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(54) Title: PRESSURE RELIEF LATCH MECHANISM

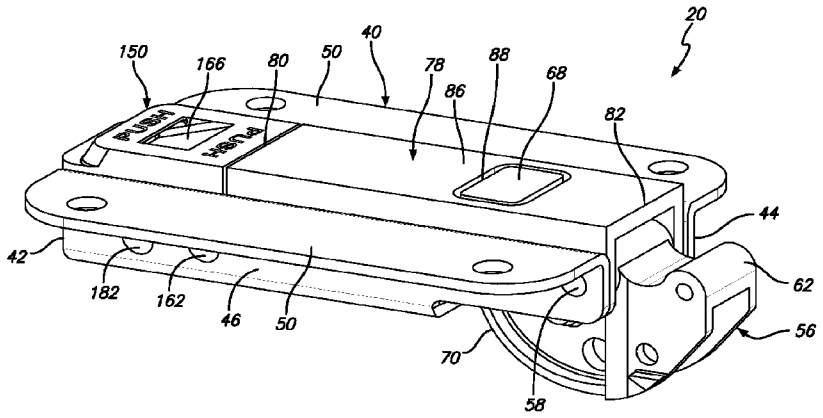

FIG. 1

(57) Abstract: A latch mechanism for use in attaching portions or panels on an aircraft. The latch mechanism and related method include a detent mechanism for releasably coupling a bolt portion of the latch to a handle portion of the latch. The latch allows the bolt and handle to conjointly pivot with respect to a corresponding mounting bracket. The latch operates to relieve pressure in an excess pressure condition when the forces associated with the detention mechanism are overcome.

PRESSURE RELIEF LATCH MECHANISM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. provisional patent application no. 61/266,803, filed December 4, 2009, the disclosure of which is herein incorporated by reference in its entirety.

BACKGROUND

[0002] The present disclosure relates to a pressure relief latch mechanism for releasably latching and/or holding a first member with respect to a second member, and in particular to a latch mechanism including a manually operable trigger for releasing a bolt of the latch mechanism from a latched condition and that is configured to alternatively automatically release the bolt of latch mechanism from the latched condition in response to an over-pressure condition encountered by the first member.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

[0003] Fig. 1 is a perspective view of the latch mechanism shown in the latched condition.

[0004] Fig. 2 is a partial cross sectional view of the latch mechanism shown in the latched condition and releasably latching a first member to a second member.

[0005] Fig. 3 is a broken-away side elevational view of the latch mechanism shown in the latched condition.

[0006] Fig. 4 is a top plan view of the latch mechanism shown in the latched condition.

[0007] Fig. 5 is a bottom view of the latch mechanism shown in the latched condition.

[0008] Fig. 6 is a left end view of the latch mechanism shown in the latched condition.

[0009] Fig. 7 is a right end view of the latch mechanism shown in the latched condition.

[0010] Fig. 8 is a side cross sectional view of the latch mechanism shown in the latch condition with the mounting bracket removed.

[0011] Fig. 9 is a top perspective view of the latch mechanism shown in the latched condition with the handle removed.

[0012] Fig. 10 is a bottom perspective view of the latch mechanism shown in the latched condition with the mounting bracket removed.

[0013] Fig. 11 is a perspective partial cross section view of the handle of the latch mechanism.

[0014] Fig. 12 is a partial view of the latch mechanism showing the trigger, bolt and detent mechanism in the latched condition.

[0015] Fig. 13 is a top view of the trigger, bolt and detent mechanism as shown in the latched condition with the handle and mounting bracket removed.

[0016] Fig. 14 is a bottom view of the trigger, bolt and detent mechanism shown in the latched condition with the handle and mounting bracket removed.

[0017] Fig. 15 is a partially exploded view of the latch mechanism.

[0018] Fig. 16 is a side elevational view of the latch mechanism showing the trigger pivoted toward an extended position and the latch mechanism in an unlatched condition.

[0019] Fig. 17 is a side elevational view of the latch mechanism shown in an unlatched condition with the bolt, handle and trigger in extended positions.

[0020] Fig. 18 is a perspective view of the latch mechanism showing the bolt pivoted to an extended position in response to an over-pressure condition such that the latch mechanism is in the unlatched condition while the handle and trigger are in the retracted position.

[0021] Fig. 19 is a side elevational view of the latch mechanism shown in Fig. 18 with the bolt in the extended position and the trigger and handle in the retracted position such that the latch mechanism is in the unlatched condition.

DETAILED DESCRIPTION

[0022] As shown in the drawing figures, latch mechanism 20 is adapted to releasably latch a first member 22 to a second member 24. First member 22 includes a first surface 26, a second surface 28 and an aperture 30 that extends through first member 22 from first surface 26 to second surface 28. Second member 24 includes a first surface 32 and a second surface 34. Second member 24 may be, for example, an aircraft frame or other body member. First member 22 may be, for example, a door or panel that is adapted to be removed or displaced with respect to second member 24.

[0023] Latch mechanism 20 includes a mounting bracket 40 that extends between a first end 42 and a second end 44. Bracket 40 includes a pair of generally planar side walls 46 that are spaced apart and generally parallel to one another. A generally planar bottom wall 48 extends between the bottom ends of side walls 46 and is generally perpendicular to side walls 46, such that the side walls 46 and bottom wall 48 are generally U-shaped and form an open receptacle therebetween. A flange 50 extends outwardly and generally perpendicularly from the top end of each side wall 46. Each flange 50 includes one or more apertures adapted to receive a fastener for use in attaching bracket 40 in engagement with the second surface 28 of the first member 22 in alignment with aperture 30.

[0024] Latch mechanism 20 includes a bolt 56 pivotally coupled to bracket 40 by a pin 58 having a generally linear central axis 60. Pin 58 extends generally transversely between side walls 46 of mounting bracket 40 and is coupled at each end to a respective side wall 46. As

shown in Fig. 2, bolt 56 is in a retracted position with respect to bracket 40 such that latch mechanism 20 is in a latched condition whereby latch mechanism 20 releasably latches first member 22 to second member 24. Bolt 56 is pivotal with respect to bracket 40 about axis 60 from the retracted position as shown in Fig. 2 toward an extended position as shown in Figs. 17-19, wherein latch mechanism 20 is in the unlatched condition and first member 22 may be removed from, or displaced with respect to, second member 24. Bolt 56 includes an engagement member 62 that is located longitudinally outwardly from second end 44 of mounting bracket 40, such that engagement member 62 is adapted to engage second surface 34 of second member 24 when bolt 56 is in the retracted position and latch mechanism 20 is in the latched condition. Bolt 56 also includes an arm 64 extending between a first end 66 and a second end 68. Arm 64 and engagement member 62 are located on opposite sides of pin 58 and axis 60. Arm 64 includes a convexly curved outer surface 70 that extends between first end 66 and second end 68. A recess or detent 72 is formed in outer surface 70 adjacent second end 68 of arm 64. Outer surface 70 of arm 64 conforms generally to an arc of a circle about axis 60 between second end 68 of arm 64 and detent 72.

[0025] Latch mechanism 20 includes an elongate handle 78 that extends between a first end 80 and a second end 82. Handle 78 includes a pair of generally planar side walls 84 that are spaced apart and generally parallel to one another. A generally planar top wall 86 extends between the top ends of side walls 84 generally perpendicular to side walls 84, such that side walls 84 and top wall 86 are arranged in a generally inverted U-shaped manner. Top wall 86 includes an aperture 88 configured to receive arm 64 of bolt 56. As shown in Fig. 11, handle 78 includes an internal wall 90 located between first end 80 and second end 82 and that extends generally perpendicular to side walls 84 and top wall 86. Internal wall 90 includes a central

generally circular aperture 92. Handle 78 includes a bottom wall 94 that extends between first end 80 and internal wall 90, and between the bottom ends of side walls 84. An elongate generally cylindrical chamber 96 is formed in handle 78 between side walls 84, top wall 86 and bottom wall 94 that extends from first end 80 to internal wall 90. Aperture 92 is in communication with chamber 96. Bottom wall 94 includes an aperture 98 that is communication with chamber 96.

[0026] Side walls 84 of handle 78 include an aperture 100 at second end 82. Side walls 84 of handle 78 are located between side walls 46 of mounting bracket 40 with bolt 56 located between side walls 84 of handle 78. Pin 58 extends through apertures 100 of side walls 84 of handle 78 such that handle 78 is pivotally coupled to mounting bracket 48. Handle 78 is pivotal with respect to mounting bracket 40 about axis 60 between a retracted position as shown in Fig. 1, and an extended position as shown in Fig. 17 wherein latch mechanism 20 is in an unlatched condition. A resilient biasing member, such as a torsion spring or a leaf spring, is coupled to handle 78 and resiliently biases handle 78 toward the extended position.

[0027] Handle 78 includes one or more retention members 104 at first end 80. A retention member 104 may be respectively located at each side wall 84. Each retention member 104 includes a generally planar top engagement surface 106 and a biasing surface 108 at the outer distal end of the retention member 104. Biasing surface 108 may be generally planar and inclined with respect to a central longitudinal axis 110 of handle 78 or biasing surface 108 may be curved.

