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Cerniglia et al.

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(54) **ROTATIONAL LOCKOUT**

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(51) **Int. Cl.**

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G06F 1/18	(2006.01)
G11B 33/12	(2006.01)
H05K 7/14	(2006.01)
H05K 13/00	(2006.01)

(52) **U.S. Cl.**
CPC ***H05K 5/0286*** (2013.01); ***G06F 1/183*** (2013.01); ***G11B 33/128*** (2013.01); ***H05K 5/0221*** (2013.01); ***H05K 7/1489*** (2013.01); ***H05K 13/00*** (2013.01); *Y10T 29/49826* (2015.01)

(58) **Field of Classification Search**
CPC H05K 5/0286–5/0295; H05K 7/1489; G11B 33/128
USPC 361/726, 727, 732
See application file for complete search history.

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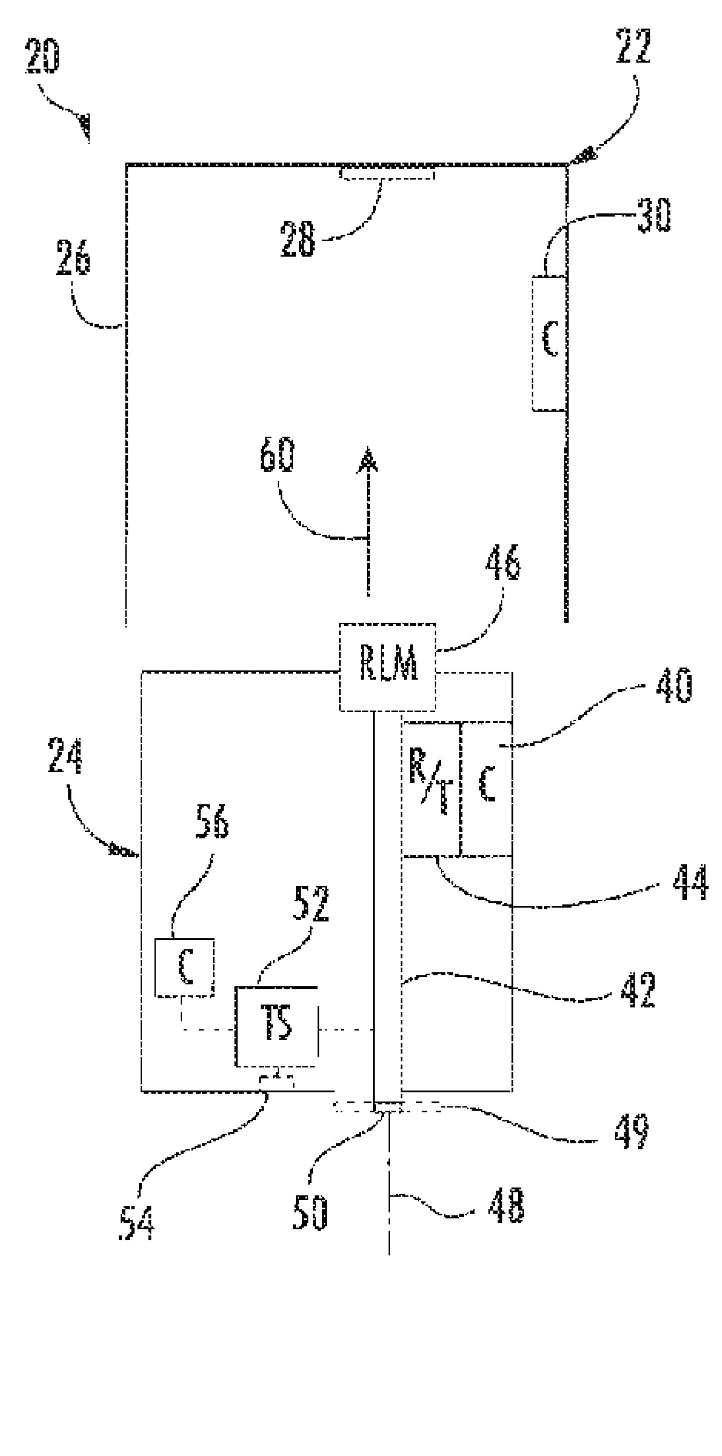
(57) **ABSTRACT**

An apparatus and method unlock a shaft (**42**, **142**) of a unit (**24**, **124**) for rotation in response to a mechanical reaction between the unit (**24**, **124**) and an enclosure (**22**, **122**) receiving the unit (**24**, **124**) when the unit (**24**, **124**) has been sufficiently inserted into the enclosure (**22**, **122**), whereby rotation of the shaft (**42**, **142**) linearly translates a component of the unit (**24**, **124**) into connection with a component of the enclosure (**22**, **122**).

