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61/485,317 12 May 2011 (12.05.2011) US(71) Applicant (for all designated States except US): **ALCOA INC.** [US/US]; 201 Isabella Street, Pittsburgh, PA 15212-5858 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **DO, Thai** [US/US]; 24392 Kings View, Laguna Niguel, CA 92677 (US).(74) Agent: **AGOSTINO, Joseph**; c/o Greenberg Traurig, LLP, Alcoa Inc., 100 Technical Drive, Alcoa Center, PA 15069 (US).

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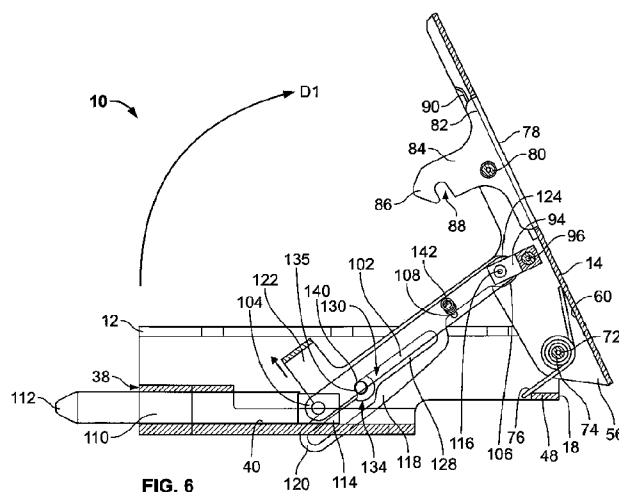


FIG. 6

(57) Abstract: A pin latch (10) includes a housing (12), a handle (14) attached to the housing (12), a shear pin (110) attached to the handle (14), and a finger member (118) attached to the handle (14) and the shear pin (110). The handle (14) may be set in an intermediate position between open and closed positions. Trigger pins (140) slidably engage slots (128) formed within the finger member (118) until they engage stops (135) to retain the handle (14) in its intermediate position. To further retract the shear pin (110) and move the handle (14) towards the open position, the finger member (118) is lifted and the trigger pins (140) disengage the stops (135). Alternately, the latch (10) includes a button mechanism (372) having a cross-pin (384) that engages a stop (344) formed by a slot (342) within the shear pin (330) to maintain the handle (214) in its intermediate position. To further retract the shear pin (330) and rotate the handle (214), the button mechanism (372) is depressed to disengage the cross-pin (384) from the slot (342) of the shear pin (330).

PIN LATCH HAVING AN INTERMEDIATE POSITION

Cross-Reference to Related Applications

This application is a Section 111(a) application relating to and
5 claiming the benefit of commonly owned, co-pending U.S. Provisional
Patent Application Serial No. 61/452,717 entitled "PIN LATCH HAVING AN
INTERMEDIATE POSITION", filed March 15, 2011, the entirety of which is
incorporated herein by reference, and commonly owned, co-pending U.S.
Provisional Patent Application Serial No. 61/485,317 entitled "PIN LATCH
10 WITH AUTOMATIC INTERMEDIATE POSITION", filed May 12, 2011, the
entirety of which is incorporated herein by reference.

Technical Field of the Invention

The present invention relates to pin latches, and, more particularly, a
15 pin latch having an intermediate position, and a pin latch having an
automatic intermediate position.

Background Art

Removable and moveable elements installed on exterior surfaces of
20 aerospace vehicles, such as hatches, doors, access panels, engine
cowlings, nacelles, and radomes employ latches. Handles mounted on the
latches are used to open or close the elements. A typical pin latch has two
positions: a closed position and an open position.

Disclosure of the Invention

In an embodiment, a pin latch, comprising a housing having at least one pin; a handle attached pivotally to the housing; a shear pin housed
5 slidably within the housing and connected to the handle; and a finger member connected to the handle and to the housing, the finger member including at least one slot that is sized and shaped to receive slidably the at least one pin of the housing, the at least one slot including a first slot portion, a second slot portion, and a third slot portion that bridges the first
10 and second slot portions with one another, the third slot portion forming a stop located between the first and second slot portions, wherein the handle is moveable between a closed position, in which the handle is retained releasably within the housing and the shear pin is extended from the housing, and an open position, in which the handle is retracted from the
15 housing and the shear pin is retracted within the housing, wherein the handle is further moveable to an intermediate position, in which the handle is retained releasably in a position between its closed position and its open position, such that when the handle is moved from its closed position to its intermediate position, the at least one pin of the housing travels within the
20 first slot portion of the finger member and engages the stop of the finger member in order to retain releasably the handle in its intermediate position, and wherein the finger member is moveable from an engaged position, in which the at least one pin of the housing engages the stop of the finger member, and a disengaged position, in which the at least one pin of the

housing is disengaged from the stop and is adapted to travel within the second slot portion of the finger member so as to enable the handle to be moved from its intermediate position to its open position.

In an embodiment, the finger member includes at least one side member having a first end and a second end opposite the first end, and wherein the at least one slot of the finger member is formed within the at least one side member. In an embodiment, the at least one side member of the finger member includes a pair of side members, and the at least one pin of the housing includes a pair of pins, and wherein the slot of one of the side members is sized and shaped to receive slidably one of the pins of the housing, and the slot of the other of the side members is sized and shaped to receive slidably the other of the pins of the housing. In an embodiment, the finger member includes a grasping member that bridges the pair of side members, and wherein the grasping member facilitates the movement of the finger member from its engaged position to its disengaged position. In an embodiment, the first slot portion of the slot of one of the side members of the finger member is formed parallel to the second slot portion thereof, and the first slot portion of the other of the side members of the finger member is formed parallel to the second slot portion thereof. In an embodiment, the third slot portion of the slot of one of the side members of the finger member is positioned obliquely relative to the first and second slot portions thereof, and the third slot portion of the slot of the other of the side members of the finger member is positioned obliquely relative to the first and second slot portions thereof.

In an embodiment, the pin latch further comprises a link having a first end and a second end opposite the first end of the link, the first end of the link being attached pivotally to the handle and the second end of the link being attached to the shear pin.

5 In an embodiment, the handle includes a trigger that is releasably engageable with the pins of the housing when the handle is in its closed position. In an embodiment, the handle includes a block, wherein the first end of the link is attached pivotally to the block and the first ends of the side members of the finger members are attached pivotally to the block. In
10 an embodiment, the handle includes a back spring.

In an embodiment, the pin latch further comprises at least one finger extension spring having a first end connected to one of the side members of the finger member and a second end opposite the first end of the at least one finger extension spring connected to the link. In an
15 embodiment, the at least one finger extension spring includes a pair of finger extension springs, one of which is connected to one of the pair of side members and to the link, and the other of which is connected to the other of the pair of side members and to the link.

In an embodiment, the housing includes a first end, a second end
20 opposite the first end of the housing, and an aperture formed within the first end of the housing, and wherein the shear pin is sized and shaped to slide within the aperture. In an embodiment, In an embodiment, the housing includes at least one mounting bracket.

In another embodiment, a pin latch comprises a housing; a handle attached pivotally to the housing; a shear pin housed slidably within the housing and connected to the handle, the shear pin including a slot and a stop located at one end of the slot; and a button mechanism including a cross-pin, wherein the handle is moveable between a closed position, in which the handle is retained releasably within the housing, and an open position, in which the handle is retracted from the housing and the shear pin is retracted within the housing, wherein when the handle is in its closed position, the shear pin extends from the housing, and the button mechanism is in a depressed position such that the cross-pin of the button mechanism is disengaged from the slot of the shear pin, wherein the handle is further moveable to an intermediate position, in which the handle is retained releasably in a position between its closed position and its open position, wherein when the handle is moved from its closed position to its intermediate position, the button mechanism is moved from its depressed position to a raised position, and the shear pin retracts into the housing such that the cross-pin of the button mechanism engages the slot of the shear pin and glides therein until the cross-pin engages the stop of the shear pin. In an embodiment, the handle is moveable from its intermediate position to its closed position by depressing the button mechanism into its depressed position so as to disengage the cross-pin of the button mechanism from the slot of the shear pin.

In an embodiment, the pin latch further comprises a link having a first end and a second end opposite the first end of the link, the first end of

the link being attached pivotally to the handle and the second end of the link being attached to the shear pin. In an embodiment, the housing includes at least one trigger pin and the handle includes a trigger that is releasably engageable with the at least one trigger pin of the housing when
5 the handle is in its closed position. In an embodiment, the handle includes a block, wherein the first end of the link is attached pivotally to the block. In an embodiment, the handle includes a back spring.

In an embodiment, the housing includes a first end, a second end opposite the first end of the housing, an upper end, a lower end, and a first
10 slot positioned proximate to the lower end, wherein the cross-pin of the button mechanism is housed movably within the first slot, and wherein the cross-pin travels within the slot when the button mechanism is moved between its depressed position and its raised position. In an embodiment, the button mechanism includes a spring to facilitate movement of the
15 button mechanism from its depressed position to its raised position. In an embodiment, the handle engages the button mechanism and maintains it in its depressed position when the handle is in its closed position.

In an embodiment, the pin latch further comprises a plunger mechanism housed within the housing, the plunger mechanism including a
20 plunger having a first end, a second end opposite the first end of the plunger, an interior portion extending from the second end of the plunger, a stop pin positioned proximate to the first end of the plunger, and a spring housed within the interior portion of the plunger, and wherein the housing includes a second slot extending longitudinally between the first and

second ends of the housing and including a first end and a second end opposite the first end of the second slot, wherein the stop pin of the plunger is sized and shaped to engage and travel within the second slot of the housing. In an embodiment, when the handle is moved from its
5 intermediate position to its open position, the second end of the shear pin urges the plunger towards the second end of the housing and the stop pin of the plunger to travel within the second slot of the housing until the stop pin stops at the second end of the second slot, and the spring of the plunger mechanism is maintained in a compressed state.

10 In an embodiment, the handle is adapted to be manually held in its open position, and wherein when the handle is manually released, the spring of the plunger mechanism expands from its compressed state to an expanded state, thereby urging the plunger to extract the shear pin until the stop pin stops against the first end of the second slot of the housing, and
15 the cross-pin engages the slot of the shear pin.

In an embodiment, the housing includes an aperture formed within the first end of the housing, and wherein the shear pin is sized and shaped to slide within the aperture. In an embodiment, the housing includes at least one mounting bracket.

20 **Brief Description of the Drawings**

For a more complete understanding of the present invention, reference is made to the following detailed description of exemplary embodiments considered in conjunction with the accompanying drawings, in which:

FIG. 1 is a top perspective view of a pin latch constructed in accordance with an embodiment of the present invention, the pin latch being shown in a closed position;

FIG. 2 is a partial, cross-sectional side view of the pin latch shown in **FIG. 1**, with portions thereof being shown transparent for the purposes of clarity;

FIGS. 3A and **3B** are top perspective and top plan views, respectively, of a housing employed by the pin latch shown in **FIG. 1**;

FIG. 4 is a top perspective view of a handle employed by the pin latch shown in **FIG. 1**;

FIG. 5 is a top perspective view of the pin latch shown in **FIG. 1**, the pin latch being shown in an intermediate position, and with portions thereof being shown transparent for the purposes of clarity;

FIG. 6 is a partial, cross-sectional side view of the pin latch shown in **FIG. 5**, with portions thereof being shown transparent for the purposes of clarity;

FIGS. 7A through **7C** show perspective, front elevational, and side elevational views, respectively, of a block employed by the pin latch shown in **FIGS. 1** and **5**;

FIGS. 8A through **8D** show perspective, top plan, front elevational, and side elevational views, respectively, of a finger member employed by the pin latch shown in **FIGS. 1** and **5**;

FIG. 9 is a top perspective view of the pin latch shown in **FIG. 1**, the pin latch being shown in an open position;

FIG. 10 is a partial, cross-sectional side view of the pin latch shown in **FIG. 9**, with portions thereof being shown transparent for the purposes of clarity;

FIG. 11 is a top perspective view of a pin latch constructed in accordance with another embodiment of the present invention, the pin latch
5 being shown in a closed position;

FIG. 12 is a partial, cross-sectional side view of the pin latch shown in **FIG. 11**;

FIGS. 13A through **13G** show top and bottom perspective, top plan, side, front and rear elevational, and bottom plan views of a housing
10 employed by the pin latch shown in **FIG. 11**;

FIGS. 14A and **14B** are top and bottom perspective views, respectively, of a handle employed by the pin latch shown in **FIG. 11**;

FIG. 15 is a top perspective view of the pin latch shown in **FIG. 11**,
15 the pin latch being shown in an intermediate position;

FIG. 16 is a cross-sectional side view of the pin latch shown in **FIG. 15**;

FIGS. 17A and **17B** show perspective and rear elevational views, respectively, of a block employed by the pin latch shown in **FIGS. 11** and
20 **15**;

FIGS. 18A through **18D** show top perspective, top plan, side elevational, and rear elevational views, respectively, of a shear pin employed by the pin latch shown in **FIGS. 11** and **15**;

FIGS. 19A through **19E** show top perspective, top plan, side elevational, and rear and front elevational views, respectively, of a plunger
25

employed by the pin latch shown in **FIGS. 11** and **15**;

FIGS. 20A through **20E** show top perspective, top plan, front elevational, side elevational, and bottom plan views, respectively, of a button employed by the pin latch shown in **FIGS. 11** and **15**;

5 **FIG. 21** is a top perspective view of the pin latch shown in **FIG. 11**, the pin latch being shown in an open position; and

FIG. 22 is a cross-sectional side view of the pin latch shown in **FIG. 21**.

10 **Best Mode for Carrying Out the Invention**

Referring to **FIGS. 1** and **2**, in an embodiment, a pin latch **10** includes a housing **12** and a handle **14** attached pivotally to the housing **12**. In an embodiment, the handle **14** pivots relative to the housing **12** between a closed position, in which the handle **14** is releasably retained within the
15 housing **12** (see **FIGS. 1** and **2**), and an open position, in which the handle **14** fully extends from the housing **12** (see **FIGS. 9** and **10**). In an embodiment, the handle **14** may be set in an intermediate position, whereby the handle **14** is releasably retained in a position that is between its open and closed positions (see **FIGS. 5** and **6**). The structure and
20 function of the housing **12** and the handle **14** shall be described in further detail.

Referring to **FIGS. 3A** and **3B**, the housing **12** includes a first end **16** a second end **18** opposite the first end **16**, an upper end **20**, and a lower end **22** opposite the upper end **20**. In an embodiment, a channel **24**
25 extends from the first end **16** to the second end **18**, and is disposed

between a pair of sidewalls 26. In an embodiment, each of the sidewalls 26 includes an aperture 28 positioned intermediate the first and second ends 16, 18, and another aperture 30 positioned proximate to the second end 18 (only the apertures 28, 30 of one of the sidewalls 26 being shown in FIG. 3A). In an embodiment, a block portion 32 defines a portion of the channel 24 and extends from the first end 16 to an end 34. In an embodiment, the block portion 32 includes slots 36 formed adjacent the sidewalls 26. In an embodiment, the block portion 32 includes an aperture 38 (see FIG. 3A) that extends from the first end 16 to the end 34 along a longitudinal axis A-A. In an embodiment, a semi-tubular-shaped trough 40 extends from the end 34 of block portion 32 to an end 42 intermediate the first and second ends 16, 18. In an embodiment, the trough 40 is integrally connected with the end 34 of the block portion 32. In an embodiment, the end 42 of the trough 40 is connected to the sidewalls 26 by a pair of spans 44. In an embodiment, the trough 40 has an interior portion 46 that is aligned with the aperture 38. In an embodiment, a crossbar 48 extends between the sidewalls 26 proximate to the second end 18.

Still referring to FIGS. 3A and 3B, in an embodiment, a pair of mounting brackets 50 extends outwardly from the upper end 20 of the housing 12 perpendicular to the sidewalls 26, and longitudinally from the first and second ends 14, 16. In an embodiment, the mounting brackets 50 enable the pin latch 10 to be mounted to an external structure. In this regard, and in an embodiment, each of the brackets 50 includes a plurality of apertures 52 that are sized and shaped to receive mounting hardware, such as fasteners (e.g., bolts, screws, rivets, etc.), for fastening the pin

latch **10** to the external structure (not shown in the Figures).

Referring to **FIG. 4**, in an embodiment, the handle **14** includes a first end **54** and a second end **56** opposite the first end **54**, an exterior surface **58**, an interior surface **60**, and opposing side members **62**. In an embodiment, the handle **14** includes a rectangular-shaped aperture **64** extending from the exterior surface **58** to the interior surface **60**. In an embodiment, each of the opposing side members **62** includes a trigger pin aperture **66** positioned at one end thereof, a pivot pin aperture **68** positioned at an opposite end thereof (only one of which is shown in **FIG. 4**), and a pair of apertures **70** positioned intermediate the apertures **66**, **68**.

Referring to **FIGS. 2** and **5-6**, in an embodiment, the second end **56** of the handle **14** is attached pivotally to the second end **18** of the housing **12** by a handle pivot pin **72** that extends through the apertures **68** of the opposing side members **62** (the apertures **68** being shown in **FIG. 4**). In an embodiment, the handle pivot pin **72** includes bushings **74**. In an embodiment, a back spring **76** surrounds the handle pivot pin **72** and engages the crossbar **48** of the housing **12** and the interior surface **60** of the handle **14** in order to maintain it in its intermediate and open positions, which will be described in greater detail below.