[0028] Latch mechanism 20 includes a detent mechanism 114 located within chamber 96 of handle 78. Detent mechanism 114 includes a detent member 116 such as a generally spherical metal ball or cylindrical roller. Detent mechanism 114 includes an adjustable biasing

mechanism 118 having a resilient biasing member 120, such as a helical coil spring, a plunger 122 and a plug or base member 124. Biasing member 120 extends between a first end 126 and a second end 128 generally concentrically about axis 110. Plunger 120 includes a head 130 having a recess 132 configured to receive a portion of detent member 116. Plunger 120 also includes a generally cylindrical stem extending from head 130 along axis 110. Stem 134 extends within second end 128 of biasing member 124. Base member 124 includes a head 138 and a stem 140 that extends within first end 126 of biasing member 120.

[0029] First end 126 of biasing member 124 engages an interior surface of head 138 of base member 124, and second end 128 of biasing member 120 engages an interior surface of head 130 of plunger 122. Biasing member 120 resiliently biases plunger 122 into engagement with detent member 116 and thereby resiliently biases detent member 116 toward internal wall 90 of handle 78 and into detent 72 of bolt 56 as shown in Fig. 8. The outer circumferential surface of head 138 of base member 124 threadably engages threads in cylindrical chamber 96 such that selective rotation of base member 124 about axis 110 will move base member 124 along axis 110 in a desired direction to compress or expand biasing member 120 to a desired extent such that biasing member 120 applies a desired force to detent member 116 for engagement with detent 72.

[0030] When detent member 116 is in an extended position as shown in Fig. 8, a portion of detent member 116 projects outwardly from aperture 92 of internal wall 90 and is located within detent 72 of arm 64 of bolt 56 to inhibit pivotal movement of belt 56 with respect to handle 74. Detent member 116 thereby releasably locks bolt 56 to handle 78 such that bolt 56 and handle 78 will conjointly pivot with one another about axis 60. However, when a sufficiently large force as applied to engagement member 62 of bolt 56 in a generally

downward direction is viewed in Fig. 8, the retention force with which biasing member 120 presses detent member 116 into detent 72 of bolt 56 may be overcome, such that arm 64 of bolt 56 presses detent member 116 toward base member 124 and first end 80 of handle 78 along axis 110 and compresses biasing member 122, such that bolt 56 may rotate in a generally clockwise direction about axis 60 with respect to handle 78 and bracket 40. When detent member 116 is no longer located within detent 72, bolt 56 may pivot about axis 60 with respect to mounting bracket 40 and handle 78 to a retracted position as shown in Figs. 18-19. Outer surface 70 of arm 64 slides along detent member 116 as bolt 56 pivots about axis 60 between the retracted position as shown in Fig. 8 and the extended position as shown in Fig. 18. Bolt 56 may be manually returned to the position as shown in Fig. 8 with respect to handle 78 by pressing downwardly on second end 68 of arm 64 to pivot bolt 56 in a counter-clockwise direction about axis 60 with respect to handle 78 until detent member 116 is located within detent 72 of bolt 56.

[0031] Latch mechanism 20 also includes a trigger 150 that extends between a first end 152 and a second end 154. Trigger 150 includes a body 156 and an arm 158 that extends downwardly from the bottom end of body 156. A distal end of arm 158 includes a bore 160. A pin 162 having a central axis 164 extends through bore 160. The ends of pin 162 are coupled to respective side walls 46 of mounting bracket 40. Trigger 150 is located between side walls 46 of mounting bracket 40 and is pivotally coupled to mounting bracket 40 by pin 162 such that trigger 150 is pivotal with respect to mounting bracket 40 about axis 164. Axis 164 is spaced apart from and generally parallel to axis 58 of pin 60. Body 156 of trigger 150 includes an inclined slot 166 that is open at the top surface of body 156. Slot 166 is adapted to receive a tool, such as the tip of the screw driver, to assist in manually pivoting trigger 150 from a

retracted position as shown in Figs. 1 and 8 in a counter-clockwise direction about axis 164 to an extended position as shown in Figs. 16 and 17. Body 156 of trigger 150 includes a locking member 170 having a bottom surface 172 adapted to engage engagement surface 106 of retention members 104 of handle 78 when handle 78 is in the retracted position and trigger 150 is in the retracted position as shown in Figs. 3 and 8, such that locking member 170 prevents pivotal movement of handle 78 about axis 68 in a generally clockwise direction with respect to mounting bracket 40 when a force is applied to engagement member 62 of bolt 56.

[0032] Latch mechanism 20 includes a resilient biasing member 180, such as coil torsion spring. A pin 182 extends between and is coupled to side walls 46 of mounting bracket 40 and couples biasing member 180 to bracket 40. Biasing member 180 includes a first end 184 that is in biased engagement with a bottom surface of body 156 adjacent first end 152 of trigger 150 and a second end 186 that is in biased engagement with bottom wall 48 of mounting bracket 40. Biasing member 180 may be wrapped around pin 182. Biasing member 180 resiliently biases trigger 158 in a generally clock-wise direction about axis 164 from the extended position of trigger 150 as shown in Figs. 16 and 17 toward the retracted position of trigger 150 as shown in Fig. 3. Trigger 150 is selectively manually pivotal from the retracted position as shown in Figs. 3 and 8, wherein trigger 150 locks handle 178 in the retracted position with respect to mounting bracket 40, toward an extended position as shown in Figs. 16 and 17 wherein locking member 170 of trigger 150 is released from retention members 104 of handle 78, such that handle 78 and bolt 56 may conjointly pivot about axis 60 from their retracted positions toward their extended positions whereupon bolt 56 is released from second member 24. First member 22 may then be removed from, or repositioned with respect to, second member 24.

[0033] When trigger 150 is manually released, the biasing member 180 will resiliently bias trigger 150 from the extended position to the retracted position. When the handle 178 and bolt 56 are in the extended positions, the handle 78 and bolt 56 may be manually pivoted in a generally counter-clockwise direction about axis 60 by manually pressing second end 80 of handle 78 toward the retracted position. As handle 78 is pivoted toward the retracted position, biasing surfaces 108 of retention members 104 will engage second end 154 of trigger 150 and will pivot trigger 150 in a counter-clockwise direction about axis 164 until retention members 104 pass by locking member 170 of trigger 150. Biasing member 180 then pivots trigger 150 in a clockwise direction about axis 162 such that locking member 170 of trigger 150 engages retention members 104 of handle 78 to thereby releasably lock handle 74 in the retracted position.

[0034] In the event an excess-pressure condition is encountered, wherein an excess pressure above a predetermined pressure is applied to second surface 28 of first member 22, which results in a predetermined excess force being applied to engagement member 62 of bolt 56, the excess force will overcome the force with which detent member 116 engages arm 64 of bolt 56 such that the arm 64 of bolt 56 will move detent member 116 along axis 110 in a direction away from bolt 56 and toward base member 124. Bolt 56 will then automatically pivot in a generally clock-wise direction about axis 60 with respect to handle 78 and mounting bracket 40 toward an extended position as shown in Figs. 18 and 19 whereby engagement member 62 is released from second member 24. Arm 64 of bolt 56 will extend and pass through aperture 88 in top wall 86 of handle 78 as bolt 56 pivots in a clockwise direction about axis 60 with respect to handle 78. First member 22 may be automatically removed from, or repositioned with respect to, second member 24 as a result of the excess-pressure condition,

thereby preventing or reducing damage that may otherwise be caused to first member 22 and second member 24. Bolt 56 may be manually reset to the retracted position with respect to handle 78 as shown in Fig. 8 by pressing downwardly on second end 68 of arm 64.

[0035] Various features of the invention have been particularly shown and described in connection with the illustrated embodiment of the invention, however, it must be understood that these particular arrangements merely illustrate, and that the invention is to be given its fullest interpretation within the terms of the appended claims.

CLAIMS

1. A latch mechanism for releasably latching a first member to a second member, the latch member comprising:

a mounting bracket adapted to be coupled to the first member;

a handle having a first end and a second end pivotally coupled to the mounting bracket, the handle being pivotal from a retracted position toward an extended position;

a trigger for selectively locking the handle in the retracted position;

a bolt pivotally coupled to the mounting bracket for pivotal movement with respect to the handle and with respect to the mounting bracket from a retracted position toward an extended position, the bolt including an engagement member adapted to engage the second member; and

a detent mechanism for releasably coupling the bolt to the handle such that the bolt and the handle may conjointly pivot with respect to the mounting bracket, whereby the detent mechanism will release the bolt to pivot with respect to the handle when an excess force is applied to the engagement member of the bolt.

2. A method of releasably latching a first member to a second member, the method comprising:

providing a latch mechanism including a mounting bracket adapted to be coupled to the first member; a handle having a first end and a second end pivotally coupled to the mounting bracket, the handle being pivotal from a retracted position toward an extended position, a trigger for selectively locking the handle in the retracted position, a bolt pivotally coupled to the mounting bracket for pivotal movement with respect to the

handle and with respect to the mounting bracket from a retracted position toward an extended position, the bolt including an engagement member adapted to engage the second member, and a detent mechanism for releasably coupling the bolt to the handle such that the bolt and the handle may conjointly pivot with respect to the mounting bracket, the detent mechanism adapted to release the bolt to pivot with respect to the handle when an excess force is applied to the engagement member of the bolt; and

pivoting the handle and the bolt conjointly with one another from their retracted positions toward their extended positions to release the bolt from the second member.

