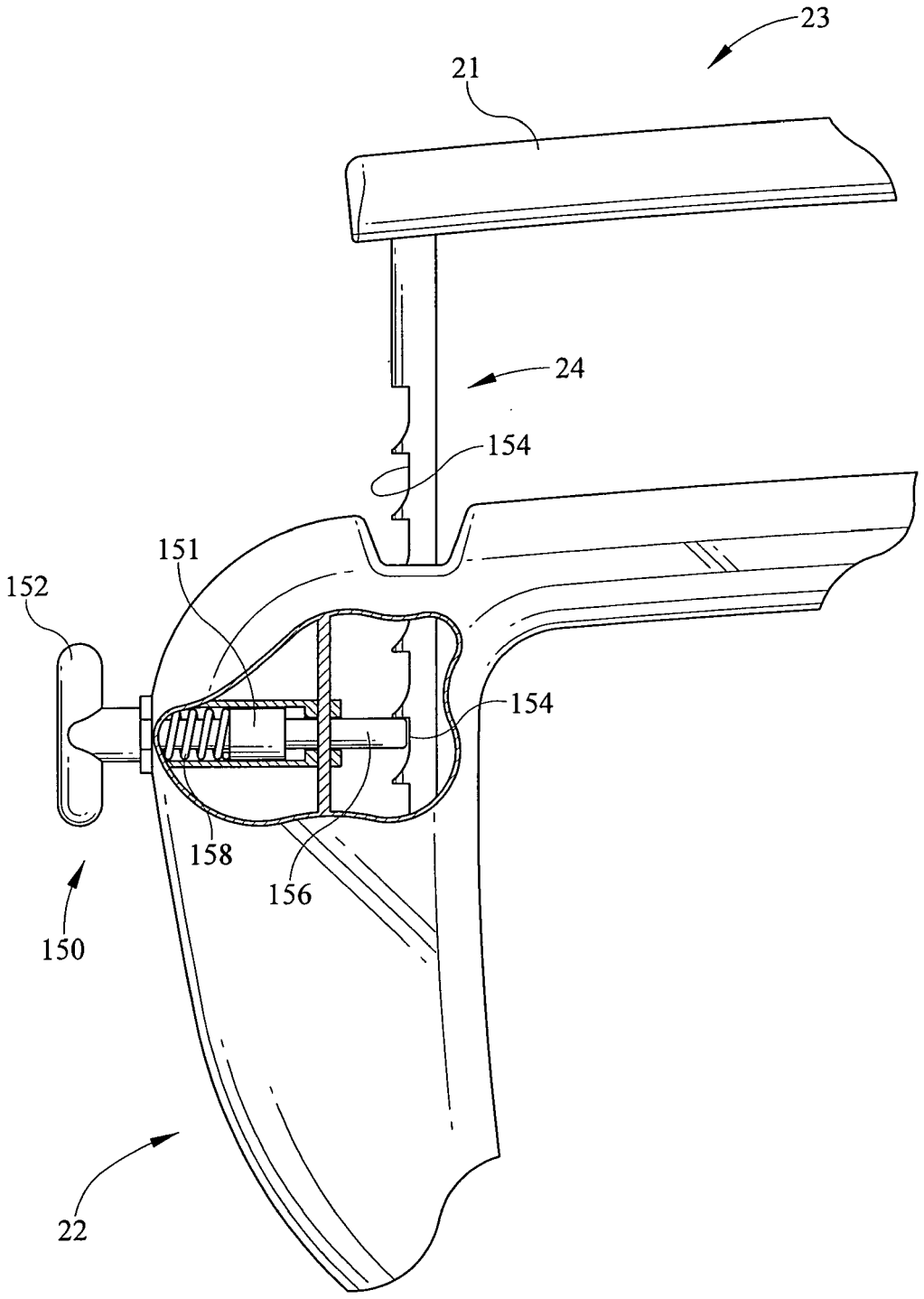

FIG. 14