15 Claims, 11 Drawing Sheets



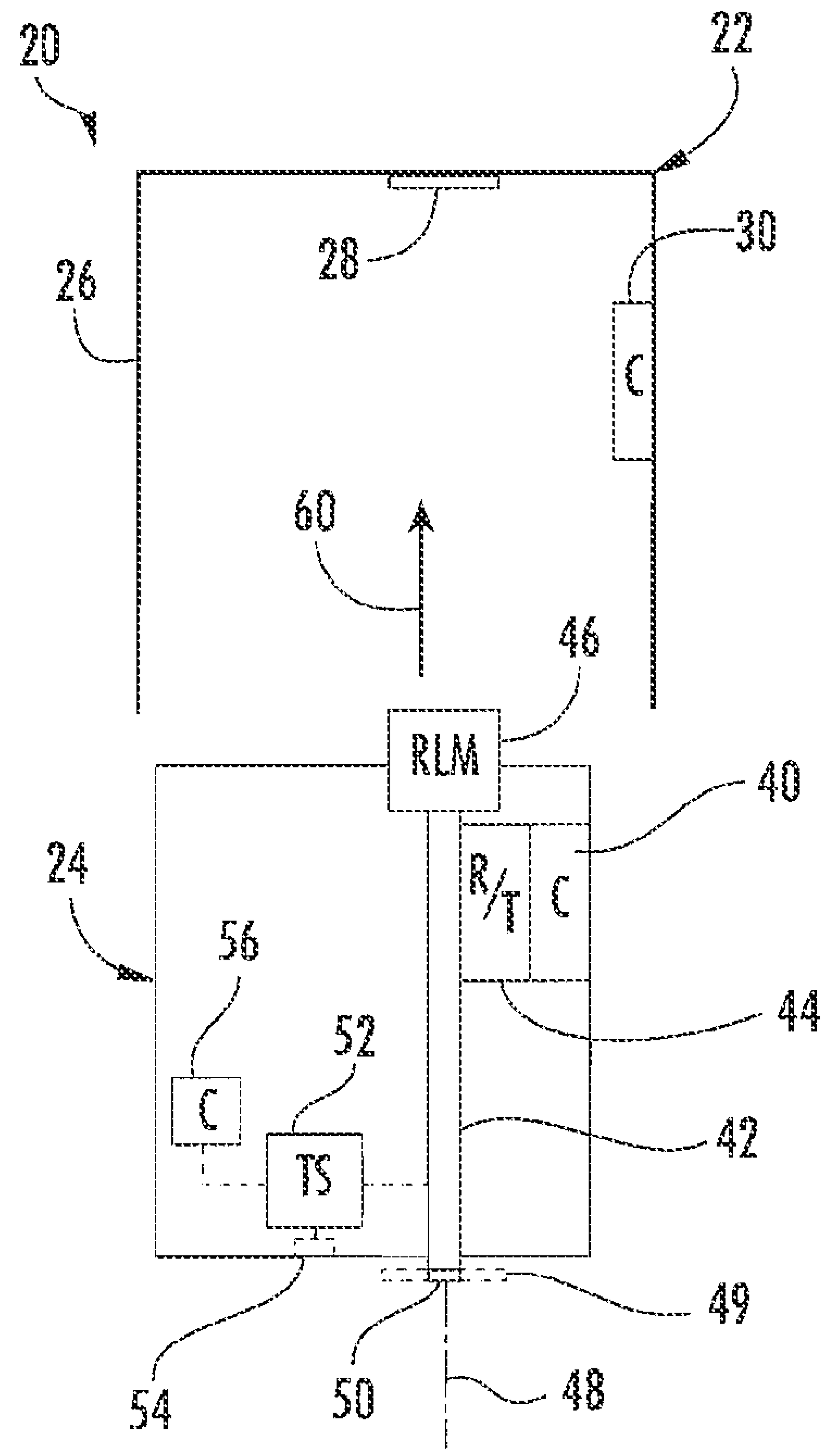


FIG. 1

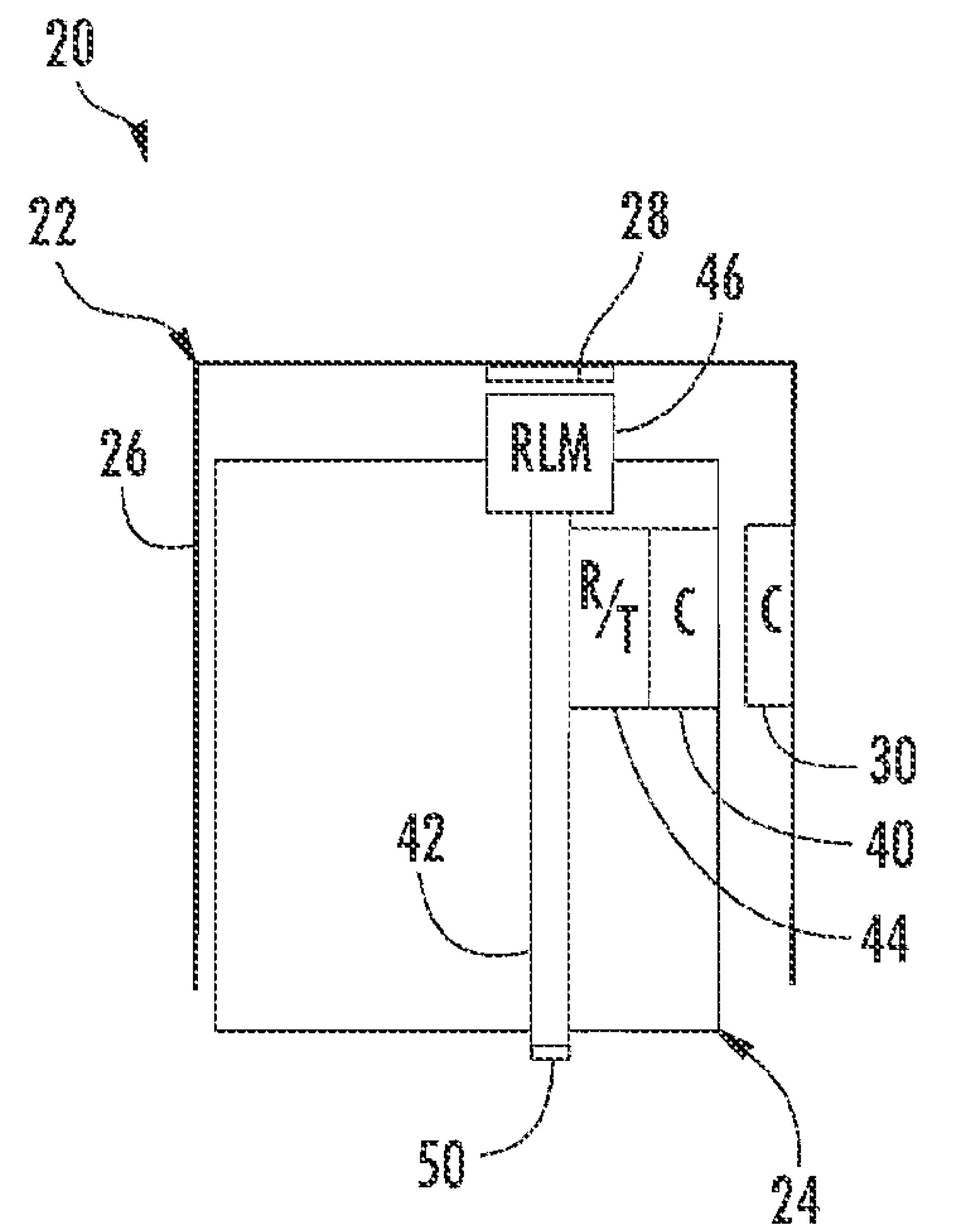


FIG. 2

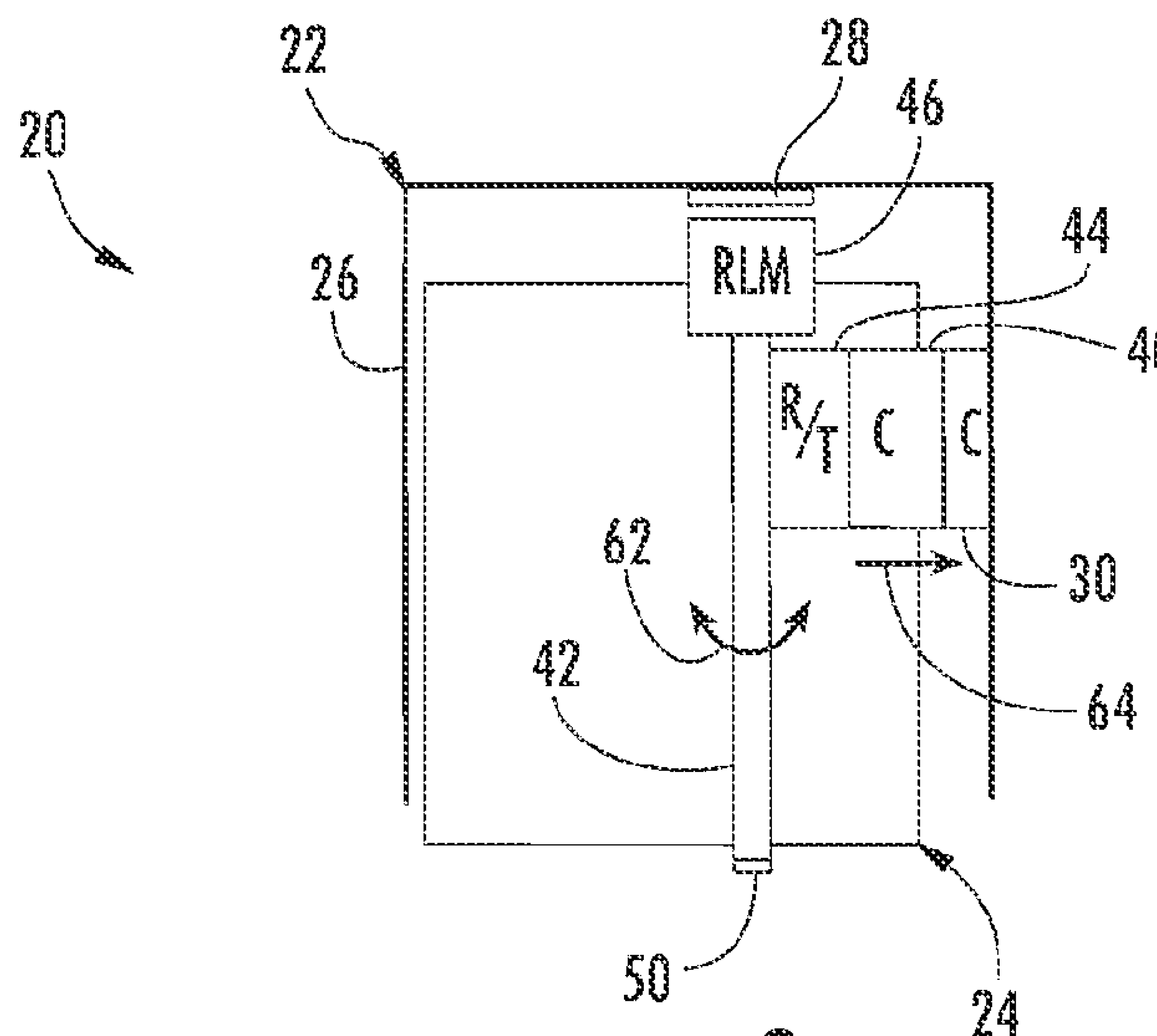


FIG. 3

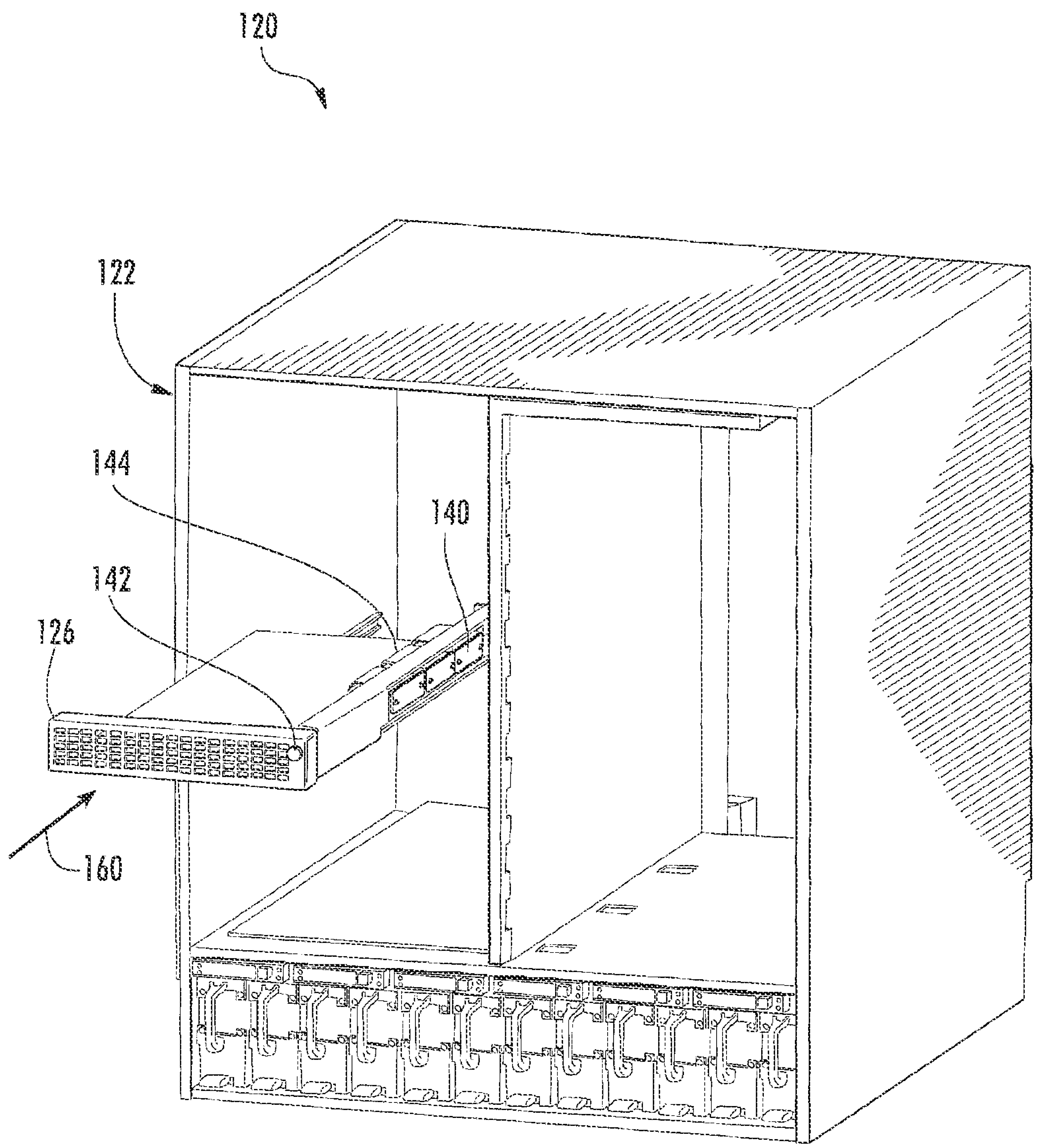


FIG. 4

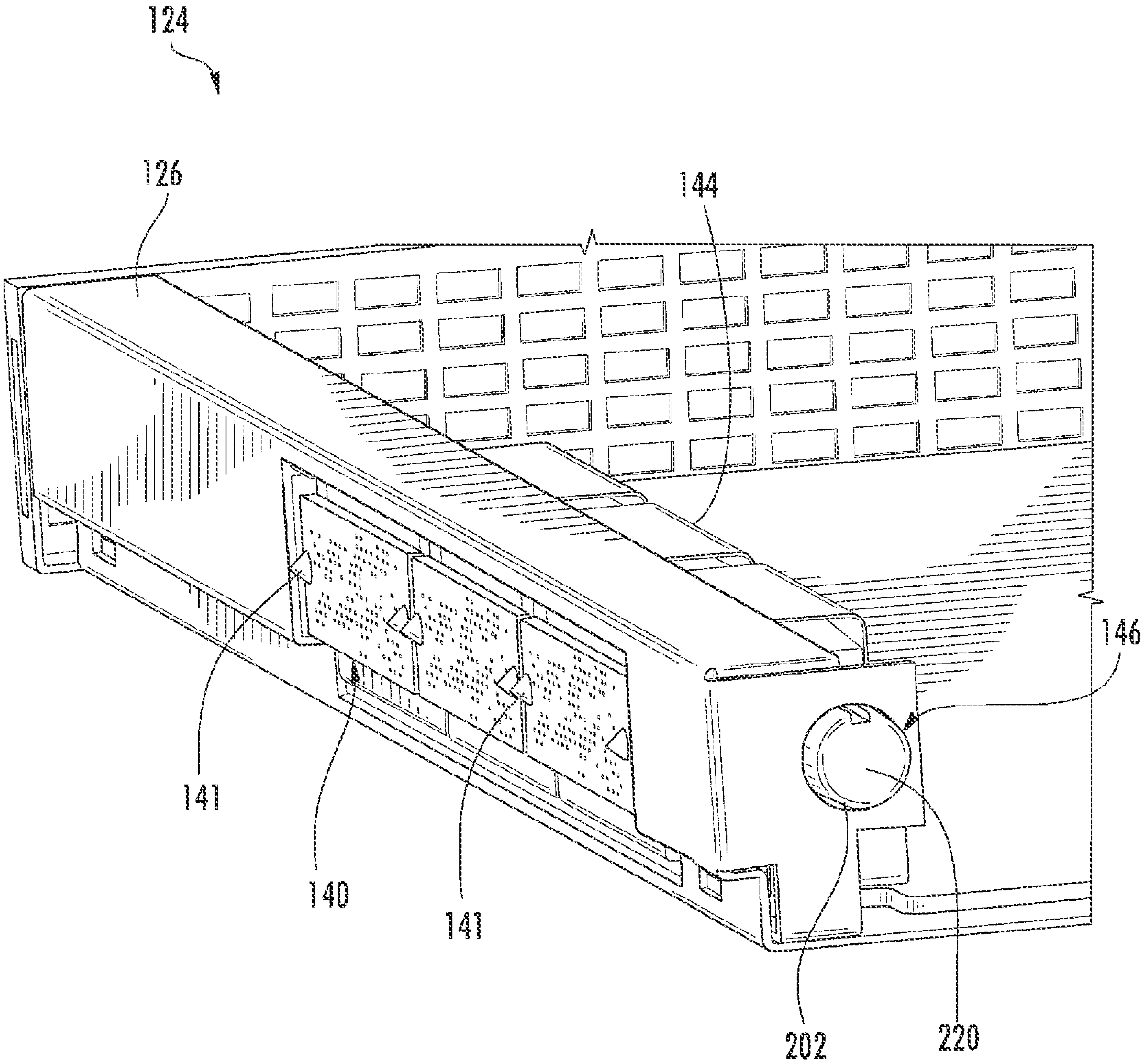


FIG. 5

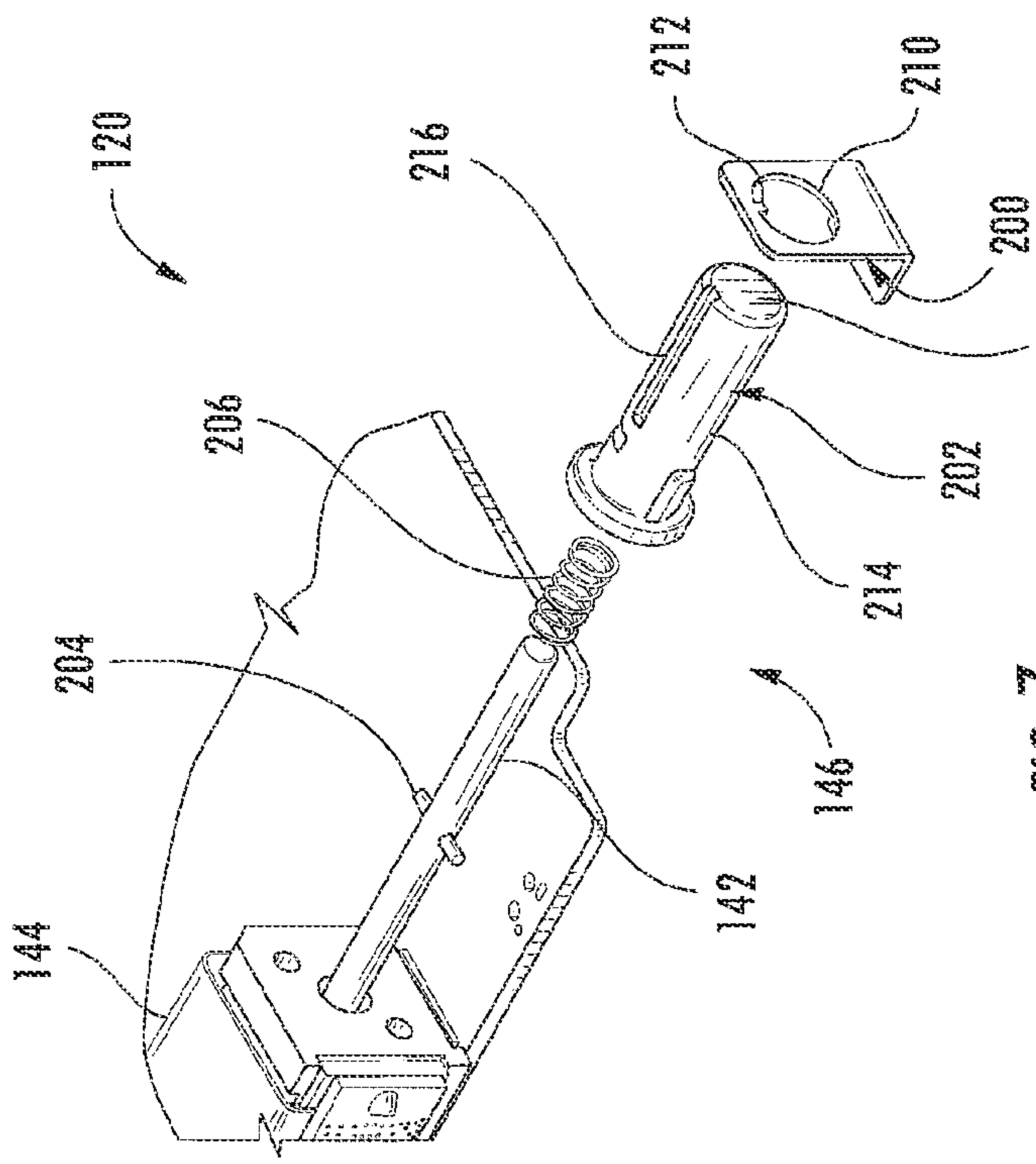

120
212
210
216
200
220
206
202
214
204
146
142
144

FIG. 7

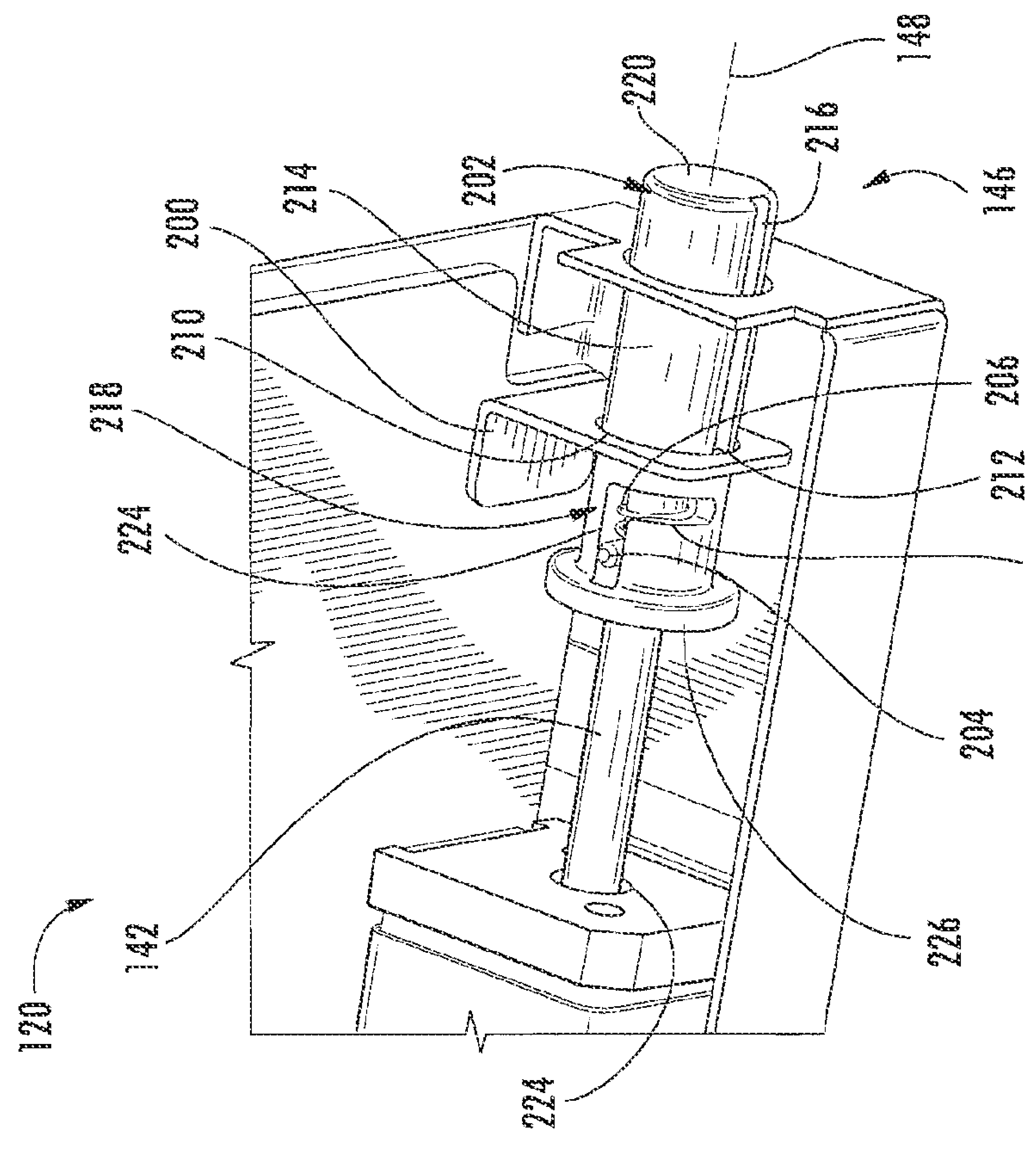

220
148
202
216
214
146
200
210
218
206
212
224
226
204
142
226
120
224

FIG. 6

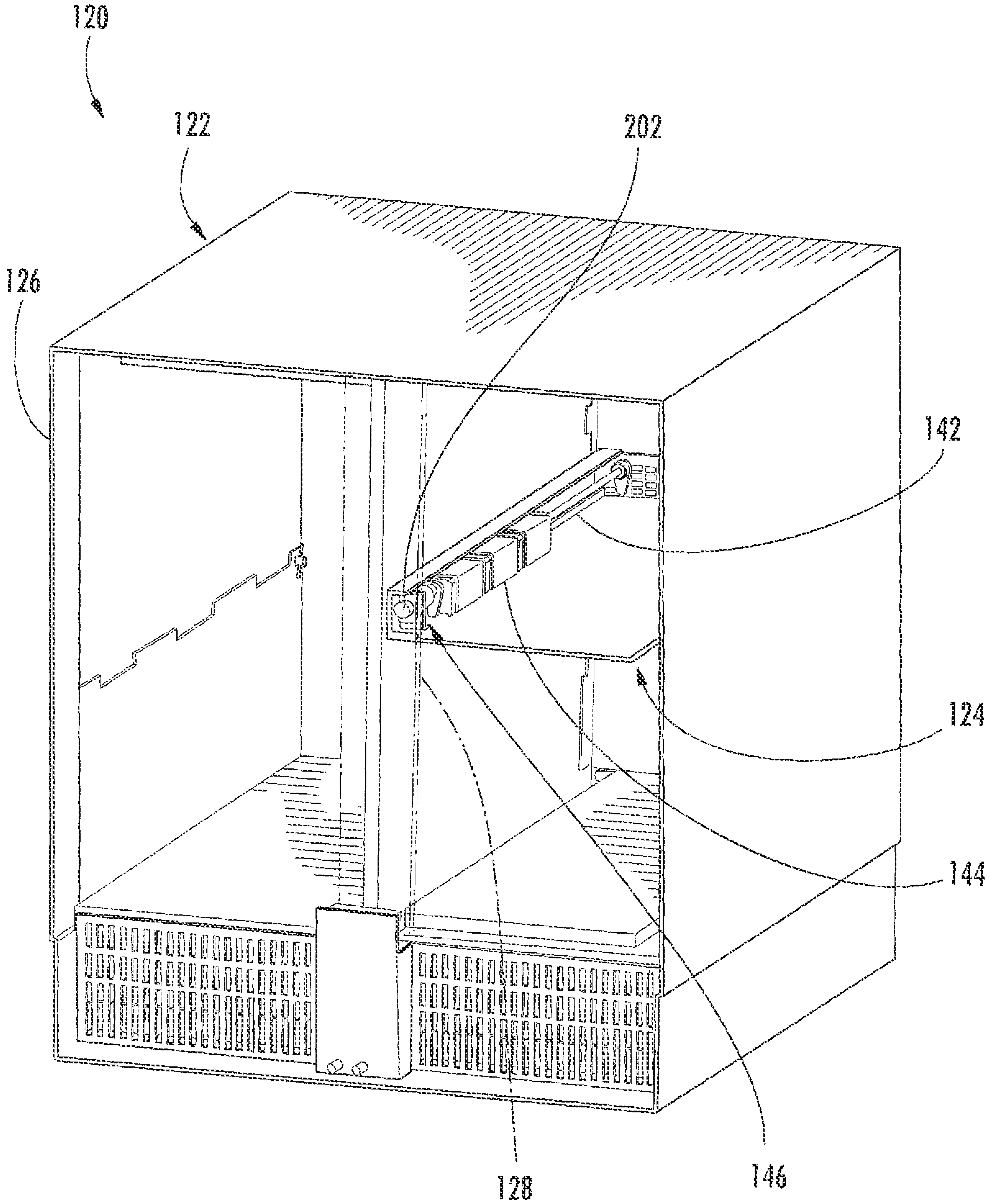


FIG. 8

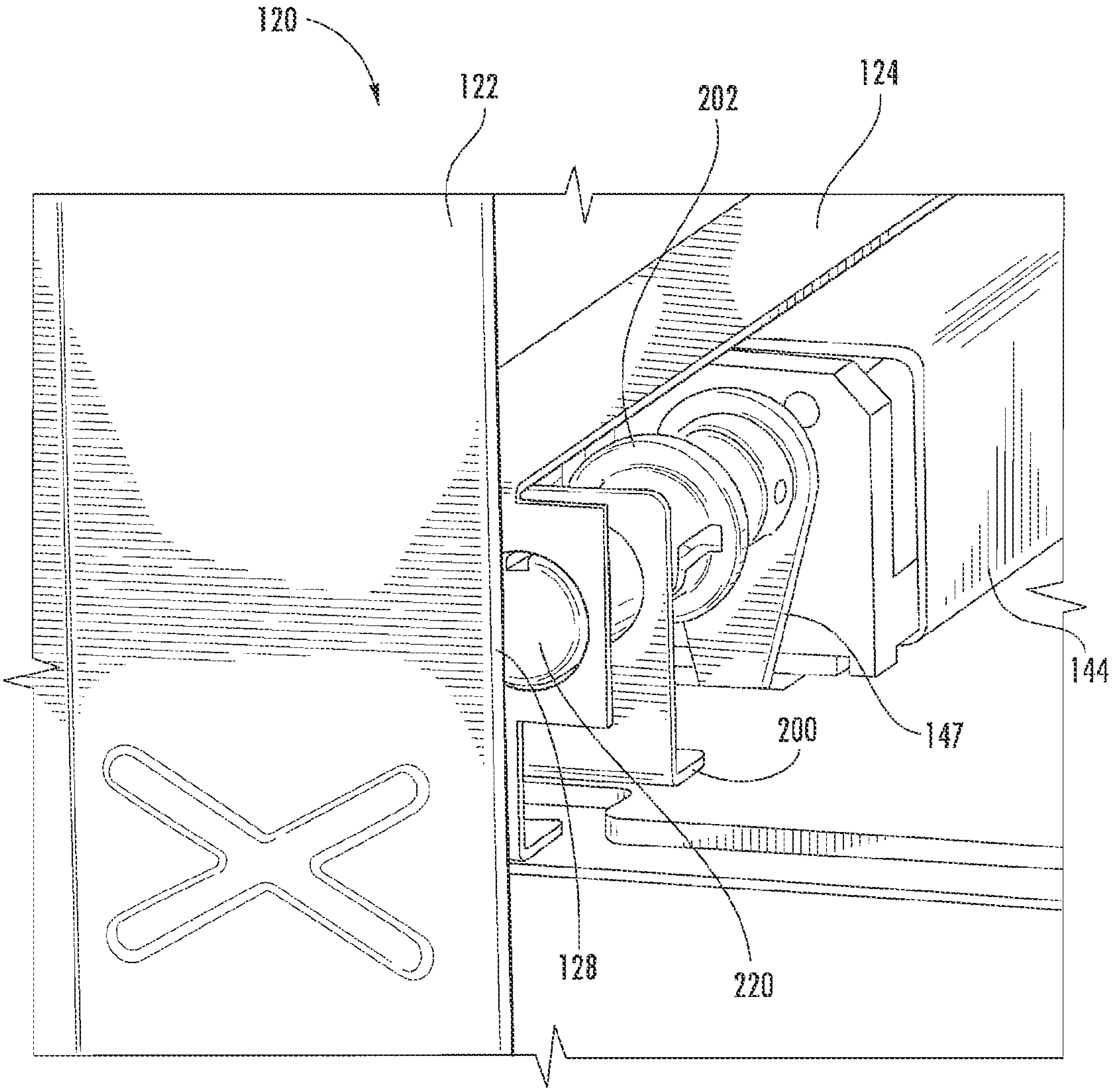


FIG. 9

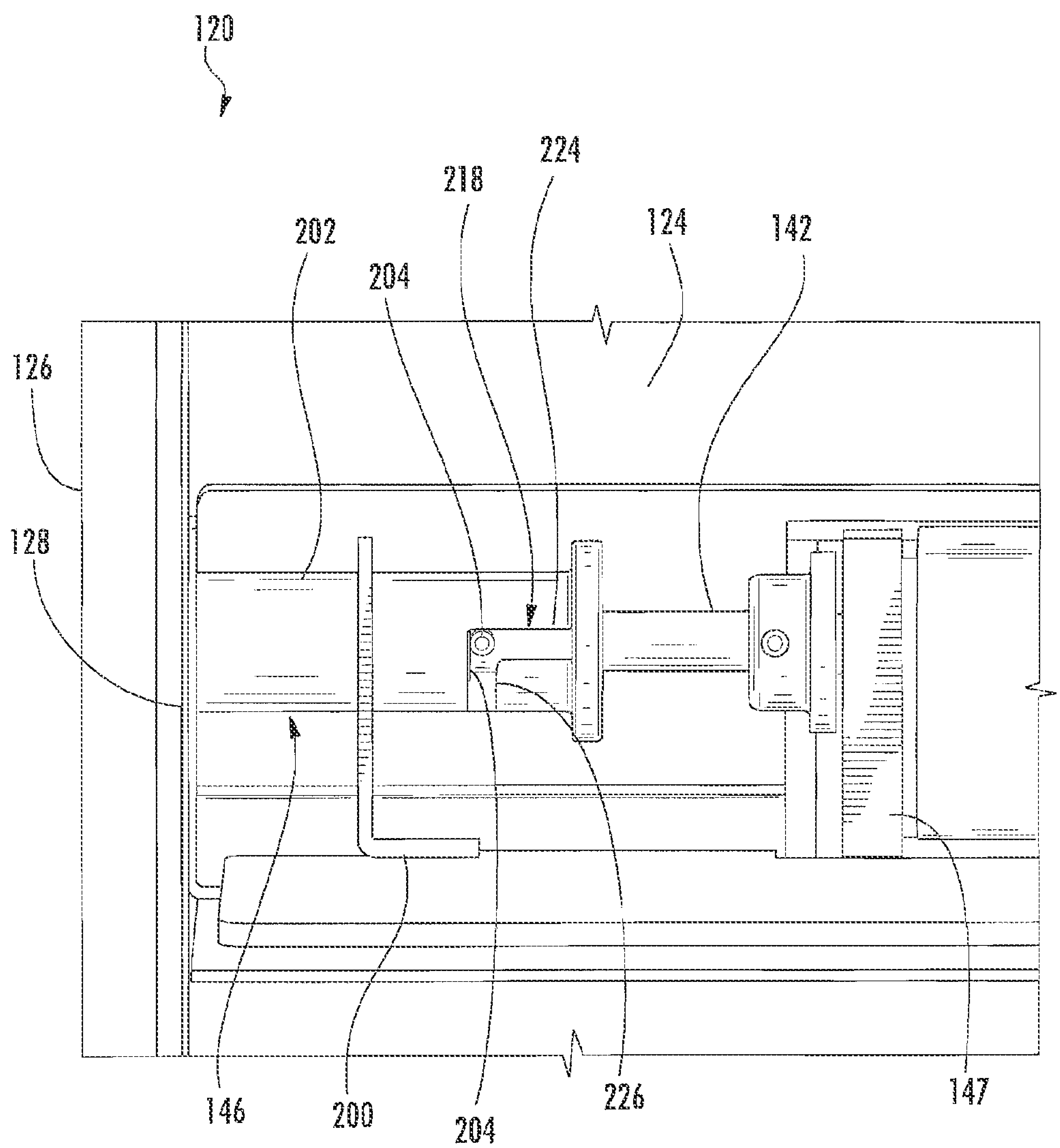


FIG. 10

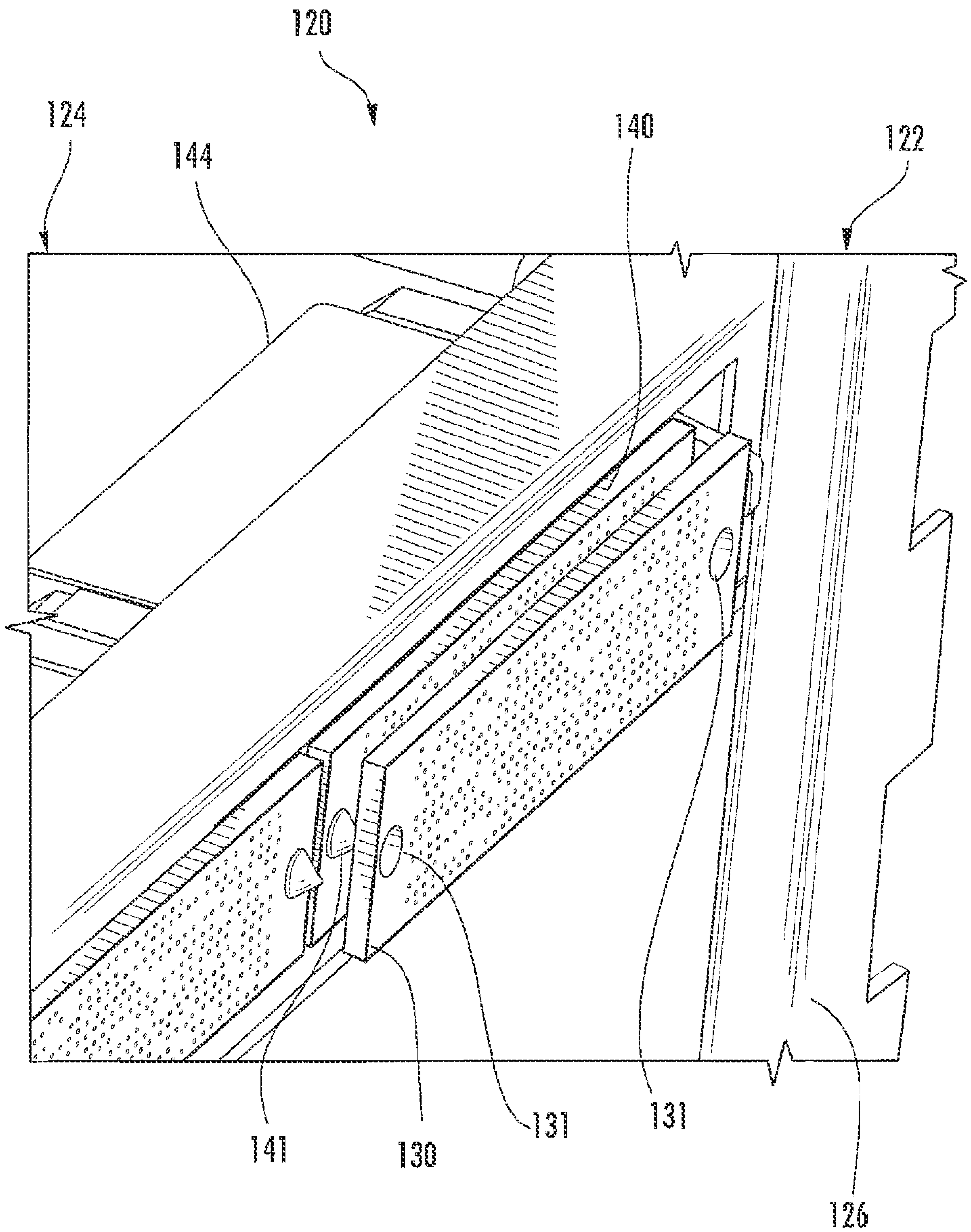


FIG. 11

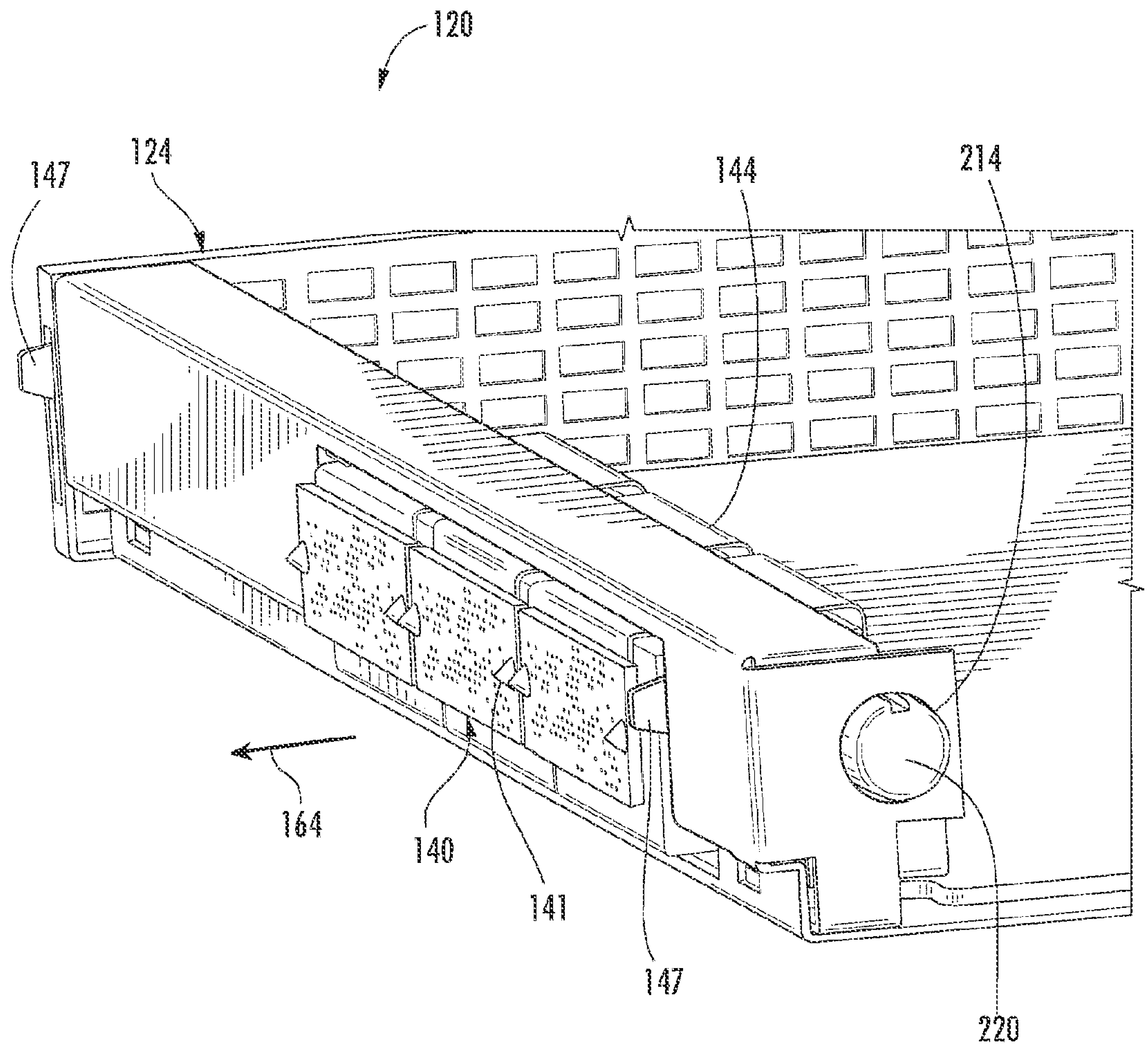


FIG. 12

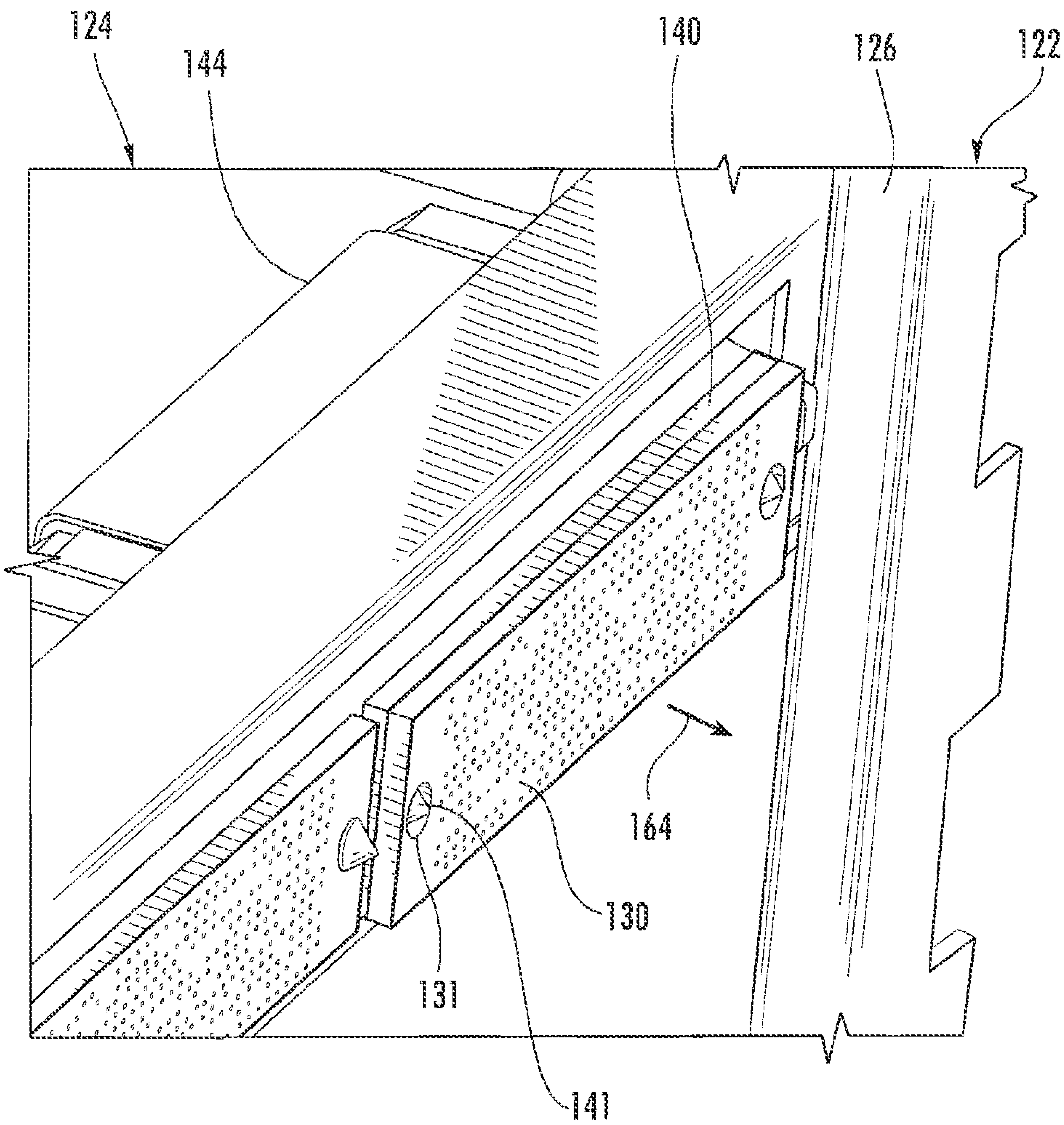


FIG. 13

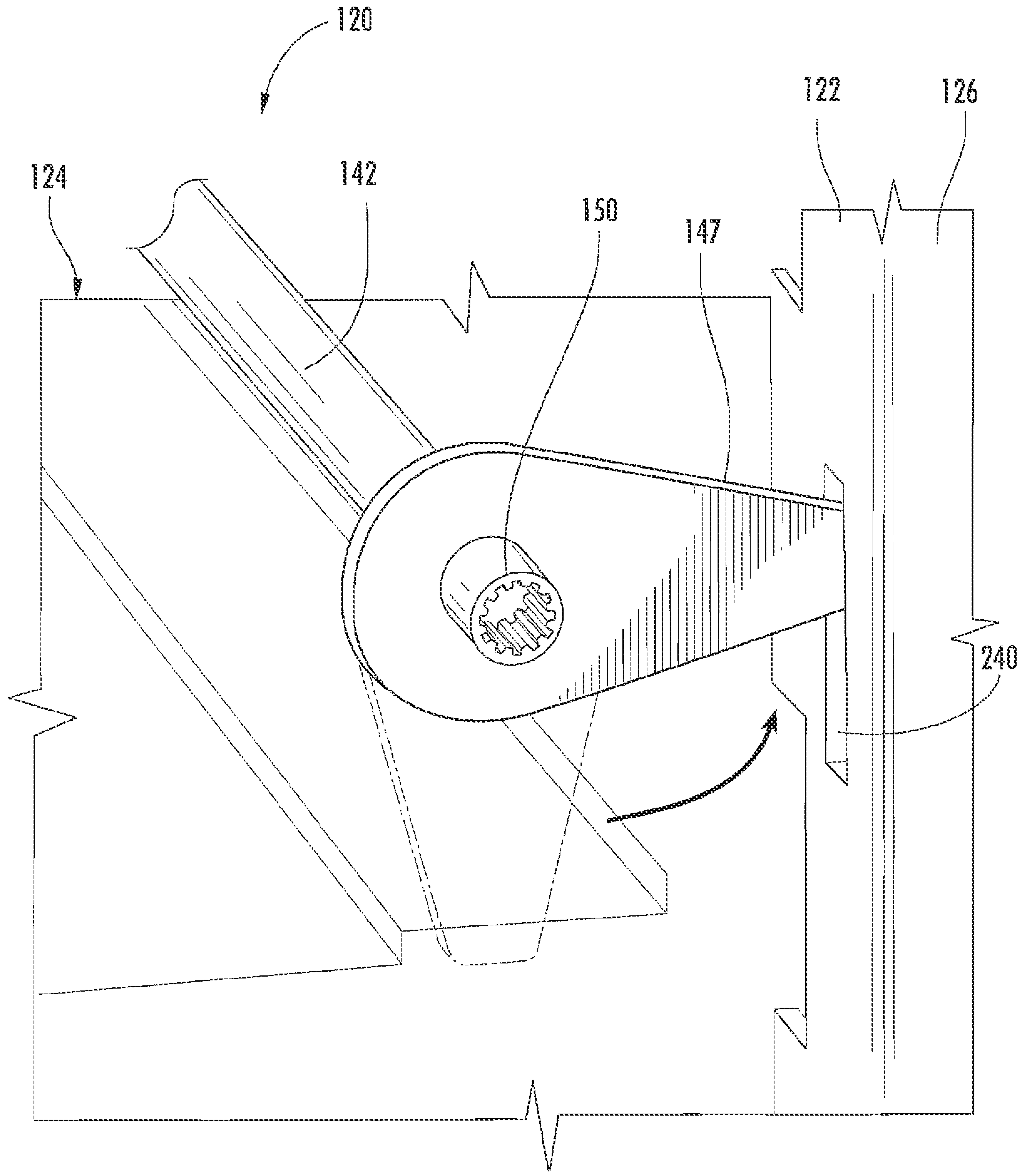


FIG. 14

ROTATIONAL LOCKOUT

BACKGROUND

In many devices or systems, a component of a unit may connect to a component of an enclosure while the unit is within the enclosure, If the components of the unit and the enclosure are not properly aligned during an attempted connection, the components may become damaged.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic illustration of a connection system with a unit withdrawn from an enclosure according to an example embodiment.

FIG. **2** is a schematic illustration of the connection system of FIG. **1** with the unit inserted into the enclosure according to an example embodiment.

FIG. **3** is a schematic illustration of the connection system of FIG. **1** with the unit inserted into the enclosure and the unit connected to the enclosure according to an example embodiment.