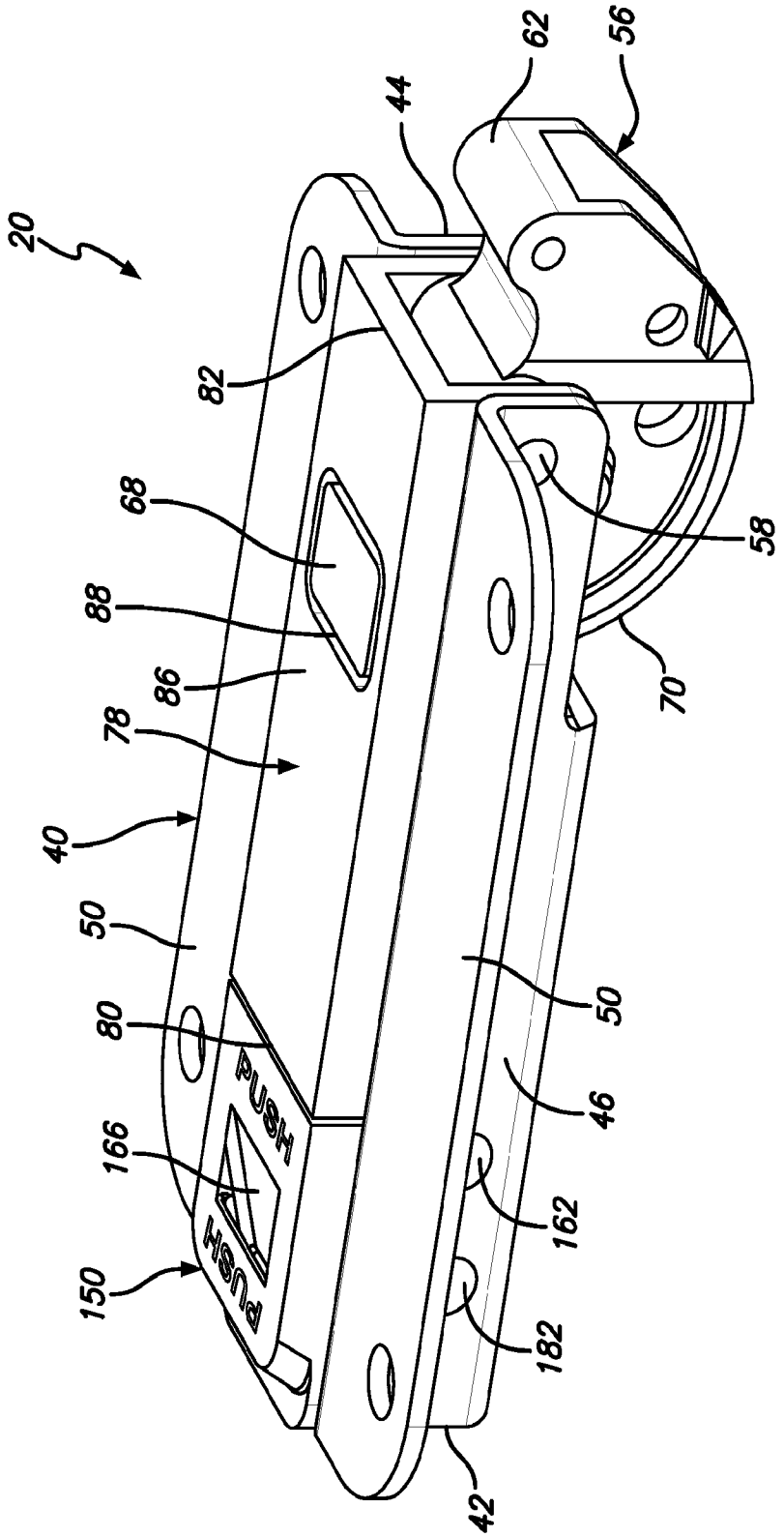
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FIG. 1

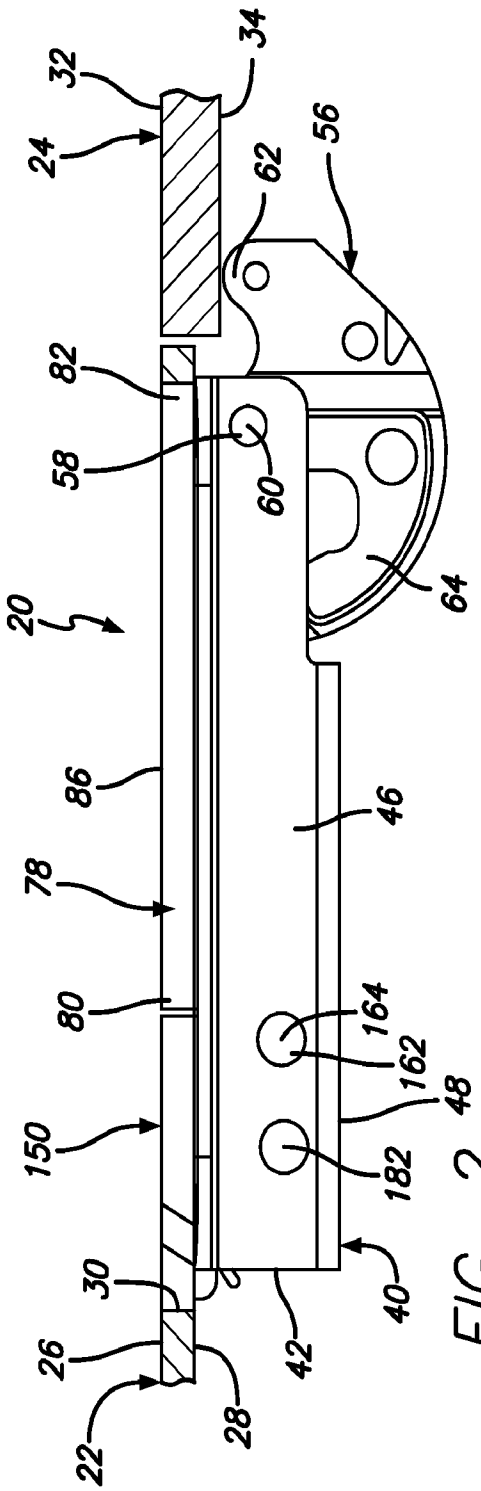
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FIG. 2