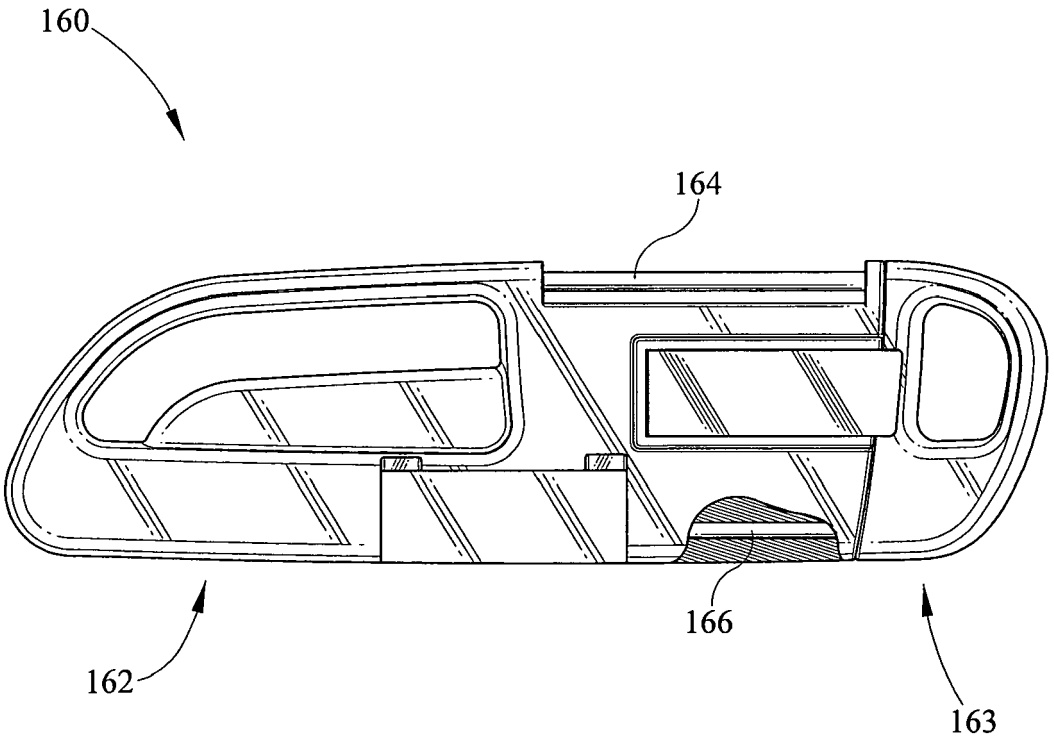

FIG. 15

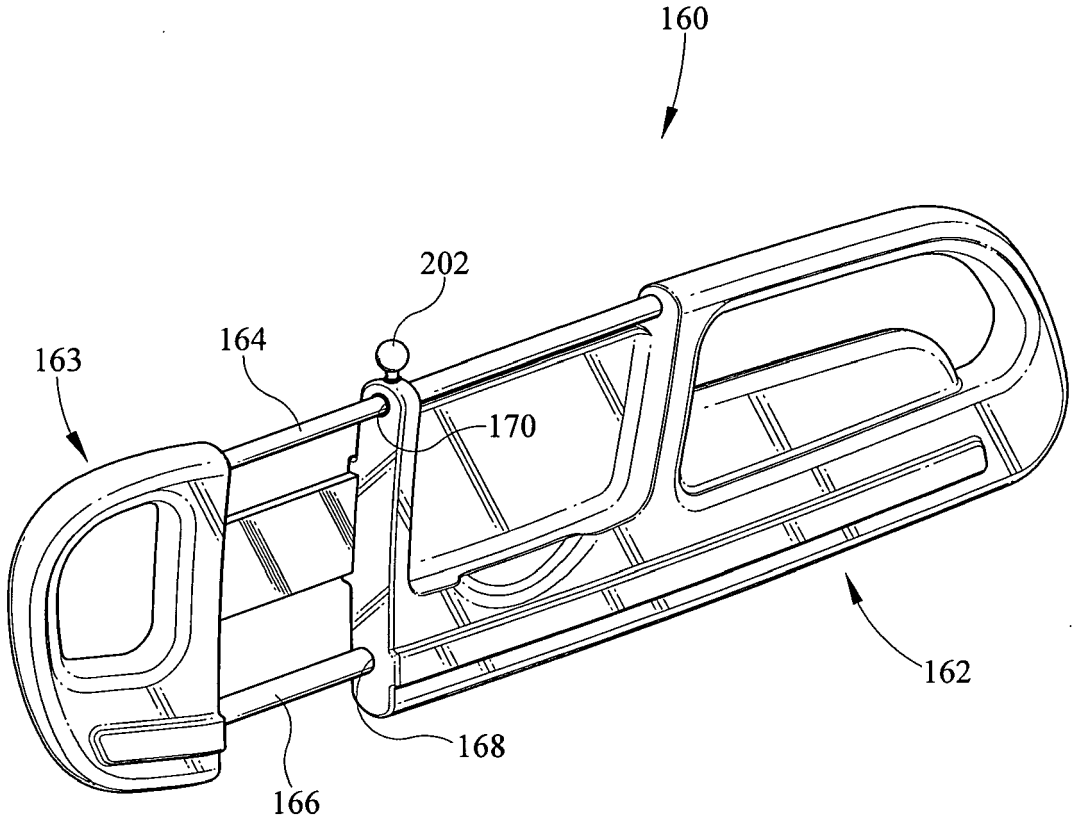