Still referring to **FIGS. 2, 5** and **6**, in an embodiment, the handle **14** includes a trigger **78** mounted pivotally therein by a pair of trigger pivot pins **80**, which are fitted within the first apertures **66** of the opposing side members **62** (the first apertures **66** being shown in **FIG. 4**). In an embodiment, the trigger **78** includes a rectangular-shaped top portion **82** that is sized and shaped to mate with the aperture **64** of the handle **14** (the

aperture **64** being shown in **FIG. 4**), and a pair of opposing detents **84**, each having a cupped tip **86** and a slot **88**, and depending from the top portion **82** of the trigger **78**. In an embodiment, the trigger **78** includes a trigger spring **90** mounted to the trigger pivot pins **80** by trigger bushings **92**
5 (see **FIG. 2**).

Still referring to **FIGS. 2, 5** and **6**, in an embodiment, the handle **14** includes a block **94** mounted between the opposing side members **62** thereof by rivets **96**, which are received by the apertures **70** of the handle **14** (the apertures **70** being shown in **FIG. 4**). Referring to **FIGS. 7A**
10 through **7C**, in an embodiment, the block **94** includes a base portion **95** and two legs **97** extending from the base portion **95** and separated by a central slot **98**. In an embodiment, a pair of side slots **100** flank the legs **97**. In an embodiment, the base portion **95** includes an aperture **99** extending therethrough, and each of the legs **97** include an aperture **101** extending
15 therethrough, respectively.

Referring back to **FIGS. 2** and **5-6**, in an embodiment, the pin latch **10** includes an elongated link **102** having a first end **104**, a second end **106** opposite the first end **104**, and an aperture **108** positioned intermediate the first and second ends **102, 104**. In an embodiment, the pin latch **10**
20 includes a shear pin **110** having a free first end **112** and a second end **114** opposite the first end **112**. In an embodiment, the first end **104** of the link **102** is received within the central slot **98** of the block **94** (the central slot **98** being shown in **FIGS. 7A** and **7B**) and is attached pivotally to the block **94** by a central pivot pin **116**. In an embodiment, the second end **106** of the
25 link **102** is attached pivotally to the second end **114** of the shear pin **110**. In

an embodiment, the shear pin **110** is received slidably within the trough **40** and the aperture **38** of the housing **12**. In an embodiment, the pin latch **10** includes a finger member **118** attached pivotally to the housing **12** and the handle **14**. The finger member **118** is described hereinbelow.

5 Referring to **FIGS. 8A** through **8D**, in an embodiment, the finger member **118** includes a pair of opposed elongated side members **120** bridged by a U-shaped grasping member **122**. In an embodiment, each of the side members **120** includes a first end **124** and a second end **126** opposite the first end **124**, and a Z-shaped slot **128**. In an embodiment,
10 each of the slots **128** is characterized by a first, upper slot portion **130**, a second, lower slot portion **132**, and a third slot portion **134** that connects the first upper and second, lower slot portions **130**, **132** and forms a stop **135** (see **FIG. 8D**). In an embodiment, the third slot portion **134** is formed oblique relative to the slot portions **130**, **132**. In an embodiment, the slot
15 portions **130**, **132** are parallel to one another. In an embodiment, each of the side members **120** includes an aperture **136** positioned intermediate the first and second ends **124**, **126**. Each of the first ends **124** of the side member **120** include an aperture **137**.

Referring back to **FIGS. 2** and **5-6**, in an embodiment, the first ends
20 **124** of the side members **120** of the finger member **118** are received within the side slots **100** of the block **94**, respectively, and are connected pivotally thereto by rivets **138** received within the apertures **68** of the handle **14** and the apertures **137** of the side members **120** of the finger member **118** (the apertures **137** being shown in **FIGS. 8A** and **8D**). In an embodiment, each
25 of the apertures **28** of the housing **12** (which are shown in **FIG. 3A**)

receives a trigger pin 140. In an embodiment, the trigger pins 140 are received within the slots 128 of the side members 120. In an embodiment, first finger extension springs 142 connect each of the side members 120 with the link 102, such that one end of each of the first finger extension springs 142 is attached to the apertures 136 of the side members 120 and an opposite end of each of the springs 142 is attached to the aperture 108 of the link 102. The purpose and function of the first and second finger extension springs 142 shall be described hereinafter.

In an embodiment, the housing 12 and the handle 14 are fabricated from stainless steel, but other suitable materials can be used. In an embodiment, all other structural elements depicted in the Figures may also be fabricated from suitable grade stainless steel or other suitable alloy metals.

Referring to FIGS. 1 and 2, the pin latch 10 is shown in its closed position. While in the closed position, the handle 14 is retained within the channel 24 of the housing 12, with the exterior surface 58 of the handle 14 being flush or substantially flush with the upper end 20 of the housing 12. In an embodiment, the exterior surface 58 of the handle is flush or substantially flush with the exterior surface of the external structure to which the pin latch 10 is attached (not shown in the Figures). As shown in FIGS. 1 and 2, the shear pin 110 is in its fully extended position, i.e., the first end 112 of the shear pin 110 is positioned at a maximum distance from the housing 12. The shear pin 110 is sized and shaped to engage an external structure (not shown in the Figures). In addition, the trigger 78 engages the trigger pin 140 such that trigger pins 140 engage the slots 88

of the detents **84**. In an embodiment, the trigger **78** is spring-loaded via the trigger spring **90**. In an embodiment, the finger extension springs **142** are in a relaxed state: that is, a state in which the springs **142** are neither tensioned, nor compressed, nor torqued (e.g., twisted).

5 Referring to **FIGS. 5** and **6**, in an embodiment, the pin latch **10** is opened by pressing the trigger **78**, wherein the tips **86** of the trigger **78** are released from the trigger pins **140**, and the trigger pins **140** disengage the slots **88** of the trigger **78**, freeing the handle **14** to be rotated outwardly in direction **D1** from the exterior surface of the structure (not shown in the

10 **Figures**). In an embodiment, when the trigger **78** is pushed, the handle **14** automatically and freely opens via the back spring **76**. In an embodiment, when the handle **14** is rotated in this manner, the link **102** is pulled and, in turn, the shear pin **110** retracts into the housing **12**. Simultaneously, the first ends **124** of the side members **120** of the finger member **118** pivot

15 about the rivets **138** which are fixed in the block **94**, while the trigger pins **140** guide the second ends **126** of the side members **120** via the slots **128**. More particularly, in an embodiment, the trigger pins **140** glide within the first, upper slot portions **130**, until they reach the third, oblique slot portions **134** and engage the stops **135**, respectively. The shear pin **110** then stops

20 and the handle **14** is retained in place in the intermediate position, as shown in **FIGS. 5** and **6**. Moreover, in an embodiment, the finger extension springs **142** extend and pull the side members **120** of the finger member **118** and the link **102** towards one another in a scissor-like action. In an embodiment, the springs **142** are under tension load in order to retain the

25 handle **14** in its intermediate position. In an embodiment, in order to further

retract the shear pin **110**, the finger member **118** is manually lifted up by the grasping member **122** in order to disengage the trigger pins **140** from the third slot portions **134** of the finger member **118** and clear the stops **135**. Referring to **FIGS. 9** and **10**, in an embodiment, lifting the finger member

5 **118** in the foregoing manner allows the trigger pins **140** to engage the second, lower slot portions **132** of the finger member **118**. As a result, the handle **14** may then be further rotated in direction **D1** until the second end **56** of the handle **14** engages the crossbar **48** of the housing **12** (see **FIG. 10**). At this point, the handle **14** is in the open position and the shear pin

10 **110** is fully retracted within the housing **12**, as shown in **FIGS. 9** and **10**. Moreover, the finger extension springs **142** extend further and continue to remain under a tension load.

In order to close the handle **14** from the open position to the closed position, the handle **14** is rotated in an opposite direction **D2** towards the

15 closed position (see **FIG. 9**). In this regard, the handle **14** pushes the link **102** to extract the shear pin **110** until the trigger **78** engages the trigger pins **140** and the handle **14** is retained within the channel **24** of the housing **12** (see **FIGS. 1** and **2**). Simultaneously, the trigger pins **140** slide through the second, lower horizontal slot portions **132**, respectively, and then through

20 the first, upper horizontal slot portions **130**, respectively, of the finger member **118**. Also, the finger extension springs **142** are brought back to a relaxed state.

Referring to **FIGS. 11** and **12**, in an embodiment, a pin latch **210** includes a housing **212** and a handle **214** attached pivotally to the housing

25 **212**. In an embodiment, the handle **214** pivots relative to the housing **212**

between a closed position, in which the handle **214** is releasably retained within the housing **212** (see **FIGS. 11** and **12**), and an open position, in which the handle **214** fully extends from the housing **212** (see **FIGS. 21** and **22**). In an embodiment, the handle **214** may be automatically set in an intermediate position, whereby the handle **214** is releasably retained in a position that is between its open and closed positions (see **FIGS. 15** and **16**). The structure and function of the housing **212** and the handle **214** shall be described in further detail.

Referring to **FIGS. 13A** through **13G**, the housing **212** includes a first end **216** a second end **218** opposite the first end **216**, an upper end **220**, and a lower end **222** opposite the upper end **220**. In an embodiment, a channel **224** extends from the first end **216** to the second end **218**, and is disposed between a pair of sidewalls **226**. In an embodiment, the channel **224** is closed off at the first end **216** of the housing **212** and open at the second end **218** of the housing **212**. In an embodiment, each of the sidewalls **226** includes a pair of horizontally aligned apertures **228** positioned proximate to the first end **216**, a pair of apertures **230a** positioned proximate to the second end **218** and the upper end **220**, and an aperture **232** positioned intermediate the first and second ends **216**, **218**. In an embodiment, one of the sidewalls **226** includes an aperture **230b** positioned proximate to the lower end **222** and spaced apart from the aperture **230a** formed within such sidewall **226**. In an embodiment, the housing **212** includes a first portion **234** and a second portion **236**, which define the channel **224**. In an embodiment, the first portion **234** extends from the first end **216** to an end **238**. In an embodiment, the first portion

234 includes a pair of slots **240** formed adjacent the sidewalls **226**. In an embodiment, the first portion **234** includes a cross-pin housing **242** containing an elongated slot **244**, and a shear pin housing **246** containing an aperture **248** (see FIG. 13A) that extends axially from the first end **216** to the end **238** along a longitudinal axis **A-A**.

Still referring to FIGS. 13A through 13G, in an embodiment, the second portion **236** includes a semi-tubular-shaped trough **250** (see FIG. 13C) that extends from the end **238** of the first portion **234** to an end **252** intermediate the first and second ends **216**, **218**. In an embodiment, the trough **250** is integrally connected with the end **238** of the first portion **234**. In an embodiment, a pair of elongated slots **254** flank the trough **250**, while an elongated central slot **256** is formed in the trough **250** and positioned intermediate the slots **254**. In an embodiment, the central slot **256** includes a first end **257** and a second end **259** opposite the first end **257**. In an embodiment, a circular-shaped aperture **258** and an overlapping, elongated horizontal slot **260** is formed in the end **252** of the second portion **236**. In an embodiment, the trough **250** has an interior portion **262** that is aligned axially with the aperture **248** of the first portion **234** and the aperture **258** of the second portion **236**. In an embodiment, a crossbar **264** extends between the sidewalls **226** proximate to the second end **218**.

Still referring to FIGS. 13A through 13G, in an embodiment, a pair of mounting brackets **266** extends outwardly from the upper end **220** of the housing **212** perpendicular to the sidewalls **226**, and longitudinally from the first and second ends **214**, **216**. In an embodiment, the mounting brackets **266** enable the pin latch **210** to be mounted to an external structure. In this

regard, and in an embodiment, each of the brackets **266** includes a plurality of apertures **268** that are sized and shaped to receive mounting hardware, such as fasteners (e.g., bolts, screws, rivets, etc.), for fastening the pin latch **210** to the external structure (not shown in the Figures).

5 Referring to **FIGS. 14A** and **14B**, in an embodiment, the handle **214** includes a first end **270** and a second end **272** opposite the first end **270**, an exterior surface **274**, an interior surface **276**, and opposing side members **278**. In an embodiment, the handle **214** includes a rectangular-shaped aperture **280** extending from the exterior surface **274** to the interior
10 surface **276**. In an embodiment, each of the opposing side members **278** includes a trigger pin aperture **282** positioned at one end thereof, a pivot pin aperture **284** positioned at an opposite end thereof, and a pair of mounting block apertures **286** positioned intermediate the apertures **280**, **282**. In an embodiment, each of the trigger pin apertures **232** of the
15 housing **212** receives a trigger pin **283** (see **FIG. 15**), whose purpose shall be described hereinafter.

Referring to **FIGS. 12, 15** and **16**, in an embodiment, the second end **272** of the handle **214** is attached pivotally to the second end **218** of the housing **212** by a handle pivot pin **288** that extends through the pivot pin
20 apertures **284** of the opposing side members **278** of the handle **214** (the pivot pin apertures **284** being shown in **FIGS. 14A** and **14B**). In an embodiment, the handle pivot pin **288** includes bushings **290**. In an embodiment, a back spring **292** surrounds the handle pivot pin **288** and engages the crossbar **264** of the housing **212** and the interior surface **276**
25 of the handle **214** in order to maintain it in its intermediate and open

positions, which will be described in greater detail below.

Still referring to **FIGS. 12, 15 and 16**, in an embodiment, the handle **214** includes a trigger **294** mounted pivotally therein by a pair of trigger pivot pins **296**, which are fitted within the trigger pin apertures **282** of the
5 opposing side members **278** of the handle **214** (the trigger pin apertures **282** being shown in **FIGS. 14A and 14B**). In an embodiment, the trigger **294** includes a rectangular-shaped top portion **298** that is sized and shaped to mate with the aperture **280** of the handle **214**, and a pair of opposing detents **300**, each having a cupped tip **302** and a slot **304** (see **FIG. 15**),
10 and depending from the top portion **298** of the trigger **294**. In an embodiment, the trigger **294** includes a trigger spring **306** mounted to the trigger pivot pins **296** by trigger bushings **308**.

Referring to **FIGS. 15 and 16**, in an embodiment, the handle **214** includes a block **310** mounted between the opposing side members **278** of
15 the handle **214** by rivets **312**, which are received by the apertures **286a**. Referring to **FIGS. 17A and 17B**, in an embodiment, the block **310** includes a base portion **314** and two legs **316** extending from the base portion **314** and separated by a central slot **318**. In an embodiment, the base portion **314** includes an aperture **320** extending therethrough, and each of the legs
20 **316** include an aperture **322** extending therethrough, respectively (see **FIG. 17A**).

Referring back to **FIGS. 15 and 16**, in an embodiment, the pin latch **210** includes an elongated link **324** having a first end **326** and a second end **328** opposite the first end **326**. Referring to **FIGS. 15, 16, and 18A**
25 through **18D**, in an embodiment, the pin latch **210** includes a shear pin **330**

having a free first end **332**, a second end **334** opposite the first end **332**, and a first slot **336** formed axially within the second end **334**. In an embodiment, each of a pair of apertures **338** is formed transversely within the shear pin **330** proximate to the second end **334**. In an embodiment, a
5 bottom edge **340** of the shear pin **330** includes a curved slot **342** terminating at a stop **344**. The purpose and function of the slot **342** and the stop **344** shall be described hereinafter. Referring specifically to **FIG. 15**, in an embodiment, the second end **328** of the link **324** is received within the central slot **318** of the block **310** and is attached pivotally to the block **310**
10 by a central pivot pin **346**. In an embodiment, the first end **326** of the link **324** is attached pivotally to the second end **328** of the shear pin **330**. In an embodiment, the shear pin **330** is received slidably within the trough **250** of the housing **212** and through the aperture **248** of the shear pin housing **246** of the housing **212**.

15 Referring to **FIGS. 12** and **19A** through **19E**, in an embodiment, a plunger mechanism **348** includes a cylindrical-shaped plunger **350** having a first end **352** and a second end **354** opposite the first end **352**, an first aperture **356** extending axially from the first end **352** to the second end **354**, a flat edge **358** formed proximate to the first end **352**, a second aperture
20 **360** formed transversely through the plunger **350** proximate to the second end **354** thereof, and a U-shaped slot **362** formed within the first end **352**. In an embodiment, an interior **364** of the plunger **350** is sized and shaped to house a plunger spring **366** (i.e., a compression spring), one end of which engages a rivet **368** that is inserted within the aperture **230b** of the
25 housing **212** (see **FIG. 12**). In an embodiment, a stop pin **370** is positioned

within the second apertures **360** of the plunger **350** (see **FIG. 12**). As to be described in more detail below, in an embodiment, the plunger **350** is guided in the housing **212** and limited in axial travel by the stop pin **370**, which engages and is guided in the central slot **256** of the housing **212**.

5 Referring to **FIGS. 12** and **20A** through **20E**, in an embodiment, a button mechanism **372** includes a button **374** having a base **376** with a hollow interior portion **378** and a pair of legs **380** extending from the base **376**, each of the legs **380** being parallel to one another. In an embodiment, each of the legs **380** includes an aperture **382** that is sized and shaped to
10 receive a cross pin **384**, which also extends through the slot **244** of the housing **212** (see **FIG. 12**). In an embodiment, a button spring **386** (i.e., compression spring) is nested within the interior portion **378** of the base **376** of the button **374** and against the housing **212** (see **FIG. 12**). As to be described in more detail below, in an embodiment, the button **374** is guided
15 by a pair of rivets **388** inserted through the apertures **228** of the housing **312**, and is limited in travel by the cross pin **384**.