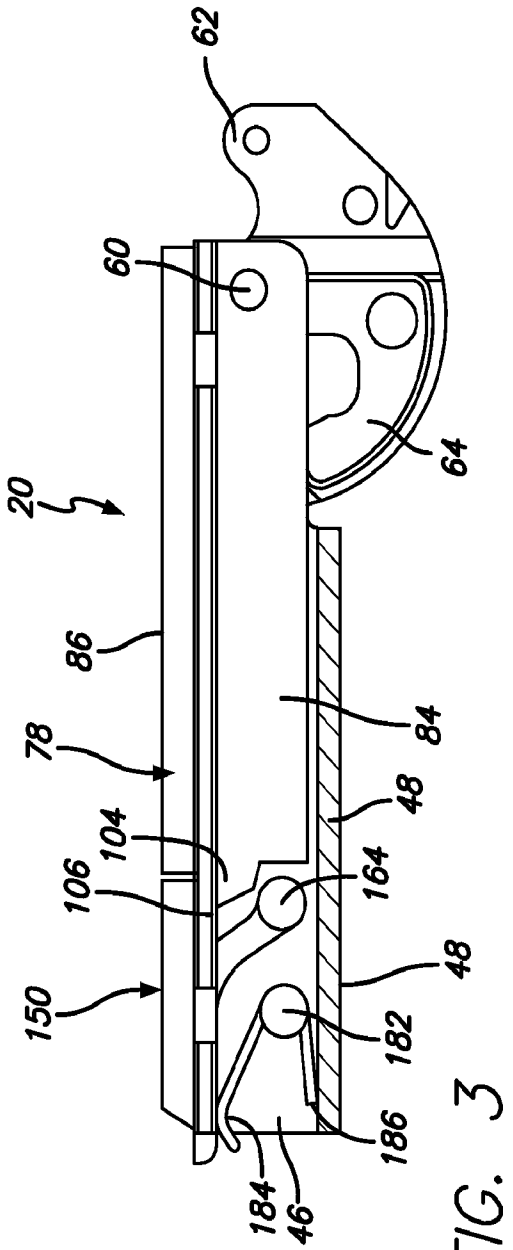
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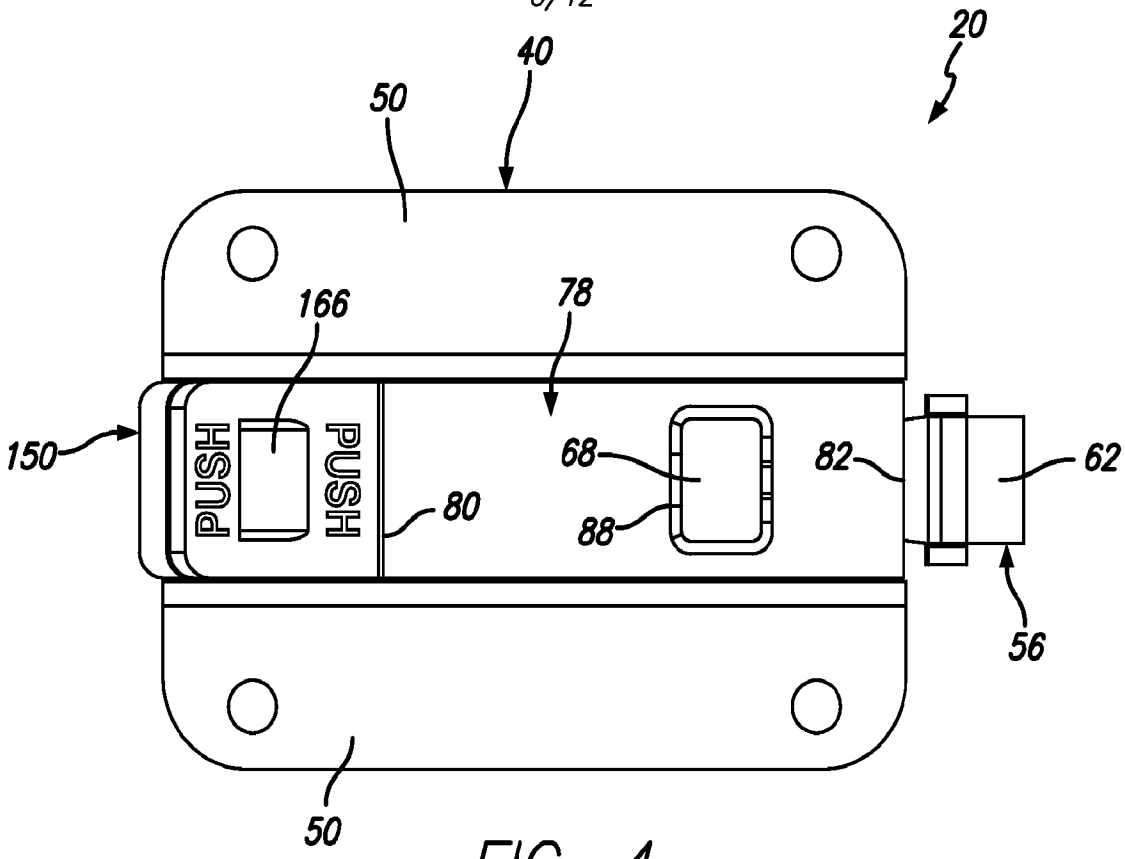
FIG. 3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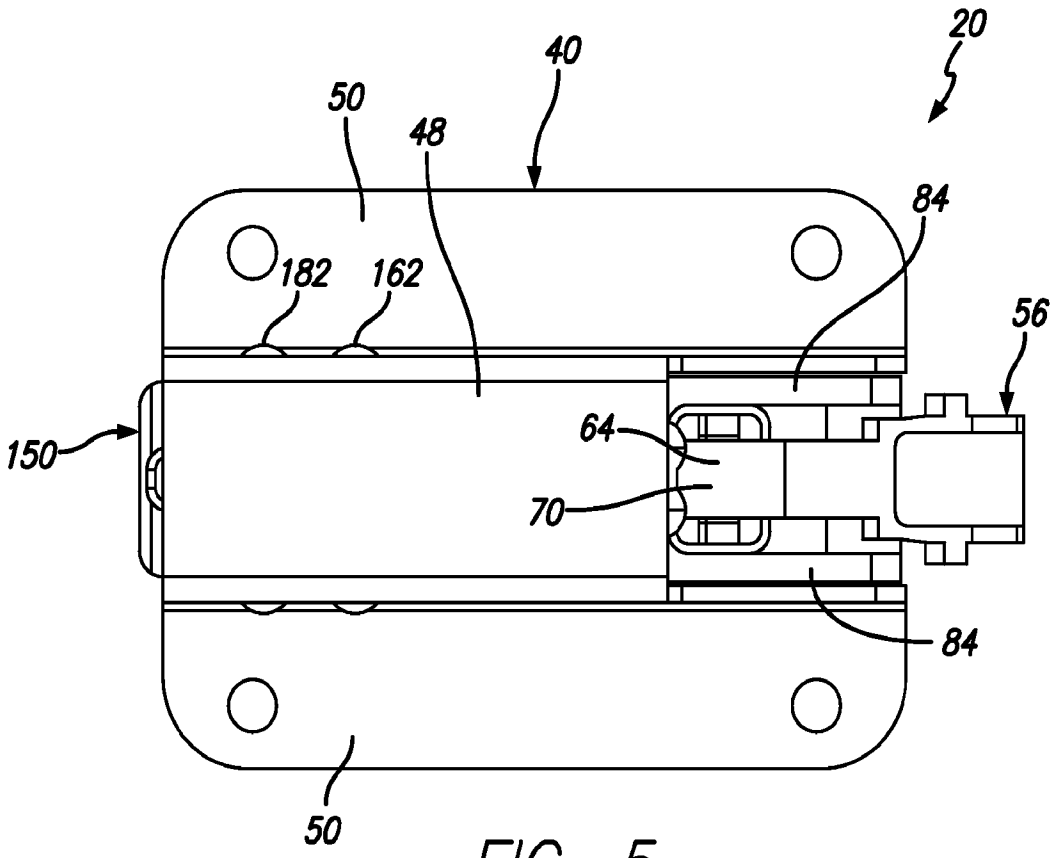
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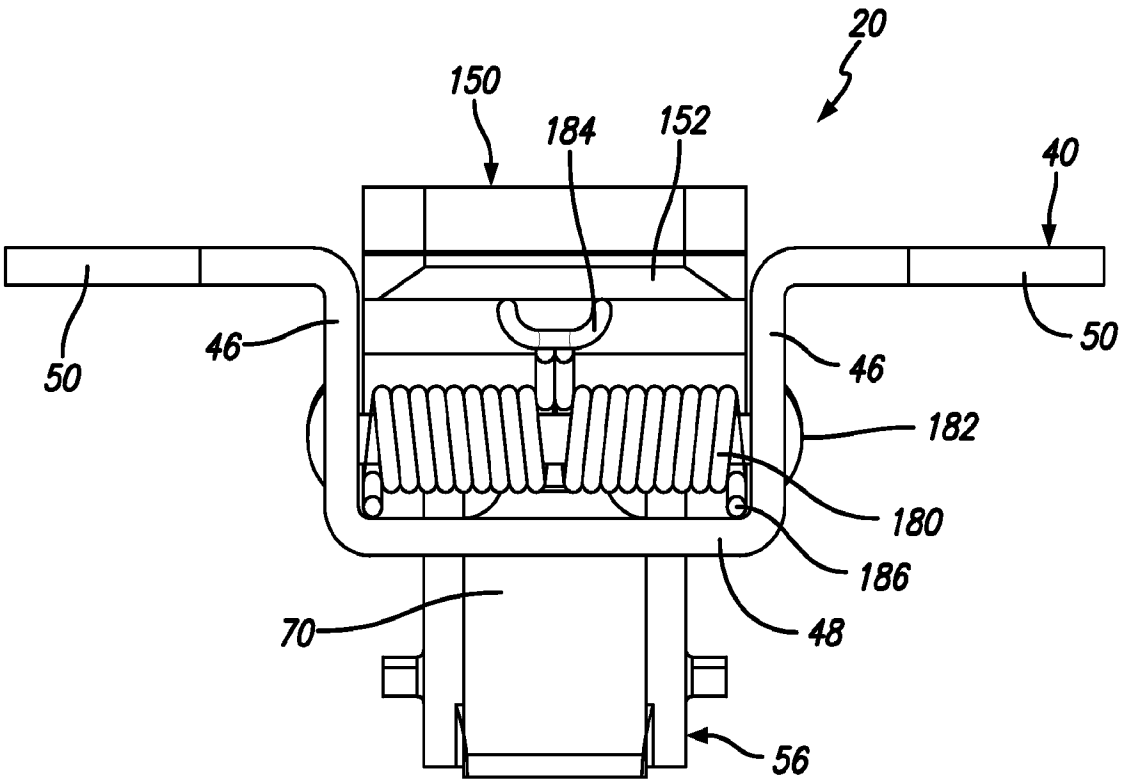
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FIG. 6