FIG. 16

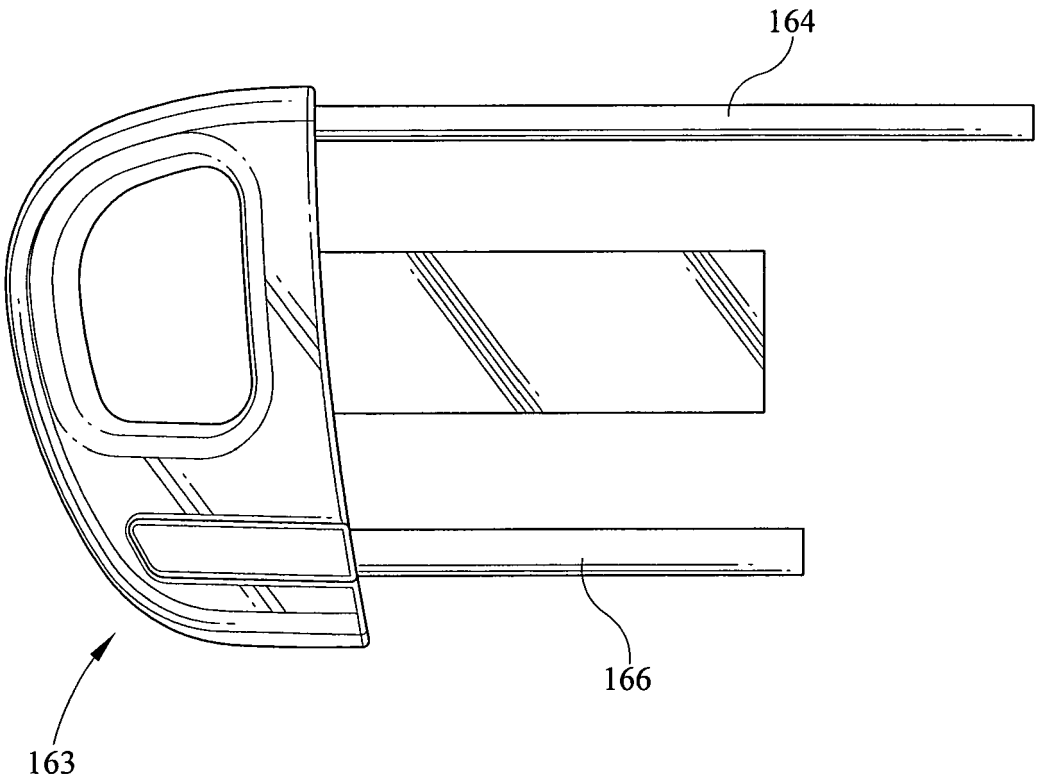