In an embodiment, the housing **212** and the handle **214** are fabricated from stainless steel, but other suitable materials can be used. In an embodiment, all other structural elements depicted in the Figures may
20 also be fabricated from suitable grade stainless steel or other suitable alloy metal.

Referring to **FIGS. 11** and **12**, the pin latch **210** is shown in its closed position. While in the closed position, the handle **214** is retained within the channel **224** of the housing **212**, with the exterior surface **274** of the handle
25 **214** being flush or substantially flush with the upper end **220** of the housing

212. In an embodiment, the exterior surface **274** of the handle is flush or substantially flush with the exterior surface of the external structure to which the pin latch **210** is attached (not shown in the Figures). As shown in **FIGS. 11** and **12**, the shear pin **330** is in its fully extended position, i.e., the first end **332** of the shear pin **330** is positioned at a maximum distance from the housing **212**. The shear pin **330** is sized and shaped to engage the external structure (not shown in the Figures). In an embodiment, the trigger **294** engages the trigger pins **283** such that trigger pins **283** engage the slots **304** of the detents **300**. In an embodiment, the trigger **294** is spring-loaded via the trigger spring **306**. In addition, in an embodiment, while the pin latch **210** is in its closed position, the interior surface **276** of the handle **214** engages the button **374** so that it is maintained in a depressed position, the button spring **386** is in a compressed position, and the cross pin **384** is disengaged from the shear pin **330**. In an embodiment, the plunger **350** is set in an extended position, while the associated plunger spring **366** is in a relaxed state: that is, it is neither tensioned nor compressed.

Referring to **FIGS. 15** and **16**, in an embodiment, the pin latch **210** is opened to its intermediate position by pressing the trigger **294**, wherein the tips **302** of the trigger **294** are released from the trigger pins **283** and the trigger pins **283** disengage the slots **304**, freeing the handle **214** to rotate outwardly in direction **D1** from the exterior surface of the structure. In an embodiment, when the trigger **294** is pushed, the handle **214** automatically and freely opens via the back spring **292**. In an embodiment, when the handle **214** is rotated in this manner, the link **324** is pulled and, in

turn, the shear pin 330 retracts into the housing 212. Simultaneously, in an embodiment, the button spring 386 expands, causing the button 374 to lift to a raised or elevated position. In addition, in an embodiment, the cross pin 384 travels within the slot 244 of the housing 212 and glides against the bottom edge 340 of the shear pin 330. In an embodiment, the cross pin 384 reaches and falls into the slot 342 of the shear pin 330 and travels within the slot 384 until it engages the stop 344. At this point, in an embodiment, retraction of the shear pin 330 stops and the pin latch 210 is set in its intermediate position.

Referring to FIGS. 21 and 22, in an embodiment, to further retract the shear pin 330, the button 374 is pushed (i.e., depressed) from its raised position in order to disengage the cross pin 384 from the slot 342 of the shear pin 330, and, simultaneously, the handle 214 is rotated further outward towards the open position in direction D1. During this sequence, in an embodiment, the link 324 further retracts the shear pin 330, and the second end 334 of the shear pin 330 pushes the first end 352 of the plunger 350 and compresses the plunger spring 366 until the second end 272 of the handle 214 engages the rivet 368 (see FIG. 22). In an embodiment, the stop pin 370 is urged to travel through the central slot 256 of the housing 212 until it stops against the end 257 of the central slot 256. At this point, in an embodiment, the handle 214 is in the open position and the shear pin 330 is fully retracted within the housing 212, as shown in FIGS. 21 and 22. In this open position, in an embodiment, the back spring 292 no longer provides a load in the handle 214, but the plunger spring 366 maintains a load thereon. In an embodiment, the slot 362 of the plunger

350 provides for clearance over the rivet **368**. In this regard, in an embodiment, the handle **214** is manually held in the open position in order to maintain the shear pin **330** in its fully retracted position. In an embodiment, once the handle **214** is manually released, the pin latch **210**
5 automatically returns to its intermediate position, as shown in **FIGS. 15** and **16**. In this regard, in an embodiment, the plunger spring **366** expands, causing the plunger **350** to push the shear pin **330** until the stop pin **370** stops against the second end **259** of the central slot **256** of the housing **212**. In turn, the handle **214** rotates in direction **D2**. In an embodiment, the
10 cross pin **384** then falls into the slot **342** of the shear pin **330**, and the extension of the shear pin **330** stops in this intermediate position, as shown in **FIGS. 15** and **16**.

In an embodiment, in order to close the handle **214** from the intermediate position to the closed position, the handle **214** is rotated in
15 direction **D2** towards the closed position. In this regard, in an embodiment, the handle **214** pushes the link **324** to extract the shear pin **330** further, and the cross pin **384** glides on the bottom edge **340** of the shear pin **330** until the trigger **294** engages the trigger pins **283** and the handle **214** is retained within the channel **224** of the housing **212** (see **FIGS. 21** and **22**). The pin
20 latch **210** is then latched in its closed position.

It will be understood that the embodiments described herein are merely exemplary and that a person skilled in the art may make many variations and modifications without departing from the spirit and scope of the invention. For instance, in certain embodiments, the pin latches **10**,
25 **210** may be used for doors and access panels for aircraft, such as

fuselages, nacelles, engine cowlings, radomes, etc. In other embodiments, the pin latches **10**, **210** can be used in other suitable environments and for other vehicles and structures. In other embodiments, each of the pin latches **10**, **210** can be configured as a pin latch or other suitable latch, such as a hook latch. All such variations and modifications are intended to be included within the scope of the invention as defined in the appended claims.

CLAIMS

What is claimed is:

1. A pin latch, comprising:
 - 5 a housing having at least one pin;
 - a handle attached pivotally to the housing;
 - a shear pin housed slidably within the housing and connected to the handle;
 - and a finger member connected to the handle and to the housing,
 - 10 the finger member including at least one slot that is sized and shaped to receive slidably the at least one pin of the housing, the at least one slot including a first slot portion, a second slot portion, and a third slot portion that bridges the first and second slot portions with one another, the third slot portion forming a stop located between the first and second slot
 - 15 portions,
 - wherein the handle is moveable between a closed position, in which the handle is retained releasably within the housing and the shear pin is extended from the housing, and an open position, in which the handle is retracted from the housing and the shear pin is retracted within the housing,
 - 20 wherein the handle is further moveable to an intermediate position, in which the handle is retained releasably in a position between its closed position and its open position, such that when the handle is moved from its closed position to its intermediate position, the at least one pin of the housing travels within the first slot portion of the finger member and

engages the stop of the finger member in order to retain releasably the handle in its intermediate position, and

wherein the finger member is moveable from an engaged position, in which the at least one pin of the housing engages the stop of the finger member, and a disengaged position, in which the at least one pin of the housing is disengaged from the stop and is adapted to travel within the second slot portion of the finger member so as to enable the handle to be moved from its intermediate position to its open position.

2. The pin latch of Claim 1, wherein the finger member includes at least one side member having a first end and a second end opposite the first end, and wherein the at least one slot of the finger member is formed within the at least one side member.

3. The pin latch of Claim 2, wherein the at least one side member of the finger member includes a pair of side members, and the at least one pin of the housing includes a pair of pins, and wherein the slot of one of the side members is sized and shaped to receive slidably one of the pins of the housing, and the slot of the other of the side members is sized and shaped to receive slidably the other of the pins of the housing.

20

4. The pin latch of Claim 3, wherein the finger member includes a grasping member that bridges the pair of side members, and wherein the grasping member facilitates the movement of the finger member from its engaged position to its disengaged position.

25

5. The pin latch of Claim 4, wherein the first slot portion of the slot of one of the side members of the finger member is formed parallel to the second slot portion thereof, and the first slot portion of the other of the side members of the finger member is formed parallel to the second slot portion thereof.

6. The pin latch of Claim 5, wherein the third slot portion of the slot of one of the side members of the finger member is positioned obliquely relative to the first and second slot portions thereof, and the third slot portion of the slot of the other of the side members of the finger member is positioned obliquely relative to the first and second slot portions thereof.

7. The pin latch of Claim 6, further comprising a link having a first end and a second end opposite the first end of the link, the first end of the link being attached pivotally to the handle and the second end of the link being attached to the shear pin.

8. The pin latch of Claim 7, wherein the handle includes a trigger that is releasably engageable with the pins of the housing when the handle is in its closed position.

9. The pin latch of Claim 8, wherein the handle includes a block, wherein the first end of the link is attached pivotally to the block and the first ends of the side members of the finger members are attached pivotally to the block.

10. The pin latch of Claim 8, wherein the handle includes a back spring.

11. The pin latch of Claim 10, further comprising at least one finger
5 extension spring having a first end connected to one of the side members
of the finger member and a second end opposite the first end of the at least
one finger extension spring connected to the link.

12. The pin latch of Claim 11, wherein the at least one finger extension
10 spring includes a pair of finger extension springs, one of which is
connected to one of the pair of side members and to the link, and the other
of which is connected to the other of the pair of side members and to the
link.

13. The pin latch of Claim 1, wherein the housing includes a first end, a
15 second end opposite the first end of the housing, and an aperture formed
within the first end of the housing, and wherein the shear pin is sized and
shaped to slide within the aperture.

14. The pin latch of Claim 1, wherein the housing includes at least one
20 mounting bracket.

15. A pin latch, comprising:
a housing;
25 a handle attached pivotally to the housing;

a shear pin housed slidably within the housing and connected to the handle, the shear pin including a slot and a stop located at one end of the slot; and

a button mechanism including a cross-pin,

5 wherein the handle is moveable between a closed position, in which the handle is retained releasably within the housing, and an open position, in which the handle is retracted from the housing and the shear pin is retracted within the housing,

wherein when the handle is in its closed position, the shear pin
10 extends from the housing, and the button mechanism is in a depressed position such that the cross-pin of the button mechanism is disengaged from the slot of the shear pin,

wherein the handle is further moveable to an intermediate position, in which the handle is retained releasably in a position between its closed
15 position and its open position, wherein when the handle is moved from its closed position to its intermediate position, the button mechanism is moved from its depressed position to a raised position, and the shear pin retracts into the housing such that the cross-pin of the button mechanism engages the slot of the shear pin and glides therein until the cross-pin engages the
20 stop of the shear pin.

16. The pin latch of Claim 15, wherein the handle is moveable from its intermediate position to its closed position by depressing the button mechanism into its depressed position so as to disengage the cross-pin of
25 the button mechanism from the slot of the shear pin.

17. The pin latch of Claim 16, further comprising a link having a first end and a second end opposite the first end of the link, the first end of the link being attached pivotally to the handle and the second end of the link being
5 attached to the shear pin.

18. The pin latch of Claim 17, wherein the housing includes at least one trigger pin and the handle includes a trigger that is releasably engageable with the at least one trigger pin of the housing when the handle is in its
10 closed position.

19. The pin latch of Claim 18, wherein the handle includes a block, wherein the first end of the link is attached pivotally to the block.

15 20. The pin latch of Claim 18, wherein the handle includes a back spring.

21. The pin latch of Claim 20, wherein the housing includes a first end, a second end opposite the first end of the housing, an upper end, a lower end, and a first slot positioned proximate to the lower end, wherein the
20 cross-pin of the button mechanism is housed movably within the first slot, and wherein the cross-pin travels within the slot when the button mechanism is moved between its depressed position and its raised position.

22. The pin latch of Claim 21, wherein the button mechanism includes a
25 spring to facilitate movement of the button mechanism from its depressed

position to its raised position.

23. The pin latch of Claim 22, wherein the handle engages the button mechanism and maintains it in its depressed position when the handle is in
5 its closed position.

24. The pin latch of Claim 23, further comprising a plunger mechanism housed within the housing, the plunger mechanism including a plunger having a first end, a second end opposite the first end of the plunger, an
10 interior portion extending from the second end of the plunger, a stop pin positioned proximate to the first end of the plunger, and a spring housed within the interior portion of the plunger, and wherein the housing includes a second slot extending longitudinally between the first and second ends of the housing and including a first end and a second end opposite the first
15 end of the second slot, wherein the stop pin of the plunger is sized and shaped to engage and travel within the second slot of the housing.

25. The pin latch of Claim 24, wherein when the handle is moved from its intermediate position to its open position, the second end of the shear
20 pin urges the plunger towards the second end of the housing and the stop pin of the plunger to travel within the second slot of the housing until the stop pin stops at the second end of the second slot, and the spring of the plunger mechanism is maintained in a compressed state.

25 26. The pin latch of Claim 25, wherein the handle is adapted to be

manually held in its open position, and wherein when the handle is manually released, the spring of the plunger mechanism expands from its compressed state to an expanded state, thereby urging the plunger to extract the shear pin until the stop pin stops against the first end of the
5 second slot of the housing, and the cross-pin engages the slot of the shear pin.

27. The pin latch of Claim 21, wherein the housing includes an aperture formed within the first end of the housing, and wherein the shear pin is
10 sized and shaped to slide within the aperture.

28. The pin latch of Claim 1, wherein the housing includes at least one mounting bracket.

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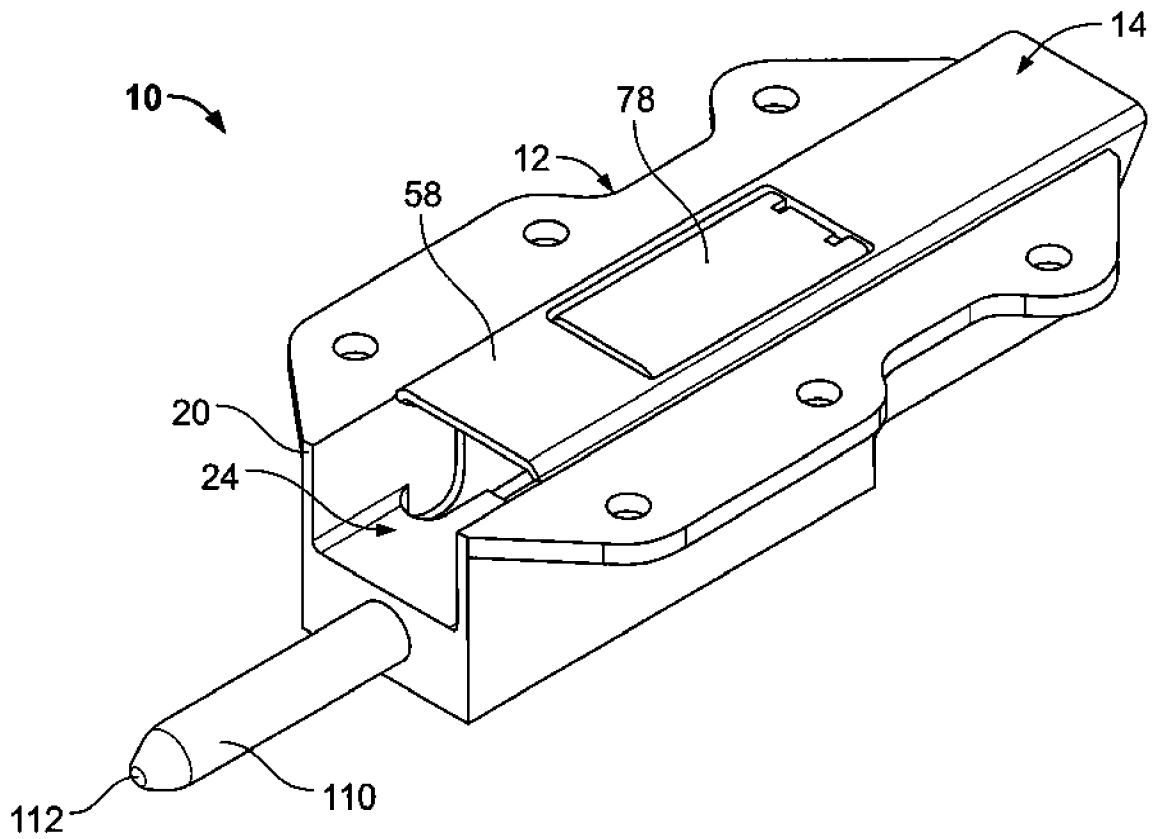