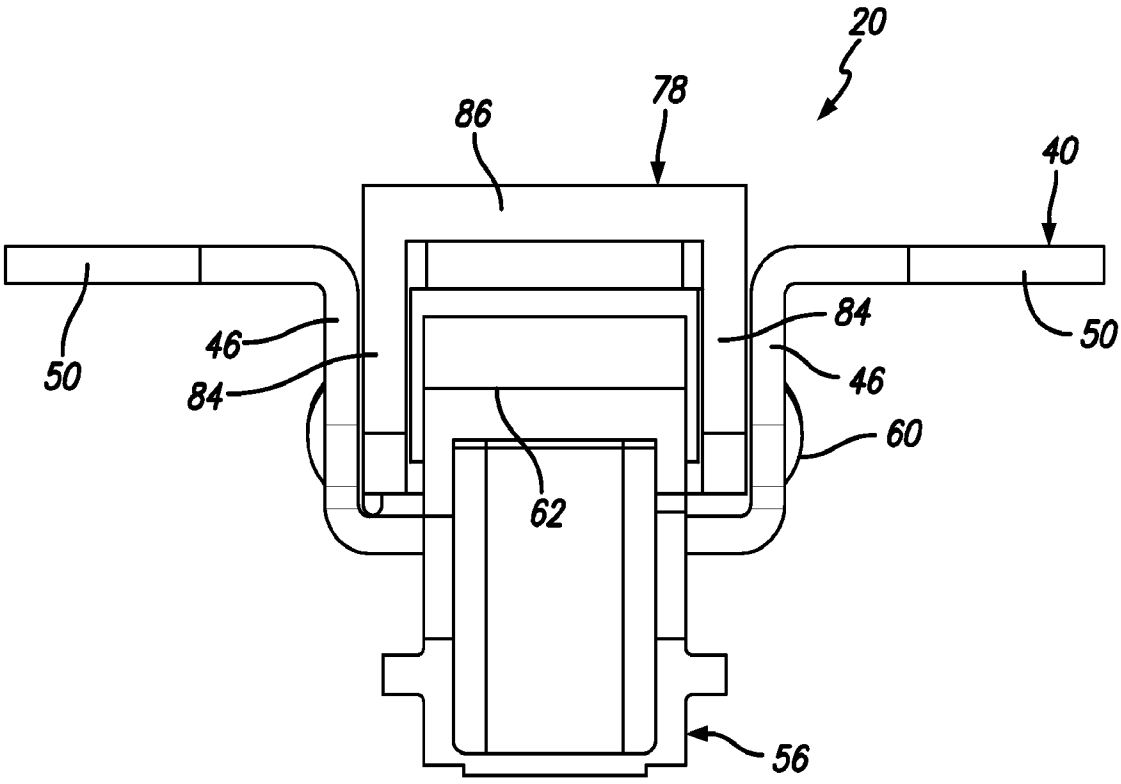
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FIG. 7

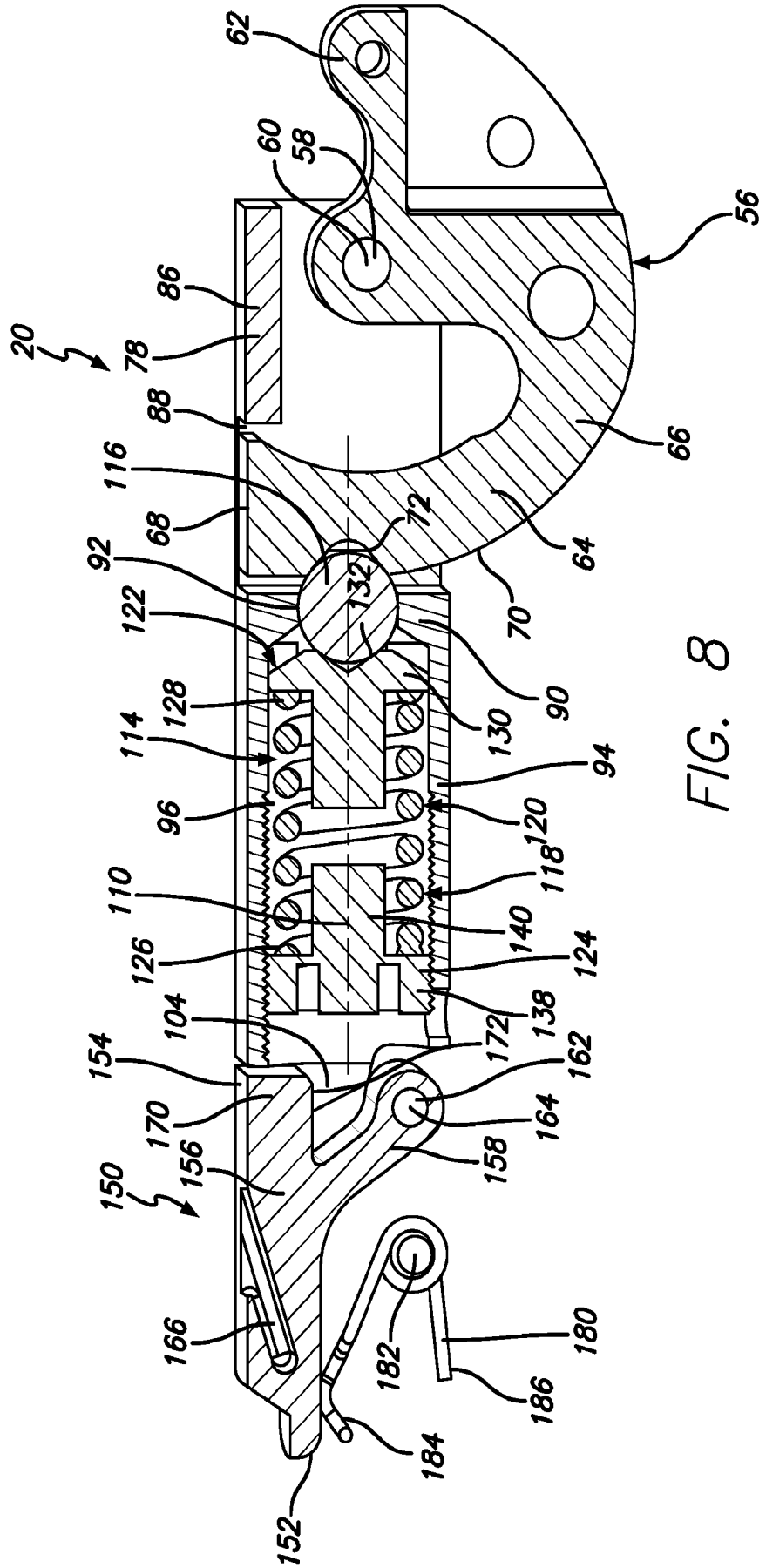
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FIG. 8

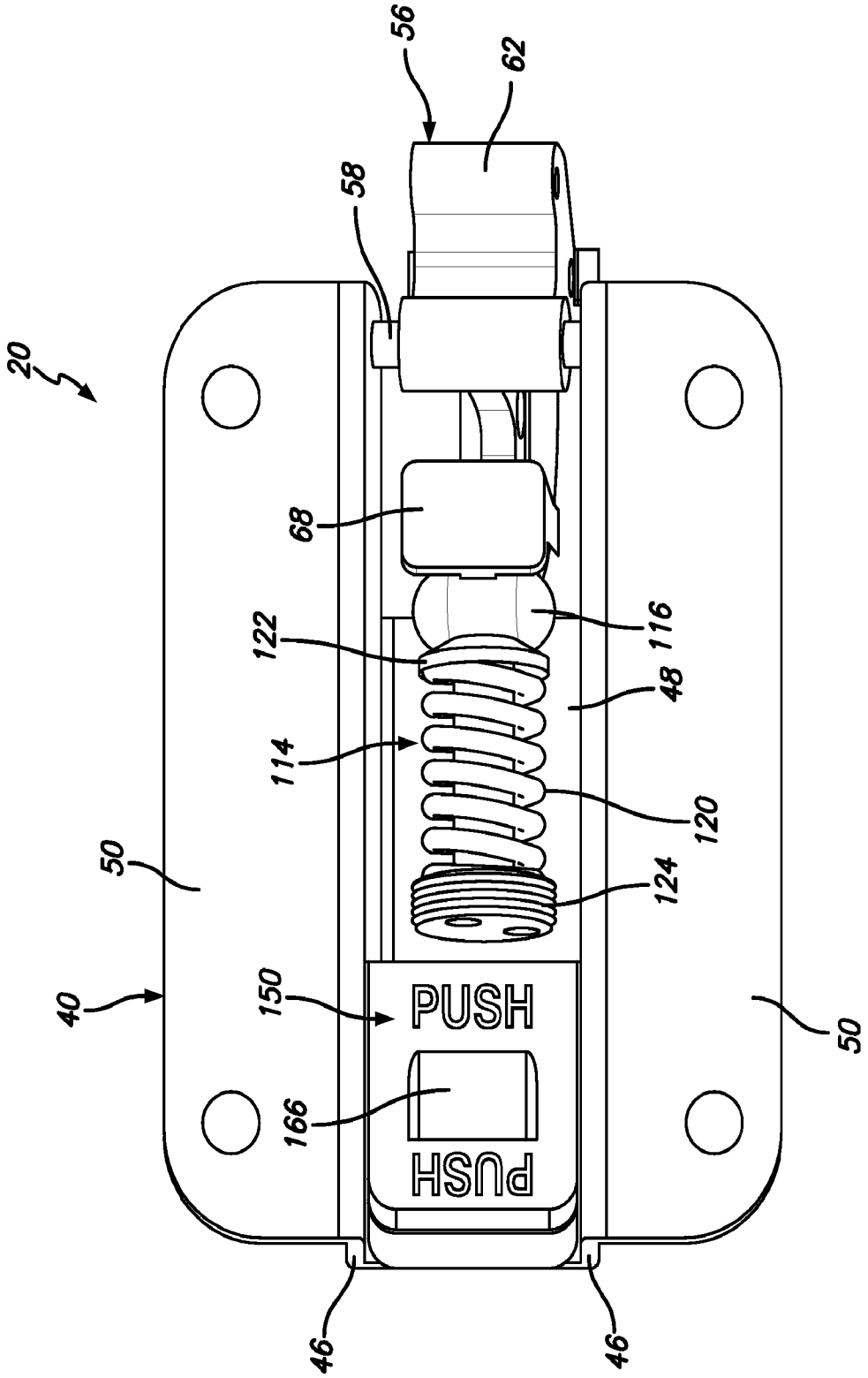
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FIG. 9