FIG. **4** is a front perspective view of another embodiment of the connection system, unit and enclosure of FIG. **1** with the unit withdrawn from the enclosure according to an example embodiment.

FIG. **5** is a fragmentary perspective view of the unit of FIG. **4** illustrating a connector component in a retracted position according to an example embodiment.

FIG. **6** is a fragmentary perspective view of a rotational lockout mechanism of the unit of FIG. **4** with a rotational lockout mechanism in a locked state according to an example embodiment.

FIG. **7** is an exploded perspective view of the rotational lockout mechanism of FIG. **6** according to an example embodiment.

FIG. **8** is a rear perspective view of the connection system of FIG. **4** with the unit inserted into the enclosure according to an example embodiment.

FIG. **9** is an enlarged fragmentary perspective view of the unit inserted into the enclosure. According to an example embodiments

FIG. **10** is a fragmentary sectional view of the unit inserted into the enclosure with the rotational lockout mechanism in an unlocked state according to an example embodiment.

FIG. **11** is a fragmentary perspective view of the unit of FIG. **8** with a connector component of the unit proximate to a connector component of the enclosure according to an example embodiment.

FIG. **12** is a fragmentary perspective view of the unit of FIG. **8** with the rotational lockout mechanism and the unlocked state and with the connector component in an extended position according to an example embodiment.

FIG. **13** is a fragmentary perspective view of the unit of FIG. **12** with the connector component in the extended position in connection with the connector component of the enclosure according to an example embodiment.