FIG. 1

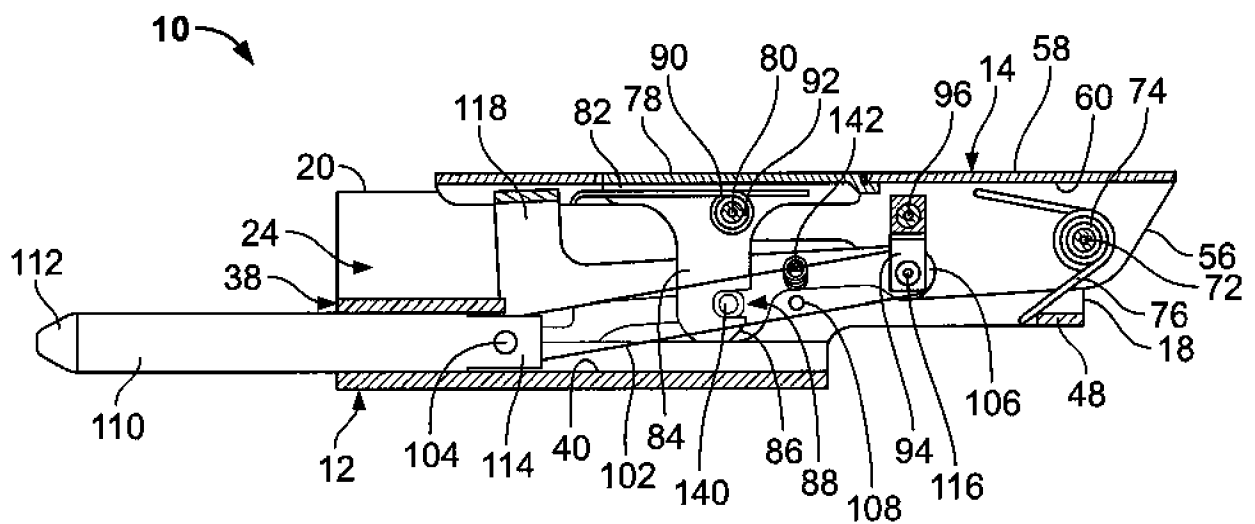
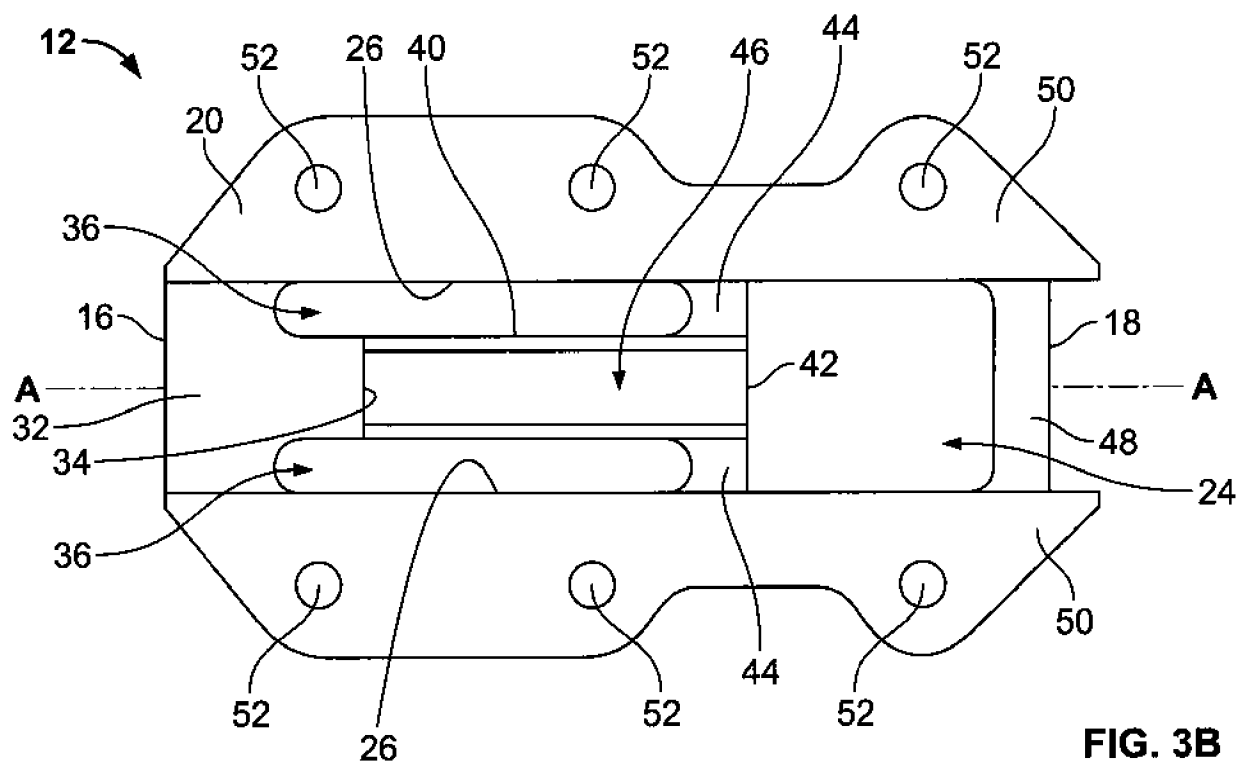
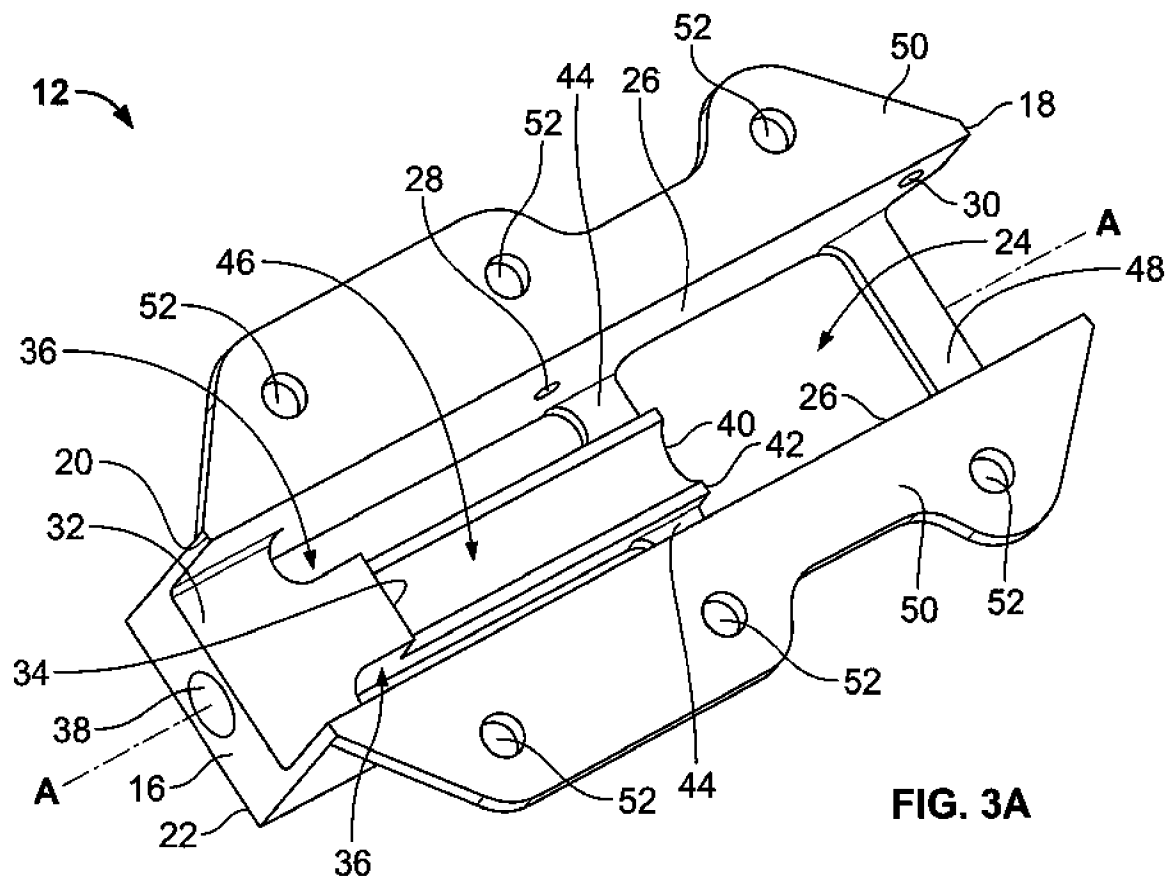


FIG. 2

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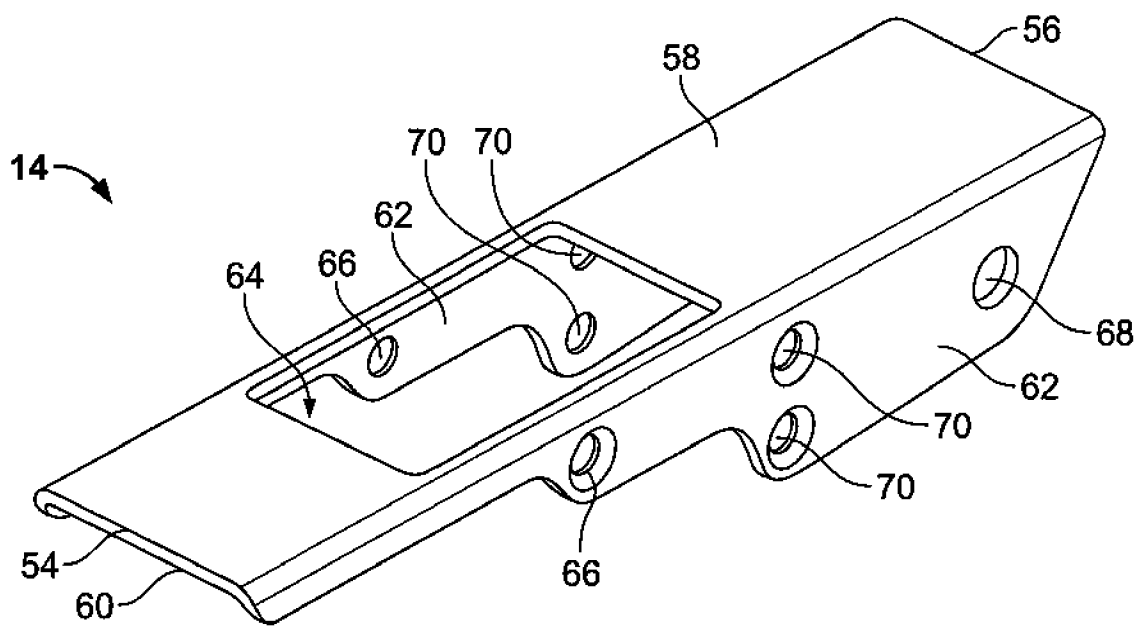


FIG. 4

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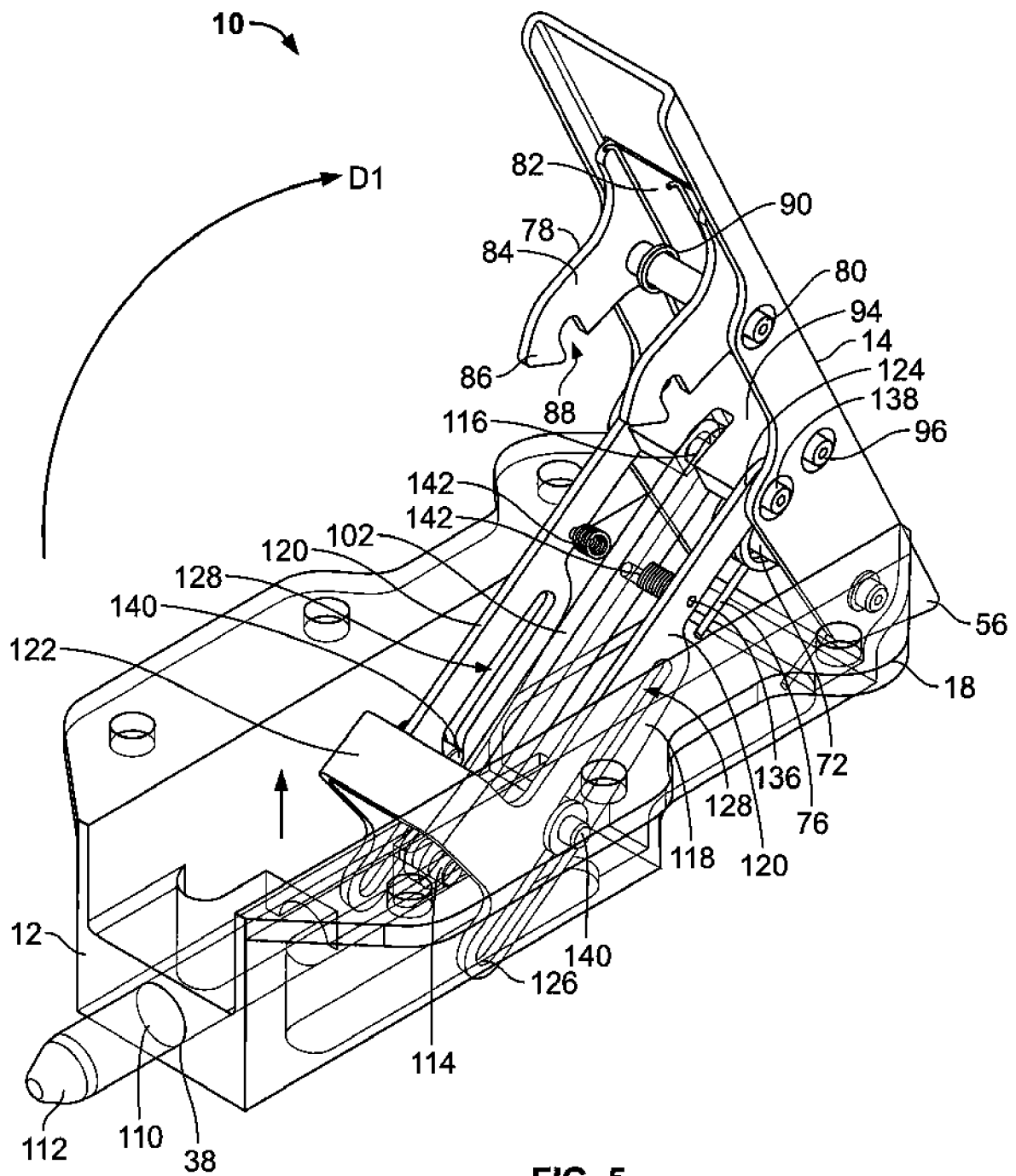


FIG. 5

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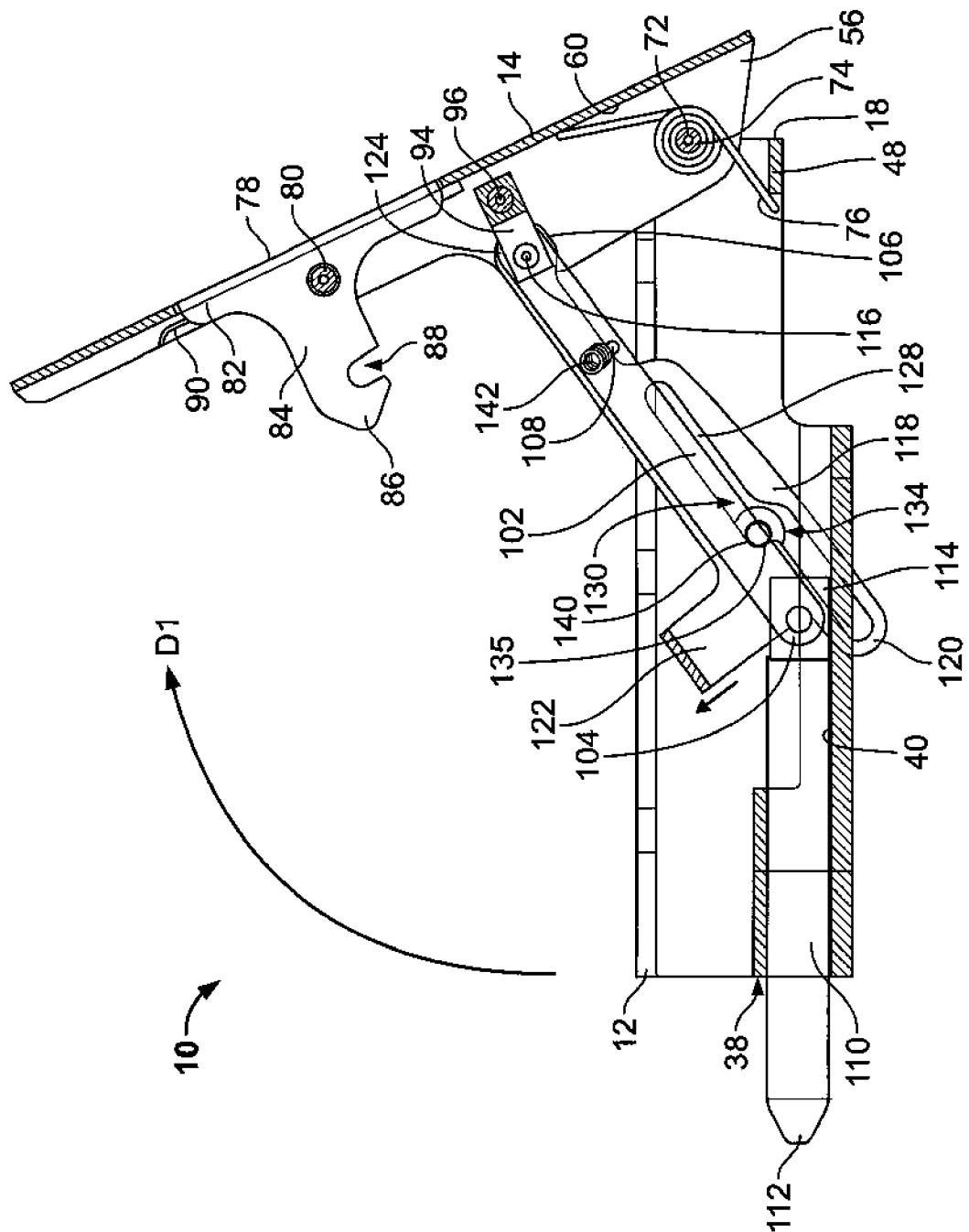