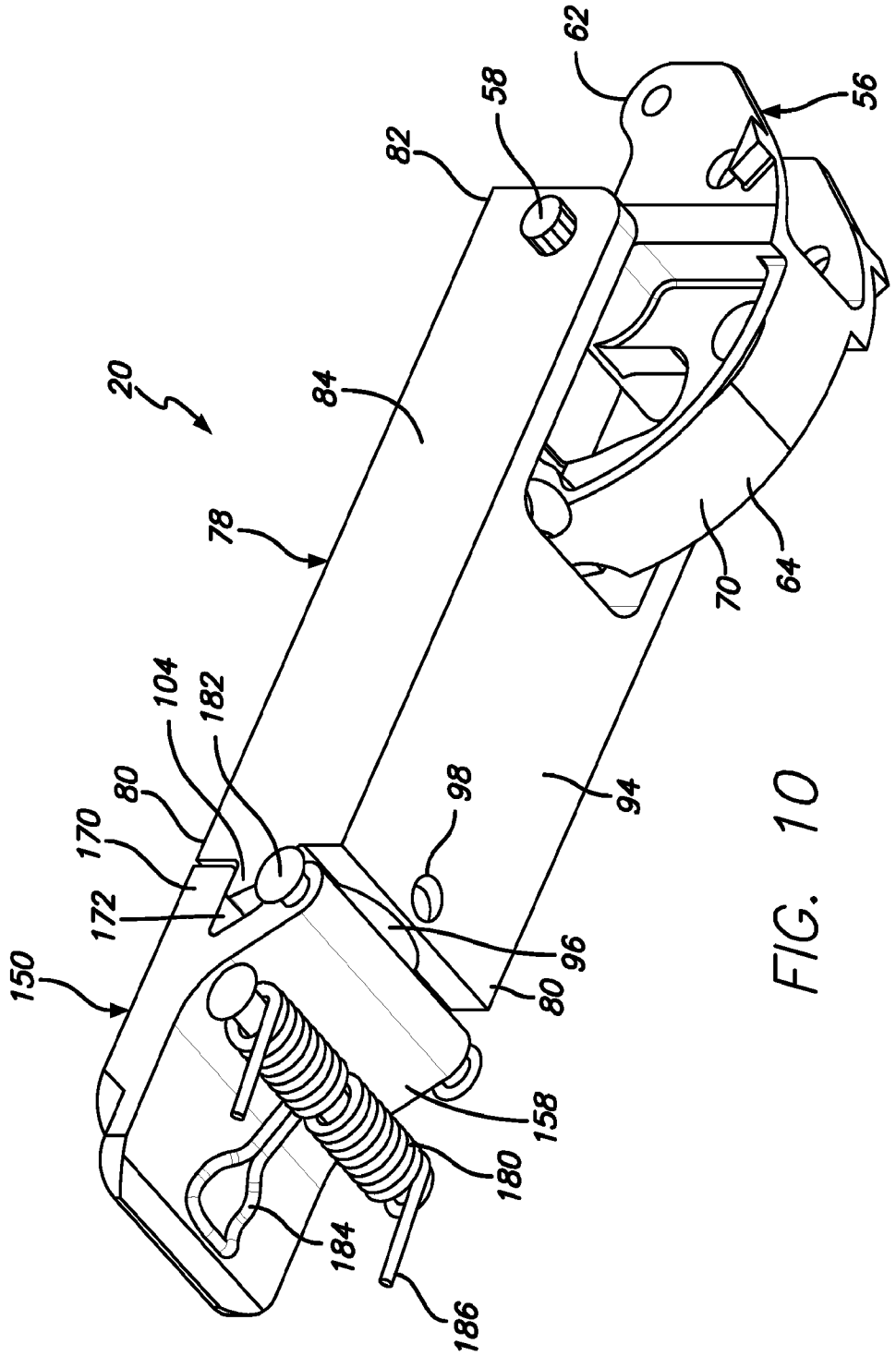
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FIG. 10

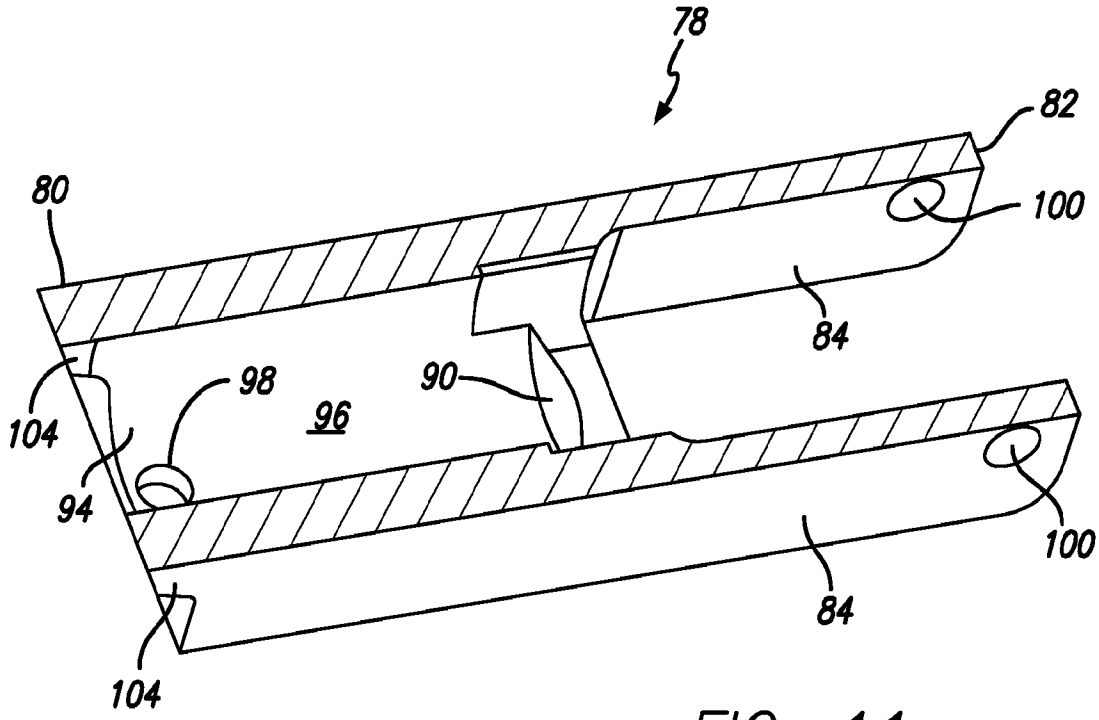
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FIG. 11

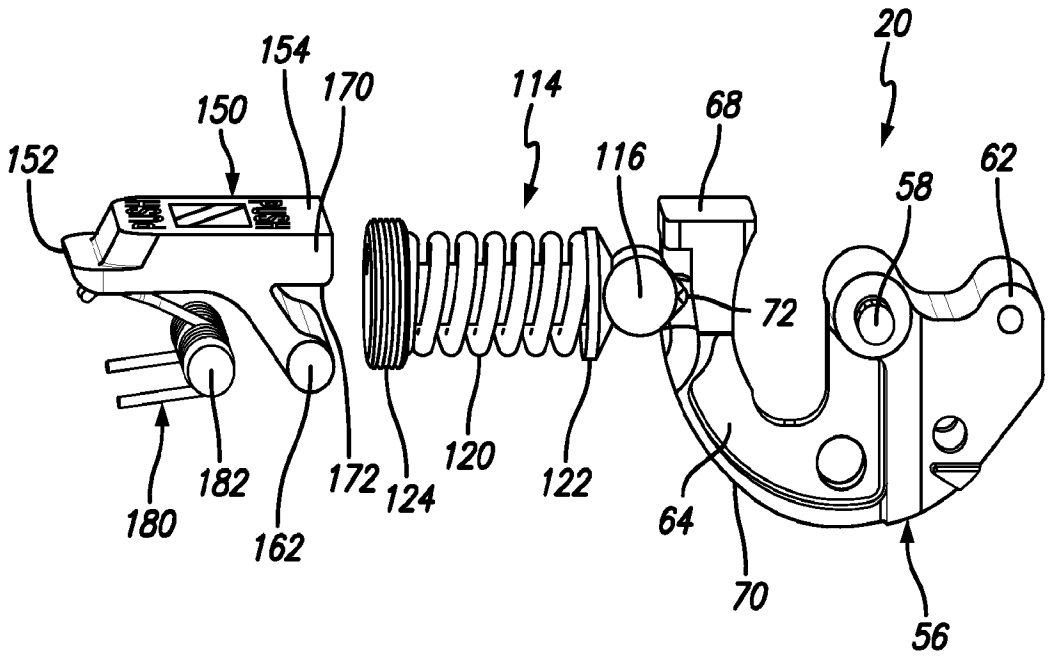
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FIG. 12