FIG. 17

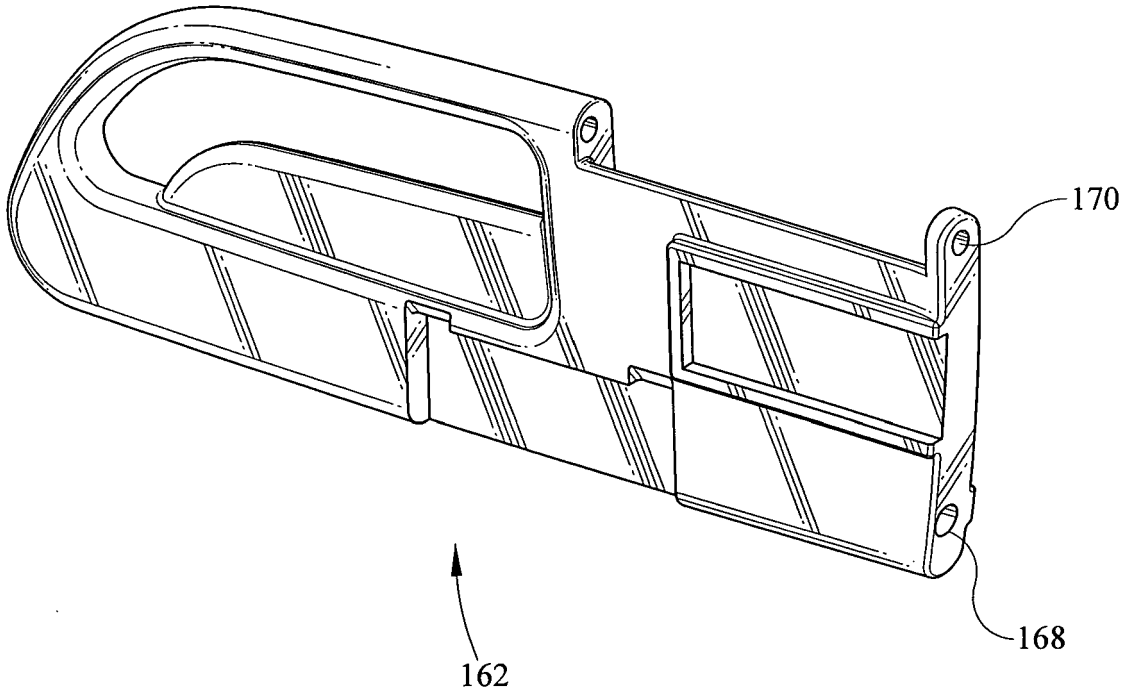

FIG. 18