FIG. 6

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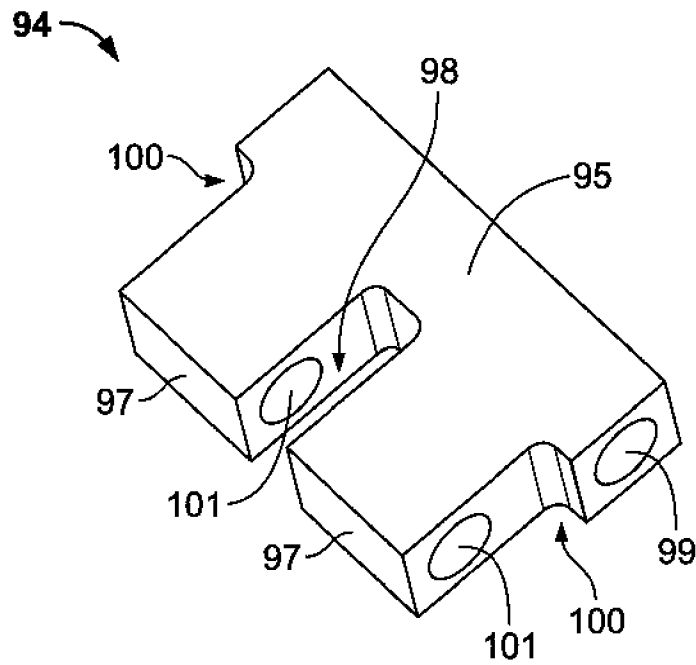


FIG. 7A

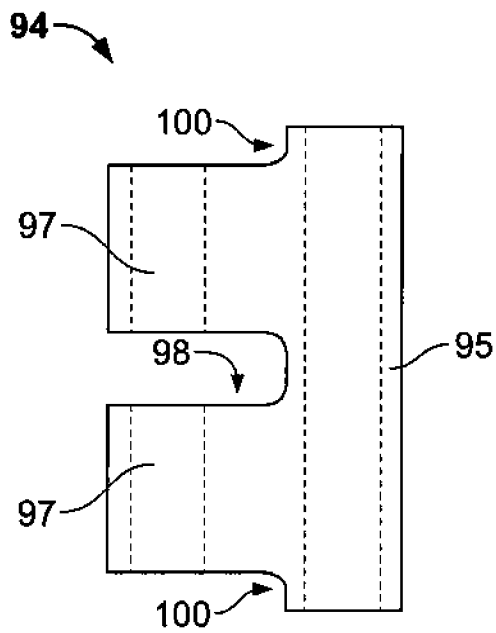


FIG. 7B

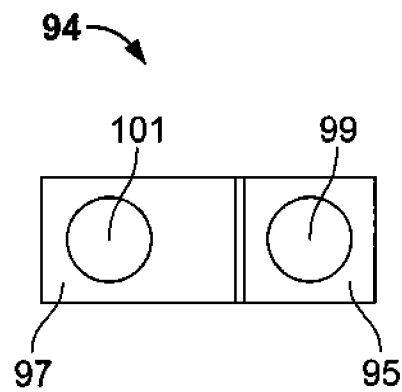


FIG. 7C

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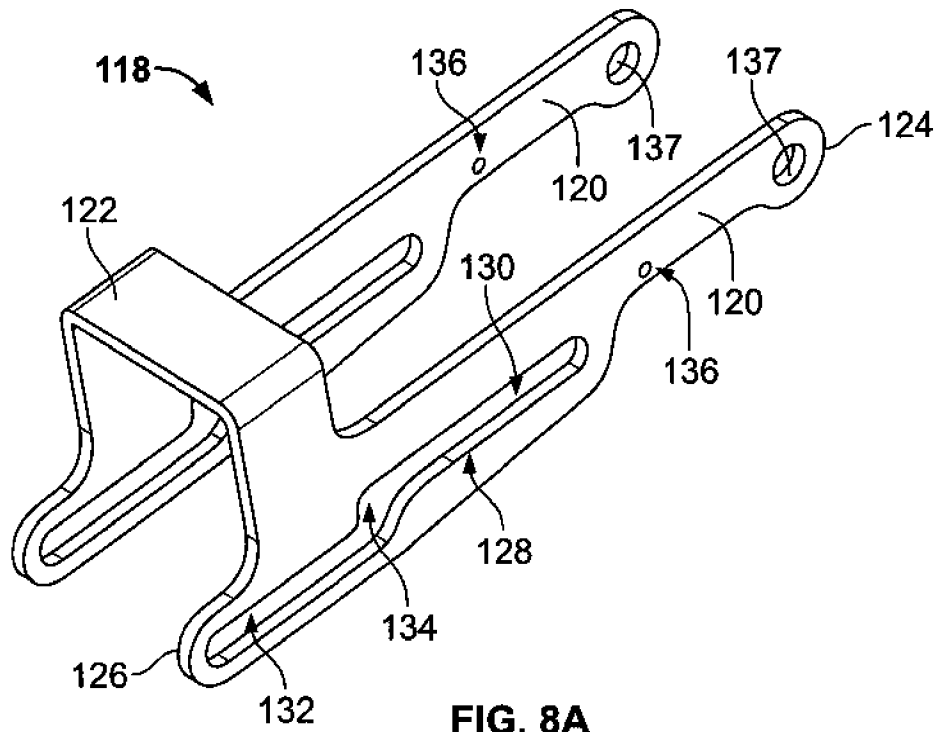


FIG. 8A

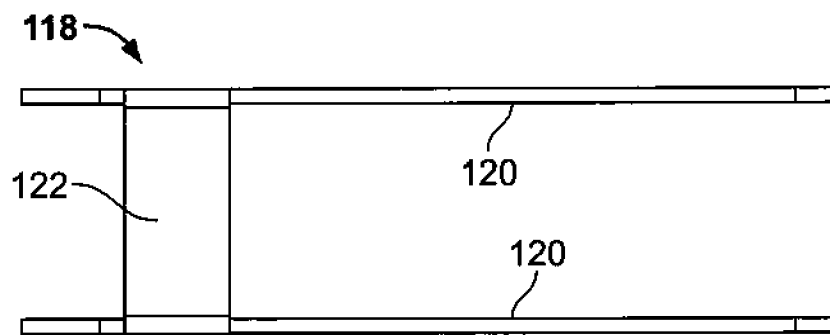


FIG. 8B

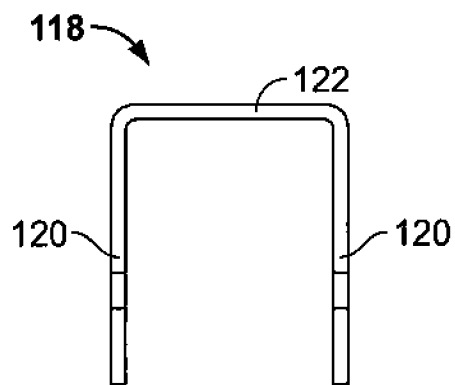


FIG. 8C

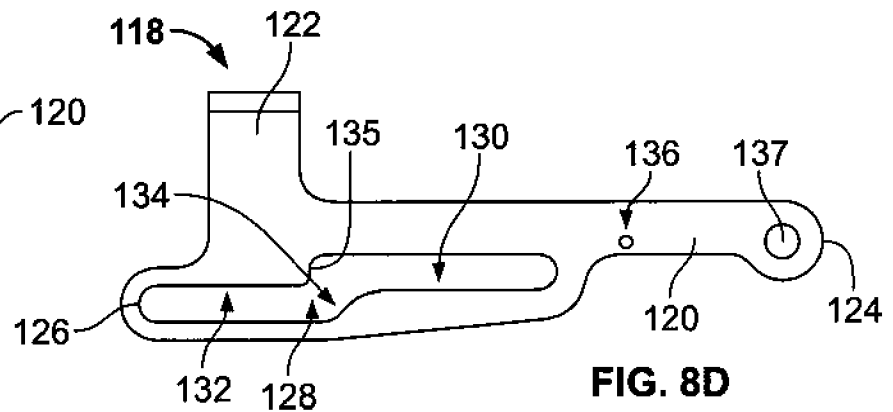


FIG. 8D

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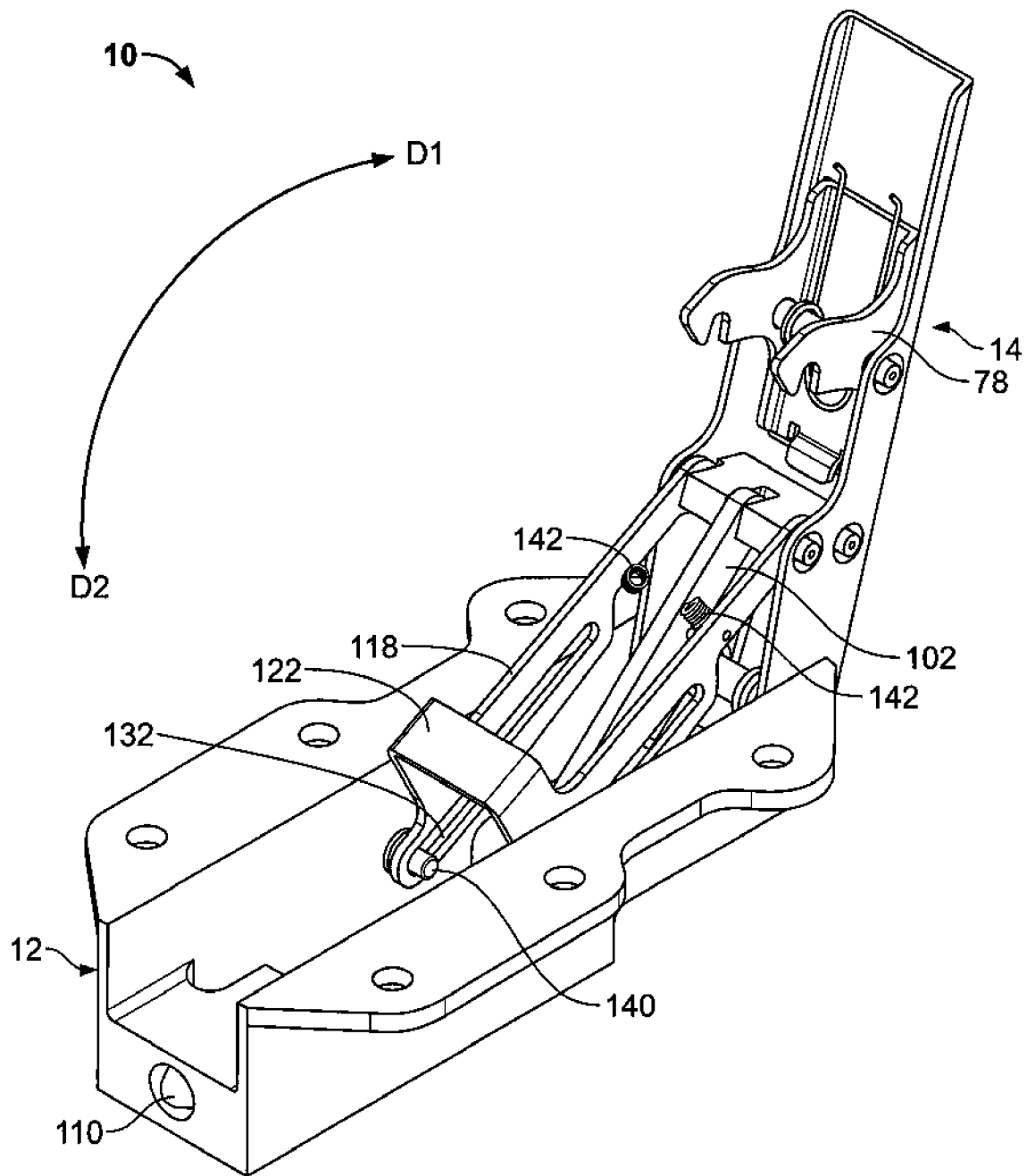
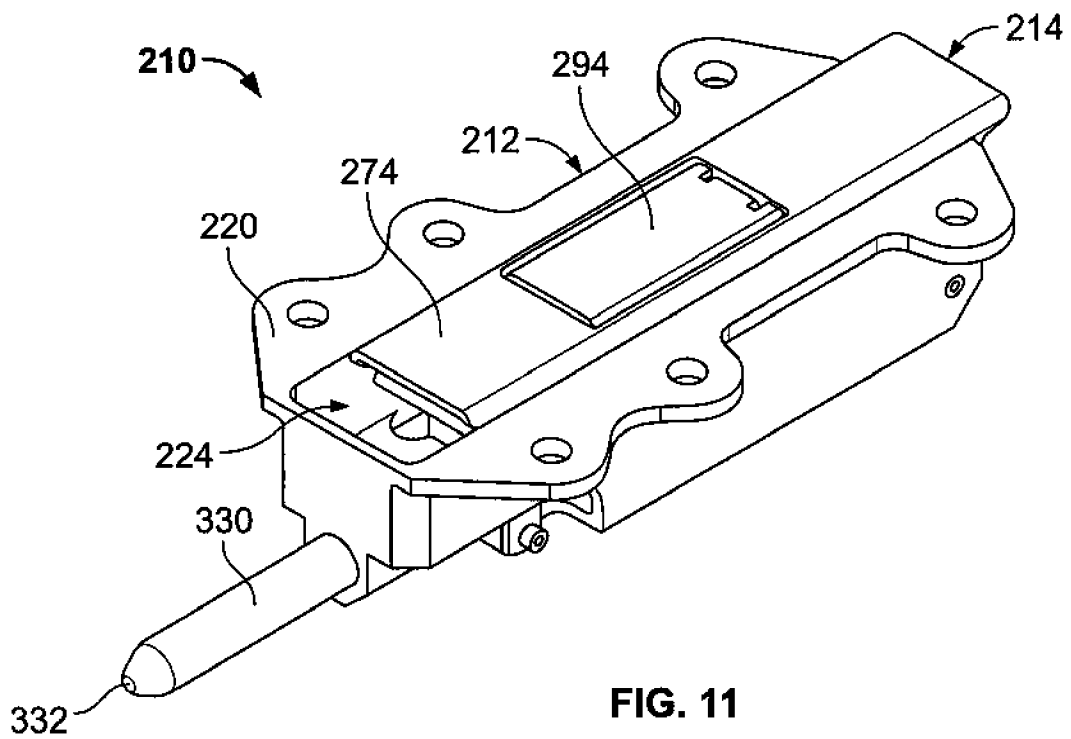
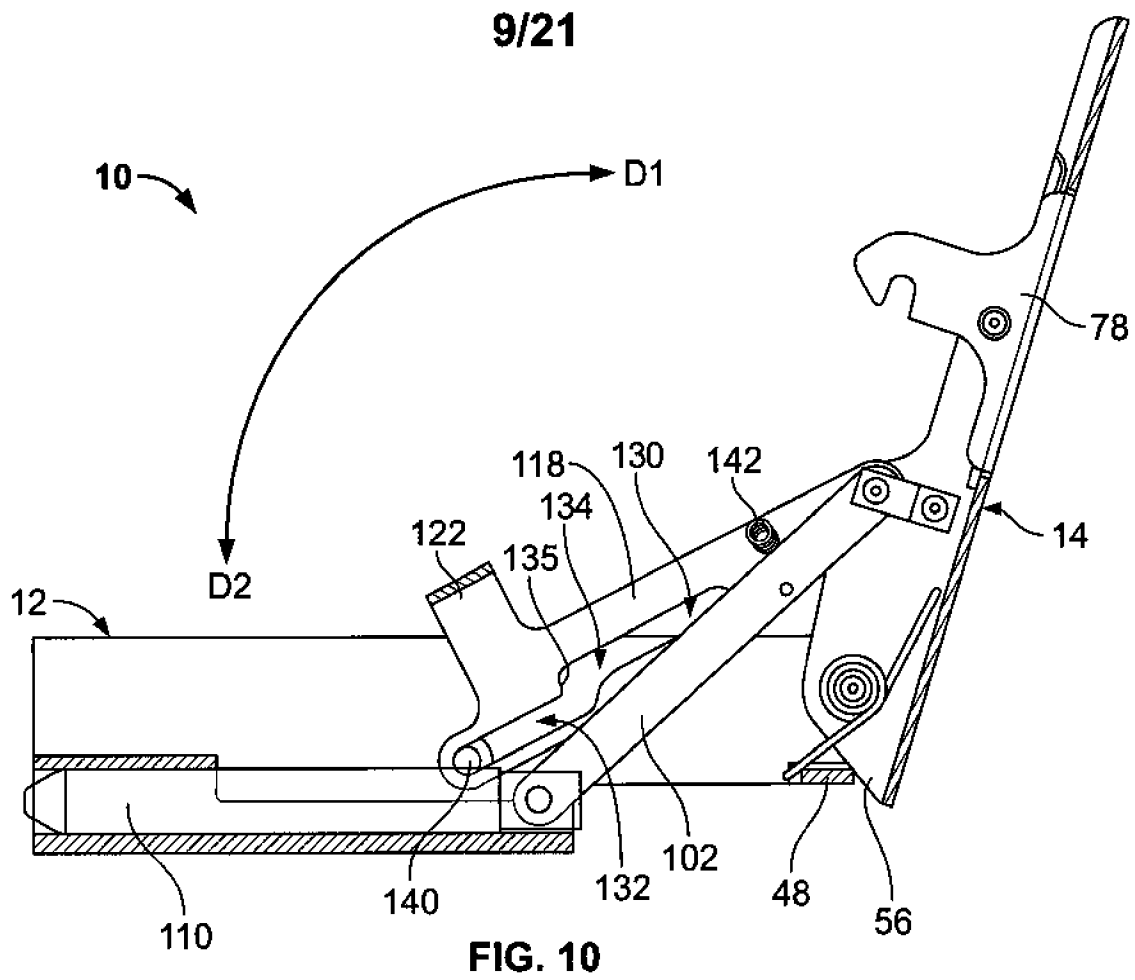