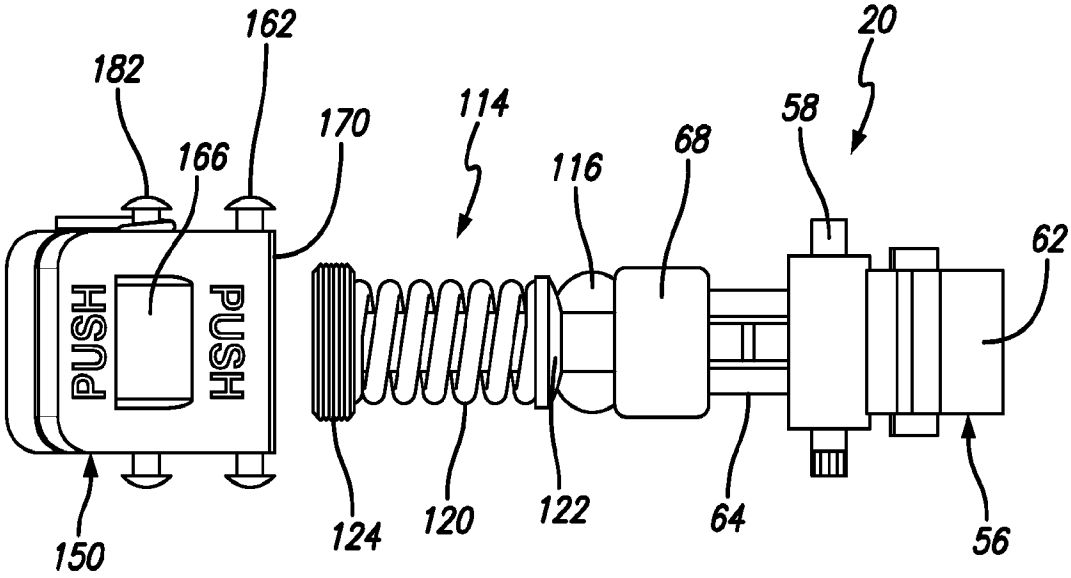
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FIG. 13

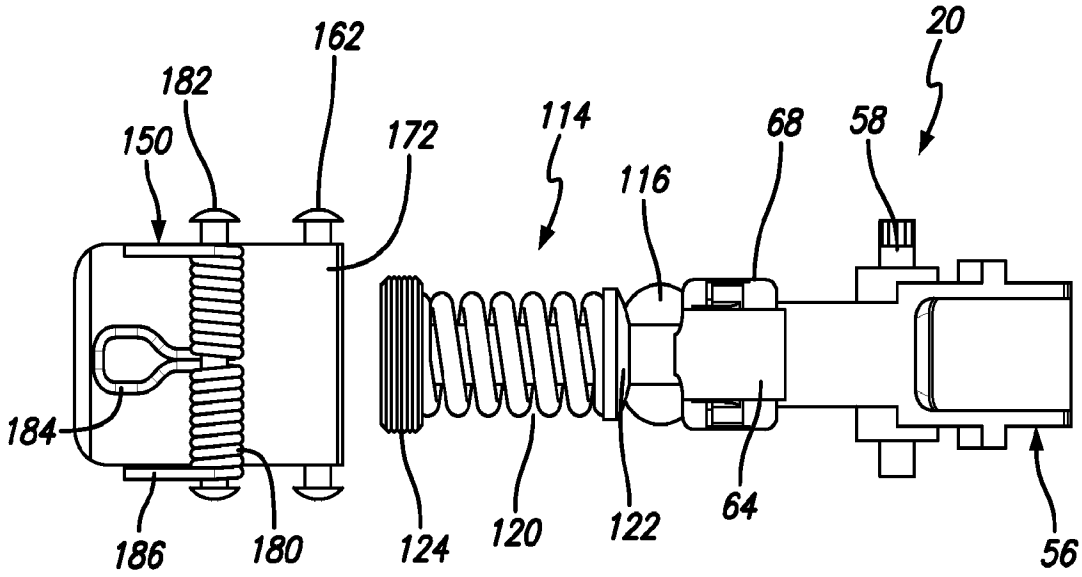
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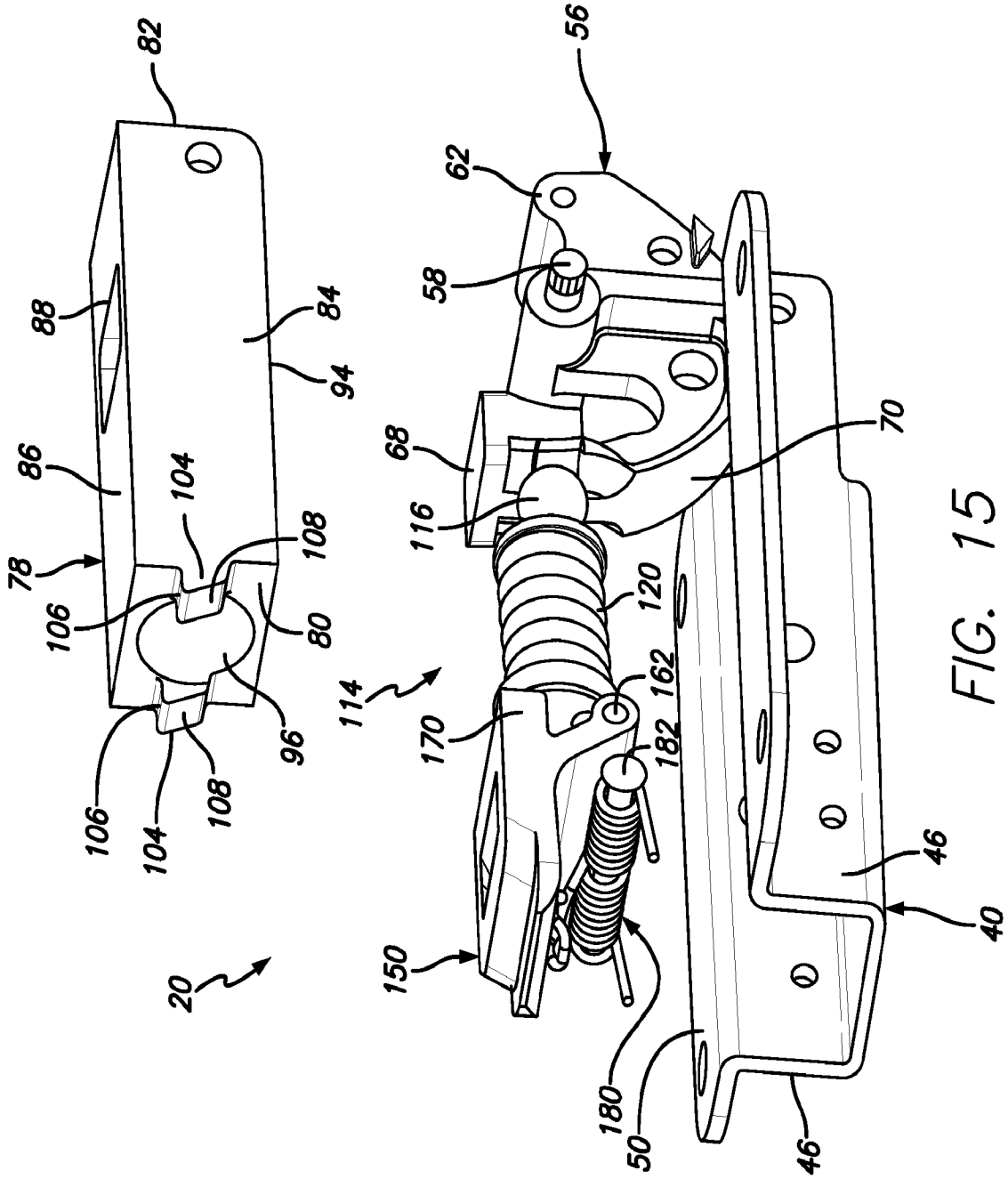
FIG. 14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88
84
94
86
104
78
108
106
80
96
106
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108
20
56
62
58
68
70
116
120
114
162
170
182
150
180
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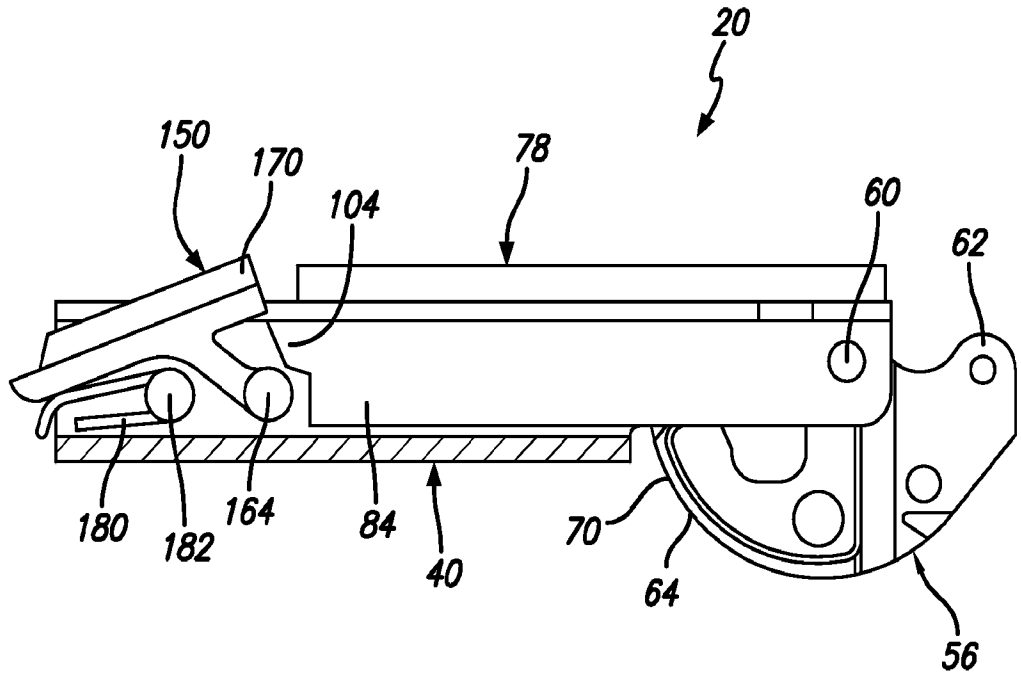
FIG. 15