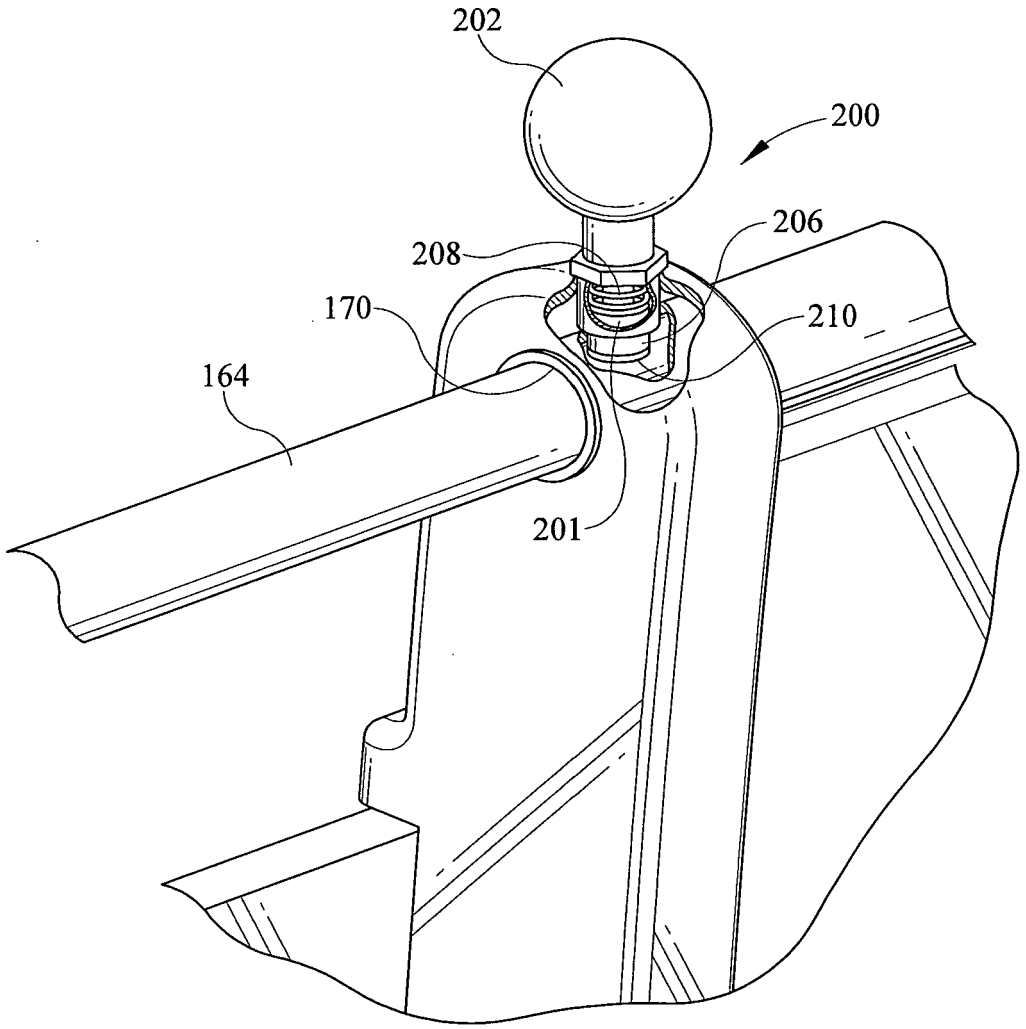

FIG. 19