FIG. **14** is a fragmentary perspective view of the unit of FIG. **13** with the connector component in the extended position in connection with the connector component of the enclosure according to an example embodiment.

DETAILED DESCRIPTION OF THE EXAMPLE EMBODIMENTS

FIGS. **1-3** schematically illustrate a connection system **20** according to an example embodiment. Connection system **20** comprises enclosure **22** and insertable unit **24**. As will be described hereafter, connection system **20** facilitates interconnection between components of enclosure **22** and unit **24** while unit **24** is within enclosure **22** and with a low likelihood of damage to such components.

Enclosure **22** comprises one or more structures **26** configured to receive or at least partially surround or enclose unit **24**. Enclosure **22** further comprises a mechanical interaction surface **28** and a connector component **30**. Mechanical interaction surface **28** comprises one or more surfaces configured to interact with portions of unit **24** to facilitate connection of connector component **30** to portions of unit **24**. Connector component **30** comprises a component configured to connect with and interact with a connector component of unit **24**. In one embodiment, connector component **30** is configured to facilitate the transmission of electrical signals between unit **24** and enclosure **22**. In another embodiment, connector component may be configured to facilitate the transmission of other mediums, such as gases, liquids or mechanical motion or force between unit **24** and enclosure **26**.

Unit **24** comprises a unit configured to be inserted into and connected to component **30** of enclosure **28**. Unit **24** comprises connector component **40**, shaft **42**, rotation to translation coupler **44** and rotational lockout mechanism **46**. Connector component **40** comprise a component configured to connect to and/or mate with connector component **40** of enclosure **22**. In one embodiment, connector component **40** is configured to facilitate the transmission of electrical signals between unit **24** and enclosure **22**. In another embodiment, connector component may be configured to facilitate the transmission of other mediums, such as gases, liquids or mechanical motion or force between unit **24** and enclosure **26**.

Connector component **40** is movable between a retracted position (shown in FIGS. **1** and **2**) and an extended position (shown in FIG. **3**). In the retracted position, connector component **40** is sufficiently recessed or retracted into unit **24** such that connect component **40** is not completely connect with connector **30** and is less susceptible to damage during insertion of unit **24** into enclosure **22**. In the extended position, connector component **40** sufficiently projects from unit **24** so as to completely connect with connector **30** of enclosure **22**. One embodiment, connector component **40** may be movably supported by one or more guides, tracks, channels, bearings or the like.

Shaft **42** comprises an elongate member rotationally supported by enclosure **22** for rotation about its axis **48**. Shaft **42** is operably connected to rotation to translation coupler **44** which transmitter converts rotational motion from shaft **42** into linear or translational motion or movement to linearly translate controller component **40** between the extended and retracted positions. Shaft **42** is further operably coupled to rotational lockout mechanism **46** which controls or limits rotational shaft **42**. In one embodiment, shaft **42** may include a handle **49** for facilitating manual tool less rotation of shaft **42**. In another embodiment, shaft **42** may include an interface **50** for interaction with a tool, such as an Allen wrench, screwdriver and the like, for rotation of shaft **42**. In yet other embodiments, shaft **42** may be operably coupled to an optional torque source **52** (schematically illustrated) such as a motor (with associated worm gear-bevel gear arrangement, belt and pulley arrangement, chain and sprocket arrangement or the like) or rotating shaft **42** in response to actuation of a switch **54** or in response to control signals from an optional controller **56**.

Rotation to translation coupler **44** comprise one or more mechanisms operably coupling shaft **42** to connector **40** such that rotation of shaft **42** linearly translates connector component **40** between the extended position and a retracted position. In one embodiment, coupler **44** may move connector component **40** in one direction, wherein a resilient bias, such as a spring, resiliently moves connector component **40** in the other direction. In another embodiment, coupler **44** may move connector **140** in each of two opposite directions. According to one embodiment, rotation to translation coupler **44** may comprise one or more cam and cam follower arrangements. In another embodiment, rotation to translation coupler **44** may comprise other mechanical arrangements such as an incline, a chain and sprocket arrangement or a belt and pulley arrangement for converting rotational motion to linear motion.