FIG. 9



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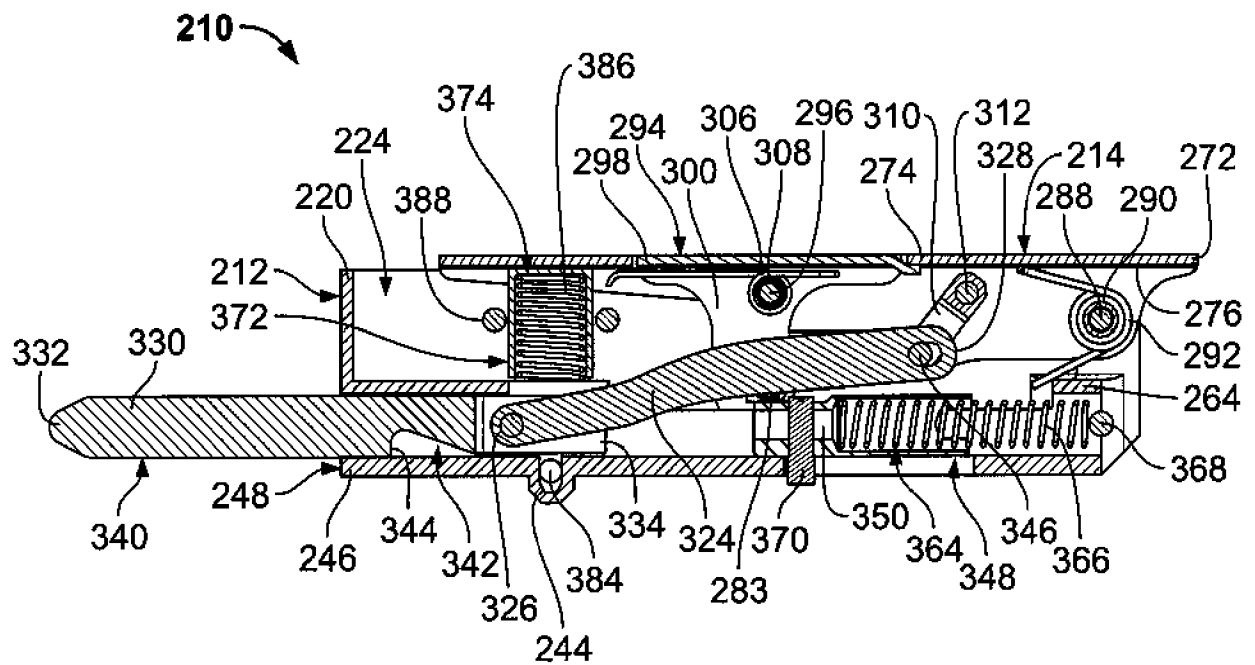


FIG. 12

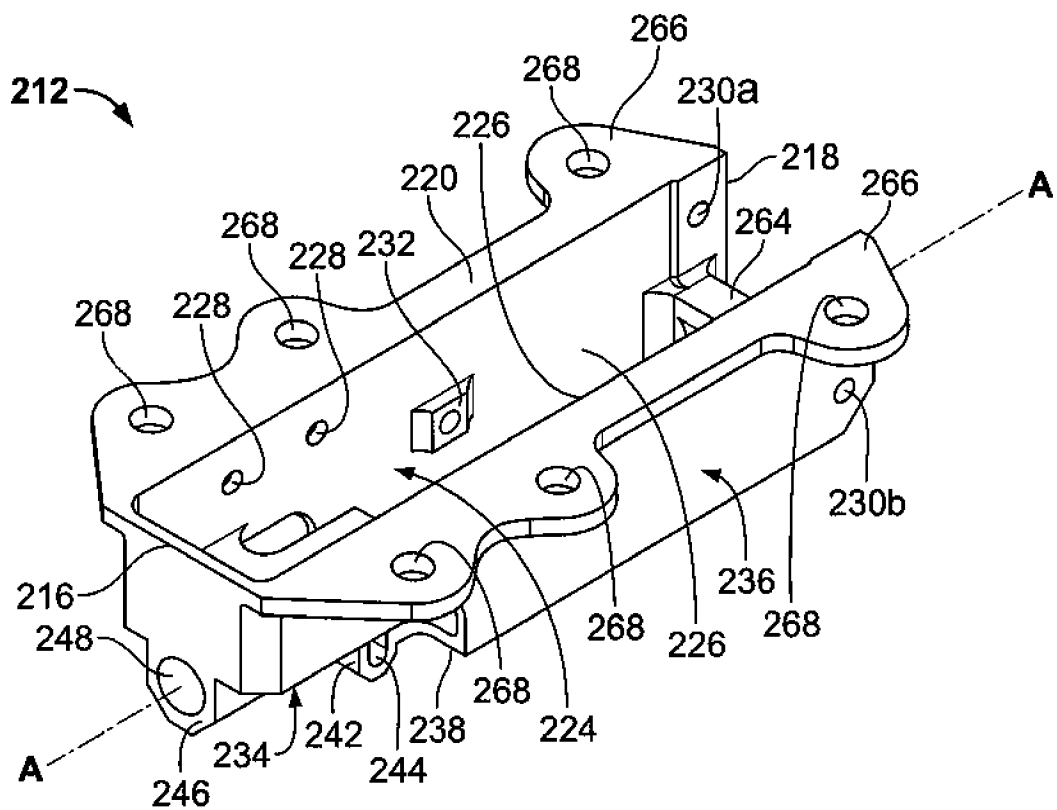
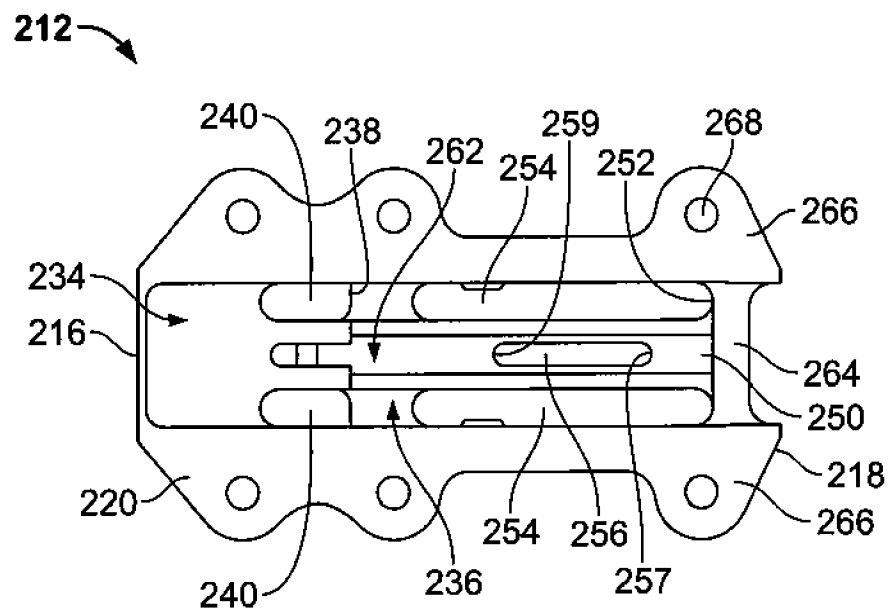
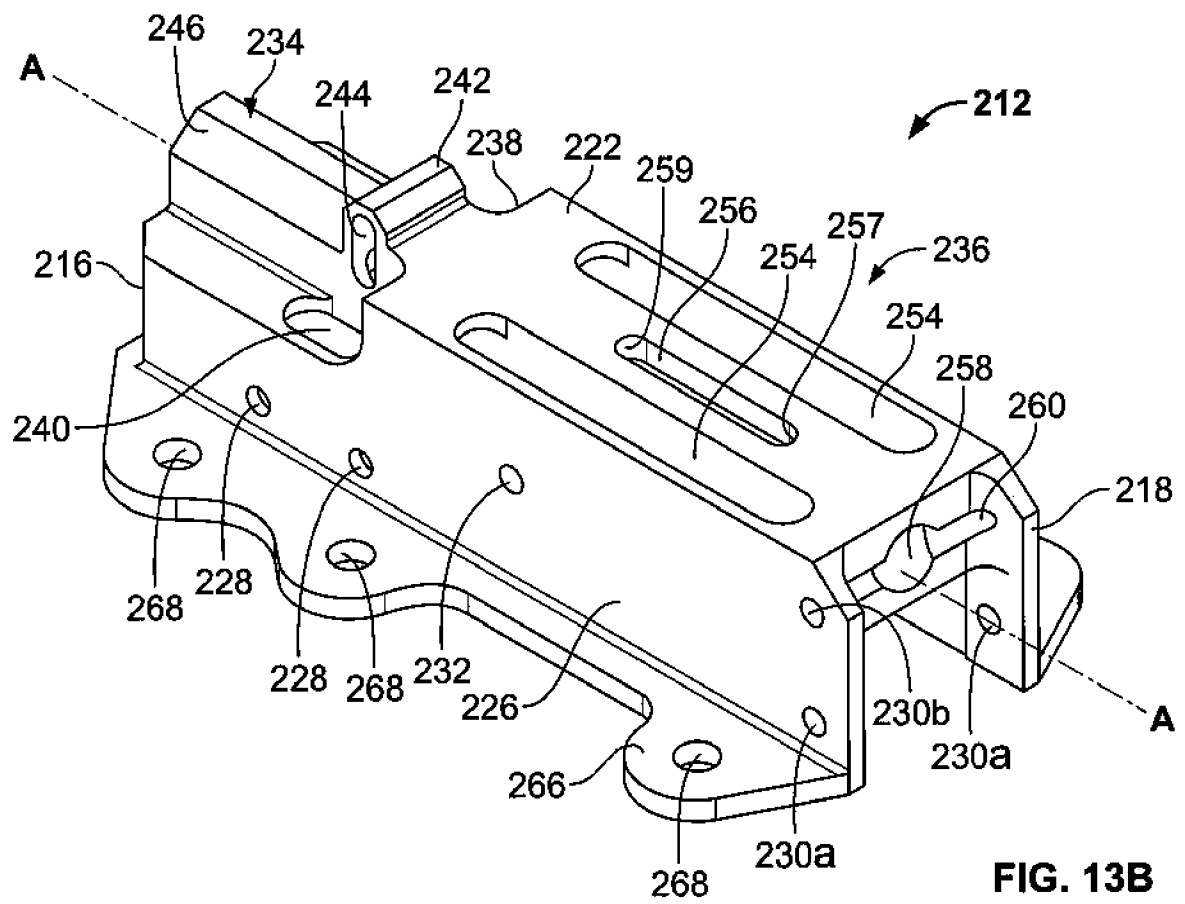


FIG. 13A

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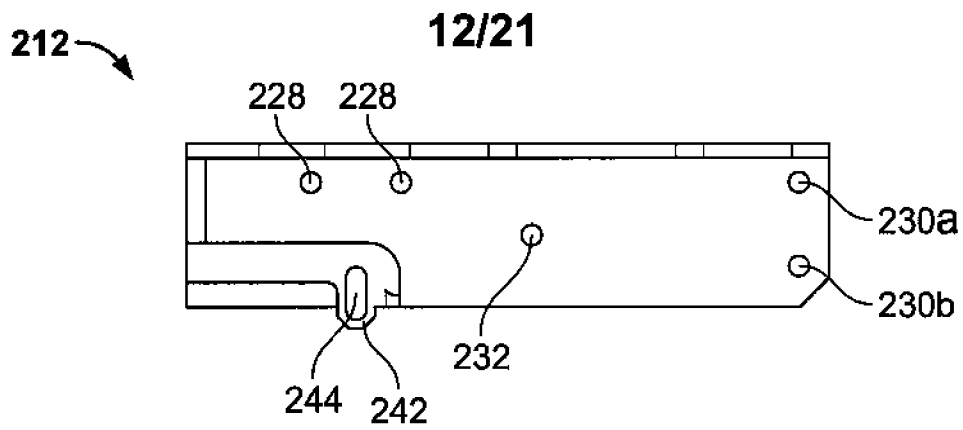


FIG. 13D

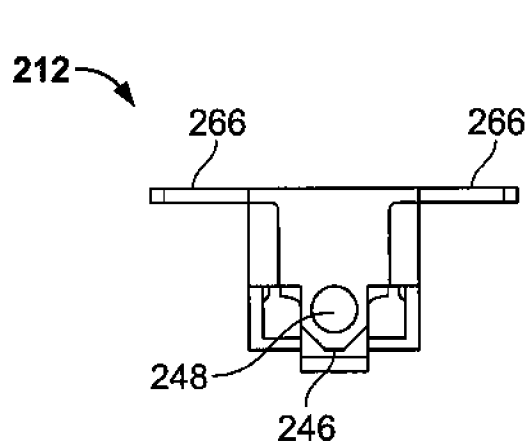


FIG. 13E

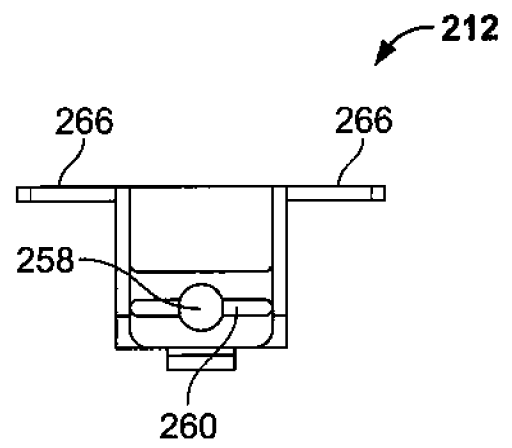


FIG. 13F

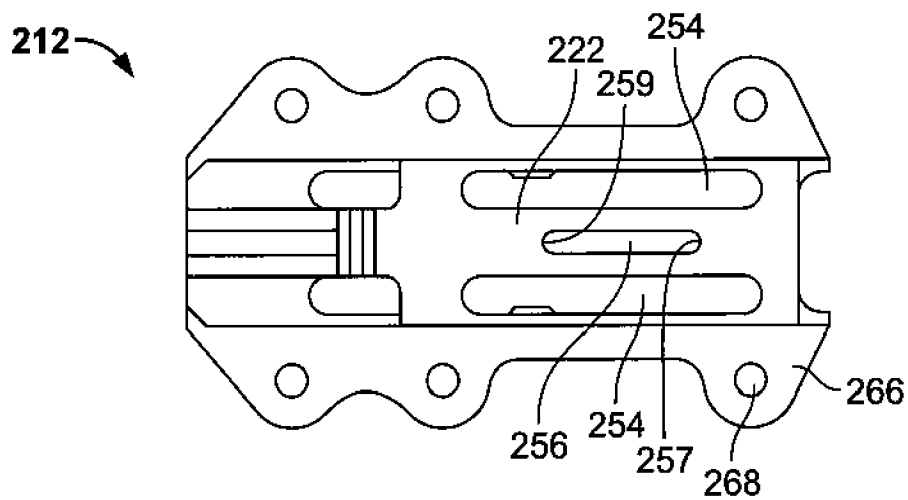


FIG. 13G

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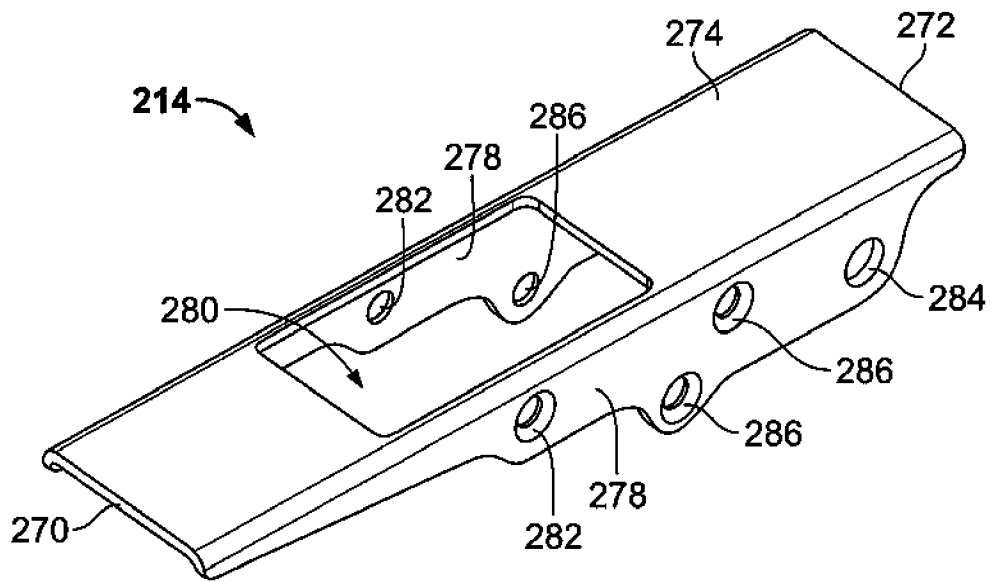