20
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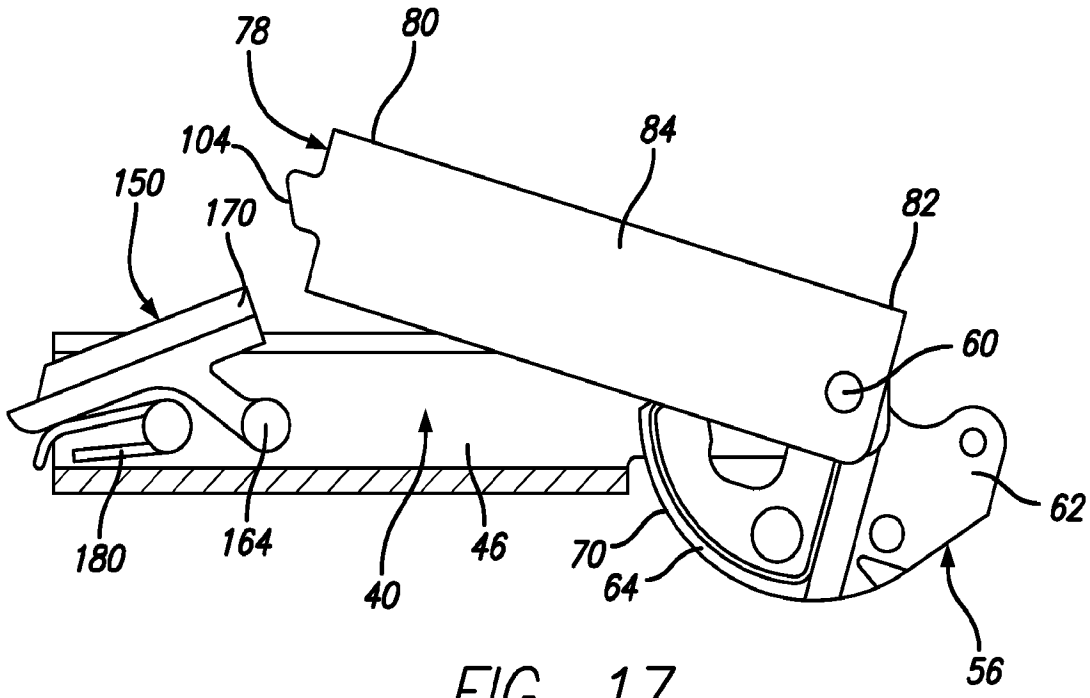
170
104
78
60
62
180
182
164
84
40
70
64
56

FIG. 16


78
80
104
84
150
170
82
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62
180
164
40
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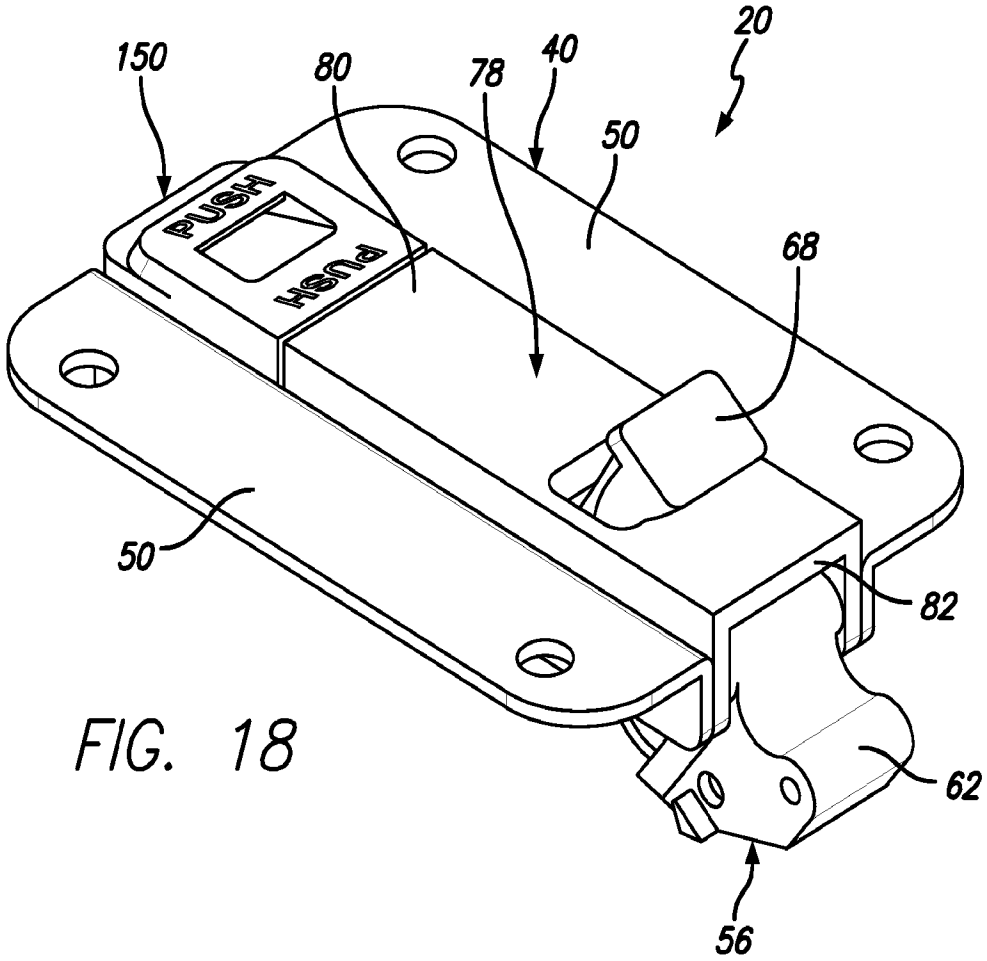
64
56

FIG. 17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150
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78
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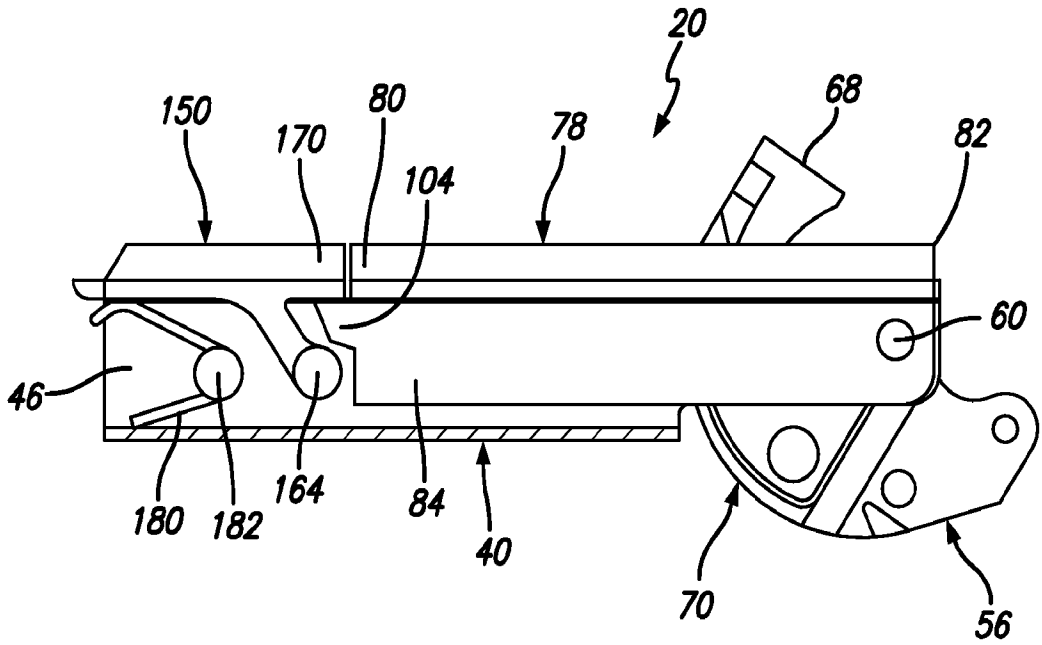
50
PUSH
PUSH
68
50
82
62
56

FIG. 18


20
150
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82
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84
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FIG. 19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/058957

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - E05C 19/12 (2011.01)
USPC - 292/114
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)
IPC(8) - E05B 3/00; E05C 19/12 (2011.01)
USPC - 292/113, 114, 336.3

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)
PatBase, Google Patents

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/0214431 A1 (HELSLEY et al) 28 September 2006 (28.09.2006) entire document	1-2
A	US 2005/0087996 A1 (JACKSON et al) 28 April 2005 (28.04.2005) entire document	1-2
A	US 2004/0012212 A1 (PRATT et al) 22 January 2004 (22.01.2004) entire document	1-2

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"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	Date of mailing of the international search report
18 January 2011	02 FEB 2011

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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