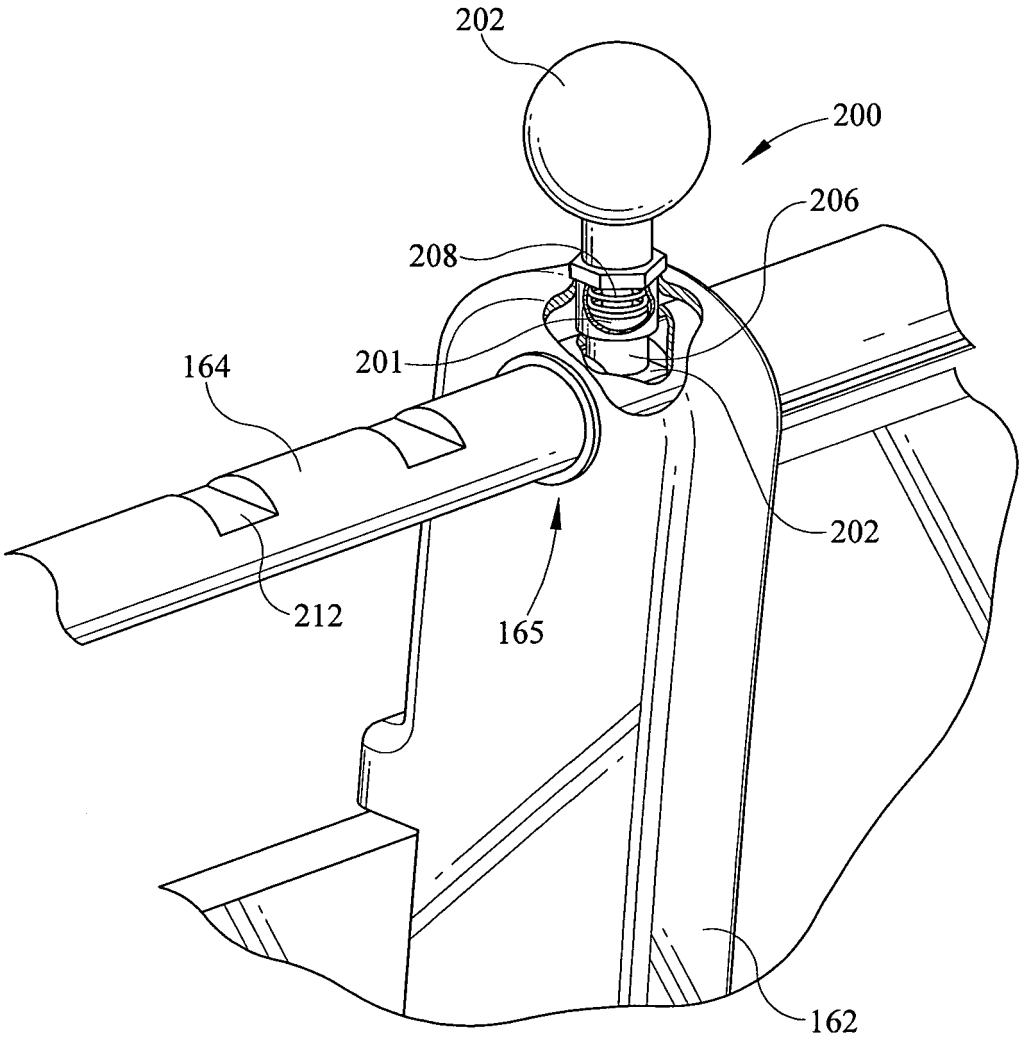

FIG. 20

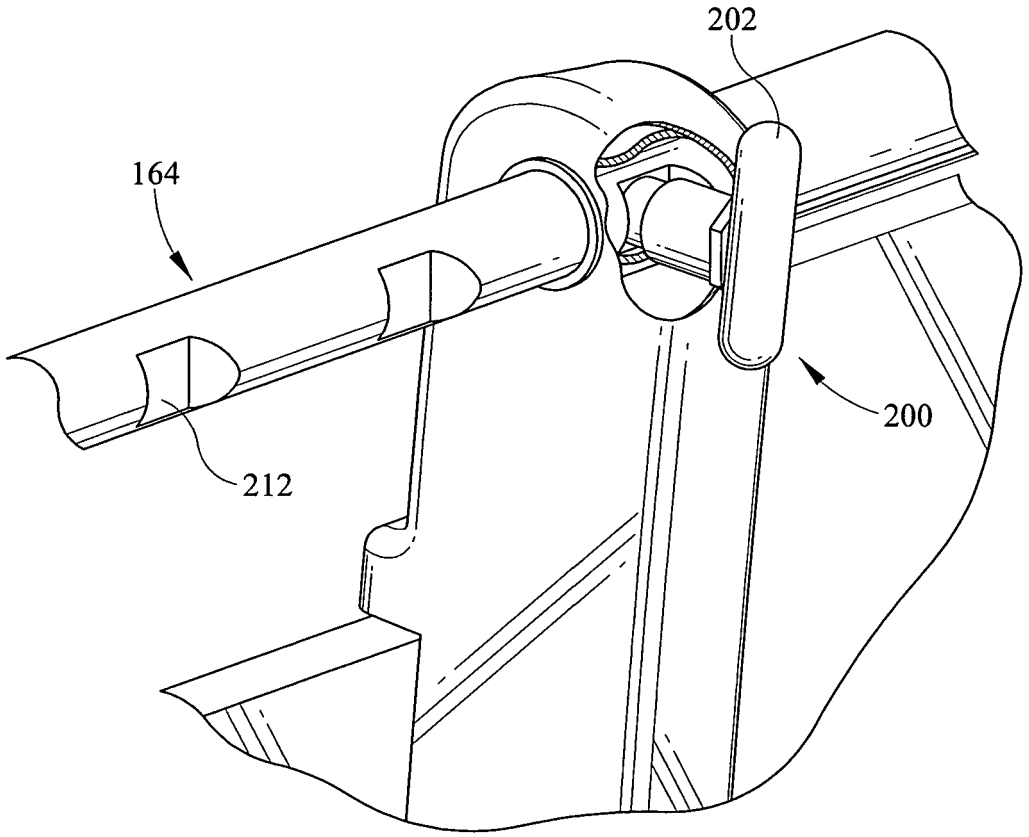