FIG. 14A

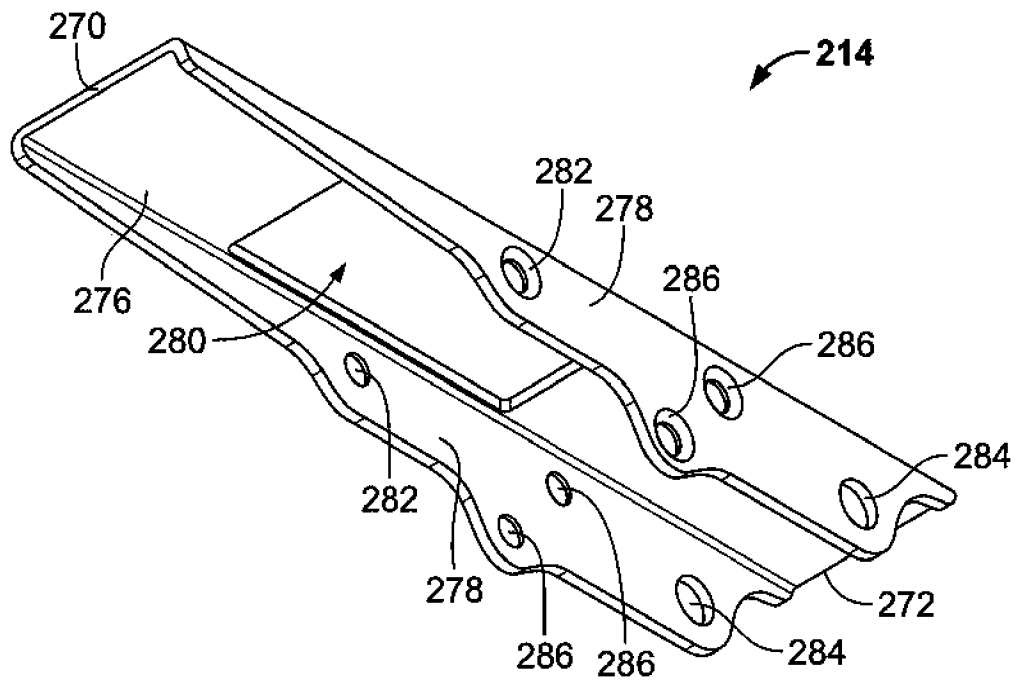


FIG. 14B

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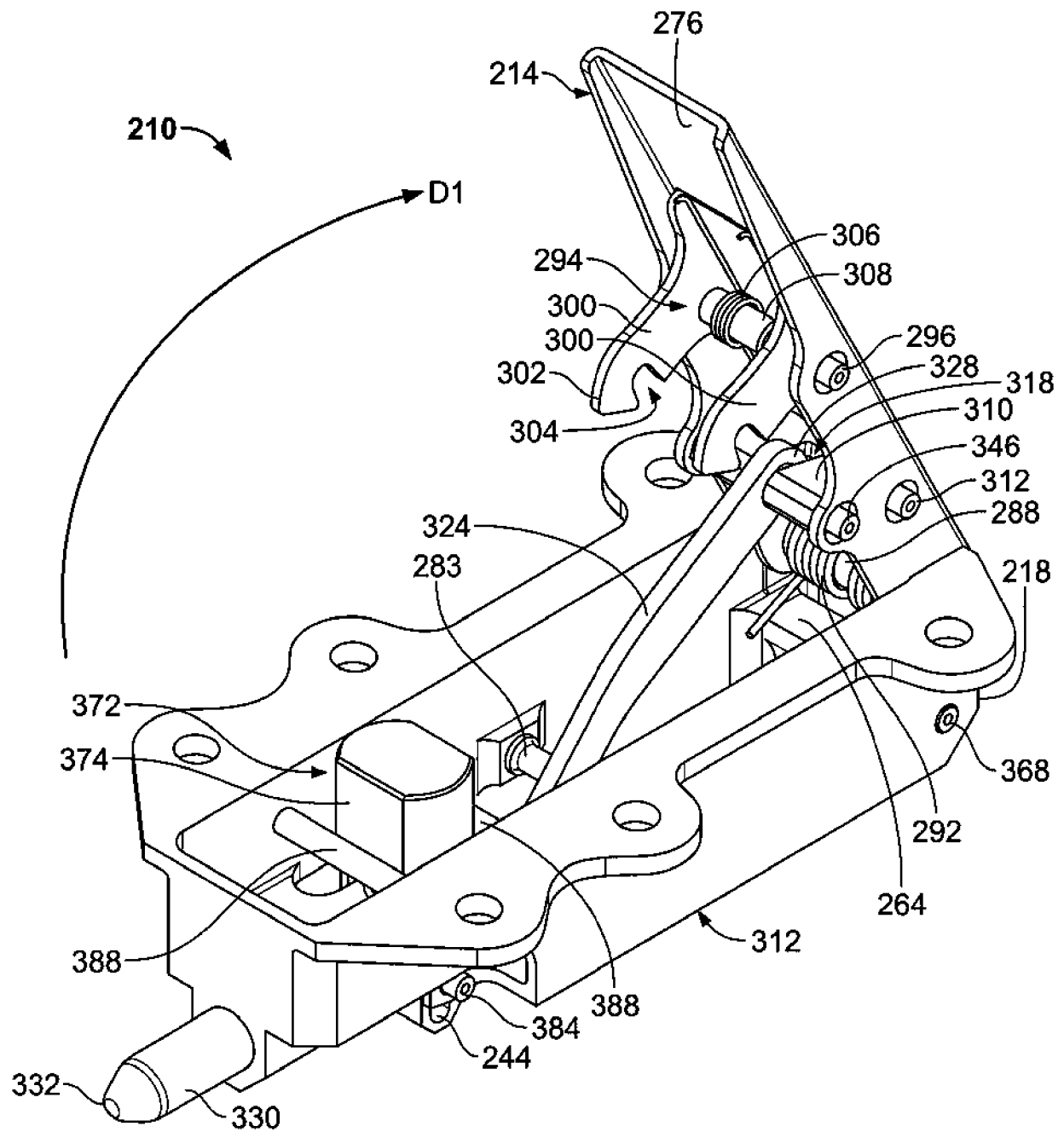


FIG. 15

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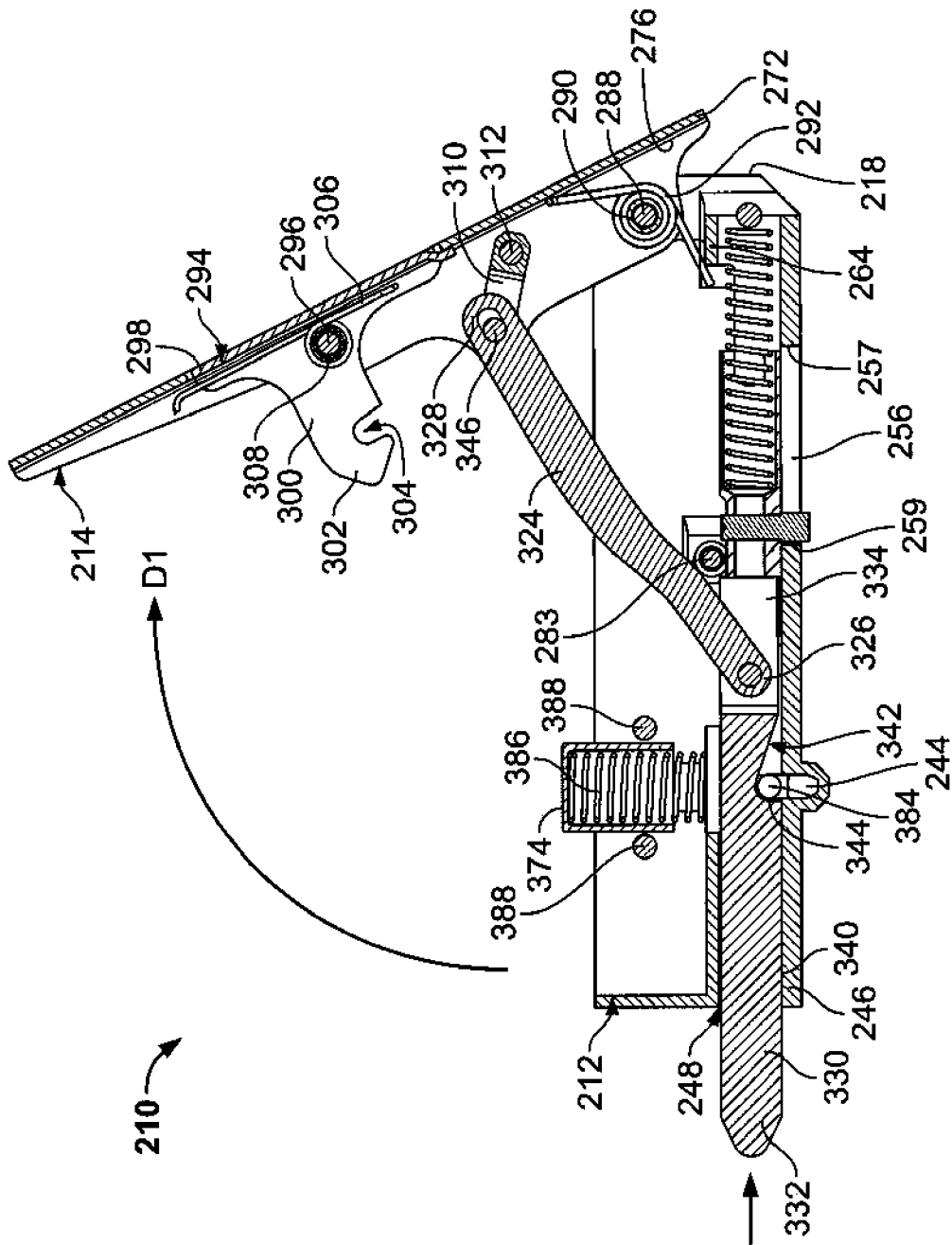


FIG. 16

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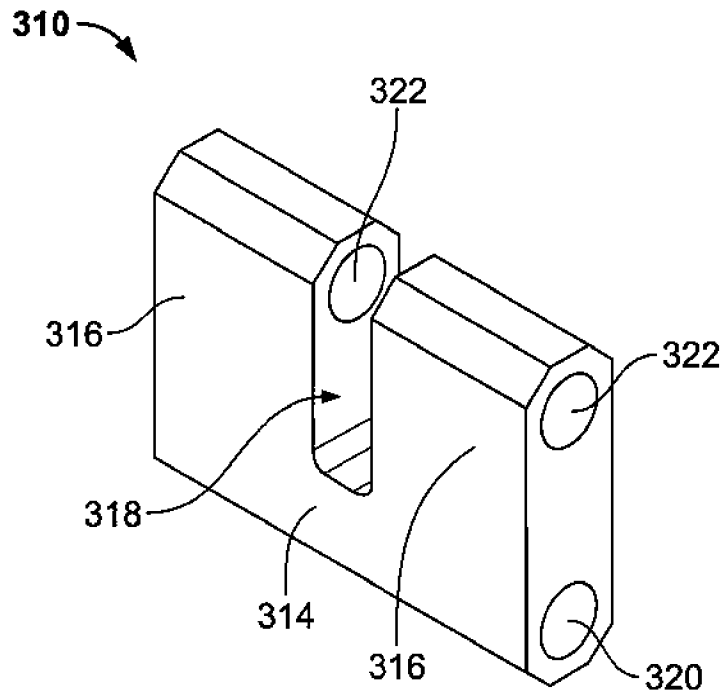


FIG. 17A

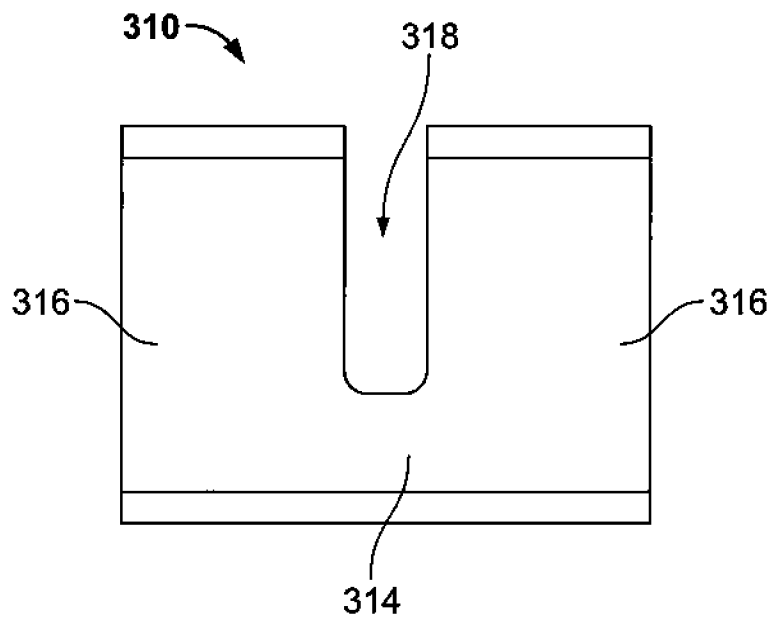
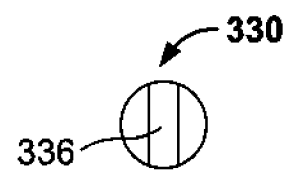
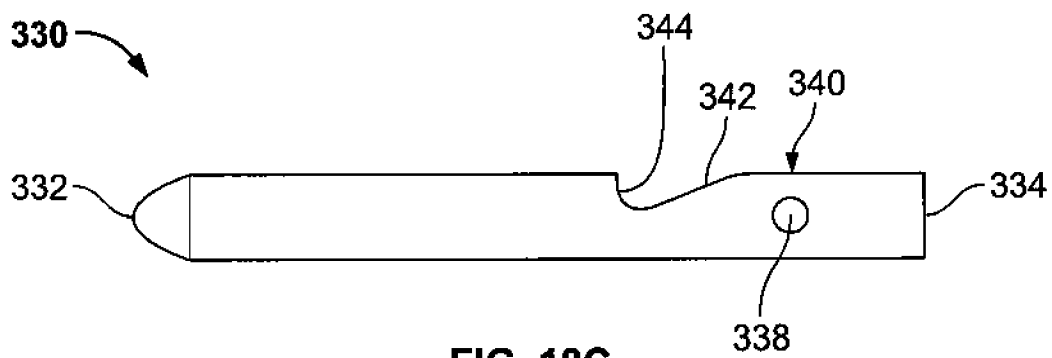
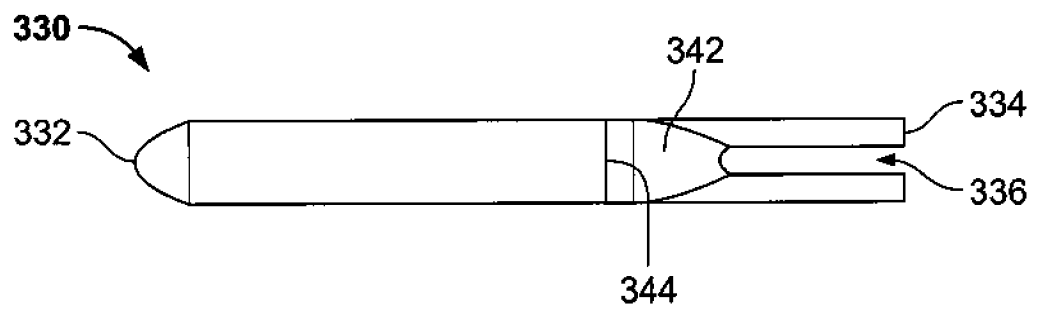
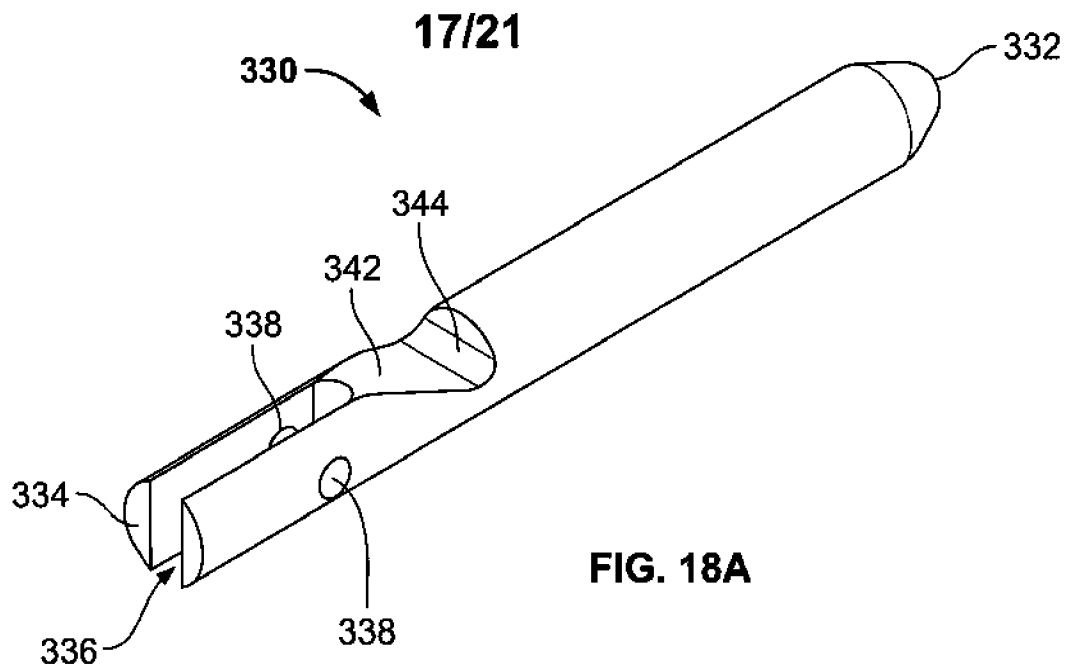
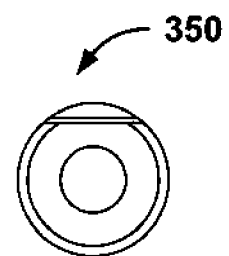
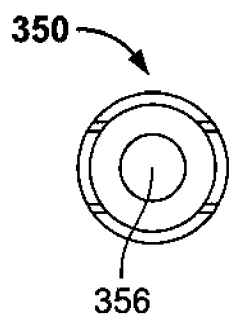
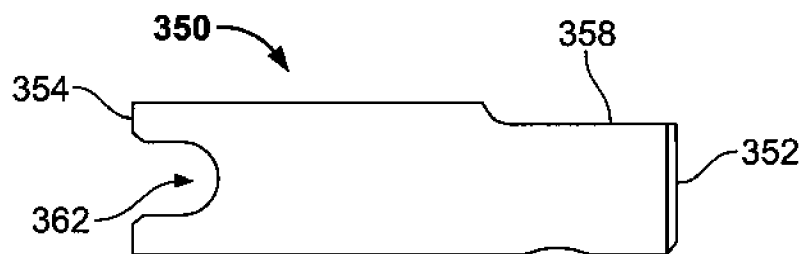
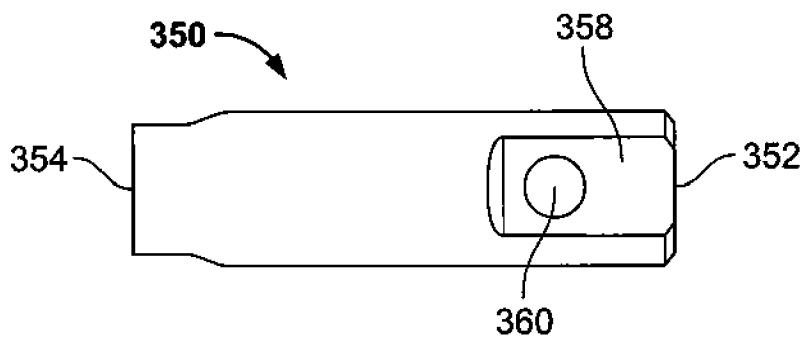
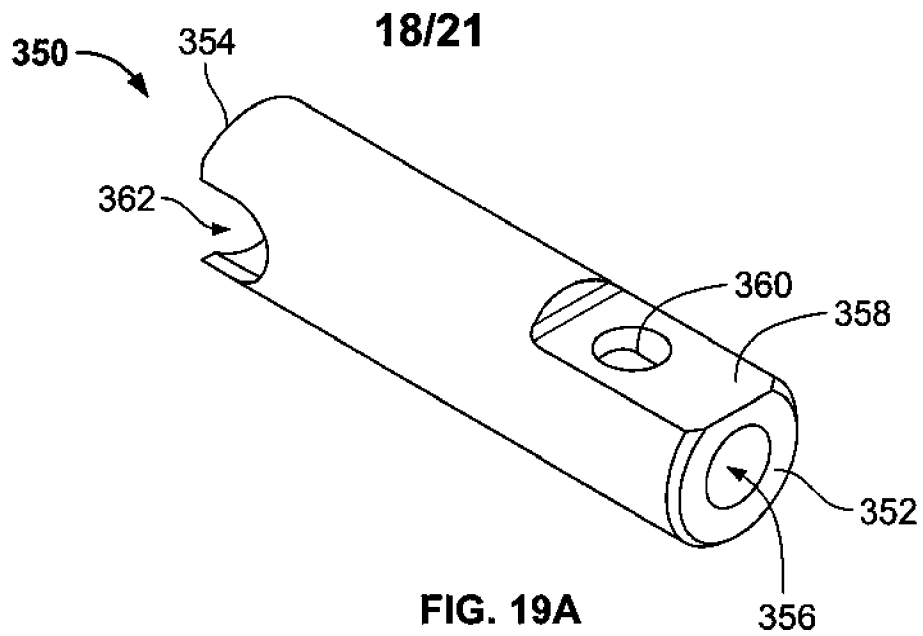