Rotational lockout mechanism **46** comprises a mechanism or arrangement of members configured to lock shaft **42** against rotation and to unlock shaft **42** for rotation in response to a mechanical reaction between enclosure **22** and unit **24** that occurs when unit **24** has been sufficiently inserted into enclosure **22** such that connect component **40** is sufficiently proximate to or aligned with connector component **30**. In the example illustrated, the mechanical reaction occurs when portions of rotational lockout mechanism **46** physically contact surface **28**. For purposes of this disclosure, the term "mechanical reaction" means that mechanical forces solely resulting from the manual force applied to unit **24** to push or insert unit **24** into enclosure **22** (and against surface **28**) are transmitted to and used to physically move members of rotational lockout mechanism **28** so as to activate or actuate rotational lockout mechanism **46** to an unlocked state. In other words, actuation of rotational lockout mechanism **46** does not utilize external power such as from a cylinder assembly, motor, solenoid and the like to move mechanism **46** between locked and unlocked states and does not employ optical or electrical sensors or switches for detecting when unit **24** has been sufficiently inserted into enclosure **22**. Such a mechanical reaction may be similar in nature to the insertion of a key into a padlock, wherein the insertion force of the key into the padlock moves various tumblers to allow the key to be subsequently rotated to unlock the padlock.

FIGS. **1-3** further illustrate an example process or method by Which unit **24** is inserted into and connected to enclosure **22**. As shown by FIG. **1**, while connector component **40** of unit **24** is in the recess or retracted position, unit **24** is inserted into enclosure **26** by being moved in the direction indicated by arrow **60**. As shown by FIG. **2**, such insertion continues until rotational lockout mechanism **46** physically contacts surface **28** of enclosure. While rotational lockout mechanism **46** is in physical contact with surface **28**, connector component **40** is in sufficient proximity or alignment with connector component **30** of enclosure **22** for subsequent connection to connector component **30**. The physical contact or physical interaction between rotational lockout mechanism **46** and surface **28** causes a mechanical reaction whereby the manual force is used to press rotation lockout mechanism **46** against surface **28** also causes one or more mechanical members of rotational lockout mechanism **46** to also move so as to actuate rotational lockout mechanism **46** from a locked state, preventing rotation of shaft **42**, to and unlocked state, allowing rotation of shaft **42**.

As shown by FIG. **3**, once rotational lockout mechanism **46** has been activated to an unlocked state as a result of the mechanical reaction between rotational lockout mechanism **46** and surface **28**, shaft **42** is rotated about its axis **48** in one of two possible directions as indicated by arrows **62**. Rotation of shaft **42** generates circular motion and torque. Rotation to translation coupler **44** converts the rotational motion and torque provided by the rotation of shaft **42** to linear translational motion so as to move connector component **40** in the direction indicated by arrow **64**, perpendicular to direction **60** and axis **48**, from a recessed or retracted position to a projecting or extended position and into connection or contact with connector component **30**. Because rotational lockout mechanism **46** potentially inhibits or prevents rotation of shaft **42** and therefore prevents or inhibits extension of connector component **40** until connector component **40** is sufficiently proximate to and aligned with connector component **30**, rotational lockout mechanism **46** reduces the likelihood of accidental damage to connector components **40** and **30**, which might otherwise result from premature attempted connection of such components. This is especially beneficial in some embodiments where connection components **30** and **40** cannot be visibly seen or cannot be visibly aligned with one another when unit **24** is inserted into enclosure **22** (a blind connection, insertion or assembly action).

Disconnection and withdrawal of unit **24** from enclosure **22** occurs by sequencing through the above-mentioned steps in an opposite manner. in particular, shaft **42** is rotated, moving or allowing connector component **40** to move to the retracted or recessed position in which component **40** is disconnected from component **30**. Thereafter, unit **24** is withdrawn from enclosure **22**.

FIGS. **4-14** illustrate connection system **120**, another embodiment of connection system **20** shown in FIGS. **1-3**. Connection system **120** comprises enclosure **122** and insertable unit **124**. As with connection system **20**, connection system **120** facilitates interconnection between components of enclosure **122** and unit **124** while unit **124** is within enclosure **122** and with a low likelihood of damage to such components. In the example illustrated, connection system **120** comprises a computer blade system, wherein enclosure **122** comprises a computer blade enclosure or receptacle configured to receive a plurality of computer blades and wherein unit **124** comprises one of the computer blades. In other embodiments, connection system **120** may be embodied as other devices.

Enclosure **122** comprises one or more structures **126** configured to receive or at least partially surround or enclose unit **124**. Enclosure **122** farther comprises a mechanical interaction surface **128** (shown in FIGS. **8-10**) and a connector component **130** (shown in FIG. **11**). Mechanical interaction surface **128** comprises one or more surfaces configured to interact with portions of unit **124** to facilitate connection of connector component **130** to portions of unit **124**. Connector component **130** comprises a component configured to connect with and interact with a connector component of unit **124**. In the example illustrated, connector component **130** is configured to facilitate the transmission of electrical signals between unit **124** and enclosure **122**. In the example illustrated, connector component **130** includes alignment apertures **131** configured to receive alignment structures such as alignment pins of a connector component of unit **124**. In other embodiments, connector component **130** may be configured to facilitate the transmission of other mediums, such as gases, liquids or mechanical motion or force between unit **124** and enclosure **126**.

Unit **124** comprises a unit configured to be inserted into and connected to component **130** of enclosure **128**. Unit **124** comprises connector component **140**, shaft **142**, rotation to translation coupler **144**, rotational lockout mechanism **146** (shown in FIG. **5**) and secondary unit locks **147**. Connector component **140** comprise a component configured to connect to and/or mate with connector component **130** of enclosure **122**. In the example illustrated, connector component **140** is configured to facilitate the transmission of electrical signals (signals representing data or controls) between unit **124** and enclosure **122**. In the example illustrated, connector component **140** includes alignment projections or pins **141** configured to be received within alignment apertures **131** of connector component **130**. In other embodiments, connector component **140** may include alignment apertures while component **130** includes alignment projections or pins. In another embodiment, connector component **140** may be configured to facilitate the transmission of other mediums, such as gases, liquids or mechanical motion or force between unit **124** and enclosure **126**.

Connector component **140** is movable between a retracted position (shown in FIGS. **5** and **11**) and an extended position (shown in FIGS. **12** and **13**). In the retracted position, connector component **140** is sufficiently recessed or retracted into unit **124** such that connect component **140** does not completely connect with connector **130** and is less susceptible to damage during insertion of unit **124** into enclosure **122**. In the extended position, connector component **140** sufficiently projects from unit **124** so as to completely connect with connector **130** of enclosure **122**. One embodiment, connector component **140** may be movably supported by one or more guides, tracks, channels, bearings or the like.

Shaft **142** comprises an elongate member rotationally supported by enclosure **122** for rotation about its axis **148**. Shaft **142** is operably connected to rotation to translation coupler **144** which transmitter converts rotational motion from shaft **142** into linear or translational motion or movement to linearly translate controller component **140** between the extended and retracted positions. Shaft **142** is further operably coupled to rotational lockout mechanism **146** which controls or limits rotation of shaft **142**. In the example illustrated, shaft **142** includes an interface **150** (shown in FIG. **14**) for interaction with a tool, such as an Allen wrench, screwdriver and the like, for rotation of shaft **142**. In other embodiments, shaft **142** may include a handle such as handle **49** shown in FIG. **1** for facilitating manual tool less rotation of shaft **42**. In yet other embodiments, shaft **142** may be operably coupled to an optional torque source **52** (schematically illustrated in FIG. **1**) such as a motor (with associated worm gear-bevel gear arrangement, belt and pulley arrangement, chain and sprocket arrangement or the like) for rotating shaft **142** in response to actuation of a switch **54** or in response to control signals from an optional controller **56** (shown in FIG. **1**).

Rotation to translation coupler **144** comprise one or more mechanisms operably coupling shaft **142** to connector **140** such that rotation of shaft **142** linearly translates connector component **140** between the extended position and a retracted position. In one embodiment, coupler **144** may move connector component **140** in one direction, wherein a resilient bias, such as a spring, resiliently moves connector component **40** in the other direction. In another embodiment, coupler **144** may move connector **140** in each of two opposite directions. According to one embodiment, rotation to translation coupler **144** may comprise one or more cam and cam follower arrangements. In another embodiment, rotation to translation coupler **144** may comprise other mechanical arrangements such as an incline, a chain and sprocket arrangement or a belt and pulley arrangement for converting rotational motion to linear motion.

Rotational lockout mechanism **146** comprises a mechanism or arrangement of members configured to lock shaft **142** against rotation and to unlock shaft **142** for rotation in response to a mechanical reaction between enclosure **122** and unit **124** that occurs when unit **124** has been sufficiently inserted into enclosure **122** such that connect component **140** is sufficiently proximate to or aligned with connector component **130**. In the example illustrated, the mechanical reaction occurs when portions of rotational lockout mechanism **146** physically contact surface **128**. As with rotational lockout mechanism **46**, rotational lockout mechanism **146** uses and transmits mechanical forces resulting from the manual force applied to unit **24** to push or insert unit **24** into enclosure **22** (and against surface **28**) to physically move members of rotational lockout mechanism **146** so as to activate or actuate rotational lockout mechanism **146** to an unlocked state. In other words, actuation of rotational lockout mechanism **146** does not utilize external power such as from a hydraulic or pneumatic cylinder assembly, motor, solenoid and the like to move mechanism **46** between locked and unlocked states and does not employ optical, electrical or other types of non-manual powered sensors or switches for detecting when unit **124** has been sufficiently inserted into enclosure **122**.

FIGS. **6** and **7** illustrate rotational lockout mechanism **146** in more detail. As shown by FIGS. **6** and **7**, rotational lockout mechanism **146** comprises keyed guide **200**, plunger **202**, projection **204** and bias **206**. Keyed guide **200** comprises a structure fixed or extending from a frame or housing of unit **24** and configured to interact with plunger **202**, allowing plunger **202** to translate along its axis or center line while inhibiting rotation of plunger **202** about its axis or center line. In the example illustrated, keyed guide **200** comprises an opening **210** having a notch **212** forming a keyway.