FIG. 21

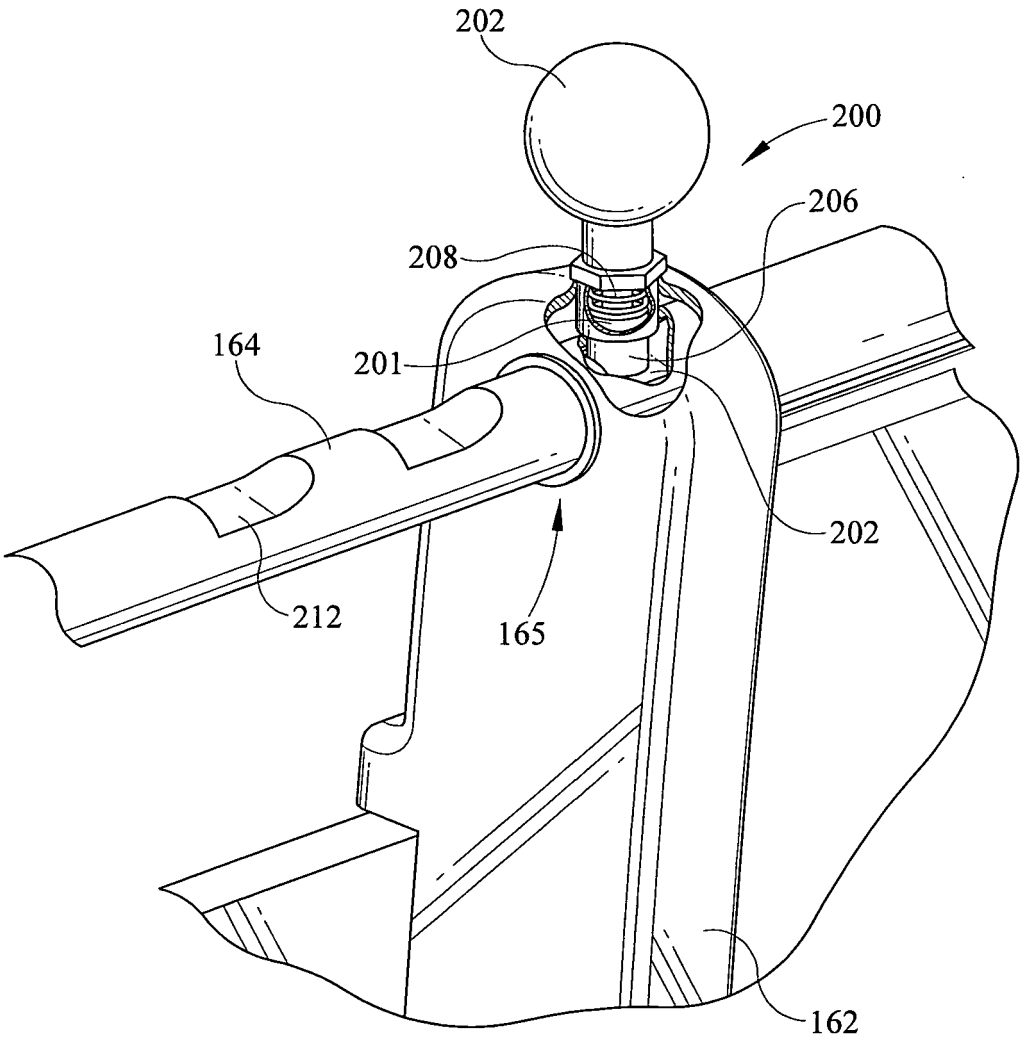

FIG. 22