FIG. 17B





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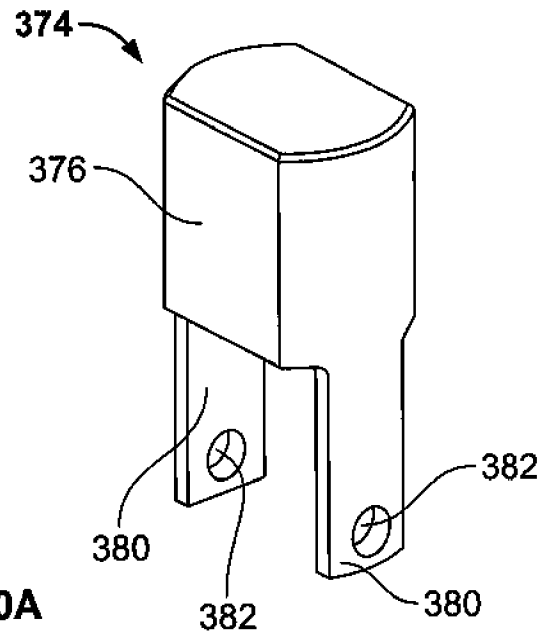


FIG. 20A

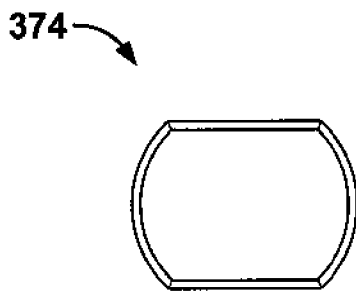


FIG. 20B

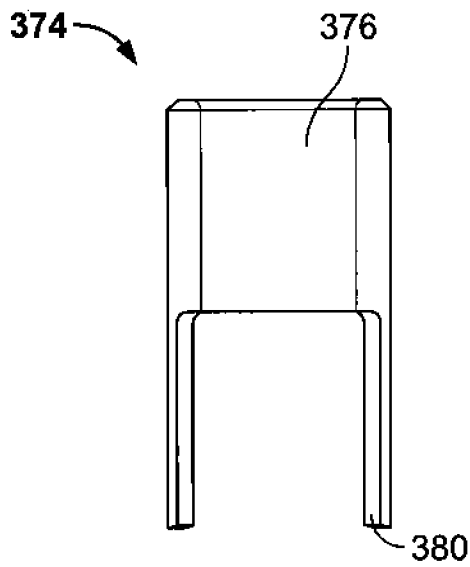


FIG. 20C

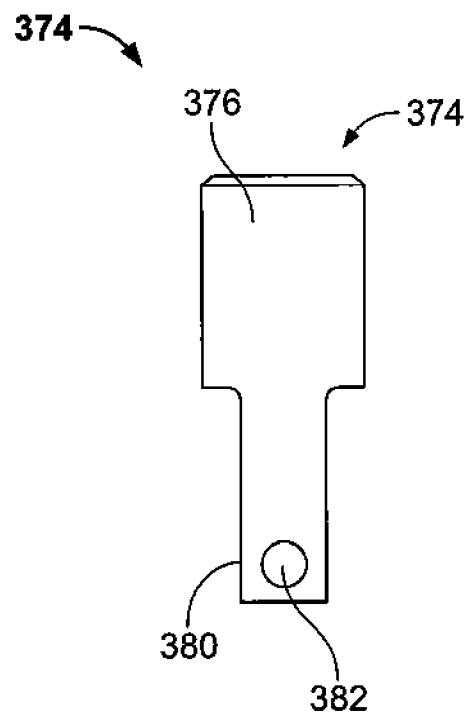


FIG. 20D

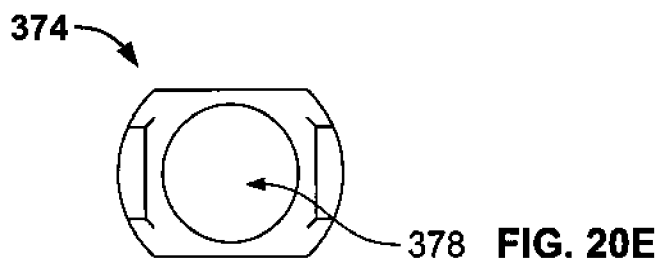


FIG. 20E

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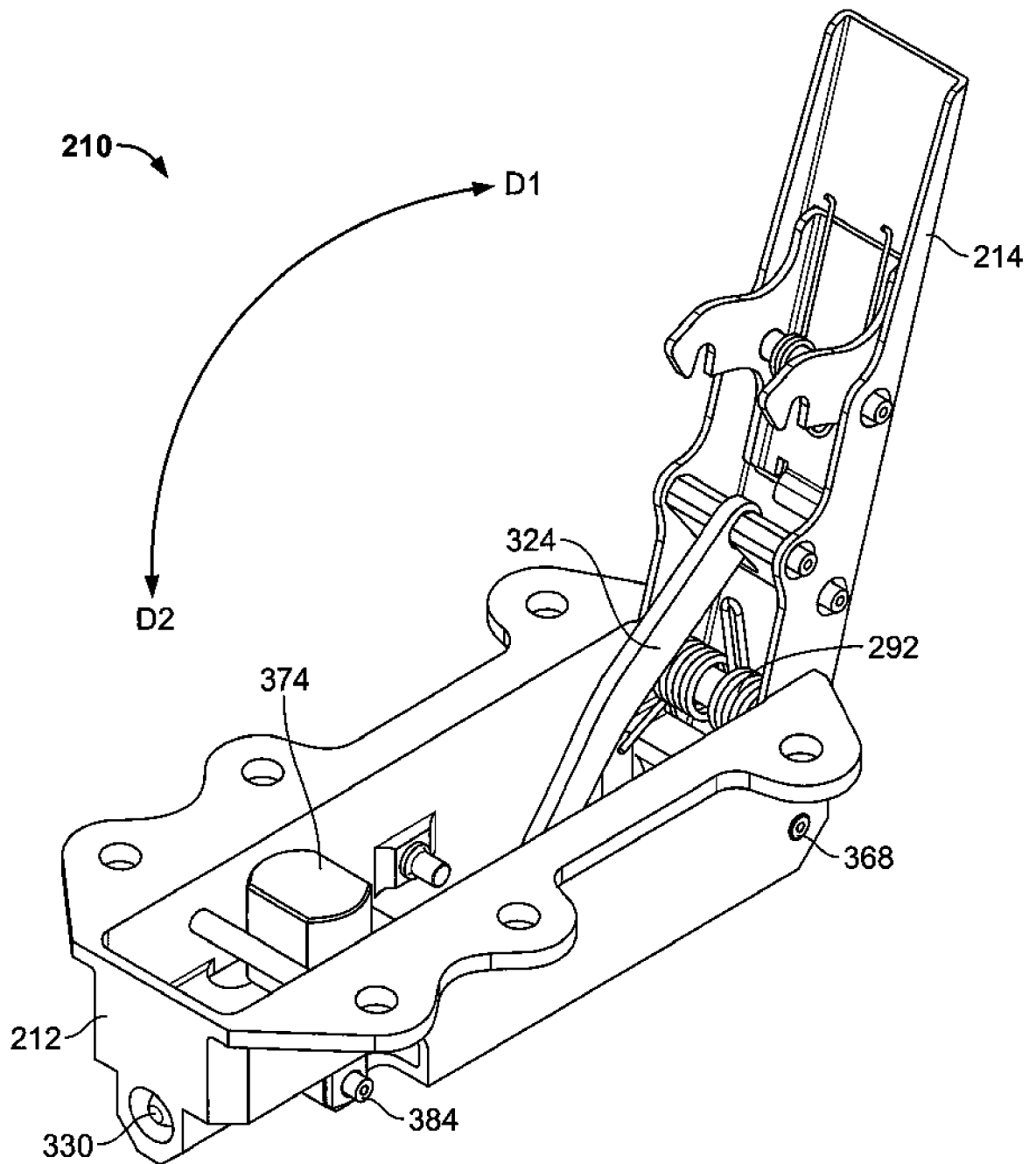


FIG. 21

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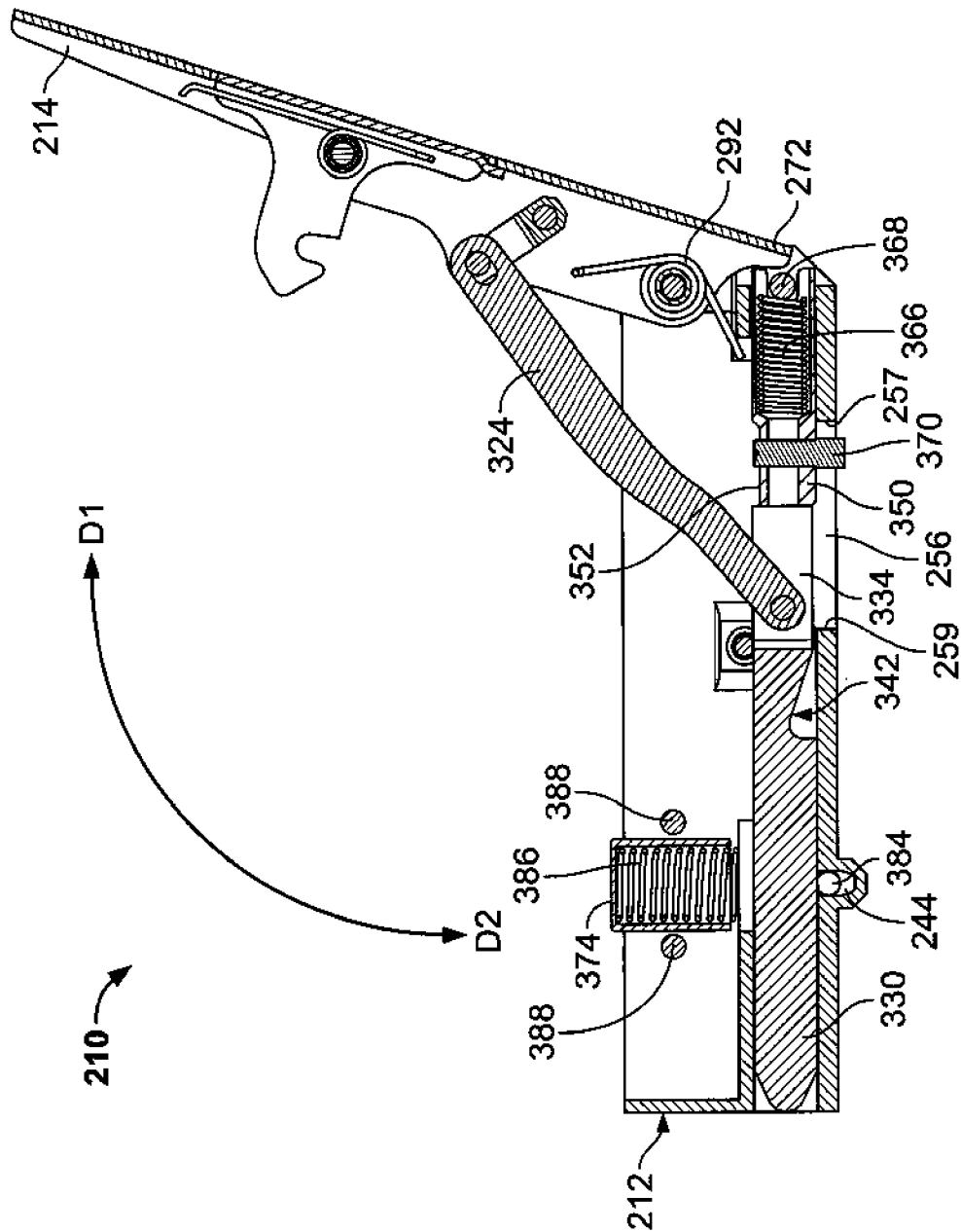


FIG. 22

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/028418

A. CLASSIFICATION OF SUBJECT MATTER

INV. E05C1/06

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 397 503 A1 (ALSTHOM ATLANTIQUE [FR]) 9 February 1979 (1979-02-09) page 3, line 12 - page 5, line 5; figures 1-3 -----	1,13-15, 28
A	FR 2 852 049 A1 (LAPERCHÉ SA [FR]) 10 September 2004 (2004-09-10) page 4, line 14 - page 8, line 29; figures 1-11 -----	1-28
A	US 4 828 299 A (POE L RICHARD [US]) 9 May 1989 (1989-05-09) column 2, line 58 - column 6, line 39; figures 1-8 -----	1,13-15, 28

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

13 July 2012

Date of mailing of the international search report

20/07/2012

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Pérez Méndez, José F

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/028418

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2397503	A1	09-02-1979	NONE
FR 2852049	A1	10-09-2004	NONE
US 4828299	A	09-05-1989	NONE