Plunger **202** comprise a member key to guide **200** against rotation and configured to linearly translate through the keyway formed by opening **210** in the notch **212**. In the example illustrated, plunger **202** includes tubular portion **214**, projection **216** and slot **218**. Tubular portion **214** slidably receives an end of shaft **142**, allowing tubular portion **2142** slide relative to shaft **142**. Tubular portion **214** has an end **220** configured to physically contact surface **128** of enclosure **122** upon sufficient insertion of unit **124** into enclosure **122**. Tubular portion **214** has an outer profile substantially matching that of hole **210**. In other embodiments, tubular portion **214** may have other outer profiles.

Projection **216** asymmetrically extends from tubular portion **214** and is configured to slide through notch **212**. In other embodiments, the keying relationship may be reversed wherein guide **200** includes a projection while plunger **202** includes an elongate channel slidably receiving the projection. In yet other embodiments, notch **212** and projection **216** may be omitted, wherein other keying relationships are provided such as where both hole **210** and the outer profile tubular portion **214** have non-circular shapes.

Slot **218** extends through the outer profile to an interior of tubular portion **214**. Slot **218** receipts projection **204**. Slot **218** includes art axial portion **224** and a circumferential portion **226**. Axial portion **224** axially extends along axis **148** of shaft **142**, receives projection **204** when rotational lockout mechanism **146** is in a locked position or state and allows plunger **202** to move axially along shaft **142** while preventing substantial rotation of shaft **142** relative to plunger **202**. Circumferential portion **226** extend at least partially about shaft **142**. Circumferential portion **226** receipts projection **204** when rotational lockout mechanism is in the unlocked position or state and allows shaft **142** and projection **204** to be rotated about axis **148** relative to plunger **202**.

Projection **204** comprises a protuberance extending from shaft **142** into slot **218**. In the example illustrated, projection **204** is formed by pin fit in place through a bore in shaft **142**. In other embodiments, pin **204** may be integrally formed as a single unitary body, welded, fused or otherwise joined to shaft

142 so as to rotate with shaft **142**. Projection **204** cooperates and interacts with slot **218** such that plunger **202** is movable relative to shaft **142** between (1) a first locked position (shown in FIG. **6**) in which plunger **202** locks shaft **142** against rotation relative to plunger **202** when projection **204** is within axial portion **224** and (2) a second unlocked position (shown in FIG. **10**) in which shaft **142** is rotatable relative to plunger **202** when projection **204** is within circumferential portion **226**.

Bias **206** comprises one or more structures configured to resiliently urge bias plunger **202** towards the first locked position in which plunger **202** projects beyond an end of unit **124** by a greater extent as compared to when plunger **202** is in the second position and in which projection **204** is contained within axial portion **224** of slot **218**. in the example illustrated, bias **206** comprises a compression spring captured between projection **204** and an internal blind hole (not shown), shoulder or other surface of tubular portion **214** of plunger **202**. In other embodiments, bias **206** may be provided by other arrangements. For example, bias **206** method for comprising compression spring between an end of shaft **142** and an axially facing surface of an internal blind hole of plunger **202**. In another embodiment, bias **206** may comprise a compression spring extending between surface **224** and surface **226** or between service **224** and projection **204** (as seen in FIG. **6**). In yet other embodiments, bias **206** may have other locations and utilize other forms of springs or biasing structures.

Secondary unit locks **147**, (shown in FIGS. **9**, **10** and **14**) comprise latches, bars or other structures operably coupled to shaft **142** so as to move, in response to rotation of shaft **142**, between a locking state in which the unit **124** is locked or retained relative to enclosure **122** when in the enclosure **122** and an unlocked state. In the example illustrated, locks **147** comprise projections fixed to shaft **142** and extending from shaft **142**. Secondary unit locks **147** include both a front lock **147** (shown in FIG. **14**) and a rear lock **147** (shown in FIG. **9**). As shown by FIG. **9** and in broken lines in FIG. **14**, in the unlocked state or position, locks **147** are contained within or do not sufficiently project beyond unit **124** to interact with enclosure **22**. As shown by FIGS. **12** and **14**, in the locked state or position, locks **147** sufficiently project beyond unit **124** so as to extend into corresponding receiving slots or openings **240** (one of which is shown in FIG. **14**) to inhibit or prevent movement and withdrawal of unit **124** from enclosure **122**. In addition to retaining unit **124** in enclosure **122**, locks **147** additionally provide a path for shock and loads instead of such loads and shocks extending through connection components **140** and **130**. When unit **124** is withdrawn or removed from enclosure **122**, secondary locks **147** further prevent or inhibit insertion of unit **124** into enclosure **122** when connector component **140** is inadvertently in the extended position, further inhibiting accidental damage to connector component **140**. In other embodiments, one or both of secondary locks **147** may be omitted.

FIGS. **4**, **5**, **6** and **8-13** further illustrate an example process or method by which unit **124** is inserted into and connected to enclosure **122**. As shown by FIGS. **4-6**, while connector component **140** of unit **124** is in the recessed or retracted position, unit **124** is inserted into enclosure **122** by being moved in the direction indicated by arrow **160**. As shown by FIGS. **8-11**, such insertion continues until end **220** of plunger **202** physically contacts surface **128** of enclosure **122**. As shown by FIG. **11**, while plunger **202** is in physical contact with surface **128**, connector component **140** is or is moved into sufficient proximity or alignment with connector component **130** of enclosure **122** for subsequent connection to connector component **130**. The physical contact or physical interaction between end **220** of plunger **202** and surface **128** causes plunger **202** to move from the state shown in FIG. **6** to the state shown in FIG. **10** against bias **206**, whereby projection **204** is relocated from axial portion **224** into circumferential portion **226** of slot **218**, allowing shaft **142** to be rotated. As shown by FIGS. **12** and **13**, once rotational lockout mechanism **146** has been activated to an unlocked state as a result of the mechanical reaction between plunger **202** and surface **28**, shaft **142** is rotated about its axis **148** to generate circular motion and torque, Rotation to translation coupler **144** converts the rotational motion and torque provided by the rotation of shaft **142** to linear translational motion so as to move connector component **140** in the direction indicated by arrow **164**, perpendicular to direction **160** and axis **148**, from a recessed or retracted position to a projecting or extended position and into connection or contact with connector component **130**. Because rotational lockout mechanism **146** potentially inhibits or prevents rotation of shaft **142** and therefore prevents or inhibits extension of connector component **140** until connector component **140** is sufficiently proximate to an aligned with connector component **130**, rotational lockout mechanism **146** reduces the likelihood of accidental damage to connector components **140** and **130**, which might otherwise result from premature attempted connection of such components. In the example illustrated in which connection components **130** and **140** cannot be visibly seen or visibly aligned while unit **124** is inserted into enclosure **122**, the alignment indication provided by rotational lockout mechanism **146** offers enhanced protection against accidental damage to connection components **130**, **140** during an attempted connection.

Disconnection and withdrawal of unit **124** from enclosure **122** occurs by sequencing through the above-mentioned steps into an opposite manner. In particular, shaft **142** is rotated, moving or allowing connector component **140** to move to the retracted or recessed position in which component **140** is disconnected from component **130**. Thereafter, unit **124** is withdrawn from enclosure **122**.

Although the present disclosure has been described with reference to example embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing front the spirit and scope of the claimed subject matter. For example, although different example embodiments may have been described as including one or more features providing one or more benefits, it is contemplated that the described features may be interchanged with one another or alternatively be combined with one another in the described example embodiments or in other alternative embodiments. Because the technology of the present disclosure is relatively complex, not all changes in the technology are foreseeable. The present disclosure described with reference to the example embodiments and set forth in the following claims is manifestly intended to be as broad as possible. For example, unless specifically otherwise noted, the claims reciting a single particular element also encompass a plurality of such particular elements.

What is claimed is:

1. An apparatus comprising:

a unit insertable into an enclosure having a first component, the unit comprising:

a second component;

a shaft operably coupled to the second component to linearly translate the second component between a first state connected to the first component and a second state disconnected from the first component in response to rotation of the shaft; and a rotational lockout mechanism configured to lock the shaft against rotation and to unlock the shaft for rotation in response to a mechanical reaction between the enclosure and the unit that occurs when the unit has been sufficiently inserted into the enclosure such that the second component is proximate the first component.

2. The apparatus of claim **1**, wherein rotational lockout mechanism comprises:

a keyed guide associated with the unit; and

a movable plunger keyed to the guide against rotation and configured to contact a fixed physical stop surface of the enclosure upon insertion of the unit into the enclosure, wherein the plunger is movable relative to the shaft between a first position in which the plunger locks the shaft against rotation and a second position in which the shaft is rotatable relative to the plunger.

3. The apparatus of claim **2**, when the plunger is resiliently biased toward the first position and wherein insertion of the unit into the enclosure on the plunger is in contact with the fixed physical stop surface moves the plunger against a bias to the second position.

4. The apparatus of claim **2**, wherein the plunger includes a slot having an axial portion axially along the shaft and a circumferential portion at least partially about the shaft and wherein the shaft includes a projection movable within the slot.

5. The apparatus of claim **4** further comprising a spring captured between the projection and the plunger to resiliently bias the plunger towards the first position.

6. The apparatus of claim **1** further comprising a unit lock that, in response to rotation of the shaft, is actuatable between a locking state in which the unit is locked to the enclosure when in the enclosure and an unlocked state.

7. The apparatus of claim **6** wherein the unit lock comprises a latch configured to prevent insertion of the unit into enclosure when the lock is in the locking state prior to insertion of the unit into the enclosure.

8. The apparatus of claim **1**, wherein the unit is insertable into the enclosure in a first direction, wherein the shaft is rotatable about an axis parallel to the first direction and wherein the second component is linearly translatable in a second direction perpendicular to the first direction.

9. The apparatus of claim **1**, wherein the first component and the second opponent comprise first and second electrical connectors, respectively.

10. The apparatus of claim **1**, wherein alignment of the first component and the second component are not visible to an operator when the unit is within the enclosure.

11. The apparatus of claim **1** further comprising the enclosure having the first component.

12. The apparatus of claim **11**, wherein the enclosure comprises a computer blade enclosure configured to receive a plurality of computer blades and wherein the unit comprises one of the computer blades.

13. A method comprising:

inserting a unit into an enclosure having a first component, the unit having a second component;

unlocking a shaft for rotation automatically in response to a mechanical reaction between the unit in the enclosure upon a predetermined extent of insertion of the unit into the enclosure; and

rotating shaft to linearly translate the second component into connection with the first component.

14. The method of claim **13** further comprising locking the shaft against rotation using a keyed guide associated with the unit and a movable plunger keyed to the guide against rotation and configured to contact a fixed physical stop surface of the enclosure upon insertion of the unit into the enclosure, wherein the plunger is moved relative to the shaft between a first position in which the plunger locks the shaft against rotation and a second position in which the shaft is rotatable relative to the plunger.

15. The method of claim **13**, wherein the enclosure comprises a computer blade enclosure configured to receive a plurality of computer blades and wherein the unit comprises one of the computer blades.

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